

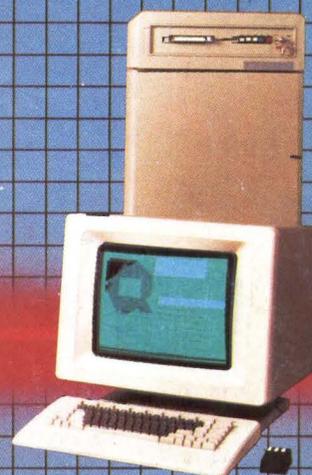
Mini-MicroSystems

A CAHNERS PUBLICATION

MARCH 1984

Data communications:

- Getting more from modem-support software
- Simplifying systems with modem expansion boards



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Integrator's guide to CAE workstations

Model 6455 Cartridge Tape System

Loaded with Features — Loaded with Benefits.

Kennedy products have always provided innovative new features. And these features have always provided added benefits and convenience for the user. For instance, our Model 6455 offers these features and benefits:

Feature: Start/Stop Operation

Benefit: Drive can emulate a 1/2" tape drive by providing the ability to perform selective file back-ups, file-restructuring, journaling and software updates.

The drive is effectively a 1/2" Tape Drive in a smaller package.

Feature: Hard Read Error Spec. of 1 in 10¹¹ bits.

Benefit: Best data reliability of any tape cartridge drive. Gives the user confidence in the integrity of the back-up medium.

Feature: On-board Diagnostics

Benefit: Drive can be tested off-line with no test equipment required. Use of S.A. also lowers the MTTR.

Feature: Cartridge Jam Protection

Benefit: Protects the cartridge from damage if cartridge jams. This is accomplished by sensing a current surge and then disabling the motor, thus insuring that the cartridge will not be damaged.

Feature: High Density Recording

Benefit: Storage capacity of 23 MB on a single cartridge.

Feature: Optional industry standard 1/2" tape interface.

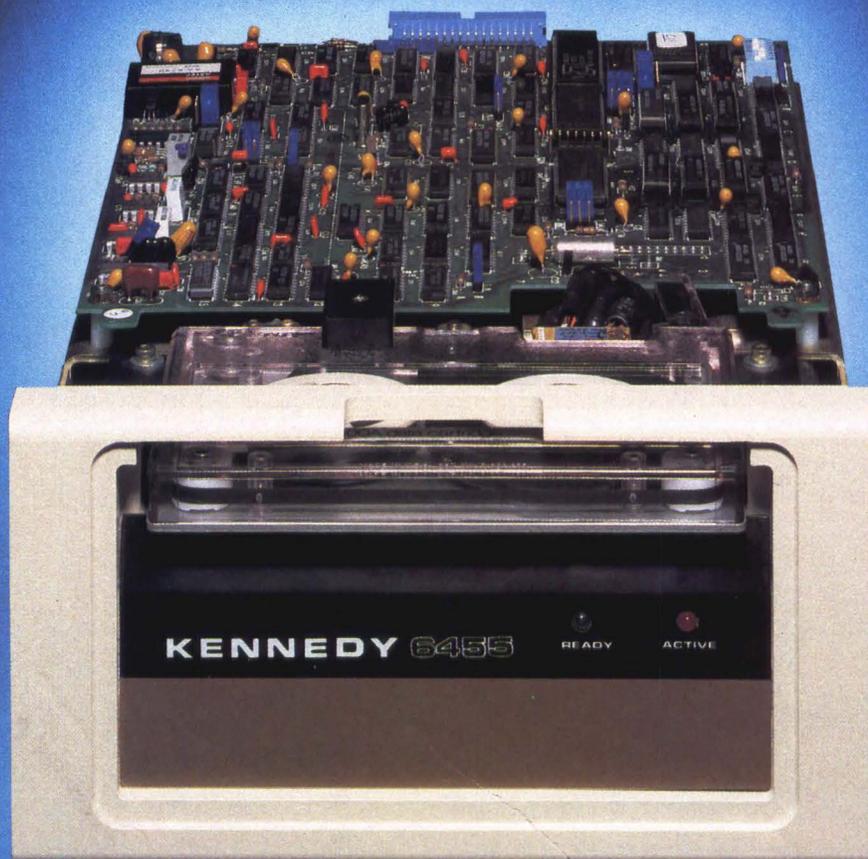
Benefit: Operates with existing tape couplers and software. The drive operates as though it were a 1/2" tape drive without having to modify existing hardware or software.

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Introducing COMPAQ PLUS, the first high-performance portable personal computer.

The makers of the COMPAQ™ Portable Computer, the industry standard, announce another breakthrough—the COMPAQ PLUS™ Portable Personal Computer. No other personal computer can handle so much information in so many places.

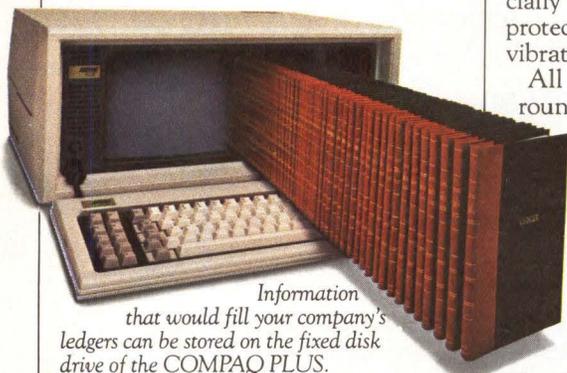
The new COMPAQ PLUS offers an integrated ten-megabyte fixed disk drive in a portable.

Plus a bigger payload

How much is ten megabytes?

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Information that would fill your company's ledgers can be stored on the fixed disk drive of the COMPAQ PLUS.

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Plus more programs

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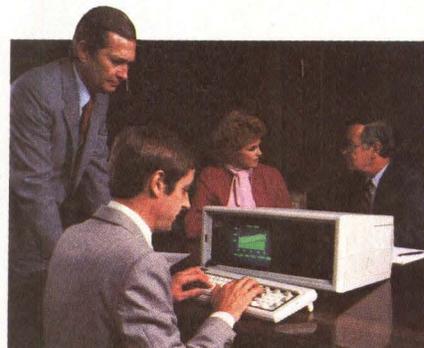
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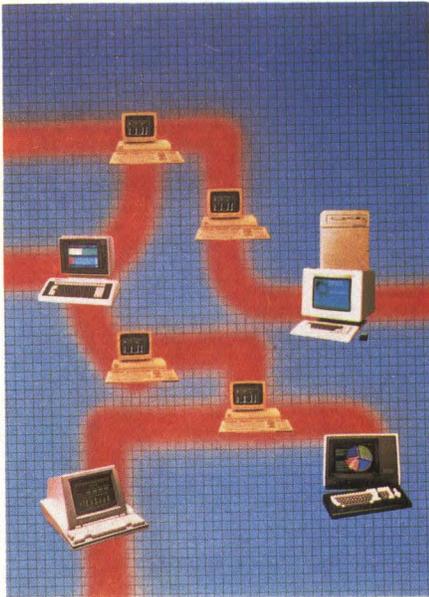
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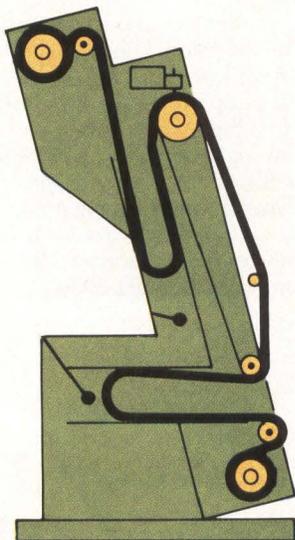
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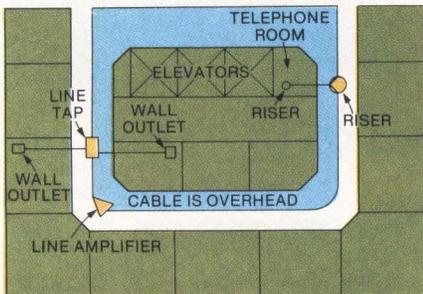
Mini-Micro Systems



Cover art design by Vicki Blake, airbrushing by Doug Glen



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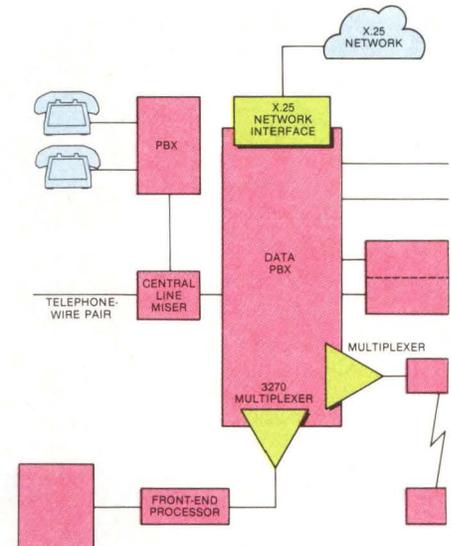
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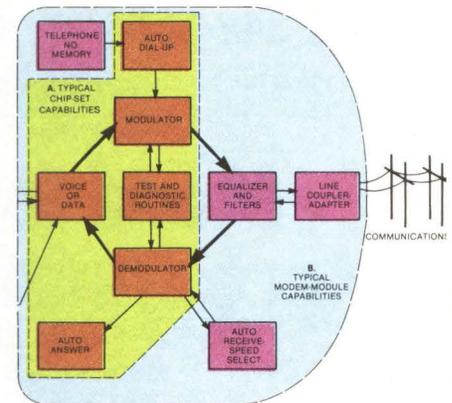
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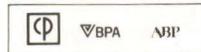
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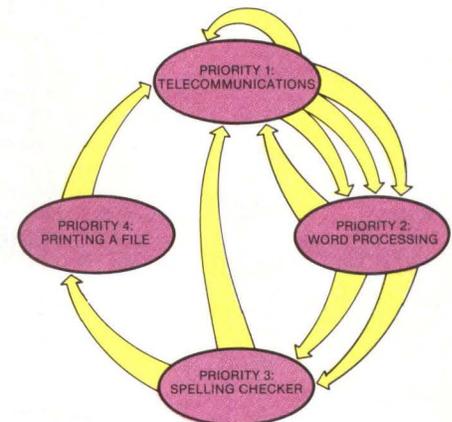
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p. 231 OS runs tasks concurrently

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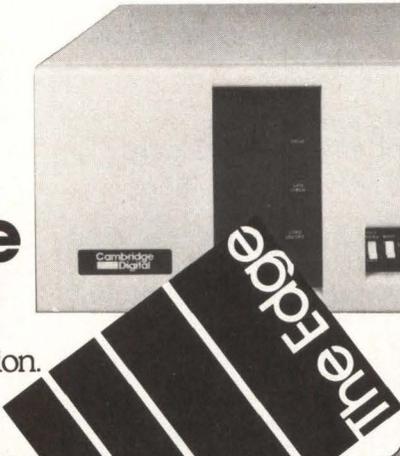
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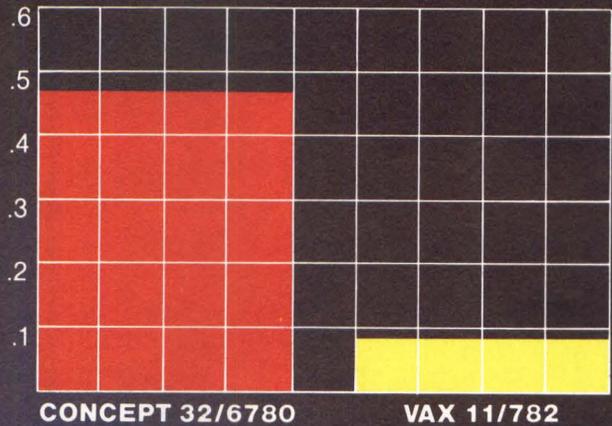
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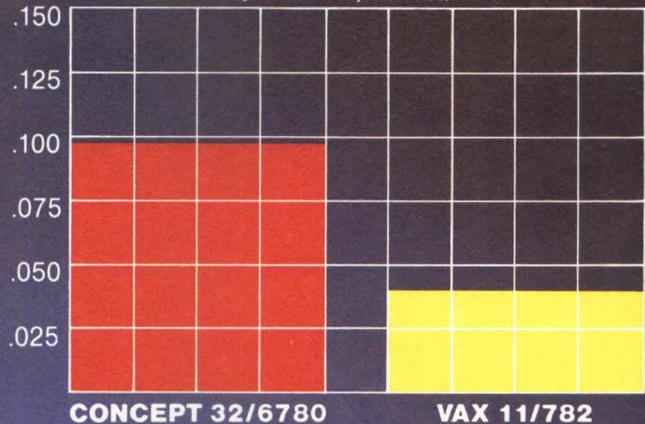
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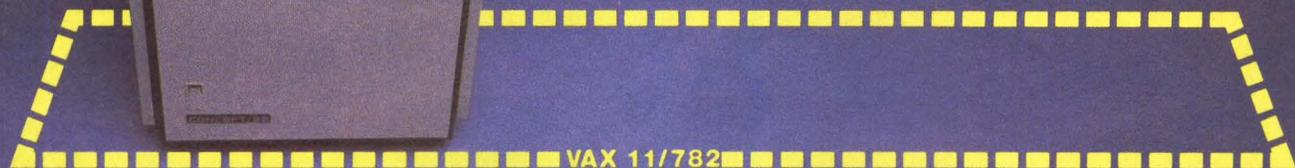


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* All chart data from published competitive information.

