

Mini-MicroSystems

A CAHNERS PUBLICATION

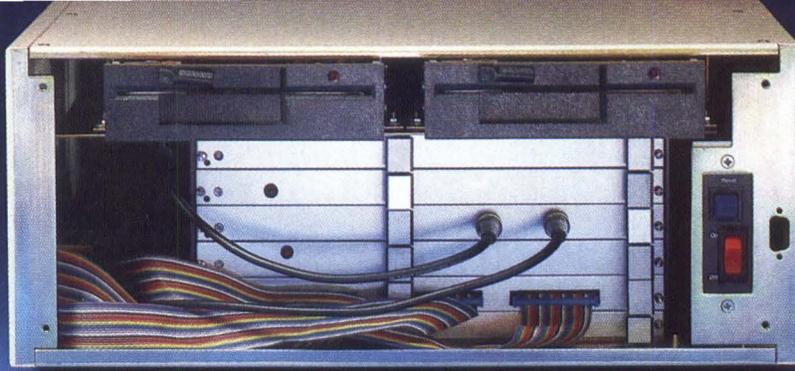
FEBRUARY 1986

SPECIAL REPORTS:

- **SCSI opens integration opportunities**
- **Super-SCSI controllers boost I/O performance**
- **Software tools speed integration**

**Controller combines
VMEbus and ESDI
for fast data transfer**





The Americanization of VME.

If you're faced with the problem of putting a VMEbus system together, then look at the American solution to the Eurocard packaging dilemma.

Look first at the location of the VME cards. The front panels are *behind* the enclosure front panel. So you can attach cables to card fronts without having them clutter your bench or dangle down your rack.

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You can mount standard 5 $\frac{1}{4}$ " disk drives or other devices in our 5-slot SE-805 and SE-805DM VME enclosures—you don't need specially-designed, expensive VMEbus modules to add peripherals. Each has room for two half-height 5 $\frac{1}{4}$ " drives accessible from the front panel and room for an additional full height Winchester inside.

Electronic Solutions VME enclosures are available in a broad range of tabletop, rack mounting, and free-standing DeskMate™ styles, from 3 to 20 slots.

Call us today for all your VME packaging requirements.

 **Electronic
Solutions**

The solution to the VME packaging dilemma.

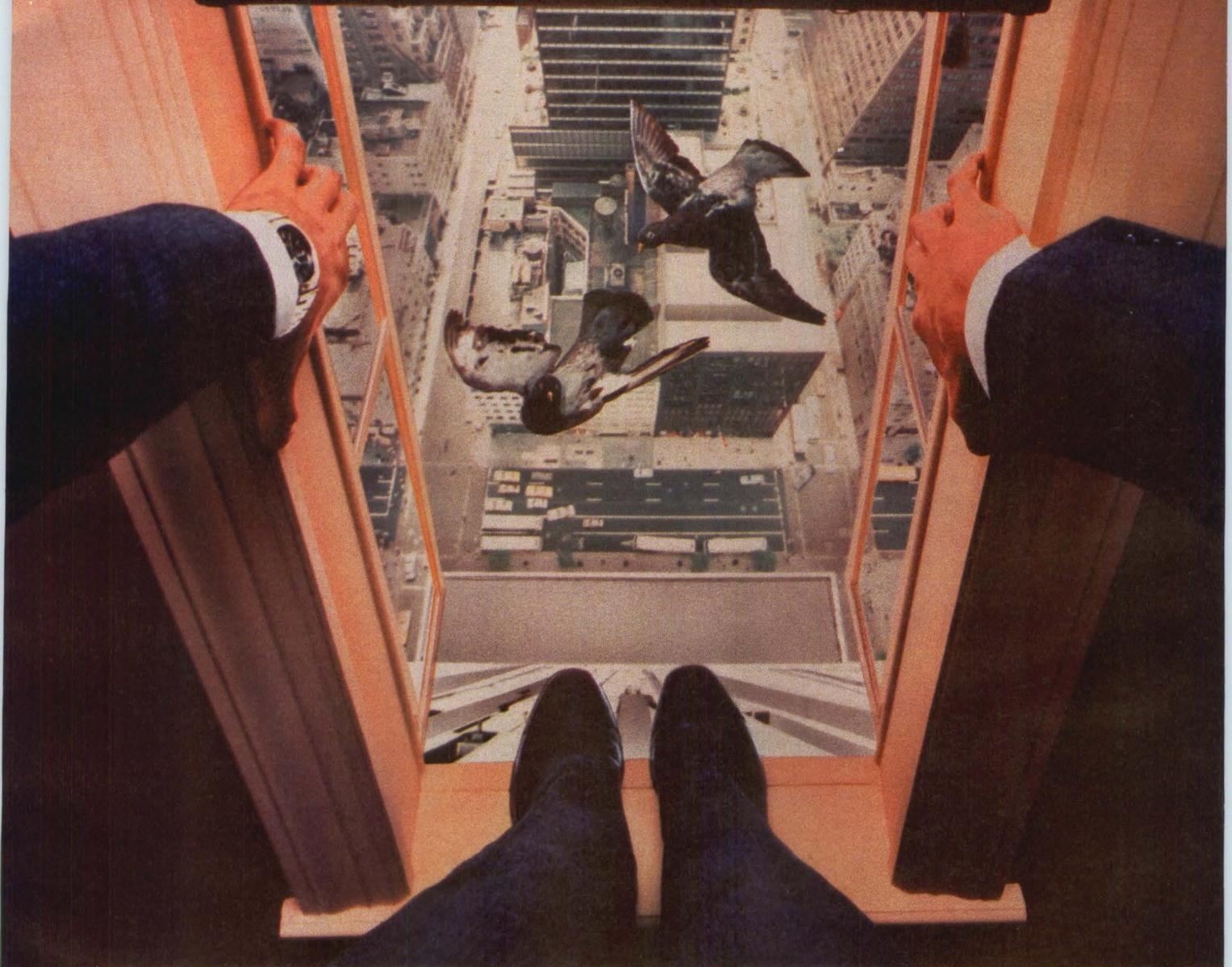
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We're Infotron. We design, build and install communications networks.



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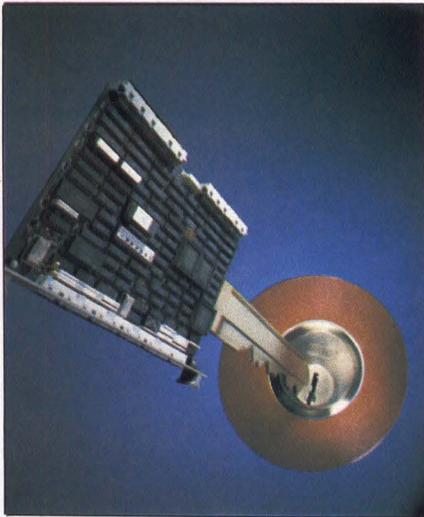
Our ANM Advanced Network Manager, coupled with a 990/992NP Network Processor, can pinpoint real or potential trouble spots,

plus eliminate costly downtime by automatically rerouting data.

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 **INFOTRON** SYSTEMS



p. 25 Xylogics's new 712 controller. Design by Beaupre and Company. Art direction by Vicki Blake. Photography by Stephen Grohe. Courtesy of Xylogics Inc.

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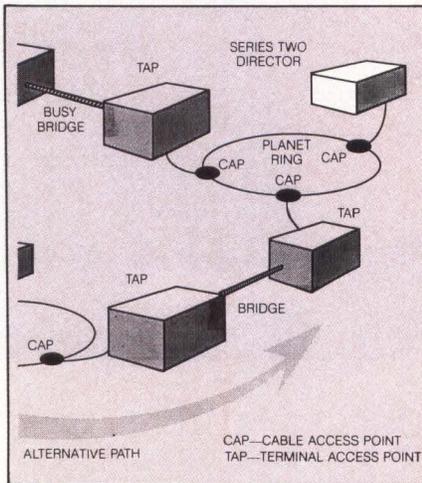
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* DIGITAL DIRECTIONS

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DEC supermicros attain VAX storage levels D1
 DEC's 16-bit MicroPDP-11/83 and the 32-bit MicroVAX II accomodate the huge disk capacities of high-end VAXes, thanks largely to Digital Storage Architecture

*Appearing in issues of subscribers who have indicated having DEC computers



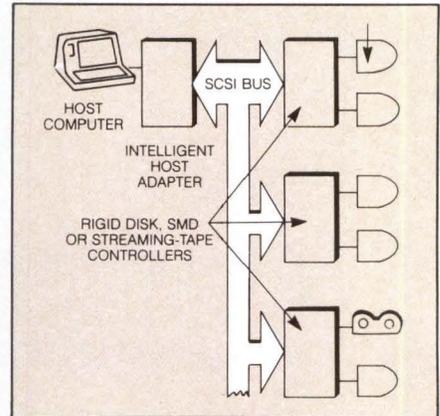
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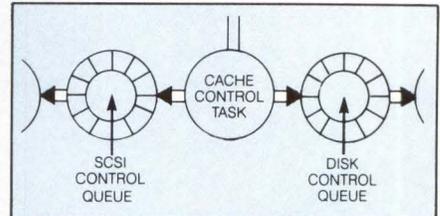
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DEC Users

The waiting for disk response is over

- Finally there is a cost-effective way to speed up PDP-11 and VAX computers.
- Waiting time for disk access can be dramatically reduced.
- Caching and disk emulation techniques combined.

With the MegaDSC-11 high performance storage management system.



If your system is I/O bound because of disk intensive applications, the MegaDSC-11 can significantly increase your system's performance.

How?

The MegaDSC-11 intelligent disk caching system anticipates the data most likely to be needed by the CPU and holds that data in high-speed cache memory. Many read responses come directly from the cache memory, thereby eliminating mechanical motion as a factor in disk access time. Extra performance is gained by off-loading storage management functions from the CPU.

Features:

32MBytes of cache • Solid-state disk emulation
• Transparent to existing system software • Provides all UDA 50 functions • Supports MSCP protocol • Multiporting • Automatic error detection and recovery • User selectable caching algorithms • Volume shadowing.



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EDITORIAL

U.S. AGENCY ASSESSES DISK STORAGE INDUSTRY



A recent study by the Office of Computers and Business Equipment/Science and Electronics in the U.S. Department of Commerce examines the reasons for the U.S. disk-storage industry's loss of market share and evaluates the major factors that will affect future competitiveness.

In 1981, the U.S. trade surplus for computer equipment and related parts peaked at \$6.9 billion, with \$8.5 billion in exports and \$1.6 billion in imports. Since then, the surplus has declined to about \$5.9 billion in 1984, representing \$13.5 billion in exports and \$7.6 billion in imports. If current trends continue, however, this surplus could turn into a deficit in 1986. Substantial imports of computer peripherals, principally disk-storage devices, printers and display terminals, have originated with foreign suppliers and U.S. overseas subsidiaries.

By bringing their production techniques to bear on high-volume, price-sensitive, disk drive products, companies in Taiwan, Hong Kong and Japan represent serious foreign competition. In an effort to remain price-competitive, most U.S. disk storage suppliers have moved all or a portion of their production offshore.

In addition to price, five other competitive factors determine an industry's position in the world disk-storage market: ready availability of the product in sufficient volume; performance; quality; marketing, including after sales service and support; and socio/political factors, such as government-imposed market restrictions. The U.S. disk-storage industry has advantages over its competitors in marketing and performance. However, its lead in performance is eroding. Likewise, the U.S. disk-storage industry remains even in terms of availability and quality, but suffers from disadvantages in price and socio/political factors.

The following policy options are recommended actions for the U.S. government in order to address the foreign-competition:

- Encourage incentives, such as tax breaks, to expand domestic production.
- Encourage expansion of research and development by establishing a permanent R&D tax credit, by expanding the present tax credit to cover expenses incurred in developing a process or production-equipment technology and by encouraging increased private sector R&D consortia and joint university/private sector R&D programs.
- Encourage automation in manufacturing through tax and financial incentives.
- Work diligently through bilateral and multilateral forums to lower foreign barriers to free trade.
- Ensure that signatory nations adhere to international conventions on intellectual property rights. Combat violations of U.S. patents and trademarks by insisting that countries seeking access to the U.S. market provide protection for U.S. intellectual property in their domestic markets.
- In the development of U.S. export control policy, strike a balance between national security and commercial interests so as not to place U.S. suppliers at a competitive disadvantage.
- Recruit small-to-medium-size companies for participation in export promotion programs and encourage the use of export trading companies to penetrate foreign markets.

In sum, U.S. government efforts could address the sharply declining U.S. share of the global disk storage market by helping to develop an environment that fosters innovation, promotes cost-competitiveness with foreign nations and seeks to lower barriers to international competition.

Copies of the Department of Commerce report can be obtained from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, or call (202) 783-3238. Please refer to order number 003-009-00461-6.

A handwritten signature in cursive script that reads "George V. Kotlly".

George V. Kotlly
Editor-in-Chief



Open more doors, and you can sell

It's not a one-problem market out there. And single-solution thinking may get your foot in the door. But no further.

Sperry has not one answer, but many. A range of products and applications to fit not only today's prospect, but the valued customer he'll be tomorrow.

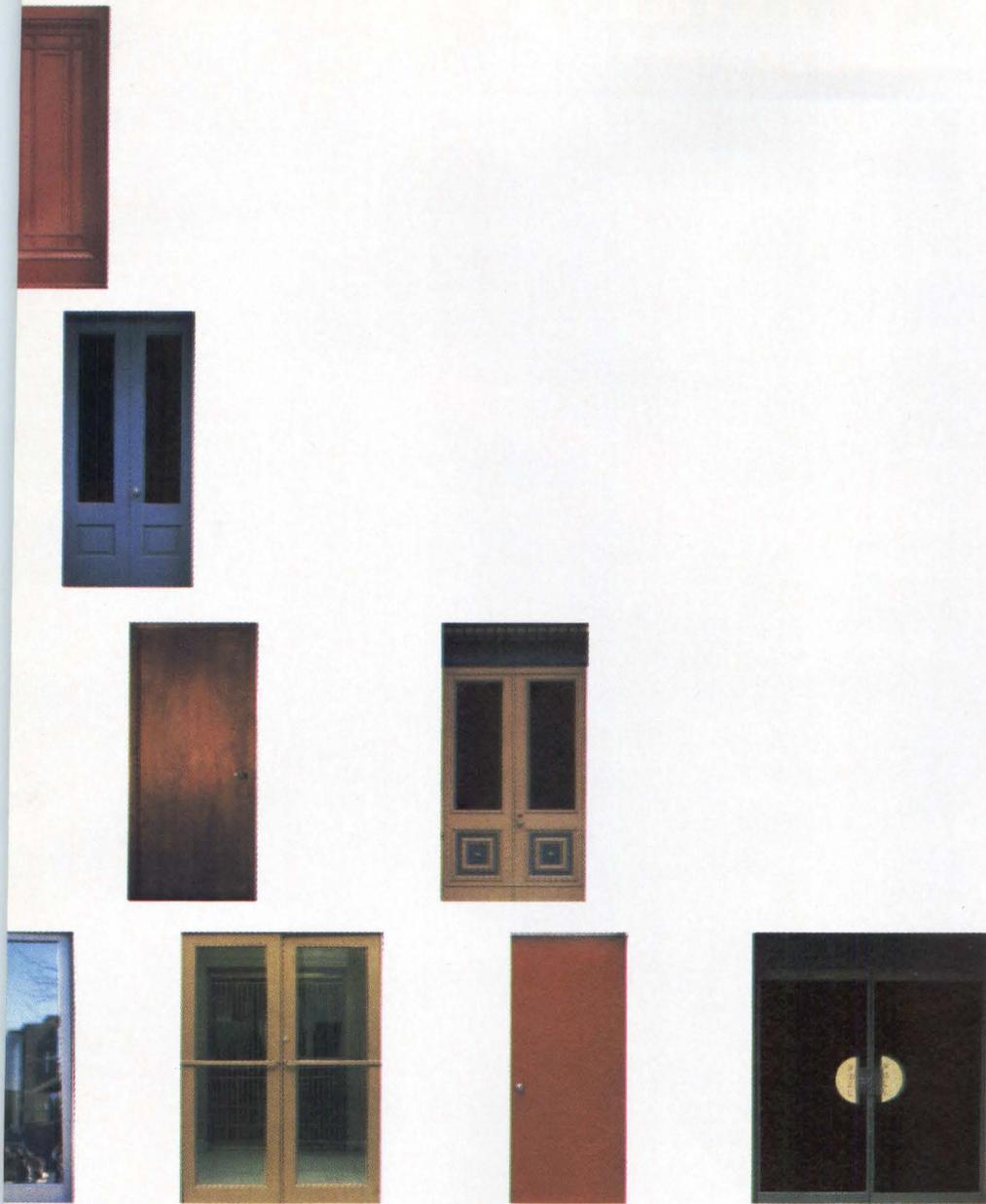
Every product works a little harder. Every application does a little more. Every growth path is so clearly defined, that the reasons are obvious for buying Sperry. And, more importantly, buying it from *you*.

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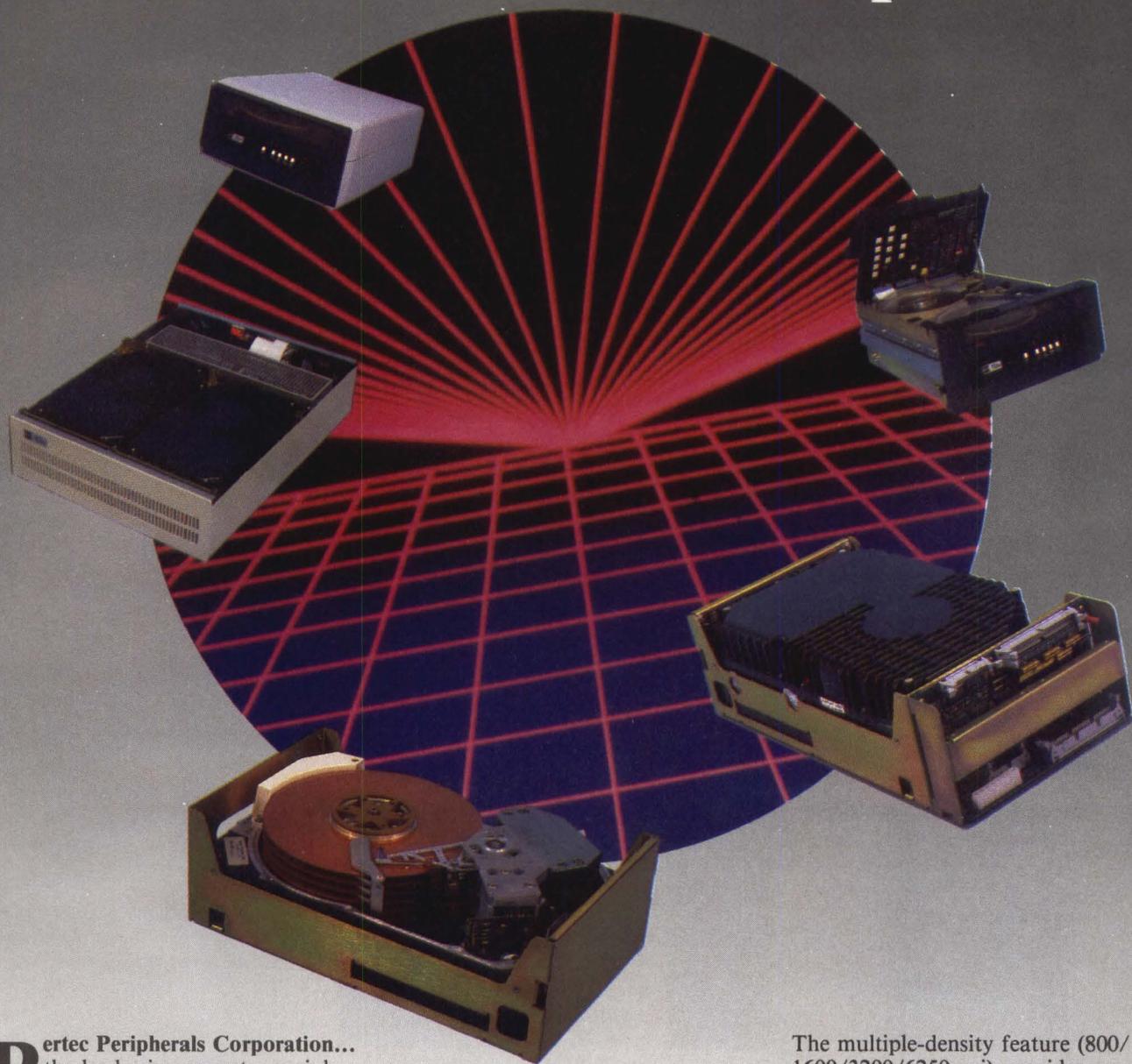


Strengths you can build on.

MINI-MICRO SYSTEMS/February 1986

CIRCLE NO. 4 ON INQUIRY CARD

The World of Pertec® Peripherals



Pertec Peripherals Corporation... the leader in computer peripherals, has served OEMs worldwide since 1967. More than a quarter-million Pertec peripherals are currently in use, backed by PPC's dedicated customer support team.

PPC provides applications consultation, training, product support and a worldwide spares network.

We are providing disk and tape data storage solutions for system builders and integrators ... worldwide, and we are continuing to set new standards for our commitment to excellence.

The new DX548 Winchester disk drives provide storage capacities to 548 megabytes, using the popular SMD interface at the faster data transfer rate of 14.52 MHz. An optional SCSI interface is available, as well as dual-port models. Future enhancements will include the SMD-E

and IPI-2 interfaces. With all its capability and capacity, the DX548 still fits an 8" floppy drive footprint.

The newly-announced DX368 provides systems integrators with 368 megabytes of unformatted data and 18 msec access time. This model also provides data transfer at 14.52 MHz.

PPC's new Data Package comprises either one or two DX332 or DX548 drives and power to supply up to **1.1 gigabytes** of data storage in a compact desk-top or rack-mount package. Data access is 18, 20, or 22 msec with a data transfer rate of 9.67 or 14.52 MHz.

The new FS2000 **quad-density** 1/2" autoloading streaming tape drive is ideally suited for Winchester backup, data interchange and mass storage.

CIRCLE NO. 5 ON INQUIRY CARD

The multiple-density feature (800/1600/3200/6250 cpi) provides capacities of 23 to 270 megabytes (unformatted), in ANSI and IBM format. All of these capabilities are housed in the same size package as the FS1000. It's the smallest GCR package available today, in 19" rack mount or a new desk-top enclosure. PPC is the recognized standard for 1/2" tape storage, and the FS2000's reliability is backed by the expertise that has placed tens of thousands of GCR tape drives in the field, worldwide.

Phone, write or TWX for complete technical data and fast, firm delivery dates.



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800-443-9577, TWX 910-494-2093

LETTERS

COMPUTER DIGEST UPDATE

The following companies did not appear in the Computer Digest

ITT Information Systems 2350 Qume Dr., San Jose, CA 95131, (408) 945-8950

Single-User Microcomputers

Model	ITT XTRA Model II	ITT XTRA Model III (256K RAM)	ITT XTRA Model IV (640K RAM)	ITT XTRA Model V	ITT XTRA XP Model III	ITT XTRA XP Model V
Display size, color	14-inch; amber, green	14-inch; amber, green	14-inch; amber, green	14-inch; amber, green	14-inch; amber, green	14-inch; amber, green
Screen format (col. x lines)	(80 x 25)	(80 x 25)	(80 x 25)	(80 x 25)	(80 x 25)	(80 x 25)
CPU type	8088	8088	8088	8088	80286	80286
Main memory min.-max. (bytes)	256K-640K	256K-640K	356K-640K	256K-640K	512K-1.6M	512K-1.6M
Operating systems available	ITT DOS 2.11, MS-DOS	ITT DOS 2.11, MS-DOS	ITT DOS 2.11, MS-DOS	ITT DOS 2.11, MS-DOS	ITT DOS 2.11, MS-DOS	ITT DOS 2.11, MS-DOS
Programming languages supported	BASIC, COBOL, FORTRAN, Pascal	BASIC, COBOL, FORTRAN, Pascal	BASIC, COBOL, FORTRAN, Pascal	BASIC, COBOL, FORTRAN, Pascal	BASIC, COBOL, FORTRAN, Pascal	BASIC, COBOL, FORTRAN, Pascal
Unit price \$	1,595	2,595	3,095	3,195	3,995	4,595
Configuration	one parallel, one serial port; two 5¼-inch, 360K-byte flexible drives available	one 5¼-inch, 360K-byte flexible drive, one 10M-byte hard disk drive available	same as Model III	one 5¼-inch, 360K-byte flexible drive, one 20M-byte hard disk drive available	one 5¼-inch, 360K-byte flexible drive, one 10M-byte hard disk drive available	one 5¼-inch, 360K-byte flexible drive, one 20M-byte hard disk drive available

Plessey Microsystems

One Blue Hill Plaza, Pearl River, NY 10965, (914) 735-4661

Single-Board Microcomputers

Model	PME 68-1B	PME 68-2	PME 68-2D
CPU type (Word size)	MC 68000 (8, 16, 32)	MC 68000 (8, 16, 32)	MC 68000 (8, 16, 32)
Bus	VME	VME	VME
Operating system	P-DOS, pSOS	P-DOS, pSOS	P-DOS, pSOS
Software support	debugger, editor	debugger, editor	debugger editor
Programming languages	BASIC, FORTH		
On-board/bytes RAM (ROM)	128K (16K)	256K (32K)	128K (32K)
Notes, features, options	three RS232C ports, SIO, programmable timer, real-time clock with battery support; opt. 10-MHz 68000, 512K-byte DRAM	one RS232C port, SIO, PIO, dual ported RAM, real-time clock, programmable timer, floppy disk controller; opt. 1M-byte DRAM, 10-MHz 68000	one RS232C port, SIO, dual ported RAM; opt. 10-MHz 68000, 8-, 10-MHz 68010, 512K-byte DRAM
Price \$ (quantity)	1,037 (Q1)	1,609 (Q1)	1,188 (Q1)

9-TRACK MAG. TAPE SUBSYSTEM FOR THE IBM PC/XT/AT



For information interchange, backup and archival storage, IBEX offers a 9-track, IBM format-compatible ½" magnetic tape subsystem for the IBM PC, featuring:

- 42 M-Bytes on a single reel.
- IBM format 1600 cpi.
- Software for PC-DOS, MS-DOS.

IBEX

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CIRCLE NO. 6 ON INQUIRY CARD

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When great ideas converge,

If you've been searching for computer solutions that can turn your great ideas into a great success story, you've come to the right place. Our workstations, minicomputers and software meet OEM and VAR needs for configuration flexibility and continual growth.

WE'VE MADE OBSOLESCENCE OBSOLETE...

You can put these systems together in the precise way that suits your specific application. And you never have to replace the computers when your needs grow or you want to take advantage of new technologies. Growth potential is built in, so Convergent computers never become obsolete.

For example, Convergent NGEN® workstations expand module by module to make more than a million configurations, which can all be put together by end users without training. When new technologies arrive, you don't replace NGENs — you simply add new modules.

If you need greater computing power, we deliver a range of 32-bit UNIX* minicomputers that adapt to applications in engineering and manufacturing as well as the office.

You can choose from the MiniFrame Plus,[™] which combines low cost and high performance for up to 16 users; the MightyFrame,[™] a 32-user system that's wide open to flexible



great products emerge.

configurations; or the MegaFrame,[™] which gives you incremental expansion for up to 64 users.

These minicomputers are designed to offer all the features you need in flexible arrangements so you don't have to compromise on performance.

That adaptability also applies to our software, which is designed for modular growth. Our OEM licensing and source code agreements allow you to integrate your great ideas with ours.

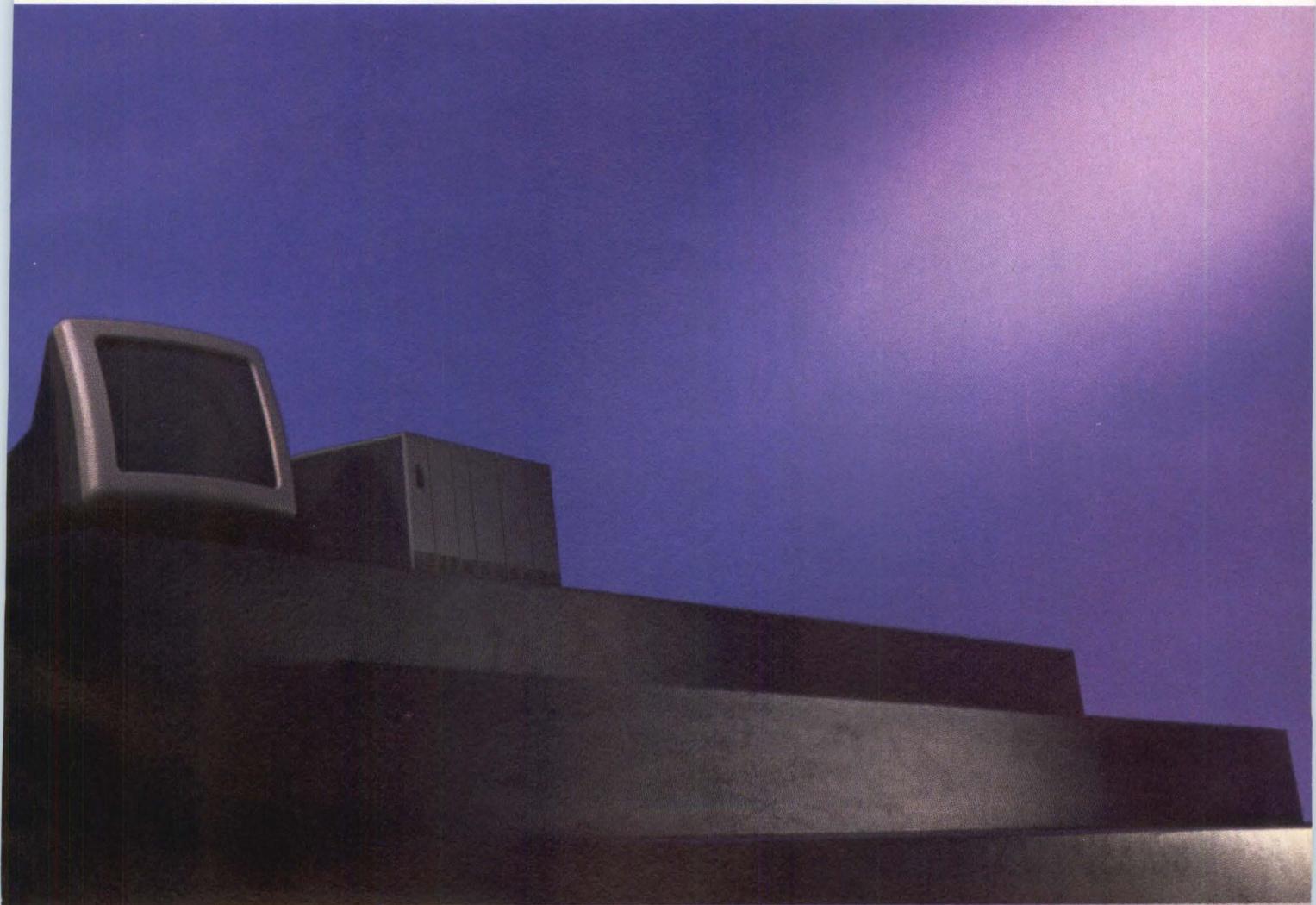
...AND DEPENDABILITY ABSOLUTE.

All our products are backed by Convergent's commit-

ment to excellence in engineering, craftsmanship in manufacturing and fast turn-around in high-volume production.

We'd like to show you how this convergence of thinking can work for you. Call us for more information at 800-538-8157 ext. 951 (in California call 800-672-3470 ext. 951). Or write us: Convergent Technologies, 2700 North First Street, P.O. Box 6685, San Jose, CA 95150-6685, Attention: Mail Stop 10-015.

That is, if creating great computer systems sounds like a good idea to you.



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CIRCLE NO. 7 ON INQUIRY CARD

The Hewlett-Packard A-Series Automators:
a rugged family of real-time computers with
total software compatibility.

Available as boards, boxes,
systems or microsystems.

256K RAM error-correcting memory.
Up to 24 MB. So flexible, it can manage
large data bases or work as a true
memory-based controller.

4 MB/sec I/O bandwidth
for fast performance.
(DMA per channel).

Virtual code and data for large
program support.

State-of-the-art pipeline
architecture, with cache,
optimized for real-time
performance.

Performance range: 1-3 MIPS.

Why you should consider buying one of our real-time computers.

Low maintenance fees (half the rate of the closest competitor) due to the exceptional reliability of our products.

A profitable Sales Support Program. Direct selling, if you need us. Sales aids, if you don't.

HP's program for system designers, software suppliers and resellers includes discounts from 5 to 39%.

CPU prices start at U.S. list \$2278 (with average quantity discount).

Support beyond the year 2000. Guaranteed.

Local HP support representatives. Datapro has rated our support #1 for four consecutive years.

1-800-556-1234
ext. 160.

Call this toll-free number for a brochure on the program and the products. (In California, call 1-800-441-2345, ext. 160.)

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CIRCLE NO. 8 ON INQUIRY CARD

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- A. **Touch Pad** - a multi-purpose input device usable as a programmable function pad, mouse, fast cursor control device and digitizing tablet.
- B. **Speech Recognition** - natural, language independent command entry for hands free operation.
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- D. **Mouse** - accurate pointing and selecting tool in a maintenance-free design.
- E. **OCR** - optical character recognition capability.

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CIRCLE NO. 9 ON INQUIRY CARD

BREAKPOINTS

SEIKO UNVEILS COLOR THERMAL COPIER

Seiko Instruments U.S.A. Inc. this month takes the wraps off its newest thermal, ink-transfer color copiers, the Series CH-5300. Produced by the company's graphic devices and systems division in Milpitas, Calif., the copiers can be configured with three different 8-bit parallel or two video interfaces. The CH-5301, with a resolution of 152 dots per inch, prints an 8½-by-11-inch image in about 40 seconds and costs \$5,995. The larger CH-5312 prints an 11-by-17-inch image in less than two minutes. It costs \$9,995 and has a resolution of 203 dots per inch. The copiers support a four-port multiplexer that allows system integrators to specify a variety of input devices.

