

APRIL 1986

# Mini-Micro Systems

THE MAGAZINE FOR COMPUTER SYSTEMS INTEGRATION

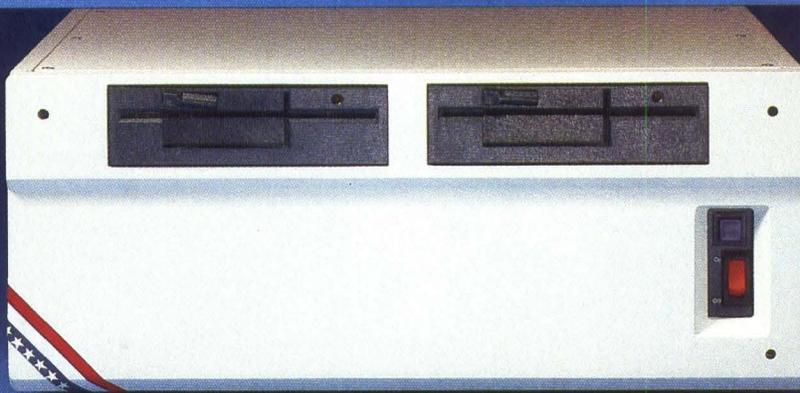
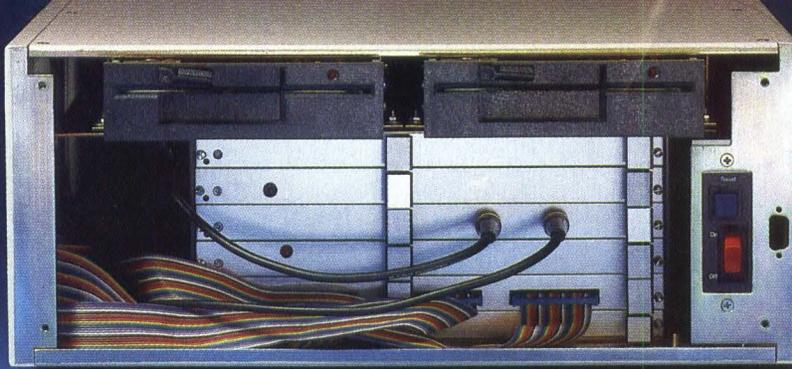
A CAHNERS PUBLICATION



**More capacity,  
OEM contracts  
fuel 1/4-inch  
tape-drive market**

## **REPORTS:**

- Database integration shakes minimarket
- Annual survey of minicomputer manufacturers
- UPSes keep pace with users' needs



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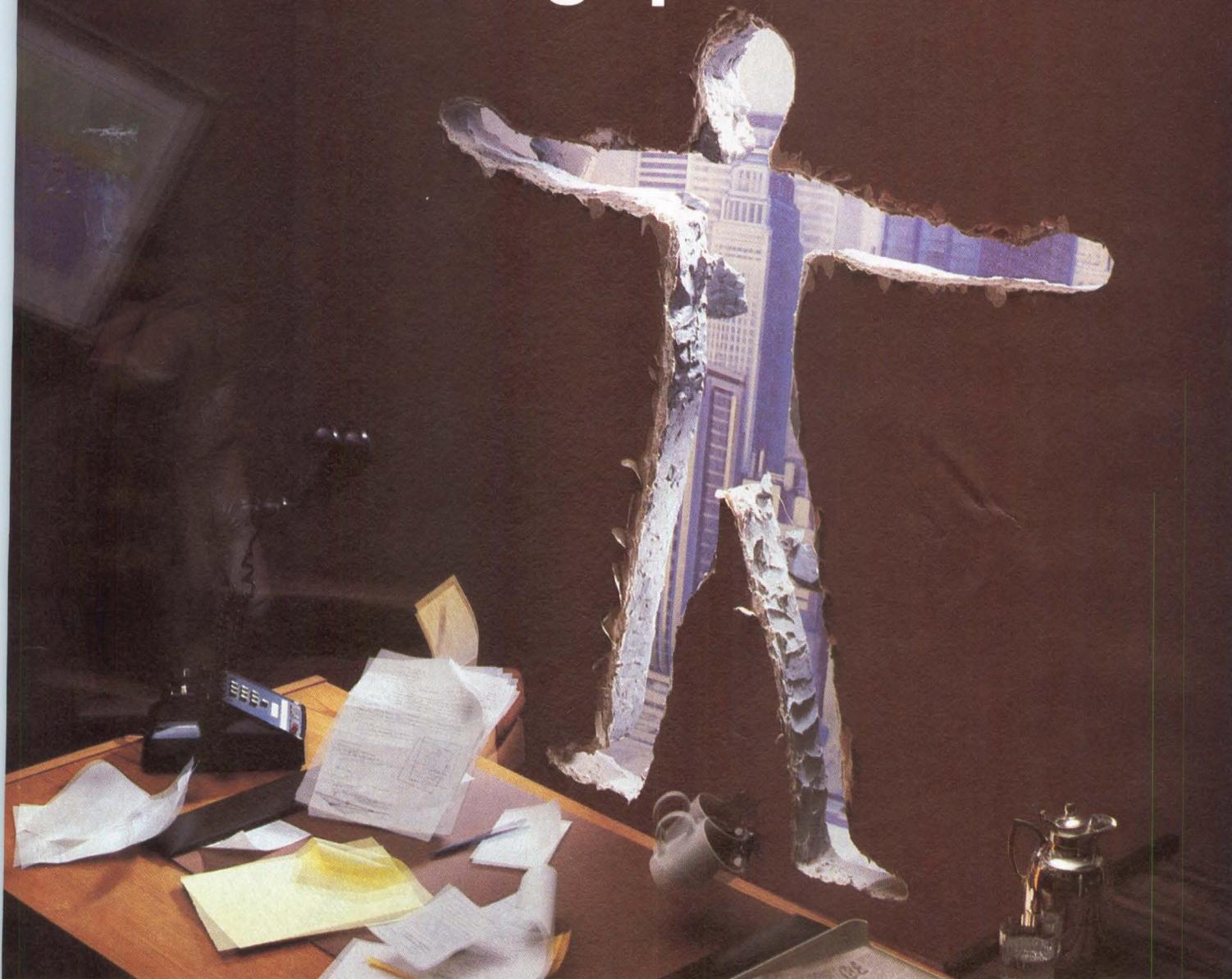
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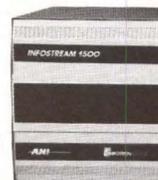
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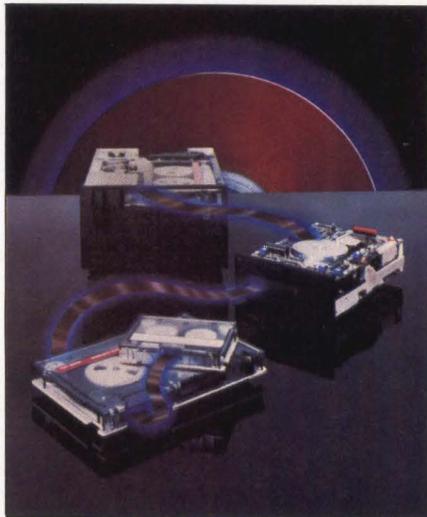
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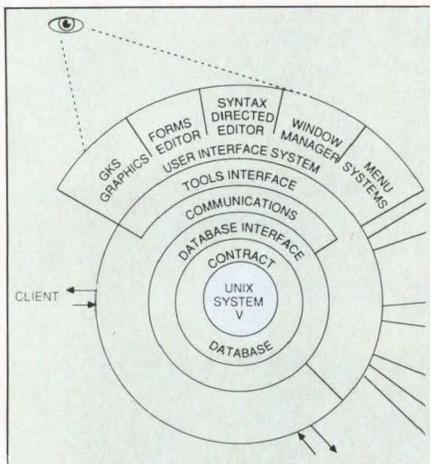
# Why you should consider buying a lot of our real-time computers.

 **HEWLETT  
PACKARD**

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MINI-MICRO SYSTEMS (ISSN 0364-9342) is published monthly with additional issues in February, April, June and November by Cahners Magazine Division of Reed Publishing USA, 275 Washington St., Newton, MA 02158. William M. Platt, President; Terrence M. McDermott, Executive Vice President. Copyright 1986 by Reed Publishing USA, a division of Reed Holdings Inc., Norman L. Cahners, Honorary Chairman; Saul Goldweitz, Chairman; Ronald G. Segel, President; Robert L. Krakoff, Executive Vice President. Circulation records are maintained at Cahners Publishing Co., 270 St. Paul St., Denver, CO 80206. Second class

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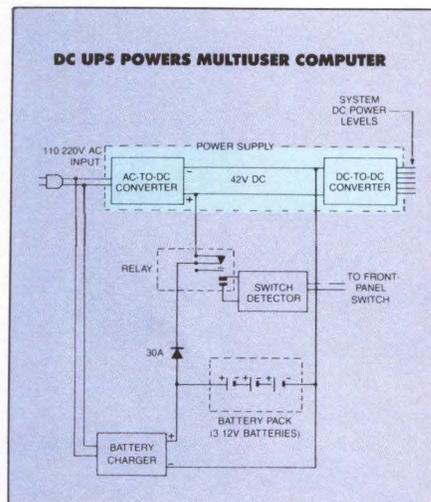
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postage paid at Denver, CO 80202 and additional mailing offices. Postmaster: Send address changes to MINI-MICRO SYSTEMS, 270 St. Paul St., Denver, CO 80206. MINI-MICRO SYSTEMS is circulated without charge by name and title to U.S.- and Western European-based corporate and technical management, systems engineers and other personnel who meet qualification procedures. Available to others at the rate of \$65 per year in the United States; \$70 in Canada and Mexico; \$95 surface mail in all other countries; air mail surcharge, \$35 (16 issues). Special HANDBOOK issues, \$15. Single issues, \$5 in the United States; \$6 in Canada and Mexico; \$7 in all other countries.



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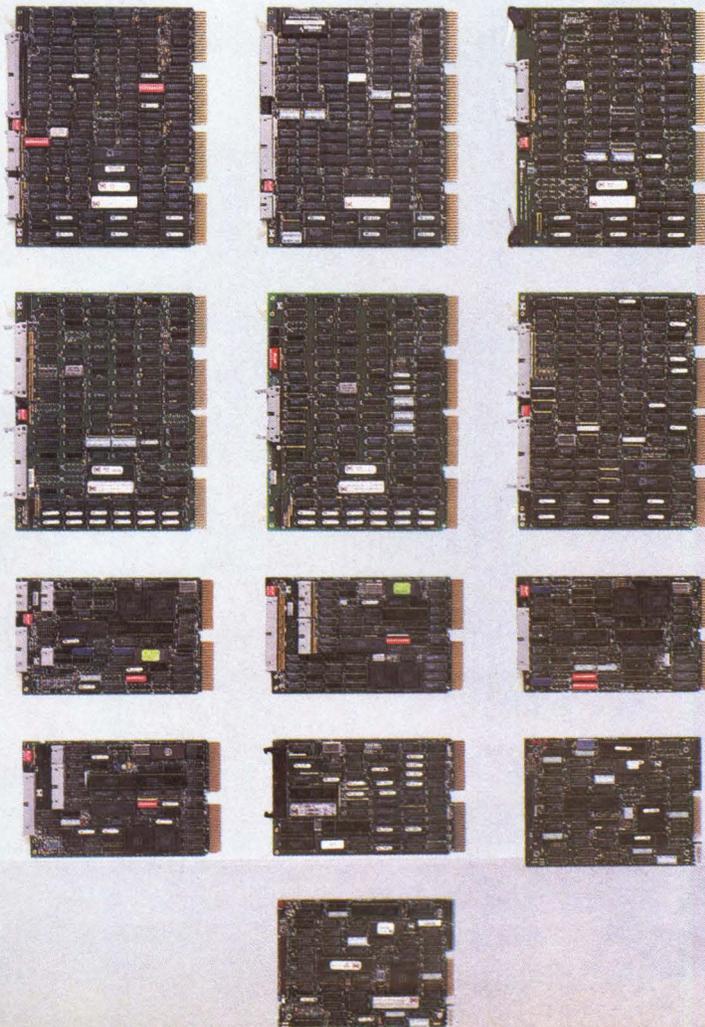
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# EDITORIAL



## UNIX NEEDS A STANDARD

Despite some encouraging signs that related hardware and software products have gained favor in government, engineering and technical circles, the UNIX operating system still lacks widespread acceptance in the business and commercial markets. This conclusion comes from analyzing all the events, announcements and meetings conducted at this year's Uniform Show. The premier presentation of the UNIX industry, this three-day exposition attracted 12,000 to 15,000 exhibitors, buyers, sellers and users. Interpreting the positive and negative comments, opinions and statements gathered at the show helps us evaluate the current conditions of the UNIX market.

Because this year's attendance approximately equalled last year's, one can infer that interest in—or need of—UNIX has not increased appreciably over the past 12 months. That is, with the overall computer industry mired in a prolonged downturn, business-equipment buyers and users appear to be in no hurry to implement UNIX-based products as the means to cost-effective application solutions. Even though supporters propose AT&T Co.'s UNIX System V as a de facto industry standard, users resist accepting it because of several perceived weaknesses, such as record locking and file transferring.

The UNIX industry seems split in two. On the one side, system developers, programmers and scientists form a close-knit technical community of UNIX proponents. On the other side, business executives, managers and users remain skeptical. And neither side seems to have moved significantly over the last year.

The technologists rightly point to the numerous attributes of UNIX—flexibility, portability, connectivity among multivendor equipment and abundant development tools. They also eagerly emphasize that UNIX meets multitasking, multiuser and real-time system needs.

In contrast, critics cite UNIX's shortcomings: an unfriendly command structure, a paucity of application software, more than 30 variations and slow operation in high-volume transaction environments. To them, UNIX is just one of many system solutions to linking microcomputers, minicomputers and mainframes.

Another reliable UNIX market status indicator is that few new products were announced at Uniform. Historically, the number of new products introduced at a trade show is an accurate gauge of sales activity in the industry. In this case, a dearth of new products tends to confirm that UNIX sales are moving slowly.

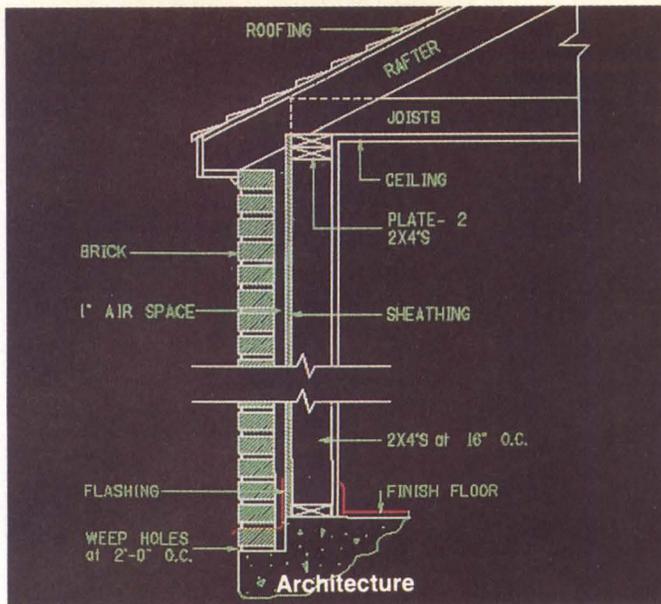
What's more, Uniform press conferences were poorly attended and several were cancelled due to lack of interest. Those press conferences that were held drew only a handful of reporters. The deduction is that most trade publications have downgraded their interest in UNIX. Evidently, these publications believe UNIX is not of prime importance to their readers.

Uniform floor activity also proved revealing in measuring UNIX's importance. The first and third show days were markedly quiet in the exhibition areas. However, the second day was very busy and probably saved the show for another year. Still, only about a dozen booths of the more than 200 exhibitors attracted steady traffic.

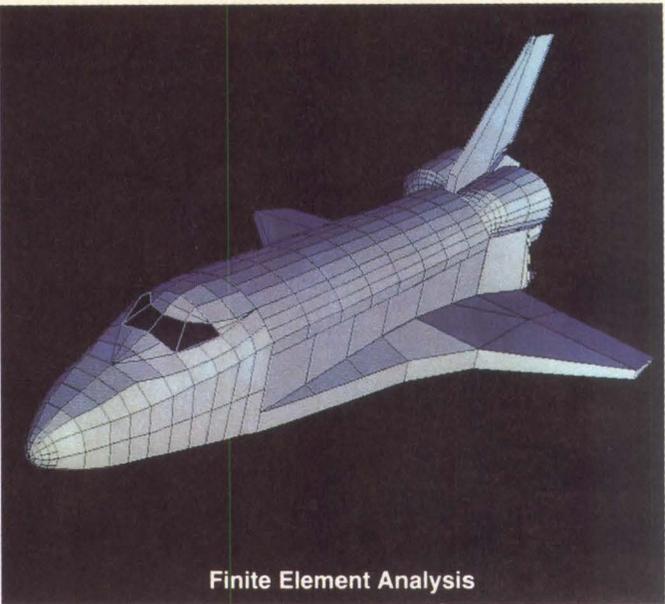
The overall conclusion? That the business-user community is still only mildly interested in UNIX. One reason is that the nearly three dozen UNIX mutants confuse users. A single UNIX standard is therefore mandatory for acceptance by the commercial arena. Anything less means that UNIX will remain just another contender.

*George V. Kotelly*

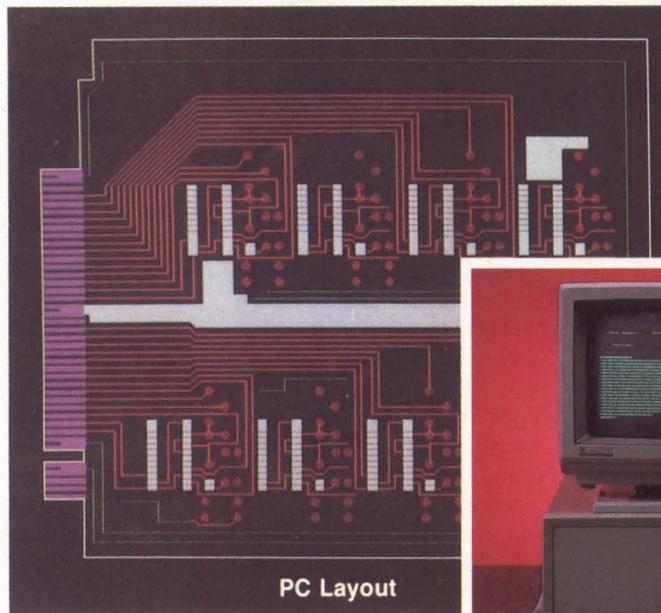
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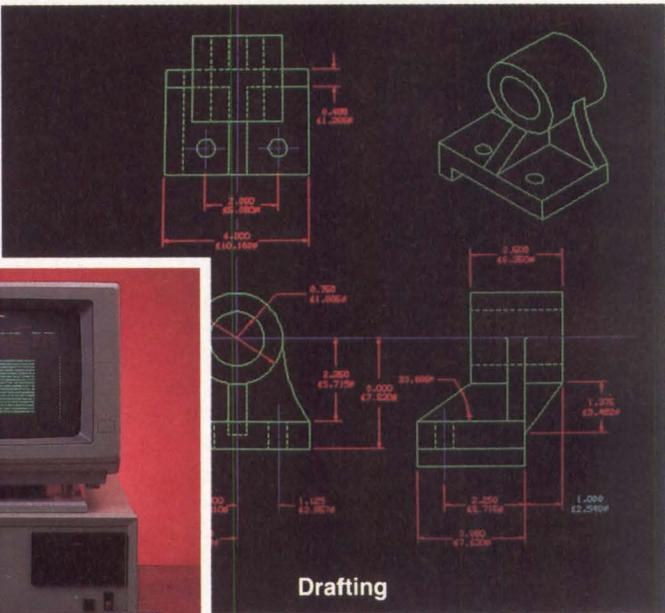
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For more information, contact: Graphics Marketing, Lundy Electronics & Systems, Inc., One Robert Lane, Glen Head, N.Y. 11545. (516) 671-9000.



CIRCLE NO. 7 ON INQUIRY CARD

# BREAKPOINTS

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## **VENDORS PROMISED MORE FROM GRAPHICS THAN IBM'S EGA**

It's pronounced "dee-jis," spelled DGIS and stands for Direct Graphics Interface Specification. DGIS is what a dozen vendors of graphics chips, software-application programs and add-on graphics boards hope will become a new standard. DGIS' goal is to supplant the present de facto graphics standard for personal computers: IBM Corp.'s Enhanced Graphics Adapter (EGA). EGA is limited to output only, is hardware-dependent and supports only a single device; DGIS provides for use of any graphics processor, supports a range of monitors of any resolution and allows for input devices, such as a mouse. Companies promoting DGIS include Graphics Software Systems Inc., Beaverton, Ore.; Intel Corp., Santa Clara, Calif.; and board manufacturer Paradise Systems Inc., San Francisco.—*Mike Seither*

## **PC PAGE SCANNER OFFERS RESOLUTION OF LASER PRINTERS**

Vision Research, a San Jose, Calif., start-up, plans to demonstrate at Comdex/Spring in Atlanta this month (April 28-May 1) a graphics-input system, the VR300, that the company claims can scan an 8½-by-11-inch document in 7 seconds. The desktop publishing system, designed for IBM Corp. PCs and compatibles, consists of a flatbed scanner, a plug-in interface board and (Digital Research Inc.) GEM-like software to manipulate text and graphics. The finished document can be printed at 300 dots per inch—the resolution of many popular laser printers. The VR300 features automatic contrast control to separate image from background and can create halftones through a dithering process. The price will be about \$2,000.—*Mike Seither*

## **FOR CDROM, STILL MORE QUESTIONS THAN ANSWERS**

Microsoft Corp.'s major conference on CDROM (compact disk ROM) technology, held recently in Seattle, raised more questions than it answered. Sony Corp. and N.V. Philips chose the forum to publicize a new interactive compact disk format, Compact Disk Interactive (CDI), that allows both sound and video to be placed on a disk with text and graphics. Although CDI is ostensibly aimed at home and education markets, publishers have seriously questioned what its impact will be on CDROM, and that could further delay widespread use of CDROM. CDI's specifications also have to be incorporated into the High Sierra Group's file-format proposal (common specifications permitting disks to run on various players). A draft working standard of the file-format proposal was originally scheduled to be announced at the conference.—*Bruce MacDonald*

## **QANTEL PACKAGES ITS OPERATING SYSTEM FOR PCs**

Unlike Honeywell Inc., Digital Equipment Corp. and other minicomputer makers that introduced microcomputers to protect and expand their customer base, MDS Qantel has put its hopes on software alone. The Hayward, Calif.,

maker of minicomputers and superminicomputers has packaged its BEST/AOS operating system for use on IBM Corp. PCs and compatibles. The company says the software, which comes on a set of flexible disks and requires 360K of memory, will sell for \$800 to \$900 and will be available by summer. Qantel adds that its operating system offers to PC users a wide range of application packages written for Qantel machines, including applications such as manufacturing control and retail accounting.—*James Donohue*

### **VOICE CARD USES ENCRYPTION TO PROTECT VAR SOFTWARE**

Votan, Fremont, Calif., is introducing a voice-recognition card for the IBM Corp. PC this month that uses a hardware-encryption scheme to prevent unauthorized use of software developed by value-added resellers. The VPC2140 card, priced at \$1,200, allows users to enter information such as numbers into the computer by using voice commands. With the new card, Votan sets up the encryption for individual VARs, in effect preventing customers from buying cards from another source for use with the VARs' software. Votan has also instituted a new program for VARs that gives them a free development system with the purchase of a minimum number of cards, the number of which has yet to be determined.—*Mike Seither*

### **FLEXIBLE POWERS FLEX/32 MULTICOMPUTER WITH 68020**

Flexible Computer Corp. of Dallas is adding this month a Motorola Corp. MC68020 version to its line of National Semiconductor Corp. 32032-based Flex/32 "multicomputers." As many as 20 68020-based C2C cards plug into the Flex/32 cabinet, providing computation speeds of up to 50 million instructions per second (MIPS), as well as real-time computing and true parallel processing. In addition, users can mix 68020s and 32032s without modifying existing software. The company claims that a 68020-based system is two to three times faster than the 32032-based systems for separate-task processing. Shipments begin next month.—*Dave Simpson*

### **DESIGNER OF IRS LAPTOP FILES FOR CHAPTER 11**

Morrow Designs Inc., the company that designed the laptop computer that the Internal Revenue Service purchased last month from Zenith Data Systems Corp. for \$27 million, has filed for protection from creditors under Chapter 11 of the federal bankruptcy law. Morrow, of San Leandro, Calif., licensed the laptop technology to Zenith, which will supply the IRS with as many as 18,000 Zenith Z-171 computers. Chairman George Morrow says the company is \$5 million in debt and has depleted its resources. He adds that Morrow will continue to make the Pivot II laptop, which is identical to the Z-171. Meanwhile, Morrow is shopping for a buyer for the company or for its technology.—*Mike Seither*

### **COMMERCE RULES THE JAPANESE ARE DUMPING CHIPS**

The Department of Commerce has issued a preliminary ruling that eight Japanese manufacturers are dumping on the U.S. market—selling at prices below the cost of production—electrically programmable ROMs (EPROMs). The manufacturers will be required to post a cash bond with the U.S. Customs Service, equal to the dumping margin, before their EPROMs can be imported

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# The Cipher Files.

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## Cipher Helps the Ultimate Corp. Cache in on GCR.

When The Ultimate Corp. of East Hanover, New Jersey, increased the Winchester capacity of its PICK-based computer system, the company turned to Cipher Data's high-capacity GCR CacheTape® half-inch tape drives for the kind of streaming performance that is usually difficult to maintain with virtual-memory operating systems.



Ultimate's Model 3030 system combines a Digital Equipment Corp. (DEC)-based computer with Ultimate's proprietary, easy-to-use version of the sophisticated PICK operating system. The systems are resold along with application software via an international dealer network.

While the Model 3030's virtual-memory operating system makes it ideal for running concurrent on-line, batch and time-sharing applications, it also presented difficulties for optimizing tape drive performance.

"With a virtual-memory environment, you can't predict host delays that might hinder the performance of real-time devices like streaming tape drives," explains Frank J. Kacerek, Ultimate Vice President of Technical Services. "In fact, streaming tape drives usually must stop to wait for the host or disk drive, drastically reducing streaming performance."

To solve this problem, Ultimate turned to Cipher's proprietary cache-memory tape drive design, which had already proved effective in the lower-density 1600/3200 bits-per-inch (bpi) Cipher CacheTape® drives Ultimate offers with its Model 3030 system family.

Unlike simple buffers, Cipher's cache design uses dynamic RAM and look-ahead algorithms to emulate start/stop interaction between host and device. This allows the physical operations of the tape drive to continue unhindered.

When Ultimate increased the Model 3030's Winchester capacity to just over a

gigabyte, it was an easy task to graduate to the higher-performance, tri-density (1600/3200/6250 bpi) GCR CacheTape drive. The drive offers 270 Mbytes of capacity rather than the usual 180 Mbytes by using 1.0 mil-thick tape rather than 1.5 mil-thick tape.

Kacerek said the GCR CacheTape's low profile design also was convenient for integrating the drives into Ultimate's compact system configuration. The tape drives offer Ultimate 3030 users faster backup times, less tape reel handling, improved data integrity, and compatibility with GCR-based tape libraries.

For more detailed information or a technical article about cache technology, contact 1-800-4-CIPHER, and ask for item # MM-1.

## Packing more GCR performance into a smaller box.

Cipher Data had many hurdles to cross when the company set out to package one of the industry's most sophisticated GCR tape drive implementations into one of the smallest, most cost-effective packages.

Cipher first had to streamline chip and board use to achieve a far more elegant design than most GCR drives, dramatically reducing package size while lowering power consumption and heat generation.

First, by avoiding a heavy reliance on the discrete logic most manufacturers use in their GCR tape drives, Cipher has achieved a highly programmable device, with more configuration flexibility than generally available.

For instance, the Cipher GCR CacheTape drive's unique 8-character alphanumeric display helps users determine drive status and tape utilization. Select from 29 configurable options. Control on-board diagnostic test sequences. And even select transfer rates that improve tape and host interaction and optimize effective throughput. All using ordinary English messages and without touching a dip switch.



## Cipher and Spectra Logic plug GCR CacheTape into MicroVAX II.

Cipher Data's Spectra Logic Division of Mountain View, Calif., has introduced a multifunction disk/tape controller that enables Cipher's GCR CacheTape drive to be used with the popular Digital Equipment Corp. (DEC) MicroVAX II computer.

The Spectra 25-M can be used to interface the GCR CacheTape drive to the MicroVAX II and DEC's Q-BUS minicomputers. It is the highest performance disk/tape controller of its type available today.

For more information and literature on the complete line of Spectra Logic controllers, contact 1-800-4-CIPHER, and ask for item # MM-2.

## Maximizing data integrity in an imperfect world.

Cipher also closely examined data integrity issues, widening the GCR interchange bandwidth to ensure data interchange compatibility with any other GCR tape drive. Regardless of how well these other drives comply with ANSI specifications.

The Cipher GCR CacheTape drives also automatically rewrite and reread any records with errors, significantly reducing the burden on the operating system. And an enhanced two-track bi-directional software error recovery technique improves the recovery rate of read data that would often be lost with other GCR drives.

Cipher uses a signal conversion system under microprocessor control to optimize tape speed control and minimize the instantaneous speed variations that plague most tape drive designs. And a patented autoloading capability means computer users will never contribute to a data integrity problem related to improper tape loading or handling.

## SCSI plug-and-play performance improvement.

Cipher offers either the standard Cipher/Perfec interface or the intelligent Small Computer System Interface (SCSI) with its tape drives.

With SCSI, integrators can write a single set of software drivers for any of Cipher's half-inch reel-to-reel tape drives, preserving design and equipment investments as disk capacities and tape storage requirements increase.

For more information or technical articles about GCR CacheTape and SCSI tape integration technology, call 1-800-4-CIPHER, and ask for item # MM-3.

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data products, inc.

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CIRCLE NO. 9 ON INQUIRY CARD

into the United States. Companies found to be dumping EPROMs, and the calculated percentages of their dumping margins, are Hitachi Ltd., 29.9; Fujitsu Ltd., 145.9; NEC Corp., 188; and Toshiba Corp., 21.7. The dumping complaints were brought against the manufacturers by three U.S. chip makers: Advanced Micro Devices Inc., Intel Corp. and National Semiconductor Corp.  
— *Stephen Shaw*

### **SBS, M/A-COM JOIN IN SATELLITE EARTH-TERMINAL VENTURE**

Satellite Business Systems (SBS), McLean, Va., and M/A-COM Inc., Burlington, Mass., have signed an agreement to jointly market very small-aperture earth terminals (VSAT) for data communications networks. The VSATs, using satellite antennas as small as 6 feet in diameter, could be employed in corporate communications networks to relay data at throughput rates as high as 512K bits per second. SBS, which was folded into MCI Communications Corp., Washington, as part of IBM Corp.'s acquisition of a substantial interest in the long-distance telephone company, will provide network engineering, design services and satellite capacity for the venture. M/A-COM will supply the VSAT earth stations.—*Stephen Shaw*

### **TECH FILES: A QUICK LOOK AT NEW PRODUCTS AND TECHNOLOGY**

The Intelligent Peripheral Interface (IPI) forum held in Boston recently spotlighted the growing trend toward more intelligent peripherals that permit off-loading I/O duties from the central processor. **Emulex Corp.** of Costa Mesa, Calif., is supporting that trend with its IP7000 embedded disk controller for Digital Equipment Corp.'s VAX 11/780. It uses a proprietary bipolar microprocessor; supports the IPI-2 interface and transfers up to 8M bytes per second. Meanwhile, **Fujitsu Ltd.**, **Hitachi Ltd.** and **NEC Information Systems** are preparing IPI-2 and IPI-3 versions of 8- and 9-inch Winchester disk drives for availability in the third quarter of this year.—*Carl Warren*

Higher-resolution characters, built-in calendar, clock and calculator, and seven pages of local display memory are some of the features **Wyse Technology** has added to its latest high-end ASCII terminal. The San Jose, Calif., company will begin shipping the new WY-60, priced at \$699, to OEMs and distributors this month. Wyse claims that the WY-60's character cell—10 by 16 pixels—has the highest resolution of any ASCII terminal on the market, allowing up to 44 lines of text to be displayed with either 80- or 132-column formats. The WY-60 mimics the keyboard layout of the WY-50, Wyse's former high-end terminal, and those of IBM Corp.'s PC/AT and 3161 terminal.  
—*Mike Seither*

**Orchid Technology** will introduce a \$95 local-area-network-software package at Comdex/Spring in Atlanta (April 28-May 1) that it says will make its PCnet LANs compatible with IBM Corp.'s PC Network and Microsoft Corp.'s MS-Net. The Fremont, Calif., company claims its network basic input/output system (NetBIOS) supports all application programs, DOS 3.1 software and

hardware designed for the IBM and Microsoft networks. Orchid claims there are 70,000 PCnet nodes installed worldwide. Wyse says its implementation of NetBIOS protocol will allow those PCnet users to communicate over IBM's PC Network.—*Mike Seither*

Look for an IBM Corp. 3480 look-alike tape subsystem from the Odawara Works of **Hitachi Ltd.**, Japan, later this year. According to company officials, Hitachi is developing thin-film heads to be used in the drives. In addition to the tape subsystem, the company is also preparing a 100M-byte, 5¼-inch Winchester with an embedded small computer systems interface (SCSI) controller, and a smaller capacity, 3½-inch version of the drive for introduction possibly as early as the National Computer Conference in Las Vegas in June.—*Carl Warren*

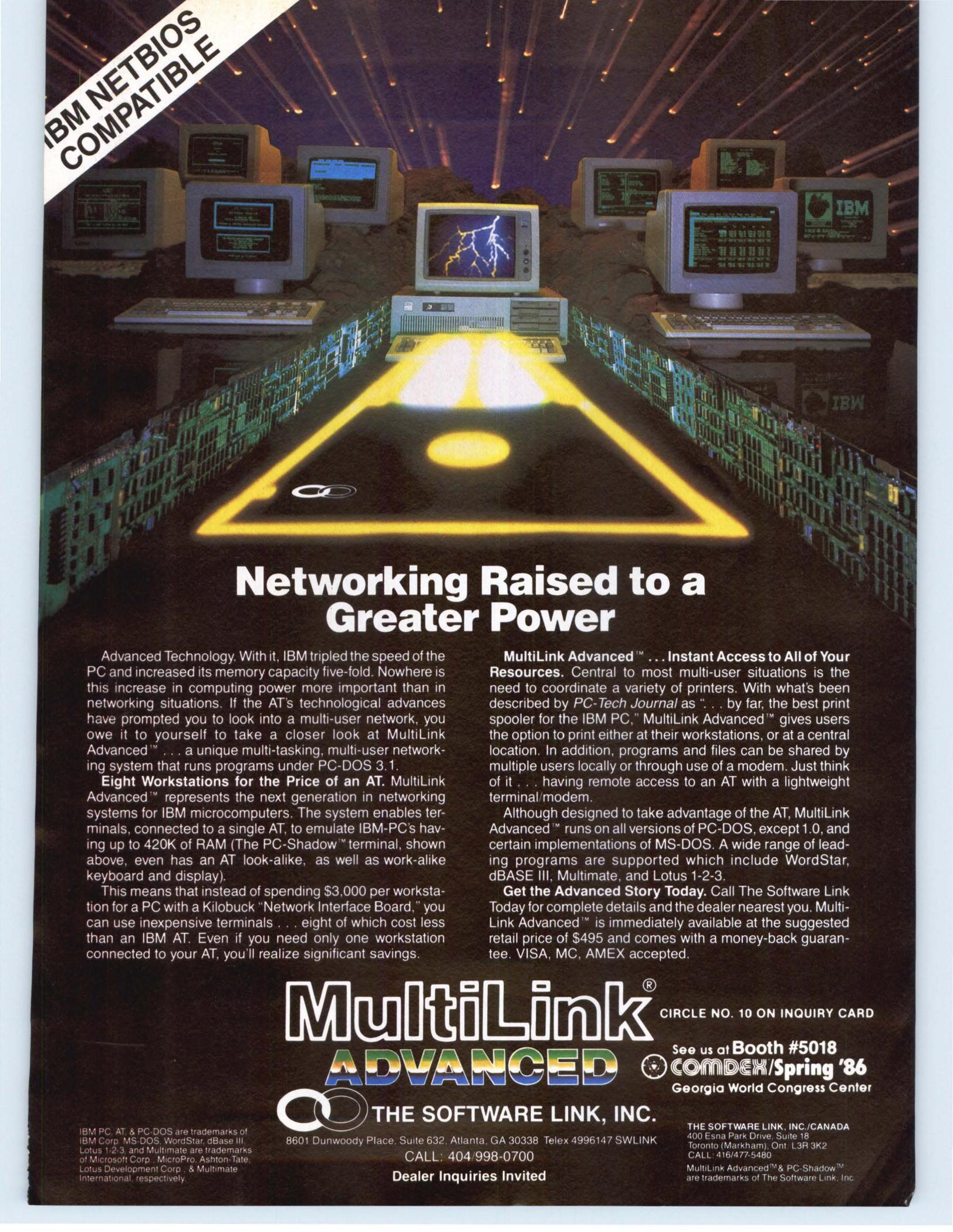
Following up on its Micro PC single-board computer, **Faraday Electronics**, Sunnyvale; Calif., has launched a \$550 CMOS Micro PC in a 4.2-inch-by-6.2-inch form factor that's reportedly compatible with IBM Corp. PC expansion cards. The board is configured with a Harris Corp. 80C88 microprocessor and Intel Corp. 8087 math coprocessor socket; keyboard and speaker ports; 256K bytes of CMOS RAM; and Faraday's PC-compatible basic input/output system. The company is targeting factory-floor and remote data-collection applications where CMOS' low power consumption, high noise immunity and reduced heat dissipation would be advantageous.—*Jesse Victor*

**NOTES FROM OVERSEAS:** A member of Britain's Parliament, Michael Meadowcroft, has accused **Digital Equipment Corp.** of "illegal and improper activities" against Systime Plc., Leeds, England, at one time the largest system integrator selling DEC machines in Britain. Meadowcroft has alleged that in 1979 DEC's British subsidiary began a campaign called "Kill Systime" because Systime chose to buy hardware directly from DEC in the United States. He charged the subsidiary with supplying information to the U.S. Department of Commerce about Systime re-exporting U.S.-built hardware to countries such as South Africa and Iraq without U.S. government permission. A spokesman for DEC in Britain has described Meadowcroft's accusations as "a series of unsubstantiated allegations made under the cloak of Parliamentary privilege." MPs are immune from libel action under that privilege.—*Keith Jones*

**ESPRIT II**, the second five-year phase of the European Strategic Program for Research in Information Technologies, may find itself \$2 billion wealthier, if the governments of Common Market countries accept recent proposals made by the European Commission. Commission director for industry and research, Karl-Heinz Narjes, has proposed increasing the funding for the pan-European research collaborative from the \$750 million earmarked for its first phase. If approved by the governments in June or July of this year, the grants will be awarded over a five-year period beginning in 1987.

—*Keith Jones*

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## More capacity, OEM contracts fuel 1/4-inch tape-drive market

**Mike Seither**

Associate Western Editor

In the coming months, manufacturers of drives for 1/4-inch streaming tape will race to provide higher capacity backup systems for minicomputers, supermicrocomputers and personal computers. At least four companies plan to bring out drives in the 5 1/4-inch form factor that will store as much as 125M bytes of data. And at least 10 manufacturers have targeted the low end of the market with drives storing up to 46M bytes, most of them in the 3 1/2-inch form factor.

This month, industry leader Archive Corp., Costa Mesa, Calif., jumps into both ends of the fray. At the high end, Archive is introducing the 5 1/4-inch Super Scorpion, based on the newly adopted QIC-120 formatting standard for 125M bytes. Archive is also introducing a 3 1/2-inch drive that the company hopes will help create a formatting standard for 40M bytes.

The optimism expressed by Archive's introductions, and those planned by others, has been underscored by a recent IBM Corp. announcement. Tape-drive makers are ebullient over IBM's decision to make a standalone, 1/4-inch, streaming tape drive standard equipment with its new RT PC technical workstation. IBM is buying the 55M-byte tape drive, which uses a modified QIC-02 interface, from Cipher Data Products Inc., San Diego. According to industry analysts, this marks the first time that IBM has gone outside for a tape drive for any of its major product lines. Observers agree that the IBM imprimatur on 1/4-inch tape will go a long way toward boosting sales of such drives.

"IBM has not only endorsed 1/4-inch technology, but also a QIC-02 interface," says Louis Domshy, director of product marketing for Archive. "It's



**The Super Scorpion** from Archive holds 125M bytes on DC600A cassettes and reads data already stored on smaller-capacity DC300XL cartridges.

good for us and companies like us."

IBM is not the only major computer manufacturer sold on 1/4-inch streamers. In January, Archive signed a \$10 million OEM pact to supply 60M-byte drives to Texas Instruments Inc. of Dallas for use in its Business Pro microcomputers. At about the same time, Wangtek Inc., Simi Valley, Calif., struck a similar deal with Burroughs Corp., Detroit. The Wangtek Series 5000E tape drives will be incorporated into Burroughs' B25 multiuser computer system.

### Recognition at last

Streamer manufacturers have been looking for this kind of recognition for years. Since 1982 they have been working to establish formatting and interface standards for 1/4-inch drives through the Working Group for Quarter Inch Compatibility (QIC). The new QIC-120 formatting standard for high-end drives is the latest result of the organization's effort.

QIC-120 is an extension of, and is

compatible with, QIC-24, a standard adopted by more than half a dozen makers of 1/4-inch drives. QIC-24 defines the recording format for 20M bytes on four tracks and for 45M bytes on nine tracks for the DC300XL cartridge from 3M of St. Paul, Minn. The QIC-24 also defines a 60M-byte, nine-track format for 3M's high-capacity DC600A cartridge. Under the QIC-120 standard, OEMs and system integrators can build systems that read data on DC300XL cartridges recorded on QIC-24 machines. More significantly, QIC-120 allows up to 125M bytes of data to be written on the DC600A cartridge using a new 15-track scheme.

Industry analyst Joe Molina of Technology Forums, Pomona, Calif., says the QIC-120 drives will allow system integrators and OEMs to double capacity for about a 20 percent increase in price. Most QIC-120 drives will be priced between \$800 and \$900 in OEM quantities, he believes.

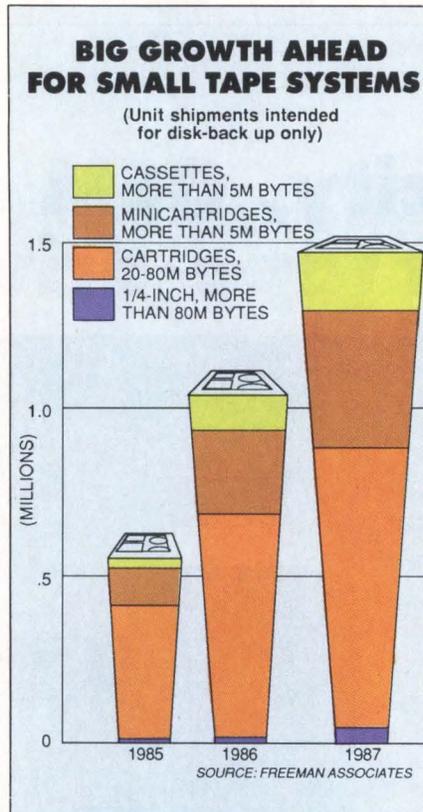
Archive is among the first to introduce a QIC-120 drive. Tom Makmann,

Archive's vice president of marketing and sales, says evaluation units will be available in July; production is scheduled to start in October. The Super Scorpion, a full-height drive in the 5¼-inch form factor, "offers upward growth for our existing Scorpion line," he says. System integrators will be able to upgrade without modifications to their systems, using the QIC-02 host interface. The data-transfer rate remains the same at 90K bytes per second. The drive reads QIC-24 tapes at 90 inches per second and writes at 72 ips for QIC-120 recording formats. Backup time for a full 125M-byte rigid disk is about 23 minutes. The Super Scorpion will be priced at about \$850.

Also playing in the QIC-120 game is Tandberg Data Inc., Anaheim, Calif., with three models. Marketing manager John Vecera says evaluation units were shipped in March. The drives come in half-height or full-height 5¼-inch form factors and are available with the QIC-02 and small computer systems interface (SCSI). Production is scheduled to begin this month. They will be priced at about \$900.

Two other manufacturers are expected to unveil QIC-120 devices in the near future. They are Kennedy Co., Monrovia, Calif., and Wangtek, which plans to produce evaluation units this summer and to ship in volume early next year.

With existing recording media, QIC-120 pushes ¼-inch streamers to the



limit of their capacity. Another proposed standard, QIC-150, would allow storage of 130M bytes on 3M's DC600XTD cartridge. However, only one company, the Qantex Division of North Atlantic Industries, Hauppauge, N.Y., has announced a QIC-150 drive. Delaying the introduction of drives based on the QIC-150

has been the 3M DC300XTD cartridge, which 3M began shipping to OEMs just this month.

QIC-120 was born because ¼-inch-drive manufacturers have been under substantial pressure from customers to increase backup capacity to keep pace with the growing capacity of Winchester disk drives, says Lee Elizer of Freeman Associates, a Santa Barbara, Calif., consulting and publishing company that follows the mass-storage market. Delays by 3M in getting out the DC300XTD increased the pressure.

Elizer calls the QIC-120 standard a good solution to the need for adding capacity while maintaining the standardization of QIC-24. "Users will lose nothing in upward migration," Elizer says. Key to the QIC-120, as with the QIC-24, is that users can read data, regardless of which manufacturer's drive a tape has been recorded on. That's important, analysts agree, as more and more customers use streamers not only to back up rigid disk drives, but also to distribute database information and store archival files.

**'It's a mess'**

Meanwhile, there seems to be little agreement at the hectic low end of the market over standards for smaller drives intended for use in personal computers. The primary reason is the growing number of participants. Last year there were only four main players: InterDyne Co., Milpitas, Calif.; Irwin Magnetic Systems Inc., Ann Arbor, Mich.; Memtec Corp., Salem, N.H.; and Teac Corp. of America, Montebello, Calif.

Now at least 10 companies intend to stake out a piece of the market. They offer, or plan to offer this year, both 5¼-inch and 3½-inch drives that will range in capacity from 10M bytes to 46M bytes (see "Who's doing what in 3½-inch tape drives," left.)

"There are three or four kinds of media, 17 different recording formats and 10 potential suppliers," laments analyst Molina. "It's a real mess."

To further confuse the issue, manufacturers are choosing different interface schemes. Irwin, which has more than 120,000 3½-inch tape drives on the market, attaches its 10M-byte and 20M-byte drives to existing controllers for flexible disk drives. The company

**WHO'S DOING WHAT IN 3½-INCH TAPE DRIVES**

Manufacturer	Media	Capacity (M bytes)	Interface	Rewind time (sec)	Price (\$)
Alloy Computer Products Inc.	DC2000	40	flexible	27	325
Archive Corp.	DC2000	39.98	flexible	36	350
Irwin Magnetics Inc.	DC1000	10.35	flexible	31	275
	DC1000	21.63	flexible	31	330
	DC2000	39.98	flexible	36	N/A
Interdyne Co.	Microreel	10.49	flexible	60	117
Mountain Computer Inc.	DC1000, DC2000	19.5	flexible	36	300
	DC2000	40	flexible	36	415
Tallgrass Technologies	DC2000	20.05	QIC to be defined	32	275
	DC2000	40.11	SCSI, QIC to be defined	32	400
3M Co., Magnetic Media Div.	DC2000	40.11	SCSI; QIC to be defined	27	400

uses 3M's 0.15-inch DC1000 tape cartridge. Other 3½-inch-drive manufacturers taking the same tack include Mountain Computer Inc., Scotts Valley, Calif., with its 40M-byte TD-4000, and Archive, with its newly introduced 40M-byte drives. Mountain supports both the DC1000 and DC2000 cartridge; Archive will use only the DC2000. Meanwhile, Memtec and Teac have SCSI and QIC-02 interfaces in their half-height 5¼-inch models but use the data cassette as media.

If there is to be any standardization at the low end, it's likely to be for 3½-inch, 40M-byte drives that use 3M's DC2000 cartridge, according to some analysts. At a QIC committee meeting earlier this year, members agreed on a format of 20 tracks and recording density of 10,000 flux reversals per inch, says Archive's Domshy. But there is still work to be done on the error-correcting algorithm.

Although Archive is the only manufacturer to announce such a 3½-inch drive under the proposed standard, others are believed to be considering it. They include Irwin, Mountain and Alloy Computer Products Inc., Framingham, Mass.

Whether there is a market now for a 3½-inch, 40M-byte tape drive for backup purposes is still unclear. Analysts point out that no Winchester manufacturer is producing 40M-byte, 3½-inch rigid disk drives in quantity. But tape-drive companies like Archive believe that such drives are inevitable, and that a 3½-inch form factor will supplant the 5¼-inch standard for many applications, especially for portable and desktop computers. "I'm convinced there is a real need for a 3½-inch, 40M-byte product in the OEM world," says marketing director Domshy.

By offering smaller tape drives, Archive and others say they can provide OEMs a "double buy" in one product. OEMs who aren't worried now about space can mount the smaller drives in a 5¼-inch bracket. And that's where most of them are expected to wind up in the near future. However, those OEMs planning portable, desktop or laptop computers will be able to use the same 3½-inch tape drives in the smaller systems. □

## IBM, DEC threaten Apollo and Sun in workstations

Lynn Haber, Associate Editor

The familiar turnkey, host-based systems commonly found in computer aided design/computer aided manufacturing installations are rapidly giving way to fast and affordable standalone workstations made possible by the advent of speedier 32-bit chips. According to research company International Data Corp. (IDC), Framingham, Mass., 42,000 of these workstations will be shipped in 1986—up from 19,000 last year.

Four companies lead the field, agree industry analysts: Apollo Computer Inc., Digital Equipment Corp., IBM Corp. and Sun Microsystems Inc. Apollo, with 40 percent of installed units, and Sun, with 31 percent, dominate. Indeed, DEC and IBM are very much the new kids on the workstation block: DEC with its VAXstation II/GPX and IBM with its RT PC, for RISC (reduced instruction set computer) Technology Personal Computer. But their influence, coupled with the anticipated growth in the technical-workstation market, is bound to reconfigure market shares.

Not that the market leaders are reacting passively: Apollo, for example, has just unveiled the second generation of its Domain workstations.