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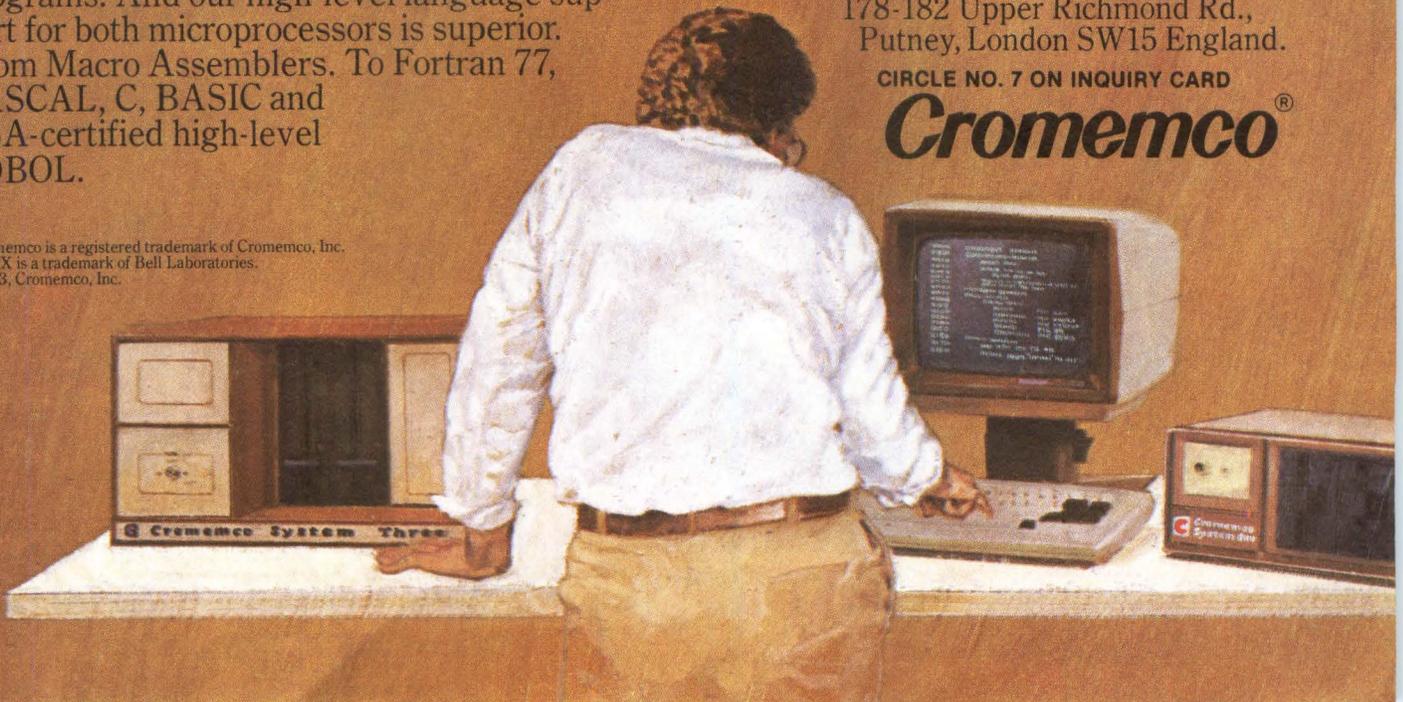
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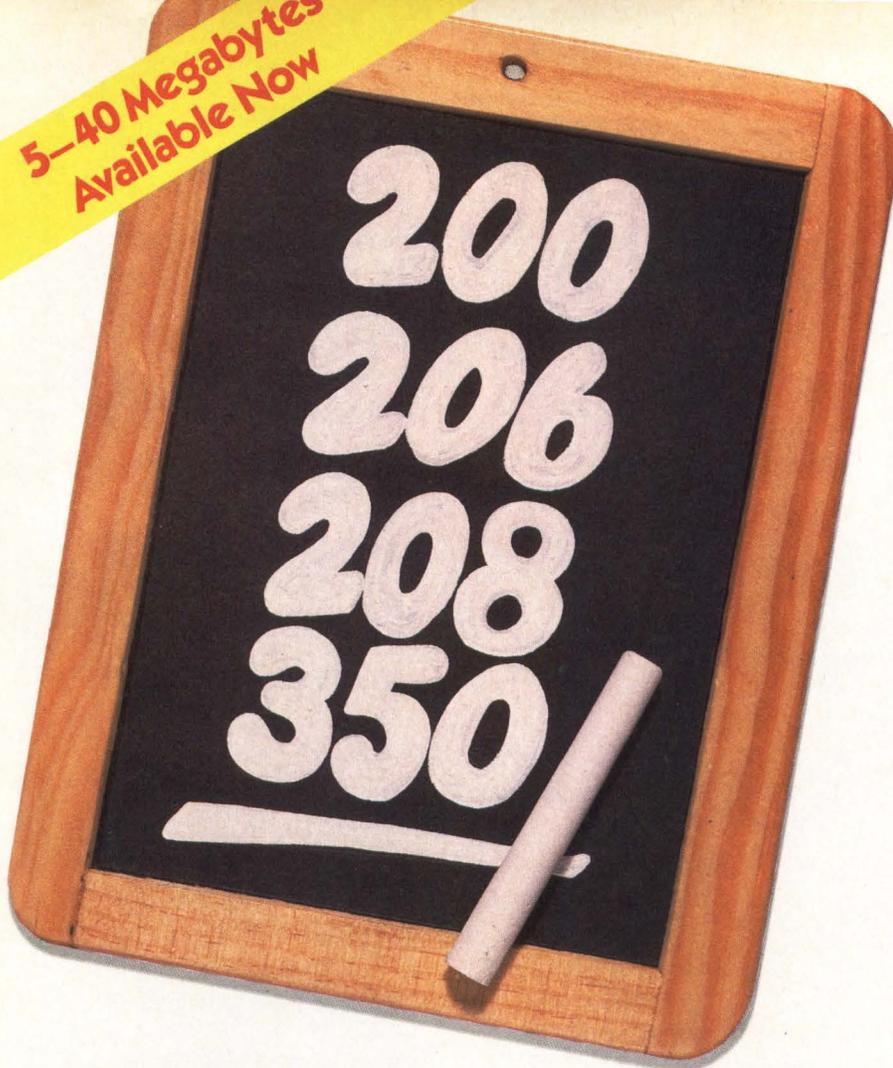
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CIRCLE NO. 8 ON INQUIRY CARD

New personnel strengthen editorial team

To help meet an expanded publication commitment of 15 issues this year while maintaining editorial excellence, *Mini-Micro Systems* has recently added three editors to its staff. The first new editor, Paul Sniger, served six years with *Digital Design* magazine as associate editor, managing editor and editor-in-chief and two years with *EDN* magazine as associate editor. He has written several hundred special technical reports, articles and stories. He holds a bachelor of science in electrical engineering from Southeastern Massachusetts University. Working out of our Boston headquarters as senior editor, Sniger will write special product surveys and reports.

The second new editor, Ron Shinn, comes to us after one year at *Systems and Software* magazine and four years at *Electronic Design* magazine. At both publications, he worked as Southwestern editor and wrote news stories, product updates and special reports. As senior Western editor for *Mini-Micro Systems*, Ron will cover the Southern California region out of our Irvine, Calif., office as news editor and special report writer. He will supervise our West Coast field staff of Bob Sehr, Ed Foster and Tom Moran.

The third new editor, Marjorie Stenzler-Centonze, will serve as our New York news editor and focus on the minicomputer and software fields. Her experience includes positions as managing editor of *Office World News*, senior editor at *Circuit News* and senior editor at *Electronic Engineering Times*.

Also joining the magazine is Eileen Milauskas, editorial secretary. A graduate of Bates College with a degree in English, Eileen will help the managing editor in various production, proofreading and copy-editing assignments.

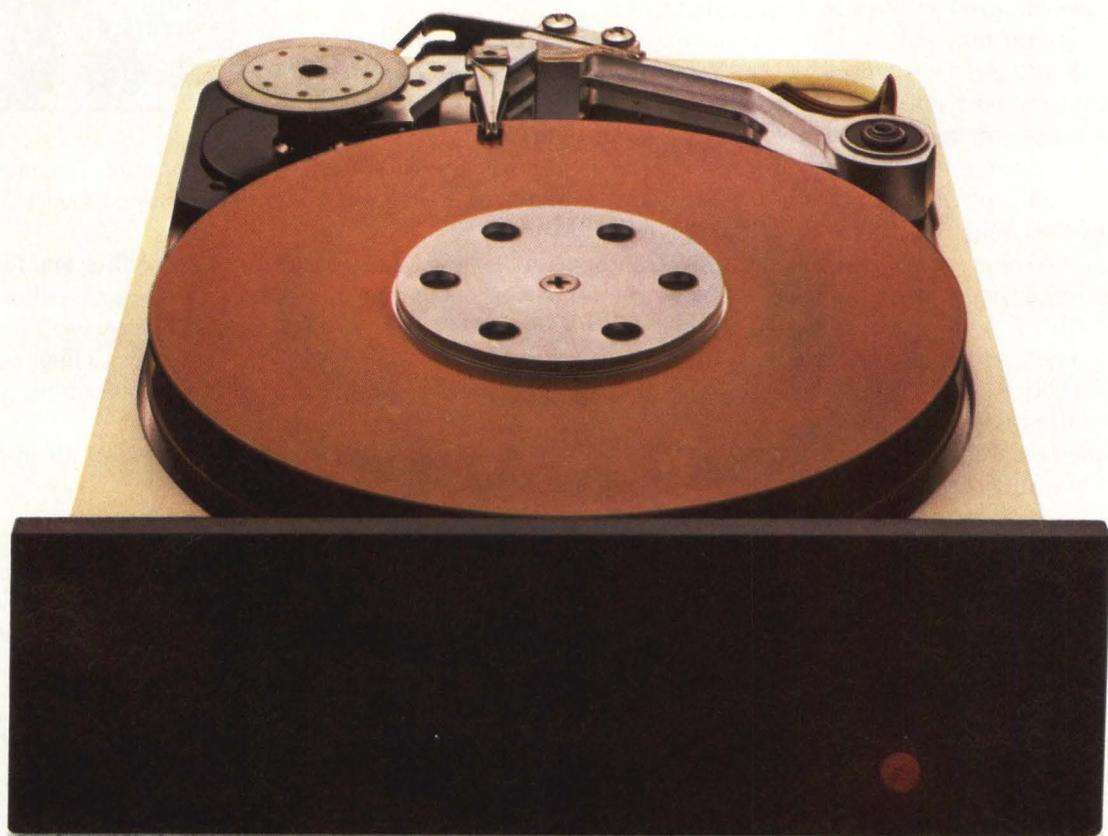
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George V. Kotelly

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CIRCLE NO. 10 ON INQUIRY CARD

Letters

Shugart's microfloppies

To the editor:

Shugart's layoff last December (MMS, January, Page 15) of approximately 150 employees had nothing to do with production delays or lack of demand for our new generation of half-height, 5¼-inch minifloppy and rigid disk drives or 3½-inch microfloppy products. On the contrary, by implementing innovative product venture teams, which operate much like start-up companies and are independent from the larger organization, Shugart met or exceeded every milestone for delivering prototype, evaluation and production units of these products. In short, the venture concept has been very successful, as these products are on or ahead of schedule and are now being shipped in volume.

In addition, these products have received exceptional customer acceptance and demand, as evidenced by Shugart's strong market position and major contract signings in each of these new product categories. As an example of this acceptance, Shugart has become the leading U.S. supplier of half-height minifloppy disk drives just 18 months after announcing a product. Shugart shipped several hundred thousand of these drives in 1983 alone. In addition to these three products, the enthusiastic customer response to our recently announced optical disk drive indicates a positive future for this new product technology.

Regarding the December layoff, this situation was due, in large part, to our decision to "end-of-life" our half-height, 8-inch floppy disk drives, which did not achieve the high-volume market demand necessary to sustain a product in the OEM disk drive industry. The lack of volume demand for half-height, 8-inch floppy disk drives was a result of the marketplace movement from full-height, 8-inch floppy products to 5¼-inch minifloppy drives, rather than half-height, 8-inch drives, as we expected.

Jim McCartney
Corporate Communications
Shugart Corp.
Sunnyvale, Calif.

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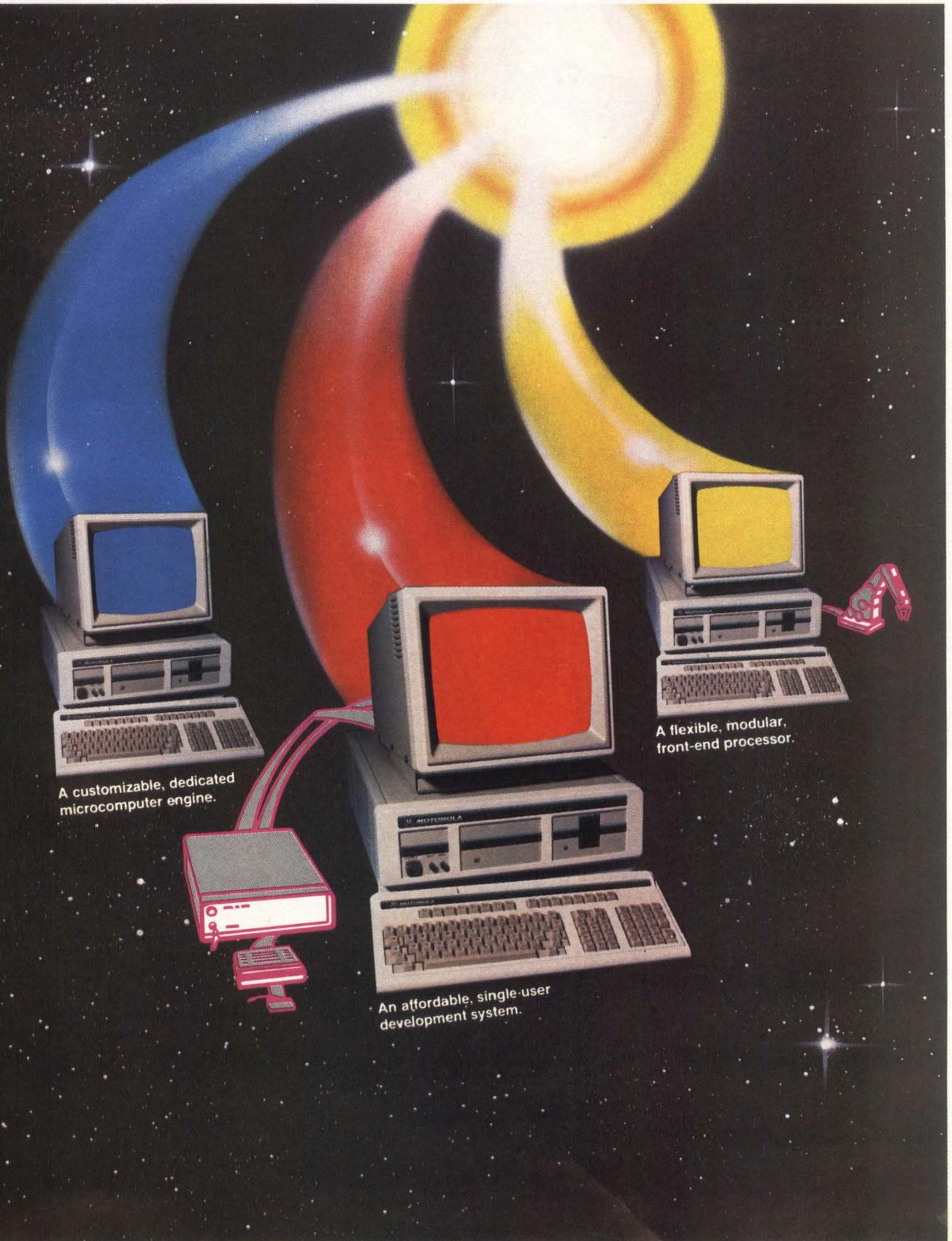
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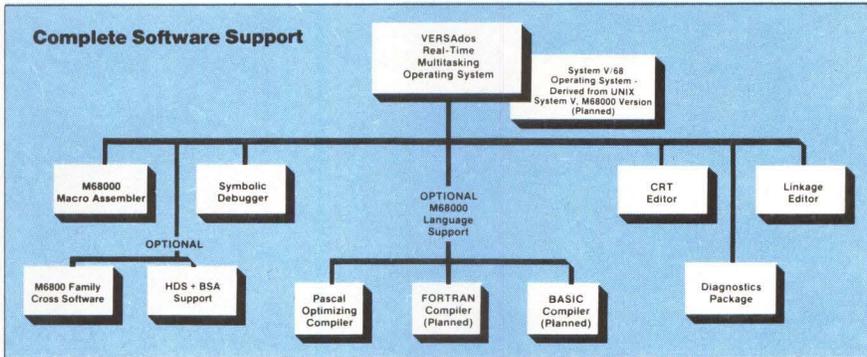
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Breakpoints

