Mini-Micro Systems

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NOVEMBER 1984

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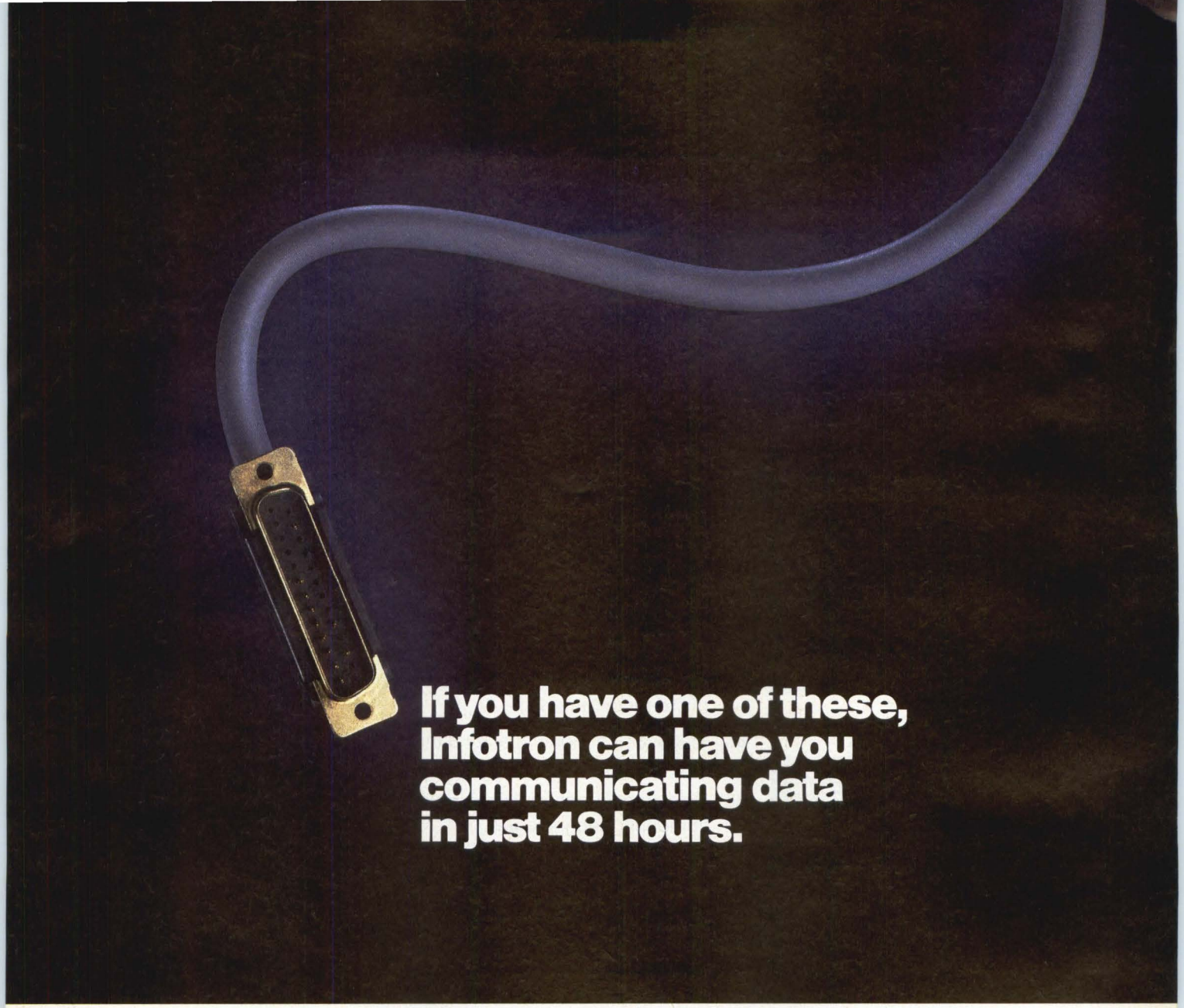

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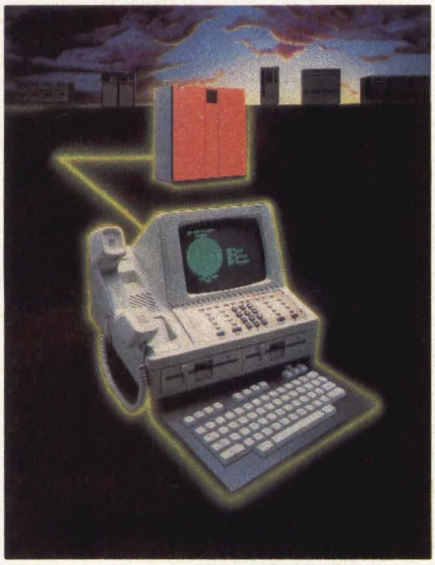
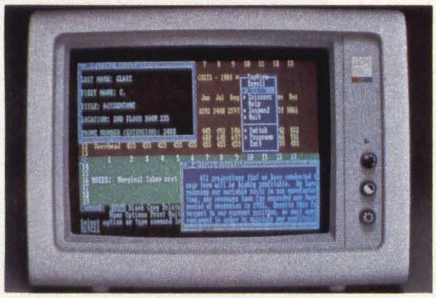
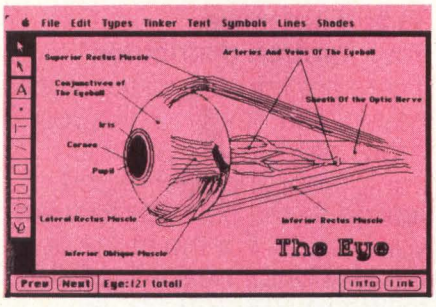


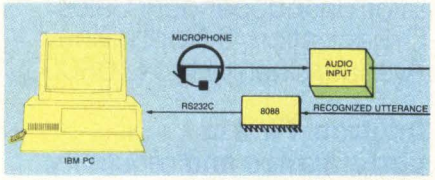
p. 31 . . . Rolm bolsters its PBX network with the Cedar micro and the Juniper add-in board. Art direction and design by Bricker Associates. Courtesy of Rolm Corp.



p. 34 . . . . . Window on the software world



p. 45 . . . . . Focusing on Apple software



p. 56 . . . . . Verbex amplifies IBM PC

MINI-MICRO WORLD
News

31 Rolm integrates IBM PC compatibility into its proprietary PBX network

34 TopView begins IBM's shift to proprietary software

37 Oracle reduces size of relational DBMS for microcomputers

43 Heard on the Hill: High technology receives low priority in presidential campaign

45 Apple slices Macintosh software projections

46 Unibus-compatible controller combines 16 communications channels, dual emulation

51 Macrolink enters market for Perkin-Elmer disk controllers

54 Expandable Stride Micro family supports 22 users

56 Verbex voice-recognition terminal talks to IBM PC

62 Pathway Design steps into UNIX territory with micro-mainframe link

65 Megavault's high-capacity 8-inch Winchesters access data in 18 msec

68 Daisy wheel printer prices must drop to slow advances of competing technologies

Corporate and Financial

75 Visicorp sells Visi^{On} technology to CDC, stresses marketing

77 Market Barometer: Sony's 3½-inch disk triumphs in micro market

77 Corporate and financial briefs

International

83 Britain's Torus Systems employs icons to help IBM PC users on local networks

86 Britain's Psion joins heated integrated-software market

*European News: E1 Ada activity increases despite low funding

E2 Explosion of products to market Data Recording's independence

E4 Fast-developing X.400 gains on Telex in popularity

E5 Pacific Perspective: Tangible results rally support for Japan's Fifth Generation computer project

*Appearing in the European edition only

INTERPRETER

103 Fiber-optic technology sheds light on local area networks

119 Superminicomputers climb to new levels of performance

INTEGRATOR

137 Publishing system streamlines document production

FEATURES

149 **Feature Highlights**

150 **Multiprocessor-based computer acts like super-mini**. . . tightly coupled multithread architecture and multiple buses serve high-speed information-management applications

165 **Low-cost terminals: More power for less**. . . faced with increased competition and falling prices, terminal manufacturers are cutting costs and looking ahead to automation and new market opportunities

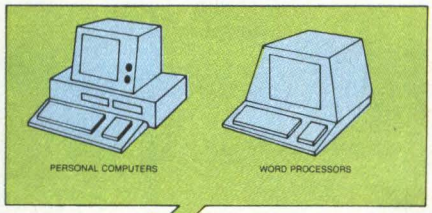
183 **Terminal emulation software links micros to mainframes**. . . a variety of products convert micros into terminals that can access mainframe databases

199 **Software-transparent front-end processor links hosts, terminals to Ethernet**. . . Bridge Communications Inc.'s CS/1-X.25 communications server reduces computer-room cable maze, increases file-transfer speed

209 **COMDEX/Fall '84 preview**. . . spotlight is on multifunction products

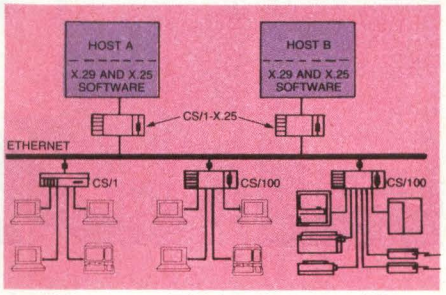
219 **Color workstation offers winning combination of hardware and software**. . . Convergent Technologies' AWS scores high points with ergonomic design and powerful processor; loses a few for its BASIC compiler, linker

233 **Law column:** Court restricts right to duplicate ROM software



p. 137 . . . . . Streamlining with CAP

p. 165 . . . . . More power for less



p. 199 . . . . . Bridging the gap to Ethernet

DEPARTMENTS

4 Editorial Staff

11 Editorial

15 Breakpoints

242 New Products

270 Calendar

271 Classified Advertising

273 Career Opportunities

279 Index to Advertisers

280 Mini-Micro Marketplace

MINI-MICRO SYSTEMS (ISSN 0364-9342) is published monthly (with additional issues in spring, summer and fall) by Cahners Publishing Company, Division of Reed Holdings, Inc., 221 Columbus Avenue, Boston, MA 02116. Norman L. Cahners, Chairman; Saul Goldweitz, President and Chief Executive Officer; Ronald G. Segel, Executive Vice President and Chief Operating Officer. MINI-MICRO SYSTEMS is published by the Cahners Magazine Division: J. A. Sheehan, President; William Platt, Executive Vice President. Circulation records are maintained at Cahners Publishing Co., 270 St. Paul St., Denver, CO 80206. Second class postage paid at Denver, CO 80202 and additional mailing offices. Postmaster: Send address changes to MINI-MICRO SYSTEMS, 270 St. Paul St., Denver, CO 80206. MINI-MICRO SYSTEMS is circulated without charge by name and title to U.S. and Western Europe based corporate and technical management, systems engineers, and other personnel who meet qualification procedures. Available to others at the rate of $55.00 per year in the U.S.; $60.00 in Canada and Mexico; $75 surface mail in all other countries; $120 foreign air mail (16 issues). Special DIGEST issues, $15.00. Single issues $4.00 in the U.S.; $5.00 in Canada and Mexico; $6.00 in all other countries.

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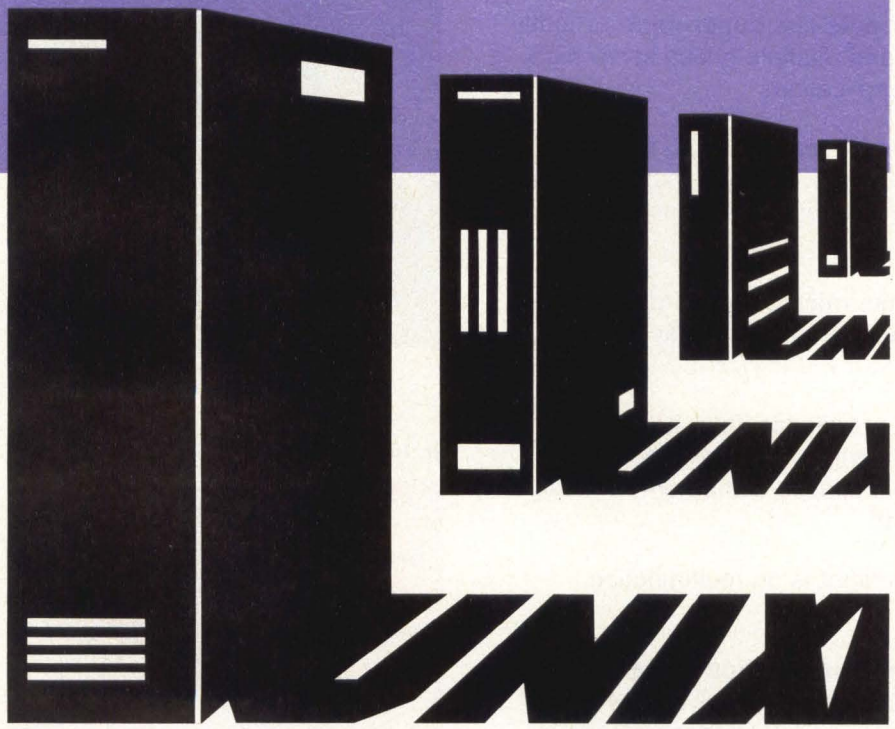

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Reprints of Mini-Micro Systems articles are available on a custom printing basis at reasonable prices in quantities of 500 or more. For an exact quote, contact Art Lehmann, Cahners Reprint Service, Cahners Plaza, 1350 E. Touhy Ave., Box 5080, Des Plaines,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

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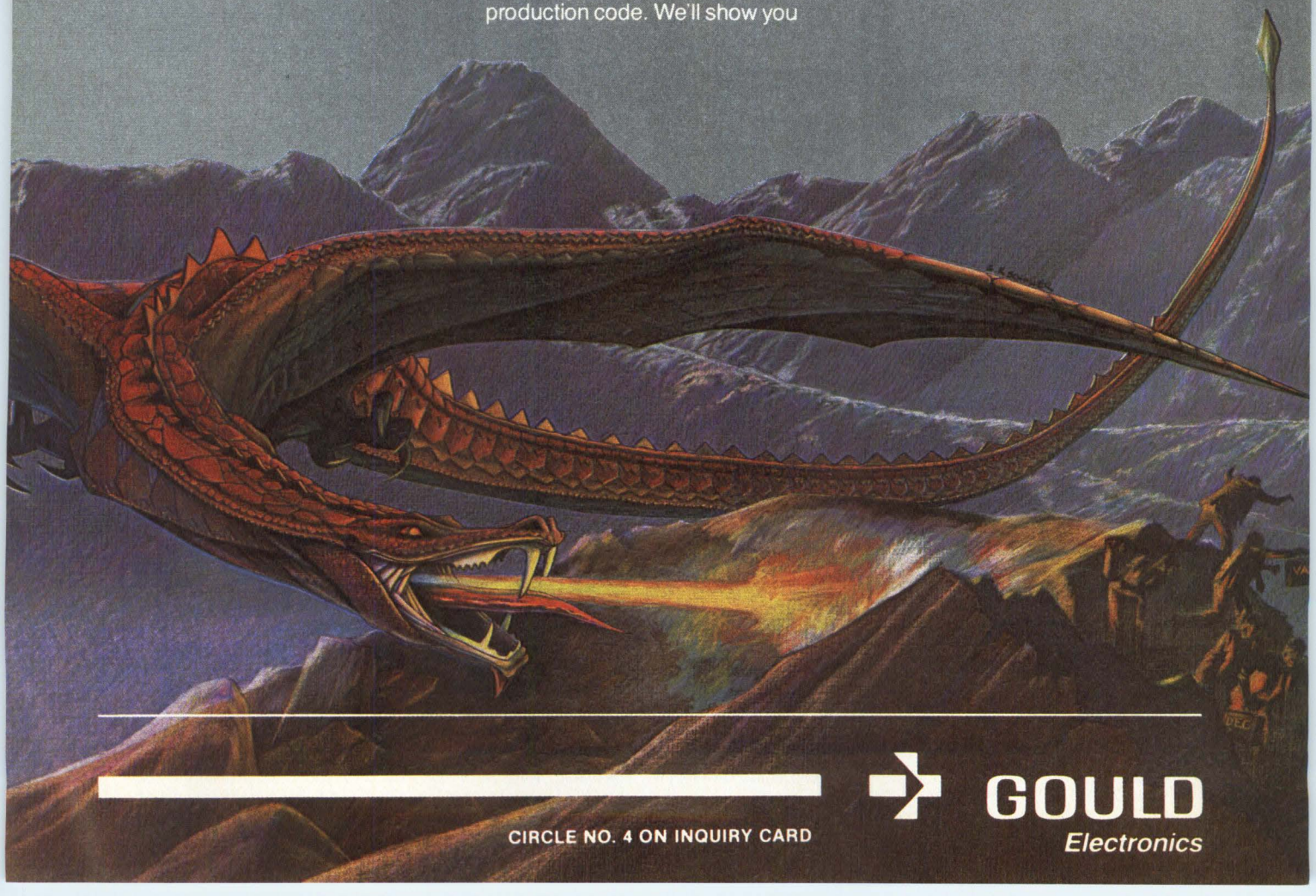

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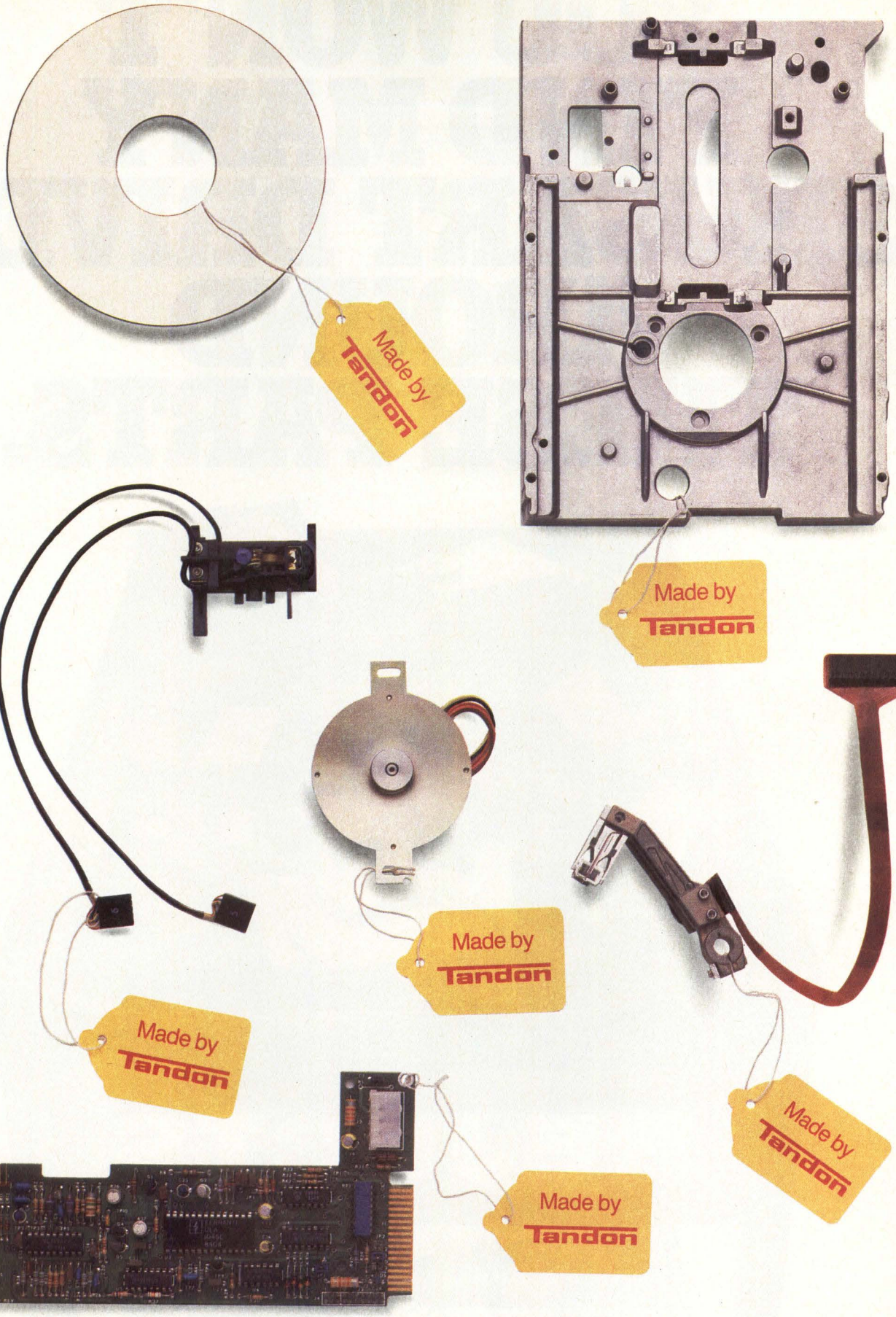

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CIRCLE NO. 6 ON INQUIRY CARD

Editorial

Value-added resellers escalate vertical markets

Because software packages are becoming extremely complex, and highly competitive hardware retail marketing is strangling profit margins, computer hardware and software manufacturers have turned to value-added resellers (VARs) to penetrate new and more profitable markets.

In fact, according to a major industry study conducted by *Mini-Micro Systems*—the trade journal of the value-added marketplace—sales of minicomputers and microcomputers in 1984 through the value-added marketing channel will exceed $50 billion. Another recent study by Digital Equipment Corp. estimates a $111 billion market among first-time users in vertical markets alone over the next five years.

But who are these VARs? By *Mini-Micro Systems*' definition, VARs are system houses, consultants (who configure systems), computer distributors/dealers (who configure systems) and third-party system integrators. They all share a common purpose: They provide hardware and software system solutions, not just products. To accomplish this goal, VARs buy computer hardware from manufacturers, add on hardware and/or software (the added value concept) and resell the complete system to end users. Equally important, VARs also provide system support, training and service.

In this manner, VARs help customize products that aim at meeting specific applications needs. In turn, these products infiltrate untapped vertical markets. Although the VARs' approach has been around for several years, it has recently emerged as a significant marketing channel for many companies mired in stagnant sales growth. In fact, most of the computer industry is now emphasizing vertical marketing channels instead of horizontal ones.

For example, on the software side, Lotus Development Corp. has recently made software tools available to software development VARs. These tools enable VARs to structure specialized packages that augment Lotus 1-2-3 software. Likewise, MicroPro International Corp. is licensing several run-time versions of its products to VARs for integration into tailored packages. Other microcomputer software companies that have opted for the VARs' approach include Ashton-Tate, American Business Systems Inc., RealWorld Corp. and Digital Research Inc.

On the hardware side, IBM Corp., Apple Computer Inc. and Tandy Corp. pioneered the development of personal computer system-integration sales channels. In addition, over the past two years, Digital Equipment Corp., Data General Corp., Wang Laboratories Inc., Texas Instruments Inc. and Hewlett-Packard Co. have introduced personal computer products and programs geared toward VARs.

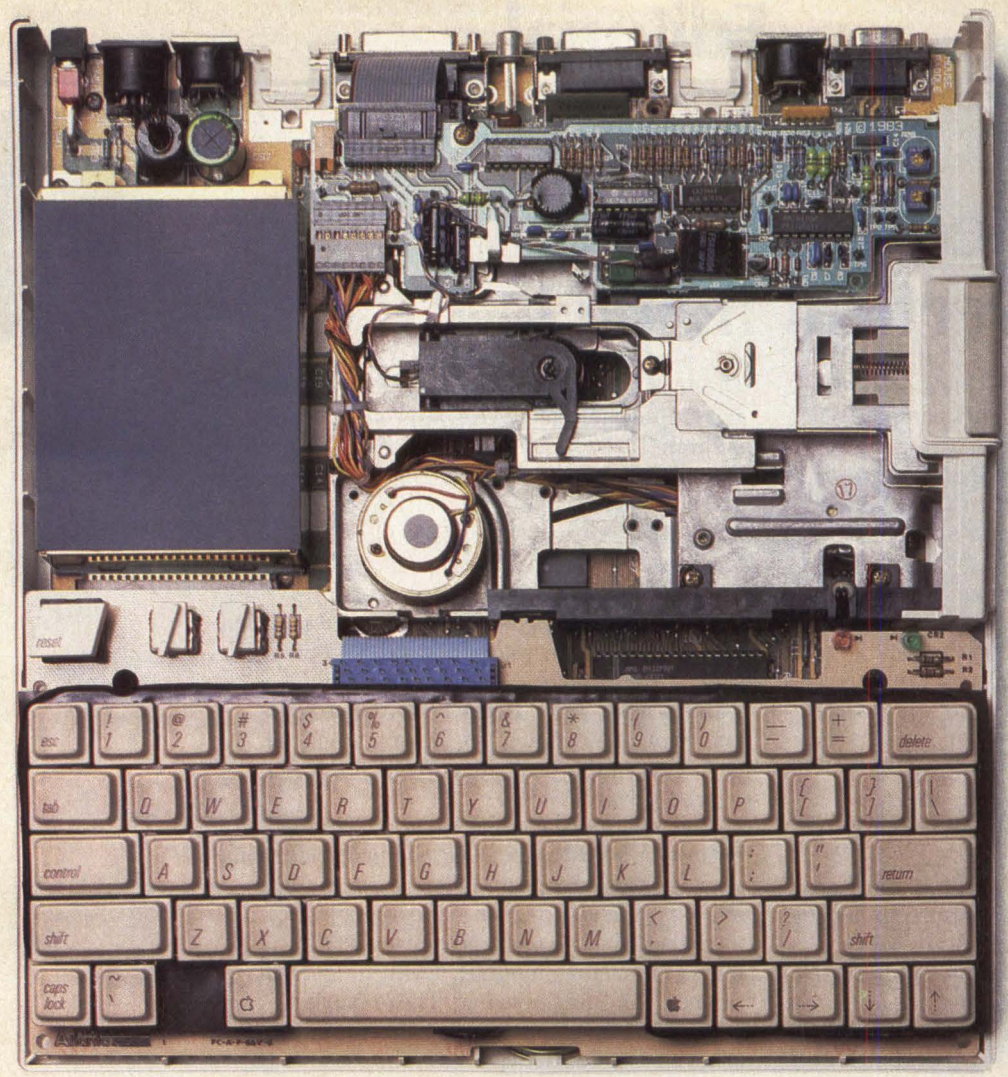
And still more companies appear poised to enter the VARs marketing channel. Informal surveys made by *Mini-Micro Systems*' staffers reveal a dramatic movement of various software packages into vertical markets, such as medical, legal, industrial, financial and engineering. These markets open up extra sales opportunities that would otherwise be difficult or even impossible to reach. Furthermore, customized systems translate into accessibility to more end users. Whether computer products are designed for general or special-purpose use, skilled VARs can still add value and therefore increase market availability.

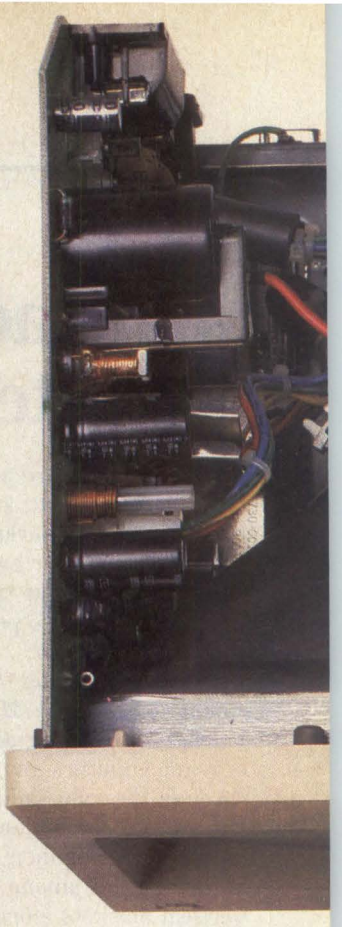
On the debit side, though, vertical markets call for unique solutions to unique problems at satisfactory costs. To achieve those solutions, computer systems must be changed, modified, tailored or customized to a particulary narrow need—not a trivial task. Equipment manufacturers cannot meet this need because they can't anticipate all requirements for all users. Knowledgeable VARs do meet this need, however, by integrating add-on hardware/software into a capable product. In addition, by not reinventing the wheel, VARs get cost-effective products to market in short turnaround times.

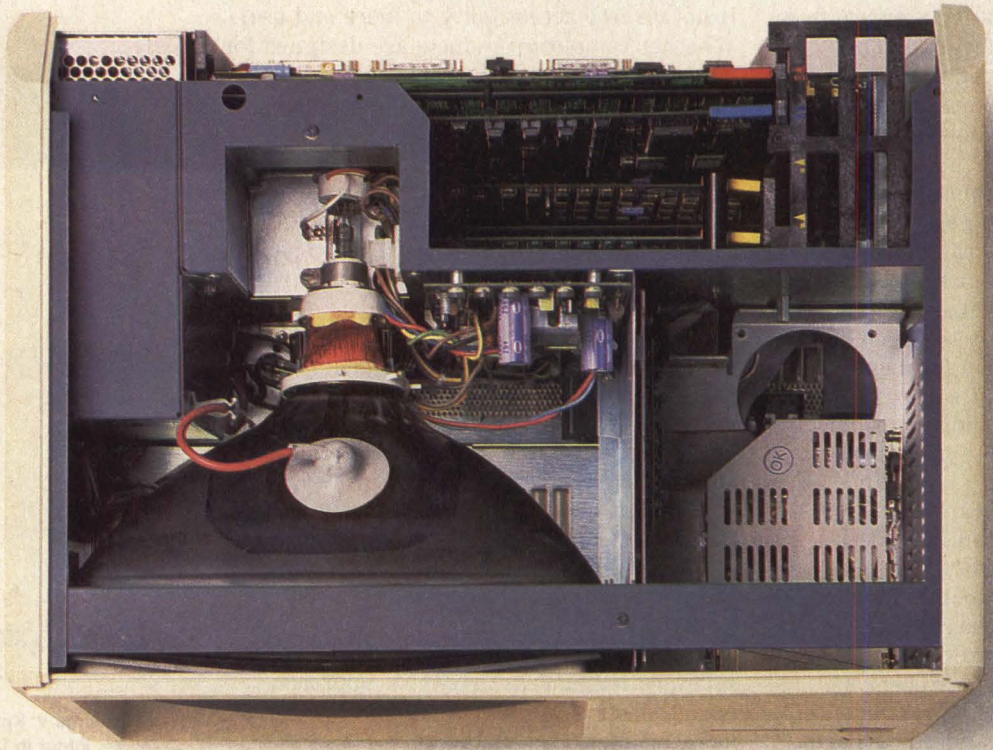
VARs will play a key role in overcoming the presently soft sales period and reduced growth rate in the computer industry. What's more, for some computer, peripheral and software companies, the VARs' approach means sheer survival; for others, a potentially lucrative market growth.

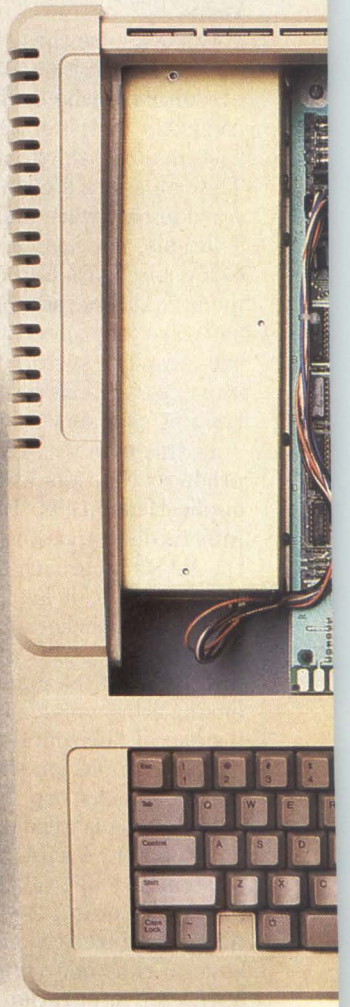
George V. Kotelly

George V. Kotelly
Editor in Chief









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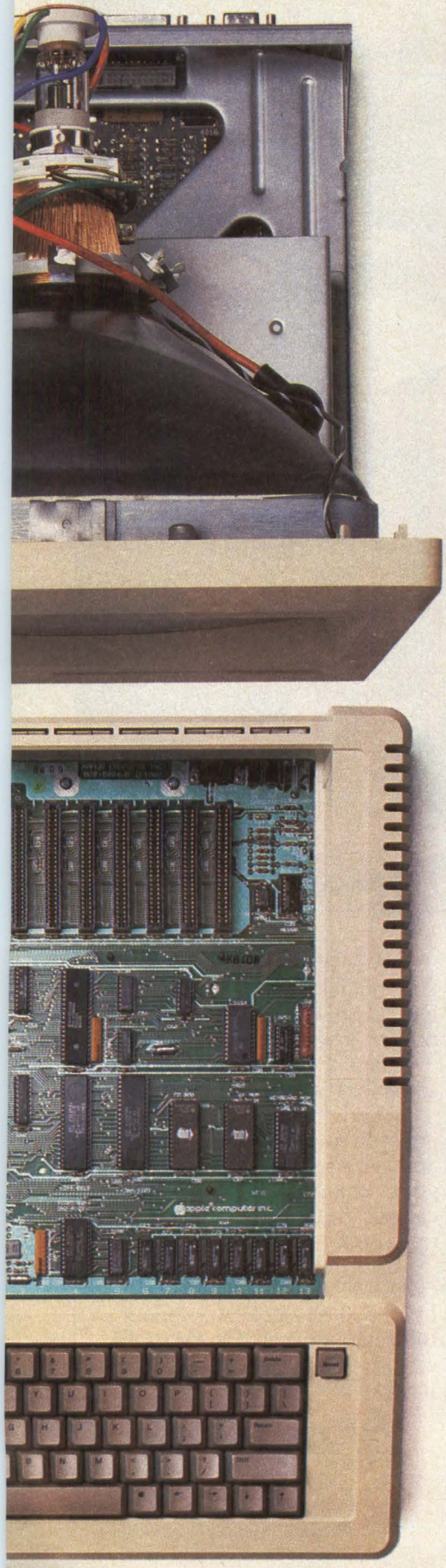

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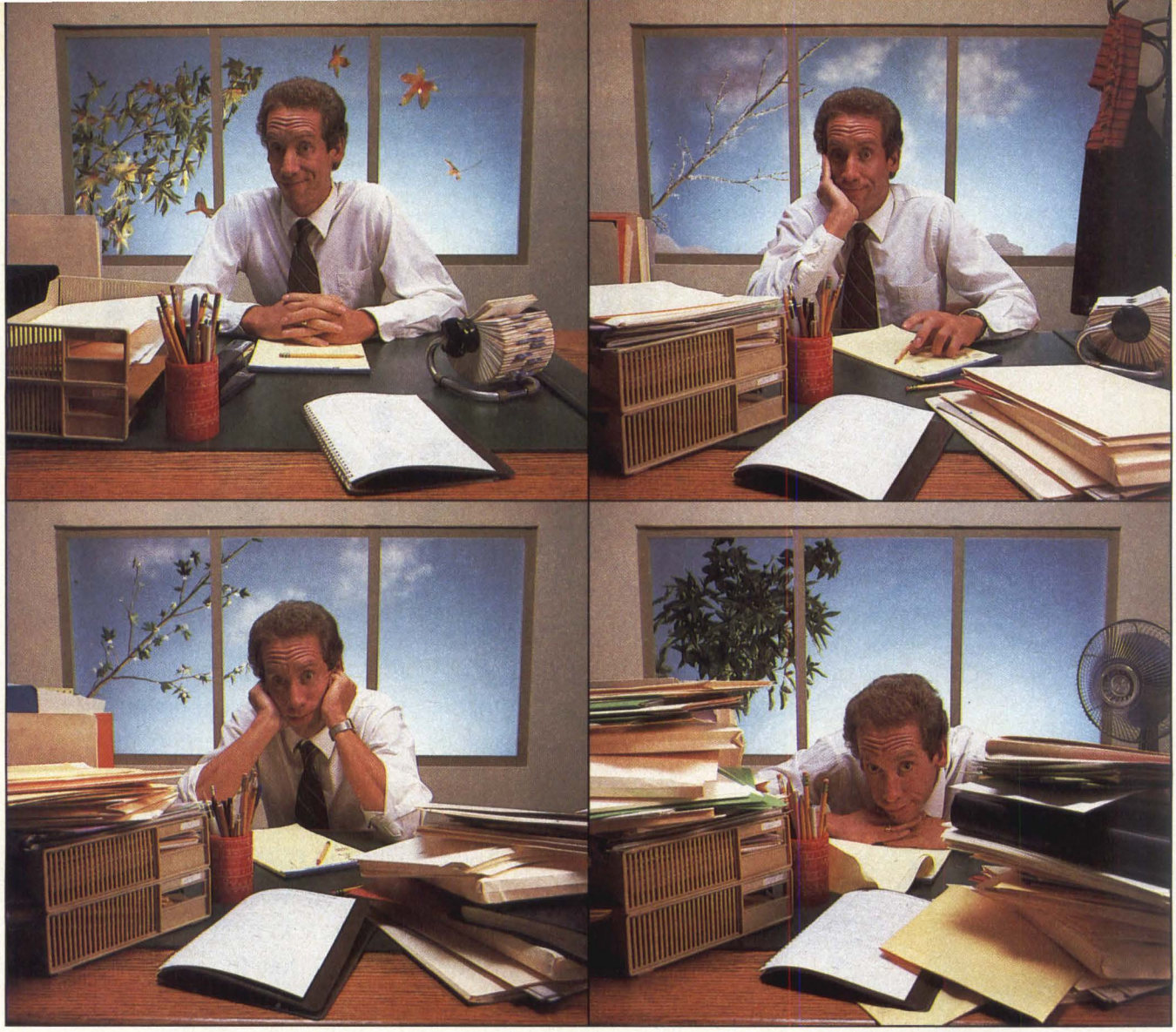

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CIRCLE NO. 8 ON INQUIRY CARD

Breakpoints

SEAGATE TO INTRODUCE THREE DISK DRIVES, INCLUDING 3 1/2-INCH WINCHESTER

Seagate Technology, Scotts Valley, Calif., scheduled three disk drives for introduction at the recent Comdex show in Las Vegas, including the ST112, a 12.76M-byte (unformatted), 3½-inch Winchester drive supporting the ST412 interface. The company plans to ship the $495 (for 1,000-unit purchases) drive this month. Seagate chairman Alan F. Shugart says the drive eventually will store 20M bytes (formatted) of information, but will require new media to achieve that density. The two other newcomers are the ST225, a half-height 25.52M-byte (unformatted), 5¼-inch Winchester, and the ST451, a 51M-byte (unformatted) Winchester disk drive. In a related development, Seagate plans to build all of its own stepper and spindle motors, beginning with the ST112 and ST225 drives.—L. Valigra

DRI ANNOUNCES MACINTOSH-LIKE INTERFACE FOR MS-DOS

Digital Research Inc., Pacific Grove, Calif., early this month planned to announce an Apple Computer Inc. Macintosh-like user interface for MS-DOS machines. Code-named "Crystal," the single-tasking Graphics Environment Manager (GEM) runs on IBM Corp. and AT&T Co. personal computers, as well as on IBM PC-compatibles with 256K bytes of RAM, two floppy disk drives, a bit-mapped graphics display and a mouse. GEM, which is an addition to the MS-DOS operating system, features overlapping windows and replaces operating system commands with icons and pull-down menus. DRI plans to work closely with OEMs to develop the screen drivers necessary for porting GEM from machine to machine. Availability for GEM, related presentation-graphics applications and a programmer's toolkit is scheduled for the first quarter.—D. Bright

RESHAPED OSBORNE COMPUTER CORP. BRINGS OUT ITS FIRST PRODUCT

Osborne Computer Corp., Fremont, Calif., is introducing the Vixen transportable microcomputer, its first hardware product for the U.S. market since the company reorganized under Chapter 11 bankruptcy protection earlier this year. The $1,298, 22-pound Vixen comes with a Z80A processor, 64K bytes of RAM, a 7-inch amber display, two 390K-byte 5¼-inch floppy drives, a parallel port and an RS232 serial port. Bundled software includes CP/M 2.2, WordStar 3.3, MailMerge, SuperCalc 2, and MBASIC. Osborne also offers the Osboard electronic drawing board and the Media Master software that allows data disk transfers between PC-DOS, MS-DOS and CP/M machines.—T. Moran

MORROW DESIGN DEBUTS BOOK OF QUOTATIONS FROM ITS OUTSPOKEN CHAIRMAN

"The Quotations of Chairman Morrow," a red-bound book listing the more notable quotations of Morrow Design (San Leandro, Calif.) founder and chairman George Morrow, was expected to make its debut in Las Vegas at COMDEX. Morrow's colorful comments, which began when the former short-order cook started his computer company, include, "If George Lucas designed a lunch pail for Darth Vader, it would look like a Kaypro," and "I believe in standards. Everyone should have one."—L. Valigra

Breakpoints

THESYS BOOSTS IBM PC AND XT MEMORY CAPABILITY

Startup company Thesys Memory Products Corp., Scottsdale, Ariz., has developed some add-in cards that enhance the memory capabilities of the IBM PC/XT and compatible microcomputers. The Fastcard main memory extension, which should be shipped this month, is priced at $495. It expands memory by 400K bytes, with 18K bytes used as a disk cache. A company spokesman says the memory expansion can exceed 640K bytes by using bank switching. To enhance storage capability, the Fastfile, which also uses 256K-bit dynamic RAMs, is designed to serve as a fast Winchester, ranging in size from 1M byte to 5M bytes. The Fastfile allows 1M-byte-per-second data transfers and has an access time of 250 microseconds for a 512K-byte block of data. The price for 1½M bytes is $1,795; 3M bytes is $2,795; and 5M bytes is $3,495.—C. Warren.

CORTEX' CAD/CAM-LIKE SOFTWARE AIDS BUSINESS PROGRAM DEVELOPMENT ON VAXs

The first in a series of programs incorporating CAD/CAM-like diagramming techniques to automate business software development should be introduced by Cortex Corp., Wellesley, Mass., early next month. Called the Cortex Action Diagrammer, the program gives a graphical representation of very high-level program code that lets software writers add sophisticated program logic to generated code more easily. The product is for use on Digital Equipment Corp.'s VAX minicomputers.—L. Valigra

CITIZEN AMERICA AIMS AT DOT-MATRIX PRINTER AND 3½-INCH DISK MARKETS

Japan's Citizen America Corp., which recently opened its U.S. offices in Santa Monica, Calif., announced plans to move into the volatile dot-matrix printer market with a series of low-profile and low-cost printers. The model MSP-10, 80-column unit sells for $549, and the model MSP-15, 136-column printer sells for $799. Both operate at 160 characters per second. In addition to printers, the company plans to begin shipping half-height 3½-inch, Sony-compatible flexible drives. The 1M-byte drives are one inch high, and can operate on battery power for portable computer applications.—C. Warren

CHIP BRIDGES GAP BETWEEN 8- AND 16-BIT IBM PC AND PC-COMPATIBLE MACHINES

Add-in board manufacturers who want to make IBM Corp.'s large base of installed 8-bit Personal Computers compatible with the company's new 16-bit PC-AT computers can incorporate on their boards an application-specific converter chip from Edsun Laboratories Inc., Wayland, Mass. The EL-286-88 VLSI circuit converts 80286 signals to the equivalent signals of an 8088, and solves the problem of driving slow, 8-bit 8088 peripherals with a fast 80286 processor. The chip is priced at $48 in quantities of 10,000. The company planned to demonstrate the chips at the COMDEX show in Las Vegas.—L. Valigra

MINISCRIBE BOOSTS 5¼-INCH WINCHESTER CAPACITY TO 86M BYTES

Miniscribe Corp., Longmont, Colo., expected to show its model 6086, 86M-byte (unformatted) 5¼-inch Winchester drive at the COMDEX show in Las Vegas. The new drive has a 30-msec average access time and is ST506/412

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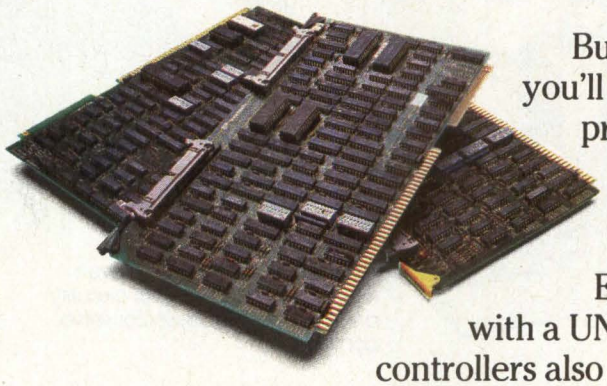

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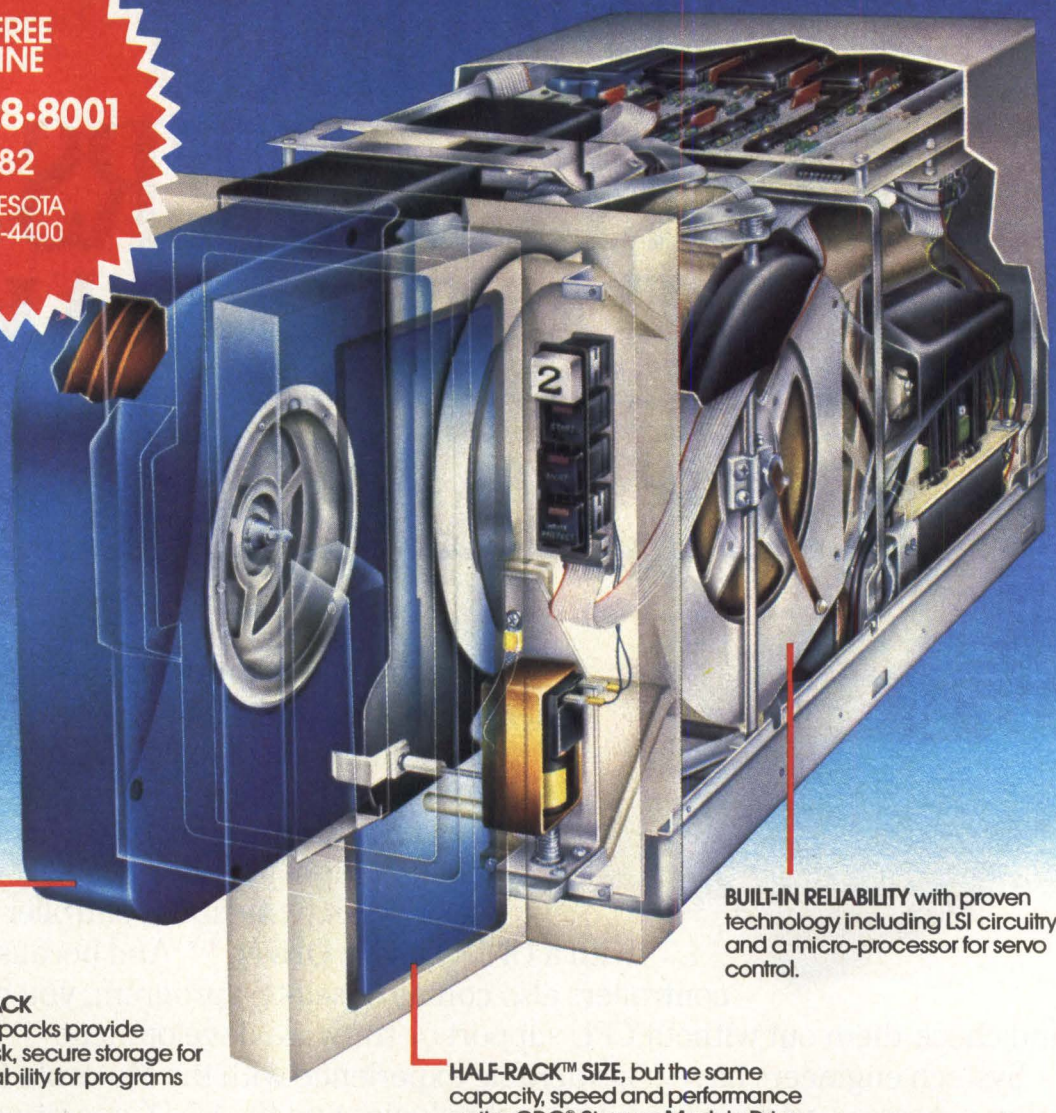

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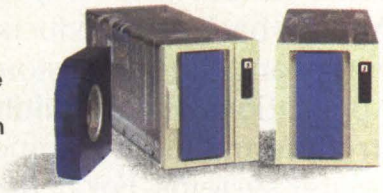

CONTROL DATA

interface-compatible. Pricing hasn't been set, but a company spokesman said it would be less than $2,000. Evaluation models should be available this quarter.—C. Warren

IBM PC USERS CAN ACCESS MAINFRAMES WITH DOS COMMANDS

Forte Data Systems, San Jose, Calif., is expected to make available in January its Off-Net micro-to-mainframe communications software and boards to OEMs and system integrators. Off-Net is designed to act as a DOS environment around a mainframe, enabling IBM PC, PC/XT or PC-AT users to access the mainframe with the same DOS commands used to access locally stored data. Pricing has not been set.—M. Stenzler-Centonze

PLEXUS LAYS THE FLOOR IN ITS MC68000 SYSTEM LINE

To broaden the product range which its OEMs and value-added resellers offer, Plexus Computers Inc., San Jose, Calif., plans to add the P/15 low-end system to its line of MC68000-based UNIX microcomputers by mid-November. The P/15 accommodates one to eight users, and includes two MC68010 processors and the virtual memory implementation of Motorola Inc.'s MC68000. With the P/15, Plexus marks its first use of 256K-bit RAMs. An entry-level system with ½M bytes of memory, a 10M-byte Winchester disk drive and a floppy disk drive sells for $11,000 to $15,000. The previous low-end system was priced at $19,000. Plexus' top-end model supports as many as 40 users.—L. Valigra

LIBERTY EXPANDS TERMINAL LINE

Liberty Electronics USA, San Francisco, planned a COMDEX introduction of two graphics terminals. The new products are the $1,395 Freedom 240, a DEC VT240-compatible monochrome graphics terminal, and the $1,295 Freedom 210, an ASCII graphics terminal. Both have 665- by 288-dot resolution displays and are compatible with Tektronix Inc. 4010/4014 graphics software.—T. Moran

PRIAM PACKS 70M BYTES IN HALF-HEIGHT 5¼-INCH WINCHESTER

Developed for multitasking microcomputer systems, the model 201 5¼-inch half-height Winchester from Priam Corp., San Jose, Calif., sports an unformatted capacity of 70M bytes and an average access time of 25 msec. The four-platter model uses sputtered media, and has an ST412 compatible interface. The drive is planned for formal introduction in February, 1985. Evaluation units should be ready by the third quarter of next year and production units by the year end.—C. Warren

LAN FOR MACINTOSH INCLUDES DBMS

Lutzky-Baird Associates, Los Angeles, has designed a local area network that links as many as 40 Apple Computer Inc. Macintosh personal computers. The Ultra Office series centers on UNIX System V-based cluster processors that host the Macintoshs over a baseband cable. Supermicrocomputers, such as Charles River Data Systems' Universe 68 and Zilog Inc.'s new Z8000 Series Two, are used as cluster processors. The software includes a UNIFY

database management system with a Macintosh shell on top for direct queries. By linking the cluster processors, as many as 1,500 Macintoshes can be supported. Pricing has not been set.—D. Bright

TECH FILES: A QUICK LOOK AT INDUSTRY DEVELOPMENTS

SOFTWARE FILES: IBM Corp. has endorsed graphics standards-based software with the latest introductions of graphic display boards and professional graphics series software for the Personal Computer. The graphics encompass the Graphical Kernel System (GKS), Virtual Device Interface (VDI) and Virtual Device Metafile (VDM), all of which are being considered by ANSI standards committees.—C. Warren

Communications Solutions Inc., San Jose, Calif., has adapted its Access/SNA software to work with systems running UNIX. The product enables UNIX users to access IBM mainframes through IBM's Systems Network Architecture protocols. Access/SNA can be used with UNIX System III, System V and XENIX operating systems. Licensing fees range from $75,000 to $100,000.—M. Stenzler-Centonze

Peachtree Software, Atlanta, Ga., is joining the software companies now providing programs on Sony Corp.'s 3½-inch floppy diskette. Peachtree's PeachText 5000 office productivity series, Back to Basics accounting, and Calendar Management programs are available for the recently announced Data General/One portable computer, which incorporates either one or two Sony drives.—M. Stenzler-Centonze

MINI FILES: Burroughs Corp. has introduced its first UNIX product: the XE-550 minicomputer, which is built around Convergent Technologies Inc.'s MC68010-based MegaFrame. The XE-550 simultaneously runs a version of Burroughs' proprietary BTOS operating system as well as Convergent's CENTIX implementation of UNIX System V. CENTIX includes Berkeley 4.2 enhancements such as virtual memory support. System prices begin at $43,000.—D. Bright

Also joining in the increasing support for UNIX, **Stratus Computer Inc.,** Marlboro, Mass., has added System V capabilities to its fault tolerant computer systems. The operating system shares a common kernel with Stratus' proprietary VOS operating system. VOS already incorporates UNIX functions, a feature that helped Stratus merge the two operating systems, Stratus officials say. Most competitors, such as Auragen Systems Corp. and Sequoia Systems Inc. offer UNIX on their fault-tolerant systems, although market leader Tandem Computers Inc. does not. Yet another company developing a UNIX-based fault-tolerant system is startup EnMasse Computer Corp., Acton, Mass.—D. Bright

RANDOM DISK FILES: CPT Corp., Minneapolis, Minn., should introduce a high-capacity 3½-inch flexible drive early in the first quarter of 1985. The drive, obtained

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from Toshiba Corp., should offer as much as 6M bytes of unformatted data storage by using vertical recording methods.—C. Warren

Archive Corp., Costa Mesa, Calif., and **Convergent Technologies Inc.,** Santa Clara, Calif., reportedly have inked a three-year, $40 million pact, under which Archive will supply the supermicrocomputer manufacturer with 45M-byte, ¼-inch Scorpian streaming tape drives. Although neither company would comment on the agreement, industry observers say the deal gives Archive and the quarter-inch streaming tape drive market a much-needed boost.—C. Warren

Indicative of the vogue of 3½-inch disk formats, **Cambrian Consultants Inc.,** Calabasas, Calif., has both 10M-byte and 21M-byte models. Both units are compatible with the Seagate ST506/412 and the Rodime 350 interfaces. The company is looking for shared licensing on a non-exclusive basis.—C. Warren

Startup company **Lancore Technologies Inc.,** Westlake Village, Calif., is readying its first product for introduction at the COMDEX show in Las Vegas, November 14 to 18: a 5¼-inch, intelligent disk drive subsystem with an average access time of 30 msec. The drive, priced at $5,995, features tape backup, an Intel Corp. 80186 processor, 128K bytes of dynamic RAM, an SCSI interface and an optional internal modem. It performs caching and allows concurrent multiuser access and simultaneous operation of both the disk and the tape drives.—D. Bright

MICRO FILES: Tandem Computers Inc. has developed what it calls the Dynamite workstation to supply corporate customers with MS-DOS compatibility. The modular workstation operates in three modes: Tandem terminal emulation, IBM Corp. 3270 terminal emulation and as an MS-DOS workstation. Users can extract files from Tandem's Encompass database management software running on its fault-tolerant computers, and have Dynamite's software format the files for integration with popular personal computer software such as Lotus Development Corp.'s 1-2-3. Prices start at $2,995. Tandem stresses that it is not entering the personal computer retail market.—D. Bright

Sydis Inc., San Jose, Calif., plans to ship in December and February a number of enhancements to its VoiceStation office information system. Scheduled for December are multiple file servers, Wang-compatible word processing software, a GKS graphics library, and directory enhancements. February additions are said to comprise production shipments of Sydis' integrated voice/data workstation, a communications server subsystem, data communications software, networking software, business graphics and support for Hewlett-Packard Co.'s LaserJet printer and six-pen plotter.—T. Moran

PRINTER FILES: Fujitsu America Inc. is implementing a new retail channel strategy. As a start, its Peripheral Products division, San Jose, Calif. has begun to move its DotMax 9 and DotMax 24 wire impact printers through Fujitsu's own

distributor/dealer network. Fujitsu had been selling almost all its products through OEM channels. The network presently includes 19 U.S distributors and more than 350 dealers, to be expanded to 1,200.—T. Moran

NOTES FROM OVERSEAS: IBM Corp. has hammered out its first technical collaboration pact in Europe by teaming up with Italian manufacturer Elsag SpA, an industrial controls subsidiary of the highly influential, state-controlled, telecommunications combine, STET. The pair will launch a joint venture to design and produce factory automation software. Observers note that it is the only major joint venture outside Satellite Business Systems in which IBM has settled for a 49 percent interest. The liaison may prove a stepping stone to the real prize, a coveted multimillion-dollar alliance with STET itself to provide Italy's high-technology companies with much-needed packet-switching gear in addition to database services, value added networks and perhaps the manufacture of a PABX.—M. O'Gara

ITT Corp. is starting to look serious about playing in the European computer theater. First it bought a 37 percent interest in a leading Continental software house, Holland Automation BV. Then it opened up negotiations to acquire the choice parts of newly bankrupt Danish data-communications CPU company, Christian Rovsing. And now, via its German subsidiary, giant Standard Elektrik Lorenz AG, it has picked up 49 percent of German minicomputer maker Computertechnik Mueller GmbH (CTM). CTM's fame is based on the 9032, the first German-designed, German-built 32-bit minicomputer, a conventional AMD 2901 bit-slice product. The $75-million-a-year firm had intended bringing the 9032 to the United States, but ITT may short-circuit that strategy and use CTM products as a launching pad into heavy-duty office automation market in Europe.—M. O'Gara

Britain's premier computer maker, **ICL Plc.,** wants to be the top office systems supplier to Europe's very largest firms, vying with IBM Corp. for the business of companies with sales of $125 million a year and up. To do so it has formed an Office Business Center to develop systems integrating data, text, image and speech. Its newly published statement of direction pooh-poohs PABX-based office systems as immature and indicates it will use its Oslan version of Ethernet as a substitute central product for those systems. Another ploy in the strategy will be the Clan, Datamedia Corp.'s MC68000-based Pick/UNIX machine, which ICL currently sells only in Australia and South Africa. Other plans will see UNIX System V offered on the ICL DRS workstations and UNIX under VMS supported on its 2900 mainframes. Above all, ICL promises to make its proprietary protocols interface with anybody else's office wares—most particularly IBM's and Wang Laboratories Inc.'s.—M. O'Gara

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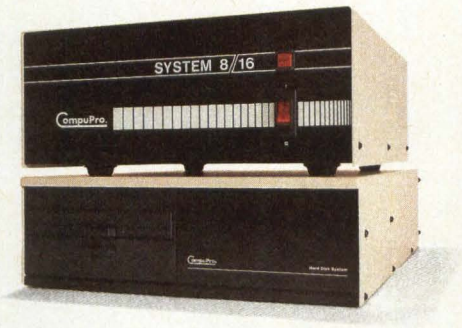

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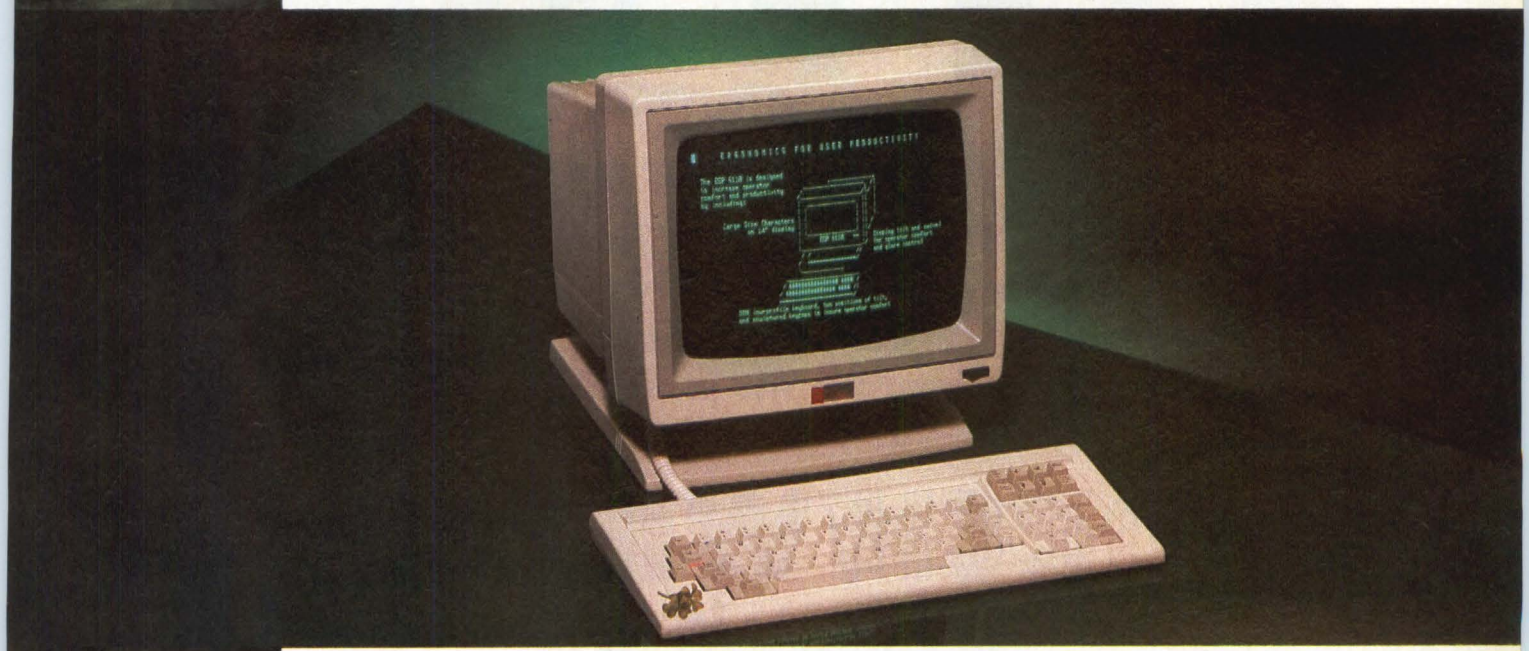

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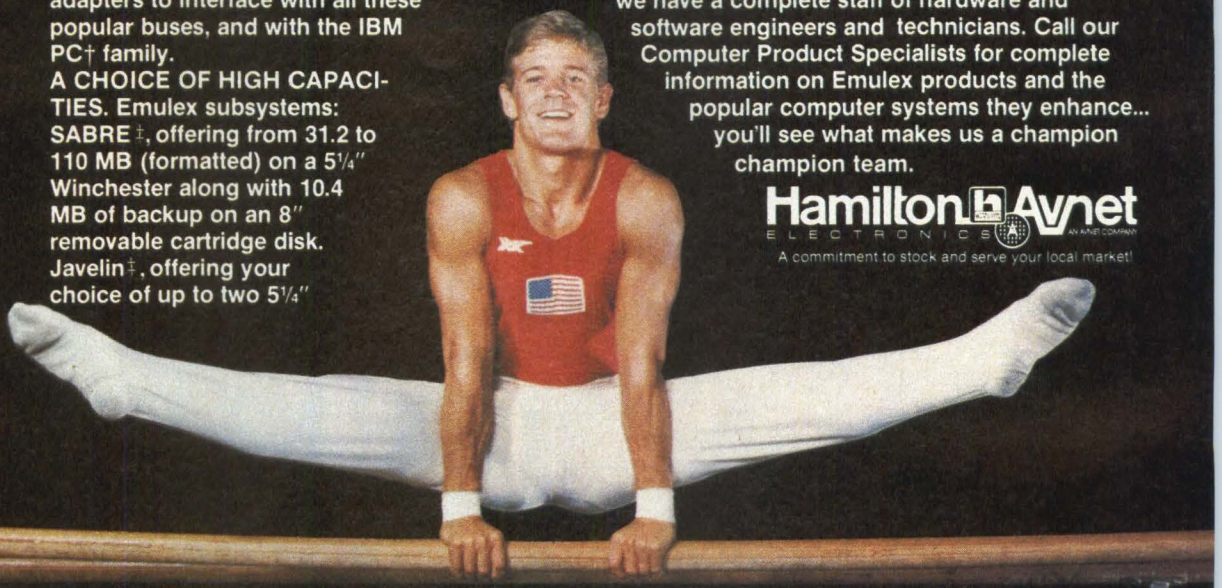

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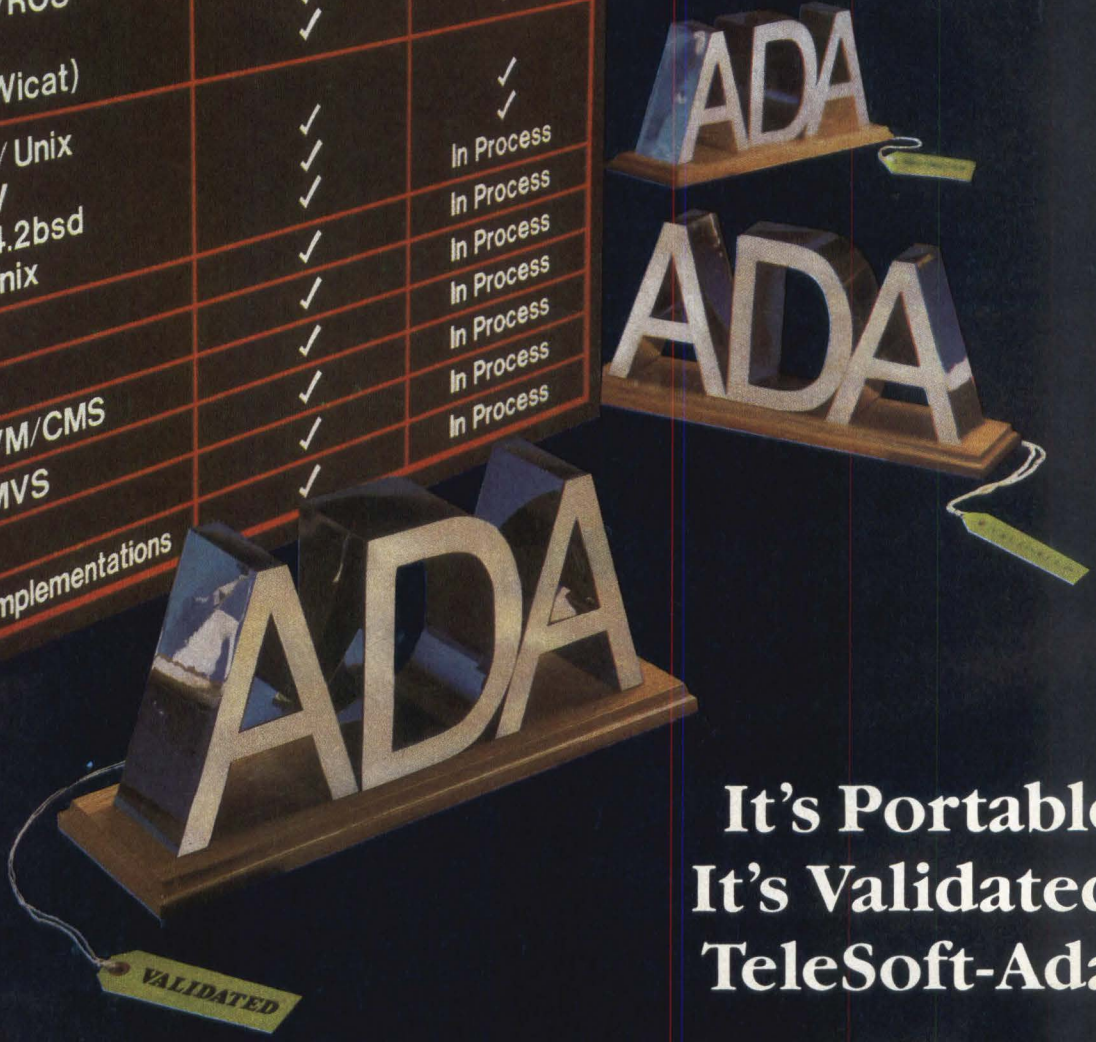

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CIRCLE NO. 17 ON INQUIRY CARD

Rolm integrates IBM PC compatibility into its proprietary PBX network

Tom Moran, Associate Editor

Rolm Corp., Santa Clara, Calif., this month bolstered its proprietary, digital private branch exchange (PBX) network by embracing IBM PC compatibility in two new products. They are the Cedar microcomputer and the Juniper add-in board that links IBM PCs into Rolm's PBX, called the CBX. Both products have a telephone handset and office automation and telephony software closely integrated with the CBX. The Cedar computer is one of the first PC-compatible products to integrate office automation and advanced telephony features coordinated by a PBX.

Rolm's Cedar personal-communications computer *offers IBM PC compatiblity and integrates a telephone and a keyboard that can be slipped under the system unit when not in use.*

Depending on whether Rolm plays its trump card—a marketing agreement with IBM Corp., which recently boosted its 23-percent stake in Rolm to complete ownership—the company could have an advantage over companies like Datapoint Corp., which recently opened its proprietary attached resource computer local area network (ARCNET) to connect both IBM PCs and its own MS-DOS Vista-PC (MMS, August, Page 48). IBM paid $1.25 billion in securities to merge with Rolm, the giant's first acquisition in more than 20 years. Rolm will become an independent subsidiary of IBM, retaining its name and top managers. The coupling is subject to approval by Rolm's stockholders and federal antitrust representatives.

A Rolm spokeswoman would not comment about IBM possibly selling Rolm products in Europe. But it is the opinion of Bill Frank, senior vice president of InfoCorp, Cupertino, Calif., that the relationship between

The Juniper add-in board from Rolm *splices an IBM PC, PC/XT or PC-compatible with a full-featured digital telephone and Rolm's proprietary CBX private branch exchange.*

Rolm and IBM will broaden to other products. "[The IBM connection is] pivotal [for Rolm] because to establish a relationship with the IBM world is a strategic decision that will affect what Rolm will be in the future....It should open up a lot more markets. Together, IBM and Rolm will end up stronger."

Norm DeWitt, associate director of personal computer programs for Dataquest Inc., San Jose, Calif., agrees. "[They're] very likely to increase [cooperation] further. Rolm brings expertise in the PBX area to IBM."

The June, 1983 marketing agreement with IBM to enhance interconnectibility of Rolm and IBM products produced an IBM message center product that works with Rolm's CBX and is due out now. Different versions of that product are to be marketed by each party.

The Rolm spokeswoman emphasizes that both new PC-compatible products must be used with Rolm's CBX. "We have not been contacting IBM value-added resellers because our system doesn't work without the CBX. We have our own sales and service organization in the United States, which accounts for about 80 percent of U.S. sales. The rest [of the sales] are through exclusive, independent distributors," says Janice Carnes, director of corporate marketing at Rolm.

Closely integrated with the PBX

Cedar and Juniper are tailored to take advantage of the proprietary aspects of Rolm's CBX systems, resulting in greater integration of total system functions. Software with the board-based Juniper works to link the IBM PC, PC/XT, and PC-compatibles with the CBX.

Stacking up Rolm PC-compatibles against the competition

With its IBM PC-compatible Cedar microcomputer and Juniper add-in board for the IBM PC, Rolm Corp., will face increasing competition with integrated voice, telephone and data communications products.

The desktop office-automation market for such products has been broken into three categories by the Gartner Group, Stamford, Conn.: PBX-proprietary devices like Cedar and Juniper; standalone workstations with analog data communications like Zaisan Inc.'s ES.1 or ES.3; and proprietary or non-proprietary add-ons to the IBM PC, such as Cygnet Technology Inc.'s CoSystem and Northern Telecom Inc.'s Displayphone.

Rolm group product manager Carol Wingard says the sales potential for the Cedar and Juniper products is between 100,000 and 200,000 Rolm units, based on her estimates of an installed base of more than 3 million telephone lines in its CBX private branch exchange system.

The 8088-based Cedar comes with MS-DOS 2.11, GW-BASIC, two 360K-byte 5¼-inch floppy disk drives, and 512K bytes of RAM, 384K bytes of which can be accessed by the user. The system measures 13.5 inches wide by 14.6 inches long by 11.5 inches high. The 9-inch diagonal screen displays 80 characters by 24 lines in alphanumeric mode, and has medium and high resolution graphics modes. A status line at the top of the screen informs the user of incoming calls and messages.

Other Cedar and Juniper features include one-touch terminal configuration, one-touch logon/logoff for mainframes, minicomputers and databases, the terminal emulations, an auto-dial directory that holds around 200 names and numbers, 11 repertory dial keys for different dialing functions, a five-function calculator, data communication at speeds up to 19.2K bits per second, and simultaneous voice and data transmission.

With the simultaneous voice and data capability, a user can send memos or spreadsheets while discussing their content on a telephone with the person receiving them. Time-division multiplexing allows one physical line to provide several voice channels, and data and CBX-control channels. The CBX acts as a system controller, automatically routing long-distance calls and informing each workstation of incoming calls, voice messages and the status of other workstations. As a digital system, it avoids the limitation of some personal computers and workstations using low-speed analog modems to communicate with PBXs.

One company targeting the same base of installed IBM PCs as Rolm is Cygnet, Sunnyvale, Calif. Cygnet's CoSystem is an add-on voice and data telephony system for the IBM PC. The Cygnet device is not closely integrated with a PBX. The CoSystem includes a 300-bits-per-second (bps) modem, and a 1,200-bps modem is optional.

Zaisan, Houston, Texas, introduced its ES.3 professional workstation this summer, touting it as the first IBM PC-compatible microcomputer with an integrated telephone. The $2,595 ES.3 has an internal 300-bps modem with a 1,200-bps option, and is designed to be used with PBXs in general.

Frank Dyer, director of marketing operations for the advanced communications terminals division of Northern Telecom, Nashville, Tenn., declines to comment on whether Northern Telecom is planning to add personal-computing capability to its product line. Northern Telecom offers the $1,295 Displayphone terminal and the $1,595 Displayphone Plus, a recent upgrade which adds full VT100 emulation and an internal 1,200-bps modem instead of the external modem of the earlier Displayphone. The Displayphone Plus also uses amber instead of white phosphor in its display.

The Displayphones can be set up to work with standard PBXs, which means they target a wider total market than Cedar and Juniper, but lack the full features that result from closer integration with a specific PBX. Northern Telecom expected to begin shipping the Displayphone Plus last month.

Cedar is a personal-computer version of Rolm's personal communications terminal, the Cypress, which the company began shipping in June. Besides attaining IBM PC compatibility by using an 8088 processor and MS-DOS, the Cedar offers simultaneous high-speed voice and data communications, a host of message and dialing features and IBM 3270 and DEC VT100 terminal emulations. Rolm did not include any expansion slots in the Cedar because of the product's full features, a company spokesman says. For those desiring expansion slots, Rolm recommends the Juniper with IBM equipment.

The Juniper comprises an IBM PC-standard long add-in board, software on diskette and a Rolmphone digital phone with a cable to connect it to the add-in board. The Juniper requires a minimum of 256K bytes of system RAM, but Rolm recommends having at least 384K bytes.

Success seen for Juniper

Christine Hughes, vice president for office systems for the Gartner Group, a Stamford, Conn., strategic planning concern, says the Juniper will be the more successful of the two new products. "It's probably the least expensive way for an existing IBM PC user to capitalize on the phone features that Rolm has to offer, so it's a very good marriage between an existing Rolm CBX and an existing installed base of IBM PCs." Most of Rolm's installed systems are in Fortune 500 or 1000 companies.

Laura Lundquist, an analyst with Future Computing Inc., Dallas, Texas, projects that IBM PCs and fully compatible personal computers will account for 65 percent of shipments of microcomputers to Fortune 2000 companies in 1984 and 81 percent by 1989. She says the overall penetration of personal computers into Fortune 2000 companies was 10 percent in 1984. She adds that it's difficult to sell a machine that is not fully IBM-compatible into these IBM shops.

Shape of things to come

According to Robert R. Maxfield, Rolm executive vice president and co-founder, Rolm assumes that the major PBX makers will follow the trend of combining telephones, personal computers and PBXs with office automation software. "We're convinced that the integration of voice and data and personalized communications services [results] in very strong productivity-enhancing products for desktop workers," he says. "So we really believe that this is the shape of things to come, and that the market success of these products will force our competitors to offer similar functionality."

Maxfield says Rolm has no present plans to offer similar products for non-Rolm PBXs. "Our prime thrust is to provide CBX customers with solutions, and to differentiate Rolm as a total communications system supplier." Maxfield declined to say whether Rolm would offer Juniper-like products for the IBM PC-AT or any non-IBM microcomputer that is not PC-compatible. "What we have said very strongly is that we intend to provide maximum connectability and integration with IBM products, and so it's logical to assume that we will be looking very hard at other IBM desktop products," he says.

The Cedar will be priced at $4,995 for one unit, and $4,245 each for 100 units, with further discounts possible. The Juniper's single-unit price will be $1,495, and $1,360 each in quantities of 100. Both products include the Rolmphone and should be available 60 days after their planned introduction early this month. The price of the CBX system ranges between $700 and $900 per line. □

SYDIS, ITALTEL SIGN $8 MILLION OEM PACT

Sydis Inc., San Jose, Calif., has signed an OEM contract to supply $8-million worth of its VoiceStation system workstations over a three-year period to Italtel Telematica—Italy's largest telecommunications manufacturer. Italtel will combine the workstations, which integrate data, voice, text and graphics processing, under its own name with its private-automatic-branch exchanges. Recently, Sydis also sealed a $142-million deal with GTE Business Communications Systems for the VoiceStation.

PC WORD-PROCESSING MARKET BOOMS

Sales of personal-computer word-processing applications will boom through 1988, while standalone word processor sales will fall off, according to a report from New York market research firm Frost & Sullivan Inc. The word-processing-application sales should increase 23 percent from $8.7 billion in 1983 to $10.7 billion in 1988. During the same period, sales of standalone word processors will decline from $897 million to $183 million. But the greatest word-processing growth rate will be in the electronic-typewriter market, where sales are expected to rise 40 percent, from $3 billion in 1983 to $4.2 billion in 1988.

TopView begins IBM's shift to proprietary software

Marjorie Stenzler-Centonze
Associate Editor

IBM Corp.'s recently introduced personal computer windowing environment, TopView, may be part of a major move by the company to shift toward more proprietary software with direct hooks to IBM hardware, analysts say. The TopView announcement was followed by IBM's introduction of 31 software packages developed internally for its PCs.

IBM's TopView provides *a multitasking and windowing environment for IBM applications. The program runs on the PC, PC/XT, PC-AT, Portable Personal Computer and 3270-PC.*

An issue of control

Kenneth Lim, an analyst with the research company Dataquest Inc., San Jose, Calif., sees IBM's decision to keep TopView products in-house as part of the company's underlying philosophy to move its hardware and software toward more proprietary systems. "IBM wants to maintain more control over the quality of the product, the usage of it and compatibility between various products," Lim says, "and at the same time get a little bit more of the end-user dollar."

Jean Yates, president of Yates Ventures, Palo Alto, Calif., says there is a growing faction inside IBM that questions the advisability of third-party dominance in the market for generic software applications like spreadsheets and word processors. "There will," Yates says, "undoubtedly be a shift by IBM toward more proprietary software in these areas, while the company pushes for the development of third-party vertical market applications." The three new programs include a series of five accounting packages.

TopView offers multitasking and windowing for single-user applications. It runs with PC-DOS versions 2.0, 2.1 or 3.0, and can be used with the IBM PC, PC/XT, PC-AT, the Portable Personal Computer, and the 3270-PC. It requires a minimum of 256K bytes of RAM and two double-sided, double-density disk drives or one double-sided drive and a fixed disk. TopView can be used with either a keyboard or a mouse pointing device. The $149 program will be sold through IBM Product Centers, authorized dealers, and the company's national accounts branches.

A glance at TopView

TopView provides a single-user operating environment and runs with DOS 2.0, 2.1 or 3.0. Its facilities allow applications to have one or more windows. Additional features include:

- Multitasking
- Cut and paste
- Keyboard or mouse support
- Ability to run text and graphics applications
- Ability to run on monochrome or color displays
- Support of frequently used DOS functions

The TopView program gives graphics applications control of the full screen when they are in a foreground task. Medium resolution color (320-by-200 four-color pixels) and high resolution black and white video modes can be used for graphics applications.

In the future, IBM expects to have TopView capabilities available in productivity environments such as 3270 emulation and the IBM PC Network.

PC-compatible makers wait

Since IBM did not design TopView with portability in mind, PC-compatible microcomputer makers are anxiously waiting to test the product, industry sources say. According to one beta test user, who wished to remain unnamed, the program in its current form runs without modification on Compaq Computer Corp. machines. A spokesman for Compaq notes that things could change significantly when the final version of TopView hits the market in the first quarter of 1985. Some analysts speculate that TopView will be sold in a form that ties it to parts of IBM hardware.

TopView works with applications programs for the IBM PC such as the Assistant Series, DisplayWrite 1 and 2, Multiplan, VisiCalc and several programming languages. IBM is encouraging third-party development of applications that use TopView's features. IBM will not spell out what other major companies' software runs with TopView. A spokesman for IBM says third-party software companies are still reviewing the program and "it's up to them to certify compatibility." Lotus Development Corp., Cambridge, Mass., would not comment on the compatibility of its products with TopView.

IBM is making available a TopView programmer's Toolkit for $395. The kit advises on how to access TopView's functions from applications programs using a mouse and manipulating windows.

Robert M. Lefkowits, director of microcomputer system software re-

Microsoft's Windows vs. IBM's TopView

One of the most significant differences between IBM Corp.'s TopView product and Microsoft Corp.'s Windows is that TopView is designed specifically to run on an IBM machine.

The goal of Windows is portability. Close to 30 different manufacturers already support the windowing environment, says Leo Nikora, group manager of product marketing at Microsoft, Bellevue, Wash.

Another big difference between the two products, according to Jean Yates, president of Yates Ventures, Palo Alto, Calif., is that TopView is character-oriented, while Windows is bit-mapped. TopView uses the screen as an array of characters and supports character operations. Windows places icons on the screen.

In addition, Yates says, TopView is designed to allow IBM's proprietary applications to run within its windows, while Microsoft's product is designed to allow generic applications to run.

In examining the windowing products announced so far, analyst Kenneth Lim of Dataquest Inc., San Jose, Calif., says TopView will come closer in functionality to VisiOn. "While Microsoft's Windows is basically an extension of the operating system, VisiOn is an operating environment separate from any operating system, and sits between the operating system and the applications packages."

search at InfoCorp, Cupertino, Calif., says companies who don't make a concerted effort to live with TopView's standards are going to make a big mistake in the long run. He expects companies like Lotus and Ashton-Tate to react to TopView shortly. "It will be interesting to see if they go back and recode their routines and, in the long run, potentially sacrifice speed of execution to [create] well-behaved software products that work within the TopView parameters and standards," Lefkowits says. "Then again, they might thumb their noses at TopView because they feel they can do it better and put users in the position where they would have to run Lotus in the foreground on a TopView machine."

Some IBM watchers question the overall wisdom of developing a windowing program in house, instead of going with a third-party product such as VisiOn or Microsoft Corp.'s Windows. VisiOn was recently acquired from VisiCorp by Control Data Corp. Up to now, 27 companies have announced their support of Windows. While TopView differs from Windows in functionality, technical differences between the two products may not have been IBM's only reason in deciding to develop the program in house. Its close relationship with Microsoft was likely to have been behind that decision as well. Microsoft and IBM cooperated closely in developing the PC's PC-DOS operating system.

InfoCorp's Lefkowits says he believes IBM is concerned with burdening the comparatively small Microsoft with too much work. He says: "With all Microsoft's work in the operating system area, I think IBM was concerned about the company's resources to do a windowing product as well. As we have already seen with third-party suppliers on the hardware side, IBM does not like to put all its eggs in one basket," in case the smaller company cannot pull together the resources to produce a major product in time.

Dataquest's Lim believes the MS-DOS 8088 world has gotten too big for IBM's comfort. "Although the company will continue to support MS-DOS, a year or two down the line they will begin to move farther from it," he says. Lim says IBM has under development three operating systems code-named Nina, Pinta and Santa Maria. They are expected to be proprietary, multiuser, multitasking systems that will allow MS-DOS or CP/M-86 to run as tasks underneath them. "That would give IBM the proprietary angle they are looking for and at the same time allow the coexistence of the existing standards," Lim says. He expects IBM to announce the first of these operating systems in the next 12 to 18 months. And he thinks there are likely to be proprietary hooks in TopView that pertain to such future uses.

Also significant to TopView's introduction, according to InfoCorp's Lefkowits, is that IBM has finally endorsed a windowing product. "That means windows will become a de facto standard and all the IBM-compatibles will have to go out and scramble for a version of a windowing product, and it obviously can't be TopView, which is IBM-proprietary," he remarks. □

INTERFACE CONNECTS APPLE TO EPSON PRINTERS

Hanzon Data Inc., Woodinville, Wash., has introduced an intelligent serial interface card that connects Epson America Inc. printers to the Apple Computer Inc. IIe, IIc, Macintosh and Lisa personal computers. With the Model 12319 universal card installed, Epson RX and FX dot-matrix printers can be used as direct replacements for Apple Image Writer printers. Baud rates can be set from 300 to 19,200 bits per second with either 7- or 8-bit data. An on-board 2K-byte memory buffer is expandable to 16K bytes. Retail price is $129.50.

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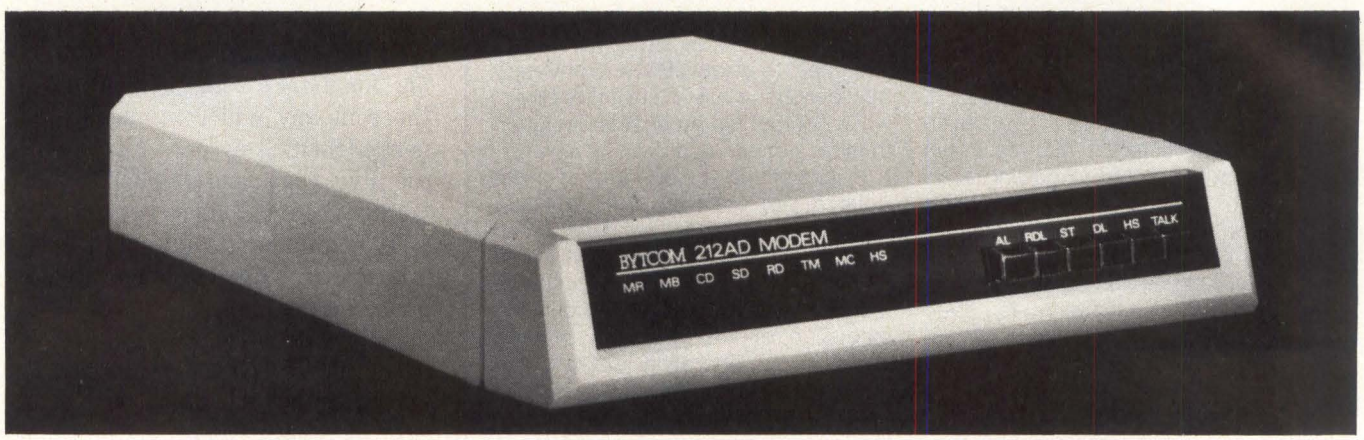

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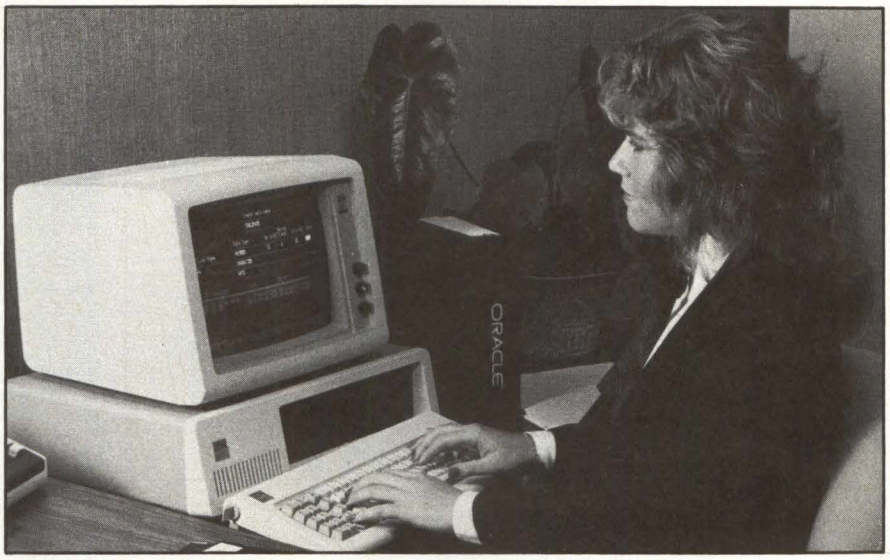
CIRCLE NO. 18 ON INQUIRY CARD

Oracle reduces size of relational DBMS for microcomputers

Tom Moran, Associate Editor



The PC Oracle relational database-management *system runs on microcomputers such as IBM Corp.'s PC as a complete, but reduced-code, version of Oracle Corp.'s Oracle system for mainframes and minicomputers.*

The Oracle Corp. claims it has adapted its Oracle large-computer database-management system (DBMS) to run on most major microcomputers by reducing its code by half. Company spokesmen maintain that the new PC Oracle retains all the relational DBMS features the original software offered on the larger minicomputers and mainframes. The company also has introduced Oracle Link, a complementary networking package for PC Oracle owners.