According to Vicki J. Brown, senior analyst at IDC, a technical workstation is defined by several features: a 32-bit CPU; a UNIX-based operating system; graphics capability; an ability to

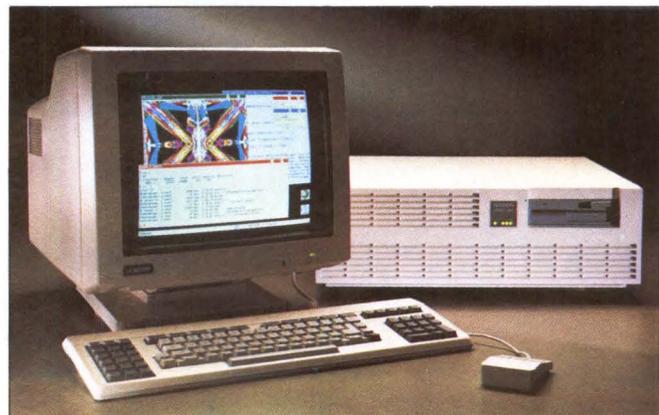
operate as a standalone unit; main memory ranging from 2M bytes to 16M bytes; rigid disk storage from 31M bytes to 380M bytes; and networking capability based upon Ethernet (the de facto industry standard), or the ability to offer gateway access to an Ethernet network.

While IBM calls the RT PC a technical workstation, Brown and other analysts say its technical limitations—a 16-bit bus that slows I/O performance, weak graphics and poor networking options—will restrict its acceptance as a serious scientific and engineering device. They don't expect it to have a significant impact on the technical-workstation market this year. Nevertheless, IBM's entrance, although a weak one, puts a strong stamp of authority on such products. "IBM's pioneering will create a market draft that will increase the sales of competitive products," contends IDC.

Industry observers say DEC, with its new VAXstation II/GPX, is the one to watch in 1986, and eventually they expect a head-to-head battle between DEC and IBM for dominance in the technical-workstation market. They also maintain that Apollo, of Chelmsford, Mass., and Sun, Mountain View, Calif., will remain in the field as formidable competition to the giants.

Apollo pioneered technical workstations in 1981 with the Domain system products. Apollo recently revamped the entire product line,

**Apollo's Domain Series 3000 workstation** combines a Motorola MC68020 CPU and an MC68881 floating-point coprocessor with an IBM PC/AT bus for fast, low-priced functionality.



replacing its first generation of products—the DN300, DN330, DN460, DN560, DN660 and DN660A—with the Series 3000 and DN570 and DN580. The new machines combine a Motorola Corp. MC68020 CPU with an MC68881 floating-point coprocessor to provide speed and superior graphics. The Series 3000 incorporates the PC/AT bus. IDC's Brown says Apollo's high-end DN570 and DN580 position the company as the leader in workstation computer graphics. Apollo also introduced the DSP 9000, a parallel processor and compute server, based upon the FX series of minisupercomputers from Alliant Computer Systems Corp., Acton, Mass.

Apollo's primary obstacle to greater popularity is the widely held perception that Domain cannot be easily connected to other systems. "System interconnectivity is extremely important to this marketplace and, unfortunately, Apollo, because of its proprietary Domain architecture, is not thought of as an open system."

Apollo is working hard to correct the connectivity issue. Last summer it launched what it called its open-architecture program with the introduction of products that allow interconnectivity to other vendors'

equipment, such as IBM PCs and DEC VAX minicomputers. The announcement included promises to support industry standards and, eventually, the International Standards Organization's Open Systems Interconnection model. More recently, Apollo introduced the Open System Toolkit, designed to let Apollo users add devices, build transparent connections to other vendors' files and define new types of files; and Etherbridge, a gateway that forms an Ethernet-based link between Domain network rings.

**Sun proves a shining star**

Gaining rapidly on Apollo is Sun Microsystems. It uses industry-standard components in its Sun-3 products and promotes connectivity to position itself against Apollo.

Perceived by many analysts as the price leader, Sun is catching up to Apollo fast, says IDC's Brown, particularly in market share. But Sun has its problems. For one thing, says Brown, it has a reputation of providing poor customer support. To counter that, Sun hired Robert Lux as vice president of customer support. He came from Apollo, where he was vice president of customer services.

Sandy Gant, an analyst with

InfoCorp, Cupertino, Calif., points out that Sun offers low-priced products, enabling the company to stay competitive in the low-end of the workstation market. "Sun seems to be staying fast on their feet," she says, "making changes, remaining open with information and making alliances where they're beneficial."

In the meantime, Sun is gaining substantial industry recognition for its Network File System (NFS), which permits users to transparently access files across a network supporting multiple vendors. According to Sun, NFS is machine- and operating-system-independent and enhances the usefulness of local area networks. The company says more than 20 computer manufacturers and software houses have committed to NFS and over 30 other companies are evaluating it. DEC announced support of NFS in January.

**DEC strengthens product base**

Industry analysts say that, with the introduction of the VAXstation II/GPX, DEC proved it was a serious contender in the technical-workstation market. The VAXstation II/GPX is based on the MicroVAX II chip and, in a severe departure from company tradition, is initially being offered with ULTRIX, instead of DEC's proprietary VMS operating system. VAXstation II/GPXes running VMS will be available this summer. ULTRIX is DEC's implementation of UNIX.

According to Brown, DEC's offer of a UNIX operating system before offering VMS shows that even DEC, with its large installed base of VAX computers in the engineering and workstation market, must bow to customers' demand for UNIX. (The same can be said of IBM and the RT PC, which uses the proprietary AIX—Advanced Interactive Executive—operating system, based on AT&T Co.'s UNIX System V.)

The VAXstation II/GPX also implements a VLSI graphics coprocessor. DEC currently offers only 2-D graphics capability and will have to provide users with 3-D to stay competitive, say analysts. But they contend that DEC will make 3-D available this year. □

**HOW THE LEADING COLOR WORKSTATIONS COMPARE**

Company Model	CPU	MIPS*	Memory (M bytes)	Storage (M bytes)	Price (\$)
<b>Apollo Computer Inc.</b>					
DN570	MC68020	1.3-2.0	2-16	69-308	29,900-48,000
DN580	MC68020	1.3-2.0	2-16		
<b>Digital Equipment Corp.</b>					
VAXstation II	proprietary	0.9-1	2-9	31-62	26,500-30,000
VAXstation 5XX	proprietary	0.9-1	2-9	31-102	40,700-73,100
VAXstation II/GPX	proprietary	0.9-1	2-9	71-213	35,000-53,800
<b>IBM Corp.</b>					
RT Model 20	proprietary	1-1.5	1-3	40-180	45,475**
RT Model 25	proprietary	1-1.5	2-4	70-210	46,675**
RT Model A25	proprietary	1-1.5	2-4	70-210	48,245**
<b>Sun Microsystems Inc.</b>					
Sun-3/75	MC68020	1.5-2	2-8	71	12,900-21,900
Sun-3/160C	MC68020	1.5-2	2-16	71-380	31,900-41,900

\*Vendor claims

\*\*Prices for the IBM RT PC 6151 Models 20, 25 and A25 include the 5085 Model 2 graphics display (19 inches; 1,024x1,024 pixels). The same configuration using the Model 1A graphics display (instead of the Model 2) costs \$5,000 less.

Source: International Data Corp. and Mini-Micro Systems

# U.S. government launches offensive in chip wars

**Stephen J. Shaw**  
Washington Editor

The following message was found on a carrying case for RAM chips at a local computer retailer: "Made in one or more of the following countries: Hong Kong, Korea, Japan, Malaysia, Singapore, Taiwan, Mexico, Mauritius, Thailand, Indonesia and the Philippines. The exact country of origin is unknown."

The economic forces behind this message cost the United States semiconductor industry last year approximately 54,000 jobs and tens of millions of dollars in financial losses, according to the Semiconductor Industry Association (SIA), a trade group based in Palo Alto, Calif. Fortunately, the damage has not gone unnoticed by the U.S. government. For once, the government has initiated action rather than merely respond to it, and is even looking ahead to prevent the same abuses from occurring to chip technology that has yet to reach the market.

Japan is seen as the prime culprit in these chip wars. At recent hearings before a Senate subcommittee on labor and employment, Michael Maibach, governmental affairs manager for chip manufacturer Intel Corp., testified that unfair Japanese trade practices,

along with the high cost of U.S. capital for investments, are responsible for the decline of the U.S. semiconductor industry.

In December, the U.S. government opened an investigation into whether Japanese semiconductor manufacturers are engaged in unfair trading practices. Specifically, the Department of Commerce is examining whether the Japanese chip suppliers are dumping—i.e., selling in the United States at prices lower than in Japan—256K-byte dynamic RAMs (DRAMs). As part of the investigation, the International Trade Commission (ITC) is looking into whether the U.S. semiconductor industry has been injured by Japanese DRAM imports.

The investigation has set several precedents in U.S. trade policy. First, Commerce initiated the action. Until now, the department investigated trade complaints only in response to formal petitions from the affected industries. Second, the mandate for the investigation includes possible penalties on 1M-byte DRAMs, marking the first time Commerce has attempted to anticipate technical advances in its trade investigations.

Both the United States and Japan have signed the anti-dumping provisions in the General Agreements on

Trade and Tariffs (GATT), a multilateral body of regulations governing international trade practices. GATT provides for the identification of unfair trade practices and the imposition of tariff penalties to redress those practices. Some countries have questioned whether U.S. trade laws governing U.S. response to dumping are consistent with GATT. Nonetheless, "the Commerce investigation is perfectly GATT-legal," asserts a department official, who asked not to be identified.

The Department of Commerce has accused Japanese chip producers of capturing more than 75 percent of the U.S. market for 256K-byte DRAMs through extensive dumping of their chips in the United States. Trade officials say that all 256K-byte DRAMs sold in this country cost upwards of \$20 apiece in 1984. At the end of 1985 the price had fallen to under \$2, and annual imports had doubled to 25 million chips. The alleged chip dumping has cost the U.S. industry approximately \$900 million in lost revenues, the agency estimates.

If the government investigation confirms that Japanese manufacturers are dumping 256K-byte DRAMs on the U.S. market, explains Melissa Skinner, a trade economist with Commerce's Office of Import Trade Administration (ITA), then tariff surcharges will be imposed not only on 256K-byte but also on 1M-byte DRAMs. The surcharges will be based on the margin of dumping, established by the difference

## Ammunition for DRAM wars is filed in court

Dynamic RAM (DRAM) manufacturer Texas Instruments Inc. (TI), Dallas, waded into the chip wars in late January by filing a lawsuit in federal district court against eight Japanese companies and one Korean semiconductor manufacturer. The suit alleges that the foreign suppliers violated TI patents for 64K-byte and 256K-byte DRAM production.

The 10 patents in question cover production techniques of DRAM systems architecture, matrix decoding and packaging techniques, explains a TI spokesman. Included among the companies that TI claims have utilized its patents without prior licensing are Fujitsu Ltd., Hitachi Ltd., OKI Electric Corp. and To-

shiba Corp. in Japan, and Korea's Samsung Semiconductors and Telecommunications Co. Ltd.

The manufacturers have refused overtures from TI to sign licensing agreements, according to the spokesman. "They're using our patents to make all of their chips," he complained. "The issue here is what we have to do to protect our intellectual property."

If the case is not settled, and the court agrees with TI that its patents are being infringed, the DRAMs in question from those manufacturers could be blocked completely from the United States. The International Trade Commission has recently decided to open an investigation into the alleged violations.

between the price of Japanese chips in the United States and in Japan.

"If we impose the penalties, they would automatically be applied to the future chip generation," explains Skinner. "For the first time we are considering DRAMs as a single class of product."

ITC's preliminary finding in the case late in January stated that there was "reasonable indication" that the U.S. semiconductor industry is injured or threatened with injury by imports of 256K-byte DRAMs allegedly being sold at less than fair value.

Following ITC's finding, Commerce's Import Trade Administration began sending questionnaires to the Japanese chip manufacturers to determine production costs and home-market sales prices. The five Japanese companies under investigation are Fujitsu Ltd., Hitachi Ltd., Matsushita Ltd., Nippan Electric Corp. (NEC) and Toshiba Corp. According to an ITA official, these five represent approximately 85 percent of all Japanese DRAM imports into the United States.

Under statutory requirements, the chip investigation must be completed by early August.

The Department of Commerce has just recently issued a preliminary ruling that eight Japanese companies are dumping erasable programmable read-only memories (EPROMs) on the U.S. market. The offenders, which include Fujitsu, Hitachi, NEC and Toshiba, will be required to post a cash bond with the U.S. Customs Service, equal to the dumping margin, before their EPROMs can be imported into the United States (See "Breakpoints," see Page 12).

The SIA has been waging a crusade against Japanese chip makers since last June. In a petition filed with the U.S. Trade Representative, SIA accused the Japanese of blocking American access to Japan's DRAM-semiconductor market. The arguments on both sides are well-known. SIA contends that the U.S. share of the Japanese market has remained relatively constant at approximately 10 percent since the early 1970s, when the Japanese government supposedly dropped formal chip-import barriers. SIA points to the perfor-

mance of both nation's industries in the European market, where U.S. semiconductor manufacturers outsell their Japanese counterparts by a 5-to-1 margin, as evidence that the Japanese are continuing to restrict U.S. imports.

The Electronic Industries Association of Japan replies that the U.S. market share in Japan is almost double what SIA estimates. The association also says that U.S. chip exports to Japan increased 432 percent between 1975 and 1984.

Not everyone in the U.S. computer industry is pleased with such government and industry aggressiveness.

"I'm worried that the United States will end up shooting itself in the foot," comments Charlotte LeGates, public affairs representative with the Computer and Business Equipment Manufacturers' Association, an industry trade group in Washington. If the Department of Commerce levies tariff surcharges on imported Japanese chips, the Japanese may retaliate with higher import duties on U.S. equipment, she explains.

"The problem of correcting unfair trade practices with higher tariffs is that the cure may be worse than the disease," she adds. □

## Software-project tools win trans-Atlantic support

Keith Jones, European Editor

Not only considered to have reached the market two years ahead of its competition, Istar, a project-support environment just introduced by Imperial Software Technology Ltd. (IST) of London, has also received key endorsements from the Ada marketplace in both the United States and Europe.

Ada-compiler vendors Gould Inc., Fort Lauderdale, Fla., and Alsys SA., La Celle Saint-Cloud, France, are promoting Istar as a complement to their own products and recommending it to customers worldwide for large software-development projects. Istar runs on any system that hosts UNIX System V.

Both portable and language-independent, Istar is the first commercially available, integrated support environment on either side of the Atlantic and is aimed by IST at system integrators and large end users. Valerie Rice, a senior industry analyst with the Palo Alto, Calif., office of International Data Corp., Framingham, Mass., says she knows of no product comparable to Istar from a U.S. vendor. She believes that its portability across computers running UNIX System V and its language independence will be key attractions for U.S. buyers.

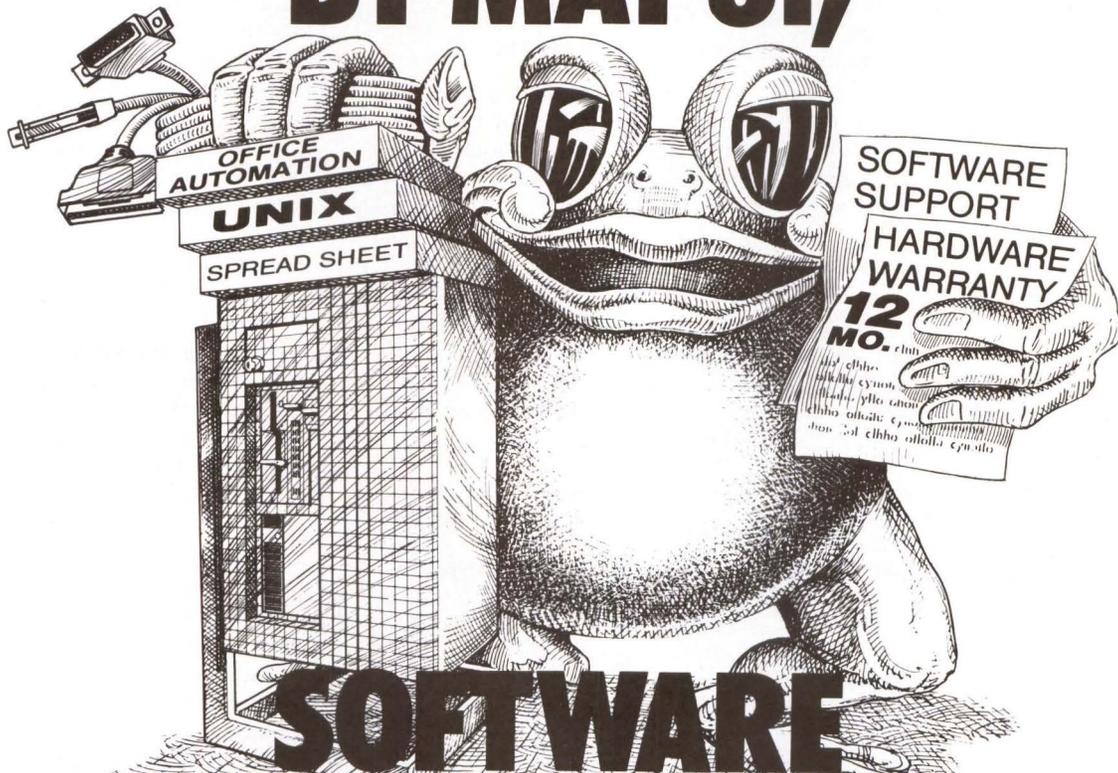
With such a headstart, IST can expect to capture a significant portion of

the market for system-building tools. Research concern Frost & Sullivan Inc., New York, predicts sales of system-building tools will reach \$1 billion a year in Europe alone by 1989.

Philip Martin, UNIX systems marketing manager for Gould Electronics Ltd. in Sutton, England, has evaluated Istar and believes it will have no competition from other portable, language-independent, project-support environments for at least two years. Although some European computer makers are working on support environments expected to be introduced this year, they are designing them specifically for their companies' own machines.

In contrast, Alsys promotes Istar as a support environment for its Ada compilers on workstations from Sun Microsystems Inc. of Mountain View, Calif. And Martin says Gould will recommend Istar not only to customers worldwide whose projects involve Ada, but also to those writing in other languages, notably C and FORTRAN. IST says Istar can also support languages such as COBOL and Pascal. John Barnes, managing director of Alsys' British subsidiary, Alsys Ltd., Henley-on-Thames, says that Alsys selected Istar as a support environment for its Ada compilers rather than wait for environments being developed specifically for Ada because Istar is avail-

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able now. "We also know and trust the designers of Istar," adds Barnes.

The Ada market is characterized by large-scale, long-term development projects, for which Istar is said to be particularly suited. However, that degree of software sophistication is also a temporary bane to IST. Martin believes that Istar's complexity demands that the product be installed and supported by IST itself. And, at the moment, Istar has no representation in the United States, where numerous major Ada development projects have recently been announced.

"Because of the cost of educating the market about Istar," explains IST marketing director James Stoddart, "we will focus initially on big organizations, notably defense contractors." Stoddart says IST requires agreements worth at least \$500,000 to justify IST's

support of the product, and adds that IST plans some form of joint venture this year with a U.S. software house to support Istar in the United States. IST's strategy in Europe is to market Istar through hardware manufacturers via OEM agreements.

#### Istar provides a tool kit

Istar's roots lie in a joint-development project with common carrier British Telecommunications Plc., London, which uses the system to develop complex, real-time telecommunications switching software. Istar comprises a framework built around UNIX System V in layers. The kernel is a contract database holding details of each software-development contract broken down into subtasks, such as project specification and scheduling, acceptance criteria-checking and prog-

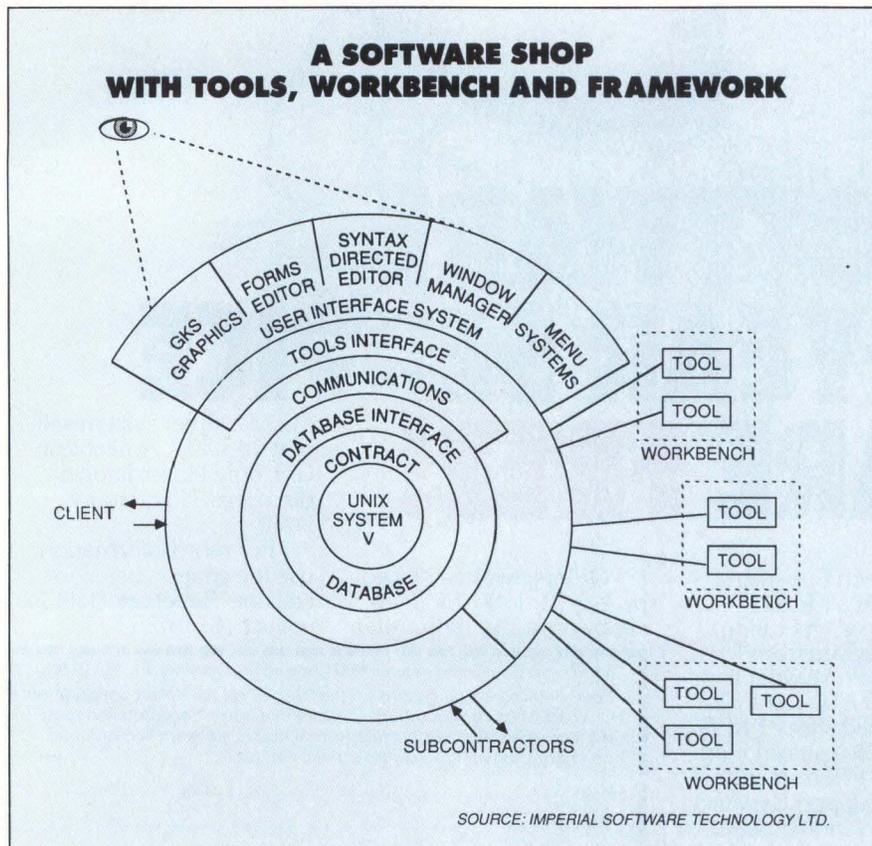
ress reporting. Surrounding the contract database is an interface to software that handles communications over local or wide area networks with other participants in a project, such as the client and subcontractors, who could have Istar running on their own machines.

The contract database also interfaces with the Istar tools. Those tools include a user-interface system that is linked to users' terminals to provide facilities for specifying, creating and managing screen features that might assist in programming and project management—such as menus, windows and forms. Istar also provides an interface to support terminals compatible with the graphical kernel system (a graphics set of standards supported by ANSI and the International Standards Organization) for project-management tasks that benefit from diagrams. It also includes an editor for checking the syntax of the language being written at the terminal.

The tools interface also provides users with a collection of programming workbenches for each language supported by the system. Those workbench facilities can provide estimations of program magnitude and the man-years required for completion; quality-assurance tools; and resource allocation for people and equipment.

#### Hardware makers respond

European computer manufacturers are also eyeing the market for integrated project-support environments. Unlike Istar, however, their products are anticipated to be machine-specific. Groupe Bull, ICL Plc., Nixdorf Computer AG, Olivetti SpA and Siemens AG are expected to launch commercial products for their own computers this year that will be based on the UNIX System V-compatible Portable Common Tool Environment (PCTE). PCTE was developed jointly by those manufacturers under Europe's strategic program for research, ESPRIT. Groupe Bull is preparing to unveil Emeraude, a support environment based on PCTE for its SPS-7 line of minicomputers. PCTE supports programming in C, Pascal, Prolog and LISP, and will support Ada in a year's time. □



**Istar comprises** a framework and programming workbenches that all run on the same machine under UNIX System V. Details of each project are held in a contract database surrounding the UNIX. The framework communicates with other Istar systems on local or remote computers, and each workbench can have tools to support a specific language, such as Ada, C, COBOL, FORTRAN or Pascal.

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## Rigid-disk drive cards: Is there a deal for OEMs?

**Mike Seither**  
Associate Western Editor

It hasn't been a hard act to follow at all. In the last few months the number of vendors mimicking Plus Development Corp. in mounting 3½-inch Winchester disk drives on expansion cards for personal computers has mushroomed. Now, with a price war in full swing, OEMs and system integrators may find the devices not only useful but also affordable.

The rush was triggered last summer when Plus, of Milpitas, Calif., brought out its Hardcard, a 10M-byte rigid disk drive that plugs into an expansion slot in an IBM Corp. PC or compatible.

The result of a quiet, two-year, multimillion-dollar development project, the Hardcard caught on quickly. In the first three weeks of production, Plus claims, it shipped 5,000 of the drives, which come complete with controller electronics and software for installation and file management.

"A lot of people smacked themselves on the head and wondered why they hadn't thought of it," says Allen Taylor, marketing director of CMS, a Santa Ana, Calif., disk-drive manufacturer. At last count, eight companies, including CMS, had announced similar products (see table, right). Many now claim to be shipping such drives in volume.

Like Plus, the competition is aiming the drive cards at the retail market. Because the devices are designed for self-installation, and because the markup on them is relatively low, retail distribution seems a sensible way to get them into the hands of non-technical users, says William Frank, an analyst with InfoCorp, a Cupertino, Calif., market research firm. Nevertheless, manufacturers are beginning to address the market for OEMs and system integrators.

Microscience International Corp., Mountain View, Calif., manufactures drive cards for other companies that, in turn, sell them under their labels. At

the same time, Microscience is moving its EasyCard through distributors to grab a piece of the retail action for itself, according to company marketing director Ron Schlitzkus.

Tandon Corp., Irvine, Calif., geared up production earlier this year for a drive card that initially will appear on store shelves with Tandon's name on it. "If OEMs express an interest in this kind of device, we certainly would consider building it for them as well," says Mike Sanders of Tandon's marketing department. The same goes for CMS, which says OEMs have asked about selling its DrivePlus card under their names.

Another market for the new drives may be system integrators who want to "do a quick hit on their installed base or upgrade a new product without it becoming a major production," says Bob Katzive, vice president of Disk/Trend Inc., a Los Altos, Calif., research company that follows the disk-drive business.

### Prices come tumbling down

Already the number of players in the fledgling business is putting pressure on prices. When it had the market to itself, the Plus Hardcard sold for

\$1,095. But Plus cut its price to \$895 in February. Plus marketing director Don Huizingh concedes that the lower price is an acknowledgment of the sudden spate of competitors. Further price erosion seems inevitable: InfoCorp's Frank believes most of the devices will be selling for \$500 by the end of the year.

Part of the heat Plus is feeling has to do with capacity. Most of the new entrants have introduced 20M-byte drives that are priced comparably with Plus' 10M-byte Hardcard. And the 20M-byte products seem to have a lot of appeal. Mountain Computer Inc., Scotts Valley, Calif., markets both 10M-byte and 20M-byte versions of its DriveCard. But Mountain officials say the 20M-byte drive, which has an average access time of 85 msec (\$1,195), has "overwhelmingly outsold" the 10M-byte device (\$1,095). Mountain claims it is shipping about 5,000 drives a month.

Meanwhile, Plus' parent company, Quantum Corp., also of Milpitas, has brought suit against both Mountain and NEC Corp., Boxborough, Mass. The suit claims that the 20M-byte drive, which Mountain buys from NEC, infringes on a patent for wedge-servo disk architecture held by Quantum. NEC, by contract, must indemnify Mountain for any loss due to an infringement judgment, according to Mountain president James Sedin. In

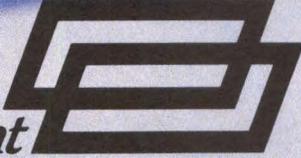
### WHO'S GOT THE CARDS IN RIGID DISK DRIVES

Manufacturer	Product	Capacity (M bytes)	Average access time (msec)	Price (\$)	Power requirements (watts)
AK Associates	HC2045	20	45	995	9
CMS	DrivePlus	20	65	595	13
Maynard Electronics	Onboard	10;20	60;85	975;1,195	4.5-6
Microscience International Corp.	EasyCard	20	80	1,095	9
Mountain Computer Inc.	DriveCard	10;20	85;85	1,095;1,195	15;15
Plus Development Corp.	Hardcard	10	65	895	10.9
Systems Peripherals Consultants	Scorecard	20	68	895	13
Tandon Corp.	Diskard	21	80	995	11
Western Digital Corp.	FileCard	10	147	1,095	4.95

Source: Manufacturers

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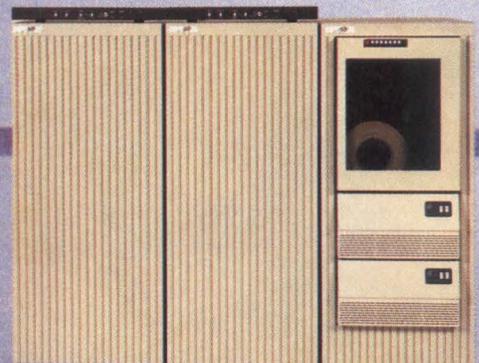
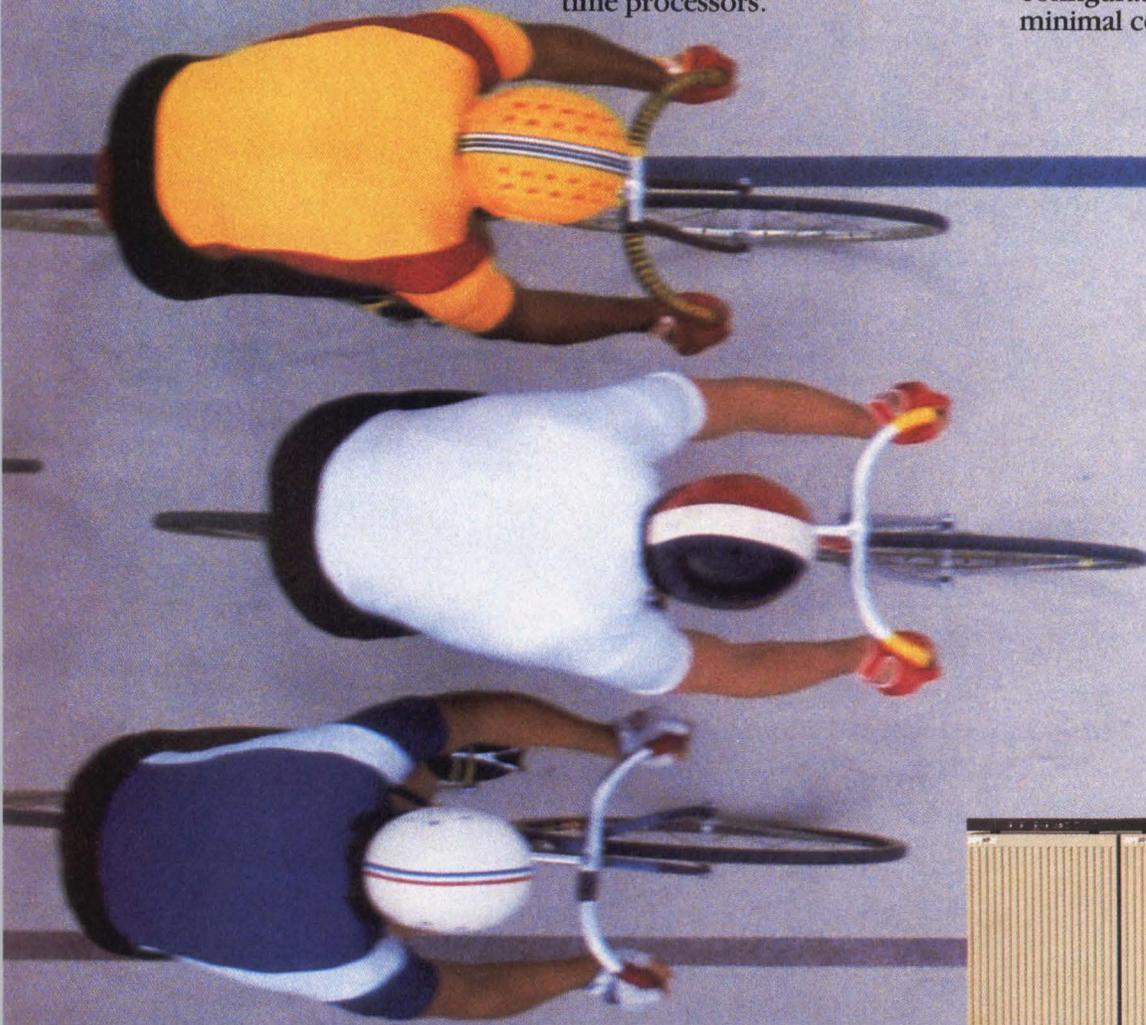
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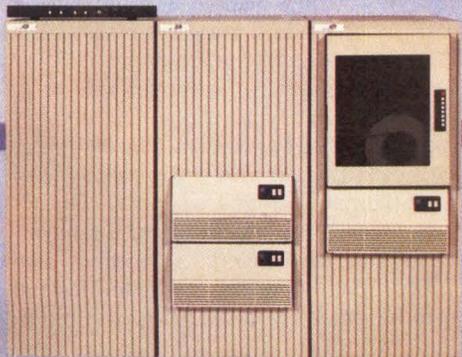
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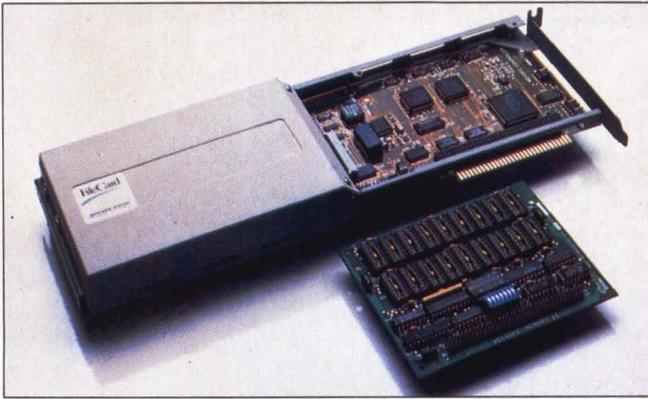
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**Up to 512K bytes of RAM** can be piggy-backed on Western Digital's 10M-byte FileCard.

any event, Mountain has alternative drive sources and plans to continue shipping its DriveCard, Sedin adds.

Other manufacturers also plan multiple product versions. CMS wants to eventually market three models of its 20M-byte Drive Plus. It has staked out its territory with an aggressively priced \$595 drive that uses the ST506 interface. CMS shipped evaluation units of that drive earlier in the year and has begun to get ready for production, says marketing director Taylor.

A ruggedized version of the same ST506 drive will cost \$695 and feature lifters to raise and lock the read/write head when the drive is not in use.

Seasoned drive manufacturers like Plus, Microscience, Tandon and Western Digital Corp. of Irvine, Calif., which makes the 10M-byte FileCard, aren't the only ones taking a hand. For example, Systems Peripherals Consultants of San Diego offers the \$895 Scorecard. This company has taken a different approach to product design. While other manufacturers mount the head-drive assembly and controller electronics on a single card, Systems Peripherals keeps them separate. The controller takes up a half slot, while a bracket suspends the drive itself above adjacent boards. The Scorecard package also includes a mounting bracket in the 5¼-inch form factor and extra cables. That way, if users decide they need the card-cage space for other boards, they can replace a flexible drive in the front panel with the Scorecard.

Another start-up is AK Associates of Manhattan Beach, Calif. President Keith Ullal says that AK's drives are manufactured overseas and will be

available in May. The company plans to sell a 20M-byte HC2045 drive for \$995. Plans call for the company to sell directly to Fortune 1000 businesses. Ullal believes AK can sell between 30,000 and 40,000 drive cards in its first 12 months of operation.

The wealth of vendors gives OEMs and system integrators a broad range of product specifications from which to

choose. Power requirements for the drive cards range from 5W to 15W, with average access time spanning 45 to 147 msec. Many of the new devices, unlike the Hardcard, are so much larger than the 1-inch width of IBM PC boards that the head-drive assembly hangs over half an adjacent slot. This means the drives plug into a single slot but effectively use up two.

Whether it's price, use of slot space or capacity, all these drives have "more similarities than differences," says InfoCorp's Frank, adding that each still has at least "one significant attribute that differentiates it from the others." But in the end, Frank believes, product reliability will ultimately separate the serious contenders from the amateurs.

For the moment, however, it's anyone's game. Says Taylor of CMS, "There are four million PCs out there without hard disk drives, all waiting for these products." □

## Ada continues push into mainstream computing

**Michael Tucker**, Associate Editor

Ada, the programming language for advanced computing designed to the specifications of the Department of Defense, is slowly moving into the commercial market. Long regarded as too big and complex for anything but the most demanding government applications, Ada is starting to catch on with producers of 32-bit microcomputers and 64-bit minisupercomputers—particularly those exploiting exotic parallel-processing architectures. Ada could also open the doors to value-added resellers as teachers.

In recent months, several vendors have introduced a horde of Ada workstations and programming environments. New entrants to the field include Convex Computer Corp., Richardson, Texas; Digital Equipment Corp., Maynard, Mass.; Flexible Computer Corp., Dallas, and Sequent Computer Systems, Beaverton, Ore.

Ada is an oddity among programming languages. Rather than the prod-

uct of some individual or group of programmers writing a language to deal with their own particular problems, Ada was designed to DOD specifications in a development project that ran from 1975 to 1979. The DOD was in search of a language that could be all things to all programmers. It was to be as modular as Pascal or Modula II, as scientifically oriented as FORTRAN, as capable of large database applications as COBOL, as useful in artificial-intelligence experiments as PROLOG or LISP and as portable as C.

The result was named after the woman who's been called the patron spirit of modern programming—Lady Augusta Ada Byron, countess of Lovelace (1815-1852). A remarkable individual, Ada Byron was simultaneously a noted mathematician, the daughter of poet Lord Byron and a colleague of mathematician and scientist, Charles Babbage. Her work with Babbage's "Difference Engine," sometimes considered the first true computer, led her to be called the first true programmer.

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Pictured above is Rory O'Reilly, current world record holder in the flying 500 Meter and flying 1000 Meter sprints.

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The problems with Ada as a language, however, have been that, while it was every bit as powerful as designed to be, "the Lady" was also astoundingly complex, virtually unknown outside the Defense community and so large that it simply wouldn't run on many machines smaller than full-blown mainframes. Indeed, even though the DOD mandated that Ada should be the language of choice for all Defense applications well before the end of the century, many observers thought the language would eventually fade away.

Despite such predictions, evidence that Ada is gaining acceptance in mainstream computing began to emerge last November at the Boston convention of SigAda—the Association of Computing Machinery's special interest group. Several computer vendors used the convention, which functions as Ada's de facto trade show, to reveal highly significant commitments to the language. DEC, for example, announced the Ada Programmer's VAXstation II, a modified MicroVAX II expressly for Ada projects. The Ada VAXstation II gives the programmer not only the

rather intimidating power of the MicroVAX and DEC's Ada compiler, but also networking under Ethernet and a host of tools, such as windowing and a graphics-based user interface.

Impressive as the Ada VAXstation II is as technology, it may be more important as an act of faith. While some vendors have chosen to believe that the DOD will eventually abandon Ada, DEC clearly feels the language is here to stay. And DEC is in a position to know. Its machines are ruggedized and remarketed for the military by Norden Systems Inc., Merrimack, N.H.

#### Ada regards the market

The real evidence of Ada's continued good health may be found in civilian circles. At SigAda, vendors with both military and commercial customers were unusually active—particularly those at the forward edge of computing. Makers of parallel-processing machines and "Crayettes," 32- and 64-bit machines that use vector and scalar processing to achieve supercomputer-like performance, were especially in evidence.

For example, Convex, maker of the C-1 Crayette, announced that it would be remarketing the Verdix Ada Development System (VADS) from Verdix Corp., Mclean, Va. VADS is a programming environment consisting of a Verdix Ada compiler, a debugger, a library of utilities and assorted other tools. "We think it's a pretty good marriage," says Bill Wallace, Convex's manager of software products. "You've got, on the one side, a proven Ada compiler and, on the other, our number-crunching computer technology." As a result, Convex has come increasingly to the attention of aerospace companies and related organizations that require both strong mathematical abilities and conformance with DOD specifications.

At almost the same time, Flexible, makers of the parallel-processing Flex/32, and Sequent, which markets the Balance 8000, another parallel machine, announced that they too would be remarketing VADS. Their reasons for endorsing Ada are fairly obvious—like Convex, they sell into a research community that is heavily influenced

### And now, appearing on the PC...

Traditionally, Ada has been regarded as a mainframe language. It is so big and so complex that few minicomputers, much less microcomputers, could really use it. This meant that Ada was virtually unavailable to all but the largest developers.

Now, that's changing. The introduction of 32-bit microprocessors has made it possible to put Ada directly on the desktop. The IBM Corp. PC/AT and compatibles could make Ada available to quite small software houses—or even individual programmers. Companies supplying desktop Ada include:

- RR Software Inc., Madison, Wis., which offers what is arguably the smallest Ada on the market. The company's Janus/Ada, a "partial implementation" of the language, runs quite successfully on the IBM PC and other Intel Corp. 8088-based machines. Though the compiler is partial, and therefore isn't validated—that is, hasn't passed the suite of tests with which the Department of Defense distinguishes true Adas from those that merely come close—it's available now and is finding customers both in the DOD and commercial worlds. In fact, at \$99.95, Janus/Ada also may be the cheapest Ada in existence.

- Alsys Inc., Waltham, Mass., which showed an Ada compiler for the IBM PC/AT at the 1985 SigAda show. The company plans to put it on the market

early in 1986. Alsys is the American branch of Alsys S.A., La Celle Saint-Cloud, France, the company founded by Dr. Jean Ichbiah, who headed the design team that originally developed Ada between 1975 and 1979. The company views its PC/AT compiler as a kind of loss-leader, an attempt to popularize the language by getting it into as many hands as possible.

- General Systems Corp., Ansonia, Conn., which is taking a combined hardware/software approach to a PC-Ada. The company remarkets the Trump Card, a single-board, 32-bit computer from Sweet Micro Systems, Cranston, R.I., equipped with an Ada compiler. Buyers can simply plug the modified Trump into an IBM PC expansion slot and have both Ada and a 32-bit system. General Systems plans to have the product on the market sometime in the first quarter of 1986.

- General Transformation Corp., Berkeley, Calif., which offers Ada compilers for the IBM PC and PC/XT. The company says its compilers are among the fastest of desktop Adas, with compilation speeds of 1,000 lines per minute (lpm) on the PC/XT and 2,000 lpm on the PC/AT. The company expects its products to be on the market sometime in the first quarter of this year.

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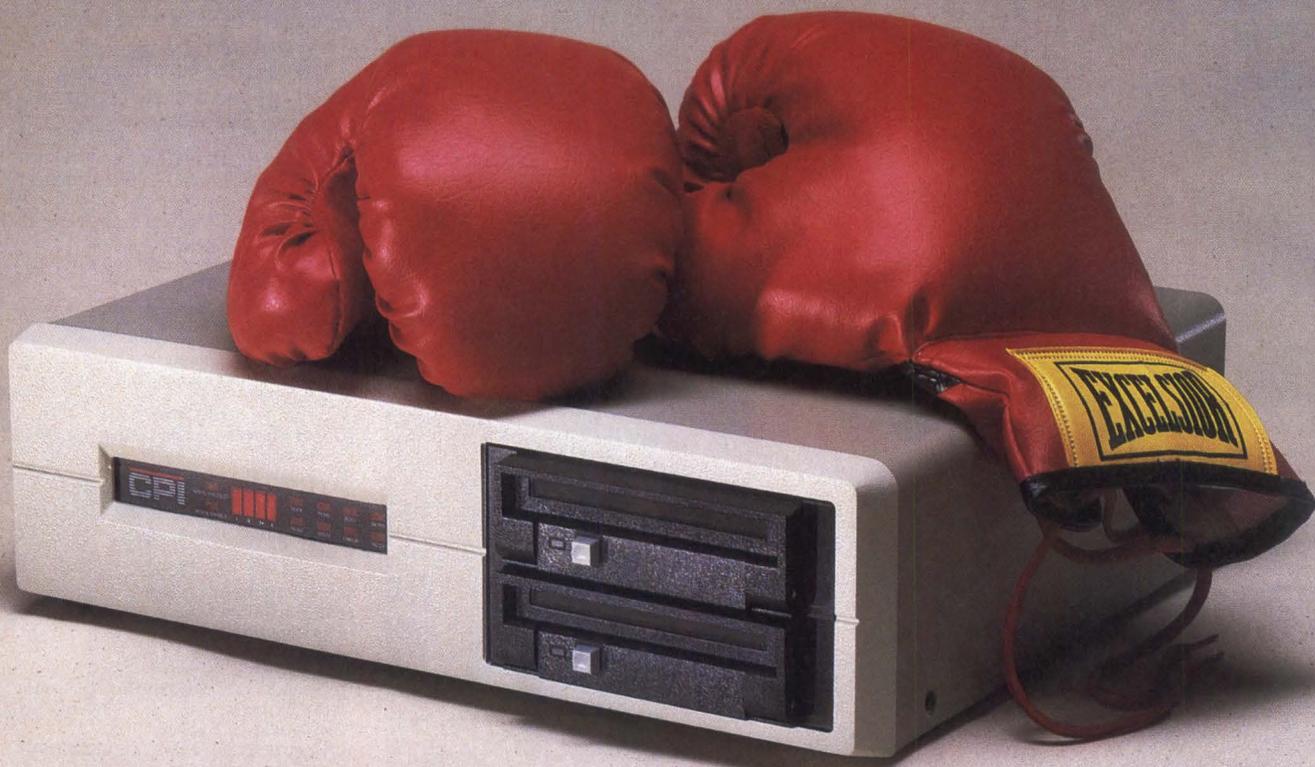


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# EXCELSIOR CHALLENGES BERNOULLI



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Fixed Hard Disk Capability	Yes	No
256K RAM Cache Controller	Yes	No
Complete System LED Display	Yes	No
Fixed/Removable Systems	Yes	No
System Write Protect Switch	Yes	No
Hard Disk Capacity	to 360mb	N/A
Shared Backup for 4-8 users	Yes	No

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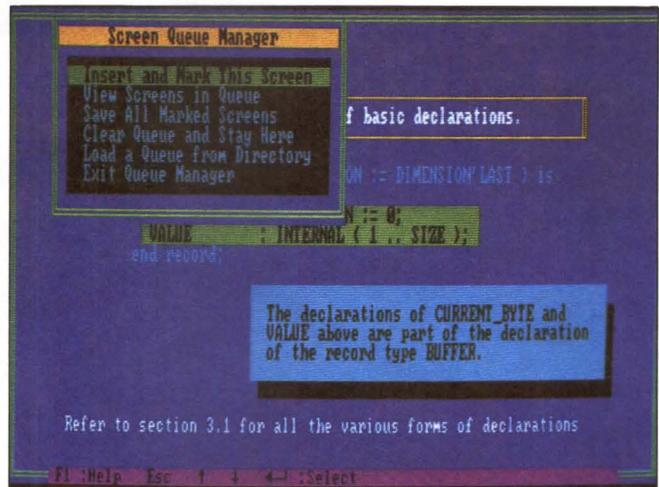
But the Flexible-Sequent-Vertex announcements could have an effect greater than the sum of their parts. Ada, unlike just about every other programming language in use today, assumes parallel processing as a basic principle. Where it might be argued that DEC and Convex will profit from Ada for mostly marketing reasons, Flexible and Sequent could benefit for technical reasons as well. It's simply easier to exploit their machines with Ada. The Ada market may, therefore, grow along with the parallel-processing market.

The common denominator in all of this is that these are tools. Convex, DEC, Flexible and Sequent have entered the Ada business as suppliers. They're marketing programmers' development environments, not end-user Ada products, and Ada remains little known among programmers. Therefore, one of the quickest and easiest ways a VAR could exploit Ada would be to become an educator. The territory is unknown, but it's also virtually unpeopled.

Several companies aim to profit by changing that fact. For example, the president of Alsys Inc., Dr. Jean Ichbiah, is the man who headed the design team that first developed Ada. As one would expect, Alsys, of Waltham, Mass., sells a line of Ada compilers, but the company's real focus has been training. It markets an entire line of tutorials, film clips and so on, specifically for would-be Ada programmers. It's also working on an Ada compiler for the IBM Corp. PC/AT to be released sometime in the first quarter of this year. "We call it the compiler for the masses," says Chuck Patrick, Alsys' executive vice president. "We're trying to get Ada to the people who can make the language happen on a very large scale."

Meanwhile, Tachyon Corp. of San Diego, offers an entirely IBM PC-based training product, "CATalyst." Described by the company as an "on-line Ada encyclopedia," CATalyst provides a tutorial for novice users and a reference manual for more experienced users. Programmers could, for example, develop an Ada application on a mainframe and simultaneously

**CATalyst from Tachyon** is an entirely IBM PC-based Ada training product. An "on-line Ada encyclopedia," CATalyst provides a tutorial for novice users and a reference manual for more experienced users.



run CATalyst on the PC—also being used as a terminal. CATalyst is set up to allow users to rapidly switch back and forth between their coding and their reference.

Many longtime software analysts will find these characteristics of the Ada market disturbingly familiar. In many ways, Ada is in much the same

position that UNIX was perhaps 10 years ago—when that software too was just beginning to appear in the commercial market, primarily on very advanced machines, and VARs found their biggest opportunities in training. It may be, then, that Ada will follow a similar course into mainstream, commercial computing. □

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## HEARD ON THE HILL

## Capitol computer lobby reflects diverse interests

**Stephen J. Shaw**  
Washington Editor

The emergence of a computer lobby in Washington is a relatively recent phenomenon. In the mid- to late-1970s, the industry was too small and unfocused, by Washington standards, to support much lobbying. As the nation's economy continued its shift from smokestack to information industries, however, the computer and other high-technology industries garnered increased attention from Capitol Hill and the federal bureaucracy. That attention, coupled with growing political sophistication within computer companies, has given rise to industry efforts to listen to, and try to shape, what is happening along the Potomac River.

In trying to describe the Washington computer lobby, several observers pointed to what it is not. Comparisons were made to the banking and steel industries, both with strong, well-established lobbying forces in Washington. Both are characterized by a relatively small number of large companies with a clearly identifiable set of interests.

In sharp contrast, the computer industry comprises a handful of big companies that have been in business for decades and a huge number of start-up organizations. Because of its diverse makeup, the industry has not developed the broad-based political unity that distinguishes other industries' lobbying efforts.

"There's a lot of internal squabbles," remarks Roger Majak, Washington representative for government and public affairs for Tektronix Inc. and a former staff director for the House subcommittee on international trade and economic policy.

Some semblance of industrial unity has occurred, however, in response to specific political and public-policy issues. Working primarily through the computer-trade associations, the industry was successful last year in loos-

ening export controls on personal computers in the Export Administration Act. It also has obtained Congressional approval for industry-inspired legislation on computer-security and crime issues.

### Few go it alone

Despite the computer industry's heritage as a divergent collection of independent interests, one rarely encounters single companies trying to peddle influence, or shape events to their liking, within the confines of the District of Columbia. Even IBM Corp.'s 43-member Washington office is primarily a sales operation. AT&T Co.'s famed legion of pin-striped lobbyists that once overran House and Senate office buildings has largely given way to proposal-toting representatives there to sell computer and communications systems, not to influence legislation.