APPLE TO BUY MODEMS FROM U.S. ROBOTICS

Apple Computer Inc., Cupertino, Calif., and modem maker U.S. Robotics Inc., Chicago, have reached an agreement whereby U.S. Robotics will supply Apple with as many as 20,000 modems per month for the next three years. Apple will sell the full-duplex, asynchronous modems, which offer auto-dial/auto-answer and self-test features, under its own label with accessory kits containing cables, connectors and communications software for specific Apple computer systems. Apple will offer two versions: a 300-bit-per-second (bps) version and a 300- to 1,200-bps unit. The 300-bps version, including the accessory kit, will retail for \$225, and the higher-speed modem will retail for \$495. A serial card with the Apple II accessory kit will sell for \$70. Communications software will initially be available only for the Apple II, IIe and III.—S. Shaw

HP REDUCES PRICE OF NEW INK-JET PRINTERS

Hewlett-Packard Co. is reducing the price of its new HP 2225 family of ink-jet printers (see "HP introduces low-cost ink-jet printers," Page 36). Originally slated to sell for less than \$600, the printers will now sell for \$495 each and will be called the "Thinkjet" family. HP plans to introduce the series March 13, and it will be available April 1.—T. Moran

NETWORKING TECHNOLOGY IS INDEPENDENT OF PROTOCOLS

Doelz Networks Inc., Irvine, Calif., has announced a data networking technology with a universal architecture. It's based on a virtual circuit switch. The switch provides a continuous transmission path and is independent of user protocols for local- and wide-area networking. The company's first two products are the Elite One local-area, distributed packet-switching concentrator and the Esprit One wide-area, large switching concentrator. The Elite One, priced at \$4,500, accepts asynchronous, bisynchronous, SDLC and X.25 data at 2.4K to 9.6K bits per second (bps) and asynchronous and synchronous data at 75 to 9.6K bps. It networks as many as 60 nodes with a maximum of 32 ports per node. The Esprit One, priced at \$35,000, accepts 67 asynchronous data links at 9.6K to 1.344M bps and asynchronous and synchronous data at 75 to 19.2K bps. It networks as many as 99 switches with more than 4,000 addressable ports per switch.—R. Shinn

ADDS BUYS RIGHTS TO BRITISH GRAPHICS TERMINALS

Display builder Applied Digital Data Systems, Inc. (ADDS), Hauppauge, N.Y., has moved into the high-resolution, bit-mapped graphics terminals business, says marketing director Joe Maronna. ADDS has bought the U.S. manufacturing and sales rights to the X-Series of color and black-and-white graphics units from Data Type Ltd., Cymbran, Wales (MMS, November 1982, Page 135). Maronna notes that the X-Series offers compatibility with Tektronix Inc.'s 4014, TeleVideo Systems Inc.'s 925 and Digital Equipment Corp.'s VT100 terminals. ADDS will manufacture the terminals in Hauppauge. A Data Type spokesman says his company's U.S. sales office in Palo Alto, Calif., has been closed, but he stresses that Data Type will continue to build and sell the X-Series products

Breakpoints

outside the United States. ADDS offers a medium resolution graphics board for its Viewpoint family of displays.—K. Jones

TARTAN LABS AND GENSOFT PREPARE ADA FOR VAX/VMS

What may be the first fully validated Ada compiler for VAX/VMS should emerge in late spring. The compiler is a joint effort by Pittsburgh companies Tartan Laboratories Inc. and Gensoft Corp. The "portable" compiler was written for Western Digital Corp.'s 16-bit WD1600 computer system. It is written in Tartan Labs' proprietary Ada-like GNAL language. Tartan Labs automates porting with Ada and other compilers, each of which comprises code skeletons. Tartan's automated tools "flesh out" the code skeletons with the specifics of the target environment.—D. Bright

LIBERTY UNVEILS ALPHANUMERIC TERMINAL

Liberty Electronics USA, San Francisco, is introducing the Freedom 110 alphanumeric terminal, an upgrade of its low-end Freedom 100. The \$545 Freedom 110 offers the same ergonomic tilt-and-swivel display and sculptured Deutsches Institut für Normung-standard keyboard as Liberty's more expensive Freedom 200 (MMS, November 1983, Page 46). The 110 adds 10 shiftable programmable function keys, a green or amber screen, non-volatile setup using software instead of dual in-line package switches and a screen saver that automatically dims the CRT when not in use. The Freedom 110 is expected to be available this month.—T. Moran

MICRODATA ANNOUNCES NETWORKING WORKSTATION SOFTWARE

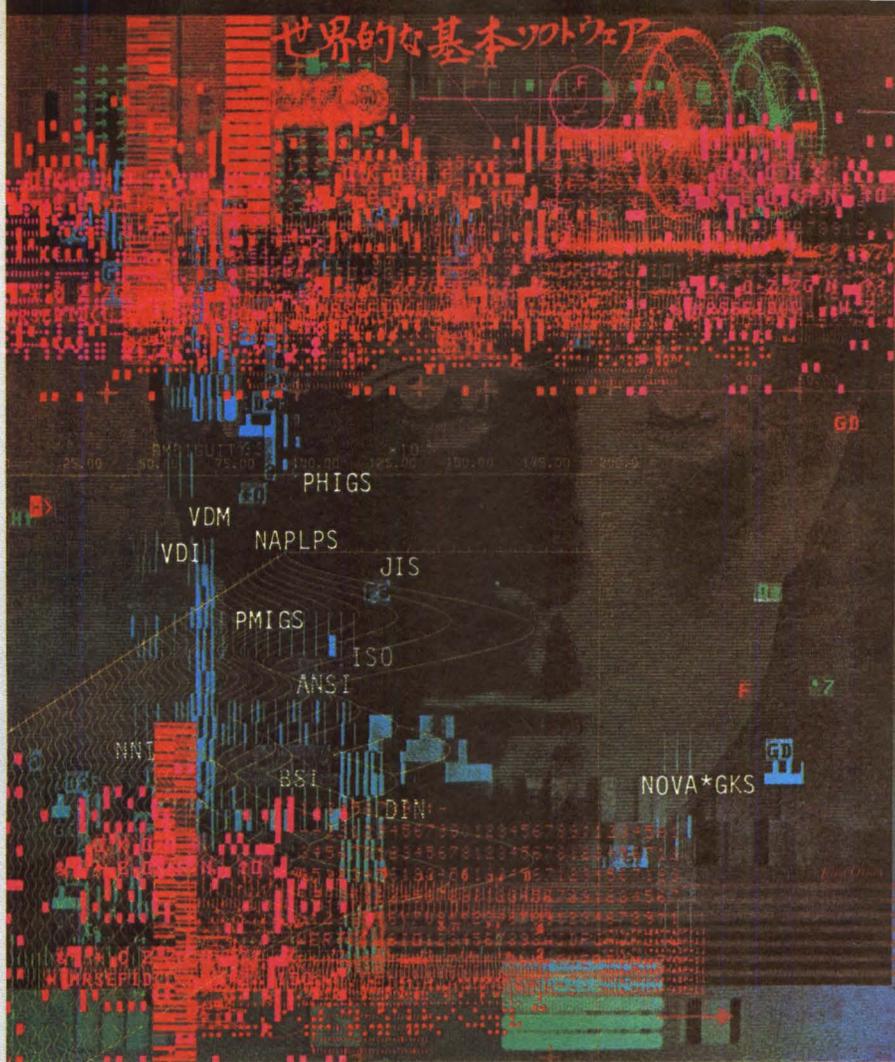
Microdata Corp., Irvine, Calif., has unveiled its Microdata 1000 workstation that is intended for networking to the company's minicomputers, and a companion fifth-generation-like software package called Natural Language. The program "learns" users' syntax personalities to help them use the system. The workstation runs the Reality operating system with a relational database and the ALL application generator. Convergent Technologies Inc. supplies the Microdata 1000 to Microdata under OEM contract. Base price of the system is \$5,075.—R. Shinn

EXCELAN PLANS LAN FRONT-END PROCESSORS

Next month, Excelan Inc., San Jose, Calif., should introduce four front-end processors for local-area-networking. Buoyed by the success of its Ethernet-compatible Exos/101 front-end processor for the Multibus, the company will introduce an upgraded Multibus product and products for the Q-bus, the Unibus and the VME bus. Designed for ease of integration, the board-level products contain local memory and I/O and an 80186 processor for fast protocol processing and almost-transparent interfacing to host systems.—C. Bailey

SOFTWARE ARTS WANTS VISICALC BACK

Citing VisiCorp's failure "to use its best efforts to maximize sales of VisiCalc," VisiCalc creator Software Arts, Wellesley, Mass., has announced that it wants VisiCorp, San Jose, Calif., to return VisiCalc trademark rights. Under a 1979



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Breakpoints

agreement, VisiCorp had exclusive rights to sell, license and distribute VisiCalc. Software Arts plans to market VisiCalc itself. VisiCorp had sought a temporary restraining order and preliminary injunction prohibiting Software Arts from using the trademarks "Visi," "VisiCalc" and "VisiCalc Advanced Version," but the request was denied. Software Arts filed a countersuit in the U.S. District Court of Massachusetts. Software Arts claimed that VisiCorp was promoting its new Visi^{On} windowing environment over the VisiCalc series. Much of Software Arts' contention stems from recent advertisements in the Wall Street Journal that encourage VisiCalc series users to upgrade to Visi^{On}.—D. Bright

CONCORD DATA TO DEBUT 2,400-BPS, FULL-DUPLEX MODEM

Concord Data Systems, Waltham, Mass., plans to introduce the CDC 224 SD, a 2,400-bit-per-second (bps), full-duplex, dial-modem at this month's Interface '84 show in Las Vegas, Nev. The CDC 224 SD is one of the first modems of its kind to combine a three-port statistical multiplexer, error correction and automatic dialing. Concord claims the modem eliminates the need for leased telephone lines. The statistical multiplexer supports 14 asynchronous ports with user-specified speeds from 50 to 9,600 bps and automatically matches its speed to the user's computer via an "autobaud" port. Concord Data has tentatively set the price at \$1,695.—D. Bright

TECH FILES: A QUICK LOOK AT INDUSTRY DEVELOPMENTS

DEXPO PREVIEW: Let's hope next month's DEXPO/East will be more exciting than previous DEXPOs. Expoconsul International Inc., Princeton Junction, N.J., is staging the show April 3-6 at Boston's Bayside Exposition Center. The Independent RSTS Users Society (IRUS) will hold its Spring conference at the same time and place. **C. Gordon Bell**, chief technical officer of Encore Computer Corp. and former Digital Equipment Corp. vice president of engineering, will make the keynote address at the IRUS conference. Bell **will assess the latest developments at DEC**. DEC, which has headquarters in Maynard, Mass., joins some 260 DEC-compatible vendors that will attend the conference with about 500 new products and services.—D. Bright

Alcyon Corp., San Diego, plans to unveil its APS.RMS rack-mount workstation, which it claims equals the performance of the DEC LSI-11/73. The APS.RMS uses a 10-MHz MC68000. The system measures 5¼ by 19 by 24 inches. It contains 256K bytes of RAM, expandable to 4M bytes, and as much as 112M bytes of formatted Winchester disk storage with an average seek time of 30 msec. A 5M-byte removable hard disk or a 60M-byte, ¼-inch streaming-tape drive provides backup. Four serial RS232C ports and a parallel printer port are standard, as is Alcyon's UNIX-compatible Regulus operating system and a C compiler. Prices start at \$9,950.—D. Bright

Breakpoints

Plessey Peripheral Systems Inc. should announce its DEC LSI-11/73 processor, the KDJ11-AA, as part of its new Series 8500. The 8500 is an upgrade to the LSI-11/23-based Series 6000. The LSI-11/73 is combined with Plessey's proprietary memory-mapping technology to provide as much as 2M bytes of on-line system memory. Price will be only slightly more than the lower-level product. Plessey is performing all development work to ensure compatibility with Q-bus LSI-11-based systems. A basic Series 8500 system includes the KDJ11-AA processor, an eight-by-four-slot mapped backplane, a four-port DLV11J interface board, DEC LSI-11/23 and PDP-11/24 operating system and software compatibility and either a 53M-byte fixed/removable Winchester or a ¼-inch tape drive.—R. Shinn

Quadrex Information Systems Ltd., Montreal, plans to introduce the **Spacewriter, a VT100-compatible dedicated word-processing terminal.** The Spacewriter uses the Z8000 16-bit processor and contains as much as 512K bytes of RAM. The host need be used only for disk storage. The system comes with a local printer, and users can add a floppy or hard disk drive.—D. Bright

The MicroFCS decision-support system from **EPS Inc.,** Windham, N.H., runs on the DEC Rainbow with MS-DOS. It allows users to transfer files to and from the VAX, as well. MicroFCS features user-defined functions and commands, a report writer and menu building.—D. Bright

Digital Information Systems Corp., Sacramento, Calif., plans to announce a version of its DBL DIBOL language for the Rainbow 100+. Written in C, DBL 4.0 runs under MS-DOS, CP/M-86 and UNIX.—D. Bright

Computer Systems Development Inc., Pleasant Hill, Calif., should announce SMC BASIC for the RSX11-M, POS and VMS operating systems. SMC BASIC is a business BASIC featuring as many as 10 indexed files per user, business math and automatic code generation.—D. Bright

BG Enterprises Inc. plans to display Control Data Corp.'s newest and largest Winchester disk drive, the 14-inch, rack-mounted 9771 extended module drive (XMD). The XMD provides 825M bytes of unformatted storage and uses thin-film heads. It can include controllers from Emulex Corp. and Spectra Logic Corp.—D. Bright

Winchester Systems Inc., Winchester, Mass., plans to introduce the 5¼-inch, 21M-byte 4xRLO1 fixed/removable hard disk system. The rack-mounted system is 5¼ inches high. Single-quantity price is \$10,000.—D. Bright