Oracle reduced the size of the software's code from 1M byte to less than 512K bytes, the company says. But the Menlo Park, Calif., manufacturer maintains that the same applications programs can be run without alteration on microcomputers such as IBM PCs, minicomputers and mainframes. PC Oracle includes a report writer, a networking system, an integrated data dictionary and an application generator and is compatible with IBM's SQL/DS and DB2 database software.

PC Oracle is available for IBM's PC/XT and PC-AT, Compaq Computer Corp.'s Compaq Plus, Eagle Computer Inc.'s Spirit XL, Durango Systems Inc.'s Poppy, Texas Instrument Inc.'s Professional, Digital Equipment Corp.'s Rainbow, Apollo Computer Inc.'s Domain, Fortune Systems Corp.'s 32:16 and Stratus Computer Inc.'s fault-tolerant systems. Oracle expects to produce a version for AT&T's 3B2 computer this month and plans ports to several other systems.

To run PC Oracle on IBM microcomputers requires 512K bytes of RAM, DOS 2.0 or 2.1, a 10M-byte Winchester disk drive with at least 3M bytes of free space, and one floppy-disk drive. PC Oracle runs on DEC VAXs with VMS and UNIX, DEC PDP-11s with RSX-11/M+, the IBM 30XX series, and Data General Corp. and Harris Computer Corp. computers.

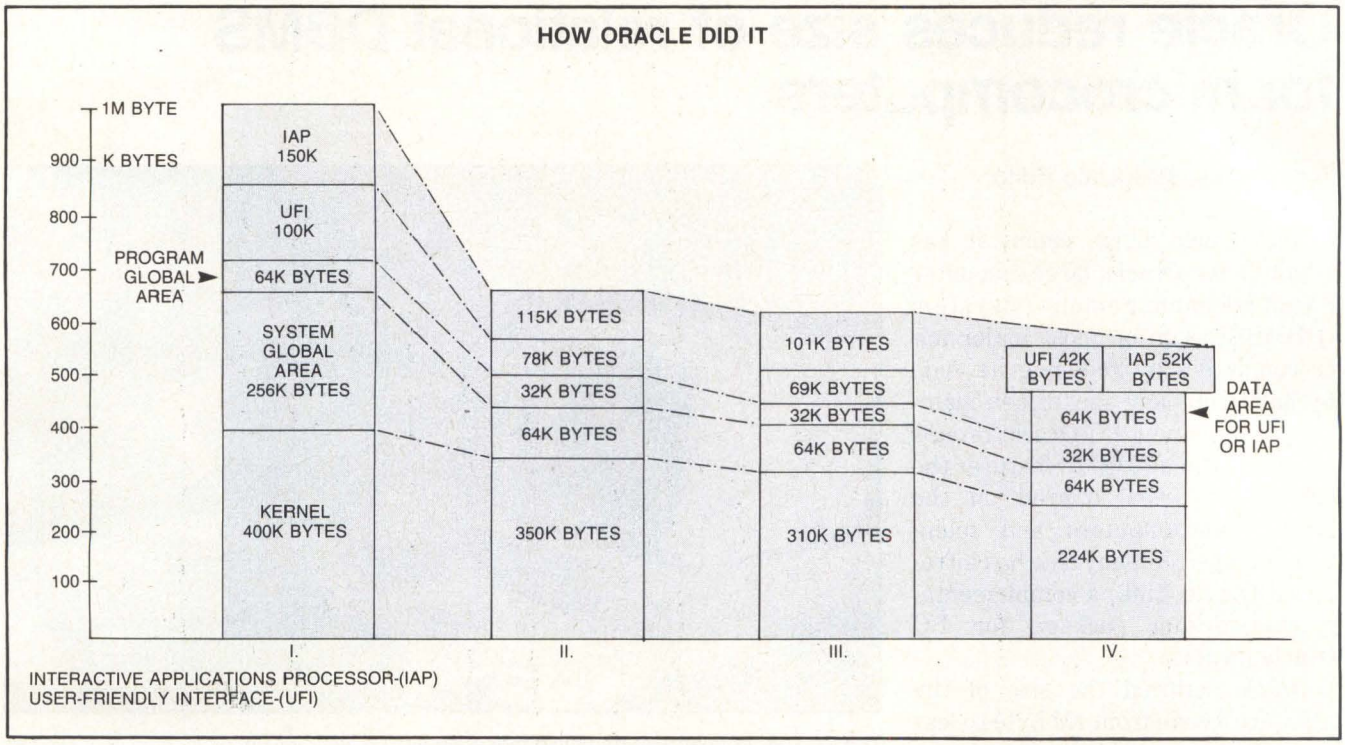
According to Oracle president Larry Ellison, to compress Oracle for microcomputers the company had to create new compilers, a linkage editor and a debugging system. The process took almost two years.

Link supports communications

Oracle's new Oracle Link networking package communicates with versions of Oracle for DEC VAX superminicomputers and IBM mainframes. Oracle Link permits the exchange of shared database information to and from the large computer and PC Oracle on the microcomputer. PC Oracle's price, including Oracle Link, is $1,000 per system with a minimum order of six packages.

Robert M. Lefkowits, director of microsystems software research for InfoCorp, a Cupertino, Calif., research company, says growing companies may choose to start out by buying an upscale high-end PC like the IBM PC-AT to run PC Oracle. Then, as they expand their databases, they could upgrade to larger machines without having to worry about converting software.

Jim Renalds, manager of the small computer industry service for Dataquest Inc., San Jose, Calif., disagrees with Lefkowits. "I don't see it as that much of an advantage to run the exact same software on the micro as on the mainframe. [In what application] would you use a microcomputer in the same way that you use a mainframe? There's a [storage] capacity problem in that the database on the mainframe typi-



Bar I *represents the original Oracle relational database-management system. In Bar II, the object code has been reduced by the instruction set architecture of the 8088 chip and by eliminating multiuser capability. Reductions in Bar III result from optimized pointer-reference handling and intermediate-results handling. The C compiler and reduction of the longest data pointer to 16 bits account for the final compression shown in Bar IV.*

cally accesses a fairly complicated and large [amount of data]." Renalds maintains that, if a company needs that complex a database, the company would use dumb terminals or PCs acting as dumb terminals. But the task of extracting a subset from the main data remains. "The real question is, will users be willing to put up with the offloading time and slower execution of the micro, versus just [accessing data] on the mainframe?"

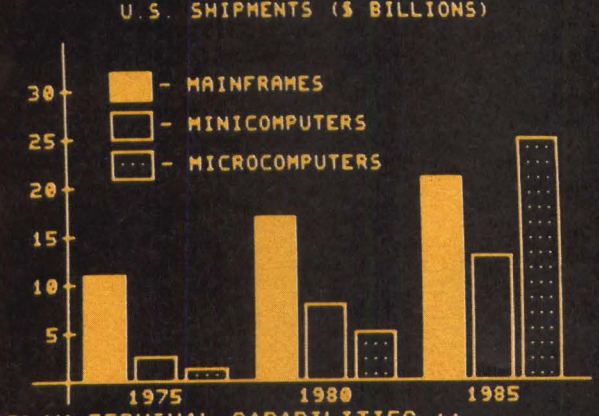
Renalds feels PC Oracle is an attempt to slice into the predominant market share of Ashton-Tate, Culver City, Calif., Microrim, Bellevue, Wash., and Software Publishing, Mountain View, Calif. "The reason those three [companies'] products, among others, have been so successful is that they run on the IBM PC," he says.

Dataquest estimates that Ashton-Tate has installed 280,000 units of dBASE II and Software Publishing has in place more than 300,000 units of PFS:File. But Renalds concludes that Oracle is not entering the microcomputer market too late. "Databases are increasingly in demand by the small business user, so Oracle is still in the window for significant market share and sales," he says. □

PRINTED-CIRCUIT BOARD INDUSTRY GROWING UP

Until recently, the printed-circuit-board (PCB) manufacturing industry borrowed heavily from photographic, metal finishing and laminating production methods. But the advent of increasingly sophisticated microprocessors has forced PCB vendors to begin developing a native technology to efficiently produce the much denser patterns of conductive lines and insulation spaces required by microprocessors and other VLSI semiconductor devices. The cost of such retooling will be high, leading to a shakeout among the more than 800 industry participants, according to a Frost & Sullivan Inc. report. In the study, the New York market research firm predicts that, despite the high cost of industrial change, the PCB market will grow from $3.5 billion in 1983 to $13.7 billion in 1993. Double-sided boards will lead the market with a 49 percent share, followed by multi-layer boards with a 41 percent share.

A Picture's Worth:



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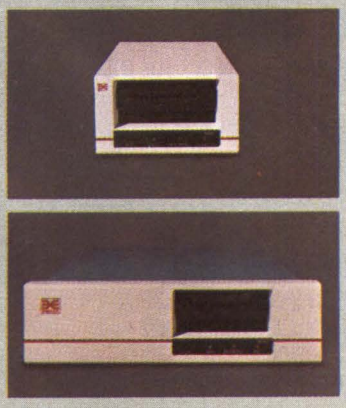

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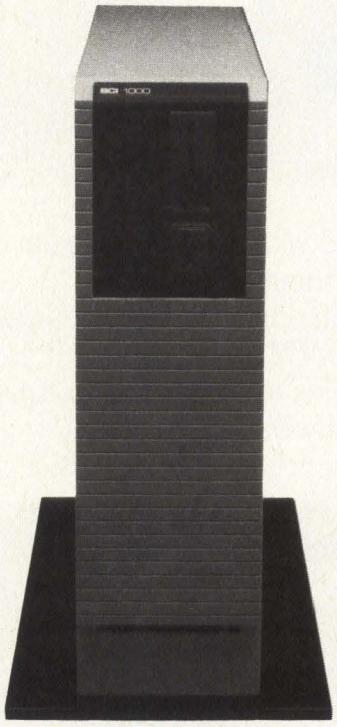

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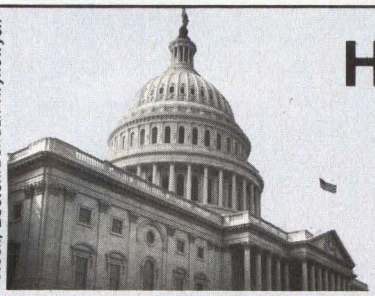

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HEARD ON THE HILL

High technology receives low priority in presidential campaign

Stephen J. Shaw
Washington Editor

Regardless of the outcome of this month's presidential election, both Ronald Reagan's and Walter Mondale's campaigns have proved to be disappointments to the U.S. computer industry. During the long months of campaigning, both men consistently and repeatedly failed to address issues critical to the continued development of high-technology industries in this country.

This is not to say that the candidates paid no political lip service to high-technology industries. Reagan called for "high tech, not taxes," in one of his speeches. And Mondale pointed out that the basic industries of the 1990s will differ significantly from those of the 1970s. But aside from the most banal and soporific utterances, there was no significant national discussion concerning the future of those industries which both men agree represent the future of this country.

In preparing this column, we contacted both parties' national campaign headquarters and asked them to send position papers, speeches and any background material that would shed light on the candidates' points of view on the development of the U.S. computer industry and other high-technology industries. The response from both camps was astonishing: "We really don't have anything directly relating to high tech." No position papers (normally churned out in volumes by campaign staffs, and read by a scant handful of voters), no speeches, no compilation of legislative records. Nothing.

The issues branch of the Reagan campaign said that they had no high-tech specialist as they did for military spending, overall economic policy and social issues. In the words of Bob Dawson, Reagan's campaign manager in Massachusetts, "Reagan's philosophy is, what's good for business in general is going to be good for the high-tech industrial segment." He added that, "Since the president doesn't support a planned industrial policy, the campaign has concentrated on his development of investment incentives such as accelerated cost recovery schedules and tax cuts." Coincidentally, Dawson works at Wang Laboratories Inc.

The Mondale campaign staff in Washington referred us to the Democratic platform (non-binding on the candidate), and a document released in January by the National Democratic Caucus that outlined a blueprint for the country's future as seen by the Democratic members of the House of Representatives. (Again, the plan does not obligate Mondale.) Both documents contain some references to the need to address U.S. high-tech industrial development and related concerns, but only in the most vague terms. As political documents, they fall far short of providing any basis for the national discussion that is needed on this country's future economic mainstays, of which high tech is one.

Many issues deserve a national debate because they are so crucial to the computer industry and are therefore of national importance. Export administration, increased research and development expenditures, increased access to foreign markets, protection of domestic markets and the trend toward offshore manufacturing are issues that received short shrift from both candidates when it came to relating party philosophies to concrete proposals.

The reason for this, according to a computer industry association executive, is the campaign's broad focus. "This campaign did not get down to many industry-specific issues," commented Ted Heydinger, vice president for government relations with the Computer and Business Equipment Manufacturers Association. The industries that did attract national attention—automobile, steel and agriculture—generated campaign discussions that were split along party lines. High-tech issues have not attracted such partisan support or opposition. Campaigns outline differences, notes another political observer, so since both Mondale and Reagan essentially agree on the importance of the computer industry and other high-technology industries to the future of the United States, what would be the point of getting bogged down in details?

The danger in such a superficial analysis is that differences between the two candidates were not likely to surface until after the election. While agreeing to the importance of high technology to this country's future, Mondale and Reagan assumed, and failed to live up to, the responsibility of formulating and communicating specific policy positions. It's a failure for which the winner of this month's election should be called to account.

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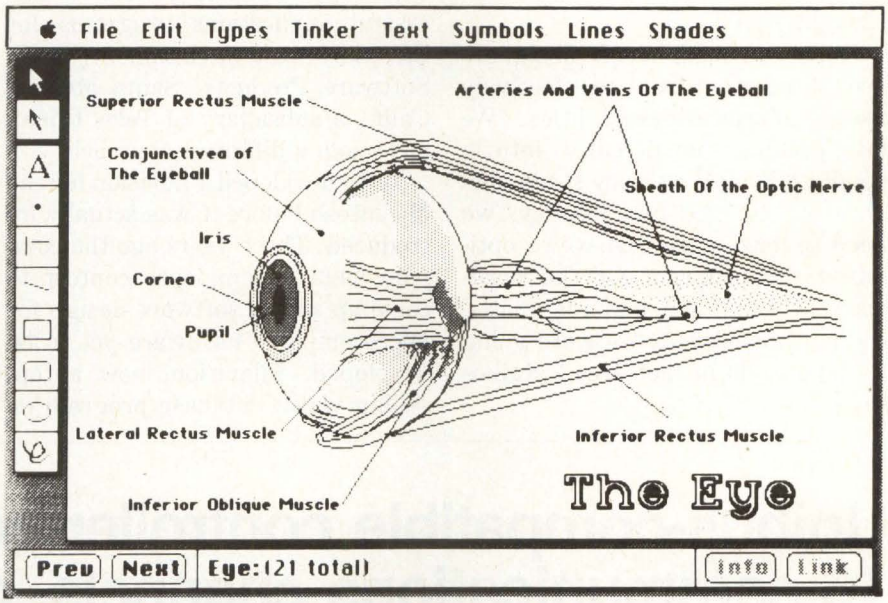
Apple slices Macintosh software projections

Marjorie Stenzler-Centonze
Associate Editor

Apple Computer Inc., Cupertino, Calif., has revised its lofty projections about how many applications packages will be available for its Macintosh microcomputer by year's end. Apple had announced in January that more than 500 software packages would be available. But with only 75 applications shipped as of September, Apple officials have now reduced their estimate to a maximum of 150 software packages by the end of 1984. Even that may be overly optimistic because of the longer-than-expected learning curve for programmers, say some industry observers.

Apple is counting on third-party software developers for more than 90 percent of Macintosh software products, but applications development has been slower than anticipated. "We were overly optimistic in our initial forecast," states Guy Kawasaki, who heads the third-party software development effort at Apple. The first time programmers write a Macintosh application, they find it to be quite a challenging environment, Kawasaki explains. "The richness of our ROMs and the user interface have made Macintosh programs typically a six- to nine-month development process."

Once a third-party software developer comes out with its first Macintosh software product, subsequent packages will require less effort. But it is still a task to write for the Macintosh: Macintosh applications are not well-suited to porting from an IBM PC or Apple IIe, because the machines' features are so different. "Developers have to think about how to use scroll bars, windows, icons and a mouse-based system. [In] taking a program from the PC to the IIe, no one had any of those considerations," Kawasaki states.



Telos Software's Filevision program *for Apple's Macintosh computer combines filing with an object-oriented drawing system so that technical illustrations such as the one above can be created, stored and retrieved by the mouse cursor controller.*

"The Macintosh environment is so different from the Apple [IIe] or IBM world that it essentially requires a rewrite to move existing software onto the machine," concurs Valorie Cook, group product manager at Software Publishing Corp., Mountain View, Calif., which has released two products for the Macintosh—File and Report.

Spreadsheets are needed

The important products for Apple to add to its stable of Macintosh products for business users are spreadsheets, according to Kenneth G. Bosomworth, president of the research company International Resource Development, Norwalk, Conn. During the first quarter of next year, Lotus Development Corp., Cambridge, Mass., plans to ship the Macintosh version of its 1-2-3 integrated spreadsheet. Apple's Kawasaki expects 1-2-3 to quickly climb to the top of the Macintosh best-seller list.

Although software packages are not as plentiful as Apple would have liked, most developers working on Macintosh applications agree that the programs that have come to market so far make good use of Macintosh features. "People aren't compromising on product design just to shove software out the door for Macintosh," says Jeff Raikes, director of applications marketing at Microsoft Corp., Bellevue, Wash. "They are really taking advantage of what Macintosh has to offer, including the high-speed processor, high-resolution bit-mapped graphics and the mouse pointing device," Raikes says.

Microsoft has released Multiplan, Microsoft Basic and Microsoft Chart for the Macintosh and expects to ship its Word and File programs by the end of this month. "We are pretty much on target with the pro-

grams we are bringing to market," Raikes says, "although the timing took a bit longer than we had thought."

Raikes says Microsoft designers are taking great pains to effectively use the Macintosh capabilities. "We are packing functionality into a small 128K-byte memory space, and once we get the functionality, we need to make sure that we've optimized the program for the hardware. I think we underestimated the amount of work we were going to have to do in that area," Raikes says.

Writing for theoretical machines

While many of the major software houses are rewriting already successful applications programs for the Macintosh environment, Telos Software Products, Santa Monica, Calif., a subsidiary of Telos Corp., has taken a different approach.

Telos developed Filevision for the Macintosh before it was actually introduced. Three years ago the company held an employee contest to come up with a software design for microcomputer hardware yet to be developed. Filevision, now a top-selling visual database program on the Macintosh, was the winning product.

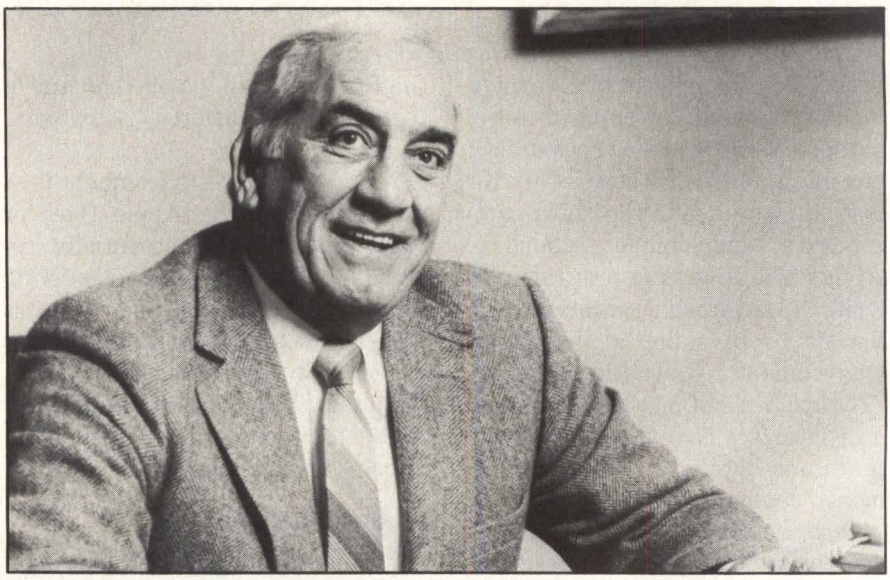
Telos, which had previously specialized in mainframe and minicomputer software, committed resources to the microcomputer market for the first time. "We were waiting for the right computer to come along," says Robert Foster, vice president of marketing for Telos Software. "We were different from other companies in that we knew just what we were going to do and only had to worry about implementing it on the right computer." □

Unibus-compatible controller combines 16 communications channels, dual emulation

Carl Warren, Western Editor

Distributed Logic Corp. has developed a multifunction, 16-channel asynchronous communications controller to help system integrators and end users extend communications on Digital Equipment Corp. VAX minicomputers using Unibus.

The Anaheim, Calif., company's new controller features full power-up diagnostics and user-selectable emulation of DEC's own DH11 and DMF32 asynchronous controllers on one Unibus-compatible board. Called the CU160, it also permits up to 38.4K baud on all channels. Each channel can be fully configured using onboard DIP (Dual In-line Package) switches. Therefore, all lines for each channel can be set up for either a modem/null-modem-transmit with receive lines switched, or high-speed, 600-line-per-minute printers.



Distributed Logic's Raymond Ball *explains that the CU160 Unibus-compatible controller emulates both DMF32 and DH11 asynchronous controllers, but at no extra cost for the dual capability.*

Extending the word

The CU160 also supports multiword (4-bit to 16-bit words) on single direct-memory-access (DMA) transfers. Therefore, according to Raymond Ball, corporate vice president of marketing at Distributed Logic, "The CU160 doesn't clobber the Unibus with multiple transfers" each time a bus is strobed with a signal that data are correct on the bus. To achieve the fast DMA transfers without impacting the controller, host bus or other communications lines, a 64-character

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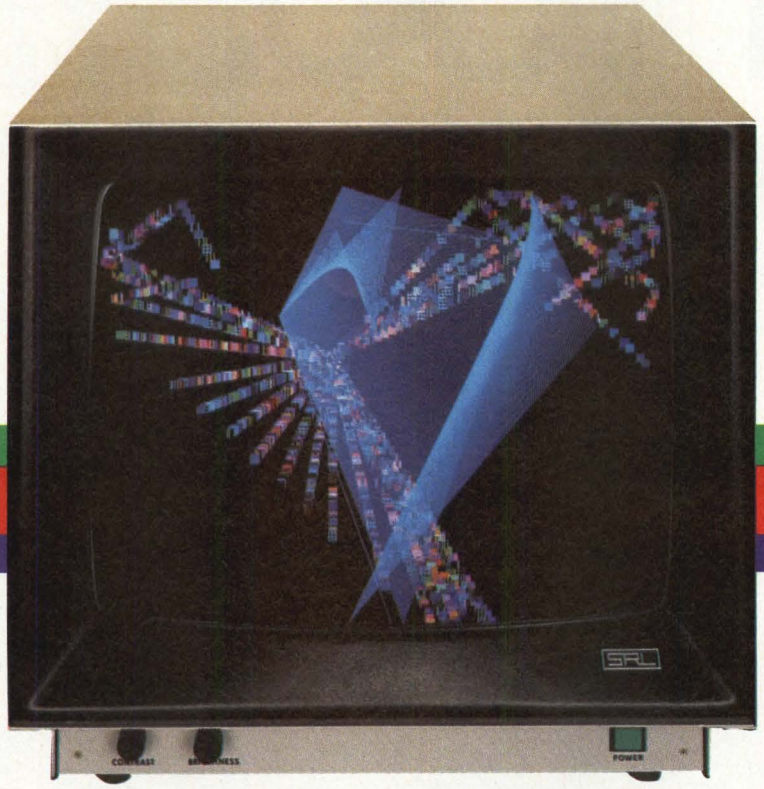

on an SRL 60 Hz noninterlaced display.

Our new 60 Hz noninterlaced Model 2110 display offers you one of the highest line rate, highest resolution color monitors available today. And at an economical price.

This state-of-the-art 1280 x 1024 format display features a 100 MHz ultra-high video bandwidth and a 64 kHz horizontal line rate for flicker-free performance. You get consistent brightness of narrow horizontal and vertical grid lines—and 1000 line resolution images at a 60 Hz noninterlaced frame rate.

There's no need to buy several monitors or to make circuit changes to meet your multiple line/frame needs. Simply select a range from 26.8 to 66.2 kHz with the Model 2110's unique *Select-a-Rate*.

And the SRL Model 2110 features even more benefits at no extra cost: differential video inputs...separate horizontal and vertical drive inputs...an adjustable bezel that allows you to insert anti-glare filters, and factory convergence that never deteriorates. Optional mechanical designs to meet specific packaging needs and custom engineering services are available.

The Model 2110 is the result of clean, precise engineering. No fans or baffles...no massive heat sinks or power supplies. Just the components necessary to give you spectacular color images.

So when you need better convergence, linearity and pure color fidelity across the screen and from edge to edge, contact us to find out more about our new 60 Hz Model 2110 color display.

Screen graphic courtesy of Metheus Corp.

CIRCLE NO. 23 ON INQUIRY CARD

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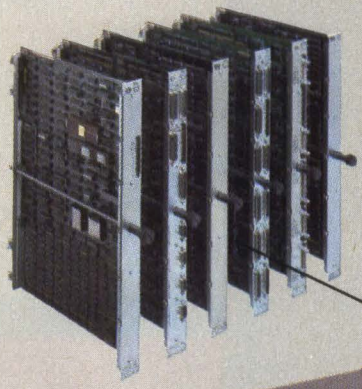
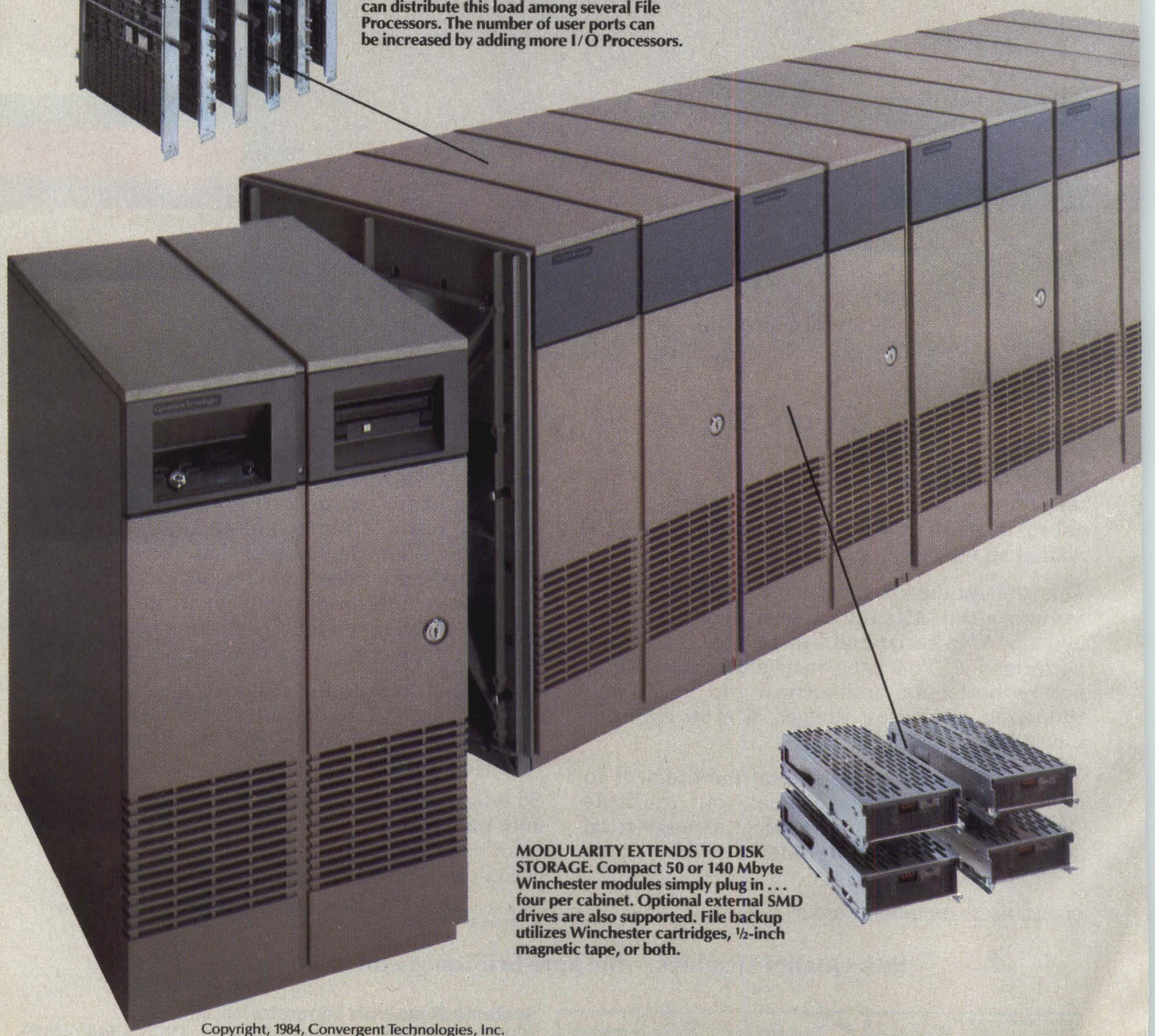


CONFIGURABLE ACCORDING TO USER NEEDS. As many as six processors can be installed in each enclosure. CPU-intensive jobs utilize multiple Applications Processors. Systems with heavy disk usage can distribute this load among several File Processors. The number of user ports can be increased by adding more I/O Processors.



MODULARITY EXTENDS TO DISK STORAGE. Compact 50 or 140 Mbyte Winchester modules simply plug in . . . four per cabinet. Optional external SMD drives are also supported. File backup utilizes Winchester cartridges, ½-inch magnetic tape, or both.

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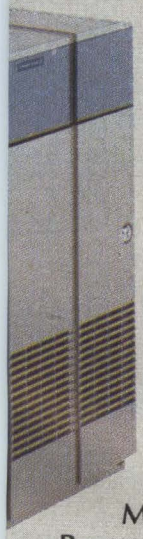
MegaFrame™. Now OEMs can offer a high-performance UNIX™-based system that can't run out of performance.

OEMS can now deal cost-effectively with the problems encountered when user applications produce computing demands that outstrip the capabilities of conventional systems.

Convergent Technologies' MegaFrame is a revolutionary new UNIX-based super-minicomputer—so innovative in its architecture that it represents the ultimate in multiuser systems design. It grows exponentially from a system offering minicomputer-level performance to an enormously powerful engine serving as many as 128 users with 36 parallel processors, 24 megabytes of RAM and gigabytes of disk storage.



No other system can match the MegaFrame's potential for field expansion. It enables manufacturers and systems builders to keep pace with today's requirements for more and more computing services . . . but *not* at the cost of discarding hardware or performing expensive CPU upgrades.

MegaFrame's architectural breakthrough. Dependence on traditional single-CPU shared-logic architecture is the root of systems bottlenecks.

Convergent's response: a novel system utilizing *multiple* specialized processors to distribute workloads for optimum performance—even if user needs are unpredictable or subject to rapid change.

MegaFrame's virtual memory Applications Processors each have a 32-bit CPU, up to 4 Mbytes of RAM and run a demand-paged version of UNIX System V. Up to 16 of them can operate in parallel.

The File Processors effectively function as back-end machines providing DBMS, ISAM and other disk-related services. Up to six File Processors each with four disks can operate in parallel.

Terminal and Cluster Processors can also be added—the latter serving front-end communications needs. They off-load communications from the other processors by running protocols such as SNA and X25 networks.

MegaFrame's daisy-chained cabinets offer total expansion potential of up to 36 slots. OEMs configure the system needed for specific applications simply by adding the correct number/combination of processors.

Flexibility in applications development. Inclusion of one or more Applications Processors allows running UNIX System V. All standard UNIX tools are provided, along with COBOL, FORTRAN-77, BASIC interpreter and compiler, plus Pascal.

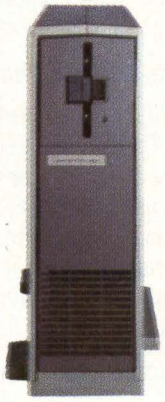
The "least-cost solution" to serving a wide range of UNIX-systems needs, MegaFrame has won acceptance from OEMs in the U.S. and abroad. The uniqueness of its modular design, its versatility in providing upgrade-path options and its price/performance advantages give it market-share potential of outstanding dimensions.

The system that will grow on you starts at a very attractive price: about $20,000 for a system that effectively supports 16 users. Send now for a comprehensive Information Package including reprints of magazine articles. It explains how MegaFrame's growth potential can impact favorably on your plans for growth in the UNIX market.

Convergent Technologies, Data Systems Division, 3055 Patrick Henry Drive, Santa Clara, CA 95050. Phone: 408/980-0850. Telex: 176-825.

MiniFrame™: the entry-level multiuser UNIX system.

Starting at under $5,000 for a single-user system, Convergent's MiniFrame offers outstanding capabilities for small to medium sized organizations running large UNIX-based applications. Utilizing an MC68010 microprocessor operating at 10Mhz, with no wait states, it provides impressive CPU speed—comparable to VAX™-11/750 running the AIM™ Benchmark. MiniFrame features virtual memory management, with demand-paged implementation of UNIX System V. It runs as many as eight terminals, with up to 50 Mbytes of integral mass storage. MiniFrame and MegaFrame are object-code compatible, allowing OEMs to offer a *complete family* of systems unrivaled in price/performance characteristics.



Convergent Technologies

Where great ideas come together

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CIRCLE NO. 24 ON INQUIRY CARD

Go from port to port without ever leaving the terminal.

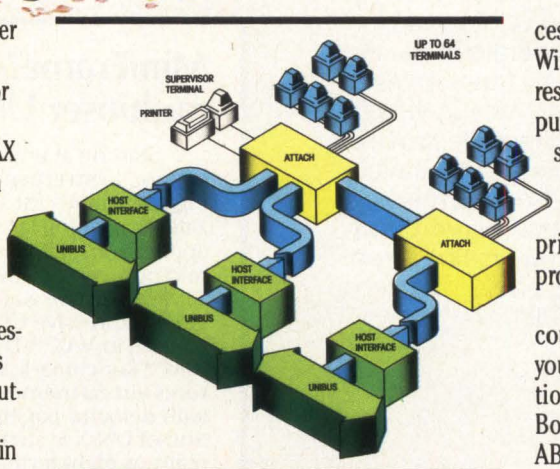
The ATTACH system from ABLE Computer helps the data processing manager avoid a mutiny among users by enhancing processor efficiency. A multi-host terminal network system, ATTACH supports DEC UNIBUS VAX and PDP computers...and with its Softswitch feature that supports port selection, makes for smooth sailing through your network.

Ports-Of-Call, The User's Choice

With ATTACH, users select their network destination. The data processing manager assigns user class definitions for various host computers. Then users can initiate switching between any VAX and PDP-11 UNIBUS computer ports in the system. Access to specific data files and applications in the appropriate host computer is readily available.

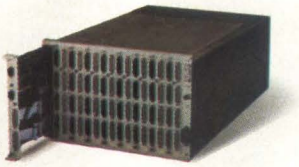
Navigate The Network Efficiently

With port selection, users match themselves to the application port required — no more wasted user time, or wasted support resources. And no host computer is sitting idle while others are overloaded.



Secure A Safe Passage

The ATTACH system assures the data processing manager of security in the network. With user class definition the supervisor restricts access to any specified host computer, set of computers or subset — this safeguards critical data files. Plus, with ATTACH, the supervisor is free to allocate a particular host computer to high priority users who demand instant access and processing time.



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Contact an ABLE representative near you, or call us toll free at 800-332-2253.

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CIRCLE NO. 25 ON INQUIRY CARD

first-in-first-out buffer is provided for each line. That allows the 4-word [64-bit] DMA transfers when the bus is strobed.

Joel Jaworski, president of Peripheral Concepts Inc., Irvine, Calif., a marketing research firm specializing in controllers, points out that reducing bus traffic is an important feature for communications controllers. However, Jaworski points out that multiple emulation may be a more important factor. "Offering multiple emulation [DH11 and DMF32 on one product] reduces the manufacturing cost, the end-user cost and level of [product] complexity. Controller manufacturers are being forced to create more flexible devices [because of user demand]," he explains.

Emulex Corp., Costa Mesa, Calif., offers similar capability with the CS21 series of 16-channel controllers. Like Distributed Logic, Emulex provides multiple emulations for DMF32 and DH11. The Emulex emulation method, however, requires new programmable read only memories (PROMs) for each emulation, all at additional cost. Ball explains that the dual emulation capability on the CU160 is free. "A user can use or ignore the extra one," he says.

Packs in more

Distributed Logic provides extensions on the CU160 such as flow control. This lets users turn data streams off or on in accordance with the requirements of the attached device, or of the host. "Typically on DEC equipment, this is a one-way street. We added bidirectional flow control, thus either the host or attached device can signal a go or no-go condition," claims Ball.

Distributed Logic also extends the available space and power of Unibus systems via the CU300 series of add-ons. The CU300 provides four additional Unibus slots, has an internal 20A power supply, can support either full-size or half-size boards and can accommodate up to 128 communications channels.

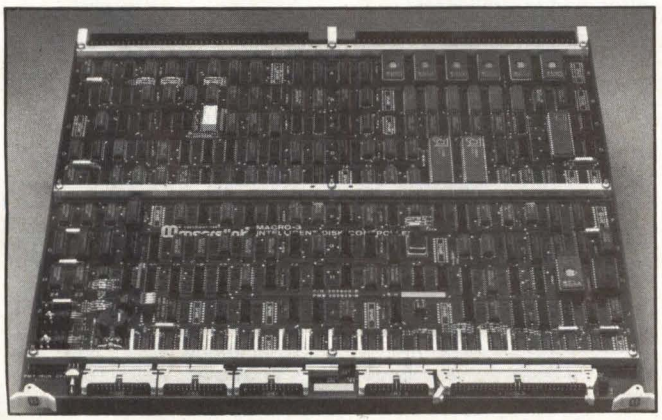
The model CU160 with DH11 and DMF32 emulation, 16-channels, multiword DMA, and bidirectional flow control is priced at $3,000. The CU300 add-on is priced at $7,500. □

Macrolink enters market for Perkin-Elmer disk controllers

Carl Warren, Western Editor

Tape controller maker Macrolink Inc., Anaheim, Calif., is invading the market for Perkin-Elmer Corp. computer disk controllers with the Macro 3 storage module device (SMD). The board is for use with high-performance Perkin-Elmer 3205 minicomputers.

By developing the Macro 3, Macrolink challenges a substantial number of competitors in the Perkin-Elmer niche, particularly Spectra Logic Corp. of Sunnyvale, Calif., which has more than 65 percent of the Perkin-Elmer disk controller market. According to Vipul Mehta, vice president of Peripheral Concepts Inc., an Irvine, Calif., research firm specializing in controllers, the Macrolink board competes directly with Spectra Logic's Spectra 14. "The Spectra 14 is currently the most used controller. Typically, you find Spectra Logic disk controllers and Macrolink tape controllers on Perkin-Elmer machines," says Mehta.



Macrolink's Macro 3 disk controller *for Perkin-Elmer minicomputers uses a single DIP switch to set the device address, while all other functions are established via soft menus.*

Both the Macro 3 and Spectra 14 are capable of supporting extended SMD functions by special interleaving or staggering of the sectors, thus allowing for the 1.9M-byte-per-second transfer rate expected when using high-capacity disk drives such as the Fujitsu Eagle. However, Macrolink claims that the Macro 3 provides a strong upgrade path for Perkin-Elmer users. Macrolink president, R. David Vednor, explains: "Older Perkin-Elmer machines used the Mass Storage Module. The newer machines migrated

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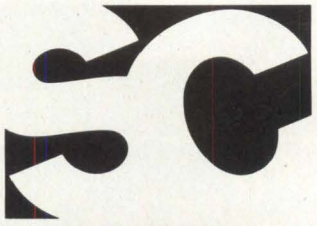

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CIRCLE NO. 27 ON INQUIRY CARD

DATARAM

to the Intelligent Device concept. This means that older disk packs can't be read—so upgrading was tough. We solved the problem [in our controller] by reading both simultaneously." Vednor notes that pricing is part of the marketing strategy. The Macro 3 is priced at $3,475, which contrasts to $4,500 for the Spectra 14.

Soft menu helps users

The Macro has a soft menu whereby the user can establish the characteristics of the system by following the menu items. To set the functions of the controller, a writable control store is provided, as are erasable programmable read only memories (EPROMs) that can be used for coding special functions. A single DIP (Dual In-Line Package) switch sets the device address. Company vice president William Goodale says the writable control store and EPROM allow for more control over functions. The use of 256K bytes of cache RAM with built-in Error Correction Code means that virtually all errors can be corrected. "This is something Perkin-Elmer doesn't have," claims Goodale.

The Macro 3 is available now with complete compatibility to all Perkin-Elmer disk formats. The cost is $3,475 per unit, or $2,155 in orders of 100. □

LOOKING AHEAD IN MMS

The Interpreter section of Mini-Micro Systems' December issue focuses on office-automation systems.

OA systems have the potential to move mountains of paperwork and boost worker productivity. Yet, year after year, the promise is not quite realized. Buyer perceptions of machines as not user-friendly could be one reason. This article examines what's being done to improve OA's image.

Expandable Stride Micro family supports 22 users

Tom Moran, Associate Editor

Stride Micro, Reno, Nevada, formerly Sage Computer, has introduced a family of MC68000-based, expandable multiuser supermicrocomputers with prices ranging from $2,900 to $58,500.

The three members of the Stride 400 series are the first systems to run Softech Microsystems Inc.'s Liaison operating system, which is a p-System superset that includes networking capability. The models 420, 440 and 460 use the VMEbus and sport the same CPU board, with a 10-MHz MC68000, 256K bytes of RAM, a 640K-byte floppy disk drive, a Centronics-compatible printer port and a battery-backed real-time clock. Also standard is a Corvus Omninet local area network interface. Operating system options include UNIX System V, CP/M-68K and RM-COS. The Stride systems support a total of 30 compilers and languages.

System building blocks

Bill Delaney, Stride's vice president of marketing, says that because all the Stride 400s run the same CPU and have LAN capability, "The same software that runs on a $2,900 machine also runs on a $60,000 computer. The idea is that you can use these three as building blocks in much larger systems."

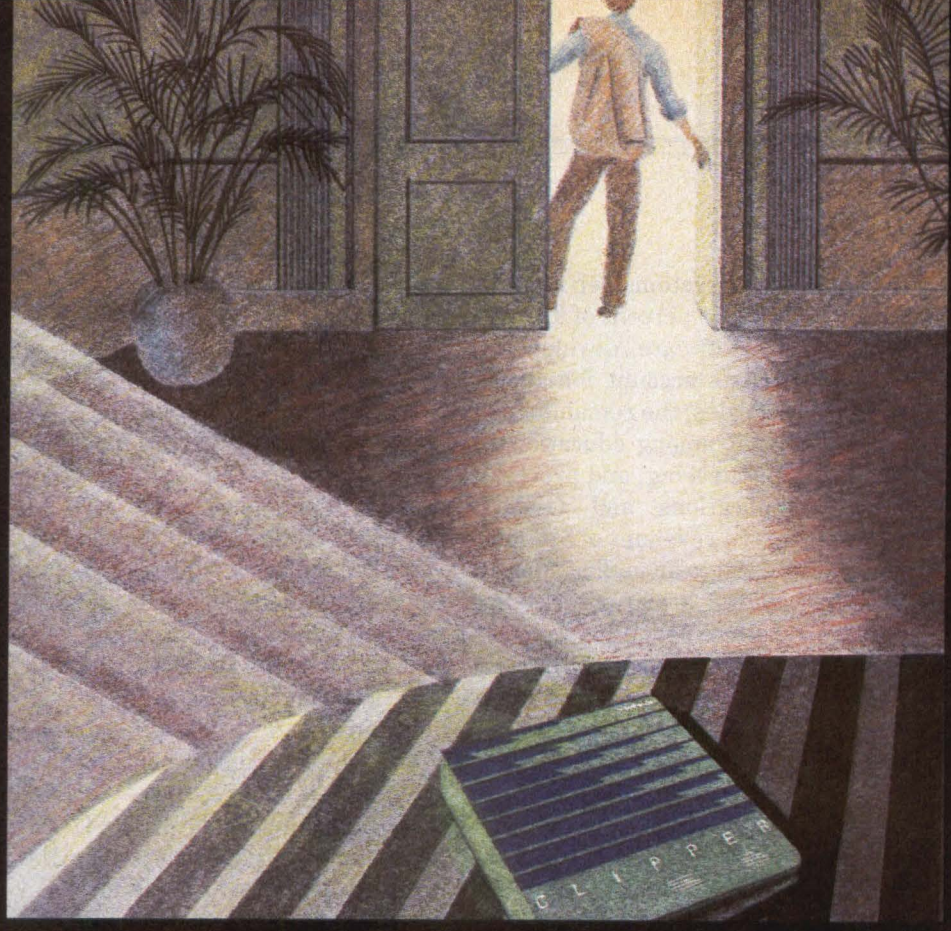
In the United States, Stride distributes its systems mainly through 145 third-party dealers and value-added resellers, with a small percentage going through OEMs. A Stride spokesman says that up to 40 percent of the company's sales are to the international market, through 35 distributors in 43 countries.

As Sage, Stride had 4,000 installed units, with a recent installa-

The Stride 400 series from Stride Micro, *Reno, Nevada, all contain an identical CPU board with a 10-MHz MC68000 processor. A Corvus Omninet local area network interface is standard.*

dBASE users will have only one thing to say when they hear about Clipper, the compiler that lets them run dBASE up to 20x faster.

"It's about time"



Introduce dBASE users to the time of their life.

Now you can sell a million dBASE users their most valuable commodity. Time.

Time to indulge themselves. *Or,* more time to utilize their computer to its fullest.

Announcing Clipper, the industry's hottest entre into the tremendous existing user base of the world's most popular database management system. Clipper, the first true compiler for dBASE III gives your customers the gift of time by making their dBASE run up to 20x faster than with the standard dBASE interpreter.

A dBASE interpreter painstakingly checks and executes one line of source code at a time every time a program runs. With Clipper, once source code is debugged, it's compiled into more efficient machine code. Subsequently, the progam runs without the time-consuming overhead of redundant translation.

And since it's impossible to translate from machine code back to source code, developers will appreciate the security as well as the speed. Clipper compiles your customers' existing dBASE III programs and any they'll use or write in the future.

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CIRCLE NO. 28 ON INQUIRY CARD

tion-rate of 250 systems per month. Approximately 50 percent of its systems go to software developers; vertical markets account for about 30 percent of sales; the remaining 20 percent is split among educational, scientific, engineering, and process-control applications and OEMs. Stride reported revenues of $10 million in the fiscal year ending March 31, representing a 420 percent increase over fiscal year 1982.

Norm DeWitt, associate director of personal computer programs for the market research group Dataquest Inc., San Jose, Calif., comments, "It sounds like they have a lot of horsepower for the dollar. They appear on the surface to be priced down in the area of the [IBM] PC-AT, which also offers multiuser capability, but not as much as Stride is offering."

System prices begin at $2,900 for the 420, $5,900 for the 440 with a 10M-byte Winchester disk drive, and $8,900 for the 460 with a 15M-byte Winchester disk drive. A 460 configuration, with four 112M-byte Winchester disk drives and 3M bytes of RAM, is $49,000.

Other options for the Series 400 include a 12-MHz MC68000 (for $500) and a second floppy disk drive (also $500). The standard 420 comes with its maximum four serial ports; the 440 and 460 models come with 10 serial ports. The 440 can be expanded to 16 ports and the 460's maximum is 22 serial ports; under certain operating systems, every serial port can support a user. The 420 can be expanded to 512K bytes of RAM for $500; the 440, to 2M bytes for $2,800, including six additional serial ports; and the 460, to 3M bytes and the optimum 22 serial ports for $5,600.

Although Stride's former products, the Sage II and Sage IV, are being phased out, Delaney says the company will fulfill present contracts and continue support. □

Verbex voice-recognition terminal talks to IBM PC

David Bright, Assistant Editor

After selling fewer than 100 of its $25,000, Verbex 3000 continuous-voice-recognition terminals, Verbex Corp. has scaled down the system to a $4,900 unit called the Verbex 4000 that attaches to the IBM Corp. PC.

Officials at the Bedford, Mass., company and Verbex's parent, Exxon Enterprises, are betting that the more attractive price and its identification with the IBM PC will lead to much greater success for the product. Near-term plans also call for the unit to connect to a variety of other machines, including Digital Equipment Corp. (DEC) VAX superminicomputers and Hewlett-Packard Co. 1000 and 3000 minicomputers, says Dr. Michael McCallig, director of engineering.

While the Verbex 3000, which the company continues to carry, is the size of a small washing machine, the new 4000 is smaller than an IBM PC system unit, measuring 17 by 4 by 12 inches. The reduction was achieved by trimming the 360-word, speaker-dependent user vocabulary to 100 words, and by making the new peripheral less intelligent. (Although it contains processors and memory, the unit functions like a dumb terminal and requires attachment to a host computer.) As a result, the 4000 needs one board, while the 3000 contains four. Compared to its predecessor, the 4000 uses a CMOS RAM cartridge for storing user voice templates, rather than a floppy disk drive, does not include a voice response (or "echo") feature for verifying speakers' input and doesn't perform chores such as error checking and data formatting.

The Verbex 4000 voice-recognition terminal, *with a claimed accuracy rate of 98 percent against background noise of 85 dB, is designed for industrial data-entry applications. Not shown is the host IBM PC.*

How to make your PC-XT multiply.

If you think that's no big deal, we'd like to introduce you to a multiplication table you've never seen before.

One PC-XT plus two terminals times one Pick System™ equals a three-user business system.

Net result: a savings of about 50% over the cost of three separate PC-XTs (which can't share data like we can, anyway).

To explain in slightly greater detail, the Pick System transforms a single-user PC-XT personal computer into a complete business computer system.

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Which shows you just three more examples of Pick Power, and how our 20 years of business experience is ready to work for you.

If you'd like to add to your awareness of the Pick System, contact any authorized Pick dealer. Ask him how the Pick System can make your PC-XT multiply, and he'll give you his undivided attention.

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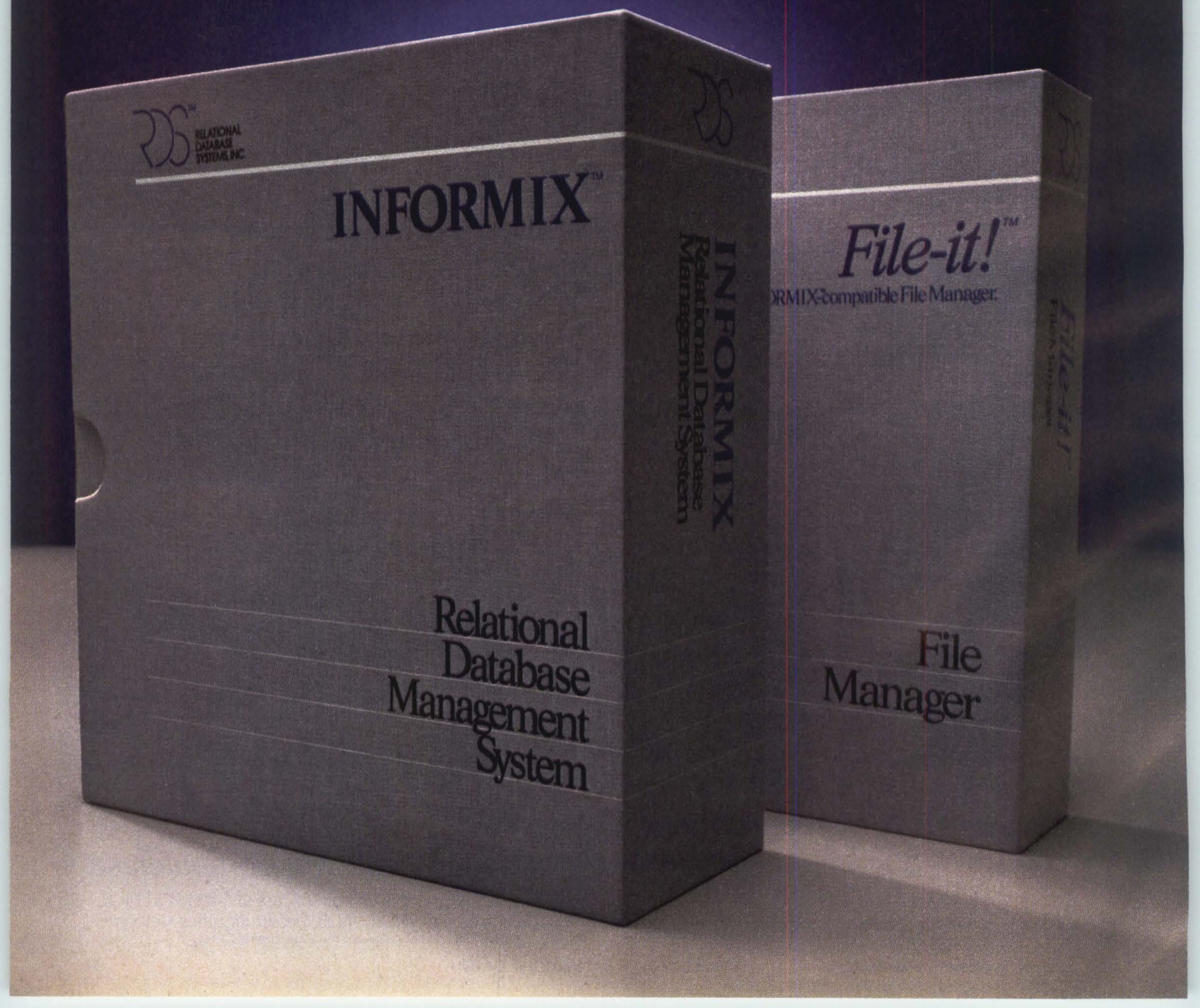

Now OEMs and systems integrators can sleep better at night. Because one company has taken the worry out of buying the right software.

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Incompatibility is a thing of the past.

INFORMIX®and File-it!™ are compatible with UNIX,™ MS™-DOS, PC-DOS,™ and PC/IX systems (over 60 micros and minis* at last count).

INFORMIX is a true relational database system designed to take full advantage of the power of UNIX. It includes the most widely used report writer on the market.

Then there's File-it! The first easy-to-use UNIX file manager. Together, they have the flexibility to accommodate novices and experts alike.

INFORMIX and File-it! are fully integrated. Users can upgrade from File-it! to INFORMIX or access data from one program or the other without re-entering data, retraining employees or reprogramming.

Applications can also be moved from MS-DOS to UNIX and vice versa without having to rewrite the application.

Simplify program development.

RDS offers C-ISAM,™ the de facto standard ISAM for UNIX. It's a library of C subroutines with a B^+-Tree based access method that stores, retrieves and modifies data from indexed files. It's embedded in INFORMIX and File-it! Or is available as a standalone product.

Software good enough for AT&T.

AT&T, inventor of UNIX, has co-labeled INFORMIX, File-it! and C-ISAM to run on their full AT&T 3B Computer line (from micros to minis).

Hewlett-Packard, Altos, Zilog, Siemens, Cromemco, Perkin-Elmer, Sydis and General Automation have selected RDS as well.

In fact, INFORMIX has an installed base of over 6,000 copies. And RDS has sold over 35,000 licenses for all their products to date.

But before you make up your mind, check the facts one more time.

There's only one database software family that's UNIX-, PC-DOS-, MS-DOS- and PC/IX-based. It runs on more than 60 systems. And it's ideal for both novice and expert.

Now it doesn't matter where the future's headed. You're already there.

*RDS products are available for the following systems:

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- Apollo DN300
- AT&T 3B2, 3B5, 3B20, AT&T Personal Computer
- BBN C machine (all models)
- Bunker Ramo Aladdin 20
- Charles River Data Systems Universe 68
- Convergent Technologies Miniframe and Megaframe
- Corvus Systems Uniplex
- Cromemco System 1
- DEC 11/23, 11/34, 11/44, 11/60, 11/70, VAX 11/730, 11/750, 11/780
- Dual Systems System 83
- Fortune 32:16
- Forward Technology 320
- General Automation Zebra (all models)
- Hewlett Packard 150, 9000 Series 200, 9000 Series 500
- IBM PC, PC-AT, PC-XT
- Intel System 86/380, 286/310
- Masscomp NC 500
- Momentum Hawk 32
- NCR Tower
- Onyx C8002, C8002A
- Pacific Micro Systems PM200
- Perkin-Elmer 32 Series, 7350
- Pixel 100/AP, 80 Supermicro
- Plexus P/25, P/35, P/40, P/60
- Pyramid Technology 90X
- Radio Shack Model 16
- SCI Systems IN/ix
- Silicon Graphics IRIS 1400
- Visual Technology 2000
- Wicat Systems
- Zilog System 8000 (all models)

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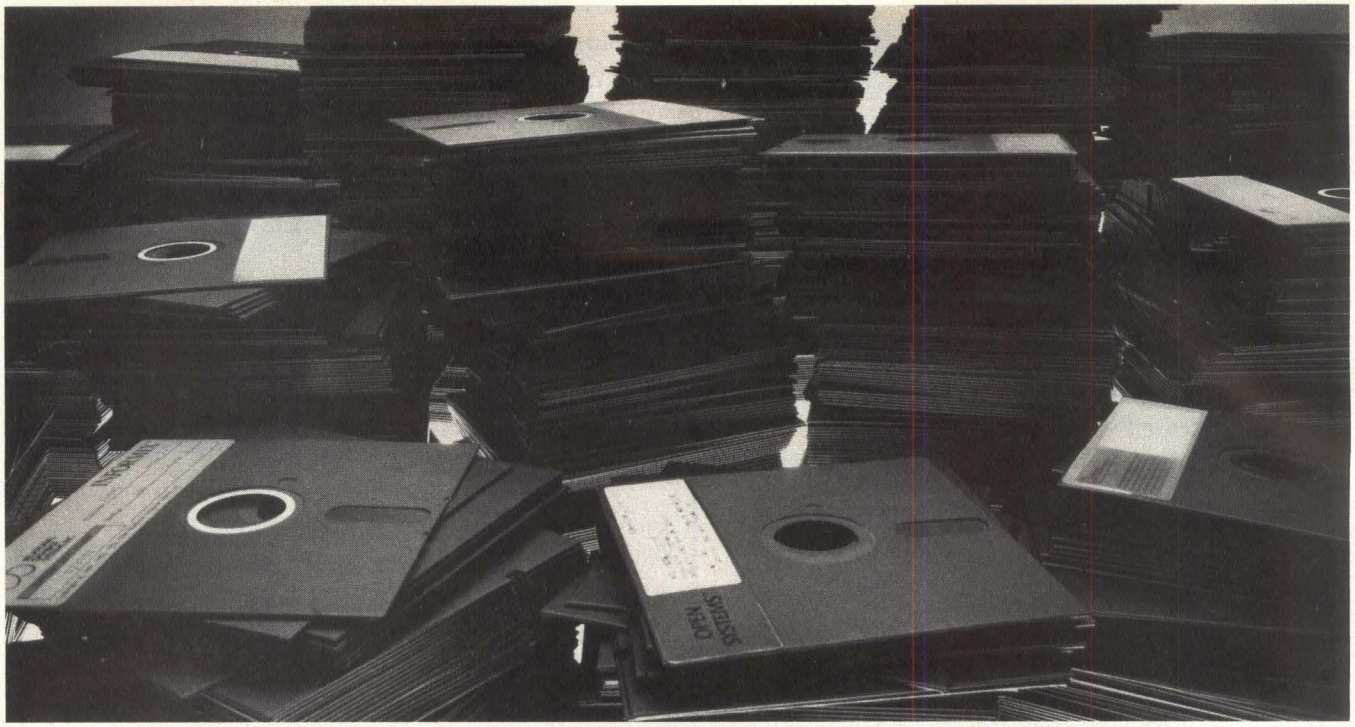

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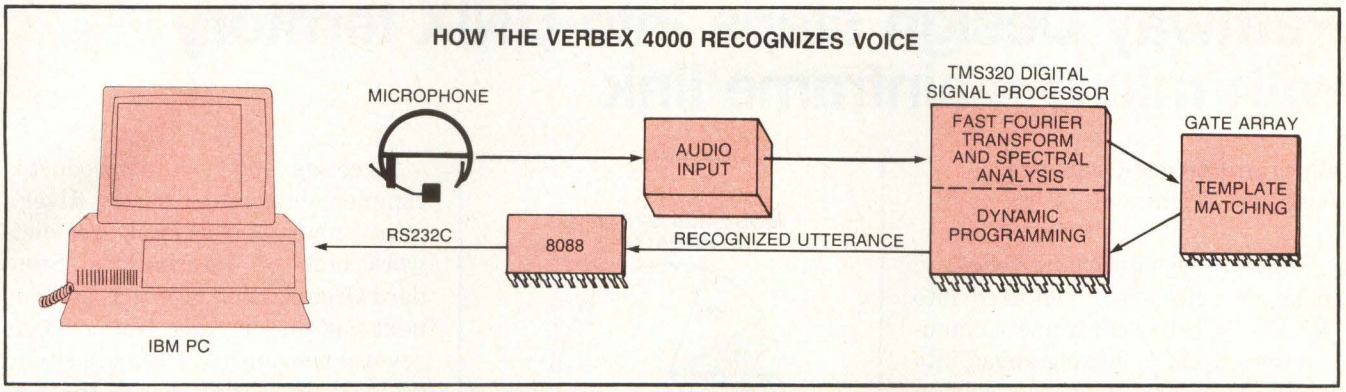


The TMS320 digital signal processor *converts analog voice waves to digital form, and a gate array compares each voice pattern with the original. Dynamic programming algorithms then organize the voice patterns and send the recognized utterance to the host.*

As voice-recognition technology advances, products will eventually make their way into the office, but for now, the 4000, like the 3000, is targeted mainly for industries where a worker needs the use of both hands while entering data. A typical application is an automobile assembly line, where a quality control inspector can walk around a vehicle and instantly report his observations by uttering strings of words like: "solder splatter left windshield post," and, when done, "end of car, end of car."

Other applications include entering data for product shipments from the warehouse floor, or baggage handling at airports. General Electric uses a model 3000 for inventory control at its New Concord, Ohio, parts distribution center. And at United Airlines' baggage-handling operation, at Stapleton International Airport, Denver, use of Verbex 3000 systems reportedly increased sorting capacity from 12 to 30 bags per minute. Most applications of this nature require fewer than 100 commands and descriptors—used for defining a particular item—so the 3000's maximum vocabulary of 360 words is usually unnecessary, explains marketing vice president Kenneth Backer. He cites an integrated circuit inspection program, for instance, which calls for only 79 words.

Gate array compares voices

The 4000's board contains an Intel Corp. 8088 microprocessor, a Texas Instruments Inc. TMS320 digital signal processing chip, a custom gate array chip with 5,000 gates, RAM and ROM totaling 160K bytes, and three standard 25-pin RS232C ports with 9,600-bits-per-second capacity. (Two of the RS232C interfaces can be used simultaneously.) Initial power-up diagnostics take 30 seconds; to operate the 4000, the user inserts an application vocabulary cartridge containing his or her speech patterns, and the system loads those patterns into the host within two seconds. When the user speaks into the microphone, the voice waves travel to the TMS320 digital signal processing chip, where they are converted from analog to digital by fast Fourier transform and spectral analysis algorithms. The custom gate array then compares the digitized voice with templates of the original from the cartridge. That comparison, or template matching, takes place at the sub-phoneme level. (A phoneme is the most basic unit of human speech. Verbex breaks each phoneme down to four or five acoustic kernels for an even finer comparison.) The TMS320 then uses dynamic programming algorithms to logically piece the parts of speech back together and sends the recognized utterance through the 8088, and an RS232C port, to the host. (Besides handling the RS232C ports, the 8088's other functions are cartridge reading and writing.)

An ASCII terminal is required for the speech training. The user connects the terminal to the 4000 via an RS232C port and inserts the training cartridge created by the optional Voice Planner software. Following the menu-driven prompts displayed on the terminal's screen, the user repeats each word or phrase into the microphone headset and the speech patterns are put onto the cartridge. An ASCII terminal can also be used to display the echo of each utterance; or, a voice synthesizer such as DEC's DECtalk can provide voice response. Recognition response time is less than 300 milliseconds, and the stated accuracy level is at least 98 percent with background noise as high as 85 dB.

In addition to marketing the 4000 to OEMs and end users, Backer says the company plans to become a value added dealer of IBM PCs, reselling the PC, the 4000 and specialized applications software in vertical markets. Verbex also provides assistance in application development. The basic unit comprises three RS232C ports, a cartridge, a headset microphone and a switching power supply. The Voice Planner software is $500. □

Pathway Design steps into UNIX territory with micro-mainframe link

Majorie Stenzler-Centonze
Associate Editor

Pathway Design Inc., Wellesley, Mass., which earlier ventured into the MS-DOS-to-mainframe communications area, is forging ahead into UNIX territory with the release this month of UniPATH gateway products.

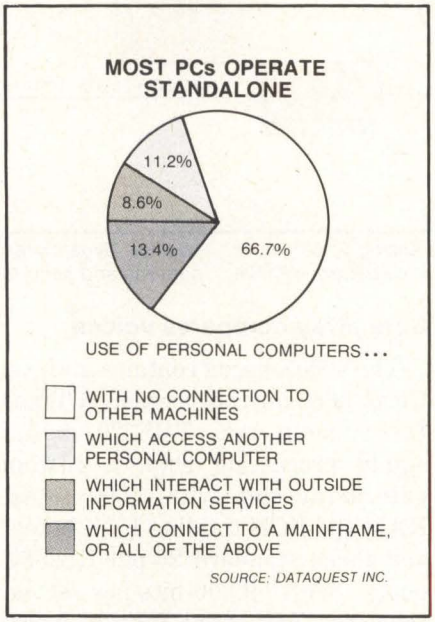
UniPATH software products operate on 32-bit supermicrocomputers running under UNIX System III and V. With UniPATH, as many as 32 asynchronous terminals and printers can communicate with a variety of IBM Corp. hosts in SNA/SDLC and BSC networking environments. The software occupies 256K bytes of memory and offers concurrent emulation of 3270, 3280 and 2780 devices. A package including the software, a communications adapter and cabling lists for $940.

"UniPATH represents a significant step toward enhancing our line with multiuser, multitasking capabilities as the market moves in the direction of UNIX," states Robert Broggi, president of Pathway. Broggi says Pathway expects the UNIX products to account for close to half of the company's revenue over the next couple of years. During that period, the company projects that revenues will jump from $5 million to $15 million.

Sales of UniPATH products will be handled by Pathway's direct sales force and through OEM contracts. The company expects approximately half its sales to be made through OEM channels.

Major OEM deal signed

Pathway has been directly developing its software on Charles River's hardware. Users who purchase the Universe 68 will not have to spend any money on additional hardware for the IBM connection, says Dick Swee, manager of networking and operating system development at Charles River. According to him: "A lot of people offer the IBM connection through a third party by having a board-level solution. The user then has to spend $1,500 to $3,000 for the board, plus buy the software—and then it's not well-integrated into the system."



The market for micro-to-mainframe communications products *is just beginning to take hold. Currently, more than half of all personal computers are being used as standalone units.*

Swee says the Pathway product is complementary to Charles River's own Universe Net local area network built on International Standard Organization protocols and due next month. Universe Net connects several machines at a remote site to do local processing across the network, while the Pathway software ties the remote locations to the IBM host.

Pathway will manufacture and package UniPATH, but the contract gives Charles River the option to manufacture and package products under its own name and make royalty payments to Pathway.

Pathway has also signed an approximately $1-million OEM agreement with Visual Technology Inc., Tewksbury, Mass., Broggi says. The company plans to use the gateway products in its System 2000 supermicrocomputer that operates under the UNIX-compatible XENIX operating system. Shipments are scheduled to begin in December.

Pathway is also developing a UniPATH package that will permit IBM communications to hosts for 32 logical units, including IBM PC or intelligent terminals in SNA/SDLC and BSC environments. The second release will place presentation components of the software in individual workstations while maintaining the SNA communications gateway on the supermicrocomputer. □

LOOKING AHEAD IN MMS

Mini-Micro System's December issue is our third annual overview of those leading edge technologies impacting our value-added market readership. A long-lasting sourcebook for technology and market data, the report presents past, present and future perspectives on key areas.

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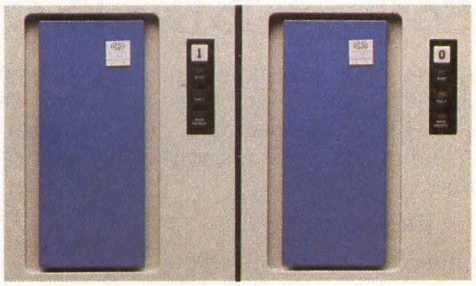

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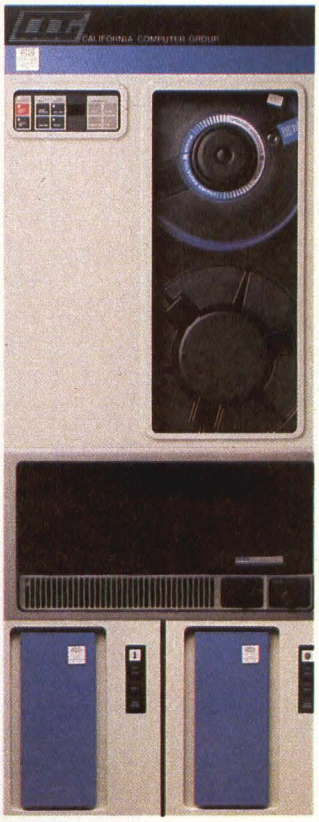

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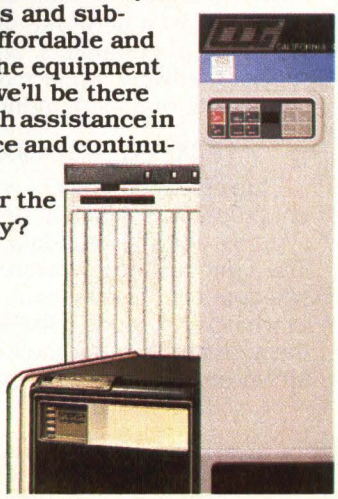

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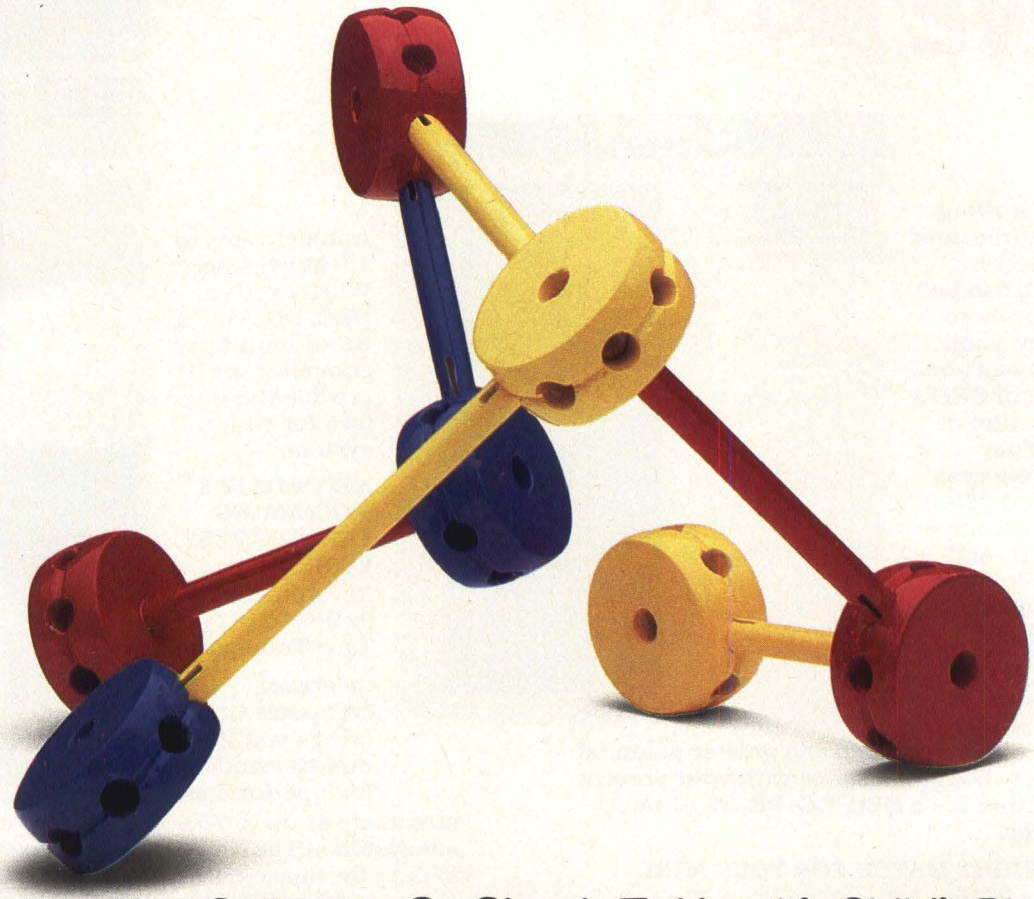

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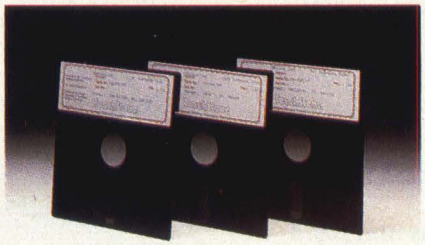

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Megavault's high-capacity 8-inch Winchesters access data in 18 msec

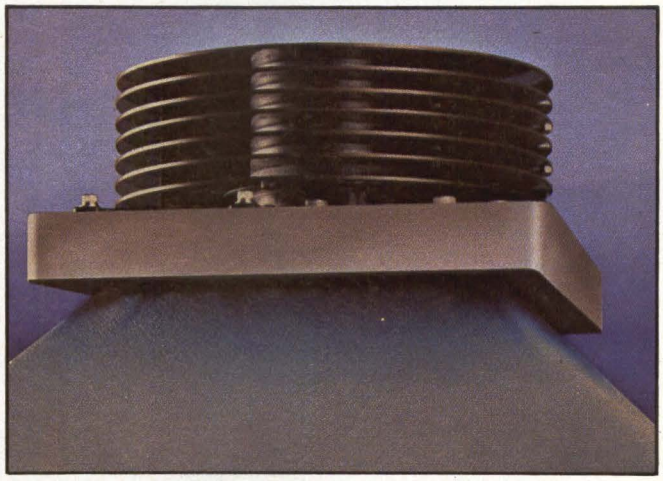
Carl Warren, Western Editor

Megavault Corp., Woodland, Hills, Calif., has added two 8-inch Winchester disk drives to its line: the 331.8M-byte (unformatted) MV-330 and the 660.4M-byte (unformatted) MV-660. Both drives feature an average access time of 18 msec, making the seven-platter drives some of the fastest on the market.

The drives are designed for integration into large systems using the industry standard Storage Module Device (SMD) interface. Megavault officials concede to maintaining a fairly conservative approach with the MV-330, which uses modified-frequency-modulation (MFM). "We didn't have to go to a group coding," says company president Clyde F. Czernek. "We built in lots of margin." In contrast, the MV-660, which is essentially the same drive as the MV-330, uses run-length-limited 2/7 code to boost the number of flux-changes-per-inch. Moreover, both the drives offer dual-porting capability which allows the attachment of more than one host.

Megavault is also preparing a parallel interface option to speed data transfers, and eventually will use dual drive heads to allow parallel data transfer. "These drives are for very large data bases in multiuser systems," elaborates Czernek. "The designers want to get the data quickly and with the least amount of difficulty."

In the past three years, 8-inch Winchesters haven't received as much attention as 5¼-inch Winchesters. But James Porter, publisher of *Disk/Trend Report*, Los Altos, Calif., says the market is growing and forecasts that in 1986, 8-inch drives in the 100M- to 300M-byte range will account for about 15 percent of the units shipped worldwide, as compared to 11 percent in 1984. The share of larger 8-inch Winchesters should slip from 7.9 percent to 5.7 percent, however. Porter explains that the higher capacity 8-inch drives will contribute more to industry revenues than will smaller diameter drives, even though the total number of units is less.



By using seven platters, *Megavault's 8-inch Winchester disk drives offer 18-msec access time and capacities of 331.8M and 660.4M bytes.*

Technology over packaging

Czernek claims that the continued market growth for 8-inch drives is really based on the technological limitations of smaller drives. "It's a function of areal density—how many bits you can get per square inch. With smaller drives you end up with a situation where the small drive can be more expensive than a drive with a larger form factor. The small drives offer nice packaging, but there are impracticalities to contend with."

Since drives with capacities above 50M bytes are normally used with multiuser systems and local area networks rather than with desktop systems, compact size becomes less of a consideration, says Czernek.

Not everyone agrees with him, however. For example, Applied Information Memories (AIM), Milpitas, Calif., with its 250M-byte Dart, is currently one of the only 5¼-inch manufacturers clearly aiming a product at the 8-inch SMD market. According to vice president of engineering, William Glover, "Everything 8-inch SMD drives are can be put into smaller form-factors. It's a packaging job. The costs are about the same and eventually will be less. It is market dependent." But Glover does admit that squeezing the SMD requirements into the 5¼-inch form-factor takes some innovative VLSI and is an expensive undertaking.

Megavault plans to begin shipping the MV-330 in volume this November at just under $3,000, with MV-660 shipments set for the second quarter of 1985 at just under $6,000. Both drives should be shown at this month's COMDEX show in Las Vegas. □

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CIRCLE NO. 34 ON INQUIRY CARD

Daisy-wheel-printer prices must drop to slow advances of competing technologies

David Bright, Assistant Editor

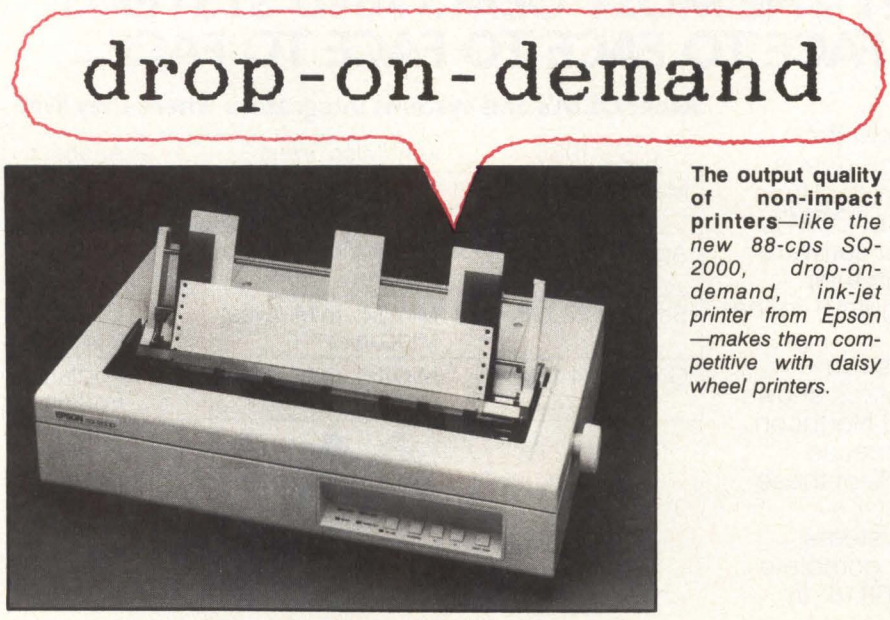
Are high-end daisy wheel printers losing their popularity? Although they currently remain the standard for letter-quality output, they are caught in a price/performance squeeze by several competing technologies that produce faster, quieter printers with better graphics capabilities at an equivalent price. Analysts and vendors say that since daisy wheel printers are nearing their technological limits, the best way for their producers to fight back is through price reductions.

Larry Barber, product marketing manager at Qume Corp. tersely sums up the general marketing strategy: "Get the price down!"

The San Jose, Calif., company makes the $2,800 Sprint 11/90 PLUS, which at 90 characters per second (cps), is one of the industry's fastest daisy wheel printers.

One notable threat to daisy-wheel technology is Hewlett-Packard Co.'s recently introduced eight-page-per-minute (ppm) LaserJet laser printer that provides 300-dot-by-300-dot-per-inch (dpi) text-resolution output. The unit is based on Canon USA Inc.'s LBP-CX print engine. At $3,495, the LaserJet competes in price with high-end daisy wheel printers, with print quality almost as good. Daisy wheel printers in this price range include the $3,495 Diablo Systems Inc. 80-IF and the $2,950 Fujitsu America Inc. SP830. Both run at 80 cps—much less than half the speed of the HP LaserJet. More low-priced units incorporating Canon's LBP-CX are expected to appear shortly from other vendors.

Also coming on strong, and comparatively priced, are other non-impact technologies, including ink-jet and thermal-transfer printers. One example is the new SQ-2000 drop-on-demand ink-jet printer from Epson America Inc.'s OEM products division. With a quantity price of less than $2,500, the non-clogging SQ-2000 produces 88 cps in letter-quality mode.



The output quality of non-impact printers—*like the new 88-cps SQ-2000, drop-on-demand, ink-jet printer from Epson—makes them competitive with daisy wheel printers.*

Daisy wheel printers also face competition from impact dot-matrix printers. Near-letter-quality models from several vendors, including Dataproducts Corp., Fujitsu, and soon, NEC Information Systems Inc., rival daisy-wheel-printer performance, often at lower prices.

Low growth means layoffs

Citing lower-than-expected growth in its daisy wheel printer shipments, caused partly by increased competition, Diablo, a Xerox Corp. subsidiary, recently laid off 284 workers—a third of its production force at Fremont, Calif. The pressure comes from two fronts: impact dot-matrix printers and Japanese daisy wheel printers on the low end of the price scale, and laser printers on the high end. In a reorganization following the layoffs, Xerox separated Diablo's impact and non-impact printer responsibilities and consolidated its electronic-typewriter operations with impact-printer operations. Because many Xerox typewriters and Diablo impact printers use the same parts, the company reasons that economies of scale will help reduce manufacturing costs.

But manufacturing costs, and ultimately prices, are not the only factors daisy-wheel-printer manufacturers must consider. Major drawbacks plaguing daisy wheel printers include limited speed, high noise level and limited graphics capability—the latter an increasingly important factor as more graphics packages and integrated software packages are introduced.

On the plus side, daisy wheel printers, unlike non-impact techno-

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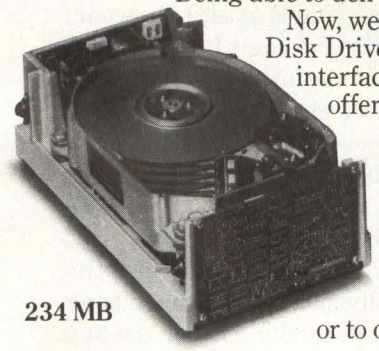

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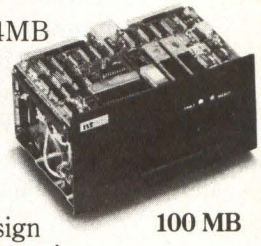

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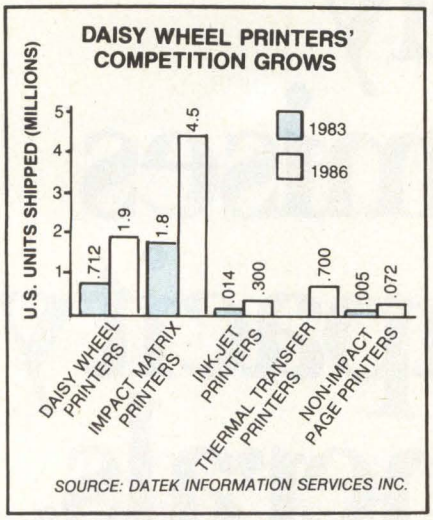

logies, can print multiple forms, which is an important issue in an office setting. Most daisy wheel printers offer interchangeable fonts. And many are workhorses, consistently churning out sharp, letter-quality print, with long intervals between failures. Moreover, maintenance on the new non-impact printers is generally not as straightforward as the simple ribbon cartridge change required by daisy wheel printers.

Nevertheless, the heyday of daisy wheel printers is nearly over, according to Jonathan Dower, vice president of Datek Information Services Inc., Waltham, Mass. Datek researches the printer field and publishes the industry newsletter, *Printout*. "People think the writing is on the wall [for high-end daisy wheel printers]," says Dower. He gives the high-end daisy-wheel-printer market about two more years of rapid growth. Datek predicts that daisy-wheel- printer unit shipments will rise from 712,000 in 1983 to 1.9 million in 1986, while non-impact page printer shipments will spurt from 5,200 to 72,000 in the same interval, a growth rate nearly five times as fast. A big reason Dower says, is that competitive laser printers emerged "a lot sooner than people expected." He looks for more LBP-CX-based introductions in the near future.

Thermal transfer technology is not mature enough to be a major threat for a while, says Dower. Most are slow (under 120 cps) and have high upkeep costs. In fact, there's currently only one domestic supplier of thermal transfer ribbons. Datek does predict 1986 thermal-transfer printer shipments of at least 700,000, but most of those should be very low-end models, Dower says.

Customers want 'tried and true'

Susan Hayes, product manager for NEC Information Systems Inc.'s popular Spinwriter 3500 series of daisy wheel-like thimble printers, concurs with Dower's assessment. By late 1986 or early 1987, laser printers "will give us some trouble," she says. But she stresses laser printers' difficulty with multiple forms and heat-sensitive labels. And she suggests that customers may initially be reluctant to switch technologies: "They'd rather stick with the tried and true." But Hayes also points out that NEC produces a broad range of printers at its Boxborough, Mass., plant so it is prepared to use its product line as leverage to meet customer demands.

Hayes expects NEC to drop Spinwriter prices as much as 15 percent by next summer. In addition, NEC is working to increase the units' speed and reduce their noise level from the current 60 dBa to less than 55 dBa. Use of new platen materials could eliminate noise rather than merely mask it.