It's not that these and other computer-industry companies do not engage in influence peddling. Far from it. In fact, far more people are paying far more attention than ever to events on Capitol Hill.

The difference is that most of the computer companies are team players now. Rather than go it alone, the companies are pushing their interests through the dozens of trade associations, formal and informal coalitions and ad hoc groups that have sprung up recently.

"The computer companies are not moving in on issues on their own," comments Ted Heydinger, vice president for government relations for the Computer and Business Equipment Manufacturers' Association. "They're very anxious to see a consensus built around particular issues."

In at least one instance, such cooperation was required by the House subcommittee on international trade and economic policy. The subcommittee was the focus of industry attempts to have favorable trade legislation passed. Tektronix's Majak, then still

subcommittee staff director, remembers that, when the Export Administration Act was under consideration, word was passed to the high-tech companies that the panel would not talk with individual companies. "We and the executive branch insisted that they work primarily through associations in order for us to determine what was truly in the industry's interest," Majak says.

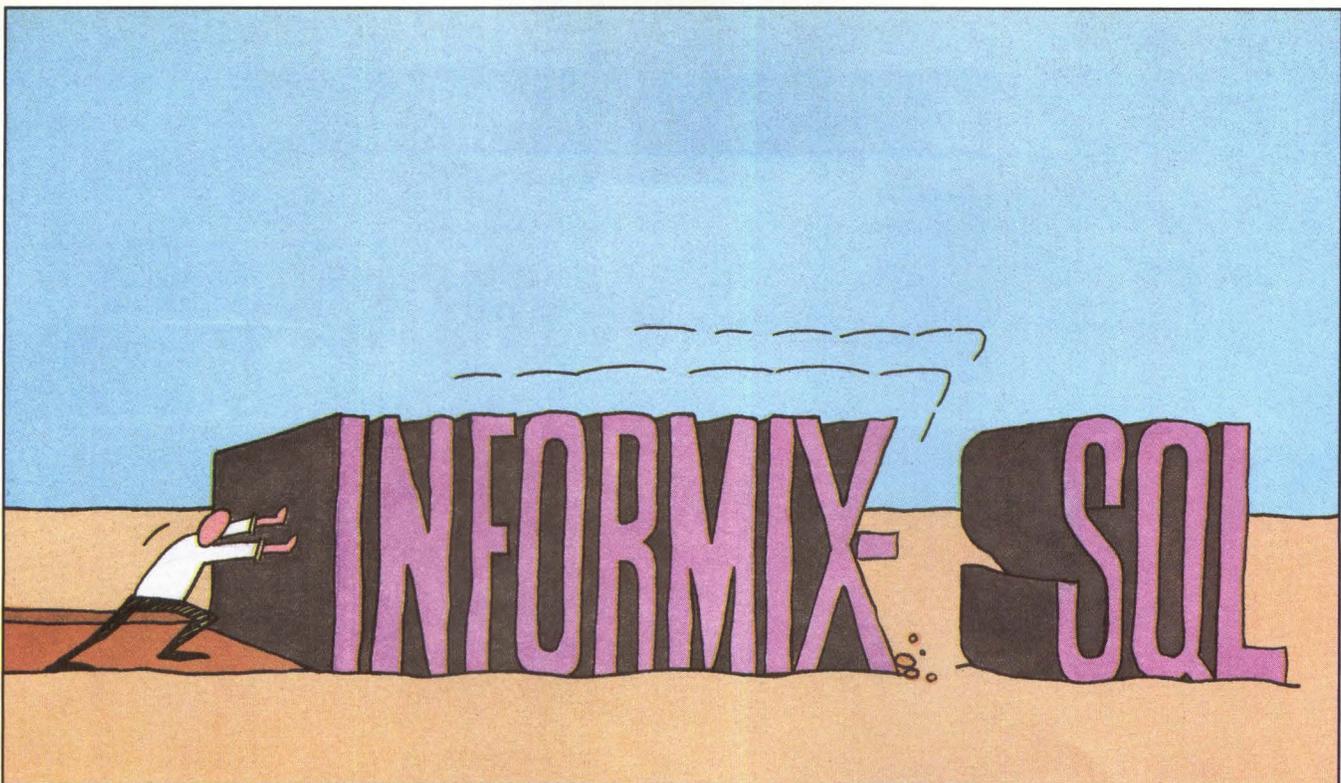
In other areas, coalitions of several trade associations and individual companies have been formed on single-issue concerns. Most recently, for example, the Coalition for the Advancement of Industrial Technology was established to concentrate on research-and-development-tax issues, while the Coalition for Office Technology concentrates on fighting laws restricting use of video-display terminals.

Another marked difference between the Washington computer lobby and those of more well-established industries is the lack of big-name public-relations outfits or law firms. Partly due to the relative adolescence of the industry and partly due to the lack of widespread expertise among public-relations and law firms, these organizations are only rarely utilized on computer issues—and then only in fairly narrow areas.

"We use outside law firms to handle filings at the Federal Communications Commission, for instance, and for other specific tasks," comments Olga Grkavac, senior director of government relations at the Association of Data Processing Service Organizations. "Otherwise, we prefer to work ourselves or work through coalitions with other trade groups on particular issues."

As the computer industry becomes an even larger national economic and political force, however, it's likely that independent lobbying organizations will enter the picture. Still, the current efforts, mounted largely by trade groups and ad hoc industry coalitions, represent a quantum leap in sophistication and political effectiveness over that seen only a few years ago.

"Sure, I still smoke cigars," says one company lobbyist, "but only when I go up to the Hill."



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CIRCLE NO. 16 ON INQUIRY CARD

## Neatness, low power drain propel flat-panel displays

**James F. Donohue**  
Managing Editor

Flat-panel displays are gradually becoming the screen of choice for computers and terminals when system integrators and OEMs want neatness and low power consumption. That means flat-panel displays will continue to be the screens on battery-powered portable computers, and you'll see more and more of them on desktop computers in the office.

"When you walk around an office today and you see all these kludgy arrangements [desktop computers with CRT displays] taking up all that space and room, you know they cannot be the answer," says Charles M. Apt, senior consultant at market researcher Arthur D. Little Inc., Cambridge, Mass.

But flat-panel displays won't replace CRT displays in most offices over the short term because CRTs have too much going for them, including easy readability and low price. Although their share of the non-television screen business is expected to decline in the years ahead, CRT screens will nevertheless hold a healthy 86 percent share of worldwide shipments in 1990, according to Joseph Castellano, president of Stanford Resources Inc., San Jose, Calif.

Apt of A.D. Little says that in 1989 manufacturers will ship to U.S. users 5.76 million flat-panel displays for use on desktop computers (up from 3.5 million in 1984), 1.8 million for use on computer terminals (up from 900,000 in 1984) and 225,000 for use on portable computers (up from 100,000 in 1984).

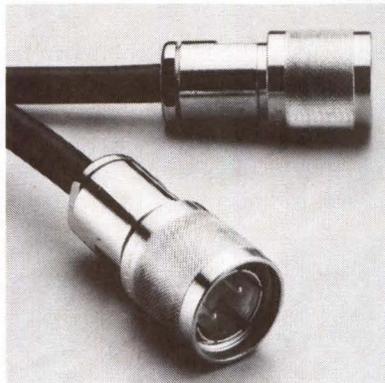
However, Apt conceded in a recent seminar sponsored by flat-panel display maker Epson America Inc., Torrance, Calif., that predicting shipments even two or three years ahead is chancy. In a study conducted in 1982, he said, A.D. Little forecast shipments of 130,000 units for 1984; actual shipments were 303,000. For 1985, the A.D. Little forecast said shipments

would total 785,000 units; actual shipments were a little more than 430,000. The forecasts covered products made with the three leading technologies employed in flat-panel displays: liquid

crystal display, electroluminescence and plasma.

The LCDs used on the early versions of battery-powered portable computers were considered by many users to

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be hard to read (see "Portables give LCDs a black eye," Page 46). But performance is improving fast and manufacturers are finding ways to overcome many major problems.

Epson America, for example, describes a material/technology under development that solves the problems of LCDs' slow refresh rate. (Electric-powered drivers charge LCD screens one line at a time, and the response time of the materials used in some LCDs has not been quick enough to prevent flickering on screens of 25 lines or more.) Toshiaki Saito, director of research and development with the Japanese consortium Suwa Seiko-Epson Group, says the developing ferroelectric smectic C (SmC) technology has a response time of 10 msec. That compares to 100 msec for one current technology, twisted nematic.

With SmC, says Saito, manufacturers can build flat-panel LCDs that take only 5 msec to refresh 500 lines. "The smectic display is the most promising candidate for sophisticated displays such as those used in information terminals," says Saito.

**Price will tell**

Most analysts say price will determine which flat-panel display technol-

### LCDs LEAD THE FLAT-PANEL PACK

Worldwide shipments of displays that can show 25 lines by 80 characters or more (\$ millions)

	1983	1984	1985	1986	1987	1988	1989	1990
Liquid crystal	0	2	19	47	89	114	149	192
Plasma (AC, DC)	15	18	22	25	30	35	42	50
Electroluminescent	0	3	6	12	20	30	35	40
Flat CRT	0	0	0	2	4	5	8	12
Light-emitting diode	0	0	0	0	0	1	2	3
Vacuum fluorescent	0	0	2	4	8	12	15	20
Electrophoretic	0	0	0	2	4	8	14	18
Others	0	0	0	0	0	1	2	4
<b>TOTAL</b>	<b>15</b>	<b>23</b>	<b>48</b>	<b>92</b>	<b>155</b>	<b>206</b>	<b>267</b>	<b>340</b>

*Source: Stanford Resources Inc.*

ogy will win out. Right now, LCDs seem to have the edge. User resistance to the first LCD-equipped portable computers gave a boost to the competing electroluminescent (EL) displays. LCDs use mirrors and reflected light;

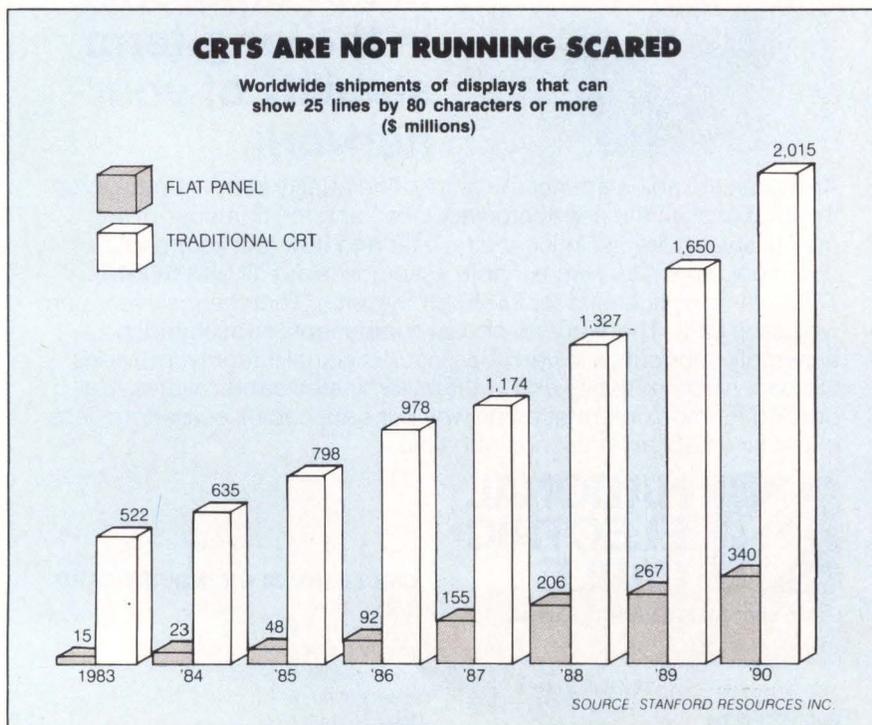
EL displays use charged electrons that emit light.

User dissatisfaction with LCDs "was a boon for our business," says James Hurd, president of Planar Systems Inc., Beaverton, Ore., a manufacturer of EL screens.

EL displays have two problems when they compete with LCDs. They require 13W to 15W to run a 3.8-inch-by-7.7-inch screen, according to consultant Apt (compared with 0.2W for a similar-sized LCD screen), and they're expensive. Apt puts the price of EL screens in OEM quantities at \$500 to \$600 each. That compares with \$150 to \$175 for OEM quantities of LCDs. Apt says CRTs in OEM quantities are priced from \$100 to \$125 each. Other sources say black-and-white CRTs carry a price as low as \$50 in OEM quantities.

Apt estimates the unit price of plasma screens in OEM quantities at \$450 to \$500.

Castellano of Stanford Resources says that, in choosing between flat-panel displays and CRTs, system integrators and OEMs are willing to pay for the "premium of flatness," but not a whole lot: maybe 50 percent to 100 percent over the price of a CRT. If



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CIRCLE NO. 17 ON INQUIRY CARD

# EMC just gave the most advanced superminis the most advanced supermemory.

EMC announces an extraordinary leap forward in memory board technology for the VAX™ 8650 and 8600 superminicomputers.

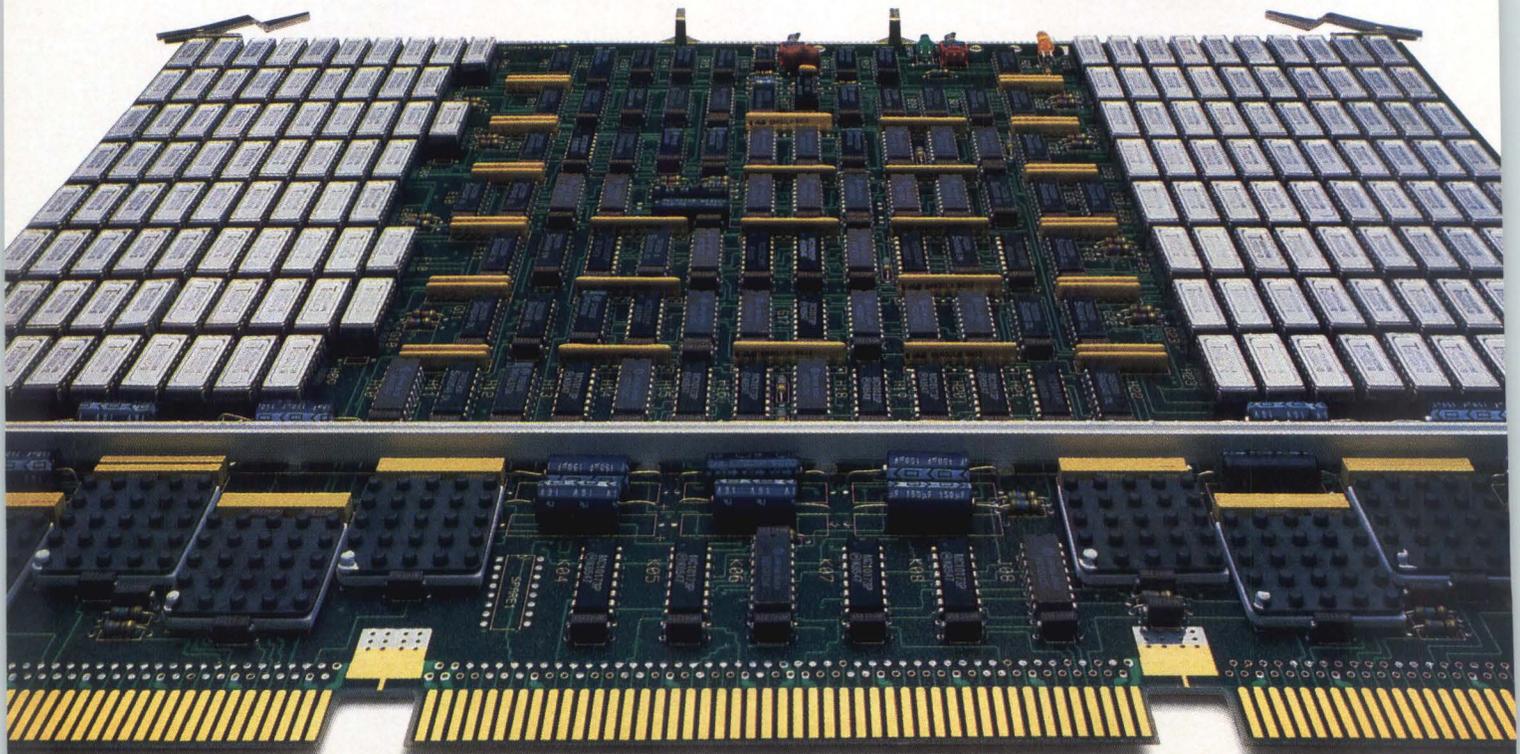
Supermemory: The first commercially available memory boards to utilize high-density Megabit chip technology.

No longer does your VAX system have to be

limited by DEC's 68MB memory capacity. Now you can give it as much memory as your current and future applications require—from 20MB all the way up to 128MB.

And do it with the most reliable memory ever manufactured.

For the first time, you can give your VAX sys-



tem enough speed and performance to rival most mainframes.

## Our 16MB supermemory design takes half the space of DEC™ add-in memory boards.

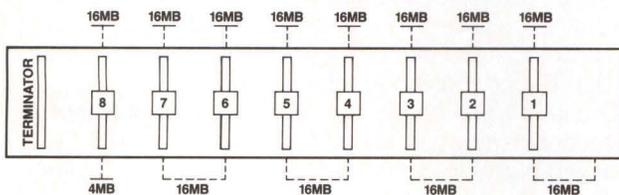
One of the big differences between EMC's new 16MB supermemory and DEC's 16MB memory is obvious at a glance.

DEC's board is twice as fat as ours.

That's because it's actually a cumbersome multiple board assembly.

What's more, DEC uses older 256K RAM technology and surface-mounted devices that require over 11,000 solder points. That's nearly *five times* as many board connections as you'll find on our new supermemory.

Each EMC 16MB supermemory board takes up only one slot.  
Maximum capacity 128MB.



Each DEC 16MB memory board takes up two slots.  
Maximum capacity 68MB.

As a result, DEC's multi-layered 16MB board takes up two full slots. While EMC's new 16MB supermemory board occupies just one.

By making full use of every available memory slot, our new supermemory virtually *doubles* your VAX system's main memory capacity.

And you'll protect your investment with EMC memory through generous trade-up credits. If you start with our 4MB cards and in the future want to upgrade to higher capacities, you never lose a cent of your initial investment.

You can configure our supermemory with any combination of EMC or DEC 4MB or 16MB memory boards into either an 8650 or 8600.

All, we might add, without affecting your DEC maintenance agreement in any way.

See us at DEXPO SOUTH, Booth #1126

## Super reliability plus the industry's only unconditional lifetime warranty.

Our new supermemory's greater density of RAM delivers the *highest reliability per bit or byte ever offered* by any manufacturer.

Every single EMC supermemory board undergoes a rigorous 100-hour test and burn-in procedure. Including 24 straight hours of CPU qualification under online conditions in our own VAX 8600 superminicomputer.

Because EMC memory boards are so reliable, there are *no maintenance charges* of any kind.

While with a DEC memory board, your maintenance charges over five years would amount to a stiff \$24,000 per card.

## Another super product from the world's largest independent supplier of add-in memory.

No other independent supplier offers you anywhere near the variety of different memory sizes for the VAX system family.

Not just for the 8650 and 8600, but for the 785, 780, 750, 730 and the MicroVAX™ II systems as well.

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or to order—just call us at the toll-free number below. Or write EMC Corporation, 12 Mercer Road, Natick, MA 01760.

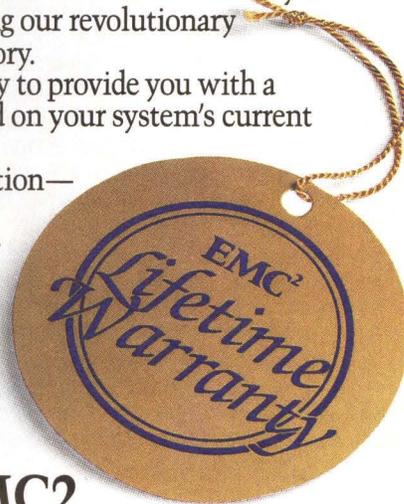
**For information or to order, call today:**

**1-800-222-EMC2**

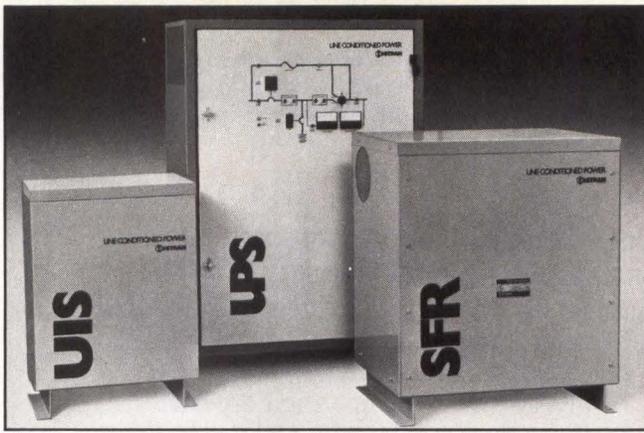
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\*"The Quality of US Commercial AC Power," Goldstein, M. and Speranza, P.D.; IEEE April 1982

CIRCLE NO. 19 ON INQUIRY CARD

that's so, then only LCDs are close.

Nevertheless, Castellano thinks flat-panel displays represent a growing product line in the computer industry, even though they will not be overnight sensations. "In five or six years," he says, "these things will be so common that students will be taking them to school. That's my vision of the future." □

### Portables give LCDs a black eye

Portable computers have been a big disappointment to makers of flat-panel displays. The failure of battery-powered portable computers to achieve the booming sales once predicted for them is a major factor in the less-than-anticipated shipments of the flat-panel displays intended for their screens.

"The idea behind the forecasts for portable computers," explains Charles M. Apt, senior consultant at Arthur D. Little Inc., Cambridge, Mass., "was that the executive, once he got a personal computer on his desk, would need one wherever he went. Well, maybe he did. But he didn't need it that badly."

Because liquid crystal displays require little power, that technology was most widely used on battery-powered portable computers. But users, accustomed to the brightness and good contrast of CRT screens, didn't take to LCDs, which used reflected light and, in some early versions of portable computers, offered poor contrast.

Computer publisher and distributor, Wayne Green, says LCD screens that were 40 characters wide were easy to read, "but at 80 characters it was hard to see anything."

"They put [LCD] technology into products, and people didn't like it," says David Matthews, national sales manager for Sharp Electronics Corp., a flat-panel display maker in Paramus, N.J.

Manufacturers of LCD screens are working on various ways to eliminate the readability problem. Stanley Electric Co. Ltd., Tokyo, is trying back-lighting on some LCD screens. Many portable computer makers, like Tandy Corp., Fort Worth, Texas, are getting more characters on the screen by adding lines (from eight lines on the model 100 to 16 on the model 200) instead of by using smaller characters.

Apt says the portable computer makers also are making up for past mistakes by building portable computers that are compatible with the rest of the computers in their product line. "A lot of these companies admit to me they were stupid not to be sure the portables were compatible from the beginning."

Apt implies that the portable makers thought their machines only had to serve the ego of the executive. "Now," he says, "they've learned that portables have to serve the purposes of the company, not just the purposes of the executive."

# Office software spans multiple operating systems

Mike Seither

Associate Western Editor

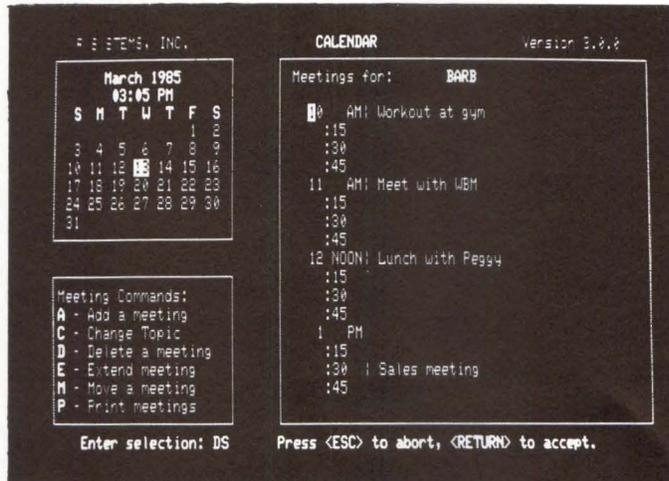
How can system integrators, value-added resellers and OEMs offer customers a single, office-automation software package when those same customers' offices are littered with different computer systems?

A growing number of software companies, such as Marc Software International Inc., Palo Alto, Calif., Quadratron Systems Inc., Sherman Oaks, Calif., R Systems Inc. of Dallas, and Syntactics Corp., Santa Clara, Calif., believe they have the answer. They offer office-productivity software that runs—often almost identically—on a variety of systems based on standard operating systems such as IBM Corp.'s PC-DOS, Microsoft Corp.'s MS-DOS and XENIX, and AT&T Co.'s UNIX. And in some cases these software vendors also make their products available for proprietary operating systems.

The pitch seems alluring for customers and suppliers alike. For a customer, such products can drastically cut training costs. For example, office personnel used to working on standalone MS-DOS-based personal computers would not have to relearn the system when the company upgrades to a multiuser system running UNIX.

For system integrators and resellers, these so-called "computer-independent" programs mean they don't have to be experts in a variety of software products. Instead, integrators need only learn and support a single system that they can sell in a variety of vertical markets.

The major goal of these software companies is to make the user interface of their packages look exactly the same, regardless of the operating system, says Jim Chapman, a software analyst with International Data Corp.'s market research office in Palo Alto. "Many [software vendors] have realized that UNIX is not going to revolutionize the office in the near future, even though they have developed UNIX products," adds Chap-



**R Systems' calendar utility, part of the company's integrated, office-automation software package called R Office, appears the same and functions identically under the UNIX, XENIX and MS-DOS operating systems.**

man. "By taking their products into the MS-DOS world, and making them look the same, they think customers will find them more attractive."

## The face is familiar

Marc Software first offered its word-processing system, WordMarc, for UNIX-based computers made by Digital Equipment Corp., Hewlett-Packard Co. and others. Then Marc converted the program to run on MS-DOS. "We were involved with providing a consistent interface before personal computers came along," says Marc's national sales manager, Bob Brock. Customers who had mastered WordMarc on a multiuser system were not faced with mastering a new system when a PC suddenly landed on their desk. "It works as you expect it to work," says Brock.

R Systems began doing business eight years ago as a reseller of Texas Instruments Inc. multiuser computers, adding value by providing word-processing software. R Systems has branched out and now offers an integrated package called R Office. Besides word processing, R Office includes integrated modules for database management, report generation, spreadsheet operation and desktop organization such as calendaring and calculating.

R Systems claims its software now

runs identically on UNIX, XENIX, MS-DOS and RM/COS (Ryan-McFarland COBOL Operating System, a proprietary operating system from Ryan-McFarland, Rolling Hills Estates, Calif.).

"The main thing we're trying to do is work across operating systems so that businesses don't have to retrain operators or worry about compatibility of files," says R Systems' Harold Kinne, an assistant to the company president.

R Systems further claims that its software operates on more than 70 computer systems, and that it has an installed base of 10,000 users of MS-DOS and 3,500 of UNIX/XENIX. Until recently, the company marketed its products through a direct-sales force, but it now reaches VARs through major software distributors, says Kinne.

## Late out of the chute

A direct competitor of R Systems is Quadratron, which introduced its Q-Office integrated package for UNIX System V and the Berkeley UNIX Version 4.2 in 1984. Quadratron was unable to bring the product to market until late last year, however. Q-Office includes a word processor, calendar, electronic mail and a feature that allows operators to create their own menus.

Developing a full-blown office-auto-

mation package for multiple operating systems was "more work than we had anticipated," admits Quadratron president and chief executive officer John Theiss. He says the company now has versions of its software for MS-DOS and PC-DOS. Quadratron recently brought out additional modules for what it calls Q-Office Plus. Those include a data manager, a filing system, a

spreadsheet function and a graphics creator.

Quadratron, which deals only on an OEM basis, has 58 contracts with computer manufacturers, says Theiss. His company has taken a different approach from R Systems, whose products look the same on-screen regardless of a user's brand of computer. Quadratron has designed its software

so that individual hardware manufacturers can create a user interface that matches Quadratron's existing products. The user interface could be consistent across a manufacturer's line but not resemble Q-Office running on another vendor's computer.

"The biggest hurdle computer manufacturers must cross is to keep their hardware and software investment from becoming obsolete," says Theiss. By adding MS-DOS capability to Q-Office, Theiss claims PCs can be used now just like terminals in an existing installed base.

Another software vendor moving toward the multiple-operating-system approach is Syntactics Corp. Its CrystalWriter word processor was originally designed with a user interface that would operate identically over several UNIX-based systems. Syntactics plans versions for MS-DOS and XENIX by mid-year, according to marketing vice president Verlaine Crawford.

The company's strategy is to move away from simple word processing to "document management," a direction in which many large companies are moving, she says. Engineers, managers, clerks and accountants will all work on the same system so that "you can sit down at any terminal at any time and create the documents you need." She claims such a system will be an advantage when many workers are involved with a single project and must route information to a central location, where the document is organized and edited for final production.

Although companies like Quadratron and R Systems believe they are on the right track by bringing consistency to an integrated set of software products across various operating systems—both single-user and multiuser—some analysts have reservations.

"The bulk of companies are not looking for a standardized interface because different machines are used for different applications," says Robert Lefkowitz, director of software services at InfoCorp., a Cupertino, Calif., market research concern. "If they were concerned about it, they would standardize on one operating system, maybe UNIX, and outlaw all others." □

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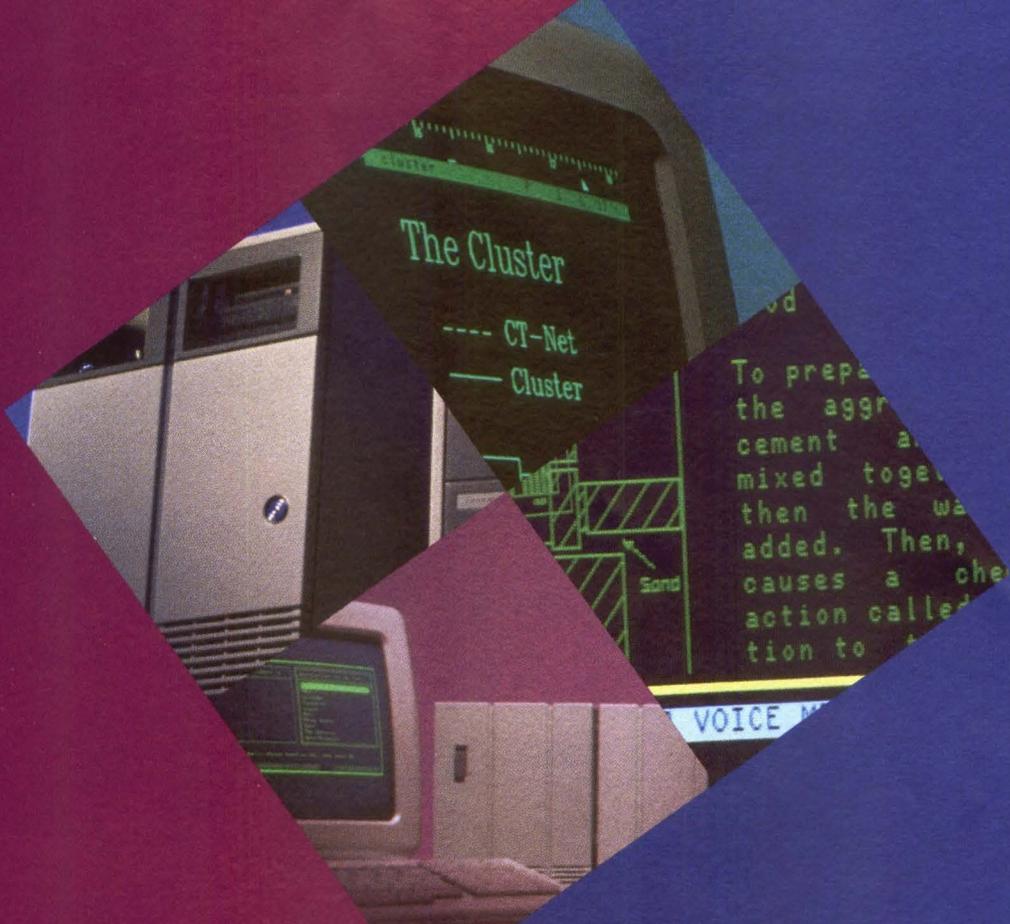
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---

# great products emerge.

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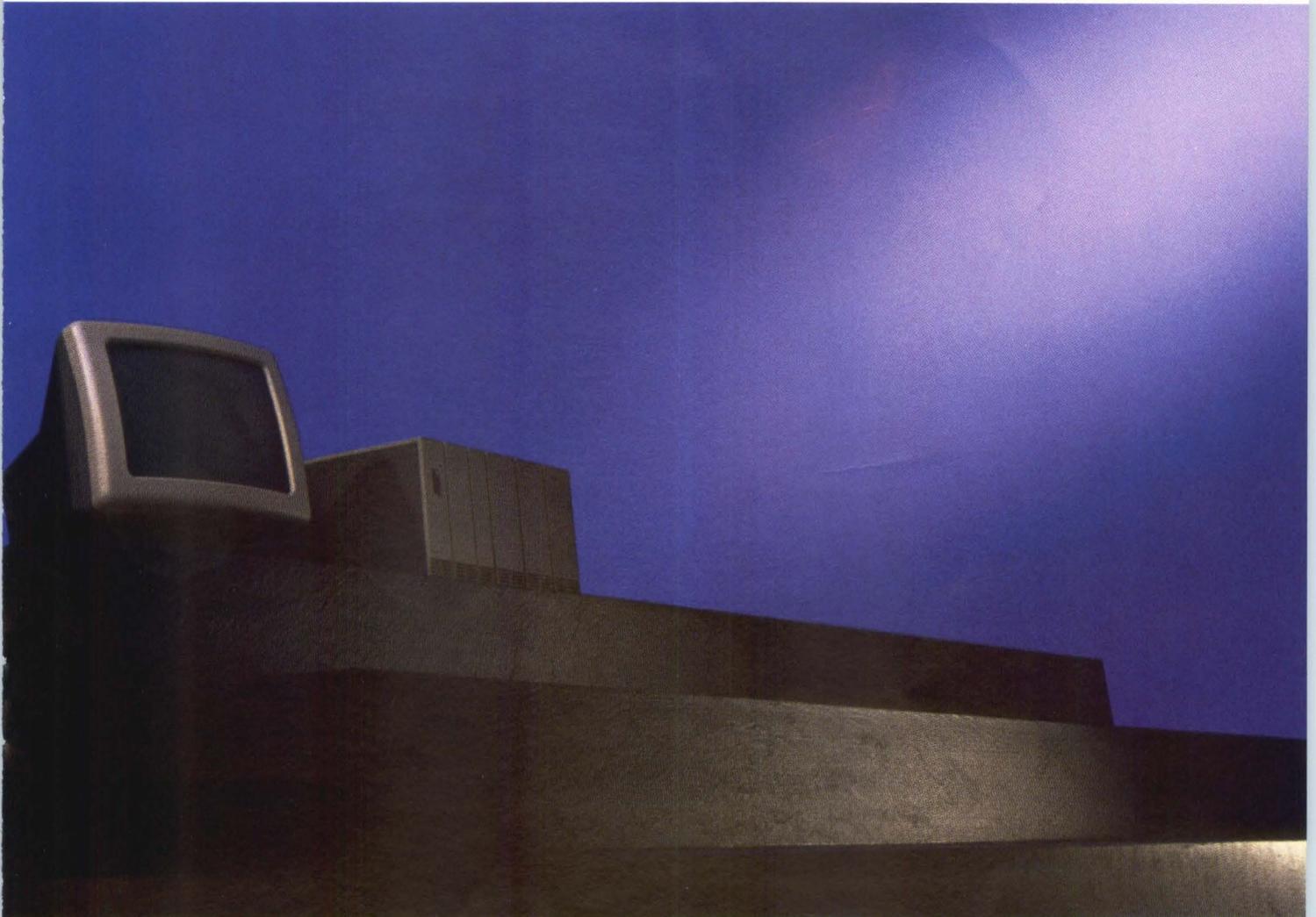
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# expand on a great idea.

And the modules can be changed in seconds by the people who use them. Connecting or disconnecting modules requires neither training nor tools.

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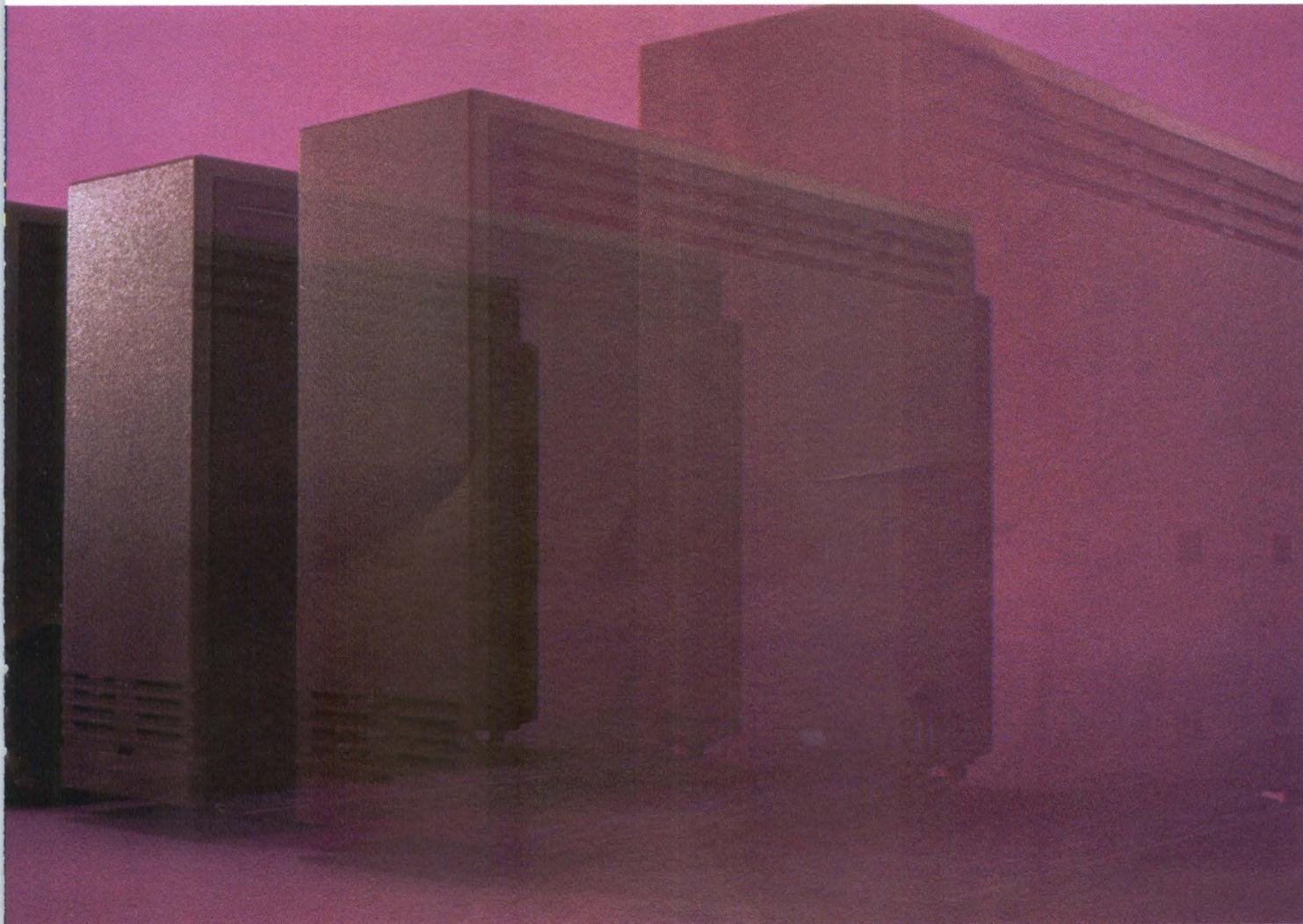
NGEN workstations never become obsolete. As your needs change or new technologies emerge, new modules simply latch on to existing ones.

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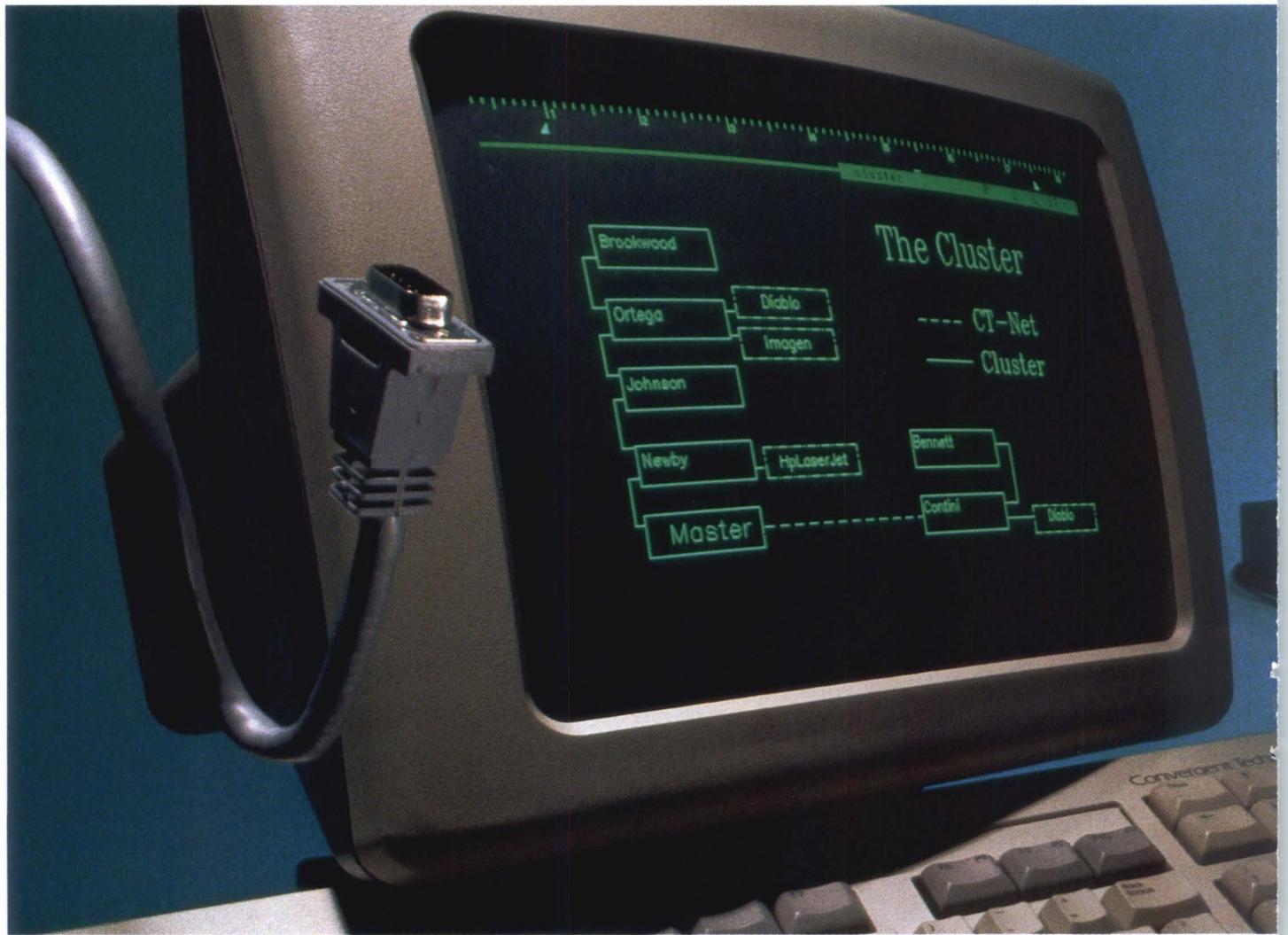
For a business to succeed, great ideas must be shared throughout the company. But a single network can't connect all the different kinds of computers you find in business today. That's why we offer a choice of networks that let you link workstations, PCs, minicomputers and mainframes in the specific arrangement that best suits your needs.

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---

# great ideas with others.

## THE EXTENDED NETWORKS

Obviously, not all computers are designed for the Cluster. So we offer SNA or X.25 communication packages that link workstations to large mainframes or public data bases.

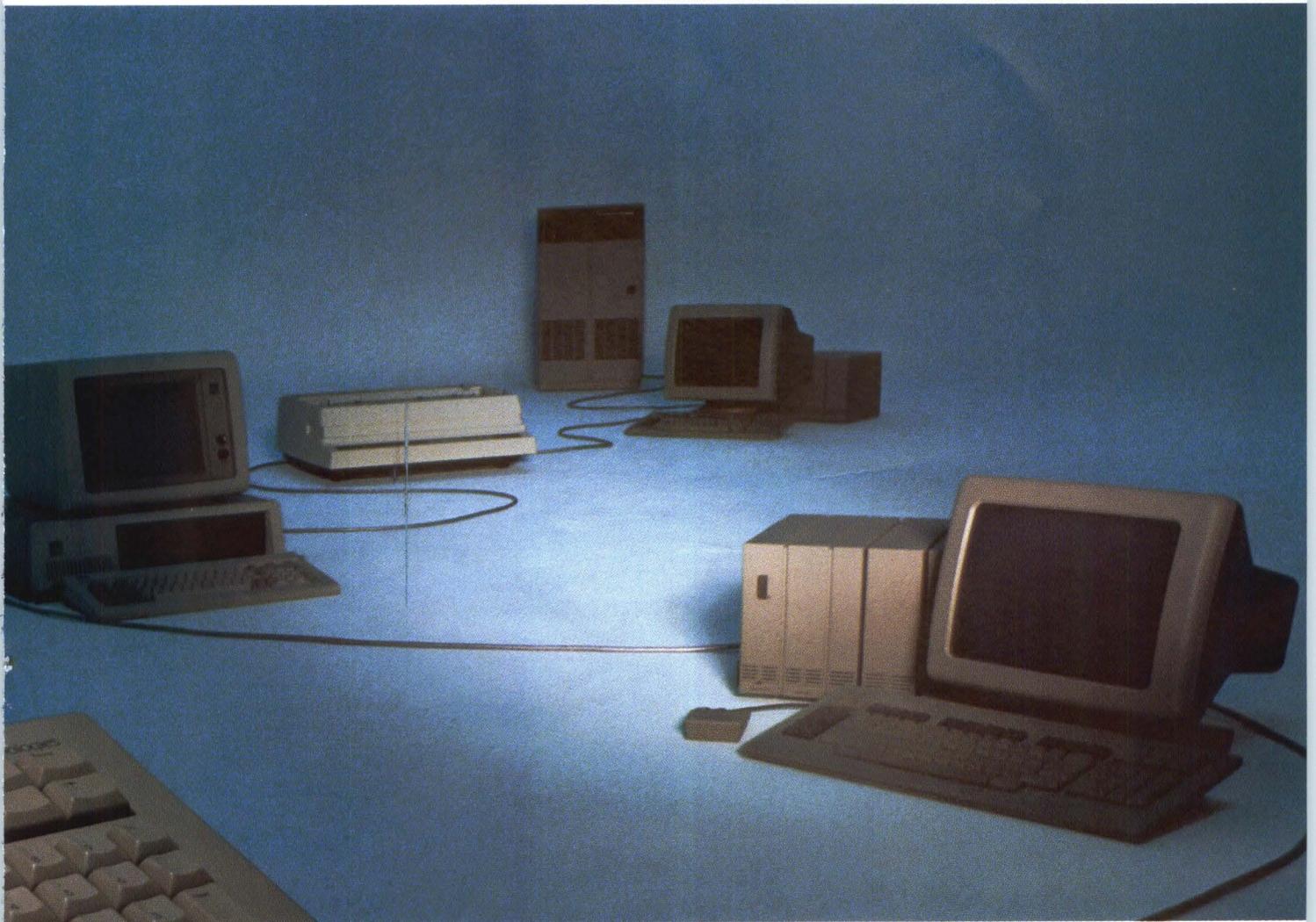
Our 3Com™ network products connect all the greats in the PC-compatible world so they can exchange information. 3+™ software and network servers like 3Server™ establish compatibility with Ethernet,\* Token Ring and Starlan.\*

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That is, if great computers and total networking sound like good ideas to you.



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# Our software integrates

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## SUPERIOR APPLICATIONS

Of course, the programs you integrate are as important as how well you integrate them. For Document Designer, we made sure that each application in the package was exceptional in its own right.

Our word processor, for example, delivers such advanced features as table of contents generation, serpentine and synchronized columns and spelling checkers in multiple languages.

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# your great ideas with ours.

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That is, if true software integration and an open architecture sound like good ideas to you.

The screenshot displays a software interface for 'Modern Carpentry'. At the top, there is a ruler and a yellow bar with the text 'carpentry.4'. Below this, the title 'Modern Carpentry' is written in a large, stylized font, followed by 'Chapter 7' and 'Concrete'. The main content area is divided into two columns. The left column contains text describing the composition of concrete and a diagram of a brick wall. The right column contains a table of materials and coefficients, and another diagram of a brick wall. At the bottom, a blue bar indicates 'THIS DOCUMENT CONTAINS 3 VOICE MESSAGES'.

**Modern Carpentry**  
Chapter 7  
**Concrete**

Concrete is made by mixing cement, fine aggregate like sand, and water in proper proportions. When a

To prepare concrete, the aggregate and cement are first mixed together and then the water is added. Then, water causes a chemical action called hydration to take place and the mass hardens.

Materials	Coefficients
Brick	125 cps 250 cps 500 cps
Brick, painted	0.03 0.03 0.03
Concrete	0.36 0.44 0.31
Wood	0.15 0.11 0.1

This new concrete

To prepare concrete, the aggregate and cement are first mixed together and then the water is added. Then, water causes a chemical action called hydration to take place and the mass hardens.

This new concrete

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All three minicomputers are based on the UNIX System V operating system, so you can take advantage of third-party software.