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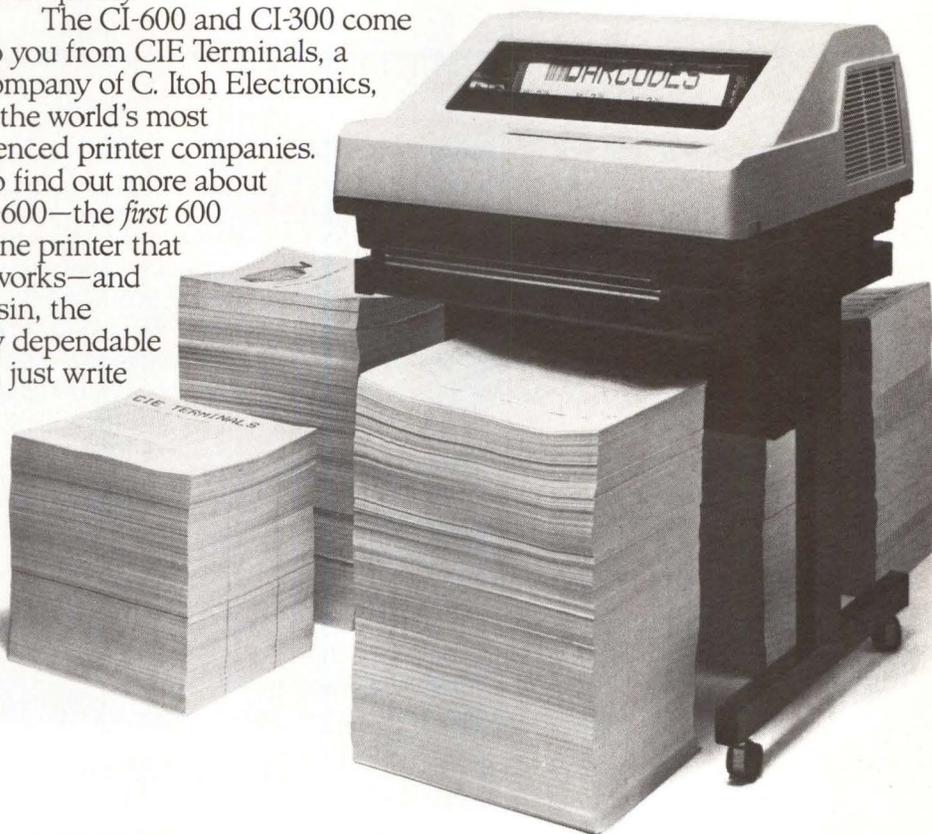
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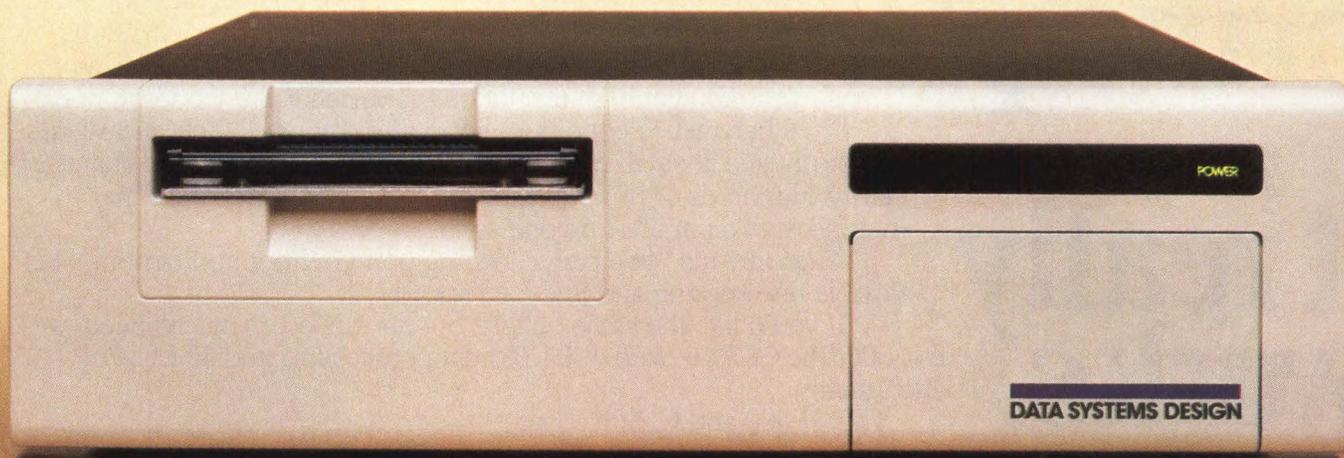
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Pictured here, the 880 Winchester/Floppy. Shown above, the 890 Winchester/Tape.



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CIRCLE NO. 15 ON INQUIRY CARD

Breakpoints

Emulex Corp., Costa Mesa, Calif., should display its new SC72 disk controller that permits intermixing of four disk drive types on PDP-11/70s. The controller uses the slots occupied by DEC's RH70. The drives can transfer data as fast as 2M bytes per second. It interfaces directly with the internal cache bus for high-speed direct-memory-access transfers, thus eliminating the need for a Massbus. List price is \$7,950.—D. Bright

SOFTWARE FILES: **Cortex Corp.**, Wellesley, Mass., has introduced the **Application Factory application generator for use on Digital Equipment Corp. VAX superminicomputers**. Generated applications can run on VAX processors or DEC Professional microcomputers. The Factory works with the Builder fourth-generation language. Licenses for the Factory for the VAX-11/780 or -11/750 sell for \$25,000. An application accelerator sells for \$15,000. An application targeter, also \$15,000, can be used to target applications to the Professional microcomputer.—L. Valigra

Pick Systems, Irvine, Calif., has introduced a version of its **operating system for the IBM PC XT**. Billed as the XT's first true multiuser system, the Pick virtual-memory managing software is priced at \$495. The Pick implementation for the XT will share the XT's disk drive and trade information with other XT operating systems such as PC-DOS. The package is expected to be available in the second quarter.—T. Moran

CHIP FILES: **In an effort to push yet another standard, Intel Corp. recently announced its first microcontroller on a board, which is the first board from Intel using the single Eurocard form factor.** The 8044 microcontroller, which consists of an 8051 microcontroller and a serial interface unit, is aimed at applications requiring distributed control of intelligent industrial machines including robots and numerical-control products. The controllers are connected via a **Bitbus, whose specifications—in an effort to develop a standard—Intel will provide to industrial companies this month for review and comment.** Other products available for the Bitbus scheme are the iSBX expansion module, the iRCB 44/10 Bitbus remote controller board and the iRMX 51 operating system plus utilities.—L. Valigra

NOTES FROM OVERSEAS: **Post, Telephone and Telegraph (PTT) monopolies and market protectionism took a back seat last month to standards issues in Europe when senior officials from the 26 European nations agreed to speed efforts to set and enforce common pan-European telecommunications standards.** The countries reached an accord in Paris at the Commission of European Postal and

Breakpoints

Telecommunications Administration's (CEPT) meeting. It should result in a new agency charged with drawing up technical standards for telephone handsets, videotex, networks and interfaces. Once established, these standards will become mandatory.

CEPT also agreed to simplify licensing procedures by establishing common testing routines and to have all countries accept the marketing approvals that one country grants.

Observers view the CEPT agreement as a response to the deregulation and increasing expansion into Europe of American Telephone & Telegraph Co. and to similar perceived Japanese competition.—M. O'Gara

Mercury Communications, a British equivalent to America's MCI Communications Corp. and part of the government's plan to break British Telecom's monopoly on the U.K. telecommunications market, is **accelerating plans for a national integrated services digital network. It expects to seek a manufacturer by year-end for the public digital phone switch it is designing.** The company wants its first digital telephone exchanges, worth roughly \$105 million, in place by fall of 1985.

The Mercury exchange specifications include a 2M-bit-per-second (bps) signaling rate, a marked improvement over British Telecom's 64K-bps rate. **With the higher rate, Mercury should be able to offer integrated voice, data communications and video.**

Mercury plans to be in the international telecommunications market this summer by linking with the United States and Europe via satellite. Mercury has so far signed carriage pacts with at least six U.S. companies—MCI Communications, Graphnet Inc., TRT Co., FTCC Co., International Radio Inc. and Western Union. An "understanding" was also reached with AT&T.—M. O'Gara

Memorex Corp. has signed a three-year worldwide distribution pact with British start-up Future Computers Ltd. By year-end, **Memorex should start manufacturing a version of Future's IBM-compatible, 8088-based FX20/FX30 microcomputer** that runs MS-DOS and Concurrent CP/M. Memorex's Communications division in Cupertino, Calif., will manufacture the system. Memorex's 3270-compatible terminal line should benefit from Future's small-screen IBM PC-like technology. Memorex could sell the systems as communications equipment and resell them under Future's label. Memorex says Future will become its terminals and workstations "think tank," handling the R&D and production engineering of technologies new to Memorex. Memorex reportedly has picked up an option to buy 15 percent of Future's privately owned holding company, Cawdor, for \$3 or \$4 million.—M. O'Gara

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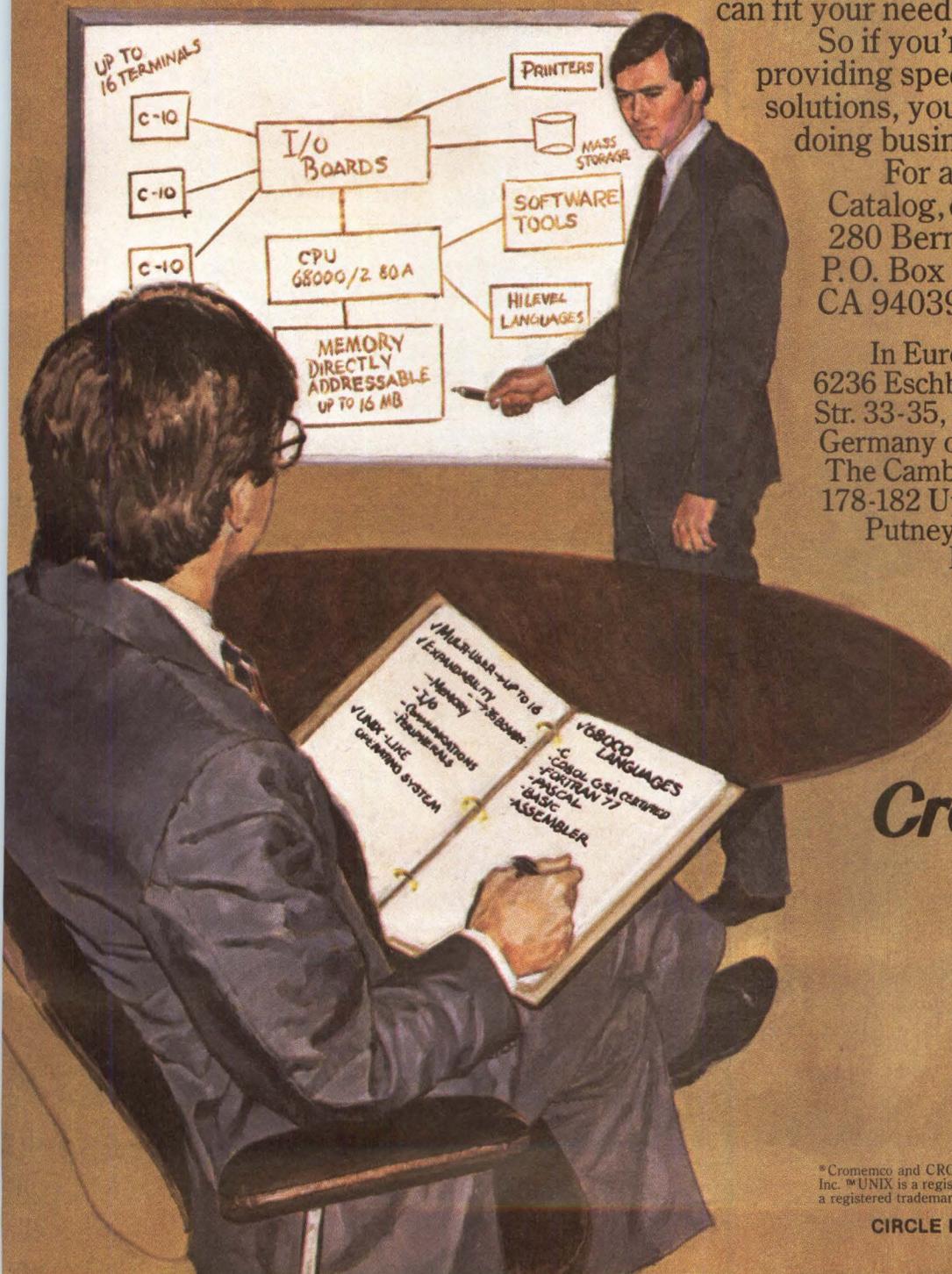
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The Xebec 9710H is a classic example of experience showing. Utilizing sophisticated computer-aided design equipment, the same engineering team that has been responsible for just about every major breakthrough in disk controller technology this past decade, has rendered a subsystem product of significant design superiority, inside and out. It weighs just 9.5 pounds. Its slim "bookend" styling makes it both handsome and unobtrusive. There's no fan, so the 9710H is as easy on the ears as it is on the eyes. And its universal design makes this subsystem compatible with IBM, Apple, S100, Multi-bus, Q-bus and other popular micro-computer busses.