Other vendors state similar goals of increasing speed while lowering both noise and price. Dataproducts Corp., Woodland Hills, Calif., intends to cut the noise level of its daisy wheel printer models to at least 50 dBa, says distribution marketing manager Todd Hunter. "There's a good three years of growth left in the daisy-wheel-printer market," but Dataproducts will eventually drop the line, he says. In the meantime, another potential life-prolonging enhancement will be the addition of a keyboard and extra features to a daisy wheel printer, enabling it to function as both a terminal and a printer. Late this year Dataproducts plans to introduce a 20-cps model that sells for under $1,000 with a keyboard, Hunter adds.

Dataproducts' fastest unit, the DP-55, prints 55 cps. Although Hunter feels that 80 cps is the fastest that daisy wheel printers can print at high quality, Anthony Mauro, president of Primages Inc., Bohemia, N.Y., is confident of pushing his company's machines to speeds of 100 cps. Dataproducts employs a servo motor to move the printhead, but Primages uses a less complicated open-loop stepper motor in its 45-cps Primage I, which retails for $1,695. With the stepper, costs are also saved because it doesn't require a special, regulating power supply or a complicated encoder. The simple position encoder used on the Primage I is one-tenth the cost of the more complex position-and-velocity encoder needed for printhead tracking with a servo motor, Mauro says.

Diablo recently announced its Series 80-IF, 80-cps daisy wheel printer. Paul Shapiro, Xerox printing system division marketing manager, says speed alone is not the key: Vendors have to do more than just offer "a vanilla-flavored 80-cps daisy wheel printer." Diablo's high-end strategy, he says, is to offer extra functions that attract local area network users and other vertical sector users. Some of those functions include the ability for a remote operator to change parameters, the use of double hammers to eliminate shifting, and a graphics wheel. □

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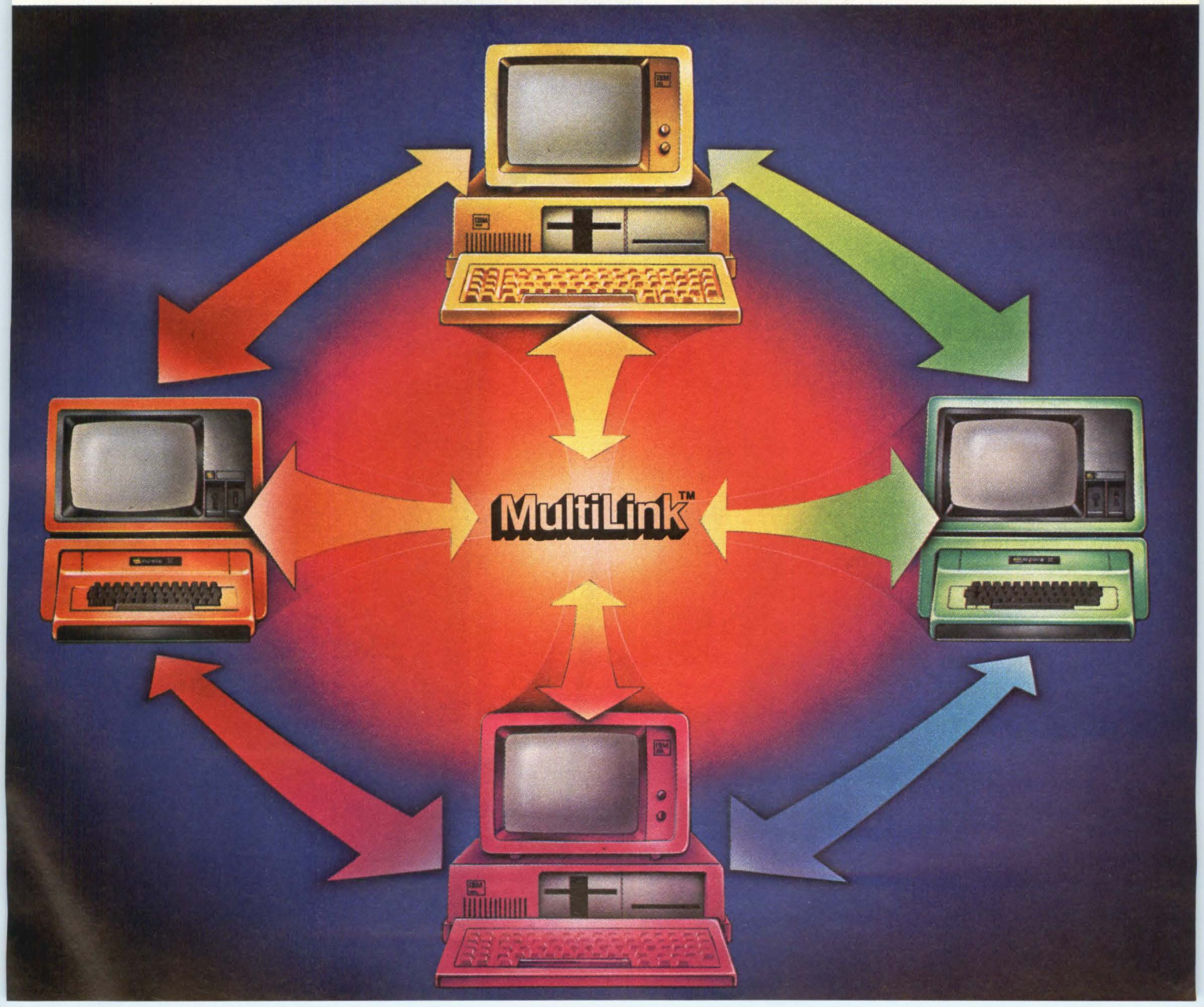

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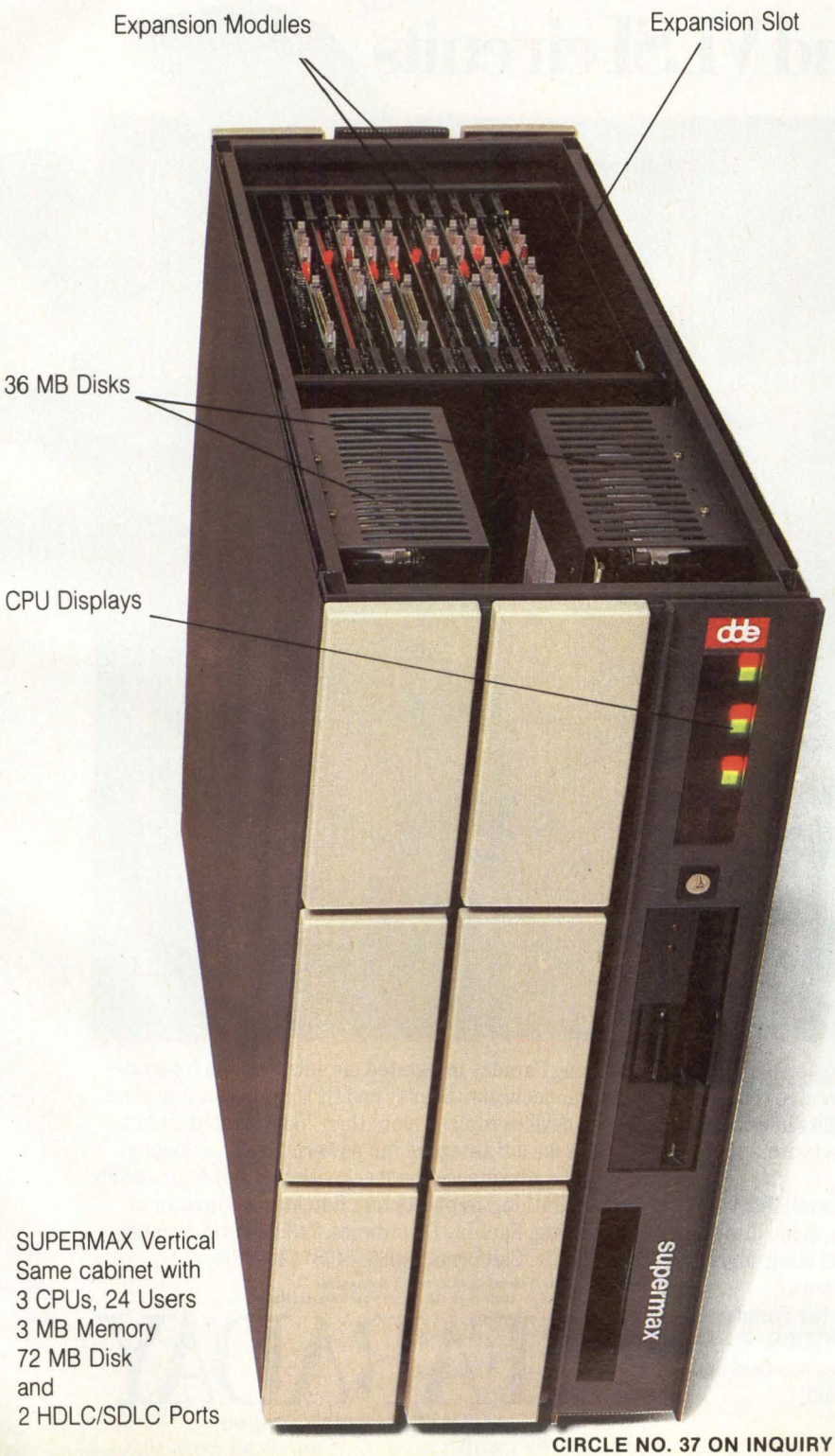

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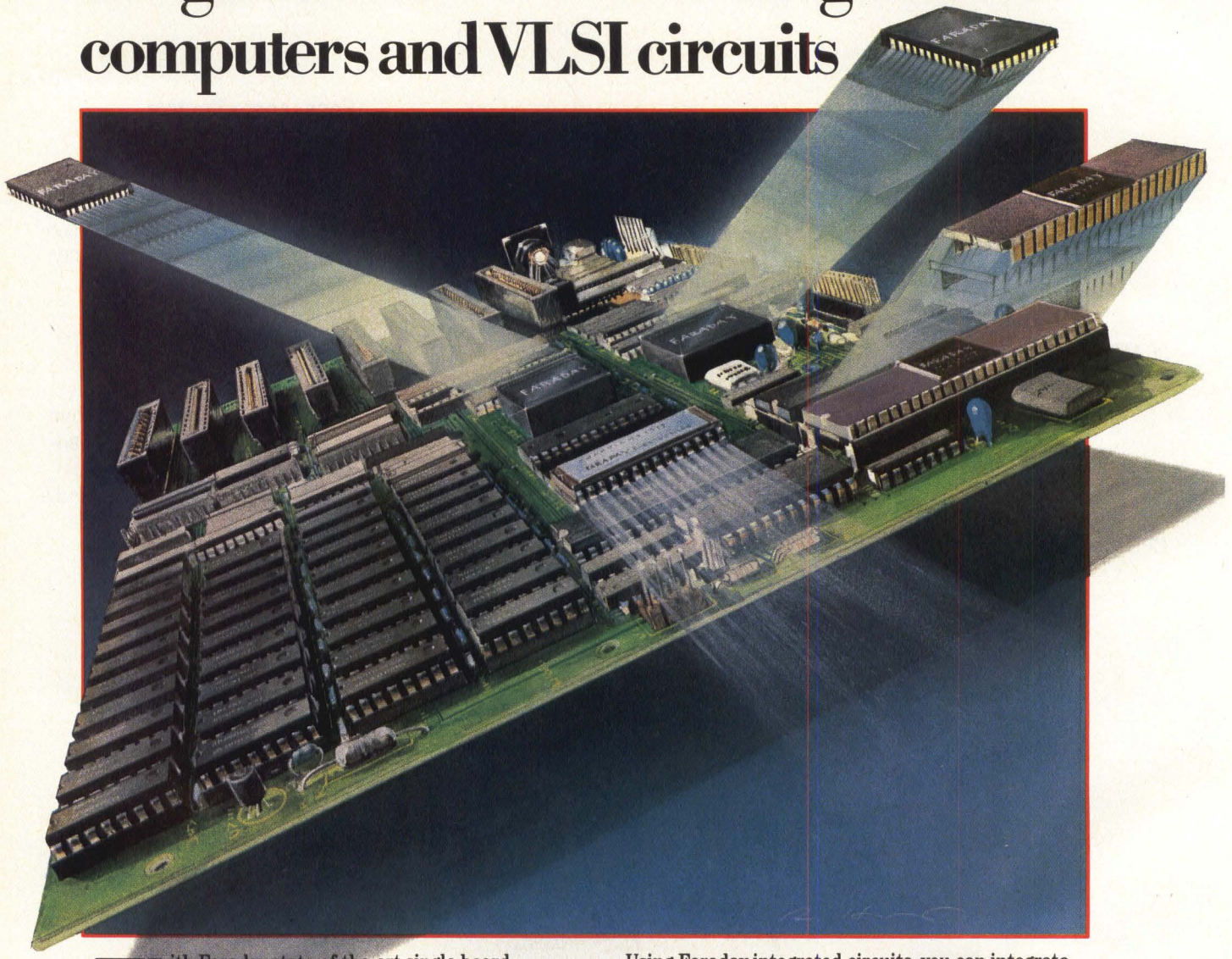

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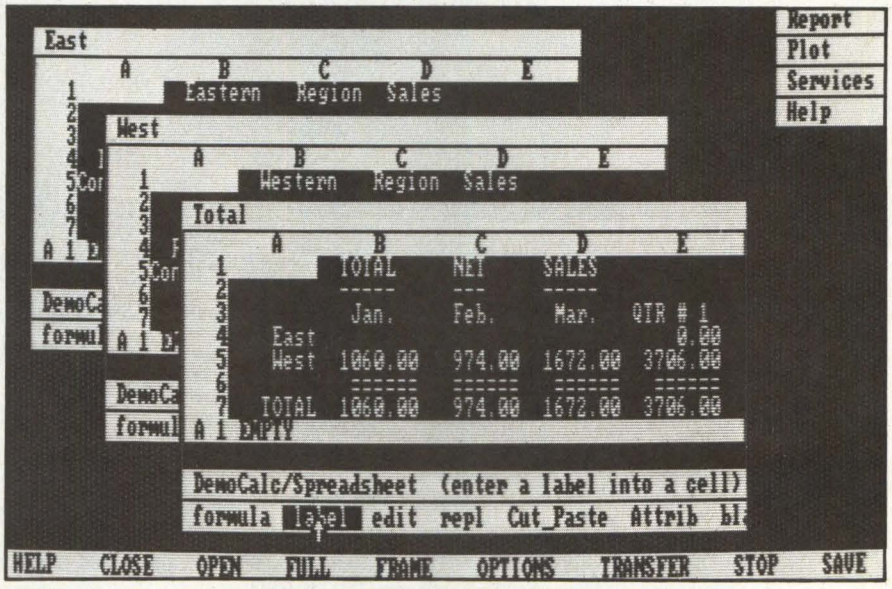
CIRCLE NO. 38 ON INQUIRY CARD

VisiCorp sells Visi^{On} technology to CDC, stresses marketing

Marjorie Stenzler-Centonze
Associate Editor



Visi^{On}, which displays applications in overlapping windows, *spawned a windowing craze in the personal-computer software market. But its developer, VisiCorp, recently sold the Visi^{On} technology to Control Data Corp.*

VisiCorp has sold all Visi^{On} technology rights to Control Data Corp.(CDC). The San Jose, Calif., software company's enormously popular VisiCalc spreadsheet program helped spark the personal computer boom and its Visi^{On} windowing environment was expected to set yet another standard.

But Visi^{On}, which was announced nearly a year before shipments began, never took off as planned. VisiCorp has lately been under severe financial strain and has laid off more than 100 employees since May, making it even harder for the company to push development of Visi^{On} and the accompanying applications software. "We have been developing Visi^{On} for quite some time, but not at the pace we felt it really needed," acknowledges Michele Niven, product marketing programs manager at VisiCorp. "We did not have the resources to accelerate that pace at all. CDC has been involved with Visi^{On} as an independent software developer, using the open-ended features of Visi^{On} to do the customization for themselves," she explains.

CDC has purchased the Visi^{On} applications manager along with Visi^{On} Word, Visi^{On} Calc, Visi^{On} Graph and several other unfinished packages. CDC will also employ the eight-person Visi^{On} development team; the group already operates from CDC's Campbell, Calif., facility.

CDC plans to use the applications manager and user interface for portions of its own management applications systems, which run on personal computers, and for its remote computer services users. CDC will market the products to major account customers through its Business Information Services division. VisiCorp retains exclusive retail marketing rights and will continue to sell the applications manager, software and any enhancements through its retail distribution channels.

Industry observers say VisiCorp's problems stem from a number of causes, the most noteworthy being the premature announcement of Visi^{On}. But all in all, analysts believe the product shows good promise and that CDC is likely to be its salvation. "Despite the fact that VisiCorp had trouble making a go of it, Visi^{On} still remains a good product and is probably the only thing that is competitive with Lisa or Macintosh software in the IBM marketplace," states Kenneth R. Churilla, vice president and manager of the microcomputer industry research group at Creative Strategies International, San Jose, Calif.

Back to 'startup mode'

While VisiCorp will not detail just what the CDC deal will net the company, Niven says expenses are matching income, and the recent infusion of cash from CDC and investors has stabilized the company.

Creative Strategies' Churilla estimates the VisiCorp-CDC agreement at $2.5 million, and says those funds, combined with the venture capital VisiCorp has received, are likely to help VisiCorp establish a new operating strategy. "[VisiCorp is] basically heading back to where [its] roots are, and that is to be a publisher, rather than a developer, of software," he says. It was as the publisher of VisiCalc that VisiCorp made its mark. VisiCorp bought the rights to market VisiCalc from the product's developer—Software Arts Inc., Wellesley, Mass. □

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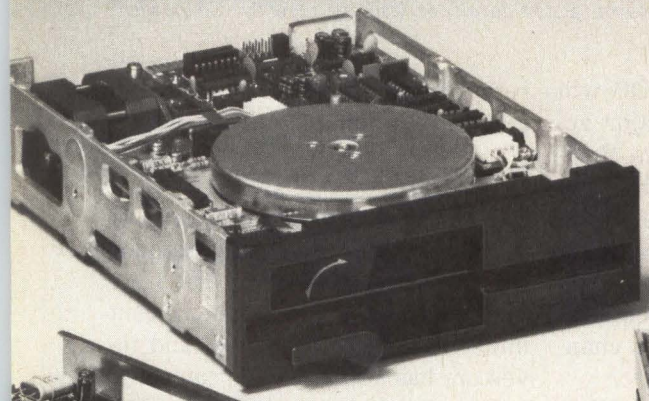

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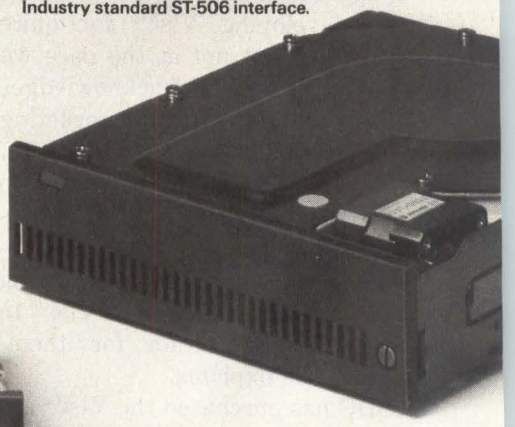

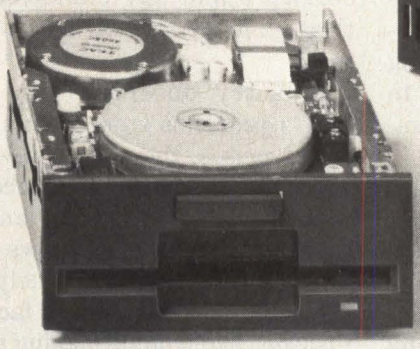

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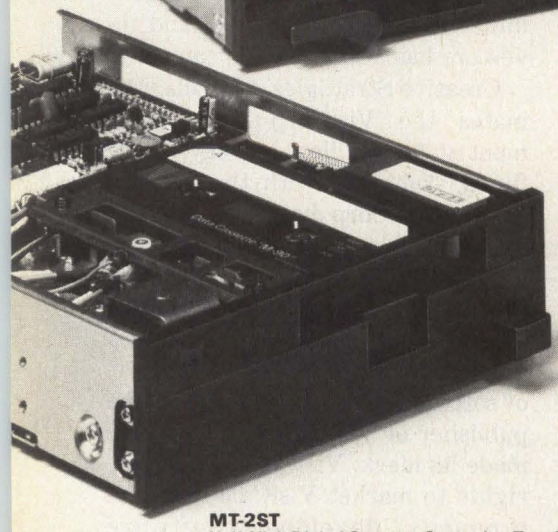

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CIRCLE NO. 39 ON INQUIRY CARD

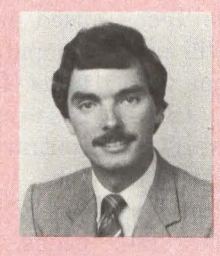
Financings

Graphic Communications Inc., the Waltham, Mass., developer of Graphwriter business graphics software, has secured $1.5 million in new venture capital financing. Firms included in the investment are Abingworth Plc., London, and Transatlantic Investment Corp. Graphic Communications also provides device drivers for the Microsoft Corp. Windows operating environment.

The software networking vendor **Linkware Corp.**, Waltham, Mass., has received $2.2 million in venture financing, bringing total investment in the startup to $4.2 million. The investment was led by networking pioneer Ungermann-Bass Inc. Linkware produces information servers for sharing information among microcomputers, minicomputers and mainframes.

Pyramid Technology Corp., the first company to market a computer system based on reduced instruc-

MARKET BAROMETER



David L. Bunzel is the director of the Santa Clara Consulting Group, a San Jose, Calif., company specializing in market trends in the data-recording media industry.

Sony's 3½-inch disk triumphs in micro market

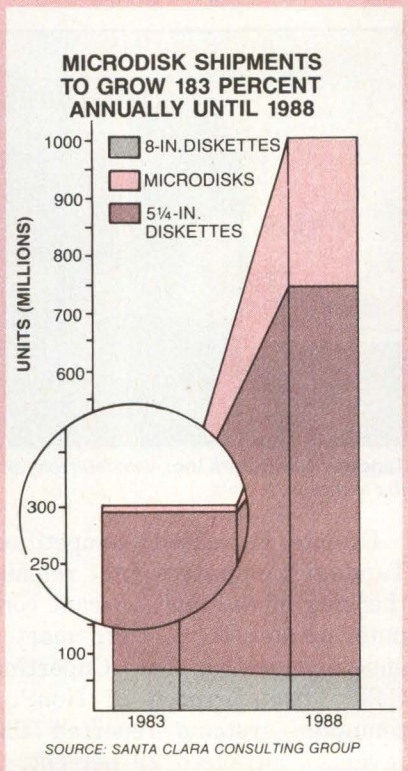
David L. Bunzel
Santa Clara Consulting Group

Since its introduction in 1982, the microdisk's format and value have been subjects of controversy. But strong sales of personal computers that use the Sony Corp. 3½-inch disk have made it evident since 1983 that this size microdisk would become the de facto format standard. Acceptance of this standard by companies such as Hewlett-Packard Co., Apple Computer Inc. and ACT Plc. of Birmingham, England, has virtually eliminated wide acceptance of other formats produced by companies such as Hitachi-Maxell (3 inches), IBM Corp. (4 inches), and Tabor Corp. (3¼ inches).

With the format issue decreasing in significance, the question of how, and in what market segment, microdisks will be used in the future remains. Of particular concern to hardware and media manufacturers is competition from the 8-inch and 5¼-inch disk market, and the influence of IBM on this market.

For now, microdisk-based systems are confined to use in individual productivity systems, which include portables. Innovations such as half-height 3½-inch drives, double-sided 3½-inch drives and the "Fat Mac" (an Apple MacIntosh using 256K chips) may make microdisk systems serious contenders in the office automation market as well.

Although this enhanced technology will allow more sophisticated software applications for these systems, it will also result in a much higher disk consumption per disk drive, thus inducing market growth. A 1984 estimate by the Santa Clara Consulting Group illustrates this: microdisk drives use an average of 15 disks per year compared to 19 per year for the 5¼-inch disk drives. By 1988, a reversal is expected, with microdisk drives consuming 17 disks per annum and 5¼-inch drives consuming 14.



SOURCE: SANTA CLARA CONSULTING GROUP

The microdisk market would be dramatically affected were IBM to begin offering them. That appears unlikely at present, with IBM reluctant to adopt the 3½-inch microdisk standard. Microdisks are incompatible with all of the IBM's microprocessor-based systems. And the microdisk does not offer a significant advantage over 5¼-inch disk technology; the microdisk drive form factor and performance criteria are almost the same as that of the half-height 5¼-inch disk drive.

In any case, the microdisk has excellent growth prospects. The Macintosh alone represents an installed base of 100,000 machines in the United States, with Apple expecting this to grow sevenfold by the end of 1985. The Santa Clara Consulting Group expects sales of microdisks in this market to grow from 1.5 million units to 267 million units between 1983 and 1988, a compound annual growth rate of 183 percent. And, during the same time, microdisks will increase their share of the disk market from less than one percent to 27 percent.

tion set architecture—the 32-bit, 90X, UNIX superminicomputer—has received $11 million in new financing. The funds come from a $6 million, private stock placement and a $5 million line of credit extended by the Bank of America.

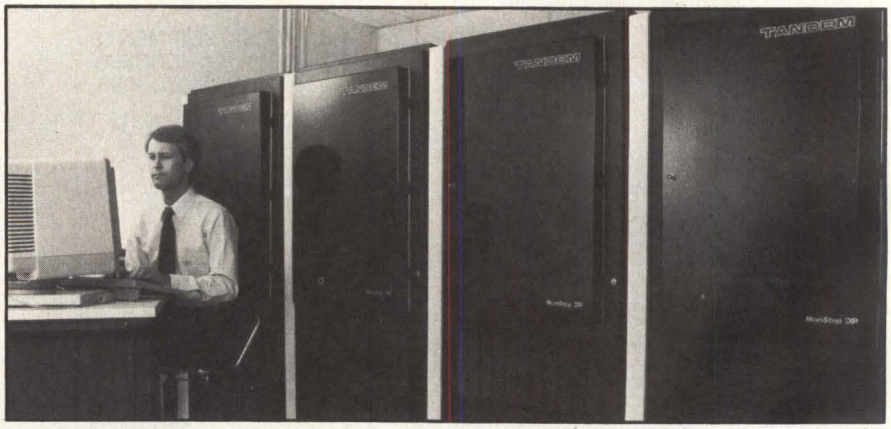
Wet ink

Under a two-year, $20 million private label agreement, **Wyse Technology**, San Jose, Calif., will provide Altos Computer Systems with customized, low-cost terminals....**Delphax Systems**, Westwood, Mass., has secured an $8 million OEM contract with Hamilton GmbH for Delphax's S6000 60-page-per-minute, non-impact printer. Under the three-year agreement, Hamilton will sell the ion deposition printer in West Germany and the Netherlands under the Hamilton label....**Numerix Corp.**, Newton, Mass., will deliver $3.5 million worth of its MARS 432 array processors to Digicon Geophysical Corp. The Mars 432 will form part of Digicon's DISCO seismic data-processing system used for oil and gas exploration....**Pathway Design Inc.**, Wellesley, Mass., plans to supply Visual Technology Inc. with software gateways for microcomputer-to-IBM-mainframe communication. The three-year deal is for $1 million worth of gateways....**Rodime Plc.**, the Scottish company that supplies 3¼-inch Winchester disk drives for the Compaq Plus portable computer, has signed a $5.5 million contract with Convergent Technologies. Rodime's 20M-byte 5¼-inch Winchester will be used in Convergent's MiniFrame computer system....**Sun Microsystems Inc.**, Mountainview, Calif., has won the bidding for a $15 million contract to supply VIA Systems Inc., with workstations for VIA's WorkSystem graphics and design nodes. Under another contract, the Sun workstations will be distributed in Australia by the Lionel Singer Group's new company, Sun Computer Australia....**Tandon Corp.**, Chatsworth, Calif., has begun shipping disk drives and subsystems to Atari Inc. as part of an agreement potentially worth $130.5 million. The deliveries are scheduled to continue through the first half of 1985.

Numerix Corp.'s MARS 432 array processor *will be sold with Digicon Geophysical Corp.'s seismic data processing equipment.*

Quarterly reports

Compaq Computer Corp.'s growth rate has slowed. Compaq, which is currently the leading vendor of IBM PC-compatible computers, recorded sales of $65.9 million in the second quarter of 1984 and $62.9 million in the first quarter. The Houston company's 1983 second-quarter sales were $18.1 million. Unit shipments for the second quarter of this year totaled 33,000, compared to 27,500 in the first quarter. Net income in the second quarter of 1984 reached $892,000, or a gain of 3 cents per share, compared with a loss of $1.2 million, or 33 cents per share, in the same period a year earlier. Compaq's new Deskpro desktop computer has not yet had an impact on sales and earnings, since Deskpro shipments began late in the second quarter.



Tandem Computers Inc., *with fault tolerant computer systems like the NonStop TXP, remains the leader in its field.*

Despite increased competition, **Tandem Computers Inc.** remains the king of the fault tolerant computer market. For its third quarter, ended June 30, the Cupertino, Calif., manufacturer of NonStop computer systems reported that revenues advanced 29 percent, to $142 million, compared to $110 million in the same quarter a year earlier. Net income also increased—to $9.3 million, or 23 cents per share, from $8.4 million, or 21 cents.

Year-to-date revenues reached $379.5 million, as opposed to $300.4 million for the preceding year. Net income, however, declined to $21.3 million from $22 million.

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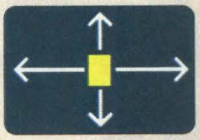


Which kind of editing operation is quickest to execute and easiest on the eyes of the word processing user?

a) Full screen editing allowing for easy cursor movement around the screen?

b) Moving the cursor around by doing a line count?

c) Editing on the bottom line of text only?

2 DOCUMENT LAYOUT

Whatever document format you choose. . .you want to see what the finished article will look like. Should you. . .

a) View it on the screen as it would come out of the printer?

b) Run it through a pre-processor to see what it looks like and then if you like it, print it?

3 KEYSTROKES

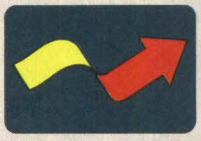
Using a well designed w-p system, how many keystrokes should it take to execute the most often used w-p functions?

a) One easy stroke with no codes?

b) Two or more with complex w-p codes?

c) Three or more?

4 FLEXIBILITY

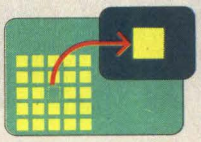


As the business manager of your company, you would like to find w-p software that you can tailor to your company's specific needs. Should you. . .

a) Look for w-p software that allows you to change and add menus, and change function keys?

b) Write your own custom software?

5 RETRIEVAL

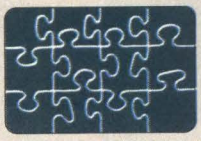


If you want to retrieve information quickly from a large database, which w-p software should you choose?

a) One that can access a particular record by going to it directly?

b) One that searches through all the records on the database sequentially until it finds the right one?

6 COMPATIBILITY



As a manager of MIS, you want a w-p system that can be integrated with other application software. Should you choose w-p software with. . .

a) ASCII formatted files?

b) Software which requires non-printing characters in it's file system?

CIRCLE NO. 40 ON INQUIRY CARD

7 MATH

Your company has a number of financial applications and is looking for a w-p package with math capabilities. Should you choose. . .

a) On screen calculating allowing for editing, storing and recall of equations, calculations integrated with your word processing applications?

b) Software where the math capabilities are tied to the list processing module?

c) A separate math package?

THE ANSWERS:

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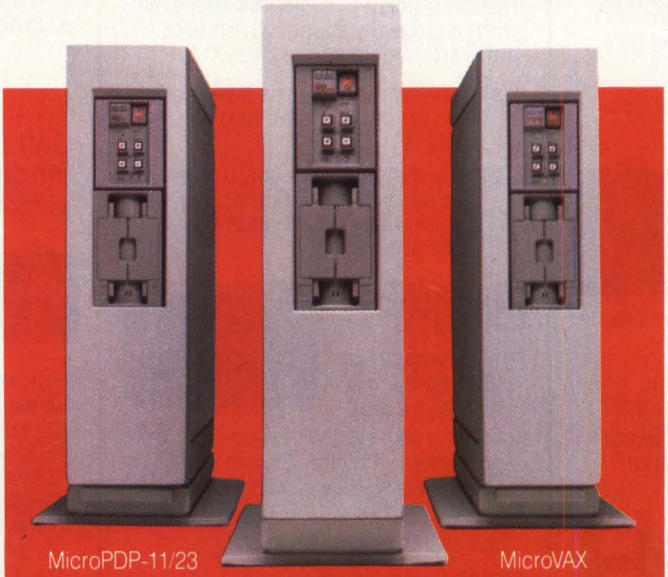

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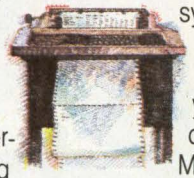

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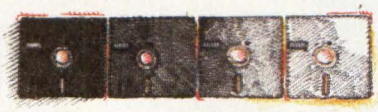

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Britain's Torus Systems employs icons to help IBM PC users on local networks

Keith Jones, European Editor

Torus Systems Ltd., Cambridge, England, is applying easy-to-use icon symbols, similar to those employed in Apple Computer Inc.'s Macintosh microcomputer, to help users become acclimated to local area networks (LANs) for IBM Corp. Personal Computers. Called the Torus Icon, the combination hardware and software product can connect up to 100 PCs over a one-kilometer Ethernet LAN. Icon permits each PC workstation to access networked facilities, including electronic mail and file managers; to tap into a variety of external communications methods; and to share programs, files and printers. The PC still can be operated as a standalone device.

"Systems software features like these are already available from U.S. vendors," notes Dr. John Hemphill, head of the technology group at Future Computing Inc., Richardson, Texas. But Torus marketing director Bernard Allenstein says Icon offers more user facilities than packages currently available. For example, Icon replaces often-obscure instructions with icon images that can be selected using a cursor or a mouse. Icon also has 450 "help" messages in English.

Applications make networks

Future's Hemphill insists that sophisticated systems software is not enough to make networking successful. "Applications software is now the key feature for networked machines. Network vendors in the United States are working with software houses to modify packages for a multi-user environment."

Torus' Allenstein agrees with Hemphill's assessment. He explains that Torus is working with the British company that represents Ashton-Tate, Culver City, Calif., to modify a multi-user version of Ashton-Tate's dBase II database-management software to run with Icon. He notes that Ashton-Tate's product is already available on equipment from 3Com Corp., Mountain View, Calif. Allenstein also says that Icon can be easily changed to run applications developed for other popular network products. Icon, for instance, supports semaphores used in network products from 3Com and Orchid Technology Inc., Fremont, Calif. "The semaphores mean that applications developed for these networks can easily be modified for Icon," claims Allenstein.

Network access via a floppy

A PC user can access shared application programs and other Icon facilities by inserting a floppy disk into a workstation. When the disk is inserted, the user's workstation software notifies a designated network workstation manager that the user is on the network. In addition to sharing applications, authorized users can access network management functions. These functions enable PC operators to add users and file or printer server stations, or to rearrange files, discard mail messages, open and close the print queue and maintain the software library. This library contains both applications and systems software and can be stored on one or more stations on the network.

Systems software in the library includes the code needed to make a workstation act as a file, printer or communications server. The role of any of these three server types can be assigned to one or more workstations on the network by the network manager workstation, which transfers the relevant software from the library to each selected station.

Access to files on a file server is protected on several levels. The level least controlled allows anyone to read and write information in files. The most restricted level allows only one person access and that person can only read files. The Icon system uses icon images to represent and manipulate files as though they were drawers in a filing cabinet. This is similar to Xerox Corp.'s Star workstation, one of the earliest devices to use icon technology.

Managers use Winchesters

The network manager and the stations acting as servers must be PC/XT models with Winchester

Sension links VAX with LANs

Integration of Digital Equipment Corp. VAX superminicomputers with Ethernet local area networks may be facilitated using a family of products from Sension Scientific Ltd., Northwich, England. Sales manager Richard White says Sension is seeking distributors and OEM customers in the United States.

The product line includes transceivers, coaxial and fiber-optic repeaters and an interface unit that enables as many as 16 asynchronous terminals to share one Ethernet node. As many as 48 asynchronous terminals can communicate over Ethernet with the VAX. The VAX requires only one DR11 parallel interface board. The VAX interface should be available this month for about $7,000 to $10,000, including DR11 driver software written by Sension to run under the VAX VMS operating system.

disk storage. Torus provides a multitasking software kernel enabling such a station to run its special software concurrent with the software used in other workstations on an Icon network. Winchester storage is not essential on other network workstations, but each one must have at least 256K bytes of random access memory. A mixture of color and monochrome PCs can be supported by the same Icon network.

Allenstein quotes a price of around $600 for the software shared by the network. The main expense is the hardware and software for each PC workstation, about $1,500

British file server duo seeks U.S. distributors

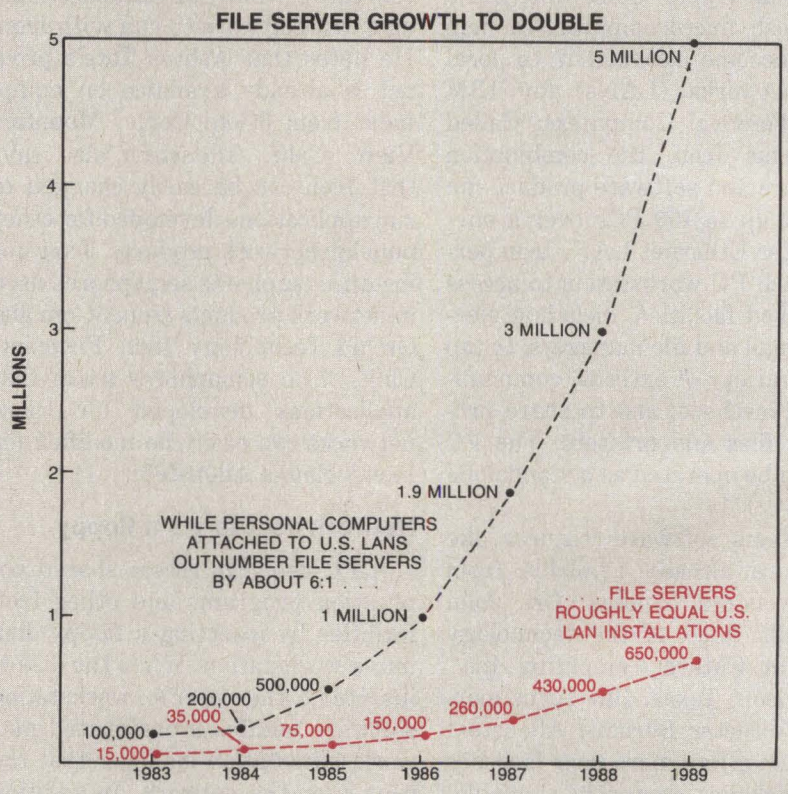
Quorum Computers Ltd. and Micromite Plc., two Southampton, England manufacturers of file server systems, are seeking U.S. distributors. They're addressing a market that could have an installed base of 650,000 file servers by the end of 1989, says Bill Ablondi, vice president of the office group at Future Computing Inc., Richardson, Texas.

Quorum manufactures QuorumNet, a server offered on an OEM basis to builders of multiple workstation systems running under the CP/M-86 operating system. It provides as much as 280M bytes of disk storage, and can support as many as 64 stations over a one kilometer local area network (LAN).

Micromite builds a file server, called Micromite, which enables a mixture of microcomputer workstations, some running under CP/M-86 and others under MS-DOS or PC-DOS, to share the same data files. The server has up to 40M bytes of disk storage and can support up to 254 stations; 12 to 15 is the average number.

Both systems use proprietary LAN technologies to communicate with workstations. Quorum marketing director Martin Willard explains that QuorumNet employs a general poll technique: all the stations are polled in succession starting with the one nearest the server. Requests requiring data from these stations are stored and serviced in a batch, priority being determined simply by the location of the disk read/write heads. With Micromite, request priority assignments depend on the identity of the workstation. Both LANs have coaxial cable as the physical medium, support communication at 625,000 bits per second and use protocols based on IBM Corp.'s Synchronous Data Link Control.

Micromite sales manager Brian Goodall reveals that his company is negotiating a joint venture in the United States to manufacture its product under license.



John Budden, OEM sales manager at Quorum, explains that his company is seeking U.S. distributors that can provide hardware backup, such as the integration of Winchester disk drives. He points to Quorum's existing OEM agreements in Europe with microcomputer suppliers that include Olympia Business Machines Ltd., London, and the British operations of two Japanese manufacturers, NEC Business Systems (Europe) Ltd., London, and Canon (UK) Ltd., Croydon, England.

Goodall quotes a price range of about $9,000 to $10,000 for servers providing 10M, 20M or 40M bytes of storage, and each package includes a 20M-byte streaming tape drive for backup. Budden at Quorum quotes roughly $9,000 for the smallest QuorumNet, providing 20M bytes of storage, and up to $25,000 for a 280M-byte system with two 140M-byte drives. A 20M-byte cartridge backup unit adds an extra $4,000.

Quorum's Willard says that his company is also offering U.S. dealers a complete networked system called Q-LAN, which employs QuorumNet technology. It also provides workstations built by Quorum, each configured around the Intel Corp. 80186 microprocessor. Each station is priced at $2,500, not including a CRT.

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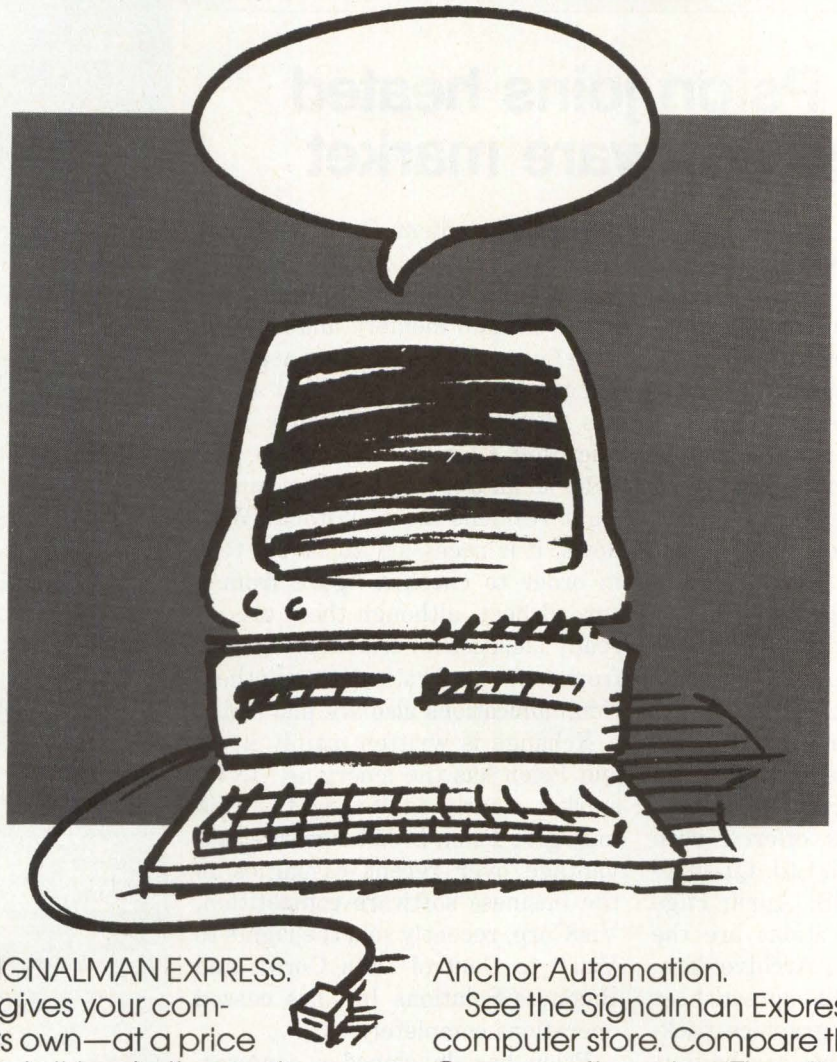

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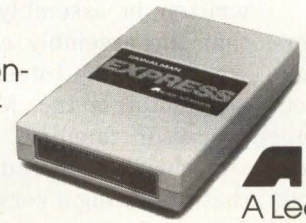

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for each. This includes an Ethernet interface board, originally from 3Com but now built by Torus.

Possible U.S. marketing outlets being explored by Allenstein include Ethernet hardware vendors, manufacturers of IBM PC-compatible personal computers and retailers of IBM PCs and compatible machines. He names banking giant Citicorp's International Technology Group, Parsippany, N.J., as one of the first U.S. users to evaluate Icon. □

Britain's Psion joins heated integrated software market

Tim Palmer
European Correspondent

Psion Ltd., until recently a computer hobbyist company, is jumping into the hotly competitive integrated business software market.

The four-year-old London company has completed beta testing of its Xchange suite of integrated applications, which were released in September.

Unlike many integrated packages, Xchange is designed to work with future UNIX-based systems and with IBM Corp., Apple Computer Inc. and other microcomputers now. Xchange arose from Psion's successful creation of the bundled applications offered with the Sinclair Research Ltd. QL business computer (MMS, April, Page 83). The four applications are the Quill word processor, Archive database manager, Abacus spreadsheet and Easel business graphics package. The four elements can be purchased together for $650. Separately, Archive is $250 and the others are $175 each.

Xchange partners

The first version of Xchange is for the IBM PC and Applied Computer Techniques Plc.'s Sirius, Apricot and xi. A version for the Apple Macintosh running under MACDOS is due out now, as is one for the Digital Equipment Corp. Rainbow 100.

Xchange minimally requires 256K bytes of main memory and a 320K-byte floppy disk drive. It is not yet a full windowing package, but Psion has plans to marry Xchange with Microsoft Corp.'s Windows to provide simultaneous views of up to eight resident tasks. Without Windows, it is necessary to save a text in order to check a figure from a spreadsheet, although there are already facilities for transferring data from one application to another. Communications also are planned.

Xchange is written mainly in C, and Psion has the emerging UNIX market clearly in its sights. This may give Psion broader market advantage over recent casualties in the business software competition. VisiCorp, recently sold the rights to Visi^{On} to Control Data Corp., and Business Solutions Inc. has ceased operations completely.

Psion has developed a compression tool, the Psion Table Language, which it claims can reduce 10K bytes of C code to just 2K bytes. Other parts of Xchange are written in assembly language, so that the assembly code is already written for the Intel Corp. iAPX-86 and Motorola Inc. MC68000 microprocessor families. Psion founder and chairman David Potter claims that producing a version of Xchange

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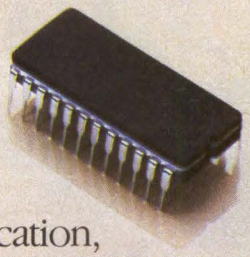
A good place to start is the VRTX kernel. Because with it, you can subtract two years from a lengthy design cycle.

Think of it as task management, real-time clock support, dynamic memory allocation, basic I/O, interrupt handling and fast pinpoint timing — all rolled into a neat 4K of memory.



4 Years

OK, sounds like a lot, but not quite two years? You're right. That doesn't just come from design time. But from what makes VRTX as reliable as a quartz watch.

6 Years

100,000 manhours of debugging and testing. The stuff nights and weekends can be made of.

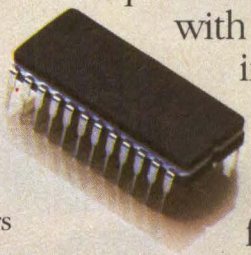
Still you'll be happy to know, for all VRTX takes off, there's not much to give up.

Unlike other operating systems, it doesn't lock you into one processor for life. Or tie you to one type of I/O and file management forever. VRTX is compatible with all major processor families and all standard types of file management and I/O.

And with that choice, we're back to the count.

Meaning if you don't want to spend time on I/O, take off another two years. Since our IOX component works with VRTX to take care of all block, disk and character I/O.

And right along with that goes our FMX file manager. And another two years off. Besides which, FMX includes all the things you'd want in a hierarchical file system. Concurrent file access. Random and sequential access. And compatibility with standard file systems, including none other than PC-DOS.



We could go on. But it's now time for our final summation.

A total of six years if you want it all off (VRTX, IOX and FMX). Two or four years if you'd like a real-time head start.

Or if you'd like to know more before you decide, write Hunter & Ready, 445 Sherman Avenue, Palo Alto, CA 94306. Or call (415) 326-2950.

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for a new microprocessor—National Semiconductor Corp.'s series 32000, for example—and a new operating system would take a couple of months.

Virtual memory speeds access

A key feature of Xchange's software architecture is a virtual memory structure that quickly accesses the next required and the most recently used instructions and data from a 40K-byte space set up in main memory. As that space becomes filled, the least-recently used items are first buffered to another part of main memory, and eventually buffered back to disk. According to the company, it takes no longer to jump from page 1 to page 295 of a text than it does to jump from page 1 to page 2. Users should never get an "out of memory" error message no matter how large the Abacus speadsheet is.

Psion has a wholly owned U.S. subsidiary, Psion Inc., Fairfield, Conn., that reportedly has signed OEM agreements with major international computer manufacturers. □

LOOKING AHEAD IN MMS

Mini-Micro System's December issue is our third annual overview of those leading edge technologies impacting our value-added market readership. A long-lasting sourcebook for technology and market data, the report presents past, present and future perspectives on key areas including:

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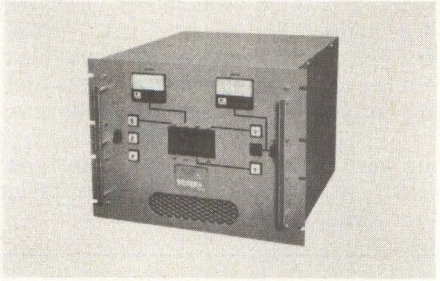

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PACIFIC PERSPECTIVE

Databases to bloom in Japan

Ichiro Kakehashi,
Tokyo Correspondent

The word database is a relatively new one to most Japanese, partly because there haven't been many databases around and not many ways to get at those that are.

Two factors are sparking interest. The first is anticipated competition for so-called value-added networks, or VANs, expected to arise from the deregulation next April of the Nippon Telegraph and Telephone Public Corp. (NTT), Japan's government-supervised, telecommunications monopoly.

The second factor is an expected improvement in domestic hardware that will let Japanese businesses obtain and manipulate data. Although the use of computers to improve office productivity has been slow to emerge in Japan, interest is soaring. The announcement of products like IBM's PC-AT and the accompanying network that can link up to 72 IBM personal computers to share information, programs, messages, printers and storage devices whets the appetites of computer-hunting corporate purchasing officers.

They are encouraged by word that IBM Japan Ltd., the wholly owned subsidiary of IBM, is preparing a year-end introduction of a new business personal computer that would be a somewhat lower-level relative of the popular 5550, an office personal computer that was introduced in June, 1983 in Japan. IBM has no comment on the new product, but the Matsushita Electric Industrial Co., which builds the 5550 under an OEM agreement, is tooling now for production at its Kadoma plant in Osaka, which has a capacity for 2,000 to 3,000 units a month.

The smaller machine is expected to be based on the same Intel 8086 that drives the 5550, providing general software compatibility. The expectation of Japanese analysts is that IBM Japan will follow a strategy similar to that used by its parent company: It will move nearer the home market by providing a machine for small, cost-conscious offices and businesses—that can be used for work at home.

IBM has been less circumspect about its intention to get into a VAN market—a market that no one has been able to measure yet, because it doesn't exist. Even though many companies have filed with Japan's Ministry of Posts and Telecommunications to offer data services, the race is quickly shaping up to a formidable three-way contest pitting IBM and AT&T's International Division against NTT.

The NTT software developers are already at work on a large-scale network for operation as early as next year. The communications utility started tests in September on its fiber-optic, cable-based, high-speed data network, the Information Network System (INS).

Software has been one of the most important areas of the VAN market research done so far by companies preparing to offer VAN services. One of the reasons AT&T has been seeking a Japanese partner is to obtain software. Another reason for AT&T's desire to align itself with a Japanese company is that the proposed VAN legislation restricts foreign capital participation to less than 50 percent.

The Diet, Japan's parliament, is expected to resume debate on the VAN bills and the closely allied NTT deregulation bills when its next session begins in December. Passage of NTT's deregulation is virtually assured.

One of the most recent examples of domestic databases was introduced late in August by IBM Japan Ltd., and Teikoku Data Bank Ltd. It is a corporate background file with information on the size and nature of companies and their financial condition. The service can be drawn upon by users of the IBM 5550 computer and the IBM 3278-52 Kanji display equipment. Information moves at 2,400 bits per second on the public telecommunications network. IBM will provide remote computing services.

LOOKING AHEAD IN MMS

The Interpreter section of Mini-Micro Systems' December issue focuses on office-automation systems.

OA systems have the potential to move mountains of paperwork and boost worker productivity. Yet, year after year, the promise is not quite realized. Buyer perceptions of machines as not user-friendly could be one reason. This article examines what's being done to improve OA's image.

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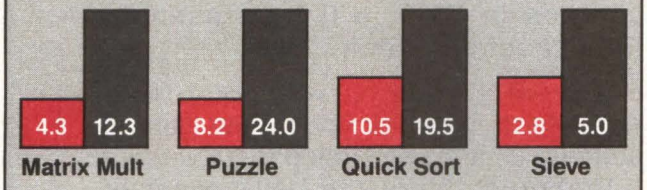
TARTAN C Benchmarks



Standard benchmark tests* compare TARTAN C (in red) and Portable C compiler object code performance (measured in seconds) for various computational profiles.

TARTAN C Error Messages

C Program with Syntax Errors:

```
1  bubble(a) int a[100]; {int tmp,last,i;
2   for (last=100; last >= 2; last--)
3      {for (i=1; i <= (last-1; i++)
4          if (a[i] > a[i+1])
5             {tmp=a[i] a[i]=a[i+1];
6              a[i+1]=tmp;};
7      }
8  }
```

Portable C Compiler Error Messages:

```
"bubble.c", line 3: syntax error
"bubble.c", line 3: syntax error
"bubble.c", line 8: syntax error
```

TARTAN C accurately pinpoints errors and recovers:

```
2| for (last=100; last >= 2; last--)
3|    {for (i=1; i <= (last-1; i++)
                            ^1
*** 1 Error 101: Parse error; token ")" inserted.
4|         if (a[i] > a[i+1])
5|            {tmp=a[i] a[i]=a[i+1];
                          ^1
*** 1 Error 101: Parse error; token ";" inserted.
6|              a[i+1]=tmp;};
```

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*A complete report on these and other benchmarks is available on request.

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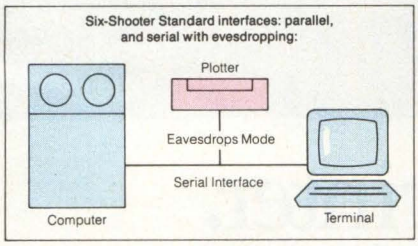

Source notes: *Yankee Group, The Technical Office, Vol.III 1983
**Wharton School Study, September 1981

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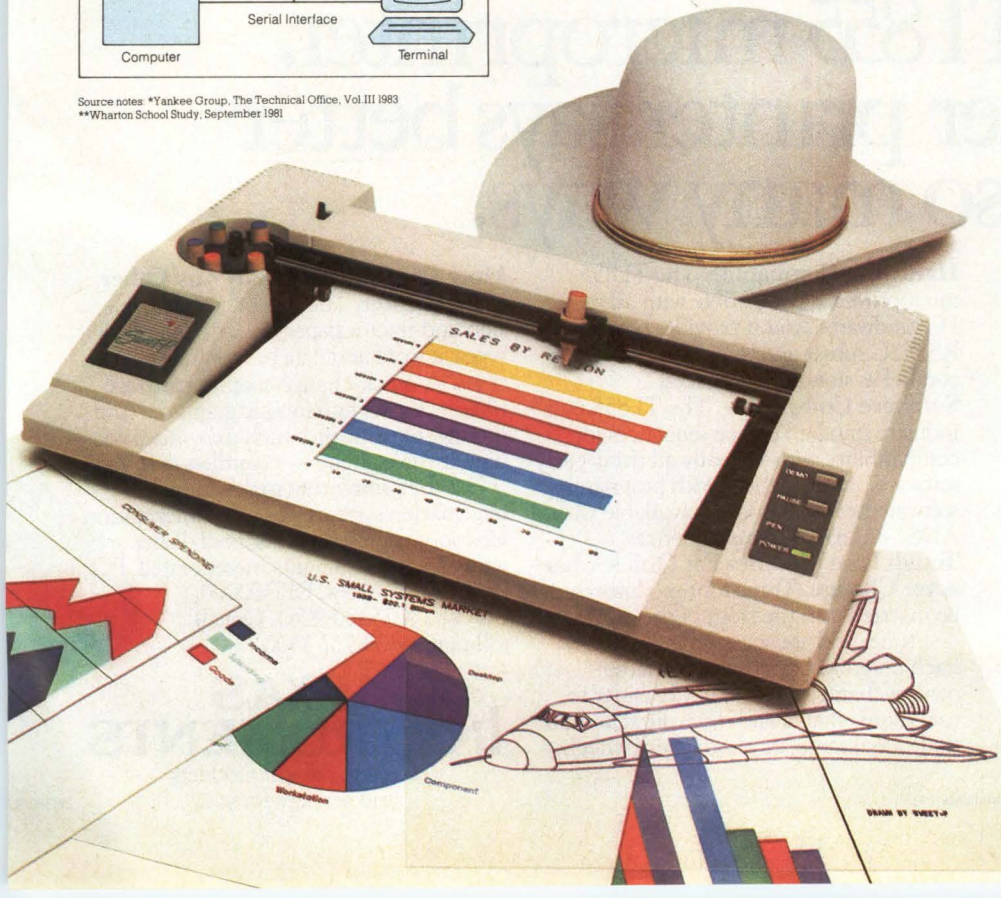

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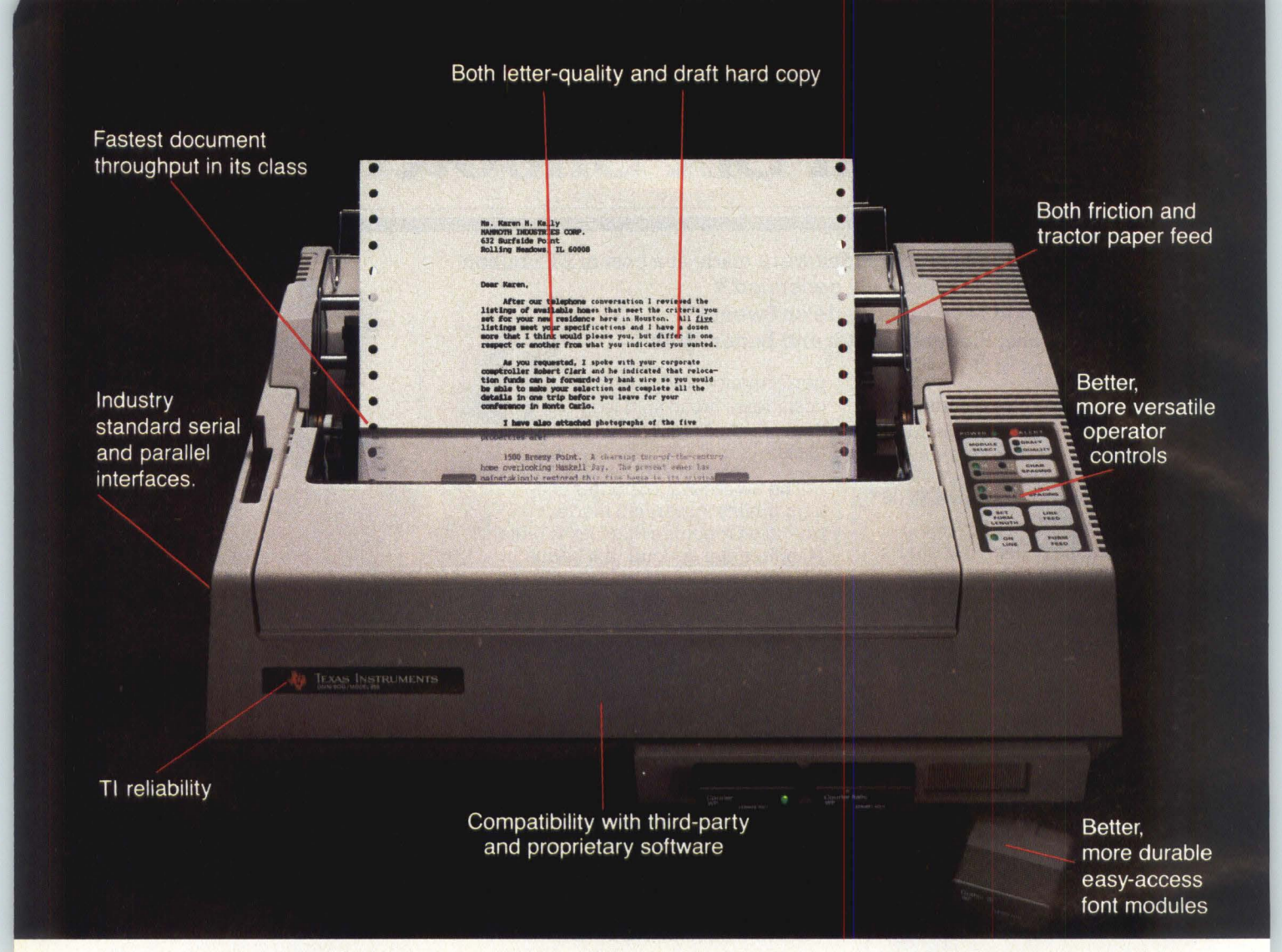

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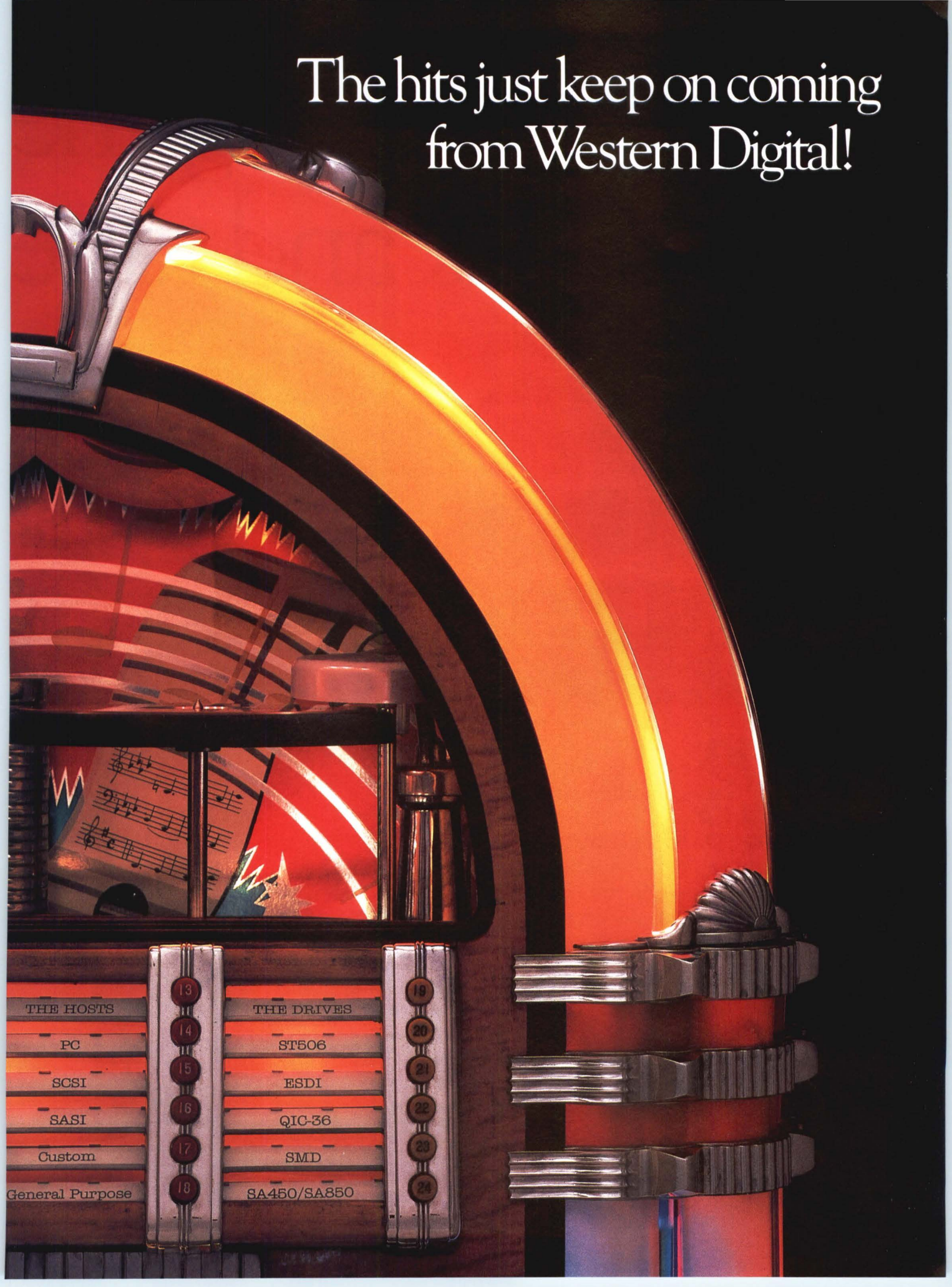

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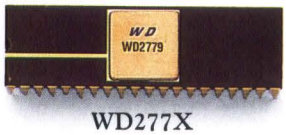

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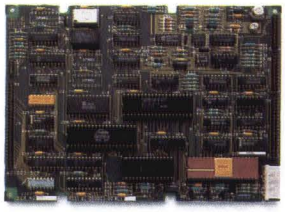

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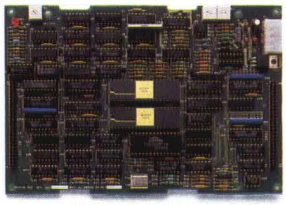

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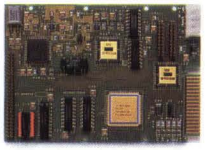

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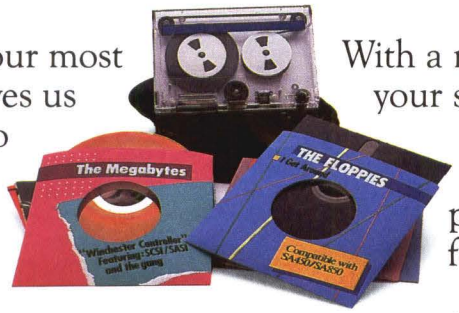

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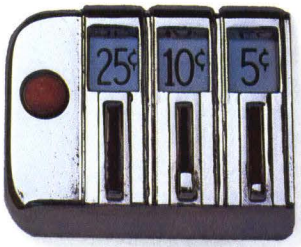

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	WD279X	Integrated data separator	+5V	40 pins	FD179X with built-in analog data separator and write precompensation, single/double density, and internal clock divide.
WINCHESTER DISK CONTROLLER DEVICES	WD1010	5MHz	+5V	40 pins	5.25" and 8" Winchester controller chip.
	WD1050	Single chip	+5V	68 pins	SMD controller.
	WD2010	5MHz	+5V	40 pins	WD1010 with ECC.
WINCHESTER DISK SUPPORT DEVICES	WD10C20	CMOS	+5V	28 pins	Data separator, and write precompensation device compatible with the WD1010 and WD2010.
	WD1015	Single chip	+5V	40 pins	Winchester buffer manager control processor.
	WD11C00-13	Single chip	+5V	20 pins	ECC support device compatible with the WD1010.
WINCHESTER BOARD PRODUCTS	WD1002-05/HDO	Board	+5V	5.75"X8"	5.25" Winchester/floppy controller board with ECC. HDO Winchester only.
	WD1002-SAS	Board	+5V	5.75"X8"	WD1002 Winchester/floppy with SASI interface.
	WD1002-SHD	Board	+5V	5.75"X8"	WD1002-SASI interface – Winchester only.
	WD1002S-SHD	Board	+5V	5.75"X4"	3.5" form factor of 1002A-SHD.
	WD1002-WX2	Board	+5V, −12V, +12V	3.85"X13"	WD1002 with IBM PC compatible interface – Winchester only.
	WD1003-SCS	Board	+5V	5.75"X8"	5.25" Winchester controller board with SCSI interface.
TAPE DRIVE CONTROLLER PRODUCTS	WD2401	Single chip	+5V	40 pins	Motion control & buffer manager
	WD24C02	Single chip	+5V	40 pins	Read/write formatter
	WD1036-SHD	Board	+5V, +12V	5.5"X8"	¼" tape controller (SASI:QIC-36)
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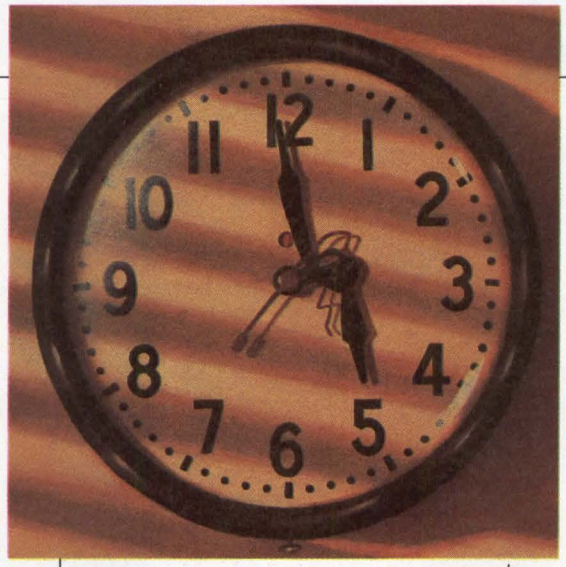

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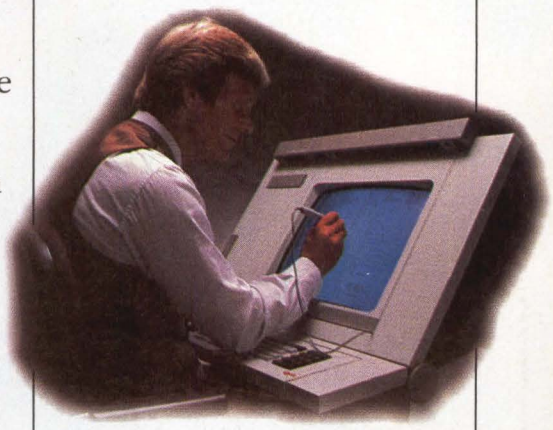

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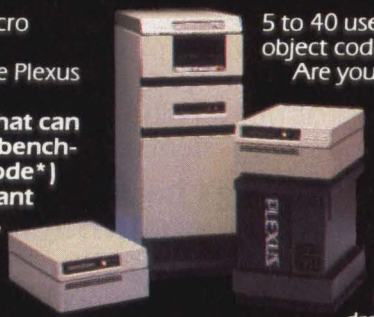

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Fiber-optic technology sheds light on local area networks

System integrators choose fiber-optic links for certain LAN applications

Lynn Haber, Associate Editor

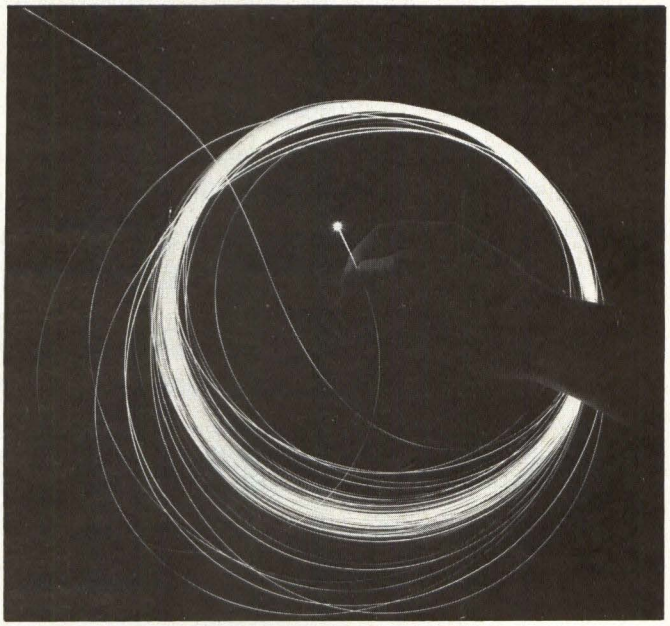
The increasing use of microcomputers and intelligent workstations in the workplace has laid the groundwork for local area networks (LANs) which can satisfy the need for reliable, high-speed data communication. Currently considered a diamond in the rough by LAN experts, fiber-optic (lightwave) technology may soon become a polished gem for networking.

Boasting properties such as high bandwidth, light weight, immunity to electromagnetic interference and resistance to tapping, optical fiber is an attractive medium for LAN implementation. Though fiber-optic LAN technology remains in its adolescence, system integrators can opt for fiber-optic links within LANs in certain environments. These might include a campus where several LANs in separate buildings must be connected, a factory floor where machinery causes electromechanical interference and in applications that require a high level of data security.

According to Strategic Inc., a San Jose, Calif.-based research and consulting firm, by 1988, there will be 4,000 fiber installations out of an installed base of more than 124,000 LANs. In contrast, Strategic reported only 20 fiber LANs out of nearly 20,000 in 1983, with prototype installations existing exclusively in factories, universities and the military. Translated into dollars, Strategic estimates 1988 revenue from fiber LANs will amount to $640 million, compared to almost $500 million for broadband coaxial systems and approximately $12 million for baseband coaxial systems.

Popular as a long-haul transmission medium, fiber optics will not be fully embraced as a LAN medium until designers can overcome technological obstacles. These include difficulties in tapping a signal from the fiber, connecting fibers to other LAN components and finding suitable network architecture for the physical and logical LAN design.

Fiber-optic technology utilizes light energy as opposed to electrical energy. In an optical link, information is transmitted as pulses of highly focused light emitted from a light source (transmitter), either a light-emitting diode (LED) or injection-laser diode. The light energy is carried over hair-thin fibers of glass (lightguides) enclosed in cable to a light detector (receiver), which converts the light pulses to electrical impulses.



Hair-thin fiber-optic cable *offers benefits such as light weight, high transmission speeds and immunity to electromagnetic interference and security.*

In a LAN, the foremost benefit of fiber is its ability to carry vast amounts of information faster and over longer distances than can the more commonly used twisted pair, or coaxial cables. Fiber's high bandwidth —the range of frequencies that can pass over a circuit— allows the transfer of data along with other forms of communications such as voice, video and graphics. Today, fiber's capacity is 250 times that of copper, according to a spokesman from AT&T Bell Laboratories, Allentown, Pa. In the near future, that figure is expected to double, as technology improves.

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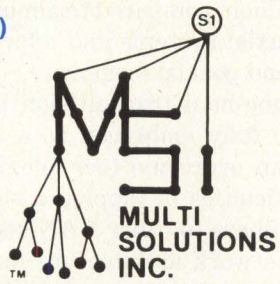

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Additional advantages of optical fiber over metallic conductors include immunity to electromagnetic interference, because these lightguides do not conduct electricity; light weight, which makes installation easy; and security. Unlike copper cable, fiber-optic cable is very difficult to tap, unless physically broken.

Pioneers produce fiber LANs and components

Despite the youth of the fiber-optic industry, pioneers are making fiber LANs and their components available today. Among them are Ungermann-Bass Inc., a supplier of general-purpose LANs, and a handful of companies—such as Codenoll Technology Corp., Proteon Associates Inc., American Photonics Inc., Fibronic International Inc., and Seicor Fiberlan—that manufacture fiber-optic equipment.

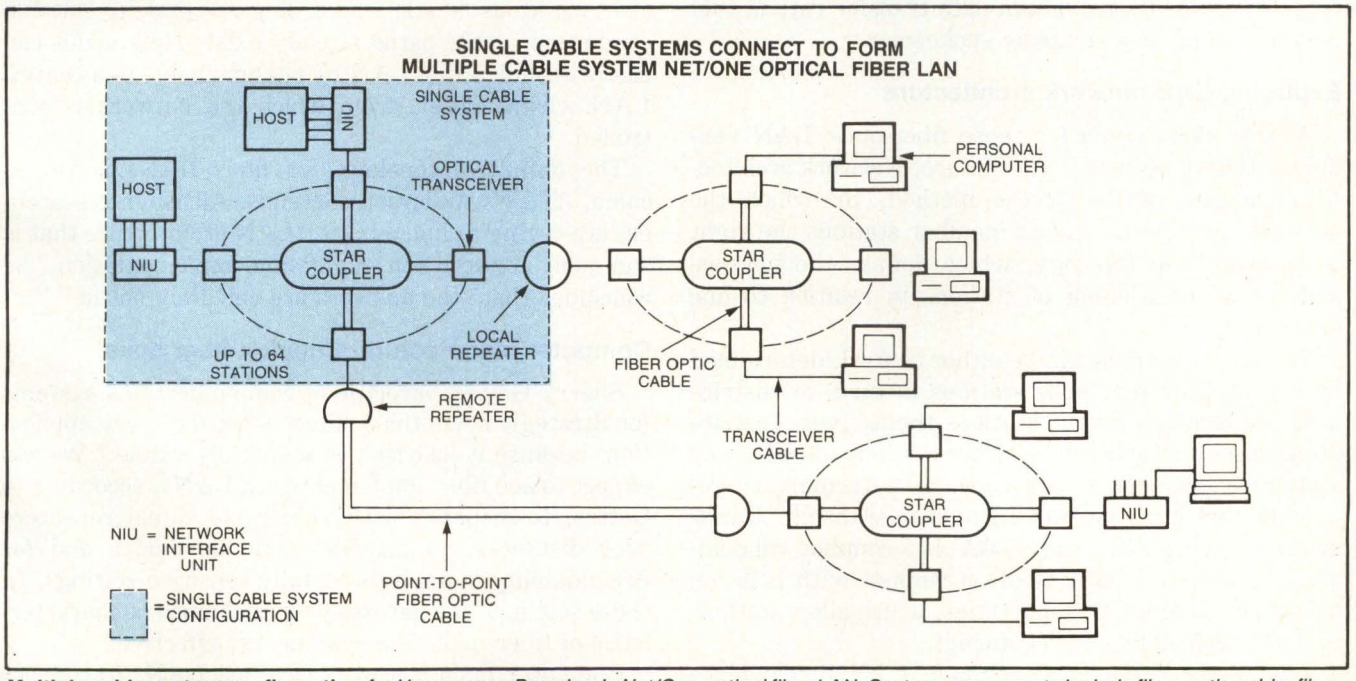
In announcing a fiber version of the company's Net/One product earlier this year, Ungermann-Bass, Santa Clara, Calif., made one of the first fiber-optic LANs commercially available. Net/One is also available in its original coaxial cable versions.

The Net/One Optical Fiber LAN has a 10M-bits-per-second (bps) data-transfer rate, is Ethernet-compatible and employs carrier sense multiple access with collision detection (CSMA/CD), a scheme by which stations in a network compete for access. System components include fiber-optic cable, fiber-optic star couplers and the star wiring center.

"One of the founding commitments of the company," says Anthony Russo, director of product marketing for Ungermann-Bass, "was that we be a media-independent company and support all emerging standards. Fiber is another technology in which we need to have expertise." According to Russo, the company has installed four fiber systems, the largest for a Fortune 500 company at the cost of $1.1 million.

Although fiber links are more expensive than copper ones, the cost gap between copper and fiber is narrowing. A typical fiber-optic Net/One with 200 device interface ports sells for $135,000, according to a company spokesman. The same system in a baseband coaxial version sells for $110,000, and an equivalent broadband coaxial system sells for $115,000 (the cost of the cable is not included in these prices). Depending on a variety of cable characteristics, prices range from $1 per foot for baseband coaxial cable; $1 to $7 per foot for broadband coaxial cable; and $2 to $15 per foot for optical fiber cable.

Although Codenoll, Yonkers, New York, and Proteon, Waltham, Mass., classify their respective products—proNet and Codenet—as LANs, Ungermann-Bass claims the Net/One fiber LAN distinguishes itself from these other products by its network interface unit (NIU), which reportedly functions as the intelligent interface between the LAN and other information processing equipment. "Other companies don't have an NIU. Their products only allow a certain subset of equipment to be hooked up in the network," explains



Multiple cable system configuration *for Ungermann-Bass Inc.'s Net/One optical fiber LAN. System components include fiber-optic cable, fiber-optic star coupler, network interface unit (NIU) and optical transceiver.*

Russo. Without software to translate data files from a form used by one type of equipment to a form other equipment can understand, the network can't include equipment from a variety of vendors, he says.

Michael Coden, president of Codenoll, claims that by providing software and equipment interfaces, the Ungermann-Bass product is a turnkey system. In contrast, Codenoll sells fiber-optic network components. "We provide the interconnect technology. The software and computer interfaces are left up to the user," he says.

Researchers are trying to find a better LAN architecture that is 'uniquely attractive in a lightwave implementation...the answers are certainly not in.'

Codenoll, founded four years ago to develop fiber-optic communications equipment, makes Codenet, a fiber-optic, Ethernet-compatible LAN with a 10M-bps data transfer rate. Since the product became commercially available 18 months ago, the company has installed hundreds of systems which are either all-fiber or implement some fiber technology, Coden says.

Also Ethernet-compatible is the proNet network made by Proteon which can use fiber, coaxial or other types of cable. Its maximum data transfer rate is 10M bps, according to a company spokesman.

Exploring LAN network architecture

A precarious arena for these fiber-optic LAN vendors is that of network architecture. Network architecture consists of the access method, by which the network distributes among member stations the right to transmit and topology, which defines the physical and logical positioning of stations in relation to one another.

The access method can be either central, determined by a controller that polls stations in turn, or distributed, determined by the stations themselves. Distributed access methods can be either random, allowing any station to transmit at any time, or deterministic, requiring that stations wait in turn to transmit. Carrier sense multiple access (CSMA) is a common random-access method. CSMA is often refined with collision detection (CSMA/CD) capabilities, which allow stations to detect collisions and retransmit.

Among the three most common LAN topologies—bus (or tree), ring and star—the bus is the most popular in the United States, according to Lawrence K. Anderson, director of electrical components and subsystems for AT&T Bell Laboratories. It is also the most difficult in which to implement fiber-optic technology, because so much tapping is required.

Most prototype fiber LANs utilize ring or star topologies. According to Ungermann-Bass' Russo, the fiber optic Net/One physically utilizes a star configuration, but is logically arranged as a bus. "The bus is ideal, but difficult to do physically," he explained. "The star is inexpensive and makes it easy to reconfigure the network [because] you splice at the star."

In a star topology, the system utilizes what is called a star coupler, made by criss-crossing optical fibers and melting them where the fibers intersect, according to Coden. Whatever light (digital information) is inputted on one side of the coupler, after passing through the melted point, divides itself equally among all of the other fibers and travels on to the network nodes.

As opposed to coaxial cable, which typically runs down a corridor with a tap branching off for every office, the star arrangement requires that a cable run from each office to a central point called a wiring closet. In this arrangement there are never more than four connections—a transmitter and a receiver at the computer, and one each at the wiring closet. Whereas any tap causes a large power loss, the star topology minimizes the number of taps.

Since most utility power grids in office buildings are also wired as a star, according to Coden, suitable conduits or cable paths already exist. New nodes can easily be added to a LAN by running cable to a central LAN wiring closet, from which the network is controlled.

The definitive topology for fiber LANs is yet to come, AT&T's Anderson contends. Although researchers are trying to find a better LAN architecture that is "uniquely attractive in a lightwave implementation," he concludes that "the answers are certainly not in."

Computer manufacturers market fiber links

Sherry Gettes, director of communications systems for Strategic notes that, "fiber is not for every application, because it just isn't economically viable." We can expect to see fiber implemented in LANs, according to Gettes, to dispense with vulnerable signal repeaters over distances, to provide wide bandwidth and for dependability in environmentally sensitive settings. In these settings, the necessity for the inherent characteristics of fiber make the system cost effective.

Computer manufacturers that sell LANs to connect their own equipment have been testing the waters of

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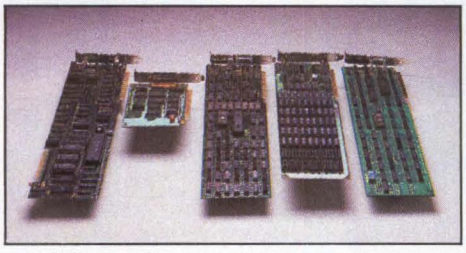

ISI International also offers an expanding array of adapter cards for use with ISI International systems, as well as IBM and other PC-compatible systems.

Factory Control: ISI's 6160.

The ISI 6160 is essentially the same easily expandable processor as the 5160, featuring the same PC and XT-compatibility, but with important additional features that make this the ideal system for factory applications.

For example, it's 19″ rack-mountable RETMA enclosure is ruggedly designed and manufactured, and features fan cooling with positive airflow to eliminate hot spots; changeable filters for extra protection from contamination; and a key-lockable cover for limited access to power and reset switches, as well as to the shock-mounted disk drives.

Both the 5160 and the 6160 offer MS-DOS* and GW-Basic;* in addition, the 6160 factory system offers VRTX†, a multitasking kernel that permits you to run real-time, interrupt-driven control applications.

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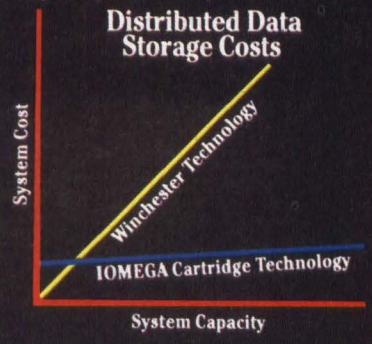
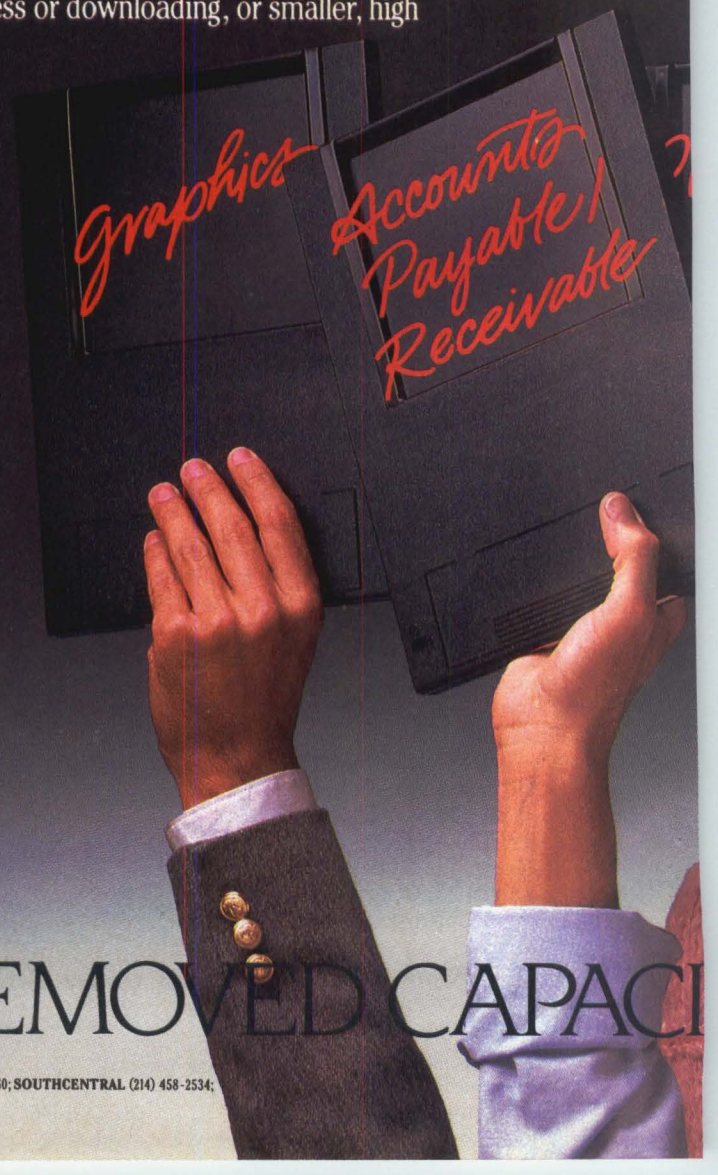


Slavery By Any Name . . .