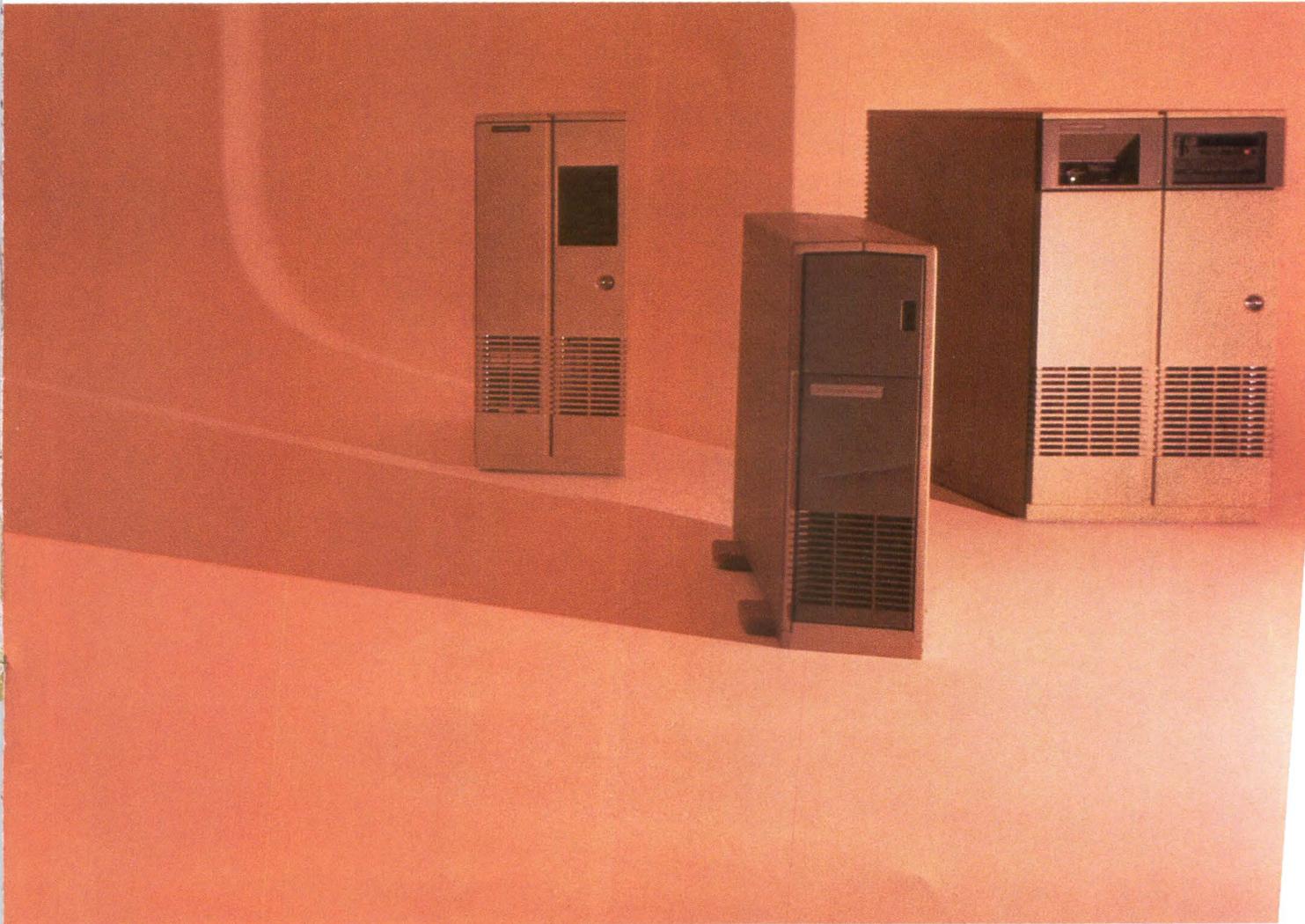
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That is, if minicomputers that meet all your needs sound like good ideas to you.



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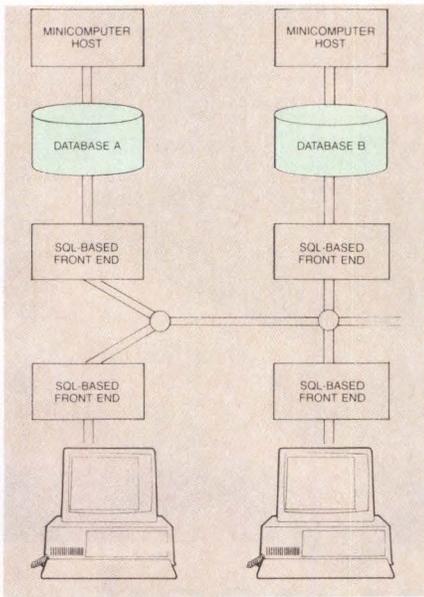
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# Convergent

# FEATURE HIGHLIGHTS



p. 63 . . . Daydreams become reality

## DATABASE INTEGRATION SHAKES MINI MARKET . . . . .63

Although not yet a commercial reality, database integration promises to change the way system integrators and information-management professionals think about minicomputer software. Recent moves by DBMS vendors and government agencies indicate that database integration is closer to reality than most analysts believe. But questions remain: Do you attain integration via "superuser software" or through a standard query language and data structure? And how do you get vendors offering proprietary products to jump on the bandwagon?

## ANNUAL SURVEY OF MINICOMPUTER MANUFACTURERS .81

Mini-Micro Systems' annual survey covers more than 30 companies' minicomputers, noting key characteristics such as CPU type and word size, main-memory ranges, operating systems, programming languages supported and pricing information. The product table also includes company addresses and telephone numbers.

## UPSes KEEP PACE WITH USERS' NEEDS . . . . .93

Those readers who have experienced the spikes, surges, transients, dips, brown-outs and blackouts that accompany commercial AC power can appreciate the advantages of uninterruptible power systems. Those who haven't need ask only one question: How valuable is my data? A UPS product table, beginning on Page 102, accompanies the feature. The table covers over 30 companies along with key UPS parameters, including power rating, input voltage, input current, size, weight and price.

## VOICE/DATA DEVICES CUT PHONE SYSTEM COSTS . . . . .119

Digitized-voice products, uniting the computer and the telephone, are dropping rapidly in price, thus removing the major impediment to widespread acceptance. And the potential applications are prime for value-added resellers.

## COMDEX/SPRING FOCUSES ON DISTRIBUTION . . . . .125

Effective use of distribution channels takes center stage at the sixth annual Comdex convention, taking place April 28 to May 1 in Atlanta. The show's producer expects over 700 exhibitors and an array of new products.

REPRESENTATIVE UNINTERRUPTIBLE POWER SYSTEMS

Company	Model	Power Rating (VA)	Power Rating (W)	Input Voltage (V)	Input Current (A)	Size (H x W x D)	Weight (LBS)	Price
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	AP-200	200	140	115-120	5.0	11.5 x 11.5 x 11.5	30	290
	AP-400	400	280	115-120	10.0	11.5 x 11.5 x 11.5	60	580
BORGES CORP. P.O. Box 488, Framingham, MA 01460, (617) 486-8463	BP-100	100	70	115-120	2.5	11.5 x 11.5 x 11.5	15	145
	BP-200	200	140	115-120	5.0	11.5 x 11.5 x 11.5	30	290
	BP-400	400	280	115-120	10.0	11.5 x 11.5 x 11.5	60	580
CALICO ELECTRONICS 1500 West 10th St., Phoenix, AZ 85029, (602) 944-0400	CE-100	100	70	115-120	2.5	11.5 x 11.5 x 11.5	15	145
	CE-200	200	140	115-120	5.0	11.5 x 11.5 x 11.5	30	290
	CE-400	400	280	115-120	10.0	11.5 x 11.5 x 11.5	60	580
GENERAL POWER SYSTEMS 1000 N. 17th St., Suite 100, Phoenix, AZ 85016, (602) 944-0400	GP-100	100	70	115-120	2.5	11.5 x 11.5 x 11.5	15	145
	GP-200	200	140	115-120	5.0	11.5 x 11.5 x 11.5	30	290
	GP-400	400	280	115-120	10.0	11.5 x 11.5 x 11.5	60	580
JEFFERSON ELECTRIC 1400 Central Expressway, Danvers, CA 95615, (707) 881-2400	JE-100	100	70	115-120	2.5	11.5 x 11.5 x 11.5	15	145
	JE-200	200	140	115-120	5.0	11.5 x 11.5 x 11.5	30	290
	JE-400	400	280	115-120	10.0	11.5 x 11.5 x 11.5	60	580
KALICO ELECTRONICS CO. INC. 8888 Route 90, Bethlehem, PA 18018, (610) 877-0700	KE-100	100	70	115-120	2.5	11.5 x 11.5 x 11.5	15	145
	KE-200	200	140	115-120	5.0	11.5 x 11.5 x 11.5	30	290
	KE-400	400	280	115-120	10.0	11.5 x 11.5 x 11.5	60	580

p. 93 . . . . . UPS roundup

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### Dot matrix printers.

its features. And, along with most of the 2024L's print functions, it's also equipped with a one-inch paper cut function to save paper and a buffer memory to save time.

For personal computer users, our newest entry, the Brother M-1109 is packed with features rarely found in this price range. It offers both a friction-feed platen and a built-in tractor feed. It too has dual interfaces and a wide range of print options. All to give small computer users big system advantages.

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# DATABASE INTEGRATION SHAKES MINI MARKET

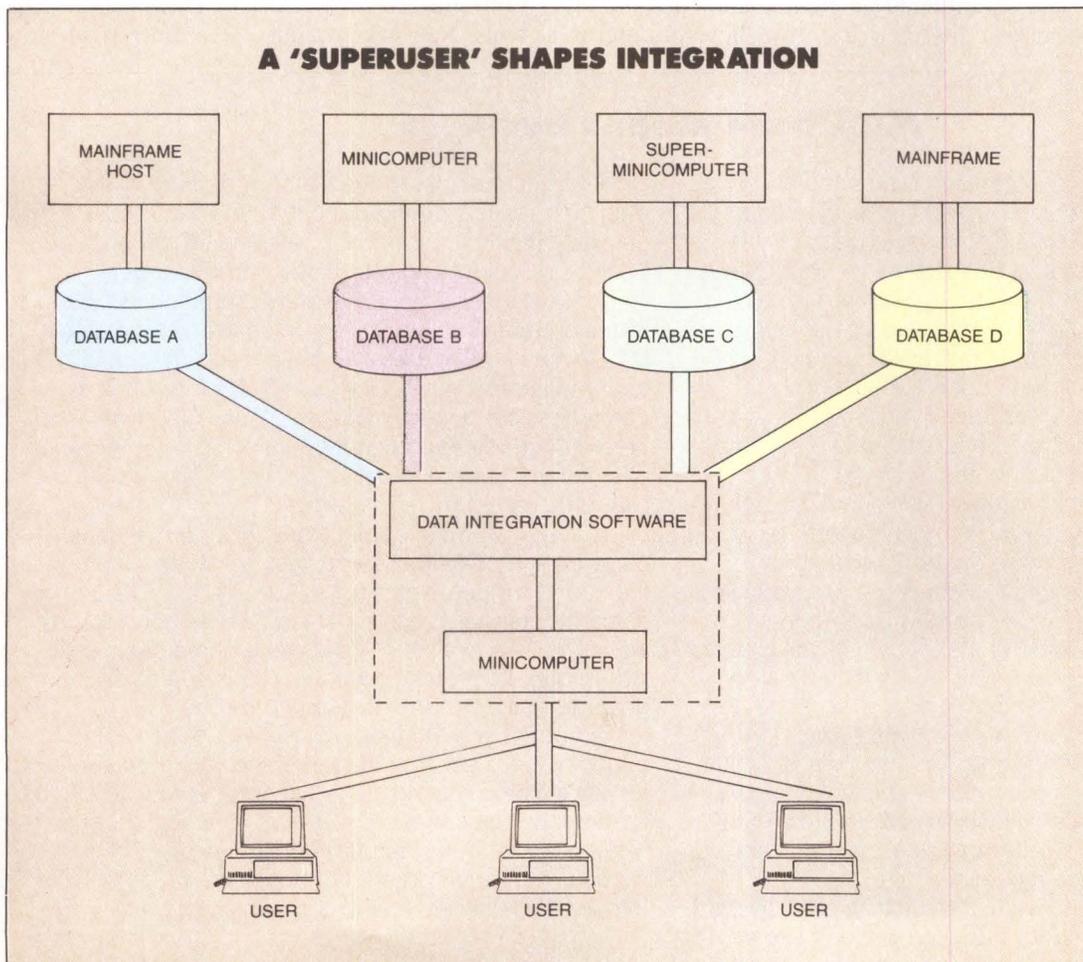
Long thought impossible, database integration now emerges as a viable process, and helps standardize the minicomputer software industry

**Michael Tucker**, Associate Editor

Database integration has long been one of the daydreams of the information-management business. It has especially been a fantasy held by companies that have built up investments in

heterogeneous machines and database applications: Linking those machines and applications together in a distributed network would conjure up the apparition of a single application coming from a single machine.

Too often observers have awakened to find



**One approach** to database integration is to install software at the minicomputer level to manage data throughout the network. This software locates data upon request and re-formats it to a common user interface.

that the possibility of database integration was still a dream. However, recent research conducted by both the government and private industry suggests that such integration is not only possible, but inevitable.

**An impossible dream?**

Minicomputer database integration is simple in theory and extremely complex in practice. In one scenario, the software functions as a kind of superuser. It keeps track of the position of data within the network's assorted machines and databases, accesses it upon request and reformats the data so that it conforms to a common user interface.

Alternatively, some software developers hope to reach data integration through universal standards. Their desire is to somehow find a query language and a data structure—the two highest hurdles when standards are at issue—that all database management system vendors could support. Subsequently, vendors could write front-end software that would allow their existing products to use those standards.

Users want that sort of integration desperately because it fits their historical buying patterns.

Most companies' information-processing equipment is an odd collection of machines and software of varying degrees of obsolescence, all gathered haphazardly to meet changing needs over a period of many years. Making a single, unified whole of that jumble is now the unhappy (and, certainly, unenviable) task of information managers everywhere.

One difficulty has as much to do with marketing as with technology. DBMS developers with proprietary data structures and captive customer bases only reluctantly embrace anything that might encourage a potential competitor.

"If everybody developed their products in exactly the same way and standardized on an operating system, then, yes, database integration could happen," says Lee Doyle, senior communications analyst for the market-research company International Data Corp., Framingham, Mass. "But there are lot of things holding that up."

Those "things," says Doyle, are proprietary approaches to data management. "Sure, a lot of firms are supporting some common communications protocols...specifically, [IBM Corp.'s] Systems Network Architecture. But, right now,

**Multibase means business**

One of the first experiments in data integration was the Multibase project conducted by the Computer Corp. of America (CCA), Cambridge, Mass. Multibase was originally sponsored by the Pentagon's Defense Advanced Research Projects Agency and is still supported by the U.S. Army. It provides users with a single, uniform means of recalling—though not modifying—files in existing database applications.

"We developed a breadboard version of the system in 1982, as a proof of the concept," says Terry Landers, director of the Distributed Systems Section of CCA's Research and Systems Division. "Then, we redesigned it for an Ada environment, something which presented difficulties since, in 1982, Ada compilers weren't yet available to us." Ada is the programming language designed in 1979 for the Department of Defense. The DOD intends that eventually all its software will be in Ada, but it took years for validated Ada compilers to get to market. However, there are over 12 validated compilers available now.

Multibase is in a third redesign, this time to cast it completely in Ada. "We expect to ship it to the customer, the Army Materials Command, in January of 1987," says Landers. After that, the company hopes to expand it to the commercial market.

In many ways, Multibase is the minicomputer, database-integration product par excellence. It sits on a

Digital Equipment Corp. VAX and from there manages data communication throughout a network. It accesses individual databases via special front and back ends, as well as with a standardized query language. Unlike similar research efforts, such as the National Bureau of Standards' Integrated Manufacturing Distributed Database Administration System, its query language is not IBM Corp.'s Structured Query Language, but a variant of Ada. "We began work long before anybody had even thought of SQL as any kind of standard," says Landers. "So we developed our own data model."

Planned upgrades of Multibase include making it capable of modifying files, as well as of recalling them, and further exploiting of Ada's famed DOD-enforced standardization. "At first, when there weren't any compilers available, Ada was a tremendous problem," notes Landers. "But now, Ada is eventually going to make things very easy for us."

Meanwhile, the technology involved in the project is bound to have serious effects on the whole database industry. For one thing, says Landers, vendors can forget about having a software lock on their buyers. He contends, "A product like Multibase gives organizations much more freedom of choice. You don't have to consider a single-vendor solution."

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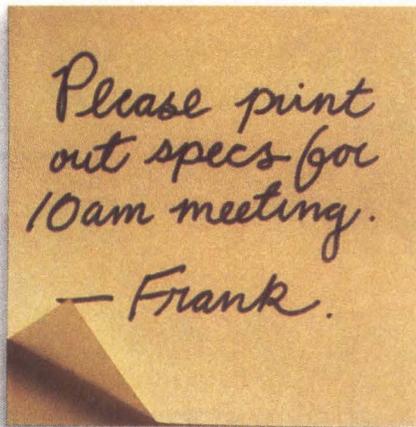
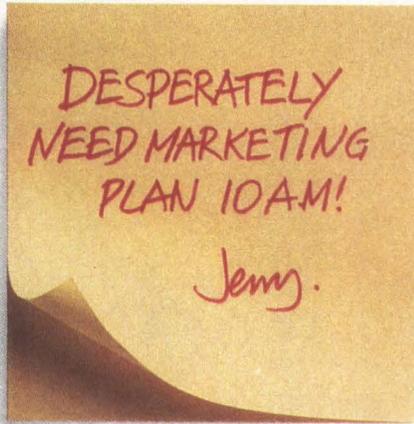
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SNA is confined to textual documents. When you get beyond that, when you're talking about databases, you're talking about completely different ways of representing data."

Doyle doesn't speculate on the possibility of data integration in the long run. "I think we're seeing real progress in networking. The ability to develop common networks, that's happening now. It's going to be a lot harder to develop a common data universe. I don't like to look further than the 1990s, and I don't see it happening before then."

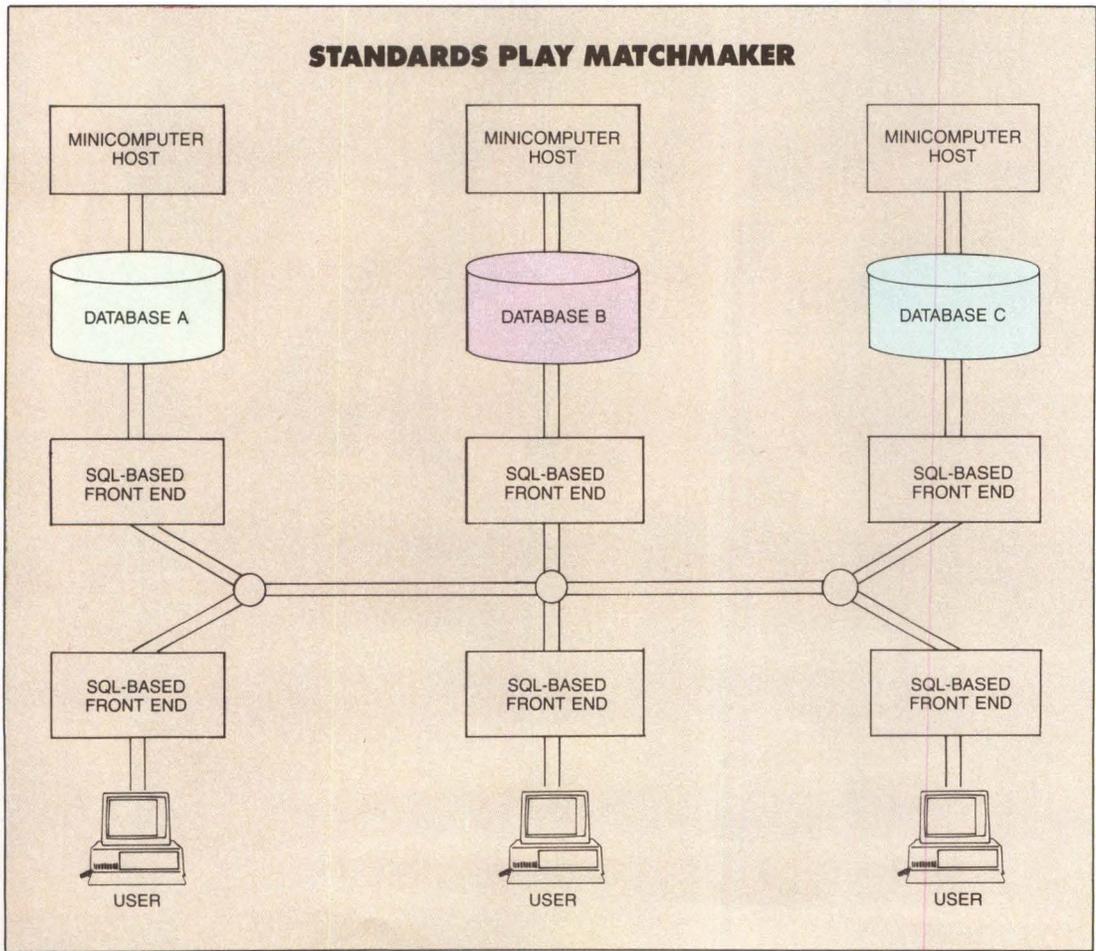
Not everyone, however, is quite so certain that data integration won't happen. Michael Goulde, a market analyst with the research company, the Yankee Group, Boston, notes cautiously, "Well, from what I understand, yes, it is possible...and vendors are looking at a couple of approaches to the problem. People like IBM are looking into standards—particularly its Structured Query Language [SQL] and various standardized data structures. Other researchers are looking into artificial intelligence, that is, using some sort of expert system on top of the

network to manage the information in all those different databases."

But the real sign of data integration's possibility may come from the database makers themselves. Relational Database Systems Inc. (RDS), for example, markets a DBMS known as Informix-SQL for UNIX-based minicomputers, microcomputers and, recently, mainframes. As the name suggests, Informix-SQL relies heavily on SQL.

SQL fits into the RDS strategy because, as vice president Laura King explains, it allows the company to divide its applications into front and back ends. The front end interfaces with the user and other front ends. The back end interfaces with the operating system of the involved machines. Thus, Informix-SQL back ends can be widely different, whereas the front ends remain the same. This situation, in turn, means heterogeneous machines can share information, and appear to be a single device to users, as long as they all run Informix-SQL.

Because this approach requires information managers to depend on a single DBMS, it's still a



**The standards path to data integration uses a query language—such as IBM's SQL—and a data structure that all DBMS vendors could support.**

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**Distributed databases present data-integrity problems that aren't matched in static applications.**

long way from true application integration. But, the rub is in the SQL. Since the company's beginning, RDS has been heavily involved with attempts to get the database industry to standardize the language for information-management applications. Moreover, they've done so with an eye toward making it possible for disparate applications to share data, at least within a UNIX environment. To that end, the company last year announced what it called the "Hooks" program, under which it revealed part of its own source code to selected developers wishing to give their software the power to share data with Informix-SQL. Several participants have since become involved with Hooks, including makers of word processors, accounting programs and so forth.

The step beyond that, providing links with other DBMS products, would be an easy one to take. From there, the construction of a common environment would be a difficult, but not impossible, problem to solve. Indeed, the company seems to feel application integration is inevitable, and that its own survival—or even the survival of the DBMS industry—depends at least partly on accepting what is impossible to avoid. "My feeling has been that it's pretty frustrating for the user to deal with all the different system syntaxes and data formats," says King. "I think that, for the software industry to remain viable, some of this integration has to be done."

Another database vendor also getting its start in the UNIX market, but considering an interface approach to data integration, is Unify Corp., makers of the Unify DBMS. "I believe there's an overemphasis on query languages in this industry," says Unify's president and chief executive officer Nicolas Nierenberg. "Most users don't want what a query language can do for them. They're not programmers. What they want is a standard interface...something that acts

as a kind of giant filter, sitting between their machines and the assorted DBMSes that are already out there."

Unify also has a different idea of where that "filter" should be located. Rather than with the departmental minicomputer, says Nierenberg, "The most likely place for that filter is at the personal computer level. Quite simply, there are already so many communications facilities available at that level, it seems logical."

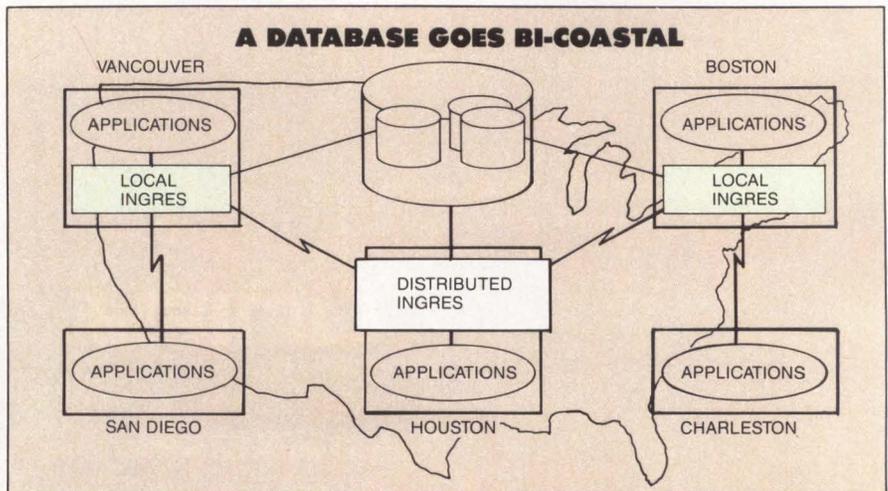
Still another DBMS maker eyeing database integration is Relational Technology Inc. Their "Ingres" DBMS product has been available for some years on minicomputers. Yet, RTI has not announced a distributed version of Ingres, and the company makes a point of not even announcing such an intention. However, their staff significantly includes a "project manager for distributed Ingres," Dr. Robert McCord.

McCord notes that distributed-DBMS applications should provide transparency in the areas of location, replication and failure. With location transparency, a user neither knows nor cares where a file is located in the network. Replication transparency gives a user the illusion of working with a single record, although he may be working with two or more copies of a file—one, perhaps, at a local workstation, and another at a departmental minicomputer. Failure transparency repairs network damage, without disturbing a user.

McCord says that, if everything in the network is running Ingres, RTI can support all three attributes. "Further, if you want heterogeneous applications, we can still provide some of that functionality, if the other DBMS products speak a query language we can translate—like SQL—and have two-phase commit."

Two-phase commit is, in some ways, an outgrowth of the location-transparency require-

**Distributed Ingres** is one example of a distributed database manager already on the market. It gives widely dispersed users the illusion of single, non-distributed database application.



ment. Distributed databases present data-integrity problems that aren't matched in static applications. For example, should a user at a local workstation request a file from a departmental minicomputer, the network must pass a copy of the file to the user and also make certain that any changes by the user to the copy are written into the master file as well. When an entire file is transferred as a whole, there must be some method of protecting data in transit. A system with two-phase commit divides each data transaction into two distinct tasks, or "phases." The first is an automatic check of the network to ensure data integrity, and the second is the actual transfer of information.

So, says McCord, a DBMS that is "foreign" to Ingres, but maintains SQL and two-phase commit, can be used with Ingres. This applies to a growing number of DBMSes. In fact, Sandra Duerr, an RTI product manager, argues, "Five years from now, I don't think there'll be a DBMS that won't support SQL or two-phase commit."

**A search for tomorrow**

Ultimately, whether or not distributed data integration becomes a reality depends on the power of customers to force vendors away from proprietary solutions. And the single largest consumer of software on earth, the U.S. government, has announced its intention to make data integration work.

The government is interested in data integration for two reasons. First, as a consumer of DBMS software with immense databases scattered around the globe, it needs integration desperately. Second, it seems to feel integration is vital to the continued success of American industry in the face of vigorous foreign competition. Therefore, federal agencies ranging from the military to the National Bureau of Standards

(NBS) have launched database-integration research projects.

One example is the Integrated Manufacturing Distributed Database Administration Systems (IMDAS) project at the NBS Advanced Manufacturing Research Facility (AMRF) in Gaithersburg, Md. Although the project aims at factory-automation applications, IMDAS shows how different data types—documents, real-time data, instrument readings—can be efficiently integrated into a distributed system of heterogeneous machines and databases.

AMRF consists of seven workstations, each of which typically contains an industrial robot, a computer, a machine tool and a loading/unloading facility. "We've built these workstations with parts from different vendors," says Howard Bloom, chief of the Factory Automation Systems Division of NBS. "We've obtained a variety of different computers, we're using a variety of operating systems, and we have about eight different languages...so we've had to look at the problems of interfacing rather hard."

The result was IMDAS. Still incomplete, it will eventually be composed of three parts—a generic query language based on SQL, a data dictionary that would tell each node of the network where information was stored within it, and a data model that will provide a software bridge between individual databases. "The data model is the work of Sidney Su, at the University of Florida," says Bloom. "We envision it providing the common front end that would allow commercial DBMS makers to write the preprocessors and postprocessors to move data between their products."

And, finally, private industry has entered the database integration business. Enhansys Inc. has announced that its commercial, database-application integration product, also called "Enhansys," is ready for market.

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**The U.S. government has announced its intention to make data integration work.**

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**Distributed management breaks through**

The problems of managing distributed information—even given software homogeneity—aren't small. One company that has made a significant commitment to managing information in a distributed environment is VenturCom Inc. The company's recently introduced Prelude provides real-time data management in a network of hardware from different vendors. To make this possible, Prelude is actually a collection of over 100 independent software modules that can be distributed among the processors of a network.

More than simply a database management system, Prelude includes a number of common business func-

tions. Among other things, it offers business graphics, spreadsheets and form generators.

VenturCom originally got into the software business with a IBM Corp. PC implementation of the UNIX operating system, VENIX. However, says Gig Graham, VenturCom's executive vice president, VENIX "was an ice breaker for the product we actually had in mind two or three years ago—Prelude. Basically, we wanted to bring the advantages of the UNIX shell to distributed information management. For instance, Prelude can write to, and read from, UNIX."

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**UNIFY**  
CORPORATION

CIRCLE NO. 26 ON INQUIRY CARD

At least for some machines, Enhansys is nothing less than proof of data integration as a technology. According to the company, Enhansys retrieves information from any database for which the developer or user has written an interface residing on incompatible computers. The software incorporates a set of interpreters that takes generic requests for data, translates them into the specific language of local databases, retrieves the data and then translates it for display in a common user interface.

In many ways, Enhansys resembles the NBS IMDAS. They both reside on a network server and, from there, function as a data manager. But Enhansys' working language is nothing as exotic as SQL. Rather, it's written in standard FORTRAN.

Currently, Enhansys runs on minicomputers and mainframes from IBM, Digital Equipment Corp., Hewlett-Packard Co. and Tandem Computers Inc. Depending on the configuration, a typical Enhansys package costs approximately \$150,000 or more.

**Integrators mull over integration**

If, then, database integration is happening, what will it do to the minicomputer software industry? Yankee Group's Goulde, for one, asserts that it puts a real squeeze on people who take a proprietary approach. In his opinion: "It's going to remove a lot of barriers to entry to the market. For smaller vendors, it becomes a definite advantage. They'll be able to bring a product to market with their customers knowing they don't have to worry about compatibility problems. For larger vendors, though, with a lot of proprietary leverage—well, let's just say it's not going to be greeted with a lot of enthusiasm."

One consequence of that loss of proprietary leverage would be that suddenly DBMSes would

**Companies mentioned in this article**

<b>Computer Corp. of America</b> 4 Cambridge Center Cambridge, Mass. 02412 (617) 492-8860 <b>Circle 404</b>	<b>Relational Technology Inc.</b> 1800 Marina Village Parkway Alameda, Calif. 94501 (415) 769-1400 <b>Circle 407</b>
<b>Enhansys Inc.</b> 20111 Stevens Creek Blvd. Cupertino, Calif. 95014 (408) 255-2920 <b>Circle 405</b>	<b>Unify Corp.</b> Suite 255 400 Kruse Way Place Lake Oswego, Ore. 97034 (503) 635-6265 <b>Circle 408</b>
<b>Relational Database Systems Inc.</b> 4100 Bohannon Drive Menlo Park, Calif. 94025 (415) 322-4100 <b>Circle 406</b>	<b>VenturCom Inc.</b> 215 First St. Cambridge, Mass. 02142 (617) 661-1230 <b>Circle 409</b>

be judged strictly in terms of price and performance. DBMSes would be effectively reduced to database engines, fighting for customer attention purely in terms of horsepower. "It's going to get down to a question of what's the best DBMS on any local machine," says Unify's Nierenberg. "If you stick with simple database products alone, then you're going to find yourself in a severe price/performance situation."

Accordingly, Unify has recently branched out into the fourth generation language (4GL) business. In 1985, Unify published Accell, which is essentially the Unify DBMS plus powerful application-development facilities. Nierenberg admits that the new product was developed at least partly to give Unify some unique identity should data integration become real.

RDS's King makes similar arguments: "For

**NBS seeks researchers**

Interested in doing database integration research? Or, would your company like to obtain access to some of the research already done in the field? For free, that is?

If so, then the National Bureau of Standards' Integrated Manufacturing Distributed Database Administration System (IMDAS) program may be your best bet. The Bureau is seeking companies interested in becoming research associates.

Under the research-associate program, companies send technical staff members to NBS' Advanced Manufacturing Research Facility at Gaithersburg, Md. There, they assist in NBS' continuing research and

development efforts. In the process, the research associate receives the fruits of those efforts, most of which are considered purely in the public domain, and all of which can be upgraded into marketable products.

"Technology transfer is a long process," says Howard Bloom, chief of NBS' Factory Automation Systems Division. "We've got to get this technology into the commercial market...and the best way we know of is the research-associate program."

For more information on NBS and the research-associate program, contact the National Bureau of Standards, Gaithersburg, Md. 20899, (301) 921-2673.

# Your back-up shouldn't leave you behind.

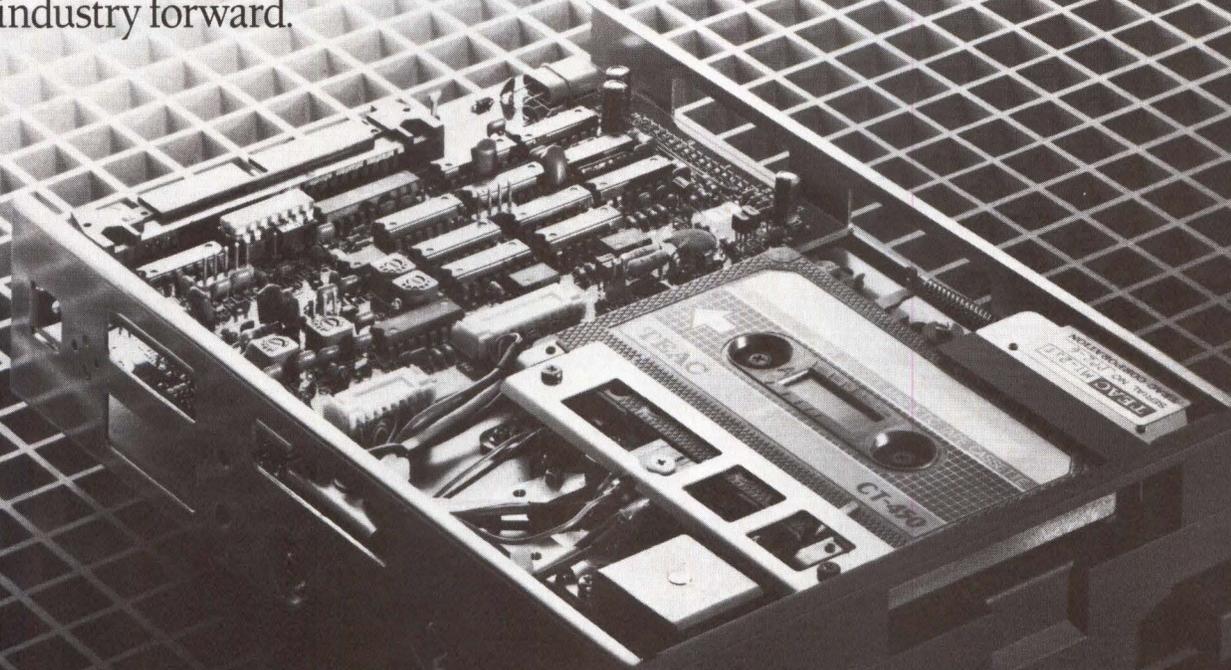
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The M253X series include five 3½" drives with capacities from 500 kilobytes to 2 megabytes.

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Fujitsu's new flexible disk drives and media. They're just the latest additions to a long line of data storage products that has built Fujitsu's reputation as a leader in the industry.

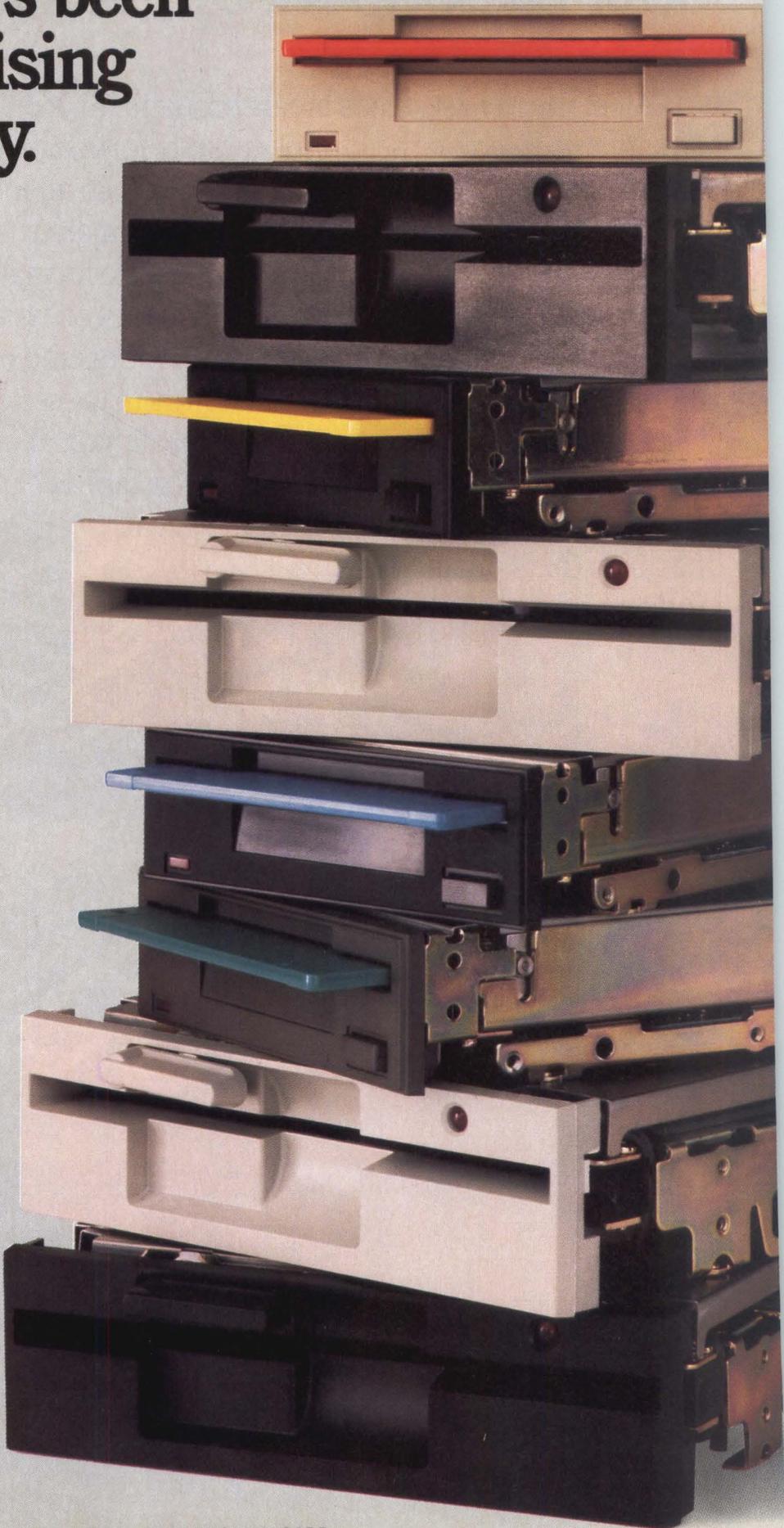
To be sure of consistent quality, top performance and absolute reliability to meet all your data storage requirements, there's just one company to call. Fujitsu America. (408) 946-8777. Or—for detailed information—write to the Flexible Disk Products Group at 3055 Orchard Drive, San Jose, CA, 95134-2017.

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software to really come into its own, this [integration] is the direction we all have to move. It's going to take time, but we've got to provide common front ends and transparent access to files." And, not surprising, RDS too has recently gotten into the 4GL business, with a product known as Informix-4GL.

RTI's McCord goes even further. He argues that distributed data integration will fundamentally reshape the priorities of software: "I think, eventually, distributed operating systems will not be nearly as important as distributed database systems." Other analysts have even speculated—privately—that data integration could drastically reduce the number of operating systems on the market. The argument goes that users already networking databases on their existing machines will gear their future purchases away from proprietary operating systems that might get in the way of distributed database integration. Under those conditions, only those operating systems that have very large installed bases, like IBM's virtual machine (VM) and DEC's virtual machine system (VMS); or which are extremely generic, like UNIX, will survive.

But, one way or the other, the feeling in the industry is that lack of readiness courts disaster. Warns McCord, "Vendors should know that distributed data integration is the future. It's coming, and it's coming fast. They'd better prepare." □

Interest Quotient (Circle One)  
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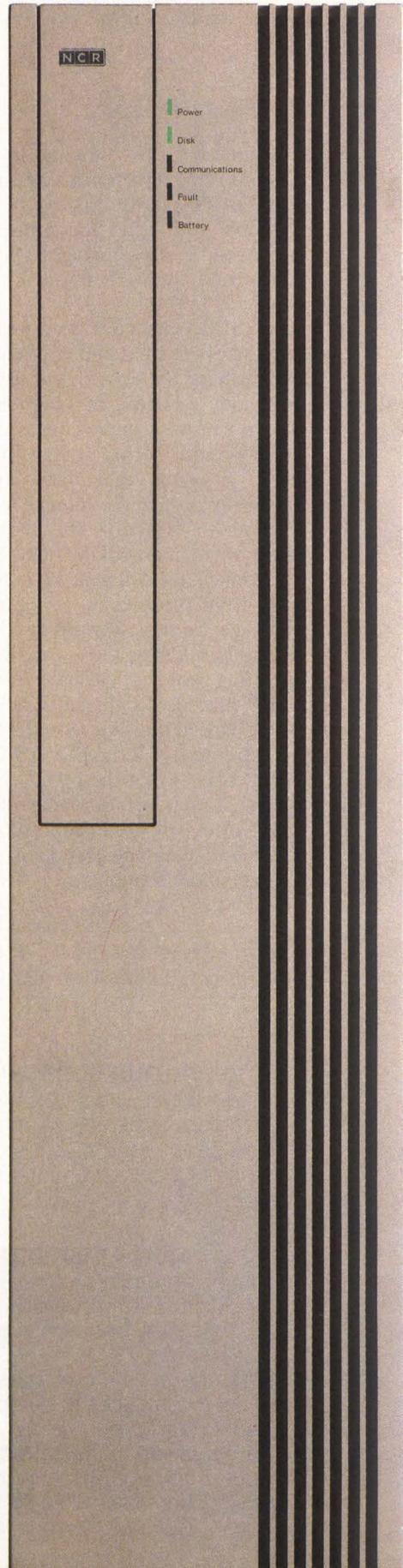
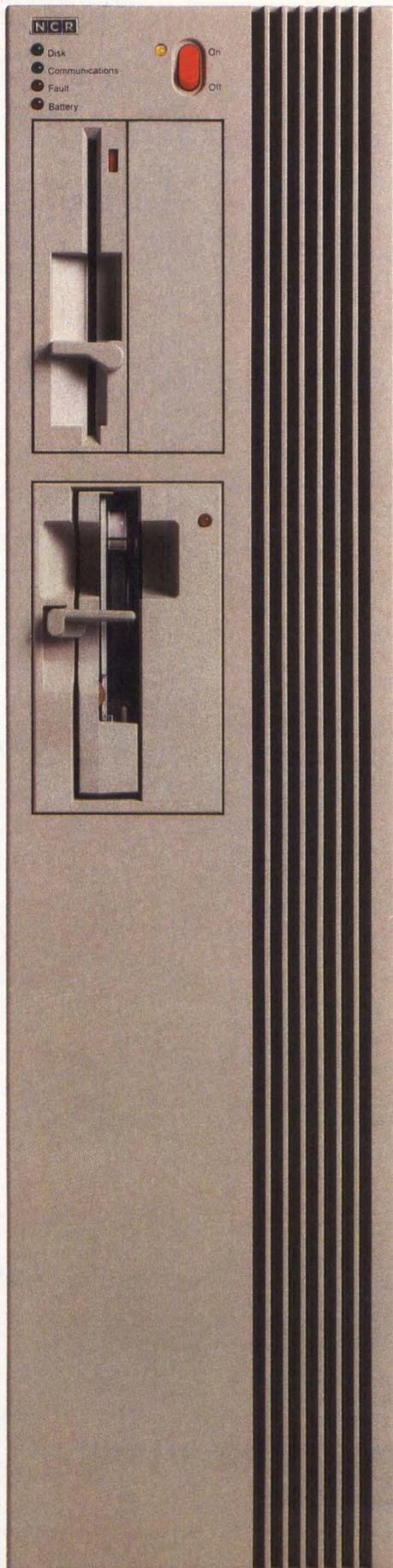
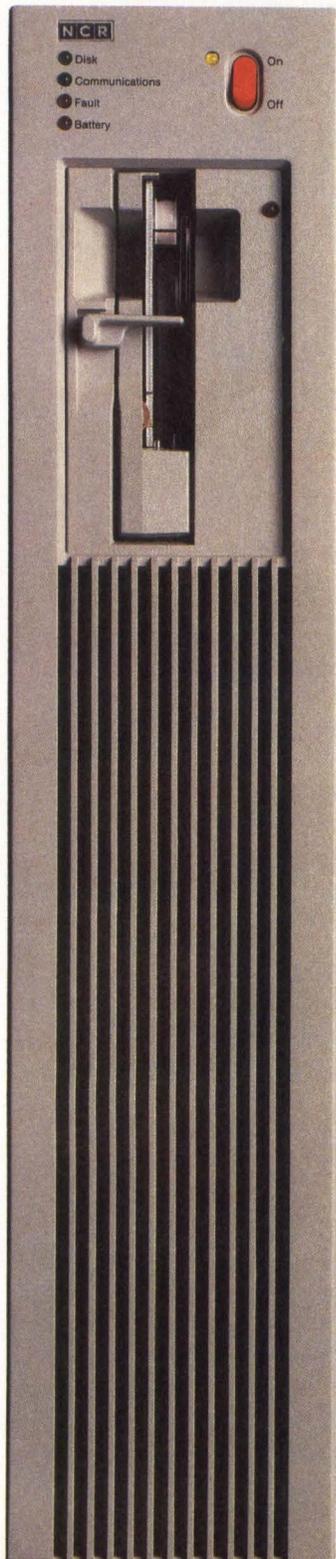
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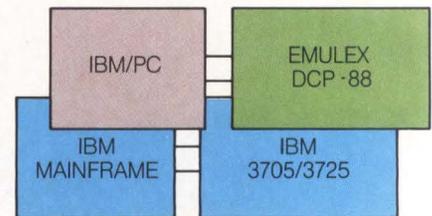
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CIRCLE NO. 30 ON INQUIRY CARD

# MINICOMPUTER SYSTEMS

Company Model	CPU word size (bits)	CPU type	Memory min.-max. (bytes)	Operating systems available	Programming languages supported	Base price \$	Base configuration
<b>APOLLO COMPUTER INC.</b>							
330 Billerica Rd., Chelmsford, MA 01824, (617) 256-6600							Circle 371
Domain Series 3000	32	68020, 68881	2M-4M	AEGIS, Berkeley UNIX Version 4.2, UNIX System V	Ada, C, Common LISP, FORTRAN, Pascal	9,900	opt. one 5¼-inch, 1.2M-byte flexible disk drive; one 86M-byte Winchester disk drive; ¼-inch, 60M-byte tape drive
DN 560	32	68020	1M-3M	AEGIS, UNIX	C, FORTRAN, LISP, Pascal	35,500	one or two, 86M-byte rigid disk drive(s); keyboard; mouse
DN 570/ DN 580	32	68020, 68881	2M-16M	AEGIS, Berkeley UNIX Version 4.2, UNIX System V	Ada, Common LISP, FORTRAN, Pascal	29,900/ 43,900	
<b>ARETE SYSTEMS CORP.</b>							
2040 Hartog Dr., San Jose, CA 95131, (408) 263-9711							Circle 372
1100/1200	32	68020	2K-1.6M	Berkeley UNIX Version 5.2	BASIC, COBOL, FORTRAN, Pascal	61,650/ 53,804	one 8-inch, 160M-byte rigid disk drive; 16 terminal ports; 45M-byte tape cartridge drive
1600	32	68020	2K-1.6M	Berkeley UNIX Version 5.2	BASIC, COBOL, FORTRAN, Pascal	69,054	one 8-inch, 160M-byte rigid disk drive; 16 terminal ports; ½-inch, 96M-byte tape drive
<b>BTI COMPUTER SYSTEMS</b>							
870 W. Maude Ave., Sunnyvale, CA 94086, (408) 733-1122							Circle 373
6000	16	proprietary	256K-1M	proprietary	BASIC X	40,950	one 14-inch, 58M-byte rigid disk drive; tape cartridge drive
8000 Series 50	16	proprietary	2M-16M	proprietary	Assembly, BASIC, COBOL, Pascal	54,950	
<b>CANAAN COMPUTER CORP.</b>							
39 Lindeman Dr., Trumbull, CT 06611, (203) 372-8100							Circle 374
DCS 5800	32		1M-8M	UM/CMS compatible	BASIC, C, COBOL, FORTRAN, PL/1	45,000	two 8-inch, 661M-byte rigid disk drives; 36 terminals; Dataproducts printer
<b>COMPUTER AUTOMATION INC.</b>							
2181 Dupont Dr., Irvine, CA 92713, (714) 833-8830							Circle 375
4/85/ 4/95	16	Series/5	512K-8M	CARTOS, OS4, UNIX, OMNIX	Assembly, BCPL, CORAL 66, FORTRAN, Pascal	7,975/ 16,465	
LSI 2/10/ LSI 2/20/ LSI 2/40	16	proprietary	64K-2M	OS2	Assembly, Advanced BASIC, Extended BASIC, FORTRAN IV	5,000/ 5,300/ 5,665	battery backup
NM 4/12/ NM 4/90	16	NM 4 (proprietary)	128K-160K/ 128K-2M	OS4	Assembly, BCPL, CORAL, FORTRAN IV, Pascal	3,035/ 4,635	
<b>CONCURRENT COMPUTER CORP. (FORMERLY PERKIN-ELMER)</b>							
2 Crescent Place, Oceanport, NJ 07757, (201) 870-4500							Circle 376
3230/ 3230XP/ 3250XP	32		1M-16M	OS/32, XELOS	Assembly, BASIC, C, COBOL, FORTRAN, Pascal, RPG-II	74,150/ 85,000	one terminal, battery backup
3230MPS/ 3260MPS/ 3280MPS	32		2M-16M	OS/32, XELOS	Assembly, BASIC, C, COBOL, Pascal, RPG-II	125,000/ 185,000/ 250,000	one terminal, controller
XF/400	32		2M-4M	XELOS	Assembly, C, COBOL, FORTRAN, UNIBOL	21,995	one 5¼-inch, 51M-byte rigid disk drive; controller; ¼-inch, SCSI tape cartridge drive
<b>COMARK CORP.</b>							
P.O. Box 474, Medfield, MA 02052, (617) 359-8161							Circle 377
DISKSTOR M-6	16	8086	1M	Concurrent CP/M	BASIC, C, FORTRAN, Pascal	11,995	one 8-inch flexible disk drive; one 20M-byte rigid disk drive; 16 terminals
<b>DATA GENERAL CORP.</b>							
4400 Computer Dr., Westboro, MA 01580, (617) 366-8911							Circle 378
ECLIPSE MV/20000 Model 1	32	ECLIPSE	64M	AOS/VS, AOS/DVS, MV/UX	BASIC, Business BASIC, Extended BASIC, C, COBOL, FORTRAN, Pascal, PL/1, RPG-II	234,000	
ECLIPSE MV/20000 Model 2	32	ECLIPSE	64M	AOS/VS, AOS/DVS, MV/UX	BASIC, Business BASIC, Extended BASIC, C, COBOL, FORTRAN, Pascal, PL/1, RPG-II	337,000	

## MINICOMPUTER SYSTEMS

Company Model	CPU word size (bits)	CPU type	Memory min.-max. (bytes)	Operating systems available	Programming languages supported	Base price \$	Base configuration
ECLIPSE MV/2000DC	32	ECLIPSE	2M-5M	AOS/V.S, AOS/DVS, DG/UX		17,500	
<b>DATAPOINT CORP.</b> 9725 Datapoint Dr., San Antonio, TX 78284, (512) 699-7000							<b>Circle 379</b>
1600/1200	16	80286/80186	512K/512K-1M	MS-DOS/RMS	DATABUS, GW BASIC/BASIC, COBOL, DATABUS, FORTRAN, Pascal	5,995/3,195	one 1.2M-byte flexible disk drive; one 20M-byte rigid disk drive/two 630K-byte flexible disk drives
8400	80286		512K-1M	RMS	BASIC, COBOL, DATABUS, RPG	7,500	
8850	16	proprietary	512K-1M	RMS	DATABUS	16,500	
<b>DIGITAL EQUIPMENT CORP.</b> 146 Main St., Maynard, MA 01754, (617) 897-5111							<b>Circle 370</b>
PDP-11/84	16	J11	1M-4M	RSX-11M-Plus, RT-11, ULTRIX-11, DSM-11, RSTS/E, CTS 500	BASIC, C, COBOL, CORAL 66, DIBOL, FORTRAN, DSM(MUMPS) Pascal	16,000	
<b>FLEXIBLE COMPUTER CORP.</b> 1801 Royal Lane, Bldg. 8, Dallas, TX 75229, (214) 869-1234							<b>Circle 380</b>
Series 600	32	32032, 68020 (4)	2M-24.5M	UNIX System V, MMOS	Ada, C, Concurrent C, Concurrent FORTRAN, FORTRAN	75,000	one 5¼-inch, 80M-byte rigid disk drive; tape cartridge drive; eight terminal ports
Series 1200	32	32032, 68020 (8)	2M-56.5M	UNIX System V, MMOS	Ada, C, Concurrent C, Concurrent FORTRAN, FORTRAN	120,000	one 5¼-inch, 80M-byte rigid disk drive; tape cartridge drive; eight terminal ports
Series 2000	32	32032, 68020 (10)	4M-72M	UNIX System V, MMOS	Ada, C, Concurrent C, Concurrent FORTRAN, FORTRAN	180,000	one 5¼-inch, 80M-byte rigid disk drive; tape cartridge drive; eight terminal ports
<b>FORMATION INC.</b> 823 E. Gate Dr., Mt. Laurel, NJ 08054, (609) 234-5020							<b>Circle 381</b>
F4000-101 F4000-201	32	2901	1M-8M	VM/SP, DOS/VSE, OS/VSI, OS/MVS	COBOL, FORTRAN, PL/1	83,350/ 96,850	one 8-inch, 1M-byte flexible disk drive; one 14-inch, 100M-byte rigid disk drive; two terminals; one 300-lpm printer
F4000-301	32	2901	2M-8M	VM/SP, DOS/VSE, OS/VSI, OS/MVS	COBOL, FORTRAN, PL/1	121,450	two 8-inch, 1M-byte flexible disk drives; one 14-inch, 100M-byte rigid disk drives; two terminals; one 300-lpm printer
<b>HEWLETT-PACKARD CO. (DATA SYSTEMS DIV.)</b> 11000 Wolfe Rd., Cupertino, CA 95014, (408) 257-7000							<b>Circle 382</b>
A600+	16	AMD 29XX bit-slice	512K-8M	RTE-A	BASIC, FORTRAN, MACRO, Pascal	6,600	
A700	16	AMD 29XX bit-slice	512K-8M	RTE-A	proprietary	12,600	one 270K-byte flexible disk drive; one 15M-byte rigid disk drive; power supply
A900	16	proprietary	568K-24M	RTE-A	BASIC, FORTRAN, MACRO, Pascal	23,600	one 270K-byte flexible disk drive; one 15M-byte rigid disk drive; power supply
<b>HONEYWELL INFORMATION SYSTEMS INC.</b> Honeywell Plaza, Minneapolis, MN 55408, (612) 870-5200							<b>Circle 383</b>
DPS 6/75-1/ DPS 6/45-1	16	proprietary	2M-8M/2M-4M	GCOS 6	Ada, Assembly, BASIC, C, COBOL, FORTRAN, Pascal	36,000/ 27,000	
DPS 6/98-2/ DPS 6/95-1	32	proprietary	4M-16M	GCOS 6	Ada, Assembly, BASIC, C, COBOL, FORTRAN, Pascal	138,000/ 86,000	
DPS 6/85-1	32	proprietary	4M-8M	GCOS 6	Ada, Assembly, BASIC, C, COBOL, FORTRAN, Pascal	62,000	
<b>INTELLIMAC INC.</b> 6001 Montrose Rd., Sixth Floor, Rockville, MD 20852, (301) 984-8000							<b>Circle 384</b>
IN/7000 M	16, 32	68000	4M-16M	UNIX System V	Ada, C, FORTRAN 77	39,390	one 5¼-inch, 53M-byte rigid disk drive; 9-track tape drive
IN/7000 AT/R	16, 32	68000	4M-16M	UNIX System V	Ada, C, FORTRAN 77	35,950	
<b>MAI BASIC FOUR</b> 14101 Myford Rd., Tustin, CA 92680, (714) 731-1500							<b>Circle 385</b>
MAI 1600	8	proprietary	128K-512K	BOSS	Business BASIC	23,155	one 5¼-inch, 22M-byte rigid disk drive; one 120-cps printer; controller

# Input Devices - The Solution is Through the Keyboard



A.