—*Mike Seither*

BRITAIN AND FRANCE COLLABORATE ON PROLOG STANDARD

Standards makers in Britain and France have begun collaborating on a standard for the artificial-intelligence language Prolog through their respective national standards organizations. Both the British Standards Institution (BSI) and the Association Française de Normalisation (Afnor) are also proposing that their activities be adopted as a "work item" by the International Standards Organization as the first step toward a worldwide standard for the language's numerous versions. Prolog vendor Quintus Computer Systems Inc. of Palo Alto, Calif., says it expects any future ANSI standard for the language to closely follow that developed by BSI and Afnor.—*Keith Jones*

CIPHER DATA TO UNVEIL IBM 3480 LOOK-ALIKE

Industry watchers expect Cipher Data Products Inc., San Diego, Calif., to unveil next month at the Hanover Fair in West Germany a deliverable model of an IBM Corp. 3480, half-inch, tape-cartridge drive look-alike. The drive will reportedly use a serpentine recording method to record nine tracks in one direction and the other nine on the way back, rather than record the 18 tracks simultaneously as does the 3480. The drive is said to read tape written on an IBM 3480 but offers no upward compatibility. Operating at a 433K-byte-per-second transfer rate, it will back up its full capacity of 200M bytes in 12½ minutes. Meanwhile, IBM is said to be preparing a higher capacity version of the 3480 for introduction this summer. Code-named Sonoma, it uses 36 tracks arranged in twin pairs of 18 tracks linked in a serpentine fashion. Capacity is expected to be 1G byte.—*Carl Warren*

STANDARDS WORK PROMISES HOTTER AND FASTER TOKEN RINGS

ANSI has given the go-ahead for work on an enhancement to its Fiber Distributed Data Interface standard, FDDI, called FDDI-II, that will support real-time, digitized voice communication around the ring. Work on a data-only version of FDDI, which will provide for token-ring speeds of 100M bits per

second (bps)—compared to IBM Corp.'s 4M bps—is already well advanced. The protocols employed by FDDI and FDDI-II will reportedly be close enough to those established by the IEEE 802 committee to enable the high-speed ring to act as a backbone connecting 802 standard rings and buses.—*Keith Jones*

NEW LAWS MAY LOWER THE BOOM ON NETWORK BYPASSERS

Reports from Capitol Hill indicate that Rep. Edward Markey, D-Mass., will shortly introduce legislation that would require the Federal Communications Commission to take a tougher stance with network bypassers. Preliminary legislation, according to industry trade group North American Telecommunications Association (NATA), would require the FCC to hold hearings and conduct at least five months of investigations before granting tariffs that allow market-dominant carriers to offer switched bypass services. NATA says the bill's aim is to curb recent AT&T Co. service offerings, including Megacom and Software-Defined Networks, that would provide customers with end-to-end switched connections without the need to connect with the local telephone company switches.—*Stephen Shaw*

ATASI SELLS REPAIR SERVICE AS PART OF REORGANIZATION

Winchester disk drive manufacturer Atasi Corp. of San Jose, Calif., has sold its repair facility as part of a plan to reorganize after having filed for protection from creditors under Chapter 11 last August. E.F. Industries, Hawthorne, Calif., bought the repair equipment and now has worldwide rights to work on Atasi drives. E.F. Industries acquires capital equipment, spare parts and inventory from troubled or defunct manufacturers and provides service for their products.—*Mike Seither*

ALTOS GIVES UP STAKE IN WYSE TO PURSUE SOFTWARE INVESTMENTS

Altos Computer Systems has decided its best investment is in software companies, not hardware concerns. As a result, Altos is selling off 27 percent share of its Wyse Technology stock. Altos and Wyse, both of San Jose, Calif., have had a close relationship since 1981. Altos, which manufactures multiuser systems for vertical markets, first invested in Wyse in 1981. Since then Wyse has become the top independent terminal manufacturer. Altos vice president Philip White indicated that his company will seek equity positions in software firms that specialize in communications, graphics, database and office-automation applications.—*Mike Seither*

IPI TO GET NOD FROM INDUSTRY AT CONFERENCE

After five years of design effort within ANSI, the Intelligent Peripheral Interface (IPI) will finally appear in products to be announced by several vendors at the IPI Forum at the Parker House hotel in Boston from March 12 to 14. Among the numerous chip sets, testers, controllers and subsystems expected to be introduced will be a range of products from Control Data Corp. that includes an OEM disk with a 3M-byte-per-second data rate, the fastest on the market. Digital Equipment Corp. president Kenneth Olsen is the keynote speaker.—*Carl Warren*

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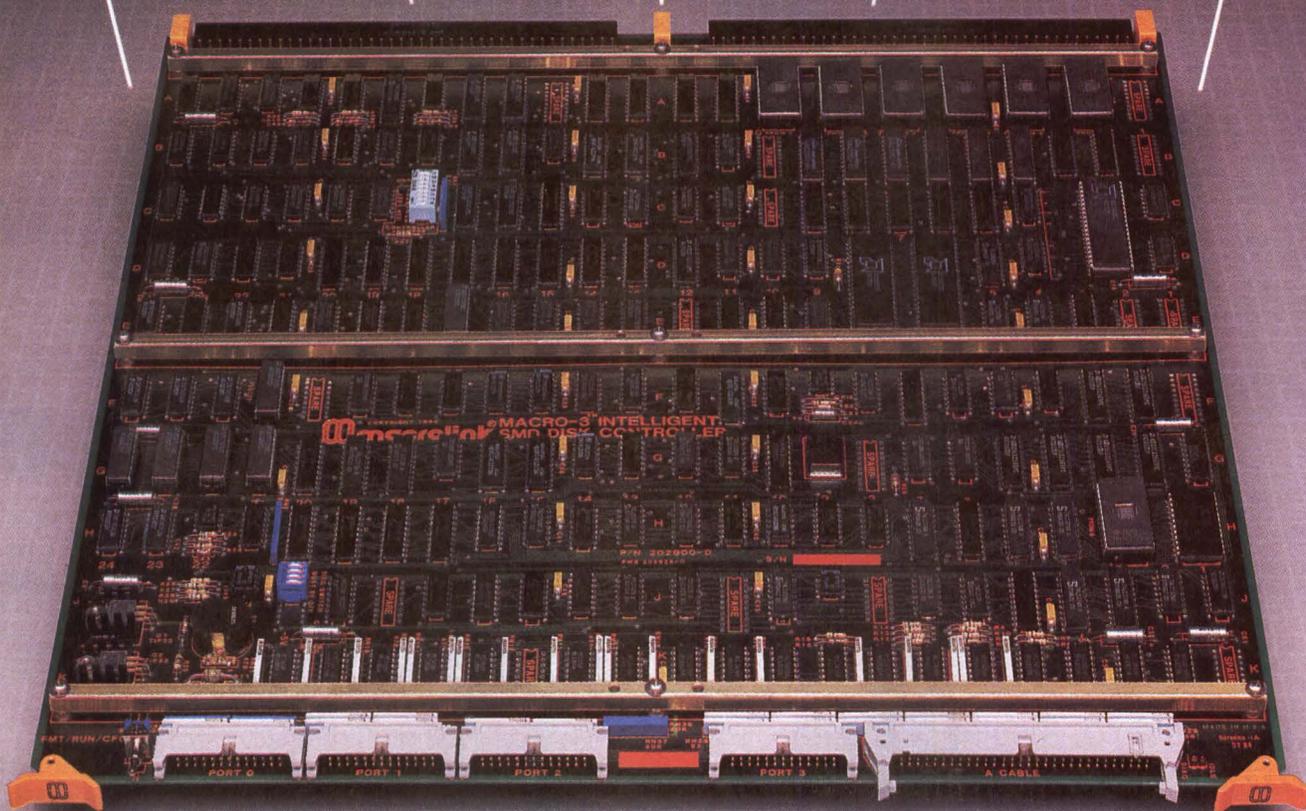
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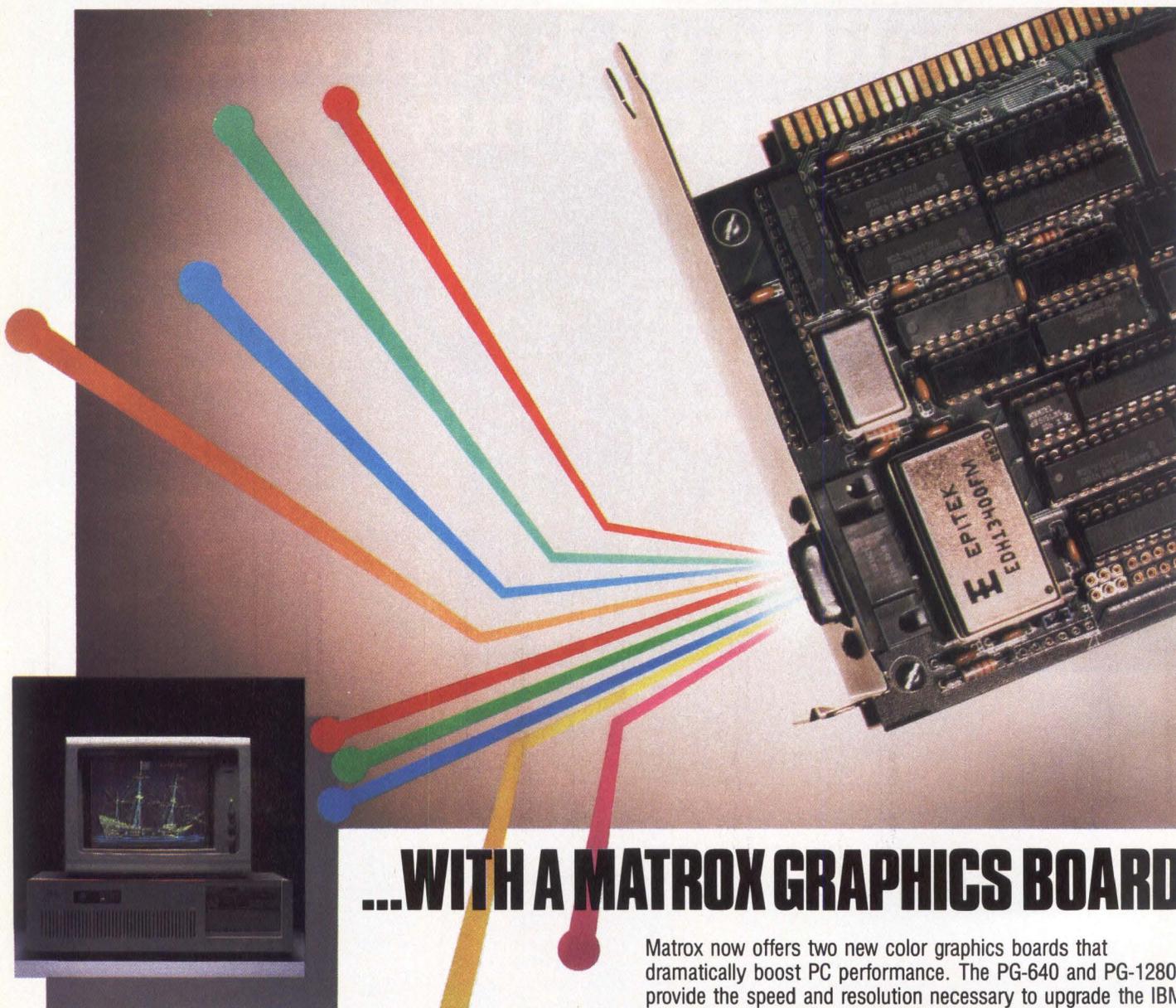
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TECH FILES: A QUICK LOOK AT NEW PRODUCTS AND TECHNOLOGY

The VAXstation II/GPX from **Digital Equipment Corp.** is the company's first technical workstation for the UNIX marketplace. The system, which also supports VMS, implements a new DEC VLSI graphics subsystem that frees the CPU for application-specific computation. DEC offers four configurations priced between \$33,000 and \$53,800. An entry-level color package for \$35,000 contains the MicroVAX II, a 71M-byte disk drive, a 95M-byte tape drive, 3M bytes of memory, an operating-system license, a four-plane graphics coprocessor and a 19-inch color monitor.—*Lynn Haber*

Softech Inc., Fairborn, Ohio, began distributing the Prototype Ada Compiler Evaluation Test Suite last month. Developed by the Institute for Defense Analysis, the suite is intended to provide users with an organized suite of compiler-performance tests along with support software for executing compiler-evaluation tests and for collecting performance statistics, according to the Ada Joint Program Office. The test suite is contained on a single tape in either VAX-BACKUP or ANSI-STD formats and can be obtained from: The Prototype Test Suite Distribution Office, Softech Inc., 3100 Presidential Drive, Fairborn, Ohio, 45324.—*Stephen Shaw*

Shipments of a 16M-byte add-in memory card for the Digital Equipment Corp. VAX 8600 and 8650 will begin next month from **EMC Corp.**, Natick, Mass. The VX86-16MB will be the first add-in card to use 1M-bit chips. It will enable users to configure up to 128M bytes of physical memory in the adjacent slots of the VAX machines, as the card requires only one slot; DEC's requires two. The quantity-one price is \$58,000.—*Bruce MacDonald*

Pathway Design Inc.'s new FootPath package brings full bidirectional, file-transfer capabilities to the Natick, Mass., company's NetPath local-area-network-to-mainframe product installed on a gateway personal computer. Supporting up to 32 concurrent sessions, the software operates with IBM Corp.'s mainframe-based 3270 PC file-transfer program in CICS, VM/CMS and MVS/TSO environments.—*Jesse Victor*

Last fall, **Sun Microsystems Inc.** introduced three new workstations based on Motorola Inc.'s MC68020 32-bit processor that ranged in price from \$13,000 to \$32,000. Now the Mountain View, Calif., vendor is offering the same 32-bit technology in a \$7,900 diskless workstation that can act as a low-cost network node. The Sun 3/50M, which comes with 4M bytes of memory, an 1152-by-900-pixel monitor and built-in Ethernet transceiver, is being positioned against the DN330 workstation (about \$16,000) from Apollo Computer Inc., Chelmsford, Mass. A standalone version, the Sun 3/52M, has a 71M-byte rigid disk drive and 60M-byte quarter-inch streaming tape. It is priced at \$13,900 and positioned against Digital Equipment Corp.'s \$26,000 VaxStation II.—*Mike Seither*

Using CADKEY software from Micro Control Systems Inc., Vienna, Va., **Gerber Systems Technology Inc.** of Vernon, Conn., has created a 3-D desktop workstation that utilizes the IBM Corp. PC/AT with a 20M-byte rigid

disk and math coprocessor. Priced at approximately \$20,000, the Sabre-PC is compatible with Gerber's UNIX-based Sabre-5000 32-bit CAD/CAM system. It can execute crosshatching and true 3-D mesh generation and mirror imaging. —*Gregory Solman*

AstraNet from **Astra Communications Inc.**, Mountain View, Calif., allows an Ethernet local area network to operate over IBM Corp.'s Cabling System for users requiring support for both Ethernet and IBM's Token-Ring network. AstraNet includes concentrators, transceivers and utility cables and is implemented in a hierarchical star topology, transmitting data at up to 10M bits per second. Installation costs range from \$225 to \$450 per host connection. —*Lynn Haber*

Celerity Computing of San Diego, Calif., is addressing computer aided engineering and scientific research with its new UNIX-based C1260 and C1230 superminicomputers. Incorporating a reduced-instruction-set architecture, the machines feature a proprietary 32-bit processor and floating-point coprocessor, open communications and support for up to 128 users. The C1260 can be configured with a dual processor to achieve throughput of 6.15 million instructions per second. —*Bruce MacDonald*

Recent product introductions from **Xerox Corp.**, Stamford, Conn., include the XC 22, a 1M-bit-per-second network linking MS-DOS microcomputers over standard, twisted-pair phone wires; the Documenter series of workstation/printer systems for electronic publishing; the 4050 50-page-per-minute laser printer; the 7010 Telecopier facsimile machine; an entry-level, electronic-publishing terminal system; and various application software. —*Bruce MacDonald*

NOTES FROM OVERSEAS: Telecommunications equipment manufacturer **Standard Elektrik Lorenz AG**, Stuttgart, West Germany, a subsidiary of **ITT Inc.**, has acquired West German minicomputer maker CTM Computertechnik Müller GmbH, of Konstanz, West Germany. If CTM's products are marketed worldwide by ITT—an ITT spokesman says it's a "little early" to tell if that will happen—look for the 32-bit CTM 9032 system under the ITT label. Based on a proprietary processor and 32-bit bus, the 9032 supports up to 48 interactive display terminals. —*Keith Jones*

Twenty European companies, including **Groupe Bull**, **N.V. Philips** and **Siemens AG.**, are working together on an open systems architecture for computer integrated manufacturing similar to the Manufacturing Automation Protocol and Technical and Office Protocol (MAP/TOP) promoted by General Motors Corp. and Boeing Co. Funded in part by the Common Market, the proposed architecture should not conflict with the upcoming MAP/TOP protocols, says British participant **ICL Ltd.** —*Keith Jones*

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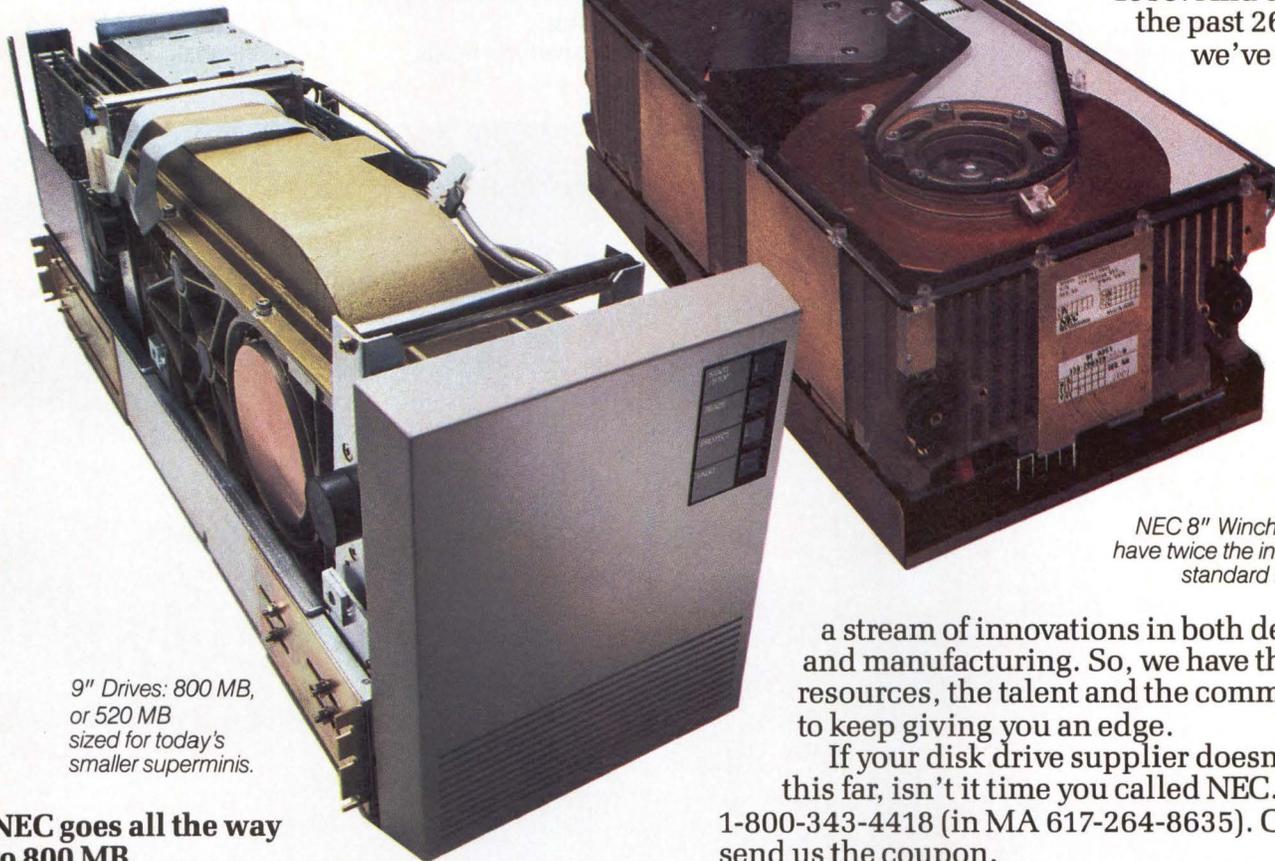
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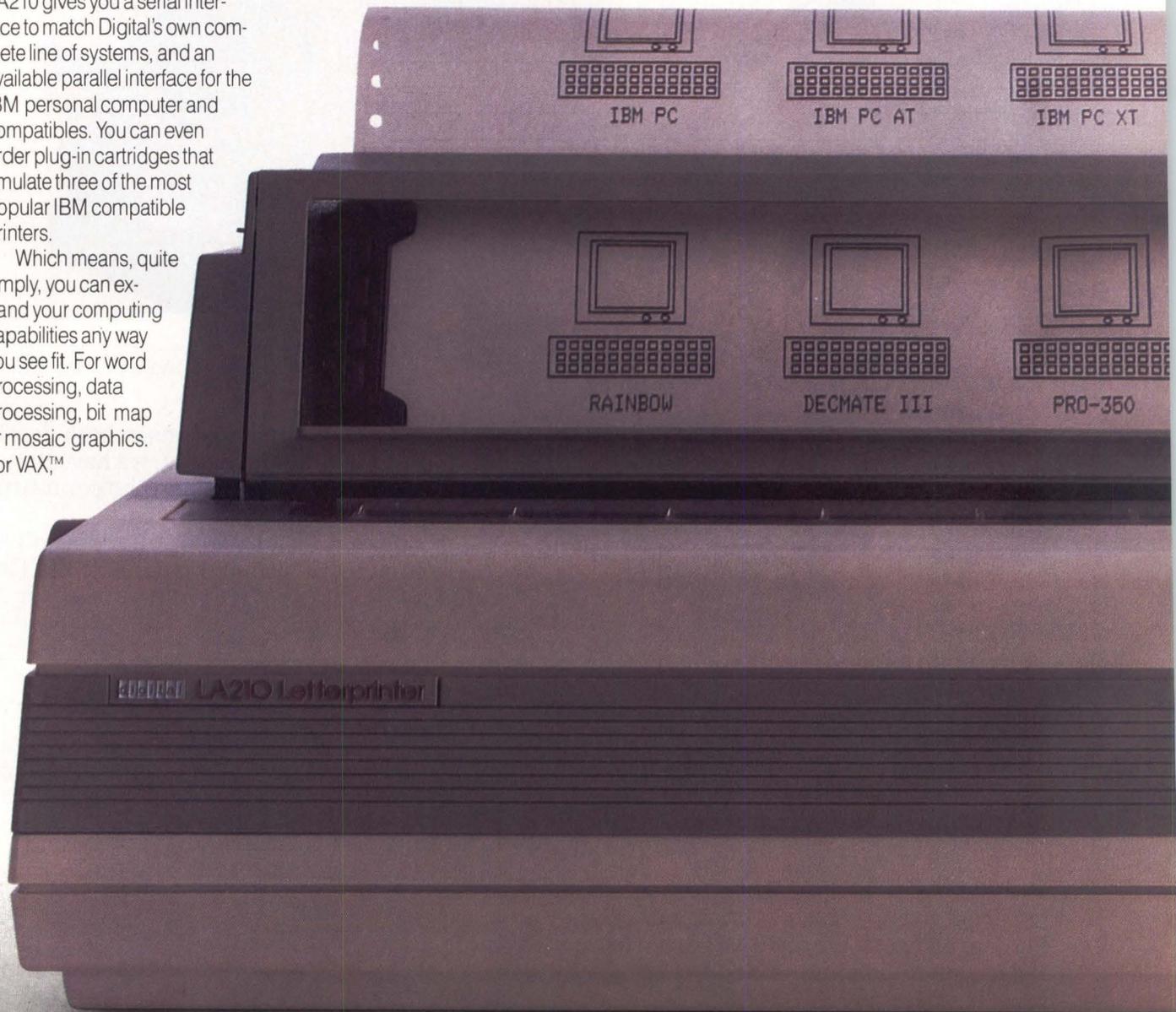
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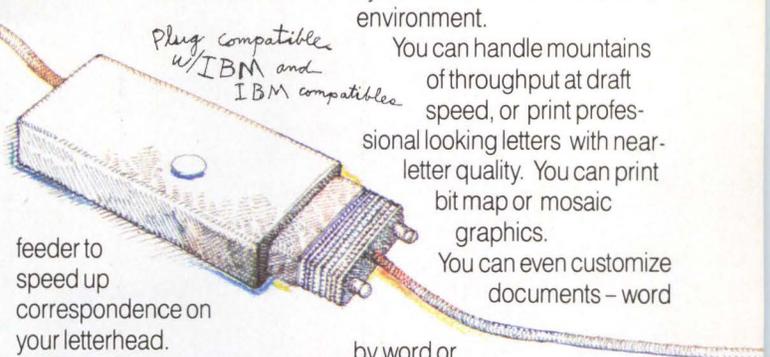
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CIRCLE NO. 14 ON INQUIRY CARD

Controller combines VMEbus, ESDI for fast data transfer

Jesse Victor, Associate Editor

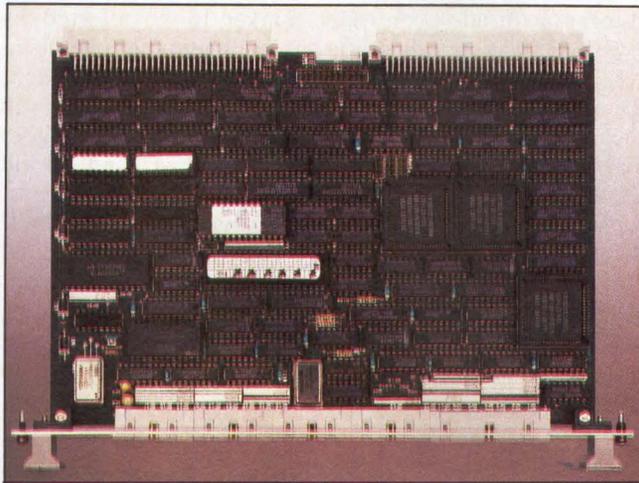
Calling it a winning combination, Xylogics Inc. has merged a VMEbus interface with an enhanced small device interface (ESDI) to create a rigid disk controller with a 2.4M-byte-per-second maximum data-transfer rate and 10M-byte-per-second direct-memory access (DMA).

The Burlington, Mass., company says its new 712 controller allows system integrators to overcome the data-transfer limitations of the older ST506/ST412 rigid disk interface and at the same time meet the high-performance demands of multiuser, UNIX-based computer systems. It also will permit the company to ride the ground swell of ESDI, 5¼-inch, Winchester disk drives expected later this year from drive manufacturers.

Rounding out Xylogics' 700 Series of storage module device (SMD) and half-inch, tape-drive VMEbus controllers—and preserving software-interface compatibility with them—the \$1,995 712 uses custom VLSI chips and an 8K-byte, first-in-first-out (FIFO) buffer to minimize data-transfer times and overcome the I/O bottleneck to fast disk access.

A programmable DMA throttle allows software to optimize controller-access time for maximum performance. Dynamic switching of word size during DMA transfers permits starting on odd-size byte boundaries. Firmware support for features such as elevator seek, scatter/gather reads and writes and command chaining fine-tunes the controller for UNIX-based systems.

"There is a tremendous need for fast-transfer, large storage capacities and the ST506 footprint," asserts Kevin Gonor, Xylogics' vice president



Data-transfer rates to 2.4M bytes per second, fast DMA, UNIX software support and programmable interrupt levels, vectors and address modifiers suit the 712 controller for multiprocessor VMEbus systems.

of sales. "There is a lot of demand in our customer base for ESDI. A typical multiuser system now has a 1.2M-byte-per-second data-transfer rate. They are upgrading to 1.9M bytes per second and looking to 2.4M bytes. Replacing an ST506 interface with ESDI, an integrator can double or triple the transfer rate at about the same price. With ESDI, the same-sized drive can handle 300M bytes or above at SMD speeds."

Indeed, Xylogics sees most of the demand for its ESDI controller coming from integrators dissatisfied with ST506's 1.2M-byte-per-second maximum data-transfer rate. "The majority of high-performance users of 5¼-inch drives will go to ESDI from ST506. This is where 80 percent of our market will come from," predicts Chap Cory, Xylogics' vice president for research and development. "Another 20 percent will come from people who migrate down from SMD."

Gonor sees the ESDI-controller market on a fast-growth track. Xylogics expects 1986 sales of about \$3 million to \$4 million, reflecting a 30 percent annual growth. Gonor predicts

a total ESDI-controller market of \$8 million to \$9 million in 1986 and a 60 percent jump in 1987 sales over 1986. "Once the market gets a solid year, it will really skyrocket," he forecasts.

The way to upgrade

Other analysts are equally optimistic about the ESDI controller market—and especially about the VMEbus-ESDI controller segment. "VMEbus and ESDI will be the way to go for upgrading low- to mid-range computer systems," says Joe Jaworski, president of Peripheral Concepts Inc., Irvine, Calif. "Anybody with ST506 and 40M bytes or less who wants to step up capacity will probably go to ESDI. The VMEbus-ESDI controller market will grow as fast or faster than SMD through 1988. If you track it from 1986 on, you will probably end up with tremendous figures."

Although Jaworski says VMEbus-ESDI controllers for Winchester drives will produce only \$317,000 in revenues this year, they will capture 15.8 percent of the VMEbus-controller market in 1987 and 22.5 percent in 1988 with \$4.27 million in revenues. Meanwhile,

the ST506 market share will decline, from 92.9 percent in 1985 to 40.1 percent in 1988.

"The VMEbus-ESDI controller market will show strong growth because of the increasing number of small disk drives that are offering a better price-per-bit with ESDI on them," asserts consultant I. Dal Allan of ENDL, Saratoga, Calif.

Allan sees the small-form-factor advantages of lower power dissipation and a "more attractive box with sex appeal" winning SMD users over to ESDI. "ESDI will knock out the bottom end of the SMD market. It will eat up the 150M-byte-to-200M-byte SMD drives. They will be replaced with the same-capacity ESDI drives."

Another big plus for ESDI, Allan emphasizes, is its automatic-reconfiguration feature. "The drive tells you what its characteristics are. You don't have to run around setting jumpers and playing 'Mickey Mouse' games."

Supports UNIX systems

Along with the controller, Xylogics provides a model driver for UNIX operating systems that supports overlapped seeks and logical partitions.

Formatting and bad-block-detection utilities furnish sector-slip and cylinder-slip capabilities. The "matched set" of software driver and firmware improves controller performance in multiuser, UNIX-based systems, adds Cory.

"We moved a lot of the functionality for UNIX out of software and into the controller," R&D chief Cory explains. "To utilize features such as elevator seek effectively you have to write the proper driver. A good driver writer could write effective software. But only a few of our customers would put that much time and effort into the driver."

Controller and disk-drive parameters, such as throttle-burst size, dead-band time, interleave factors and sector sizes are software-programmable in electrically erasable, battery-backed-up ROM, Cory emphasizes.

Using custom VLSI silicon and a FIFO buffer instead of a cache, Cory stresses, minimizes bus overhead dur-

ing DMA transfers.

The controller's 8K-byte FIFO buffer can be filled and emptied simultaneously, Goner emphasizes, and users will not encounter the data-overflow or rotational-latency problems that have plagued some FIFO implementations.

IPI won't hurt ESDI

Gonor does not expect the ESDI-controller market to be affected by device-level, intelligent-peripheral-interface controllers—IPI-2—which, when they appear on the market, will offer 3M-byte-per-second and higher data-transfer rates. "ESDI and IPI will be two distinct markets," he contends. "IPI is a natural big brother to SMD. It will pick up where SMD left off. ESDI takes over where ST506 leaves off. Our customers are only now migrating to a 2.4M-byte-per-second transfer rate. They will have to triple that to need IPI."

Allan also sees little short-term impact from IPI-2: "IPI-2 will take years to affect ESDI. It will have to grow down from very-high-performance products. It'll take a lot of silicon and a lot of expense. Users will want a small drive with IPI-2 only after they have it on larger disks."

Neither Gonor nor Allan expect variations in ESDI implementations and the lack of a formal ANSI standard to impair ESDI controller-market growth—or deter potential users. Because 712 controller parameters are microcoded, Gonor says, they can be easily adapted to future ESDI variations.

In any case, Gonor emphasizes, ESDI is already a de facto standard, so standardization is not an issue. "You can't build to a standard," he asserts. "You have to build to a spec. We're taking a spec we've designed our products to and are trying to make it a standard."

VMEBUS ESDI RIGID-DISK CONTROLLERS SQUARE OFF

Model	712	VESDI-32
Manufacturer	Xylogics	Dual Systems
No. of drives supported	four 5¼-inch or larger	four 5¼-inch or larger
Sector sizes (bytes)	any size	512, 1,024, 2,048
Maximum data-transfer rate (M bytes per second)	2.4	2.4
Maximum 32-bit DMA rate (M bytes per second)	10	4
Type of buffer	FIFO	dual-port cache
Size of buffer (K bytes)	8	250
Error detection	32- or 48-bit ECC	CRC-16, ECC to 56-bit
Flaw skipping	to sector level	to sector level
Minimum interleave	1:1	1:1
Board size	dual high, wide; Eurocard; (160 by 233 mm)	dual high, wide; Eurocard; (160 by 233 mm)
VMEbus support	16-, 32-bit data transfers; 16-, 24-, 32-bit addressing	16-, 32-bit data transfers; 24-, 32-bit addressing
Features	elevator seek, scatter/gather, dynamically switched DMA word size, command chaining, zero-latency read	scatter/gather, look-ahead/look-around algorithm, single-command reads to multiple parts of address space, zero-latency read
Price (\$)	1,995 (Qty 1)	1,990 (Qty 1)

Source: Xylogics Inc., Dual Systems Corp.

Fiber LANs: A market groping toward the light

Stephen J. Shaw
Washington Editor

Xylogics is looking ahead, Gonor says, to a version of the 712 controller, the \$1,795 722, that will provide two rigid disk-drive ports and two half-inch, tape-cartridge-drive ports. But, Gonor adds, the company plans a second-quarter introduction of the 722 only if a sufficient number of ESDI tape drives appear on the market.

Xylogics also has a controller for Winchester and optical disks in Multibus and VMEbus versions that it expects to make available in the second half of the year, Gonor says.

Competition in the VMEbus-ESDI controller market will heat up later this year when Ciprico Inc., Plymouth, Minn., and Interphase Corp., Dallas, introduce products to match Xylogics' 712 and the recently released VESDI-32 from Dual Systems Corp., Berkeley, Calif.

Like the 712, Dual's controller supports 16- and 32-bit transfers over the VMEbus and 24- and 32-bit addressing. Meanwhile, Interphase will ship sample quantities of its VMEbus-ESDI controller between June and August, says director of marketing Tom Kent, and the company also plans a Multibus II version. Ciprico intends to produce sample quantities of its product at the end of the third quarter, says marketing director Bill Rost.

Rost adds, "We will offer a VMEbus-ESDI controller because that is what our customers want. They like the size of the ST506 drive but want a higher transfer rate. VMEbus is here now and we have to respond to it."

Although Xylogics is committed to Multibus II as well as VME, says Gonor, it lead off with a VMEbus ESDI product because VMEbus "is here today. A good percentage of Multibus I customers are going to VMEbus. Multibus II right now lacks off-the-shelf peripheral products."

That situation will change later this year, Gonor thinks, when Multibus II picks up steam. But, for now, VMEbus has an edge.

"Technology is not as important as time-to-market these days," he adds. "What's shipping is the best. Both buses will have a place. But whatever the market tells us, that's where we want to be." □

Despite years of high expectations, the use of optical fibers in local area networks has met only limited acceptance among system integrators and end users. However, signs indicate that more vendors are realizing that the lightguides do have a niche, albeit small at present, for specialized LAN applications.

Many LAN vendors now offer a fiber-optic-based implementation of their products, and traditional optical-component suppliers report a tremendous upsurge of customer interest for a new generation of higher speed, fiber-optic LANs. Fiber optics is also starting to play a role in the design of terminal and central processor interfaces. For instance, Wang Laboratories Inc., Lowell, Mass., is expected to announce this month "FiberWay," a commercial version of a fiber-optic port assembly and remote cluster switch for its VS 65 and VS 300 mini-computer systems. The original system was introduced in mid-1985 for government applications demanding TEMPEST standards for secure computer processing and communications.

Fiber-optic-based LANs have never suffered from a lack of technological promise. Compared with conventional coaxial cable or twisted-pair wiring, optical fiber offers amazing advantages. Researchers at Bell Laboratories have demonstrated fiber-optic throughput rates well in excess of 20G bits per second (bps)—the equivalent of more than 300,000 simultaneous telephone conversations or 200 high-resolution television channels. And the massive bandwidth and complete immunity to electromagnetic interference (EMI) make fiber optics an ideal medium for transferring huge amounts of data in environments, such as factories, that would render conventional cable media useless.

Fiber optics offers particular advantages for military applications. The

light-wave cable is highly resistant to covert interception, because the cable cannot be easily tapped without an operator knowing that someone has broken the light beam. Additionally, fiber optics' lack of radio-frequency emissions and its imperviousness to EMI has made it the choice for secure, TEMPEST data and voice communications. TEMPEST refers to the Defense Department's set of standards for secure data processing. Applications range from command and control networks on the battlefield to the communications system at the Air Force Space Command, now under construction in Colorado Springs, Colo.

Commercial applications for fiber optics have traditionally lagged far behind those of the defense establishment, but have begun to make up lost ground during the last few years. Many telephone companies are now in the latter stages of laying thousands of miles of optical fibers for long-distance trunk communications. The first trans-Atlantic fiber-optic cable is expected to carry integrated voice, data and video communications between the United States and Europe by 1989.

For local applications, fiber optics up to now has had a miniscule impact. The reasons, according to industry analysts and fiber-optic vendors, include the technological immaturity of light-beam splitters, which are required for certain LAN topologies; the high relative cost of some fiber-related components, such as transducers that convert light signals to electrical impulses; and the huge installed base of traditional information-management hardware with conventional coaxial or twisted-pair interfaces.

"Fiber certainly is finding a place for LAN interconnection and other trunk-type applications, but it will take time for it to penetrate the LAN market," concedes Adam Namm, an analyst with Kessler Marketing Intelligence Corp., Newport, R.I., a fiber-optic consulting organization.

According to a recent study issued

by Kessler, the value of fiber-optic components within LANs totaled only \$10 million this year, a lilliputian 2.5 percent of an overall \$400 million LAN-component market.

However, Kessler estimates that by 1990 the value of fiber-optic components within LANs will swell to \$360 million, representing 30 percent of a projected \$1.2 billion market for LAN components.

The current market may be pint-size, but market forecasters and vendors alike say that end users in respectable numbers are beginning to request fiber-optic-based LANs. At Proteon Inc., a LAN vendor in Natick, Mass., senior product manager Ed Brohm reports that 70 percent to 80 percent of the company's customers who want high-speed LANs (80M bps) are requesting fiber optics. In response, Proteon last year introduced an 80M-bps, token-ring, fiber-optic LAN. Brohm adds that 15 percent to 20 percent of Proteon's customers specify optical fiber for at least some portion of lower capacity—up to 10M bps—LANs.

This past November, at the Autofact '85 factory-automation conference in Detroit, Codenoll Technology Corp., Yonkers, N.Y., introduced its Codenet 3030S Fiber Optic Ethernet Transceiv-

er. Priced at \$295 in OEM quantities, the unit is switch-selectable to meet the equipment interface standards of IEEE 802.3 and Ethernet versions 1.0 and 2.0.

Codenoll also introduced its 125M-bps Codelink 100B fiber-optic link. The chip set, priced from \$800 to \$1,600, can be mounted on a printed-circuit board and is compatible with the 100M-bps ANSI Fiber Distributed Data Interface (FDDI) ring networks.

According to Kessler's Namm, Codenoll has supplied roughly 40 percent of all fiber-optic components for LANs. Codenoll president Michael Coden says that his company has supplied approximately 2,000 fiber-optic LANs, which represents approximately 20,000 pieces of equipment.

Artel goes Mainstream

Artel Communications Corp., Marlboro, Mass., is expected to unveil this month Mainstream, a 200M-bps fiber-optic LAN. The company says that Mainstream is the first digital broadband LAN using fiber.

The 200M-bps throughput on this token-ring LAN can be split into eight separate 25M-bps channels for independent voice, data or video communications. Each band can be further sub-

divided into separate channels and subchannels for communications among many network devices.

Artel envisions two levels of applications for Mainstream. It can serve as a work-area network connecting clusters of computer aided design equipment, which typically require much higher throughput capabilities than other workstations, or multiple data centers for a single high-speed LAN. It also can be used as a network backbone to carry aggregated voice, data or video traffic for inter-LAN communications. As such, the fiber-optic-based network can be incorporated with other wiring schemes, including twisted-pair or coaxial cable.

Wang's FiberWay is a sign that manufacturers of computers and office-automation equipment are beginning to consider fiber optics in designing systems. Wang's product manager in fiber optics and secure networking, Dennis Careon, describes FiberWay as a 40M-bps multiplexed link that works off the back end of the VS 65 and VS 300 central processors and provides a fiber-optic path to a remote cluster switch. The remote cluster switch translates the light signal into electrical impulses and interconnects up to 16 peripherals per switch via conventional Wang coaxial cable. "In this fashion," explains Careon, "no peripherals will have to be modified."

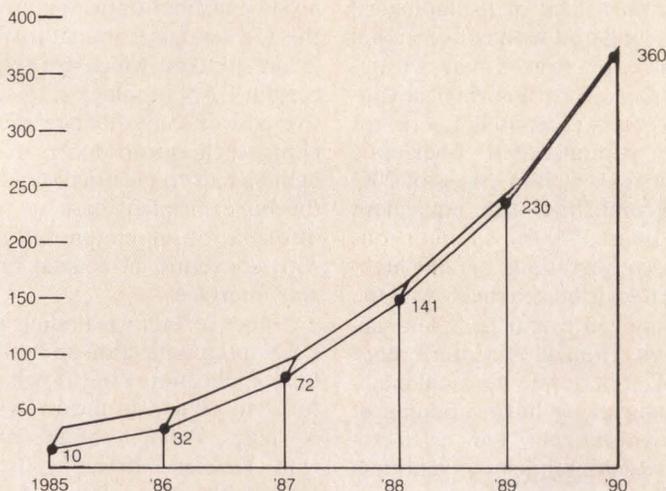
Prices for FiberWay components are \$700 for fiber-optic master converters, \$2,600 for a 16-port TEMPEST-approved remote cluster switch with link alarm, and \$1,550 for a two-port, TEMPEST-approved active port assembly that interconnects with the CPU.

"Fiber is adding another technology layer, and it's going to take time to educate not only users but also vendors' sales and support people that fiber offers a powerful transport medium for integrated communications," Careon says.

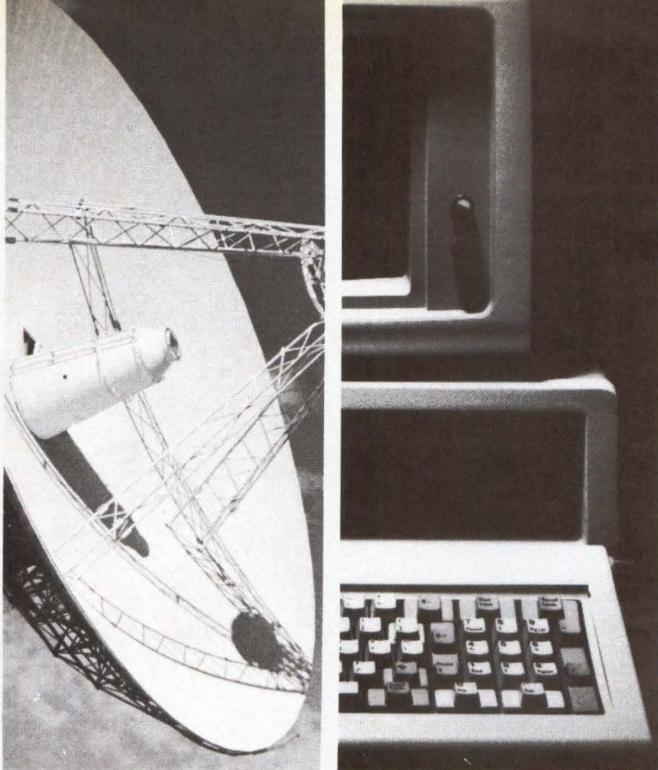
If that education does occur, and if the LAN community settles on some coherent network standards, fiber-optic-based LANs may, finally, be on the verge of living up to their technological promise and the early expectations of both vendors and end users. □

VALUE OF OPTICAL FIBER COMPONENTS IN LANs

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SOURCE: KESSLER MARKETING INTELLIGENCE CORP.