There are lessons here. That the central issue isn't more data, but more data dynamics. And that Winchesters are hardly data dynamic at all.

Consider the aggravations of "wait your turn" access, or the need for lots of "system savvy" on the user's part. Consider the time consumed in backing up and restoring data. And consider the ever-present risk of a system going down or files lost to expensive head crashes.

Now consider the alternative.



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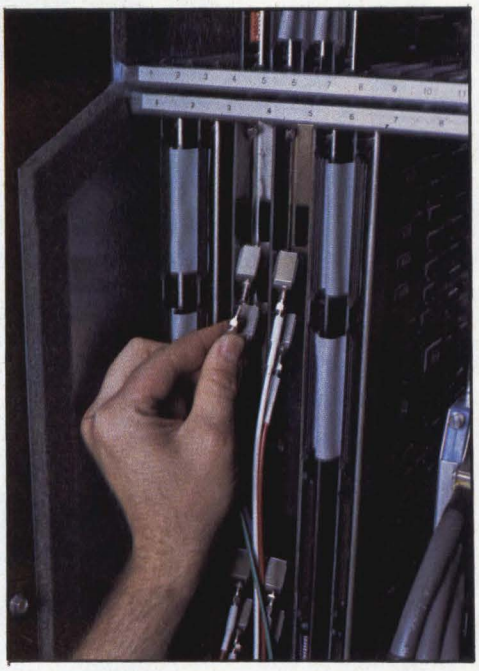

The fiber-optic Extension (FOX) from Tandem Computers Inc. *allows up to 14 of the company's NonStop II systems to form a high-speed information network. Fiber-optic cable is directly connected to a FOX controller board in the NonStop II system.*

In a LAN, the foremost benefit of fiber is its ability to carry vast amounts of information faster and over longer distances than can the more commonly used twisted pair, or coaxial cables.

fiber technology, rather than taking the plunge. Companies such as Wang Laboratories Inc., Digital Equipment Corp. (DEC) and Tandem Computers Inc. have already introduced fiber-optic products, although none is a complete LAN and most are only links that expand the distance capacity of a system.

Tandem, a Cupertino, Calif., maker of network-oriented minicomputer systems based on parallel processing architecture, uses optical fiber in the company's Fiber Optic Extention (FOX) product. According to a company spokesman, FOX is a high-speed interface that enables users to expand their processing power beyond the maximum of 16 processors in a single Tandem system. A system-to-system link, FOX allows users to connect two to 14 of the company's NonStop II systems over distances as great as one kilometer. "We decided to use fiber because we saw a need for a high-speed interconnect between systems," the spokesman says. "Our users are large organizations, such as banks, the stock exchange and manufacturers who require strong communications capabilities."

Other companies say full implementation of fiber-optic technology is three to five years away. "We're looking at all types of LAN technologies," says a spokesman for Data General Corp. of Westboro, Mass. "Our position is to be compatible with all the standards, but we think it's premature now for our participation in the market. I'm sure we'll support fiber in the future." The company markets two LANs. One is a proprietary network bus system that uses baseband coaxial cable, can support 32 nodes and has a data-transfer rate of 2M bps; the other is based on the Ethernet standard.

While Stratus Computer Inc., a Natick, Mass. maker of continuous processing equipment, doesn't presently support fiber-optics in their Stratanet network, it is a technology that the company eventually will support. "We don't see the requirement to have fiber today," states William Foster, company president. "Clearly, it is a new technology and one that you'll see more of in communications systems."

With standards for fiber-optic LAN technology still to come, many vendors are waiting to see in what direction the industry leaders will move. IBM Corp. virtually gave fiber its stamp of approval with an announcement earlier this year of the company's cabling system. One of four types of transmission cable being marketed by IBM is optical fiber. The cabling system is reportedly one piece of the proposed token-ring LAN that IBM is expected to make available within the next couple of years.

Closely following suit, AT&T Information Systems, Morristown, N.J., introduced the Information Systems Network (ISN), a local area network that combines fiber optics and existing copper wire to link workstations, terminals, personal computers, minicomputers and communications processors into one system. The network reportedly supports data transfer rates of up to 8.6M bps, and supports a multiplexed fiber interface for selected host computers.

Fiber makes ideal spine for hybrid LANs

The most successful networking application for fiber in the near term, according to industry experts, is as the backbone (spine or trunk) for one or more LANs. In this capacity, the fiber acts as a transparent high-speed data highway. With other media connected to the fiber trunk, the LAN becomes a multimedia or hybrid LAN.

At the Massachusetts Institute of Technology (MIT) in Cambridge, a five-year experimental project in the use of computers in education, called Project Athena, began in May, 1983. It will utilize a distributed network of 3,000 terminals and computers including DEC's VAX 11/750 and VAX 11/730 minicomputers, VS100 workstations and Professional microcomputers, and IBM

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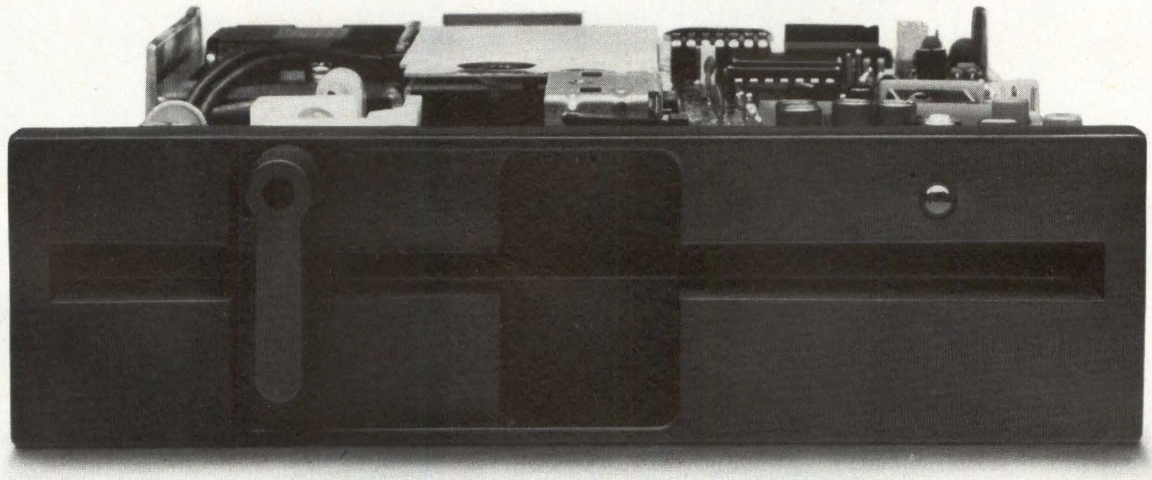

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4341 computers and PC/XTs dispersed across the approximately one-mile-by- two-mile campus. The project is funded by DEC, IBM and MIT.

According to Doug Wilson, manager of system development and operations for the project, the personal computers will be organized into Ethernet clusters, each with about 50 machines and one or more file servers. The Ethernet clusters will then be interconnected via a campus-wide fiber backbone network. "The philosophy behind our connection is to make the topology of the spine be transparent to any of the applications that would use the spine," Wilson explains.

The first fiber prototype will use four kilometers of cable in a ring topology. The project planners decided to install a dual redundant ring, making the total length of fiber used eight kilometers. The network will serve the entire campus. "We expect fiber to be the dominant technology," said Wilson.

According to AT&T's Anderson, advances in fiber-optic technology will eventually extend fiber right to the workstation via various star and ring networks. He also foresees interfaces between fiber-optic LANs and the switched telecommunications network. "The main thrust here is to integrate various services and various technologies."

The most successful networking application for fiber in the near term, according to industry experts, is as the backbone (spine or trunk) for one or more LANs.

According to Codenoll's Coden, whose customers include NASA, the National Bureau of Standards, Pacific Telesis and Westinghouse Electric Corp., for those who previously used coaxial cable, then moved on to fiber, there's no turning back. "There's no sense going back to that old, antiquated, heavy stuff." □

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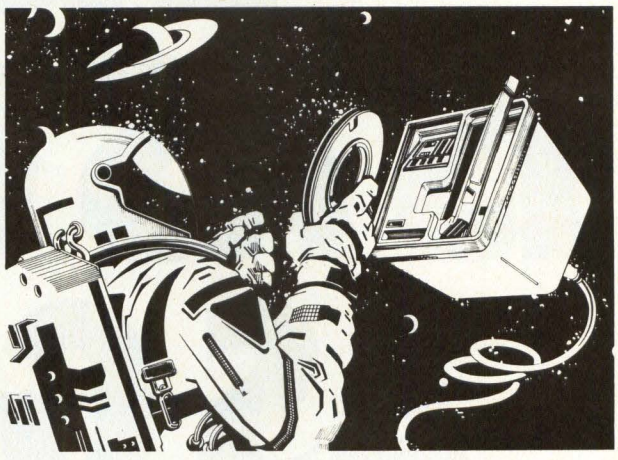

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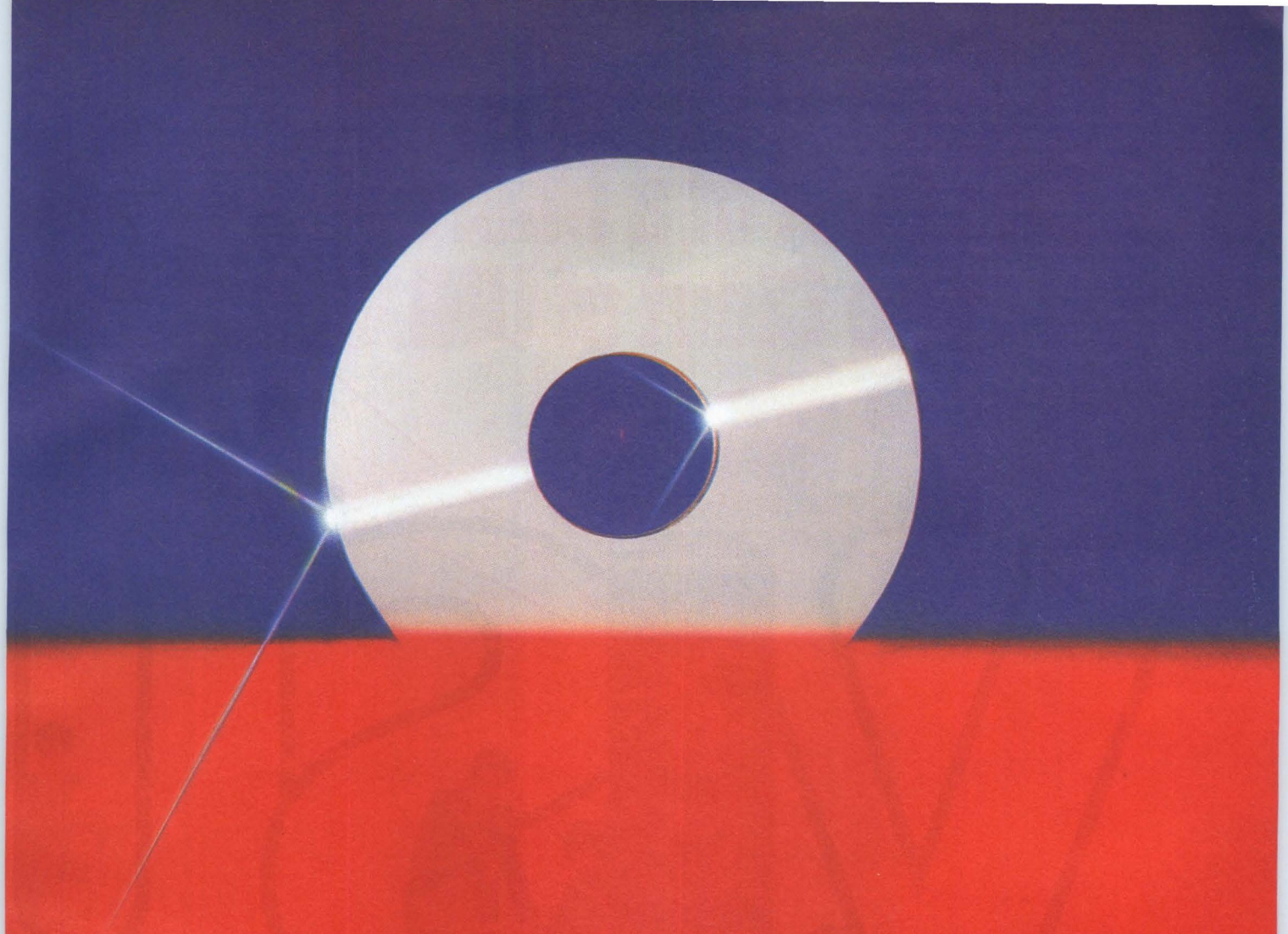

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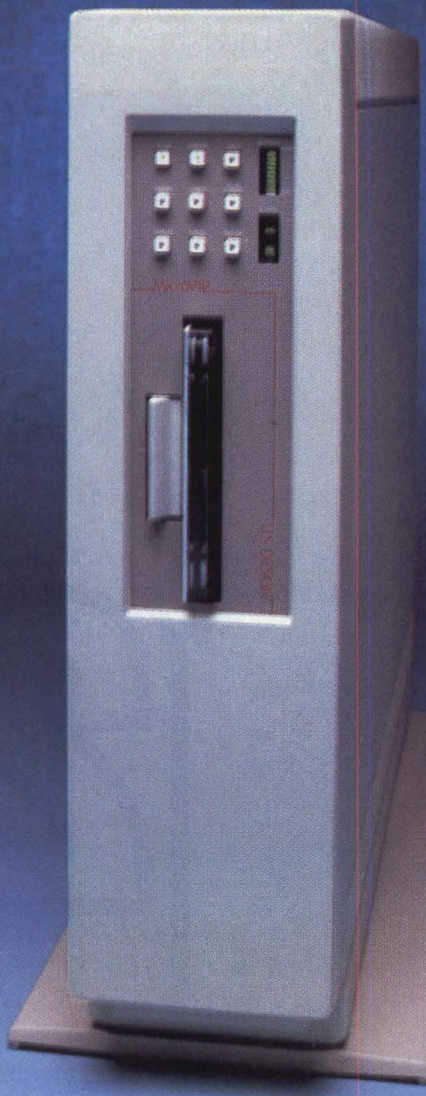

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Superminicomputers climb to new levels of performance

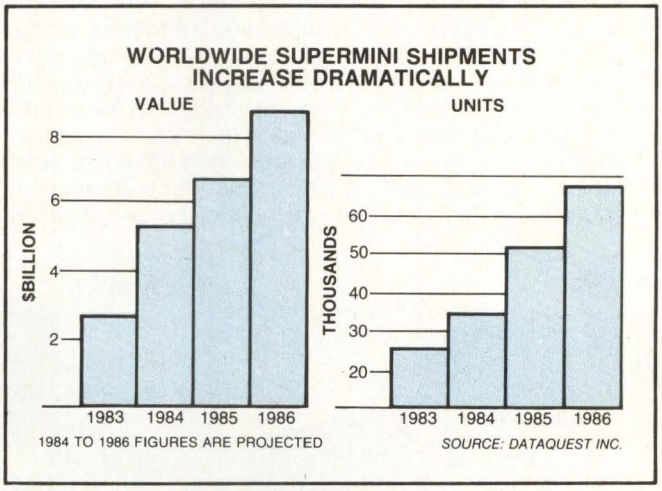
DEC's anticipated high-end Venus will expand superminicomputer boundaries, forcing countermoves from competitors

Geoff Lewis, Contributing Correspondent

Since its introduction in 1977, Digital Equipment Corp.'s (DEC) VAX has dominated the superminicomputer market. With an installed base of more than 25,000 systems, VAX actually defines the market. Almost every competitor measures its products by the VAX yardstick, claiming similar performance at a lower price, or some other price/performance advantage.

Soon, however, DEC will provide a new yardstick with its long-anticipated and much-delayed high-end system—Venus. How Venus will alter those measurements and whether it will enable DEC to maintain market mastery are the essential questions for participants in the superminicomputer industry.

To some extent, both Data General Corp. (DG) and Prime Computer Inc. have recovered market share with high-end products that extend their capabilities beyond those of current VAXs. For companies such as Gould Inc.'s Computer Systems division and Perkin-Elmer Corp.'s (P-E) Data Systems group, which concentrate on niches within the superminicomputer market, Venus may represent a fresh threat. For the industry as a whole, bound to follow DEC wherever it leads, Venus represents an extension of boundaries more deeply into traditional mainframe-computer turf.



Analysts project the value *of worldwide superminicomputer shipments to exceed $8 billion by 1986.*

Venus symbolizes move toward mainframes

At this point, Venus' true identity remains shrouded in mystery. However, DEC president Kenneth Olsen has promised that Venus will be introduced by the year-end. Other DEC officials confirm that the system is being built around emitter-coupled-logic (ECL) circuitry, the difficulty of which reportedly has contributed to Venus' delays. DEC indicates that Venus will deliver performance in the 3- to 5-million instructions per second (MIPS) range. Most observers predict that the machine will sell for approximately $100,000 per MIPS.

None of these statistics are particularly threatening to DEC's traditional superminicomputer competitors, many of which already have delivered more powerful or price-competitive systems. Instead, Venus will be a symbol of the changing structure of the superminicomputer business.

The emergence of "this whole 3- to 5-MIPS class is a very important development," says Hambrecht & Quist securities analyst Marc Schulman. "It is going to change the product-line structure of these companies. Their current products have become more and more commodity-like as standard microprocessor designs move up in power. But at three to five MIPS, they will be out of the commodity range and will be able to charge higher prices and get better margins," he explains.

As superminicomputers escalate in processing power to the range of small mainframes, Schulman observes, "there is one humongous price umbrella under the IBM 3083 for them." The 3083, IBM Corp.'s entry-level mainframe, operates at about 4.4 MIPS and is priced at

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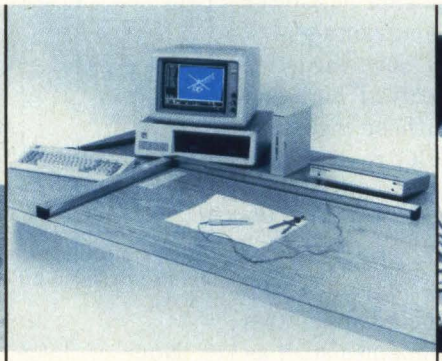

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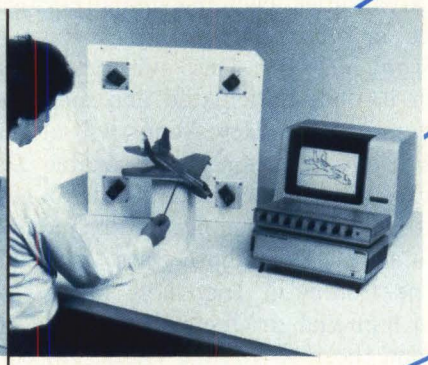

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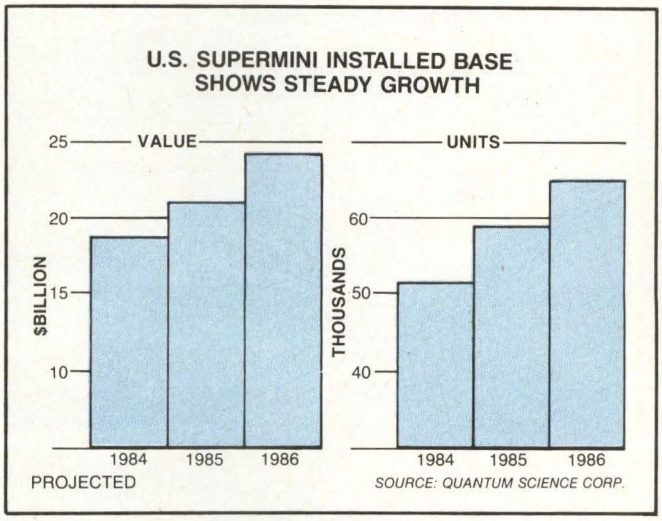
approximately $275,000 per MIPS, compared to as little as $60,000 per MIPS for superminicomputers. IBM's own superminicomputers, the 4300 series, are priced as low as $150,000 per MIPS, but market observers do not expect IBM to carry that pricing into a Venus-class product in the near future for fear that such a move would shift sales from high-profit mainframes to lower-margin 4300s. James Renalds of the San Jose, Calif., research firm Dataquest Inc. expects the average price of a superminicomputer to decline from $180,000 in 1983 to $120,000 in 1986.

Jack Hart, an IBM analyst with International Data Corp. (IDC), says that there is already some overlap between IBM's 2.7-MIPS 4381 and its 3083 in some applications. But he adds that IBM has kept most mainframe customers tied to its more profitable 308X family by not providing a clear upgrade path from the 4300s.



The U.S. superminicomputer *installed base is expected to exceed 60,000 units by 1986, representing a value of almost $25 billion.*

IBM may refrain from using muscle

"So in a sense," Schulman continues, "high-end superminis play into a part of the market where it is not necessarily in IBM's interest to compete." David Chanoux, VAX group product manager, agrees. "IBM has certain revenue and product-cycle expectations. It has a business in that space [where superminis run into IBM mainframes], so even though we expect IBM to drop prices, it may not be too aggressive in order to protect that business," he says.

George Weiss of Quantum Science Corp., New York City, predicts that Venus and other high-end superminicomputers will capture a sizable share of the late-1980s mainframe market as large-scale system applications change. Almost 85 percent of mainframe applications still are commercially oriented and use batch-processing methods. Weiss predicts, however, that by 1989, the figure will drop to 65 percent and that most commercial mainframes for batch-processing applications will be upgrades for the current installed base. The remaining 35 percent will be scientific applications and interactive processes such as computer-aided design, manufacturing and engineering (CAD/CAM/CAE), expert systems and other artificial intelligence applications, he says.

"Supermini suppliers really will be selling mainframes, but doing the highly interactive transaction-processing functions that IBM mainframe operating systems aren't suited to," Weiss adds. IDC's Hart, however, cautions that before that happens, there will emerge a new generation of IBM systems in the 4- to 8-MIPS range that match or improve on current prices for the company's 4300 systems.

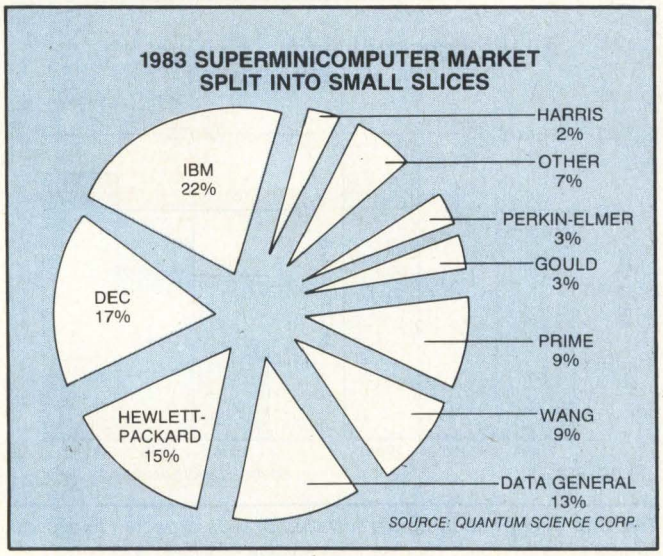
At The Gartner Group research outfit in Greenwich, Conn., analyst William Rosser adds, "In the past, as the lines between hardware categories blurred, there was still specialization by applications; but now functions overlap, too." Functional overlap leads to increased demand for networking capabilities and for software that allows data interchange among different-sized hardware performing similar tasks. "The resource requirements for these integrated systems puts the emphasis on the larger players," Rosser points out.

In the meantime, VAX group product manager David Chanoux says DEC is concentrating much of its competitive energies on IBM, which is becoming a more frequent rival. "With the 4361 and 4381 [introduced in late 1983], we see IBM calling on more and more of our accounts and pitching our kinds of applications. If we are going to respond to any competitor, we'll respond to IBM. From where I sit, IBM is the main competition by virtue of its size, its assets and its general business smartness," Chanoux says. He adds, "Of course, I don't want to turn my back on my neighbors at Data General and Prime, but IBM is my main concern."

Within its own base, Chanoux says, DEC is satisfying some demand for higher processing capabilities with its recently introduced 11/785 machine and the VAXcluster, a high-speed networking system that ties VAXs together. The latter solution alleviates system-access problems caused by connecting large numbers of terminals, but it does not increase computing power, he notes.

Data General prices MIPS aggressively

Schulman estimates that DG, DEC's long-time minicomputer-market rival from Westboro, Mass., has used increased CPU power to broaden its 32-bit supermini-



IBM Corp., *Digital Equipment Corp. and Hewlett-Packard Co. captured more than 50 percent of the superminicomputer market in 1983.*

computer business by 80 percent, for the fiscal year ended in September. Much of that gain—which helped the company expand revenue to a record $745 million in the first three quarters of this year—came from sales of the high-end MV10000, a 2½-MIPS machine priced aggressively at $70,000 per MIPS.

Donald McDougall, vice president and general manager of DG's Technical Products division, says that the addition of a high-end product that performs well above DEC's current VAX maximum of 1.7 MIPS has helped DG increase its presence in the *Fortune* 500 large-account business. "On the technical side, you need the CPU power to run computer-intensive [application] packages such as solids modeling. On the commercial side, we can fulfill the demand to add more and more users. On both sides, we can handle larger databases, an increasingly important requirement," he says.

McDougall says that the prospect of a 3- or 4-MIPS Venus does not threaten his company. "I don't think a 3½ MIPS or even a little faster Venus should panic us," he says. "When we came out with the MV8000 [DG's first 32-bit superminicomputer], we were three years late. With the MV10000 we were ahead. Now with Venus, we'll get back to the historical leap-frog we've played with DEC in product introductions."

However, McDougall is not convinced that DEC can retain its "stranglehold" on the superminicomputer market with Venus. "If it is readily accepted and is a real 'hummer' in the market, then DEC will maintain its position. If not, that image will be shattered. The concept of a DEC-defined market has not been shattered yet, but it has been cracked," he maintains.

Jan-Pieter Scheerder, DG's Technical Product division marketing director, points out that the move into mainframe-size applications is putting additional demands on superminicomputer makers. "The effect is to put a lot of pressure on system-software capabilities. It is not enough just to pump out high-end hardware. Gross profits may be higher on such systems, but the price of software support, customer support and a lengthy sales cycle are higher too," he points out.

In nearby Natick, Mass., Prime is using its longer experience selling into a traditionally mainframe market to propel sales of its new high-end products. Like DG, Prime expanded its superminicomputer line in 1983, adding the ECL-based 9950 at 2½ MIPS. Product marketing manager Steven Haley says that the company has retained its 22 percent share of the superminicomputer market and points out that Prime has competed with IBM for a long time.

"Our original mission was to bring the [Honeywell Inc.] Multics mainframe operating system into the minicomputer market. I think we know how to compete in the mainframe market already," he asserts. As to Venus itself, he says, "at 3 to 5 MIPS and $100,000 per MIPS, we'll be competitive."

Haley also hints broadly that the 9950 may not be the top of Prime's line for long. "The next increment will be at least 4 MIPS. Possibly, we can deliver our high end prior to DEC's delivery schedule—if DEC is planning to ship in the spring, as we expect." For now, Prime is filling in below the 9950 with the 1.7-MIPS 9750, which replaces the earlier 750/850 series and the 9650, a system optimized for COBOL applications.

For the first six months of 1984, Prime has recorded sales of $307 million, a 27 percent gain over last year's figures. At the same time, it improved net earnings by 35 percent, thanks to the more profitable 9950.

Beyond the 9950 and any Venus-class addition, Prime is looking toward an accelerated performance battle in the late 1980s. Recently, a Prime official declared that any superminicomputer competitor that does not have plans for an 8-MIPS machine by 1988 is not "with it."

But IDC's Hart points out that such a route could raise problems for manufacturers. "There seems to be a practical limitation for air-cooled uniprocessor architectures [of] around 8 MIPS, and I don't know if minicomputer manufacturers are ready to take on water cooling," he explains. DEC's Chanoux says, "As a marketer, I'd love to have an 8-MIPS machine to sell, but you do need water cooling—even with the technology we expect from Trilogy." In the near term, he says, DEC will be able to address many anticipated large-system needs by including the Venus in VAXclusters.

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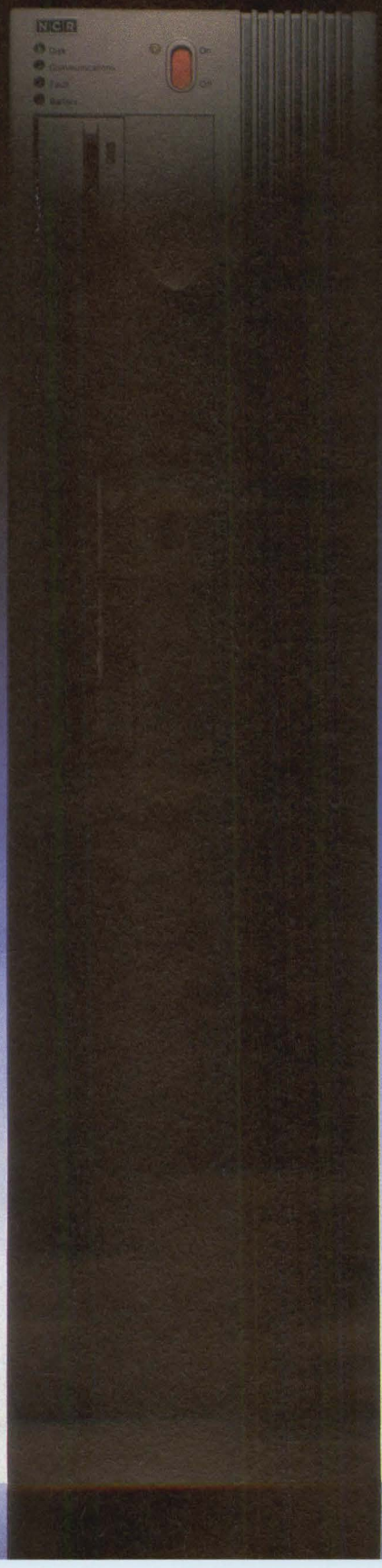

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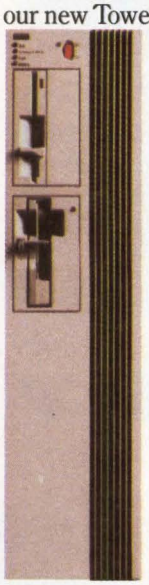

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Unlike DG and Prime, which apparently are waiting for Venus before making any moves beyond 2½ MIPS, both Wang Laboratories Inc., Lowell, Mass., and Harris Corp.'s Computer Systems division of Ft. Lauderdale, Fla., have gone ahead with Venus-class products. The latter is best known as a supplier of products built around an unusual 48-bit architecture and oriented toward the market niche for real-time processing. However, according to product marketing director Rick Maule, the division has diversified into more general-purpose engineering applications including CAD and CAE, from which it derives half its annual revenues. Part of that move has been with the year-old H1000, a 5-MIPS system that starts at a very competitive $250,000.

Maule says that Harris originally planned to introduce the ECL-based H1000 to coincide with DEC's Venus announcement. "We were going to announce in a comparable time frame and try to piggyback the publicity surrounding Venus," Maule recalls. However, in mid-1983 it became apparent that DEC would postpone introducing Venus for a year to reorient the product. "I believe DEC had a 3-MIPS machine in the works last year, having backed off from an original target of 4 to 5 MIPS. But the company realized that 3 MIPS would be too little too late, so they re-specified the design to 4 to 5 MIPS," Maule theorizes. In the meantime, Harris needed a product to counter new Gould models in the real-time processing market and brought out the H1000 last October.

The H1000, Maule says, is helping Harris' program to expand into more general-purpose systems. The company is selling H1000s against VAXs in general engineering, CAD and software-development applications. Harris sells another product, the 1-MIPS H60, as an alternative to the similarly powered VAX 11/780 in departmental applications—but at $60,000 with peripherals. In the near future, Harris will be competing in yet another DEC market with machines running the UNIX operating system, sources close to the division predict.

Wang has announced a high-end VS300 system rated at 3.3 MIPS, with a price starting around $170,000. Wang introduced the system last April, but will not ship units until spring. Company officials say that such an early introduction was necessary because of the system's magnitude. Some observers argue that Wang was anxious to assure major-account customers that it will deliver a high-end superminicomputer comparable to Venus and to the Data General MV10000. The MV10000, with DG's CEO software, has already made inroads into Wang's office-automation turf. By announcing a high-end minicomputer, Wang also quiets critics that portray the company exclusively as an office-automation vendor.

But dangling new products in front of customers' eyes may also work to the advantage of Wang's competitors. Gartner's Rosser points out that DEC might have a better crack at the office-automation market with the introduction of Venus because its added power can more efficiently handle the performance-draining overhead built into DEC's ALL-in-1 office-automation system.

"One of the biggest impacts of Venus," DG's McDougall says, "is that it moves everybody up to the 2½- to 5-MIPS range. That takes away the reason people had to go with smaller players such as Gould and P-E because the majors can provide more languages, software packages and support."

But P-E and Gould have not been sitting still in their high-end niches. Both—along with Harris — traditionally have served the scientific and technical markets, which require intensive number-crunching capabilities for applications such as flight simulation and seismic research. In the past year, both P-E and Gould have made a pronounced effort to broaden their bases—specifically by embracing the UNIX operating system.

For the industry as a whole, bound to follow DEC wherever it leads, Venus represents an extension of boundaries more deeply into traditional mainframe-computer turf.

P-E, Gould meet demand for standards

James K. Sims, vice president and general manager of P-E's Data Systems group, predicts that this year the company will ship 2,000 systems, representing a substantial increase over 1983's 1,200 units. Sims contends this will give P-E the third-largest installed base in the market, behind only DEC and Prime. However, 1984 shipments include a 0.75-MIPS supermicrocomputer based on Motorola Inc.'s MC68000 microprocessor that sells for $24,000, he notes.

"I have never considered DEC a competitor," Sims says. "With Venus, DEC will top out at 3 to 5 MIPS. Our supermini line goes from 3 MIPS to 21 MIPS. We compete with Gould, but [now that they have extended their product lines], I begin to worry about DEC and Data General," he adds.

Sims points out that, as Interdata (prior to its acquisition by P-E), the Data Systems group pioneered the 32-bit minicomputer market. "We have repositioned this company twice before, in the early 1970s with the

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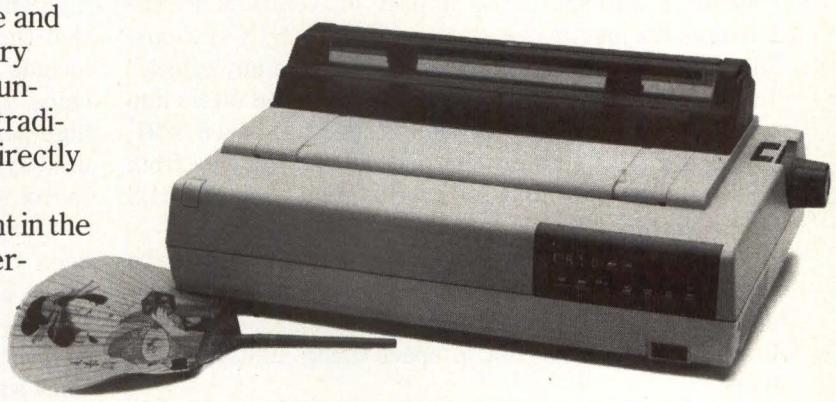

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32-bit system and in the early 1980s by embracing standards," Sims says. P-E's strategy is almost antithetical to that of DEC or DG, which rely more and more on end-user sales of office-automation and engineering systems.

"End-user sales may be a good strategy for them, but we don't want to compete with our customers. Instead, we see a huge demand for 32-bit systems in systems houses that want standard operating systems and communications," Sims explains. He adds that the group intentionally has raised its reseller channel by 10 percentage points to account for 65 percent of current volume.

'We see a huge demand for 32-bit systems in systems houses that want standard operating systems and communications.'

Another company meeting the demand for standards is Gould, which uses the UNIX operating system for its new product line built around Gould superminicomputers and Convergent Technologies workstations and supermicrocomputers. Jerry Rodts, a former Prime and IBM marketing executive who was recently named Gould's vice president of sales and marketing, says, "Where I anticipate the impact of Venus is in the business we just are entering with the UNIX systems. In our real-time market Venus won't have any effect." In the UNIX market, Gould recently topped off its line with a virtual-memory version of its ECL-based 3297, giving it a UNIX family that extends all the way from an Intel Corp. 80186-based workstation to a 10-MIPS superminicomputer.

"DEC has a very loyal customer base, but we have cracked some accounts," Rodts says. "There is heavy demand for more performance, and DEC customers literally are running out of space using multiple VAX [clusters]."

Rodts says that demand for UNIX-based systems may increase sales in that segment by as much as 60 percent annually. He predicts that within three years, UNIX-based systems could account for half of the division's volume—even as the real-time portion continues to grow by as much as 20 percent annually. "I think we are a jump ahead with UNIX, and I see it as something that won't go away. Now everybody is committing to it," he says.

Indeed, even DEC itself is supporting a native-mode version of UNIX. Until recently, DEC supported only its VMS operating system, even though VAXs make up the largest installed base of minicomputers running UNIX. However, Chanoux points out, UNIX may be somewhat irrelevant to the emerging high-end market. "At the low end, we see Ultrix 32 [DEC's superminicomputer UNIX package] shipping on as many as 20 percent of our systems. But on the high end, I don't think it will go out on more than 5 percent," he says.

Enter AT&T

AT&T, DEC's latest challenger in the superminicomputer market, naturally sees things differently. Thomas Arnold, AT&T Technologies Inc.'s computer systems marketing manager, argues that the compelling economics of transportable software—programs able to run unaltered on different computers—will make UNIX popular on machines of all sizes. "The question is no longer how fast a computer is. We view as much more important the question of how much it will cost to maintain software. You always can change the computer to fit your needs," he argues. "UNIX becomes the great leveler of the industry, putting all the difference on the computer itself, because the operating systems will be the same," he explains.

AT&T's initial hardware includes three superminicomputer-class products in the 3B20 series, machines that deliver power as high as 1.7 MIPS. However, Arnold says, use of intelligent input/output processors helps speed throughput to even higher performance levels. As for AT&T's plans for competing in the high-end-superminicomputer market, Arnold says only that the company is exploring several methods. These include advanced bipolar technology (such as ECL chips, which are used in limited numbers on the 3B20s), high-performance 32-bit microprocessors and distributed systems such as DEC's VAXclusters. He declines to say which path is most likely for AT&T.

"Our principle strategy is built around UNIX. It has been visible in the engineering community for a long time, and now we are seeing commercial resellers turning to it," Arnold says. Speaking of the eventual competition with mainframes, he adds, "In the applications-software area, there are an incredible amount [of packages] in the mainframe environment that are not available on minis and superminicomputers. But they are beginning to show up—especially under UNIX, and smaller, cost-conscious customers are beginning to buy these packages." □

Geoff Lewis is a senior editor for *Electronic Business*, in which this article originally appeared.

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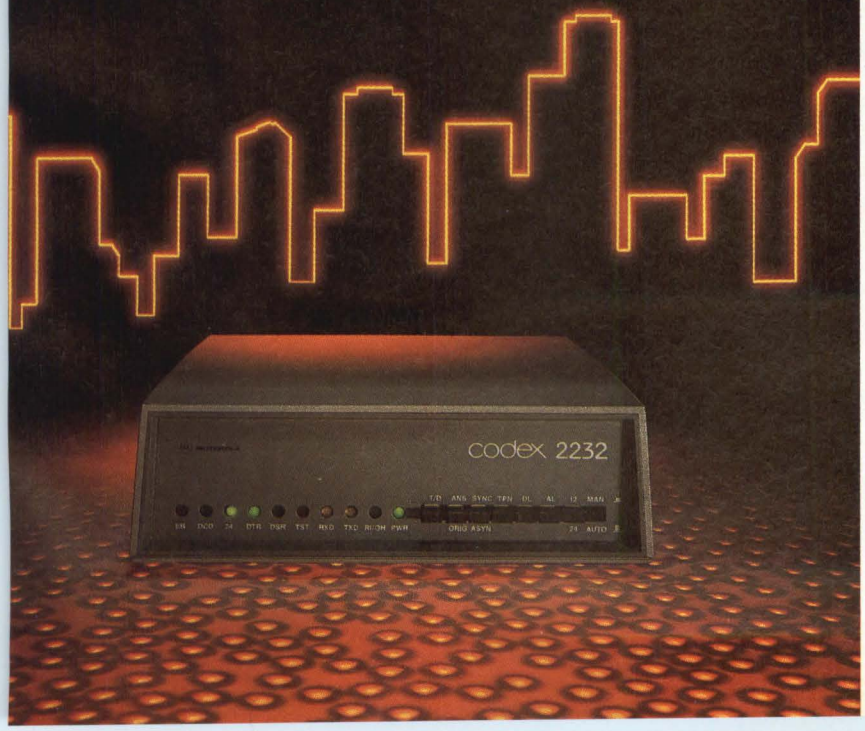

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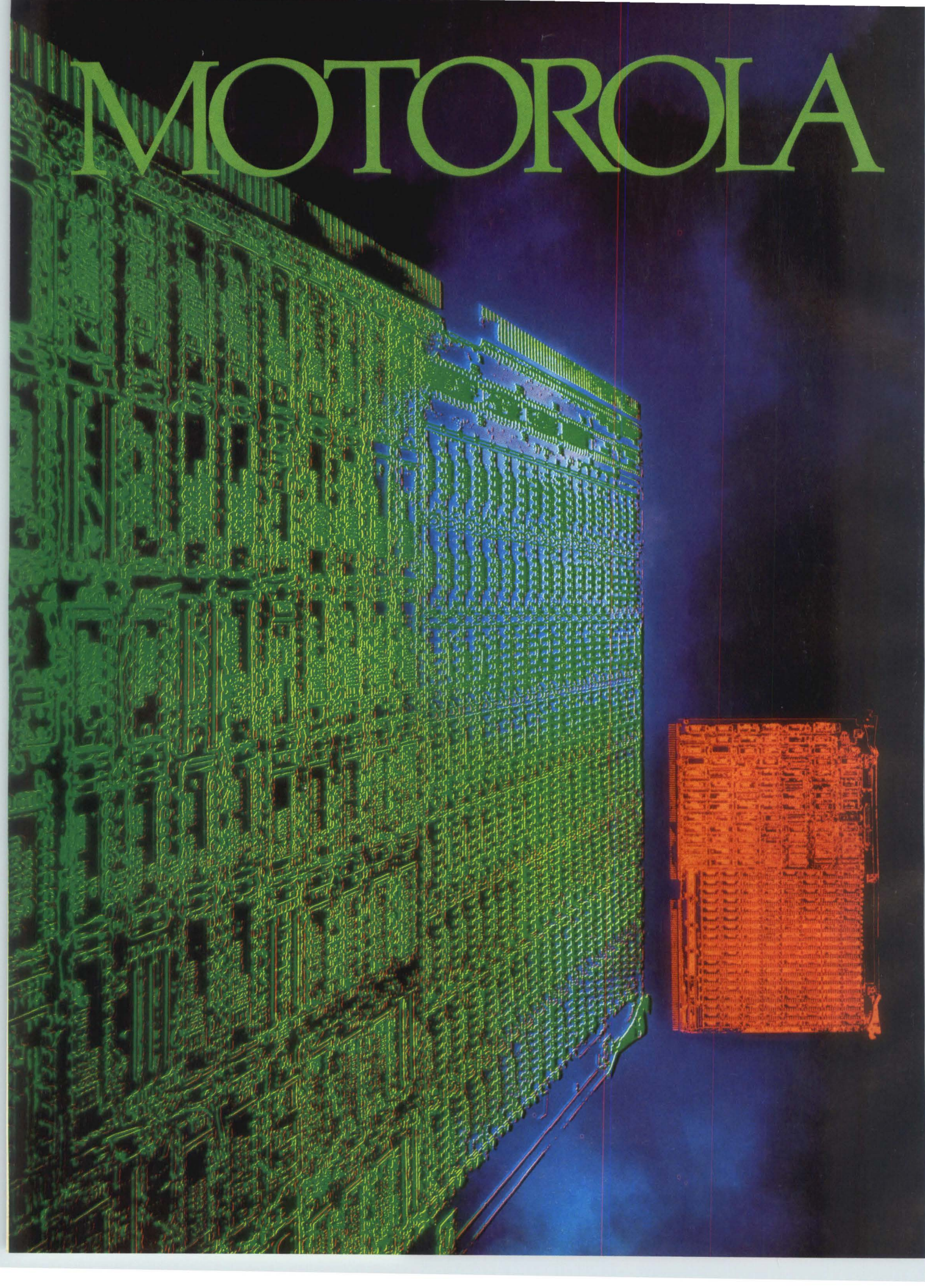
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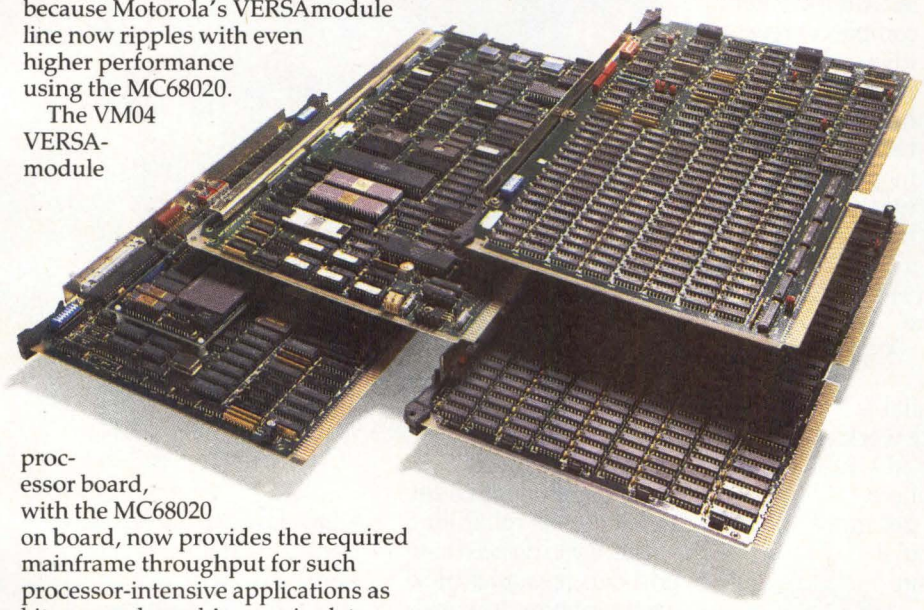

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The new VERSAmodule VM04 processor board can access more than 4 billion bytes of data and manipulate or process 32 individual pieces of information every 180 billionths of a second (180 nanoseconds). Measured in millions of instructions per second (MIPS), the VM04 operates at a sustained rate of 2 to 3 MIPS, with burst rates exceeding eight MIPS, challenging the speed of some mainframe computers.

16K bytes of instruction/data cache on-board help reduce off-board memory accesses to ensure top performance. When off-board access is needed, the VM04 calls on the interface capabilities of Motorola's MC68020-specific RAMbus™ to eliminate most arbitration overhead and speed memory transfers.

The VM04 monoboard is the first MC68020 processor board to offer paged memory management hardware, plus an interface to support the soon available MC68881 floating point math co-processor.

These new modules add to a broad offering of board-level products including processor, memory, controller and communication modules with complete evaluation and development systems.

Broad VERSAmodule line.

Two new high density memory boards have been added to the line to complement the MC68020-based monoboard.

The VM12 includes 1 or 4 Mbytes of RAM and supports the full 32-bit address width of the M68000 Family.

The VM13 dynamic RAM module provides 1 or 4 Mbytes of random access memory dual ported to both RAMbus™ and VERSAbus.™ A perfect system mate for the VM04 32-bit monoboard, the VM13 has error detection and diagnostic capability.

For system applications requiring high-capacity rotating mass storage, the VM22 disk controller supports four SMD drives and four SA 400/800 floppy disk drives. Data transfer speeds up to 3 Mbytes/sec are maintained by the direct memory access feature of the disk controller.

A choice of real-time and whose-time-has-come operating systems.

The VERSAmodule Family is supported by both of Motorola's M68000 operating systems: the VERSAdos™ operating system for real-time applications, and the SYSTEM V/68™ operating system where a UNIX™ operating system environment is desired.

Full operating system support, including VERSAdos real-time device drivers, is available today for MC68000- and MC68010-based VERSAmodule monoboards. Porting is under way to assure their early availability on the VM04 monoboard.

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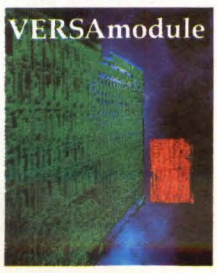

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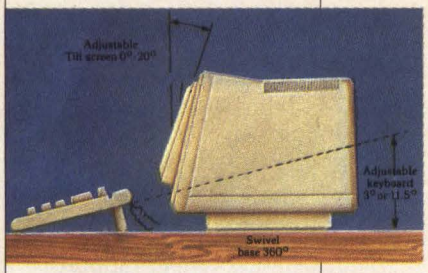

with less effort. In less space. For less money. And with more confidence, having HP's reliability and quality to count on.

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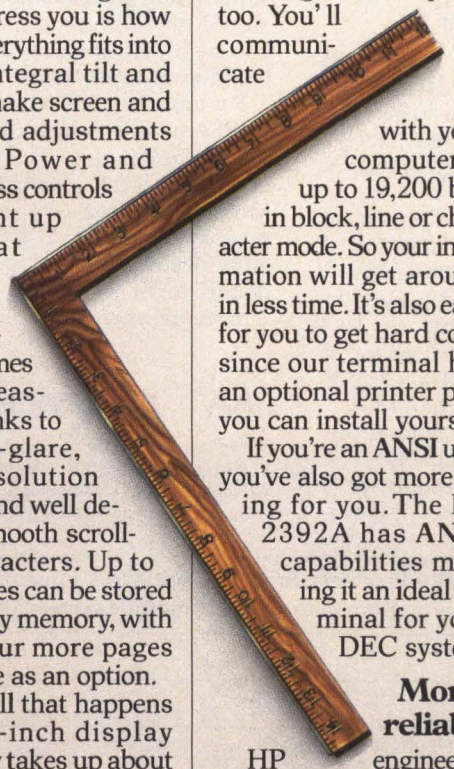

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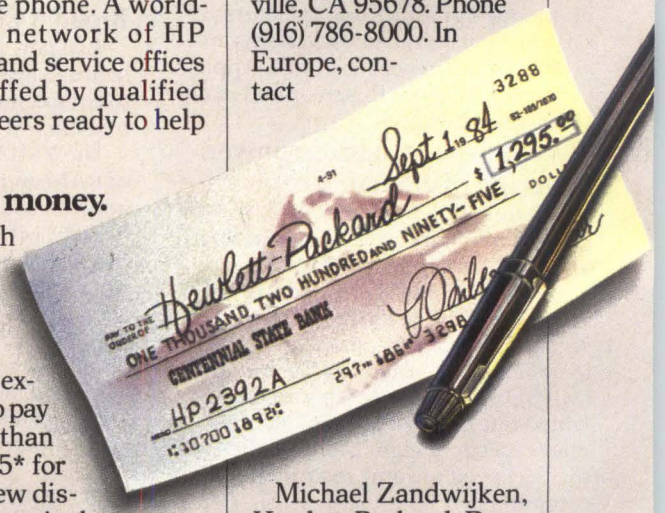

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CIRCLE NO. 68 ON INQUIRY CARD

Publishing system streamlines document production

Microprocessor-based publishing system integrates a workstation, a laser printer and special software for high-quality on-site production

Mike Iannamico, Sun Microsystems Inc.

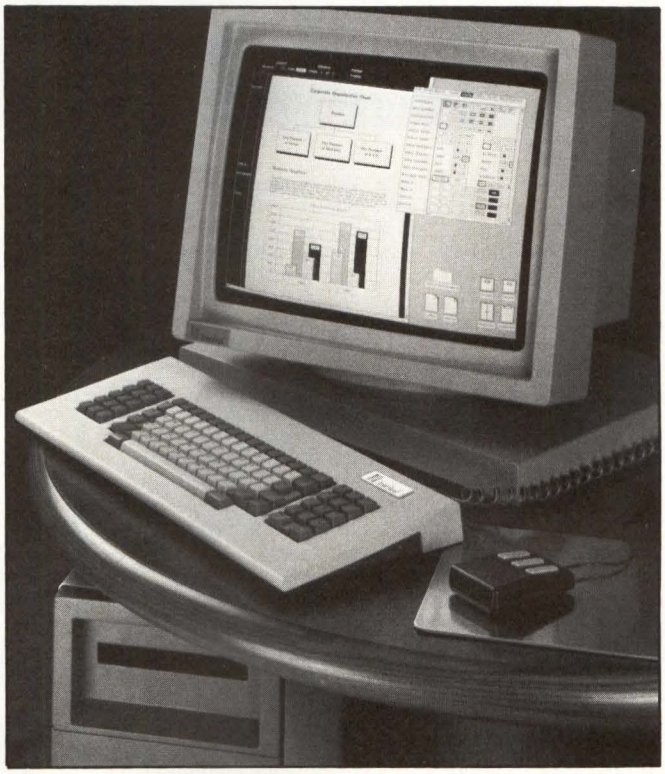
The use of computers for text processing began with crude line editors designed to aid programmers writing code. But it didn't take long for office workers to take note of—and to demand—the word-processing capabilities of these early line editors. These systems have now evolved, however, to the point where almost any office worker can use a word-processing system to write, edit and print a document for informal in-house distribution.

But typeset-quality documents intended for the public, such as financial publications, quarterly reports and technical manuals, must incorporate illustrations, diagrams and other artwork; therefore, most companies must hire typesetters and graphics artists to produce anything to be externally distributed. But, by allowing the creation and printing of typeset-quality documents with graphics, the OPS-2000 computer-aided publishing system from Interleaf Inc., Cambridge, Mass., extends the scope of traditional word processing by performing many of these costly and time-consuming steps.

The OPS-2000 combines the microprocessor-based UNIX SunStation workstation from Sun Microsystems Inc., Mountain View, Calif., Interleaf's text-processing software and the 8/300 laser printer from Imagen Corp., Santa Clara, Calif., to produce documents with multiple type fonts and integrated graphics. The OPS-2000 and the 8/300 take up only as much space as a personal computer and a desktop photocopier, respectively.

The 32-bit MC68010-based SunStation provides 16M bytes of virtual-memory addressing, a high-resolution, 19-inch monochrome monitor and bit-mapped graphics. It can be used in a high-speed local area network, enabling communications with other computers and peripherals.

The Imagen 8/300 laser printer uses an image-processing system with the LPB-CX print engine from Canon USA Inc., Lake Success, N.Y. The LPB-CX provides 300-dot-per-inch resolution and 8-page-per-minute (ppm) output, in contrast to the 1-ppm rate of most daisy-wheel printers. In addition, it accommodates non-standard-sized paper, such as envelopes and business cards. The LPB-CX uses dry toner, encapsulated in a disposable cartridge, instead of often-messy liquid toner. The printer uses Imagen's Impress page-layout and -description language to define typesetting fonts and graphics. Imagen's software also supports several communications protocols, including Ethernet.



The Interleaf OPS-2000 computer-aided publishing system *integrates advanced multiple-font word processing, business graphics diagramming and laser printing. The system uses Sun Microsystems' 32-bit SunStation, Interleaf's software and Imagen's laser printer. The user interface, which includes a mouse and a "what-you-see-is-what-you-get" display on a bit-mapped screen, makes it easy for those unfamiliar with computers to learn and use the system.*

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CIRCLE NO. 69 ON INQUIRY CARD

Mouse and icons ease system use

The OPS-2000 makes extensive use of menus and icons, so illustrations, diagrams and charts appear on the screen as close as possible to how they will appear in print. Users employ a mouse pointing device to select from menus and icons and to manipulate, extract and merge text and graphics. The "what-you-see-is-what-you-get" approach makes it easy for users with little knowledge of computers to learn and become productive on the system. A multiwindowing feature allows users to view different pages of the same document or pages of different documents simultaneously; using the mouse, users can "cut-and-paste" text within the windows.

The OPS-2000's software features a desktop-management system that transforms the UNIX file and directory hierarchy into a collection of familiar symbols, or icons. Each user is assigned an account, or "desktop," in which to keep personal files and directories. Each document file is represented by an icon of a "manuscript," stored in a directory depicted by a "file folder," which is in turn stored in a "file cabinet." A "clipboard" denotes a directory for temporary files created as a preventive measure against mistaken deletions or system failures. To create, copy, move and delete files, or to assign codes that limit read and write access, the user merely points with the mouse to select these options from the appropriate menu.

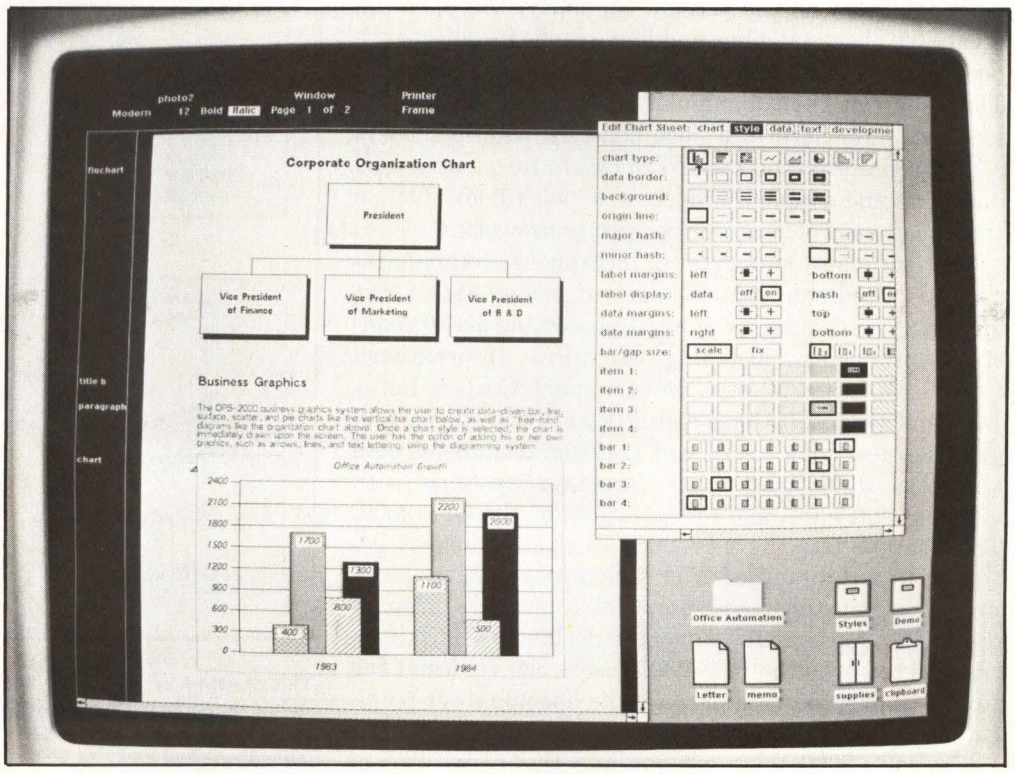
Illustrations, diagrams and charts appear on the screen just as they will appear in print.

In addition to letting users enter text with a keyboard, the OPS-2000 supports standard text-editing features, and also allows the selection of point size, spacing and style of type fonts. The type fonts produce 6- to 24-point classic or modern; 8- to 24-point bold or italic; and Greek, mathematics and logic symbols. The typewritten fixed-width options are limited to 8-, 10- or 12-point sizes. All of these fonts come standard.

Users of the OPS-2000 can employ its structured document-editing feature to specify a documents layout and the chosen character fonts. Each portion of a document, such as its headline, section headings, subheadings and paragraphs has its own "field." Users can specifically define each field before entering any text, and can alter these attributes at any time.

Create illustrations on-screen

Besides processing text, the software allows users to create diagrams, graphs and freehand illustrations and



By integrating multiple-font text with business charts and diagrams on one page, *the Interleaf OPS-2000 replaces the manual cut-and-paste process. The screen shows text, business graphics and line art (center). A user selects from a menu (top right) to select the design charts and from various fields that make up the document (left). The desktop-management system uses icons (lower right) to create and manipulate files.*

Examining the OPS-2000's hardware

Interleaf Inc.'s OPS-2000 computer-aided publishing system combines the MC68010-based SunStation microcomputer from Sun Microsystems Inc. and the 8/300 laser printer from Imagen Corp.

A Sun Microsystems memory-management unit (MMU) works with the virtual-memory capabilities of the 10-MHz MC68010 to provide memory allocation, address translation and data protection for as many as eight simultaneously active processes. The MMU also allows high-speed peripheral devices such as disk and tape drives to access virtual memory directly.

The SunStation's 19-inch monochrome monitor displays more than a million pixels in a 900-by-1,152 matrix. The non-interlaced, bit-mapped display is refreshed at 70 Hz and has exclusive access to 128K bytes of dual-ported, frame-buffer memory. One port performs video-refresh operations, and the other updates the frame buffer. A customized very-large-scale-integration RasterOP chip provides hardware assistance for placing arbitrary bit patterns on the screen and performing complex manipulations of raster patterns.

The SunStation uses the Berkeley 4.2 version of the UNIX operating system, which includes more than 200 support utilities for preparing documents, writing programs and maintaining the system.

The other part of the OPS-2000, the 8/300 laser printer, uses Imagen's proprietary software to convert data transmitted from a host computer into page images. Canon USA Inc.'s LPB-CX print engine then converts the data into printed output.

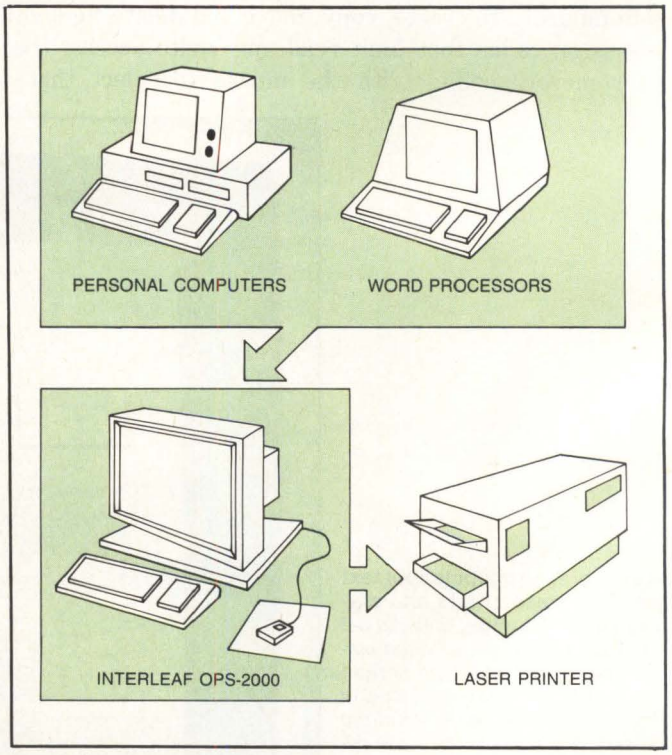
To print an image with the LPB-CX, a semiconductor-diode laser beam passes repeatedly across the surface of a rotating cylindrical drum, leaving an electrostatically charged image that is then coated with a toner and transferred to paper. To scan the drum efficiently, the laser is reflected from a polygonal mirror that, when rotated at high speeds, distributes the beam across the surface of the drum, which has been charged with an electric current. The laser beam is modulated as it scans back and forth, causing a dot-matrix image to be etched onto the drum. The charged areas of the drum not exposed by the laser attract the toner, which is then deposited on the paper to produce the printed page.

Imagen's Multibus-based image-processing hardware incorporates a 32-bit MC68000 microprocessor with 512K bytes of RAM, expandable to 1.5M bytes. The image processor translates data from a host computer into images and generally controls the functions of the print engine. It can accept serial data through an RS232C interface or parallel data through a Centronics interface.

to place them anywhere in a document. To create a diagram, a user selects a series of graphics components, such as lines and circles, from a menu and positions them on the screen. Similarly, the user can create pie charts and bar and line graphs by selecting a presentation style and entering the appropriate data. The user can then manipulate, size and position the graphics anywhere in a document. In addition, users can store information needed to create frequently used diagrams and graphics objects in a "wish book" file, so they need not re-create or re-specify artwork.

The software supports asynchronous communications and document conversions that accept ASCII text and data from a number of word-processing and spreadsheet programs, including MicroPro International Corp.'s WordStar, Lotus Development Corp.'s Lotus 1-2-3 and Microsoft Corp.'s MultiPlan. With editing and graphics features, users can transfer documents and statistical data from other computer systems with different software, and format them for the OPS-2000. This feature lets the OPS-2000 work as a shared resource in an organization in which inexpensive word-processing systems and personal computers prepare documents for transfer. Once the documents have been transferred onto the OPS-2000, users can reformat the text, add graphics and prepare the document for publication.

The OPS-2000 does not provide the versatility of



This drawing, created using the OPS-2000, *shows how it works with word processors and personal computers. Users can transfer ASCII files composed on other systems to the OPS-2000, which interprets most popular word-processing and spreadsheet programs.*

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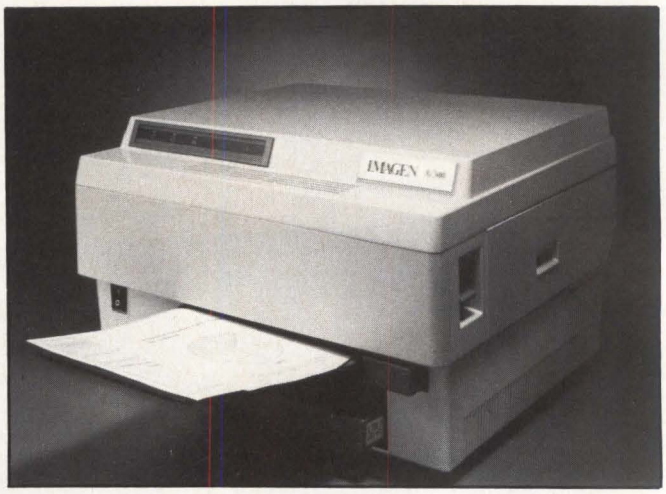
The Integrator



The OPS-2000 uses Imagen's 8/300 laser printer, *which produces 8 pages per minute with a resolution of 300 dots per inch. The printer uses a dry toner encapsulated in a disposable cartridge.*

typesetters and graphics artists, but it can prove more cost-effective in the long run than paying for these services. The OPS-2000, including a SunStation and all standard software, sells for $37,500, and the Imagen 8/300 sells for $14,500. For a total of $52,000, the system can yield significant savings to organizations that need large quantities of high-quality documents for public distribution. □

Mike Iannamico is a technical writer for Sun Microsystems Inc., Mountain View, Calif.

Interest Quotient (Circle One)
High 837 Medium 838 Low 839

LOOKING AHEAD IN MMS

Mini-Micro System's December issue is our third annual overview of those leading edge technologies impacting our value-added market readership. A long-lasting sourcebook for technology and market data, the report presents past, present and future perspectives on key areas including:

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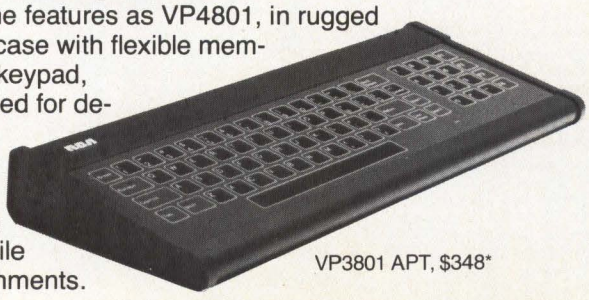

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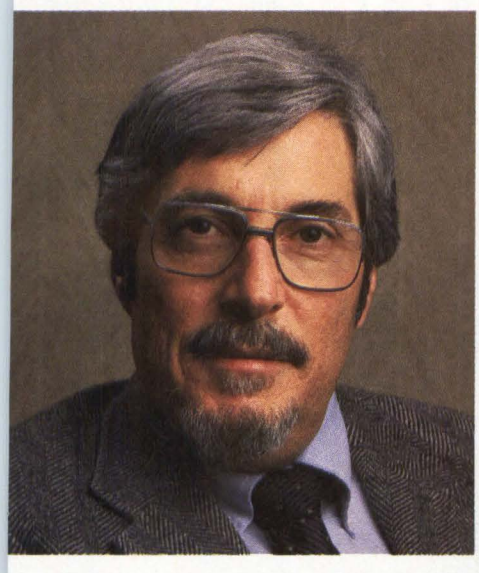

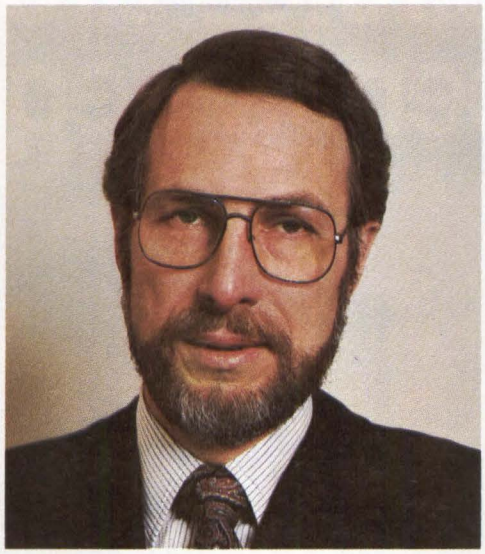

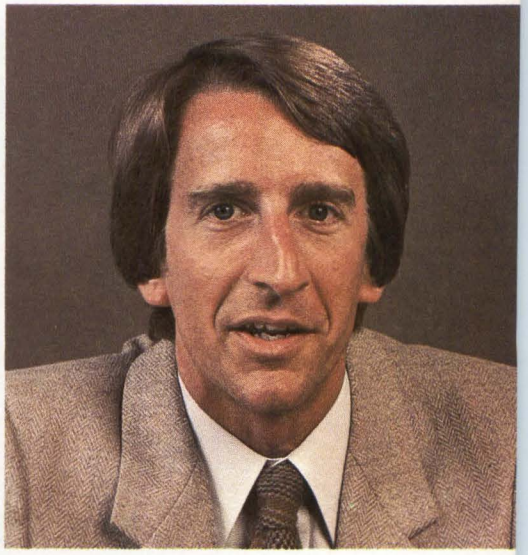

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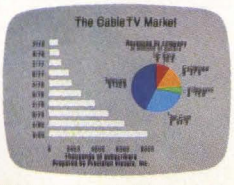
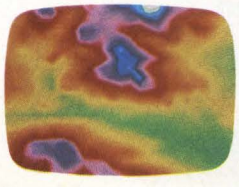
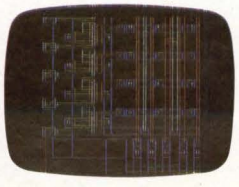


Enhanced Contouring

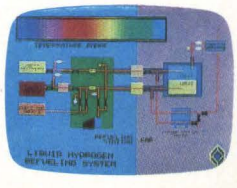


VLSI Design



Solids Modeling

Process Control



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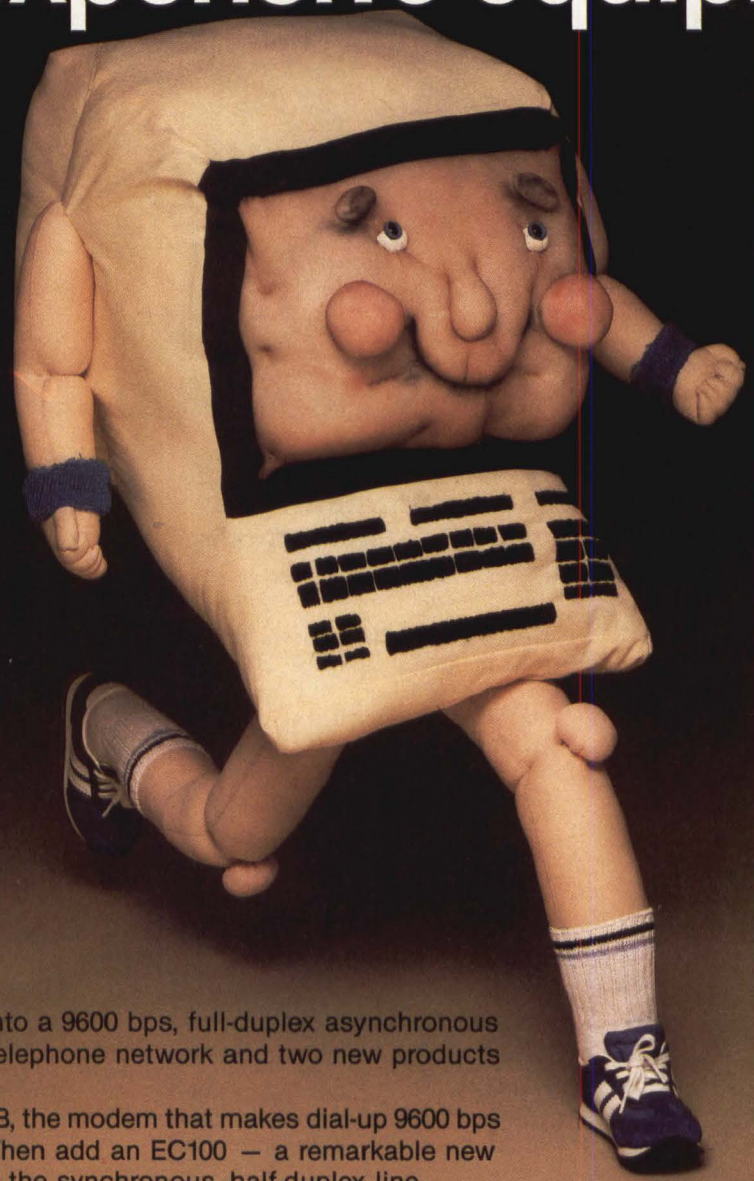
843

CIRCLE NO. 74 ON INQUIRY CARD

Make your dumb terminal run circles around more expensive equipment



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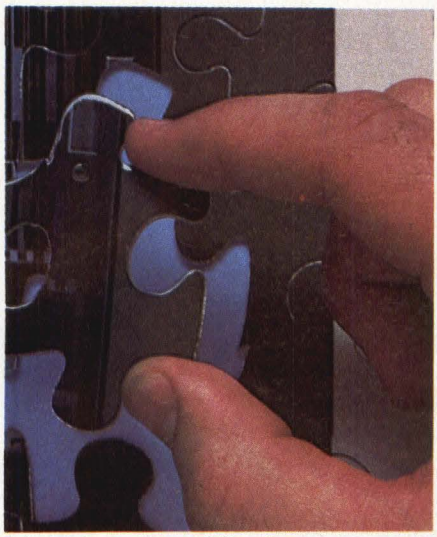
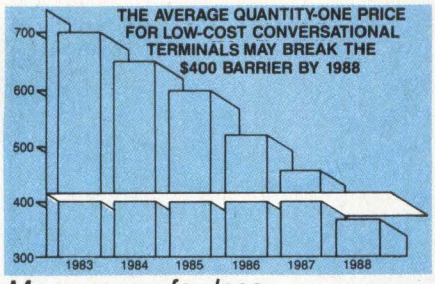
Created by Dayner/Hall, Inc., Winter Park, FL

FEATURE HIGHLIGHTS



Multithread architecture

SYSTEMS: Until now, fault-tolerant minicomputers have been considered an expensive luxury, what with costly hardware duplication and large amounts of unused processing power. However, with tightly coupled multimicroprocessor architecture, multiple buses and a fault-resistant design, Arete Systems Corp.'s Arete 1200 enables OEMs to develop a cost-effective customized product. See **p. 151** for details.

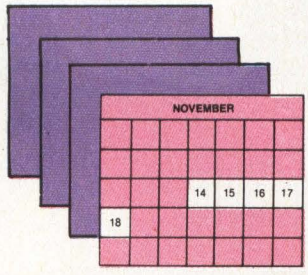


More power for less

TERMINALS: OEMs and system integrators looking for powerful terminals at low prices may find their answer in **alphanumeric terminals.** For a market analysis and a directory of manufacturers, see **p. 165.**

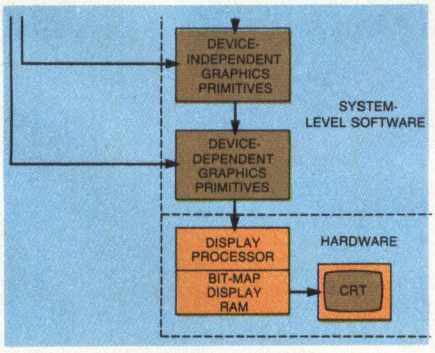
New micro-to-mainframe communications and **terminal emulation hardware and software** products make mainframe databases accessible to microcomputers. A look at what's available and a manufacturers listing begins on **p. 183.**

Increased file-transfer speed and a reduction of the computer-room cable maze are just two advantages of the CS/1-X.25 **communications processor.** See **p. 199.**



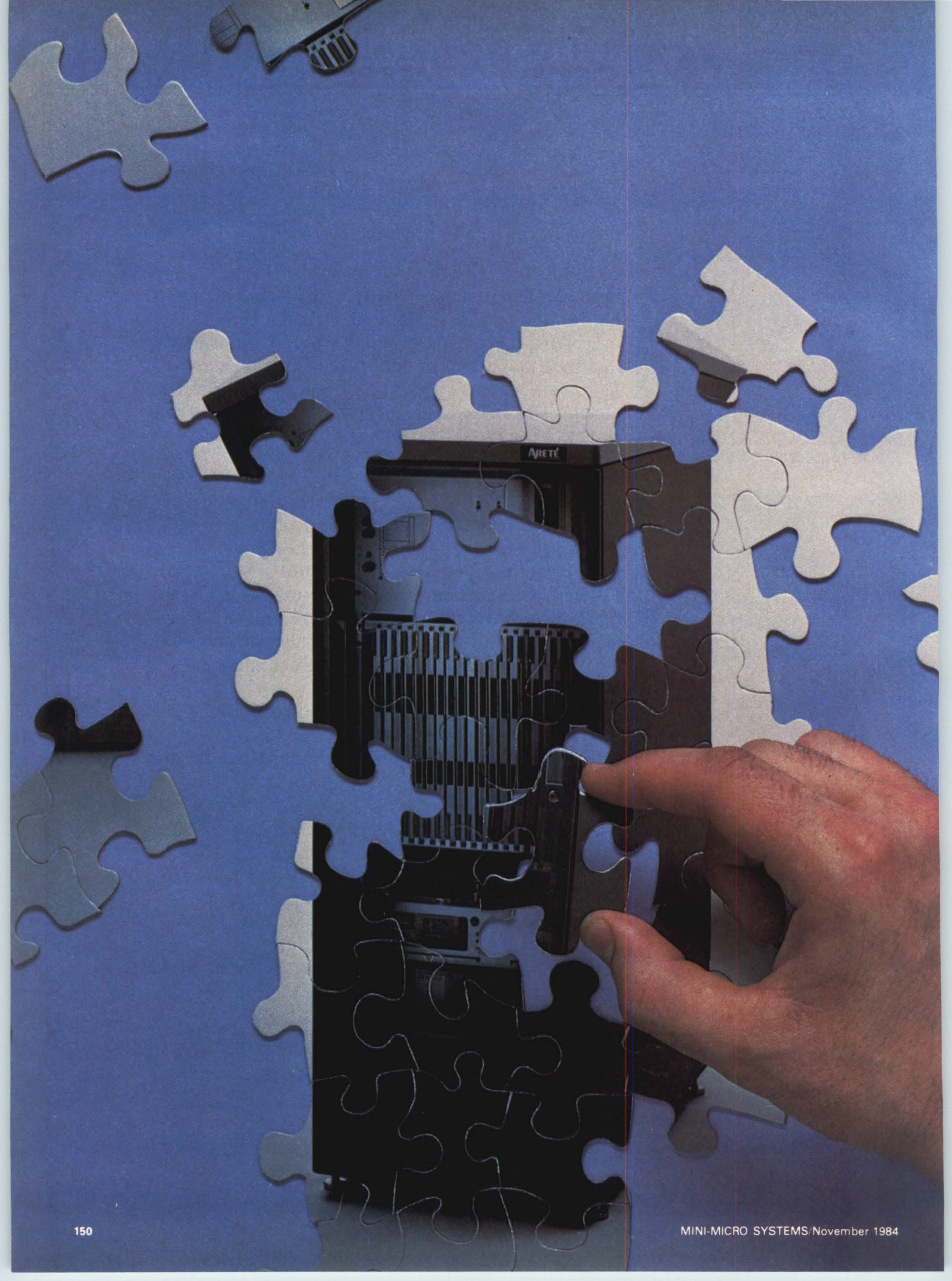
Multifaceted Las Vegas preview

COMDEX/FALL '84: A crowd of more than 83,000 is expected to convene November 14-18 in Las Vegas for COMDEX/Fall '84, a conference featuring 1,400 exhibitors, including manufacturers of small computer systems, software and accessories. The show will focus on multifunction products such as multiuser computer systems and multiapplication software packages. For more show information, see **p. 209.**



Workstation boasts powerful mix

PRODUCTION EVALUATION: Starting on **p. 219,** MMS presents an evaluation of a color graphics workstation from Convergent Technologies that features a powerful processor, a sophisticated operating system and an ergonomic design.


ARETÉ

Fitting the pieces into a super-minicomputer

Multi-microprocessor-based computer combines tightly-coupled multithread architecture, multiple buses and semi-custom design into a system to serve high-speed information-management applications

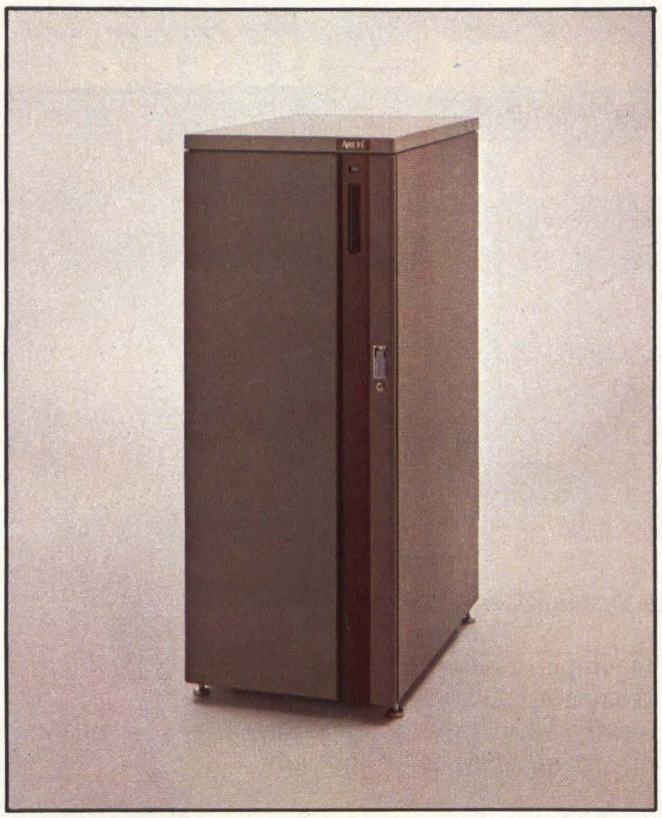
John R. Vrolyk, Arete Systems Corp.

Fault-tolerant minicomputers designed for on-line transaction-processing applications can be expensive, requiring costly hardware duplication, although most of their processing power normally remains unused.

Arete Systems Corp's Arete 1200, in contrast, takes a different approach. It relies on tightly coupled multi-microprocessor architecture, multiple buses and fault-resistant design to provide cost-effective high-speed computing for a range of on-line information-management needs as well as traditional transaction-processing functions. OEMs can use the open architecture program to fine tune the Arete 1200 system to their application with semicustom or custom boards that afford easy entry into the computer's proprietary bus architecture.

Implements tightly coupled architecture

The Arete 1200 implements a tightly coupled multithread architecture that supports the UNIX System V operating system. With single-thread architecture, one CPU runs all user programs. Often, the CPU also performs all I/O processing, producing an architectural bottleneck that limits performance to the CPU's speed. In contrast, multithread architectures, such as the Arete 1200's, allow user programs to execute in any of four CPUs, thereby avoiding the design bottleneck of single-thread systems.



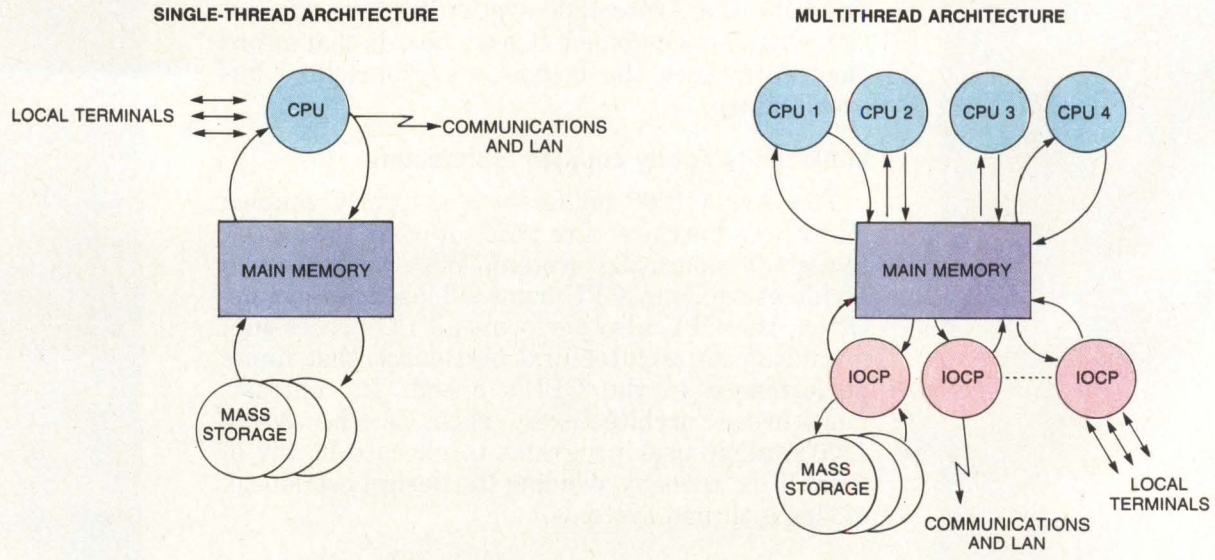
Multiple, 32-bit, tightly coupled *microprocessors and a 33.3M-byte-per-second data-transfer bus help the Arete 1200 system achieve 2½-million-instruction-per-second performance.*

There are two basic types of multithread computer systems: loosely and tightly coupled. An analogy to customers at a bank clarifies the differences between the two systems. Figuratively, in a loosely coupled bank (system), there is a line of customers (processing tasks) queued up in front of each teller (CPU). Because large differences exist in the time required for the tellers (CPUs) to complete different transactions, a wide disparity occurs in the time required to serve the separate queues.

In a tightly coupled system, such as the Arete 1200's, one large queue of tasks waits for processing. As tasks reach the head of the queue, they are handled by the next available CPU. Thus, with all CPUs operating at full capacity, each task meets with a nearly equal delay in receiving service regardless of the processor to which it is assigned. A tightly coupled architecture thus provides dynamic load leveling without operator or systems-software intervention, significantly increasing the computer system's ability to respond to changing system processing loads.