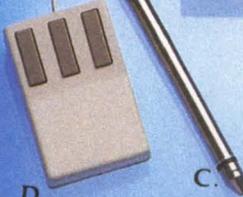
B.



D.



C.



In a world where the cost of memory, processing and output are decreasing, why doesn't the cost of input fall as well?

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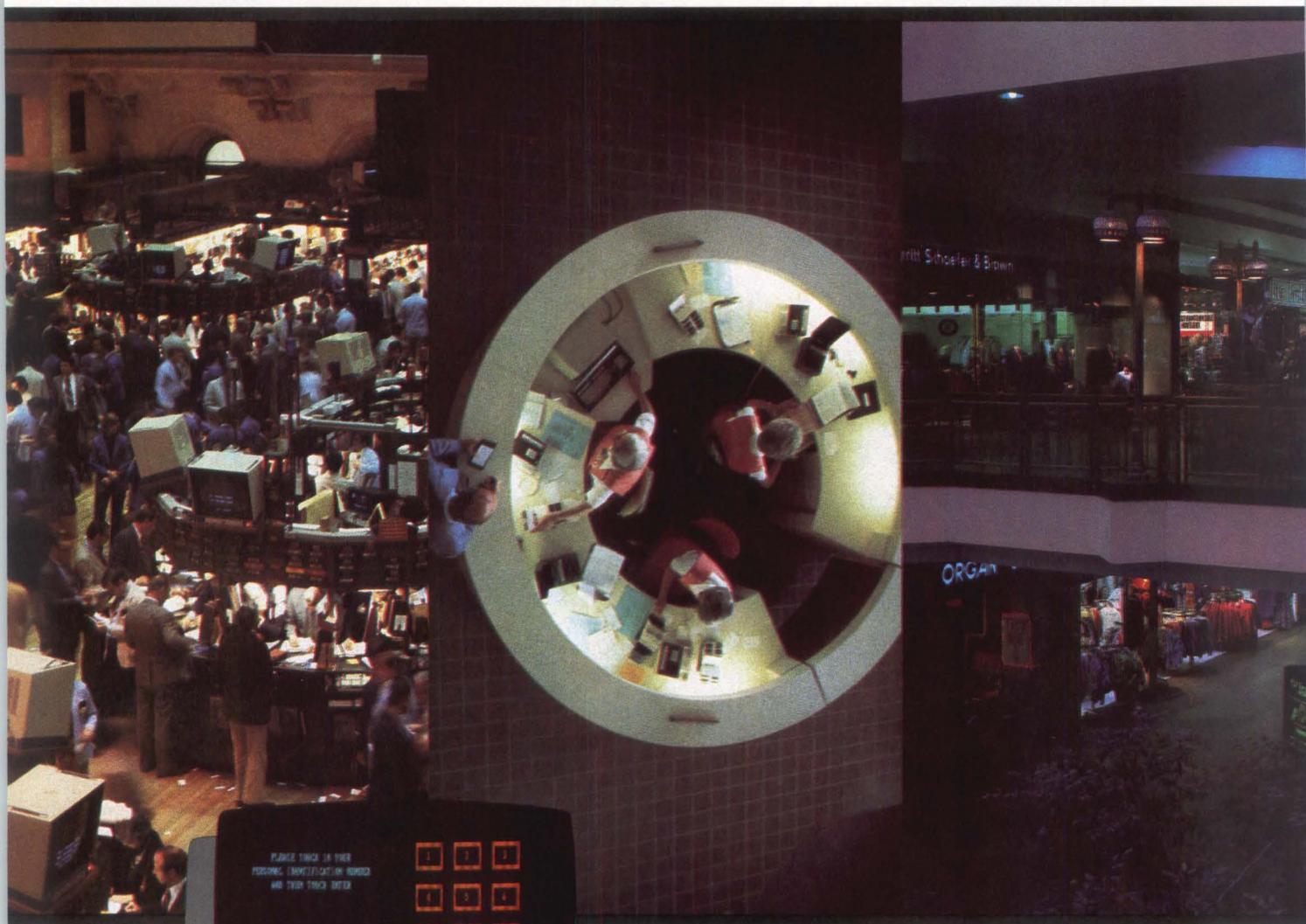
Incorporating a touch activated display into your system shouldn't be an afterthought. Adding touch is the best way to make your product truly interactive, easier to use, and better suited for the real world.

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**CIRCLE NO. 32 ON INQUIRY CARD**

## MINICOMPUTER SYSTEMS

Company Model	CPU word size (bits)	CPU type	Memory min.-max. (bytes)	Operating systems available	Programming languages supported	Base price \$	Base configuration
<b>MDS QANTEL INC.</b>							
4142 Point Eden Way, Hayward, CA 94545, (415) 887-7777							<b>Circle 386</b>
45	8	Q30	256K-1M	BEST/AOS	COBOL, QIC BASIC	20,000	one 5¼-inch, 45M-byte rigid disk drive; one terminal; 180-cps printer; controller; ¼-inch tape cartridge drive
55/58	8	Q31	512K-4M/ 512K-16.3M	BEST/AOS	COBOL, QIC BASIC	42,760/ 73,670	one 5¼-inch, 150M-byte rigid disk drive; one 300-lpm printer; controller
<b>MOTOROLA COMPUTER SYSTEMS</b>							
10700 N. DeAnza Blvd., Cupertino, CA 95014, (408) 255-0900							<b>Circle 387</b>
200	24	proprietary	864K-1.5M	MFE/IV	Assembly, COBOL, Vision	68,593	one 5¼-inch, 67.5M-byte rigid disk drive; eight terminals
300	24	proprietary	864K-1.5M	MFE/IV	Assembly, COBOL, Vision	103,109	one 5¼-inch, 67.5M-byte rigid disk drive; 16 terminals
400	24	proprietary	864K-1.5M	MFE/IV	Assembly, COBOL, Vision	131,741	one 5¼-inch, 67.5M-byte rigid disk drive; 20 terminals
<b>NATIONAL SEMICONDUCTOR DATACHECKER/DTS</b>							
800 Central Expwy., Santa Clara, CA 95050, (408) 986-8560							<b>Circle 388</b>
1110	16	PDP 11/23+	256K-4M	RSX-11M+	COBOL, FORTRAN	15,000	one 5¼-inch, 655K-byte flexible disk drive; one 5¼-inch, 20M-byte rigid disk drive; one terminal; one character printer
1120	16	PDP 11/73	256K-4M	RSX-11M+	COBOL, FORTRAN	18,500	one 5¼-inch, 655K-byte flexible disk drive; one 5¼-inch, 40M-byte rigid disk drive; one terminal; one character printer
<b>NCR CORP.</b>							
1700 S. Patterson Blvd., Dayton, OH 45479, (513) 445-2190							<b>Circle 389</b>
Mini Tower	16	68010	1M-2M	UNIX	BASIC, C, COBOL, FORTRAN, Pascal	6,995	one 5¼-inch, 1M-byte flexible disk drive; one 5¼-inch, 25M-byte rigid disk drive; controllers
Tower XP	16	68010	1M-8M	UNIX	BASIC, C, COBOL, FORTRAN, Pascal	10,125	one 5¼-inch, 1M-byte flexible disk drive; one 5¼-inch, 25M-byte rigid disk drive; controllers
Tower 32	32	68020	1M-16M	UNIX	BASIC, C, COBOL, FORTRAN, Pascal	21,900	one 5¼-inch, 46M-byte rigid disk drive; controllers; 45M-byte tape cartridge drive
<b>NEC INFORMATION SYSTEMS INC.</b>							
1414 Massachusetts Ave., Boxboro, MA 01719, (617) 264-8000							<b>Circle 390</b>
Astra 300 Series	32	NEC IDP-1	1M-6M	ITOS	BASIC, COBOL	16,895	one 8-inch, 1M-byte flexible disk drive, one 8-inch, 63M-byte rigid disk drive; eight terminals
<b>NIXDORF COMPUTER CORP.</b>							
300 Third Ave., Waltham, MA 02154, (617) 890-3600							<b>Circle 391</b>
8850	16		128K	DPEX		24,250	one 630K-byte flexible disk drive; one 8M-byte rigid disk drive
8870	16		256K-1M	NIROS	BASIC	19,200	one or two, 32M-byte rigid disk drive (s); up to eight terminals; 100-cps printer
<b>POINT 4 DATA CORP.</b>							
15442 Del Amo Ave., Tustin, CA 92680, (714) 838-2225							<b>Circle 392</b>
Mark 2/ Mark 4	16	proprietary	64K-128K/ 512K	BLIS, COBOL, IRIS	BASIC, COBOL	8,995/ 21,995	one 5¼-inch, 1M-byte flexible disk drive; one 5¼-inch, 19M- to 86M-byte rigid disk drive/one 5¼-inch, 1M-byte flexible disk drive; up to three, 5¼-inch, 86M- to 258M-byte rigid disk drive(s)
Mark 5	16	proprietary	128K	BLIS, COBOL, IRIS	BASIC, COBOL	28,200	up to 20, 8-inch, 84M-, 688M-byte rigid disk drives; up to 64 terminals; serial, parallel printer; ¼-inch streaming tape cartridge drive
Mark 9/ Mark 12	16	proprietary	512K/128K	BLIS, COBOL, IRIS	BASIC, COBOL	34,200/ 42,430	up to two, 8-inch, 84M- to 688M-byte rigid disk drive (s); up to 100 terminals; serial printer; ¼-inch, 20M- or 45M-byte streaming tape cartridge drive

## MINICOMPUTER SYSTEMS

Company Model	CPU word size (bits)	CPU type	Memory min.-max. (bytes)	Operating systems available	Programming languages supported	Base price \$	Base configuration
<b>PRIME COMPUTER INC.</b> <span style="float: right;">Circle 393</span>							
Prime Park, Natick, MA 01760, (617) 655-8000							
2350/2450	32	50 Series	8M	Primos	BASIC/VM; C; COBOL; FORTRAN 66, 77; PL/1-G; Pascal; RPG-II		up to two, 5¼-inch, 60M- or 120M-byte Winchester disk drive(s); band, matrix printer
2655	32	50 Series	8M	Primos	BASIC/VM; C; COBOL; FORTRAN 66, 77; PL/1-G; Pascal; RPG-II		up to two, 315M-byte Winchester disk drive(s); 64 terminals; band, matrix printer
9655/9750/9955	32	50 Series	8M/12M/16M	Primos	BASIC/VM; C; COBOL; FORTRAN 66, 77; PL/1-G; Pascal; RPG-II		128/192/254 terminals; band, matrix printer
<b>PYRAMID TECHNOLOGY CORP.</b> <span style="float: right;">Circle 394</span>							
1295 Charleston Rd., P.O. Box 7295, Mountain View, CA 94043, (415) 965-7200							
90x	32	proprietary	4M-32M	OSx	C, FORTRAN, FRANZ LISP, Pascal	140,000	one 150M-, 450M-byte rigid disk drive; 16 terminals; 600-lpm printer; 9-track tape drive
98x Isoprocessor	32	proprietary	4M-32M	OSx	C, FORTRAN, FRANZ LISP, Pascal	250,000	three 8-inch, 150M-, 300M-, 450M-byte rigid disk drives; dual processor
Work Center	32	proprietary	4M-8M	OSx	C, FORTRAN, FRANZ LISP, Pascal	90,000	three 8-inch, 150M-, 300M-, 450M-byte rigid disk drives
<b>SENTINEL COMPUTER CORP.</b> <span style="float: right;">Circle 395</span>							
8800 Governor's Hill Dr., Cincinnati, OH 45249, (513) 677-2400							
DS-130	16	8086	128K-1M	DBOS	BASIC, COBOL, DBL, FORTRAN, Pascal	14,500	one 8-inch, 1.6M-byte flexible disk drive; one 5¼-inch, 30.8M-byte rigid disk drive; nine terminals
DS-140	16	8086	544K-1M	DBOS	BASIC, COBOL, DBL, FORTRAN, Pascal	20,150	one 8-inch, 1.6M-byte flexible disk drive; one 5¼-inch, 72M-byte rigid disk drive; 32 terminals
<b>SPERRY CORP.</b> <span style="float: right;">Circle 396</span>							
P.O. 500, Blue Bell, PA 19424, (215) 542-4011							
5000/50	32	68020	1M-16M	UNIX System V	BASIC, C, COBOL, FORTRAN, RPG		1M-byte flexible disk drive; 45M-byte tape cartridge drive; battery backup
5000/90	32	68020 (up to 4)	1M-16M	UNIX System V	BASIC, C, COBOL, FORTRAN, RPG		64 terminals; serial, parallel printer, 45M-byte tape cartridge drive; battery backup
<b>STRATUS COMPUTER INC.</b> <span style="float: right;">Circle 397</span>							
55 Fairbanks Blvd., Marlboro, MA 01752, (617) 460-2000							
FT250	32	68000	2M-8M	VOS/USF (UNIX)	BASIC, C, COBOL, FORTRAN, Pascal, PL/1	115,000	two 32M-, 60M-, 143M-, 448M-byte rigid disk drives; 64 terminals; printer; text editor; two memory controllers
XA400/XA600	32	68010	2M-16M	VOS/USF (UNIX)	BASIC, C, COBOL, FORTRAN, Pascal, PL/1	185,000/275,000	two 32M-, 60M-, 143M-, 448M-byte rigid disk drives; printer; text editor; two memory controllers; XA400: 256 terminals; XA600: 64 terminals
<b>SUPERSET INC.</b> <span style="float: right;">Circle 398</span>							
11025 Roselle St., San Diego, CA 92121, (619) 452-8665							
PGM-2 XP/48	48	SPU (proprietary)	393K-1.5M	SOS (proprietary)	FORTRAN	27,500/19,900	one 20M-byte rigid disk drive; one terminal; graphics software
<b>SYFA DATA SYSTEMS CORP.</b> <span style="float: right;">Circle 399</span>							
P.O. Box 851077, Richardson, TX, 75085-1077, (214) 783-0993							
SyFA 150/170/190	16	LSI-2	128K-256K	SyCLOPS (proprietary)	SyBOL (proprietary)	20,440/24,440/26,440	one 5¼-inch, 36M-byte rigid disk drive; one terminal; 200-cps, matrix printer; 60M-byte tape cartridge drive
SyFA 300/1000	16	LSI-2	128K-384K	SyCLOPS (proprietary)	SyBOL (proprietary)	60,840/76,740	two 9-inch, 80M-byte rigid disk drives; one terminal; 300-lpm band printer
<b>SYMBOLICS INC.</b> <span style="float: right;">Circle 400</span>							
11 Cambridge Center, Cambridge, MA 02142, (617) 577-7500							
3640/3645	32	proprietary	2M-28M	proprietary	Ada, FORTRAN, Pascal, PROLOG, Symbolics LISP	70,800	one 5¼-inch, 196M-byte rigid disk drive; one terminal; ¼-inch tape cartridge drive



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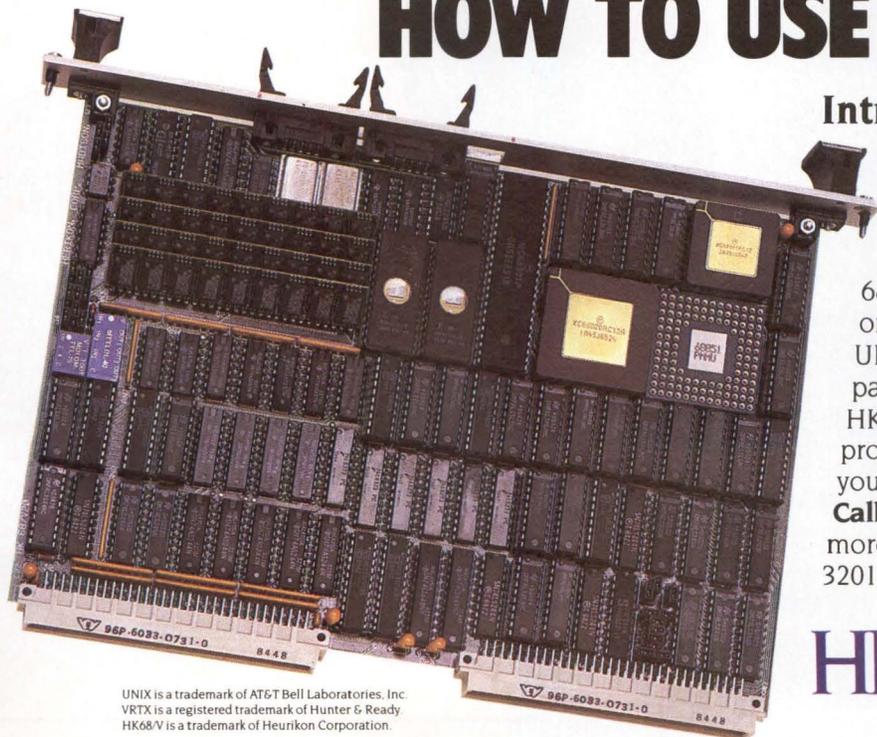
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CIRCLE NO. 34 ON INQUIRY CARD

## MINICOMPUTER SYSTEMS

Company Model	CPU word size (bits)	CPU type	Memory min-max. (bytes)	Operating systems available	Programming languages supported	Base price \$	Base configuration
3670/3675	32	proprietary	2M-28M	proprietary	Ada, FORTRAN, Pascal, PROLOG, Symbolics LISP	101,400	one 14-inch, 474M-byte rigid disk drive; one terminal; 1/4-inch tape cartridge drive
<b>TOLERANT SYSTEMS INC.</b> 81 E. Daggett Dr., San Jose, CA 95134, (408) 946-5667 <span style="float: right;">Circle 401</span>							
Eternity Series	32	National Semiconductor Series 32000	4M-12M	TX	Ada, C, COBOL, FORTRAN, Pascal	80,000-190,000	up to two, 8-inch, 168M-byte rigid disk drives
<b>ULTIMATE CORP.</b> 717 Ridgedale Ave., E. Hanover, NJ 07936, (201) 887-9222 <span style="float: right;">Circle 402</span>							
2000/2000S	16	LSI-11	128K-512K	ULTIMATE (PICK-based)	Extended BASIC, RECALL, PROC	36,000	one 14-inch, 33M-byte rigid disk drive; up to 32 terminals; serial printer port
3030	16	LSI-11	1M-3M	ULTIMATE (PICK-based)	Extended BASIC, RECALL, PROC	77,000	one 8-inch, 188M-byte rigid disk drive; up to 64 terminals; serial printer port
6800	16	Honeywell DPS 6	1M-2M	ULTIMATE (PICK-based)	Extended BASIC, RECALL, PROC	179,000	one 5 1/4-inch, 640K-byte flexible disk drive; one 9-inch, 515M-byte rigid disk drive; up to 256 terminals
<b>WANG LABORATORIES INC.</b> One Industrial Ave., Lowell, MA 01851, (617) 459-6405 <span style="float: right;">Circle 403</span>							
Micro VP	8	proprietary	128K-512K	BASIC 2	BASIC 2	4,950	
VS85/VS100	32	proprietary	2M-8.2M/2M-16.3M	UNIX, VS/OS	Assembly, BASIC, COBOL, FORTRAN, PL/1, Procedure, RPG-II	67,700/99,750	one 8-inch, 1.2M-byte flexible disk drive
VS300	32	proprietary	4K-16.3K	UNIX, VS/OS	Assembly, BASIC, FORTRAN, PL/1, Procedure, RPG-II	178,500	one 5 1/4-inch, 360K-byte flexible disk drive; modem

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CIRCLE NO. 35 ON INQUIRY CARD





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No other support program, foreign or domestic, is

as far-reaching as ours. With worldwide applications engineering, training, parts, and field service, Control Data will make sure you are never left in need.

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That's why, we've launched a steady stream of new products. Better. Faster. Smaller. More. More new, more reliable products, than ever before.

So no matter what direction you're headed in the OEM market, you can count on Control Data to always be a step ahead. For more information write Control Data Corporation, OEM Marketing (HQW08X), P.O. Box 0, Minneapolis, MN 55440.



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Once you consider the source.

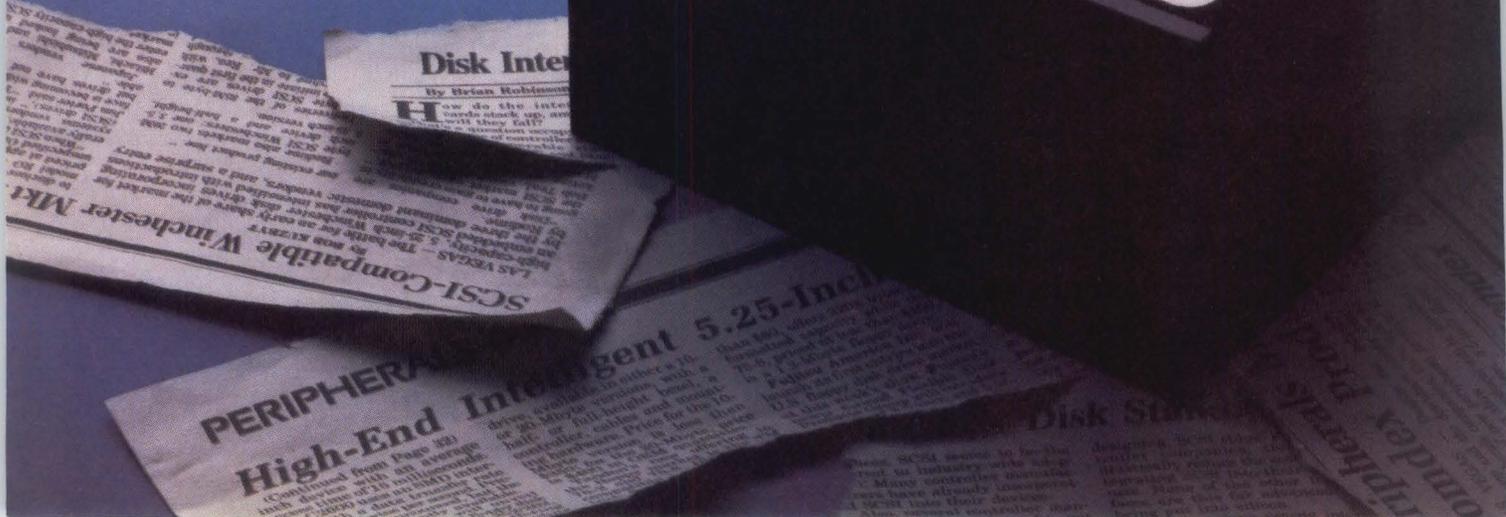
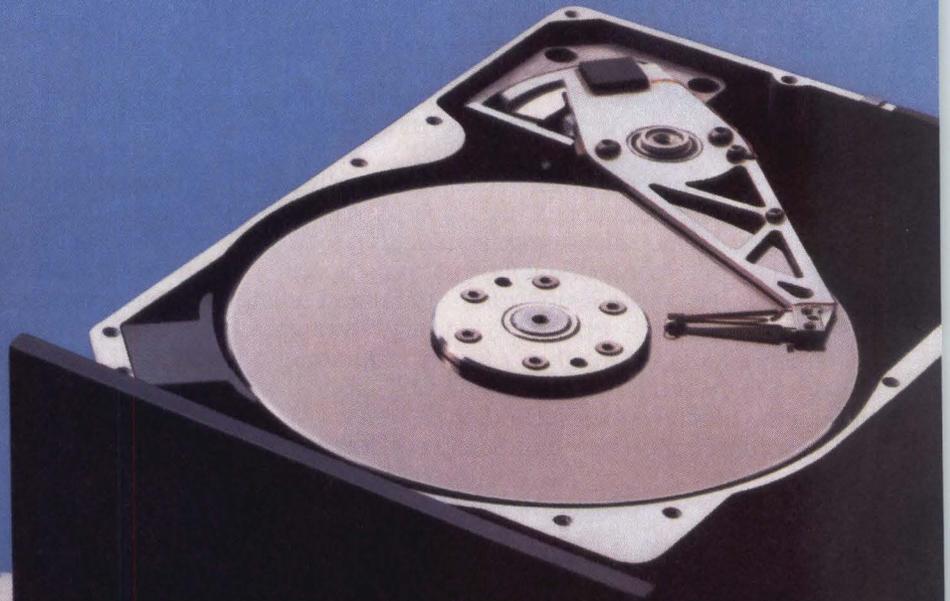
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CIRCLE NO. 37 ON INQUIRY CARD



# UPSes KEEP PACE WITH USERS' NEEDS

Advances in technology make it easier to integrate UPSes into a wider range of computer-based applications and provide integrators with greater incentive to specify power protection

**Jesse Victor**, Associate Editor

Today's uninterruptible power systems (UPS) are doing a better job than ever in safeguarding important data and protecting sensitive electronic equipment from the omnipresent noise, spikes, surges, transients, dips, brownouts and blackouts that accompany commercial AC power.

There are several reasons for the improved performance. One, transistorized pulse-width-modulation (PWM) technology enables smaller, lighter and quieter on-line units to furnish fast transient response to load changes. Two, faster transfer times and sine-wave outputs of off-line, standby UPSes operate effectively with a wider range of microcomputers and are closing the performance gap with on-line systems. Three, new software products are easing backup of data when blackouts occur. And, finally, linear-power-amplifier and three-port UPSes offer alternatives to more traditional designs.

Such advances in UPS technology—along with greater awareness of power problems—are melting the glacial resistance of many system integrators and end users to UPS power-protection for computer systems.

All of these factors translate into surging sales for UPS vendors—especially for low-end systems (rated at less than 10 kVA) designed for microcomputer and smaller minicomputer systems. In fact, Venture Development Corp., Natick, Mass., predicts the value of U.S. sales of all UPSes will increase at a 23.4 percent average annual rate through 1990, rising from \$408.2 million in 1984 to \$1.439 billion. Units of less than 10 kVA will do best: 30 percent average annual growth. The value of sales of UPSes rated at 11 to 100 kVA will grow at a 22 to 23 percent rate.

Most UPSes (58 percent of installations) are there to protect data-processing systems, and Venture Development project director Daniel J. Kennedy says that this and other market segments can expect healthy sales, even if sales of computer systems remain depressed. "Even if there are not tremendous sales of new computers, people who own computers now will still need UPSes," he says.

End users and system integrators who have not addressed the UPS issue constitute a large cloud on the UPS horizon. Despite healthy sales projections, UPS vendors agree that the market for their power-protection devices could be larger than it is. Analysts estimate that only 3 percent to 5 percent of microcomputers and minicomputers are protected by UPSes.

Although greater awareness exists now than two or three years ago, "There is still a fairly low awareness level of the problems utility power creates for a computer system," contends Jerry

## ONLY UPSes GIVE COMPLETE PROTECTION FOR COMPUTER-BASED SYSTEMS

Power-protection-equipment type	Power problem solved?					
	Voltage transient	Momentary interruption	Voltage dip	Outage / blackout	Brownout	Frequency variation
Voltage regulator	yes	no	yes	no	yes	no
Isolation transformers	yes	no	no	no	no	no
Power conditioners	yes	no	yes	no	yes	no
Motor generator	yes	yes	yes	no	no	no
UPS	yes	yes	yes	yes	yes	yes

Source: General Power Systems

**Advances in UPS technology and greater awareness of power problems are melting the glacial resistance to UPS power protection.**

Hanwacher, market planning and operations manager at AT&T Technology Systems. "Garbled data and misfiled data may not ever be picked up as arising from power problems, or not until long after the power problem has occurred."

End users' and system integrators' reluctance to specify UPSes stem from two related factors: First, the apparent costliness of UPS protection, and, second, ignorance of the true cost of data destroyed or scrambled, production lost and equipment damaged by power problems. The "buy" decision for UPS products is thus screened by more value imponderables and perceptions than it is for any other form of electronic equipment.

However, the perceived high cost of UPS protection is not the barrier it once was, contends Tony Materna, low-power UPS product manager at Emerson Electric Co. "Years ago, cost was literally a barrier. A 5-kVA system cost \$19,000; a 10-kVA, \$25,000. That was a lot of money compared to the cost of the computers involved. Those costs have been roughly cut in half," notes Materna.

Vendors point out, however, that the overriding consideration in specifying a UPS is the value of the data the unit protects. Explains Materna, "If you have a blackout seven times a year, which is the national average, how much will that cost you in terms of lost data and redoing programs?"

**LANs especially vulnerable**

Cost factors to consider, Materna suggests, include the time it takes to reload the computer, the time required to reconstruct data not saved on disk, and the time and cost involved when

**UPS SALES NEED NO SUPPORT**  
**UPS shipments by power rating**  
**1984 to 1990 (\$ millions)**

UPS rating (kVA)	1984	1986	1988	1990	Average annual growth (%)
0 to 1	73.8	137.9	222.5	357.3	30.1
1.1 to 10	66.3	123.8	199.7	320.8	30.1
11 to 30	45.9	77.1	111.9	160.1	23.2
31 to 50	38.6	62.6	90.4	127.0	22.0
51 to 100	40.3	65.4	94.4	132.6	22.0
101 to 200	42.6	63.3	88.4	119.8	18.8
201 to 500	43.8	65.1	90.9	123.1	18.8
Over 500	56.9	69.7	80.2	98.8	9.6
Total	408.2	664.9	978.4	1439.5	23.4

Source: Venture Development Corp.

data is irretrievably lost because there is no backup from which to reconstruct it.

In this respect, multiuser computers, networked systems and local area network file servers are especially vulnerable to both data loss and damage from power problems. "It is one thing to lose one terminal. It is quite another to lose six or 10 terminals and take out a whole department," warns Patrick Kareiva, president of Electronic Protection Devices Inc., of Billerica, Mass., a subsidiary of ALS Corp. "If you lose one hour of keystroking, it is not a big deal. If you lose 1,000 hours, your whole business may depend on it."

All systems with highly integrated or complex software are particularly at risk, Kareiva stresses, because they are more sensitive to dropping a bit in their RAM. "Consider a small business system, running highly integrated accounting software," he explains. "If you get a data glitch you may or may not know about it at the time it happens."

Damage to electronic equipment is another cost that comes from power problems. Often this cost shows up on corporation balance sheets disguised as service costs. "There is more damage from (power) transients than people suspect. If you get enough hits, it will eventually break down the device," says Mark Dillely, product marketing manager at General Power Systems.

Such costs stay hidden, vendors contend, because service organizations don't ascribe equipment failures to power surges or spikes. "If they see a problem, they might say, 'Oh, another batch of bad components,'" Kareiva notes.

System integrators or end users who decide to specify UPSes are getting higher performance for their money with today's units. On-line UPS vendors such as Emerson, General Power, Elgar

**LOWER UPS EFFICIENCY MEANS HIGHER POWER COST**

**Annual energy cost for 75-kVA UPS by electrical cost per kWh for 60-kW full-load operation**

UPS System efficiency (%)	Electrical cost per kilowatt hour (cents)			
	6	8	10	12
85	\$5,566	\$7,421	\$9,277	\$11,132
86	5,135	6,847	8,558	10,270
87	4,709	6,279	7,849	9,419
88	4,299	5,732	7,166	8,599
89	3,900	5,200	6,500	7,800
90	3,506	4,674	5,843	7,012

Source: Emergency Power Engineering Inc.

# No. It's not a computer.



## But Emerson's New UPS for minicomputers is right at home in the computer room.

Until now, if you wanted a true, uninterruptible power system for your minicomputer, you'd have to hide it in the basement or equipment room.

They were big. They were noisy. And they were expensive.

Emerson has put an end to all that. Our new AP100 series UPS in power ratings of 3, 5, and 10 KVA are small, quiet (less than 60db) and very affordable.

They have internal sealed batteries that continue to give perfect power even when the lights go out.

And because it is a true UPS, it gives you complete isolation from the hazards of raw utility power.

Every AP100 UPS has a built-in microprocessor that monitors your computer's total power requirements, displays real time status, and performs hundreds of system checks every second.

With its single rotary control switch, anyone can learn to operate it in 5 minutes.

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CIRCLE NO. 38 ON INQUIRY CARD

# THE WORST POSSIBLE TIME TO FIND OUT HOW DEPENDABLE YOUR UPS IS.

The most important test of UPS dependability is what happens when the power goes out.

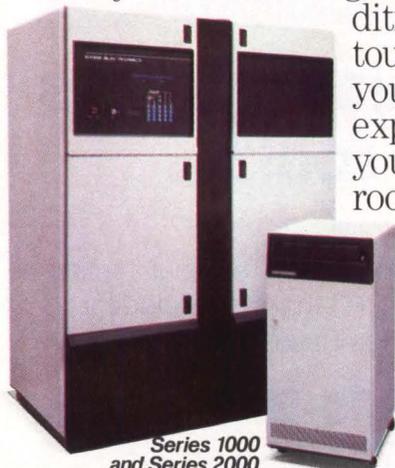
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Corp., Emergency Power Engineering Inc. (EPE) and Solid State Controls Inc. (SCI) are increasingly turning to PWM inverters and power transistors, instead of to older ferroresonant technology. These inverters tighten voltage regulation, improve transient response and reduce emitted electromagnetic interference (EMI) and radio-frequency interference (RFI) on units of over 1 kVA,

usually designed for minicomputer backup.

**PWM improves dynamic response**

Because of PWM, tight voltage regulation of 1 percent to 2 percent is becoming the norm, rather than the 5 percent commonly encountered a few years ago. For example, EPE's 2-kVA to 300-kVA on-line UPSes combine PWM technology and power transistors to provide 1 percent

**How to specify a UPS for a minicomputer system**

**Mark E. Dilley**, General Power Systems

The need for an uninterruptible power system is determined by the extent your system is affected by power disturbances, and by the value you place on the work the minicomputer performs.

The first step in specifying a UPS is to analyze your system to determine the components that require protection. Typically, the CPU, storage devices and terminals are connected to the UPS.

The next step is to list the power required by each component and, from that, to calculate total system power consumption, as shown in the table. The data plate on your equipment will usually have this information, or you may have to call the manufacturer. If the power consumption is listed in amperes, multiply voltage by total amperes to determine the total volt-ampere (VA) requirement. If it is listed in watts, divide the total wattage by the power factor to achieve the same result. Add 25 percent for future system expansion to the total VA requirement to determine the VA rating of your UPS.

If your application is critical or involves real-time data access, an on-line supply is your best choice. If your application is less critical or can survive momentary interruptions of 8 to 10 msec (typical transfer times), a standby supply will be the most cost-effective approach. Standby systems will typically protect against 5 percent to 30 percent of all power disturbances.

Look for the following specifications in the data sheets of on-line and standby UPSes:

**On-line UPSes**

- Input voltage range: +10 percent to -15 percent of nominal
- Output voltage regulation: within ±2 percent of nominal
- Transient recovery: within 20 msec
- Total harmonic distortion: less than 5 percent
- AC-to-AC efficiency: greater than 70 percent, between 50 percent to 100 percent of full load
- Internal, sealed, maintenance-free batteries
- Adequate visual and audible alarms to indicate system status

**Typical minicomputer system power requirements**

<b>CPU</b>	120V AC	60 Hz	3 amps	324 watts
<b>Disk drive</b>	120V AC	60 Hz	5 amps	540 watts
<b>Terminal A</b>	120V AC	60 Hz	1 amp	108 watts
<b>Terminal B</b>	120V AC	60 Hz	1 amp	108 watts
<b>Total</b>			<b>10 amps</b>	<b>1,080 watts</b>

Total VA rating required = 1,200

- Low noise level (less than 55 dB at 6 feet) to permit installation near work station.

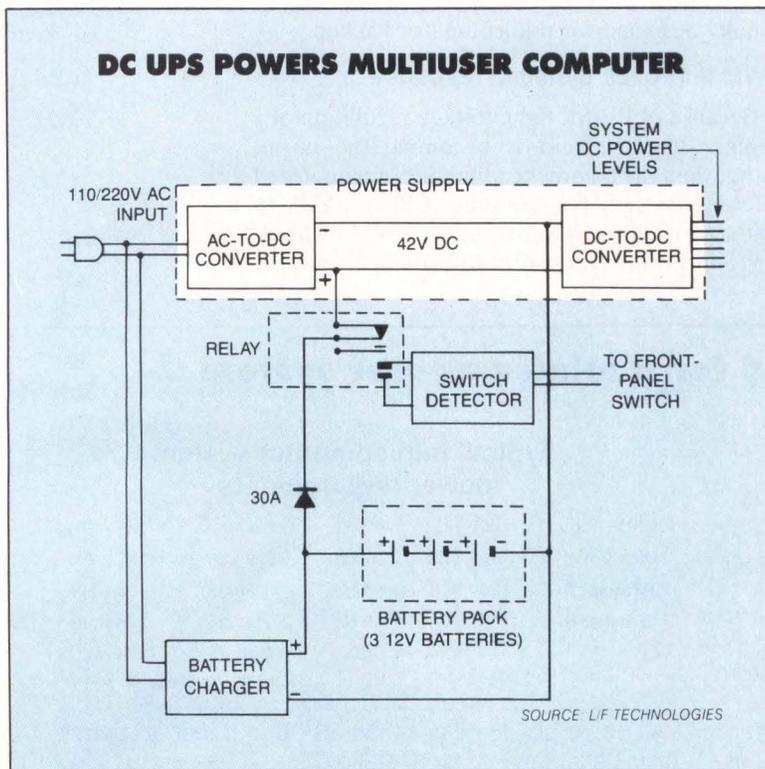
(A solid-state, make-before-break transfer switch is desirable. With a static transfer switch, the UPS should accept overloads of 150 percent for at least 10 minutes; without a switch, overloads of 125 percent for at least 10 minutes.)

**Standby UPSes**

- Transfer time: less than 4 msec
- Output: sine wave or rectangular
- Output-voltage regulation: to within ±5 percent of nominal
- Internal, sealed, maintenance-free batteries
- Visual and audible alarms to indicate system status
- IEEE 587 surge suppression or electromagnetic and radio-frequency interference filter to protect against voltage transients
- Adequate output receptacles to connect computer and peripherals.

Finally, consider the environment in which the UPS will be installed. Newer units, utilizing transistorized inverters, provide better operating efficiencies, take up less space, dissipate little heat and are quiet. Select a manufacturer with a broad product range, local sales-and-service support and a wide selection of options to enable customizing to a specific application. Underwriters Laboratories' approval assures operator safety and eliminates the need for municipal inspections when the unit is installed.

**Mark E. Dilley** is product marketing manager at General Power Systems, Anaheim, Calif., a vendor of standby and on-line UPSes.



**The DC UPS option** for LIF Technologies' multiuser computers brings the batteries on line to power the load when system DC voltage drops below normal levels. The switch detector allows a user to turn off the power-backup system from the computer's power switch.

no-load-to-full-load regulation over the battery voltage range.

PWM technology also offers faster response to step-load changes than do other designs, claims John Reed, EPE product manager for UPS. "With PWM, you are back within the specified regulation band within 30 msec when equipment, such as rigid disk drives, turn on and off. Other designs may take 50 to 100 msec."

General Power claims fast response to load changes as well as low output impedance for its 1-kVA to 50-kVA on-line units. Power transistors, Dilley says, allow for smaller units with less radiated EMI than designs based on silicon-controlled rectifiers (SCR).

Crest-factor-measurement circuitry enables SCI's Powerbase 4000 Series on-line units to respond to high-inrush currents—at a low noise level—without degrading output regulation or distorting the sine-wave output. SCI claims a 53-dB rating for its 5-kVA UPS.

For especially demanding applications, Behlman Engineering Corp. offers on-line units using linear power amplifiers that furnish better than 1 percent voltage regulation,  $\pm 0.001$  percent frequency accuracy and 1 percent maximum harmonic distortion. Load power factors from zero to unity, leading or lagging, can be handled without degrading output specifications, says Dave Lorelli, sales engineer at Behlman.

"You can have problems with SCRs turning on

and off. They generate a lot of EMI noise," Lorelli adds. "Our units meet MIL SPEC 461B, which is more stringent than Federal Communications Commission requirements for emitted EMI/RFI." Behlman's new H Series units, Lorelli reports, blend PWM regulation and linear devices to provide 3 percent regulation, 3 percent maximum distortion and 85 percent efficiency—overcoming the relatively low efficiency of PWM technology.

Another alternative to traditional UPS design comes from AT&T Technology Systems' new Protected Power series of 3-, 5- and 10-kVA UPSes. Their three-port "parallel processing" design uses a phase-shift technique to eliminate the transfer-time penalties of off-line units but with higher efficiency (90 percent), smaller design, better reliability and quieter operation than many on-line units, according to Bernard Schirmer, market operations manager.

Two primary isolated inputs—one, commercial AC, the other, DC from an inverter—feed into a ferroresonant transformer. The inverter remains in an idle state, synchronized to the frequency of the input AC. Excess energy from the transformer charges the batteries.

"Fewer components and the inverter not continuously operating increase reliability," explains Schirmer. "We claim a conservative mean time between failure of 40,000 hours."

Elgar's new Failsafe software seeks to remedy the problems of limited battery backup time (typically 5 to 20 minutes) and the consequent need for the speedy user response normally required when power fails. It works with IBM PCs, XTs, ATs and compatibles running MS-DOS or PC-DOS 2.0 or more recent versions and Elgar's SPF or SPR standby UPSes. The \$299, flexible disk-based package automatically shuts down the computer system, transfers file data to backup media through a programmable countdown procedure, then reboots the system when AC power is restored, bringing processing back to the same point as before the power failure.

The software shuts down as many connected peripherals as can be accommodated under the backup time available. Explains Julie Angelitch, application engineer at Elgar: "In the last minute of a 5-minute countdown the package can shut down an applications file, such as [Lotus Developments Corp.'s] 1-2-3 or [Ashton-Tate's] dBase II, then shut down a system file, initialize up to six printers and park a rigid disk drive."

Elgar plans to introduce soon an upgrade to the MS-DOS version that will operate with multiuser computer systems running Berkeley UNIX Version 4.2, System V or XENIX and a version that will work with Novell Inc.'s NetWare LAN

# THE SHOCK ABSORBER

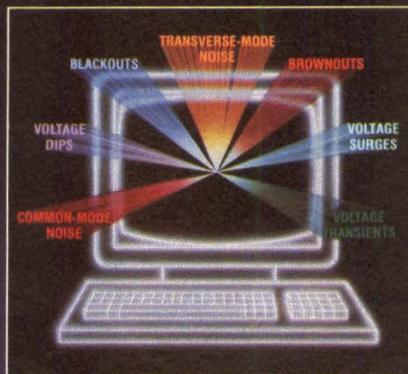


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## UNINTERRUPTIBLE POWER SYSTEMS

network software. Residing on the network file server, the LAN package will probably have no limitation on the number of connected microcomputers it can support, according to the company.

### The giants' shadows loom

From the vendors' point of view, bundling UPSes with systems would forestall the entry of major computer vendors into the UPS market. So far, however, computer manufacturers have resisted this opportunity for several reasons. Mentioning power protection to potential customers suggests that there is something wrong with the vendors' machines if they cannot operate with normal "wall" power.