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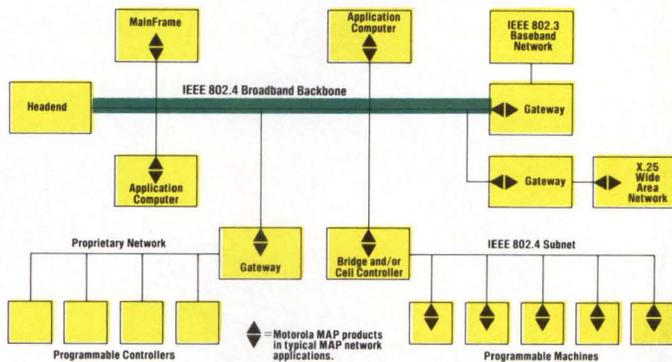
For fast transfer of data frames to and from memory, the MC68824 features on-chip, four-channel DMA, a full 32-bit address range, 8- or 16-bit data bus operation and a 40-byte FIFO. It can implement token bus network bridges to other LANs by using IBM-defined source-routing options, and also provides byte-swapping capability for alternate memory organizations.

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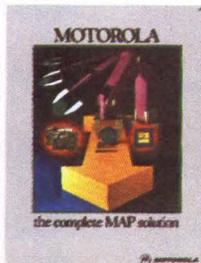


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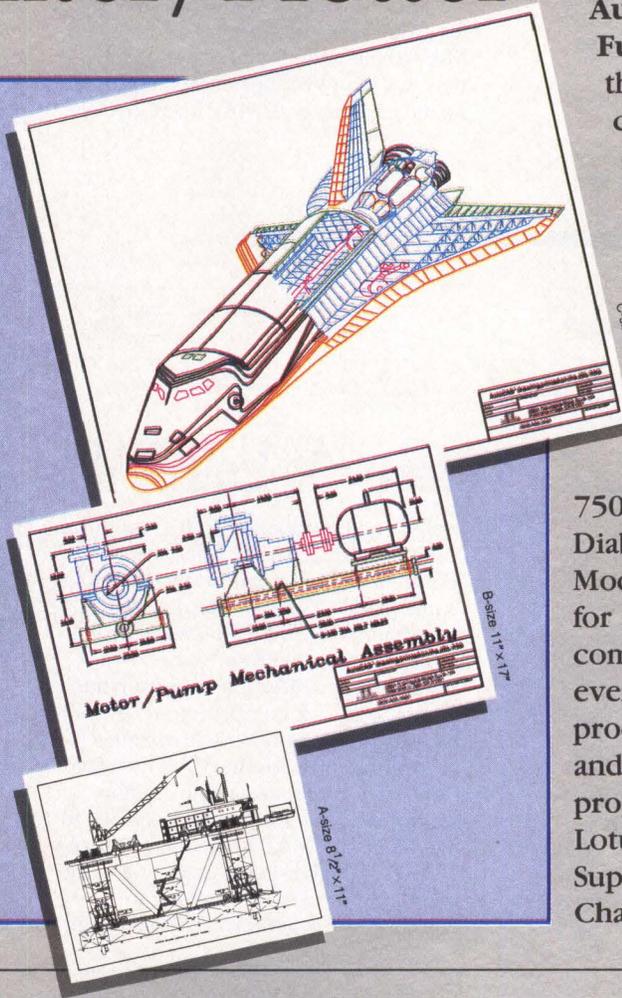
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CIRCLE NO. 15 ON INQUIRY CARD

Tolerant Systems justifies the name

Mike Seither

Associate Western Editor

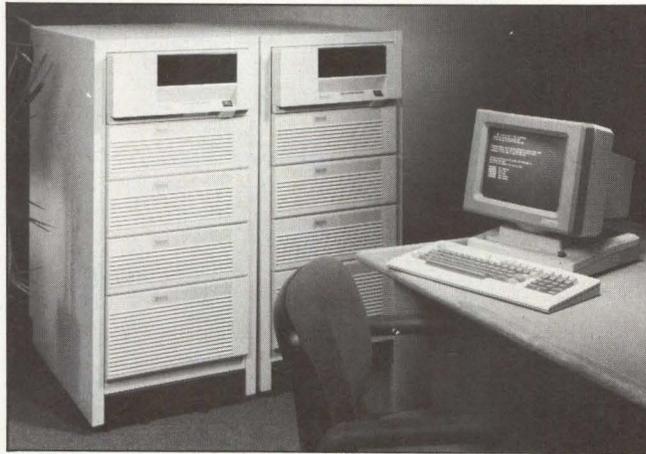
Other contenders have had little success in taking on the two leading manufacturers of on-line transaction processing computers with built-in fault tolerance. Today, Tandem Computers Inc., Cupertino, Calif., and Stratus Computer Inc., Marlboro, Mass., still dominate the market with their disparate shares of 88 percent and 7 percent, respectively.

A handful of other companies vie for the remaining 5 percent of the market. One of them, Tolerant Systems Inc., San Jose, Calif., believes it can become a significant "other." Tolerant Systems claims that both its machines and marketing strategy directly address the needs of OEMs and system integrators looking for fault tolerance—that ability of a computer system to operate despite failures in either hardware or software.

Specifically, Tolerant says its Eternity system, introduced in January, has a 2-1 price/performance ratio over anything Tandem or Stratus offer. Moreover, Eternity operates, not on a proprietary operating system as do its competitors, but on Tolerant's modified version of UNIX. And later this year, Eternity should be able to use the Ada programming language, a requirement laid down by the Pentagon for defense computing.

With that list of attributes, Tolerant hopes to woo, among others, those system integrators and resellers that are bidding on government contracts. "It's true that more and more federal RFPs [requests for proposals] are stipulating UNIX and fault tolerance," says Richard Mikita, an analyst with International Data Corp., Framingham, Mass. "The push is also on to make Ada a standard programming language," he adds.

Also included in Tolerant's marketing strategy are computer manufacturers who do not offer fault tolerance. Only last year did IBM Corp., the leading vendor of on-line transaction-processing systems, begin to offer fault



Tolerant's Eternity series for on-line transaction processing features fault tolerance and accommodates up to 2,500 users.

tolerance. But IBM had to go outside to get it; the IBM System/88 is the result of an OEM arrangement with Stratus. Big Blue just recently announced the general availability of the System/88.

"Other computer manufacturers, especially the BUNCH companies [Burdoughs Corp., Sperry Corp. (Univac), NCR Corp., Control Data Corp. and Honeywell Inc.], are faced with the prospect that IBM now has a fault-tolerant computer," says Shirley Henry, Tolerant's director of marketing. "They'll have to be prepared to sell around that hole in their line."

IBM-Stratus set pattern

Some industry analysts believe that situation may bode well for Tolerant. It's unlikely that many companies could bring their own fault-tolerant architecture to market quickly enough to offset IBM's advantage. OEM systems are generally not available from Tandem because, for the most part, it sells to end users. On the other hand, Stratus has indicated it is willing to sell to other buyers as well as to IBM. But would Honeywell, for example, want a product in its line that's essentially the same as the one IBM gets from Stratus? Most analysts agree that's unlikely.

"It's not impossible that someone from BUNCH might pull a similar trick with Tolerant like IBM did with Stratus," says Omri Serlin, president of

Itom International Co., a Los Altos, Calif., research concern that follows the transaction-processing market.

Tolerant's Eternity series does not mark the introduction of a new product so much as it does a method of connecting multiples of its System Building Blocks (SBB) into a fault-tolerant system. Tolerant has been shipping its SBB computer, built with National Semiconductor Corp. 32016 processors, for more than a year.

Eternity reflects Tolerant's technique of connecting a maximum of 15 SBBs, each capable of performing four transactions per second, with a dual-channel Ethernet connection. A minimal fault-tolerant system consists of a pair of SBBs, which could accommodate a total of 288 terminals. That configuration costs about \$190,000. A 15-SBB system can handle up to 2,500 terminals, the company says. With savings gained in volume buying, Tolerant estimates a 15-unit system would cost between \$1 million to \$1.5 million.

Tolerant claims that it has invested more than \$10 million in refining UNIX to handle on-line transaction processing. The reconstituted operating system, called TX, "gives users the functionality they see in large-scale database management systems without the overhead that makes those systems unusable in large-scale, on-line transaction-processing applications," says Tolerant's Henry.

The way the operating system dy-

COMPARING TOLERANT AND THE COMPETITION

Product name	Tandem			Stratus			Tolerant
	EXT	NS II	TXP	FT250	XA400	XA600	Eternity
TPS per CPU	1.9	1.9	4.7	1.7	3.4	5	4
CPUs in FT system	2	2	2	1	1	1	2*
Total TPS in FT system	3.8	3.8	3.4	1.7	3.4	5	8
Entry price (\$000)	160.3	224.5	331.1	122.5	233.5	335.8	190
Cost per TPS (\$000)	42.2	59.1	40.5	72	68.7	67.2	23.8
Tolerant P/P advantage (%)	43.7	59.8	50.1	67	65.4	64.6	

*System building blocks (SBBs)

TPS = transactions per second

NS II = NonStop II

P/P = price/performance

FT = fault tolerant

Source: Tolerant Systems Inc., ITOM International Co., Datapro Corp.

namically allocates database work among the SBBs' multiple processors gives Eternity a transaction-processing power that can grow linearly. That is, a single SBB is capable of four transactions per second (tps). A four-SBB system operates at 16 tps; a full 15-SBB system at 60 tps.

A major part of Tolerant's marketing campaign revolves around the expandability of Eternity. System integrators can expand a customer's system as needed by adding modules. Tolerant doesn't see this happening with the competition.

"People don't tend to buy Stratus modules for growth. Stratus has a small [FT250], medium [XA400] and large [XA600] system," says Henry. "Customers upgrade by going to a larger Stratus system."

How much a Tolerant system can be upgraded is now limited by the bandwidth of the dual-channel bus, which can move 2.5 bytes of data per second. IDC analyst Mikita says that a fiber-optic link that one of Tolerant's OEM customers is expected to announce soon will allow Eternity to grow to 50 times the 2,500 terminals the system can now handle.

It's conceivable that Tolerant will be able to get into the high ground of transactions, much like what is now done with IBM's mainframes and Information Management System, says Mikita.

"Conceivable" is the key word. Most observers agree that Tolerant has its work cut out for it, trying to under-

cut the competition on the basis of cost.

"They [Tolerant] are certainly not the first to claim a tremendous price/performance edge over Tandem or Stratus," says Itom's Serlin. "When customers agree with those claims, that's when you can safely say they are correct."

Serlin adds that what's most significant about Tolerant's announcement is Eternity's ability to recover and maintain the integrity of a database should a system failure occur. "It's probably the lowest priced system you can get with that feature," says Serlin. "That's clearly a claim they can make if it proves to work in the market." □

Data General's challenge lies in marketing

Lynn Haber, Associate Editor

Data General Corp. fleshed out its product line recently with the announcement of a high-end supermini-computer—the Eclipse MV/20000, available in single- or dual-processor models that range from 5.5 million instructions per second (MIPS) to 10 MIPS—and a low-end, three- to 24-user minicomputer called the MV/2000 DC. The Westboro, Mass., company also announced the DS/7500 and DS/7700 workstation series, based on the same hardware as the MV/2000 DC for engineering and manufacturing markets.

DG's strategy in offering these integrated-computing solutions to office-automation and technical environments received praise from industry analysts as being both timely and impressive. Yet the strategy alone does not guarantee market recognition. "Data General demonstrated that the company is capable of staying up with DEC [Digital Equipment Corp.], their primary competitor, in applying the latest technology in both low- and high-end systems," says Myron Kerstetter, program director for small-computer-system service at the Gart-

ner Group Inc., Stamford, Conn. "Now the issue for DG is not a product problem but, rather, a marketing problem."

Kerstetter says that DG's direct-sales staff of less than 1,000 people has a tough task ahead in competing with the larger forces of its chief rivals. DEC has more than 3,000 direct-sales people and IBM Corp. has more than 8,000. "This means that DG must be very astute as to where they go and how they go about marketing their products," contends Kerstetter. Analysts concur that DG must attract a new customer base and not simply rely on existing DG users.

A DG spokesman says criticism of the company's marketing practices dates to the late 1970s when, he admits, DG did not have an end-user marketing force.

Last November, however, DG overhauled its business division to increase emphasis on industry-marketing programs and product marketing, and to consolidate channels of distribution. The company's current marketing approach is to sell what it calls "complete computing solutions"—both hardware and software—to targeted industries such as finance, manufacturing and

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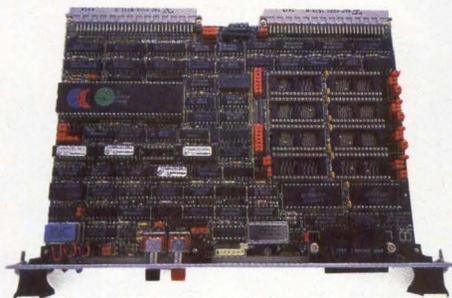
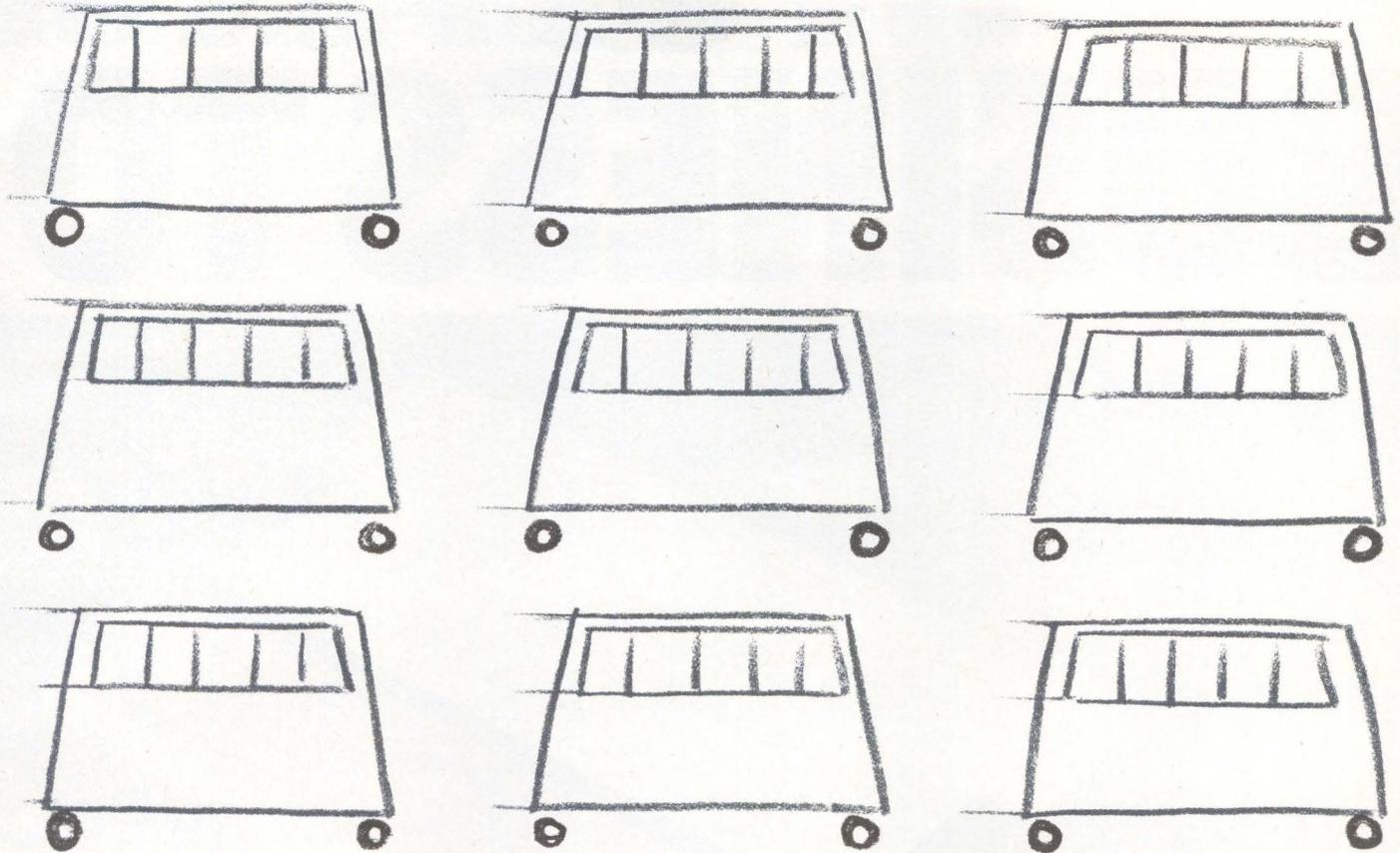
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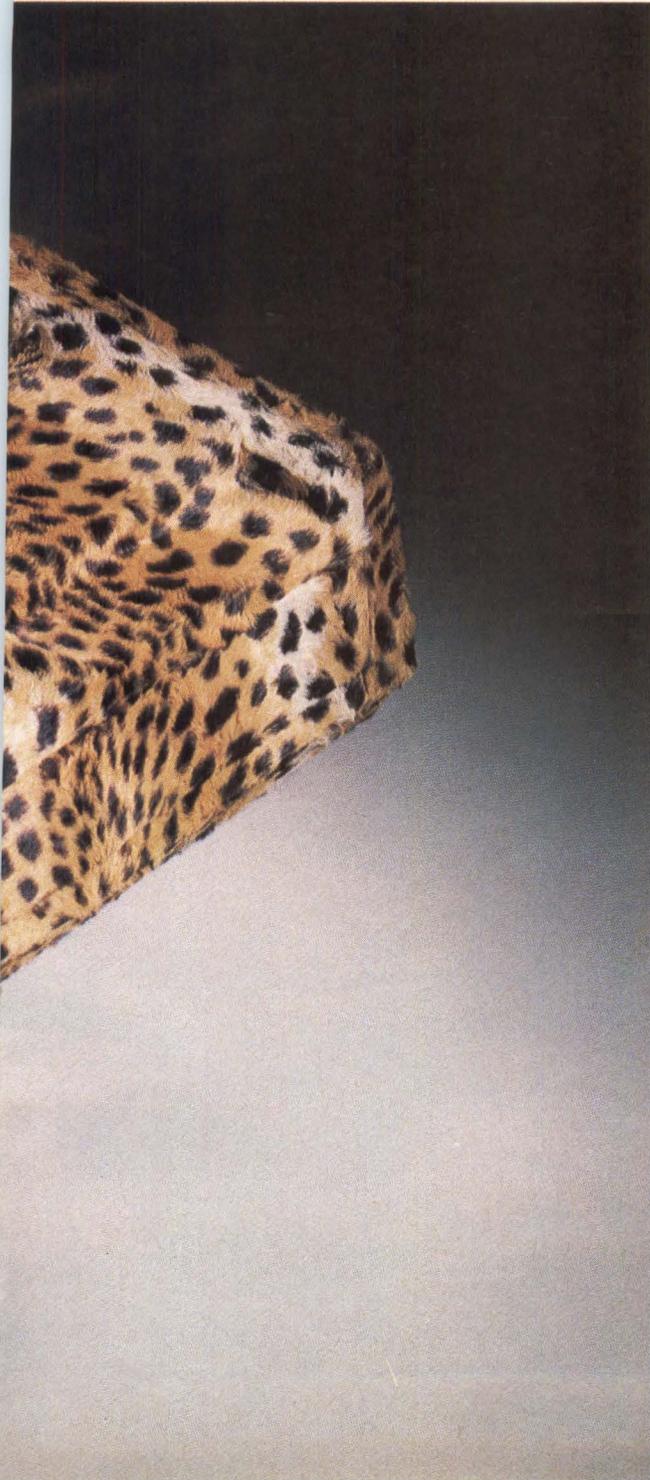
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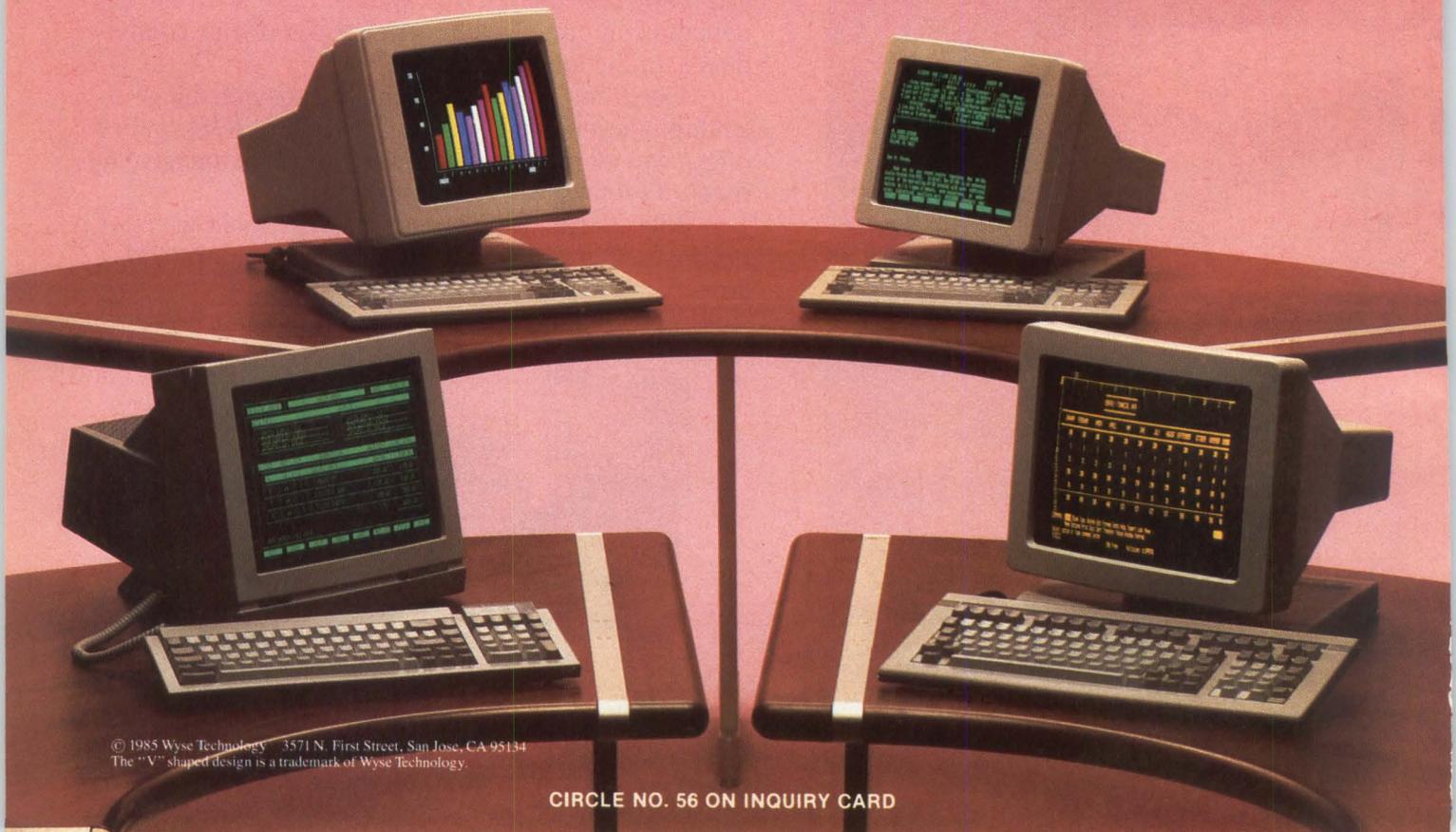
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engineering.

From a product perspective, DG has maintained its competitive position in terms of price/performance and technological leadership—despite DEC's recent announcement of a new high-end superminicomputer, the VAX 8650, capable of processing information at 6.3 MIPS.

The MV/20000, for example, ranges in price from \$200,000 to \$400,000, whereas DEC's VAX 8650 carries a base price of \$475,000. A DG spokesman concedes that DEC's 8650 is 16 percent faster on a uniprocessor-model basis, but, he adds, it's 73 percent more expensive. DG's MV/20000 dual-processor machine is reportedly much faster than DEC's uniprocessor model and still less than half as expensive as the 8650 on a price-per-MIPS basis.

For existing DG customers, the new product range is reassuring in that it offers both low-cost, entry-level systems for work-group expansion and room to grow into more powerful systems. According to DG, the MV/20000 is fully compatible with software and peripherals for earlier MV systems. Additionally, the MV/2000 DC runs Advanced Operating System/Virtual Storage (AOS/VS), the company's proprietary operating system; DG/UX, DG's native UNIX; MV/UX, hosted UNIX; and DG's recently introduced distributed system, AOS/DVS (Distributed Virtual Storage).

An entry-level MV/2000 DC system, designed for departmental computing and small-business users, is priced at \$19,000, according to DG. It includes the operating system, 2M bytes of main memory, four-terminal capability, a 38M-byte rigid disk and a 24M-byte tape-cartridge drive.

Industry analysts believe that DG's MV/2000 DC will compete most directly with DEC's MicroVAX II supermicrocomputer, although DG contends that its entry-level system is geared toward the office-automation market. In the OA marketplace, the MV/2000 DC will likely compete with IBM's System/36 minicomputer.

The high-end MV/20000 reportedly offers users more than twice the processing power of the company's previous high-end processor, the MV/

10000. The MV/20000 is available in three models.

According to the company, DG's DS/7000 family of engineering workstations, the DS/7500 and DS/7700 series, "incorporates the foundation for integrating all of an engineer's daily functions—engineering or scientific, managerial and administrative, into one system."

The DS/7000 family system is based on a single system board featuring a full 32-bit, 25-MHz CPU, a floating-point unit, 2M bytes of main memory,

four RS232C/422 ports, one parallel printer port, interfaces and controllers for system peripherals, an I/O processor for control of magnetic peripherals, output devices and the system console processor.

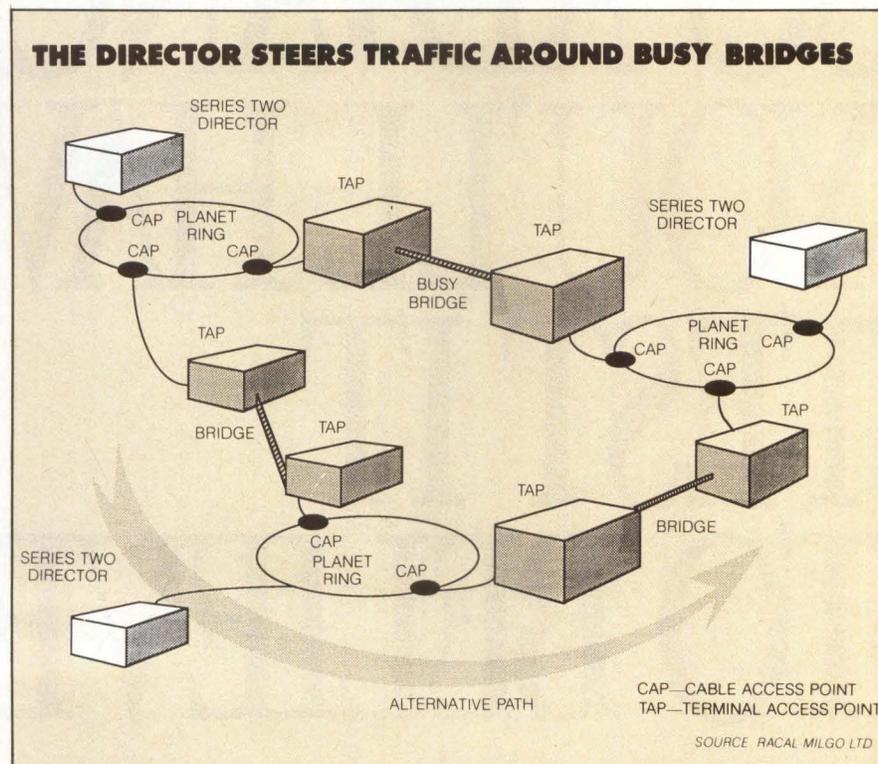
DG's new Technical Electronic Office (TEO) software combines DG's CEO software with DG/Stage (Data General/Standard Applications and Graphics Environment). DG/Stage is a software environment that integrates an engineer's analysis and design-automation processes. □

IBM's Token-Ring finds competition from Europe

Keith Jones, European Editor

In the wake of IBM Corp.'s Token-Ring Network, Racal-Milgo Ltd.,

Hook, England, a seller of token-passing-ring technology for nearly four years, has substantially enhanced its Private Local Area Network (Planet)



The Series Two Director for the Racal-Milgo Planet enables up to 2,000 computers and terminals, including IBM PC compatibles, to communicate with each other on up to four Planet rings. Series Two Directors find an alternative path between rings when the bridge providing the shortest path is busy.

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to achieve greater compatibility with IBM PCs and compatibles. Meanwhile, leading European vendors of PC compatibles are considering the introduction of their own local-area-network products for Token-Ring compatibility.

Geoffrey Norman, industry consultant with Xephon Ltd., Newbury, En-

gland, believes that IBM's endorsement of token-ring technology will give Racal-Milgo's Planet a boost. "Planet is much more flexible than the IBM Token-Ring Network," asserts Norman. "It is 2½ times faster, covers greater distances and can support any kind of attachment, including mini-computers and terminals, as well as

PCs."

Novell Inc. of Orem, Utah, customizes its PC DOS-compatible NetWare file-server software to enable up to 30 PCs on a Planet ring to use the same server. Up to five clusters of 30 PCs will be able to operate concurrently over one ring. David Pinnell, Racal-Milgo's office networks marketing manager, adds that the file-server software, called Sonata, will enhance NetWare with features such as the ability to transmit videotex and electronic mail between PCs.

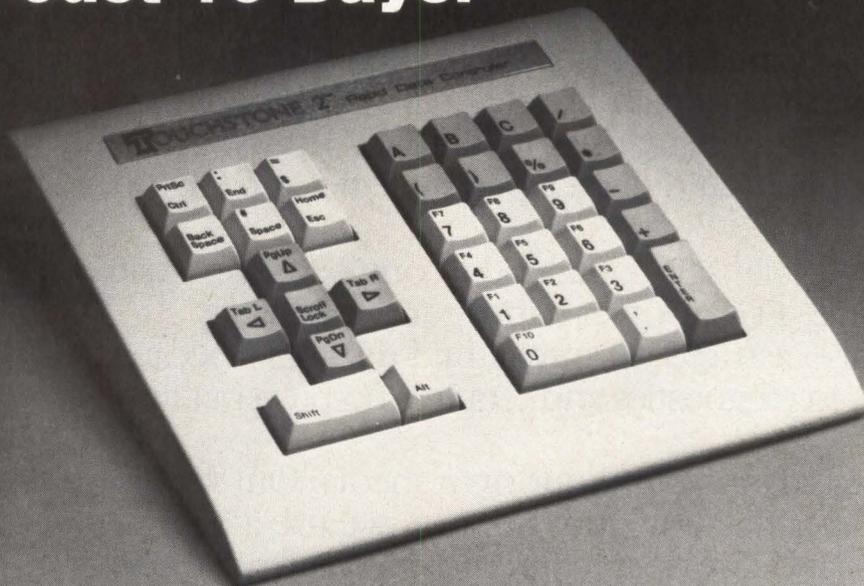
Racal-Milgo is currently readying a plug-in card for PCs and compatibles that is equivalent to the PC Adapter card offered by IBM for use with the Token-Ring Network. The Racal-Milgo card will be sold by the company as an alternative to Racal-Milgo's current device for linking a computer or terminal to a Planet ring, the Terminal Access Point, TAP. TAP is offered as a separate box costing \$1,035. The IBM PC Adapter card costs \$840, while Racal-Milgo's new card will be priced at \$740.

Pinnell believes that most application programs that can run on a PC attached to an IBM Token-Ring Network will be able to run on a PC linked to Planet. But he stresses that Racal-Milgo has no plans to move toward total IBM compatibility. "It would be a retrograde step to modify Planet in line with the IEEE 802.5 standard employed by the IBM Token-Ring Network," he declares.

Pointing to the 4M-bit-per-second speed of IEEE 802.5 and its support for just one token per ring, Pinnell says Planet runs at 10M bits per second and can handle multiple tokens so that more than one device can transmit at the same time. He adds that one Planet ring can handle 500 devices of all kinds, including PCs, while the IBM ring is limited to 260 PCs. That number is reduced to 72 on the IBM ring if unshielded, voice-grade, twisted-pair cabling is used instead of shielded, twisted-pair.

Planet uses coaxial cable, which permits a 300-meter maximum distance between TAPs. Fiber-optic cable will soon be added to allow for distances of up to 2,000 meters between TAPs and

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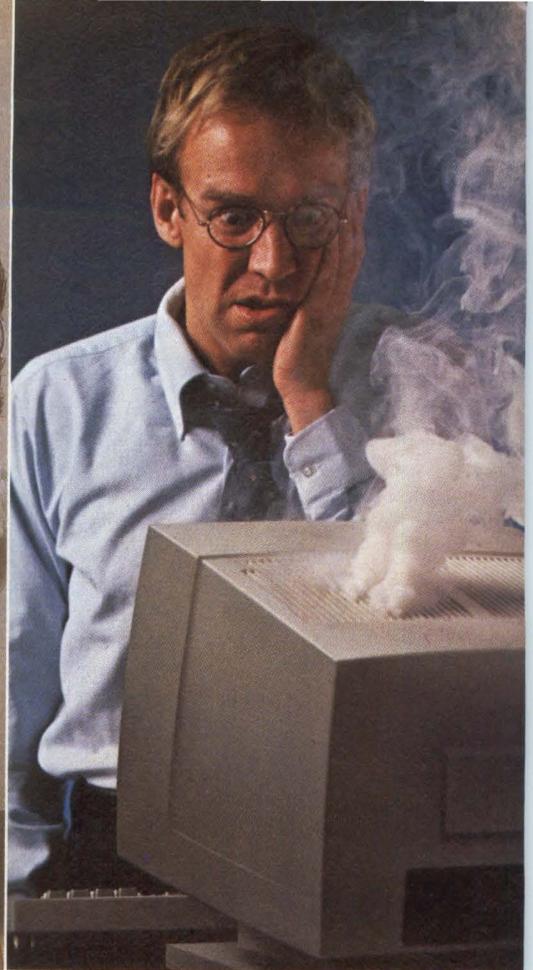
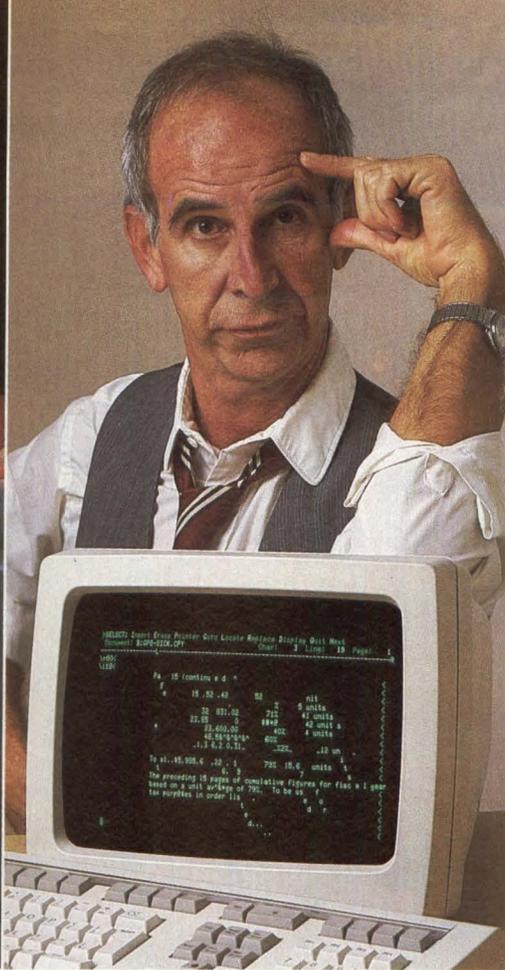
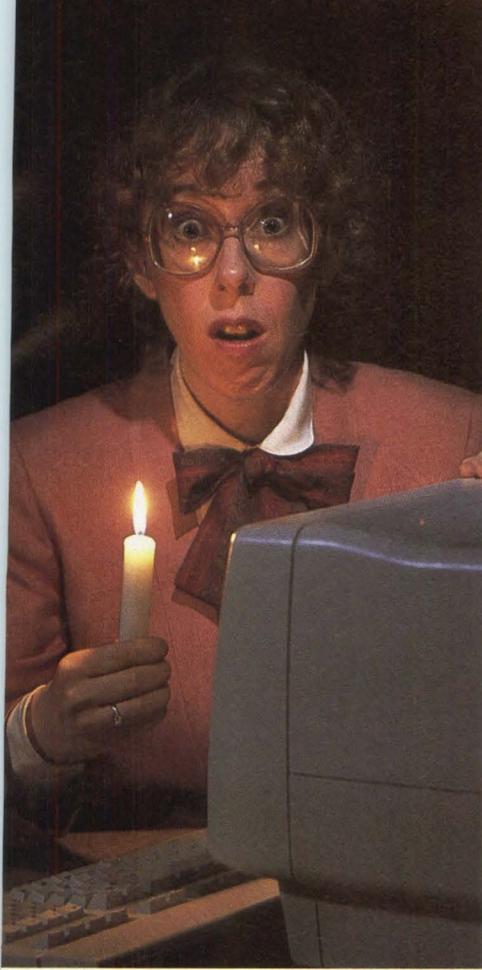
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A. Once you're in the dark? **B.** During a total memory loss? **C.** After the smoke clears?

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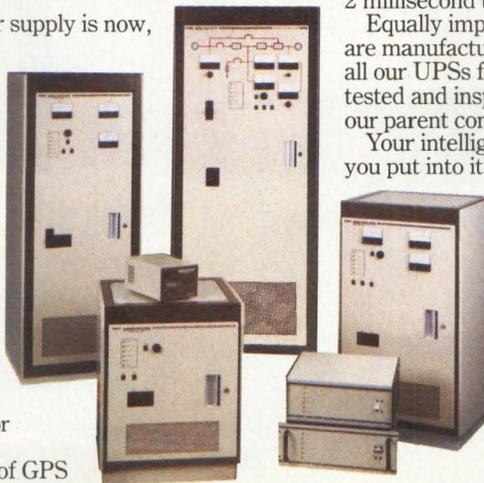
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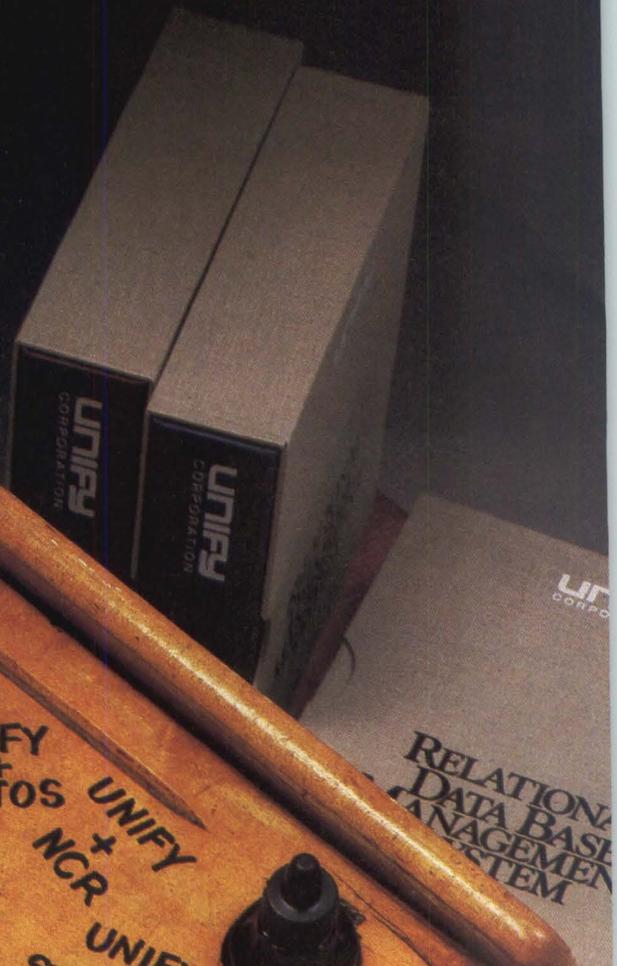
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for electrically noisy areas.