A traditional problem with tightly coupled computer architecture centers on the processing demands imposed on main-memory bandwidth. Because several CPUs can access main memory at the same time, it is busy much of the time, and one or more of the CPUs has to wait for memory access. The Arete 1200, however, eliminates this problem by using 4K-byte cache memo-

AVOIDING BOTTLENECKS: SINGLE-THREAD AND MULTITHREAD ARCHITECTURE



Computer systems with multithread architecture *avoid the processing bottlenecks of single-thread designs in which one central CPU runs all end-user programs. I/O control processors (IOCPs) in the multithread architecture offload I/O handling tasks from the main CPUs.*

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What's more, Mostek is launching some exciting new STD BUS products, like our MDX-ISIO intelligent serial I/O controller, with software programmable baud rates up to 1M baud. And our intelligent MDX-I488 module, which simplifies the implementation of IEEE 488 General Purpose Interface Bus standards at data rates up to 300K bytes/second. Then there's our MDX-ZRAM, a BYTEWYDE™ memory card with up to 16K bytes of our ZEROPOWER™ nonvolatile RAMs on board.

Part #	Designator	Description	Price	% Savings
MK77857	MDX-CPU3	Z80 CPU with 64K DRAM, 1-serial & 1-parallel port	$300	30%
MK77761	MDX-DRAM32A	32K dynamic RAM	$223	19%
MK77764	MDX-RAM64	64K dynamic RAM	$300	26%
MK77765	MDX-RAM128	128 dynamic RAM	$375	34%
MK77763	MDX-UMC2	Universal memory card	$150	22%
MK77677	MDX-FLP2	Floppy disk controller	$282	6%

Check the table for the savings on selected products, then contact your nearest Mostek sales office for more information on this special offer, or for details of the new Mostek STD BUS products.

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ries on all of the CPUs. This setup permits the CPUs to get 92.5 percent to 96.3 percent of their memory accesses through the cache memories, requiring them to access main memory directly only 3.7 percent to 7.5 percent of the time. As a result, the four CPUs cumulatively load main memory directly only 14.8 percent to 30 percent of the time.

Multiple buses improve performance

The multithread architecture allows the multiple CPUs to generate several I/O requests per second, far more than a typical single-thread system. To optimize system performance in high-speed information-management operations, the computer uses four separate buses, each of which performs different functions.

The first bus, the processor memory bus (PMB), provides a 16M-byte-per-second channel between system main memory, the direct memory access (DMA) channels and the four CPUs. The PMB can transfer 32 bits of data on each cycle and supports 26-bit addressing, permitting a 64M-byte physical address space. Note that the PMB carries no I/O data; its sole function is to provide the CPUs' access to main memory.

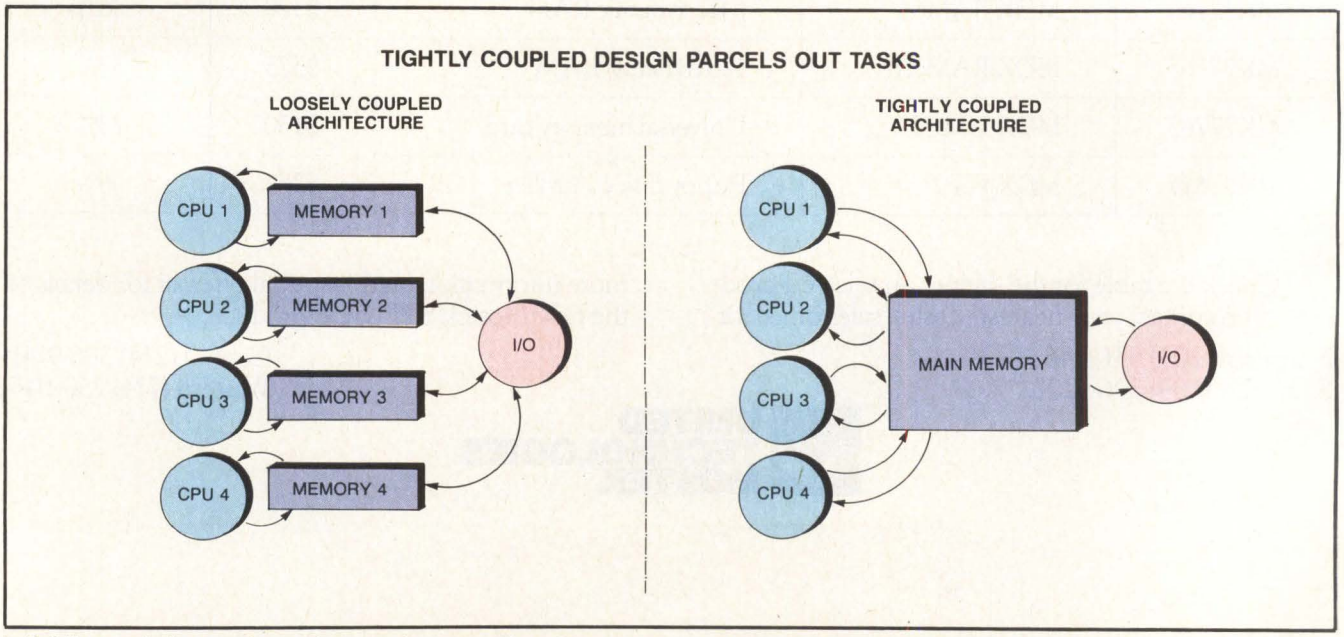
Data transfers between the I/O control processors (IOCPs), or between an IOCP and main memory, are handled by the 32-bit-wide data transfer bus (DTB). It can speed data at 33.3M bytes per second, faster than the Multibus's 10M bytes per second or the VMEbus, which has a usable bandwidth of 10M to 15M bytes per second, although it affords burst rates of 40M bytes per second. The DTB allows IOCPs to send data directly to each other without using main memory or the PMB, thus conserving valuable main-memory bandwidth.

This feature permits the Arete 1200 to handle as many as 88 on-line users while also functioning as a local area network (LAN) file server. Transfers from the disk IOCP to the LAN IOCP are handled by the DTB without impacting the main CPUs or main memory.

The interprocessor communications bus (ICB) handles data transfer synchronization and control within the system and provides the master CPU with a number of functions. For example, it allows the base address of memory boards to be set dynamically, and any board in the system to be withdrawn from active use (and diagnostics run on it). The master CPU also uses the ICB to inform the various IOCPs of pending I/O transfers. Because the system uses the ICB for control, synchronization, and communication functions, the bus conserves valuable CPU cycles as well as main-memory bandwidth.

The fourth bus in the system, the utility transfer bus (UTB), furnishes environmental status and control information to the master CPU from the power-control and supply subsystem. In this respect, the Arete 1200 comes with an external uninterruptible power supply (UPS) that keeps main memory and the disk and tape drives functioning whenever power fails or a "brownout" occurs.

Providing complete on-line diagnostics, the power subsystem can change system logic voltages under diagnostic-software control. This capability allows the computer system to test itself under marginal operating conditions before it is forced to run programs under those conditions.



In tightly coupled computer systems, *tasks queued in main memory are distributed to the next available CPU, avoiding the risk of slowdowns in loosely coupled architecture caused by disparities in the time required for processing each task.*

VMEbus

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There's no better way to combine truly high performance with a compact board structure than to base your 16-bit design on the VMEbus system.

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What's more, Mostek is launching some exciting new VMEbus products, like the 1MB DRAM—the second generation of VMEbus-compatible DRAM boards. And our new, 10 MHz high-performance Matrix 68K™ family of VMEbus microcomputer systems.

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MK75601	VME-SBC	MK68000 microprocessor (8 MHz), RS-232 serial I/O channel with 8 pre-configured BYTEWYDE™ memory sockets	$1012	20%
MK75602	VME-MMCPU	Memory management CPU; MK68000 processor with MK68451 memory management unit	$1700	20%
MK75701	VME-DRAM	256K dynamic RAM card; automatic refresh	$1120	20%
MK75802	VME-SASI™	Hard disk controller interface; DMA can transfer up to 64K data blocks	$ 805	20%
MK75803	VME-FDC	Floppy disk controller; word DMA or programmed byte transfer over VMEbus	$ 820	20%
MK75605	VME-SYSCON	System controller card VMEbus slot 1 slave; control and check features and real-time clock (with battery backup)	$ 921	6%

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High I/O bandwidth speeds data

The key specification of an on-line information-management system is the speed at which it moves data through its I/O subsystem. In addition to the 33.3M-byte-per-second DTB, the Arete 1200's IOCPs also maximize data flow. Each intelligent device includes a 10-MHz 68000 processor, RAM memory dual ported onto the DTB, and peripheral device control logic.

The computer system distributes its I/O processing load across all the IOCPs. This distribution has two important effects. First, it frees the main CPUs from real-time I/O processing tasks, a significant advantage with an operating system such as UNIX, and helps preserve CPU cycles and main-memory bandwidth. Second, because each IOCP is intelligent, it can perform I/O transfers without the aid of the main CPU and operating system—an important benefit when dealing with real-time high-speed data communications over synchronous communications links and LANs.

Reduces the cost of data protection

Because on-line information-management systems are critical to the success of the businesses that they monitor and control, computer systems must address the possibility of system failure. Avoiding the costly redundant electronics and software overhead associated with fault-tolerant systems, the Arete 1200 system takes, instead, a fault-resistant approach. In furnishing a large measure of protection at a fraction of the cost of fully redundant systems, it follows the 80-20 rule: provide 80 percent of the function and performance of the system at 20 percent of the original equipment's cost. Consequently, those sections of the computer that are prone to failure or are critical to the recovery of data in failure situations, have been reinforced, based on a careful analysis of expected computer system failures in the field.

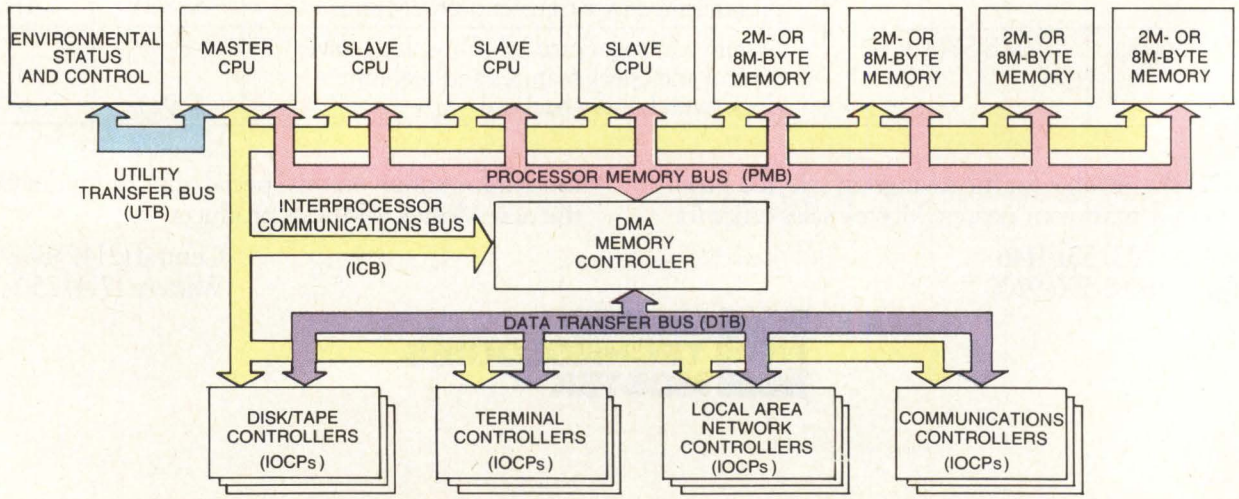
In this regard, the parts of a computer system most likely to fail are the power supply, the disk drives, the tape drives and the fans, in that order. It is important to note that, aside from power problems, all these failures involve moving parts. To address these problems, the Arete 1200 provides a UPS, an optional transparently mirrored disk system and redundant fans. Because a tape failure does not bring the system down, tape drives have not been made redundant.

Although few problems in computer systems occur frequently enough to warrant complete hardware redundancy, a computer's main memory must be protected. To insure reliability of the 64K- and 256K-bit dynamic RAMS, all of the main-system memory locations are protected by error detection and correction (EDAC) circuitry. Because the EDAC circuitry resides on the DMA memory control board, it does not have to be duplicated as main memory capacity is increased, which reduces the cost of memory expansion.

Semi-custom boards fine-tune the system

The performance requirements of the on-line information-management computer marketplace mandate the use of proprietary buses. Without the PMB, DTB and ICB each handling their dedicated functions, the Arete 1200 could not have reached its price/performance goals. Standard buses, however, such as the VME or Multibus, have obvious advantages. Plug-compatible boards for these and other standard buses

MULTIPLE ARETE 1200 BUSES IMPLEMENT HIGH-SPEED ON-LINE DATA PROCESSING



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Whether you're designing for the 8-bit or 16-bit world, Mostek has a system solution to get you there faster.

And if you act fast, you can take advantage of some substantial discounts on selected STD BUS and VMEbus products. You'll still get the high quality and reliability you've come to expect from Mostek products, but at a savings of up to 34% from our regular prices.

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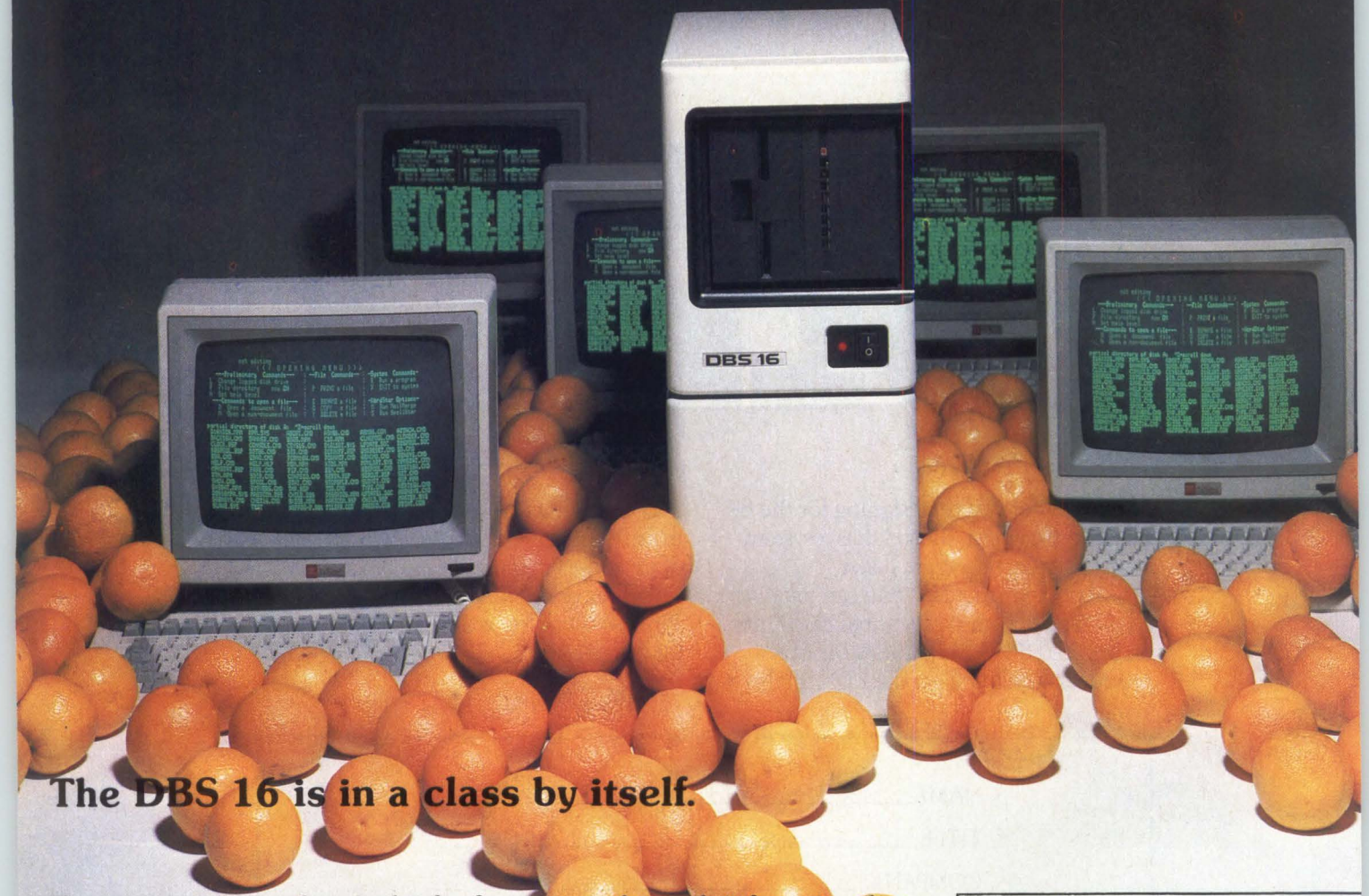
THERE'S NO COMPARISON.



The DBS 16 is in a class by itself.

The minicomputers that rival it for features can't touch it for price. In fact, the DBS 16 with two or more terminals even costs less than the same number of personal microcomputers.

But personal computers – no matter how they're strung together – can't offer the features and performance of the DBS 16. Designed for business from the bottom line up, the DBS 16's networking capabilities are built in from the beginning. Sixteen bit processors and exceptional data-transfer techniques offer speed and power. So the system expands – from one to 28 terminals – with ease. Inexpensively.

Your customers become clients, returning time and again as their computing needs expand.

As time goes by, they – and you – will be glad they bought DBS 16's expandability. Other multi-user micros offer fewer bits, fewer bytes, less storage, and proprietary buses that limit their usage.

And they still cost more.
Face it. There isn't any (fair) comparison to the DBS 16.

ESPRIT DBS 16 SPECIFICATIONS

- 1– 28 users via terminals
- 1–7 80186 16 bit microprocessors (8 MHz)
- Up to 3.58MB RAM (up to 512KB per 80186)
- From 720KB to 105MB of 5.25″ disk storage
- 6 slot Multibus® expansion unit
- Optional tape subsystem
- Concurrent DOS and MP/M-86 multi-user operating systems

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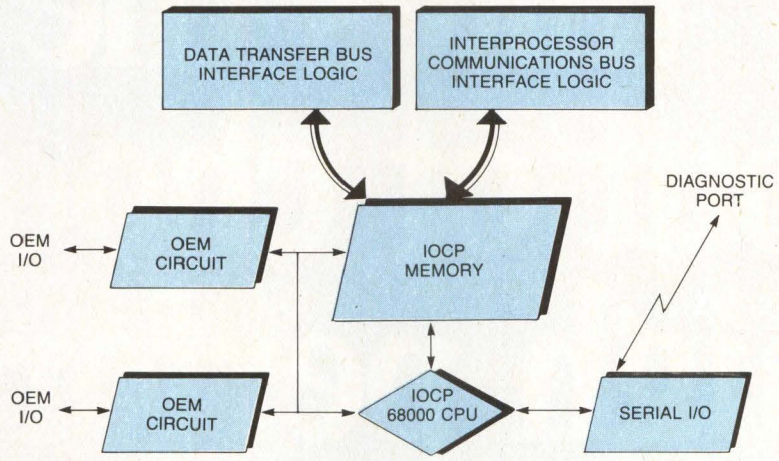
CIRCLE NO. 79 ON INQUIRY CARD

EFFECTIVE PROCESSING SPEED RISES AS SYSTEM CPUs INCREASE IN NUMBER

Number of Arete 1200 main CPUs	Effective system processing speed relative to one CPU
1	1
2	1.84
3	2.64
4	3.0

OEM-DESIGNED CIRCUITRY CONFIGURES I/O CONTROL PROCESSOR (IOCP) BOARD TO END-USER APPLICATIONS



from many manufacturers make it easy for system integrators and OEMs to reconfigure a system to meet their needs.

Therefore Arete's open architecture (AOA) program allows OEMs and system integrators to take advantage of the Arete 1200's proprietary bus structure, without losing the flexibility afforded by standard computer buses. It provides a stable CAD system that OEMs can use to develop their own semi-custom hardware based on the 1200 system. A set of library designs for board development is also furnished. The library includes bus-interface logic, CPU logic to provide the environment in which the IOCP's 10-MHz 68000s operate, and various memory-arbitration circuits used to dual-port the IOCP RAM memory onto the DTB.

Wire-wrapped boards can be generated within days of the completion of the schematic-capture phase of the design on the CAD system. After the design has been proven in wire-wrapped form, the database from the CAD system produces a printed-circuit board.

The AOA program's library elements, CAD schematic-capture capability and wire-wrapping, prototyping and PC-board services thus allow OEMs to fine-tune the Arete 1200 system to meet their application requirements and to develop and bring to market a custom product in just a few months. □

Spec summary

- **Product:** Arete 1200 computer system
- **Manufacturer:** Arete Systems Corp., San Jose, Calif. 95131
- **Central processors:** As many as four 12.5-MHz 68000 microprocessors, each with a 4K-byte cache memory
- **I/O controllers:** As many as 12 intelligent 68000-based I/O control processors (IOCPs)
- **Main memory:** To 16M bytes
- **Internal disk drive storage capacity:** To 320M bytes
- **External disk drives supported:** As many as 44 with as much as 8.8G-byte storage
- **RS232 ports:** Eight to 88
- **Operating systems:** UNIX System V, RM/COS
- **Languages supported:** C, RM/COBOL, RM/FORTRAN, AVL, MUMPS, SVS/Pascal, SVS/FORTRAN, SVS/X-BASIC, Ada, APL
- **Price:** $75,000 for typical system with two central processors and as much as 320M bytes disk storage supporting as many as 66 users

John R. Vrolyk is president and founder of Arete Systems Corp., San Jose, Calif. Previously, Vrolyk was vice president of marketing for Codata Systems Corp., Sunnyvale, Calif., where he managed development of UNIX-based 68000 systems with Multibus architecture. Prior to joining Codata, he served as director of sales for International Memories Inc., Cupertino, Calif., and as software development supervisor at Zilog Inc., Campbell, Calif. Vrolyk holds a B.A. degree from California State University, Northridge, and studied at Stanford University's Graduate School of Electrical Engineering.

Interest Quotient (Circle One)
High 840 Medium 841 Low 842

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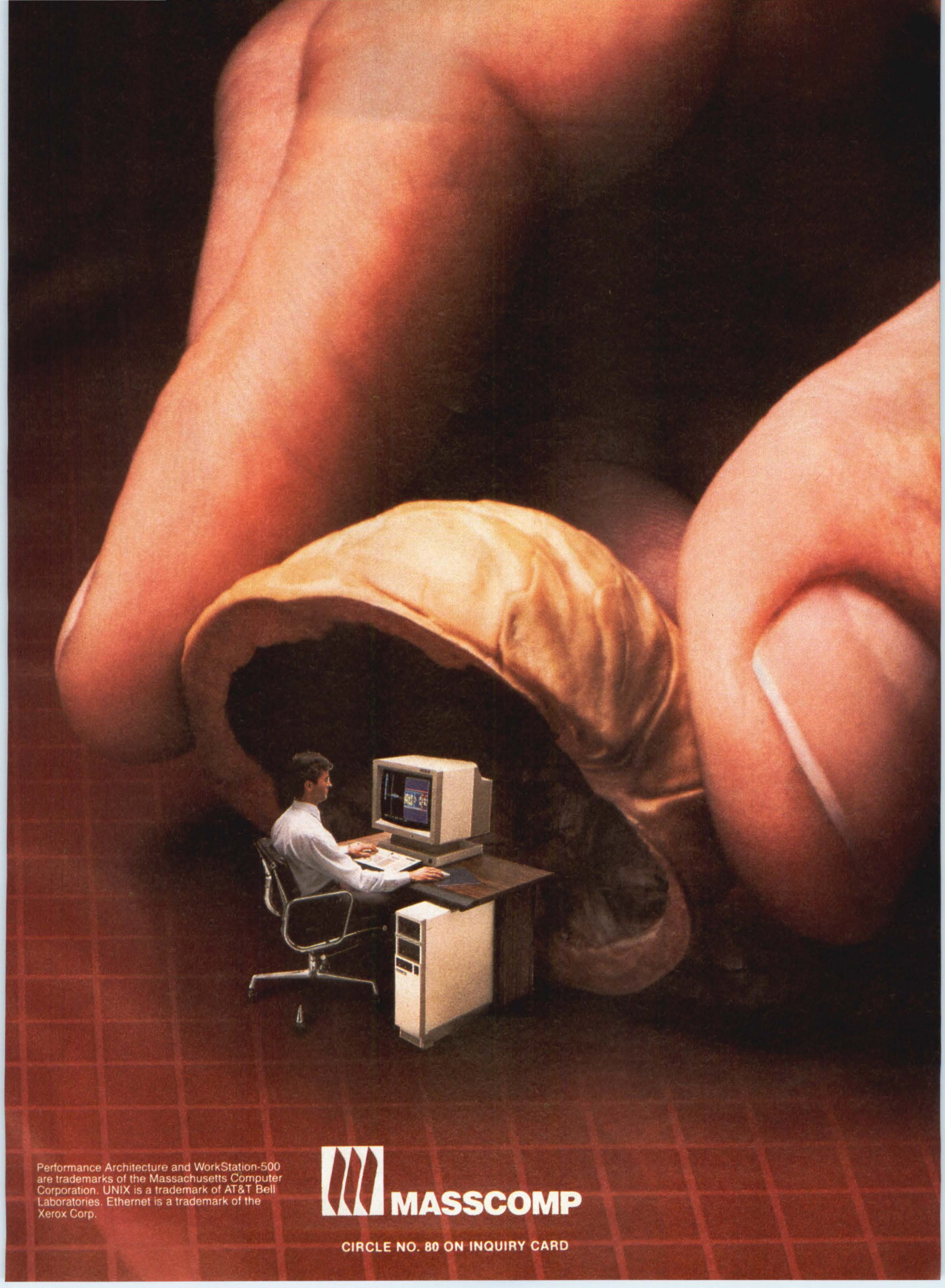

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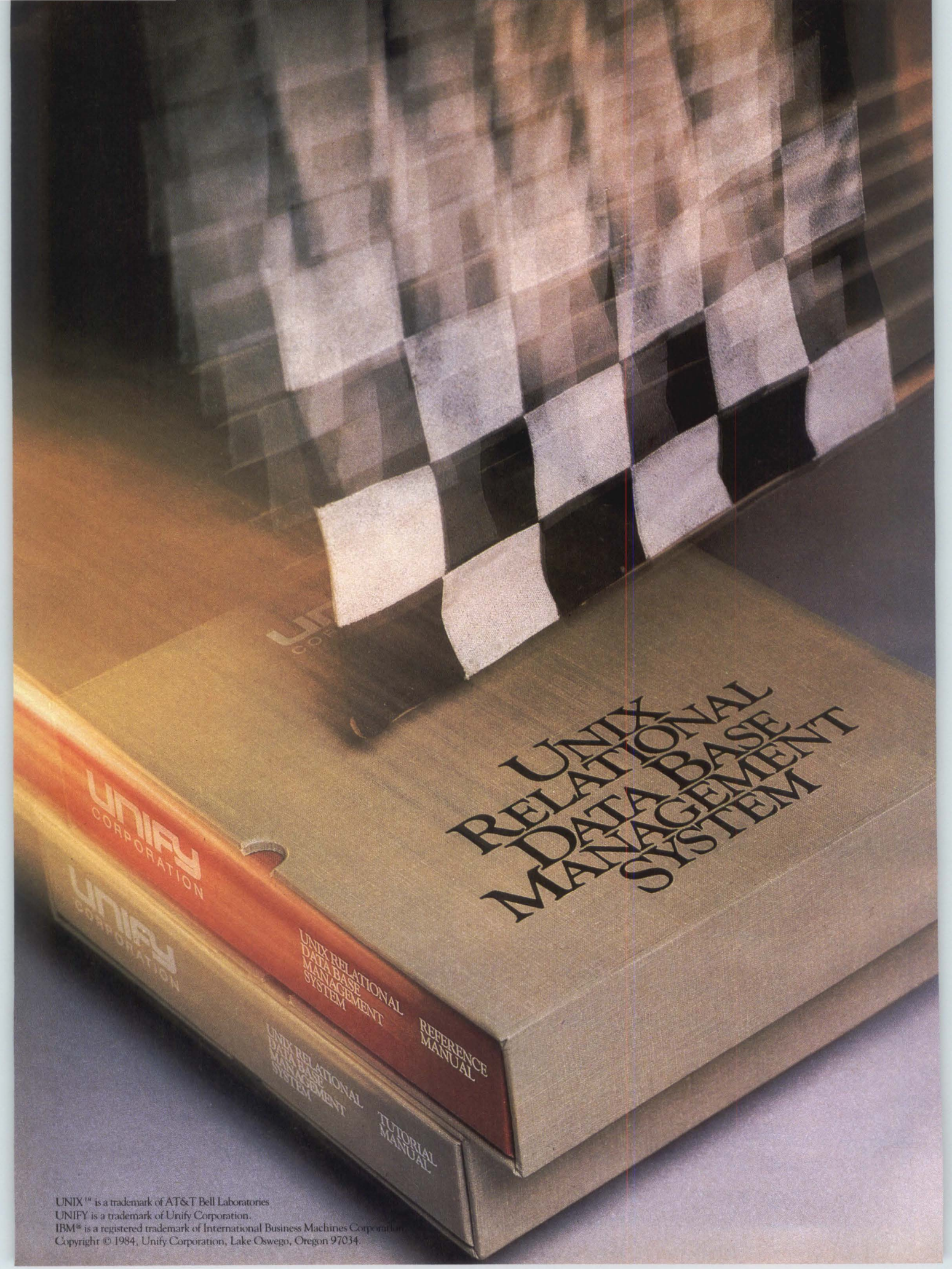

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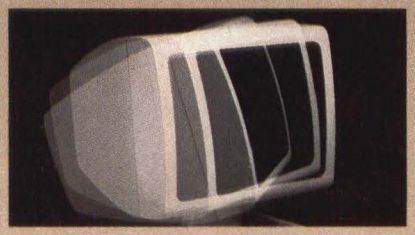

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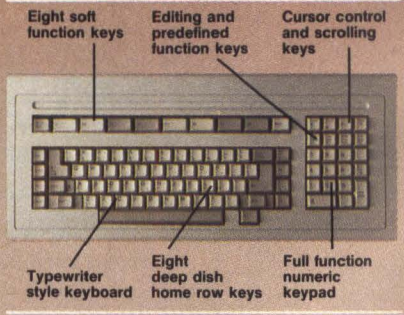

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Low-cost terminals: More power for less

Faced with increased competition and falling prices, terminal manufacturers are cutting costs, boosting capabilities, maintaining quality standards and looking ahead to automation and new market opportunities

Jesse Victor, Associate Editor

Competition is the name of the game in the low-cost terminal market and, to remain competitive, manufacturers are looking for ways to cut production costs, upgrade their products, maintain quality and protect profit margins. Low-end products are inching downward to a $400 quantity-one price and commodity status. High-end alphanumeric terminals costing less than $1,000 are, out of necessity, becoming indistinguishable from their microcomputer cousins.

A rapidly maturing market is slowing sales growth, pressuring profits and forcing terminal manufacturers to look ahead to new markets in office automation. Automated production lines are becoming a necessary and expensive requirement for boosting terminal-production efficiency. While this is a mixed message for the manufacturers, it is good news for OEMs and system integrators looking for increasingly powerful low-cost terminals at shrinking prices.

Will we see a $300 or $350 quantity-one price for an alphanumeric terminal in the next few years? Terminal vendors and industry analysts are divided on how far terminal prices will fall. "Manufacturers are continuing to drive prices down," observes George Chao, president of Liberty Electronics USA, San Francisco. "There is significant activity on the low end in terms of manufacturers trying to keep costs down and reduce the retail price. We are already at $495 with our box [the Freedom 100]. As to whether it hits $350 or not in the next few years, I think it eventually will."

Scott Kennedy, marketing specialist at RCA Microcomputer Products, Lancaster, Pa., foresees a $350 to $400 price for terminals targeted at the general business market and even lower prices for other markets. "For home use, I can see terminals going down as low as $100 for basic, dumb, interacting, conversational terminals," Kennedy says.

Low in cost but not performance, *the $640 Fame III from Falco Data Products typifies the full-featured alphaumeric terminal with a quantity-one price less than $1,000 available to system integrators and OEMs. ANSI X3.64-compatible, it furnishes a soft set-up screen, 12 function keys, three terminal modes, 80-column-by-24-line display and baud rates to 19.2K*

Will there be a floor on terminal prices?

Some manufacturers and industry analysts, however, expect distribution costs, marketing costs and squeezed profit margins to force a floor on terminal prices. "With practically everybody going offshore [to the Far East to manufacture their products], prices will fall," says Craig Lynar, director of marketing at TeleVideo Systems Inc., Sunnyvale, Calif., "but there will be a

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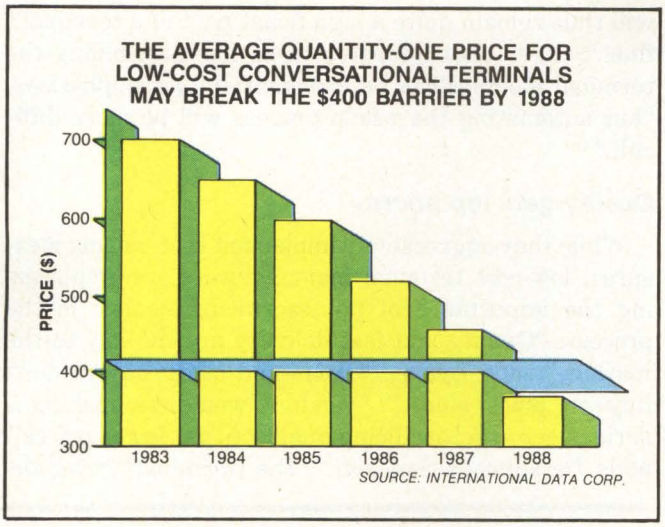


saturation point, if you want to call it that. Distributing and marketing the product in this country involves certain overhead costs, and they have to maintain a decent profit margin to support these functions."

Bob Sanekoff, vice president and director for display terminals at Dataquest Inc., San Jose, Calif., echoes this assessment: "The basic full-editing, block-mode terminal is getting pretty close to the lowest price possible. We might see $499 or $450 in the next 12 months [for this type of terminal]. That wouldn't shock me. But that is pushing the lower limit for a quantity-one list price. The main price erosion is in the 'sacred environments' of the IBM 3270- and Digital Equipment Corp. (DEC)-compatible markets." Along with price erosion, Sanekoff foresees continued migration of features down from higher end units. "The full-featured terminal that was once at the middle of the [low-cost] terminal market is now going to the low end."

John Kim, president of Kimtron Corp., Santa Clara, Calif., sees "the possibility of further price erosion based on current levels of quality for the keyboard and the CRT down to just under $500 in the next 12 months." But Kim also expects a cost threshold, primarily involving these components, as making further price reductions difficult.

Falling terminal prices, though, are a mixed blessing. They could pose a threat to manufacturers in regard to maintaining quality standards and ensuring adequate profits in a maturing market, says Dr. John Hoper, vice president of the peripherals group at Future Computing, Dallas, Texas. "Terminal price points now are very appropriate for the market, if you want to avoid terminals significantly lower in quality," says Hoper. "Companies are trying to differentiate their products by features and functionality while trying to maintain a price point. If you drop from $500 to $350, you have to increase your market significantly to justify that. But there is no great increase in market demand."

Indeed, the low-cost terminal market is rapidly maturing, and market growth is levelling off. Most market research firms classify the terminals market by product function rather than price and thus do not break out separate forecasts for low-cost terminals. International Data Corp. (IDC), Framingham, Mass., sees the installed base of conversational terminals, which occupy the low to middle segments of the low-cost terminal market, as growing at a compound annual rate of 17 percent through 1988. "We see stable, responsible, not dramatic growth," says Mary Lynn, project director for terminal studies and senior research analyst at IDC.

Maturing market puts squeeze on profits

The maturing market is forcing manufacturers to adopt one of two marketing strategies. They can drop their prices significantly in an effort to increase market share, accepting lower profit margins per unit, but maintaining overall profit levels by a corresponding boost in sales—a risky strategy in today's market. Or they can attempt to maintain profit margins and profit levels by emphasizing features and terminal capabilities, without banking on a strong rise in shipments. "You can continue disastrously to decrease your price," Future Computing's Hoper observes, "or you can be satisfied with the profit margins you have and go ahead to get money out of the business by doing features and maintaining price points."

CONVERSATIONAL TERMINAL SHIPMENTS WILL GROW SLOWLY THROUGH THE END OF THE DECADE
(Units 000s)

	1984	1985	1986	1987	1988
Terminals shipped	461.1	507.2	536.0	627.7	693.6
Installed base	2,718.5	3,198.5	3,729.5	4,319.9	4,970.3

Source: International Data Corp.

Most low-cost terminal manufacturers have opted to follow the latter course, aggressively seeking manufacturing efficiencies that will enable them to remain competitive in a highly competitive market and pass on the cost savings to their customers without jeopardizing profit margins.

Surveying five terminal component areas—microprocessor development, keyboard, CRT monitor, power supply and case fabrication—Dataquest's Sanekoff sees few possibilities for major cost reduction. "There are possibilities for increased [manufacturing] efficiencies in keyboards," he notes, "but I don't see much reduction in monitor costs. Case manufacturing admits some increased efficiency, but power-supply

costs will probably remain stable." Sanekoff, recently returned from the Far East, added, "The people I talk to in Taiwan, Hong Kong and Japan tell me it's getting close to the bottom [in cost savings.] They just can't squeeze much more out."

"Fundamentally, cost savings are really derived from technological innovation," asserts Liberty Electronics' Chao. "They will be achieved from higher levels of integration in chips for memory and CRT functionality." Chao expects additional savings in component costs as suppliers' prices decline because of economies of scale from rising production volumes. RCA Microcomputer Products also focuses on terminal electronics for cost efficiencies. "You will see cost efficiencies coming in VLSI, in surface-mount technology and similar areas," says RCA's Kennedy. "You are getting more intelligent chips and components. Terminals are implementing more features in software and becoming less hardware intensive, lowering the component count."

Kimtron's Kim expects continuing cost reductions in terminal electronics, "and to some extent, in the keyboard," although "the CRT and power supply are still resistant [to cost reductions]." Additional cost savings will depend, says Kim, on component suppliers coming up with a one-chip logic module. But further progress will require reducing the labor involved in terminal manufacturing.

This assessment is echoed by TeleVideo's Lynar, who although he expects some cost savings in case manufacturing, notes that the most labor-intensive parts of a low-cost terminal are components that collectively consititute a good part of its final cost: the monitor, power supply and keyboard assembly. Labor, Lynar stresses, will thus remain quite a significant part of a terminal's final cost. "Labor-intensive tasks like assembling the terminal modules can be mechanized," he emphasizes, "but automating the whole process will be more difficult."

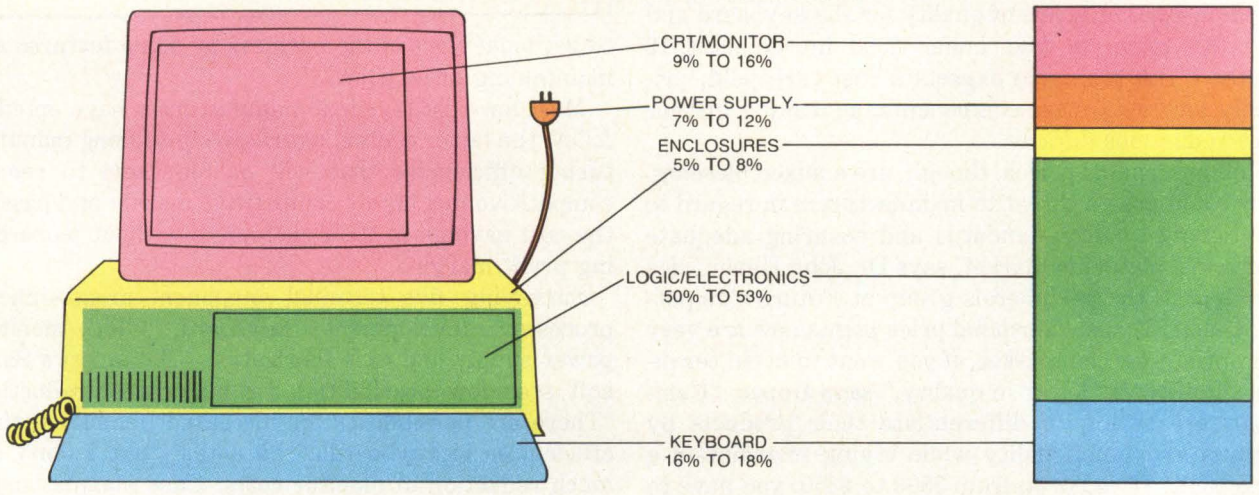
Quality gets top priority

While they aggressively implement cost-cutting measures, low-cost terminal manufacturers are emphasizing the importance of not sacrificing quality in the process. "Quality and fast delivery are the key to the market," says Lynar. "OEMs and other buyers don't buy on price alone." "Vendors would be making a serious error in sacrificing quality to get lower prices," adds Dataquest's Sanekoff. "The [terminal] buyer demands and has every right to demand top quality. Terminals must continue to operate, like telephones, and be indestructible."

'Quality and fast delivery are the key to the market.'

Is the trend toward overseas manufacturing compatible with high quality levels? Some market observers are doubtful. "The lowest priced terminals are now coming directly from offshore. The quality of these terminals is not something most OEMs would be willing to accept," contends Don Naples, vice president sales and marketing, at Falco Data Products Inc., Sunnyvale, Calif. "When you are dealing with offshore manufacturers, you have to make sure that they are shipping a high-quality product," asserts Lynar. "They can meet

LOGIC/ELECTRONICS ACCOUNTS FOR THE LARGEST SHARE OF LOW-COST TERMINAL MATERIAL COSTS



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delivery schedules, but have to be brought up to speed on quality standards set by people in the United States."

Most terminal vendors, however, acknowledge that overseas manufacturing is necessary to remain competitive in today's market. Making a virtue of necessity, they supervise closely the foreign part of their manufacturing process. Falco, for example, "keeps tight control over offshore operations to assure quality," says vice president Naples. "We have our own resident quality assurance people at the plant." Falco's custom terminal facility, though, is in the United States, Naples adds.

Falling prices...are a mixed blessing.

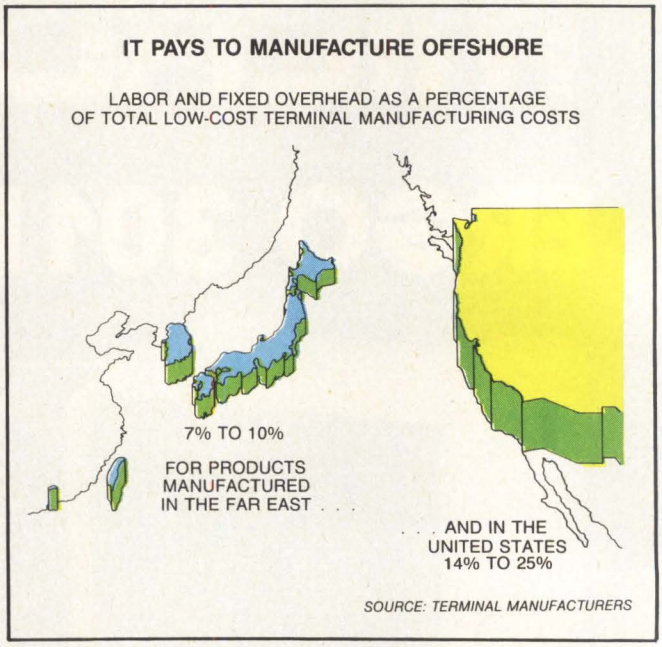
Although TeleVideo has an overseas manufacturing facility, Lynar says, it does all terminal logic-board design, case design and final assembly in the United States, enabling the company to "maintain very good control over what is coming from offshore and what is going out to the customer."

Low quality sinks offshore terminal

Some market analysts—and manufacturers—are not so sanguine about overseas manufacturers' ability to meet the quality standards the market requires. One OEM considered buying terminals from an offshore vendor, says IDC's Lynn, but "they were too poorly made for them to add value. It was not worth doing." And a former low-cost terminal manufacturer's withdrawal from the market was due in large part to quality problems from a Far East manufacturer, asserts a high-level source at the company.

"It was a very good terminal with some unique features and very popular with OEMs" he says, "but its design and production was a step down from what we wanted. We had trouble with the terminal for months. When it came in from overseas, we had to open it up and practically rebuild the thing to add reliability to it—it was a little too Far East."

Offshore manufacturing, however, will only be a stop-gap measure for companies seeking to reduce production costs, maintains Dataquest's Sanekoff: "I can't imagine any manufacturer not automating or increasing its automation. It's necessary [in order] to remain competitive and improve production quality without significantly increasing manpower." Supporting this view, one manufacturer, Kimtron Electronics will continue to make terminals overseas to reduce labor costs, during the transition to automation. But, "Down the road," says Kim, "everything will be automated."

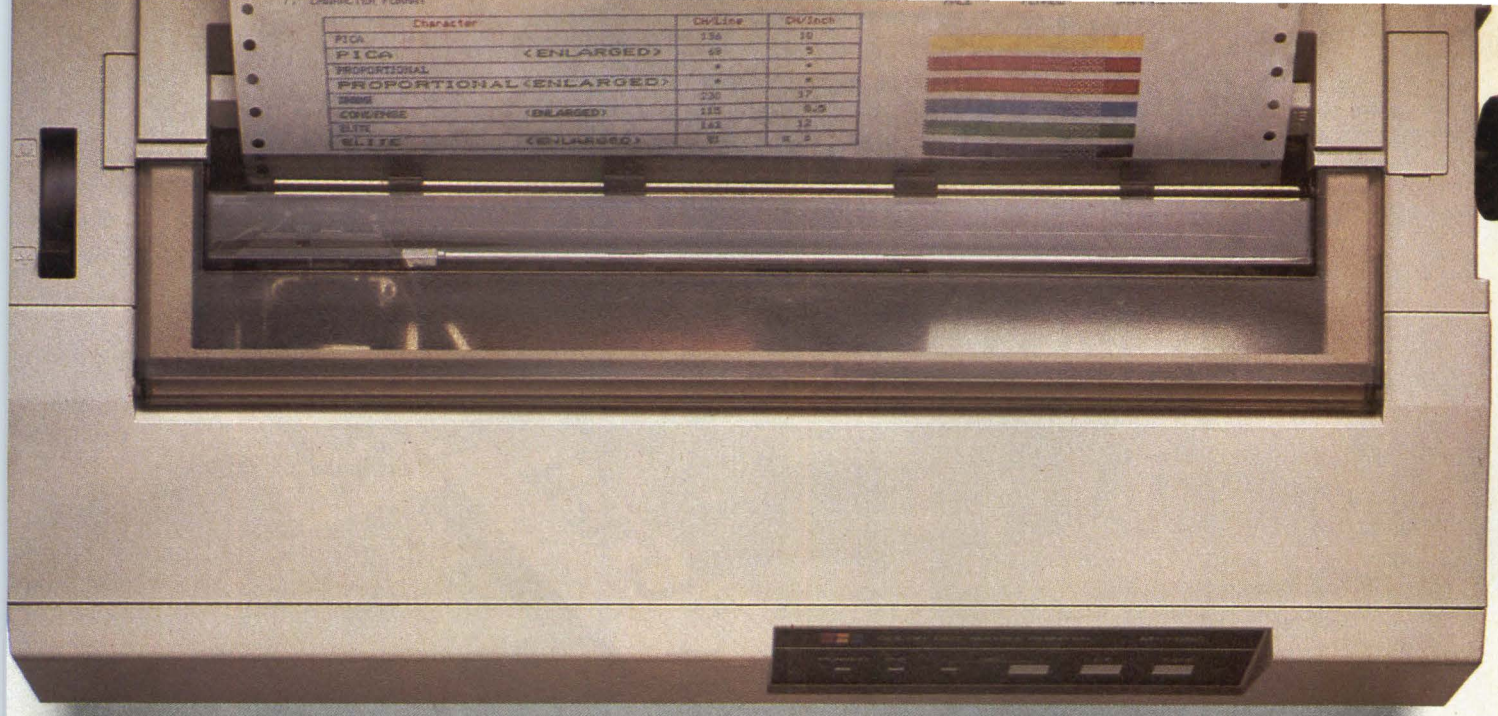


Kim, however, sees potential problems ahead for smaller terminal maufacturers. "Aside from the intensive investment required," he says, "automation requires large production volumes to justify it—approximately half a million units shipped a year."

One solution to insufficient production volume lies in integrating terminal production with other electronics products, a course followed by RCA in its year-and-a-half-old automated facility in Lancaster, Pa. And some overseas manufacturers are planning to follow suit, combining, for example, their TV and terminal production lines. Extremely fast board stuffing is one benefit of this technique, says Sanekoff. "The speed at which these devices work is unbelievable. A machine picks up as many as 30 different components and just flies in inserting them into the board."

However, when it comes to terminal production, Sanekoff says, "a tremendous amount of human intervention is still required, even though part of the line may be automated." Terminal production volumes are lower than those of TVs, and some terminal companies are not yet experienced with completely automated production. But in spite of these obstacles, offshore manufacturers are now ready to automate, Sanekoff stresses.

One terminal manufacturer, Zentec Corp., Santa Clara, Calif., is already deriving double benefits from automation, says Robert Angus, vice president for marketing and sales. In addition to terminal manufacturing, the company is using an automated system to conduct extensive burn-in and other tests of its terminal products, including computer-controlled testing of keyboards.



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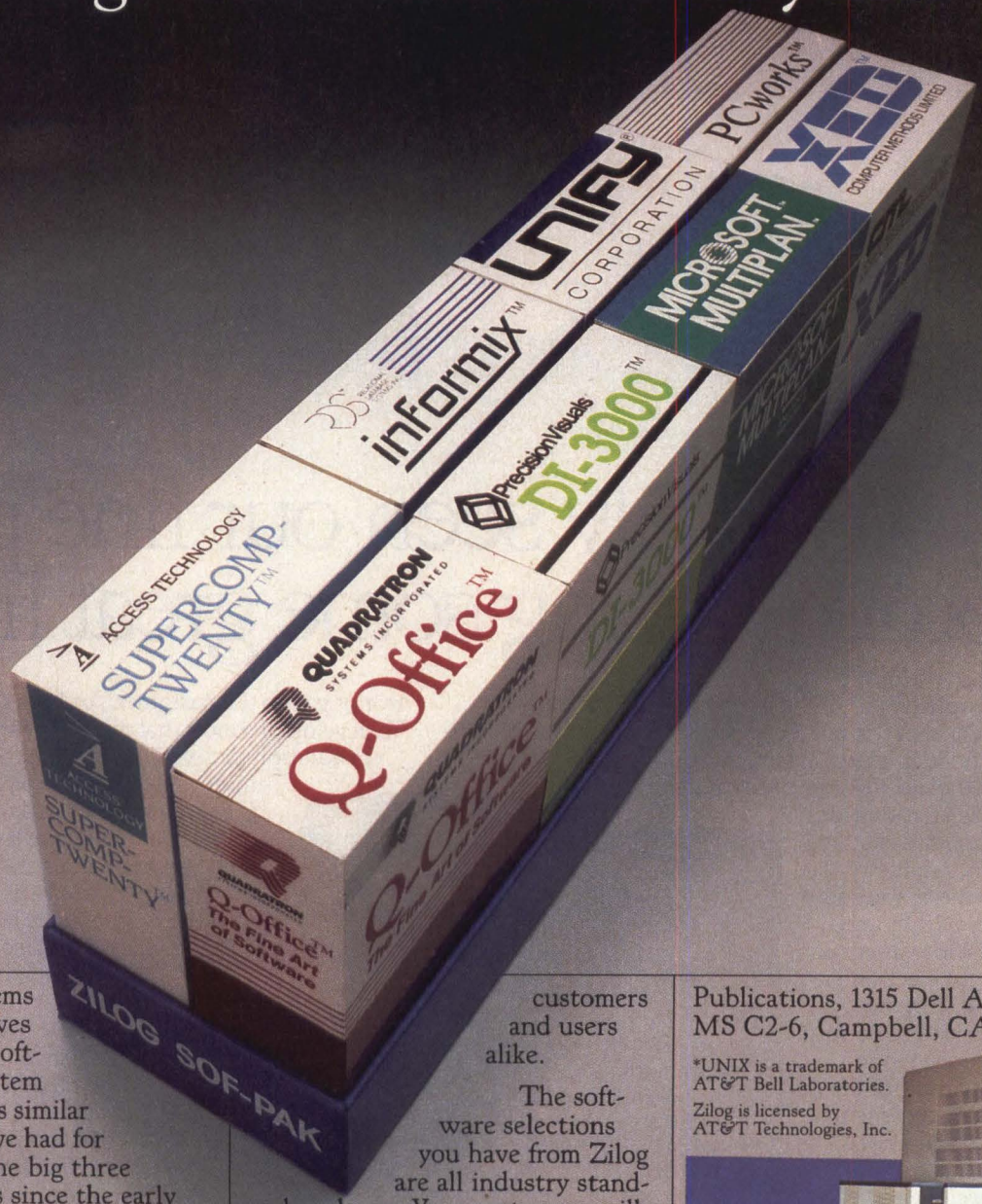

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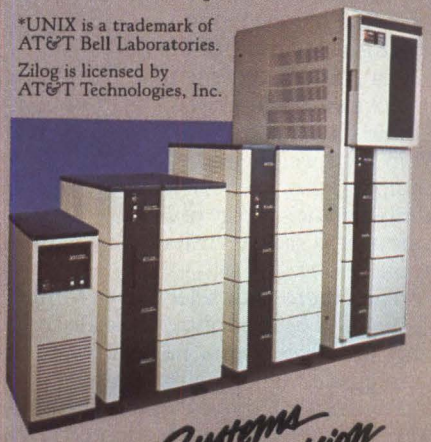

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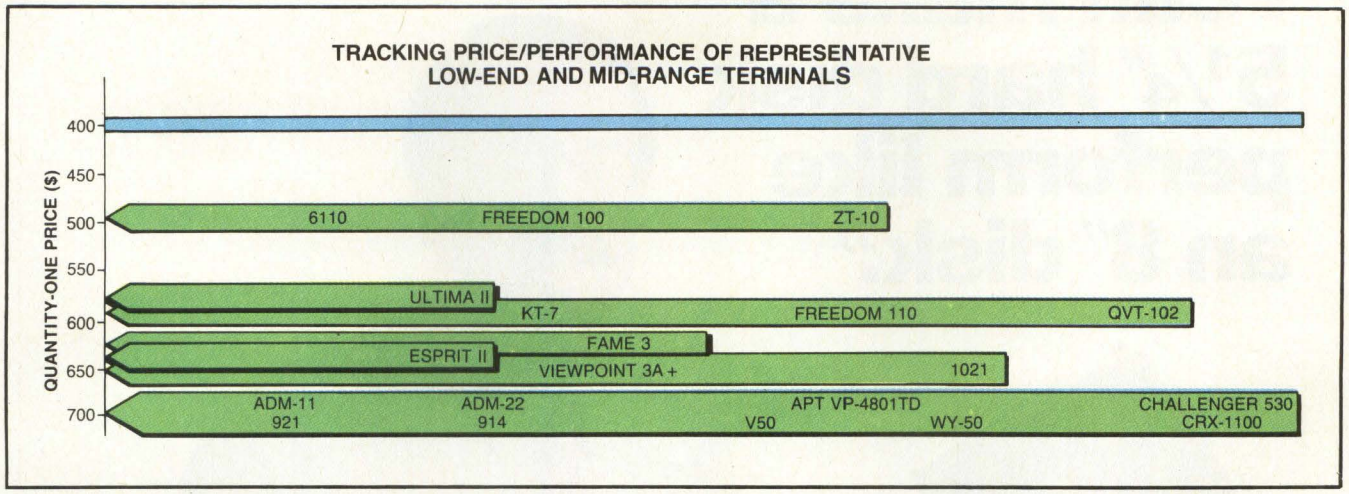

ALPHANUMERIC TERMINALS

Company Model	Display: 12-inch	Display: 14-inch	Display: Green	Display: Amber	Display: Screen format (col. X lines)	Interfaces (protocols): RS232C	Interfaces (protocols): Current loop	Interfaces (protocols): RS422	Interfaces (protocols): Printer port	Interfaces (protocols): (X-on/X-off)	Interfaces (protocols): (DTR)	Function keys	Programmable function keys	Graphics	International character sets	ANSI X3.64	Soft set-up	Pages of memory	Non-volatile function(s)	Diagnostics	Integral modem
APPLIED DIGITAL DATA																					
Viewpoint/3A+	●		●	●	80X25	●	●							●							
ESPRIT SYSTEMS INC.																					
ESP 6110		●	●	●	80X24	●	●	●	●	●					●		●		●		
ESPRIT II	●		●		80X24	●	●			●					●			1		●	
FALCO DATA PRODUCTS INC.																					
Fame 3	●		●	●	80X25	●			●	●		12				●	●				
IMS INTERNATIONAL																					
Ultima II	●		●	●	80X25	●		●		●	●		72	●	●			2		●	
KIMTRON CORP.																					
KT-7	●		●	●	80X25	●	●		●	●	●		20	●	●	●			●		●
LEAR SIEGLER INC.																					
ADM-11	●	●	●	●	80X25	●	●	●		●	●		8	●	●				●		
ADM-22	●		●		80X25	●	●			●		7		●					●		
LIBERTY ELECTRONICS USA																					
Freedom 100	●				80X25	●	●			●	●	10		●	●						
Freedom 110	●		●	●	80X25	●	●			●			10	●	●		●		●		
QUME CORP.																					
QVT 102	●		●	●	80X24	●	●			●				●							
RCA MICROCOMPUTER PRODUCTS																					
APT VP-4801TD	●		●		80X24	●			●	●		4		●					●		●
SANYO BUSINESS SYSTEMS CORP.																					
CRX-1100	●		●		80X24	●	●		●	●			8	●				1	●		
SOROC TECHNOLOGY INC.																					
Challenger 530	●		●		80X24	●				●				●							●
TELEVIDEO SYSTEMS INC.																					
914	●		●		80X25	●	●	●	●	●	●		3	●				1	●	●	
921	●		●		80X25	●	●	●	●	●	●		16	●	●			1	●		
VISUAL TECHNOLOGY INC.																					
V50	●	●	●		80X25	●	●		●	●	●	3		●	●				●		
WYSE TECHNOLOGY																					
WY-50		●	●		132X26	●			●	●			16	●					●		
ZENITH DATA SYSTEMS																					
ZT-10	●		●		80X25	●			●					●					●		
ZENTEC CORP.																					
1021	●		●		80X25	●	●			●				●		●		1	●		

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Frank Emser
Manager Hardware Development
Paradyne Corporation

The Interphase Storager Multibus™ controller can give a 5¼" Winchester disk capabilities never before possible. Storager not only gets more performance from existing ST506 drives, but also supports the new ESDI and ST412HP interfaces for more power and capacity than ever before. And since Storager can control two Winchester disks, four ¼" tapes (QIC-02), and two 3½", 5¼" or 8" floppies, the same controller can be used for every storage need.

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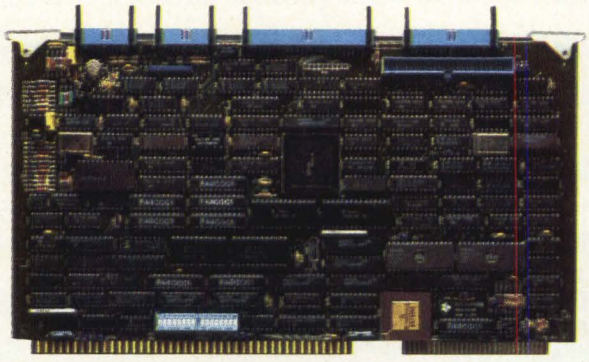

The Storager controller is the latest product in Interphase's line of high-performance Multibus controllers. Interphase also offers Multibus controllers for SMD disks, local area networks and video monitors. Plus powerful disk controllers for the IBM® PC. They're all backed by a great customer support team that works full time with Interphase customers to assure that our products work the way they should — in the system.

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The capabilities of tomorrow's low-cost terminals will be, to a considerable extent, shaped by trends already discernible in today's market—ANSI X3.64 compatibility, continued migration of features downward from top-end units, the emergence of a "standard" low-cost terminal and a major thrust into office automation.

The market is forcing standardized code structure—what the terminal responds to or transmits, says Lynar. "For large systems especially, the ANSI X3.64 standard allows many peripherals to be installed with a minimum amount of software. The trend is reinforced by the influx of UNIX systems that use the ANSI standard. PBX manufacturers are also using it."

ANSI compatibility now appears only on the high end of TeleVideo's low-cost terminal line. The $995 Model 922 is code compatible with the DEC VT220, VT100 and VT52. It offers a tilt and swivel, 12-inch green screen with 24-line-by-80-column or 12-column display; 15 programmable function keys; 10-key keypad; conversational, block, local monitor and self-test communications modes; and optional graphics upgrade board for Tektronix Corp. PLOT 10 software.

Other manufacturers offering low-cost ANSI-compatible terminals include Falco and Kimtron. Falco's $640 Fame III provides a 12-inch, 80-column-by-24-line display, 12 function keys, three terminal modes, soft set-up screen and baud rates to 19.2K. With a 14-inch CRT, the $795 Fame II furnishes an 80- or 132-column display, 50 nonvolatile programmable function keys with 900-character storage, block and monitor modes and business graphics. Available with optional ANSI compatibility, Kimtron's $595 KT-7 features ergonomic design; nonvolatile hidden or embedded video attributes, 20 programmable function keys, menu set-up and answerback; line and block graphics and 20 special and mathematical symbols.

Low-cost terminals, particularly in the low- and middle-market segments, are increasingly exhibiting similar features and capabilities. Most have 12- or sometimes 14-inch CRTs, 80-column-by-24-line screen format (with 25th status line); RS232, current loop and X-on/X-off interface protocols; and function keys. Many have limited graphics and international character sets.

Tomorrow's terminals will accelerate this trend, con-

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Circle 786

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(408) 745-7123
Circle 787

IMS INTERNATIONAL
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Carson City, Nev. 89701
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KIMTRON CORP.
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(800) 538-8725
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VISUAL TECHNOLOGY INC.
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Circle 797

WYSE TECHNOLOGY
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ZENITH DATA SYSTEMS
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Glenview, Ill. 60025
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ZENTEC CORP.
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verging toward a "standard" terminal type with more or less standard features, asserts Lynar. The classification of terminals into dumb, smart or intelligent units is becoming blurred, as features migrate down from high-end products. "Features don't cost you anything anymore," he notes, "it's simply a matter of firmware. Terminal functions will [eventually] all be about the same. They may now have the same type of cursor addressing or different numbers of function keys. But that is all going to be coming together."

As low-cost terminals become more intelligent, says RCA's Kennedy, "they will come into direct competition with both personal computers and the telephone. They are all moving toward that corner of the desktop."

In the quest for new low-cost terminal markets, office automation (OA) will indeed loom large. "What we see now is a new emerging market: 'capturing the desk,'" asserts Dataquest's Sanekoff. "The new automated office environment is where you are going to see all the expansion of the display-terminal market. That is the market where you will see increasing growth and volume."

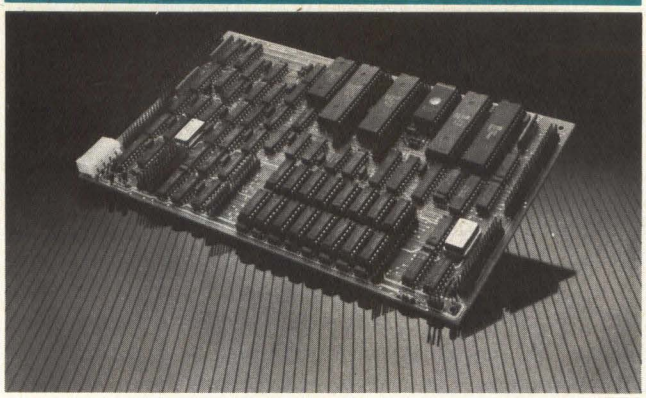
Sanekoff expects terminals to find use by a wide range of automated-office personnel—from secretaries to executives—and to hold their own against microcomputers. "Most executives need only simple data input and retrieval," he says. "They do not need word or data processing. They want to find out market status, inventory status, credit-line information and similar data. They want simple answers."

Low-cost terminals will merge into tomorrow's integrated office automation environment, including local area networks, tied to multiuser microcomputers, minicomputers or mainframes, says Sanekoff. "The key is the integration of information devices. Terminals fit into the business network and have their role in satisfying the information needs of many people in the office."

Other market observers look beyond the automated office for the development of new low-cost terminal markets. "[Tomorrow's] terminal market will depend on the computing power available to the average user," says Kim. "New applications such as videotex and electronic shopping will create new markets. The growth of multiuser computer systems will also be a big factor in creating demand. There will be a tremendous explosion of computing power."

Kim draws an analogy to the telephone in charting the future course of low-cost terminals. "When the telephone cost $1,000, there were only a limited number of users. But when the cost of owning a phone dropped down to $5, everyone could have one." □

Interest Quotient (Circle One)
High 843 Medium 844 Low 845



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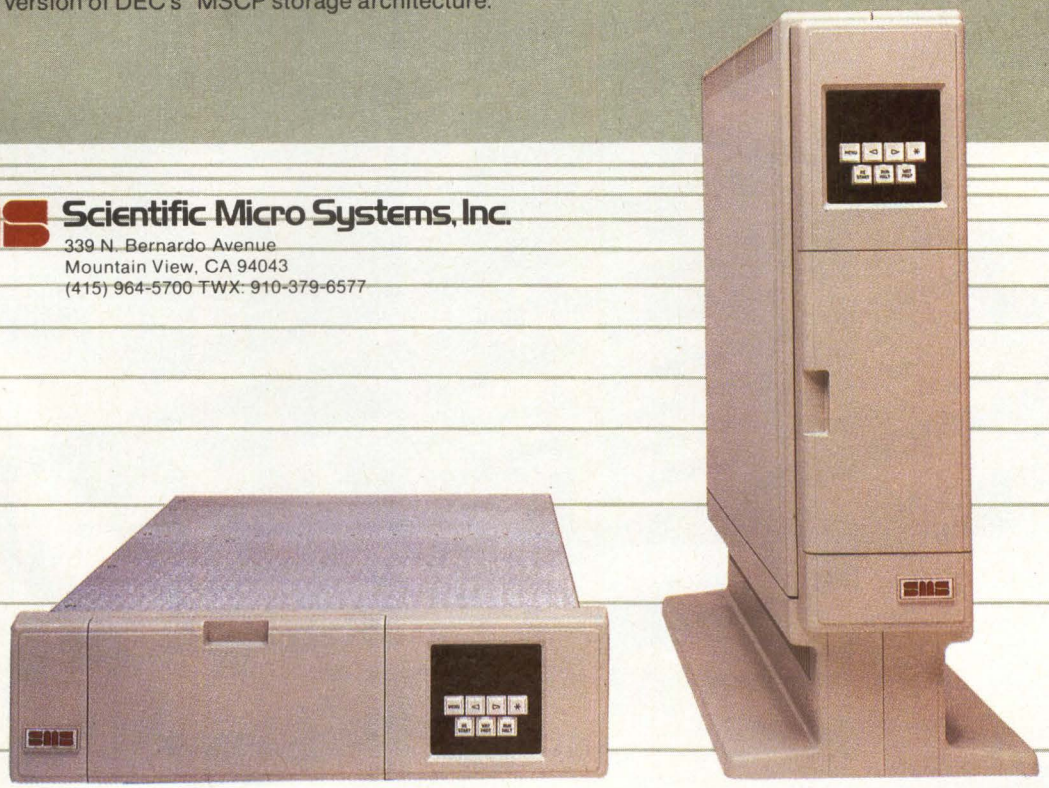

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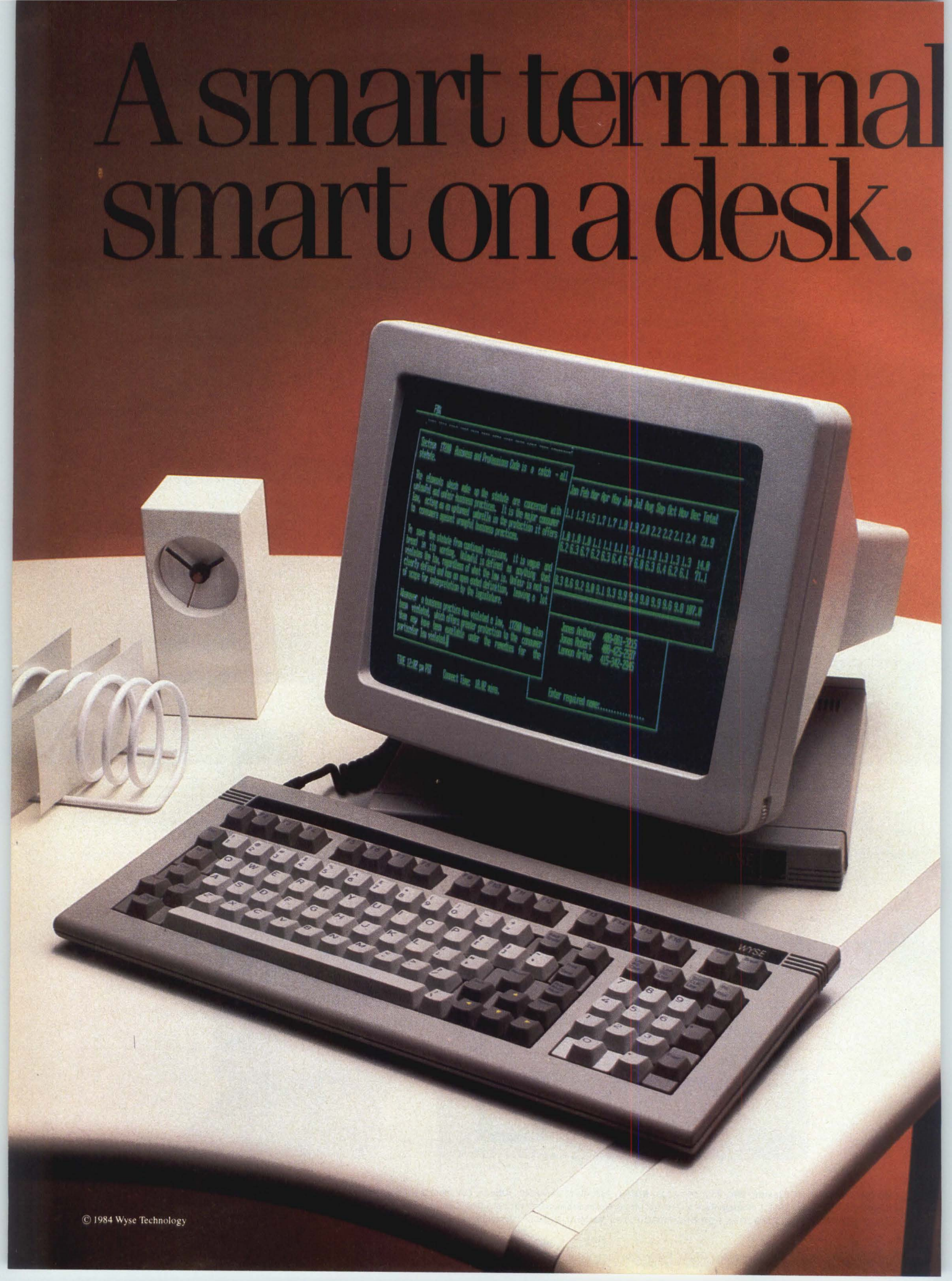
A smart terminal smart on a desk.



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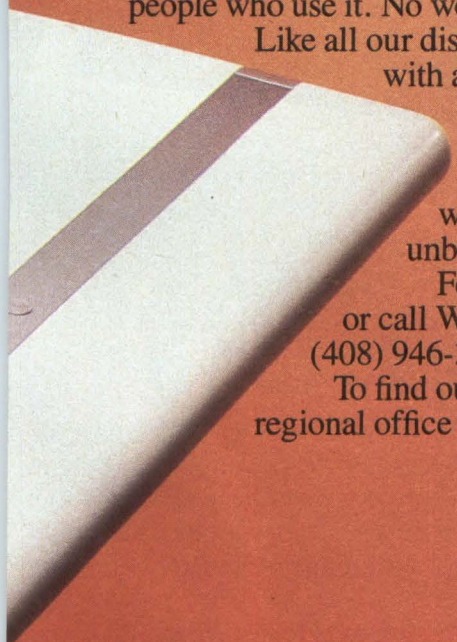
should look



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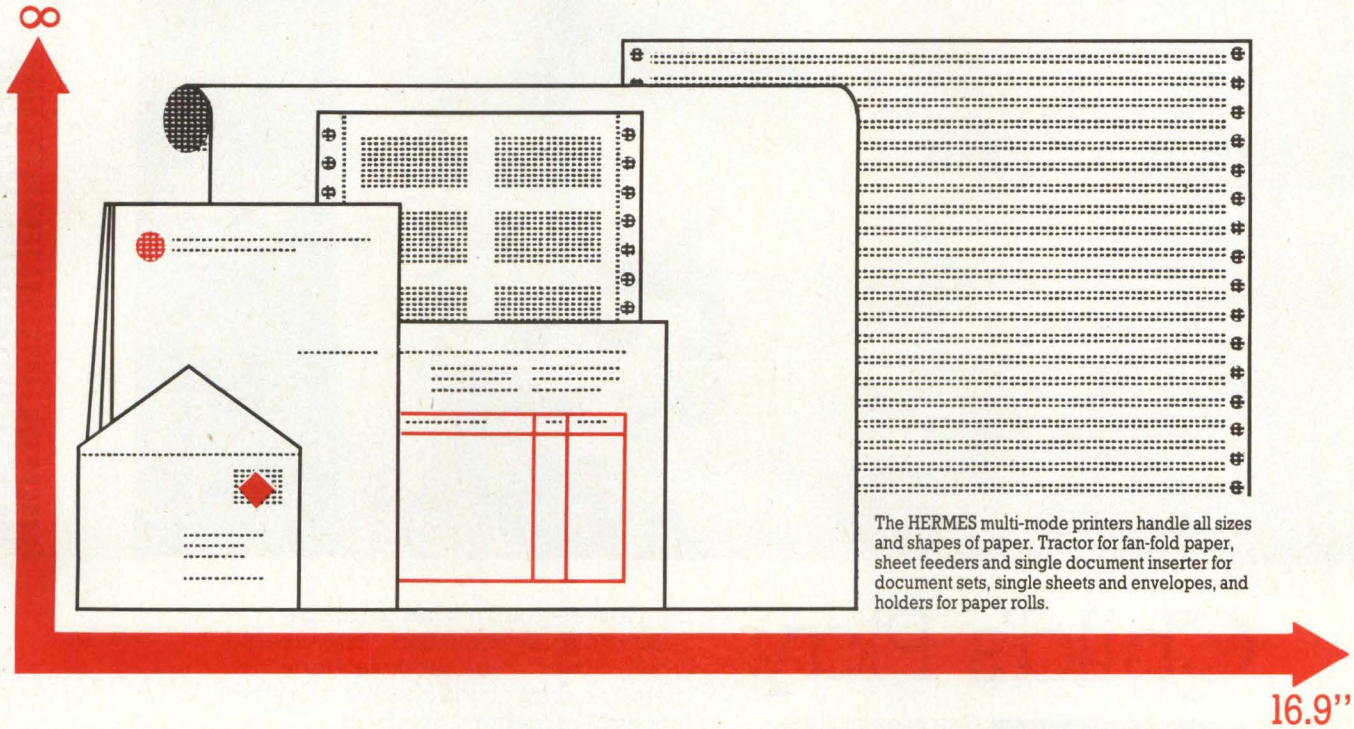

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Troquet Adverteam

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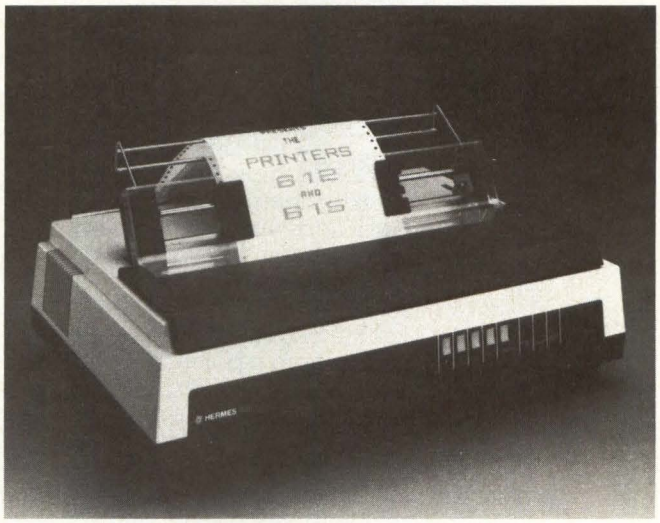

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All of which means someone is going to be very happy. Visual cueing is better. And picture manipulation is localized. Which, of course, makes operators faster and more productive. And mainframes less burdened. Two cost-efficiencies every company can live with.

The 1104 will even support ANSI 3.64. And give you a VT100 keyboard (with 16 function keys). So there are no re-learning curves to finance.

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Terminal emulation software links micros to mainframes

A variety of terminal emulation products convert microcomputers into terminals that can access mainframe databases

Paul Sniger, Senior Editor

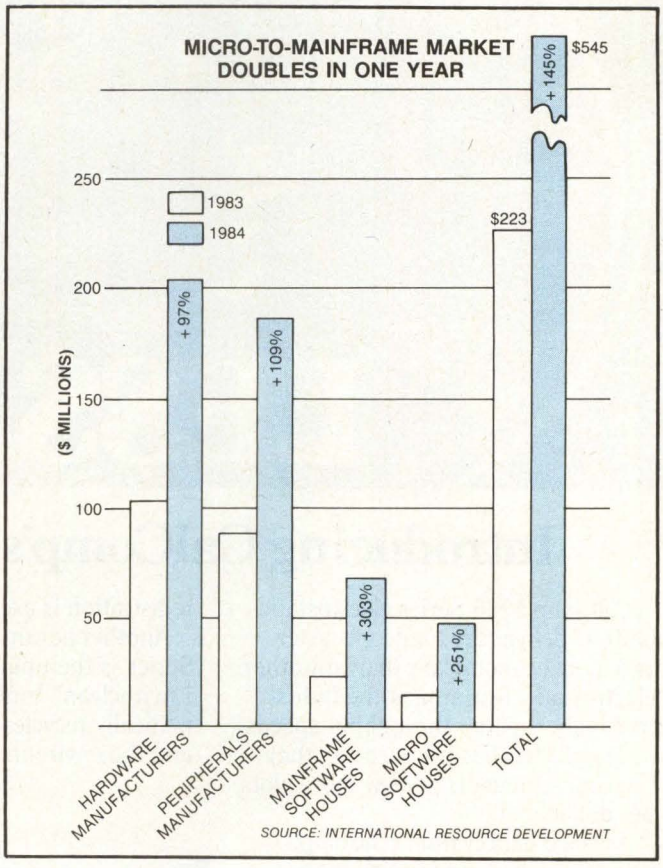
Despite the proliferation of personal computers within American businesses, most of these computers function in standalone mode, exchanging but little information with each other and sharing centrally stored data even less. New micro-to-mainframe communications and terminal emulation hardware and software products, however, are improving this situation.

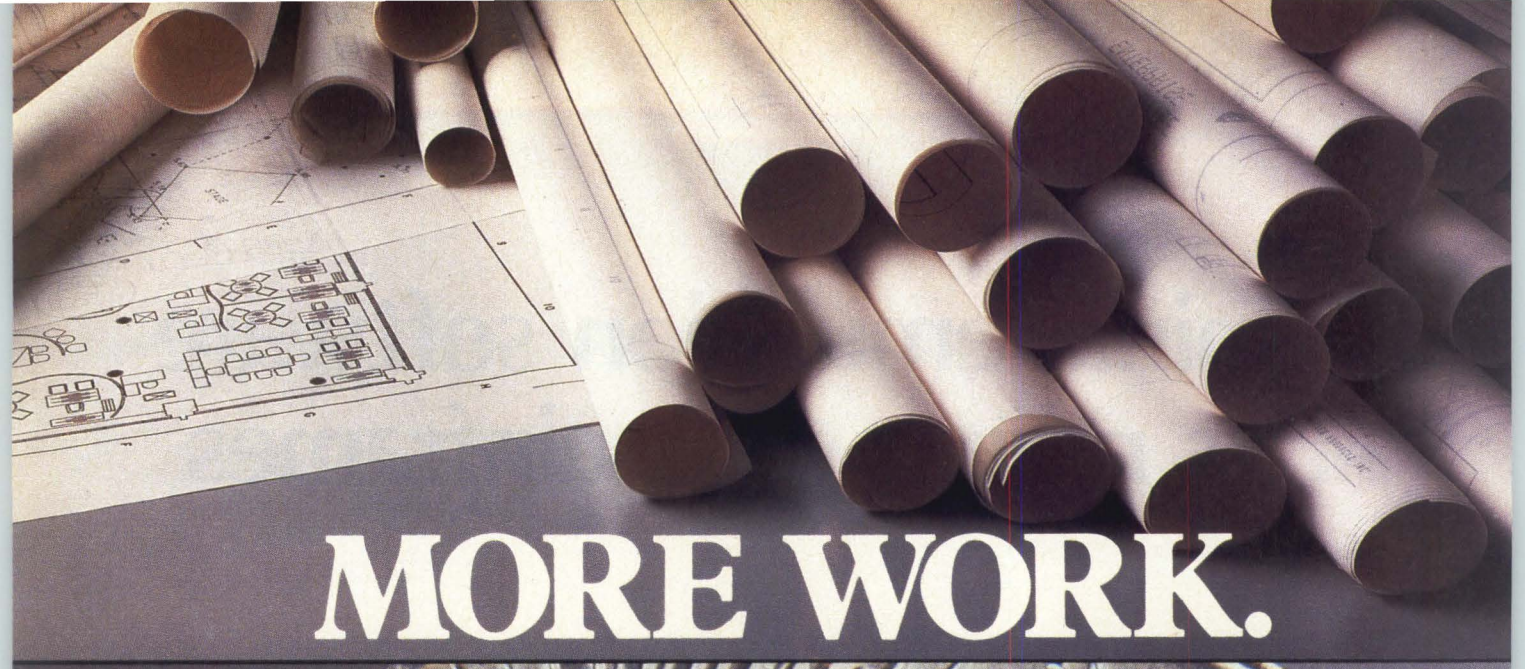
A terminal emulator reformats microcomputer-generated data into a format the mainframe recognizes. The emulation software and hardware permits any microcomputer to mimic another, typically IBM Corp. or Digital Equipment Corp. machines, so it, too, can communicate with a mainframe or microcomputer.

One of the more obvious reasons to install terminal emulation is economy. A typical IBM mainframe costs millions of dollars, contains as much as 12M bytes of RAM, and stores gigabytes of data. On the other hand, a typical IBM PC, PC-compatible, or equivalent microcomputer costs under $3,000, contains only 256K bytes of RAM and stores megabytes of data. As to convenience, an IBM PC/XT or PC-AT fits on a desktop. By contrast, a typical mainframe computer, such as an IBM 370, measures 6 feet high, 4 feet wide and 15 feet long. It also requires support devices, a controlled room environment and specially trained operating personnel.

To access mainframe databases, information and processing power, IBM offers a family of 3270 terminals. (In practice, most mainframe users employ the basic IBM 3270s or equivalent terminals as their only means to access and control mainframes.)

The ability of intelligent microcomputers to emulate these mainframe terminals permits users to not only access the mainframe, but also to upload or download information and then locally process it. An advantage, besides lower cost and smaller desktop footprints, is multiple-personality terminals that can function as microcomputers or in an emulation mode. And, since microcomputers exist in such profusion in business and engineering already, it makes economic sense to convert them into terminals that can access the mainframes.





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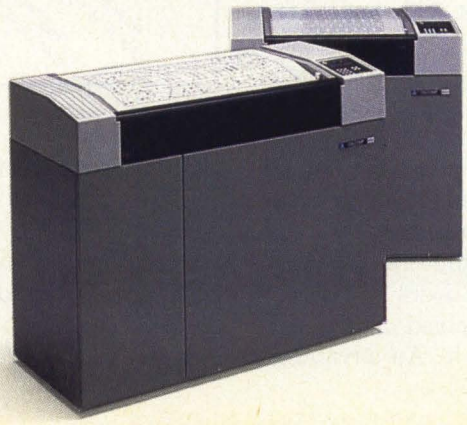

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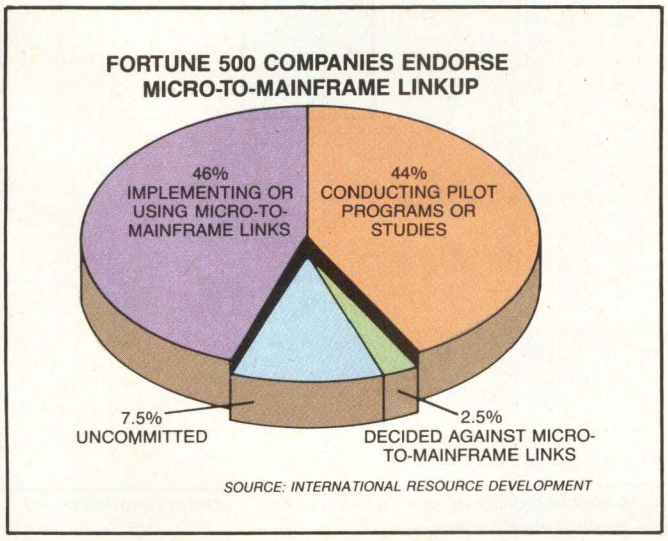
Operating a microcomputer terminal on a mainframe network requires some form of micro-to-mainframe communications software and some hardware, such as a card in the computer's expansion slot or in an external box. The communications products translate the two different protocols of the microcomputer and the mainframe. Generally, the concern centers on the data-link-control level; this level establishes and terminates a connection between two devices, performs error checking and places the data into a suitable transmission format. This level may also include character-code conversion, if different codes like ASCII and EBCDIC (Extended Binary Coded Decimal Interchange Code) are used.

But to communicate with a mainframe, a personal computer must behave like, or emulate, the terminal that normally communicates with the mainframe. This is where the terminal emulator comes in.

Terminal emulation market takes off

Although in the minicomputer world, most micro-to-minicomputer emulation products emulate VT50 or VT100 terminals for DEC minicomputers, in the mainframe world, most micro-to-mainframe emulation products emulate IBM 3270 terminals. Maureen Fleming, software products analyst at International Resource Development Inc. (IRD), Norwalk, Conn., says, "The 3270 is basically the standard for emulation. IBM has 70 percent of the mainframe market and it dominates the 3270 market and the PC market." IRD research has determined that the 1982 micro-to-mainframe market was $50 million, more than $220 million in 1983 and might exceed $500 million in 1984.

Other market research companies share this optimism. Research firm Input Inc., Palo Alto, Calif., in a recent study projected that by 1988 almost a quarter of all computer operations in larger corporations will involve micro-to-mainframe links. The report states that three-quarters of all corporations use PC or PC-compatibles today, and predicts that usage will reach 87 percent by 1986.



Another research company, Strategic Inc., reports that 31 percent of surveyed microcomputer operators used them mainly as a terminal, whether a 3270, VT100 or other type, and that another 24 percent used them as both a PC and a terminal. This dual usage is wasteful because it essentially converts a $3,000 PC into a below-$1,000, alphanumeric dumb terminal.