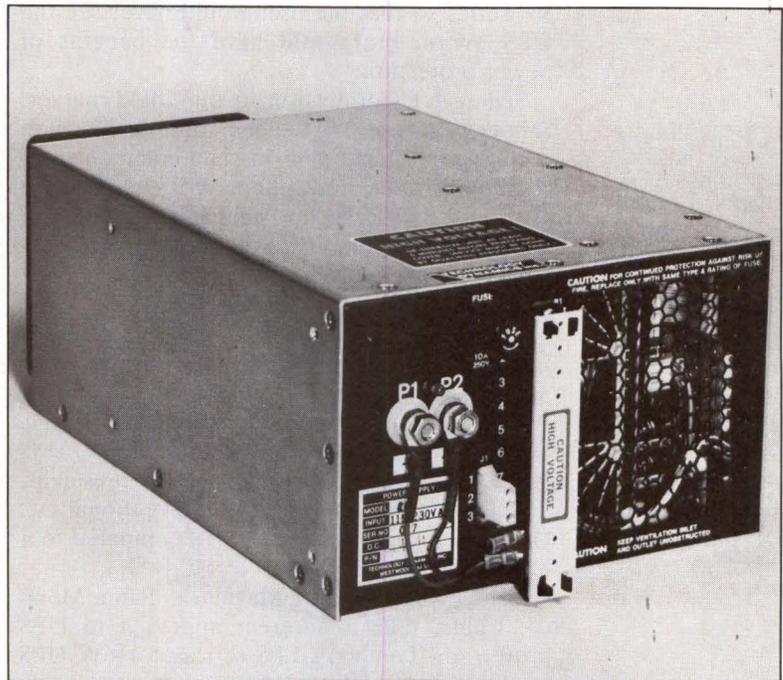
Computer vendors are also reluctant to add to the cost of their products in a highly competitive market—especially for a capability that they do not consider market driven. However, this situation may be changing. For instance, the data-storage demands of multiuser computer systems are spurring the integration of UPS power protection with computer hardware.

General Automation Inc., Anaheim, Calif., and L/F Technologies (formerly IMS International), Carson City, Nev., are two computer manufacturers that supply UPS protection for their machines.

General Automation, which sells through VARs to vertical markets, offers conventional Topaz Inc. AC UPSes with its Zebra multiuser microcomputers. The new 38-user Model 3750 has the UPS and batteries integrated into its chassis; other models, which support up to 64 users, supply a standalone unit that sits next to the computer. The batteries supply up to 20 minutes of power when AC power fails, and an automatic shutdown feature backs up memory to disk before shutting down the system.

Why UPSes? "The market is demanding this kind of power protection," asserts Pat Petillo, General Automation regional manager in Union, N.J. "It is a necessity not a luxury. Our customers would constantly ask if we supplied UPS protection. We thought it wise to incorporate it into our box."

Conventional AC UPSes rectify AC line power to DC and then invert it back to AC for the protected device. DC UPSes enable L/F Technologies to integrate on-line power-protection and power-conditioning capabilities into its Model 1620 8-user and Model 1650 30-user microcomputers and Ultima terminals at a fraction of the cost of conventional AC devices, says James Zakzeski, director of marketing. The L/F-Power option brings batteries on line to power the load when normal 42V DC intermediate voltage drops to 40V. A DC-to-DC converter brings



**The uninterruptible 600W three-output TDS-UPS Series switching power supply from Technology Dynamics (shown without fan) is typical of the battery-backed units that will soon begin appearing in microcomputer and minicomputer applications.**

voltage down to system power levels. A switch detector allows the backup system to be turned off with the computer's power switch.

The option with three batteries adds \$750 to the cost of the 1620 system; the six-battery option adds \$850 to the cost of the 1650. The terminal option increases Ultima terminal cost by \$150. Batteries reside inside the 1650 computer but are situated in a toaster-sized external unit next to the 1620.

"Power protection is more vital in multiuser environments," says Zakzeski. "Because a DC-to-DC UPS is the simplest approach, we can offer on-line power protection at a cost of only \$28 per user for the 1650 system."

Indeed, switching-power-supply manufacturers, such as Converter Concepts Inc., Pardeeville, Wis.; Lambda Electronics, Melville, N.Y.; and Technology Dynamics Inc., Bergenfield, N.J., are jumping on the UPS bandwagon to offer DC battery back-up modules and battery chargers with their products.

Converter Concepts, for example, integrates the DC UPS into its up-to-four-output Failsafe VF Series of 65W and 100W switchers. "If someone uses microcomputers, you have an application for UPSes," explains marketing manager, Michael J. Schoenwald. "We designed our

# UNINTERRUPTIBLE POWER SYSTEMS

VF series so that the user would never see the UPS option but would have the benefits of power protection."

Selling UPS protection to the OEM market, Schoenwald says, has the benefit of dealing with a more sophisticated buyer than commonly encountered in the conventional UPS market. He sees most UPS switcher sales initially going to high-end microcomputer and minicomputer systems.

Technology Dynamics protects up to three outputs with battery backup in its 600W TDS-UPS series switchers and all four outputs of its new 120W switcher.

The UPS option adds approximately 20 percent to the cost of a three-output supply, says Aron Levy, Technology Dynamics president. "Plugging a computer into a conventional AC UPS is an expensive way to do it compared to a DC UPS."

Lambda and Pioneer Magnetics, Santa Monica, Calif., take a different approach to UPS protection. Lambda's LPS series of 416W UPS modules use a DC-to-DC converter to supply high-voltage DC to the company's switchers.

The master module has a high-efficiency DC-to-DC converter, switch-mode battery charger and test circuitry; the slave module lacks the charger and failure-alarm circuits. Both modules can be paralleled for increased output power and/or battery-charging current.

Pioneer Magnetics' VMB option for its switchers furnishes 15A to secondary outputs from low-voltage standby batteries to hold up RAM, I/O ports or disk drives in the event of power failure on the main AC input.

Integrating UPS protection into microcomputer and minicomputer systems using DC units or more conventional AC devices stands to radically alter the nature of the UPS market. Once accepted as a standard peripheral on the same basis as a disk drive or printer or integrated into a computer or terminal chassis, a UPS will be totally transparent to the user and will no longer encounter the price resistance that has impeded UPS sales. □

Interest Quotient (Circle One)  
High 454 Medium 455 Low 456

## REPRESENTATIVE UNINTERRUPTIBLE POWER SYSTEMS

Company Model	Type	Power rating (KVA)	Input voltage (AC at 60 Hz)	Input current (amps/phase)	Input/output phase	Size (H x W x D/inches)	Weight (lbs.)	Price \$
<b>ATLAS ENERGY SYSTEMS</b>								
16872 Milliken Ave., Irvine, CA 92713, (714) 863-0900								
Rotary-plus	on-line rotary motor	12-1000	90, 115, 120, 208, 220, 480, 600		2 wire+GND 3 wire+GND 4 wire+GND	60 x 69 x 30 (cabinet)		
<b>CIRCLE 410</b>								
<b>BEAVER ELECTRONIC LABORATORY</b>								
P.O. Box 202, Kingston, MA 02364, (617) 585-5666								
BBU-912	on-line solid state	.1	120	4	3 wire+GND	5.25 x 19 x 19 (rack)	30	1,129
<b>CIRCLE 411</b>								
<b>BEHLMAN ENGINEERING CORP.</b>								
1142 Mark Ave., Carpinteria, CA 93013, (805) 684-8311								
UPS-10 to UPS-750	on-line solid state	.1-7.5	100, 115, 220, 230		2 wire+GND	5.25 x 19 x 19 (rack)	65 (min.)	1,750 (min.)
UPS3-100 to UPS3-600	on line solid state	3-20	120, 208, 230, 380, 460		4 wire+GND	33.25 x 22 x 19 (rack)	260 (min.)	9,925 (min.)
<b>CIRCLE 412</b>								
<b>BEST POWER TECHNOLOGY INC.</b>								
P.O. Box 280, Necedah, WI 54646, (608) 565-7200								
1.5 KVA	on-line solid state	1.5	120	20	2 wire+GND			3,995
2	on-line solid state	2	120	30	2 wire+GND 3 wire+GND			4,995
5	on-line solid state	5	120, 208, 240		2 wire+GND 3 wire+GND	33 x 17 x 30 (cabinet)	395	9,450
7.5	on-line solid state	7.5	120, 208, 240		2 wire+GND 3 wire+GND	41 x 23 x 30 (cabinet)	590	11,800

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- Display network utilization and traffic distribution graphically.
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- Store captured data for later analysis.
- Locate data fast with powerful search functions.
- Transmit user defined packets using a variety of parameters.

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Company Model	Type	Power rating (KVA)	Input voltage (AC at 60 Hz)	Input current (amps/phase)	Input/output phase	Size (H x W x D inches)	Weight (lbs.)	Price \$
<b>CLARY CORP.</b> 320 W. Clary Ave., San Gabriel, CA 91776, (818) 287-6111								
<b>CIRCLE 414</b>								
UPS1-600VA-1G-SBS	on-line solid state	.6	120	9	2 wire+GND	10.5 x 19 x 26 (rack) 16.5 x 9.5 x 28.5 (cabinet)	145 (rack) 136 (cabinet)	2,195
UPS1-800VA-1G-SBS	on-line solid state	.8	120	13	2 wire+GND	10.5 x 19 x 26 (rack) 16.5 x 9.5 x 28.5 (cabinet)	145 (rack) 136 (cabinet)	2,895
UPS1-1K-1G-SBS	on-line solid state	1	120	16	2 wire+GND	10.5 x 19 x 26 (rack) 16.5 x 9.5 x 28.5 (cabinet)	145 (rack) 136 (cabinet)	3,095
<b>COMPUTER POWER PRODUCTS (A TITAN CO.)</b> 227 E. Compton Blvd., Gardena, CA 90248, (800) 421-6102								
<b>CIRCLE 415</b>								
MRU 12K to 50K-1PH MRU 12K to 50K-3PH	on-line rotary motor	12-50	208, 230, 480		2 wire+GND 3 wire+GND 4 wire+GND	62 x 80 x 24 (cabinet)	2,300-3,400	15,000-40,000
MRU 62K-3PH	on-line rotary motor	62	120, 208, 230, 480		3 wire+GND 4 wire+GND	62 x 80 x 24 (cabinet)	3,700	48,000
SRU 75K	on-line rotary motor	75	120, 208, 230, 480		3 wire+GND 4 wire+GND	70 x 106 x 22 (cabinet)	5,500	55,000
<b>CUESTA SYSTEMS CORP.</b> 3440 Roberto Ct., San Luis Obispo, CA 93401, (805) 541-4160								
<b>CIRCLE 416</b>								
9012060	standby	.09	115, 120	1.5	2 wire+GND	4 x 6 x 9 (cabinet)	9	350
20012060	(response time: 2-10 msec)	.2		2.5			14	495
20023050	standby	.2	220, 230, 240	2.5	2 wire+GND	4 x 6 x 9 (cabinet)	14	595
	(response time: 2-10 msec)							
40012060	standby	.4	115, 120	5	2 wire+GND	13 x 13 x 2 (cabinet)	28	695
	(response time: 2-10 msec)							
<b>DISPLEX INC.</b> 1 Alexander Place, Glen Cove, NY 11542, (516) 671-4400								
<b>CIRCLE 417</b>								
PSU-7401	on-line solid state	1	115	12	2 wire+GND	7 x 19 x 23 (rack) 7 x 18 x 23 (cabinet)	85	2,995
PSU-7522	on-line solid state	2	115	20	2 wire+GND	22 x 18 x 15 (cabinet)	360	4,120
PSS-7711	standby	.2	115	3.75	2 wire+GND	6 x 7 x 13 (cabinet)	30	375
	(response time: 10 msec)							
PSS-7725	standby	.4	115	3.75	2 wire+GND	7 x 14 x 15 (cabinet)	56	520
	(response time: 10 msec)							
<b>DYNATECH COMPUTER POWER INC.</b> 4744 Scotts Valley Dr., Scotts Valley, CA 95066, (408) 438-5760								
<b>CIRCLE 418</b>								
Powerhouse/300	standby	.3	110, 115, 120	3	3 wire+GND	21.25 x 14.25 x 5 (rack)	30	595
	(response time: 4 msec)							
Powerhouse/500	standby	.5	110, 115, 120	5	3 wire+GND	21.25 x 14.25 x 5 (rack)	35	795
	(response time: 5 msec)							
<b>ELGAR CORP.</b> 9250 Brown Deer Rd., San Diego, CA 92121, (619) 450-0085								
<b>CIRCLE 419</b>								
SPR 350	standby	.35	120, 200, 220, 240, 250		2 wire+GND	15.2 x 27.3 x 32.1 (cabinet)	5	765
	(response time: 8-12 msec)							

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The result is the highest quality standards in the industry's most complete line of UPSs—the only UPS products directed specifically to OEM requirements. GPS on-line models span the range from 500VA to 50KVA, while standby units from 100VA to 2KVA are available. Inquire about our full line of options plus OEM customization.

All GPS uninterruptible power supplies have the high reliability, transistor technology pioneered by GPS, plus state-of-the-art operating features. Unusually fast transient response, low output impedance and excellent efficiency characterize the on-line models. Standby units have set the standard with 2ms transition time.

So don't settle for second rate quality. Buy the UPSs that satisfy the toughest customers—*designed for the OEM by General Power Systems.*

Call or write today for complete information. General Power Systems, 1400 N. Baxter St., Anaheim, CA 92806-1201, (714)956-9321, (800) 854-3469, TELEX 182283.



See us at Booth 2528

 **COMDEX/Spring '86**

CIRCLE NO. 85 ON INQUIRY CARD

## **GENERAL POWER SYSTEMS**

A Division of ALS Corporation

## REPRESENTATIVE UNINTERRUPTIBLE POWER SYSTEMS

Company Model	Type	Power rating (KVA)	Input voltage (AC at 60 Hz)	Input current (amps/phase)	Input/output phase	Size (H x W x D inches)	Weight (lbs.)	Price \$
SPF 550	standby (response time: 4 msec)	.563	120, 220, 240		2 wire+GND	14 x 17 x 9 (cabinet)	73	995
SPF 1000	standby (response time: 4 msec)	1	120, 220, 240		2 wire+GND	14 x 17 x 9 (cabinet)	115	1,295

### EMERGENCY POWER ENGINEERING INC.

3580 Cadillac Ave., Costa Mesa, CA 92626, (714) 557-1636

**CIRCLE 420**

UPS55SXXX-XXX	on-line solid state	5	208, 240		2 wire+GND	54 x 22 x 21 (cabinet)	550	15,750
UPS110SXXX-XXX	on-line solid state	10	120, 208, 240, 480		2 wire+GND 3 wire+GND	71 x 27 x 25 (cabinet)	990	24,100
UPS425TXXX-XXX	on-line solid state	25	208, 220, 480		3 wire+GND 4 wire+GND	71 x 31.5 x 32.5 (cabinet)	1,650	42,000
UPS4037TXXX-XXX	on-line solid state	37.5	208, 220, 480, 600		3 wire+GND 4 wire+GND	75 x 63 x 34 (cabinet)	2,770	52,000

### EMERSON COMPUTER POWER

3300 S. Standard St., Santa Ana, CA 92702, (714) 545-5581

**CIRCLE 421**

AP160/AP165/ AP175	on-line solid state	3/5/10	90, 115, 120	47/78/153	2 wire+GND	52 x 25.6 x 18.7 52 x 35 x 18.7 (cabinet)	485/730/815	6,600/8,900 /15,000
AP1000 200W	standby (response time: 4 msec)	.2	115, 120		2 wire+GND	5.9 x 7.9 x 14.6 (cabinet)	27	379
AP1000 300W	standby (response time: 4 msec)	.3	115, 120		2 wire+GND	8.5 x 22 x 10.2 (cabinet)	46.9	529
AP1000 800W	standby (response time: 4 msec)	.8	115, 120		2 wire+GND	8.5 x 22 x 15.5 (cabinet)	90.4	899

### GENERAL INTERFACE SYSTEM

6700 Sierra Lane, Dublin, CA 94568, (415) 828-4162

**CIRCLE 422**

400	on-line solid state	.4	90, 115, 120	5	2 wire+GND	7 x 12 x 15 (cabinet)	73	1,095
650	on-line solid state	.65	90, 115, 120	7	2 wire+GND	9 x 16 x 17 (cabinet)	105	1,595

### GENERAL POWER SYSTEMS

1400 N. Baxter St., Anaheim, CA 92806-1201, (800) 854-3469

**CIRCLE 423**

GPS-0.5K126R	standby (response time: 2 msec)	.5	115	.5	2 wire+GND	5.9 x 13.3 x 16.5 (cabinet)	48	895
GPS-2K126R	standby (response time: 4 msec)	2	115, 208	.5	2 wire+GND	7.8 x 13.5 x 26 (cabinet)	117	1,995
GPS-5006	on-line solid state	.5	115	12	2 wire+GND	7 x 19 x 19 (rack) 7.6 x 17 x 19 (cabinet)	110 (rack) 92 (cabinet)	1,650
GPS-2K120-61/ GPS-3K120-61	on-line solid state	2/3	120, 208, 240	23/34	2 wire+GND	18.6 x 16.1 x 27.3 (rack) 30.5 x 23.4 x 24.6/ (cabinet) 44.5 x 23.5 x 25 (cabinet)	292 (rack) 450 (cabinet)/ 612 (cabinet)	4,600/6,300

### GTO ELECTRONICS

430 Ritt St., St. Peter, MN 56082, (507) 931-4137

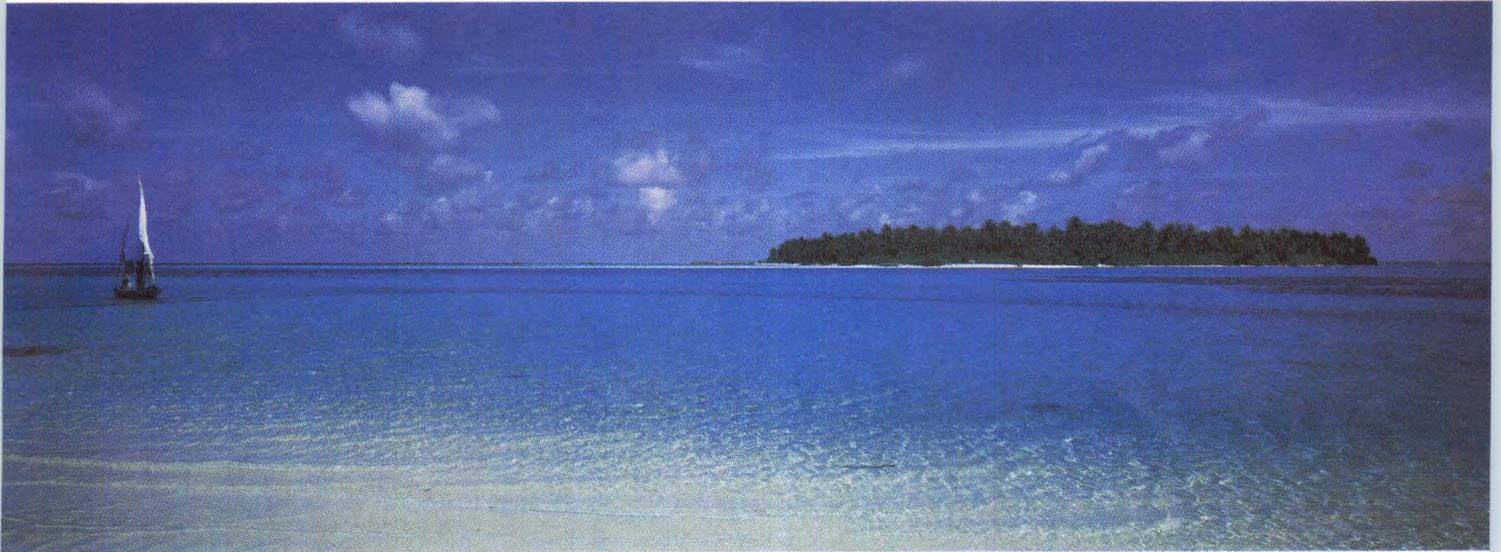
**CIRCLE 424**

PACS-325	on-line solid state	.325	90, 115, 120	100	3 wire+GND	6 x 8 x 11 (cabinet)	16	500
PACS-1500	on-line solid state	1.5	90, 115, 120	200	3 wire+GND	11 x 14 x 14 (cabinet)	55	1,600
PACS-2000	on-line solid state	2	90, 115, 120	250	3 wire+GND	11 x 14 x 14 (cabinet)	65	1,900

## REPRESENTATIVE UNINTERRUPTIBLE POWER SYSTEMS

Company Model	Type	Power rating (KVA)	Input voltage (AC at 60 Hz)	Input current (amps/phase)	Input/output phase	Size (H x W x D inches)	Weight (lbs.)	Price \$
<b>HIGH TECHNOLOGY SOFTWARE PRODUCTS INC. (FORMERLY CONTROL TECHNOLOGY INC.)</b>								
8200 N. Classen Blvd., Suite 104, P.O. Box 60406, Oklahoma City, OK 73146, (405) 848-0480								
RBS=AC 300 VA	standby (response time: less than 2 msec)	.3	115, 120, 220	3	2 wire+GND	5.375 x 13.75 x 11.4 (cabinet)	31	549
RBS=AC 500 VA	standby (response time: less than 2 msec)	.5	115, 120, 220	5	2 wire+GND	5.375 x 13.75 x 11.4 (cabinet)	39	699
RBS=AC 600 VA	standby (response time: less than 2 msec)	.6	115, 120, 220	6	2 wire+GND	5.375 x 13.75 x 11.4 (cabinet)	39	799
RBS=AC 750 VA	standby (response time: less than 2 msec)	.75	115, 120, 220	8	2 wire+GND	5.375 x 13.75 x 11.4 (cabinet)	39	849
<b>HITRAN CORP.</b>								
Route 31, RD5-65, Flemington, NJ 08822, (201) 782-5525								
BAO207	on-line solid state	2.5	120, 208, 240	41	2 wire+GND	52 x 38 x 24 (cabinet)	650	6,100
BAO208	on-line solid state	5	120, 208, 240	90	2 wire+GND	62 x 42 x 24 (cabinet)	1,200	9,500
BAO209	on-line solid state	7.5	120, 208, 240	75	2 wire+GND	62 x 42 x 24 (cabinet)	1,400	11,800
BAO237	on-line solid state	10	208, 240	87	2 wire+GND	62 x 42 x 24 (cabinet)	1,700	13,900
<b>INTERNATIONAL POWER MACHINES</b>								
11534 Pagemill Rd., Dallas, TX 75243, (214) 343-6076								
DP-38	on-line solid state	38	208, 220, 480, 600	56, 130	3 wire+GND 4 wire+GND	78 x 70 x 35 (cabinet)	2,800	
DP-50	on-line solid state	50	208, 220, 480, 600	75, 174	3 wire+GND 4 wire+GND	78 x 70 x 35 (cabinet)	3,000	
DP-75	on-line solid state	75	208, 220, 480, 600	108, 251	3 wire+GND 4 wire+GND	78 x 70 x 35	3,400	
EP32-50/60	on-line solid state	32	208, 220, 480, 600	55, 121, 128	3 wire+GND 4 wire+GND	76 x 64 x 32 (cabinet)	2,900	
<b>ISOREG CORP.</b>								
P.O. Box 486, Littleton, MA 01460, (617) 486-9483								
UPI6-050-12-12-TS-UU	on-line solid state	.5	120, 220	7, 15	2 wire+GND	17 x 19 x 7.7 (cabinet)	110	1,933
UPI6-100-12-12-TS-HU	on-line solid state	1	120, 208, 220	11, 12, 23	2 wire+GND	22.25 x 22.5 x 21.5 (cabinet)	320	3,568
UPI6-200-12-12-TS-HU	on-line solid state	2	120, 208, 220	23, 24, 48	2 wire+GND	23.5 x 24.5 x 30.5 (cabinet)	400	5,930
UPI6-300-12-12-TS-HH	on-line solid state	3	120, 208, 220	30, 32, 62	2 wire+GND	23.5 x 25 x 44.5 (cabinet)	612	7,382
<b>JEFFERSON ELECTRIC</b>								
1400 Center Circle Dr., Downers Grove, IL 60515, (312) 691-2400								
370-411-100	on-line	.25	120	2.08	3 wire+GND	11 x 15 x 20.25 (cabinet)	145	1,850
370-611-100	on-line	.5	120	4.16	3 wire+GND	11 x 15 x 20.25 (cabinet)	155	2,000
370-811-100	on-line	.75	120	6.25	3 wire+GND	11 x 15 x 20.25 (cabinet)	160	2,300
<b>KALGLO ELECTRONICS CO. INC.</b>								
6584 Ruch Rd., Bethlehem, PA 18017-9359, (215) 837-0700								
LS250	standby (response time: 2-4 msec)	.25	115, 120, 220		2 wire+GND	4.75 x 9.25 x 6.75 (cabinet)	17	549
LS500	standby (response time: 2-4 msec)	.5	115, 120, 220		2 wire+GND	5 x 13.25 x 7 (cabinet)	27	795

Last year, people like you got away with  
nearly \$200 million from us.



Hewlett-Packard's VAR discounts added up to some pretty good getaway money. Enough for a lot of trips to exotic, faraway places.

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Of course, Hewlett-Packard's commercial VAR Program offers more than discounts. For instance, service and support that have given HP a worldwide reputation.

And one of our strongest selling points: the HP 3000 Series 37.

It's a full-fledged mini-computer, expandable from 2 to 28 users. But the price for CPU, 1/2 Mbyte memory (expandable to 2 Mbyte), system software, console, 55 Mbyte disc drive and 67 Mbyte cartridge tape drive is just \$21,950 (before quantity discounts).

So first get it all from Hewlett-Packard. Then get away from it all.



### The HP Program for Value-Added Resellers

- Send me information on your commercial VAR program and the HP 3000 Series 37.
- Have an HP representative call me right away.

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Company \_\_\_\_\_

Address \_\_\_\_\_

City/State/Zip \_\_\_\_\_

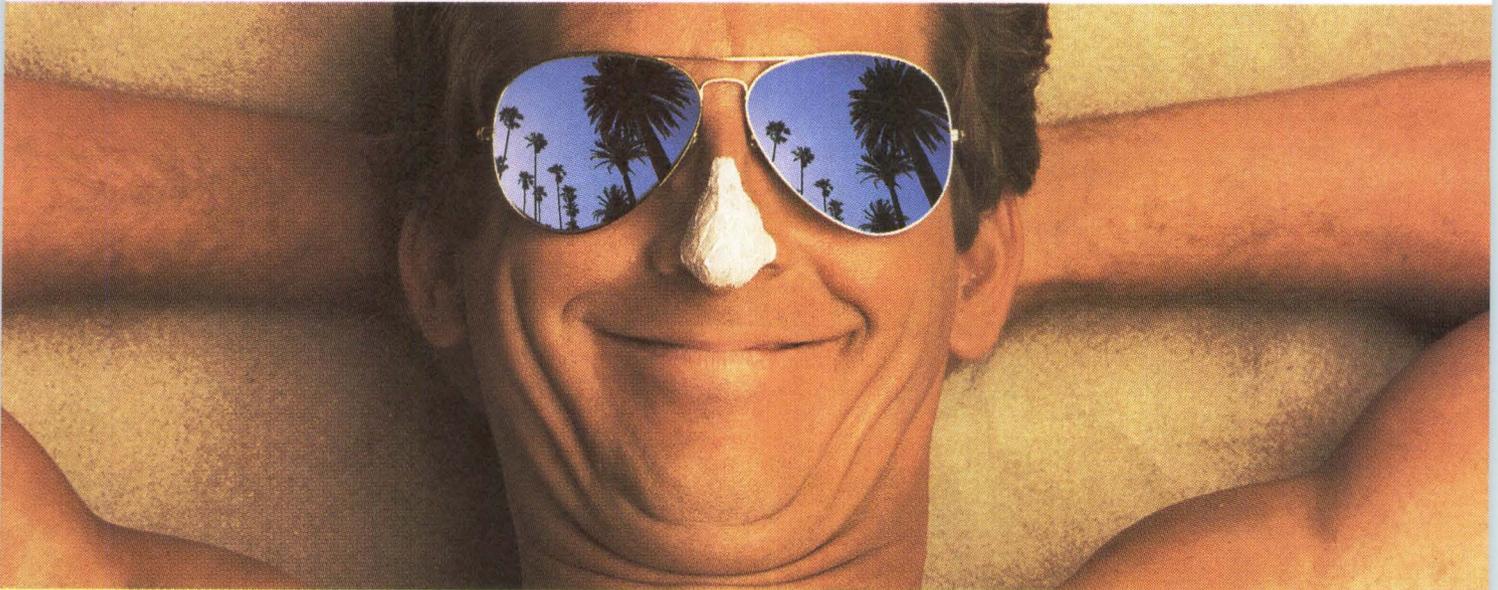
Phone \_\_\_\_\_ Market \_\_\_\_\_

Mail to: Bob Hall, Hewlett-Packard, Dept. 694B  
10520 Ridgeview Court, Cupertino, CA 95014 1502603

**REPRESENTATIVE UNINTERRUPTIBLE POWER SYSTEMS**

Company Model	Type	Power rating (KVA)	Input voltage (AC at 60 Hz)	Input current (amps phase)	Input output phase	Size (H x W x D inches)	Weight (lbs.)	Price \$
<b>LORTEC POWER SYSTEMS INC.</b>								
145 Keep Ct., Elyria, OH 44035, (216) 327-5050								<b>CIRCLE 431</b>
2KVA	on-line	2	120, 208		2 wire+GND	52 x 25 x 22 (cabinet)	700	5,995
15KW	on-line	18.75	120, 208, 480	31.2, 71.9	4 wire+GND	80 x 60 x 30 (cabinet)	2,900	24,900
400VA	standby (response time: 4-6 msec)	.4	120	3.3	2 wire+GND	13 x 11 x 6 (cabinet)	41	695
1000VA	standby (response time: 1 msec)	1	120	8.3	2 wire+GND	19 x 8 x 13 (cabinet)	81	1,495
<b>NOVA ELECTRIC MANUFACTURING CO.</b>								
263 Hillside Ave., Nutley, NJ 07110, (201) 661-3434								<b>CIRCLE 432</b>
11-1K60	on-line solid state	1	115, 120, 208, 220		2 wire+GND 3 wire+GND	7 x 19 x 21	94	4,250
11-3K60	on-line solid state	3	115, 120, 208, 220		2 wire+GND 3 wire+GND	14 x 19 x 21 (rack)	235	5,335
11-10K60	on-line solid state	10	115, 120, 208, 220		2 wire+GND 3 wire+GND 4 wire+GND	20 x 42 x 56 (cabinet)	1,050	14,100
11-15K-3/6	on-line solid state	15	120, 208, 220, 480		3 wire+GND 4 wire+GND	30 x 60 x 56 (cabinet)	2,100	21,000
<b>PARA SYSTEMS INC.</b>								
11425 Mathis St., Suite 404, Dallas, TX 75234, (800) 238-7272								<b>CIRCLE 433</b>
MM250/1	standby (response time: 4 msec)	.25	90, 115, 120	3	3 wire+GND	10.5 x 6.8 x 4.8 (cabinet)	19	435
MM300SS	standby (response time: 1 msec)	.3	90, 115, 120	4	3 wire+GND	15 x 9.5 x 5.5 (cabinet)	34	549
MM500/1 MM500/2	standby (response time: 4 msec)	.5	90, 115, 120 208, 220	5 3	3 wire+GND	15 x 10.6 x 6.3 (cabinet)	53	699 799
<b>PRECISE POWER CORP.</b>								
P.O. Box 2006, Bradenton, FL 33508, (813) 746-3515								<b>CIRCLE 434</b>
9-60 NIPS	on-line constant frequency/ variable speed M-G	9	208, 220, 480	27	4 wire+GND	60 x 32 x 38 (cabinet)	2,250	
15-60 NIPS 35-60 NIPS	on-line constant frequency/ variable speed M-G	15 35	208, 220, 480	44 100	4 wire+GND	66 x 32 x 38 (cabinet)	2,900 3,700	
<b>PTI INDUSTRIES</b>								
320 River St., Santa Cruz, CA 95060, (408) 429-6881								<b>CIRCLE 435</b>
AT500/AT800	standby (response time: 4 msec)	.5/.8	120	4.2/6.7	3 wire+GND	12 x 9 x 16 (cabinet)	27/33	823/929
PC200	standby (response time: 4 msec)	.2	120	1.7	3 wire+GND	7 x 4 x 14 (cabinet)	24	399
TURBO 350	standby (response time: under 1 msec)	.35	120	3	3 wire+GND	6 x 12 x 19 (cabinet)	40	695
XT300	standby (response time: 4 msec)	.3	120	2.5	3 wire+GND	8 x 11 x 14 (cabinet)	38	579
<b>SHAPE MAGNETRONICS INC.</b>								
901 Dupage Ave., Lombard, IL 60148, (312) 620-8394								<b>CIRCLE 436</b>
UPS 250 UPS 500	on-line solid state	.25 .5	120		3 wire+GND	17 x 8 x 20 (cabinet)		1,265 1,455

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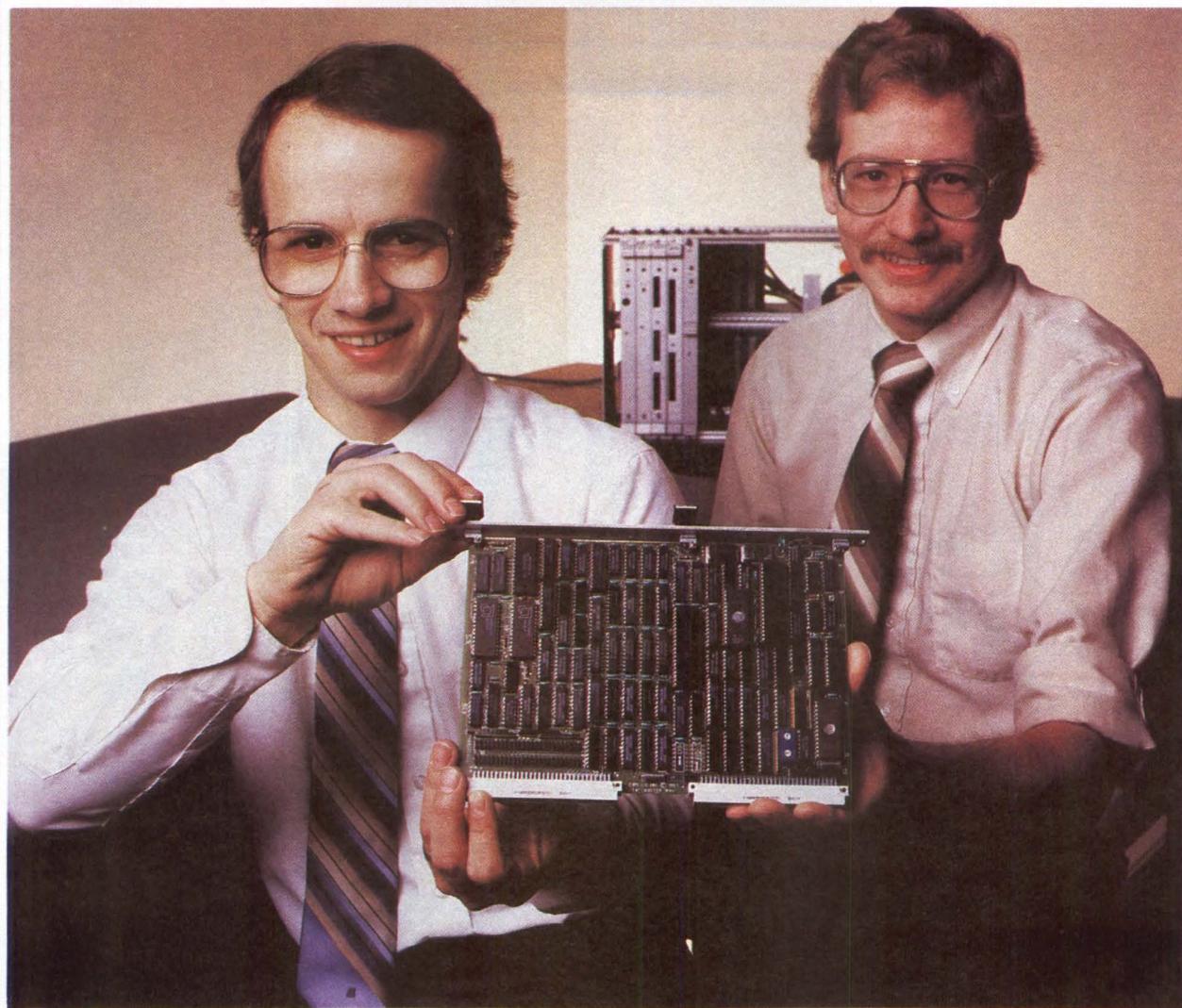
Mail to: Bob Hall, Hewlett-Packard, Dept. 694A  
10520 Ridgeview Court, Cupertino, CA 95014 ISO2604



**REPRESENTATIVE UNINTERRUPTIBLE POWER SYSTEMS**

Company Model	Type	Power rating (KVA)	Input voltage (AC at 60 Hz)	Input current (amps phase)	Input output phase	Size (H x W x D inches)	Weight (lbs.)	Price \$
<b>SL WABER</b>								
300 Harvard Ave., Westville, NJ 08093, (609) 456-5400								<b>CIRCLE 437</b>
LG-300	on-line	.3	120			17 x 17 x 4.8	48	995
LG-600	solid state	.6				(cabinet)		1,455
<b>SOLA (A UNIT OF GENERAL SIGNAL)</b>								
1717 Busse Rd., Elk Grove, IL 60007, (312) 490-0028								<b>CIRCLE 438</b>
56-01-10001-7500	on-line solid state	.75	120	6.25	2 wire+GND	11 x 12 x 19 (cabinet)		1,862
SPS 300	standby (response time: 4-8 msec)	.3	120	2.5	2 wire+GND	7 x 5 x 14 (cabinet)	21	599
SPS 400A/ SPS 800A	standby (response time: 4-10 msec)	.4/.8	120	3.3/6.67	2 wire+GND	15 x 17 x 19 (cabinet)	65/87	828/983
SPS 1200A	standby (response time: 4-10 msec)	1.2	120	10	2 wire+GND	16 x 8 x 19 (cabinet)		1,430
<b>SOLIDSTATE CONTROLS INC.</b>								
875 Dearborn Dr., Columbus, OH 43085, (614) 846-7500								<b>CIRCLE 439</b>
PB1075	on-line transistorized pulse width modulation	.75	120	13	3 wire+GND	29 x 18 x 16 (cabinet)	180	
PB1150	on-line transistorized pulse width modulation	1.5	120	22	3 wire+GND	31.5 x 18 x 20 (cabinet)	330	
PB1300	on-line transistorized pulse width modulation	3	120, 208	13, 39	3 wire+GND	40 x 18 x 26 (cabinet)	480	
PB4100-3	on-line transistorized pulse width modulation	10	208	45	4 wire+GND	58 x 28 x 30 (cabinet)	1,100	
<b>TERADO CORP.</b>								
1068 Raymond Ave., St. Paul, MN 55108, (612) 646-2868								<b>CIRCLE 440</b>
50-168 Interceptor II	standby (response time: 8 msec)	.2	115, 120	2	3 wire+GND	12 x 5.5 x 8 (cabinet)	31	379
660-112	standby (response time: 25 msec)	.5	115, 120	3.5	3 wire+GND	16.25 x 12.25 x 5.25 (rack)	29	721
660-114	standby (response time: 10 msec)	.4	115, 120	4	3 wire+GND	17 x 8.5 x 5.25 (rack)	18	495
<b>TOPAZ INC.</b>								
9150 Topaz Way, San Diego, CA 92123, (619) 569-7982								<b>CIRCLE 441</b>
Series 82000	on-line	5-1.5	115			37 x 24 x 27 (cabinet)	245-295	5,825-10,425
84126-01	standby	1	120	8.23		15 x 7 x 18 (cabinet)	74.5	1,140
84461-84462	standby (response time: 4 msec)	.4	120	8.23		15 x 7 x 18 (cabinet)	48	795
84864-01	standby (response time: 2 msec)	.8	120	8.23		15 x 7 x 18 (cabinet)	71.5	1,070
<b>U.P. SYSTEMS</b>								
7801 E. Compton Blvd., Paramount, CA 90723, (213) 634-0621								<b>CIRCLE 442</b>
M500	on-line solid state	.625	115	6.84	2 wire+GND	24 x 17 x 15 (cabinet)		1,950
M1000	on-line solid state	1.25	115	14.77	2 wire+GND	24 x 17 x 15 (cabinet)		3,251
M2000	on-line solid state	2.5	115	29.7	2 wire+GND	24 x 17 x 15 (cabinet)		4,204
5KVA	on-line solid state	5	120	58	2 wire+GND	71 x 25 x 36 (cabinet)	660	11,460

# YOU ASKED FOR A FAST VMEbus 1/2" TAPE CONTROLLER THAT WOULD ALSO OPTIMIZE YOUR SYSTEM'S PERFORMANCE



*Tapemaster 3000 design engineers Bob Simning and Larry Hull*

## WE RESPONDED WITH THE TAPEMASTER 3000

From our unequalled experience as the leading supplier of Multibus compatible half inch tape controllers, we developed a new controller architecture for the VMEbus. We call it the "Dual-ranked FIFO."

The Dual-ranked FIFO is comprised of a 4 Kbyte Data FIFO and a proprietary, VLSI based, 32 byte Short Burst FIFO. The 4 Kbyte Data FIFO is coupled to the tape interface through a 2-level pipeline that enables read/write data rates up to 2 Mbytes/second. The 32 byte Short Burst FIFO links the Data FIFO to the VMEbus and is designed to attain burst transfer rates greater than 10 Mbytes/second.

With this architecture we've given you the ability to operate the slowest start/stop to the fastest GCR caching tape drives at maximum efficiency on the VMEbus. You've asked us for the highest performance products possible. At Ciprico we listen . . . and respond.

### Other Tapemaster 3000 features include:

- 32 bit addressing, 8, 16, or 32 bit data transfers
- Programmable interrupt level and interrupt vector
- Hardware byte-order swapping
- Supports pass-through commands with optional parameters to support vendor-unique features
- Three cable exit options: through P2, from on-board connector, or through additional face-plate
- Scatter Read/Gather Write
- Reads or writes tape records of unknown and unlimited record length
- Device drivers for many operating systems including UNIX V and UNIX BSD 4.2
- Companion board to the Ciprico Rimfire 3200 VMEbus SMD-E disk controller

For information about our full line of Rimfire and Tapemaster products contact us at the following locations:

**Ciprico Inc.**  
2955 Xenium Lane  
Plymouth, MN 55441  
612/559-2034

**European Office:**  
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Phone (0252) 712-011

CIRCLE NO. 46 ON INQUIRY CARD

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... where people listen—and respond.™

# TODAY IS THE IN DOT MATRIX

It would pay you to mark it on your calendar.

Because today is the day we introduce our new Pinwriter™ P5XL dot matrix printer. The only dot matrix printer available capable of producing the crisp, black printing you associate with a letter-quality printer. Because it's the only one designed to use not just a fabric ribbon, but a letter-quality multistrike film ribbon—the same ribbon used in typewriters and letter-quality printers.

## A LITTLE BLACK MAGIC.

Actual line printed with the  
Pinwriter P5XL printer.

It's only natural that the first dot matrix printer with true letter-quality printing should be an NEC. After all we make Spinwriter® letter-quality printers, the most popular line today, as well as the Pinwriter P5 series dot matrix printers, the most advanced and extensive family of 24-pin printers available.

Black letter-quality printing is not the only thing our Pinwriter P5XL can do. It can also use an optional ribbon to print seven other colors. And it has the finest graphics resolution of any impact printer available. So charts and drawings are much more vivid. Plus it's very fast, extremely quiet and can use an array of type faces. And it's designed and built to have the reliability that has made NEC printers legendary.

# BLACKEST DAY PRINTER HISTORY.

Now for all the exclusive features we managed to pack into the Pinwriter P5XL, you'll find it only costs about the same as other top 24-pin dot matrix printers.

The Pinwriter P5XL printer is the newest addition to the only 24-pin printer line that has a model designed to fit every need and budget. See them at your dealer or for more information call 1-800-343-4418 (in MA 617-264-8635). Or write: NEC Information Systems, Dept. 1610, 1414 Massachusetts Ave., Boxborough, MA 01719.



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# Finally, a network th

Thanks to 3+.

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

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

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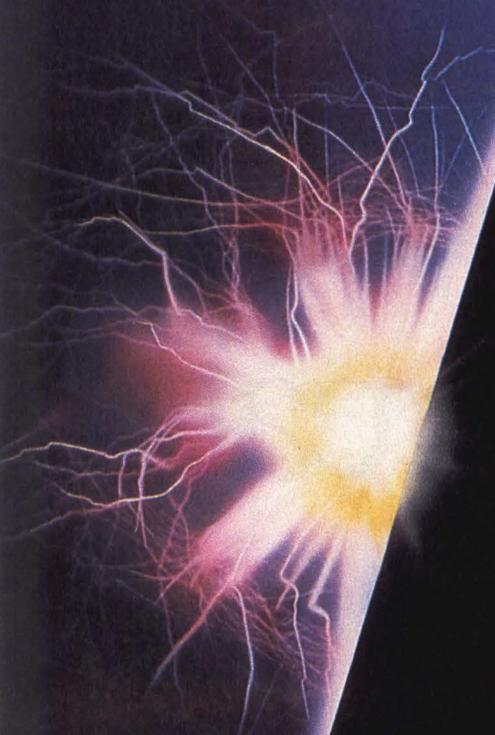
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# VOICE/DATA DEVICES CUT PHONE SYSTEM COSTS

With advanced digitized-voice technology and lower memory costs, integrated voice/data products guide computer-based telephony downward toward \$1,000 per line

## John Alderman

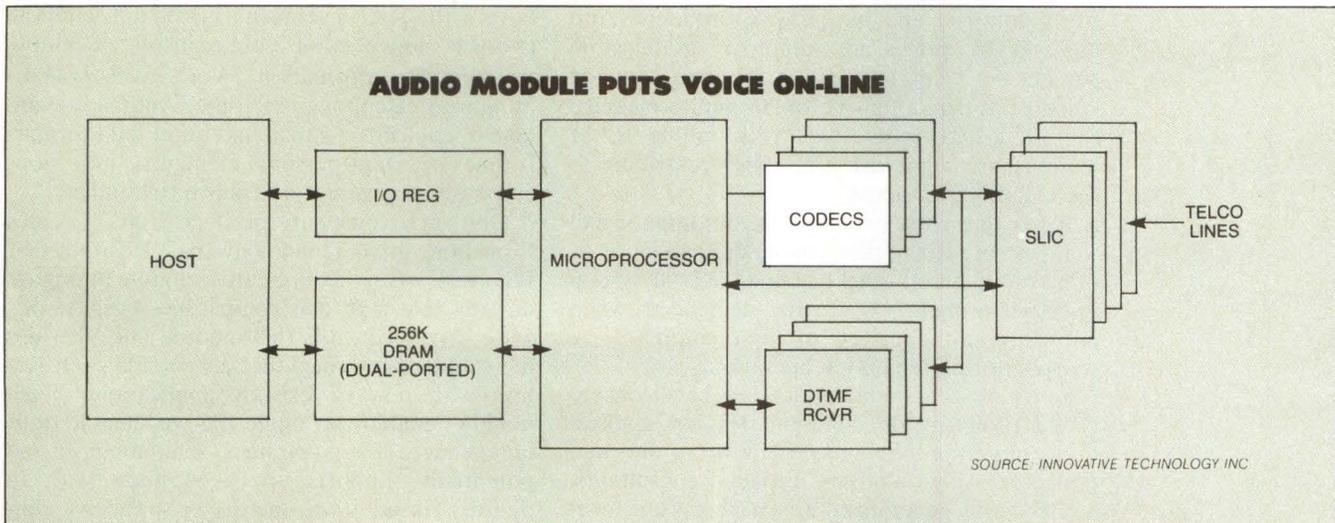
Innovative Technology Inc.

Although telephones were common long before computers—and the two components seem natural allies—they remain surprisingly unintegrated: The telephone's economics has, so far, impeded its full enlistment in the computer revolution.

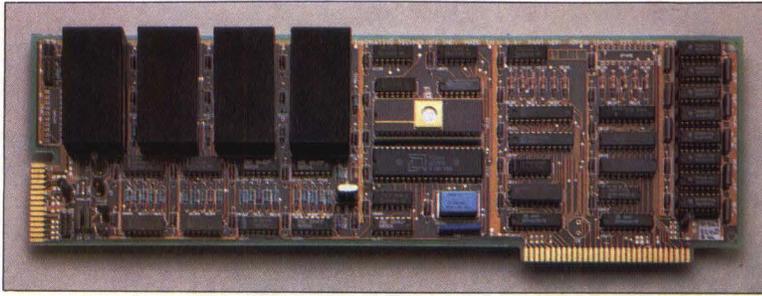
However, a spate of product announcements in the last year or so promises to change this situation. These products—derived from voice/data technology—vary widely in operation, depending on their type and implementation. So, to avoid confusion, telephone automation here means the integration of the obvious user-related functions of the telephone into a standard computing environment. These functions include audio transmission, dialing, hanging up

and transferring calls. And, because the telephone is primarily defined as a transmitter of human speech, telephone automation here excludes data and emphasizes voice digitization, particularly within the IBM Corp. PC environment. However, most of this technology is applicable to other computing environments as well.

Despite the potential of this technology, International Resource Development Inc., a Norfolk, Conn. market-research firm, estimates that only 82,000 "integrated voice/data systems" were shipped in 1984. Why has this market been so slow in developing? So far, costs and a shotgun marketing approach are to blame. Although telephones are inexpensive, the cost of integrating the audio features of a telephone into a computer system can be astronomically high. For example, several digitized voice products now on the market support only a single phone line.



**A four-channel audio module, the nita board employs codecs that digitize at 8K bytes per second. Data is sent via DMA directly to disk, bypassing the host's processor.**



**An audioboard module** that plugs into an IBM PC or compatible bus, *nita* handles four phone lines while consuming only a fraction of the PC's processing power.

And, if these products are connected to a personal computer or workstation, they usually require the PC to be totally dedicated to the telephone function. In fact, the cost of the voice/data product, telephone and dedicated PC often adds up to well over \$4,000. Also, if the device handles only one phone line, the expense cannot be spread over multiple users or multiple tasks. What's more, even when technology supports multiple phone lines, the total cost still often exceeds \$1,000 per line. Understandably, up to now, businesses have resisted telephone automation and integration at almost all levels of management.

#### Codecs enhance technology

However, significant technological factors in digitized-voice applications are working to bring costs down considerably. For instance, single-chip codecs (analog-to-digital coder-decoders) are replacing multiple-chip signal-processor units. These hybrid chips are toll-quality—meaning they meet the standards phone companies use for everyday phone transmission—and can digitize voice at the same rate (64K bits per second) as phone-line transmission. This capability significantly enhances the building of relatively compact and inexpensive products. And these codec prices are falling by at least 50 percent per year. In addition, because digitized voice is storage-intensive (a 20-minute message can fill a 10M-byte rigid disk), falling RAM memory and rigid disk prices also contribute to the technology's surge.

If per line costs of telephone automation fall to less than \$1,000, then true telephone automation could spread quickly. And, overall system price-performance is further enhanced when users are not deprived of their computer resources during telephony operation.

So far, voice/data manufacturers have concentrated primarily on common desktop applications, targeting the managerial level of information processing—analysts, brokers, consultants, etc. But this generalized approach cannot meet all the diverse needs of these clients. Consequently, this market is where value-added resellers, system integrators and software devel-

opers can succeed in integrating telephones and computers. These technical professionals can easily customize computer applications—for banking, insurance, news retrieval, and manufacturing—because they are already familiar with the applications, customer training and support.