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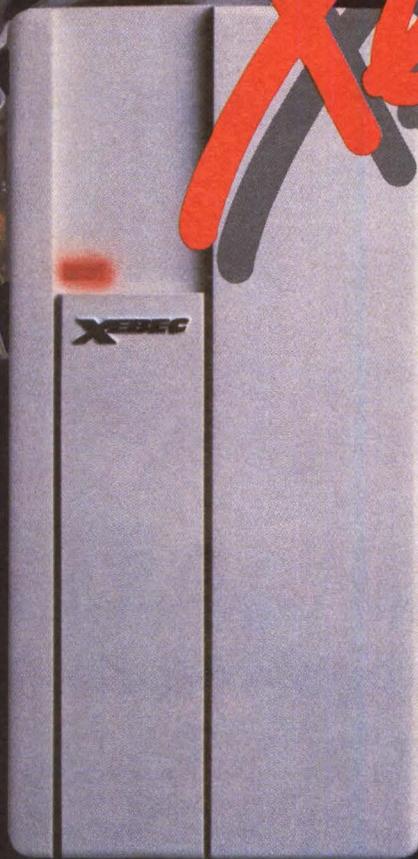
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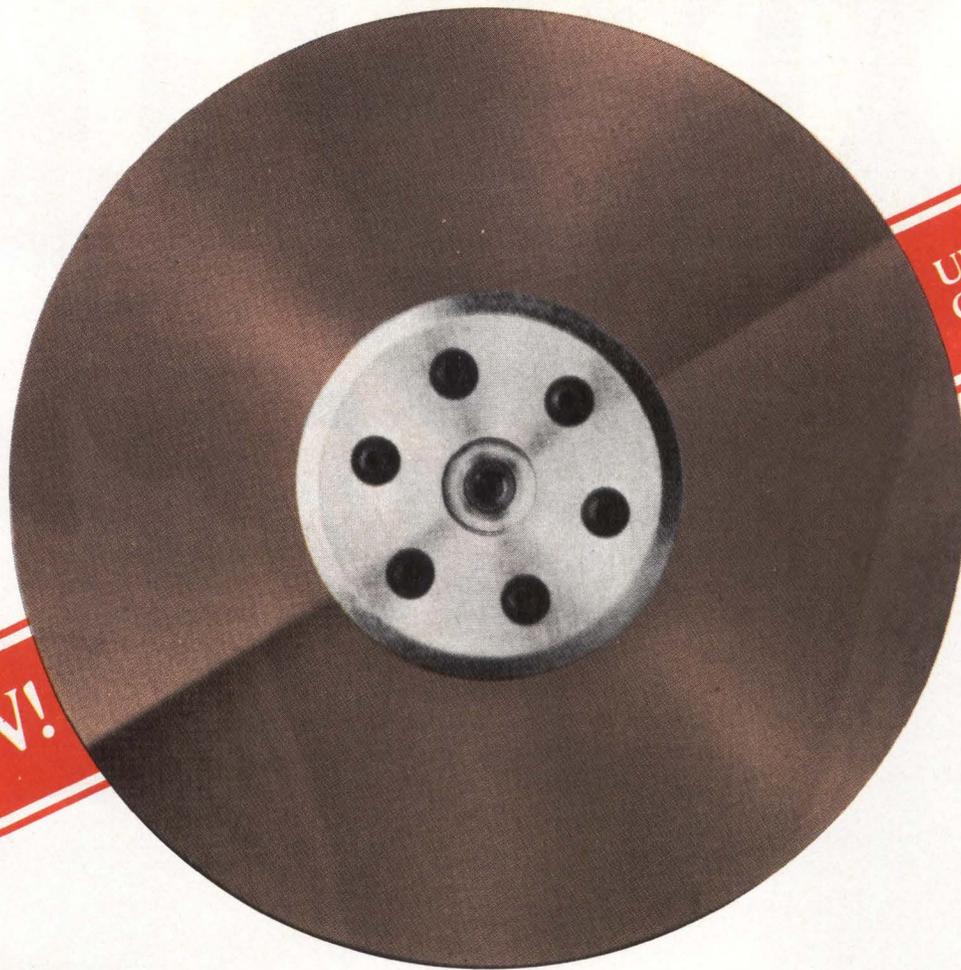
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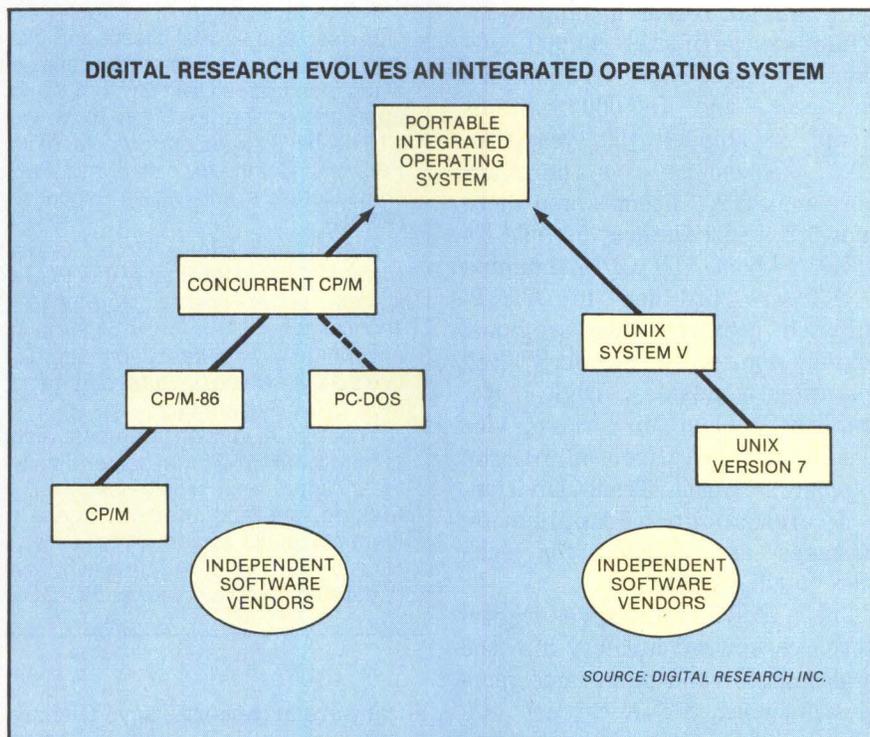
DRI's alignments with AT&T, Motorola should heat UNIX application development

Lori Valigra, Senior Editor

Digital Research Inc., Pacific Grove, Calif., and AT&T Technologies Inc., Lisle, Ill., have agreed to jointly develop a commercial UNIX System V operating system and to appoint a joint committee to review and adopt applications to be sold by both companies. The move is an effort to fix a commercialized UNIX Systems V version on which 16- and 32-bit microcomputer system integrators can develop "standard" application software.

In addition, Motorola Semiconductor Products Inc., Tempe, Ariz., has allied itself with Digital Research to implement CP/M versions on Motorola's VME/10 development systems. When completed, many of the developed applications should be portable with little or no source-code alterations between the UNIX System V/68 available on the VME/10 and CP/M-68K and Concurrent DOS-68K with PC-DOS mode for the VME/10 and MC68000-based systems.

Industry analysts say Digital Research's grouping with such major companies should increase the number of applications able to run under a commercial UNIX operating system, particularly by opening for access the approximately 16,000 applications available under CP/M and applications available for the IBM PC. The moves bolster Digital Research's position against its primary competitor, Microsoft Corp., whose XENIX UNIX environment has not been as accepted as expected by analysts because of uncertainty about AT&T's intentions with UNIX.



Digital Research plans to integrate its operating systems' approach by developing, for release next year, a new portable integrated operating system consisting of CP/M, PC-DOS, UNIX and space for one more operating system. The four will access common files.

THE DIGITAL RESEARCH/MOTOROLA AGREEMENT

- Digital Research will implement its Concurrent DOS operating system on Motorola's VME/10 development/OEM system.
- Digital Research and Motorola will develop 19 software packages in CP/M and Concurrent DOS. These include:

CP/M 68K-VME/10

- Digital Research C
- Pascal MT +
- C BASIC compiler

Concurrent DOS VME/10

- Digital Research C
- C BASIC compiler
- Pascal MT +
- FORTRAN 77
- PL/I (G)
- BASIC interpreter
- GSX graphics software

- Digital Research and Motorola will develop the same high-level languages (supporting Concurrent DOS on Motorola's VME/10) to support UNIX System V for the MC68000 family.

Source: Motorola Inc.

"Digital Research is making another XENIX with UNIX but doing it under close association with AT&T, Motorola and Intel Corp.," notes Ralph Gilman, senior vice president at InfoCorp, a Cupertino, Calif., market research company.

InfoCorp estimates 90,000 systems running UNIX were shipped last year, and 150,000 systems should be shipped this year. An AT&T spokesman says there are more than 2,200 licenses and more than 5,200 installations of AT&T's UNIX. About 750 CPUs running UNIX are installed in AT&T-affiliated companies and regional holding companies, formerly Bell operating companies. Digital Research's Stephen Maysonave, vice president and director of the company's World Trade Division, estimates about 2.5 application packages are shipped for each system using UNIX.

The AT&T link also gives Digital Research upward mobility into the minicomputer and mainframe markets, in which UNIX can act as a bridge linking microcomputers to the larger systems.

The Motorola agreement is believed to be worth \$500,000 to Digital Research, and the AT&T agreement is said to be worth more than double that amount to Digital Research.

The Digital Research/AT&T screening committee will develop an application library along the lines of Digital Research's CP/M library, including standard packaging. In anticipation of quick turnaround in developing UNIX applications, Digital Research has been transferring its CP/M library to the C language over the past year.

"The UNIX software application committee will set forth criteria for independent software vendors to submit applications to the library, which will assure products in the

IBM to use Interactive Systems' UNIX on PC

Stephen J. Shaw,
Contributing Editor, Washington

A few days before AT&T Technologies Inc. and Digital Research Inc. announced an agreement to develop a commercialized UNIX System V and applications for it, IBM Corp. unveiled a UNIX-based operating system for its Personal Computer called the Personal Computer Interactive Executive (PC-IX).

Interactive Systems Corp., Santa Monica, Calif., developed the PC-IX system under license from AT&T Technologies. The new operating environment was based on Interactive's IS-3, which in turn originated from UNIX System III.

The PC-IX version, demonstrated at the recent Uni-Forum conference in Washington, is a single-user, multi-tasking system that includes a hierarchical file system, a full-screen text editor with multiple-window capability, co-residence with PC-DOS

on fixed-disk partitions, the C programming language, utilities for file transfer to PC-DOS Version 2 and the Shell Interactive command interpreter.

Although the PC-IX can run with a minimum 256K-bit-per-second (bps) memory configuration, an IBM spokesman says resulting operations are slow. IBM recommends using a 512K-bps memory to benefit from the system's multitasking capabilities.

Third-party software vendors will do most of the application-software development for the PC-IX. Text processing, system accounting and communications diskettes will be included when delivery begins in April. IBM will not develop additional programs. "We're not going to be doing a lot of software applications ourselves," says an IBM spokesman.

The PC-IX system comprises 19 diskettes, including diskettes for the kernel, the shell and system utilities. Announced single-unit price for the system is \$900.

library are in concert," says Richard D. Dixon, assistant to the president at Digital Research. He adds that both companies will market the products under Digital Research's packaging, and both will determine suggested retail prices. AT&T plans to market the software through Digital Research's retail channels and through its own as-yet-unspecified distribution channels. A company spokesman does not confirm whether the products will be sold through phone company stores, but he hints at the possibility. Electronic distribution also is a possibility. Digital Research president John Rowley said OEMs will have access to the library under "certain terms and conditions."

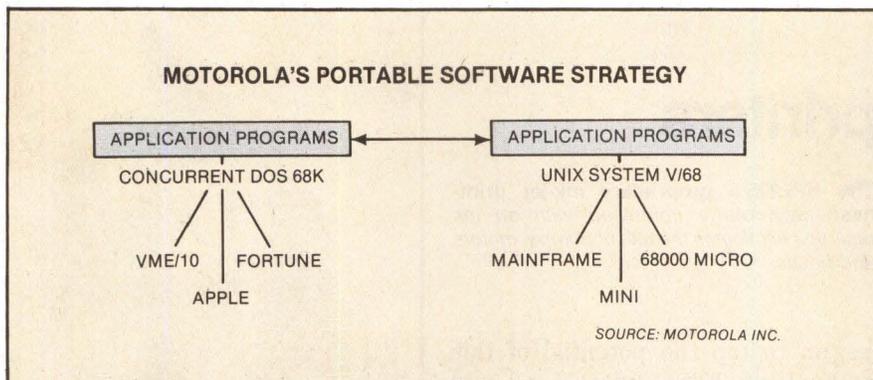
The defined standard programming environment for System V will include programming languages, graphics formats and an application

manager utility program. Part of what Digital Research's Dixon views as commercial extensions to UNIX includes adding functions in the operating system for graphics and networking.

The first products in the UNIX System V Applications Library for microcomputers are planned for the end of this year. Dixon expects thousands of products eventually to become available. He does not specify which products would be marketed first. Digital Research plans to sell UNIX System V with AT&T, but a brand name for the product has not been chosen.

Dixon says the membership of the screening committee also is now being decided. Once the committee approves products, they will belong exclusively to the library.

AT&T intends to sign other such software agreements. "Our interest



Motorola intends to achieve portability between the UNIX System V, the VME/10 development system and other major operating-system software libraries. The first move toward this goal was a contract with Digital Research to port CP/M and Concurrent DOS to its VME/10 system (left). Many developed applications will be portable to processors running Motorola's UNIX System V/68 operating system (right).

is to get as many people as we can working on the UNIX standard," says Jack Scanlon, AT&T vice president for Computer Systems. He adds that AT&T is targeting systems based on the Intel 286 and Motorola MC68000.

Digital Research will manufacture the jointly developed software in a 30,000-square-foot plant in Monterey, Calif., equipped with clean rooms. The size of the software diskettes is not yet specified, says Dixon.

Digital Research also is working rapidly on a new operating system consisting of side-by-side PC-DOS, UNIX and CP/M programs accessing common files, Dixon says. A fourth operating system can be added or customized. An example of a customized system is whatever operating system AT&T may run on a rumored microcomputer based on its 32-bit Bellmac processor. The new Digital Research operating system is not expected this year. It is oriented toward multiuser systems employing windowing and networking functions.

In addition to the UNIX port Digital Research is working on for Concurrent CP/M to run on Intel's 286 and 386 processors, Digital

Research has also signed with Motorola to port Concurrent DOS on the MC68010, MC68020 and VME/10. The goal is to port application software between UNIX System V and Concurrent DOS-68K and CP/M-68K on the MC68000 family and the VME/10. "This is the first in a series of moves to provide complete portability between the UNIX System V, the VME/10 standard and other major operating-system software libraries," says Tom Beaver, director of Motorola Microsystems operations. According to figures quoted by Motorola, 80 percent of microcomputers running UNIX and UNIX-derived operating systems use MC68000 family processors.

Seven packages for the VME/10 running under CP/M-68K and Concurrent DOS-68K will be jointly developed to support the System V/68 operating system already on the VME/10, the result of a joint project with AT&T and Motorola. Both organizations will market the seven packages. AT&T and Motorola will jointly develop 12 more packages for the VME/10 to run under CP/M-68K and Concurrent DOS-68K. Customers can develop an I/O subsystem to support

peripheral devices for MC68000-based systems in an average of two months for CP/M-68K and four months for Concurrent DOS-68K, according to Motorola.

Expected first-quarter introductions are Digital Research C, Pascal MT+ and C BASIC compiler for the CP/M-68K operating system to run on the VME/10. The following Concurrent DOS-68K products, which will supersede the CP/M-68K packages in most applications, should be ready for the VME/10 by year-end: FORTRAN 77, PL/1 (G), BASIC interpreter, GSX graphics, Digital Research C, Pascal MT+ and C BASIC compiler. Those high-level languages supporting Concurrent DOS-68K on the VME/10 are expected to be developed to support UNIX System V/68K for availability by year-end. Motorola will have its Four-Phase Systems Inc. subsidiary in Cupertino, Calif., service and support the new UNIX products.

The mixed operating environments for Motorola support InfoCorp's Gilman's contention that users in the future will not care which operating system they run because many will be running in emulation mode. "The question is what type of performance degradation there will be," he says. □

LOOKING AHEAD IN MMS

Be sure to watch for these editorial highlights in coming issues of Mini-Micro Systems.

- The April issue will spotlight minicomputers and analyze the top 10 manufacturers of minicomputers.
- MMS's Spring issue of Peripherals Digest will appear as a second issue in April.
- Office automation and business software will be featured in the May issue.

HP introduces low-cost ink-jet printers

Tom Moran, Associate Editor

Hewlett-Packard Co.'s Vancouver, Wash., division has unveiled the HP2225 series of inexpensive, high-performance, ink-jet printers aimed at the portable and personal computer markets. Designed to be compatible with Epson America Inc.'s dot-matrix printers, the bidirectional HP2225s print 150 characters per second (cps) using a disposable cartridge that contains a print head and the ink supply. The price for the HP2225 series printers will be less than \$600 each. HP planned to begin shipping the printers in February.

The heart of the HP2225 design is a disposable HP92261 ink-jet, thin-film print head designed at HP's Corvallis, Ore., laboratories. Because the ink reservoir and print head are built into a removable cartridge, the printer does not need pumps, motors or hoses. To prevent clogging, the HP2225 purges itself by squirting ink onto an absorbent pad each time the system is switched on.