Commenting on this cost-effective aspect, Corley Phillips, marketing director of Grafpoint, Cupertino, Calif., says: "We are seeing a large level of installation of alphanumeric-only terminal emulation on personal computers. We feel that terminal emulation will divide into two basic categories. The first is terminals provided by Qume Corp., TeleVideo Systems Inc. and other products that are generally monochrome, low-cost and emulate terminals like the VT100 or even dumb graphics terminals such as the Tektronix Inc. 4014. The second is personal computers running both alphanumeric and graphic terminal emulation software."

Philips feels that in the case of alphanumeric emulation, the buying choice is made because, for the price of a software package, the PC can also be used as a terminal. "In the case of color graphics," points out Phillips, "the PC, does and will continue to, cost less than a standalone color graphics terminal."

Because they require comparable amounts of processor power and memory relative to a PC, graphics terminals are presently at a cost disadvantage and will have to provide features like faster speed, higher resolution, and larger color palettes to compete. Grafpoint was the first company to pioneer color graphics terminal emulation in a market where the terminal costs more than the PC capable of replacing it.

Steven B. Weissman of the IRD research staff predicts that because the U.S. government is no longer closely scrutinizing IBM's every move, IBM will grow increasingly aggressive in lowering its product prices, such as for the 3270 family. Weissman also agrees with the generally held view that the industry is about to see a continuing flurry of new IBM product introductions. "We certainly are not alone in believing that IBM's settlement of its anti-trust lawsuit has triggered the computer maker into extraordinary new-product introduction activity." Other experts predict that IBM will become aggressive in competing with most IBM-compatible makers, and will become increasingly agile in invading niches now occupied by IBM-compatible makers. Weissman feels that this development will have

wide-reaching effects upon IBM-compatible product makers and the entire industry.

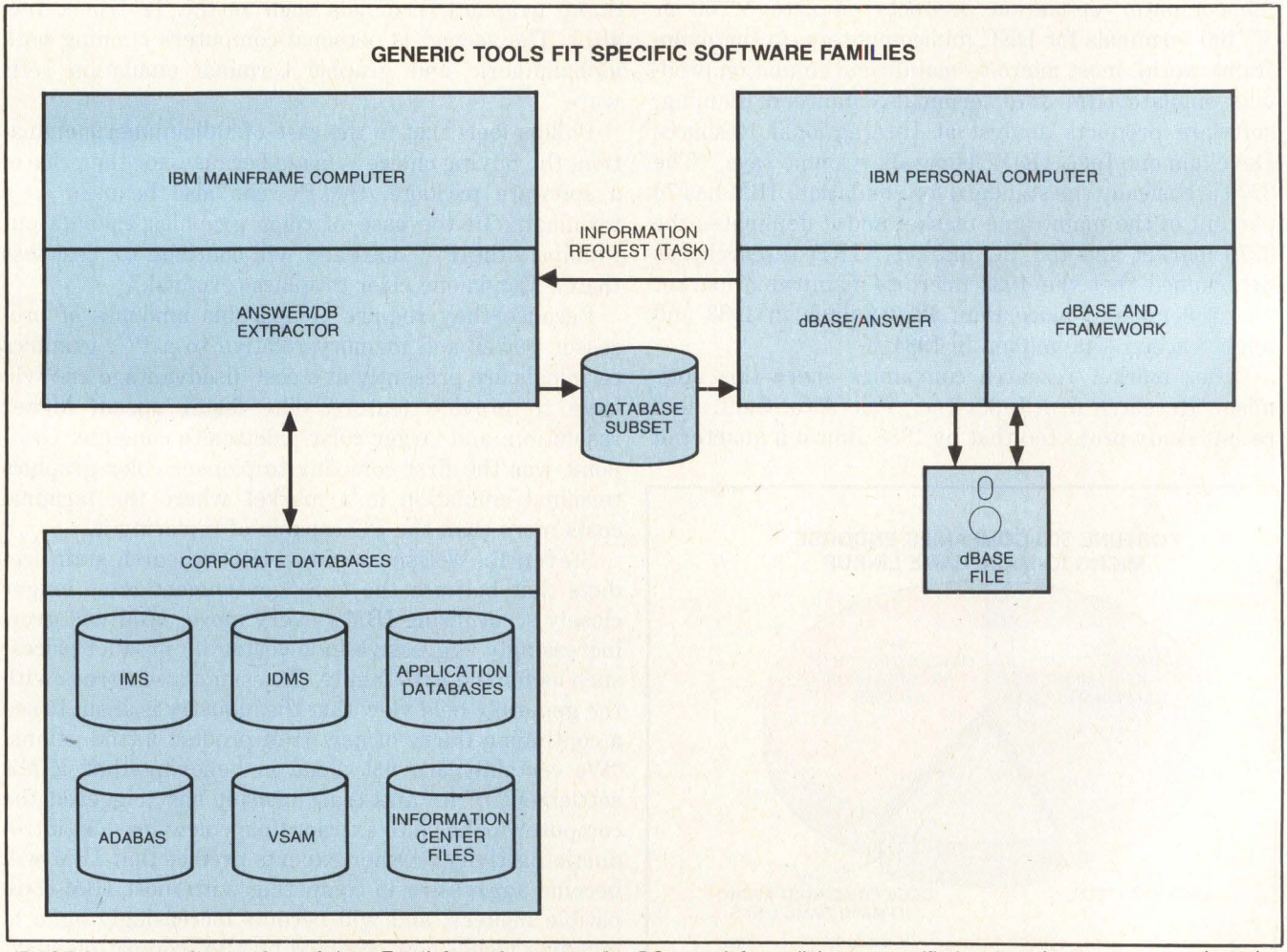
Emulation products follow a variety of approaches

But how do users select the best product for their particular application? Fortunately, terminal emulation and micro-to-mainframe communication products differ widely in their degree of emulation, their ability to link into a network and the enhancement they provide.

For example, modem-maker Hayes Microcomputer Products Inc., Norcross, Ga., recently introduced its Smartcom II 2.0. This upgraded communications software includes XMOdem protocol, batch commands and VT52, VT100 and VT102 terminal emulation. It provides enhancements such as password protection and off-line modem testing. "These enhancements ensure that this product will remain at the forefront [of the technology]," says director of marketing Garry Betty, after describing how "the VT52, VT100 and VT102 terminal emulations allow full-screen activity and other capabilities when accessing mainframes." Enhancements also include a self-test macro and detailed error messages, self-test macro tests in both originate and answer mode, user-selectable configuration of black-and-white or color monitors and a selectable on-off disk-directory for a less cluttered screen.

Another emulation software package, PC Express, from Intelligent Technologies International Corp., Palo Alto, Calif., lets users handle inter-PC and PC-to-mainframe synchronous and asynchronous communications protocols, including SNA (327X emulation) and VT52 and VT100 emulations. A full-screen text editor and phone management software permits autodialing, autoanswering and a directory.

To meet the needs of today's office environments, IBM's Systems Network Architecture (SNA) is the basis for data communications. Because approximately 70 percent of large corporations have installed IBM computers, successful terminal emulation products must link into SNA and appear like or emulate IBM SNA



dBASE/Anwers software *from Ashton-Tate/Informatics treats the PC-to-mainframe link as one unified system. It extracts user-selected data on IBM or IBM-compatible mainframes from virtually any data-base-management system.*

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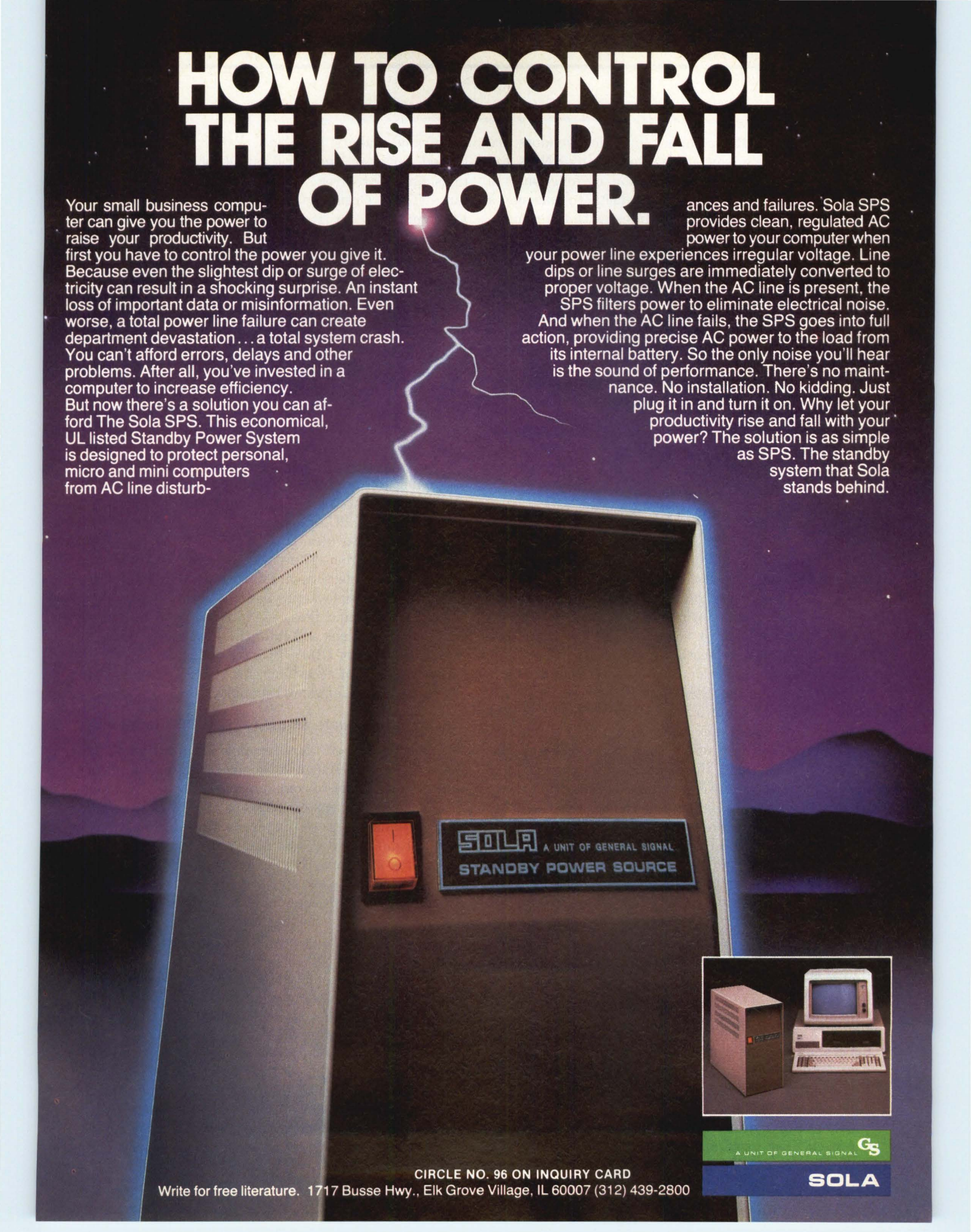

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terminals. Non-IBM terminal emulation vendors are aided in producing compatible products by SNA's six-layered architecture and separation of functions. In fact, SNA permits non-IBM products to manage a subset of SNA functional capabilities, with the remainder handled by the applications programmer.

To gain access to SNA networks, an applications program running on a terminal emulation product must gain access to an application running on the host. To do this, a software-based interface provides device control.

SNA-compatibility is an easy host-access interface, as it involves only the SNA peripheral network. This permits a vendor to sell into the large existing SNA customer base with minimal research effort.

Alternatively, a software-based interface can access the IBM (or compatible) SNA mainframe, permitting the non-IBM microcomputer to access SNA host databases and application programs. One example of a software product that permits non-IBM users to access the host is the DG/SNA software package from Data General Corp. (DG), Westboro, Mass.

SNA-compatiblity is an easy host-access interface, as it involves only the SNA peripheral network. This compatability permits a vendor to sell into the large existing SNA customer base with minimal research effort. The degrees of emulation and compatibility differ, obviously, with the many different product offerings. To emulate an SNA unit, like a 3270 terminal, the terminal emulation product must address all SNA layers appropriate to the sessions being used. (Sessions are temporary logical connections established by network-addressable units to communicate with each other. Session parameters define the manner in which data interchange will occur through a handshaking protocol.)

As an example of the full SNA support, PC Express provides 3274 cluster controller emulation and operation in a 327X display terminal. The unit allows access to the SNA environment and to 3770 RJE emulation. Providing IBM PC compatibility, it can also emulate the DEC VT52 and VT100 terminals, provide full file-transfer capability, and access and store mainframe data for local processing. The keyboard emulates the VT100 keyboard with numeric keypad, function keys and special user keys.

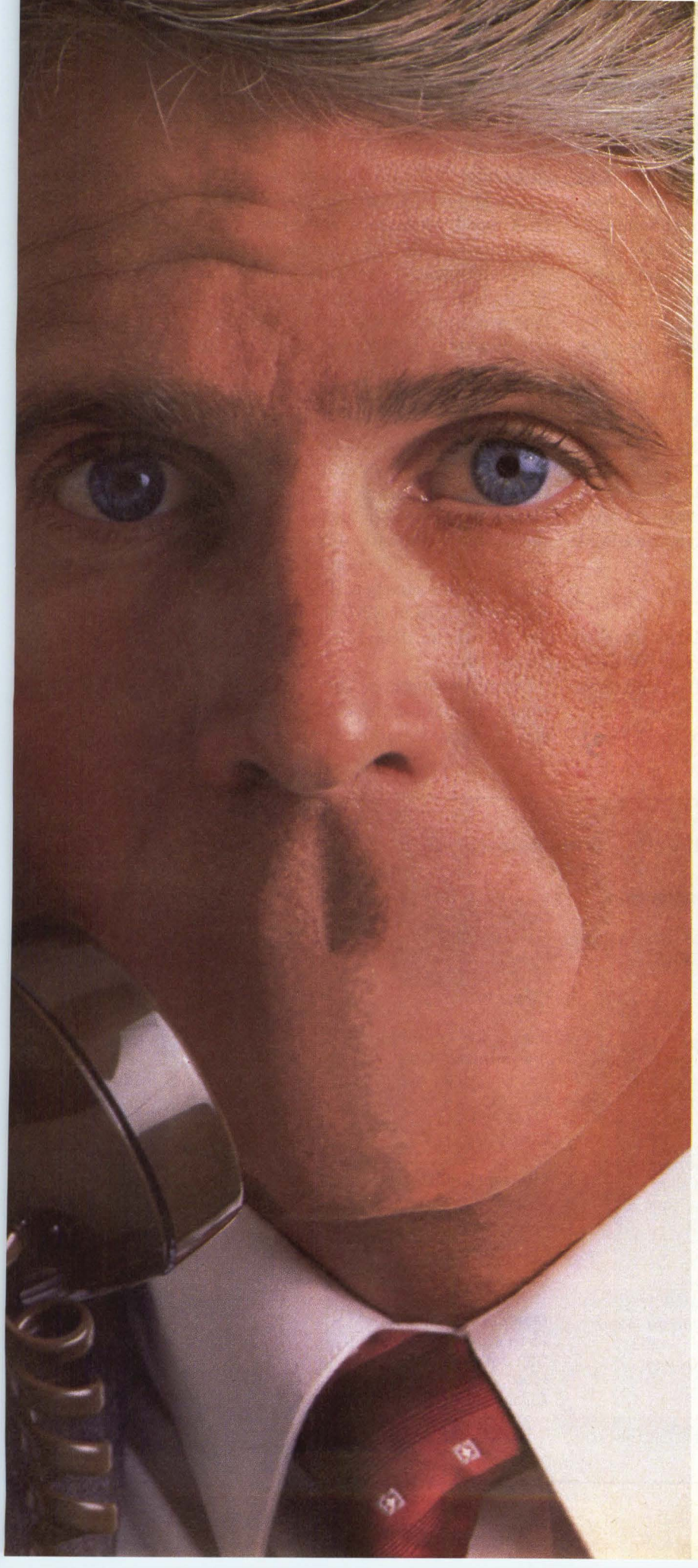
Other terminal emulation products take a different approach. They use the IBM PC to emulate other mainframe makers' terminals. For example, the integrated software family of asynchronous communications emulators from Insurance Technology Consultants (ITC), Orange, Calif., permits an IBM PC or PC-compatible to replace a Honeywell VIP7200, VIP7301 or VIP7303 terminal. This terminal emulation software requires no modification of existing host software and hardware, and uses the standard Honeywell terminal interface and functions. When combined with ITC's optional file-transmission facility FILE (Fast, Interactive, Logical Exchange), the PC becomes a powerful outboard processor in a Honeywell distributed processing network. FILE provides fast data file transfers between an IBM PC or PC compatible and a Honeywell GCOS 6 Mod 400 system. This development is only one of many that spell erosion for non-IBM mainframe terminal markets.

DEC and DG terminal emulation software is also beginning to enter this market. For example, Persoft Inc., Madison, Wisc., offers SmarTerm. This software turns an IBM PC into a DG D100, D200 or D400 terminal, or provides DEC VT52, VT100 or VT102 terminal emulation. The package provides ASCII and binary file transfers, an error-free mode, full keyboard emulation, multiple setup configurations, smart softkeys and command files, 75- to 9,600-baud operation, on-line help screens and full printer support. With the recent upgrade of IBM's PCjr, existing terminal emulation versions of SmarTerm for the PCjr, should improve terminal emulation capability.

Macintosh software emulates IBM, DEC terminals

Apple Computer's MacTerminal terminal emulation software for the Macintosh computer takes a different approach. In order to communicate with other computers, MacTerminal can emulate the DEC VT100 or IBM 3278 terminal by presenting icons, preset files, System folder, Empty Folder, and MacWrite or another word-processing program. By employing pull-down windows and dialog boxes to set up parameters, the user can set up the program to communicate with a remote host computer. By transmitting escape-code character sequences, the host can control the Macintosh screen and cursor.

For the MacTerminal software to emulate IBM and DEC terminals, Appleline hardware is required. Together, they permit the Macintosh to operate with an IBM 370 by emulating an IBM 3278 Model 2 terminal and working on-line only long enough to download data from the mainframe. From a real estate viewpoint, the Macintosh occupies half the footprint of a 3278. Unlike the 3278 with its demands made upon the mainframe, AppleLine and Macintosh are less vulnerable to response time slowdowns that can exceed half a minute



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when many users are making demands upon the mainframe's resources. Once the information is downloaded, users can use the Macintosh to manipulate the data.

Upon power-up, AppleLine, a three-pound box that fits under the Macintosh, performs self-testing diagnostics. Once logged into the IBM mainframe, pull-down menu commands duplicate operations carried out by the 3278 functions keys. Desired information is then put into the Clipboard or Scrapbook and the user logs off and processes the information with his local software.

MacTerminal software, in a manner uncharacteristic of other emulation software, easily accounts for the different file structures used by different programs. While other software requires a separate conversion utility written for each application, MacTerminal's editing commands permit the user to reformat data without using a conversion program.

Product characteristics expand

The micro-to-mainframe terminal emulation market is embryonic, and many players are entering the field. As might be expected, their products offer a diverse and homogeneous mix of characteristics.

For example, TRU/BLU from Timeplex Inc., Woodcliff Lake, N.J., provides full-screen IBM 3178 emulation, and permits users to function just as they would on IBM word processors and IBM PCs. The IBM 3278 connects to IBM 3274 standalone controllers and IBM 3276's integrated controller (which can support seven 3278s), and is IBM's main product in this line. It offers four screen sizes, and can be configured in one screen size at a time. Other products in the line emulate other IBM terminals.

AST Research Inc., Irvine, Calif., provides a range of integrated hardware/software products capable of emulating IBM terminals or creating PC-based local area networks. They permit the IBM PC to function like a terminal for a host system or as a standalone computer for smaller tasks, thus not bogging down the mainframe host with unnecessary small jobs. It also permits the PC to complete local computing without telephone line charges. The AST-PCOX allows a PC to emulate a 3278 or 3279 display terminal, and connects the PC to an IBM 3274/3276 cluster controller via coaxial cable.

Other products in the line include the AST-SNA, which emulates a 3274/3276 controller and a 3279 display terminal using the Synchronous Data Link Control

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(SDLC) protocol. SDLC is the bit-oriented protocol used in an SNA network to transmit data in frames over a communications link.

AST-BSC emulates 2770 batch RJE (Remote Job Entry) and remote 3270 terminals using the 3270 bisync protocol. (The bisync or BSC protocol is short for "bisynchronous synchronous protocol." It marks the start and end of text, headers and transmission blocks, and checks for transmission errors.) RJE facilitates batch job submission to a host from remote sites over communications links. This AST-BSC and equivalent emulation products enable various terminals, including the PC, to emulate transmission terminals.

'The 3270 is basically the standard for emulation. IBM has 70 percent of the mainframe market and it dominates the 3270 market and the PC market'.

Hewlett-Packard Co. (HP), Palo Alto, Calif., has also developed products to emulate various 3270 display terminals. Its group of interactive products, the DSN/3270 Display Station Emulation for Series 100 or 200 enables the HP 150 or Series 200 computer to emulate a 3270 display terminal. Other emulation products enable the HP 150 to emulate an IBM 3278 display terminal. The Series 200 line includes several models. Those with display enhancements support the 3270 emulator.

Motorola/Four - Phase Systems Inc., Cupertino, Calif., targets its software terminal emulation product Vision-Linc toward the distributed data processing marketplace. Vision-Linc enables Four-Phase's Vision system to emulate the host in a 3270 bisynchronous network. Vision, an advanced, transaction-oriented distributed processing system, combines source data entry, on-line inquiry and retrieval, standalone processing and batch communications. Vision provides a balance between local and central processing and data bases, with both batch and inquiry communications to the host mainframe.

The ability to perform like the host in a 3270 environment permits Vision to communicate with 3270 control units and give these control units interactive access to Vision applications and the Vision database. Vision-Linc provides 3270 communications without having a mainframe.

"The systems that will support the 3270 Vision-Linc emulator," states Howard Trailkill, president of Four-Phase Systems, "are any mapped machine from our Series 4000 or 5000. Terminal emulation fits in with the Four-Phase product family, which includes processors, operator workstations, communication facilities, various peripherals and extensive software." The series 4000 systems support as many as 32 operator stations and can store video images in RAM, permitting users to manipulate data without actually transferring it to the local terminal. This setup permits those systems using the terminal emulation and 4000 capabilities to improve system productivity and increase the speed of interaction with the system. The series 4000 disk storage ranges from 2½M bytes to 574½M bytes. Series 5000 supports as many as 64 workstations and offers 6M bytes of RAM and 150M bytes to 2.2G bytes of disk capacity.

Vision-Linc conforms to IBM standard 3270 bisynchronous EBDIC protocol in communications with 3271/3274-1C control units. Asynchronous terminals are interfaced to Vision-Linc systems with protocol converters to change BISYN EBCDIC from Vision to ASCII ASYNCH for the terminals.

Taking another approach, Molecular Computer Inc., San Jose, Calif., offers IBM 3270 and 3780 emulation communications software, CLEO-3270 and CLE0-3780, that make the firm's multiuser business systems compatible with IBM mainframes. "Both packages function as IBM 3276/2 cluster controllers for ASCII terminals," says Harvey Hartman, senior vice president of marketing. Molecular's installed base exceeds 4,000 multiuser system supporting over 15,000 users. Hartman adds that, "In the past, most of our systems were sold to smaller companies. Offering CLEO emulation software now gives us the capability to attract larger corporate end users."

CLEO-3270 emulates an IBM 3276/2 display controller and supports as many as eight 3278 interactive display terminals or 3287 Remote Batch Workstations for high speed transmission and reception of files over telephone lines. "Users will be able to run multiple applications in a cost-effective manner, without investing in an IBM 3270," says Hartman. "Users can alternate between data processing and using WordStar locally on their Molecular system, thus making it a double-duty system."

Hartman admits that in the past it was impossible to transfer files between two Molecular systems except with an asychronous modem that communicated at a much slower speed than the 9,600-baud transmission rate both packages support. Like many firms, Molecular is positioning its products to invade the larger corporations.

Joined forces create synergistic strength

Another significant trend is the joining of forces between different companies, with each bringing its own strengths to bear upon the micro-to-mainframe battlefront. Ashton-Tate, Culver City, Calif., creator of

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CIRCLE NO. 99 ON INQUIRY CARD

the relational database-management dBase II and III programs, recently entered into a joint venture with Informatics General Corp., Woodland Hills, Calif., resulting in the creation of a micro-to-mainframe system called dBase/Answer. The package permits IBM PC users to access virtually any IBM mainframe file or database-management system, and makes it possible to manipulate this data on their PCs. By transferring information directly from mainframe to microcomputer, the software eliminates time-consuming rekeying. Mainframe security is maintained, as the management-information-system and data-processing departments can specify portions of the database that are accessible to each microcomputer user. Users can then only download or upload and manipulate only the data specified.

The dBase/Answer system requires 256K of RAM in the IBM PC (or XT) and two disk drives. Although the price tag is only $500, users require a modem and circuit cards inserted into the IBM PC slots to use the dBase/Answer software.

After selectively extracting data from the mainframe database, information is provided to the PC in a format usable for dBase II/III, Friday and Framework. States Merritt Lutz, software products group vice president of Informatics, "We positioned dBase/Answer as the next step toward total micro-to-mainframe integration. This software extends the power of dBase II/III, Friday and Framework to virtually any corporate database."

Informatics is a leader in software universal data extraction technology for corporate DP organizations, and Ashton-Tate is a front-runner in microcomputer database systems and applications. The two firms will market the software products to their respective customers. The synergistic combination of this approach has the potential for setting a trend in this field. □

Interest Quotient (Circle One)
High 846 Medium 847 Low 848

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The Interpreter section of Mini-Micro Systems' December issue focuses on office-automation systems.

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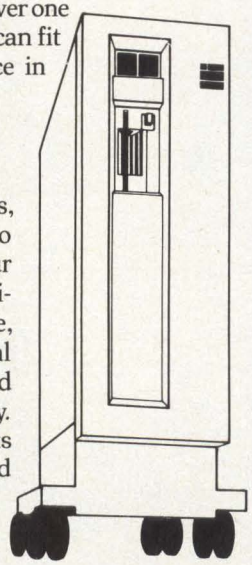

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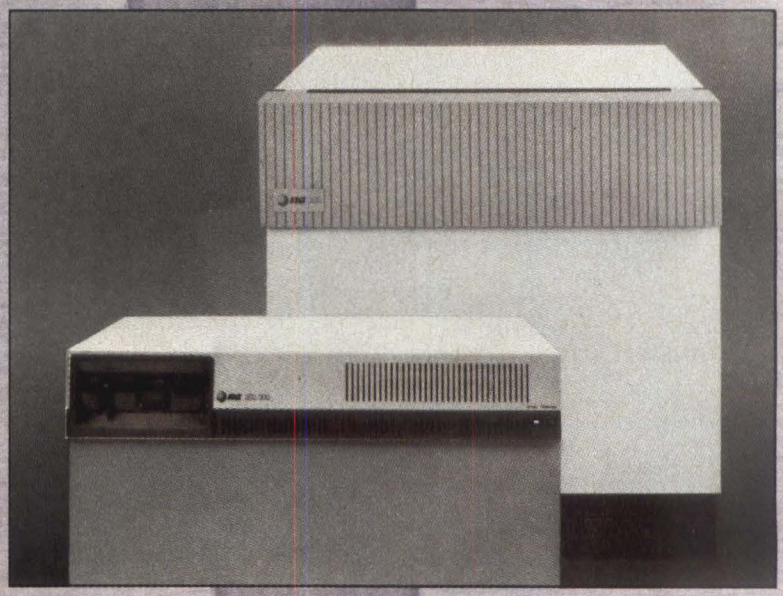

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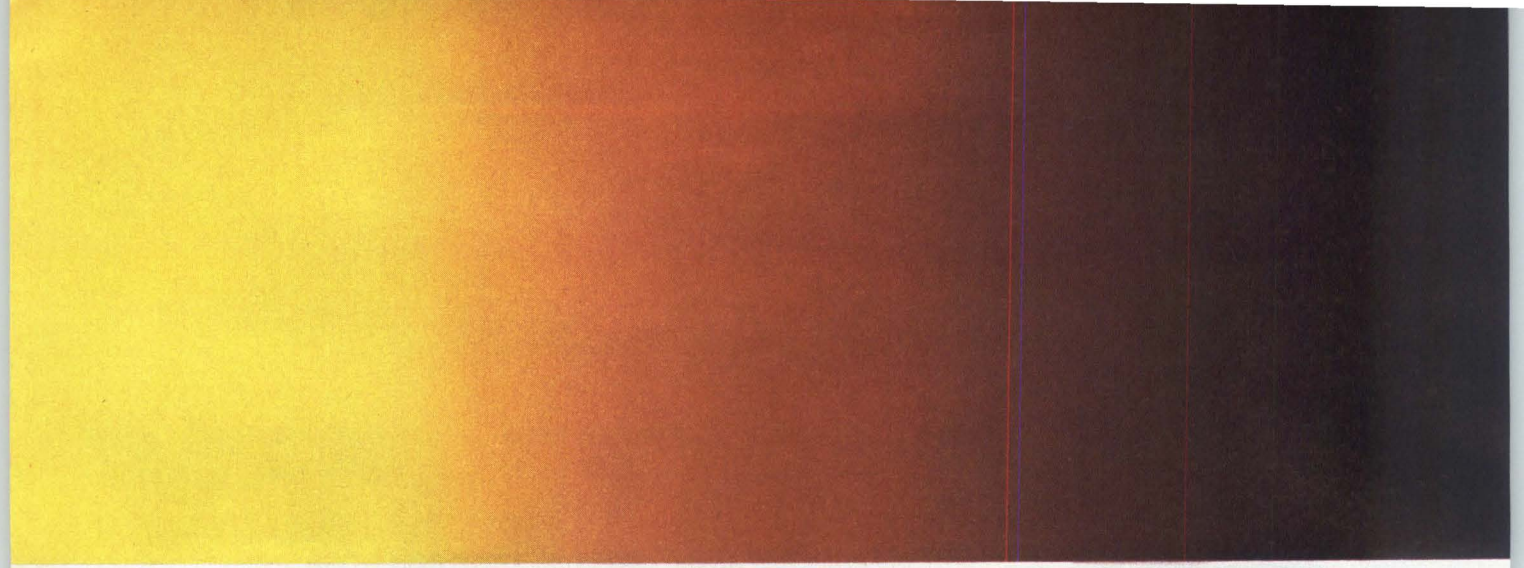

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CIRCLE NO. 102 ON INQUIRY CARD

Software-transparent front-end processor links hosts, terminals to Ethernet

Communications processor reduces computer-room cable maze and increases file-transfer speed by multiplexing as many as 48 X.25 virtual circuits over one line

Judith Estrin and **J. Patrick Malone,**
Bridge Communications Inc.

The CS/1-X.25 communications server is a front-end processor that connects host computer systems supporting standard X.25 software and hardware interfaces to an Ethernet local-area network (LAN). With support for as many as 48 multiplexed virtual circuits over a single X.25 line, the CS/1-X.25 reduces the computer-room cable maze and increases file-transfer speed to 64K bits per second (bps). Bridge Communications Inc.'s CS/1-X.25 does not require modification to the software of hosts that support an X.25 Data Terminal Equipment (DTE) software package.

There are two prevalent ways to connect a host computer to a LAN. The most common is to attach the host's RS232 terminal or modem ports to ports on a

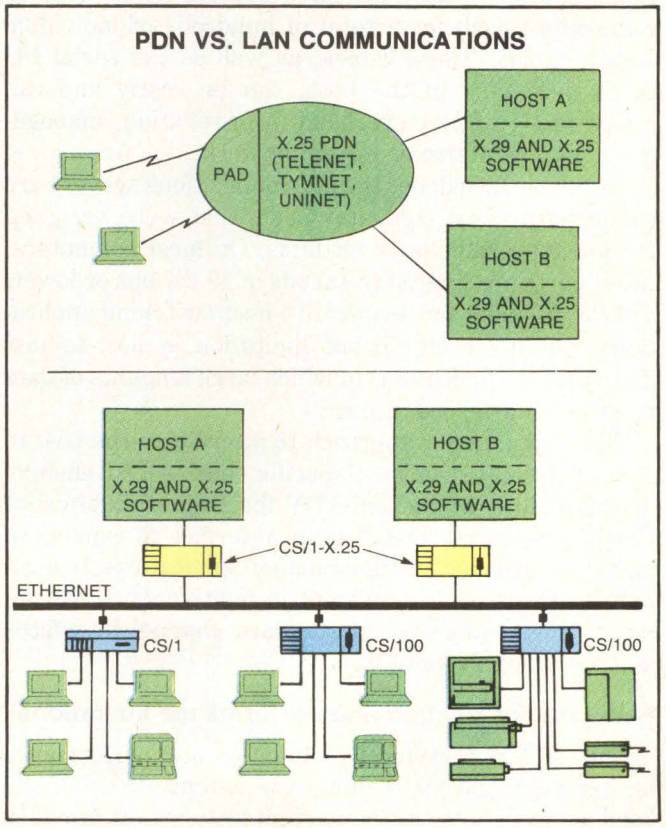

Fig. 1. Terminal-to-host communications *can take place over a public data network (PDN) (top) or over a LAN (bottom). In a PDN, terminals access a local packet assembler/disassembler (PAD) on switched lines at low speed. In a Bridge X.25/Ethernet network, communications servers, such as the CS/1, CS/100 and CS/1-X.25, link various systems and devices to the Ethernet cable. The communications servers act like PADs, performing multiplexing and packet handling. The CS/1-X.25 acts like a host interface to a PDN, enabling the host to support terminals as if they were connected over an X.25 network.*

communications server. The communications server manages the LAN interface, high-level protocol processing and multiplexing and demultiplexing of terminal traffic to the host. The communications servers collectively form a physically distributed data switch capable of interconnecting multiple host computers and hundreds of RS232-based devices.

Using RS232 ports provides transparent connection for terminal-to-host communications. However, two limitations remain—one related to physical installation; the other, to performance.

Using RS232-based communications servers in a terminal-switching application eliminates the need for much of the long-distance, point-to-point cabling required with centralized switches. However, it doesn't reduce the need for running short RS232 cables between the communications servers and the computer's ports. Although the overall cable maze is reduced considerably, it is still a major problem in the computer room. Many installations have several hosts with 32 connections each for a total of hundreds of individual RS232 cables. These cables, as well as the serial I/O cards necessary in the host, can be costly and can generate significant overhead in installation, management and maintenance of the network.

The CS/1-X.25 makes the LAN environment look like a PDN to the host.

As for performance, the communications servers are connected to host computer ports that were designed for use by terminals or modems. On most computers, these ports are limited to speeds of 19.2K bps or lower. This is sufficient for terminal-to-host switching applications, but it's a significant limitation in host-to-host file-transfer applications in which large amounts of data must be transferred at once.

The second major approach to interfacing the host to a LAN is to use a host-specific, high-speed channel interface such as the DR-11W for Digital Equipment Corp. computers. The channel interface is capable of high performance in file-transfer applications but requires extensive development in multivendor environments due to the lack of standard channel interfaces and operating systems.

Reducing installation and performance limitations

The CS/1-X.25 reduces installation and performance limitations while maintaining the independence of the host computer's operating-system software. It provides a host interface for terminal switching and host-to-host file-transfer applications and minimizes cabling and installation requirements.

The X.25 protocol is an accepted standard for multiplexing data streams over a single interface. Most minicomputers and mainframes support X.25 interfaces for connection to an X.25-based Public Data Network (PDN) such as Telenet or Tymnet. These interfaces operate as fast as 64K bps. Many computer vendors also provide file-transfer packages, built onto the X.25 protocols, that facilitate file interchange between remote computers over a PDN. Such packages can be used without modification to transfer information between hosts on a LAN via the CS/1-X.25.

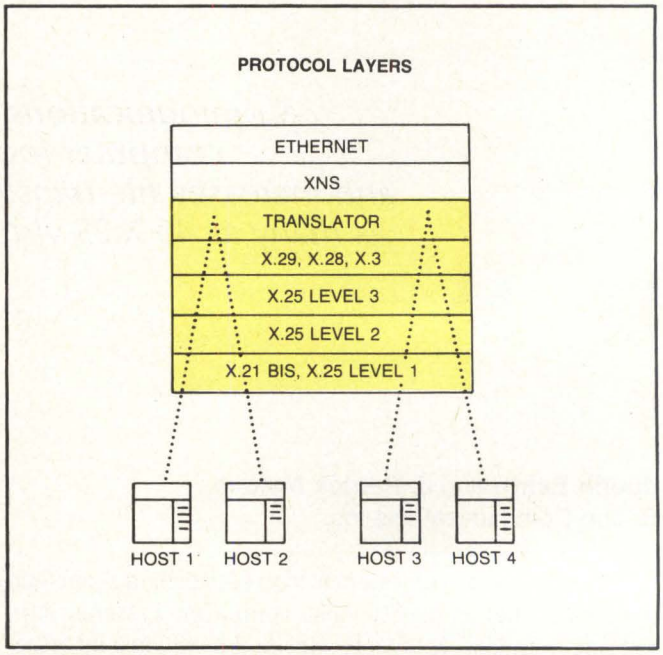

Fig. 2. The CS/1-X.25 *supports as many as four hosts. In standalone host-to-host file-transfer applications, the CS/1-X.25 does not process packets through the Xerox network system (XNS) or Ethernet protocol layers.*

Users can select an X.25 packet in sizes from 128 to 1,024 bytes, allowing users to trade off throughput vs. the number of sessions. File-transfer applications, for example, benefit from larger packets to achieve higher throughput. Terminal-oriented applications benefit from using the maximum number of terminal-to-host sessions with medium to low duty-cycle demands.

For terminal-switching applications, the CS/1-X.25 uses the X.3/X.28/X.29 protocol standards above X.25. These standard device protocols are typically used for teletypewriter-like terminal-to-host interaction across a PDN. In a CS/1-X.25 Ethernet network, a terminal or microcomputer connected to the Ethernet LAN via a Bridge CS/1 or CS/100 communications server can access a host computer attached to a CS/1-X.25. The

SUDDENLY THE TAPE CONTROLLER IS OBSOLETE.

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terminal traffic appears to the host as if it were coming from a packet assembler-disassembler (PAD) on the PDN. Thus, the CS/1-X.25 makes the LAN environment look like a PDN to the host (Fig. 1).

The CS/1-X.25 multiplexes as many as 48 connections over an X.25 serial line to the host computer, thus replacing as many as 48 RS232 cables. In the case of heavy duty-cycle sessions in which the X.25 link speed might cause a bottleneck, the CS/1-X.25 can support as many as four lines for an aggregate throughput of 150K bps in full-duplex mode.

A multiline CS/1-X.25 can also be used as a standalone X.25 link switch for file-transfer applications between as many as four hosts. In standalone mode, host-to-host connections do not go over the Ethernet cable. Thus, data need not be processed through Xerox Corp.'s Xerox network system (XNS) and Ethernet protocol layers (Fig. 2).

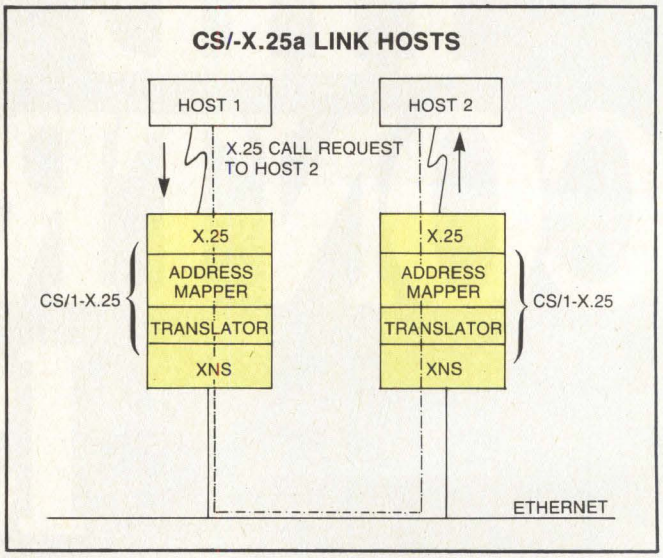
Fig. 4. Host-to-host communications *begin with a call request from Host 1 to an attached CS/1-X.25. The translator processes the request and receives the Xerox network system (XNS) address for Host 2's CS/1-X.25, establishing a connection between translators. The address mapper in Host 2's CS/1-X.25 then identifies the X.25 address of Host 2 and establishes the connection.*

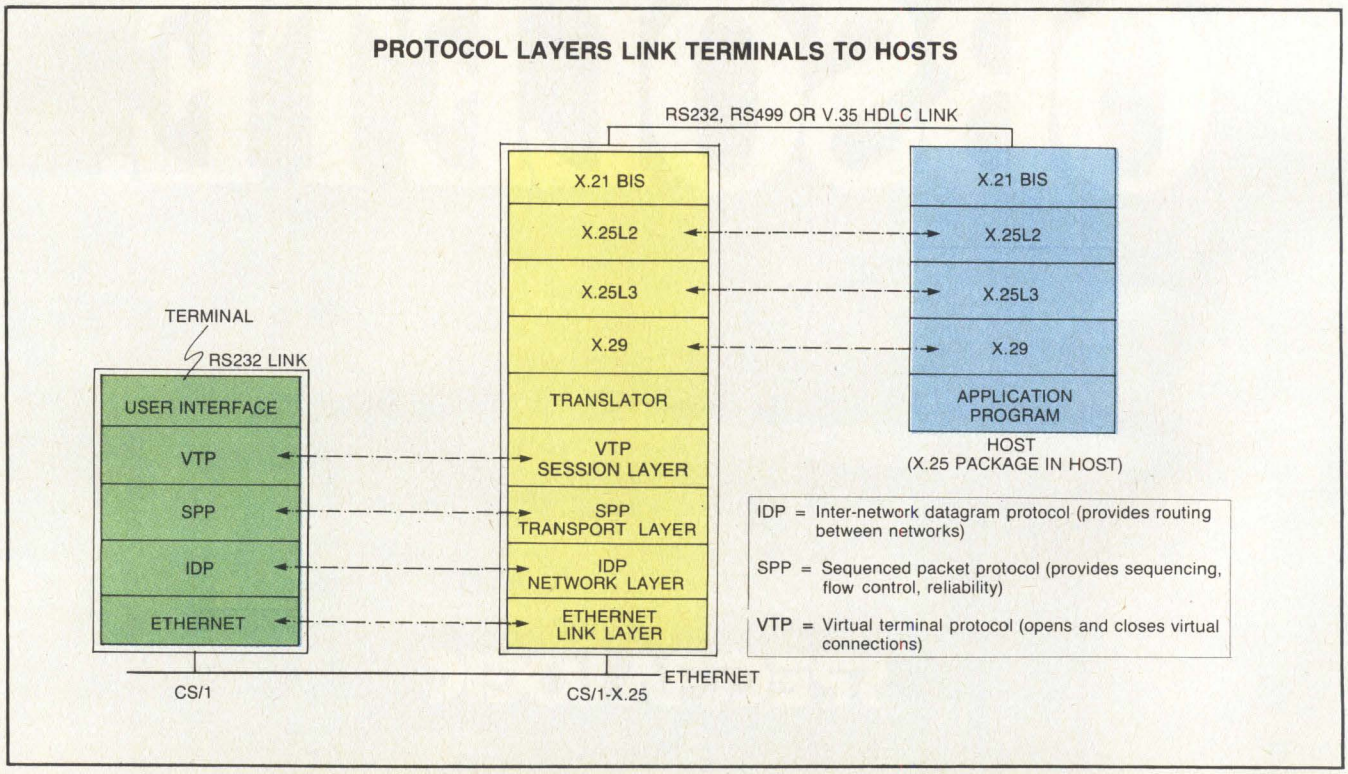
Fig. 3. Establishing and maintaining a virtual circuit *between a terminal attached to a CS/1 and a host computer attached to a CS/1-X.25 requires the use of 19 protocol layers.*

CS/1-X.25 employs one cable

The CS/1-X.25 attaches to the host computer via a single cable, over which X.25 virtual circuits are multiplexed. It can accommodate the three standard interfaces used for connection to a PDN: X.21bis (RS232) for speeds as high as 9,600 bps and RS422/449 or V.35 for speeds as high as 64K bps. The computer I/O port that would ordinarily be connected to the PDN modem is instead connected directly to the CS/1-X.25.

After the CS/1-X.25 is installed in front of the host, any terminal linked to a CS/1 or CS/100 communications





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Disk Emulation	RM02/05, RM80, RP06 (2 drives)	RM02/05, RM80, RP06 (4 drives)	RK06/07 (4 drives)
Tape Emulation	TS11 (4 drives)	TS11 (4 drives)	TS11, TM11 (4, 8 drives)
Disk Transfer Rate (SMD)	2.0MB/sec	2.0MB/sec	2.0MB/sec
Configurable On-Line	Yes	Yes	No
*Single function disk controller			

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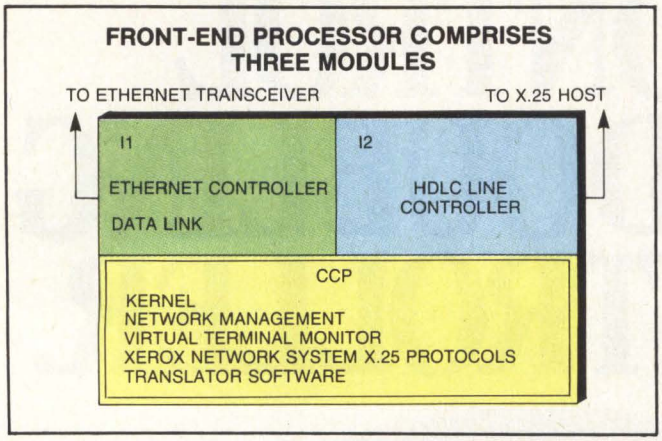

Fig. 5. The CS/1-X.25 consists of three modules: *the central communications processor (CCP), which manages the network, supports virtual circuits and performs Ethernet-to-X.25 translation; the Interface 1 (I1) module, which connects to the Ethernet; and the I2 module, which supports high-level data-link control (HDLC) and connects to the host.*

server in the network can gain access to the host by establishing virtual connections. A user accesses the host via a preassigned logical name contained in the "clearinghouse," which resembles a telephone directory.

To transmit information from a terminal attached to a CS/1 to a host computer attached to a CS/1-X.25, the user issues a connect command to the host. The CS/1 finds the name and the host destination address in the clearinghouse and issues a connect request to the host's CS/1-X.25. This involves the Bridge virtual terminal protocol (VTP) and the XNS sequenced packet protocol (SPP) and inter-network datagram protocol (IDP) on both the CS/1 and the CS/1-X.25 (Fig. 3).

The CS/1-X.25 multiplexes as many as 48 connections over a single serial line to the host computer.

On receipt of the connection request, the CS/1-X.25 translator notifies the host of an incoming call. The X.25 software (levels 1, 2 and 3) is involved on both the CS/1-X.25 and the host. When the host accepts the call, the CS/1-X.25 accepts the connection from the CS/1 and the user is notified of the successful connection.

The CS/1 maps any modified terminal parameters into the proper X.3 port parameters and communicates them to the host via the X.29 protocol. The host also can modify terminal parameters using the X.29 protocol. The translator then maps these parameters and passes them on to the CS/1 via the VTP protocol. The X.29 protocol is not used for host-to-host applications.

In the case of host-to-host communications, an address-mapper module performs the mapping from an X.25 host address to a complete LAN address on a CS/1-X.25. Host 1 issues an X.25 call request to the CS/1-X.25, using Host 2's X.25 address as a destination address. The CS/1-X.25 translator receives the call request. The address mapper supplies the LAN address corresponding to Host 2's X.25 address. The translator establishes an XNS connection to the translator residing in the CS/1-X.25 connected to Host 2. Thus, the XNS connection is extended via the translator through an X.25 virtual circuit to Host 2 (Fig. 4).

The CS/1-X.25 incorporates multiple 68000 microprocessors and a Multibus backplane with four free slots for host connection. The system consists of three logical modules: the central communications processor (CCP) module and two external interface modules (I1 and I2) (Fig. 5).

The CCP module includes the main CPU (MCPU) board, which contains a 10-MHz 68000 microprocessor and 384K bytes of local memory. This memory is used as code and local data space, so that opcode fetch operations do not require Multibus access. The kernel, communications protocols and X.25 levels II and III software execute on the MCPU.

The I1 module contains an Ethernet (or IEEE 802) interface, a 68000 for execution of the Ethernet data-link code and a 128K-byte shared buffer that is used as a packet buffer area for the various protocol layers. The shared memory also provides the common address space used for inter-processor communication. The Ethernet interface contains a sophisticated chaining direct memory access (DMA) capable of performing scatter/gather operations on incoming or outgoing Ethernet frames. This function, combined with the features of the kernel buffer manager, eliminates the need for copying packet buffers as they are passed through the protocol layers because the packet is never moved from shared memory. The CCP and I2 modules process the packets directly.

The I2 module consists of a dual-port, intelligent high-level data-link control (HDLC) serial interface and a serial I/O driver based on another 68000. It transfers data at rates up to 64K bps. □

Judith Estrin is vice president of engineering, and **J. Patrick Malone** is product marketing manager at Bridge Communications Inc., Mountain View, Calif.

Interest Quotient (Circle One)
High 849 Medium 850 Low 851

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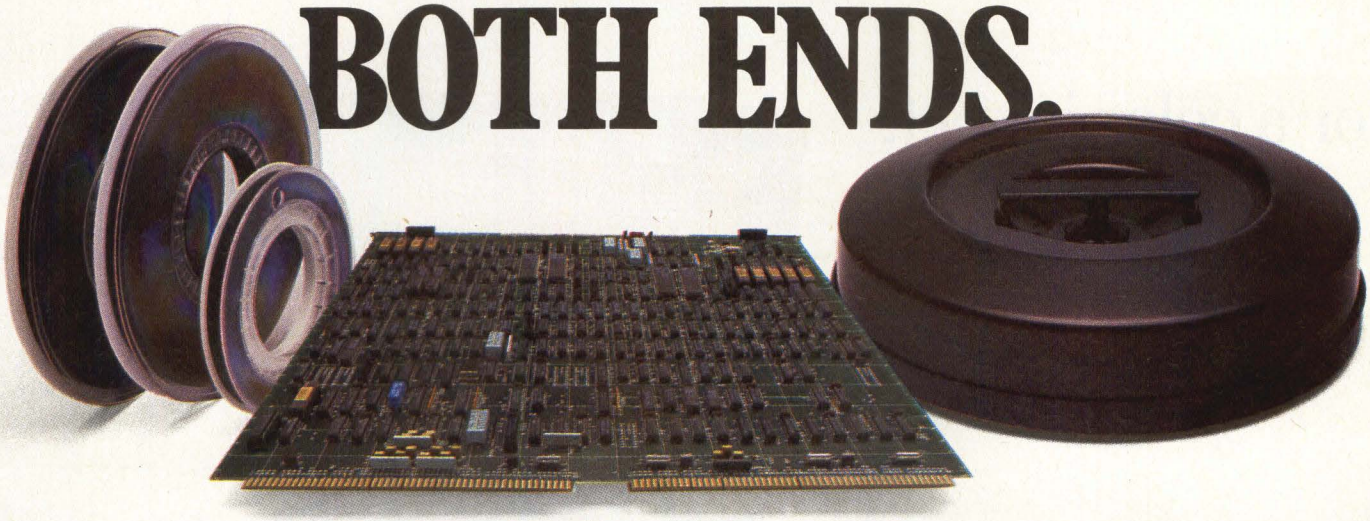

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BUS (Disk)	Burst Multiplexor Channel	Data Channel	Data Channel
Disk Emulation	606X, 6122, 6160, 6161 (4 drives)	606X, 6122, 6160, 6061 (4 drives)	606X (4 drives)
Tape Emulation (Data Channel)	6021	6021	6021
Operating Systems (without OS patches)	RDOS, AOS/VS	RDOS, AOS	RDOS
Disk Transfer Rate (SMD)	2.0MB/sec	2.0MB/sec	2.0MB/sec
Supports FCC Chassis	Yes	Yes	No

*Single function disk controller

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CIRCLE NO. 105 ON INQUIRY CARD

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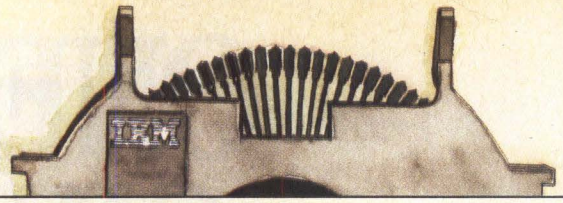
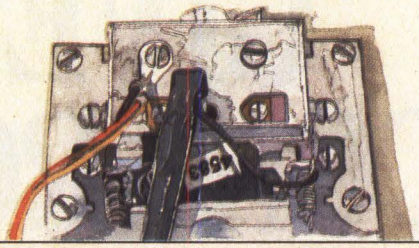
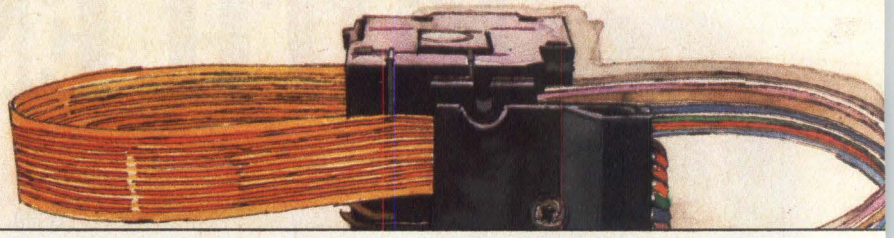


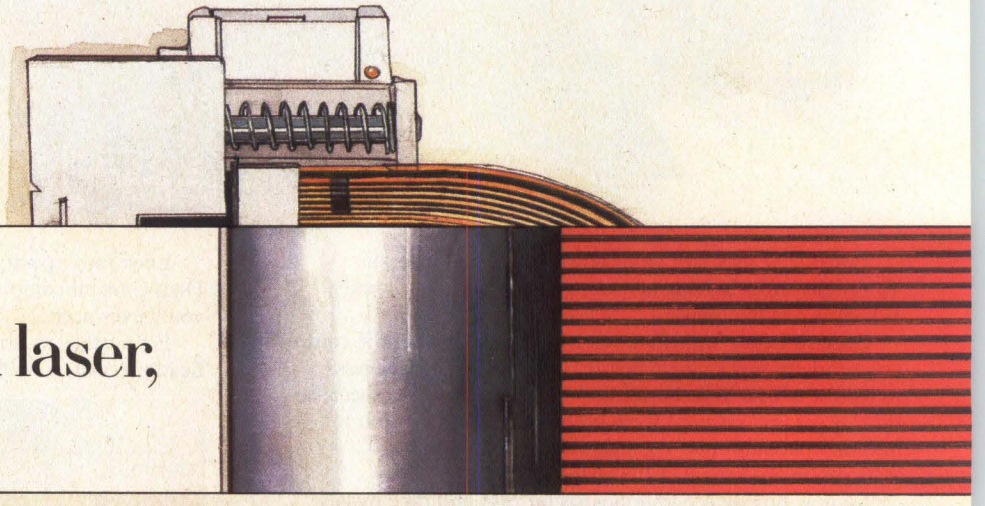
or an ink jet,



or a color ink jet,



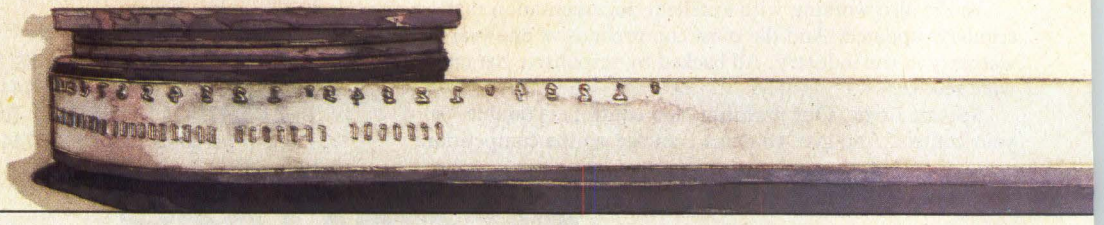
or a thermal,



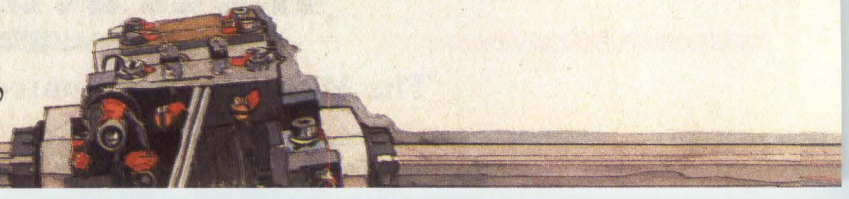
or a laser,

or a Selectric®,

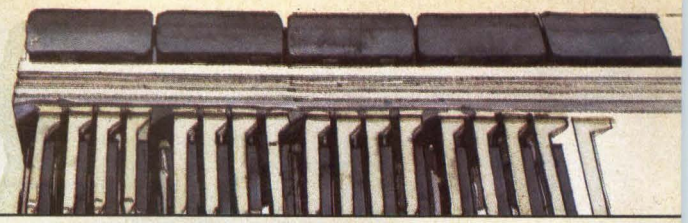
or a band,



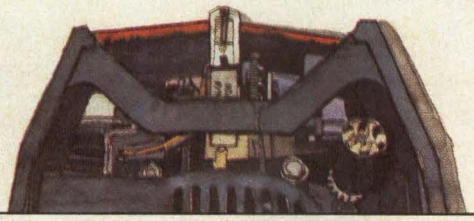
or an electro-erosion,



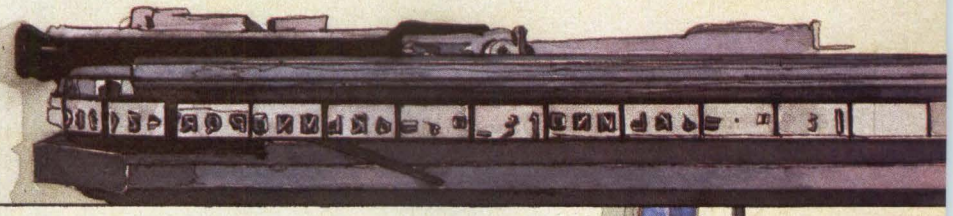
or a dot matrix,



or a color dot matrix,



or a train printer,



or even a plotter. Because we alone give you the choice of all of them.

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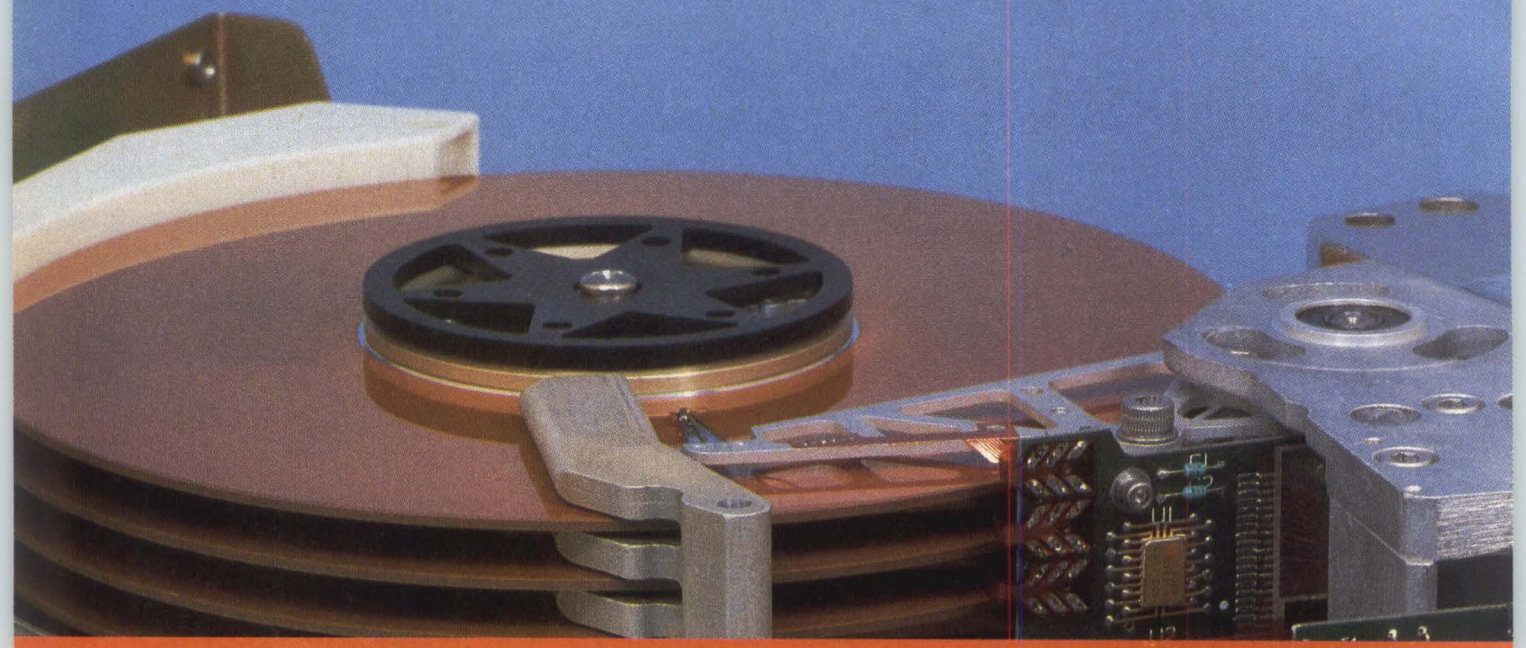
IBM PRINTERS

The Finishing Touch

CIRCLE NO. 106 ON INQUIRY CARD

A Hard Driving Success Story.



Innovative engineering in mechanical design and electronics with proven heads and media technology have been combined by PPC to create the DX Series 8-inch Winchester Disk Drives. Newly released, yet already well received by OEMs, the DX Series offers high performance, high capacity disk storage.

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CIRCLE NO. 107 ON INQUIRY CARD

COMDEX/Fall '84 Preview

Exhibitors and speakers spotlight multifunction products: multiuser systems and multiapplications software packages

Lynn Haber, Associate Editor

Attendance figures are expected to swell above last year's 83,000 mark as visitors convene November 14-18 in Las Vegas for the 6th National Fall Conference and Exposition (COMDEX/Fall '84) for independent sales organizations (ISOs).

Conferees will peruse the wares of approximately 1,400 exhibitors, which include manufacturers of small computer systems, related peripherals, software, accessories and providers of services and supplies.

Of particular interest at this season's show are multifunction products, like multiuser computer systems and multiapplications software packages.

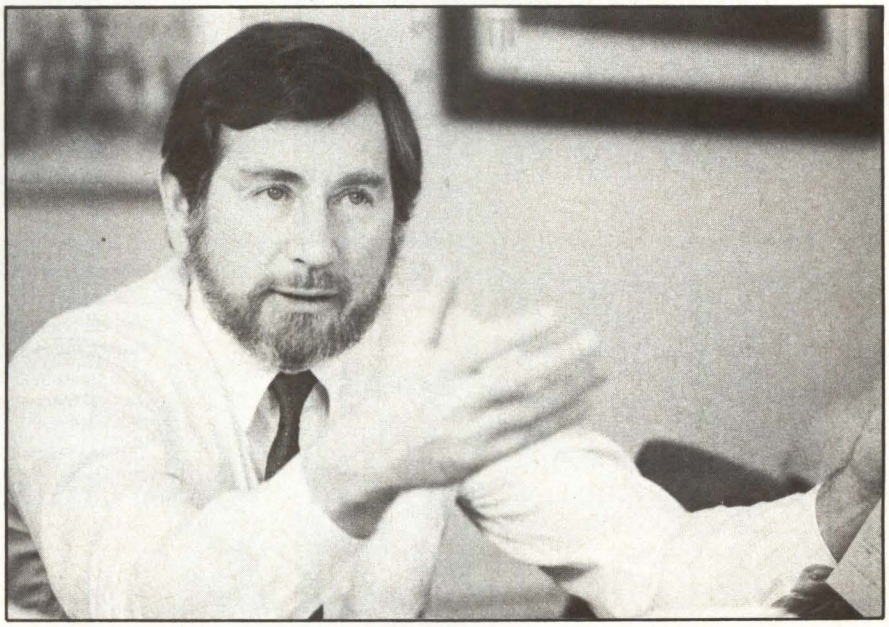
Almost single-handedly responsible for the multiuser market imperative was IBM's August announcement of the Personal Computer AT. Based on Intel Corp.'s 80286 microprocessor, and running under the PC XENIX operating system, the PC-AT can operate as either a multiuser system or a standalone computer. Multiuser systems allow people working at computers or terminals to perform tasks simultaneously, as opposed to the single-user approach of the personal computer.

Other multiuser system manufacturers and exhibitors at COMDEX/Fall include Digital Equipment Corp., Data General Corp., and smaller companies such as Fortune Systems Corp., Altos Computer Systems and Durango Systems Inc.

An important issue in this year's marketplace is the conflict between dealer and direct sales forces. Several sessions will examine the issues and possible solutions to this problem.

Forty-five sessions will explore topics pertaining to

Amy Wohl, president of Advanced Office Concepts, *will conduct a session on the future of small systems.*



"These [portable] systems are worth buying, *but people don't know that," says Gene R. Talsky, president of Professional Market Management.*

HERE ARE THE FOUR DAYS OF THE CONFERENCE

	Wednesday	Thursday	Friday	Saturday
9				
10	Keynote	ISOs vs. Mass Merchandisers		
11		The Software Shake-up	Government's Hand In ISO Success	Automating the Small Office: A Role for Resellers? The Education Market: Finding your Niche International Distribution Strategies Software Demo Dynamos Managing Your Sales Team
12		Local Ads and Promo for Lead Generation "New and Improved" Prospecting Techniques Add-Ons to the Rescue Financing ISO Growth		
1	Small Systems Forecast Shuffling Shelf Space for Increased Profits		Living With Cross-Channel Conflicts	
2	Microprocessor Companion-Chips Integrated Packages: Power vs. Functionality Stay an Independent, Go Chain or Franchise?	Computers in the Home: Redefining the Market Software Distribution: Changes and Challenges Strategies for Retail Specialization: What's Right for You?	Direct Response Tools and Techniques Closings You'll Never Forget Preview of New Storage Alternatives LANs, Links and Lettuce	The 1990 Resellers Market
3	Retail Sales Forecast Portables and Transportables UNIX and the Multi-User Opportunity	Strategic Selling for Lucrative Results Multi-User Systems: Issues and Impacts	Telemarketing Strategies for Computer ISOs The Corporate Sell: Who Profits and How?	
4	Educational Software: All Ages Can Learn! ISO Contractual Protection	ISO/Vendor Roundtable	New Deals in Database Dollars Vertical Markets: The 1985 Overview Training Products for Resellers and Users	
5				

the business of designing, manufacturing, marketing, selling and supporting small computers. Seminars will cover such topics as the microcomputer marketplace, directions in distribution, one-on-one marketing, retail success routes, systems sales training, the software market and business strategies for ISOs.

A few new sessions incorporated in this fall's line up include "ISOs vs. Mass Merchandisers," "Government's Hand in ISO Success," "The Software Shake-Up," and "Living with Cross-Channel Conflicts." Other, more familiar, topics will be presented from a new perspective.

Speakers focus on small systems

Chairing a Wednesday (Nov. 14) talk entitled "Small Systems Forecast," Amy Wohl, president of Advanced Office Concepts Corp., Bala Cynwyd, Pa., will focus on small-business systems as used by small businesses or small groups within a company. According to Wohl, these systems will be viewed from two perspectives—physically small systems used by large companies and small systems used by small companies.

Past COMDEX coverage on this topic emphasized operating system software. Wohl says this year's discussion will attempt to balance coverage of hardware, operating system software and applications software. "We'll try to spend more time on the small-business system, rather than on the computer that happens to be small," she says. "We'll also look at what kind of hardware is coming into this market, the types of operating systems that are going to be seen in that hardware, what kind of application software is available now and what's going to come along."

Wohl plans an equally significant focus on the IBM PC-AT, with particular attention placed on the multiuser (PC) XENIX operating system and the company's PC local area network. "We're going to say, 'Hey, the market has changed.' It's the three-year anniversary of the birth of a piece of this industry and we're now going to try to recalibrate based on that change," asserts Wohl. "We have lots to talk about."

Later that afternoon, Gene R. Talsky, president of Professional Market Management Inc., an Old Lyme, Conn.-based consulting firm, will look at the portable and transportable computer market. As session organizer, Talsky will present an overview of applications and market strategy. He'll examine more closely what he terms the "false hopes" and projections for this industry segment. "Dealers are selling capability rather than a device," he says. If the portable market is to gain momentum, dealers and manufacturers must change the public's perception of these machines, according to Talsky. "These systems are worth buying, but people don't know that," he says.

International marketing differs *from U.S. marketing both legally and culturally, remarks Barry E. Wagman, president of International Software Export.*

Also speaking will be Thomas Kinch, president of MicroOffice Systems Technology Inc., Fairfield, Conn. The firm markets the Roadrunner, a five-pound, CP/M, Z80-based portable computer. Lisa Williams, president of STM Electronics, Menlo Park, Calif., will center on the transportable computer market and on the transportable as a desktop computer.

Speaking at a Thursday afternoon session, "Software Distribution: Changes and Challenges," Egil Juliussen, chairman of the board and senior vice president of research at Future Computing Inc., a Texas-based company, will examine the trends in software stores, the direct sales method of software distribution and electronic distribution.

Distribution conflicts and strategies

Deborah de Peyster, editor of *Micro-Market World*, will chair a Friday afternoon session entitled "Living with Cross-Channel Conflicts." Discussion will focus on the problem between dealers who complain that there are too many channels of distribution, and manufacturers, who dealers feel set up these avenues. According to de Peyster, the result of this situation is too many distributors competing with one another to sell the product. "This is an historic problem," she states. "Each channel feels it can handle the whole market. So, you have to start drawing lines denoting territory."

The speaker will outline some of these cross-channel conflicts, and then look for possible answers or ways of eliminating the problems to find effective distribution solutions.

For those companies preparing to enter the interna-

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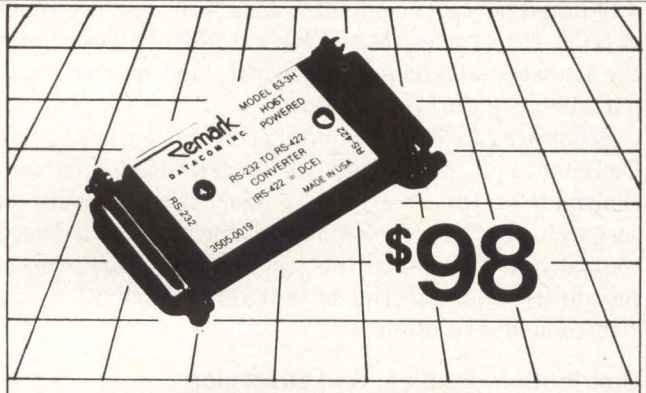

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CIRCLE NO. 109 ON INQUIRY CARD

tional marketplace, or for those already operating overseas, a session entitled "International Distribution Strategies" will examine how to approach the international marketplace, what to do once you're there and what is unique about that marketplace.

According to the session organizer, Barry E. Wagman, president of International Software Export Corp., Los Angeles, Calif., international marketing differs from U.S. marketing both legally and culturally.

If the portable market is to gain momentum, dealers and manufacturers must change the public's perception of these machines.

In approaching the marketplace, the speaker will examine what vehicles are available to the entrepreneur and the ramifications of each of those vehicles. Also to be discussed will be the pros and cons of overseas distribution outlets, using export and trading companies, getting consultation and distributing your own products.

Once you go international, how do you go about becoming profitable, what facilities and structures must be in place to succeed and what type of market strategy is needed for growth and survival in this marketplace? "These questions are more directed towards those already a part of the international marketplace, but [who] may not be profitable yet, or [those who] aren't satisfied with their strategy or are looking to expand," explains Wagman.

Alan Platt, vice president of international marketing for TeleVideo Systems Inc., and representatives from both ITT Europe (Brussels), and the Nippon Electric Corp. (NEC), Tokyo also will speak at this session. □

Interest Quotient (Circle One)
High 852 Medium 853 Low 854

LOOKING AHEAD IN MMS

Mini-Micro System's December issue is our third annual overview of those leading edge technologies impacting our value-added market readership. A long-lasting sourcebook for technology and market data, the report presents past, present and future perspectives on key areas including:

- local area networks
- natural language translation
- operating systems
- non-impact printing
- relational database systems

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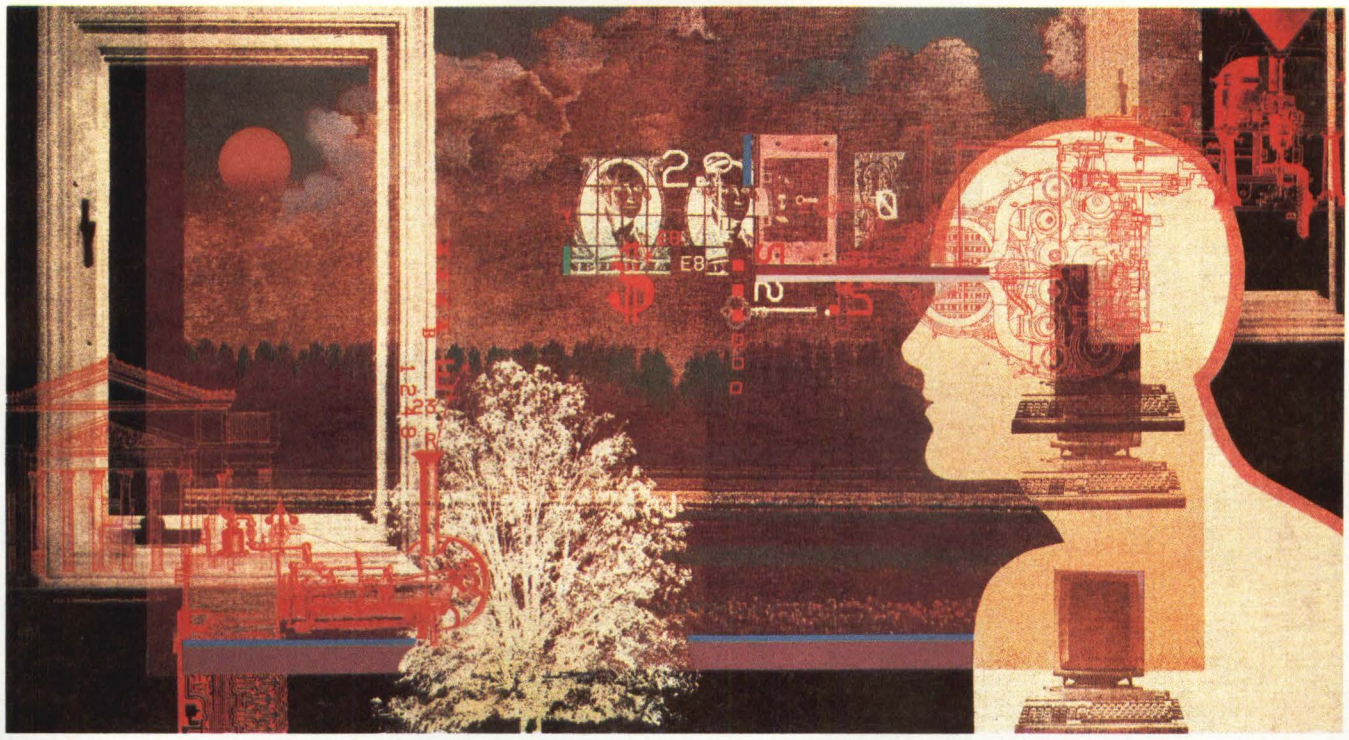

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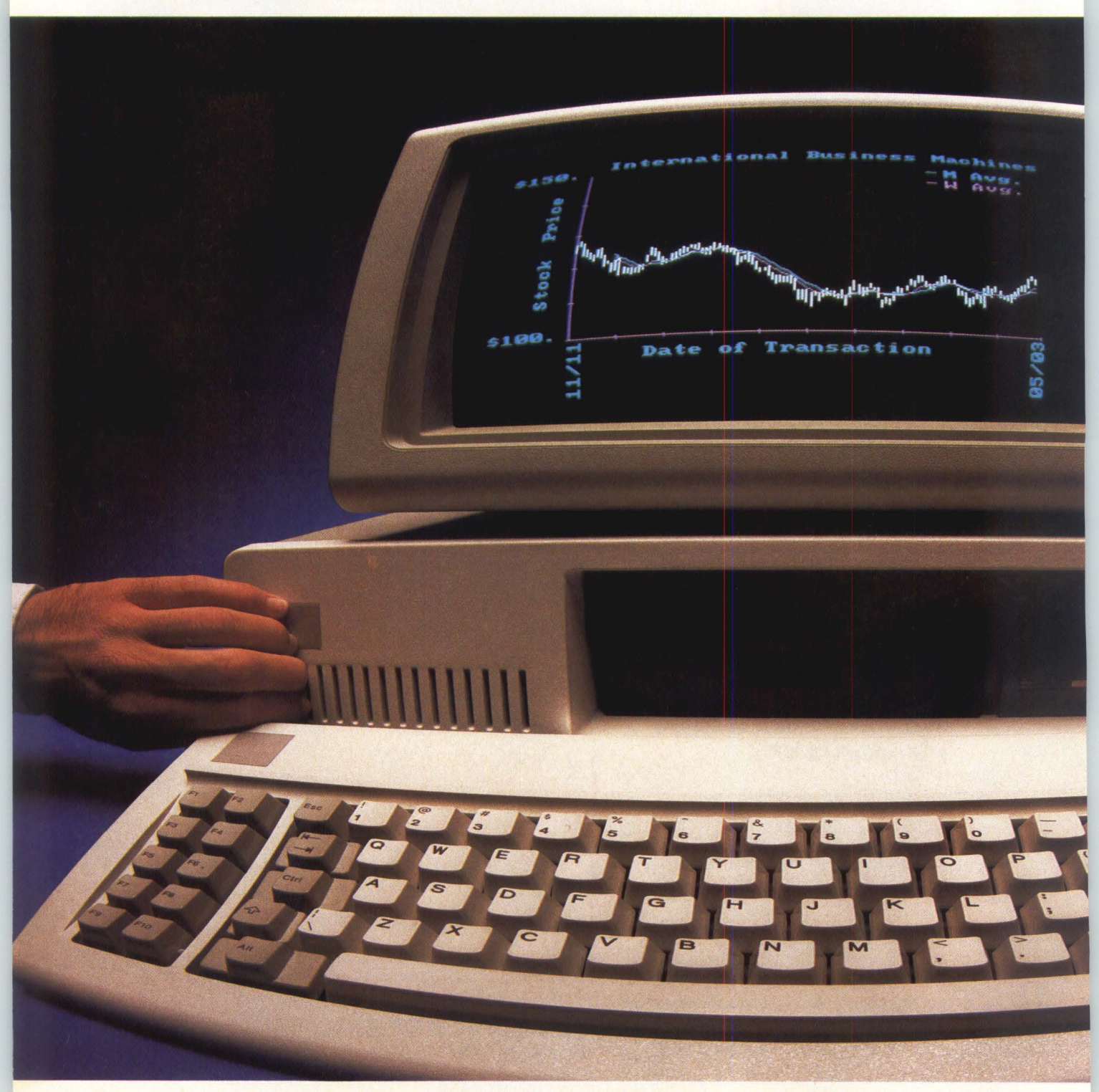
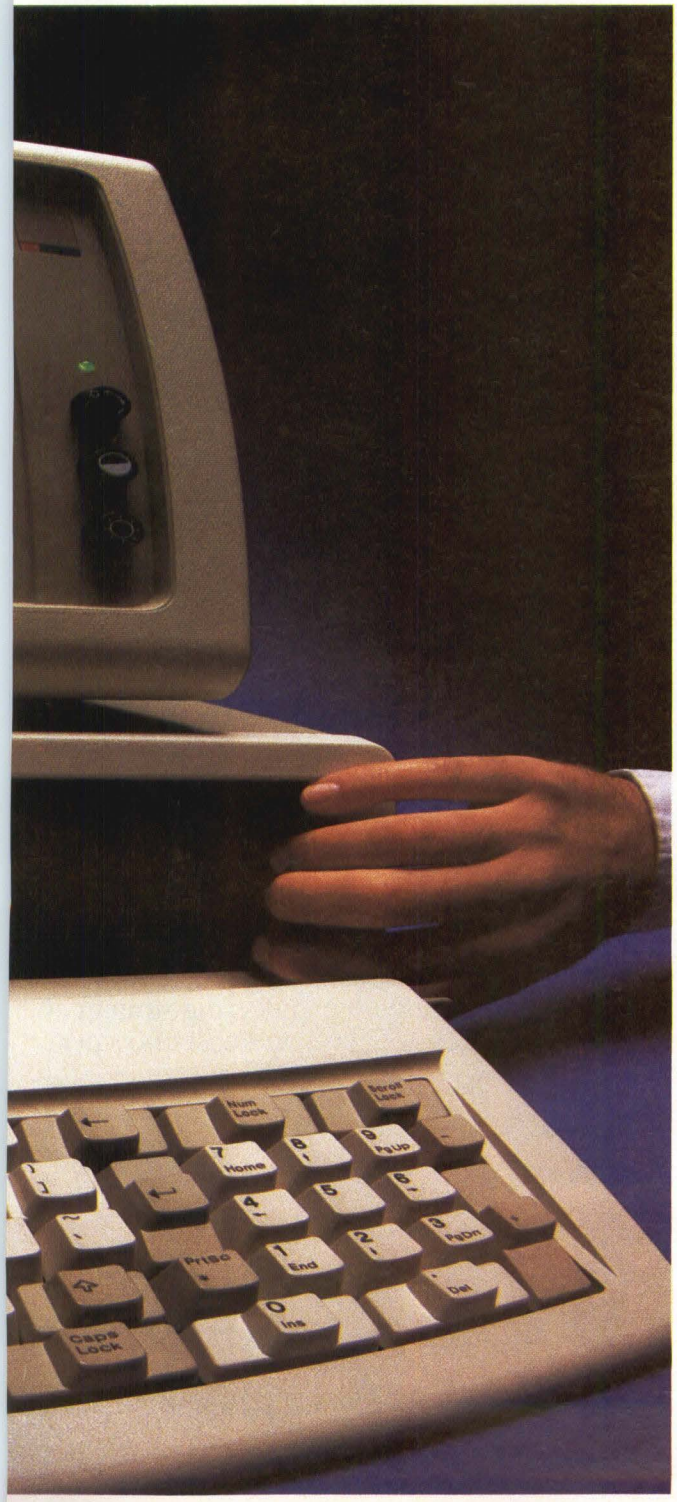
CIRCLE NO. 110 ON INQUIRY CARD

HOW TO STRETCH A PC TO CREATE NEW MARKETS.





OR EXPAND EXISTING ONES.

When is a PC not a PC? When you turn it into a personal data base cruncher. Or a personal graphics workstation. A personal image processor. Even a personal signal processor.

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Power to the PC.

We've put array processor technology to work to supercharge the PC. Suddenly a spectrum of applications that were beyond that PC's capabilities are wide-open possibilities.

If your strength is software, the Marinco array processor gives you incredible performance improvements. Even the most complex spreadsheets can ripple faster than you can say 1-2-3. Enormous data bases can search, sort and report in the blink of a cursor. And high speed arithmetic calculations which slow a standard PC down to a crawl are performed in split seconds.

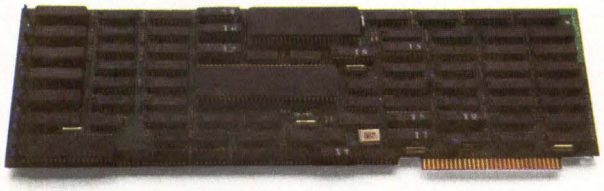
If you're a systems integrator, VAR or OEM looking for a competitive advantage, a PC with a Marinco array processor is a natural line extension, enabling you to offer a cost-effective "personal" version of your best-selling product.

The Race Is to the Swift.

The Marinco array processor is especially flexible and easy to program. So you can get to market quickly. Which, after all, is the name of the game.

We could fill pages with pertinent performance specs on our PC-compatible array processor. So we did. We've put together an 8-page brochure that will stretch your imagination. And just might open a world of opportunity. Write for a copy. Marinco Computer Products, a Helionetics company, 3878 Ruffin Rd., San Diego, CA 92123. Or call 1-800-421-4807, in CA (619) 268-4814.

Marinco array processors include a 24-bit floating point board with optional IEEE-754 compatibility and a 16-bit integer-only board for maximum price/performance.



MARINCO

CIRCLE NO. 111 ON INQUIRY CARD

Xebec's New Owl Reduc Storage To

Then.

Microcomputer storage history has progressed by a series of small "next logical steps." A replacement of a component here, a refinement of technology there. But now Xebec has taken a giant step, with its Owl intelligent disk file.

On the surface, the Owl might look like other 10-megabyte, 5¼" half-high Winchesters. Underneath, however, it's an example of superior technology. The integration of controller logic and drive electronics on a single board means not just one less PCB, but the elimination of expensive connectors and cabling, low power consumption (15 watts typical) and enhanced data integrity.

Single-board drive and controller electronics insure higher reliability

Integrated data separation within disk drive delivers higher data integrity

Ruggedized design includes head landing zone

Comprehensive diagnostics eliminate "What's wrong?" guesswork

Compatible with industry-standard Xebec SASI bus for faster system integration

We've put data separation in the HDA for precise control of data windowing and the elimination of background noise. We've provided a diagnostics channel to the host that delivers meaningful error messages.

Just as our superiority in minicomputer controllers led the way to a similar superiority in micro controllers, and our tested pairs solutions evolved from our considerable subsystem and testing experience, so too the Owl reflects our "top-down" engineering strategy—creating both technological and cost-of-owner-

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es Microcomputer Disk Two Words.

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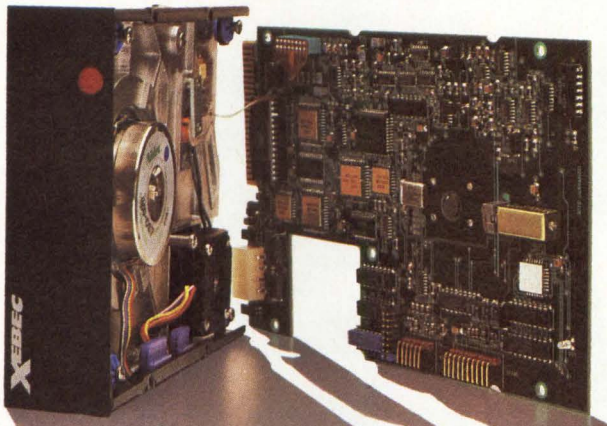

ship breakthroughs by designing sophisticated high performance, multi-user features into small-system, single-user environments.

The System-Engineered Solution.™

As a major user of drives, and a major testing resource for other drive manufacturers, we are concerned about drive reliability. And we've learned that it's not just a question of improving a component or consolidating some board real estate. The answer lies in careful consideration of overall system integration requirements.

The Owl epitomizes what we call the Xebec System-Engineered Solution. The focus is two-fold: on today and on tomorrow. Compatible now with industry-standard Xebec SASI, the Owl—by eliminating the ST506 interface—is upwardly compatible for future higher densities, capacities and performance.

In broader perspective, Xebec's approach to OEM satisfaction rests on our proven experience, our vertical integration strengths—which now include production of heads and plated media—and our commitment to zero defect quality, by way of computer-aided design and robotics manufacturing.

Call Xebec today. Let us tell you more about the Owl. And how we can deliver the difference between then and now. Now.