Racal-Milgo attaches devices to Planet with Cable Access Point, CAP, which measures 87 mm by 87 mm by 23 mm, fits onto the cable ducting and connects the cable to the TAP. IBM offers the Multi Station Access Unit, which fits into a 19-inch rack and incorporates connections for up to eight

personal computers, forming a physical star but appearing to any station like a ring.

One Planet hardware item for which there is no IBM equivalent is a special station called the Director, which contains its own TAP and interfaces to the ring via a CAP. Each Planet ring must have one Director—at a price of

\$4,440. The Director collects traffic information and controls all transmissions around the ring. An enhanced version, Series Two Director, makes possible communication between as many as 2,000 stations on four Planet rings. The rings can be installed in the same building or dispersed over a wide area, being separated by hundreds of miles. One Planet ring can be linked to any of the others by one or more connections called bridges. A single bridge connects two TAPs. Alternatively, groups of up to 128 bridges can link a nest of TAPs at each end, each nest with one CAP. One major function of the Series Two Director, priced at \$8,880, is to find an alternative path between two rings, possibly via a third ring, if a bridge is busy.

Racal-Milgo has reportedly sold 300 Planet networks in Europe to date. Most existing customers are large end users of computers, although Racal-Milgo is now also seeking OEM deals.

Olivetti SpA, Ivrea, Italy, the leading vendor of IBM-compatible machines in Europe, is "looking with great interest" at the IBM Token-Ring Network, according to a company spokeswoman. But she cannot say yet if Olivetti will introduce a product similar to IBM's. She adds that Olivetti is also studying the possibility of introducing the Starlan LAN technology promoted in the United States by AT&T Co., which owns 25 percent of Olivetti (MMS, January 1985, Page 74).

Meanwhile, Ericsson Information Systems, Sundbyberg, Sweden, is assessing the feasibility of a Token-Ring-Network-compatible product. It would employ the same Texas Instruments chip set used by IBM, according to Hendrik Abramowicz, a member of the communications planning section of Ericsson's technology staff. Ericsson already offers Ethernet-based networking products to users of its machines.

Abramowicz believes that token-ring networking is technically superior to Ethernet. He cites token ring's ability to use fiber-optic cabling and to determine precisely the maximum time a station needs to wait before being able to transmit. □

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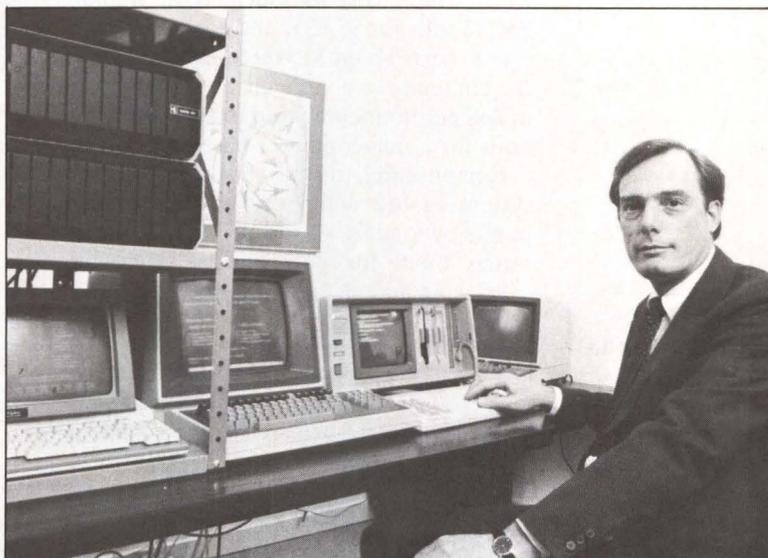
Robert A. Sehr

Until 1983, government purchasing agents drew up their own product descriptions, and no two descriptions were alike. For example, equipment for the Army differed from that specified for the Navy. As a result, purchasing agents could not realize any cost savings by buying in volume. Government contractors, in turn, increased prices to meet the costs of the extra design, production and paperwork involved in meeting the various specifications.

In 1983, the Reagan administration attempted to solve this problem by compiling the regulations of individual government departments into one volume called the Federal Acquisitions Regulations (FAR). However, the FAR is lengthy and includes a separate supplement for each branch of the military and for the National Aeronautics and Space Administration. As a result, searching through the FAR is time-consuming. What's more, because the regulations are not updated frequently enough, the contractors must ensure that those they track are still current.

To help government contractors through the regulations maze, Compusearch Corp., Falls Church, Va., uses an on-line bulletin board called Compusearch to reduce the time it takes to search through the FAR and to ensure that a regulation is up-to-date. According to company president James Benson, Compusearch reduces to an average of 20 minutes or less a search that would take two researchers two days to make manually.

The key difference between Compusearch and other on-line information services, such as Nexis from Mead Data Center, is that other databases are typically stored on mainframes or minicom-



**Compusearch
president
James Benson**
*uses an IBM PC-
compatible mi-
crocomputer to
search through
the FAR data-
base.*

puters. In contrast, the Compusearch database employs a local area network of three 16-bit Personal Mini/16 (PM/16) multiuser microcomputers from TeleVideo Systems Inc., San Jose, Calif. The LAN also includes eight IBM Corp.-PC-compatible TeleCom 1600 remote communications processors from J&L Information Systems, Chatsworth, Calif., two Paradyne Corp. Uninet modems, a TeleVideo tape-cartridge drive, a Micom/Interlan Inc. packet assembler/disassembler multiplexer and a line conditioner. Users access the network from an IBM PC-compatible personal computer by phone with the Uninet public packet-switched network system from Uninet Inc.

The PM/16 network employs a dedicated file server connected to the workstations via a star topology. Using baseband communications, the system transmits data at 800K bits per second.

The file-server unit contains two microprocessors—a 16-bit Intel Corp. 80186 for file management and an 8-bit Zilog Inc. Z80A for communication—and supports as many as 16 workstations.

The Telecom 1600 processor uses proprietary software called Redi-Program, written in Mega-BASIC from American Planning Corp., and boots up with Compusearch's FAR database. The PM/16 includes a built-in 45M-byte Winchester disk drive. Storage of FAR, not including the user interface, the communications software and the supplements, requires 5M bytes. The PM/16 allows as many as eight users to search through the Compusearch database at once.

Because Compusearch employs microcomputers, it is less expensive than a mainframe- or minicomputer-based database installation, which could cost as much as \$1 million. The PM/16 sells for \$8,995, and each port at Compusearch costs about \$1,000 to install. This enables the company to charge clients connect-time fees of \$48 per hour compared to as much as \$150 per hour for a minicomputer-based on-line service.

Compusearch tested the performance of its system against competing multiuser microcomputers by loading all systems to full capacity and rating them for performance degradation as users were added. In testing with three users, the

PM/16 needed 4 minutes to search through the FAR database, compared with 3½ minutes for the nearest competitor. With eight users, the PM/16 took only 6 minutes, whereas the nearest competitor took 30 minutes.

The PM/16 can support as many as 16 IBM PC-compatible workstations. Each TeleCom 1600 handles four telephone lines and contains an Intel 8088 microprocessor, 256K bytes of RAM and a network card that interfaces with the PM/16. According to J&L president George Lazik, the TeleCom 1600 will eventually allow an unlimited number of phone lines to access each processor. The processor in each cluster runs on TeleVideo's InfoShare operating system, a custom version of Novell Inc.'s NetWare. The processors act as diskless workstations, allowing dial-up customers to access and manipulate the database using a remote dumb terminal.

System operates unattended

After logging onto a Telenet system by phone, a user gains access to the database. The TeleCom 1600 activates Redi-Program, and users can then proceed to a menu for a specific regulation in the database. Then, users can either read through the database, which can be expensive and time-consuming, or search for the appropriate regulation using key words.

InfoShare provides several security features, including file-level read- and write-access permission, file and record locking and log-on passwords. What's more, the TeleCom 1600 provides another security level: If a user becomes disconnected from Compusearch during a search, one of the TeleCom 1600s automatically reboots the system. A user must then redial into the database and restart the log-in procedure.

Because the TeleVideo hardware is modular, Compusearch maintains an extra PM/16 as a redundant unit and additional communications processors and modems for fail-safe operation. If a hardware unit fails, Compusearch can immediately replace it.

As the Compusearch client list grows, the company expects to be able to offer several hundred ports. Clients currently include IBM, TRW and other large defense contractors. □

The Compusearch installation includes (clockwise from top right) a line conditioner, two Uninet modems from Paradyne, a TeleVideo tape-cartridge drive, a TeleVideo PM/16 micro-computer, two J&L Information Systems communications processors, a TeleVideo terminal, a Micom/Interlan packet assembler/disassembler multiplexer, two more J&L processors, another PM/16, another J&L processor and a third PM/16.



Robert A. Sehr, a former associate editor at *Mini-Micro Systems* magazine, is now a free-lance writer based in Bothel, Wash.

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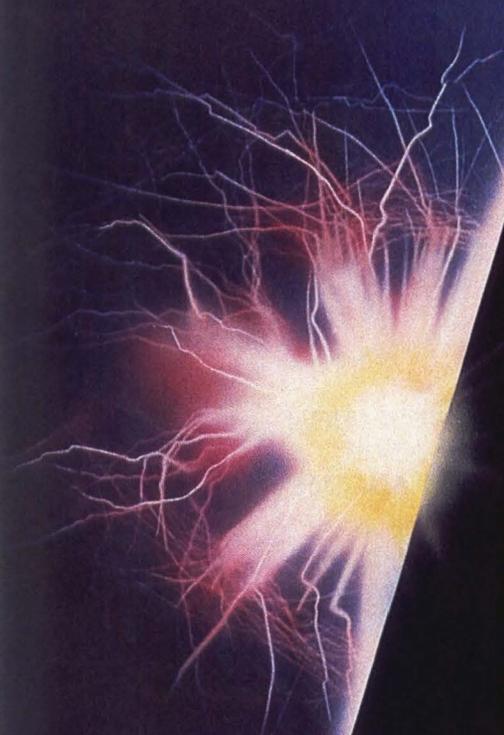
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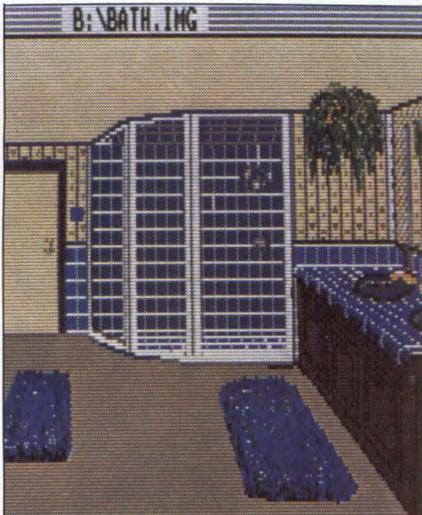
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FEATURE HIGHLIGHTS



p. 55 *Sophisticated software*



p. 95 *Boosting performance*

TOOLS SPEED SOFTWARE INTEGRATION55

Software developers who want to sell custom, integrated-software packages, rather than off-the-shelf offerings, have two alternatives: purchase software components and link them, or laboriously write code from the ground up. Fortunately, a variety of software tools exist to facilitate the construction of unique, integrated-software packages.

SCSI OPENS INTEGRATION OPPORTUNITIES71

The movement toward the small computer systems interface (SCSI) is no longer a trickle, or a trend touted in the trade press. The majority of systems and peripherals vendors are backing SCSI with plenty of products. The key to SCSI's success lies in its performance advantages and the flexibility it offers system integrators and OEMs.

ESDI JOINS INTERFACE RANKS.83

The enhanced small device interface (ESDI) takes advantage of the installed base of ST506/ST412-based peripherals by combining the electrical characteristics of ST412 with some of the advantages of the storage module device (SMD) interface. It's a sure bet that ESDI will find wide acceptance in applications involving varied peripherals because it offers system integrators superior "mix 'n match" capabilities. And, finally, there are products to back up the hype.

SUPER-SCSI CONTROLLERS BOOST I/O PERFORMANCE .95

As good at I/O as the small computer systems interface is, super-SCSI is better, according to a major controller manufacturer. The reasons include bus disconnect/reconnect, command chaining with relative addressing, command queuing and bus arbitration, all of which are specifically tuned for multiuser, multitasking computer systems.

COMDEX IN JAPAN: 'SHARE THE OPPORTUNITY'105

This year's Comdex in Japan show, to be held March 3 to 6 at the Harumi Exhibition Center in Tokyo, is an important forum for U.S. and European manufacturers trying to gain a foothold in the Asian market.

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CIRCLE NO. 27 ON INQUIRY CARD

TOOLS SPEED SOFTWARE INTEGRATION

Increasingly sophisticated software tools facilitate the construction of customized integrated software packages

Michael Tucker, Associate Editor

Integrated software, combining several different applications into one package, has long been a mainstay of the microcomputer industry. Despite early criticism from many market analysts who insisted that users would eventually prefer powerful, standalone, single-function packages, integrated software has steadily increased in market share.

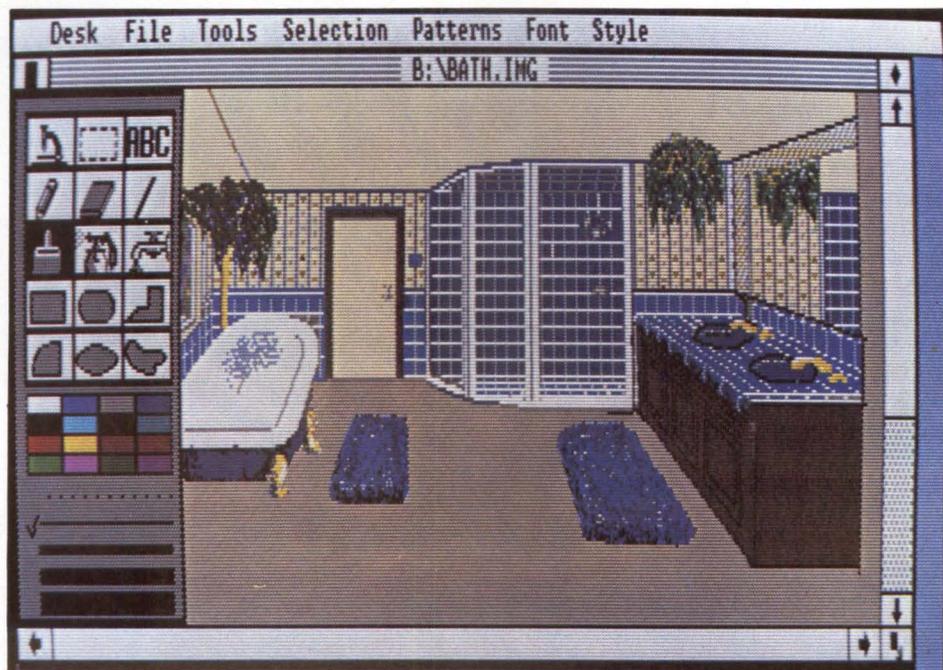
Naturally, then, value-added resellers have become eager to bring integration to their own software products. Unfortunately, that hasn't been easy—either in terms of technology or marketing. Now, however, sophisticated software tools are making software integration more like system integration. VARs generally follow

two approaches to integration: They purchase software components and configure them almost as they do hardware, or they write code from the ground up.

Ultimately, the single most important consideration VARs face in creating integrated software is deciding how much of the work they want to do themselves. The answer to that lies in how unique the final product has to be. When Ashton-Tate put together Framework II, for instance, the company used essentially no third-party software tools, preferring to write everything to ensure maximum efficiency.

Explains Robert M. Carr, chairman of Forefront Corp., the Ashton-Tate subsidiary that actually wrote Framework, "There are excellent libraries out there, full of subroutines, that are

This screen photo from Digital Research's GEM Paint package illustrates the competition the software developers using generic operating environments faces.



very good for lots of developers, but when you're developing a product for the mass market, you have to pull out all the stops. You've got to have the best possible performance or your product will get lost in the crowd."

Yet, even where VARs want to debut products in a particularly crowded field and must write applications from scratch, help is available. In fact, an entire industry exists to serve programmers with editors, linkers, debuggers and other integration tools. Perhaps the most useful of these to integrated-software developers are tools that link together individual modules of code.

Phoenix Computer Corp., for instance, markets Plink, a powerful linkage editor for MS-DOS. Reflecting the restrictions of early 8- and 16-bit microcomputers, MS-DOS has a somewhat-limited linking capacity on its own. With Plink, however, MS-DOS applications link almost as seamlessly as they would under much more powerful operating systems.

Tools take the weight

Most VARs don't write entire applications. Instead, most write for markets where elegant software design is far less important than bringing a program to market under budget in a reasonably short time. The less code VARs need to write the better their products are, because they can then afford to spend more time investing in the software with their vertical-market expertise. "Tool kits are great," says Robert Dezmelyk, president of the software-development company LCS/Telegraphics. "If you're

doing a specialized application, something for a vertical market, then you want to use them as much as possible."

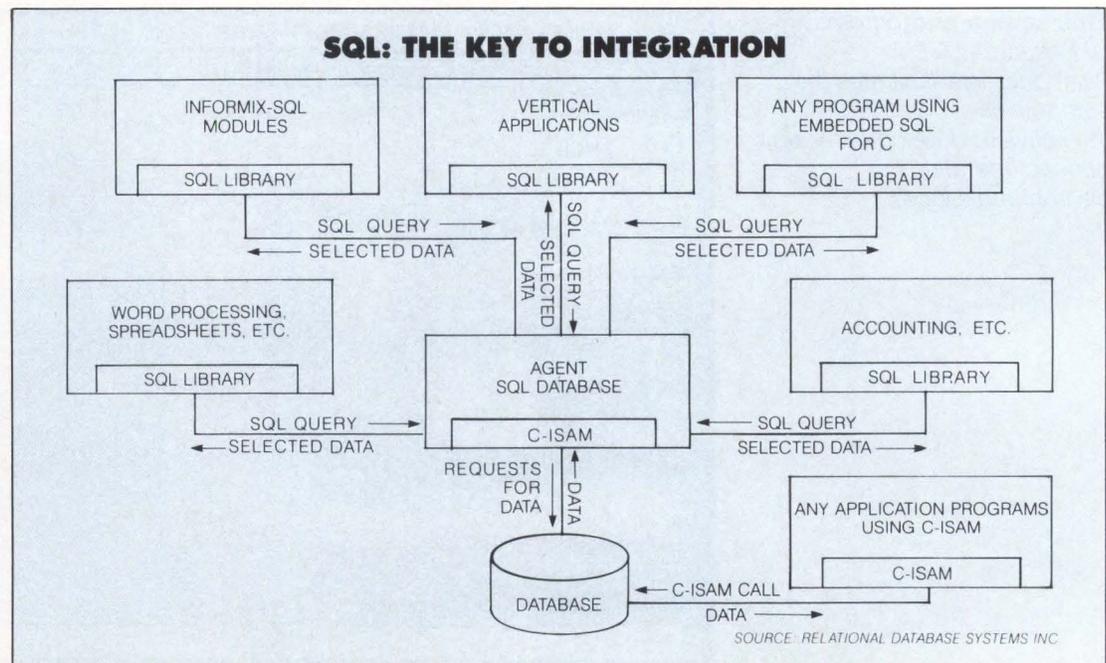
Developers who want to use traditional programming languages—such as COBOL, C or BASIC—and want to control much of the coding, but still want to reduce their own effort, can exploit the libraries of subroutines already on the market. These subroutines involve window managers, terminal emulators, report generators, string manipulators, communications functions, database-search software; and device, printer, screen, mouse and terminal drivers. Some require payment of royalties, but many—particularly in the MS-DOS world—do not.

These types of tools are often available from mail-order supply houses. For example, The Programmer's Shop, a software-supply house that specializes in tools, carries over 100 versions in the MS-DOS environment alone.

Whether developers can benefit from such tools depends on the nature of their target markets. "If I wanted to build an integrated-software package for, say, a law office," says Bruce Lynch, president of The Programmer's Shop, "I'd ask myself if I wanted to address their day-to-day, bean-counting needs, or something more exotic, like client services."

If the application is "bean counting," such as record keeping, billing and accounts payable, says Lynch, then tools are an absolute must. "Those sort of applications could be easily addressed by these [tool] packages," he says. On the other hand, he adds, "For doing particular

On the argument that, "The database is the lowest common denominator," RDI designed Informix-SQL to be the foundation of integrated-software products. Using SQL and C-ISAM, a library of C-routines, virtually any application can access the database.



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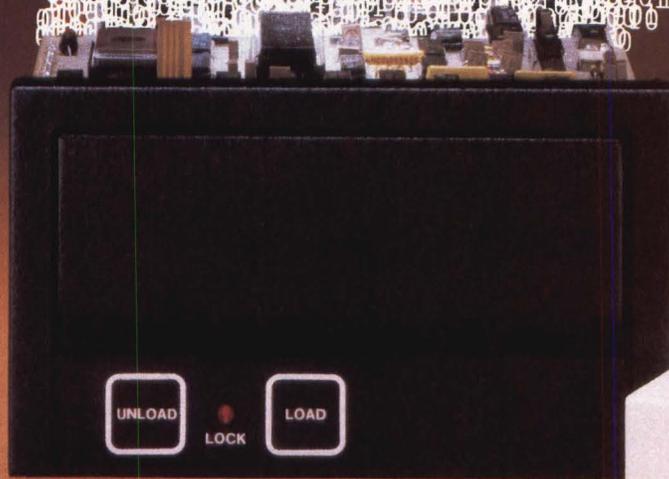
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client services, I'd be more likely to have a number of unique calculations that just wouldn't be included in these packages."

If VARs want to reduce their development time still further, they can buy, not just subroutines, but entire programs and integrate them. Where once it was virtually impossible to integrate software from different sources, now it's merely difficult.

For some years, programmers have speculated on the possibility of software that vendors could use as some sort of a "superglue" with different applications. So far, that's remained just an aspiration. Muses software consultant Andrew Allison, Los Altos Hills, Calif.: "An integrated-software compiler? No, it's pretty unlikely anyone will write one of those for quite a while. It's a difficult problem...and it shouldn't be, but all the different interfaces between different popular products make it so. The problem is that the popular products...simply don't have the facilities to link together."

Even without a "superglue" solution, system integrators can use operating environments to combine disparate applications. In the PC-DOS/MS-DOS world, for example, some operating environments provide both a user interface and an easy means of integrating software. Battling for market share at the moment are Microsoft Corp.'s Windows, IBM Corp.'s TopView and Digital Research Inc.'s (DRI) GEM.

Essentially, all three work as extensions of the operating system to provide a graphically oriented user interface—windowing—and data-passing capabilities for most MS-DOS applica-

EDITING CRITERIA			
ACTION IN CAPTION		CHECK-DATE	FILE CHEK FIELD DATE
Y N	EDIT TYPE	EDIT VALUE	
-	MINIMUM VALUE	0	
-	MAXIMUM VALUE	0	
Y	MINIMUM LENGTH	06	
Y	MAXIMUM LENGTH	06	
-	SHORT TABLE	----- (UP TO TEN 2-BYTE COMPARE VALUES)	
-	LONG TABLE	--- (TABLE NAME)	
-	KEY PRESENT	--- (FILE/FIELD NAME OF KEY)	
-	KEY ABSENT	--- (FILE/FIELD NAME OF KEY)	
-	DATE FORMAT	(M-MM/DD/YY; Y=YY/MM/DD; D=DD/MM/YY)	
-	TIME FORMAT	(Y HH:MM:SS; M=HH:MM)	
-	ALPHABETIC		
-	DEFAULT VALUE	-----	
Y	USER EXIT ROUTINE	DATE-000	*** PFS TO SCROLL THRU FILE

MESSAGES *** INQUIRY ACTION COMPLETED ***

Machine-specific 4GLs, like Tominy's Mach 1, employ an English-like structure, user-friendly menus and forms-based visual programming. Mach 1 produces code for the entire spectrum of IBM machines.

tions. Explains Richard Dill, Windows marketing manager for Microsoft: "Windows has two means of allowing different applications to share data. For short pieces of data, it has what is literally a messaging facility. For longer pieces we have what we call—for want of a better name—a clipboard facility. This allows you to 'cut' data from one application, store it on the clipboard and then 'paste' it in another application."

One benefit of products like Windows, Top-

New sheep in the integrated fold

Integrated software's continued viability as a product is indicated by the fact that it continues to evolve. Developers are eagerly including more and more functions in their integrated products—like artificial intelligence and synthetic speech.

In October of 1985, for instance, Micro Data Base Systems Inc. (MDBS), Lafayette, Ind., introduced "Guru" for the IBM Corp. PC and compatibles. Guru combines familiar, business-related functions—a relational database manager, assorted spreadsheets, a text processor and a business-graphics generator—with an unfamiliar AI-twist: an expert-system generator.

With Guru, value-added resellers or in-house integrators can produce packages that not only codify company wisdom regarding some task but also provide the tools for performing that task. Developers

could produce, for example, a package for an investment company that would allow even a relatively inexperienced agent to evaluate a complex security setup. The agent could consult the expert system as to its possible value, use a spreadsheet to calculate growth in equity and then write a memo suggesting purchase or sale, all with Guru's text processor. Somewhat disconcertingly, though, MDBS refers to Guru as "the software with a mind of its own."

Meanwhile, Paladin Software Corp., Santa Clara, Calif., announced that its new integrated spreadsheet for the Apple Computer Inc. Macintosh would include, not only graphics software and a limited text processor, but also the spoken word. With a feature known as "Say It," the program will read aloud text and numbers the user inputs. In addition, notes the company, it will "verbally explain an error message."

View and GEM is that developers can either purchase and resell them as part of their own packages, or they can leave the actual integration to their clients. "While vendors may certainly opt to build a complete, integrated package," says Dill, "they may also write their products piecemeal. They can write and sell it in sections, knowing that it can be integrated later." That way, vendors could be making a profit from their first efforts—say, a word-processing package—while their complete product lines are still in development.

From a VAR's point of view, the disadvantage of Windows, TopView and GEM is, of course, that Microsoft, IBM and DRI are themselves producing strong packages to run under their operating environments. It remains to be seen whether a third party can successfully compete with the word-processing packages, graphics programs and spreadsheets presently coming from those powerful companies and their associated developers.

One alternative that developers can consider is building a graphically oriented, integrating operating environment of their own. Several kits are now available that allow a vendor to do that. Metagraphics Software Corp., for example, markets "MetaWindow," a graphics library for the IBM PC and compatibles that has a graphics-adaptor card. With it, developers can produce menus, windows, icons, unique test fonts and

custom graphics. MetaWindow can also act as a link between individual applications.

Multiusers multi-integrate

The single-user, MS-DOS market is not alone in having strong tool kits for integrated-software development. VARs addressing the multiuser market can take advantage of what appear to be complete tool kits. As a matter of fact, it's in this market that software integration is most like hardware-system integration, with developers buying massive chunks of code and reconfiguring them.

Most developers building a product for a vertical market start with a database management system. There are dozens, if not hundreds, of DBMSes vying for the VARs' business. Three representative products within the UNIX market are Informix-SQL from Relational Database Systems Inc. (RDS), Unify from Unify Corp. and Ingres from Relational Technology Inc.

Each of these companies has taken significant steps to make certain their DBMS can be easily integrated with other software. As the name suggests, RDS' Informix-SQL, for example, is based on the structured query language (SQL), a de facto-standard database language. This means that anyone capable of writing in SQL is also capable of giving their product an interface to Informix-SQL.

"The database is the lowest common denomi-

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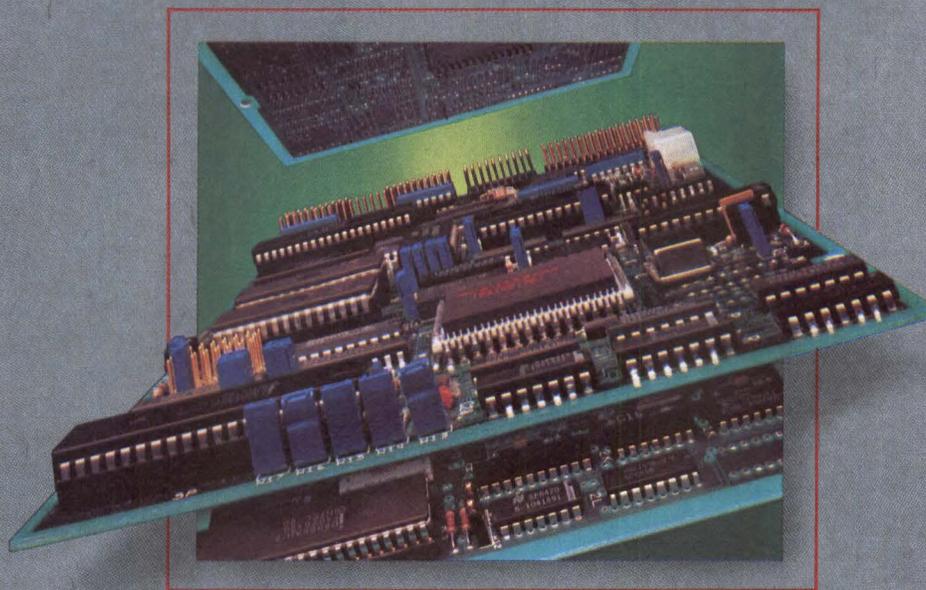
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nator in an integrated application. That's the place where integration should occur," explains Laura King, vice president of RDS. "We've set up an open architecture so that you can write a whole bunch of front ends to Informix-SQL—like a word processor, perhaps—and all of them can have a common interface to the database. In effect, if you can build something with SQL, you can get it into Informix-SQL." Developers can also link their products to Informix via a library of C routines that RDS markets as "C-ISAM."

Unify takes a similar approach. It too uses SQL, plus what the company calls "host-interface" software that is compatible with C and some COBOL programs. One company that took advantage of these tools is Syntactics Corp. It gave its UNIX-based word processor, Crystal Writer, a DBMS interface to create a new product, Document Manager, planned for release early this year. "It's a natural fit," explains Russell Salisbury, vice president of engineering for Syntactics. "Document Manager will actually be able to compose queries to the database. A user needs that sort of facility for doing things like mass mailings."

These products also incorporate links to the MS-DOS world and to the IBM PC, raising the interesting possibility that integrated software might someday include modules of code running on separate machines and different operating systems. For example, Relational Technology introduced last year a product known as Ingres/PCLink, software that connects the Ingres mainframe database with personal computer products—specifically, Lotus Development Corp.'s 1-2-3. Ingres/PCLink reformats Ingres data from a host multiuser machine so that it can be used by MS-DOS software.

4GLs ease the way

Finally, if developers want to minimize coding—or even do no coding at all—they can exploit a host of fourth-generation languages (4GL) and application generators that have recently come on the scene. Many of these spring directly from the DBMS products and may become the new "lowest common denominator" of integration. In 1985, for example, RDS and Unify introduced, respectively, Informix-4GL and Accell. They are 4GLs that make it extremely easy either to link their UNIX-based DBMS with other applications or to build new products on top of them (MMS, November 1985, Page 93).

One new wrinkle in the 4GL market is machine-specific 4GLs. Integrated-software developers working in the IBM arena, for example, can take advantage of such languages as Mach 1 from Tominy Inc. Capable of producing code for

the entire spectrum of IBM machines from mainframes to microcomputers, Mach 1 uses an English-like structure, menus, and forms-based visual programming.

A similar product in the Digital Equipment Corp. sphere is SmartStar from Signal Technologies Inc. In addition to performing some office-automation functions, SmartStar contains a 4GL that allows developers to link code in third-generation languages (3GL), such as COBOL and C, with SmartStar applications into one integrated product. "You will find many fourth-generation products that will say they can call upon a third-generation language," notes Dr. John Markel, president of Signal Technologies. "What they don't say is that they can't be called back from a 3GL, as they can with SmartStar. And that's dangerous, because a customer is certainly not going to throw away their thousands of lines of COBOL code to rewrite their applications in a 4GL."

DEC apparently concurs and has recently announced that it has an agreement to resell SmartStar under its own label.

Once again, whether VARs can benefit from 4GLs and application generators depends on how much time they can afford to spend on development and on how much control they wish to retain over their products. A 4GL can cut programming time by upwards of 90 percent but requires the developer to buy into somebody else's product. And the product may not meet the unique requirements of a vertical application. Lynch, of The Programmer's Shop, refers to that kind of integrated software with a bit of scorn: "I assume a software house is working with a real, honest-to-goodness programming language, like C or FORTRAN...[but] I know a lot of companies that do nothing more than buy somebody's product, diddle with the source code, and then resell it for a vertical market."

Still, most VARs are driven as much by market forces as by a love of programming. For them, tools make sense, particularly if they're working in integrated software. Whether as subroutines available from resellers like The Programmer's Shop or as 4GLs from DBMS companies, tools can vastly reduce programming time and even make for better products by allowing developers to incorporate other vendors' standalone applications into their packages. It's sometimes simply wiser to remarket somebody else's thoroughly debugged spreadsheet or word-processing package than to write one from scratch. □

If developers want to minimize coding—or even do no coding at all—they can exploit 4GLs.

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

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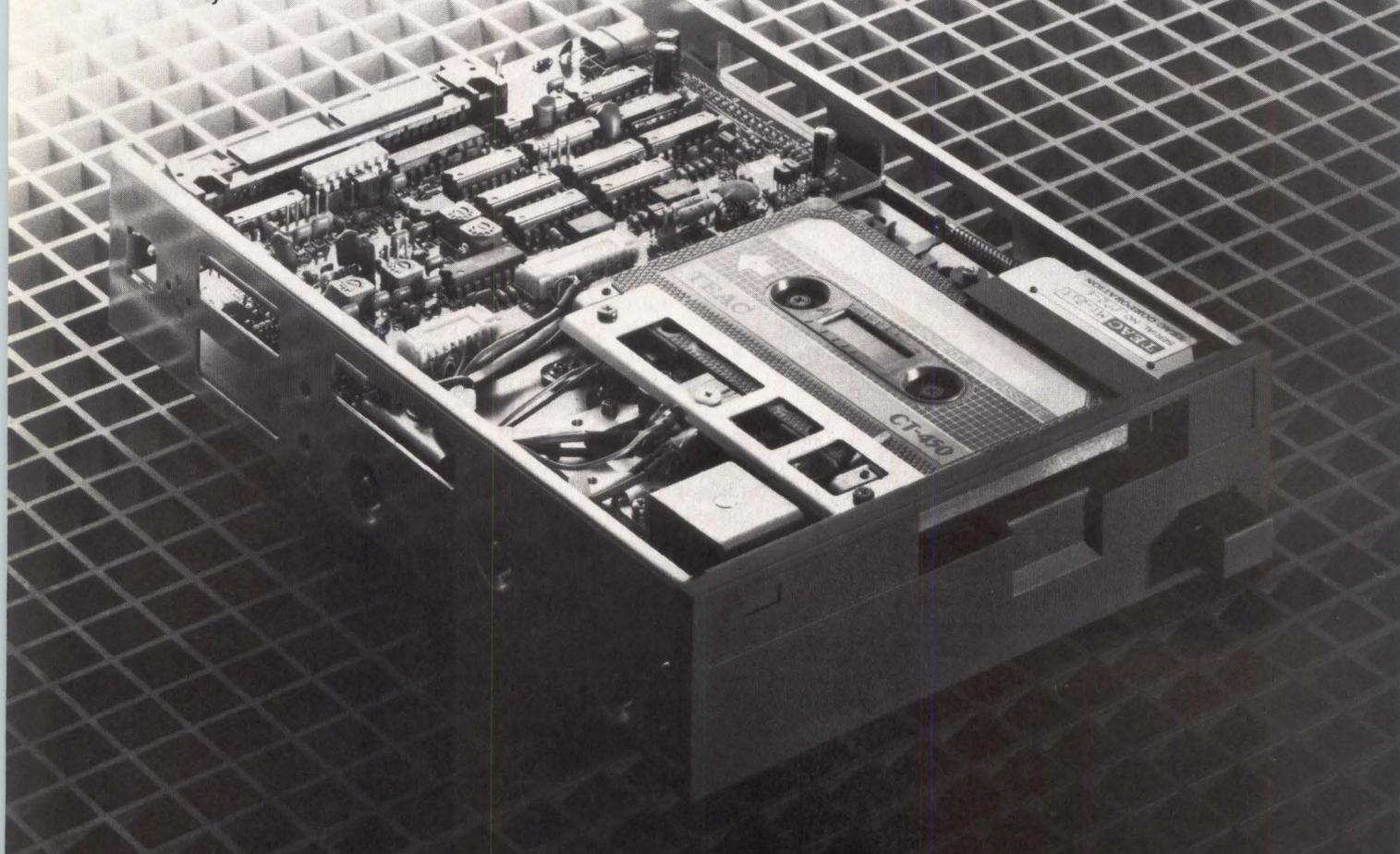
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CIRCLE NO. 32 ON INQUIRY CARD

TELEVIDEO 955

(Photo actual size)

PRODUCTS INC.

PERIOD: 03, 1985

NUMBER	ITEM	SHIPDATE	WAREHOUSE	SHIPDEST	CARRIER	CUST.TOTAL
87654	200	10/02/85	NYPHILIDE	NEW YORK	ACMETRS	250.21
50987	007	12/01/85	CENTRALLA	BOSTON	AJAXAIR	150.77
90867	999	ONHOLD	WOODLAWN	CHICAGO	DUMAIR	100.32
99999	808	11/19/85	ATLANTANW	AUGUSTA	EMFRT	500.11
85748	922	12/07/85	MINNSTPAUL	MINNIAP	TRUCKER	12.51
54970	905	09/28/86	SANJOSESE	SANMATED	SHORTAIR	500.55
88759	894	11/08/85	SACRAMENTO	SANJOSE	EZHAULER	50.34
99220	955	12/18/87	IRVINECA	WESTLAWN	LATRUCK	500.12
57463	888	10/26/86	GRTFALLS	GRTFALLS	FALLSTR	750.04
58473	543	12/24/85	DALLASFW	AUSTIN	LONSTAR	855.55
90795	666	04/01/86	NEWYORK	FARGO	TRUCKIN	905.55
95767	332	09/17/86	FLORIDAKEY	MELBORNE	SHIPWAY	888.31
58574	777	07/10/86	LASVEGAS	RENO	TRATN	777.00
58764	923	12/15/85	PORTLAND	CORVALIS	TR	
54746	345	12/17/86	GREENBAY	UPPERPEN	UP	
85767	111	11/11/85	HAMBURG	FRNKFURT	FR	
58607	456	04/27/86	CHICAGONW	HAKENSAK	M	
79585	666	05/09/86	LONDONSW	BRIGHTON	L	

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 TeleVideo

An
eye-opening
comparison
between
two
\$600 terminals.