HP used a combination of sputtering, photolithography and plasma-enhanced chemical-vapor deposition to create the thin film of the print head. HP engineering manager Frank Cloutier says capillary action draws ink into the thin-film head. There, one of 12 resistors heats a tiny amount of ink to considerably above the boiling point in less than 1 μ sec. A vapor bubble expands and collapses within a few microseconds, but, before it collapses, the ink above it shoots through the orifice plate and onto the paper.

Cloutier claims that HP has only

The HP2225's proprietary ink-jet print-head technology combined with an ink reservoir eliminates the use of pumps, motors and hoses.

begun to tap the potential of this technology. "The print speed and density is limited only by the photolithographic processes. We think it's going to be the greatest thing since Gutenberg."

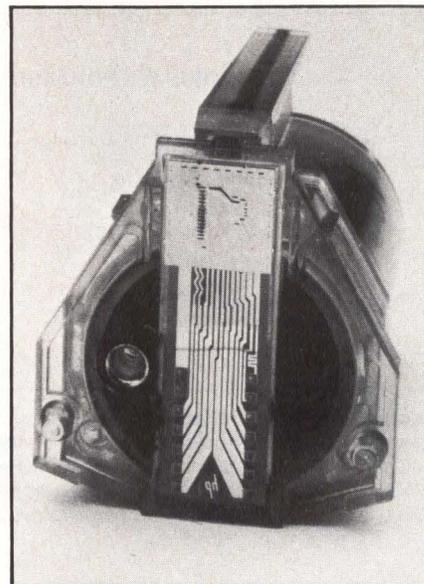
Other ink-jet printers use piezoelectric crystals, which translate electrical pulses into mechanical motion to propel the ink. The HP2225's ink consists mainly of diethylene glycol and a black pigment certified for use in food.

The HP92261 ink supply/print head will sell for about \$8, and HP will distribute it to retailers through the company's Personal Computer Distribution Operation. Retailers can opt to sell the cartridges singly or in packs of 10.

Like other ink-jet printers, the 2225 is very quiet; it produces less than 50 dB of sound pressure. Company executives and industry analysts expect the 5½-pound, 3½-by-11½-by-8¼-inch HP2225 to appear in portable applications under the HP label and in OEM systems.

Norbert Gotner, business development manager for HP's Personal Printer operation, says the printer's head life is effectively infinite because the thin-film head is replaced when the ink runs out (about every 500 pages). HP says head-carriage life is 3.5 million lines, or 100,000 pages. Non-fading ink provides permanent hard-copy storage of records.

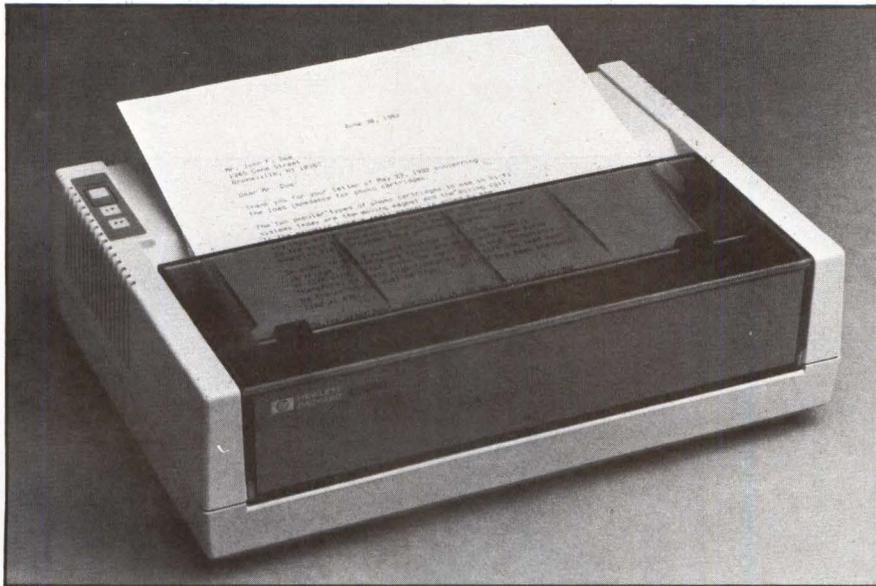
The HP2225 is available in three models. The HP2225A uses the



HP-IB interface, the 2225B uses the HP-IL and the 2225C uses a Centronics-compatible parallel port. HP had room to put a rechargeable nickel-cadmium battery into the 2225B because the HP-IL interface board is smaller than the other interface boards. The 2225B can print about 200 pages on battery power without charging and can run directly on AC power. Battery charging does not last as long when the printer is printing graphics. The 2225A and 2225C run only on AC power.

Gotner claims that additions to the product line over the next few years will offer improved performance, lower cost, higher quality and multicolor capability. To keep cost low, HP did not include serial interfaces but may add serial ports later, he says.

The HP2225 offers dot-addressable graphics at 96 by 96 dots per inch (dpi) and 96 vertical by 192 horizontal dpi. The four print pitches are 21.3 characters per inch (cpi) in compressed mode, 12 cpi in normal operation, 10.7 cpi in expanded-compressed mode and 6 cpi in expanded mode. Because the HP2225 makes only one pass per



The HP2225 ink-jet printers print at 150 cps in a package that is approximately the same footprint size as a sheet of paper.

line, head speed does not decrease when underlining or printing bold-face. The character matrix is 11 by 12 dots with one ascender and two descenders. The buffer stores 1K byte.

The 2225 family can use normal paper, and HP will provide a toll-free number for ordering a paper formulated for better contrast. The high-contrast paper will initially cost about 1.5 cents per sheet compared to 1 cent per sheet for ordinary paper. HP2225 models have friction- and pin-feed capability, but, like other non-impact printers, cannot print a multiple form or make a copy without reprinting an entire page or document. The current models print an area only $6\frac{2}{3}$ inches wide, leaving a margin of about 10 character spaces on both sides of $8\frac{1}{2}$ -inch-wide paper. This could limit the machines' usefulness for graphics and spreadsheets.

Peter Steiner, vice president and director of the Electronic Printer Industry Service Group for research company Dataquest Inc., thinks the new HP printer is competitive in portable applications. "It has a lot of potential to

compete as a portable printer, even integrated into a portable computer. There, it has a high speed advantage over most printers offered with portables, which run at about 30 to 40 cps," he says.

Steiner is enthusiastic about the disposable cartridge: "They've had some real technology breakthroughs there." He expects competition in the low-end market to include thermal-transfer units and ink-jet machines such as Canon U.S.A. Inc.'s \$695 multicolor offering and an Epson device that has not yet been introduced in the

United States. Quadram Corp. also offers its \$895, seven-color, 40-cps, ink-jet Quadjet. "Serial thermal-transfer printers in HP's price range, from a cost standpoint, will be cheaper, but the performance will not be as high," says Steiner.

Steiner also expects the products to compete in the serial impact dot-matrix market. He estimates that, in that market, unit shipments in 1983 for less-than-120-cps printers totaled 1.3 million, and shipments of 120- to 210-cps units totaled 600,000. "At 150 cps, the HP2225 brackets that whole area where the price ranges from \$300 to \$1,500 for high-speed machines," he says. Dataquest projects a 32 percent compound annual growth rate through 1987 for dot-matrix printers slower than 120 cps and 44 percent for systems faster than 120 cps.

In the first year of production, HP expects to manufacture about 30 percent of the HP2225s in Corvallis, Ore., and the rest in Singapore. HP will distribute the HP2225 through about 700 dealers and its independent sales force. □

GRAPHICS MARKET ADVANCES 37 PERCENT

The number of computer graphics hardware and software products grew at a 37 percent rate in the first nine months of last year, according to a Data Sources study. The results may indicate that the graphics systems market will become one of the fastest growth areas of data processing. Graphics systems and displays, with a 47.1 percent increase to 453 available products, were the fastest-growing market segments. Further growth is expected, says Data Sources, because the number of new companies in that area increased 60 percent. The older plotter market segment advanced by only 17.3 percent to 217 products. Digitizer products increased 45.8 percent, and image processors increased 41.4 percent.

DMA more than doubles fixed/removable storage

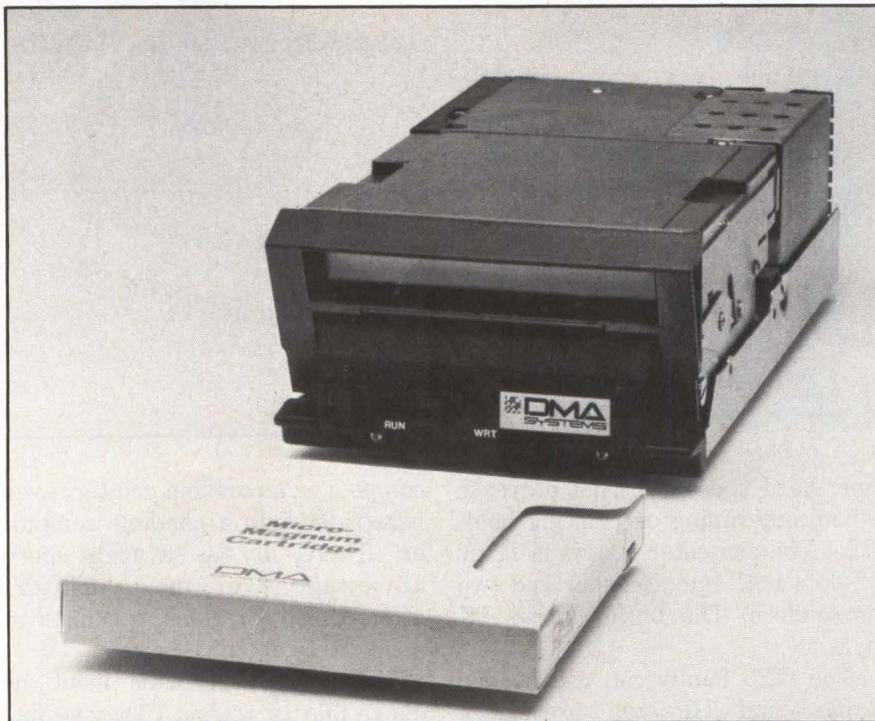
Ron Shinn, Senior Editor

A new Winchester disk drive, the Micro-Magnum 11/11 from DMA Systems Corp., Santa Barbara, Calif., offers more than twice the formatted capacity of the company's 5¼-inch fixed/removable Micro-Magnum 5/5 hard disk. The 1,000-unit price is \$1,295 for the 5M/5M-byte 5/5 and \$1,350 for the 11M/11M-byte 11/11. That's \$55 for 12M bytes more memory. Volume deliveries are scheduled for June.

Making this small incremental price for a lot more memory possible is embedded servo control and a linear voice-coil positioner that was also used in the 5/5. The transition to the higher-capacity Micro-Magnum 11/11 was relatively simple because all servo-writing and production methods were in place, says David Sutton, DMA vice president of engineering. "The basic approach to the product was to use all the same mechanics so we could run the same production line with the same vendor base in mechanical hardware, along with use of standard oxide media. We changed the head and put the load of added capacity on the servo and read/write electronics," Sutton says.

Reliable, high-volume production is key to meeting the needs of users in the market for drives storing 10M/10M bytes or more because production volumes of fixed/removable drives of these capacities are just beginning. Sutton points out that DMA has more than 11,000 drives in the field; they were produced on the same manufacturing line that will produce the new drives.

The 11/11 drives also feature



The \$1,350 Micro-Magnum 11/11 from DMA offers 11M bytes of removable storage and 11M bytes of fixed storage.

track-to-track recording compatibility with 10M-byte IBM PC hard disks. The 5/5 drive's recording pattern is electrically compatible with the PC; with the 11/11, DMA added two sectors per track, for a total of 34 sectors at 256 bytes per sector (there is one spare sector per track for redundancy, for a total of 35 sectors). This encompasses the IBM capacity of 17 sectors per track with 512 bytes per sector. With the earlier DMA recording scheme, data interchange with IBM disks could suffer from software and mechanical overhead caused by increased access time.

To increase track bit density in the DMA drive, the disk rotation speed was slowed from 3,443 rotations per minute (rpm) to 3,247

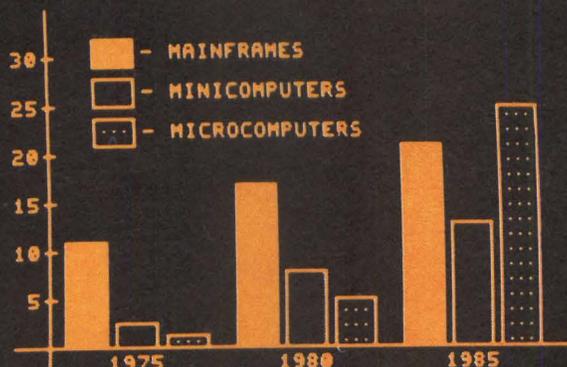
rpm, which ups recording density from 8,725 bits per inch (bpi) to 9,254 bpi. Doubling the track density from 454 tracks per inch (tpi) to 908 tpi in the 11/11 is the result of narrowing the ferrite head element by half and changing the servo writer programming. Obtaining head magnetics is not a problem because there are several sources for heads addressing track densities as high as 960 tpi.

The design effort also concentrated on the drive's electronics. The use of an embedded servo and voice-coil positioning helped there, as well, keeping soft error rates at 1 in 10^{10} and hard errors at 1 in 10^{12} .

DMA president Dick Troutte explains that DMA planned to expand the capability of the 5/5

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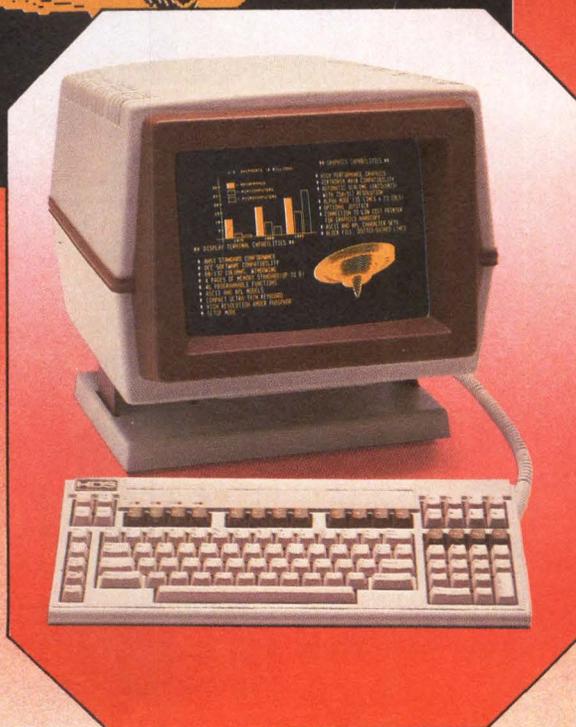


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when it was designed. DMA began producing large volumes of the 5/5 in October 1982. DMA uses ferrite heads and standard oxide media because, Troutte explains, "We decided not to try a start-up company based on thin-film heads and media, or we wouldn't be talking to you now." This bent for proven technology is basic to DMA because it is a vendor-based, assembly-only manufacturer, Troutte insists.