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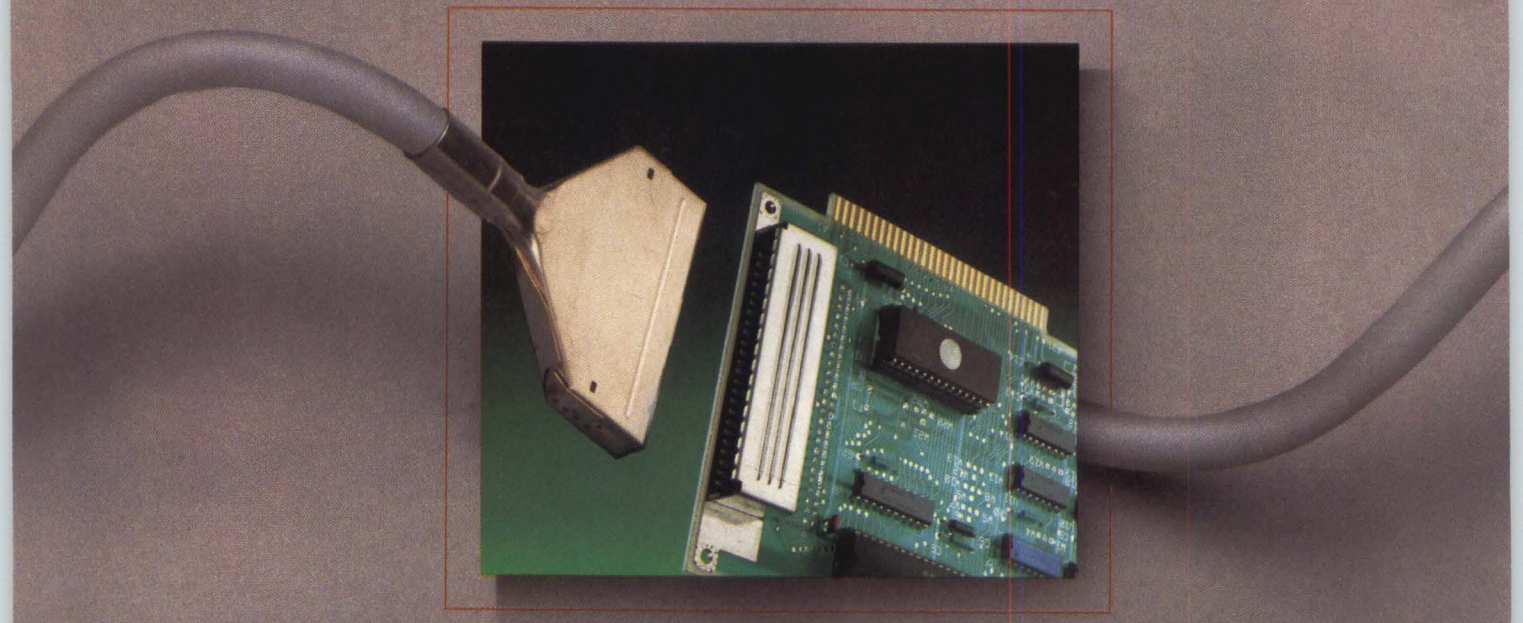
SCSI. Four letters that let you hook any host...



to any peripheral.

Presenting SCSI. Small Computer Systems Interface. An interface standard that lets you connect small computers with virtually any peripheral device — even those still on the drawing board. Without overhauling your hardware and software. So the best can go with the best, period — not the best of what's compatible.

SCSI works by masking the internal structure of the peripherals from the host. It uses an eight-port bus which can accommodate either single- or multiple-host systems. Its impressive transfer rate of 1.5 Mbytes per second allows direct copying between devices, too. Freeing the host for more important work. And giving it lots of power for lots of I/O activity.

In developing SCSI as a truly versatile standard interface, the American National Standards Institute (ANSI) enlisted some of the best minds in the industry — including more than a few from NCR-Wichita.

NCR is the undisputed leader, too, in designing and manufacturing SCSI components. We offer a complete line, from host adapters for Multibus and IBM PC architecture to ST-506 and SMDO disk controllers to PERTEC and QIC-02 tape controllers. We've also made numerous advancements in reducing the size of the components — and in reducing their price.

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CIRCLE NO. 113 ON INQUIRY CARD

Color workstation offers winning combination of hardware and software

Convergent Technologies' AWS scores high for its ergonomic design, powerful processor and sophisticated operating system. It loses a few points for its BASIC compiler and linker

A 15-inch color CRT *on a rotating and swiveling socket, and a mainframe enclosure share the AWS workstation's 27-by-9-inch base. The distinctive enclosure contains circuit boards, power supply, a 5M- to 16M-byte Winchester disk and a 5¼-inch floppy-disk drive with as much as 640K of storage.*

Marilyn Harper, Classic Systems Inc.

Convergent Technologies' 16-bit AWS color graphics workstation boasts an extremely powerful mix of hardware and software for system integrators and software developers and an impressive ergonomic design. Its drawbacks are primarily software-related, and except for one instance, relatively minor. They include the difficulty of learning to use its operating system and problems encountered with Convergent Technologies' implementation of BASIC.

My evaluation of the AWS' hardware and system software is based on first-hand experience gained during a conversion project here at Classic Systems. We converted about 30 large programs, written for Microsoft Corp.'s BASCOM BASIC compiler, to run on the 16-bit AWS workstation. During the six months of this project, I observed "from the trenches" the workstation's hardware, operating system and system software.

The Convergent workstation uses a 16-bit Intel 8086 CPU running at 8 MHz. The hardware comprises a vertical mainframe enclosure and an adjustable CRT mounted side by side on a low, flat base, with a

detached keyboard. The workstation comes with 128K, 384K or 512K bytes of RAM.

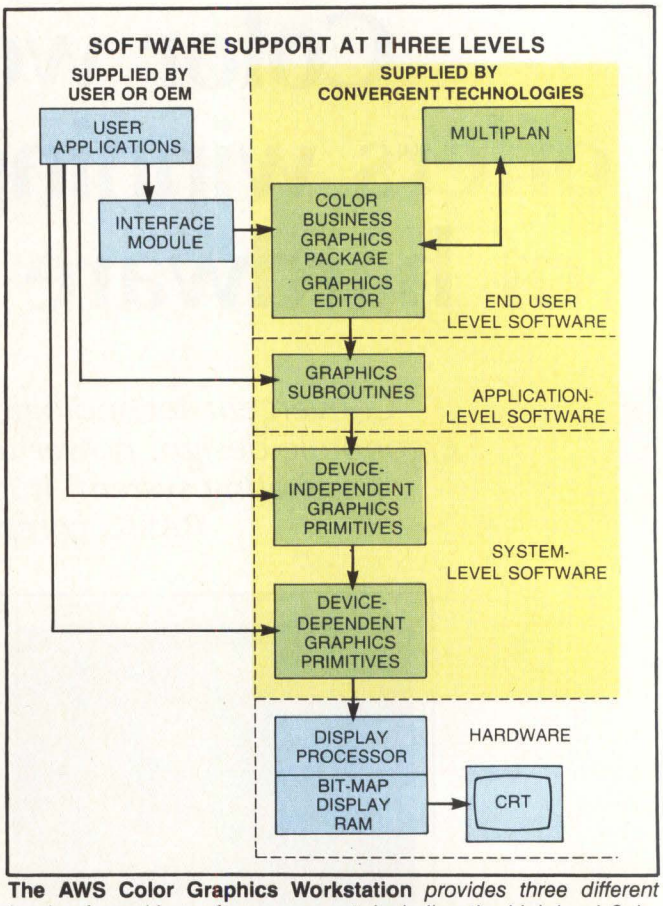
Although the workstation's footprint is somewhat large (27 inches by 9 inches), it has a good ergonomic design. The 15-inch CRT enclosure rests in a rotating socket, which allows it to tilt and swivel to almost any position. The screen has an attractive non-glare surface, but it shows fingerprints distinctly—a minor inconvenience. The boxy mainframe enclosure on the CRT's right contains power supply, circuit boards and mass storage, which includes a 5¼-inch Winchester disk drive (5M to 16M bytes formatted), and a 5¼-inch floppy drive with about 600K capacity. The floppy drive configuration is unusual; it's mounted on top of the enclosure in "pop-up toaster" fashion. However, with the drive in this location it can be difficult—especially for short people—to see inside it.

An additional problem is that the side "0" read/write head for the floppy disk is on the far side of the drive. This means that the disk must be inserted with the maker's label facing away from you. Affixing your own label on the backs of the disks can remind you of this idiosyncrasy. If you use only the AWS workstation, you could quickly become accustomed to the nonstandard routine. But if you also have other micros around, with more common drive orientations, the AWS is hard to get used to. And none of its file-transfer utilities allow you to recover from drive errors caused by inserting two disks, inserting a floppy the wrong way or leaving a drive door open.

The detached keyboard plugs into a notch in the front of the base. Having the short, coiled cord in the front is more convenient than snaking it around to plug into the back of the computer. The well-laid-out keyboard provides 98 keys, including a numeric keypad and cursor-arrow keys to the right of the main key cluster. Function keys, labelled "1" through "10," sit in a row at the top. Fourteen other keys are labeled for special functions—particularly useful during editing. Eight keys—shift lock, overtype mode toggle, and six of the numbered function keys—have red LEDs that indicate when they are engaged, which is a useful feature.

Because the workstation has two display controllers, the CRT can operate in two modes. An Intel 8275 CRT controller chip and character-generator ROM on the CPU card handle alphanumeric mode. An NEC 7330 Graphics Display Controller, piggy-backed on the CPU card, implements a bit-mapped graphics mode.

The workstation's alphanumeric screen can show either a monochrome (green) or a color display of 80 columns by 28 rows. The character font of 256 symbols includes foreign language marks and other special characters; a set of 64 graphics characters for stick-figure type drawings is included and can be invoked



The AWS Color Graphics Workstation *provides three different levels of graphics software support, including the high-level Color Business Graphics plotting package, application-level graphics plotting package, application-level graphics subroutines and system-level device-independent and device-dependent graphics primitives.*

with the keyboard. This feature, however, is not particularly well implemented. Little effort was made to logically group the keys. I found it impossible to remember the graphics character set without a written prompt.

The 28 rows of the alphanumeric screen can be treated as either a whole or split screen display. In the latter case, the top two rows are used as a status area, the third row is a line dividing the frames and the bottom 25 rows make up the application screen. Operating system commands utilize this 25-row application frame. User-written programs can be compiled and linked so as to devote all 28 rows to a single application frame.

One problem with the alphanumeric screen is that it can accommodate only 16 video attributes in any one row. Mixing text and character graphics can easily exceed this limit. It takes one video attribute to "toggle" up to the alternate font (characters 128 to 255) and another to get back to the normal ASCII range characters (0 to 127). Other attributes include reverse video,

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half intensity and blinking characters. If the attribute limit is exceeded, the results can be unpredictable; an entire row can suddenly go blank or parts of the row can drop out.

The workstation has two libraries of graphics routines. One contains the usual vector and circle-drawing procedures. The other—the business graphics package—serves data plotting and graphing. Both libraries are easily accessed from application programs by function calls.

Operating system furnishes high-end features

The AWS uses its maker's own CTOS multi-tasking and multiuser proprietary operating system. The CTOS screen prompt consists of the word "Command" followed by a row of half-intensity reverse-video blanks, onto which you type the name of a command or file-name. Some commands require parameters, others don't. If no parameters are needed, typing the command name and pressing "Go" will start execution.

The operating system provides many sophisticated features, including 16-level password protection, file locking, path selection for alternate directories and simulated menu-driven operation via the "Help" key. Most of these features can be bypassed. In a software-development environment, passwords, for example, are frills that just slow you down. But for a multiuser-application environment, CTOS is rich in high-end minicomputer-type system features.

The 50-character file names possible with CTOS are a welcome feature. To maintain convention, the BASIC programs we converted were still called FILENAME.BAS, but they could just as well have been renamed, "ProgramtoPrintCrossReferences.fromCTBASIC".

CTOS maintains an alphabetized list of programs, called up by using the "Help" key. Utilities called "NewCommand" and "RemoveCommand" allow you to add or delete programs from this list. Adding user-written programs to the command list results in a disk menu of programs.

CTOS provides a software clock—a helpful feature if used with care. For the clock to be useful, though, you must set the date and time whenever the system is powered up; the clock reading on power-up is the time recorded when the power was last shut off.

Many of the system utilities, including the editor, put a date-mark on the files they access, permitting users to determine when a file was last modified. There are several flaws to this system. Users must scrupulously keep the software clock set correctly. The editor will date-stamp a file, even if you abort without actually editing it. And, if you move a file from one disk to another, it will be date-stamped by the transfer utility, overwriting the date the file was actually last modified.

Convergent Technologies' operating system comes with a large number of system utilities, invoked by entering the utility name and then filling in the command form, if required—a procedure very close to being truly menu-driven. In many cases, defaults are presented for some of the parameters, which you can accept without bothering to fill in the entire screen.

The size-reporting utilities don't measure in the "kilobytes" to which many microcomputer users have become accustomed. For example, the Volume Status reports space remaining on the disk in free pages. But, because a page is 512 bytes, you must divide pages by two to get kilobytes. To determine file size, you use the directory command "Files" and press "Return" to get its parameter screen.

File-moving utilities don't automatically overwrite an existing file on a destination disk with the same name as the one being moved—a nice safety feature. You can thus decide to overwrite on a file-by-file basis, confirming or denying each overwrite.

Some of the CTOS utilities that send output to a printer use a parallel printer port or a system print spooler. If you use a serial printer, you'll have to do a little tinkering to be able to talk to your printer. All serial I/O is controlled by a configuration file, which can be created or modified with the system utility, "CreateConfigurationFile."

Directory scheme consumes disk space

The Convergent workstation uses double-sided, double-density mini-floppies claimed by the manufacturer to have 640K maximum formatted capacity, but this figure is somewhat misleading. The complicated directory scheme on the disk takes up a significant amount of space, reducing the storage capacity available to the user. I was thus never able to get more than 605.5K of usable disk space, no matter how leanly I configured a disk.

A floppy-disk copy utility writes the contents of a source floppy onto the workstation's Winchester, then prompts for insertion of a destination floppy. The destination disk is formatted (whether it needs it or not), and then is written on from the hard disk, floppy-image file. This process is remarkably slow—taking about 7 minutes. Additional copies from the same source take about 4 minutes each.

Convergent Technologies provides an excellent communications program, the Asynchronous Terminal Emulator (ATE). We use it to transmit ASCII BASIC source code directly from an 8-bit CP/M computer, over a wire to one of the serial ports on the workstation, where it is received by the ATE program. ATE can receive at 9600 baud, and only needs a file name to save

what it gets. On the CP/M side, "PIP TTY: =FILE-NAME. EXT" is a sufficient sending mechanism.

An MBASIC program needs minor cosmetic surgery when it has been transmitted to the workstation. CTOS uses only Line Feeds (ASCII 10) for its Newline character. The Carriage Returns (ASCII 13) should be stripped from a transmitted MBASIC program. And embedded Line Feeds in MBASIC source code should be changed to ASCII 2's in the Convergent Technologies format.

With a little effort, users can also transmit random data files from CP/M to CTOS. The random file should first be converted to Intel hex format. It can then be sent over the wire to ATE like any other ASCII file. Users will need a simple program to read this sequential file, convert it to binary in record-sized chunks and write it to a random file under CTOS.

An outstanding text editor

The Convergent text editor is the finest programming editor I've yet used. With only 14 commands, it's very easy to learn. Most commands are invoked by holding down the "Code" key and pressing the first letter of the command name, for example, "Code F" for find.

The workstation's special labeled keys, such as "Next Page" and "Previous Page," aid in large-scale movement through a file. There are no "Word-forward" type of commands, but because all keys are auto-repeat when held down, motion by cursor arrow is generally fast enough. The editor comes up in insert mode, which can be turned off by pressing the "Overtype" key. The LED on the key reminds you that you are in the overwriting mode, until you press that key again.

The AWS workstation's block commands are superb, with blocks highlighted in reverse video. Special keys ("Move" and "Copy") operate on marked blocks. Mass deletions are implemented by marking the block to be deleted, then pressing "Code Delete." An excellent feature is the monitor-mode toggle, which Convergent calls the "visible" command. This shows all of the normally unprintable control keys, such as "Tab" and "Newline," as graphic symbols on the screen.

The Convergent editor creates an automatic back-up file for saving your work. As a safety feature, the current file is written on the disk periodically as a temporary file called Editor.ts. In the event of a power failure, you can restore some or all of the text you last edited by renaming that file.

The Convergent workstation supports a BASIC interpreter and compiler, COBOL, FORTRAN, and Pascal. IBM Corp. and Texas Instruments Inc. obtained their 16-bit BASIC languages by hiring Microsoft Corp. to provide them. Convergent, on the other hand, bought the rights to Microsoft BASIC and used it to write their 16-bit CT-BASIC themselves. The difference shows.

Although most of the new 16-bit BASICs provide a full-screen editor, the CT-BASIC editor version 7.0 is still line-oriented. It uses all of the old commands, such as C for "Change" that BASIC-80 had. A few 8-bit MBasic features are missing from CT-BASIC, including the "Files" command and the "Inkey$" function.

Several new pointer functions are provided to replace "Usr" and "Varptr." The new function, "Ptr," can be used to pass parameters, allowing you to call assembly language procedures such as those in the graphics library, even from interpreted programs. "Peek" and "Poke" have new formats to accommodate the extended addressing range of the 8086 processor.

Spec summary

- **Product:** AWS Color Graphics Workstation
- **Manufacturer:** Convergent Technologies Inc., 2500 Augustine Dr., Santa Clara, Calif. 95051, (408) 727-8830
- **System configuration:** standalone unit or clustered workstation
- **Main processor:** 16-bit Intel 8-MHz 8086
- **Main system RAM:** 128K to 512K bytes
- **Graphics processor:** NEC μPD7220
- **Display:** 15-inch color screen, any eight colors for graphics and any eight for alphanumerics of 64 available colors, 28 rows by 80 columns of text
- **Screen resolution:** 432 by 319 pixel viewport
- **Display RAM:** 512 by 512 by 3-bit plane
- **Disk storage:** one 640K-byte minifloppy plus one 5M-, 10M- or 16M-byte Winchester
- **Communications protocols:** IBM Corp. 3270, 2780/3780 and X.25
- **High-level languages supported:** BASIC, FORTRAN, COBOL, Pascal
- **Operating system:** CTOS; real-time, multitasking
- **Cost:** from $12,190 with 5M-byte Winchester and 640K-byte minifloppy to $17,190 with 16M-byte Winchester and 640K-byte minifloppy

You can invoke the interpreter directly with BASIC ("Go"), or you may fill out its forms screen. There is a bizarre bug, however, involving random record size. If you run a program with a record size of anything other than 128, it is not safe to save the program from the interpreter. The saved file is likely to acquire thousands of bytes of garbage, interspersed with the orginal program.

Overcoming compiler array variable problems

CT-BASIC version 7.0 currently suffers from a high degree of interpreter-compiler differences. Many of the latter, however, appear to arise from bugs which have not yet been fixed.

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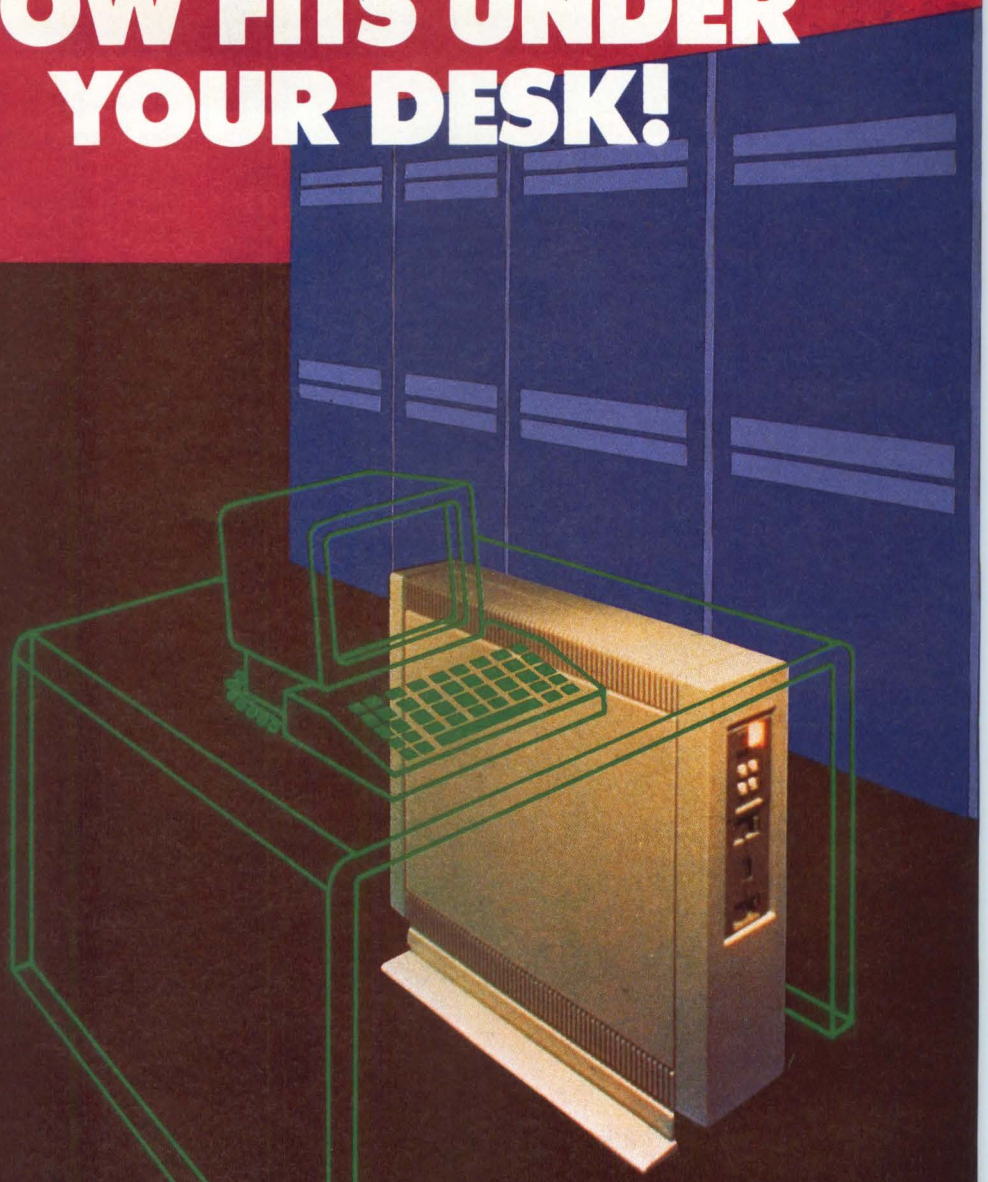

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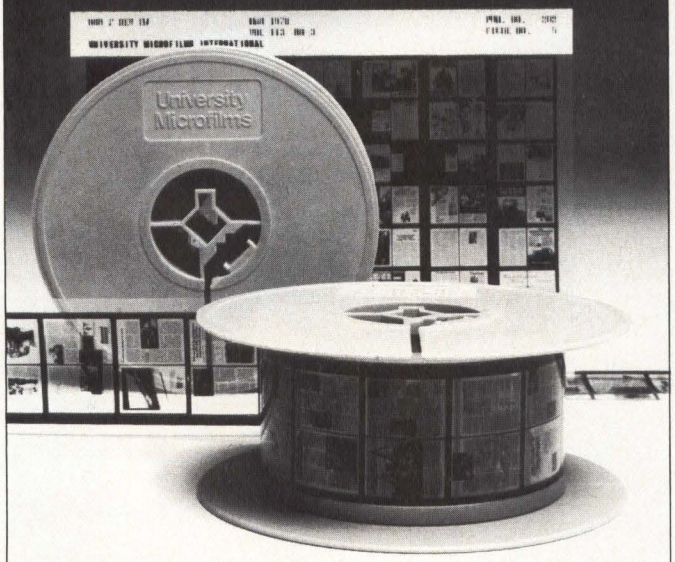

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Most of the problems we encountered with the compiler were related to array variables. For example, "Swap A$, B$" works, but "Swap, B$(I), B$(J)" doesn't. The array "Swap" is not an unsupported feature—it doesn't trigger a compiler error—it's just a bug that may eventually be fixed. Until it is, it causes a run-time system crash.

The compiler won't allow the use of "A$(n)" and "A$," or "B(n)" and "B" in the same program. Microsoft's BASCOM had no problem with conflicting array and scalar variable names like these. Again, considerable conversion effort was expended in renaming variables.

Convergent's BASIC compiler has a drastic overreaction to encountering a misused reserved word in the source code: It shuts down with an error message instructing you to call Convergent for technical assistance. We first encountered this when the new function, "Ptr," inadvertently conflicted with an old 8-bit variable of that name.

The Convergent Linker (Version 8.0) is fairly slow and creates huge executable object files. A 1-statement BASIC program, consisting of "10 End", takes 1½ minutes to link. The object code takes up 47K bytes of disk space.

Speed aside, the linker is quite sophisticated. It is designed to allow easy creation of program overlays. One program—say, a menu—is compiled as the main module; the other components of the overlay system are compiled as subordinate modules. Then, all of the object-file modules are linked together, along with a CTOS module called "Brswp." The latter handles the automatic loading of the appropriate program modules during run-time operation. The main advantage of the overlay system is that it allows common variables used by the various component programs to remain in memory.

The main output of the linker is a ".Run" object file. The program is executed by invoking the system utility called "Run," and entering the name of the ".Run" file. To make the program somewhat more directly executable, the utility called "New Command" adds the program to the list of file names displayed by the "Help" command. The program can then be loaded and runs automatically, by typing its name and pressing the "Go" key. □

Marilyn Harper is a senior analyst with Classic Systems Inc., a Houston-based company specializing in programmable controllers for industrial automation. She holds a bachelor's and master's degree in science from the University of Texas.

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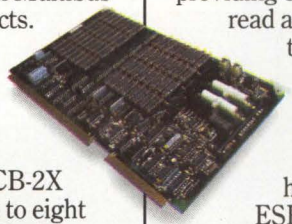

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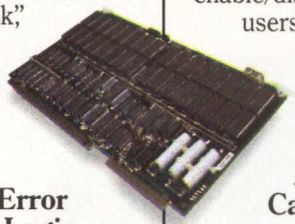

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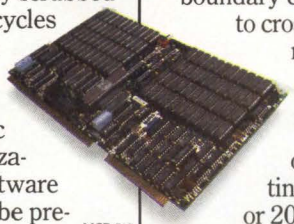

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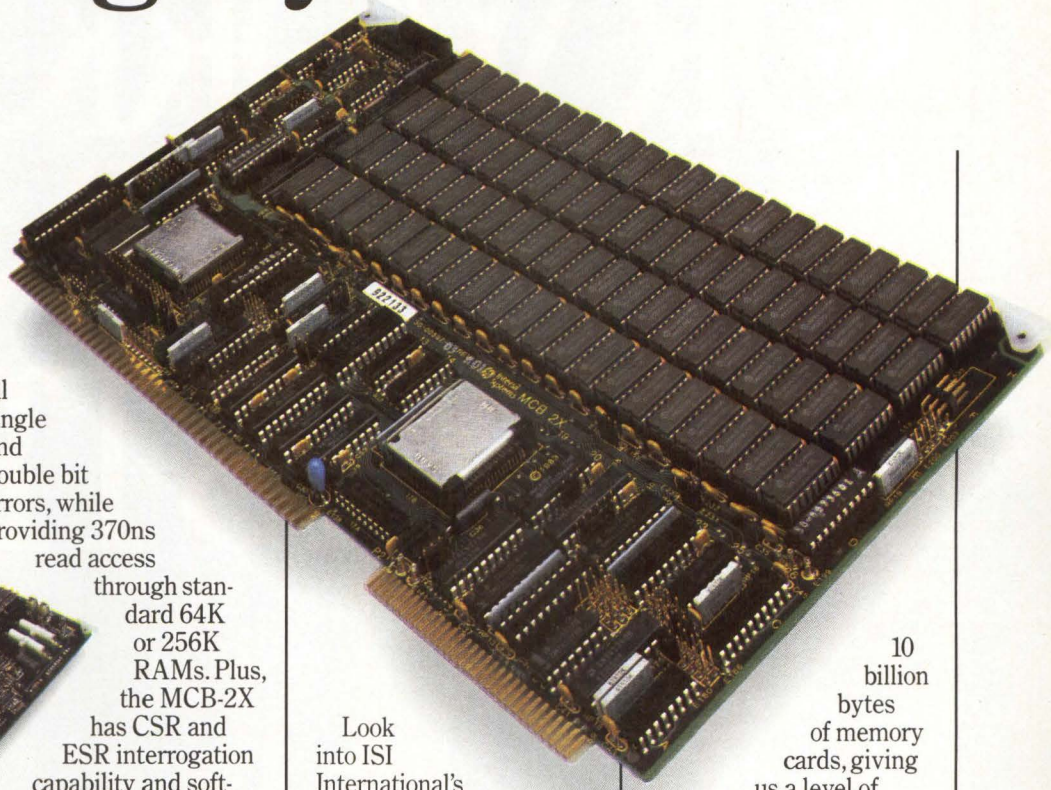

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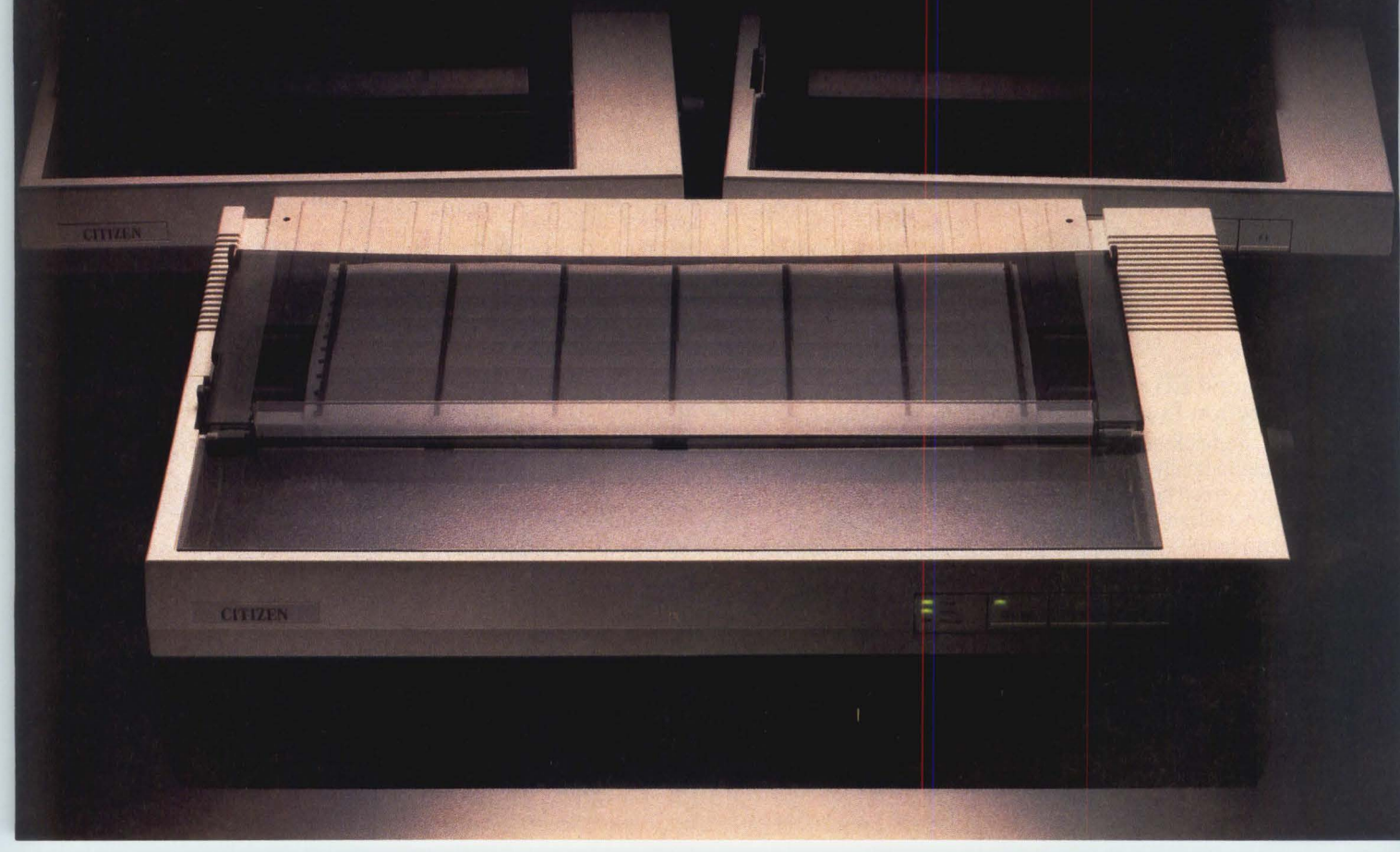

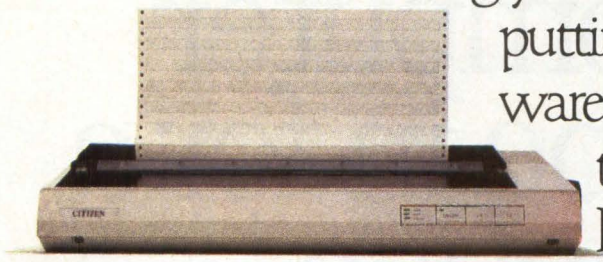

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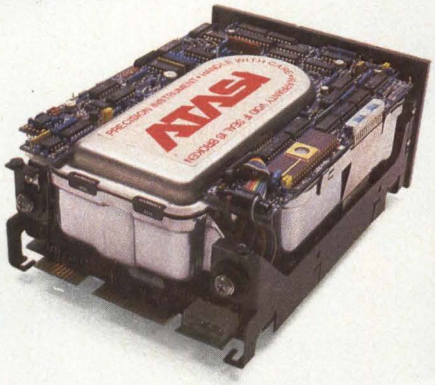
Your new computer system may be in for a cool reception.

Here's a cold, hard fact that should influence your selection of a disk drive for multi-user computer systems or local area networks: In today's energy-conscious offices, temperatures can vary enough during the day to affect the performance of a disk drive. We made the operating range of ATASI drives up to 25% greater than most competitive drives because poor performance under thermal stress can result in system downtime and even lost data. Here's how it happens.

In most drives, the bottom of the bowl serves as the base-plate where the carriage and spindle assemblies are

THERMAL STRESS

mounted. There is no thermal isolation. Heat from the motor, PC boards or a power supply can result in differential expansion of the baseplate, so that it temporarily warps. This can change the alignment of the carriage and spindle, which in turn affects the drive's ability to find data reliably.



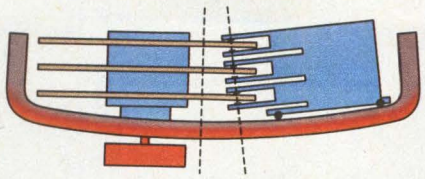
ATASI's 46 Mbyte, 5¼-inch Winchester disk drives are available in production quantities immediately.

Alignment problems

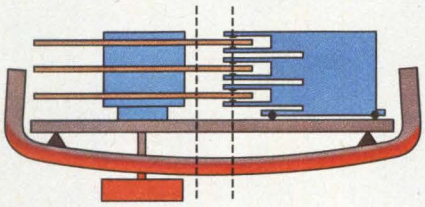
In high-performance, closed-loop drives, servo information carried on the bottom surface of the disk stack is used to position the data heads on all other surfaces. Assume that data is recorded when the drive is "cold." If the carriage and spindle go out of alignment when the drive gets "hot," the servo system cannot properly position the read/write heads to recover the data. This may mean that data written in the morning won't be accessible the same afternoon!

Thermal isolation

To prevent this from happening with ATASI's 5¼-inch Winchester disk drives, the ATASI design incorporates a baseplate which is separate and thermally isolated from



Heat can temporarily warp a drive's baseplate, causing alignment problems between carriage and spindle.



Thermal isolation in ATASI's proprietary design eliminates the problem.

the lower half of the bowl. The baseplate is therefore protected from external sources of localized heat. Even if the drive heats up, it does so uniformly, with no resultant deformation of the baseplate, and no alignment problems.

Extra margins

Thermally isolating key mechanical components is one way we improve the performance of ATASI drives, but not the only one. Everywhere in the design there are margins of safety other drives don't offer. For example, our proprietary spindle motor design provides substantially greater dissipation of heat away from the disk module than competitive drives.

The ATASI White Paper

At ATASI, we are proud of the quality we build into every drive we make, and we encourage clients to test our products rigorously. To help, we have prepared a White Paper on thermal testing which discusses test methods and interpretation of test data in detail.

If you are a systems integrator, contact ATASI Corporation now to receive your ATASI White Paper. Corporate headquarters: 2075 Zanker Road, San Jose, CA 95131, (408) 995-0335; Eastern region: (617) 890-3890; Southwest region: (714) 432-0757.

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DATA RATE	5 Mbits	5 Mbits
INTERFACE	ST 506	ST 506

Available in high volume today.

MODEL NO.	3065	3075
CAPACITY	65 MB	75 MB
ACCESS TIME (AVG.)	24 ms	24 ms
DATA RATE	5 Mbits	5 Mbits
INTERFACE	ST 506	ST 506

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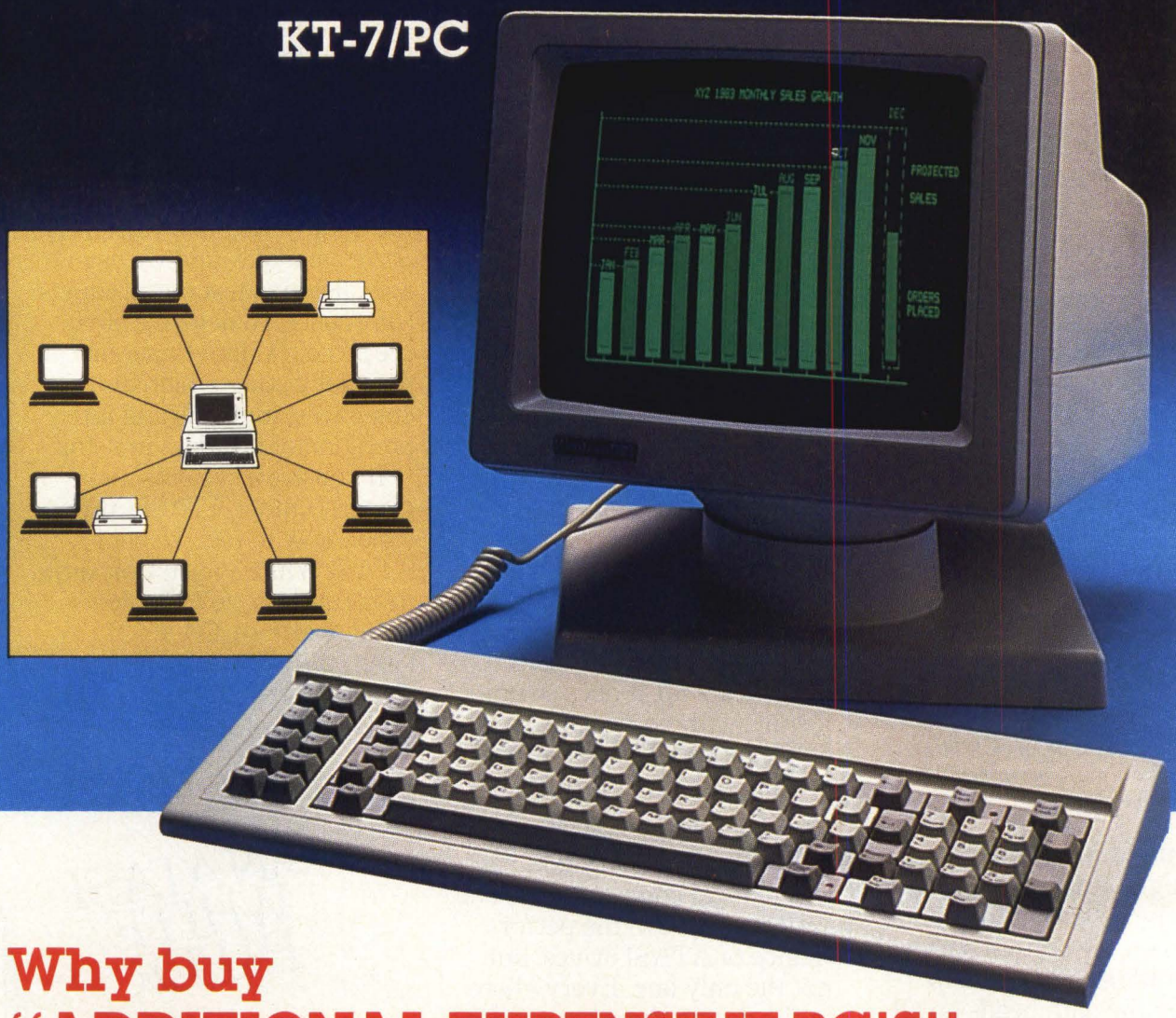

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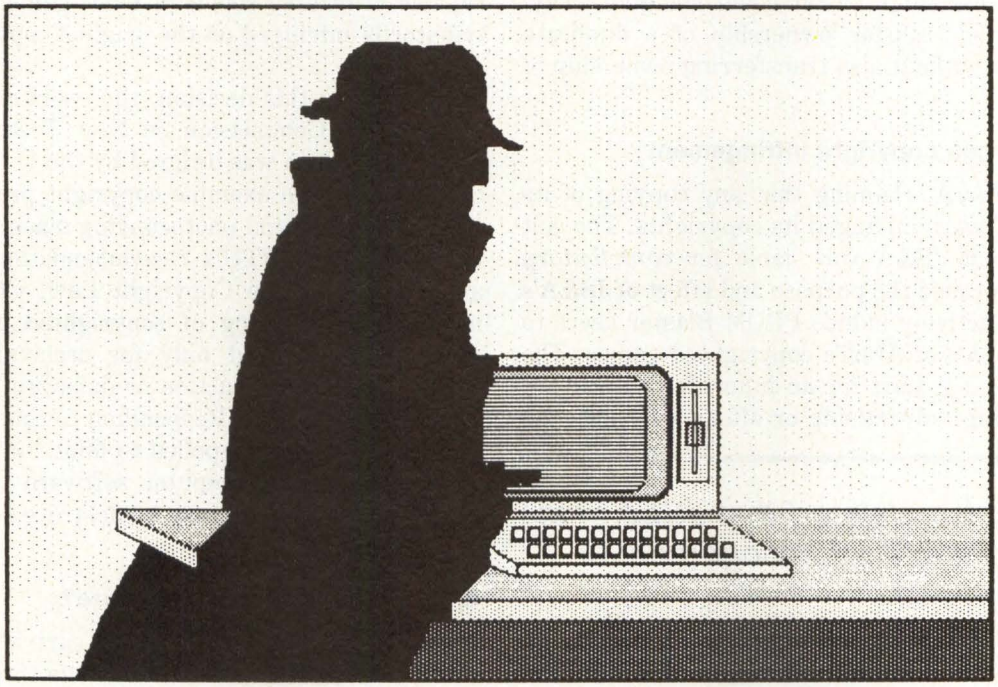
CIRCLE NO. 120 ON INQUIRY CARD

Court restricts right to duplicate ROM software



Precedent-setting ruling offers software developers increased protection against unauthorized program copying

L.J. Kutten, Attorney at Law

Piracy is a growing problem for software developers. Unauthorized copying of computer programs deprives them of their rightful share of the market and the profits necessary for continued growth. Because programs on floppy disks are relatively easy to copy, developers are increasingly putting programs in ROM. A precedent-setting decision last December by a U.S. district court restricting the right to duplicate software in ROM should provide a greater measure of protection, if upheld on appeal.

The U.S. District Court for the Northern District of Illinois ruled on a suit by Atari Inc. against JS&A Inc. JS&A, an Illinois-based retailer of electronic products, began marketing its PROM Blaster in the fall of 1983. The $119 machine duplicated video-game cartridges, containing programs in ROM, compatible with the Atari 2600 home computer.

The PROM Blaster had two slots. According to JS&A's advertisement, "You simply plug in your Atari or Activision cartridge in one slot and a blank cartridge in another, press a button and three minutes later you've created an exact duplicate." JS&A sold blank cartridges for $10. The advertisement went on to say that the PROM Blaster was a quick way to protect a software buyer's investment in video game cartridges, "which can easily be ruined." JS&A also granted purchasers of the PROM Blaster the right to copy its own nine Atari 2600-compatible video games and even to sell the copies without restrictions.

The advertisement anticipated legal problems from duplicating the copyrighted software. It claimed that the PROM Blaster did not violate any laws because Congress had given explicit authority in Section 117 of the Copyright Act (under the 1980 amendments) to the owner of a computer program copy to make archival copies for backup purposes. Section 117 states: "[Despite] . . . the provisions of Section 106 of the Act [which give the copyright owner the exclusive right to reproduce the copyrighted work], it is not an infringement for the owner of a copy of a computer program to

make or authorize the making of any other copy or adaptation of that computer program provided . . . that any such new copy or adaptation is for archival purposes only . . ."

JS&A's advertisement warned, however, that a PROM Blaster cartridge owner could not give away, sell or otherwise transfer ownership of a duplicate game cartridge without also transferring ownership of the original.

Atari suit charges copyright infringement

Atari sued JS&A, claiming that any copying of its video-game software infringed its copyrights. The suit also claimed that JS&A was liable for *contributory* infringement because the purpose and effect of JS&A's actions was to actively induce PROM Blaster users to make illegal copies of Atari's copyrighted games. The company asked the court for an injunction to prevent JS&A from using, advertising or offering for sale the PROM Blaster and the blank cartridges offered with it.

Atari's suit also claimed that JS&A was liable for contributory infringement of Atari's copyrights.

JS&A denied Atari's allegations and asserted that the copying of other manufacturers' video-game cartridges is perfectly legal. However, even if this were not a legal practice, JS&A said, the fact that JS&A sold its own games and granted buyers permission to duplicate them gave the PROM Blaster a legal use.

Court prohibits archival copying of ROM programs

In the case of Atari vs. JS&A, the U.S. District Court issued the first ruling on the achival copying provision of the Copyright Act. The court found that the PROM Blaster could fulfill only two functions: to copy JS&A's nine video games and to copy video games from other manufacturers.

The court discounted the PROM Blaster's ability to copy JS&A's games. It was highly unlikely, the court said, that anyone would buy the device only to duplicate JS&A's games because they went on the market only with the PROM Blaster. "It strains credulity," the court maintained, "to assert that consumers would spend that much for a machine that could only copy JS&A's games." Therefore JS&A's liability as a contributory infringer depended on the legality of the PROM Blaster's primary use: the duplication of other manufacturers' video-game software, the court said.

Because Section 106 of the Copyright Act gives the copyright owner the exclusive right to make copies of the copyrighted work, JS&A had to prove that the PROM Blaster created an exception to Section 106, in order to win its case.

The court, however, decided that the programs in ROM could not be duplicated. It ruled that a machine capable of making copies of video-game software contributorily infringed on the original copyright holder's copyright.

In reaching this decision, the court referred to the work of the Commission on New Technological Uses (CONTU), which was ordered by the U.S. Congress in the late 1970s to examine copyright problems arising from computers and photocopying machines. Congress incorporated CONTU's recommendations in its 1980 amendments to the Copyright Law. CONTU recommended that copying of copyrighted computer programs be permitted only for archival purposes to "guard against destruction or damages by mechanical or electrical failure." Responding to this language, the district court felt compelled to limit the right to make archival copies of computer software to "where and only where a medium may be destroyed by mechanical or electrical failure."

Are ROMs susceptible to failure?

Atari claimed that its ROM cartridges were not susceptible to destruction or damage through mechanical or electrical failure and thus did not fit into the exception created by the 1980 amendments. JS&A countered that the ROMs could be destroyed through "a wire becoming disconnected, liquid spillage, crushing, etc."

The court decided that the danger to programs in ROM cited by JS&A were not of the nature to justify copying such programs under the exceptions to the prohibition against copying granted under Section 117 of the Copyright Act. It felt the dangers cited were physical in nature "not unlike the risk that a handwritten computer program will be shredded accidentally." It said, "Every copyrighted work, whether it be a book, phonograph record, or videotape, faces that kind of risk."

The court emphasized that Congress did not, in fact, enact a general rule making backup copies of copyrighted works non-infringing. Instead, Congress granted an exception to enable preservation of computer programs that are susceptible to damage by electrical or mechanical failure. Because JS&A did not show that the PROM Blaster's copying of copyrighted programs fell within the Copyright Law's exception for archival copying, the court granted Atari's request for the injunction.

Atari vs. JS&A has important implications for microcomputer software. If upheld on appeal, it will prevent the unauthorized copying of software in ROM and the

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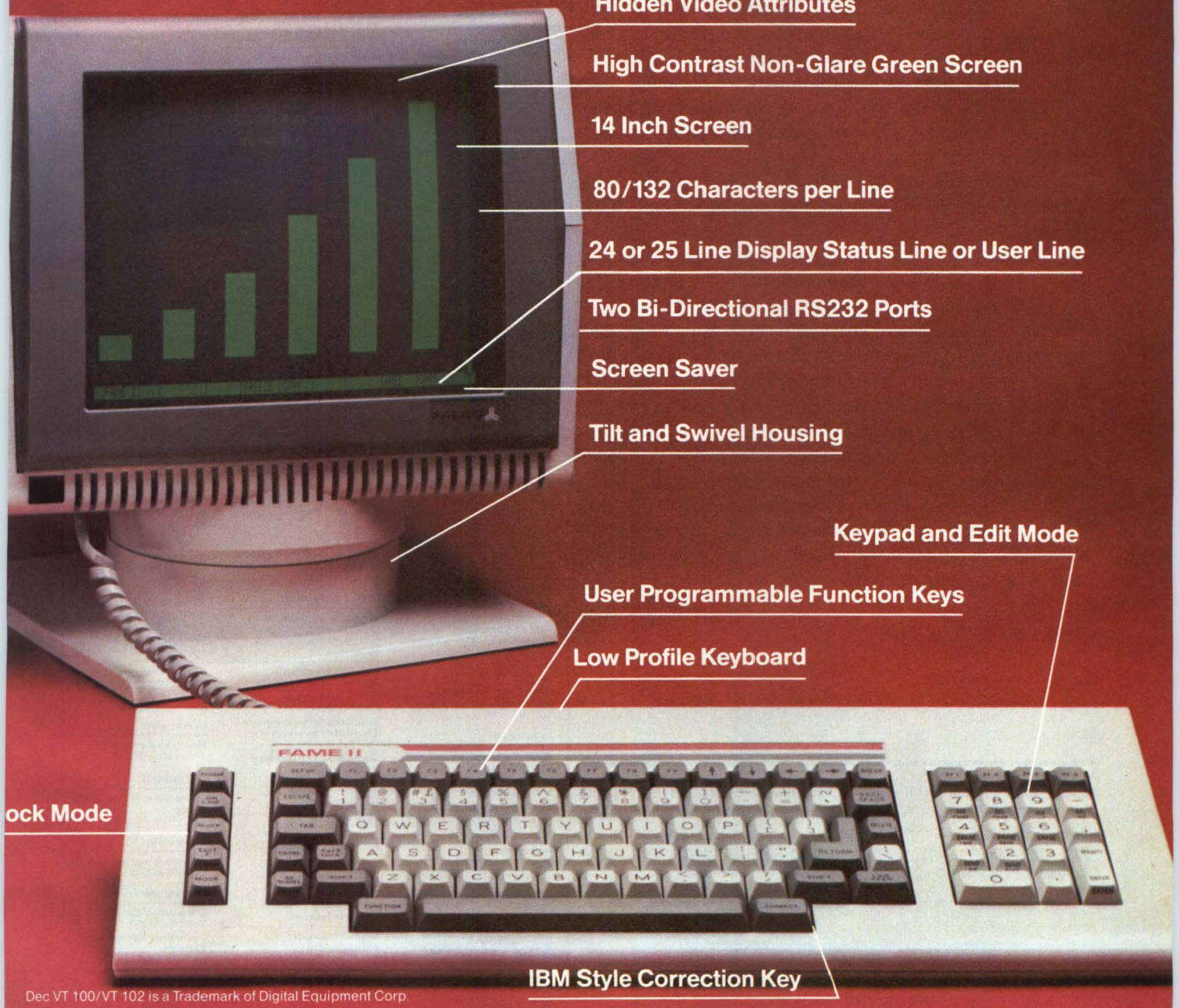

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By granting an exception to computer programs and thus considering archival copies as not infringing the original copyrights, Congress wanted to protect those programs that are susceptible to damage.

selling of ROM duplicating machinery. And it will accelerate the trend toward putting programs in ROM instead of on easily duplicated flexible disks. Software piracy should decrease for the following reasons:

- It will no longer be possible for casual computer users to duplicate software easily (no more typing "BACKUP:0 to :1").
- Most microcomputer users do not have the technical skill necessary to build a device similar to the PROM Blaster.
- If someone builds this type of hardware, he cannot advertise it for sale or offer duplication services without risking a suit for copyright infringement.
- No trade-press publication, or any other reputable magazine, will take an advertisment for a product whose sole use will violate a copyright.

Better protection for computer software can benefit all system integrators and computer users by decreasing overall software prices. Once software developers/manufacturers have a secure method of protecting their products, they can lower prices knowing that they can sell to the widest possible market and that total distribution represents true sales and not someone passing a copy of a computer program to a friend. □

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Edited by J. Victor

L.J. Kutten received the Juris Doctor degree from Washington University, St. Louis. A member of the Missouri and Illinois bar associations, he is in private practice, specializing in computer and high-technology law. Kutten is the author of *Computer Buyer's Protection Guide*, published by Prentice-Hall Inc.

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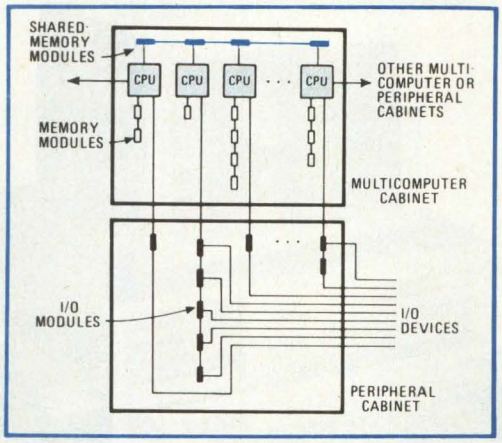

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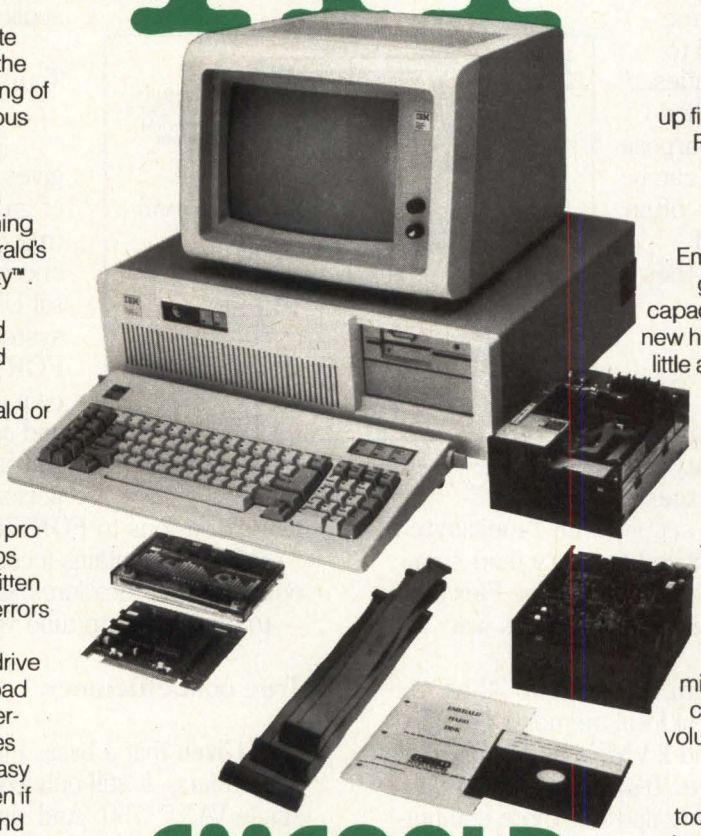

MORE RELIABLE

Our BRU-equipped tape drive protects your valuable data and helps assure timely access. All data written to tape is checked, and all write errors are corrected automatically.

Even if your AT floppy or disk drive is non-operational, you can still load files directly from tape. Media interchangeability with other machines also running BRU assures you easy access to your valuable data even if your machine is not operating. And our cartridges also allow you to distribute data files that don't fit on floppies.

MORE CONVENIENT

Do multiple volume backup from your IBM or Emerald hard disk or floppies on one data cartridge. And with a utility such as ProKey™, your backup procedure can be fully automated. BRU options invoked from the DOS command line or from a convenient menu gives you these choices:

- Backup an entire physical disk.
- Backup a logical volume.
- Backup entire DOS directories.
- Backup files by name (wild card allowed).
- Backup files by DOS date and time stamp.

■ And you can forget about file sizes. Emerald's BRU automatically breaks up files that are longer than the tape. Restoring files from tape involves options essentially the reverse of backup.

MORE ECONOMICAL

Emerald's 60 MByte tape cartridge gives you 50 times more storage capacity, yet costs less than 1/5 that of new high-capacity floppies. And for as little as $65 per MBYte you can install our hard disk kit in your PC/AT chassis. Emerald Systems' internal 40, 65, 140, 280 MByte hard disk AT upgrade kit is also 30% faster than IBM's. And our hard disk cache feature makes retrieval speed of selective files 100 times faster. This hard disk caching feature keeps often-used files available in memory at microspeed access time. And you can partition our disks into 1 to 24 volumes, with up to 240 MBytes per volume.

You may not need 280 MBytes today. But if you need to share disk storage in your LAN or expand your database without being limited by DOS to 32 MBytes, you need Emerald Systems' technology today.

SUPPORTS ALL MAJOR OPERATING SYSTEMS & LANS

Emerald's subsystems support DOS 2.0/2.1./3.0, QNX, PC/IX, UCSDp System, and XENIX (when available). Also, all fully compatible LAN's including 3 COM, PC-NET, X-NET, NOVELL, and IBM's version of SYTEK's LAN (when available).

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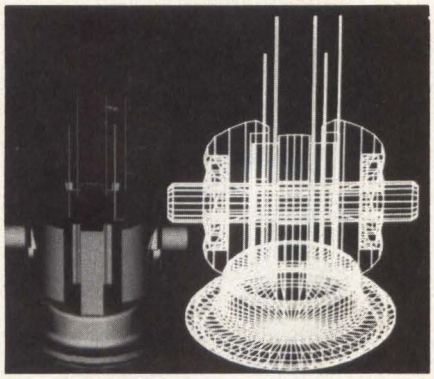
New Products

SYSTEMS



Graphics systems employ bit-slice technology

- 600-nsec-per-pixel writing speed
- processes read/write, arithmetic instructions concurrently

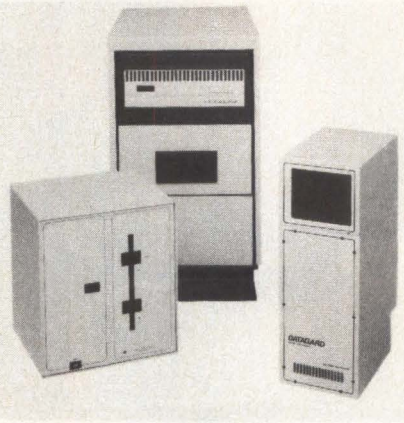
The two-member LEX 900 family of graphics systems features the System Control Module (SCM) controller. Based on 56-bit word microprocessor, the SCM achieves vector writing speeds of 600 nsec per pixel in any direction and processes multiple read/write and arithmetic instructions concurrently. The LEX 90 software architecture is based on the Extended Graphics Operating System. The LEX 90/35 Model 2 graphics system features two software-selectable resolutions. SimulRes functionality allows simultaneous display of both a 640-by-512-by-8 image and a 1,280-by-1,024-by-4 overlay. The LEX 90/35 Model 3 supports eight planes of 1,280-by-1,024 display memory. Model 2 starts at $13,925; Model 3, $19,850. Delivery for Model 2, 90 days ARO; delivery for Model 3, 120 days ARO. **Lexidata Corp.**, 755 Middlesex Turnpike, Billerica, Mass. 01865, (617) 663-8550.

Circle No 300

UNIX systems support 16 users

- 768K bytes of RAM
- 64K bytes of EPROM
- two programmable RS232 interfaces

Featuring 768K bytes of RAM and the UniPlus operating system, two new 8300 VIX one- to 16-user, MC68000-based systems are modular and can be upgraded. Both VIX variations supply a nine-slot Multibus card cage. Two 5¼-inch floppy disk drives with a storage capacity of 1.4M bytes are combined with a 5¼-inch, 20M-byte Winchester disk drive on Model I. Model II furnishes disk storage to 300M bytes and



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For prices call toll free 1-800-421-2929. In California call (213) 979-7055. TATUNG CO. OF AMERICA, INC., 2850 El Presidio, Long Beach, CA 90810.

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When your ANSI needs are multiplying, we'll be there.

Qume's QVT 103™ ANSI* terminal lets you expand your system without the usual growing pains. You get full compatibility with Digital's VT 100** series, for a *lot* less money. You can be sure of high reliability, thanks to Qume's advanced engineering and stringent quality control. And with our nationwide service network, support is always just a short hop away.

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**Full emulation of the VT 131, VT 100 and VT 52. Digital and Digital VT 131, VT 100 and VT 52 are registered trademarks of Digital Equipment Corporation.

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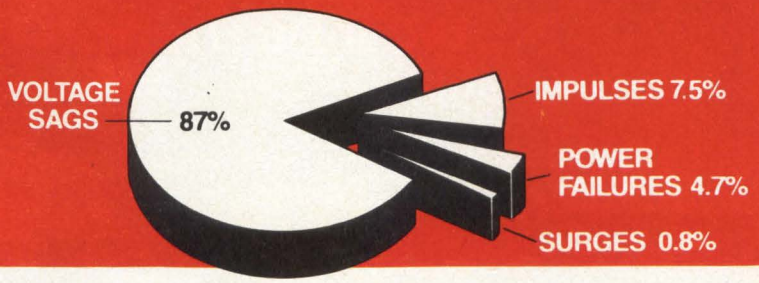
CIRCLE NO. 127 ON INQUIRY CARD

streaming tape backup. The main peripheral module contains two serial, programmable RS232 interfaces, 64K bytes of EPROM and an internal timer. Languages supported include C, COBOL 74, FORTRAN 77, Pascal, BASIC Plus, SMC BASIC, Macro Assembler and Simple Assembler. Communications protocols provided are asynchronous, bisynchronous and SNA.SDLC. A Dataguard configuration of the Model I offers EMI and RFI suppression. Model I, $10,000; Model II, $23,000. **Megadata Corp.,** 35 Orville Drive, Bohemia, N.Y. 11716, (516) 589-6800. **Circle No 301**

BELL LABS FINDS 87% OF POWER DISTURBANCES AT COMPUTER SITES ARE VOLTAGE SAGS!

Sags. Not Spikes. Not Surges. Voltage Sags!

Bell Telephone Laboratories monitored commercial electric power at 24 computer sites of Bell Operating Companies, Western Electric, and the AT&T Long Lines Department. Utility-supplied power was monitored for up to 22 months, with an average per site of more than 11 months and total observation time of 270 months. Here is what Bell found:



Sags Outnumbered Spikes Even During Storms!
Surprising, indeed! Even to the Bell Systems engineers who conducted the study.*

Your Power Is Probably Like Ma Bell's
Chances are your computer is exposed to the same kind of power line sags, impulses and occasional failures. Nasty, costly events that can cause data loss, faulty computations, disk-head crashes and sudden shutoffs.

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ISOREG power modules ***block sags, spikes, and surges*** and deliver good clean power to computers even when line voltages drop to 60% of normal — for minutes.

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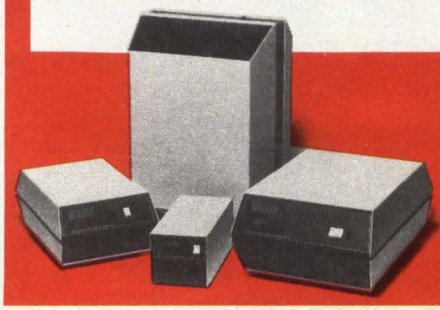

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*"The Quality of U.S. Commercial AC Power," Goldstein, M.; and Speranza, P.D.; *IEEE* April 1982.

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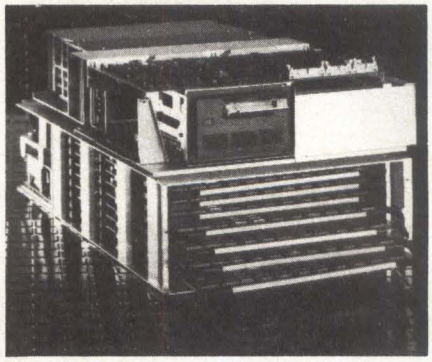

Workstation draws at 1M pixels per second

- 19-inch color display
- detachable keyboard
- 68010 processor

Accomodating the diverse packaging requirements of the value-added supplier, the RM550 color graphics workstation consists of an eight-slot processor module, a low-profile detachable keyboard and a 19-inch color display featuring 1,024-pixel-by-800-pixel resolution. The processor module contains a Motorola 68010 processor, a dedicated, bit-slice graphics subsystem, 3M bytes of main memory, 1M byte of display memory and a Domain network interface. The workstation provides 1M-pixel-per-second vector draws and 25M- to 35M-pixel-per-second area fills and bit-block transfers. The subsystem furnishes circle, arc and spline generation and user-definable area fills and vector patterns. Software support includes the proprietary operating system, AEGIS, and an implementation of Bell Labs' UNIX system III software with Berkeley extensions. $30,000. Delivery is 180 days ARO. **Apollo Computer Inc.,** 330 Billerica Road, Chelmsford, Mass. 01824, (617) 256-6600.

Circle No 302

Microcomputer features 3½-inch Winchester

- 5M- or 10M-byte capacity
- 256K bytes of main memory
- three operating systems

The Apricot xi microcomputer combines the 3½-inch, 5M- or 10M-byte Winchester disk drive and an intelligent disk controller that supports multiple directories and subdirectories, permitting the disk to be partitioned for multiple users. Based on a 8086 processor,

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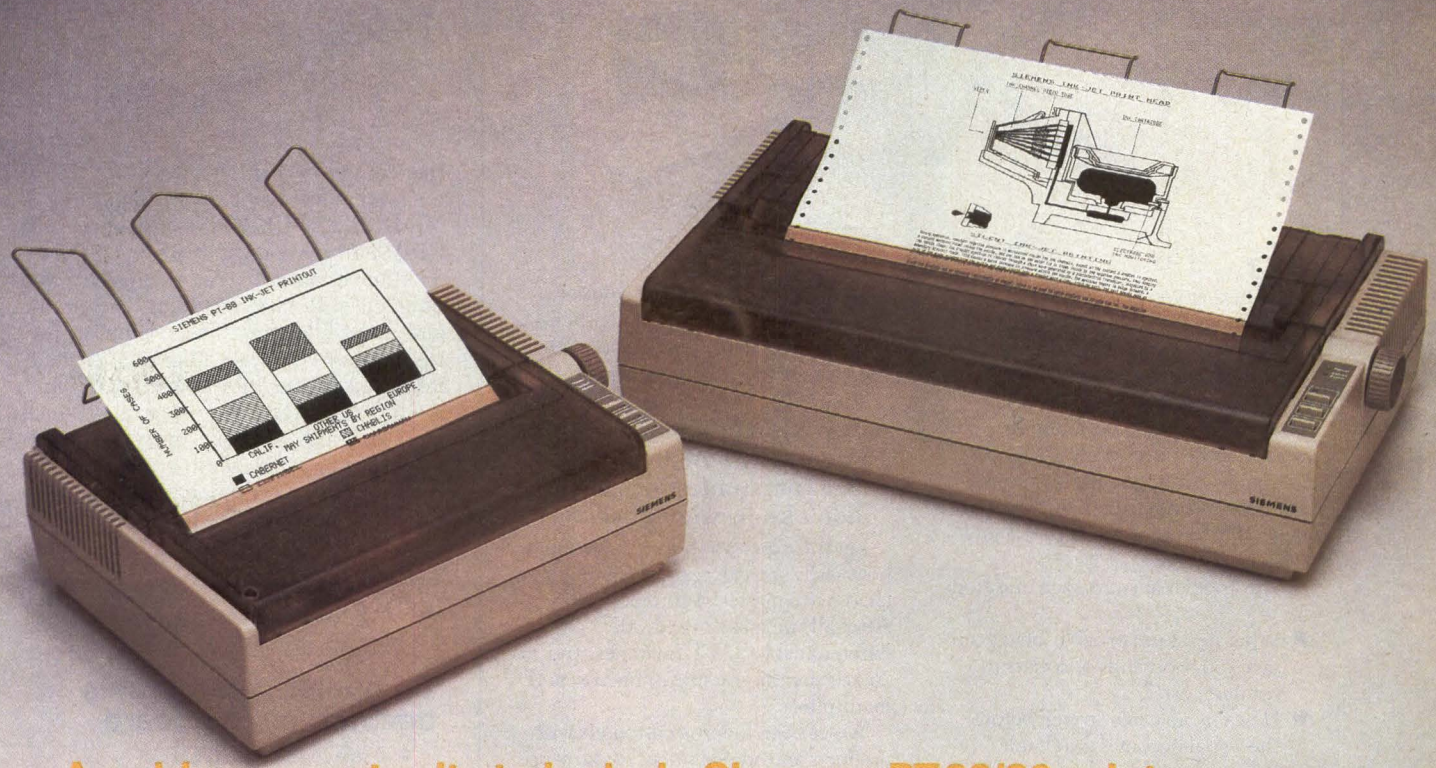

A golden opportunity to include Siemens PT-88/89 printers in your OEM system.

In today's "look-alike, sound-alike" PC systems market, the printer you select for OEM system integration reflects the importance you place on superior performance and long-term reliability. In fact, anything less than a quality printer not only compromises your system's total performance...it undermines customer perception of your system in a highly competitive marketplace.

That's why you owe it to yourself, and the success of your system, to make our incomparable PT-88 ink-jet printer...or the wide-carriage PT-89, part of your OEM system package. Just look at these unique features designed to enhance your system's performance...and give it the all-important "competitive edge":

- Ultra-silent operation ($\leq$ 45 dBa)
- Exceptionally high reliability... the print head is rated in excess of 10 billion characters!
- High speed (150 cps bi-directional) performance
- "Drop-on demand" ink-jet quality printing...crisp, clean, consistent
- IBM-PC, EPSON, and other compatibilities available
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- Friction/traction or roll paper capabilities
- Downloadable character generator
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And here's more good news! Siemens PT-88/89 ink-jet printers offer OEMs the cost pricing benefits of high value-added reseller (VAR) margins. And of course, PT-88/89 printers are fully warranted and backed by one of the world's largest technical service/support organizations.

Take advantage of this golden opportunity. Fill out the attached postcard for our detailed information package on the PT-88/89 ink-jet printers. Siemens Communication Systems, Inc., Office Systems Group, 5500 Broken Sound Blvd., Boca Raton, FL 33431 (305) 994-8800 Extension 7608.

Silence is golden...the quiet ink-jet printers from Siemens.

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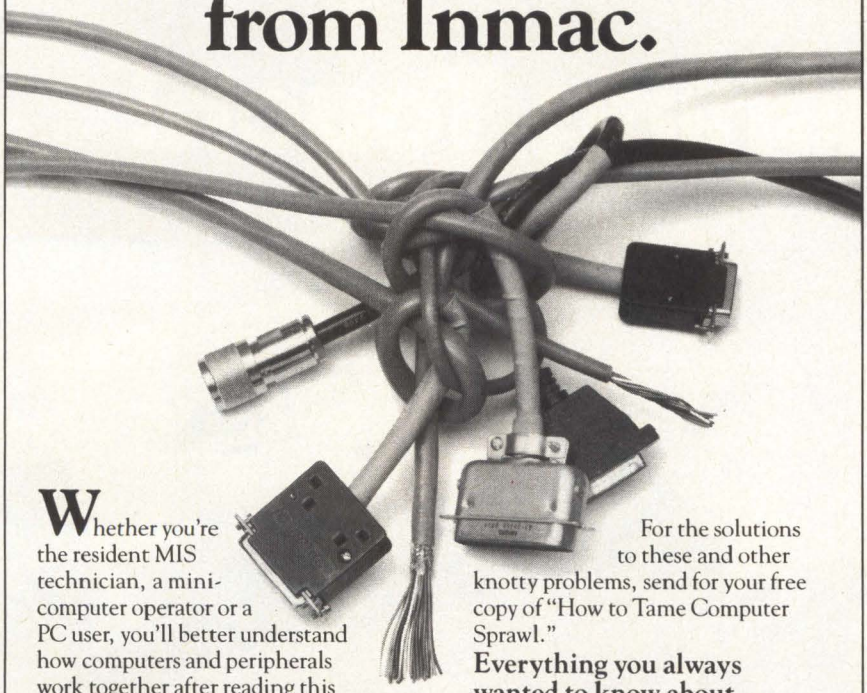

Whether you're the resident MIS technician, a minicomputer operator or a PC user, you'll better understand how computers and peripherals work together after reading this free guide. Photographs, diagrams, and easy-to-understand descriptions make this complex subject clear and manageable.

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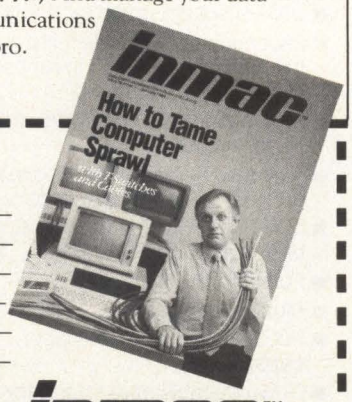

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CIRCLE NO. 130 ON INQUIRY CARD

Products

SYSTEMS

the computer contains 256K bytes of main memory; three operating systems: MS-DOS 2.0, CP/M-86 and Concurrent CP/M-86; a 3½-inch, 315K-byte floppy disk drive; an integral calculator; and bundled software including SuperCalc and SuperPlanner. The computer features an 80-character MicroScreen built into the keyboard for operation without a CRT monitor. The separate 9-inch monitor tilts, swivels and slides. 5M-byte version with monitor, $4,295; 10M-byte version with monitor, $4,795. **Applied Computer Technologies Inc.,** Suite 342, 3375 Scott Blvd., Santa Clara, Calif. 95051, (408) 727-8090.

Circle No 303

Computer incorporates adaptor, motherboard

- 512K bytes of RAM
- two 360K-byte floppy disk drives

The model PB400 single-user, desktop computer incorporates a graphics adaptor on the motherboard, leaving an extra expansion slot for adding optional devices. It features software-selectable screen resolution of 640-by-400 pixels or 640-by-200 pixels, and runs graphics software written for the IBM PC. This 8088 microprocessor-based machine includes two 360K-byte, half-height, 5¼-inch floppy disk drives; one 10M-byte Winchester disk drive; 512K bytes of RAM; a 12-inch green monitor; an 83-key detachable keyboard; one RS-232C port and four expansion slots (one dedicated to the hard disk controller). MS-DOS 2.0, GWBASIC 1.0, MultiMate word-processing and PC Tutor software are provided. $5,995. **Corona Data Systems Inc.,** 275 Hillcrest Drive, Thousand Oaks, Calif. 91360, (805) 495-5800. **Circle No 304**

When you want the ASCII terminal that leads the field in performance, we'll be there.

Now there's an affordable all-purpose editing terminal that's ahead of the pace in quality, performance, and reliability: Qume's new QVT 109™. It comes to you with a full *one-year* warranty. Though that's twice the warranty of most other ASCII terminals, over 98% of our customers never need it. Qume quality control is *that* good.

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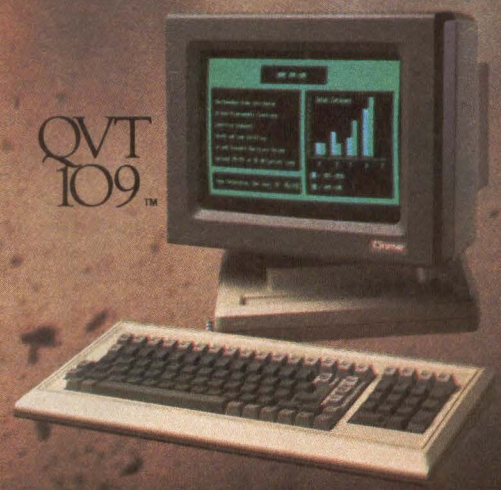

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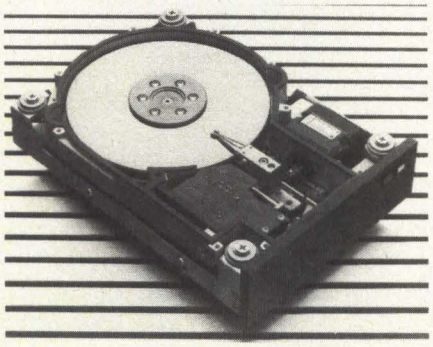
New Products

DISK/TAPE

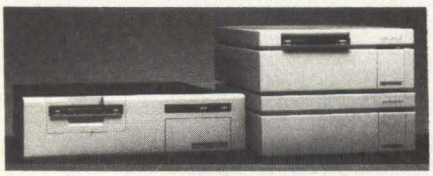


Half-height drive holds 20M bytes

- 5¼-inch format
- 5M-bps data-transfer rate
- 80-msec average access time

The model HH-725 half-height 5¼-inch Winchester disk drive provides 20M bytes of storage and uses an ST506/412 interface. It features a closed-loop servo-positioning system and a thermally isolated stepper motor, with four read/write heads. The drive features self-test when turned on, self-diagnostics, write fault detection and interface control designations and status production. A buffered seek feature allows an access time of 80 msec. The drive uses thin-film media and has a recording density of 9,680 bpi and a track density of 648 tpi. Data transfer rate is 5M bps. The 1.6-inch-by-5.75-inch-by-8-inch drive weighs 3¼ pounds and suits portable applications. Approximately $900. **Microscience International,** 575 E. Middlefield Road, Mountain View, Calif. 94043, (415) 961-2212.

Circle No 305



Storage subsystems work with DEC Q-bus computers

- 30-msec average access time
- ¼-inch cartridge tape backup
- 36M to 120M bytes of formatted capacity

The Cyclone series features 5¼-inch Winchester disk storage and ¼-inch tape cartridge backup. Both subsystems work with DEC Q-bus computer systems such as the PDP-11/23, PDP-11/73, MICRO/PDP-11 and MicroVax. They are fully compatible with DEC's Digital Storage Architecture, which supports system software modifications and logical partitioning of disk drives. The subsystem stores 36M bytes to 120M bytes (formatted). Average access time is 30 msec. The ¼-inch tape cartridge stores 20M bytes of backup and features Kennedy 6455 start/stop tape drives that provide file-oriented transfer capability. The 8250 controller/interface enables simultaneous Winchester and tape drive operation on a Q-bus-compatible board. Starts at $8,990. **Data Systems Design**, 2241 Lundy Ave., San Jose, Calif. 95131, (408) 946-5800.

Circle No 306

Tape drive employs IPI, Level 3 interface

- 160K-bps data-transfer rate
- 1,600/3,200 bpi

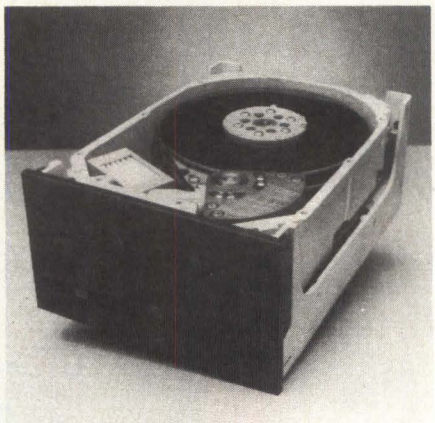
The Model 1880 Microstreamer combines a ½-inch streaming tape drive with the high-level Intelligent Peripheral Interface (IPI), Level 3. It supports high bus speeds with interface transfer rates to 6M bps in non-interlock mode, made possible by dual 1K integrated buffers. The IPI interface allows multiple block operations with one command, requiring 175 μsec., and tape and disk to share common I/O channel. The tape drive provides a 160K-bps data-transfer rate at 100 ips for streaming at 1,600 bpi; 50 ips for streaming at 3,200 bpi. In start/stop applications, it maintains 25 ips at 1,600 bpi. At 1,600 bpi, the drive can store 46M bytes of data; at 3,200 bpi, 92M bytes. $3,000. **Cipher Data Products, Inc.,** 10225 Willow Creek Road, P.O. Box 85170, San Diego, Calif. 92138, (619) 578-9100.

Circle No 307

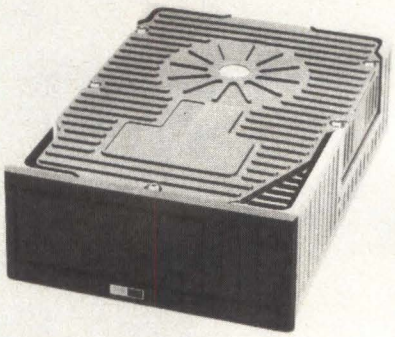
Winchesters work through ESDI interface

- 85M- to 170M-byte capacities
- 5¼-inch drive
- 28-msec average access time

The 1350 series of 5¼-inch Winchester disk drives works with the Enhanced Small Device Interface (ESDI) and offers formatted capacities of 85M, 127M and 170M bytes. The series implements the serial mode of the ESDI interface at a 10M-bps transfer rate. The serial mode permits drives to report configuration and status information. Using four to eight read/write heads, all three series drives have an average access time of 28 msec. Track density is 1000 tpi. Other features include dual-chassis construction and balanced rotary voice-coil positioner. A spindle-motor brake minimizes friction and protects heads and media. $1,469 to $1,837, OEM quantities. **Micropolis Corp.,** 21329 Nordhoff St., Chatsworth, Calif. 913ll, (213) 709-3300.



Circle No 308



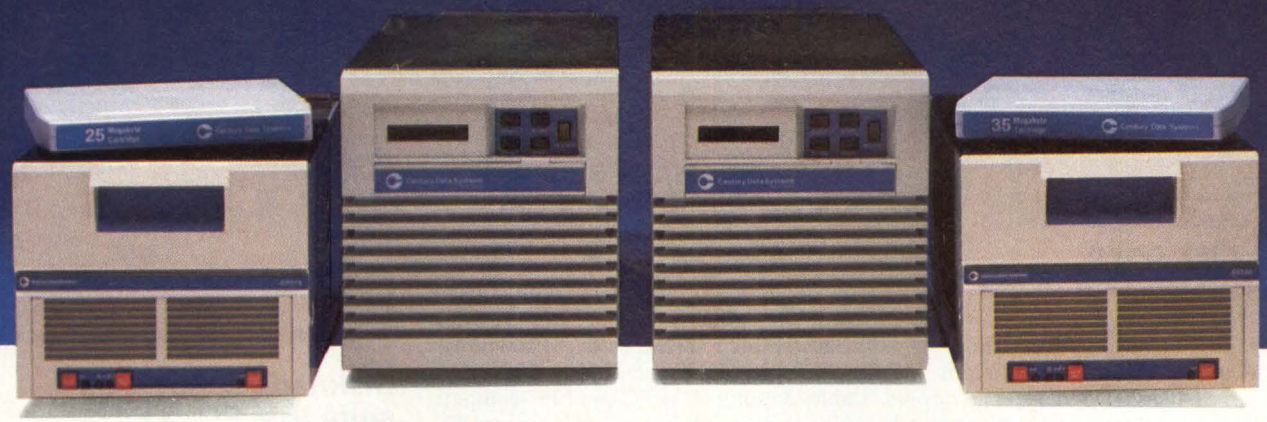
Small Winchesters store 5M, 10M bytes

- 80-msec average access time
- ST412/506 interface

The Ranger 3521 and 3522 3½-inch Winchester disk drives offer formatted capacities of 5M and 10M bytes, respectively. Equipped with the industry-standard ST412/506 interface, the drives' average access time is 80 msec. They operate reliably from 40 degrees to 122 degrees Fahrenheit. Acoustic noise is limited to less than 54 dBa. $595, OEM quantities. **LaPine Technology,** 1111 Space Park Drive, Santa Clara, Calif. 95050, (408) 986-8676.

Circle No 309

8 INCH DISK MEMORIES

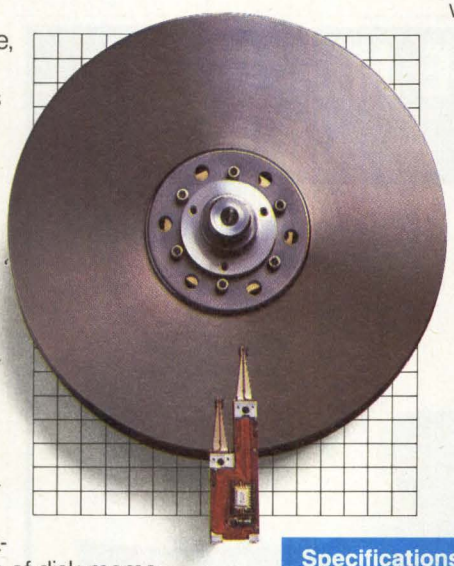


Quality Performers

Century Data Systems now introduces its new C-Series, a line of higher capacity, 8-inch disk memories. These memories are available in a variety of models to offer OEMs the versatility they want, along with the quality and reliability they have come to expect.

This new family of high performance, 8-inch disk memories uses advanced technology and provides compact, reliable mass storage. For example, our new 8-inch Winchester, the C2476, is the ideal choice for computer systems utilizing disk memories in multi-user and multi-task environments which require fast access to large files of data. The C2476 stores 476 megabytes in significantly less cabinet space than previously available models and has an average positioning time of 15 milliseconds.

The C2075, our initial C-Series offering, is an 8-inch fixed/removable disk memory containing 80.2 megabytes of storage. Continuing this line of disk memories is the C2120, our new 122.9 megabyte fixed/removable disk. Both of these disk memories provide OEMs with powerful new sales tools. The fixed Winchester disk portion of the device provides high-capacity, reliable, on-line storage while the removable cartridge extends the on-line storage and provides faster, more convenient backup than tape.



These compact, fixed/removable 8-inch disk memories are the perfect match with large personal computers, microcomputer systems or transaction-oriented systems.

All C-Series products fit in our new, standard 8.5-inch wide package. OEMs using large disk memories can now standardize on one compact package for installation in computer cabinets, equipment pedestals, or on desktops.

Like all our disk memories, the new 8-inch product line is reasonably priced, easy to install, and includes the quality and performance OEM systems require. We invite your inquiries. Write or call: Century Data Systems, Product Marketing, 1270 N. Kraemer Blvd., Anaheim, CA 92806 (714) 632-7500.

Specifications	C2075	C2120	C2476
Storage capacity, fixed disks	53.5 megabytes	87.8 megabytes	475.9 megabytes
Storage capacity, removable cartridge	26.7 megabytes	35.1 megabytes	———
Positioning time, average	32 milliseconds	32 milliseconds	15 milliseconds
Interface	SMD/LMD	SMD/LMD	ESMD
Transfer rate	1209 kilobytes/sec	1209 kilobytes/sec	1859 kilobytes/sec

New products

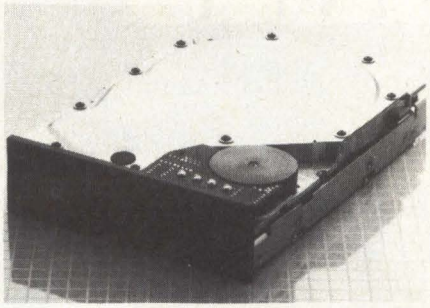
Century Data Systems
A Xerox Company

See these new products at COMDEX, Booth 2758.