WYSE WY-50

(Photo actual size)

CAPS BLK

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LATEX SPECIALITY

SALES PERSON	ID NUMBER	TERRITORY	CUSTOMER	CUST. NUMBER	PART
ABBOTT	101000000	NEW YORK	APEXINC	33333888899	KL234
ABRAMSON	102277754	BOSTON	ZINCINC	33388990044	KL234
BACH	100000456	CHICAGO	AASEWER	98750372378	KL230
BENSON	109957363	ATLANTA	TUSINC	77493887549	KL239
CAGNEY	107584948	MINNIAP	XYZCORP	34857683999	KL239
DEWITT	108958488	SANFRAN	JAKINC	82746532363	KL235
ELLIOTT	108674637	SANJOSE	ACDCORP	40874573839	KL230
FINEGOLD	107563848	LOSANGEL	LYNINC	94837394873	KL238
GOODMAN	106574647	MONTANA	CONSINC	93848473848	KL238
HILLMAN	109458574	DALLASFW	TEXACAN	75893738567	KL236
JACKSON	103546455	NDAKOTA	EXFARM	85737395473	KL230
KINGSTON	104958363	JAMAICA	DARKRUM	85736384938	KL239
		NEVADA	CASINO	91274937348	KL238
		OREGON	TIMBINC	02784503748	KL238
		WISCONS	NEWMINE	84874638459	KL238
		GERMANY	RUHRINC	85743648474	KL234
		NEWJERSY	MAPLEINC	85904874949	KL238
		LONDON	JAXCORP	85905737383	KL238

As you can more or less see, a typical \$600 terminal manages to fit 132 columns on a 14" screen. By crunching them together a lot tighter than normal. Which can lead to eyestrain, headaches, and just plain mistakes. All of which tend to be on the expensive side.

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terminals are
designed
to crunch a lot
of numbers.

The
TeleVideo 955
is designed
to actually
let you
read them.

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Available options include WY-50/50+ compatibility, graphics add-in board, and up to three additional pages of screen memory.

To see exactly how we compare feature for feature with the Wyse WY-50/50+, just look at the chart on this page.

Of course, there's an easy way to see how much more the TeleVideo 955 gives you. Get your hands on one and check it out from top to

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TELEVIDEO 955 VS. WYSE WY-50 AND WY-50+			
FEATURES	TVI 955	WY-50	WY-50+
Keyswitches tested to	100 million strokes	10 million strokes	10 million strokes
Screen color	Green or amber	Green only	Amber only
High contrast dark screen	Yes	No	No
Programmable function keys	16/64	16/32	16/32
Dynamically allocated function key memory	512 Bytes	128 Bytes	128 Bytes
Maximum bytes per function key	Unlimited	4	4
Graphics upgrade	Yes	No	No
User ROM Slot	Yes	No	No
List Price	\$629	\$599	\$699

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SCSI OPENS INTEGRATION OPPORTUNITIES

The small computer systems interface meshes a broad range of peripherals with a wide variety of architectures

Carl Warren, Western Editor

System integrators look for both flexibility and high performance in peripherals to meet the needs of today's demanding computer systems. But there are trade-offs to consider. Specifically, although plug-compatible peripherals might provide higher performance than general-purpose devices, they aren't flexible enough to permit integration into a broad range of system architectures. And although general-purpose products permit connection to a wider range of computers, they tend to suffer from performance limitations.

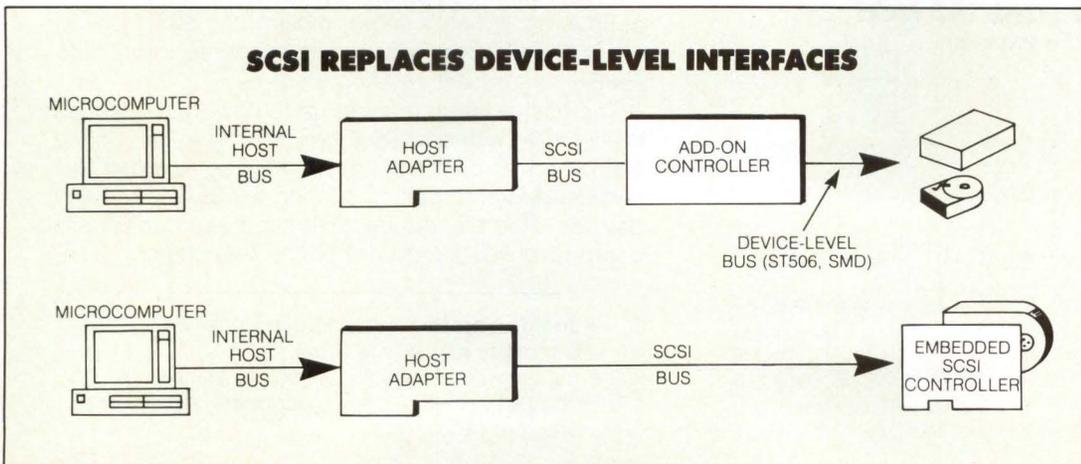
The small computer systems interface (SCSI) offers a way out of this dilemma. It combines performance where it counts, with flexibility where it's needed.

As currently defined, SCSI supports a maximum of eight logical units. These may include disk drives, tape drives, printers, communica-

tions and optical-storage devices or other host computers.

The eight logical units can be configured as one host computer and seven peripherals, or seven hosts and one peripheral. Even more devices can be connected using a gateway to a local area network. In addition, each of the eight logical units can support an additional seven units with one device serving as the bus master. (However, a system fully loaded in this manner suffers performance degradation.)

A key advantage of the SCSI bus is its ability to serve a wide range of performance requirements. Most SCSI configurations are single-initiator, single-target systems, usually with one host computer as the initiator and a disk drive as the target. A single-initiator, multiple-target configuration with arbitration increases the number of devices you can hang off the bus. But under arbitration's master/slave relationship, one target must relinquish the bus before trans-



An embedded SCSI controller replaces the add-on controller and device-level interfaces normally found on today's peripherals.

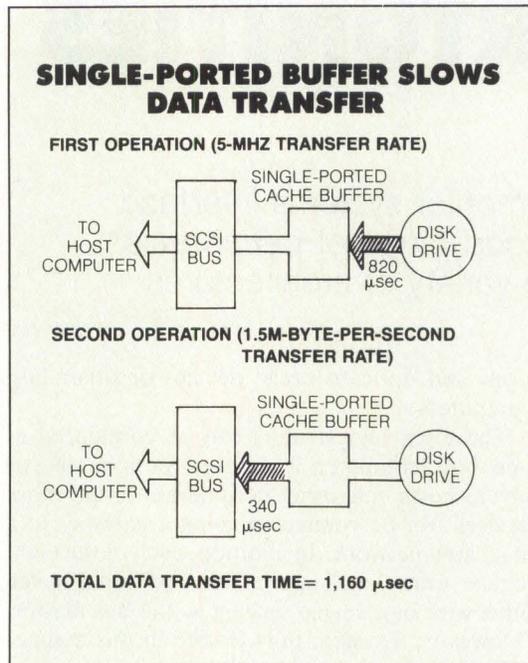
fers to others can take place. However, multiple-initiator, multiple-target systems with multiple host computers fully utilize SCSI capabilities by allowing the full complement of eight units to be attached to the bus. In this mode, SCSI acts as a clustered LAN.

The SCSI bus' ability to control seven periph-

erals through one backplane slot is a system integrator's dream come true. And because SCSI serves as its own "traffic cop"—arbitrating bus access—system integrators need only be concerned with data management at the point of access to the SCSI bus, the host-computer adapter—the vital link between the system bus and SCSI.

A single-ported cache buffer

doesn't allow for overlapped operations, thus increasing the transfer time for a 512-byte sector from disk drive to SCSI bus to 1,160 μ SEC.



Use a smarter interface

The use of the SCSI bus with disk drives and other devices establishes a trend away from the add-on controllers and device-level interfaces normally found on today's peripherals.

A typical device-level interface, such as an ST506/412, a storage module device (SMD) or an enhanced small device interface (ESDI), comprises many signal lines, each dedicated to performing one primitive drive function (e.g., seek cylinder or drive ready). In a typical configuration a controller, installed between the computer and the peripheral, converts device-level signals to parallel data/control signals.

Instructing a disk drive to read a file, for example, requires a series of commands. The controller first directs the drive's read/write head to the appropriate cylinder (a task that often requires several stepping signals), locates the appropriate sectors making up the file, checks for errors in the read data and, if necessary, performs correction or a retry. The controller

The SCSI market comes of age

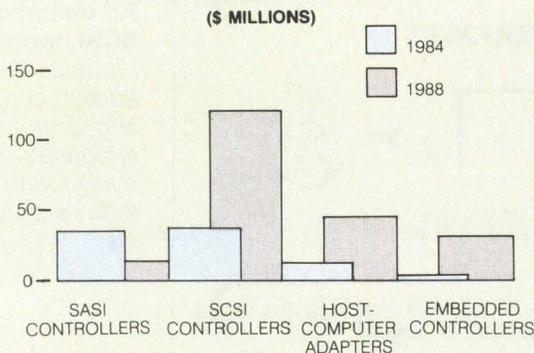
Joe Jaworski
Peripheral Concepts Inc.

The growing demand for higher performance versions of small computer systems interface (SCSI) bus

controllers will cause a strong shift away from the older Shugart Associates system interface (SASI) controllers. In fact, the market for SASI controllers is expected to decline from \$34 million in 1984 to just over \$10 million in 1988. Sales of embedded controllers will further erode SASI's sales. Drive manufacturers that require chips and chip sets to create SCSI peripherals will account for most of the \$33.1 million worth of embedded controllers expected to be sold in 1988.

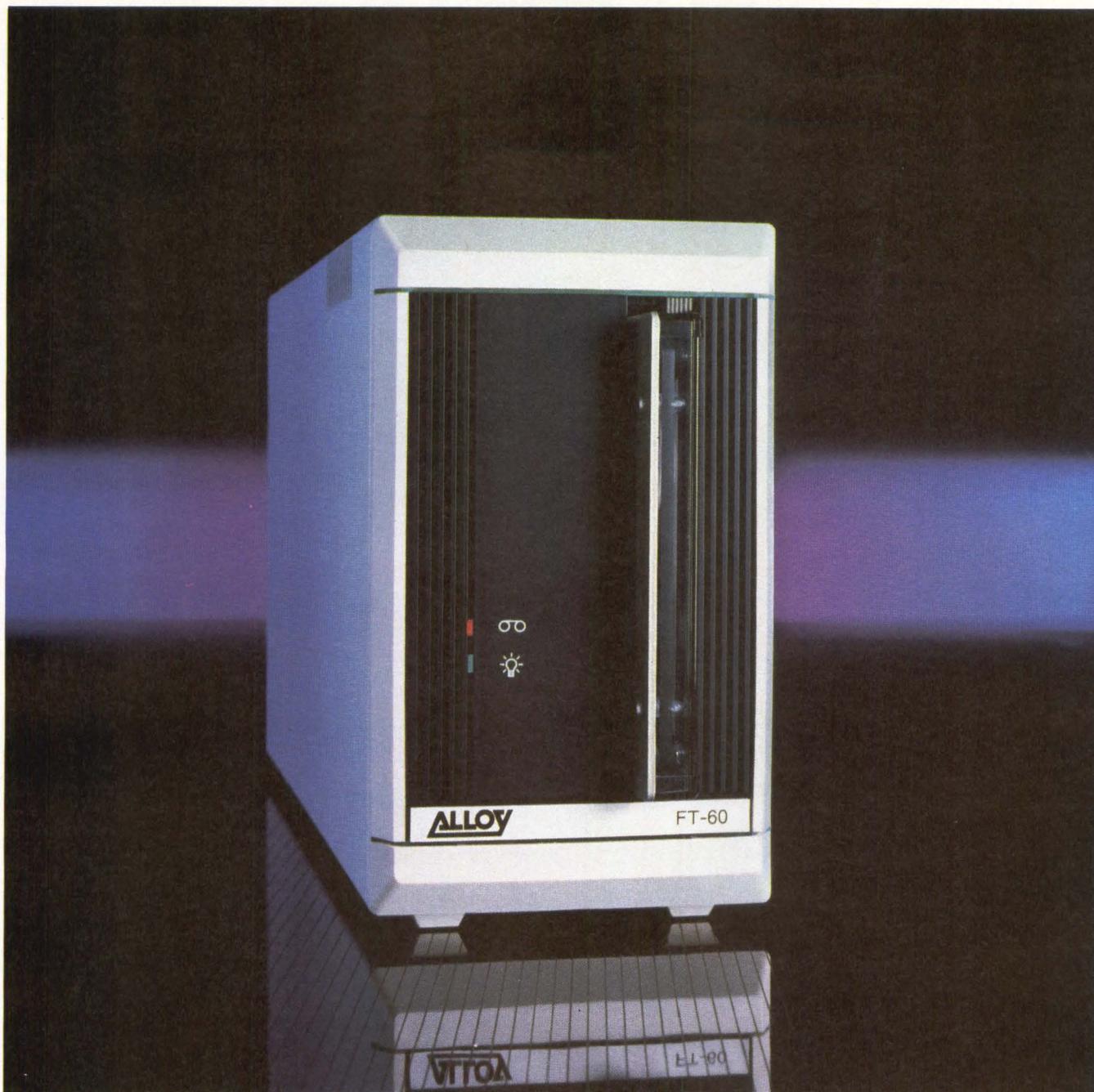
The host-adaptor market, up to now, has been relatively small, with only \$5.1 million in revenues during 1984. And future market growth will be retarded by semiconductor suppliers offering full-SCSI-protocol devices. This will reduce what has been traditionally a board-level function to just one or two chips.

SCSI TOPS MARKET



SOURCE: PERIPHERAL CONCEPTS INC.

Joe Jaworski is president of Peripheral Concepts Inc., Irvine, Calif., a management-consulting and publishing company specializing in peripheral controllers and interfaces.



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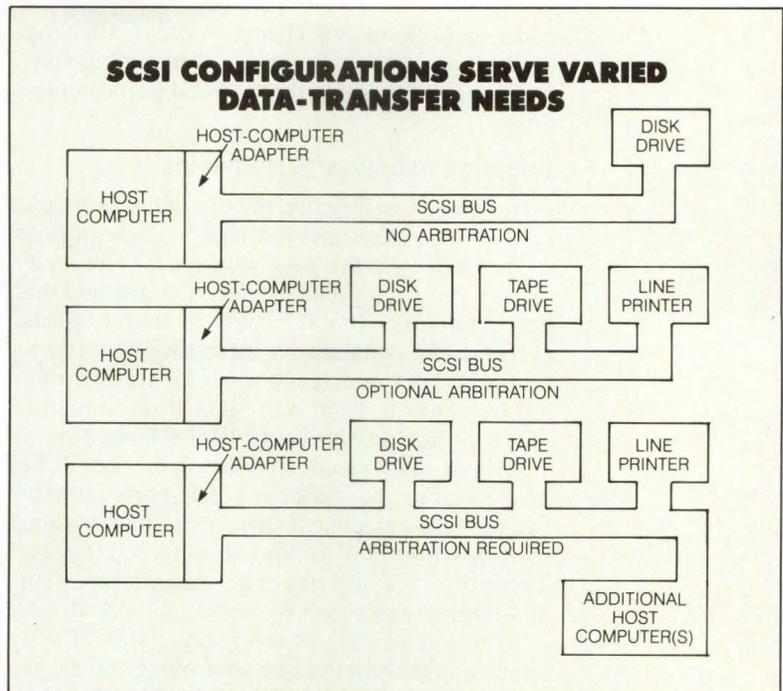
then converts the serial data from the disk into parallel data and passes it to the host.

Device level has limitations

Although using a device-level interface is a cost-effective way to integrate mass-storage devices, the approach has drawbacks. Specifically, the computer must know where each sector of data is located on a disk, the number of sectors and the electrical parameters of each signal line from the interface. As a result, integrating mass-storage peripherals using device-level interfaces requires system integrators to have in-depth knowledge of the connected devices.

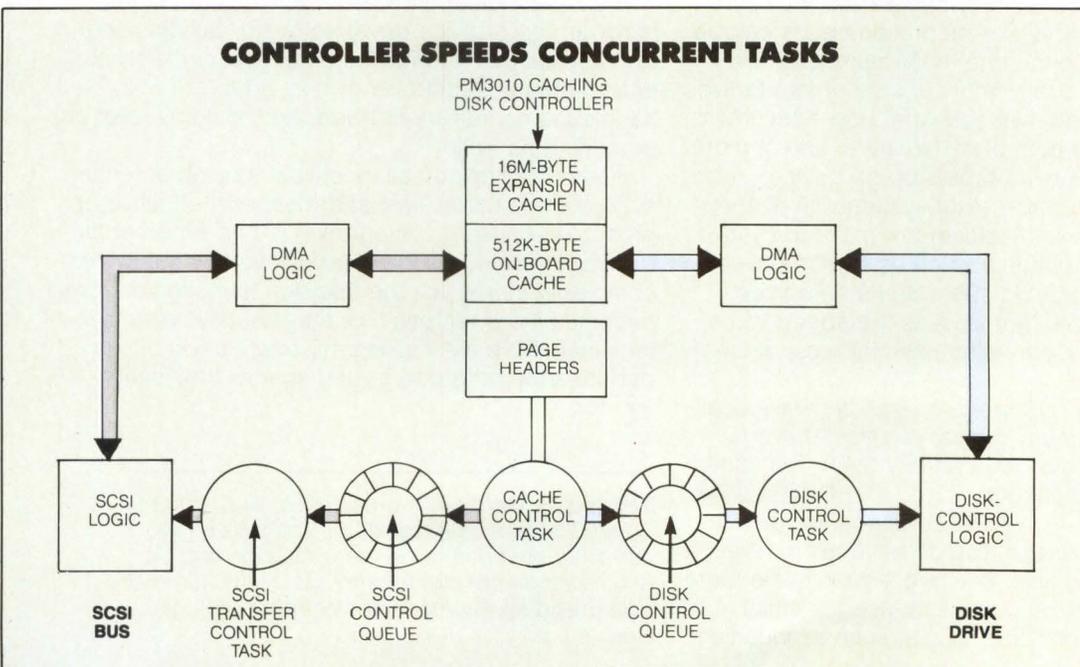
In contrast, an intelligent interface like SCSI makes device characteristics transparent to system integrators and host-computer systems. A set of commands handles such functions as seeking, reading, writing and even bus arbitration. Moreover, SCSI has an 8-bit bus (with optional parity) for data command and status. In addition, because SCSI is tightly coupled to peripherals, such as the Quantum Corp. Q200 series of Winchester, the computer is unaware of the actual data rate of the drive or its operating characteristics.

Quantum has solved drive-integration problems by integrating SCSI into the drive, requiring only a host adapter on the system end. Similarly, Maxtor Corp.'s XT-3000 series of Winchester uses an embedded SCSI controller with an on-board, 48-bit, error-correction-code (ECC) scheme to limit errors to the host.



SCSI bus configurations run the gamut from simple one-host-computer, one-peripheral systems without arbitration to complex two-host-computer systems able to support full SCSI capabilities and eight logical devices on the bus.

Because SCSI uses a "logical" block to automatically define access to a region of data (rather than having to enter the information and specify a physical sector and cylinder), a disk's capacity



Two separate data paths, control queues, on-board logic and MC68000 microprocessor on DPT's PM3010-series caching controller accelerate concurrent data transfers between a disk drive and the SCSI bus.

and organization can change without affecting the host adapter or firmware. Thus, "plug-and-play" capability is inherent in SCSI implementations.

Buffering improves performance

Buffering can improve the operation of a disk system. The basic method uses a single-ported cache buffer on the disk controller to provide interim storage for data between the disk and the host computer. But this type of buffer exacts performance penalties by increasing data-transfer times. For example, consider the transfer of a 512-byte sector from a 5-MHz drive into the sector buffer on the controller, followed by a 1.5M-byte-per-second transfer over the SCSI bus. Because the buffer is single-ported, these two processes can't be overlapped. This situation increases the total transfer time to 1,160 μ sec. Therefore, 1:1 interleaving (sometimes called non-interleaving) can't be used on the disk drive.

To maximize data-transfer rates, a SCSI system requires a method of controlling the cache buffer. For instance, Distributed Processing Technology's (DPT) PM3010 Series caching disk controller handles both a disk drive and the SCSI interface. Two separate data paths—to the SCSI

Spec summary

- **Bus:** SCSI
- **Signal lines:** Nine data, nine control
- **Cable length:** 6 meters or 25 meters
- **Transfer rate:** 1.5M bytes per second at 6 meters; 4M bytes per second at 25 meters
- **Device limit:** Eight, with arbitration
- **Bus response:** 5 μ sec to acknowledge signal at maximum cable length
- **Connectors, cable:** 2-by-25-pin header, shielded Allied Amphenol Products AMPMODU connector, shielded ribbon cable
- **Addressing:** 24 bits; maximum, 32 bits
- **Functions:** Disconnect/reconnect, reset
- **Available chips:** Protocol, controller

bus and to the disk drive—allow simultaneous data transfers with maximum overlap. Using a Motorola Inc. MC68000 microprocessor to execute concurrent tasks, the PM3010 maintains and searches its 512K-byte, on-board, cache memory (expandable to 16M bytes) for blocks requested by the host.

When implementing SCSI systems, system integrators face the choice of building or buying

How to make the build-or-buy decision for a disk subsystem

Thomas E. Gardner
Systems Surety Group

Deciding whether to build or buy a disk-drive subsystem to meet your system-integration needs can be a bewildering experience due to the number of alternatives. Typically, a subsystem consists of four to five elements: the device-driver software, host-attachment hardware, disk-drive-controller hardware, one or more disk drives and possibly a tape-storage device.

You can decide to buy the subsystem with all the necessary hardware and software or make the various supporting components, such as device drivers and host adapters. Buying subsystems minimizes risks in some respects, but lessens the added value. And in some cases it can even raise the cost of the total system.

"Rolling your own" components isn't necessarily all that intimidating. In many cases, you don't have to actually build products; you can buy them from other vendors and integrate them.

Disk and tape drives are the components you usually have to buy. However, you do have alternatives here as well. For example, you might specify the more intelligent disk and tape drives that use the small computer systems interface (SCSI), such as Quantum

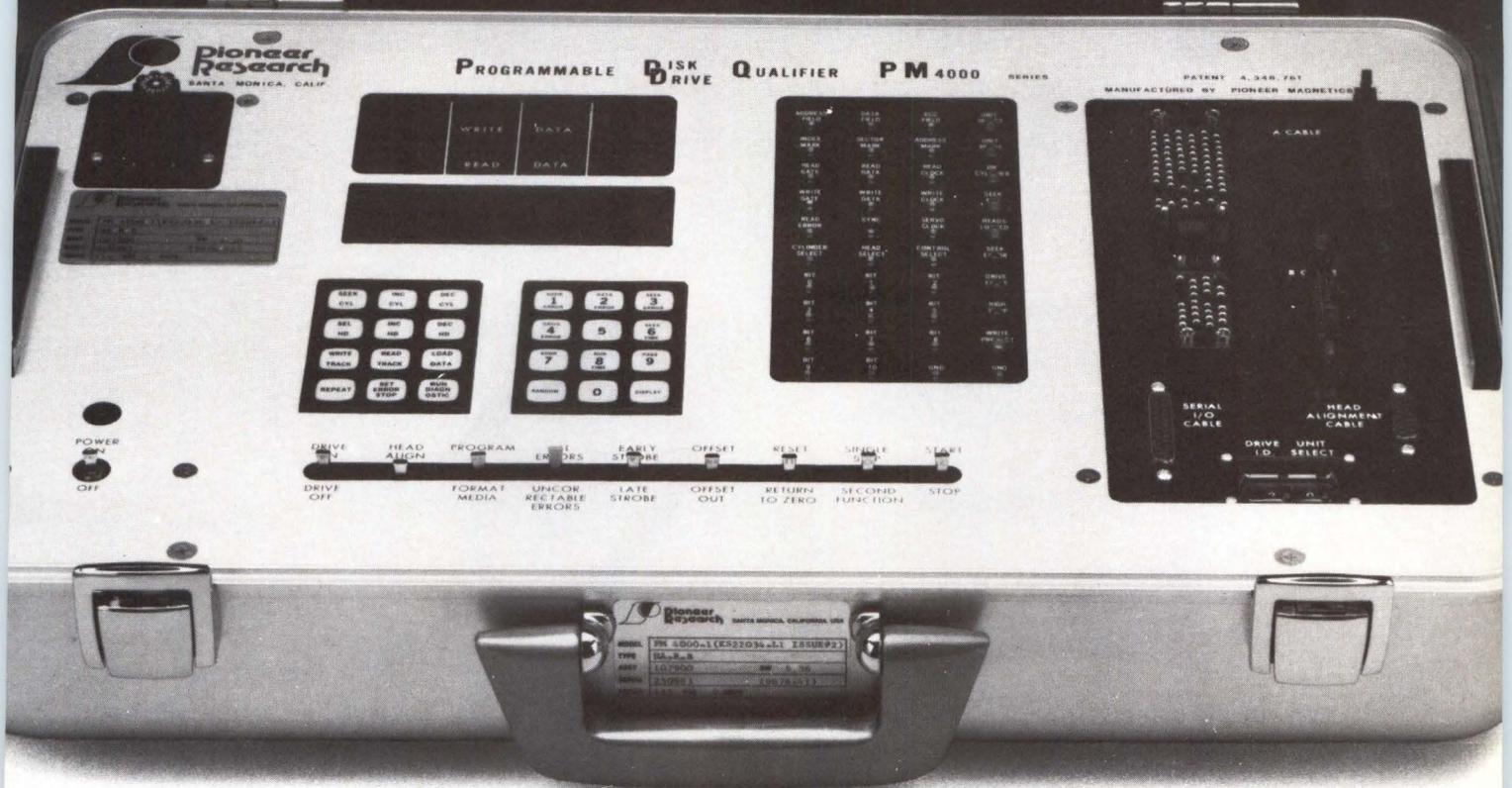
Corp.'s Q200 series or Xebec Corp.'s Owl products. Their SCSI interfaces allow you to integrate them into virtually any host architecture.

The most critical choices involve host-attachment hardware and device-driver software. Building your own implies that you have the necessary skills not only to create a controller or host adapter but to handle the necessary firmware and systems-level programming as well.

Where integration cost is critical, buying an entire subsystem is the easiest and most cost-effective approach, because the integration is performed at the distributor or end-user level. However, as subsystem complexity increases, the decision to make your own becomes more realistic. For these subsystems, system integrators are making important trade-offs in performance or in addressing special application needs.

Thomas E. Gardner is president of the Systems Surety Group, Los Altos, Calif., specializing in assisting management in the evaluation and acquisition of peripheral products. He is a former vice president and general manager of Shugart Corp.'s rigid disk drive division.

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With the PM4000 Qualifier you can standardize all your company's testing needs on a single lightweight unit. Use it in development engineering, produc-

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If you'd like to see a PM4000 Qualifier in person, call us. We'd be pleased to arrange a complete demonstration. The Pioneer PM4000. It's the only SMD drive tester you'll ever need.

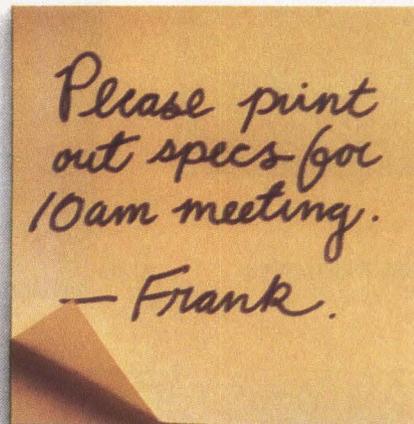
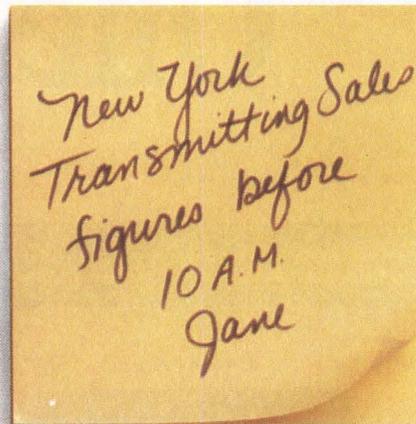
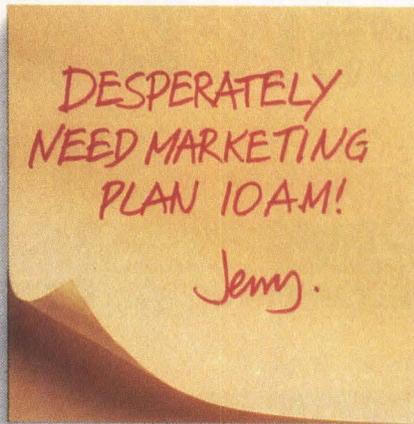
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CCS spurs SCSI standardization

The small computer systems interface (SCSI) provides system integrators with a rich command set, but the bus has suffered from manufacturers' tendencies to provide SCSI implementations that are unique to their products. To accelerate the effort to standardize SCSI commands, Scientific Micro Systems Inc., in concert with the ANSI X3T9.2 Committee, has developed a common-command set (CCS) for direct-access devices. Although CCS is not currently a part of revision 17 of the proposed SCSI standard, it is included as an appendix.

Specifically, CCS defines commands, messages, fields, bytes and bits that conform to CCS usage. In addition, there are option codes that a developer can choose. By selecting a common implementation of a subset of the SCSI commands, CCS allows software and hardware developers to create products for a range of systems. In providing true second sourcing to end users, CCS can encourage SCSI market growth by promoting software compatibility among vendors.

Companies in this article

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adapters, controllers and device drivers (see "How to make the build-or-buy decision for a disk subsystem," Page 76).

Building a device driver can be complicated. It involves having a good understanding of the device, the system and the operating environment. Surprisingly, although the graphics community has solved many device-handling problems with the virtual device interface (VDI), SCSI developers are still complicating the integration by insisting on system- and device-specific device drivers. Thus, to properly use SCSI, system integrators have often been forced to make changes to the operating system or to provide the proper firmware.

This situation, however, could be changing. Microsoft Corp. is taking an active role in SCSI development, especially as it relates to optical-disk storage. Additionally, IBM Corp. reportedly will introduce a compact-disk ROM reader in mid-1986 that will use a SCSI controller.

SCSI excels in optical applications

SCSI is being implemented as the interface of choice for optical-storage systems, due to its ease of integration over a range of architectures and its powerful command set (MMS, December 1985, Page 68). Additionally, Wang Laboratories Inc. is developing a laser printer that reportedly uses a SCSI interface.

SCSI easily handles today's data-transfer rates and can be made to go faster. Currently, most

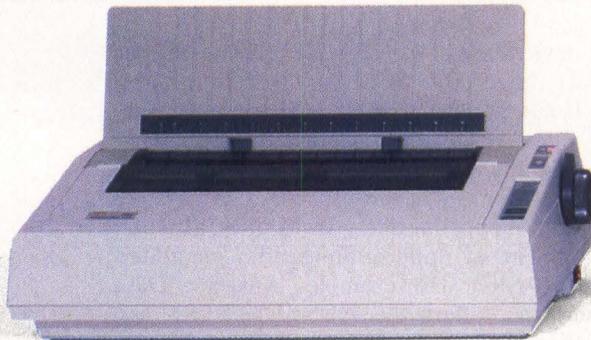
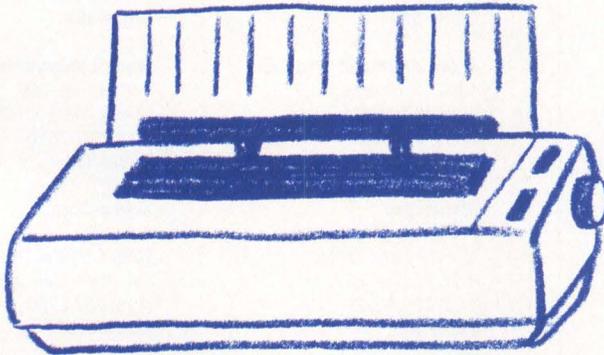
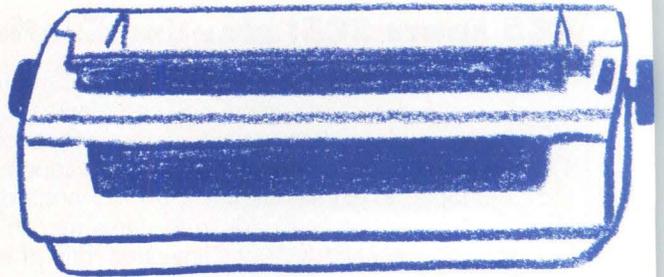
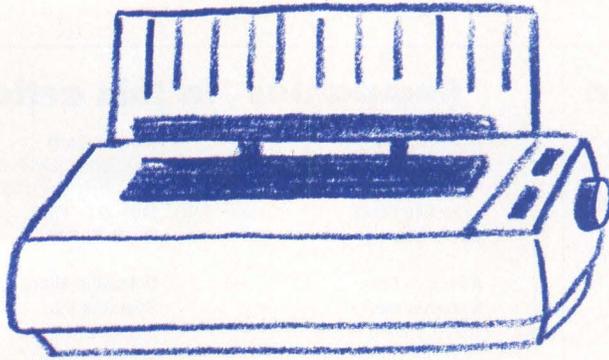
SCSI devices are in the 12-MHz (1.5M bytes per second) range. But SCSI isn't bandwidth-limited. It can handle 32-MHz (4M bytes per second) rates at distances of up to 25 meters, extending the capability of the bus for future systems.

Further supporting the growth of SCSI is the development of application-specific integrated circuits (ASIC). For example, Adaptive Data Systems Inc. offers the ADS-1000 VLSI disk controller that provides data handling for devices ranging from Winchester disk drives to optical drives. Adaptec Inc. offers similar products to allow easy integration of SCSI devices to various host architectures.

Although SCSI is defined as an open-architecture device bus for a variety of peripherals, including printers, adding printers hasn't been high on many system integrators' priority list. One reason is that no real standards for printers had emerged until Hewlett-Packard Co. introduced the LaserJet laser printer, establishing a de facto standard for printer control. Consequently, adding a SCSI interface to permit a printer to reside on the subordinate system's bus is now possible, allowing system integrators to create smarter, multiuser systems. □

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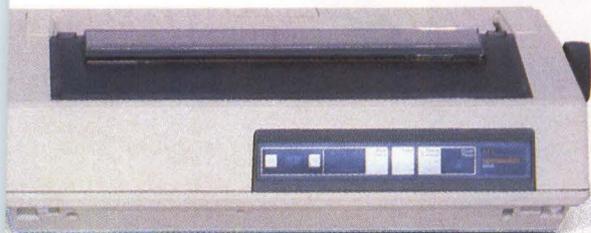
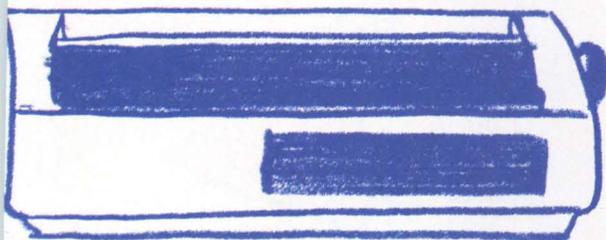
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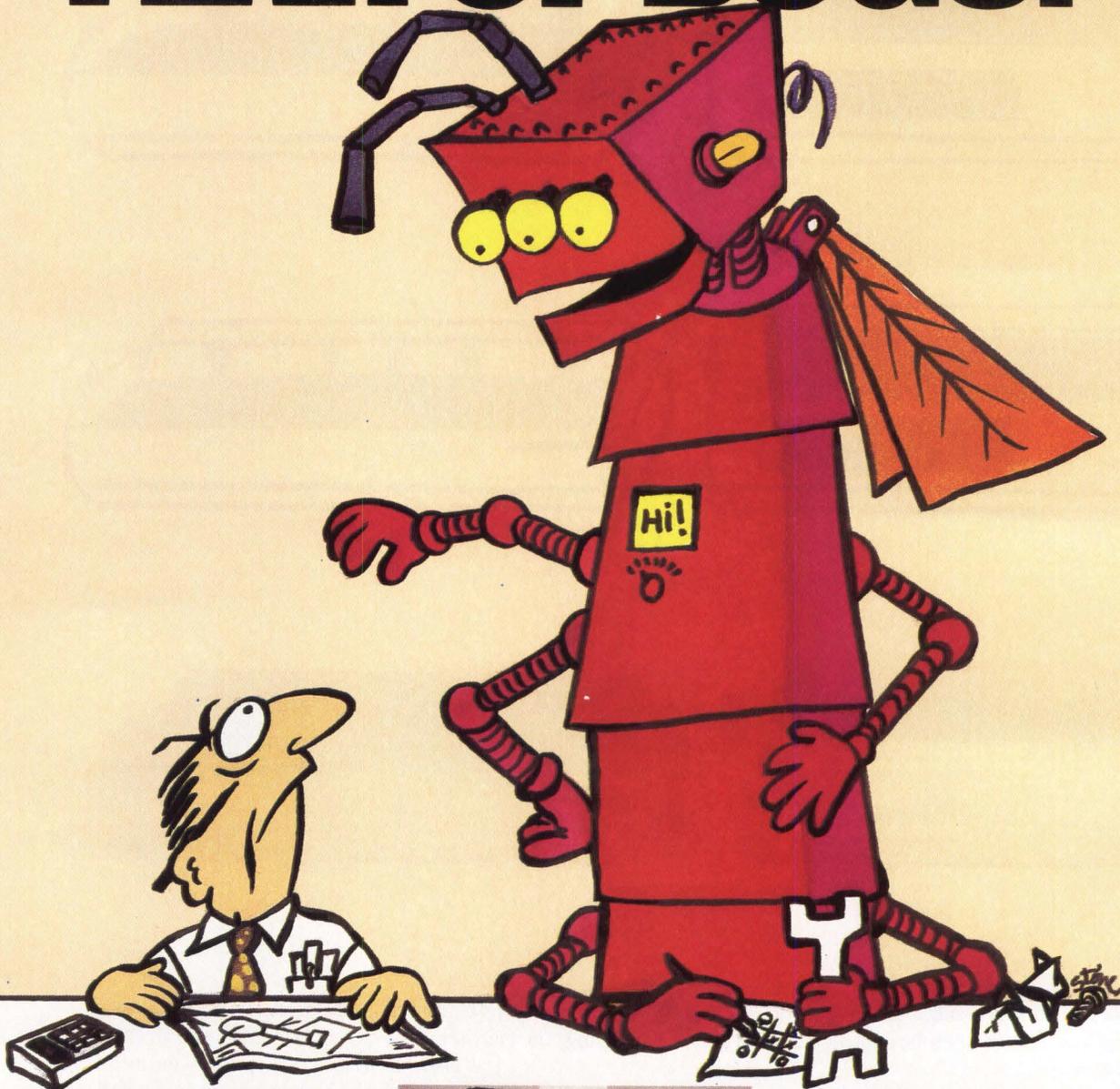
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ESDI JOINS INTERFACE RANKS

Established peripheral interface standards ST506/ST412 and SMD are holding their own, but latecomer ESDI is penetrating new application areas, particularly those with optical disks and varied peripherals

I. Dal Allan, ENDL

Two major developments of last year have significantly affected the disk-drive market. One is the integration of the small computer systems interface (SCSI) into disk drives and tape drives. The other is the emergence of the enhanced small device interface (ESDI) as an alternative to established interfaces, such as the ST506/ST412 and the storage module device (SMD).