The next step for DMA drives is another doubling of density, says Troutte. "We know all of our suppliers are out there working on new disks and heads, and we have to reach out there and make sure there are volume suppliers offering something we can get before going on to the next generation."

The biggest surprise DMA encountered over the past two years is that most potential users are accustomed to floppy disk drives and must be educated in using fixed/removables. "If you have a fixed drive, it does mass storage, and, with a removable drive, you do

both mass storage and data backup," Troutte says. "There's no way you can ever get a fixed drive with so much capacity that you never have to remove data from it. And, especially in microcomputers, you always have to load programs and provide backup. So, if you have a drive that does both—that is, half of it is fixed and operating as a system disk and half of it is removable for backup—then you have all the functions of a memory subsystem in one unit, thus saving real estate."

In typical applications, Troutte points out, the fixed portion of the drive can store operating software and application programs, while the disk cartridges can store records of departments and functions, such as accounting, marketing, payroll and inventory. The removability of the cartridge addresses the issues of data protection and increased record-storage capacity.

Another feature of cartridges is transportability. Sutton suggests that express-mailing a cartridge is often considerably less expensive than transmitting data over commu-

nications links. Because all DMA drives use dynamic head loading, the heads do not rest on the media as in earlier Winchester drives. As a result, users can transport cartridge media without the fear of data loss through heads crashing.

The cartridges for the 11/11 do not differ from those on the 5/5 except for the heads and servo patterns, Sutton says. Retail prices of the cartridges are \$25 to \$45, of which \$20 is the cost of the media.

Sutton points out that the higher capacity of the 11/11 will make the advantages of embedded-servo, voice-coil tracking more apparent compared with stepper-motor drives—especially with 16-/32-bit, multiuser machines. "In earlier systems, the stepper motor was fine, and you couldn't even see the difference [from voice coils] because the software overhead was so high that it masked the better performance," he says. "Our average access time of 40 msec. will become a more significant factor of choice when used with higher-performance microcomputers." □

Bubble-memory devices expand capabilities of IBM PCs

Tom Moran, Associate Editor

Manufacturers of bubble-memory subsystems are starting to produce a profusion of alternative storage peripherals for IBM PCs and PC-compatibles. While bubble memories aren't cheap enough for most home and business users, they offer reliability and resistance to shock, vibration, power loss and electromagnetic interference. This ensures that they will continue to penetrate the markets for personal computers, process control, data

acquisition and computer-aided design/computer-aided manufacturing.

The company with the latest bubble-memory product is Hicomp Computer Corp., Redmond, Wash. Its product, the MBM-500 memory disk, a 256K-byte floppy disk-emulation board, contains two 1M-bit Intel bubble chips and an on-board controller. It can be plugged into any available I/O slot in an IBM PC, a PC XT or a compatible machine. Because it allows a user to boot a host

microcomputer directly, the MBM-500 can be used with floppies or alone. However, the board cannot boot up older IBM PCs or compatibles lacking a ROM-scan feature, which searches for intelligent I/O cards during power-up. Such systems must be booted from a separate diskette.

Average data-transfer rate is 17K bytes per second, and average access time is 50 msec. The MBM-500 supports PC-DOS 1.1 and 2.0 and will support PC-DOS 2.1 or any other operating system that

Mini-Micro World

NEWS

becomes the standard for IBM PCs. Hicomp has tested the system in IBM PCs, PC XT's and portables from Compaq Computer Corp. and expects it to function in other compatibles as well. List price is \$995, with quantity discounts available, and delivery is four weeks.

Company president Joseph Mazarella says the two-year-old company plans to introduce a 512K-byte version, the MBM-504, in May or June. The data-transfer rate will be

	1983	1984	1985	1986	1987
Harsh environments	70	91	118	154	200
Commercial	30	60	94	168	300
Total	100	151	212	322	600

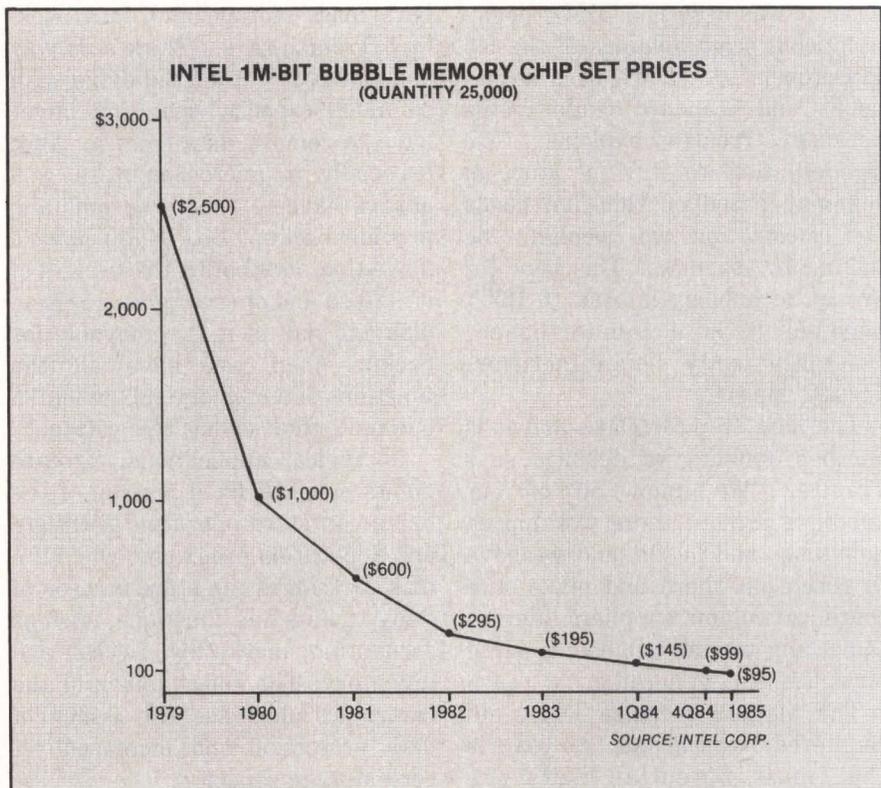
Source: Dataquest Inc.

34K bytes per second, and average access time will be 50 msec. List price will be \$1,495.

Mazarella expects Hicomp's revenues to grow in a range of from \$4.5 million to \$8 million in fiscal 1985, up from about \$1 million in this fiscal year.

Another bubble drive for the IBM PC comes from Helix Laboratories Inc., San Diego, which also makes bubble products for Apple Computer Inc.'s Apple II. The Helix PC bubble disk stores 512K bytes using four 1M-bit Intel chips and emulates a hard disk. The Helix bubble drive runs with PC-DOS 2.0, Softech Pascal IV.13 and CP/M-86 for the PC XT.

Helix has started shipping sample quantities of the bubble disk. Retail price of the product is \$1,495 in small quantities, and delivery time is two to three weeks. When Intel cuts its price for 1M-bit chip sets to \$95 this October, Helix expects to reduce the bubble system's price



and increase the company's margins, says company president Bruce McKay.

The FDE425 Solidrive from Targa Electronics Systems Inc., Ottawa, was not specifically designed for the IBM PC, but an OEM can configure the Solidrive to emulate a standard 8-inch floppy drive or several 5¼-inch drives. When the drive is configured with a 5¼-inch drive connectors, a user can switch-select various formats. The Solidrive uses removable bubble cartridges and has the same power requirements, form factor and mounting holes as a 5¼-inch floppy drive.

A limited-temperature version of the FDE425 Solidrive sells for \$2,495 with a 128K-byte cartridge and \$2,995 with a 256K-byte cartridge. Prices for the removable cartridges range from \$995 to \$2,295, depending on temperature range and capacity (256K or 512K bytes). Targa, which first shipped

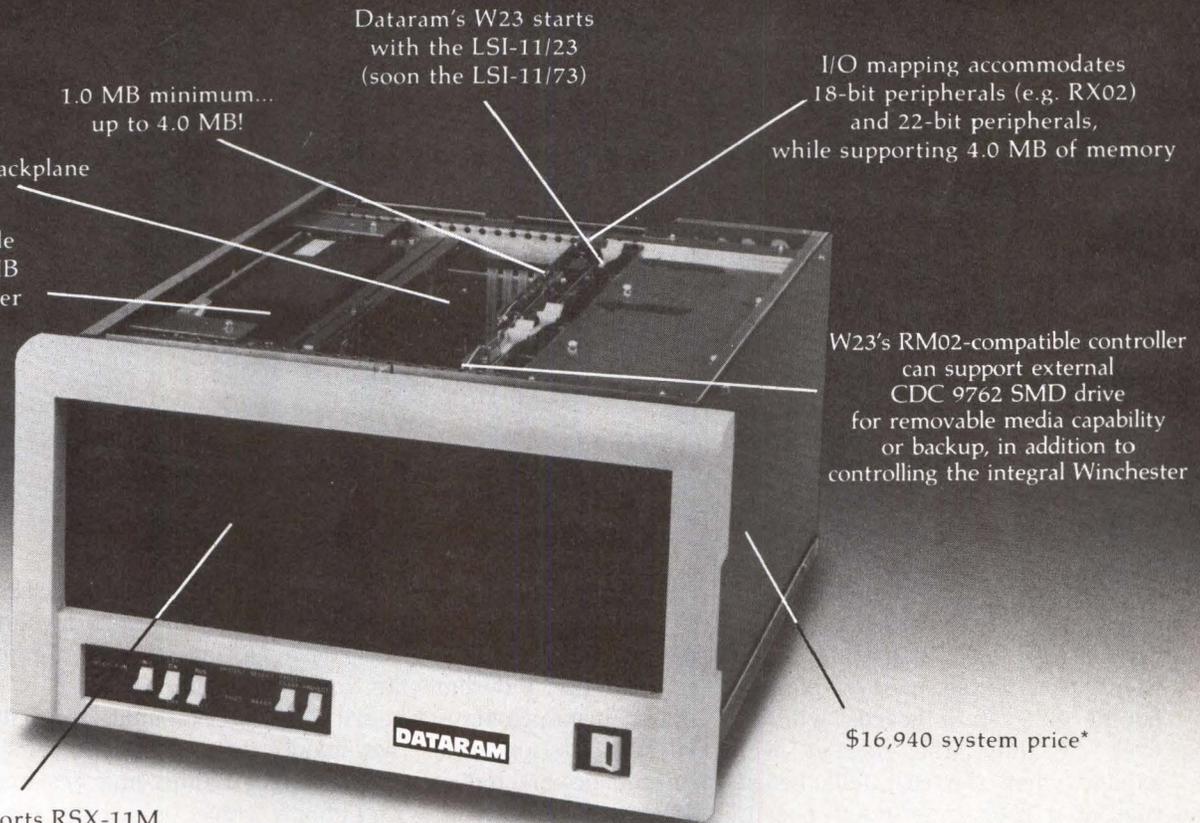
the Solidrive in November 1982, does not plan a board-level product for IBM or Apple systems.

Bubbl-tec, a Dublin, Calif., division of PC/M Inc., expects to ship an IBM PC add-in bubble-memory board this month, says company president Bob Nelson. The company currently manufactures bubble-memory boards for several other microprocessors and microcomputer buses. It has not determined price or availability of the PC add-in, but Nelson does say the product will not emulate a floppy drive. Bubbl-tec intends to provide software drivers for the product.

MPC Peripherals Corp., San Diego, makes a bubble-memory board for the Apple II and is reportedly working on a bubble-based add-in board for the IBM PC. A spokesman for MPC refuses to comment on the product, which is expected to emulate a floppy disk drive.

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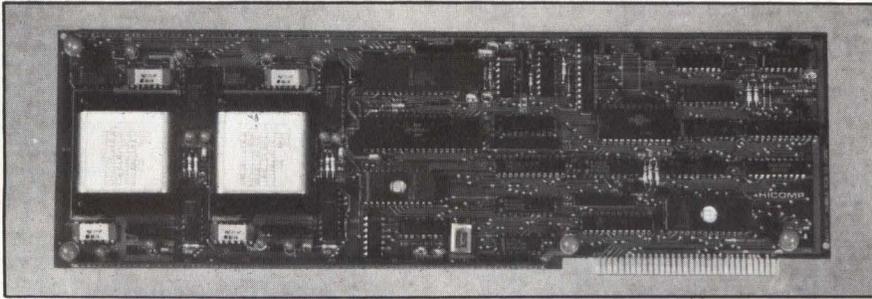
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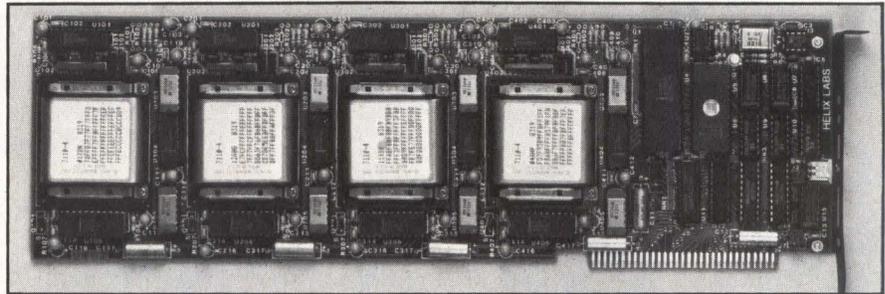
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Mini-Micro World



Hicomp's MBM-500 256K-byte bubble-memory add-in card for the IBM-PC, PC-XT and compatible systems should usher such machines into new market niches.

Helix Laboratories' PC bubble disk add-in board for the IBM PC stores 512K bytes and emulates a hard disk.



bubble-memory subsystems have a limited market, says Aaron Goldberg, research manager for research company International Data Corp., Framingham, Mass. "I don't expect to see a lot of sales [of bubbles that emulate floppies], not as much as [sales of] add-in RAM boards because RAM boards have general applicability, and a bubble emulating a floppy really doesn't."

However, Egil Juliussen, chairman of Future Computing Inc., Richardson, Texas, believes plug-in bubble subsystem boards will do well. "I think the market will expand when the cost falls below that of a 256K-byte RAM board, which is now about \$500. The advantage [of bubbles] is their non-volatility; for certain memory applications and harsh environments, [bubbles are] better." He expects bubble-memory to be used in portable personal computer products: "You'll even see some removable cartridges like the PC 5000 from Sharp [Electronics Corp.]."

Juliussen expects that 5 percent to 10 percent of personal computers will incorporate bubble memory when its price drops. He expects establishing distribution for the systems to be the most difficult part. "The key to the market is getting into the 1,100 specialty stores that sell the IBM PC and the other 1,000 stores that sell PC-compatibles," he says.

Intel Corp.'s bubble-memory

product manager Michael Eisele defines several potential market segments for bubble drives. These include harsh environments, applications in which data integrity is crucial and applications that make maintenance and human supervision difficult or expensive. "With bubble memory, there are no crashes. The error rate is so low that, under personal computer conditions, [a bubble memory] will never make a

data error. As market demand for fault tolerance develops, that will be a big market for bubbles also," Eisele predicts.