Voice digitizing allows computers to manipulate audio information like any other data. The computer edits and combines data and stores and manages it in unique files or directories. It also controls a phone line by answering or placing a call, decodes dual-tone multifrequency signals, transfers and disconnects calls. The results are flexibility and control within a “user friendly” means of transferring information. Computers can voice caller-specified information to incoming callers in high-quality, human-like speech. In addition, they can economically dial out to deliver messages, reminders and warnings to a specified number of destinations at predetermined times.

Practically speaking, what are some applications of this technology? For one example, salesmen can call their factory from the road for the latest availability and pricing on a certain part, specifying the part by using the push-button keypad on a telephone handset. The computer decodes the tones, locates vocalized information pertaining to the particular part and plays it to the salesman.

For further examples, doctors and dentists can “call” patients to remind them of appointments; collection agencies can nudge debtors; and hotels can provide personalized wake-up calls. Other vertical markets await the right type of telephone-automation product.

Studies show that almost half of communications with upper-level managers do not require a two-way conversation, but consists of simply transferring information. Voice-mail systems minimize “telephone tag” time. Another advantage over electronic mail and other data formats is that important personal elements—inflection, emphasis, emotion—are transmitted intact.

One such voice/data product, “*nita*,” comes from Innovative Technology Inc., Roswell, Ga. It consists of an “audioboard” module that plugs directly into a PC, or compatible, bus. A software driver controls this module and provides the standard interface that allows *nita*'s integration with new or existing applications. Each module enables a single PC to handle four independent telephone lines simultaneously and potentially supports up to 64 lines (with 16 boards). In addition, the driver supplies a concurrent operating environment for the PC so the system can manage the telephone interfaces (such as for answering, dialing and digitizing)



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CIRCLE NO. 51 ON INQUIRY CARD

while the PC continues with other tasks. A typical four-line configuration uses a fraction of the PC's processing power, allowing for concurrent operation.

Four standard codecs provide a Federal Communications Commission-approved interface to the phone line. These codecs digitize and dedigitize audio at the rate of 8K bytes per second. Then, digitized audio is written directly to an array of dual-ported, 256K-RAM chips (nita's standard memory array). The data is buffered in RAM and directly spooled to the computer's rigid disk via the PC's direct-memory access (DMA) channel. This setup bypasses and frees the computer's processor. Finally, the digitized data is stored on disk, where it can be edited, copied or saved for later playback with the low error rate of digitized data storage. Voice quality is exceptional because the high digitization rate divides sound into small discrete units, yielding a higher resolution to voice reproduction.

#### Module uses prerecorded speech

The software driver, written in C language, is a boot-time-installed re-entrant driver, operating up to 64 possible ports. It also provides an interface to the hardware. This driver consists of a memory-resident addition to PC-DOS or MS-DOS, and a C function library for accessing and controlling the driver processes. These functions include manipulating the hardware (i.e., on/off hook control, dialing, audio playback, record) and providing status and event notification. An application can be written in any programming language, but standard system calls are used when interfacing to the driver.

In addition, this product can create speech from a dictionary of prerecorded speech components. Thus, through an application-program utility, users choose the words or phrases from this dictionary to create different types of messages, avoiding the need for new recordings each time a message changes. Typically, messages are recorded either with an external microphone and a tape recorder—using standard audio connectors to connect to the module—or through a common push-button telephone.

Telephone-automation products like nita, and others, present new opportunities for VARs and system integrators. But in order for them to be useful, they must combine baseline functionality with the hooks into customizing for specific markets. For example, a busy stockbroker may want to leave information regarding buy-and-sell recommendations for individual clients with specified access numbers on the system. A market-research company may want to complete telephone surveys by dialing out and asking for direct responses via the telephone handset. Each

of these applications requires a specific understanding of the user and an easy route to the proper configuration.

Here, nita's development tools greatly benefit VARs and software developers. One such tool is the application-development toolkit (ADT), provided with each nita. This toolkit includes detailed documentation, especially concerning interfacing with the phone line and the PC. It also includes definitions and tutorials for using the "nitawait" interface, which consists of high-level "C" routines and macroinstructions. "Nitawait" provides an environment for customizing applications for each nita channel, based on a "wait-for-event" architecture. Furthermore, the ADT includes a driver simulator that allows programmers to validate the application in software before sending it over actual phone lines.

Nita currently comes with two end-user application packages, NitaCall and NitaNews. NitaCall delivers a prerecorded message to telephone numbers supplied by the end user; NitaNews dispenses up to 10 different messages upon answering calls.

Products like these allow users low-cost, remote access to computers via the public switched network with a push-button telephone as the only terminal device. This should allow access by even the most timid "technophobe." Such voice/data enhancements already have several important advantages. Standalone voice-mail systems, for instance, are available today in prices ranging from \$40,000 to \$250,000. A four-line, 6-hour message system might cost \$50,000. And, even at these prices, these systems are often software-exclusive: Purchasers must live with the software provided with the system. Voice-data solutions can be considerably more economical, even including application-development-time costs and a reasonable markup for a VAR. For example, a system can be customized with an IBM PC/AT (\$2,500), a four-line nita module (\$1,995) and a 120M-byte rigid disk drive (\$5,000).

Another area where telephone-automation products are likely to catch on is in information-response systems: the fast-growing "976" applications.

The impact of telephone automation on the computer industry is just beginning to be felt and may increase as costs dip below \$1,000 per line. This trend is sure to be fueled by VARs and OEMs who are well-positioned to bring the benefits of this technology to their specific industries. □

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**Significant technological factors in digitized-voice applications are working to bring costs down considerably.**

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Interest Quotient (Circle One)  
High 457 Medium 458 Low 459

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**John Alderman** is president and founder of Innovative Technology, Roswell, Ga., and the founder and former CEO of Digital Communications Associates.

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# COMDEX/SPRING FOCUSES ON DISTRIBUTION

The sixth annual conference highlights value-added strategies for stimulating business

Frances T. Granville, Associate Editor

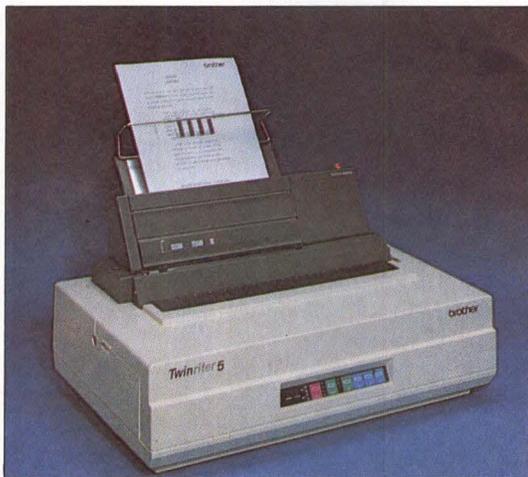
The sixth annual Comdex/Spring conference and exhibition will emphasize distribution channels for computer systems and related products. The conference will take place April 28 to May 1 in Atlanta at the Georgia World Congress Center, the Atlanta Apparel Mart and the Atlanta Merchandise Mart. Show producer The Interface Group, Needham, Mass., expects the conference to attract 50,000 attendees, most of whom will be value-added resellers, value-added dealers, retailers, distributors, system integrators, commercial OEMs, office-machine dealers and other independent sales organizations. More than 700 exhibitors will display and demonstrate such products as personal computers, printers, media, add-on boards, software and supplies.

Comdex/Spring offers 10 topic "tracks" comprising 41 sessions focusing on retailer and VAR strategies for stimulating business, particularly for building sales through fall, traditionally a difficult season for VARs. The conference also highlights technology trends and will include a "Software Summit."

The keynote track is "Office Systems Integration," and the other nine tracks are "Cross-Channel Conflicts," "Hardware Opportunities for System Integrators," "Issues for VARs," "Issues for Retailers," "Sales and Marketing Management," "Mail and Merchandising Strategies," "Multiuser Environments," "Market Intelligence" and "Software Developments."

Among companies planning to announce products at Comdex are NEC Information Systems Inc. (NECIS) and Tatung Co. of America Inc.

NECIS, Boxborough, Mass., plans to introduce a new version of its Advanced Personal Computer, the APC IV, which is compatible with IBM Corp.'s PC/AT. The APC IV contains a switch-selectable 6- or 8-MHz CPU clock, and



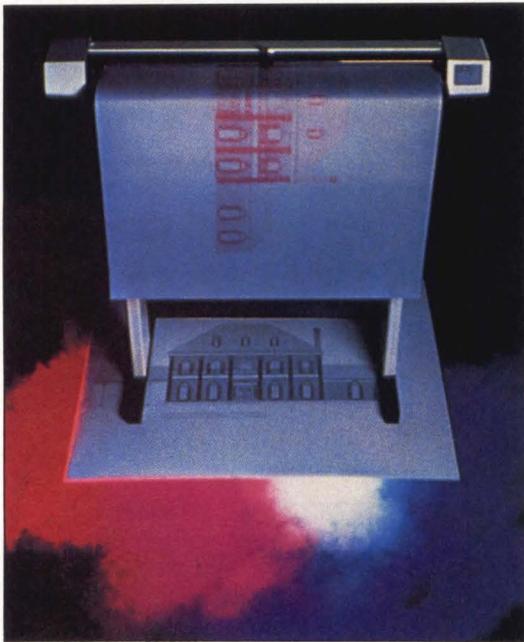
**Brother International dubs its Twinriter 5 the "world's first combination dot-matrix/daisy-wheel printer." It produces letter-quality text with its daisy-wheel printhead and graphics with its dot-matrix printhead.**

has the same speed advantages over the company's previous model, the PC-compatible APC III, as the IBM PC/AT offers over the PC. NECIS had not set a price for the new unit at press time.

Tatung, Long Beach, Calif., will announce its MM-1422, a 14-inch, tilt-and-swivel monitor that provides dual frequency—18.43 and 15.75 kHz—for compatibility with IBM PCs and Compaq Computer Corp. personal computers, respectively. The company will also introduce a medium-resolution color monitor, the CM-1363, which provides green, amber, white-on-blue, white-on-red and reverse black-and-white text modes.

Tatung will also display the CM-1380 and the CM-1376 monitors. The CM-1380 provides 15.75- and 22-kHz frequencies for compatibility with the IBM enhanced graphics display, and the 640-dot-by-480-line CM-1376 provides 4,096 colors and compatibility with IBM's professional graphics display.

Among companies exhibiting recently introduced products at Comdex are Brother International Corp., Distributed Processing Technolo-



**Houston Instrument will exhibit** its A- to E-size DMP-56 plotter (left), which offers a 0.001-inch resolution and accommodates media sizes ranging from 8½ by 11 inches to 36 by 48 inches, and its DMP-29 eight-pen plotter (right), featuring automatic frame-advance.

gy, Houston Instrument, Mitsubishi Electronics America, Office Automation Systems Inc. (OASYS), Tallgrass Technologies Corp., Tecmar Inc. and Toshiba America Inc.'s Information Systems Division.

Brother International, Piscataway, N.J., will show its dual-head, 136-column Twinriter 5 daisywheel/dot-matrix printer. The Twinriter 5 produces letter-quality text at 36 characters per second (cps) with its daisywheel printhead and draft quality at 140 cps with its nine-pin dot-matrix printhead. Price is \$1,295. Brother will demonstrate its 100-cps, 80-column M-1109 dot-matrix printer, which prints 25 cps in near-letter-quality mode and sells for \$269. The company will also exhibit a version of the M-1109 that is compatible with Apple Computer Inc.'s Imagewriter; the 180-cps, 136-column M-1509 dot-matrix printer, which sells for \$499; the HR-35, HR-25, HR-15XL and HR-10 daisy-wheel printers, ranging in price from \$349 to \$995; and the 24-pin 2024L dot-matrix printer.

Distributed Processing, Maitland, Fla., plans to exhibit its MX3001 piggyback cache-expansion board for the PM3010 series of caching disk controllers, which will also be shown. The MX3001 expands the PM3010's RAM capacity to 2.5M (\$845) or 4.5M (\$1,235) bytes without either separate mounting or power for the expansion board.

Houston Instrument, Austin, Texas, will demonstrate its DMP-56, an A- through E-size pen plotter. The \$5,995 DMP-56 produces standard, metric, oversize and architectural drawings at 0.001-inch resolution in sizes from 8½ by 11

inches to 36 by 48 inches. Houston will also show the True Grid line of digitizers, which sells for \$495 to \$975; the \$6,495 14-pen DMP-5V52 C- and D-size plotters; the \$3,295 DMP-41/42 plotters; the eight-pen DMP-29 graphics plotter, which features an automatic frame-advance that allows continuous plotting with minimal user intervention; and the four-pen PC Plotter 695.

Mitsubishi, Torrance, Calif., will exhibit some of its line of 15 IBM-compatible color display monitors. The monitors include the \$520 14-inch XC-1412C, which offers 30.488-kHz horizontal scanning frequency, 640-dot-by-480-line resolution and analog red-green-blue input; and the \$350 13-inch AT-1332A, which offers red-green-blue input and 640-dot-by-200-line resolution. Mitsubishi planned to demonstrate some monitors working with a workstation and the RG500 thermal line printer.

OASYS, San Diego, will show a less-than-\$2,000 version of its 8-page-per-minute, desktop LaserPro laser printer. The new version accepts and formats text for a new page while printing the preceding page; accepts fonts downloaded from the host; prints in portrait and landscape modes on the same page; emulates the Diablo Systems Inc. 630, Epson America Inc. FX-80 and Hewlett-Packard Co. LaserJet printers; and uses the Canon U.S.A. Inc. LBP-CX or Ricoh Corp. 4080 print engine. OASYS will also demonstrate its Jet-Assisted Takeoff (JATO) enhancement package. JATO upgrades HP's LaserJet printer to a LaserJet Plus for \$1,695. The company will also feature its LaserPro 820, which features full-page bit mapping.



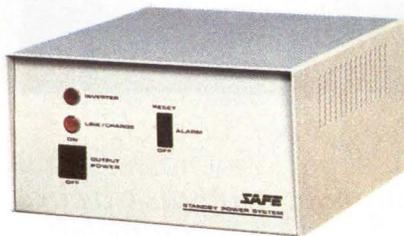
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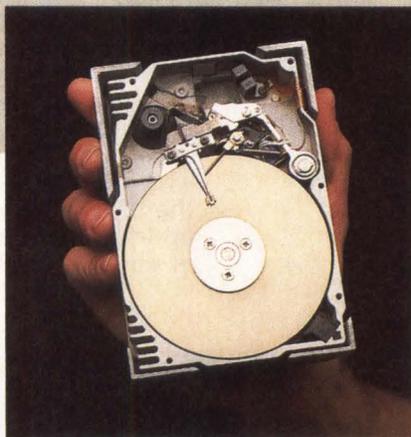
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Tallgrass, Overland Park, Kan., will display the TG-1020e and the TG-2025e external mass-storage subsystems. The subsystems mount next to a monitor on top of an IBM PC or compatible, thus taking up no desk space. The 20M-byte, PC/AT-, PC/XT-compatible TG-1020e tape drive, which sells for \$1,295, backs up 20M bytes of data on a DC-2000 tape cartridge. The \$2,295 PC/XT-compatible, 25M-byte TG-2025e rigid disk drive with a 20M-byte tape drive backs up data on a DC-2000 tape cartridge.

Tallgrass will also show the internal versions of these two subsystems, the TG-1020i and the TG-2025i, along with the TG-1425i, an internal, 3½-inch, 25M-byte rigid disk drive that mounts inside a PC, with a half-height, 5¼-inch tape drive storing 20M bytes of data on a DC-2000 cartridge. The TG-1020i, TG-2025i and TG-1425i come with documentation, Executive Systems Inc.'s XTREE file- and directory-management software package, Tallgrass' BackTrack rigid disk-backup software, a controller, cables and mounting hardware and sell for \$995, \$1,995 and \$2,095, respectively.

The company also plans to preview its LaserStore optical-storage subsystem. LaserStore is available in internal and external versions with or without a magnetic Winchester disk drive, allowing users to write data directly from the disk to the optical system. Tallgrass had not set a price at press time.

Tecmar, Solon, Ohio, will show its MegaFunction add-on board for IBM PCs and compatibles. The MegaFunction provides 1.25M bytes of memory, a RAM disk with an auxiliary power supply, parallel and serial ports and a clock/calendar. The \$895 MegaFunction decreases the time normally required to boot from a flexible disk, load programs, save and search files and switch between programs. For example, MegaFunction can boot Lotus Development Corp.'s 1-2-3 spreadsheet program in 2 seconds, compared with 15 seconds from a flexible disk, and can save a file in 3 seconds vs. 18 seconds for a flexible. Tecmar will also feature its \$2,495 eSCAN optical scanner, \$695 Graphics Master board, \$795 5251/11 Emulator, \$789 Phonegate 2400 modem, \$2,144 Q60H and \$1,695 Q60AT quarter-inch-tape backup systems and \$3,495 Q60W20 and \$3,395 Q60W20AT 60M-byte tape backups with 20M-byte rigid disk drives.

Toshiba America Information Systems, Tustin, Calif., will feature its IBM PC-compatible T1100. The 9-pound system offers 512K bytes of standard RAM, a 720K-byte, 3½-inch flexible disk drive, a 640-by-200-pixel, 80-character-by-25-line liquid-crystal display, MS-DOS, a parallel printer port, a multifunction card and a built-in, rechargeable nickel-cadmium battery

that delivers 4 to 8 hours of portable use. Price is \$1,999.

Toshiba will also show its line of 3-in-One printers, the P321, P421 and P351. The 24-pin, 80-column P321 narrow-carriage printer prints at 216 cps in 12-pitch draft-quality mode, 180 cps in 10-pitch draft quality, 72 cps in 12-pitch letter quality and 60 cps in 10-pitch letter quality. Price is \$699. The wide-carriage, 24-pin P341 sells for \$1,299 and offers several resident type fonts as well as plug-in type cartridges. The P351 features plug-in font cartridges, a 288-cps draft-mode printing speed and a price of \$1,895. Toshiba also plans to show its P351c, a color version of the P351. Price was unavailable at press time. □

Interest Quotient (Circle One)  
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# NEW PRODUCTS

## SYSTEMS

Megan Nields, Assistant Editor



### Microcomputer targets VAR market

- 40M-byte disk capacity
- 8M-byte memory
- Dual MC68000 processors

The XL microcomputer supports up to 40 users via dual Motorola MC68000 processors. One 68000 directs processing; the other controls hard disk I/O. The unit offers 2M to 8M bytes of memory. Hard disk capacity starts at 40M bytes and is expandable to 1.3G bytes with optional streaming-tape or removable hard disk backup. Available operating systems include Pick, BOS, p-System and Mosys. \$11,795. **TDI Pinnacle Systems**, 10355 Brockwood Road, Dallas, Texas 75238, (214) 340-4941.

Circle 300



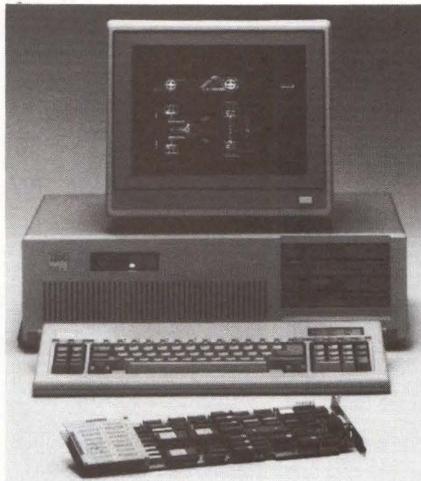
### Computer supports up to 80 users

- MC68020 processor
- 16M-byte memory
- 6.5G-byte disk storage

Incorporating a Motorola MC68020

processor, the P/75 UNIX-based computer system supports up to 80 users. The unit provides up to 16M bytes of main memory and expansion cabinets that allow up to 6.5G bytes of disk storage. It utilizes a proprietary, single-board, communications processor to remove I/O functions from the main processor and to expand user capacity. Features include a 15-slot card cage, a 60M-byte tape cartridge drive and a proprietary Intelligent Mass Storage Processor. \$36,000. **Plexus Computers Inc.**, 3833 N. First St., San Jose, Calif. 95134, (408) 943-9433.

Circle 301



### Liquid crystal shutter system suits IBM PC

- 640 pixels
- 400 lines
- 12-inch display

For use with the IBM PC, PC/XT and PC/AT, the LCS Color GraphText System displays color graphics and text with a 640-pixel-by-400-line resolution on a 12-inch screen. The unit's liquid-crystal-shutter technology allows a monochrome display to be viewed in color. Applications encompass PC-CAD, business graphics and text processing. The system is compatible with MS-DOS software. It includes the Tek LCS E480 color-graphics emulator card. \$1,575. **Tektronix Inc.**, P.O. Box 500, Beaverton, Ore. 97077, (503) 627-5000.

Circle 302



### Workstation incorporates voice and data

- 9-inch display
- 648 by 240 pixels
- PBX independent

A voice/data workstation, the Dasher D55 incorporates an ANSI-standard, text-and-graphics terminal with proprietary voice and data products. It provides a Bell 2500-compatible telephone that functions when the host is not operating. The unit displays 648 by 240 pixels on a 9-inch screen of 24 lines by 84 columns and offers RS232C and RS422 compatibility. PBX independence allows support of varied equipment. Eight programmable soft-function keys facilitate use of CEO software functions and operate the telephone. \$1,595. **Data General Corp.**, Information Systems Division, 4400 Computer Drive, Westboro, Mass. 01581, (617) 366-8911.

Circle 303

### Multiuser system supports 17 users

- IBM PC/AT compatible
- 80826 microprocessor
- 512K-byte memory

An IBM PC/AT-compatible computer system, Starport supports up to 17 users. The unit consists of a 16-bit Intel 80286 microprocessor with a 512K-byte memory, a 14-inch monochrome monitor, a detached keyboard with 30 function keys, one 1.2M-byte flexible disk and 20M bytes of fixed disk storage. Standard software includes MS-DOS, GW-Basic, and User System Diagnostics. \$5,995. **Datapoint Corp.**, 9725 Datapoint Drive, San Antonio, Texas 78284, (512) 699-7542.

Circle 304

### 3½-inch rigid disk drive mounts on card

- 20M-byte system
- IBM PC compatible
- 3½-inch disk

For use with the IBM PC and compatibles, DriveCard is a complete, 20M-byte rigid disk system mounted on a card. The unit combines a 3½-inch Winchester disk with controller electronics. It requires one and a half card slots. The half slot fills the non-connector half of a full card-edge slot, allowing the connector to accept another half card. Dual access for additional storage devices is provided. DriveCard equals the capacity of 58 flexible disks. \$1,095 to \$1,195. **Mountain Computer Inc.**, 360 El Pueblo Road, Scotts Valley, Calif. 95066, (800) 458-0300.

Circle 305

### 3½-inch Winchester combines with board

- 3½-inch disk drive
- 45-msec access
- 20M bytes

A 3½-inch Winchester disk drive combined with an IBM PC- or PC/XT-compatible controller and interface, the HC 2045 fits directly into a standard personal computer slot. The board/drive offers a 20M-byte storage capacity and an average access time of 45 msec without using an external drive or power source. It draws less than 9W from the computer's power supply. Head positioning is controlled by a closed-loop servo system. The heads automatically withdraw to a dedicated landing zone and an automatic actuator holds the positioner in place. \$500 to \$1000. **AK Associates**, P.O. Box 69, Manhattan Beach, Calif. 90266-0069, (213) 379-9616.

Circle 306

### Disk subsystem offers 613M-byte capacity

- Eight 8-inch disks
- 1.81M-byte data rate
- 24 read/write heads

For OEM and VAR multiuser, multiaccess applications, the C2600 Winchester subsystem stores 613M bytes on eight 8-inch disks. The unit achieves a data-transfer rate of 1.81M bytes through an ESMD interface and comes with 24



thin-film read/write heads and one dedicated servo head with 845 tracks per head. Head-positioning time is 3.5 msec track-to-track and 15 msec on average with an average rotational latency of 8.3 msec. Average access time is 23.2 msec. The unit allows two C2600 disk memories to be installed side by side in a standard 19-inch RETMA rack. A detachable universal power supply facilitates alternate enclosure configurations. Features include an automatic carriage and spindle lock, a closed-loop servo system and dedicated head landing/shipping zones. \$13,505, Q1; \$8,175, Q200. **Century Data Systems**, 1270 N. Kramer Blvd., P.O. Box 3056, Anaheim, Calif. 92803, (714) 999-2660.

Circle 307



### Disk subsystems run Fujitsu drive

- 168M, 337M bytes
- 20-msec access time
- DEC RM05 emulation

For DEC Q-bus computers, the MLSI-2322 and MLSI-2333 disk-drive subsystems use Fujitsu disk drives. The MLSI-2322 contains a Fujitsu M2322 drive with an unformatted capacity of 168M bytes. It offers a 20-msec access time. The unit's MLSI-RM11 controller allows emulation of two logical RM03 drives, providing 134M bytes of total storage space transparent to the DEC RM11. It has both hardware and software ECC and vertical and horizontal mapping. The MLSI-2333 uses the Fujitsu M2333K drive to achieve an unformatted storage capacity of 337M

bytes or 256M bytes by using DEC RM05 emulation. The MLSI-DK11-RM SMD controller provides direct-mapping capabilities and has all parameters of the controller and disk drive established and/or changed under software via the operator's console. \$9,640, MLSI-2322; \$12,850, MLSI-2333. **MDB Systems Inc.**, 1995 N. Batavia St., Orange, Calif. 92665, (714) 998-6900.

Circle 308

### Tape subsystem suits IBM micros

- 70M-byte disk
- 30-msec access time
- 60M-byte tape backup

A Winchester disk/streaming-tape backup for IBM PC, PC/XT, PC/AT and compatibles, the Sysgen Plus provides a formatted, 70M-byte rigid disk with a 30-msec access time and a 60M-byte, quarter-inch, tape backup. The unit offers automatic data backup and is programmed like a VCR to perform backup routines. Following the QIC-24, industry-standard format, the self-booting subsystem provides mirror-image and file-by-file backup, as well as data storage on a different disk than the one backed up. Data is verified with a separate read head and is corrected during recording time, thus eliminating stops to check data accuracy. \$5,995. **Sysgen Inc.**, 47835 Warm Springs Blvd., Fremont, Calif. 94539, (415) 490-6770.

Circle 309

### Tape drive targets OEMs

- 20M-byte capacity
- 5¼, 3½ inches
- 75 ips

Geared toward OEMs and system integrators, the Grasshopper MC-20 tape-cartridge drive provides 20M bytes of storage on 3M's DC-2000 tape cartridge. The 5¼-inch unit uses industry-standard, QIC-100 tape format and can be reduced to 3½ inches. Moving tape at 75 ips, the unit integrates a Winchester and a flexible disk drive while utilizing a linear actuator or stepper motor and direct data overwrite. The tape drive offers hardware implementation of full error detection and correction, allowing tape-cartridge interchangeability between drives. \$600. **Tallgrass Technologies Corp.**, 11100 W. 82nd St., Overland Park, Kan. 66214, (913) 492-6002.

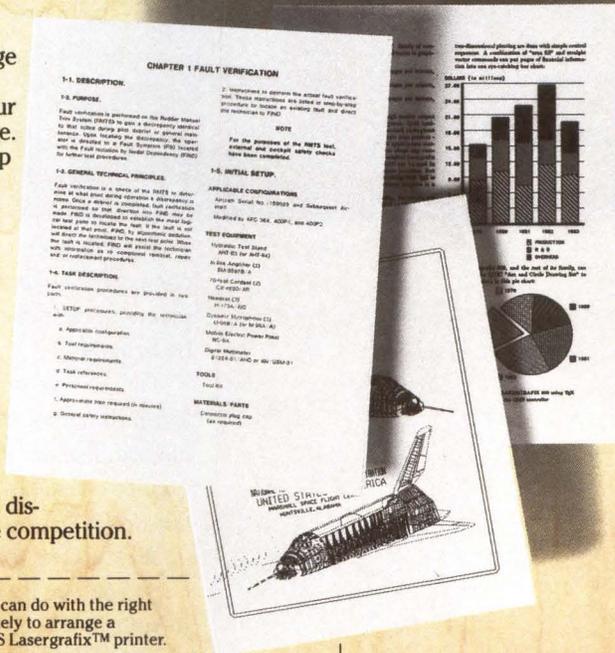
Circle 310

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Scotts Valley, CA 95066. 408-438-6550

 **Seagate**

CIRCLE NO. 65 ON INQUIRY CARD



### Dot-matrix printer targets OEMs

- Seven colors
- 100, 200 cps
- 136 columns

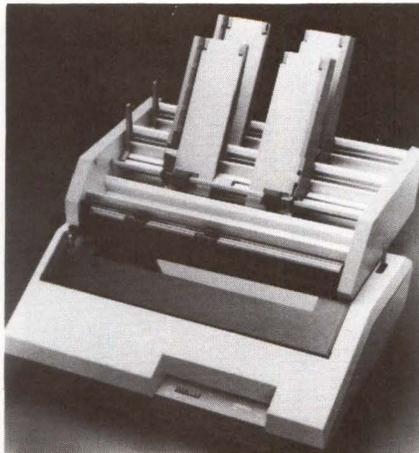
Suited for OEMs and business computer systems distributors, the Office Systems Printer uses a 12-needle printhead to produce 100 cps NLQ and 200 cps draft. The desktop matrix printer provides an automatic sheet feeder with three-part paper handling, seven-color printing and standard interfacing boards. Graphics capabilities are offered through 8- and 12-bit imaging modes. An output rate of 200 40-character lpm can be achieved through printhead weight, turnaround time, line feed and skip time. The unit prints 136 columns on cut sheets or tractor-fed paper by using 12 cpi compression. \$800. **Newbury Data Recording Ltd.**, 20 Vernon St., Norwood, Mass. 02062, (617) 551-0280.

Circle 311

### Printer handles multiple users

- 55 cps
- 56-dB(a) noise level
- 10, 12, 15 pitch

Running at 55 cps, the Advantage D50 daisywheel printer supports multi-task, multiuser, professional workstation requirements such as letter-quality printing, data processing, spreadsheet analysis and business graphics. The unit offers a 56-dB(a) noise level, built-in diagnostics and a printing pitch of 10, 12 or 15 cpi with proportional spacing. It accepts envelopes, fanfold or cutsheet paper and handles one- to four-part forms. RS232C and Centronics interfaces are standard. Other features include 255 drop-in printwheels (featuring 15 languages and IBM-compatible font styles), a bidirectional



tractor and a 1.343K-byte buffer. \$1,485. **Xerox Corp.**, Electronic Typewriter and Printer Division, 901 Page Ave., P.O. Box 5030, Fremont, Calif. 94537, (415) 498-7000.

Circle 312

### Page printer offers graphics

- IBM PC compatible
- 12 ppm
- 240 by 240 pixels

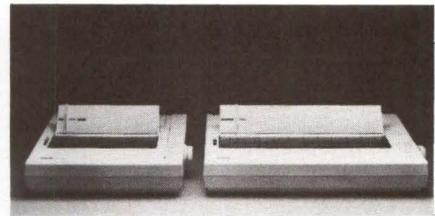
Providing letter-quality printing and high-resolution graphics, the desktop Pageprinter produces up to 12 ppm. The unit allows IBM PC and compatibles to select from 61 stored type-fonts, while handling different-sized paper with two paper cassettes holding 250 or 550 sheets. PC and VM programs allow different types of paper to be fed into the printer from both paper cassettes and enable printed copies to be offset a half-inch to the right or left. One printer may be used for multiple tasks. The model produces text and 240-by-240 pixel graphics. \$7,490. **IBM Corp.**, 900 King St., Rye Brook, N.Y. 10573, (914) 934-4488.

Circle 313

### Dot-matrix printers use 24 printwires

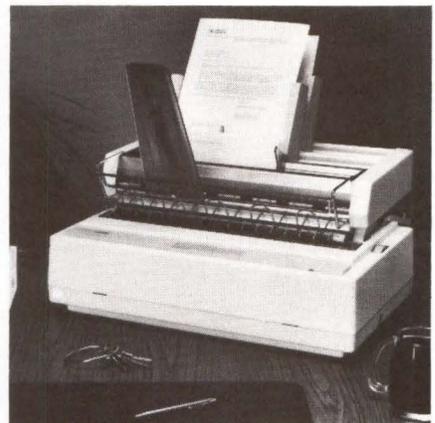
- 360 dpi
- 60, 180 cps
- 7K-byte buffer

Offering a 360-dpi resolution, the LQ-800 and wide-carriage LQ-1000 dot-matrix printers emulate IBM 5152 or Diablo 630 printers through optional cartridges. The units use a 24-pin printhead to print 180 cps, draft and 60 cps, letter quality. Both models come with built-in



serial and parallel interfaces, friction paper feed and a 7K-byte buffer. The printers provide proportional spacing; logic-seeking, bidirectional printing; 96 ASCII and 13 international character sets. \$799, LQ-800; \$995, LQ-1000. **Epson America**, Computer Products Division, 2780 Lomita Blvd., Torrance, Calif. 90505, (213) 539-9140.

Circle 314



### Daisywheel printer suits HP, IBM PC

- 48 cps
- 10, 12, 15 pitch
- 58.5 dB(a)

A Hewlett-Packard and IBM PC (and compatibles) daisywheel printer, the HP 2603A runs at 48 cps. The unit provides drop-in print wheels of 10, 12 and 15 pitch, as well as proportional spacing. Various languages are supported through composition printing. It handles virtually any type of form and paper, including cut-sheet and continuous feed. Forms length, print pitch and feeder selection may be designated without raising the cover. The printer has a 58.5 dB(a) noise level. It is compatible with a variety of word-processing software such as Multimate and WordStar. \$1,495. **Hewlett-Packard Co.**, 1820 Embarcadero Road, Palo Alto, Calif. 94303. Consult local directory.

Circle 315

### Terminals offer graphics storage

- 1,024 by 780 pixels
- 15-, 20-inch screen
- 132 columns

The Monterey MG 600 series monochrome, graphics terminals provide a pixel resolution of 1,024 by 780 and a 60-Hz non-interlaced display. The units have a 15- or 20-inch screen format with 132 columns and a video printer interface. The Flexible Graphics System supports up to four screens of graphics storage and display, locally stored vector lists and picture segments. It allows 175 lines of 80 characters to be scrolled. The series is compatible with Tektronix 4014, 4015; Westward 2019 and Retrographics VT64. \$2,697, MG 600; \$3,995, MG 620. **Pericom Inc.**, 51 Digital Drive, Novato, Calif. 94947, (415) 382-8800.

Circle 316

### CRT terminal provides 64 function keys

- 19.2K baud rate
- 14-inch screen
- 80 or 132 columns

The 4614A CRT terminal offers 15 switch-selectable baud rates ranging from 50 to 19.2K. Displaying 80 or 132 columns with a 9-by-14 character dot resolution on a 14-inch screen, it programs 64 functions by using on-board RAM. The self-testing unit has 128 ASCII alphanumeric and control characters with 32 graphics characters. It supports RS232C interfaces. Features include X-on/X-off and DTR protocols, smooth scrolling, 25th and 26th status lines and 10 setup menus. \$550. **MODCOMP**, 1650 W. McNab Road, P.O. Box 6099, Fort Lauderdale, Fla. 33310, (305) 974-1380.

Circle 317

### Graphics monitor suits IBM PC

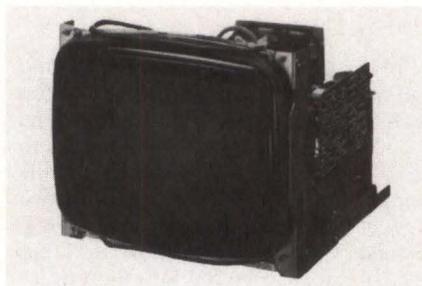
- 1,280 by 800 pixels
- 15-inch screen
- Bit-mapped graphics

Geared toward VARs and system integrators, the WY-700, 15-inch, monochrome monitor offers full IBM PC, PC/XT and PC/AT compatibility. The unit has a bit-mapped graphics board



that uses one personal computer slot. Displaying a 16-by-32 dot character resolution of 1,280 by 800 pixels, the model switches resolutions to accommodate varied applications. The monitor maps colors into four shades of gray when running IBM's Color Graphics Adapter applications. \$1,595. **Wyse Technology**, 3571 N. First St., San Jose, Calif. 95134, (408) 433-1000.

Circle 318



### RGB monitor offers dual mode

- 13-inch screen
- 720 by 240 pixels
- 16 colors

A dual-mode, 13-inch, RGB color monitor, the 722 CGA supports IBM's Enhanced Graphics Adapter and Color Graphics Adapter. The 13-inch screen displays 25 lines of up to 80 characters each. The CGA mode provides a resolution of 720 by 240 pixels, an 8-by-8 dot character cell and 16 colors. The EGA mode has a 720-by-350 pixel resolution with an 8-by-14 dot character cell and 16 colors from a 64-color palette. \$799. **Amdk Corp.**, 2201 Lively Blvd., Elk Grove Village, Ill. 60007, (312) 364-1180.

Circle 319



### Display terminal offers DEC compatibility

- 91-key keyboard
- 12-inch screen
- 15-key pad

The Z-39 video display terminal is compatible with DEC VT52, VT100; Lear Siegler ADM 3A; Hazeltine 1500; ANSI X3.64; and Zenith Z-19, Z-29 and Z-29A units. It has a 12-inch screen and a 91-key keyboard with a 15-key numeric pad. Edit functions include insert/delete, reverse and underline. The unit provides a 60-Hz refresh rate and a baud rate of 75 to 19.2K. RS232C interfaces are standard. For multiuser systems, the terminal includes a no-scroll key for selective data viewing, nine function keys and a HELP key that acts as a 10th function key. \$749. **Zenith Data Systems Corp.**, 1000 Milwaukee Ave., Glenview, Ill. 60025, (312) 391-8949.

Circle 320

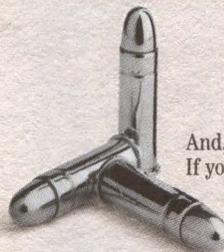
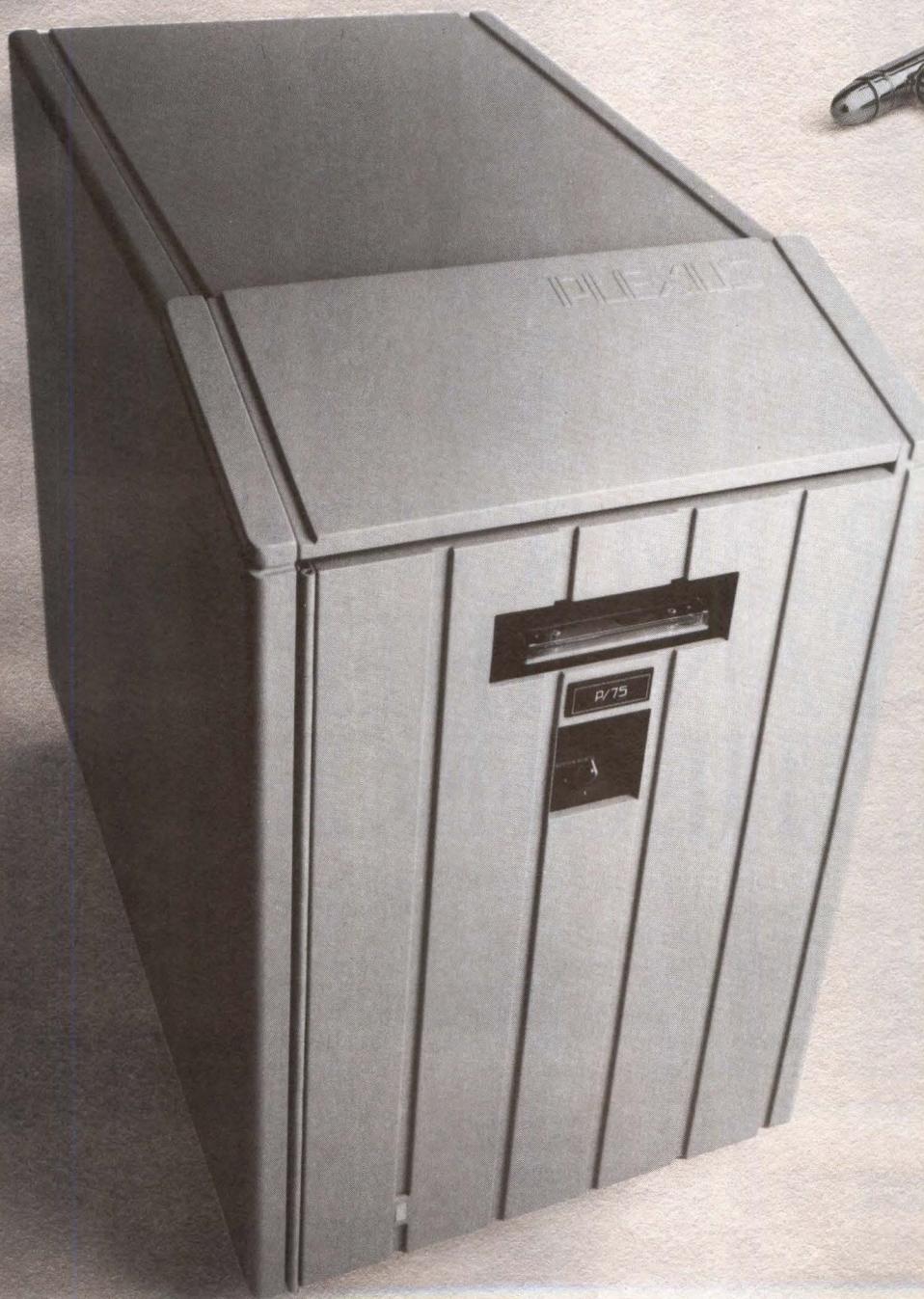
### Terminal displays 2,048 by 1,568 pixels

- 57-Hz refresh rate
- 19-inch screen
- Tektronix 4014 compatible

Achieving a resolution of 2,048 by 1,568 viewable pixels, the 3219 monochrome terminal has a non-interlaced refresh rate of 57 Hz. The unit provides a 19-inch screen and Tektronix 4014 compatibility. Pixel writing speeds are 2,200 nsec, standard, and 380 nsec, vector mode. It offers a choice of 16 Graph Makers. A second memory plane provides advanced line-smoothing. \$14,950. **Westward Technology Inc.**, 90 Montvale Ave., Stoneham, Mass. 02180, (617) 438-6623.

Circle 321

# And the Lone Ranger didn't settle for ordinary bullets.



And, in a sense, neither should you. If you're not getting extraordinary performance from your current multiuser system, you're settling for the ordinary.

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Take our top-of-the-line P/75. An expandable 32-bit, 68020-based system designed to exceed the demands of today's database-intensive applications. With advanced communications processors—offering a variety of standard or custom protocols and fast terminal response. Plus high-speed enhanced mass storage processors (EMSPs) to speed up disk I/O. (You can even run multiple EMSPs in parallel for lightning-quick access to enormous databases.)

The P/75 also offers storage capacities up to 6.5 Gbytes. A floating-point processor option. Choice of tape backups—from cartridge to GCR. And industry-standard interfaces to keep your expansion options open and flexible.

If you'd like more information on the P/75 or any of our other systems, call (800) 523-8874; in California call collect (408) 943-9433. Or write us at 3833 North First Street, San Jose, CA 95134.

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Plexus Computers, Inc.

CIRCLE NO. 66 ON INQUIRY CARD



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The Sharp PC-7000 makes transporting your work easy. It folds into a case small enough to fit



*The Sharp PC-7000.*

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Carry it for MS-DOS 2.11, and built-in dual floppy disk drives that provide the IBM® standard 360KB format. The 320KB RAM is ample memory for even large spreadsheet or data-base applications.

Or carry it because it's easy to use. In addition to a high-speed 16 bit microprocessor, the PC-7000 has an easy-to-read bit-mapped screen with backlighting from an innovative electro-luminescent panel. And the keyboard is detachable, ergonomically designed for comfortable use.

It only takes memory chips to

upgrade RAM, and a modem card enables it to communicate with other computers. And our Near-Letter-Quality (32 x 48 dots) silent transfer printer attaches directly to the main unit.

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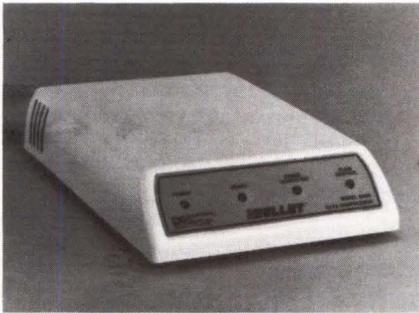
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**CIRCLE NO. 67 ON INQUIRY CARD**

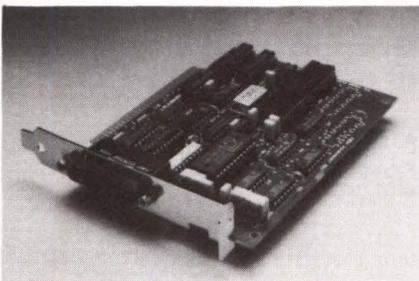


### Data compressor runs at 19.2K bps

- Error-free transmission
- Three modes of operation
- X-on/X-off, CTS

Running at 19.2K bps over two-wire, dial-up networks, the Bullet model 6400 data compressor provides 100 percent error-free transmission. Throughput of existing networks can be increased up to four times. The unit employs X-on/X-off or CTS methods of flow control and offers three modes of operation: data rate conversion and transparent; data rate conversion and error correction; and data rate conversion, error correction and adaptive data compression. All three modes are compatible with auto-dial, origination type and leased-line modems. \$995. **International Data Sciences Inc.**, 7 Wellington Road, Lincoln, R.I. 02865, (401) 333-6200.

Circle 322



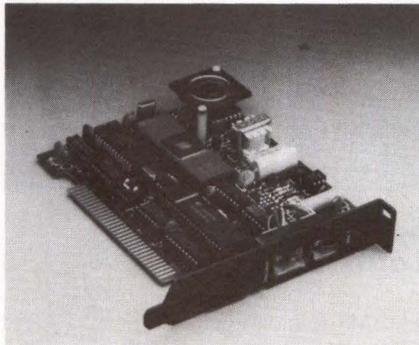
### Half-slot controller suits IBM PC

- Full-, null-modem support
- Asynch and synch protocols
- RS232C board

For use with IBM PC, PC/XT, PC/AT and compatibles, the Persyst MPC-II is an RS232C, half-slot controller for PC-to-mainframe or PC-to-PC connection. The unit utilizes Zilog's 8530-SCC serial,

controller chip to perform multiprotocol, asynchronous and synchronous communications. It supports bisynchronous, SDLC, SDLC-Loop and HDLC synchronous protocols. The device offers 16- and 32-bit, on-board counter/timers, full-modem and null-modem control and a software lock facility. \$245. **Emulex Corp.**, 3545 Harbor Blvd., P.O. Box 6725, Costa Mesa, Calif. 92626, (714) 662-5600.

Circle 323



### Intelligent modem targets OEMs

- 300, 1,200 bps
- Auto-dial/auto-answer
- IBM PC compatible

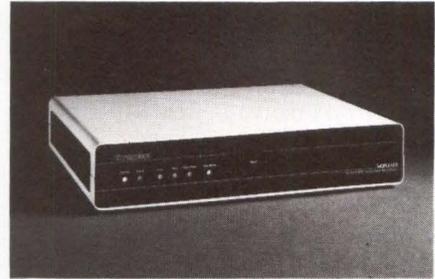
Geared towards OEMs, the Signalman Expressi intelligent, board-level modem fits IBM PC, PC/XT, PC/AT and compatibles. The auto-dial/auto-answer modem operates at 300 or 1,200 bps and conforms to all industry hardware and software standards. It uses the Hayes-compatible modem-command structure, allowing attended or unattended manual data transmission. The unit's half-size card fits in a short or full-size expansion slot. Features include 64K-byte software, automatic logon, diagnostics and password security. \$150 to \$299. **Anchor Automation Inc.**, 6913 Valjean Ave., Van Nuys, Calif. 91406, (818) 997-7758.

Circle 324

### Multiplexer combines voice and data

- 56K, 64K bps
- Four to seven data ports
- PBX voice port

Operating at 56K or 64K bps, the Voplexer voice/data multiplexer combines information from four to seven



synchronous data ports and a PBX port. Port speeds range from 1,200 to 19,200 bps. An extra speed port provides maximum utilization of data-link bandwidths. The voice PBX port utilizes continuously variable slope delta modulation (CVSD) voice-digitizing techniques. Bandwidth utilization is 28K or 32K bps. The time-division multiplexer supports statistical and diagnostic functions such as internal and external loopbacks and local and remote system test. A built-in, test-pattern generator checks various data paths. \$2,195. **Timeplex Inc.**, 400 Chestnut Ridge Road, Woodcliff Lake, N.J. 07675, (201) 390-4600.

Circle 325



### Fiber-optic multiplexer offers 9.6K baud rate

- Eight channels
- RS232C data link
- Full duplex

Connecting a host computer to terminals and peripheral devices up to three miles away, the MX8 fiber-optic, RS232C multiplexer provides a data rate of up to 9.6K baud for synchronous applications. The eight-channel unit replaces eight copper cables with a single, multifiber, optical cable. Full-duplex operation and independent transmit and receive functions allow the data link to be used with all data formats. It uses 25-pin "D" connectors for data transmission and SMA-style connectors for optical transmission. \$1,650. **Artel Communications Corp.**, P.O. Box 100, West Side Station, Worcester, Mass. 01602, (617) 752-5690.

Circle 326

### Communications package runs on IBM PC

- LU6.2 protocol
- integrated modem
- software/hardware version

Implementing IBM's LU6.2 protocol, the AdaptSNA LU6.2 communications package allows IBM PC, PC/XT, PC/AT and compatibles to communicate and transfer files as an LU6.2 device in an IBM SNA/SDLC network. The unit comes in a hardware/software version with an integrated 2,400-bps modem and SDLC interface hardware on a single plug-in board or as software version only. It provides IBM-defined APPC functions used by a PC-DOS application program to communicate and exchange information with other programs running on a mainframe or another PC. These functions, called Basic Conversation Verbs, include "allocate," "confirmed," "deallocate" and "send data." \$795, software version; \$1,590, hardware/software version. **Network Software Associates Inc.**, 22982 Mill Creek, Laguna Hills, Calif. 92653, (714) 768-4013.