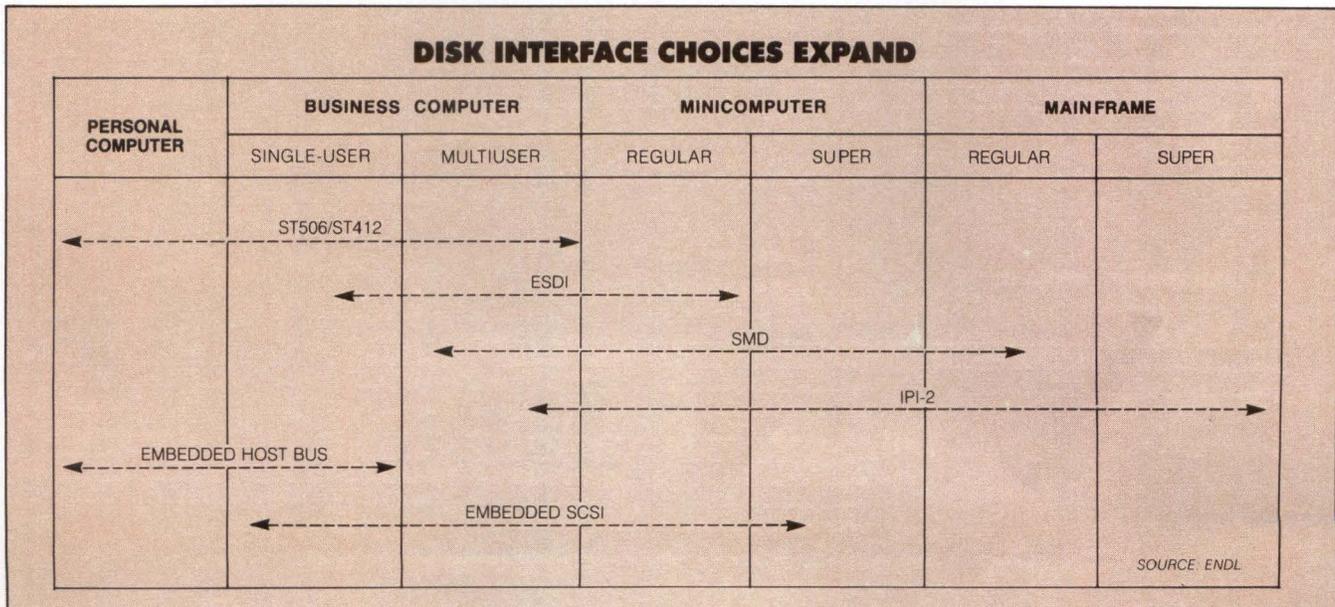
The majority of OEM disk drives are still sold for configurations in which there is one controller for each disk drive. An embedded SCSI drive is attractive here because the vendor has already addressed the system-integration problems of combining disk and controller.

SCSI, which is a host-level interface, has advantages over device interfaces because it provides buffered transfers, implicit error-correc-

tion/retry and a device-independent command set. These advantages don't imply, however, that device-level interfaces will disappear; only that new choices and decisions have to be made.

Despite the availability of new interfaces, "old" interfaces—specifically, SMD, ST506/ST412 and Pertec—dominate current shipments. This condition results from the usual two-year lag between a new product introduction and its volume shipments. Thus, system integrators must decide today which interfaces are going to dominate in the future.

Peripheral manufacturers face an equally difficult situation over the next few years as users upgrade to newer interfaces. Over the past several years, relatively little change took place in disk-drive interfaces: SMD and Pertec have endured as the mid- and high-range alternatives, while ST506/ST412 has dominated the low end.



But this situation will change dramatically because of user demands for higher performance and ease of use.

Peripheral vendors and OEMs must decide whether to incorporate new interfaces, controllers and software in new products or to try to continue using existing products.

ST506/ST412 remains the mainstay

First introduced on small, inexpensive Winchester, the ST506/ST412 interface is migrating up the performance and capacity scales. As long as data-transfer rate is not critical, ST506/ST412 is suitable for most applications.

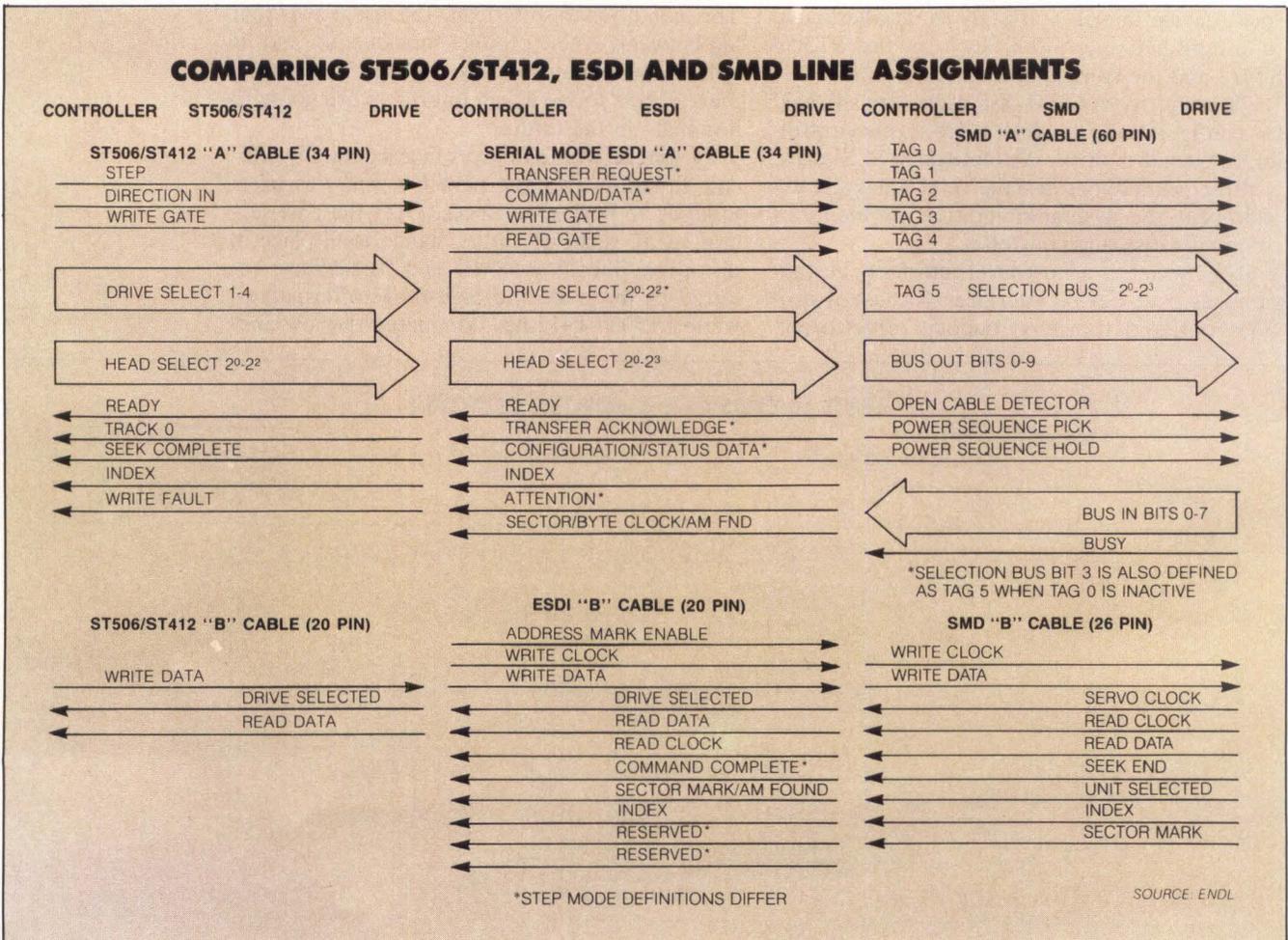
Several companies are shipping 85M-byte, ST412-based Winchesters, and Maxtor Corp. and Priam Corp. offer close-to-200M-byte drives with access speeds as fast as 20 msec. In many applications (especially UNIX-based), access time, actuator performance and rotational delay are more important than data-transfer rate. Unless the application calls for large block transfers, a data rate higher than the ST506/412's 5

MHz offers little performance improvement because of seek, latency and gap-processing times.

ST506/ST412 intermixes clock and data pulses to provide modified FM signals. Some controller manufacturers use run-length-limited (RLL) codes—such as 2,7—to increase bit density by 50 percent. However, the actual performance gain is influenced by a number of factors, such as the quality of the signals (only certain drives have sufficient margin to function with a 2,7 data separator) and increased susceptibility to defect errors. Thus, the effective capacity increase from a 50 percent improvement in bit density may be as low as 25 percent to 30 percent.

SMD serves high end

SMD has been extended with higher levels of functionality and faster data rates since it was first introduced in the early 1970s. Currently, extended versions are the HSMD and SMD-E, which typically deliver data-transfer rates of 2.4M and 3M bytes per second, respectively. To support a 3M-byte-per-second data rate, SMD-E



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uses emitter-coupled-logic (ECL) drivers and receivers. Nevertheless, some SMD-E interfaces with ECL drivers and receivers function at 2.4M- or 3M-byte-per-second data rates. The use of SMD-E or HSMD does not guarantee specific data rates.

This confusion makes it difficult to reference a specific variation of SMD. Thus, it is necessary to include information about extended functions such as tags 4, 5 and 6—as well as data rate—to clarify which implementation is being described.

It takes a long time for new products to overtake an installed base, and this is true of interfaces as well as of devices. No interface is

likely to supersede SMD in the high-performance Winchester market until the 1990s.

Two device-interface alternatives to SMD exist. One, IPI-2, is a parallel-transfer interface that provides 10M bytes per second at a distance of up to 50 meters. This exceeds SMD's rated maximum of 3M bytes per second at 15 meters. Initial shipments of IPI-2-based products will begin this quarter, but widespread availability won't emerge until the year-end.

The other alternative to SMD is ESDI and volume shipments are beginning to flow from several drive manufacturers.

ESDI, a hybrid of ST506/ST412 and SMD,

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ESDI, a hybrid of ST506/ST412 and SMD, offers data separation and commands within the limitations imposed by the ST412 electrical and cable connections.

offers data separation and commands within the limitations imposed by the ST412 electrical and cable connections. The intent behind ESDI is to take advantage of the installed base of ST506/ST412 with an interface that combines the advantages of SMD with the electrical characteristics of ST412.

To understand the advantages and disadvantages of ESDI relative to ST506/ST412 and SMD, it's helpful to look at the control and data cables of each interface.

ST506 comes with a 34-pin control cable and a 20-pin data cable, which is radially connected. However, relatively few pins are actually used by ST506. ST506 performance is limited by the speed of the step function; so buffered stepping has been added with the ST412, thereby enhancing performance with linear voice-coil disk drives.

SMD, on the other hand, uses a 60-pin control cable and a 26-pin data cable, radially connected. It has a BUS OUT of 10 bits, which are used for addressing cylinders and tracks (under different tags), and an 8-bit BUS IN for reporting status. The tags are used as control lines to indicate the contents of the bus.

ESDI uses more of the available lines than does ST412 to add data separation and tighter control. The interface transfers 16 bits of commands and status serially (including parity).

The biggest advantage ESDI has over ST412 is not that of throughput performance or capacity but of drive yields and data integrity. ESDI gives drive manufacturers greater control over the quality of the read/write chain. This advantage comes at a slight cost, though, because in a multiple-drive configuration, each drive includes a data separator, whereas only one would be needed if it were contained in the controller. However, the extra cost is compensated by improved ease of use.

ESDI provides rotational-position information on the control and data cables in the same manner as does SMD. A high-performance controller can monitor each radial cable for position while still serving another drive. In this way, the controller can select the drive that has the requested data in the shortest possible time.

Three variations of ESDI are employed: One uses a byte-clock scheme similar to that of ST412, in which a missing clock pulse signals that a sector has been located; another uses a soft-sectored approach with address marks; and the third is hard-sectored, in which the drive provides a pulse at the beginning of each sector. The dominant implementation of ESDI is expected to be the hard-sectored version because the byte-clock scheme is not suited to high-performance

applications, and address marks are not popular among users of the SMD interface.

Can ESDI overcome?

The question is whether ESDI will meet with widespread acceptance. Despite its increasing use, there is no obvious answer yet. Many of those who were zealots two years ago, when ESDI first came out, have become disenchanted with the long wait. Those who have invested money in the interface, however, are still enthusiastic.

Some system integrators who chose ESDI two years ago have switched to alternative interfaces for lack of requisite drives. Those who committed themselves to a design conceived around the 5¼-inch form factor were forced to remain with ST412 in its higher capacity versions. Others were forced to change the form factor of their product and incorporate an 8-inch SMD drive.

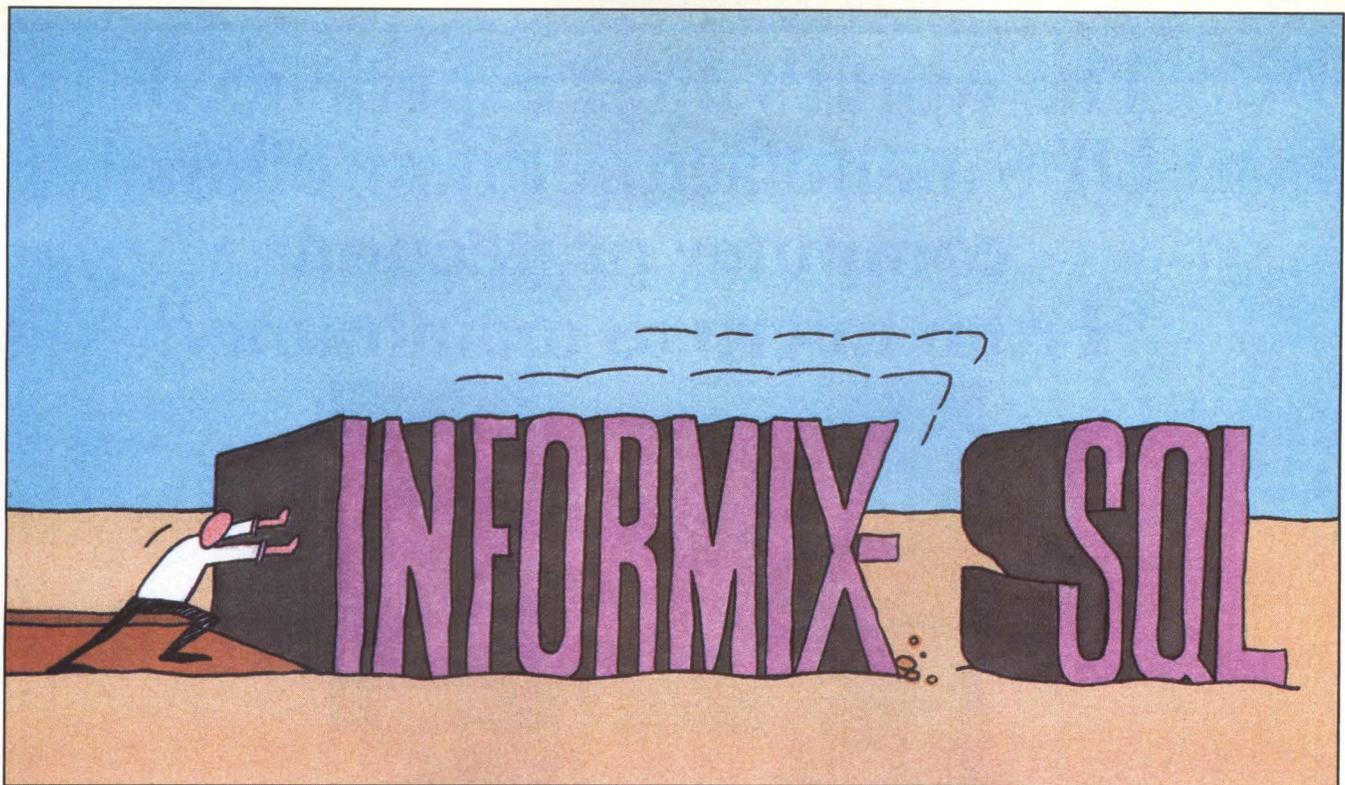
ESDI is the first interface to be implemented by controller manufacturers before the associated drives were available. Initial drive shipments were planned for mid-1984, but it was not until the third quarter of 1985 that units began to appear from multiple suppliers in evaluation quantities.

ESDI tape drives, on the other hand, are available in quantity and provide the ability to implement a disk/tape subsystem with a controller that has only one interface to support. This availability opens up applications for tape backup to disk and movement of data external to the host. It also reduces the cost of the controller because only one logic set is required for the interface, rather than two completely different ones, as required with SMD and Pertec interfaces.

Another peripheral incorporating ESDI is the 5¼-inch optical disk drive. Optical technology is extremely attractive because it offers the combination of high capacity and removability. The first-generation products use write-once technology, commonly referred to as write once, read many, or WORM (MMS, December 1985, Page 68). These WORM drives range in capacity from 100M to 800M bytes and use single-platter, removable cartridges.

ESDI was originally intended for one-controller/one-drive configurations, but embedded SCSI is easier to integrate in that environment. On the other hand, ESDI will succeed in configurations in which there are multiple drives or a mix of peripherals.

There is a large demand for ESDI but not necessarily for use with magnetic disks. A variety of ESDI peripherals other than disk drives are available or planned in the 5¼-inch form factor,



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including tapes (Electronic Processors Inc. and Fujitsu Ltd. are shipping ESDI-based tape drives) and optical disks (such as those from Information Storage Inc. and Optimum).

Peripheral families that use the same interface appeal to system integrators. But multifunction controllers must be developed to save money and thus spur significant market response. A combination of high-performance Winchester and high-capacity optical disks via a single controller (with a SCSI, Multibus or VMEbus) is particularly attractive because it marries the advantages of removability with the performance of Winchester. Similar advantages may also be gained from packaging ESDI tape drives with Winchester.

Erasable optical disks are "just around the corner" with evaluation shipments due this year. They too will adopt the 5¼-inch form factor and will also use ESDI. The configuration capability of ESDI, which permits peripherals to automatically identify their specific characteristics, is one of ESDI's key features.

Controller manufacturers are committed to ESDI and are enthusiastically marketing it as much as are the disk manufacturers. But the real

market demand for ESDI will become clear only after drive shipments appear in volume.

In the meantime, SMD has captured the market in those systems that could not wait for ESDI, and ST412 drives with expanded capacity and performance are attracting customers who are reluctant to adopt new interfaces.

ST412 has an edge over ESDI because it has a larger installed base of drives and controllers. However, ST412 does not offer data separation or automatic configuration, which are important to drive and controller manufacturers.

The advantage of SMD for systems is that it provides compatibility with current host-bus adapters and existing software implementations. On the other hand, ESDI has an advantage over SMD in that it is a general-purpose interface suitable for a number of applications. ESDI permits controllers to support a mixed environment of removable optical disks, fixed magnetic disks and removable magnetic tape. The "mix 'n match" capabilities will prove attractive to OEMs and system integrators. □

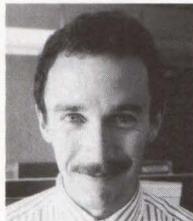
I. Dal Allan, the founder of ENDL, is the publisher of the *ENDL Letter*, which specializes in marketing and engineering consultation on interfaces and system architectures. He has been with IBM Corp., Sperry Corp. and Priam Corp. Allan is also vice chairman of ANSI Committee X3T9.3, which is responsible for the intelligent peripheral interface, and is the editor of the ESDI optical disk interface specification.

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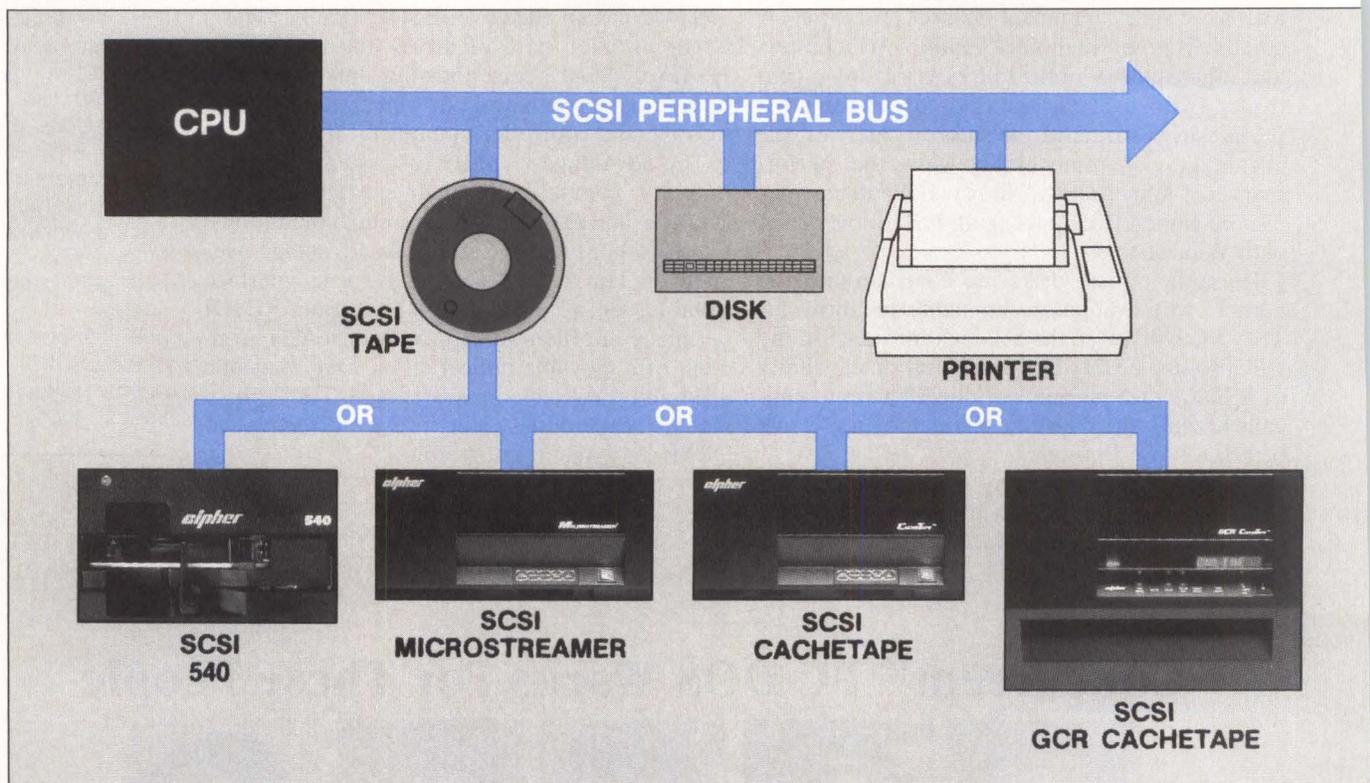
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CIRCLE NO. 43 ON INQUIRY CARD

The Cipher



Cipher announces SCSI-compatible 1/2-inch tape peripherals.

SCSI, known as the new standard interface for small, low-end computer systems, is also gaining ground in the high-performance market. With the continuing delay in the development of the Intelligent Peripherals Interface (IPI) for disks, SCSI has found its way into larger systems as well.

Cipher has taken the lead in bringing a full line of easy-to-integrate tape drives to this emerging marketplace. In addition to the 540S 1/4-inch streamer, three 1/2-inch products, the Microstreamer[®], CacheTape[®] and GCR CacheTape[®], are also available in SCSI-compatible versions.

SCSI enables integrators to use a single hardware interface, regardless of which drives are being used.

Cipher's SCSI option is a full implementation of the interface specifications being reviewed by ANSI. It offers all of the standard features found with most intelligent interfaces, plus ANSI-supported bus arbitration, disconnect/reconnect and copy command. Multiple initiator and multiple target features to improve tape management and backup efficiency are also included.

Cipher engineers can provide expertise to help you integrate tape drives into SCSI systems. For more information call 1-800-4-CIPHER, ext. 9.

Nixdorf cuts tape integration costs with CacheTape.

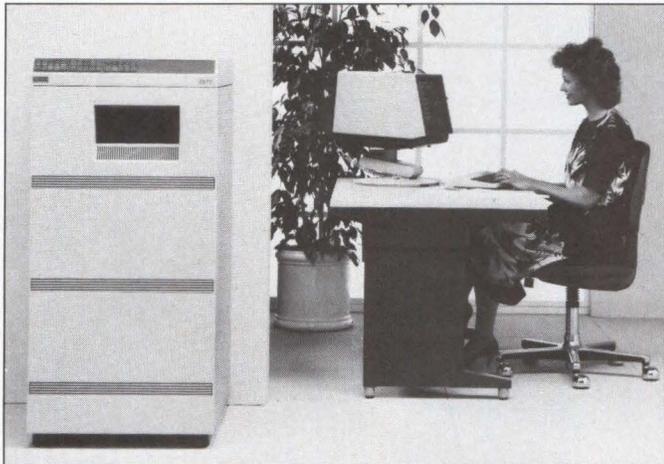
When Nixdorf Computer AG needed a new tape drive for their System 8850[™], their first choice was Cipher's Microstreamer. "It offered both streaming and 25 ips

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start-stop capability at a lower cost than the standard 25 ips drive we were using," said Rainer Muhlenweg, director of OEM product selection.

However, rather than spend time changing software to integrate the Microstreamer, Nixdorf found that Cipher's CacheTape could be integrated immediately, without modification.

"The intelligent cache memory enabled the drive's performance to be matched to that of the computer by managing the differences internally," said Muhlenweg. "And the additional cost of the cache memory was insignificant, compared to what the integration costs would have been without it."

As for the Microstreamer, Nixdorf will be using it in three other systems whose software already allows streaming.

Cipher introduces mainframe-to-PC connection.

If you have an IBM PC®, XT® or AT® you can now access 9-track tape. Just insert the tape into any Cipher Series 9000 ½-inch Tape Subsystem.™ From there, you can upload and download data directly with your PC.

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If you'd like to access 9-track tape with your PC, call 1-800-4-CIPHER, ext. 9.



CacheTape: The streamer for systems that can't stream.

Adding a streamer to systems that can't stream leaves integrators with a difficult choice. They can modify the software to fit the streamer. Or they can keep the software the same and sacrifice streaming performance.

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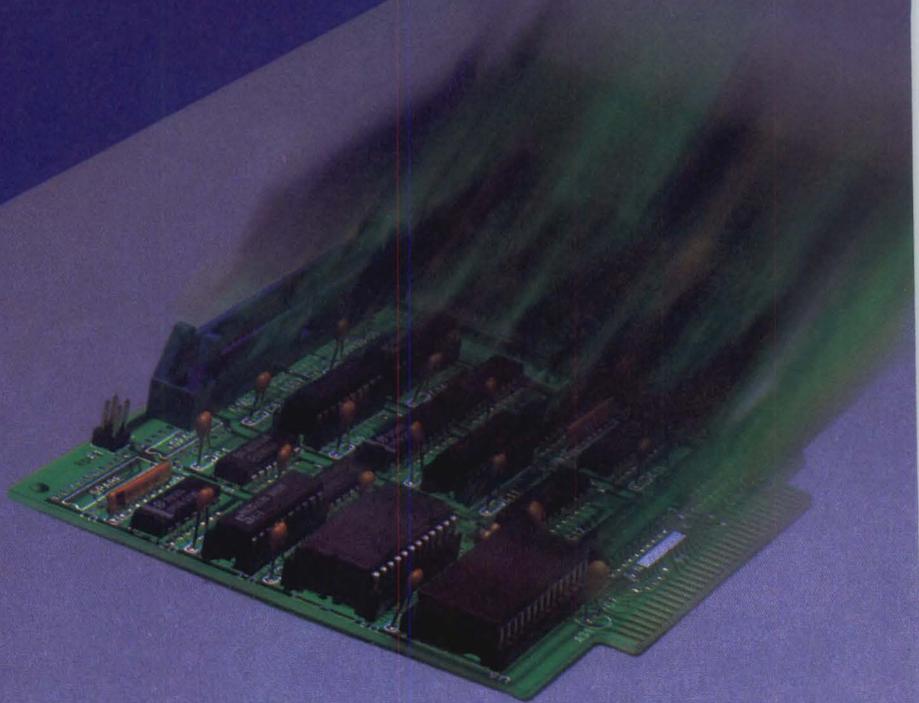
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CIRCLE NO. 45 ON INQUIRY CARD

SUPER-SCSI CONTROLLERS BOOST I/O PERFORMANCE

Need fast access to mass-storage devices for multiuser/multitasking computer systems? Consider controllers with bus disconnect/reconnect, command chaining and queuing capabilities

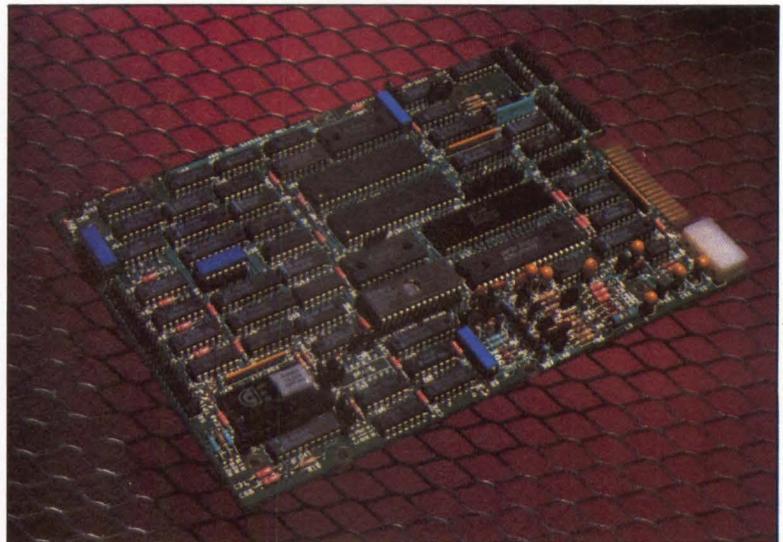
Jeffrey Fisher, Adaptec Inc.

The trend toward multiuser, multitasking computer systems requires system integrators to maximize the I/O performance of mass-storage rigid disk and tape-backup devices. Many single-tasking systems use the small computer systems interface to connect storage peripherals to the host computer bus and to reduce the execution time of I/O tasks.

The SCSI I/O subsystem employs a host-adaptor card, which provides an electrical interface and communications channel between the host CPU bus and the SCSI bus. Each host adapter can be daisy-chained to as many as seven intelligent peripheral controllers, each connecting one or more peripherals. Unfortunately, the basic SCSI interface implementation falls short in multiuser/multitasking environments.

For starters, a basic SCSI system queues all I/O requests one behind the other to be handled on a first-in, first-out basis. But this approach means that, if two users attempt to access two different disk drives, the second user must wait for the first user's task to finish before gaining access to the desired disk.

Because all I/O tasks must be executed serially, this situation creates a serious I/O bottleneck. In fact, most of the time a computer system spends in handling disk I/O involves physical movement—moving and positioning the read/write head over the appropriate rigid disk cylinder and track. And I/O performance is even more adversely affected when the SCSI bus also serves a tape subsystem. In this case, a user calling for rigid disk access must wait while another user is requesting a file to be read from a



slower tape drive.

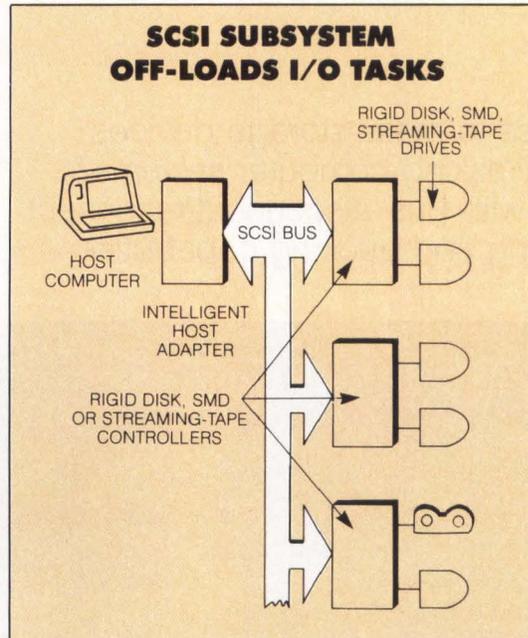
Meeting the performance demands of multiuser, multitasking systems has traditionally forced system integrators to specify costly, dedicated-bus peripheral controllers or design a proprietary controller. However, designing dedicated peripheral controllers can be a difficult task that requires expertise in digital and analog hardware as well as experience in multitasking microprogramming. And limited product availability or insufficient internal redesign effort could limit adaptation to changing peripheral technology.

In contrast, a multithread super-SCSI intelligent rigid disk controller, such as Adaptec Inc.'s ACB-5500, overcomes I/O bottlenecks by providing true concurrent I/O processing for multi-

Super-SCSI controllers reduce the execution time of I/O tasks including storage for multiuser, multitasking computer systems.

ple disks in multiuser, multitasking computer systems. To handle multiple I/O requests simultaneously, without burdening the host computer or reducing system performance, it uses bus disconnect/reconnect, command chaining with relative addressing, command queuing and bus arbitration capabilities. Although listed in the SCSI specification, these features are not implemented by single-tasking controllers.

The SCSI I/O subsystem comprises an intelligent host-computer adapter that off-loads I/O housekeeping operations from the CPU and connects the computer to the SCSI bus and to as many as seven rigid disk, streaming-tape or storage module device controllers.



To evaluate the advantages of a super-SCSI controller in a multitasking environment, consider what is involved in a typical I/O task. For example, reading two physically separated 512-byte sectors from a disk involves three basic delays: host computer and adapter processing, controller processing and disk seek and latency.

The disk seek is the longest task of the three. It ranges from an average of 30 msec for a high-speed, voice-coil positioning mechanism to 85 msec for a slower stepper-motor actuator. Taking all delays into account, the time a disk spends during a read operation extends from about 40 to 100 msec. And this delay can be multiplied by operating systems, such as UNIX, that maximize disk usage by physically scattering files over the disk.

Conventional SCSI controllers execute these operations serially, leaving the bus inactive during disk seeks. Although these single-tasking controllers allow for overlapped disk seeks, the host computer must poll the seeking drives to determine which completes the seek first. The computer must then issue a second command to access the data from the appropriate drive. The

result is slightly higher I/O performance but at the cost of valuable CPU time.

Super-SCSI disk controllers, on the other hand, provide for true concurrent I/O operations without host-computer overhead. Using the disconnect/reconnect function, they can disconnect from the SCSI bus during a disk seek, freeing the bus to transfer additional I/O requests to available peripherals. The controller reconnects to the host computer after the seek is completed and transfers data and/or indicates completion of the task. Although bus disconnection typically takes place during disk seeks, it also occurs during functions that don't utilize the SCSI bus, such as disk formatting, or verification.

A priority arbitration scheme resolves bus-contention problems that could occur, for exam-

Overlapped

Overlapped seek, as implemented by super-SCSI controllers, significantly shortens the delays involved in reading data from two rigid disk drives. Both overlapped and non-overlapped operations follow the same basic steps. The host computer's DOS passes an I/O request from an application program to the computer's basic input/output system. The BIOS generates a SCSI command block and passes it to the host adapter (1). The host adapter obtains the SCSI bus and transfers the command block to the disk or tape controller (2). The controller interprets the SCSI Read command and initiates the drive's seek (3). The disk seeks to the appropriate cylinder and the controller searches for the requested 512-byte sector (4). The controller transfers the requested sector through a dual-ported buffer and indicates completion of the task to the host computer (5). The host adapter passes a data pointer to the BIOS, which passes it to the DOS. The data is now available to the application program.

With non-overlapped seeks, the 512-byte read from drive B (and drive B's seek) must wait for the completion of the read from drive A. With overlapped seeks, however, a super-SCSI controller disconnects from the bus—freeing it for further activity—after it initiates drive A's seek. With the bus free, the host adapter can then pass on the second I/O request to read a 512-byte block of data from drive B. The controller can thus initiate drive B's seek milliseconds after drive A's seek.

ple, when a host computer attempts to initiate a command and a controller simultaneously attempts to reconnect to the bus. Each device connected to the bus is identified with a bus address of zero to seven. The device requesting the bus with the highest number gets access first.

A controller's ability to execute a string of disk requests without host-computer intervention improves multitasking performance. Super-SCSI's command-linking feature enables an application program to generate a series of commands for the controller to execute. The controller immediately executes each linked command as the preceding one is completed with neither bus-arbitration nor SCSI device-selection overhead.

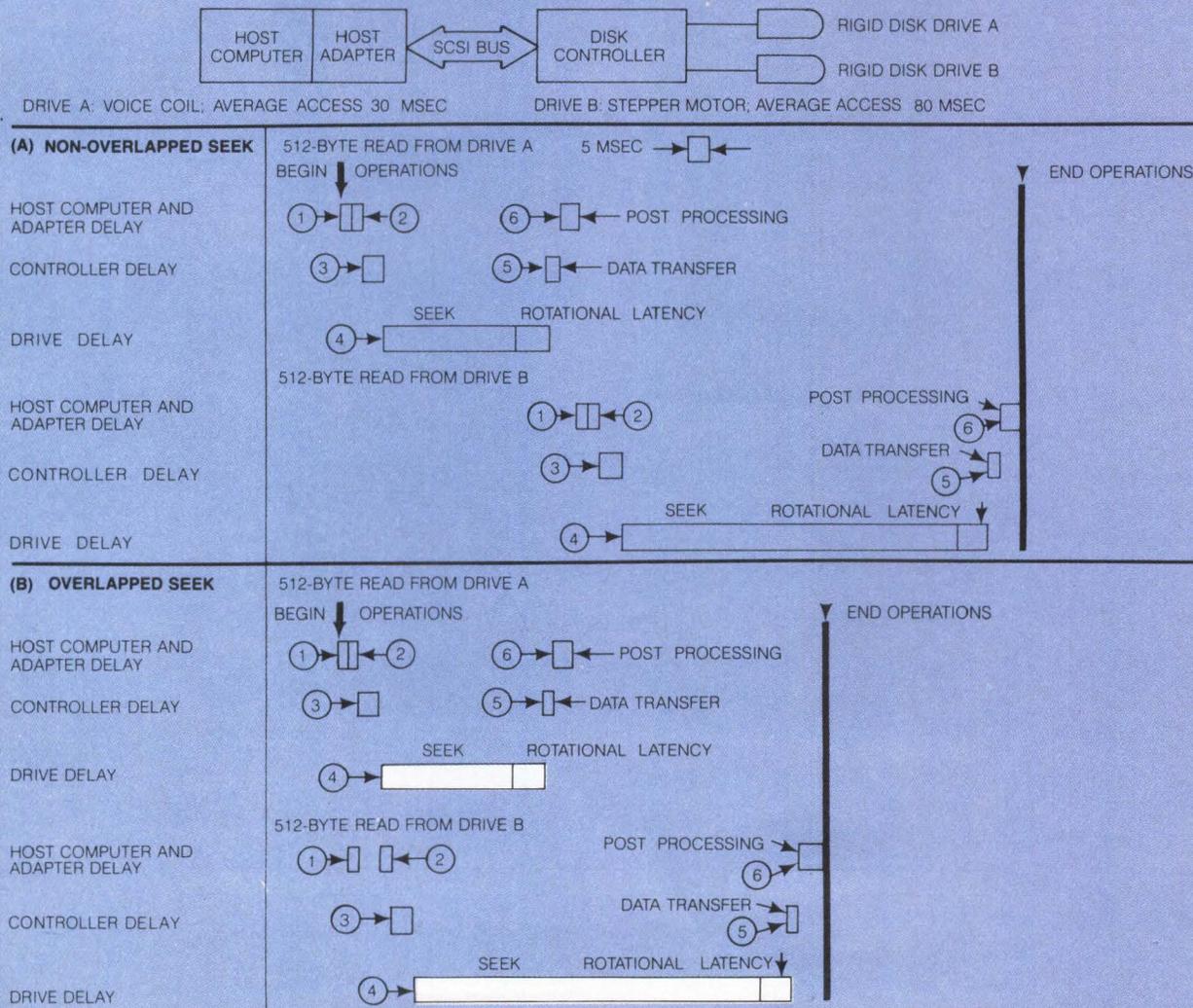
Command linking also allows system integrators to use relative addressing between com-

mands. Although the first operation of a series must address an absolute logical address in memory, all further linked operations can access logical blocks with addresses relative to the last block accessed.

The operating system can assure the integrity of protected areas of a disk by preceding a list of commands with a Set Limits command, indicating restricted areas on the disk. Any attempt to access the restricted areas causes the controller to terminate the command sequence and report an error to the host computer.