CIRCLE NO. 132 ON INQUIRY CARD

New Products

DISK/TAPE



Two-disk drive accepts 25.52M bytes

- 690-tpi density
- 85-msec average access time

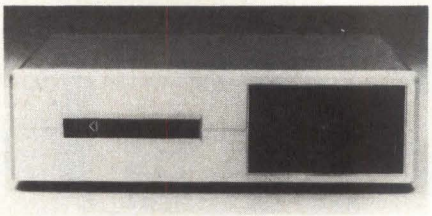
The model CM3426 half-height 5¼-inch drive uses two disks and stores 25.52M bytes of data. It features closed-loop servo positioning and a track density of 690 tpi. The drive uses a crystal-controlled spindle drive and an embedded track-zero concept. The drive employs a swing-arm actuator with closed-loop stepper motor control. The system achieves an average access time of 85 msec. Track-to-track access time is 18 msec. The interchangeable drives weigh three pounds. $525, OEM quantities, **Computer Memories Inc.**, 9216 Eton Ave., Chatsworth, Calif. 913ll, (818) 709-6445. **Circle No 310**

IBM-compatible subsystem packs 75M bytes of data

- 25M bytes removable storage
- SMD PC-80 controller

The RDS 375 75M-byte disk subsystem uses the Century Data Systems C2075 8-inch SMD disk drive and stores 50M bytes fixed and 25M bytes removable. It suits IBM PCs and PC-compatibles that maintain large databases. The Maverick SMD PC-80 controller permits three times the speed of 5¼-inch Winchester drives in PC-net, Ethernet and Netware local area networks. Packaged in a table-top enclosure with storage for three spare cartridges, the unit comes with disk drive, fan, power supply, controller, cables and software for MS-DOS 2.0 or QNX. Average access time is 30 msec. $9,495. **Interphase Corp.**, 2925 Merrell Road, Dallas, Texas 75229, (214) 350-9000.

Circle No 311



Disk/tape subsystem suits IBM PC, XT

- 10M- to 40M-byte storage capacities
- 40-msec average access time

The Datasystem combines either a 10M-, 21M-, 32M- or 40M-byte hard disk drive and a 24M-byte tape backup into one unit. Compatible with IBM PC and XT microcomputers, the subsystem features compressed or full-volume backup, file-by-file or full-volume restore and automatic flaw mapping that ensures media interchangeability. Average access time is 40 msec. The number of read/write heads on the fixed disk is two to eight and the data transfer rate is 62.5K bps. The six-track tape contains six read/write heads and moves at 78 ips. Housed in a 4½-inch-by-14-inch cabinet, the unit weighs 22 lbs. $3,295. **Davong Systems Inc.** 217 Humboldt Court, Sunnyvale, Calif. 94089, (408) 734-4900. **Circle No 312**

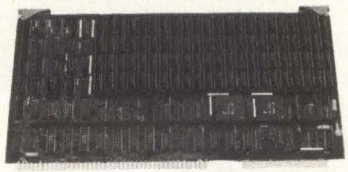
Cartridge tape drive stores 67M bytes

- 60-ips read/write speed
- 16-track recording

The HP 9144A ¼-inch cartridge tape drive stores 67M bytes of data using a density of 10,000 bpi and a 16-track recording format. Operating in streaming mode, it provides 2M-byte-per-minute backup performance. A 12K-byte buffer aids data-transfer speeds. Read-after-write capability protects data. Exclusive OR- error correction and a media monitor ensure data reliability. Search speed is 9 ips; read/write speed, 60 ips. $3,500. **Hewlett-Packard Co.**, 1820 Embarcadero Road, Palo Alto, Calif. 94303. (800) 547-3400.

Circle No 313

UNFORGETABLE MEMORIES
MULTIBUS — QBUS

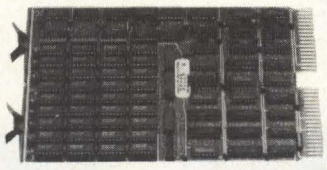


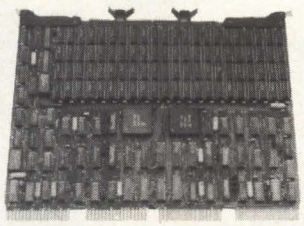
MULTIBUS MEMORY
512KB TO 2MB EDC

- Error Detecting and Correcting (EDC)
- Faster Access Times

SINGLE QTY. PRICE

	Without/EDC	W/EDC
512KB	895.00	1495.00
2MB	3595.00	4595.00





Q-BUS MEMORY
256KB TO 4MB

- Battery Backup Mode
- Block Mode DMA, ECC or Parity
- Works with LSI-11, J-11, MicroVAX

SINGLE QTY. PRICE

1MB 1695.00
256KB 525.00

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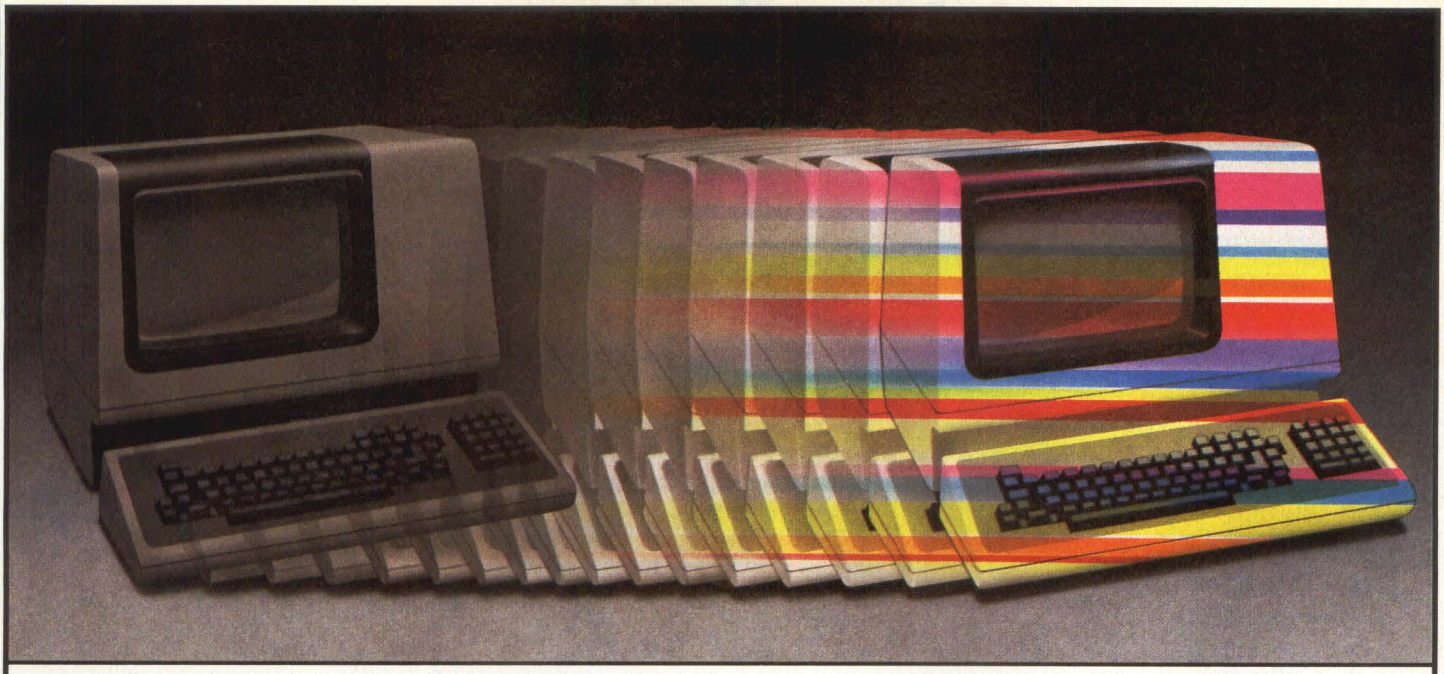
CIRCLE NO. 133 ON INQUIRY CARD



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The Solaris 1000 is far less costly than replacing your existing equipment. And there is no system disruption. The Solaris 1000 takes about two minutes to install. You simply connect a cable. No modifications are necessary.

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For more information call (408) 943-1818 or write to Solaris Computer Corporation. If you haven't upgraded your terminals to total PC capability, you're missing the advantage of micro-mainframe technology.

Solaris 1000 running Lotus 123 on a VT-100 type terminal.

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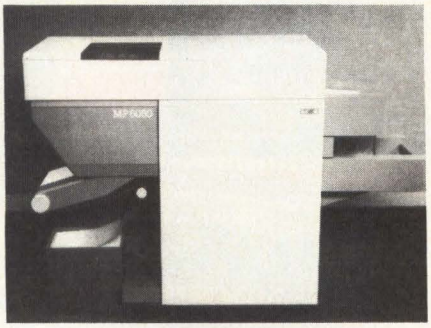
Trademark/Owners: IBM PC/International Business Machines; Lotus 123/Lotus Development Corp.; VT-100/Digital Equipment Corp.

New Products

PRINTERS

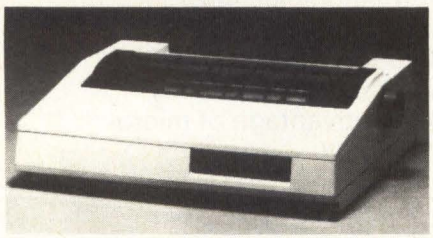


Non-impact printer achieves 50 ppm

- 240 by 240 dpi
- Handles multiple forms
- 10, 12, 13.3 and 15 cpi

The MP 6050 non-impact magnetic printer achieves a resolution of 240 by 240 dpi at a speed of 50 pages per minute. The 45.3- by 22.6- by 67.4-inch unit handles forms from 8½ to 9½ inches wide and 5½ to 12 inches high. Standard features include a video interface, a power stacker, operator or host-selected densities of 10, 12, 13.3 and 15 cpi and vertical densities of 6, 8, 10 and 12 lpi. Character sets come in four sets of 96, and are either operator- or host-selectable; page rotation occurs at zero and 90 degrees. $15,000, OEM quantities. **Cynthia Peripheral Corp.,** 766 San Aleso Ave., Sunnyvale, Calif. 94086, (408) 745-0855.

Circle No 314

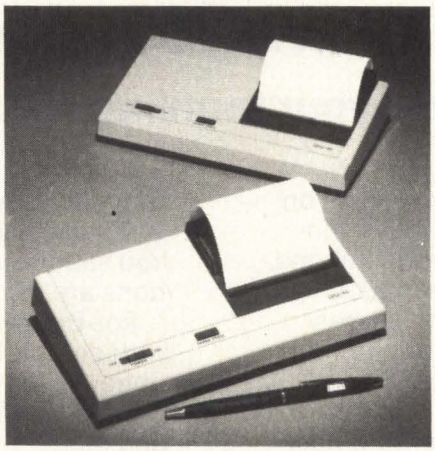


Dot-matrix printers offer IBM PC compatibility

- Single or multiple colors
- 105- to 180-cps print speeds
- 80 or 136 columns

Model 7500E of a series of IBM PC-compatible dot-matrix printers produces 80 columns at a 105-cps print speed and a 45-lpm throughput. It employs a 9-dot-by-9-dot matrix for alphanumerics and an 8-dot-by-8-dot matrix for dot-addressable graphics. The model 8510/1550SCE printers provide correspondence-print quality and seven-color business graphics at 120 cps and rough-draft printouts at 180 cps. They use a 9-dot-by-9-dot matrix and a 144-dpi-by-160-dpi resolution. A 4K-byte serial or a 2K-byte parallel buffer, 13 switch- or software-selectable character sets and a 256-byte overrun buffer are standard. The model 8510SCE printer prints 80 columns on 4½- to 10-inch-wide forms; Model 1550SCE prints 136 columns on 4½- to 15½-inch-wide forms. Parallel and RS232C interfaces are available. Model 7500E, $450; model 8510SCE, $940; model 1550SCE, $1,270. **C. Itoh Electronics Inc.,** 5301 Beethoven St., Los Angeles, Calif. 90066, (213) 306-6700.

Circle No 315

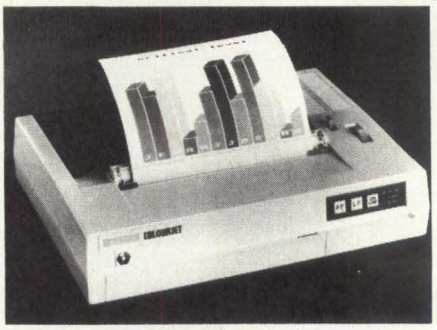


Thermal printer offers low cost, compactness

- Small size, low weight
- 5-dot-by-7-dot matrix
- 40 columns

The DPU-40 thermal printer measures 210mm long by 117mm wide by 53mm high and weighs 400 grams. The unit prints 40 columns of characters in a 5-dot-by-7-dot matrix format at approximately 0.6 lines per second. Characters are 2.4mm high by 1.1mm wide. An on-board character generator produces a 96-character ASCII set. The printer uses heat-sensitive, 80-mm paper accommodating a 40mm diameter roll of paper. The printing mechanism consists of a thermal print head, one DC drive motor, a tacho-generator and a home switch. Mean-time-between-failure is 500,000 lines. An 8-bit parallel port employs Centronics handshaking. $86.25. **Seiko Instruments U.S.A. Inc.,** 2990 West Lomita Blvd., Torrance, Calif. 90505, (213) 530-8777.

Circle No 316



Ink-jet printer furnishes 36 colors

- IBM PC-compatible
- 252 dpi
- 80 and 132 columns

The Colourjet 132 ink-jet printer produces 36 colors with a 252-dpi resolution. It prints 132 columns compressed and 80 columns normal. Using a screen-dump disk, the unit is compatible with the IBM PC. Features include double-width, double-height and double-size printing, underlining, italics and programmable foreground and background colors. The unit can print in videotex format from a Centronics parallel input. $795. **Integrex Inc.,** 233 North Juniper St., Philadelphia, Pa. 19107, (215) 568-9681.

Circle No 317

Dot-matrix printers run at 160 cps

- 60 to 240 dpi
- 80 or 136 columns
- Parallel interface

The CTM series dot-matrix printers operate at 160 cps, providing 11 print functions. Character sets encompass 96 ASCII characters, nine international sets and 96 italic characters. Special printer effects include proportional spacing, superscript/subscript modes, ninth-pin underlining, printer select and deselect by software and graphics functions with variable densities from 60 to 240 dpi horizontal and up to 216 dpi vertical resolution. Model 80 prints 80 columns on 9½-inch-wide paper and Model 100 prints 136 columns on 16-inch-wide paper. A Centronics-style, 8-bit parallel interface, a multifont interface and a word-processing card come standard. CTM 80, $370 (1,000 units); CTM 100, $500 (1,000 units). **Epson OEM Products Division,** 3415 Kashiwa St., Torrance, Calif. 90505, (213) 533-8277.

Circle No 318

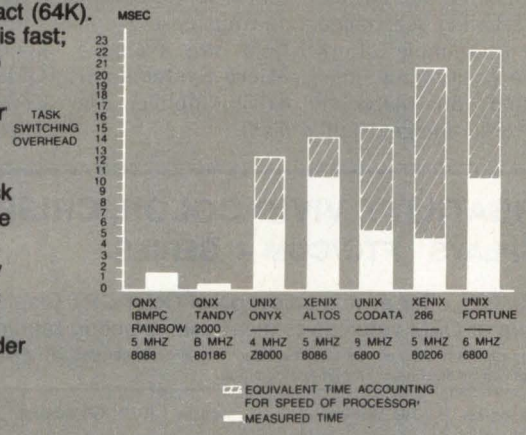
Technical Bulletin
No.1 in a series.

Subject : Engineering for maximum performance.

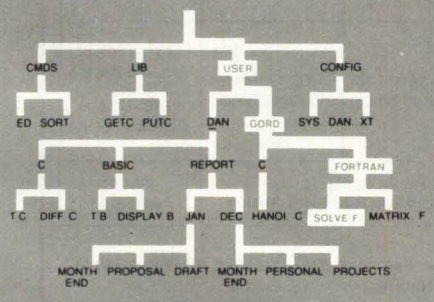
Quantum Software Systems Ltd. bring you QNX — The Ultimate Operating System. The design of QNX allows you to take advantage of an IBM-PC or similar micro-computers in ways that are only possible on large mini and mainframe computers.

Unlike other UNIX™ type systems QNX was engineered for the 8086/8088 architecture. All of QNX's features were designed into the operating system right from the beginning. As a Real-Time Multi-Tasking O/S, QNX will support up to 48 tasks executing simultaneously. It is also a Multi-User O/S with a Time-Sharing environment supporting up to 17 users, with a security conscious Message-Passing Protocol ideally suited for Local Area Networks. We will shortly be announcing a true (not just a file server) Distributed Local Area Network version of QNX.

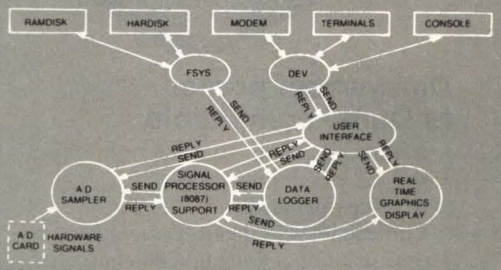
To minimize memory requirements we allow Shared Code and Shared Libraries. Disk access is accelerated by Disk Caching. To improve productivity we give you Multiple Windows. For those of you who wish to add new devices, you simply mount a Device Driver. Our operating system is compact (64K). Of course QNX is fast; benchmarked to be 20 times faster than other popular UNIX™ systems. On a 5 Mhz 8088, task switching is done within 1.3 msec. Interrupt latency is under 1 msec and kernal call overhead is under 350 usec.



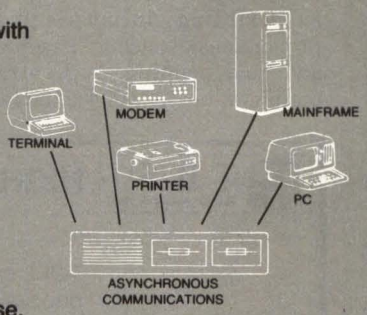
The QNX file system is highly optimized with minimum floppy disk access and is tolerant of power failure. It is a Hierarchical Directory System with 16 character file/directory names. There are NO limits to the number of files, or number of directories. The file system has a minimum File Allocation Unit of 512 bytes regardless of disk size with a directory overhead of less than 2%. Up to 40 files can be opened simultaneously. The QNX Multi-User file security includes read/write/append/execute/modify file permissions, and read/create/block/modify directory permissions. 256 Groups of up to 256 users in each group are possible. QNX files can grow automatically and need not be contiguous.



The Intertask communications include message passing, non-blocking signals, and asynchronous exceptions. Messages are passed at the rate of 3 usec/byte on a 5 Mhz 8088 and may consist of up to 64K bytes. Partial I/O of messages is permitted and message forwarding is supported. Priority task scheduling will allow up to 16 priorities and 48 simultaneous tasks. Messages may be sent between tasks on different nodes in the local area network version of QNX.



Asynchronous Communications are completely interrupt driven with up to 16 serial (RS232) devices supported. Input/output Flow Control is supported for XON/XOFF and DTR/CTS hardware. Loss of carrier can generate a High Level Exception. Line Editing is a programmable option on any terminal and terminal independence is made simple with a "TERMCAP" type database.



Other Quantum Software product development tools include a "C" Compiler, a Full Screen Editor, an 8086 Assembler, a Fortran Compiler, a Basic Compiler, a Qbol (Dibol) Compiler, and Graphics and Math libraries with complete 8087 support.

Minimum hardware required is an IBM-PC or compatible with 128K RAM, single 320K floppy drive, and display/keyboard (or terminal). Maximum requirements are 880K RAM, 8087 math co-processor, 8 disk drives (floppy, hard or ramdisk), 2 parallel printers and 16 RS232 devices (terminals, modems, printers).

QUANTUM SOFTWARE SYSTEMS LTD.
Moodie Drive, HiTech Park
215 Stafford Rd., Unit 104
Ottawa, Canada K2H 9C1
(613) 726-1893

PRICE LIST

QNX 1.20 WITH "C" COMPILER	$650	QBOL COMPILER	$595
QNX 2.00 WITH "C " COMPILER (2 NODES)	$850	QMENU	$150
BASIC COMPILER	$300	BTREE	$150
"C" COMPILER	$300	QSPELL	$199
		QDOC	$300
		TED/TERMCAP	$ 50

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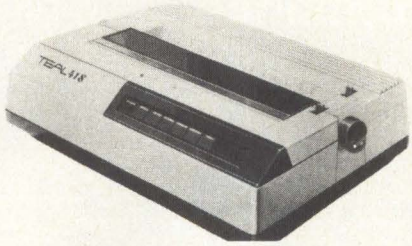
CIRCLE NO. 123 ON INQUIRY CARD

New Products

PRINTERS



Daisywheel printer is Qume-compatible

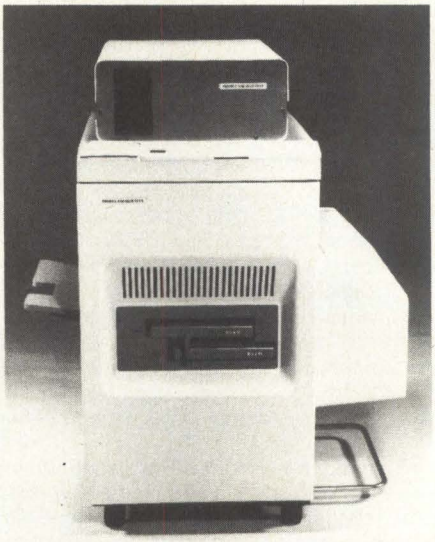
- 120 columns in 10 pitch
- 8-bit parallel interface
- 18-cps print speed

The model 418 printer furnishes an 18-cps print speed using a 96-character, Qume-compatible, 10-, 12- or 15-pitch daisywheel. The printer accommodates 13-inch wide paper printing 120 columns in 10 pitch. It prints an original and four copies with a four-level impression control. Features include superscripting, subscripting, automatic underlining, proportional spacing, shadow printing and bold printing. A Centronics-compatible 8-bit parallel interface comes standard; an RS232C interface is optional. $545. **Teal Industries Inc.,** 1741 Lomita Blvd., Lomita, Calif. 90717, (213) 539-7244. **Circle No 319**

Laser printer includes graphics controller

- 24 ppm
- 90,000-dpi resolution
- 12 resident fonts

Printing 24 ppm, the intelligent Lasergrafix 2400 laser printer includes a graphics controller with 2M-byte RAM and 512K-byte EPROM. With a resolution of 90,000 dpi, the MC68000 processor-based printer suits distributed graphics and text-processing applications. The unit bit-maps an 8½-inch-by-14-inch page. Graphics capabilities include 12 resident fonts and font downloading and line and daisywheel simulation. The QMS Utility for Image Creation (QUIC) programming offers absolute and relative positioning, line/form drawing commands, line/character spacing control, reverse image, half-



tone, vector graphics, pixel graphics and business graphics. Interface selections are available. $35,000. **Quality Micro Systems Inc. (QMS),** P.O. Box 81250, Mobile, Ala. 36689, (205) 633-4300. **Circle No 320**

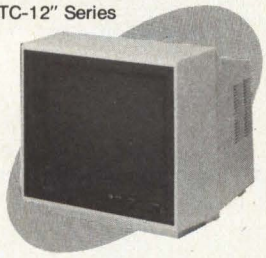
TOEI Toei Electronics Co., Ltd.

HIGH PERFORMANCE, VERSATILITY, VIVID COLOR, CRISP IMAGE

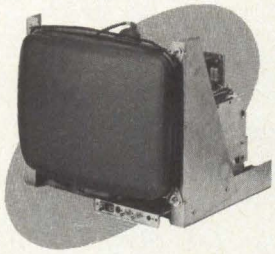
TOEI COLOR DISPLAYS FTC/CDM — SERIES.

TOEI, experienced Display Monitor specialists, offer a wide selection of Color CRT Displays. You can choose from our versatile standard models or OEM versions to meet your exacting requirements.

FTC-12" Series



CDM-14" Series



FTC Series •Housed in lightweight, impact-resistant Cabinet. •Hi-Contrast (Black Face), Hi-Brightness CRT displays a crisp, sharp image. •Limitless colors can be displayed through Analog Input.

Versions / CRT Size	RGB Version	NTSC Version	PAL Version	NTSC & RGB Version	PAL&RGB Version	IBM PC Compatible only
12" (CRT Pitch)	FTC-1201-R (0.47mm Stripe) FTC-1203-R (0.38mm Dot trio) FTC-1208-R (0.28mm Dot trio)	FTC-1200-N (0.64mm Stripe) FTC-1201-N (0.47mm Stripe)	FTC-1200-P (0.64mm Stripe) FTC-1201-P (0.47mm Dot trio)	FTC-1201-NR (0.47mm Stripe)	FTC-1201-PR (0.47mm Stripe)	FTC-1203-H (0.38mm Dot trio) FTC-1208-H (0.28mm Dot trio)
14" (CRT Pitch)	FTC-1423H-R (0.42mm Stripe) FTC-1428H-R (0.39mm Dot trio) FTC-1455H-R (0.31mm Dot trio)	FTC-1410H-N (0.52mm Stripe) FTC-1416-N (0.64mm Stripe)	FTC-1410H-P (0.52mm Stripe) FTC-1416-P (0.64mm Stripe)	FTC-1410H-NR (0.52mm Stripe)	FTC-1410H-PR (0.52mm Stripe)	FTC-1428-H (0.39mm Dot trio) FTC-1455-H (0.31mm Dot trio)
Applications	IBM PC Apple IIc, Apple IIe* RGB TTL & Analog	Commodore, Apple IIc,·IIe		IBM PC Jr, Apple IIc·IIe Commodore, RGB TTL & Analog		IBM PC with card

*through Compatible Interface-Module

FTC-1203-R, FTC-1203-I: Non-Glare

CDM Series (Unit for OEM)

Model	CRT Size	CRT Pitch
CDM-1208-R	12"	0.28mm Dot trio
CDM-1203-R	12"	0.38mm Dot trio
CDM-1201-R	12"	0.47mm Stripe
CDM-1455H-R	14"	0.31mm Dot trio
CDM-1428H-R	14"	0.39mm Dot trio
CDM-1423H-R	14"	0.42mm Stripe
CDM-1410H-R	14"	0.52mm Stripe

- Green/Orange CRT Displays are also available. (Included IBM Compatible.) CRT size: 9" or 12". Horizontal frequency: 15.75-64kHz.
- Special made products: Select Horizontal Frequency within 31-64kHz (Color), 24-64kHz (Monochrome). Display providing with more than 640x400-dot-resolution are also available.
- We are looking for reliable and established distributor worldwide.

IBM PC is a Trademark of IBM Corp. Apple IIc, IIe are Trademarks of Apple Computer Inc. Commodore is a Trademark of Commodore Business Machine Inc.

TOEI ELECTRONICS (MFG) CO.,LTD.

Kanda Cent Bldg., 2-4, Yushima 1-chome Bunkyo-ku, 113 Tokyo JAPAN
Tel. (03) 257-1131 Telex. 0222-2555 TOEICO J FAX (03) 258-3560

CIRCLE NO. 135 ON INQUIRY CARD

The new Canon TX-50 desktop computer.

It fits any customer's business as well as his desk.

No matter how specialized your customers' business needs, Canon's new compact desktop computer is uniquely designed to accommodate them.

Because the TX-50 is a self-contained computer that can be customized for a wide range of specific business applications.

Its all-in-one design includes:

- A high-performance 16-bit microprocessor with MS-DOS† operating system. Standard 128KB memory is expandable to 256KB.
- Seven-inch high-resolution monochrome CRT display.
- Fifty-function LED keyboard plus separate ten-key calculator pad and cursor control keys.
- Three-inch compact floppy disk drive with 150 K-bytes memory capacity per side.
- Optional RS-232C serial interface and Centronics-type parallel interface available.
- Wire dot impact printer that gives a sharp 5X7 dot matrix and has a maximum 30 characters per line. One original plus two copies can be made on plain paper in either black or red.

With such impressive, self-contained flexibility, the TX-50 is ideal in areas such as customer operations and counter service. Especially since the TX-50 provides such a huge range of varied functions, yet takes up so little space.

Businesses such as gasoline stations, banks, mail rooms, real estate brokers and numerous others will find the TX-50 particularly useful for sales, credit, loan or general customer calculations.

So if you're dealing with business, whether large or small, and you feel they need a rather special computer, consider the new Canon® TX-50 desktop computer.

There isn't a desk it won't fit.

For more information:
Call 1-800-323-1717, Ext. 302.
(In Illinois call 1-800-942-8881, Ext. 302.)
Or write Canon U.S.A., Inc.
Systems Division/TX-Series
P.O. Box CN 11250, Trenton, N.J. 08650

Canon Systems Division

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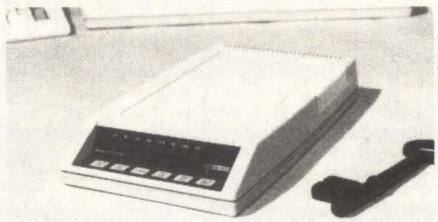
†MS-DOS is a trademark of MICRO SOFT.

CIRCLE NO. 136 ON INQUIRY CARD

New Products

DATACOMM

Auto-dial modem offers two-level security

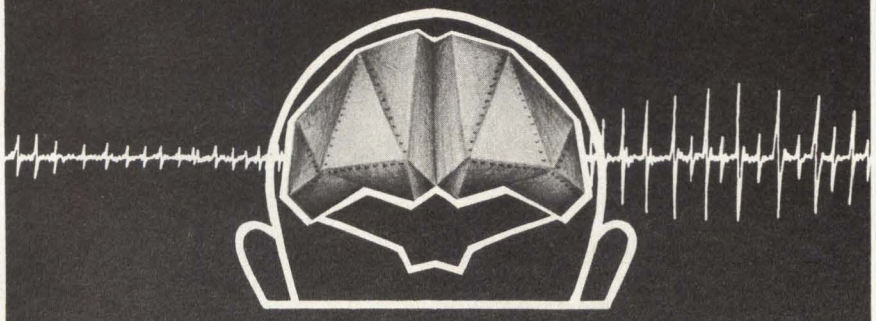


- 0-300 and 1,200 bps
- Bell 103- and 212A-compatible
- 16 telephone numbers

The AJ 1212-AD2 synchronous/asynchronous modem operates at speeds of 0-300 or 1,200 bps and is compatible with Bell 212A and Bell 103/113 modems in switched telephone network operation. It automatically dials a computer via a code name and refuses commands unaccompanied by a password. A second-level password restricts access to the modem's memory. The modem stores 16 telephone numbers of 37 digits each for automatic or touch-tone dialing. A prefix of 19 digits may be added for speed-dialing from internal memory to carrier networks. The modem is approved for direct connection to the telephone line via RJ11 modular jack or RJ41 and RJ45 data jacks. $695. **Anderson Jacobson,** 521 Charcot Ave., San Jose, Calif. 95131, (408) 945-9030.

Circle No 321

Advanced Tools for Artificial Intelligence



SRL's software for Artificial Intelligence applications are advanced tools for serious investigators. These tools permit integrating Lisp written algorithms into FORTRAN or Ada® developed systems.

FORTRAN LISP is a machine independent implemetation of the list processing language Lisp, programmed in ASA Fortran.

ADA LISP is a machine independent implementation of the list processing language Lisp, programmed in Ada MIL-STD-1815A.

Both SRL's FORTRAN LISP and ADA LISP feature:

- Lisp data structures
- Recursion
- Garbage collection
- Portable from CPU to CPU
- Designed for AI systems integration

Translate Lisp written algorithms into FORTRAN or Ada through our:

LISP TO FORTRAN TRANSLATOR
or our
LISP TO ADA TRANSLATOR.

SRL's DEXPERT™ software package is a portable expert system that features:

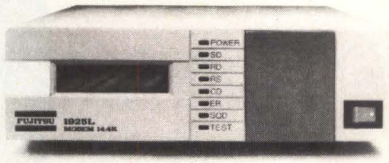
- User definable rules
- Probabilistic decision making
- A building block for integration into other applications, including Fortran and Ada

For full details about SRL's software tools for implementing such AI applications as expert systems, intelligent data base interfaces, and other scientific uses, contact:

Systems Research Laboratories, Inc.
Computer Systems Division
2800 Indian Ripple Road
Dayton, Ohio 45440-3639
(513)426-6000

SRL

*Ada® is a registered trademark of the U.S. Government, Ada Joint Program Office.



Standalone modem operates at 14,400 bps

- Six-channel multiplexer
- 32-character LCD

The model 1925L standalone modem provides 14,400-bps synchronous data transmission over unconditioned lines. It features an automatic adaptive equalizer and fallback speeds of 9,600, 7,200 and 4,800 bps. A 32-character liquid-crystal display monitors operation, checks signal quality, performs local and remote loopback tests and changes local and remote strap settings. A six-channel, time division multiplexer comes built in. $6,500. **Fujitsu America Inc.,** 1945 Gallows Road, Vienna, Va. 22180, (703) 356-5758. **Circle No 322**

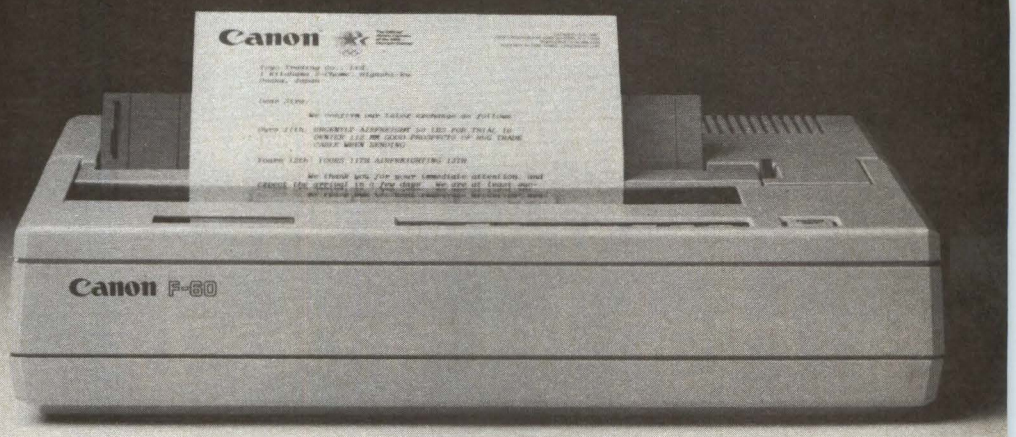
Server links 14 devices to Ethernet LAN

- MC68000 microprocessor
- Supports Xerox network protocols

The Communications Server/100-14 links an Ethernet LAN to as many as 14 devices equipped with RS232C interfaces. It contains multiple MC68000 microprocessors and supports industry-standard Xerox Network System high-level network protocols. Connection between devices is executed through user command interface software. $5,400. **Bridge Communications Inc.,** 10440 Bubb Road, Cupertino, Calif. 95014, (408) 446-2981. **Circle No 323**

Canon

How does a new, letter-quality, thermal transfer printer made by Canon sound? Very quiet.



Canon's advanced non-impact printing technology heralds yet another achievement—The F-60: a flexible, high-quality thermal transfer printer with Graphic Image capability.

Its letter-quality printing is good enough to use with a word processor, yet quiet enough to be seen and not heard. The F-60 operates at a dramatically low 45db, so it's perfect for even the most noise-conscious office.

Extreme flexibility gives access to three attractive printing modes. Printing speeds range from Graphic Image at a rapid 80cps, through Draft and Near-Letter-Quality to Letter-Quality at a smooth 20cps and an impressive high-resolution 36X24 dot matrix.

But its flexibility doesn't stop there. A simple system of interchangeable typestyle cartridges gives an incredible choice of eight different fonts.

The F-60 is also highly versatile. It handles not only thermal paper and overhead projection film, but also plain paper in single sheets, rolls or fan folded. Its self loading mechanism automatically inserts and advances the paper. It's even compatible with most leading personal computers.

Plus it prints in a choice of four bold colors.

And it does it very quietly, and at a very competitive price.

For upgraded performance, optional accessories include pin feed, tractors, roll paper holders and a serial interface card.

The new F-60 thermal transfer printer from Canon. You have to admit it sounds very good.

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For more information:
Call 1-800-323-1717, Ext. 300.
(In Illinois call 1-800-942-8881, Ext. 300.)
Or write Canon U.S.A., Inc.,
Printer Division, P.O. Box CN 11250,
Trenton, N.J. 08650

Canon Printer Division

CIRCLE NO. 138 ON INQUIRY CARD

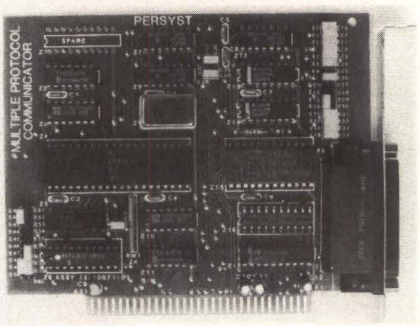
New Products

DATACOMM

Controller board supports multiple protocols

- 150- to 9,600-bps data rates
- Asynchronous and synchronous protocols

The Multiple Protocol Communicator controller board allows IBM PC and IBM PC-compatible computers to support asynchronous and synchronous communications protocols. Using a Zilog 8530-SCC serial communications chip, it offers full-duplex data rates from 150 to 9,600 bps. Standard features include an on-board Intel 8253 counter/timer and an RS232 interface with support for 208



AB standard synchronous modems and asynchronous devices such as the Hayes modem. The board supports the company's 3270 bisynchronous terminal emulation software packages. $150 (100 units). **Personal Systems Technology Inc.,** 17862 Fitch, P.O. Box 19615, Irvine, Calif. 92714, (714) 660-1010.

Circle No 324

NORM DE NARDI PRESENTS:

An Industry Salute To High Technology.

THE CALIFORNIA COMPUTER SHOW

At The Palo Alto Hyatt Hotel

The Longest Running Regional Computer Show

- A unique, one day computer showcase highlighting industry trends and product introductions.
- An opportunity to reach a base of qualified customers while simultaneously keeping abreast of the competition.
- An ideal environment for OEMs, dealers and distributors to meet with industry leaders.
- See the latest in computers, CAD workstations, graphic systems, peripherals, communication equipment, UNIX and other software development tools.
- Norm De Nardi's computer industry expertise has made the California Computer Show a most effective marketing tool.
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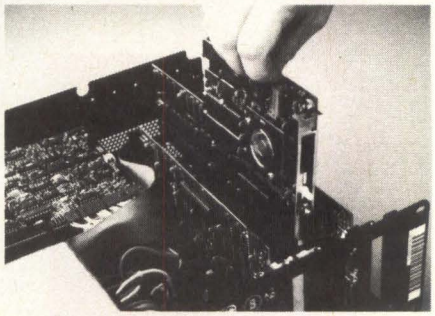
NDN 289 S. San Antonio Rd., Suite 204, Los Altos, CA 94022 (415) 941-8440

The Palo Alto Hyatt Hotel • December 6, 1984 • 12 P.M.–6 P.M.

CIRCLE NO. 139 ON INQUIRY CARD



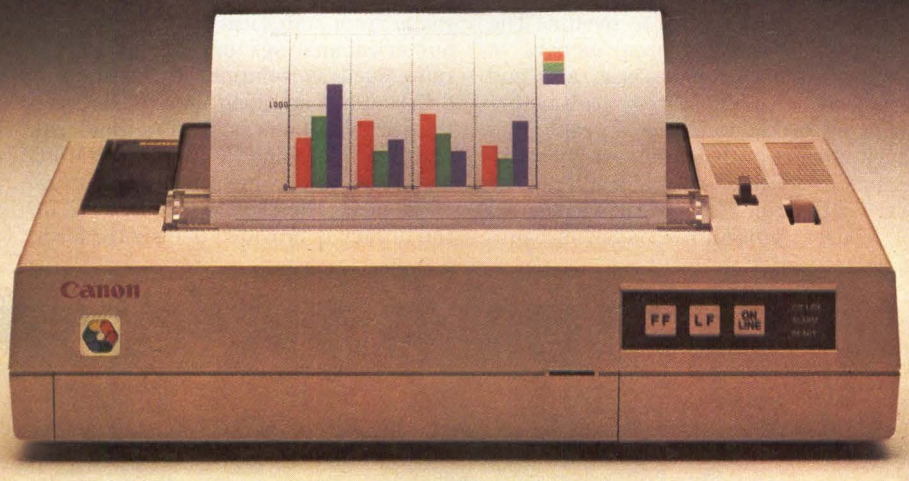
Board modems carry extra RAM

- 300- and 1,200-baud rates
- Auto-dial/auto-answer
- 64K or 256K bytes of built-in RAM

Available in three models, the Personal Communicator modem provides data-transmission capabilities at baud rates of 300 and 1,200. Two models add 64K or 256K bytes of usable RAM, a real-time clock and a parallel interface to the host computer; the basic model contains no RAM. Each version includes the company's Telpac communications software package and slides into an available slot in an IBM PC, IBM PC/XT or IBM PC-compatible machine. These asynchronous modems feature automatic speed detect, audio phone line monitor, volume control, programmable commands, two RJ11C jacks, telephone cord and a user's manual. Basic version, $499; 64K-byte version, $699; 256K-byte version, $999. **U.S. Robotics Inc.,** 1123 W. Washington Blvd., Chicago, Ill. 60607, (312) 733-0497. **Circle No 325**

Canon

What's more incredible about Canon's color ink-jet printer? The quality... or the price?



Take a look at the beautiful clarity of the Canon® PJ-1080A's color ink-jet printing. Then discover that Canon's color printer actually costs well under a thousand dollars. You'll be hard-pressed to decide which is more amazing.

What makes the quality so incredible? Features like:

- The advanced drop-on-demand printing system. Canon's patented ink-jet technology gives a sharp 640 dot-per-line scan mode, for dazzling high-resolution color and exceptionally clean, crisp printouts.
- Whisper-quiet operation of less than 50dB and an impressive speed of 37 c.p.s.
- A choice of seven bold colors for bright, imaginative graphics.
- A special dual-ink cartridge system that gives cleaner resolution on blacks and saves you money, because when black is used up only the black cartridge need be replaced.
- The ability to print high-fidelity characters and images on transparencies for overhead projection.
- Compatibility with most computers you can buy.

And how much does all this cost? Far less than a thousand dollars.

So what's more incredible about the PJ-1080A color ink-jet printer? There's only one way you'll really be able to find out.

And that's to buy one and decide for yourself.

For more information:
Call 1-800-323-1717, Ext. 300.
(In Illinois call 1-800-942-8881, Ext. 300.)
Or Write Canon U.S.A., Inc.,
Printer Division, P.O. Box CN 11250,
Trenton, N.J. 08638.

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Canon Printer Division

CIRCLE NO. 140 ON INQUIRY CARD

New Products

SOFTWARE

Tools help users build C programs

- High-level interface
- Supports graphics devices

The Csharp Realtime Toolkit comprises five real-time, multitasking C programmer tools distributed as source code. The Cisr tool accesses machine-level features such as processor priority control and device interrupts. It contains procedures written in assembly language and C and supports the DEC PDP-11 processor family and the Intel 8086/8088 processors. The Cevent tool interfaces to external events such as switch closures and button presses, and can count and time these events. The Cgraph tool enables programmers to write portable graphics programs and configure graphic system parameters using C procedure calls. Cgraph routines support graphics devices with programmer-specified device handlers. The Csched tool controls real-time execution of C-user procedures, allowing programmers to schedule, cancel and synchronize their tasks. The Cstate tool structures process control using state-system notation. $600. **The Systems Guild Inc.,** P.O. Box 1085, Kendall Square Station, Cambridge, Mass. 02142, (617) 451-8479.

Circle No 326

FORTRAN library has 114 subroutines

- Runs under MS-DOS, PC-DOS
- 450 pages

This FORTRAN 77 library contains 114 classic scientific subroutines. They range from statistical analyses through numerical analyses and encompass routines such as solutions to third-order differential equations and to M equations in N unknowns. The routines run under MS-DOS and PC-DOS on IBM PC and IBM PC-compatible computers. Written in Microsoft FORTRAN 3.13, the library is provided in diskette form, both as a linkable library and in source format. Each subroutine has an accompanying test program. The 450-page manual provides hardcopy of each subroutine, its test program, the test results and the mathematical method used. $149.95. **Peerless Engineering Service,** 5819 Soquel Drive, Soquel, Calif. 95073, (408) 462-0330.

Circle No 327

Package downloads in real-time environment

- Works with IBM PC
- Summarizes, reformats and transmits files

The pcMAINFRAME data-transfer system allows users to download and upload files in a real-time environment between an IBM PC or IBM PC plug-compatible computer and a host IBM mainframe computer running the CICS teleprocessing monitor. The system provides capabilities to selectively extract,

Delta makes your deliveries DASH.

Delta DASH® delivers the same day to over 90 cities across the U.S and abroad, covering 10,000 communities. Why get that small package delivered tomorrow when you can DASH it today? DASH (Delta Air Lines Special Handling) delivers packages up to 70 lbs . . . to over 10,000 communities. So give us a ring at the Delta Marketing Office in the city nearest you. Or call DASH at (800) 638-7333 for pick up or delivery.

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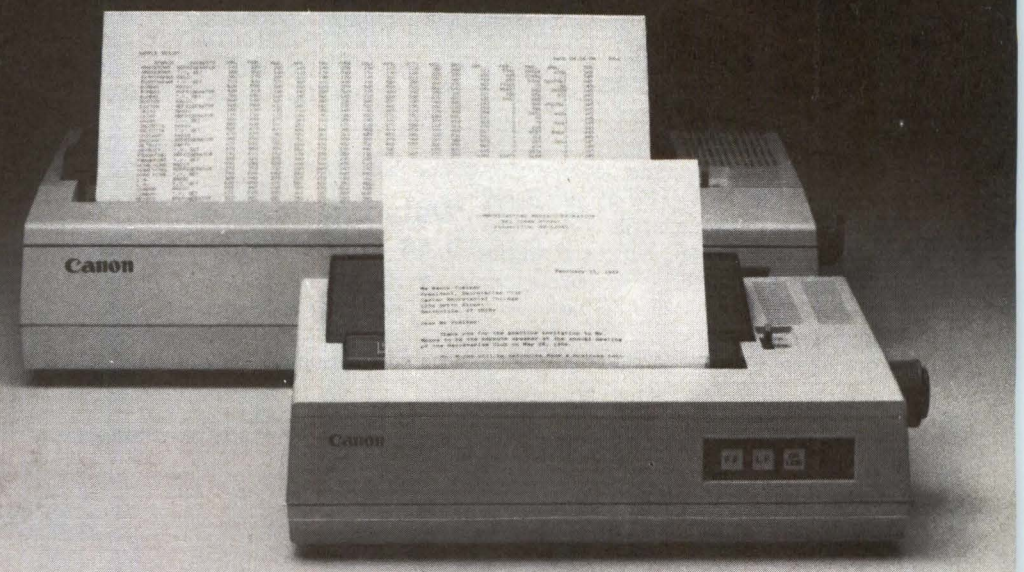
DELTA AIR CARGO. READY ALL·AROUND.

CIRCLE NO. 141 ON INQUIRY CARD

Canon

Now you don't have to sacrifice print quality for speed.

The Canon® Impact Matrix Series Printers.



High speed and high quality in one functional, compact unit. That's what Canon's Impact Matrix Printers offer you.

They print hard copy at a rapid 160 characters per second. While in the double pass mode you get an impressive, high-density 23 X18 dot matrix that gives near letter quality printing suitable for word processing.

Canon's unique technology has also dramatically reduced bothersome clatter down to a muted noise level of less than 60dB.

Even at high speed.

And that, unlike many other impact matrix printers, makes them a pleasure to work with.

Plus there's limitless flexibility with the optional down-loading function that lets you print whatever character fonts your host computer can create. As well as a choice of four different character styles (all printable on the same line) that you can enlarge or condense.

The Impact Matrix Series Printers give you a convenient choice of special paper widths–the PW-1080A for 80-character column printout and the PW-1156A for 156-character column.

Exceptional quality and high speed.

The Canon® Impact Matrix Series Printers give you the best of both worlds.

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For more information:
Call 1-800-323-1717, Ext. 300.
(In Illinois call 1-800-942-8881, Ext. 300.)
Or Write Canon U.S.A., Inc.,
Printer Division, P.O. Box CN 11250,
Trenton, N.J. 08638.

Canon Printer Division

CIRCLE NO. 142 ON INQUIRY CARD

average, summarize, reformat and transmit records and fields from mainframe files for use on the personal computer. Security is provided on the system, user and data levels. The price is $9,000 for the DOS version and $12,000 for the OS version, which includes support for eight personal computers. **Oxford Software Corp.,** 174 Blvd., Hasbrouck Heights, N.J. 07604, (201) 288-1515.

Circle No 329

Package prepares customized systems

- Includes menu utilities
- Runs under MS-DOS 2.0

The LOIS development system, for the IBM PC and IBM PC compatibles, assembles standalone applications into customized integrated software workstations. LOIS's routing facility transfers selected data between applications, automatically performing file format conversions. The facility manager identifies files in a directory and command-free file operations such as create, delete, move, copy, display, print and rename. Each LOIS is tailored to the application. The development system includes menu (screen, action, information and help) utilities, create/edit utilities, routing script create/edit utilities, a file format conversion filter library, the run-time package and documentation. Minimum system requirements are DOS 2.0 or higher, 256K bytes of RAM and hard disk. $995. **ModTech International Inc.,** 5250 S. Green St., Suite 100, Salt Lake City, Utah 84123, (801) 264-2050.

Circle No 330

Database manager has six separate modules

- Pick-based
- Requires 320K bytes

Based on the Pick operating system, the Revelation relational database management system and applications environment for IBM PCs and IBM PC workalikes uses a variable-length data structure. The only logical limits to Revelation's files are 65,535 characters per field and 65,535 fields per record. The maximum number of records per database is defined by the user's disk space. Revelation consists of six separate modules: R/Design, a fourth-generation application and program generator for defining files and building menus; R/List, a dictionary-driven report generator; R/File for creating and manipulating data files; R/Copy to convert MS-DOS or PC-DOS files for use with Revelation; R/Edit, an interactive line editor; and R/BASIC, a hybrid procedural language for advanced applications and structured programming. The program requires 320K bytes of memory. $950. **Cosmos Inc.,** 19530 Pacific Highway S., Suite 102, Seattle, Wash. 98188, (206) 824-9942.

Circle No 331

Your low-cost direct line to the value-added market

Mini-Micro Systems

DIRECT RESPONSE INFORMATION CARDS

- Sell products and services directly
- Introduce new products
- Distribute catalogs and literature
- Investigate new applications
- Develop quality sales leads

1984 Postcard Schedule

Materials Closing Date:	2/7	4/13	8/10	10/8
Mailing Date:	March	May	Sept.	Nov.

Format

Loose Card Deck / Card
Size—3½" × 5½", Live
Copy—3⅛" × 5⅛"

Mechanical Requirements

Negatives—right reading emulsion side down. Camera ready mechanicals–110 line screen

Rates

	Advertisers	Non-advertisers
1 card	1350	1600
2 cards	1300	1550
3 or more cards	1250	1500

Contact:

Carol Anderson, Sales Manager
Mini-Micro Systems
Direct Response Postcards
221 Columbus Avenue, Boston, MA 02116
(617)536-7780

The new Canon® Handy Terminal makes any computer system go farther.

The new Canon® Handy Terminal 5000 is the portable unit that lets you gather and process information out of the office.

With a maximum 32K internal user RAM plus up to 64K optional file memory, it's perfect for jobs like retail audits, warehouse inventories, order-taking anywhere in the field or any one of hundreds of business applications.

It can be programmed to perform almost any task, adopting BASIC and Assembler languages.

And can even relay information to your computer via phone hookup.

Portability is also the key word of the 5000, because Canon's Handy Terminal was especially designed for traveling light.

At a weight of less than 2 lbs., it can operate on a rechargeable battery and can be carried by neck strap or in an attache case. Yet it's highly durable, water resistant and shock resistant. Which means it can take its fair share of hard knocks.

Also available is the 5000P (shown above) which has a built-in thermal dot printer that can print one original and a copy.

And both terminals can incorporate an optional bar code reader.

So why not widen your computer horizons with Canon's new Handy Terminal. It lets you go as far as you like.

For more information:
Call 1-800-323-1717, Ext. 302.
(In Illinois call 1-800-942-8881, Ext. 302.)
Or Write Canon U.S.A., Inc.,
Systems Division/Handy Terminal,
P.O. Box CN 11250, Trenton, N.J. 08638.

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Canon Systems Division

CIRCLE NO. 144 ON INQUIRY CARD

One billion byte supermicro. Just think of the possibilities.

Introducing the new, expandable Dual 83/500. A UNIX*-based, 68000-driven supermicro so capable, you'd swear it was a mainframe.

The system already comes with 500 megabytes of Winchester storage. And our patent-pending high-speed SMD disk controller for fast access to data.

But you can increase memory to a massive one billion bytes just by adding a twin drive.

Or take an already sizeable two megabytes of RAM and expand it to six.

Or even double user capacity from 8 to 16. The hardware is already in place.

When it comes to value, no supermicro system offers you more than the 83/500. Because along with the computer, you get a 9-track, 1600 BPI phase-encoded tape drive for reliable disk backup and quick file transfers to other systems.

There's a convenient one megabyte double-sided/double-density floppy disk drive that protects individual files.

And the industry standard UniPlus+™ implementation of AT&T's UNIX System V with Berkeley enhancements. Plus a multi-user license.

All at no extra cost.

And while you're speedily going about processing your data, we're protecting your investment. For free. With a comprehensive 12-month warranty. And a nationwide service network that protects your system whether it's in or out of warranty.

See the system that's redefining the supermicro. The value-packed Dual 83/500. Call or write Dual Systems Corporation, 2530 San Pablo Avenue, Berkeley, CA 94702, (415) 549-3854

At just $65,940 base price, its possibilities are endless.

*UNIX is a trademark of AT&T Bell Labs.
™UniPlus+ is a trademark of UniSoft Corp.

There's only one DUAL

CIRCLE NO. 145 ON INQUIRY CARD

DATABUS compiler runs on MS-DOS computers

- Supports ISAM files
- Compiles into absolute machine code

SUNDB86M, a 16-bit implementation of the DATABUS language for Intel 8086-/8088-based microcomputers running MS-DOS 2.0 or PC-DOS 2.0, has many of the features found in DATABUS language with the exception of hardware-dependent instructions. The software supports sequential and random files, including read and write tabbing, and ISAM files with minor changes in the OPEN and PREP statements. It compiles into absolute machine code, poses no limit on user data area within overall program size, works with most terminals and supports print spooling. $495. **Sunbelt Computer Systems Inc.,** Suite 111, 5525 E. 51st St., Tulsa, Okla. 74135, (800) 331-9163 or (918) 660-0670.

Circle No 332

Spreadsheet offers computer compatibility

- HP 150 or IBM PC operation
- HP 3000 or DEC VAX II operation
- 24 individual or global formats

The Opticalc electronic spreadsheet offers compatible operation between microcomputers and minicomputers. It transfers entire spreadsheets directly, requiring no intermediate formats or rekeying. Data capacity per sheet is limited only by available memory. Opticalc permits a wide variety of data-input methods, entry of 190-step formulas, more than 130 built-in functions, 24 individual or global formats, independent display and print windows, sorting, editing and formula debugging. On a minicomputer, the package produces batch-mode operation. $495. **John McLean & Associates,** P.O. Box 270507, Houston, Texas 77277, (713) 871-9134.

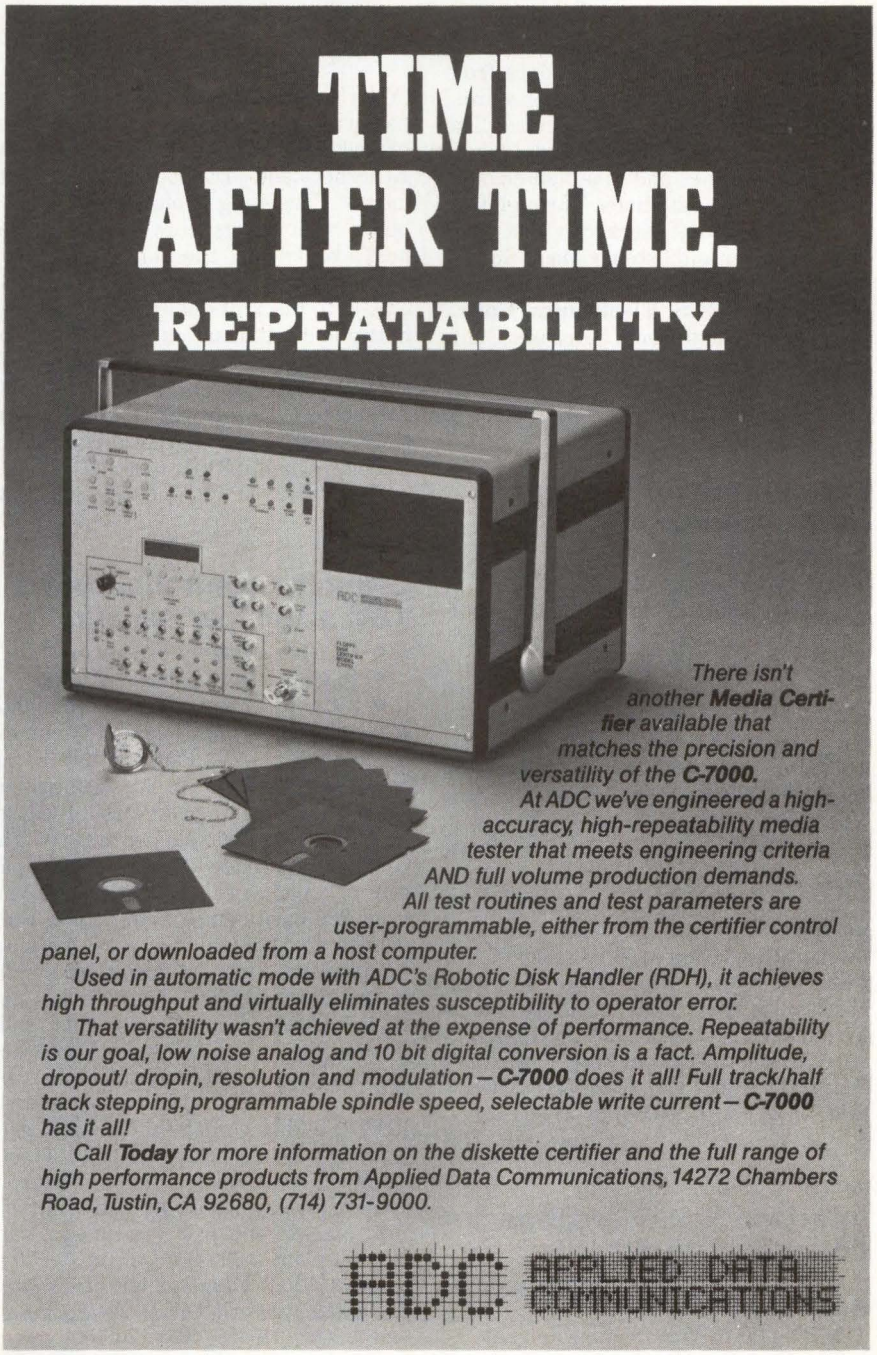
Circle No 333

Drafting software produces keyboard drawings

- Digital logic diagrams
- Printed-circuit board layouts
- Project schedules

The MGI/Schematic Drafter produces non-dimensional symbolic drawings such as electronic circuit diagrams, digital logic diagrams, printed-circuit board layouts and project schedules. Using a template guide, users enter letter-designated symbols from the IBM PC or IBM PC-lookalike computer keyboard into a series of cells on the screen. Individual symbols can be rotated or mirrored to change the symbol's orientation within a cell. Overstrike places multiple symbols into one cell. Text can be added and dragged or rotated into position. Entire blocks of an existing schematic can be saved or quickly moved for revisions. $3,900. **Microcomputer Graphics Inc.,** 13468 Washington Blvd., Marina del Rey, Calif. 90292, (213) 822-5258.

Circle No 334



CIRCLE NO. 146 ON INQUIRY CARD

New Products

SUBASSEMBLIES

Unit connects devices to IEEE-488 bus

- Joins parallel inputs/outputs
- 52 or 104 data lines
- Accepts BCD/hex data

The model 4833 programmable interface unit connects devices having parallel input and/or output interfaces to the IEEE-488 bus. As a bus talker, the unit converts BCD/hex or binary data from a parallel-output instrument into the proper format for bus transmission. As a listener, the unit converts data from the bus controller into parallel words, for use by a parallel-input device. The product comes in a single-channel model with 52 data lines and in a dual-channel model with 104 data lines. Through program commands, users can mix data lines as talker and listener lines. Single-channel version: $850, dual-channel version: $1,050. **ICS Electronics Corp.,** 2185 Old Oakland Road, San Jose, Calif. 95131, (408) 263-4844.

Circle No 335

Disk controller features cache memory

- 64K bytes of RAM
- 8K bytes of ROM
- Stores data in four 10K-byte buffers

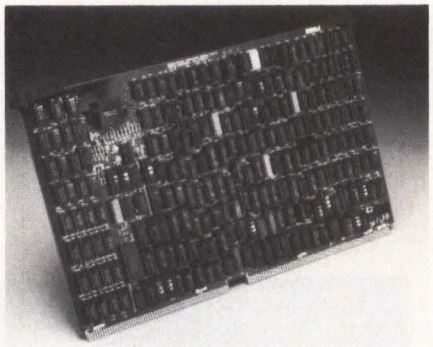
The Multibus-compatible model STDC disk controller supports two ST506 Winchester disk drives. It stores data read from the disk in four separate 10K-byte cache memory buffers. After four disk accesses, the controller purges one cache on a "least-recently used" basis. The product contains a Z80A processor, 64K bytes of RAM and 8K bytes of ROM. A DMA peripheral channel transfers data between the disk, host processor and local memory in five different modes. Other features include clock recovery via an on-board phase locked loop, and write data precompensation. $795. **Cromemco Inc.,** 280 Bernardo Ave., P.O. Box 7400, Mountain View, Calif. 94039, (415) 964-6988.

Circle No 336

Interface links Versabus computers to Ethernet

- 32K-byte block of dual-ported memory
- Plugs into Versabus backplane

The Versabus/Ethernet interface unit



(V/EIU) provides controller logic and performs physical and data-link layer protocol functions, in accordance with Ethernet and IEEE 802.3 requirements. Consisting of one printed circuit board that plugs into the Versabus host's backplane, the unit appears as a set of memory-mapped I/O ports with a 32K-byte block of dual-ported memory. Setup and initialization is controlled by the host, but all other access takes place through dual-ported memory. $3,000. **Advanced Computer Communications,** 720 Santa Barbara St., Santa Barbara, Calif. 93101, (805) 963-9431.

Circle No 337

Graphics controller draws 12M pixels per second

- Bit-slice drawing processor
- 16 colors from palette of 4,096
- 256 colors from palette of 16 million

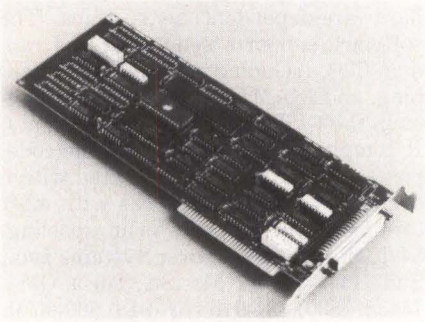
Available for Multibus and Q-bus microcomputers, the Parallax 600 series board-level raster graphics controllers feature a proprietary bit-slice processor that draws 12M pixels per second. The controllers provide 16 colors from a palette of 4,096 in the 4-bit-per-pixel version; 256 colors from a 16-million color palette in the 8-bit-per-pixel version. Their instruction set furnishes single-instruction polygon, box, circle- and vector-drawing commands, and solid fill, outline, stipple, cut-and-paste and opaque/transparent modes. The controllers feature dual-ported video memory, RS-170 video compatibility with genlock, two frame buffers, zoom, smooth pan and scroll. The double-buffered controllers display 640 by 480 pixels out of a 1024-pixel-by-512-pixel memory with four bit planes. $5,000. Delivery is 30 to 60 days ARO. **Parallax Graphics Inc.,** Suite 215, 1095 E. Duane Ave., Sunnyvale, Calif. 94086, (408) 720-1600.

Circle No 338

Host adapter brings mass storage to IBM PCs

- 2K bytes of RAM
- 6K bytes of ROM

The IB01 host adapter links SCSI-based 5¼-inch Winchester and ¼-inch cartridge tape drives to IBM PCs. Packaged on one printed-circuit board, the adapter plugs into an IBM Corp. PC, PC/XT or IBM PC-compatible com-



puter. The adapter implements the full SCSI protocol. It features 6K bytes of ROM and 2K bytes of RAM, which are used for storing initialization routines, for configuring the SCSI subsystem, for bootstrapping the loader routine and for handling SCSI operations. The unit aids hard-disk memory expansion to 1M byte and accommodates seven SCSI-compatible disk controllers. $345, OEM version. **Emulex Corp.,** 3545 Harbor Blvd., P.O. Box 6725, Costa Mesa, Calif. 92626, (714) 662-5600.

Circle No 339

Prime-compatible controller supports 32 lines

- 16 standard baud rates
- Provides DMQ and DMT transfer modes

The model 5258 communications interface for Prime computers supports 32 asynchronous channels on one card. It operates under Prime's DMQ and DMT transfer modes. Other features include 16 standard baud rates, to 19,200 bps for each channel, as well as the option to program baud rates for special applications. The card comes with a connector panel that uses standard RS232C connectors so that devices can be added without special Prime cabling. $6,500. **EMC Corp.,** 12 Mercer Road, Natick, Mass. 01760, (800) 222-3622.

Circle No 340

Key in on Your Hot Prospects

with **Mini-Micro Systems** 13th Annual Mini-Micro Computer Market Report

This year Mini-Micro Systems readers will spend $50 billion on minicomputers, microcomputers, peripherals, software and supplies. The 13th annual Mini-Micro Computer Market Report outlines 8,511 sites (buying centers) representative of the explosive value-added market. Data is available in the following formats:

MAGNETIC TAPE OF COMPLETE DATABASE

For those marketers who wish to receive all the information and be able to generate their own analysis, the complete database is available on magnetic tape. Data includes:

- *1983 Expenditures* for minicomputers, microcomputers, peripherals, and software.
- *1984 Estimated Expenditures* for minicomputers, microcomputers, peripherals, and software.
- *Geographical Regions*
- *Type of Organization*
- *Minicomputers/Microcomputers purchased in 1983 and those installed in prior years:*
  - Vendor name and model number
  - Units acquired
  - Major applications
- *Minicomputers/Microcomputers planned 1984 purchases:*
  - Vendor name and model number
  - Units planned to be acquired
  - Major applications
  - Sites planning to change major vendor
  - Fail-safe computer operations
  - Electronic office functions

PRESELECTED LISTS AND MAILING LABELS

All selections are available as a listing or as cheshire or pressure sensitive labels. Cross tabulations of categories are also available.

Site Selection	*Site Count*
Total sites surveyed	8,511
Sites by planned 1984 expenditure levels	
$50,000-99,999	4,829
$100,000-249,999	3,582
$250,000-499,999	2,218
$500,000 or more	1,403
Sites planning to install integrated electronic office functions in 1984	1,642
HOT PROSPECTS...Sites planning to change major vendors in 1984	1,085
Value-added OEMs and third parties	3,110
Value-added user sites	4,813

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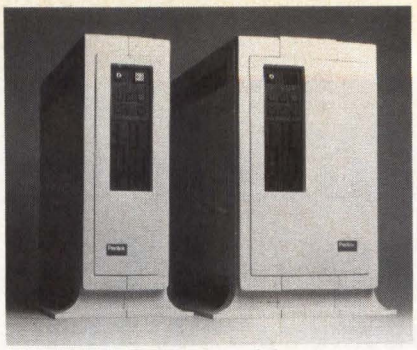

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Calendar

NOVEMBER

13-15 INTERFACE I, Conrad Hilton Hotel, Chicago, sponsored by Society of Manufacturing Engineers, Computer and Automated Systems Association (CASA/SME) and American Production and Inventory Control Society (APICS). Contact: Society of Manufacturing Engineers, One SME Drive, P.O. Box 930, Dearborn, Mich. 48121, (313) 271-1500, or American Production & Inventory Control Society, 500 W. Annandale Road, Falls Church, Va. 22046, (703) 237-8344.

13-15 Buffalo Computer and Industrial Technology Show, Buffalo Convention Center, Buffalo, N.Y., sponsored by Buffalo Area Chamber of Commerce. Contact: Sandy Zweig, Exhibit Sales, Buffalo Computer and Industrial Technology Show, 527 Statler Bldg., Buffalo, N.Y. 14202, (716) 852-2006.

13-15 CAM-I's 13th Annual Meeting and Technical Conference, Sheraton Sand Key Hotel, Clearwater Beach, Fla., sponsored by Computer Aided Manufacturing-International Inc. Contact: Rhonda Gerganess, Computer Aided Manufacturing-International Inc., Suite 1107, 611 Ryan Plaza Drive, Arlington, Texas 76011, (817) 265-5328.

14-16 "Data Communications: Network Design, Integration and Applications" course, Ramada O'Hare, Chicago, sponsored by Software Institute of America Inc. Contact: Kristin Kittle Lynch, Operations Coordinator, Digital Consulting Associates Inc., 6 Windsor St., Andover, Mass. 01810, (617) 470-3870.

14-18 COMDEX/Fall, Las Vegas Convention Center, Las Vegas Hilton, Riviera, Sahara, MGM Grand and Caesar's Palace Hotels, organized by The Interface Group Inc. Contact: Peter B. Young, Linda M. Yogel, or Lori Robak, The Interface Group Inc., 300 First Ave., Needham, Mass. 02194, (617) 449-6600 or (800) 325-3330.

19-22 Canadian Computer Show & Conference, Toronto International Centre of Commerce, Toronto, Ontario, Canada, co-sponsored by Canadian Information Processing Society. Contact: James K. Mahon, Group Show Manager, Industrial Trade Shows, 20 Butterick Road, Toronto, Ontario, M8W 3Z8, Canada, (416) 252-7791.

26-28 "Computer Graphics for Business" seminar, Hyatt on Union Square, San Francisco, offered by Technology Transfer Institute. Contact: Lee Clayton, 741 10th St., Santa Monica, Calif. 90402, (213) 394-8305.

28-30 UNIX Application Forum, Century Plaza Hotel, Los Angeles, sponsored by Yates Ventures. Contact: Meg Rustad or Janet L. Taylor, Yates Ventures, Suite 111, 4962 El Camino Real, Los Altos, Calif. 94022, (415) 964-0130 or (617) 965-5171.

28-29 Computer Vertical Markets Conference, Sheraton Harbor Isle Hotel, San Diego, sponsored by Frost & Sullivan Inc. Contact: Carol Every, Industry Representative, Frost & Sullivan, 106 Fulton St., New York, N.Y. 10038, (212) 233-1080.

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DECEMBER

5-7 **Software Connection Exposition,** New York Coliseum, New York, produced by Conference Management Corp. (CMC). Contact: Carol Sturgeon, Barmmer/Elliott Inc., 15 West 39th St., New York, N.Y. 10018, (203) 852-0500 or (212) 944-0655.

6 **California Computer Show,** Hyatt Hotel, Palo Alto, Calif. Contact: Norm De Nardi Enterprises, 289 S. San Antonio Road, Suite 204, Los Altos, Calif. 94022, (415) 941-8440.

10-13 **1984/1985 Strategic Issues Conference,** Americana Canyon Hotel, Palm Springs, Calif., sponsored by Infocorp. Contact: Corky Holden, 10833 Stevens Creek Blvd., Cupertino, Calif. 95014-2107, (408) 973-1010.

11-13 **Automotive Computer Graphics '84 (ACG '84),** Hyatt Regency, Dearborn, Mich., sponsored by the Engineering Society of Detroit and the University Center for Science and Technology. Contact: ESD, Automotive Computer Graphics '84, 100 Farmsworth, Detroit, Mich. 48202, (313) 832-5400.

11-14 **DEXPO/West '84,** Disneyland Hotel, Anaheim, Calif., organized by Expoconsul International Inc. Contact: Natalie Kaye, Project Manager, Expoconsul International Inc., 55 Princeton-Hightstown Road, Princeton Junction, N.J. 08550, (609) 799-1661.

17-19 **"Carl Machover on CAD/CAM" seminar,** Cathedral Hill Hotel, San Francisco, Calif., sponsored by Frost & Sullivan Inc. Contact: Carol Every, Industry Representative, Frost & Sullivan, 106 Fulton St., New York, N.Y. 10038, (212) 233-1080.

JANUARY

2-4 **Eighteenth Annual Hawaii International Conference on System Sciences,** Honolulu, Hawaii, sponsored by University of Hawaii and University of Southwestern Louisiana. Contact: Nem B. Lau, HICSS-18 Conference Coordinator, Center for Executive Development, College of Business Administration, University of Hawaii, 2404 Maile Way, C-202, Honolulu, Hawaii 96822, (808) 948-7396.

14-18 **International Software Update,** Kahala Hilton Hotel, Oahu, Hawaii, sponsored by Raging Bear Productions. Contact: Philip J. Russell, Raging Bear Productions Inc., Suite 175, 21 Tamal Vista Drive, Corte Madera, Calif. 94925, (415) 924-1194 or (800) 732-2300.

29-31 **Communication Networks Conference & Exposition,** Washington D.C. Convention Center, organized by Hajar Associates. Contact: Judie McDaid, CN National Sales Director, Box 880, Cochituate Road, Framingham, Mass. 01701 (617) 879-0700 or (800) 225-4698.

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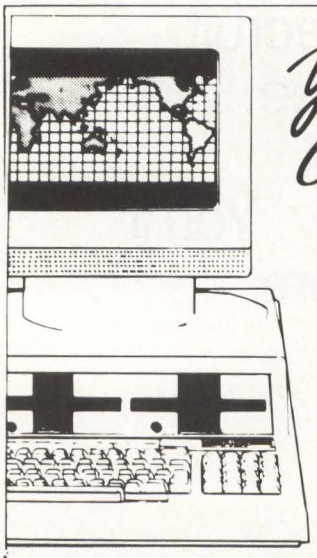

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Advertisers Index

Able Computer 50

Ampex Corp., Disk Media Operation 114-115
Anadex Inc. 193
Anchor Automation 85
Apple Computer Inc. 12-13
Applied Data Communications 267
Atasi Corp. 230-231
AT&T Technologies, Inc. . . 196-197
Bytcom 36
C. Itoh Electronics 171, E10
CalComp 184
California Computer Group 63
Canon U.S.A. 257, 259, 261, 263, 265
Century Data Systems (a Xerox Co.) 251
Chrislin Industries, Inc. 252
CIE Terminals 14, 21
Citizen America 228-229
Codex Corp. 133
CompuPro 25
Computas 44
Control Data Corp.—Business Prod. Group 86-87
Control Data Corp.—OEM 18
Convergent Technologies . . . 48-49
Cromemco Inc. 236-237
Danish Data Electronics 72-73
Data Language Corp. 213
Dataram 53
Davidge Corp. 176
Davong Systems 71
Delta Airlines 262
Digital Equipment Corp. 80-81
Digital Sound Corp. 189
Dual Systems 266
EEC Systems 79
Electronic Conventions 67
Emerald Systems Corp. 240
Emulex Corp. 40-41
Enter Computer Inc. 95
Epson America, Inc. C3
Equinox Systems 90
Esprit Computer Products 158
Esprit Systems Inc. 26-27
Facit Inc. 180
Falco Data Products 235
Faraday Electronics 74
Flexible Computer 238-239
Gould Inc., Distributed Systems Div. 5
Hamilton/Avnet Electronics 29, 225
Hermes Precisa Int'l 181
Hewlett-Packard 136, 194-195
Human Designed Systems Inc. (HDS) 39
Hunter & Ready 88-89
IBC/Integrated Business Computers 66, 221
Ibex Computers Corp. 176
IBM Corp. 206-207, 241
Infotron Systems Corp. 1
Inmac 248
Intecolor Corp., an Intelligent Systems Co. 126
Intel Corp. 60
Intercontinental Micro 22
Interface Group 28, 132
Interphase Corp. 174
Iomega Corp. 108-109
ISI International 107, 227
Isoreg corp. 244
JDL Inc. 128-129
Kennedy Co. C2
Kimtron 232
Lear Siegler Inc. 166
Liebert Programmed Power . . . 198
Logical Microcomputer 142
Madzar Corp. 192
Marinco Computer Products 214-215
Masscomp 160-161
Megavault 91
Method Systems Inc. 212
Micom Systems Inc. C4
Micro Data Base Systems Inc. 112
Micro-Term 169
Mini-Micro Systems 226, 264, 269, 273, 278, E4, E12
Mostek Corp. 153, 155, 157
Motorola Semiconductor Products 134-135
Multi Solutions 104
Nantucket 55
NCR Corp. 123-125
NCR Boardlevel Products 218
NEC E5
Norm DeNardi Enterprises 260
Northern Telecom 69
Nova Electric Manufacturing . . . 91
OEMTek 143-145
Okidata Corp. 131
Olivetti E9
Peritek Corp. 270
Perkin-Elmer Corp. 82
Pertec Peripherals Corp. 208
Philon Inc. 138
Pick Operating Systems 57
Plexus Computers 102
Precision Visual 147
Quantum Software 225
Qubix 101
Qume 243, 249
RCA 146
RDS-Relational Database Systems 58-59
Rodime 10
SCI Corp. 42
Science Accessories 120
Scientific Micro Systems 177
Seiko Instruments USA 182
Shugart Corp. 8-9, 111
Siemens Corp. 245-247
Softcon 52
Sola Electric 187
Solaris Computer Corp. 253
Spectra Logic 201, 203, 205
Systech 17
Systems Research Laboratories Inc. 47, 258
Tab Products 164
Tandon Corp. 6-7
Tartan Labs 93
Tatung Co. 242
TEAC Corp. of America 76
Telebyte Technology 212
Telesoft 30
TeleVideo Systems Inc. 222
Texas Instruments Inc. 96
Thorn EMI 113
Toei Electronics 256
TouchStone Software 64
TransNet Corp. 192
Uniforum 94
Unify Corp. 162-163
Unisoft Systems 4
Uniras E6
Universal Data Systems Inc. . . 148
U.S. Design Corp. 118
Verbex 141
Visual Technology Inc. . . . 116-117
West Computer E3
Western Digital 97-100
Wyse Technology 178-179
Xebec 216-217
Zilog Inc. 172

See P. 271 for Classified Advertising
See P. 274-277 for Career Opportunity Advertisers
See P. 280-282 for Mini-Micro Marketplace

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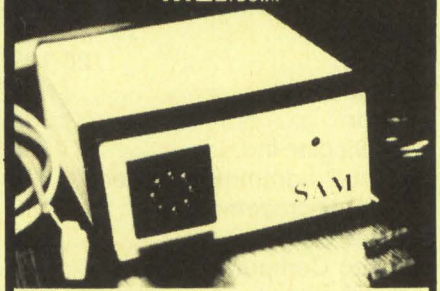

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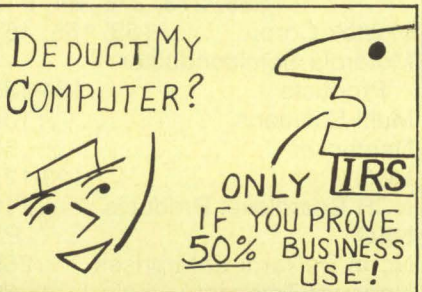

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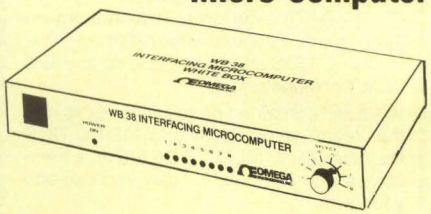

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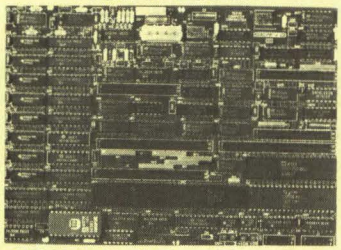

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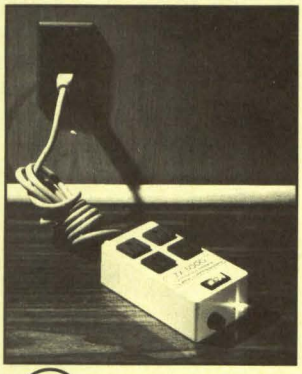

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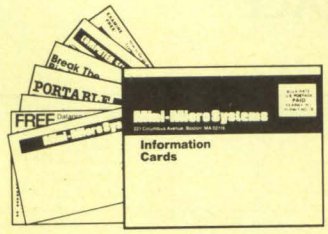

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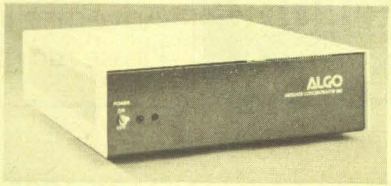

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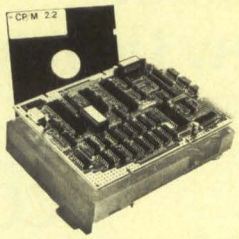

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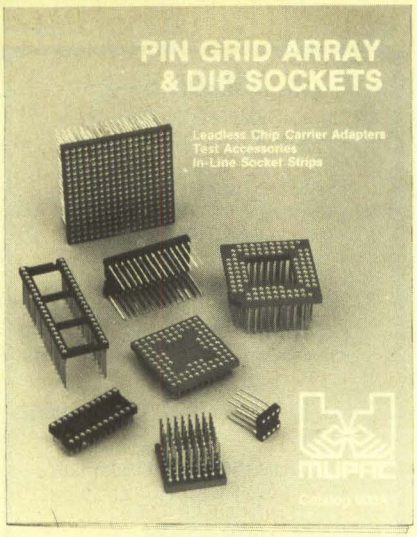

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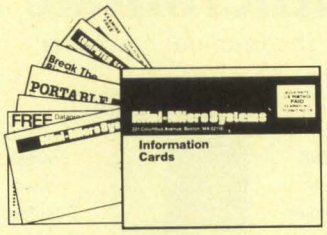

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CITY STATE ZIP

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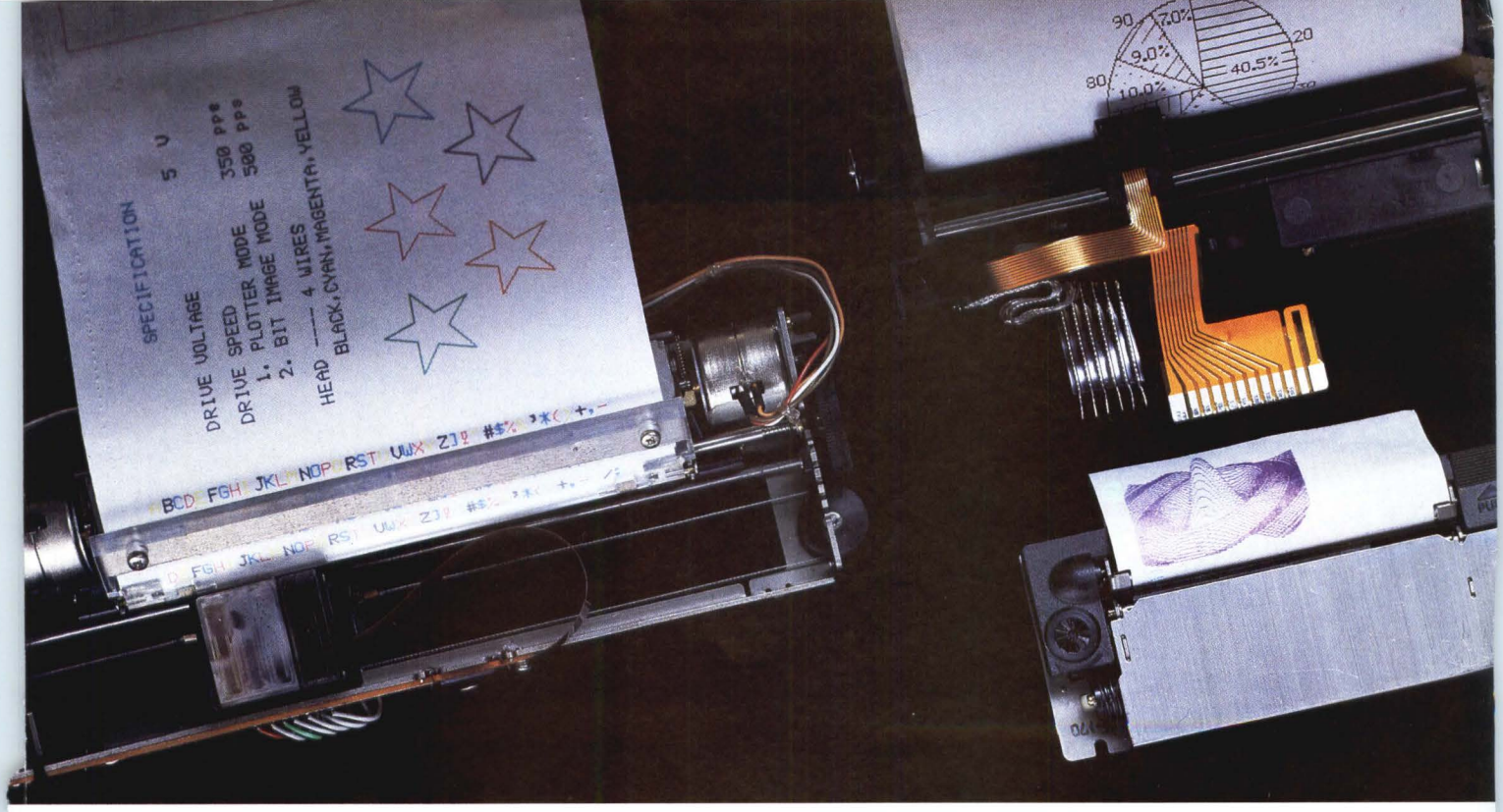

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MICOM's new Micro7400 is very, very different. It not only provides a Gateway for dumb asynchronous terminals to access IBM mainframe applications, but goes far beyond the basic capabilities of IBM 3270s and other protocol converters. *It's even easy to use.*

Since MICOM is the world's largest volume manufacturer of data concentrators, it's only natural that MICOM's protocol converter should include the same features that made the concentrators so popular. And fortunately for asynchronous terminal users wishing they could connect to IBM mainframes, and for mainframe DP managers looking for less expensive terminals, the combination makes a very effective hybrid.

All Standard IBM 3270 Features

Functioning as an IBM 3274 Model 51C Cluster Controller using either Bisync or SNA/SDLC protocol, the Micro7400 allows ASCII terminals (or personal computers emulating terminals) to perform as 3270s. Display terminals emulate IBM 3278s; printers emulate IBM 3287s. And special software allows printer terminals to interact with full-screen programs originally developed for crt's.

Plus Extra Functions

The Micro7400 also offers features not available in the IBM 3270 line, including dial-up access to the protocol converter, terminal-controlled diagnostics, and do-it-yourself channel configuration for setting terminal-related parameters like parity.

Support for IBM Personal Computers

IBM PCs connected to the Micro7400 can emulate IBM 3270 terminals, too, for communicating with mainframes. Diskette-based MICOM software makes it easy.

Switching Between Multiple Hosts

Users can switch between two IBM hosts, or between an IBM host and asynchronous ports on one or more minicomputers—completely under terminal control.

Command Port

Unique among protocol converters, the Micro7400's Command Port allows a network manager to dynamically alter operating parameters like priority assignment, as well as providing monitoring, diagnostic, and control facilities.

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