Circle 327



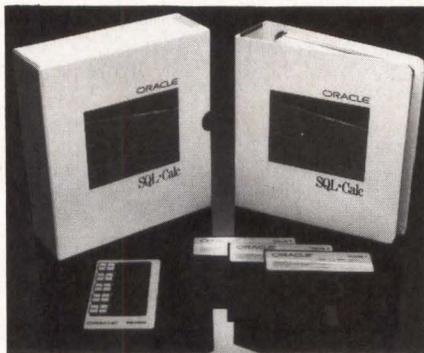
### Software turns PCs into acquisition systems

- IBM compatible
- Lotus 1-2-3 format
- Facilitates reports

Prologger software links IBM PC, PC/XT and PC/AT computers with the Fluor 2280 Series Dataloggers, turning the PC into a data-acquisition system. Application programs are created and edited on the PC and downloaded to the 2280B or 2285B. The datalogger then handles all A/D conversions, linearizations and control functions, freeing the PC for other tasks. The PC screen displays a likeness of the 2280 front-panel display to simplify programming. By allowing an IBM PC to retrieve data from the datalogger and store it in a Lotus

1-2-3 format, the software facilitates report generation. Programs are developed in BASIC or by responding to menu-driven prompts. \$295. **John Fluke Manufacturing Co. Inc.**, P.O. Box C9090, Everett, Wash. 98206, (206) 347-6100.

Circle 328



### Spreadsheet offers Lotus compatibility

- DBMS foundation
- IBM-compatible commands
- Integrated package

A Lotus 1-2-3-compatible spreadsheet, SQL-Cal integrates a mainframe-quality, relational DBMS with a PC spreadsheet user interface. The product runs on mainframes, minicomputers and PCs while providing a set of IBM-compatible SQL commands that allow data to be created, retrieved and modified directly from the spreadsheet. It is available for IBM PC/XTs and PC/ATs with 512K bytes of memory and 2M bytes of rigid disk storage, and soon will be offered for DEC and DG systems. \$395 to \$995. **Oracle Corp.**, 2710 Sand Hill Road, Menlo Park, Calif. 94025, (415) 854-7350.

Circle 329

### Software runs in IBM environments

- 3270 protocol
- Programmatic control
- Automatic file access

Communicating under IBM 3270 line protocols, Mainline software links Motorola and third-party systems such as minicomputers, microcomputers and personal computers. The package searches a wide area network either automatically or by operator control while accessing application programs, files and data stored in up to eight mainframes. It offers programmatic control, which al-

lows any part of the network to be checked. The network automatically moves from a minicomputer to a mainframe environment. Applications can be designed to cross system boundaries. \$1,500. **Motorola Information Systems**, Four-Phase Systems Division, 10700 N. De Anza Blvd., Cupertino, Calif. 95014, (408) 864-4838.

Circle 330

### Menu shell suits DOS commands

- IBM-compatible
- RAM-resident
- 15 listings per menu

For IBM PC, PC/XT and compatibles, ProDisk Control software is a DOS alternative for PC commands and applications. The program permits menus with up to 15 listings to be created, saved or changed to run applications. DOS operations and other menus are selected with a keystroke. A tutorial manual can be viewed on-screen or printed out. The Quick Index command allows specific information to be viewed with two or three key strokes. Programs are RAM-resident. Features include installation batch files for flexible and rigid disk systems and a reference guide that summarizes commands, command options and installation procedures. The software requires 19.2K bytes of RAM and DOS 2.0 or higher. It supports color or monochrome displays. \$90. **Harvey Invisible Software**, P.O. Box 1863, Cape Coral, Fla. 33910, (813) 772-0742.

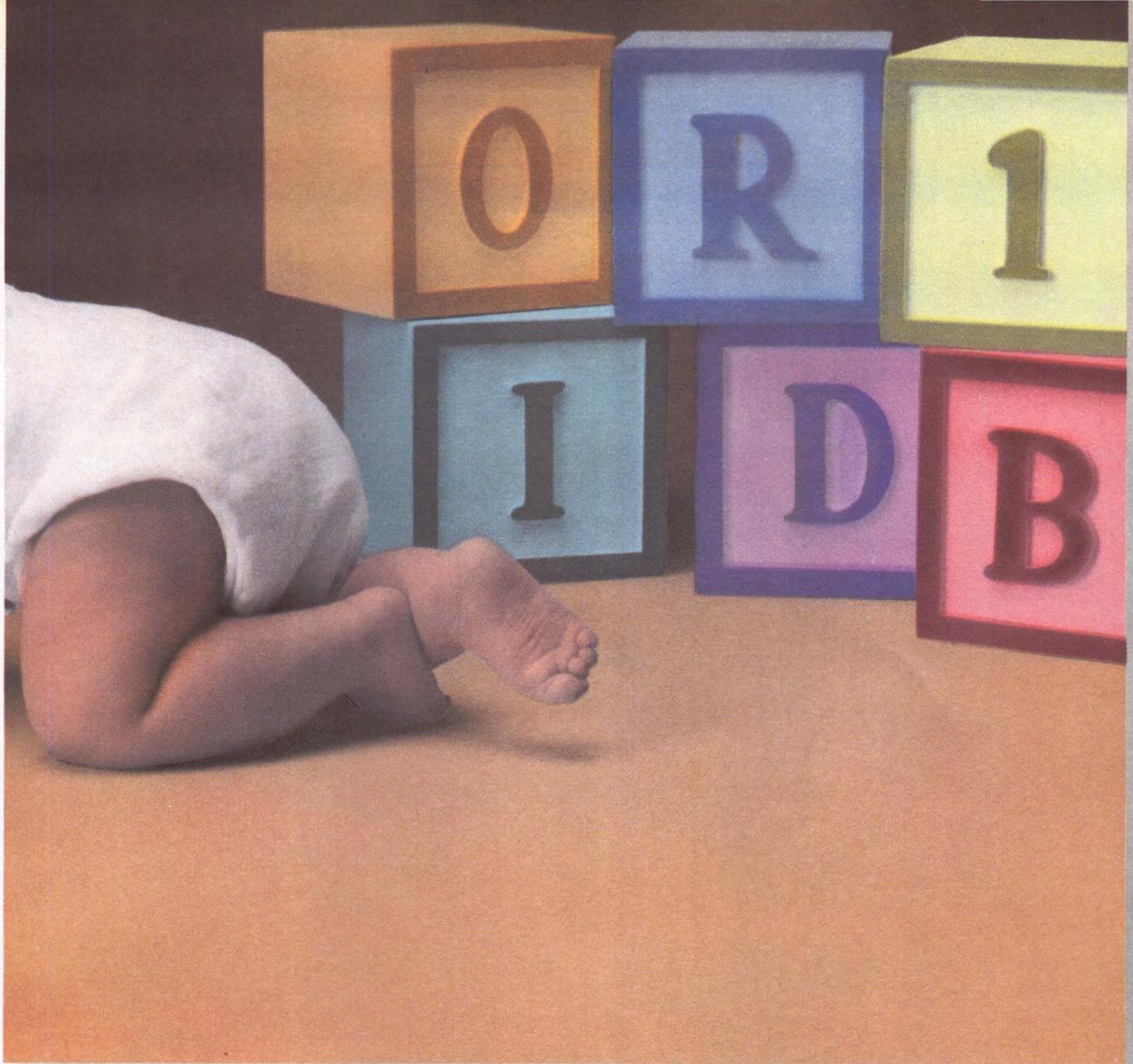
Circle 331

### Graphics software aims at personal computers

- IBM PC compatible
- 33 3-D-graph types
- 16 2-D types

A 3-D business-graphics software system for IBM PC, PC/XT, PC/AT and compatibles, 3D Graph provides graph and text drawings in true perspective. The software allows selection from 33 3-D and 16 2-D preprogrammed graph types. As many as 16 different viewing angles and axis proportions are available, permitting graph manipulation in real time. Features include a data manager and a label manager. 3D Graph operates on MS-DOS system 2.0 or higher. \$295. **The GRAFIX Connection**, 860 Via de la Paz, Pacific Palisades, Calif. 90272, (213) 459-7949.

Circle 332



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**CIRCLE NO. 69 ON INQUIRY CARD**

# THERE'S MORE THAN MONEY



	1983	1982
Total sales	17,540	19,261
Cost of products and services sold	3,939	5,297
	13,601	13,964
Other operating revenues	581	292
	1,421	1,457
Selling, administrative, research and development expenses	5,118	5,251
Intangible asset amortization	1,934	1,117
Financial income	695	85
Financial expense	1,597	1,136
	1,011	1,051
Foreign exchange translation differences	23	34
Income before share in net income of associated companies	764	791

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**CIRCLE NO. 70 ON INQUIRY CARD**

**Microcomputer software targets IBM PC**

- Data analysis
- Tabular formatting
- Statistical analysis

SPSS/PC+ is a data-analysis, micro-computer software package consisting of three parts: SPSS/PC+ for data analysis and reporting, SPSS/PC+ Tables for tabular formatting and SPSS/PC+ Advanced Statistical Analysis. The software features REVIEW, an on-line editor that uses a split-screen environment. SPSS/PC+ runs on the IBM PC, PC/XT and PC/AT with 384K bytes of memory, a 10M-byte rigid disk, an 8087 coprocessor and MS-DOS 2.0 or above. SPSS/PC+ and the advanced statistics package require 448K bytes. Up to 6M bytes of disk storage are needed for all three components. \$795, SPSS/PC+; \$295, SPSS/PC+ Tables and Advanced Statistics modules. **SPSS Inc.**, 444 N. Michigan Ave., Chicago, Ill. 60611, (312) 329-2400.

Circle 333

**Software runs on IBM PC or mainframe**

- Decision support
- Data editor
- Graphics

For use with IBM PC, PC/XT, PC/AT and compatibles or any IBM mainframe or compatible running the CMS operating system, OTIS is a decision-support command language. The software manages time-series data for analysis and forecasting. It is compatible with Lotus 1-2-3 and Symphony and Ashton-Tate dBase software and requires MS-DOS 2.0 or higher and a 320K-byte memory. The software supports a parallel printer, graphics display, rigid disk and an 8087 math coprocessor. \$995. **Odin Research**, 834 Old State Road, Berwyn, Pa. 19312, (215) 296-4485.

Circle 334

**Data-entry system suits IBM PC**

- Virtual-file access
- Two operation modes
- 32 formats per job

An all-purpose, software data-entry system for IBM PC and compatibles and most other MS-DOS-based systems, KeyEntry III completely performs entry, validation, searching and editing. The system has two modes of operation; one

for "heads down," high-speed production of data entry and another for "heads up" phone order and casual data entry. Features include virtual file access, table look-up and substitution, up to 32 formats per job and on-screen function-key labels. \$395 to \$895. **Southern Computer Systems Inc.**, 2732 Seventh Ave. S., Birmingham, Ala. 35233, (205) 251-2985.

Circle 335

**Graphics package runs with AutoCAD**

- Symbol library
- Example diagrams
- Digitizing tablet

DATA-STATION is a graphics-configuration package for use with AutoCAD. It prepares computer systems analysis and design diagrams such as entity-relationship data models, data-flow diagrams and transaction-data access maps and flow charts. The system utilizes AutoCAD's layering, color, editing and plotting features, allowing for the creation and storage of symbols. Precompiled shapes according to ANSI X3.5, ISO 1028 and IBM standards are offered. Features include digitizing-tablet and screen-menu command interfaces and block and shape definition files. \$550. **Charles River Development**, 483 Beacon St., Boston, Mass. 02115, (617), 267-2742.

Circle 336

**SNA software targets systems integrators**

- IBM compatible
- Board-level package
- Application-program interface

The mSNA/3270 is a micro-to-mainframe communications package for Multibus-compatible processor boards. The software emulates IBM's Systems Network Architecture (SNA) to give system integrators a way to communicate with IBM mainframe computers over an SNA network. It allows the Multibus host to connect to the mainframe by emulating a remote 3274 cluster controller. Terminals and printers attached to the local host exchange data with the IBM mainframe as if they were 3278 terminals and 3287 printers. The package includes an application-program interface, which allows applications to be built that integrate data from both the IBM mainframe and the Multibus host. \$200 to \$5,000. **Systems Strategies Inc.**, 225 W. 34th St., New York, N.Y. 10001, (212) 279-8400.

Circle 337



**Software automates data acquisition**

- Data scrolling
- 10-step sequences
- IBM PC compatible

A software tool for engineers and scientists performing R&D applications, Discovery automates data acquisition, analysis and data reduction. The program incorporates calculations and signal processing to build a table of selected values during analysis. The table of summary data is transferred into Lotus 1-2-3 for further analysis and presentation. Comparable to a spreadsheet program, the software allows data scrolling. Sequences of 10-steps store data acquisition for repeated use. The package runs on the IBM PC and requires a rigid disk. Integration differentiation, FTT, autocorrelation and windowing operations are supported. \$1,190. **Cyborg Corp.**, 55 Chapel St., Newton, Mass. 02158, (617) 964-9020.

Circle 338

**ANSWER TO MARCH'S PUZZLE**

P	A	D		T	A	N	D	E	M		A	T	
R	O	E	S		C	A	R	O		E	S	E	
I	N	T	E	L		N	A		U	N	I	X	
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T		R	A	S	E		T	O	P	O		S	
E	T		P	A	R	D		R	A	R	E		
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		B	U	L	L		R	U	S	H		S	T
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U	L	M		T	S	A	R		S	T	A	G	
G	E		K	A	Y	P	R	O		S	D	S	

## Array processor runs up to 80 MFLOPS

- One to five nodes
- Four to 20 I/O ports
- Up to 16M-byte memory

The MegaZIP processor allows a microcomputer such as the IBM PC/AT to be used for real-time digital signal processing. Applications include computationally intensive, digital signal acquisition and processing applications in seismic analysis, imaging and process control. Processing speeds range from 16 to 80 MFLOPS with one to five processing nodes. Each processing node simultaneously acquires data, and performs arithmetic functions and I/O with other nodes. Data within a node is stored in a memory subsystem ranging from 128K to 16M bytes. The board can have from four to 20 I/O ports, each generating data at 10M bytes per second for data acquisition. \$20,000, single-node system; \$90,000, five-node system. **Mercury Computer Systems Inc.**, 600 Suffolk St., Lowell, Mass. 01854, (617) 458-3100.

Circle 339

## Card packs voice recognition

- IBM PC compatible
- 500 voice commands
- 64K bytes of PC memory

A short-card, voice-recognition package for IBM PC, PC/XT, PC/AT and compatibles, the SRB-LC aims at OEMs and VARs. The program permits definition of up to 500 voice commands for "hands off" operation of applications. Voice commands may be created to activate menu overlays for access within a single application or to move from one program to another. The program occupies less than 64K bytes of PC memory and is menu-driven. It does not require programming knowledge to define keystrokes or voice commands. Voice recognition is achieved by using the PC's 8088 processor in a time-shared manner. \$395. **Interstate Voice Products**, 1849 W. Sequoia Ave., Orange, Calif. 92668, (714) 937-9010.

Circle 340

## UNIX subsystem suits IBM PC

- 2M bytes of memory
- 32 bits
- Non-volatile RAM

A 32-bit UNIX coprocessor subsystem for IBM PC and compatibles, the Opus532.32 Personal Mainframe is based on National Semiconductor's 32032 CPU with supporting memory management and floating-point units. The model has 1M or 2M bytes of memory and fills a single long slot in the PC chassis. A 4M-byte configuration occupies two slots. It provides non-volatile RAM and simulta-

neous support of DOS while transforming a PC into a UNIX workstation or multiuser system. Standard software includes UNIX System V with virtual memory support of 16M bytes and C and FORTRAN 77 compilers. \$3,000. **Opus Systems**, Suite 120, 960 San Antonio Road, Los Altos, Calif. 94022, (415) 941-7201.

Circle 341

## The lean, clean protection machines.

At last—Total protection from all power problems at the best price.

The Line Tamer™ Power Conditioner's advanced ferroresonant design protects your sensitive equipment against brownouts, overvoltages, spikes, transients, and noise. And only the Z-Phase Line Tamer offers the same design to protect both line-to-line and line-to-neutral loads in three-phase applications.

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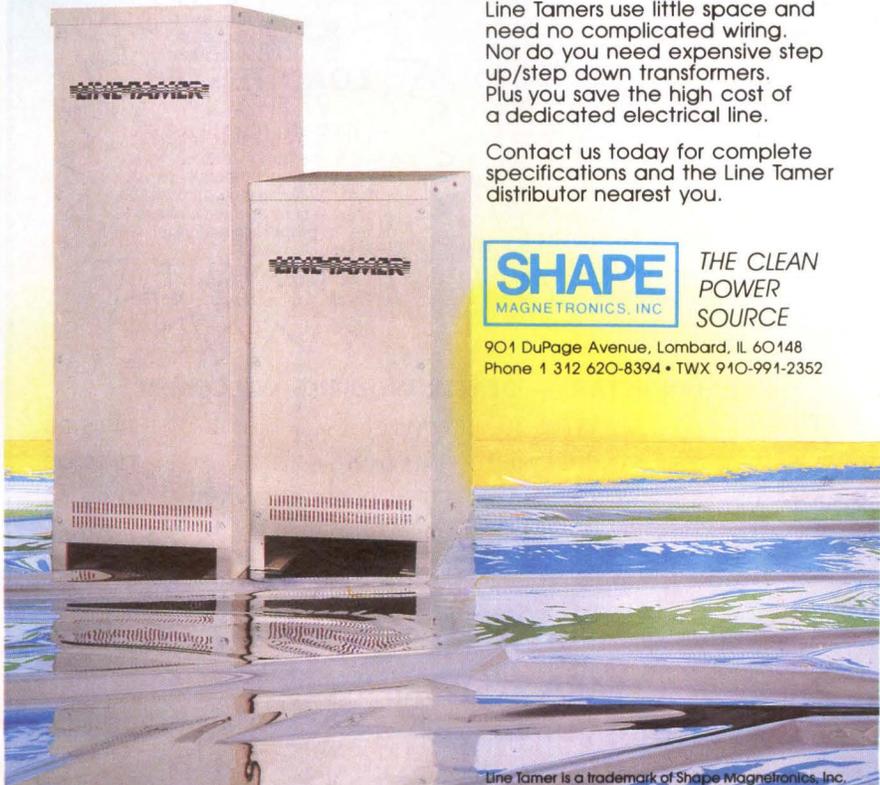
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CIRCLE NO. 68 ON INQUIRY CARD

**Image processor digitizes multiple fields**

- 752 pixels per line
- IBM PC/AT-compatible
- 1M-byte image memory

The Silicon Video image-processing board allows the IBM PC to digitize, process and display video signals. A se-

quence of images can be digitized in 1/60 of a second. Digitizing one or multiple frames or fields at 8 bits per pixel, the board offers programmable resolution of up to 752 pixels by 480 lines. It occupies a single slot in an IBM PC, PC/XT or PC/AT and comes with 256K bytes or 1M byte of image memory. Image memory is mapped into a 64K-byte window on the IBM PC bus by a 4-bit page register. The

address of the 64K-byte image memory is field modifiable. A split-screen feature allows digitizing on one side of the raster while a previously digitized image is displayed on the other side of the raster. Included is an analog-to-digital converter running at 14.318 MHz. \$2,500. **Epix Inc.**, 7223 N. Hamilton Ave., Chicago, Ill. 60645, (312) 764-9186.

Circle 342

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CIRCLE NO. 71 ON INQUIRY CARD

**Multifunction card includes STD interface**

- Z80 processor
- Three counter/timers
- 20 I/O lines

Model 7808 is a 4-MHz, Z80A-based multifunction CPU card that operates as a master STDbus CPU card or in conjunction with other model 7808 cards. Providing automatic, dual-ported RAM, the unit comes in three versions: model 7808 provides dual RS232C channels, model 7808A offers dual RS485 channels and model 7808B comes with one RS232C channel and one RS485 channel. All versions include three independent, 16-bit counter/timers; four 28-pin, JEDEC-compatible memory sockets; 16 input vectored interrupt controllers; two eight-bit I/O ports and a 4-bit port for handshaking. Access to a total of 20 parallel I/O lines is provided. \$345, model 7808. **Robotrol Corp.**, 16100 Caputo Drive, Morgan Hill, Calif. 95037, (408) 778-0400.

Circle 343

**I/O board offers 48 bidirectional lines**

- 8- or 16-bit I/O
- 80188-compatible
- Processor independent

A general-purpose TTL I/O board, the ZT 8845 provides 48 bidirectional lines for interfacing peripherals, instruments and digital devices. It decodes 8 or 16 bits for I/O addressing and includes interrupts through four event-sensing inputs with vectoring capability offered for 8085, 8088, 8016, 80188 and Z80 microprocessors. The processor-independent unit allows STDbus users to isolate electrical-signal and noise levels while providing data exchange and event interrupts. \$350. **Ziatech Corp.**, 3433 Roberto Court, San Luis Obispo, Calif. 93401, (805) 541-0488.

Circle 344

## NEW PRODUCTS SUBASSEMBLIES

### VMEbus board runs at 16.7 MHz

- 512K-byte RAM
- 68450 DMA controller
- Two serial I/O channels

Based on a 12.5- or 16.7-MHz MC68000 16-bit microprocessor, the CPU-5 VMEbus board uses 128K to 512K bytes of zero-wait-state static RAM to execute programs. The card provides a 68881 floating-point coprocessor and a 68450 DMA controller to increase system bus speed. It offers two multiprotocol serial I/O channels, a 256K-byte EPROM capacity and a single-level VMEbus arbiter. A VMXbus interface provides access to memory and peripheral I/O devices while reducing traffic on the VMEbus. The board features a 68230 Parallel Interface Timer that exercises software control over functions such as interrupt-request levels, bus-release parameters and status displays. \$2,495. **Force Computers Inc.**, 727 University Ave., Los Gatos, Calif. 95030, (408) 354-3410.

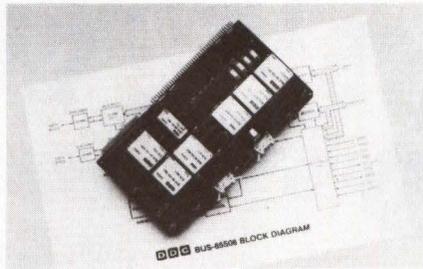
Circle 345

### Adapter connects IBM PC to SCSI

- 6K-byte ROM
- 2K-byte RAM
- On-board memory

An intelligent host adapter, the IB02 connects an IBM PC, PC/XT or PC/AT to SCSI peripherals. The unit is packaged on a single printed-circuit board and provides the SCSI interface via a protocol controller. Installed into an IBM expansion cabinet used to add rigid disk drives to the system, the model integrates 5¼-inch Winchester disk drives and quarter-inch tape-cartridge drives without modifying the operating-system software. Support of a device disconnect/reconnect feature allows the host adapter to run commands simultaneously on several drives. Up to seven controllers can be attached, each supporting eight 5¼-inch Winchester disk drives with 110M bytes of memory. Memory mapping is achieved through 6K bytes of ROM and 2K bytes of RAM. \$395. **Emulex Corp.**, 3545 Harbor Blvd., Costa Mesa, Calif. 92626, (714) 662-5600.

Circle 346



### Multibus card provides intelligent interface

- 4K-byte memory
- Six I/O commands
- Four subsystem interrupts

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Circle 347

### SBC uses MC68020 processor

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- 16-bit expansion connector

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Circle 348

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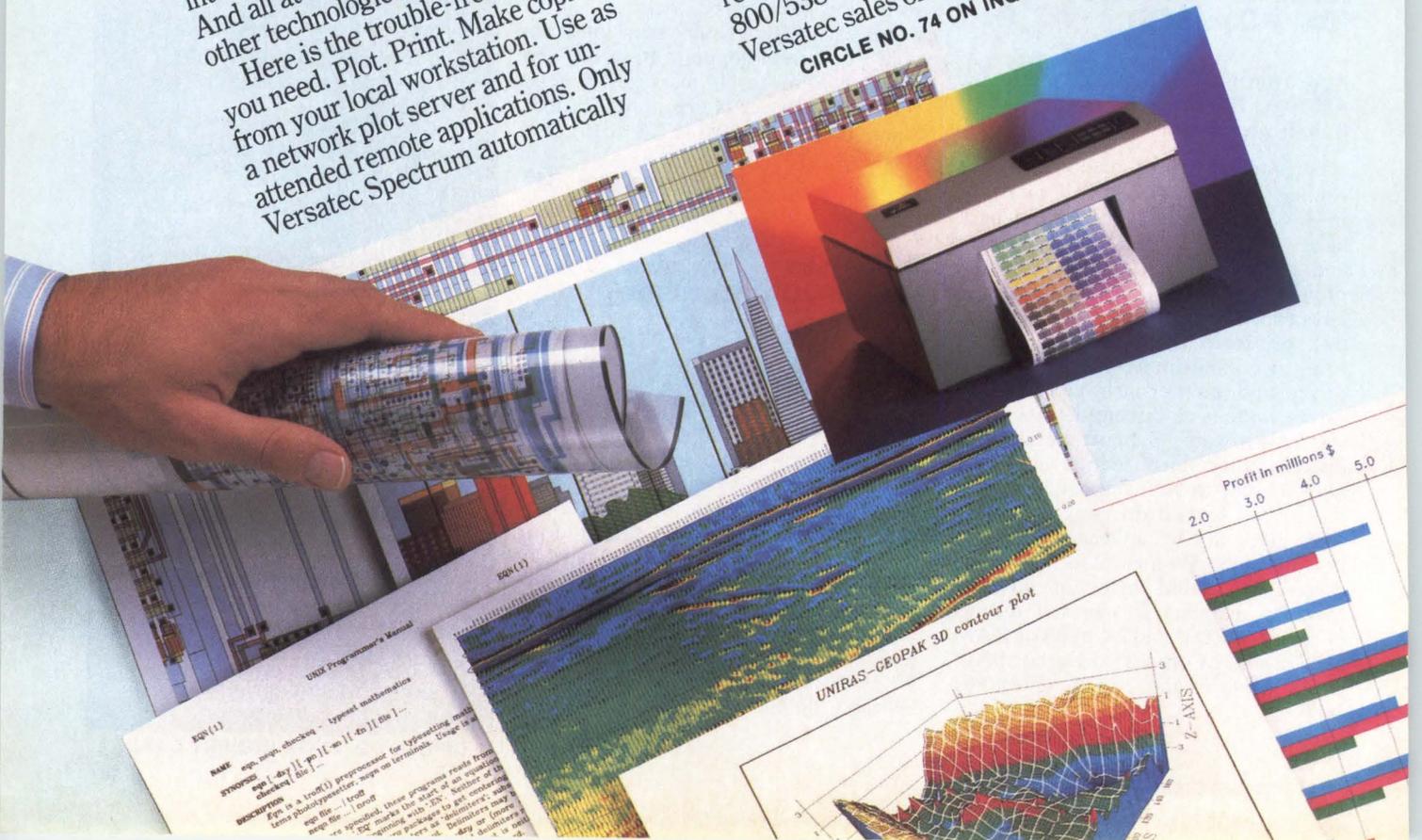
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Circle 349

**Guide targets  
IBM PC/AT**

*Inside the IBM PC/AT* explains how to utilize AT features with emphasis on multiuser, multitasking environments. The book provides information on the AT's new keyboard, enhanced graphics capability, extended interface options, operating systems and disk drives. It explores software writing and custom applications, and suits novices, programmers and system engineers. \$19.95. **McGraw-Hill Book Co.**, 1221 Avenue of the Americas, New York, N.Y. 10020, (212) 512-3493.

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*Exploring the Pick Operating System* offers an overview of the emerging business operating system. The book covers user processes such as TCL, the Editor, Access, Pick BASIC and PROC, the stored procedure language. It provides information about adding peripherals using the system's variable length and ASCII files with a dictionary/data file relationship, as well as accessing virtual-memory management. \$29.95. **Hayden Book Co.**, 10 Mulholland Drive, Hasbrouck Heights, N.J. 07604, (201) 393-6306.

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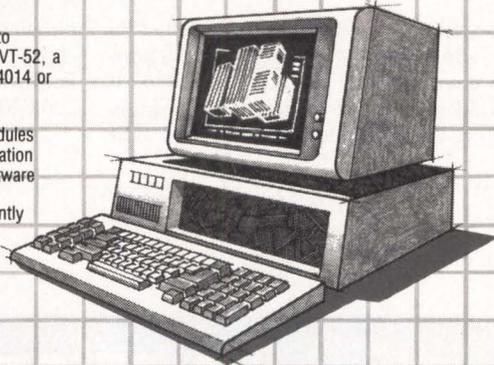
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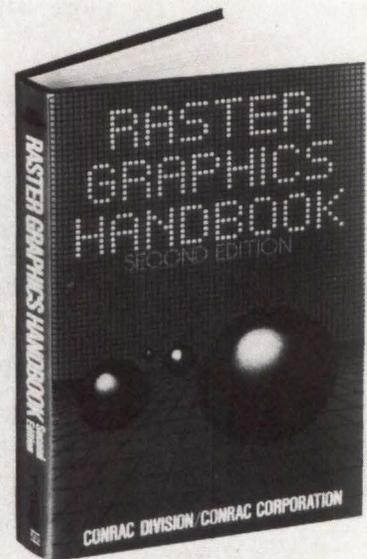
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## NEW PRODUCTS LITERATURE

### Handbook lists IBM PC products

Describing a line of data-acquisition and control interfaces for the IBM PC, PC/XT, PC/AT and compatibles, MetraByte's handbook gives information on their plug-in IEEE-488 and RS232C interface and communications boards. It also covers industrial-control interfaces, data-acquisition and control-software packages, applications, example programs and configuration guides. Free of charge. **MetraByte Corp.**, 254 Tosca Drive, Stoughton, Mass. 02072, (617) 344-1990.

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### Book describes raster graphics

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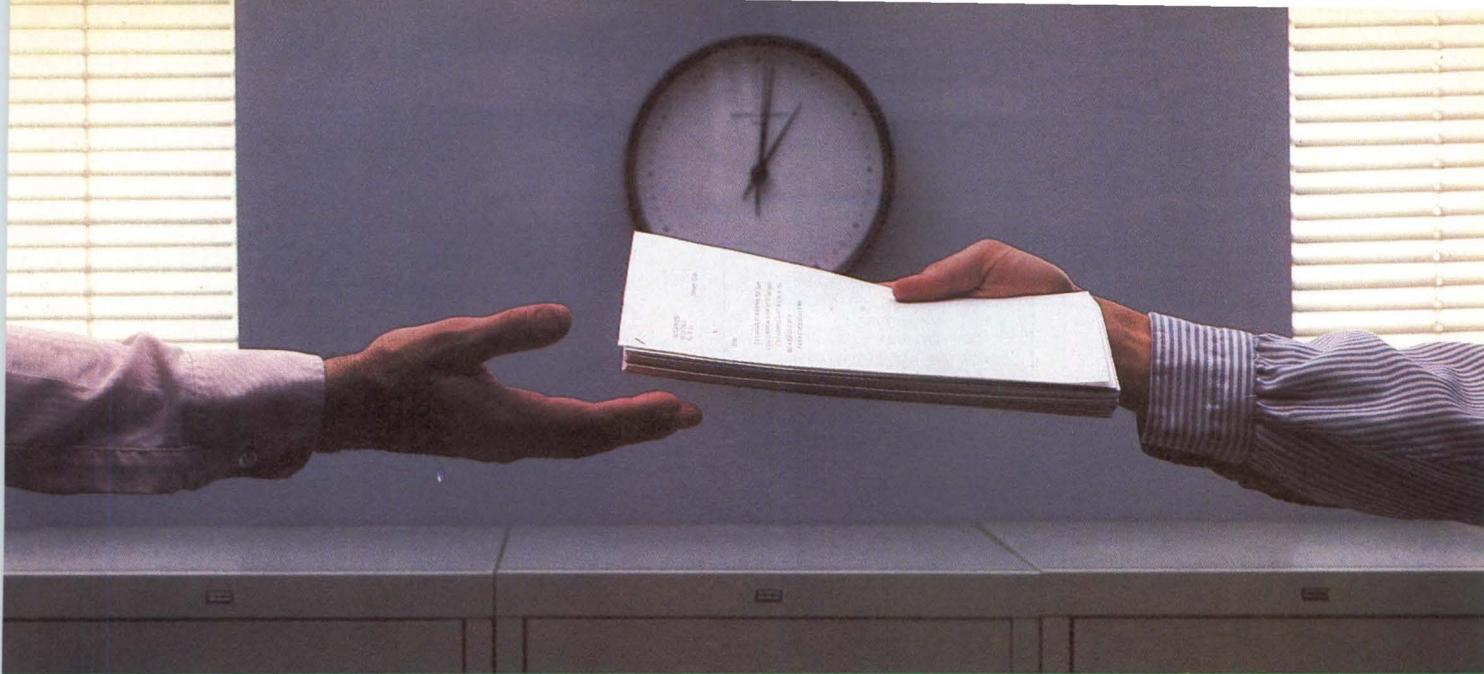
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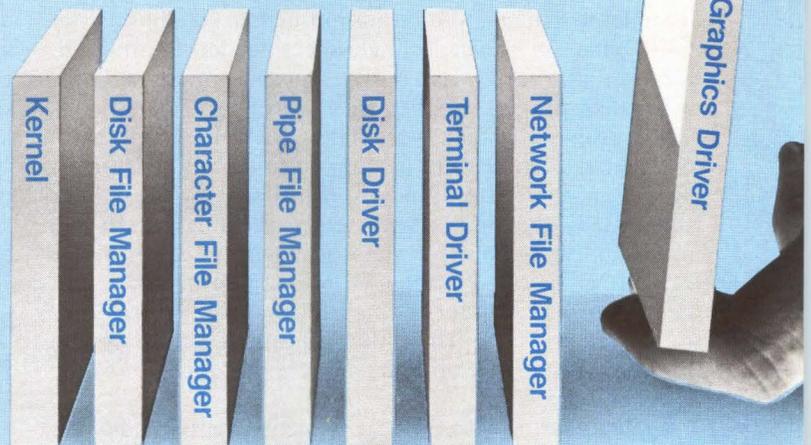
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# SYSTEM INTEGRATORS' NOTEBOOK

*Tips that make dollars and sense*

## HOW TO SOLVE SERIAL INTERCONNECT PROBLEMS

**Carl Warren**, Western Editor

Not all serial interconnect problems are hardware related. Some require software adjustments. For example, on an IBM Corp. PC, the basic input/output system uses a busy bit to sense when an I/O port is in use. When it is, the BIOS periodically sends a strobe to monitor the busy state. When the port is not busy, the BIOS sends more characters. Unfortunately, not all software drivers found in application packages respond quickly enough to shut off the stream of characters before they are lost.

MicroPro International Corp.'s WordStar version 3.3, for example, works fine when transmitting to a serial printer at 9,600 baud, or when a single-sheet feeder is attached. However, the serial device driver in DOS must be used, rather than the one supplied with WordStar.

The problem is that WordStar waits only about three-tenths of a second before moving on to the next character. Hence, an X-off (stop sending) signal sent by the printer isn't sensed—the busy bit stays ready, allowing data to spill into a full printer buffer, where it is lost. In contrast, the DOS driver, selected through WordStar at installation, uses the system's I/O buffers, which it continually checks for status (full/not full). Thus, flow control is on the system side, and outside of WordStar, rather than controlled by the peripheral device.

While tinkering with DOS, you might want to modify the command interpreter so the default is "echo off" when a batch file is run. This requires using the debugging utility and changing a few bytes of code:

```
C>debug \command.com
-e1721 28 1f
-e364a 24 26 c6 06 6e 09 00 e9 19 e8
-w
Writing 4500 bytes -q
```

Because DOS is an environment-oriented operating system, you might want to access it using batch files.

Make sure that, at boot time, the environment is limited to 128 bytes. Also note that if resident modules (print, mode or graphics) are installed, you can't expand the environment. However, the Set command establishes variables as the space limitation. Also, you can use the Set command in batch files to add or remove different programs within the environment:

```
SET PAY=\ACCOUNTING
COMSPEC=\
```

This causes the program Pay to be added to the environment from the subdirectory Accounting. Therefore, entering the Pay command causes the environment to switch to the specified subdirectory and execute the program. The second line tells DOS where the command interpreter is located, allowing use of DOS-level commands.

The COMSPEC function is especially important if the program you are running establishes its own environment (i.e., a shell within a shell). Otherwise, the DOS command function will be lost and the system will lock up.

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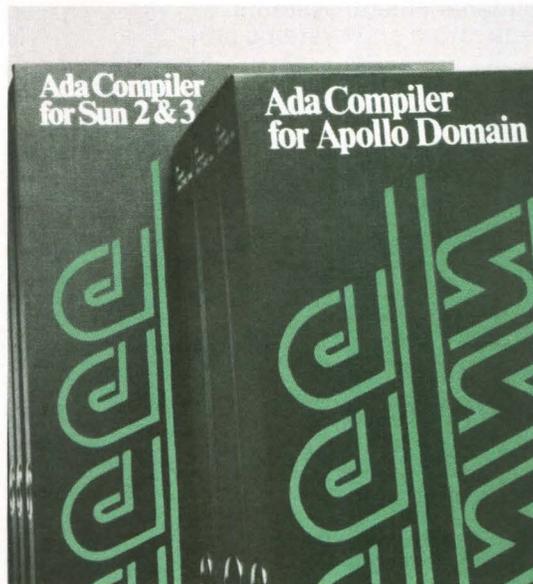
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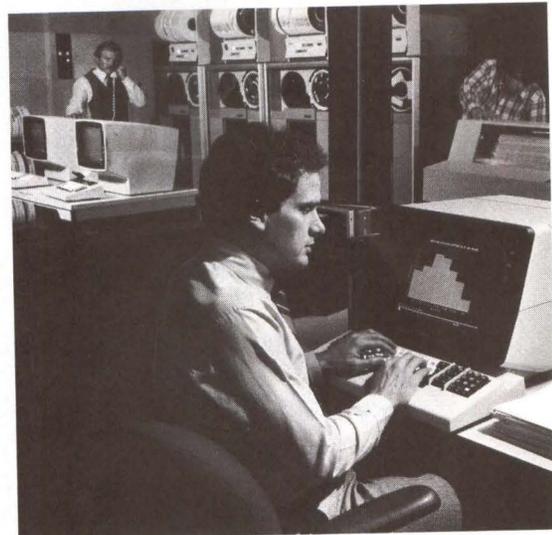
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After a successful East Coast Conference in October of 1985, the SCSI Forum plans to move West in May of 1986 with a 3 day Technical Program devoted to discussing SCSI issues, hearing about the latest SCSI developments, learning about SCSI, and promoting industry standardization.

**WHERE** The Sunnyvale Hilton

**WHEN** May 5 - 8, 1986

**TOPICS/ISSUES**

- What is the structure and size of the SCSI market?
- Who is committed to SCSI?
- What is the Common Command Set?
- How can higher performance for SCSI be achieved?
- Is SCSI a viable alternative for personal computers?
- How are intelligent SCSI storage peripherals tested?
- How is the copy command effectively used for backup?
- Is SCSI just for storage devices?
- What other steps in addition to the Common Command Set should be taken to ensure software portability?
- How do the many interface alternatives compare with one another?
- Is SCSI a viable alternative for IPI?
- What SCSI products are available today?
- Is SCSI compatible with the ISO's open systems interconnect concept?

**WORKSHOP**

In addition to covering "Leading Edge" SCSI topics, Delegates may attend an optional SCSI Workshop on Monday evening, May 5th, in order that they may derive more benefit from the technical sessions to come.

**RECEPTION**

Delegates will also have an opportunity to see the latest in SCSI Products during the Exhibitors Reception scheduled for Tuesday evening, May 6th.

**SPONSORS**

The SCSI Forum is sponsored by Technology Forums, and the SCSI Forum Advisory Board consisting of:

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- NCR
- Pertec Peripherals
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- Siemens Communications Systems
- Xebec Systems

**FEE**

The registration fee of \$995.00 for the 3 day SCSI Forum covers attendance at all scheduled sessions, a Delegate Information Binder containing the Speakers' presentations, the SCSI Specification, the Common Command Set Specification, and other material, a Welcome Reception, 3 Luncheons, the Exhibitors Reception which includes Cocktails and a Buffet Dinner, 3 Continental Breakfasts, a Wine Tasting Social Event, refreshments during breaks, gratuities and taxes.

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# ARTFUL INTELLIGENCE

by John K. Young

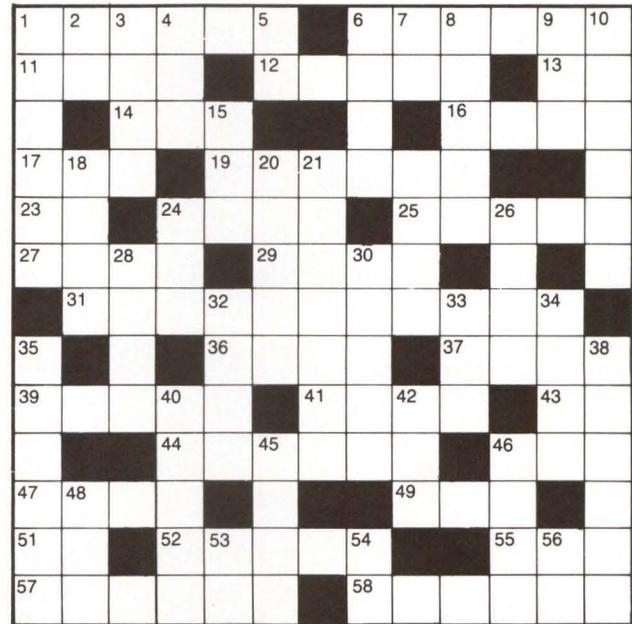
## DOWN

- 1 Massachusetts town
- 2 Hold down CTRL and press V to restore INSERT \_\_\_\_
- 3 Devices for positioning cursor
- 4 Programming languages
- 5 Canadian province (Abb.)
- 6 One trillionth
- 7 At the time that
- 8 Printer feeder type
- 9 Black member of cuckoo family
- 10 Diminutive of Charlotte
- 15 Graphics chart type
- 18 Extinct, long-horned wild ox
- 20 Flash of light
- 21 West German hardware maker
- 24 Derivative (Abb.)
- 26 Regional telephone code
- 28 What Steve Jobs had with Apple
- 30 Put forth and circulate
- 32 Light tan
- 33 Book of New Testament (Abb.)
- 34 Internal Structure
- 35 Luggable computer maker
- 38 CRT screen
- 40 Very fat
- 42 Hindu "Mr."
- 45 Advantage of rigid disk over flexible
- 46 Main computer
- 53 International peace organization (Abb.)

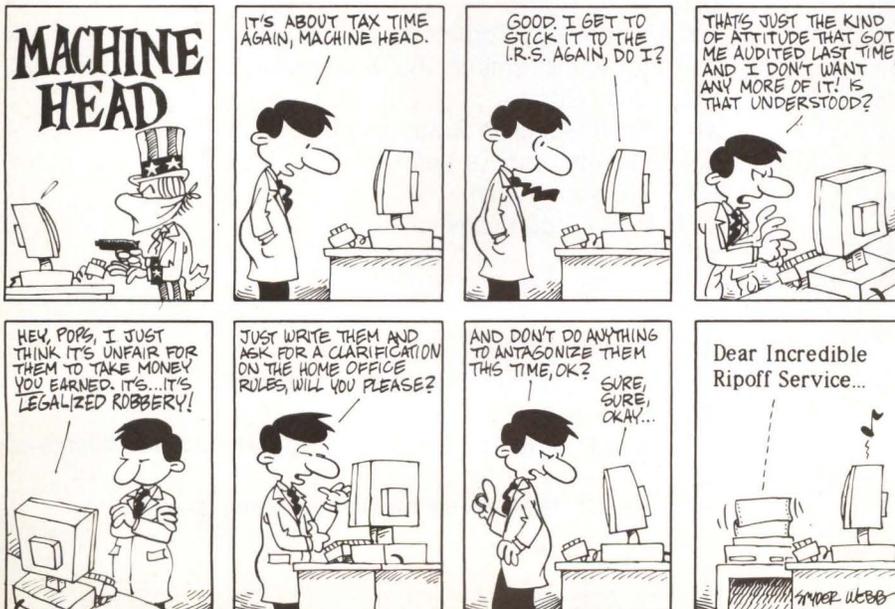
- 54 \_\_\_\_ Duce
- 56 Electrical engineer (Abb.)

## ACROSS

- 1 Magnetic location
- 6 Programming language
- 11 City in Oklahoma
- 12 Basketball sound
- 13 Negative
- 14 British computer company
- 16 Prepare manuscript for publication
- 17 Color
- 19 Overlook
- 23 Its capital is Little Rock (Abb.)
- 24 Delicatessen (slang)
- 25 Video game manufacturer
- 27 Source of inspiration
- 29 Depart from (program)
- 31 Program that projects future costs
- 36 Chip type
- 37 Young salmon
- 39 Male movie star
- 41 In-a-hurry job
- 43 Each (Abb.)



- 44 Temporary storage area
- 46 Contraction of "he is"
- 47 Free from any adulterant
- 49 International Labor Organization (Abb.)
- 51 Rupees (Abb.)
- 52 Japanese dish
- 55 Visualize
- 57 Location of high-volume computer manufacturers
- 58 Quality of printer output



Solution will be printed next month

Answers to March's puzzle can be found on Page 144

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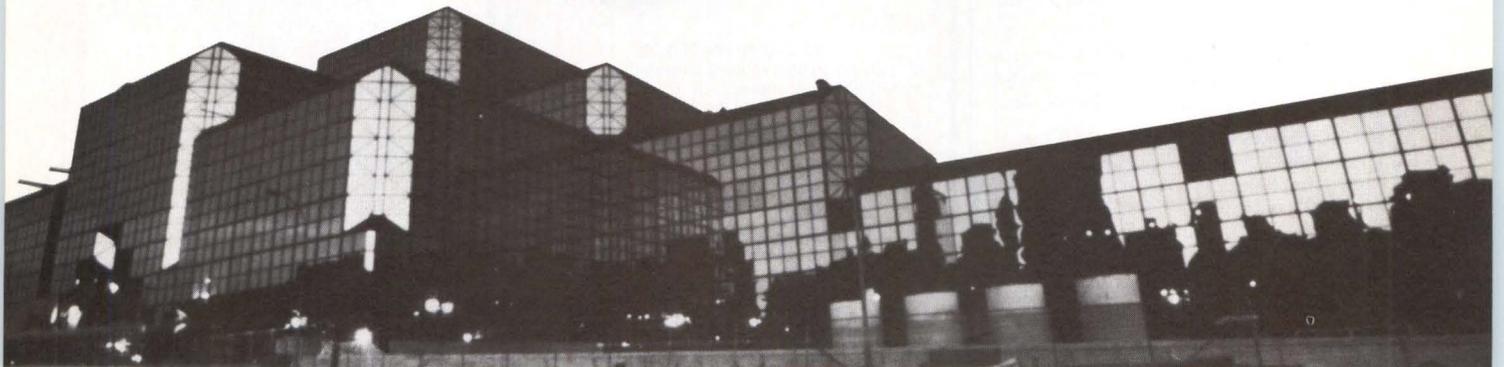
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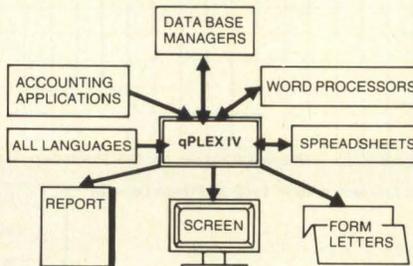
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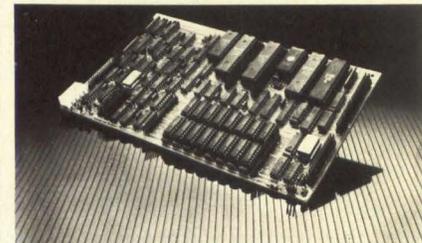


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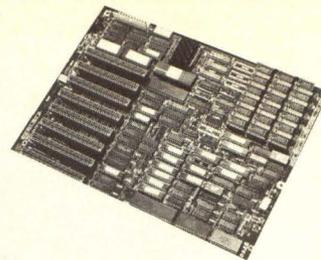
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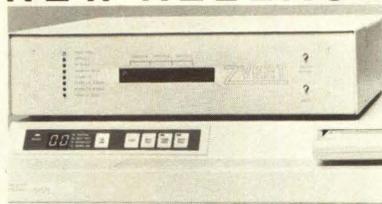
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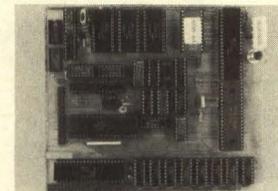
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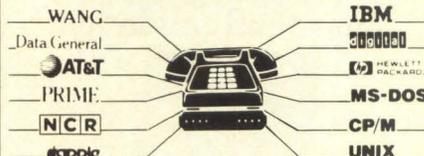
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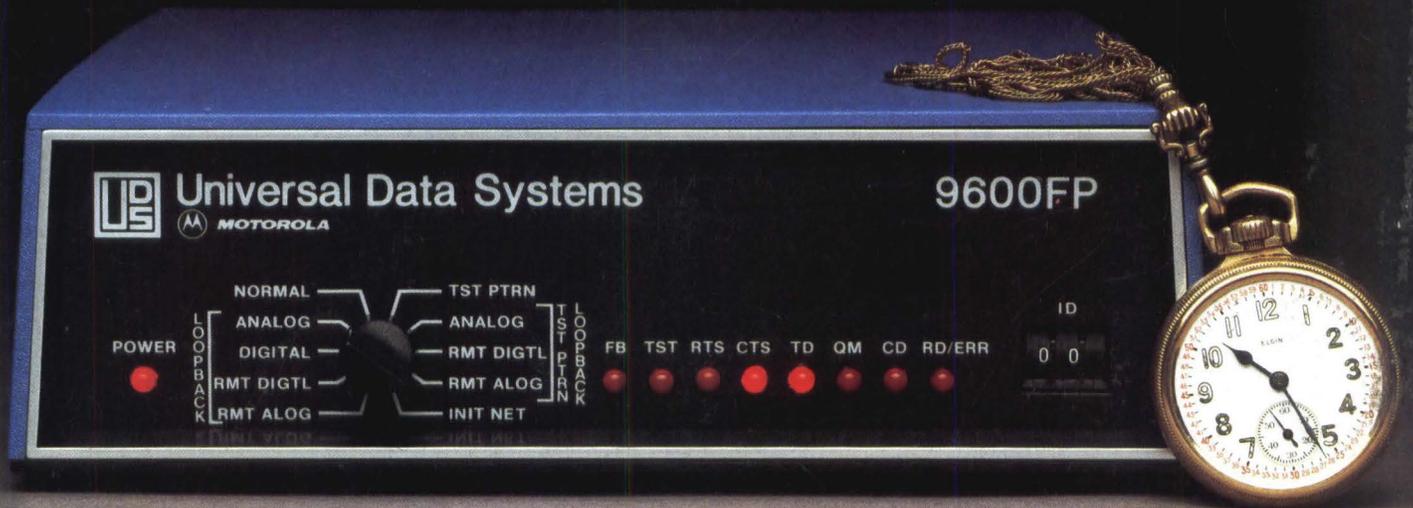
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