In addition to speeding I/O handling for memory access, a super-SCSI disk controller also furnishes significant advantages in backing up rigid disk files. Many users of multiuser computer systems are dissatisfied with conventional

seek reduces data-transfer delays



Super-SCSI capabilities ease rigid disk backup

The disconnect/reconnect and command linking capabilities of the super small computer systems interface controller speed the backup of scattered 8K-byte data from a rigid disk onto a streaming-tape drive. When the rigid disk controller disconnects from the SCSI bus after command processing, it frees the bus for further activity. This allows the streaming-tape controller to begin execution of the first 8K-byte write

to the streaming-tape-controller buffer after the controller completes the transfer of the first 8K-byte read.

Command linking permits a super-SCSI controller to automatically execute a series of commands—in this case 8K-byte reads from the rigid disk—without bus arbitration and without incurring SCSI bus selection overhead between commands.

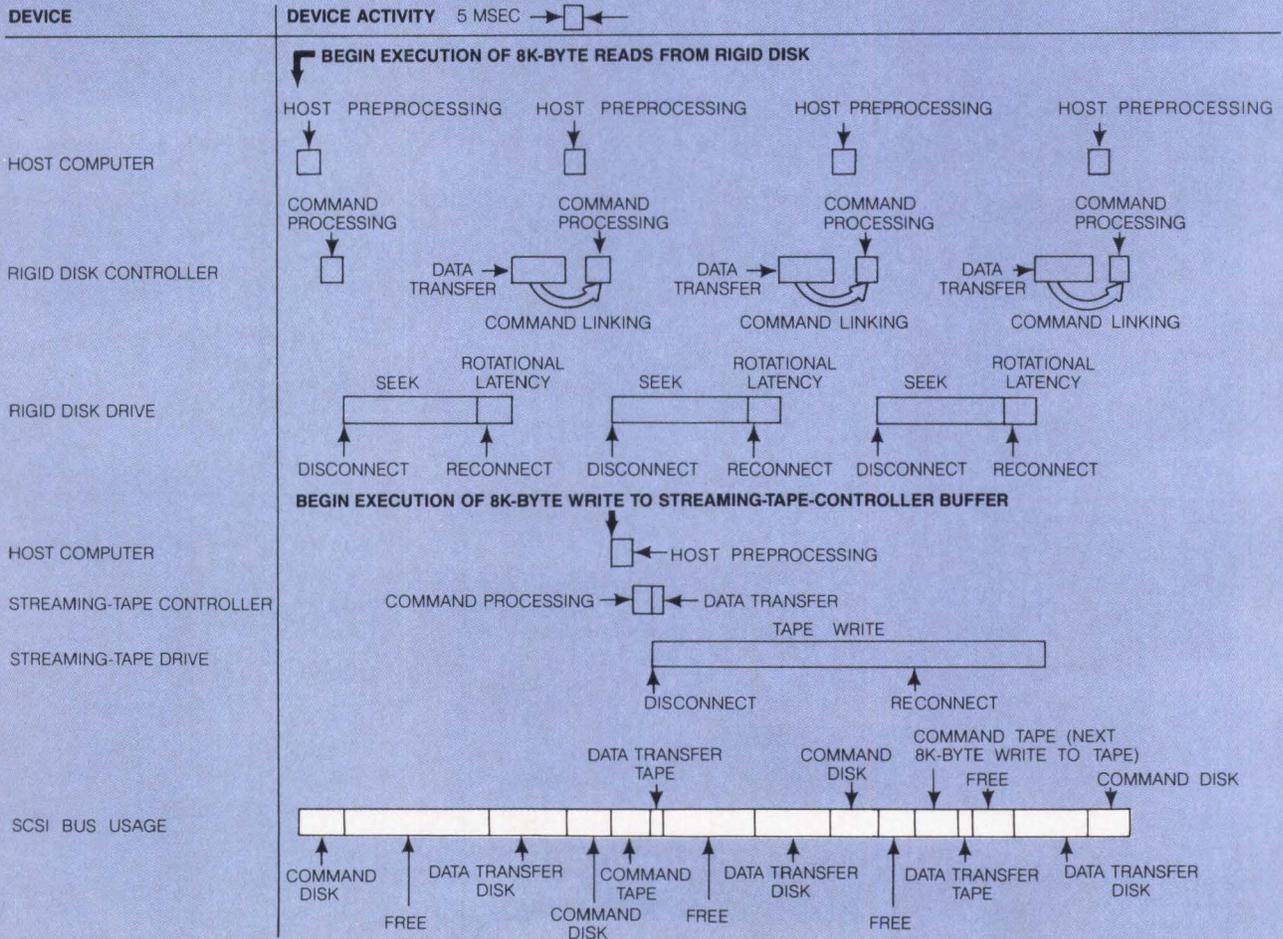
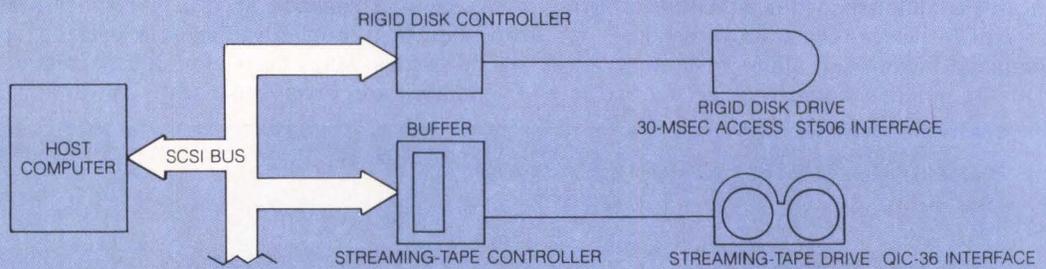


image backup of whole disks onto tape. They want to be able to back up individual files on transportable media. But because file backups may be required during peak system usage, execution time is critical for overall system performance.

Super-SCSI bus' disconnect/reconnect and command-chaining capabilities allow rigid disk backups to quarter-inch, cartridge-tape drives to be performed with little effect on overall system performance. Adaptec's disk controller and streaming-tape controller use linked reads of 8K blocks to implement the backup of a 100K-byte file scattered over a disk. The data is then written to the tape-controller buffer, which begins writing to the tape immediately and disconnects from the bus after the 8K transfer is completed.

While the controller is disconnected from the SCSI bus, the host computer has approximately 60 msec to read the next 8K bytes of file data before the disk controller reconnects to the bus to request additional data. After 12 such operations, the scattered 100K-byte file is stored contiguously on the streaming tape.

Multiple host computers connected to super-SCSI disk controllers can fully utilize bus band-

Spec summary

- **Manufacturer:** Adaptec Inc., 580 Cottonwood Drive, Milpitas, Calif., 95035 (408) 946-8600
- **Model:** ACB-5500 rigid disk controller
- **Host interface:** super-SCSI
- **Disk interface:** ST506
- **Disk data transfer rate:** 5M bits per second (bps).

- **Model:** ACB-5580 storage module device controller
- **Host interface:** super-SCSI
- **Disk interface:** storage module device
- **Disk data transfer rate:** 9.6M bps to 10.2M bps
- **Drives supported:** hard or soft sectored, fixed or removable, up to 16 read/write heads, up to 2,048 cylinders
- **Disks supported:** four
- **Block size:** 256, 512 or 1,024 bytes
- **Minimum sector interleave:** 1:1
- **Defect handling:** disk defects skipped on sector level

width in multiuser, multitasking systems. But multiple CPUs can compromise data security and cause device contention problems. Super-SCSI controllers minimize these problems through reserve/release and command-queuing capabilities.

The reserve/release function permits a com-

Why super-SCSI?

The small computer systems interface is derived from the Shugart Associates system interface (SASI). The SCSI interface is based on the concept of device independence, allowing system integrators to develop hardware and I/O software capable of running with "off-the-shelf" controllers and any type of peripheral. Device independence is achieved via logical block addressing and mode select, mode-sense and read-capacity commands.

Logical block addressing eliminates the need for the host computer to determine the data's physical location by dividing every storage device into disk sectors, each with a logical address starting at zero and incrementing to the last available block.

The mode-select command makes the host computer independent of attached peripherals by eliminating the necessity of configuring the peripheral controller at power-on. Transferring this command and disk-drive parameters before formatting the device causes these parameters to be recorded on the peripheral. The controller is then able to configure from the attached devices at power-on.

The read-capacity command permits the host computer to determine the maximum available block address and the last logical block of each cylinder. The latter information is useful in optimizing disk accesses

by sorting I/O requests by cylinder location.

Super-SCSI controllers provide a more complete implementation than SCSI devices of the ANSI X3T9.2 SCSI specification by furnishing bus arbitration and bus disconnect/reconnect features. Not supported by SCSI controllers, these capabilities allow super-SCSI controllers to execute multiple I/O tasks simultaneously and permit host computers to share peripherals.

The intelligent peripheral interface (IPI) is evolving to challenge the super-SCSI interface in high-performance minicomputer and supermicrocomputer applications. A standard mainframe I/O channel interface for IBM Corp. plug-compatible devices, it is being redefined by an industry working group for minicomputer and microcomputer systems. But as it now stands, IPI only offers 30 percent to 40 percent bus utilization (bandwidth) for I/O data compared with SCSI's 70 percent. And when data is scattered over disks, the interface's specified 3M-byte synchronous bus bandwidth is severely reduced.

The IPI supports only a single master host computer, multiple slave configuration—although multitasking can be supported by overlapping operations on more than one slave peripheral. In addition, the interface is expensive to implement due to the special I/O driver hardware and shielded cable required.

A controller's ability to execute a string of disk requests without host-computer intervention improves multitasking performance.

puter to reserve a group of logical blocks on attached peripherals, preventing another computer from reading from or writing to these blocks of data. Device contention is prevented by queued commands. In SCSI systems, a computer must continue to poll a busy peripheral until it determines that it is free to execute a task. Super-SCSI controllers and intelligent host adapters, in contrast, eliminate polling by accepting and queuing commands from multiple hosts to busy peripherals. The controllers disconnect from the bus and reconnect only when additional data is required.

Specifically, super-SCSI systems handle multiple overlapped I/O operations in the following manner. When a system computer generates I/O requests for access to peripherals, the requests are placed in the system memory allocated to the host adapter, freeing the multitasking CPU to perform other tasks. An interrupt from the super-SCSI host adapter indicates that requested data has been transferred into, or out of, memory. The controller manages all conversions from logical data blocks to physical locations on the attached peripherals.

As computers and disk drives increase in performance, I/O requests generated by multi-user, multitasking systems will require the full bandwidth of the SCSI bus: 1.5M bytes per second. Although systems capable of this level of performance will probably not become available for two to four years, the SCSI bus specification already contains the mechanism to enhance SCSI bus performance. Synchronous bus transfers will enable super-SCSI controllers to implement data transfers over the bus to 4M bytes per second, thus meeting the demands of the next generation of multiuser computer systems. □

Jeffrey Fisher is SCSI product manager at Adaptec Inc., Milpitas, Calif. He has a bachelor of science degree in electrical engineering from Purdue University and a master of business administration degree from the University of Santa Clara.

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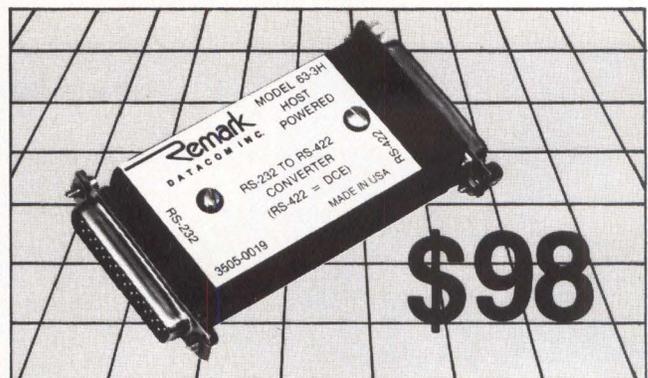


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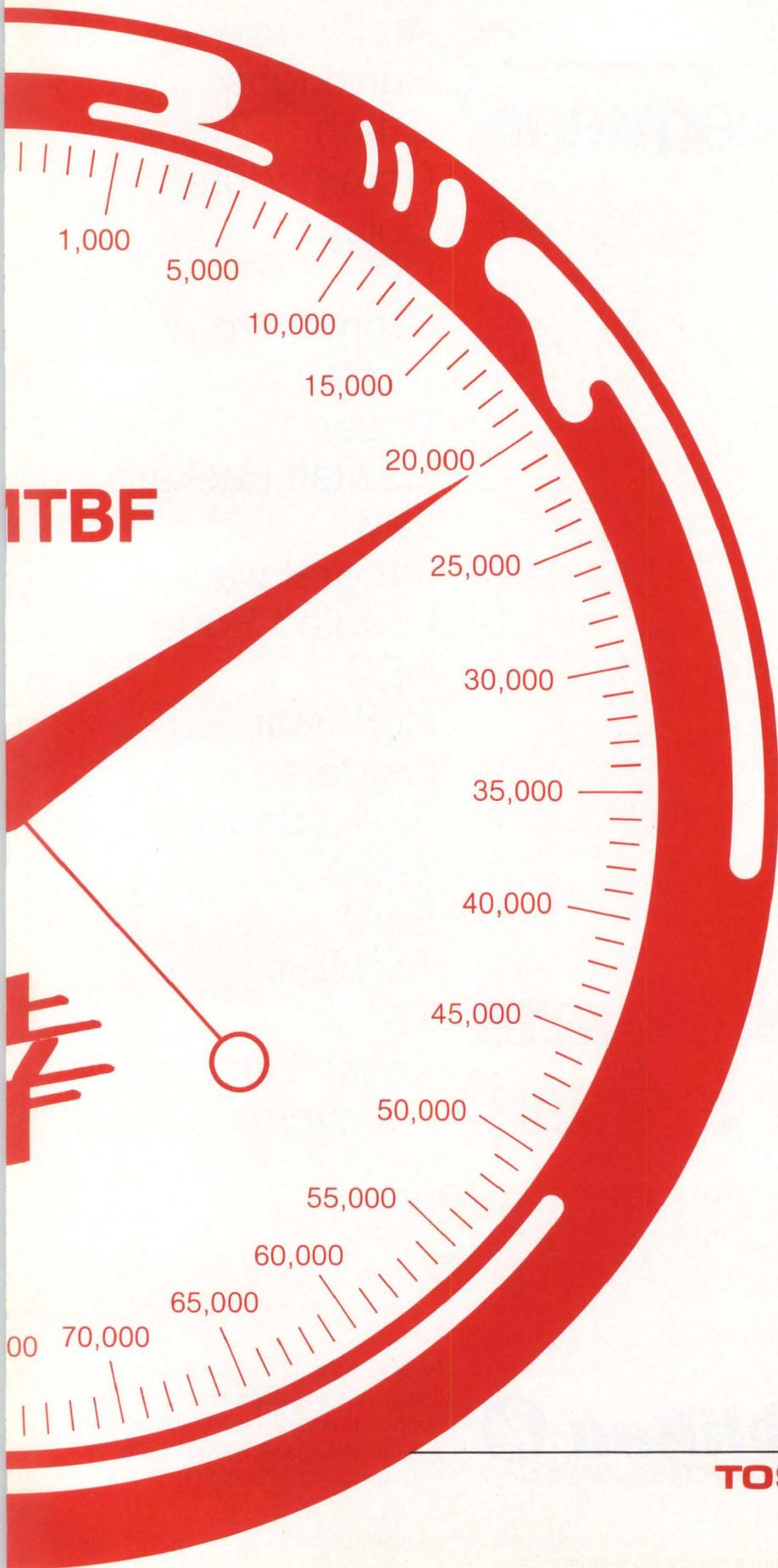
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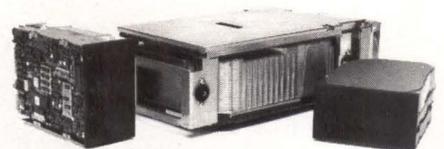
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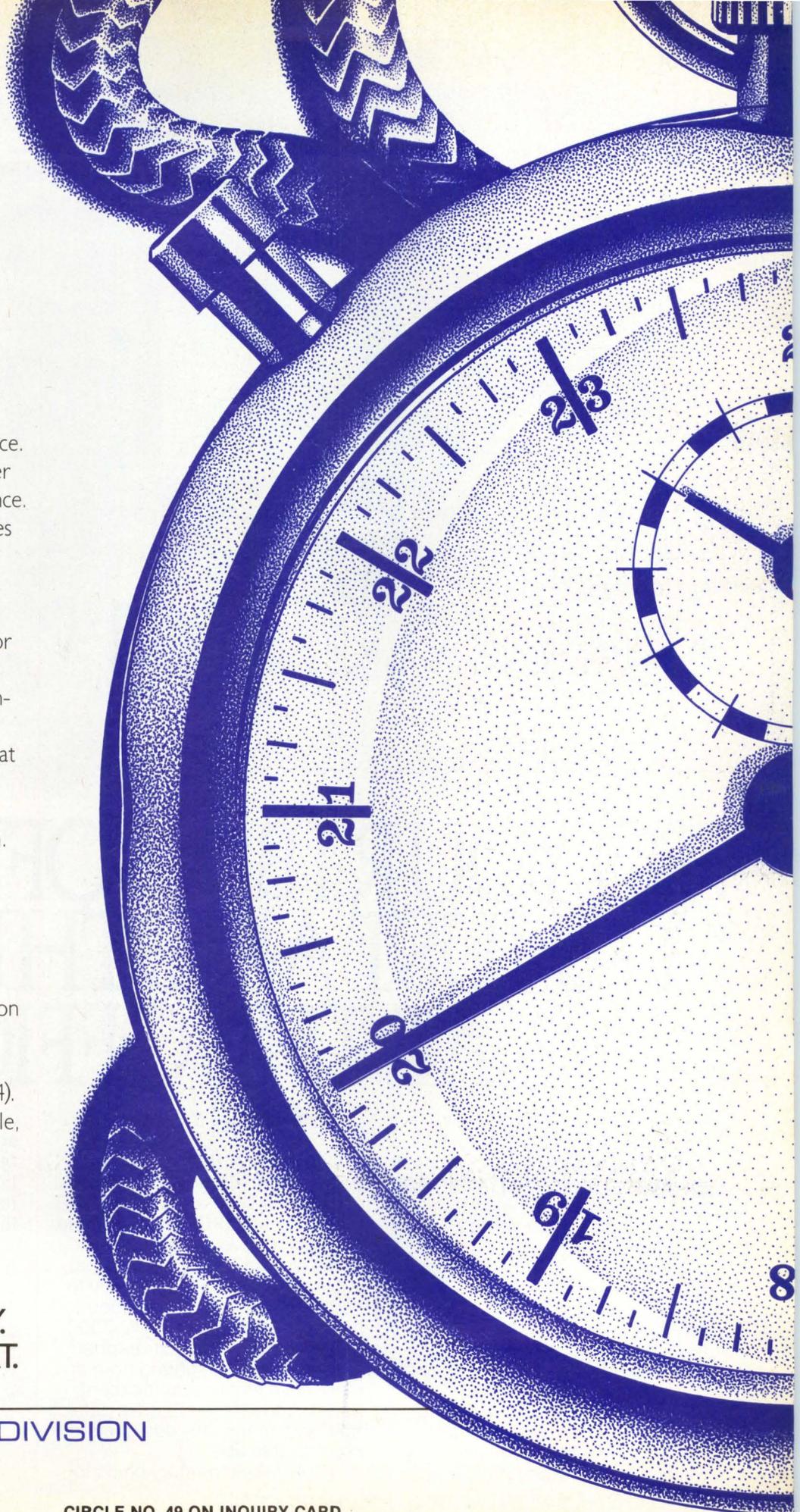
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CIRCLE NO. 50 ON INQUIRY CARD



COMDEX IN JAPAN: 'SHARE THE OPPORTUNITY'

The second annual conference seeks to turn the Asian computer-resale market into a global marketplace

Frances T. Granville, Associate Editor

"Share the opportunity; share the success" is the theme of the second annual Comdex in Japan conference and exposition, which will be held March 3 to 6 at the Harumi Exhibition Center, Tokyo. Show sponsor, The Interface Group, Needham, Mass., promotes the conference as Asia's only exclusively "reseller" event. The company sees it as a way for U.S. and European manufacturers and suppliers of computer hardware, software, peripherals and services to gain a foothold in the Asian market.

The show will emphasize business, financial and marketing issues relevant to independent sales organizations and will feature 20 sessions in which industry experts address those issues. Last year's show attracted more than 200 exhibitors from 19 countries and more than 40,000 attendees from all over Asia and 50 countries outside the continent. The Interface Group hopes to top those numbers this year.

Exhibitors will display computer systems, peripherals, software, media, supplies, services and accessories. Among the attendees will be computer retailers, distributors, system integrators, value-added resellers, commercial OEMs and dealers.

Among American companies that plan to exhibit are Datacom Northwest Inc., Everett, Wash.; Elgar Corp., San Diego; and Western



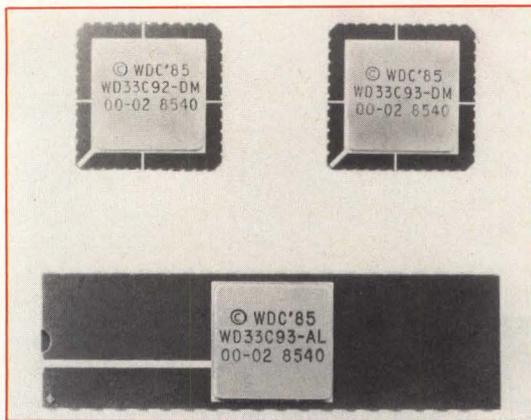
The 30-page-per-minute S3000 ion-deposition page printer was jointly developed by C. Itoh and Delphax.

Digital Corp., Irvine, Calif. Also exhibiting will be the Japanese parents of some U.S. companies, including C. Itoh Electronics Inc., Los Angeles. C. Itoh recently introduced the S3000 and S4500 ion-deposition page printers, aimed at OEMs and system integrators. The company jointly developed the printers with Delphax Systems, Westwood, Mass., and announced them at the Comdex/Fall show. The S3000 and S4500 print at 30 and 45 pages per minute, respectively, contain built-in diagnostics and print at 240 or

The Japanese character for "advantage" symbolizes Comdex in Japan.

和

Western Digital will exhibit its WD33C92 and WD33C93 single-chip SCSI controllers at Comdex in Japan.



300 dots per inch. Both printers have dual input trays and a 2,000-sheet capacity. C. Itoh will market the printers through distributor and retail channels. OEM-evaluation prices will be \$9,900 for the fully configured S3000 and \$11,900 for the S4500.

Western Digital plans to show the WD33C92 and WD33C93 single-chip small computer systems interface (SCSI) controllers, introduced at Comdex/Fall. The controllers implement such

SCSI bus features as arbitration, disconnect/reconnect, parity and synchronous data transfers as fast as 4M bytes per second, along with standard SCSI physical signaling. In addition, the company will exhibit its WD1003A-SCS SCSI-to-ST506 board, designed to support two compatible disk drives, and its enhanced small device interface (ESDI)-to-SCSI host board that supports as many as four disk drives. Western Digital will also show integrated drive/electronics chip sets and boards; a self-adjusting, flexible disk drive data separator with read/write support chips; an ESDI Winchester disk-controller chip set; a half-slot Winchester controller board for IBM Corp. PCs and compatibles and a self-adjusting, quarter-inch-cartridge—the (QIC) 36—streaming-tape data-separator module.

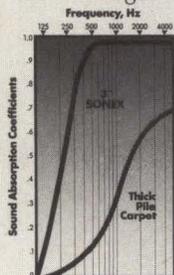
Elgar plans to exhibit its recently introduced fail-safe power supplies, and Datacom Northwest will show its hand-held test-and-measurement equipment. □

Interest Quotient (Circle One)
High 466 Medium 467 Low 468

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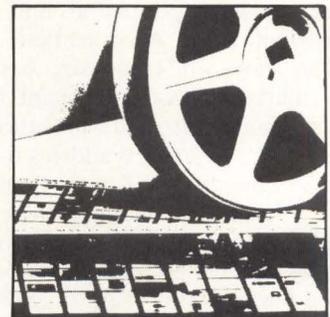


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CIRCLE NO. 51 ON INQUIRY CARD

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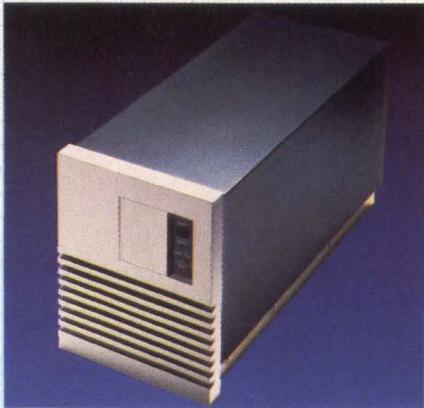
CIRCLE NO. 52 ON INQUIRY CARD



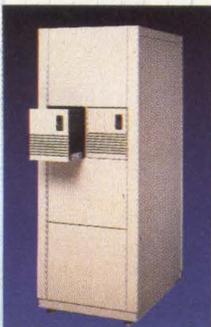
ADDING VALUE TO OEM SYSTEMS THROUGH COMPACT HARD DISKS

HITACHI DK SERIES WINCHESTER DISK DRIVES

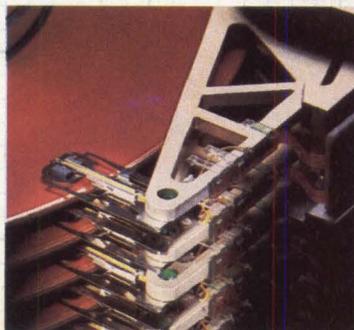
■ Hitachi's line of compact Winchester disk drives embraces 3.5-, 5.25-, 8- and 8.8-inch disk families, each offering a range of capacities up to the highest yet delivered in its class. The line thus offers the OEM the maximum flexibility in making cost/capacity tradeoffs to meet the needs of systems ranging from portable computers to high-performance CAD/CAM workstations. The use of voice-coil technology and high-speed circuits results in access times and transfer rates matching or bettering those of competitive drives. Hitachi drives employ industry-standard interfaces to simplify systems integration. The inherent ruggedness of sealed disk technology and the application of strict quality control standards at every stage of manufacturing and assembly assures that Hitachi disk drives will operate reliably for years in demanding environments such as offices and engineering laboratories.



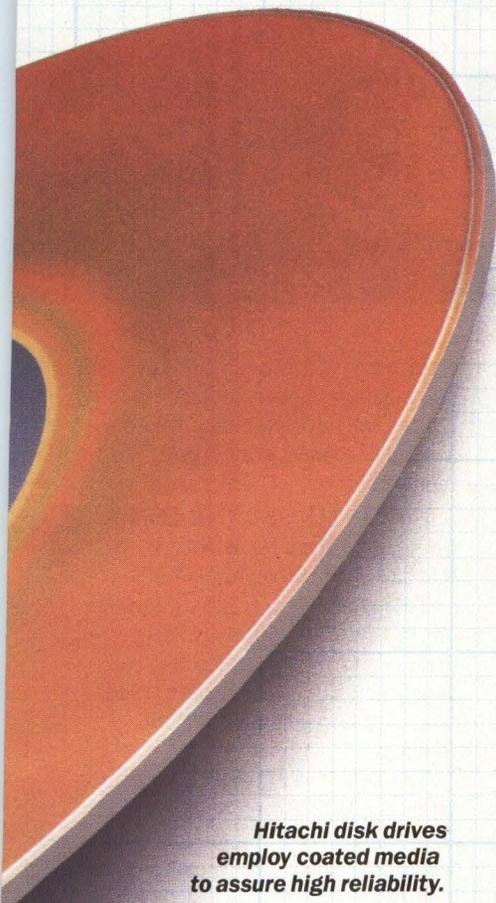
■ The DK815-5 drive employs a high-precision voice-coil actuator and spindle, new high-density read/write circuitry and high-performance 8.8-inch coated disks to squeeze 525 megabytes of unformatted storage capacity into a unit small enough to fit into one-half of a 19-inch rack. The drive, which employs an enhanced SMD interface, has an average access time of 18 milliseconds.



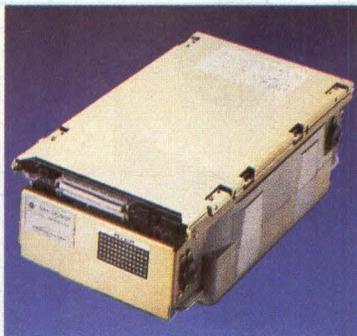
■ By employing two DK815-5 units and a Hitachi controller, you can package a computer and over 1 gigabyte of disk memory capacity in a single 19-inch equipment rack, eliminating the need for an expensive and power-hungry stand-alone drive.



Hitachi disk drives offer extremely fast access times—as fast as 18 milliseconds—thanks to the use of a microprocessor-controlled voice-coil actuator to position read/write heads.



Hitachi disk drives employ coated media to assure high reliability.



■ The DK812S Series and DK814S Series of 8-inch disk drives encompass units having unformatted storage capacities ranging from 51 to 340 megabytes. The SMD-compatible DK812S and ESMD-compatible DK814S Series drives have average access times of 25 and 20 milliseconds, with 1.2- and 1.8 megabyte-per-second transfer rates, respectively.



■ The DK511 (ST506/412) and DK512 (ESDI) Series of 5.25-inch disk drives comprise units having unformatted storage capacities ranging from 36.4 to 172.3 megabytes. Average access times are 23 milliseconds for the DK512 Series and 30 milliseconds for the DK511 Series (23 milliseconds for the DK511-8, which offers 85 megabytes of storage). Transfer rates for the two series are 1.2 and 0.625 megabytes per second, respectively.



■ The DK301 Series of 3.5-inch disk drives encompasses two units having unformatted storage capacities of 12.7 and 19.1 megabytes. These drives offer the industry-standard ST506/412 interface, and offer Hitachi quality storage devices that are ideal for portable and personal computing systems.

How Hitachi Hard Disks Can Enhance the Value of OEM Systems

In the hotly competitive OEM systems market, the name of the game is to increase a system's ease-of-use and functionality while reducing its cost. One way to do this entails increasing a system's storage capacity without increasing its physical size. Therefore, Hitachi has created a new line of compact Winchester disk drives having remarkable storage capacity. For example, you can use two of our DK815-5 8.8-inch disk drives to squeeze over 1 gigabyte of unformatted storage capacity into one shelf of a standard 19-inch equipment rack.

Our DK301 Series 3.5-inch drive is the same size as a microfloppy, yet it can store as much as 19.1 megabytes of data. Our line also includes 5.25-inch and 8-inch disk drives with capacities from 36 to 340 megabytes, giving you the widest possible choice of Winchester products, all from one vendor.

Increased memory capacity is of little benefit if it results in low drive performance. Hitachi's high-performance drives, utilizing voice-coil actuators, high-speed circuitry, and state-of-the-art interfaces, minimize access times and maximize transfer rates.

Unreliable disks can ruin an OEM system vendor's reputation. So we make and assemble all the components of our drives ourselves, applying the strictest possible standards of quality control. Our attention to quality yields demonstrable results: a 20,000-hour MTBF rate for all our drives.

Hitachi America, Ltd.

Peripheral Systems Marketing Department
Computer Sales & Service Division
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HITACHI®

CIRCLE NO. 53 ON INQUIRY CARD

MULTIPLE CHOICE:

Now DILOG gives QBus users even more disk controllers to choose from. These new models contain the latest DEC emulations, and are compatible with 11/23, 11/23+, 11/73, Micro PDP-11 and MicroVAX computer systems.

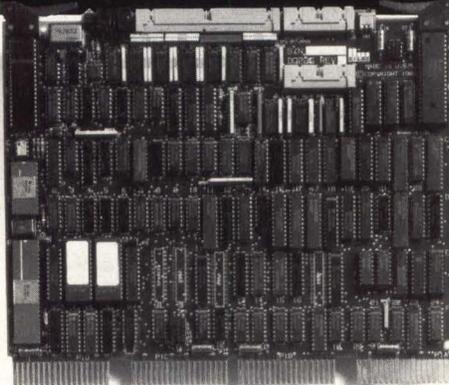
Another important feature is DILOG's Universal Formatting. It allows you to connect different types of drives to the same controller, without having to use special configuration components.

1. New DU driver compatible 2.5 MB/SEC SMD/ESMD disk controller.

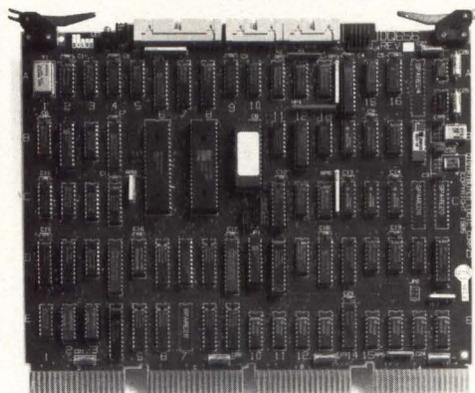
DILOG's DQ226 interfaces one or two 8", 9", 10" or 14" SMD/ESMD disk drives. Compatible with RT-11, RSX-11, RSTS and MicroVMS, it gives you 22-bit addressing and functions with both block mode and non-block mode memory. Data integrity is kept in place with 56-bit ECC, coupled with advanced error recovery routines and the storage capacity is only limited by the drive itself. With over two gigabyte capacity, our controller will grow with your requirements.

2. New DU driver compatible 1.4 MB/SEC ESDI disk controller.

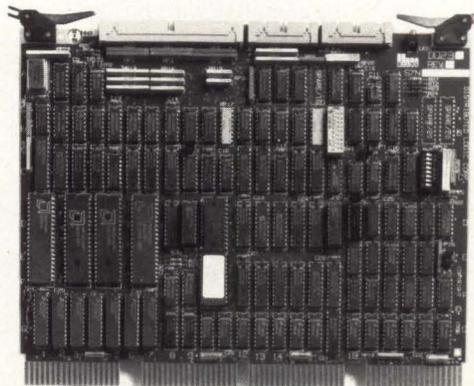
Compatible with RT-11, RSX-11, RSTS and MicroVMS, DILOG's DQ656 interfaces one or two 5 1/4" ESDI disk drives. It gives you 22-bit addressing and functions with both block and non-block mode memory. Data integrity is kept in place with 32-bit ECC, coupled with advanced



1. 2.5 MB/SEC SMD/ESMD Disk Controller. (DU Driver Compatible.)



2. 1.4 MB/SEC ESDI Disk Controller. (DU Driver Compatible.)



3. 2.5 MB/SEC SMD/ESMD Disk Controllers. (RK06/07, RM02/03/05/80 or MicroVMS Compatible.)

error recovery routines. With over two gigabyte capacity, storage is only limited by the drive, enabling our controller to meet your future requirements.

3. New 2.5 MB/SEC SMD/ESMD disk controllers for RK06/07, RM02/03/05/80 or MicroVMS.

This group of controllers interfaces one or two 8", 9", 10" or 14" disk drives. For error recovery, they contain 56-bit ECC, in addition to read retries that keep data integrity in place.

The DQ235 is for RK06/07 drivers, while the DQ238 works with RM02/03/05/80 drivers. The MV230 is for MicroVMS applications and includes a software driver that configures each attached disk drive as one logical unit.

Complete support.

When you go with DILOG, you get more than just a board. There's technical assistance via telephone, a controller board loaner service, on-site customer support, complete documentation, and rigid quality control standards. That's why DILOG has shipped over 50,000 disk and tape controllers to some of DEC's best OEMs.

DILOG has put more high performance peripheral controllers on the QBus than anyone else. Shouldn't we be your choice?

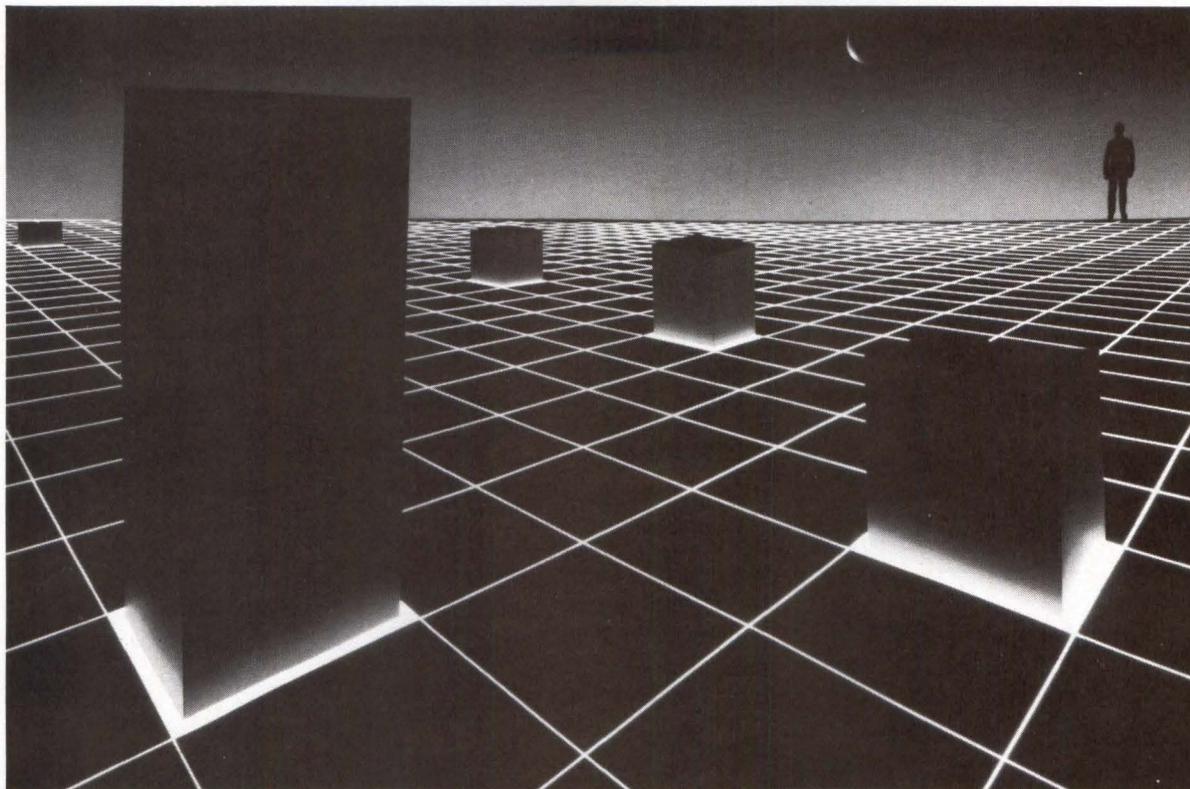
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If all you want is a disk drive, you're looking at the wrong ad.

At long last, a few companies have figured out how to make Winchester drives like Maxtor's. But they still haven't figured out how to duplicate the company that makes Maxtor drives.

Which makes all the difference.

You see, every drive we sell comes with a partnership. We work with you as your product takes shape. Your requirements become ours. Your deadlines become our deadlines. Even our new products are developed in response to your expressed needs.

That's how we became the leading manufacturer of the highest quality, highest capacity 5¼-inch drives. And that's how we'll keep our lead. Because what you're buying isn't just a disk drive.

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Sales Offices: Austin, (512) 345-2742; Boston, (617) 872-8556;
Orange County, (714) 859-3100; San Jose, (408) 435-7884.

Maxtor

CIRCLE NO. 67 ON INQUIRY CARD



NEW PRODUCTS

SYSTEMS

Megan Nields, Assistant Editor



Personal computer supports nine users

- 512K-byte memory
- XENIX System V
- 16 colors

Supporting the XENIX System V operating system, the PC/IT personal computer uses the Intel 80286 processor and the IBM PC/AT, 16-bit, open-architecture standard. The system handles up to nine users and comes with 512K bytes of memory, expandable to 1M byte, and two RS232C communication ports. It accommodates two 44.6M-byte, rigid disk drives. A 60M-byte tape storage device can be added. Switch selection permits operation at 6, 7.16 or 8 MHz. The monitor displays a range of 16 colors at one time from a total palette of 256 colors in either 640-by-200 or 640-by-400-dot resolution mode. \$6,834. **Sperry Corp.**, P.O. Box 500, Blue Bell, Pa. 19424, (205) 542-4213.

Circle 300

Supermicro runs at 2.1 MIPS

- UNIX-based
- 32-bit
- 2M-byte memory

The UNIX-based Model 1640 supermicrocomputer incorporates three 32-bit, tightly coupled microprocessors that split network communication, file

and application processing. It operates at 2.1 MIPS. Supporting up to 26 local users, the system comes with an application processor with 2M bytes of main memory, a communications processor with 0.5M bytes of memory, a storage processor with 0.5M bytes of memory and a 52M-byte, Winchester disk drive and an 80M-byte streaming tape drive. The system supports 12M bytes of main memory and 572M bytes of disk storage. \$18,500. **Datamedia Corp.**, 491 Amherst St., Nashua, N.H. 03063, (603) 886-1570.

Circle 301

Workstation aids office automation

- 1M-byte memory
- 84M-byte storage
- 16-bit microprocessor

Providing office-automation capabilities such as word processing, business graphics and spreadsheet analysis, the Performer desktop workstation employs an Intel 80186 16-bit microprocessor and stores up to 84M bytes. Internal memory of 1M byte is obtained via 256K-byte expansion cartridges. The workstation employs a 5¼-inch flexible disk and one or two 10M-byte disk-expansion modules. The unit comes with a detachable keyboard and a 12-inch monochrome monitor. Six workstations may be grouped in a local network. \$3,545 to \$11,584. **Prime Computer Inc.**, Prime Park, Natick, Mass. 01760, (617) 655-8000.

Circle 302

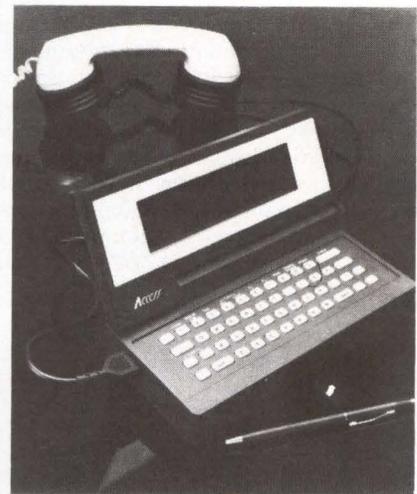
Supermicro suits multiuser tasks

- 4M bytes of memory
- 68020 microprocessor
- Eight serial, two parallel ports

A multiuser, multitasking supermicrocomputer, the P80/20 uses the Motorola 68020, 12.5 MHz microprocessor. The unit has eight serial and two parallel ports and delivers 3 MIPS. No-wait-state memory modules of 1M, 2M and 4M bytes are offered, as well as a total capacity of 16M bytes of no-wait-state or

one-wait-state memory modules. Operating under UNIX System V, the system supports virtual-memory hardware. Features include a half-inch, 9-track tape drive and up to 0.5G bytes of Winchester storage. \$23,500. **Pixel Systems Inc.**, 300 Wildwood Ave., Woburn, Mass. 01801, (617) 933-7735.

Circle 303



Portable computer targets VARs

- 64K bytes of memory
- Bit-mapped graphics
- 8-bit CMOS microprocessor

One third the size of notebook computers, the ACCESS portable computer and remote terminal offers up to 120K bytes of storage and 64K bytes of plug-in memory. The unit provides a 40-character-by-8-line LCD with bit-mapped graphics for word-processing and file-management applications. Based on an 8-bit CMOS microprocessor, the unit employs a 49-key ASCII keyboard with programmable function keys to generate 640-by-240-pixel dot-matrix graphics. An interactive terminal as well as a portable database, the system connects to remote computers, electronic-mail networks and corporate mainframes. Features include a serial interface and a 300-baud modem. \$499 to \$995. **Melard Technologies Inc.**, 5 Westchester Plaza, Elmsform, N.Y. 10523, (914) 592-3044.

Circle 304

NEW PRODUCTS PRINTERS

Laser printer offers four emulations

- 128K-byte memory
- 12 fonts
- 300 dpi

An 8-ppm laser printer with 300-dpi resolution, the model 810 comes with 12 fixed-pitch fonts. These include four IBM Selectric-style fonts (Letter Gothic, Prestige Elite, Courier and Orator), two DEC technical scientific/math fonts, two DEC VT100 line-drawing fonts, a landscape sans serif line printer font and three Epson model FX-80 fonts (Epson Pica, Epson Elite and Epson Compressed). Four printer-emulation modes are Diablo 630 ECS, Qume Sprint, Epson FX-80 and ANSI 3.64. Bit-map memory for Epson FX-80 and ANSI raster plotting is 128K bytes. Down-line-loaded font and overlay storage is 80K bytes of dynamic RAM, permitting up to five fonts to be loaded at a time. \$3,850. **Talaris Systems Inc.**, 5160 Carroll Can-

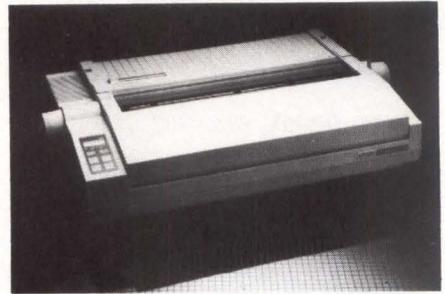
yon Road, P.O. Box 261580, San Diego, Calif. 92126, (619) 587-0787.

Circle 310

Daisywheel offers 200 character sets

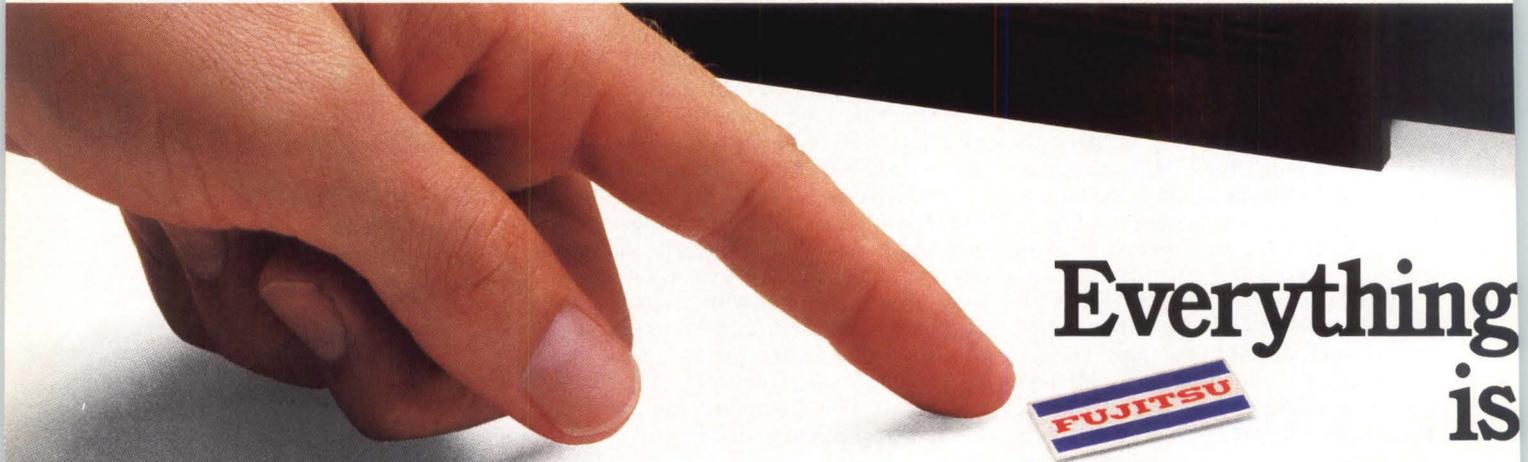
- 55 dB(a)
- 8K-byte buffer
- Diablo, NEC compatibility

Printing 35 cps in 10 pitch, the Premiere 35 letter-quality, daisywheel printer operates at a 55-dB(a) noise level. Operating bidirectionally, the unit produces 136 cpl in 10 pitch, 163 cpl in 12 pitch and 204 cpl in 15 pitch. It offers switch-selectable software compatibility with the Diablo 630, the NEC 3550 and the Qume Sprint 11+. Features include an 8K-byte buffer; selectable proportional spacing for typeset, justified appearance; push-feed, variable-width tractor and automatic paper-loading system; user-in-



terchangeable interface cartridges for hardware coupling; and LCD of print functions and error messages in English. The unit provides 200 available character sets, 18 languages and special scientific, mathematical and legal characters. Protocols supported include DTR, ETX/ACK, DCI/DC3 and X-on/X-off. \$599. **Citizen America Corp.**, Suite 300, 2425 Colorado Ave., Santa Monica, Calif. 90404, (213) 453-0614.

Circle 311



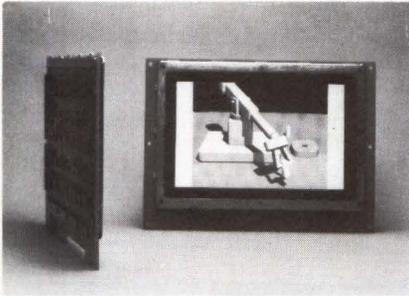
Throughout the disk drive industry, the Fujitsu name stands for proven technology, superior performance and unmatched reliability.

Throughout the world, the name represents a company that comes through with products instead of promises.

And when it comes to 5¼" Winchester disk drives, Fujitsu America has a new 172MB drive, with units available today for your evaluation.

It's the newest member of our 5¼" disk drive family—and it's based on the same proven technologies. It's fully compatible with industry standards. And it gives you a significant price/performance advantage.

This drive represents a major step in the evolution of your multi-user system. And Fujitsu America has the technology, the strength and the experience to help you continue on that growth path.



Flat-panel display is 0.55-inches thick

- 83 lines per inch
- 35 active inches
- 640 by 200 pixels

The EL8358 M is a 640-by-200 individually addressable pixel, electroluminescent flat-panel display. Providing a resolution of 83 lines per inch with a 5-by-7-inch active matrix area, the unit facilitates graphics, text and utility soft-

ware created for MS-DOS-compatible computers. The monitor is 0.55-inches thick, and suits personal computer and industrial control applications. Features include driver/control electronics, bezel and a two to one pixel aspect ratio. \$775. **Planar Systems Inc.**, 1400 N.W. Compton Drive, Beaverton, Ore. 97006, (503) 629-2006.

Circle 312

Terminal emulates DEC, Tektronix units

- 1,024 by 720 pixels
- 4,096-color palette
- 14-, 19-inch monitor

Providing DEC VT52, VT100, VT220 and Tektronix emulation, the ID 1024 graphics terminal displays 1,024 by 720 pixels from a 4,096-color palette on a 14- or 19-inch screen. The unit offers 16 levels of zoom, up to eight view ports, RS343 video and a 512K-byte display-list memory. Graphics functions include a



full set of graphics drawing primitives and multiple alphanumeric sizes and angles. The terminal supports 96 ASCII characters, ANSI X3.64 protocol, 64 control characters and reverse video. Additional features are independent graphics and alpha planes, multipage editing, pan, serial/parallel printer support and an external cursor-control port. \$6,995, 19-inch; \$4,995, 14-inch. **ID Systems Corp.**, 6175-W. Shamrock Court, Dublin, Ohio 43017, (614) 766-0440.

Circle 313

this name represents built into these 5 1/4" drives.

So no matter what capacity 5 1/4" drive you need, you can be sure of its performance, reliability and delivery. We keep close control of all three by manufacturing virtually every component of our drives ourselves. And we recently opened a plant that adds 220,000 square feet to our 5 1/4" and 3 1/2" manufacturing capacity.

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We're developing technology for you.

Model	M2233	M2235	M2243	M2246E
Capacity (MB) (unformatted)	13	27	86	172
Access Time (msec)	95	83	33	25
Interface	ST506/412	ST506/412	ST506/412	ESDI
Transfer Rate (KB/sec)	625	625	625	1250
Technology	Composite ferrite heads, Oxide media			



CIRCLE NO. 68 ON INQUIRY CARD

FUJITSU AMERICA

IEEE-488



GPIB ↔ PC

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 - 300K bytes per second
 - \$395 complete with software
- High performance data links
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Other IEEE-488 Products

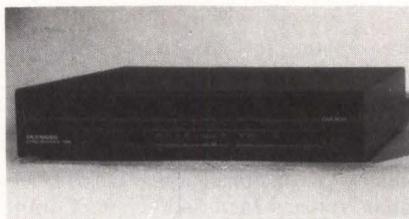
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CIRCLE NO. 69 ON INQUIRY CARD

NEW PRODUCTS DATACOMM



Multiplexer runs at 19.2K bps

- 9.6K to 64K baud
- six inputs
- three interfaces

The DCP9050 synchronous time-division multiplexer combines up to six inputs for transmission over the Data-telephone Digital Service network. It operates at switch-selectable baud rates of 9.6K, 14.4K, 19.2K, 56K or 64K. The unit comes with RS232C, RS422 and V.35 link interfaces. Each input channel is individually programmable for operating parameters including speed and timing options. These parameters are set using DIP switches on the local DCP9050 and the speed is automatically down-line loaded to the remote, unattended unit. Built-in pattern generator transmits test messages. Individual channels may be looped back, locally or remotely. \$2,150. **Datatel Inc.**, Data Communications Products, Cherry Hill Industrial Center, Cherry Hill, N.J. 08003, (609) 424-4451.

Circle 314



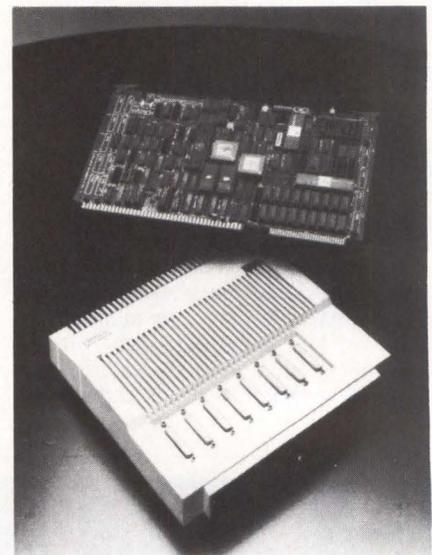
Modems offer Bell compatibility

- 2,400 bps
- Half duplex
- Synchronous, asynchronous

Offering Bell 202S, 202T and 201C compatibility, the 2200 Series of modems consists of models 2215, 2216 and 2217. Models 2215 and 2217 are two-wire, half-duplex dial modems operating at 1,200 bps asynchronously and 2,400 bps synchronously. Model 2216 runs at 1,200 bps asynchronously as a four-wire, full-

duplex, leased-line unit. Model 2215 provides a serial auto-call unit that allows both pulse and tone dialing, and stores 30-character telephone numbers. Model 2216 contains an anti-streaming unit that prevents lockups by using a strap-selectable time-delay option. \$495, Model 2215; \$425, Model 2216; \$685, Model 2217. **Codex Corp.**, 20 Cabot Blvd., Mansfield, Mass. 02048-1193, (617) 364-2000.

Circle 315



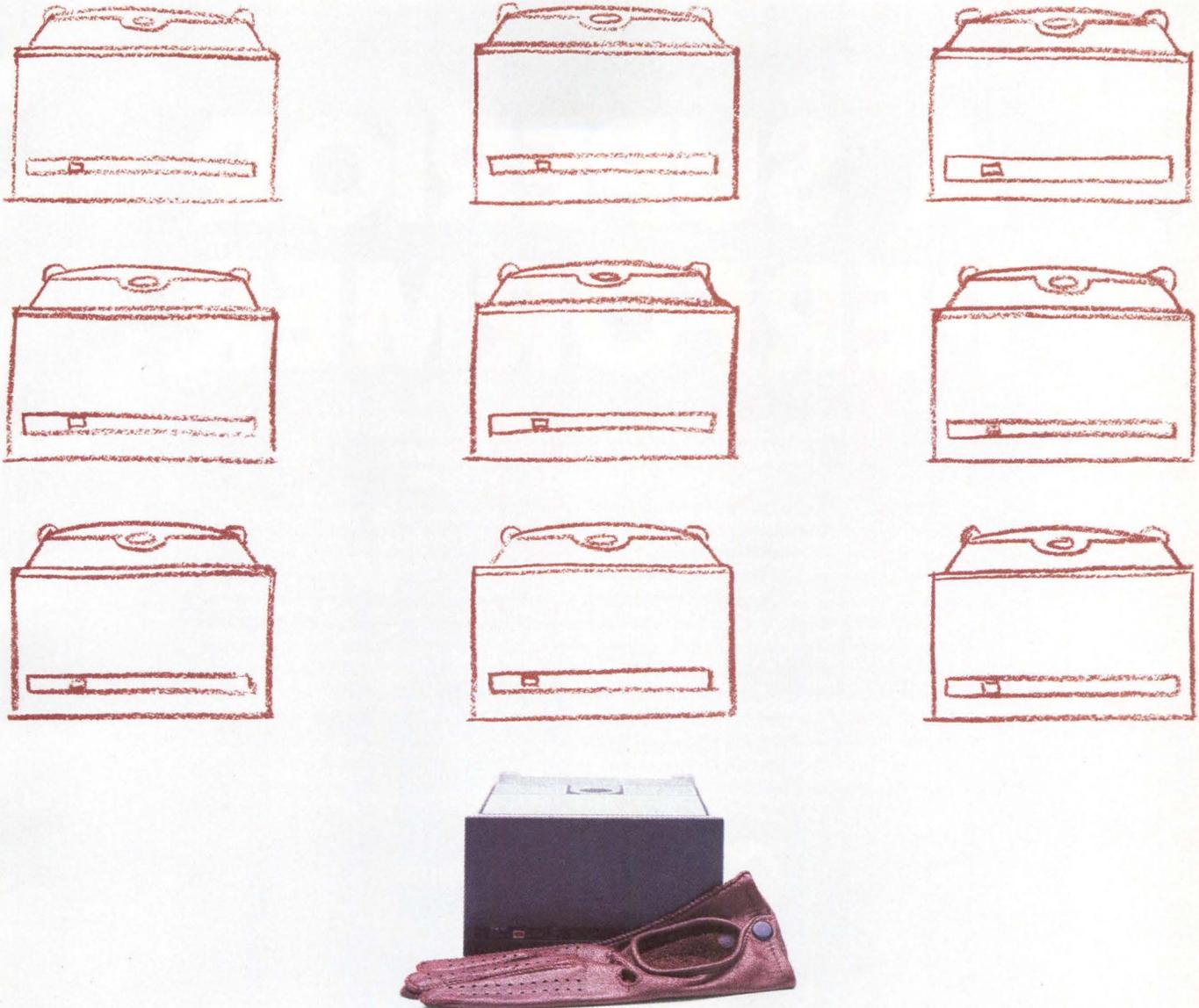
Multiplexers connect up to 128 terminals

- 512K-byte memory
- MC68010 CPU
- 2.5M-bps transfer interface

The HPS Series of intelligent, asynchronous multiplexers consist of host adapters and remote cluster controllers that handle terminals in increments of eight or 16 each. The series suits multi-user microcomputers and supermicrocomputers based on Multibus I, II and VMEbus. Supporting up to 128 terminal ports while occupying one slot in the host backplane, the host adapters include a 10-MHz MC68010 CPU, a no-wait memory of up to 512K bytes and a 2.5M-bps transport interface to the cluster controller. They run the host operating system's TTY manager as well as emulate a block-mode multiplexer with standard TTY driver. Transport mechanism between the host and cluster controllers uses token-passing LAN technology. \$895 to \$1,080. **Systech Corp.**, 6465 Nancy Ridge Drive, San Diego, Calif. 92121, (619) 453-8970.

Circle 316

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The C2600 offers OEM's superior capacity and superior performance combined with proven Century Data Systems reliability. For more information contact: Century Data Systems, Product Marketing, 1270 N. Kraemer Blvd., Anaheim, CA 92806 (714) 632-7500.



CIRCLE NO. 71 ON INQUIRY CARD

NEW PRODUCTS SUBASSEMBLIES

Circuit boards suit IBM PC/AT

- Seven DMA channels
- 512K-byte RAM
- Keyboard/speaker

The series of IBM PC/AT-compatible circuit boards, consisting of the Qc1032 processor board, the Qc1033 AT bus-compatible connector board and the Qc1034 memory card, allows system integrators to configure AT-compatible products. Using the 8-MHz, 80286 CPU, the Qc1032 processor includes a proprietary ROM BIOS, seven DMA channels, a keyboard/speaker and external reset interfaces and battery-supported clock/calendar. The Qc1033 bus connector panel has eight slots. Six of these are the two connector slots for AT boards. The remaining two suit standard PC cards. The board fits into a standard AT enclosure or equivalent. Memory for the system is provided by the Qc1034, which comes standard with 512K bytes of parity-checked RAM, expandable to 2.5M bytes. \$995, Qc1032; \$125, Qc1033; \$395, Qc1034. **Quam Corp.**, 2817 Anthony Lane S., Minneapolis, Minn. 55418, (612) 788-1099.

Circle 317

Tape controller works with VMEbus

- Pertec-compatible
- MC68000 CPU
- Two formatters

The V/Tape 3209 tape controller interfaces VMEbus-based systems to Pertec-compatible, half-inch, nine-track tape drives. The device side of the controller supports up to eight tape drives (two formatters with four transports each), with 8K bytes of on-board buffering. Its MC68000 microprocessor relieves system CPUs of tape-handling tasks. Used as a bus master for programmable, 8-, 16- and 32-bit-wide data transfers, the controller frees system CPUs from DMA activities. Addressing can be 16, 24 or 32 bits wide. \$1,750. **Interphase Corp.**, 2925 Merrell Road, Dallas, Texas 75229, (214) 350-9000.

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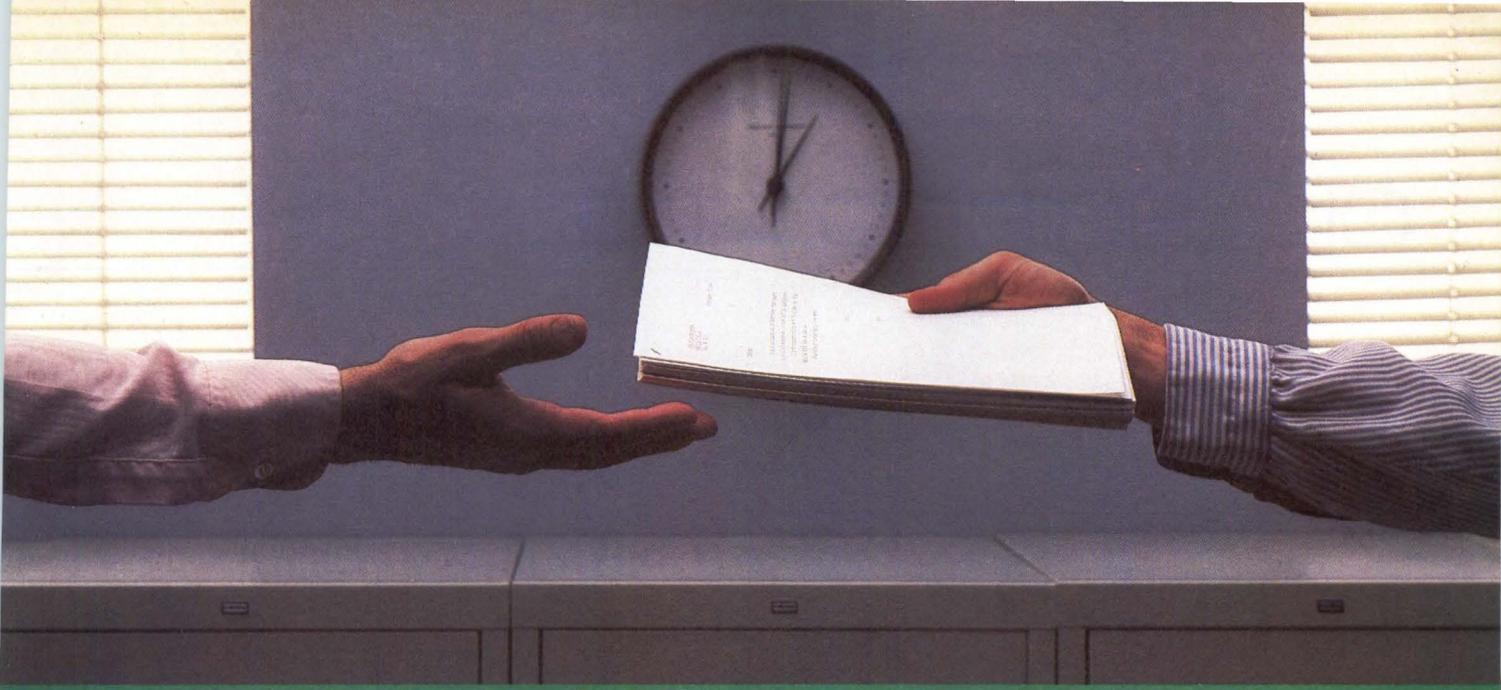
Portability

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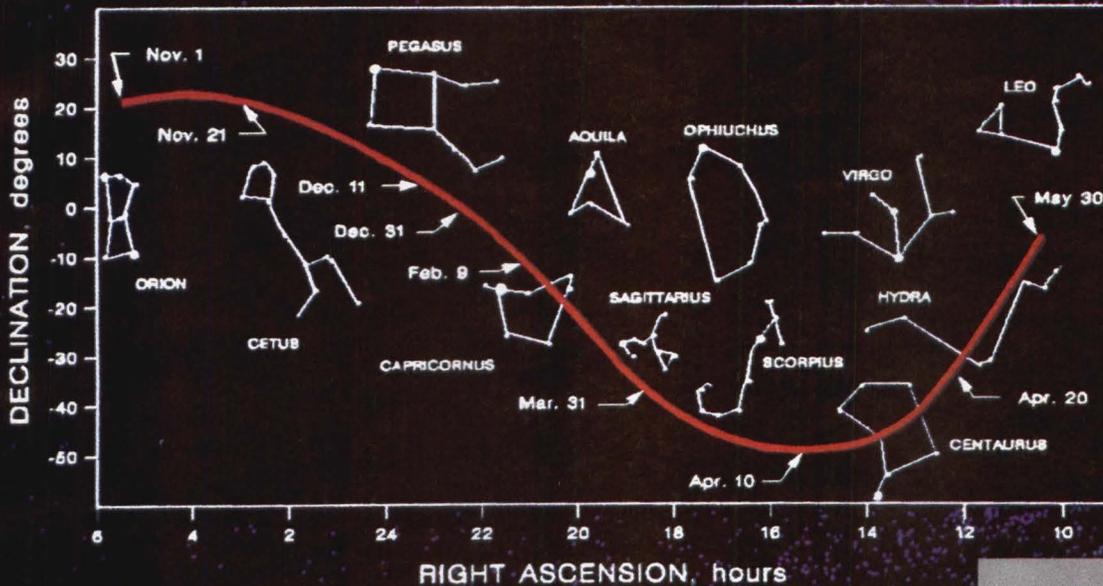
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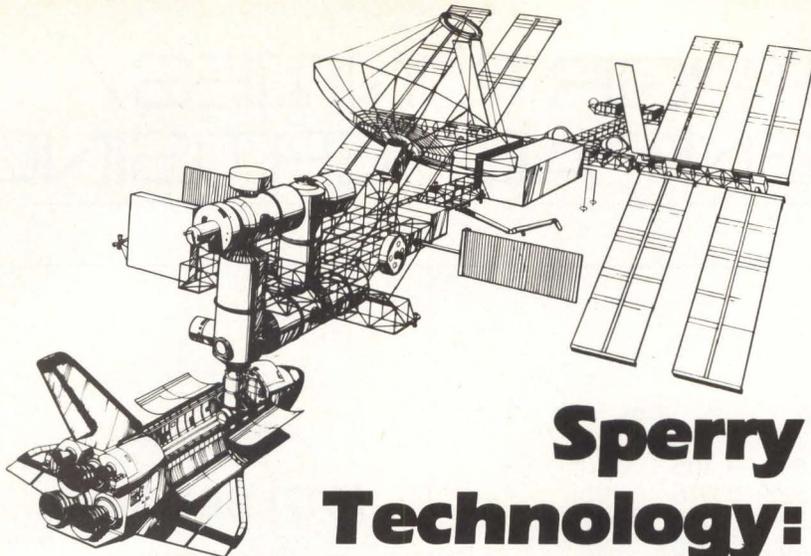
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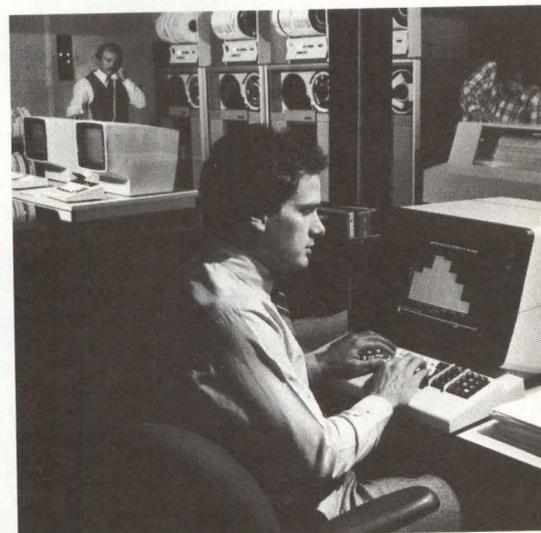
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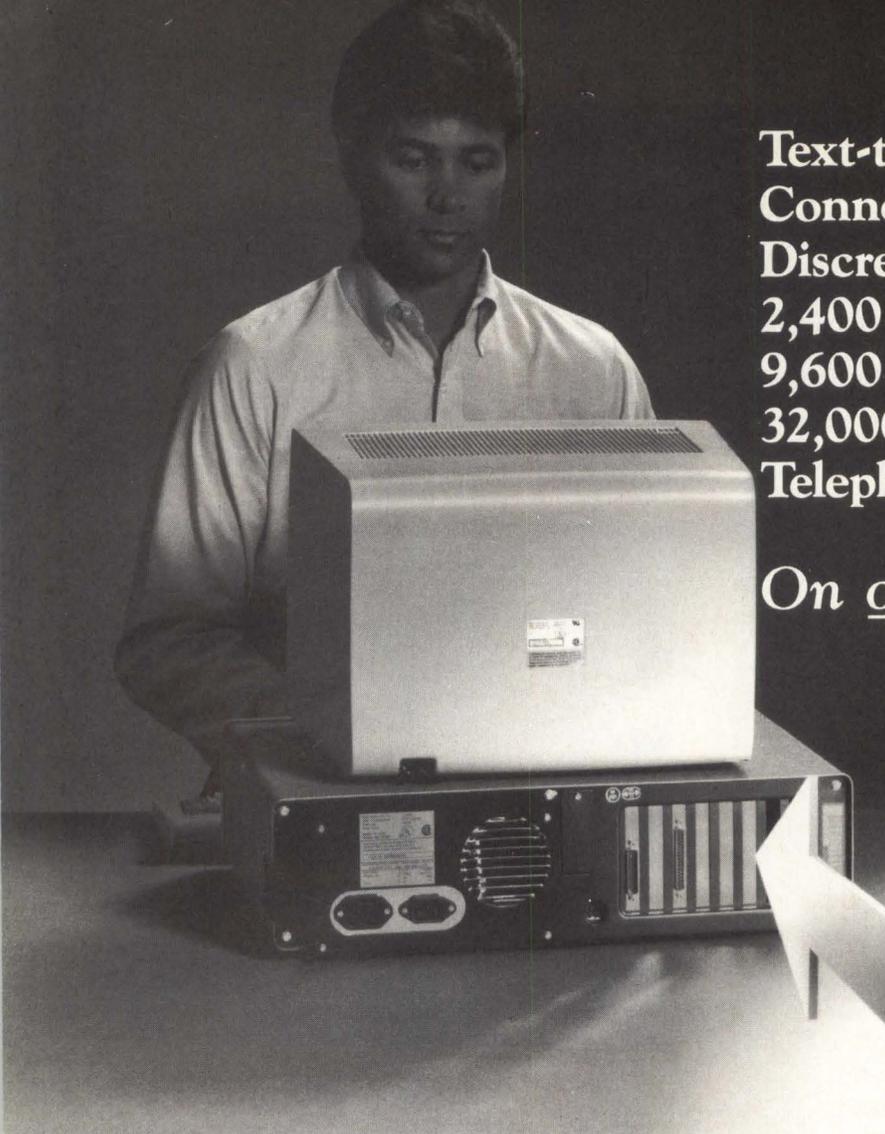
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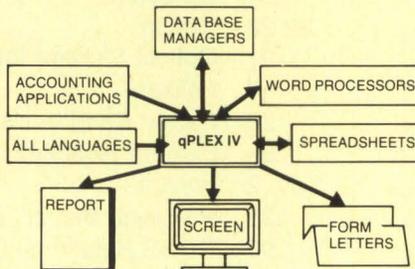
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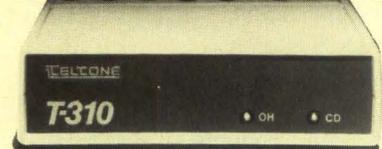


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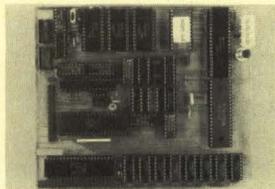
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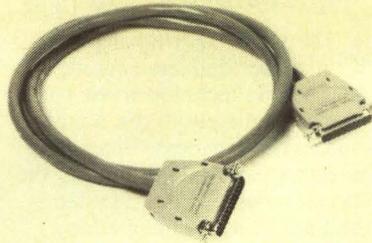


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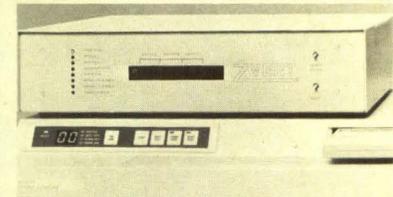
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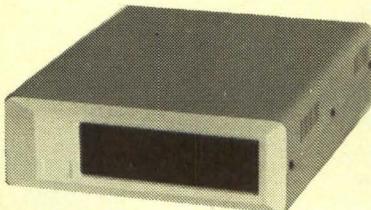
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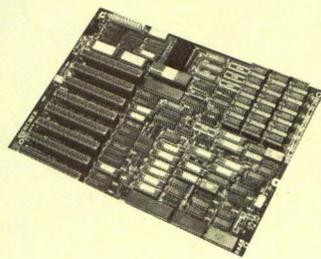


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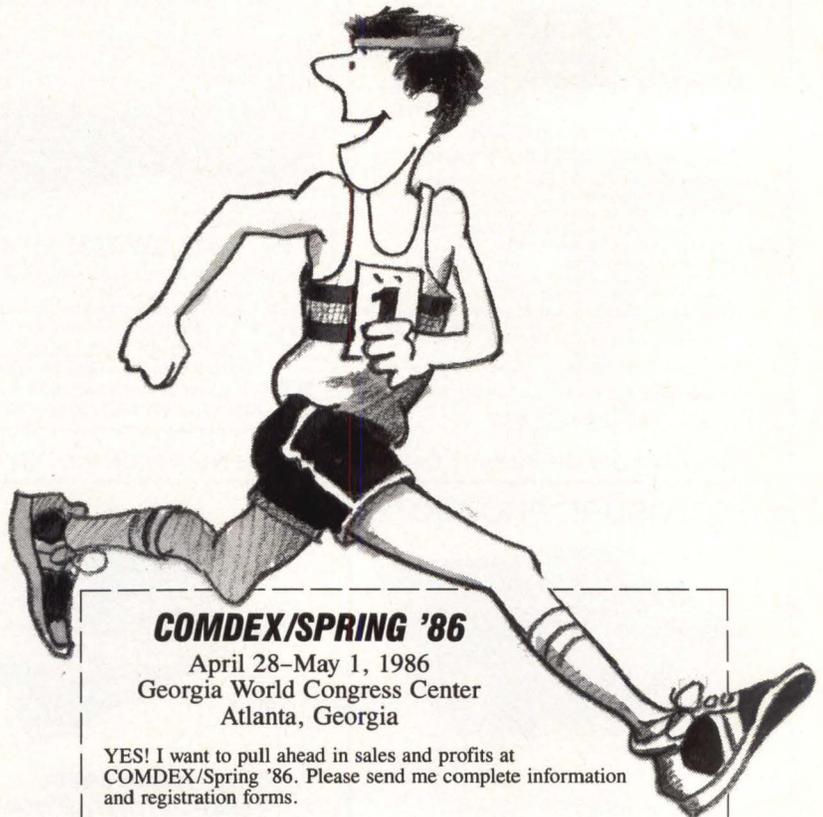
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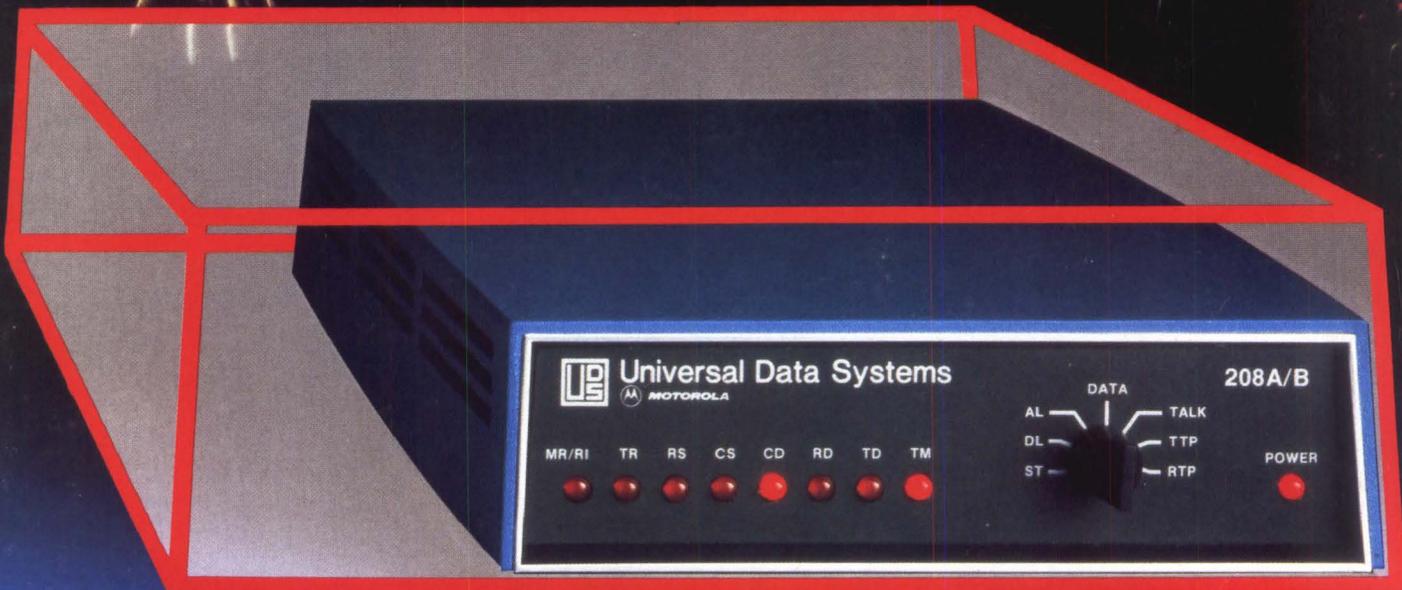
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