Companies and industry analysts agree that Intel's strategy of guaranteeing price cuts for bubble chips is clever because it lets bubble-memory companies plan ahead. Says Juliussen: "That creates demand, and it becomes a self-fulfilling policy." □

OSBORNE PREVIEW IBM-COMPATIBLE PORTABLE

Last month, Osborne Computer Corp.'s U.K. subsidiary, on its way to becoming an independent entity, previewed the anticipated IBM-compatible version of the Osborne Executive for the first time. Negotiations now under way between the subsidiary and its parent will give the U.K. offshoot manufacturing and marketing rights to the new machine. The U.K. company expects to begin producing the computer by April, although it has yet to select a local subcontractor to assemble the machine. Osborne U.K. managing director Mike Healey says the company is calling the system the Osborne PC to retain brand identification, which is not unfavorable in Europe. The 8088-based Osborne PC comes with 256K bytes of internal memory, expandable to 512K bytes, two 360K-byte floppy disk drives, a color monitor and the IBM PC keyboard. Price had not been decided by press time because of upward surges in the U.S. dollar, but Healey hopes it will be less than \$3,500. He hopes to attract volume purchasers in the United States and Europe.

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HP, CalComp vie for CAD/CAM plotter market

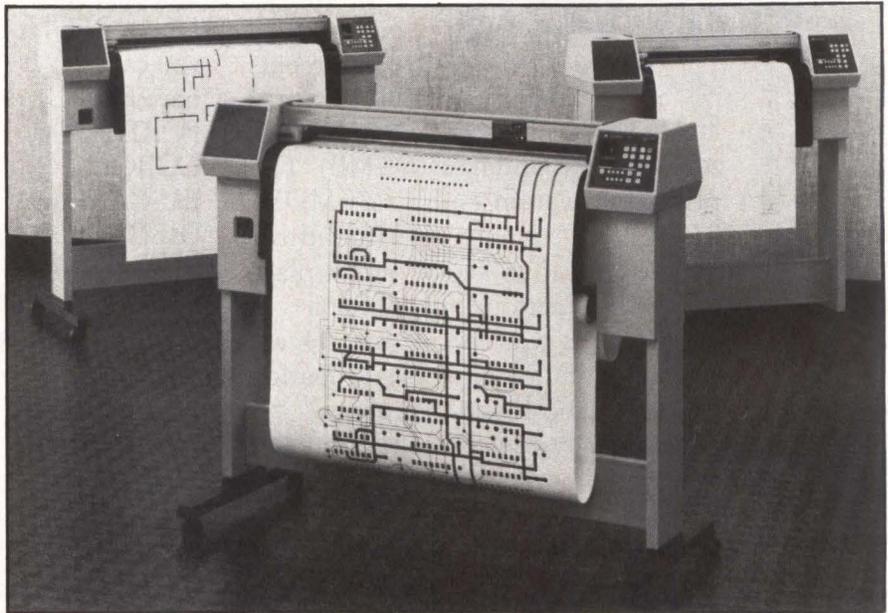
Edward S. Foster, Associate Editor

Drafting plotters for computer-aided-design/computer-aided-manufacturing (CAD/CAM) applications now offer the capabilities of both drum and flatbed devices. That's after market leaders Hewlett-Packard Co. and California Computer Products Inc. (CalComp) pushed the limits of their technology with new top-of-the-line products.

The introduction of the HP7586B from HP's San Diego division in February brings to market a plotter that handles continuous-roll media like a traditional drum plotter. The continuous-roll feature allows the plotter to produce plots while unattended and to produce plots that are longer than E-sized drawings. The HP7586B accepts cut-sheet paper from A (8½ by 11 inches) to E (36 by 48 inches) sizes. It plots in all directions at 24 inches per second (ips) and offers a resolution of 0.001 inches. Single-unit price is \$21,900.

In offering a plotter that can use both roll-feed and cut sheets, HP is closely following the lead of CalComp, Irvine, Calif., which introduced its 107X family of dual-mode plotters in November. CalComp's model 1073 plots at 15 ips on an axis with a resolution of 0.001 inches. Model 1075 plots at 25 ips with the same resolution, and model 1077 plots at 37 ips with a resolution of 0.0005 inches. Prices are \$14,950 (1073), \$19,500 (1075) and \$24,950 (1077). The lower-priced models can be field-upgraded.

HP and CalComp officials state that the plotters will attract



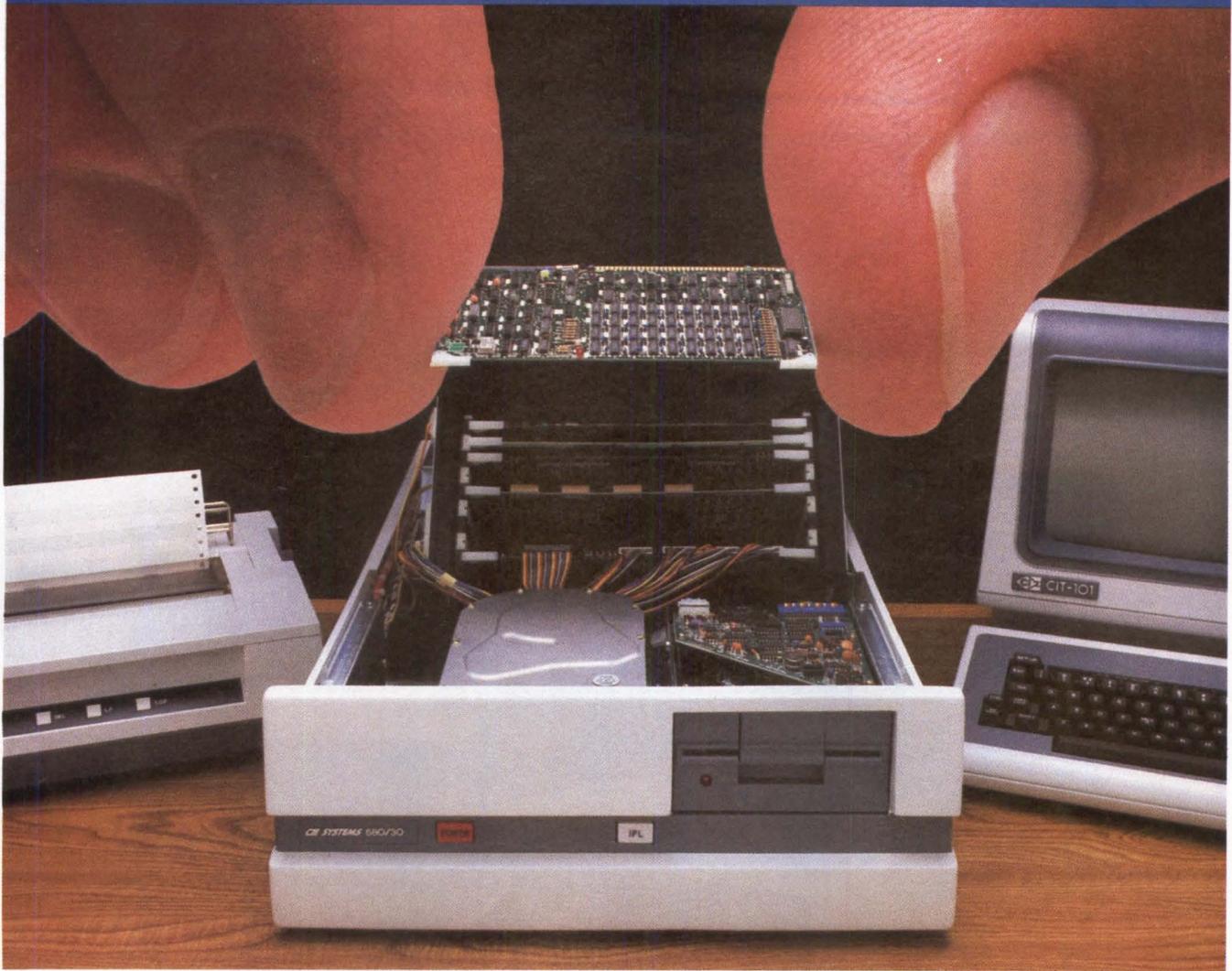
The HP7586B drafting plotter (foreground) accepts cut-sheet and continuous-roll paper. Prices of the HP 7580B and 7585B cut-sheet drafting plotters (background) have been reduced to \$13,900 and \$16,900, respectively.

customers in the CAD/CAM market. They claim the plotters' prices are about equal to those of units with fewer functions. "Customers weren't clamoring for a dual-mode drafting plotter before we introduced the 107X series," says Doyle Cavin, vice president of CalComp's plotter products division. "Now that we've shown them what it can do for them, however, we're beginning to suspect we may have underestimated the demand." CalComp is stressing the dual-mode feature of the 107X plotters because it enables users to generate a series of plots on roll media and to interrupt the series to generate a single-sheet plot. Both HP and CalComp plotters can print on a variety of media, including transparencies.

HP officials believe that one of the most attractive aspects of the HP7586B for the CAD/CAM market

is its ability to perform long-axis plotting. "There is a great deal of activity in the market where the scale and detail require more area than an E-sized plot," says Manuel Rivas, HP product manager. "Aircraft manufacturers, for example, find that they can use a plot that is as long as the wing they're designing," he says.

While HP and CalComp basically agree on what drafting plotter functions customers in the CAD/CAM market need, they take different approaches to addressing those needs. HP is employing a frame-to-frame technique for long-axis plotting that allows a user to create a plot in 48-inch-long sections. To assure accurate alignment between sections of a long-axis plot, the HP7586B makes registration marks in the margins by each section. An optical sensor



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MINI-MICRO SYSTEMS/March 1984

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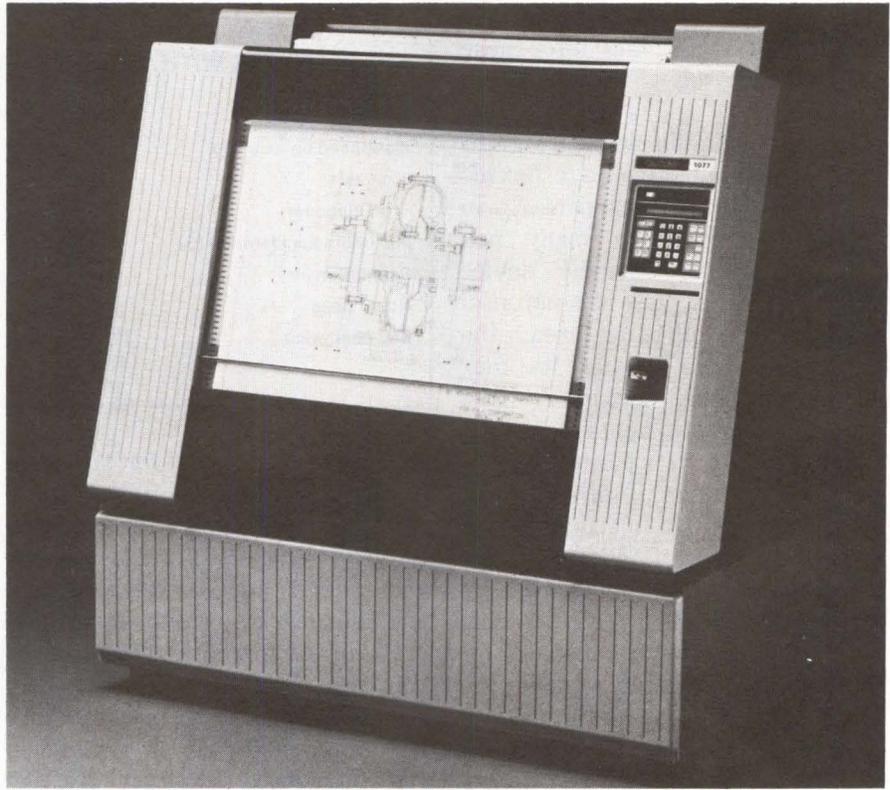
uses the marks to align the next section.

"The frame-to-frame technique is an economical solution," says HP's Rivas. "We eliminate the need for much of the complex paper handling that other long-axis, roll-feed plotters have to employ." Rivas believes that HP's micro-grip technology, which uses a grit wheel to make microscopic indentations for holding the paper, makes the 7586B the only plotter that can use unsprocketed roll media. "The grit-wheel drive we've proven on earlier plotters gives us the accuracy we need to handle the paper this way," he says.

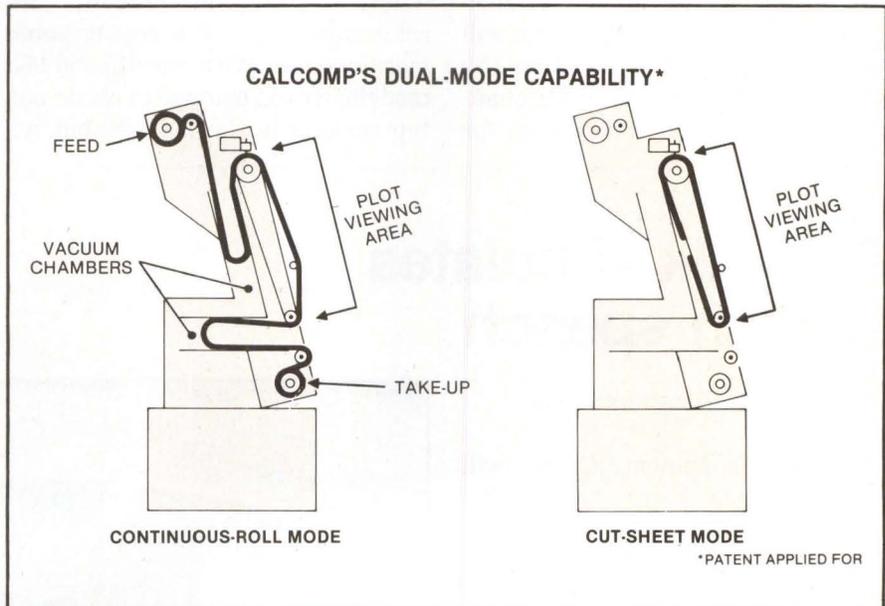
Rivas concedes that, in long-axis plotting, users can detect the point at which line segments from adjoining sections meet because extra ink is emitted when the pen hits and is lifted from the paper. Another drawback, says Rivas, is that plots longer than 12 feet may require margin adjustments for the roll-feed paper.

CalComp's approach was to devise a new paper-tracking system for its continuous roll-feed mode. The system is compatible with the design constraints of the belt bed needed for cut-sheet plotting. A belt bed makes it impossible to use a symmetrical feed and take-up unit, like those common in continuous-roll drum plotters. Theoretically, an extra-long paper path permits the plotter to draw a continuous line as long as the roll of paper. Two rough strips at both edges of an idler roller center the paper as it is being fed in or out. Optical sensors in the vacuum columns determine when the paper loop in the column is too long or too short to act as a buffer.

"By using an upright design for the beltbed, our configuration allows an operator to monitor a drawing as it is being done—something you can't do with a drum plotter," notes Mike Watterson,



CalComp's model 1077 dual-mode plotter, the company's high-end offering, plots at 37 ips.



CalComp's 107X plotter series uses an unusual paper path in its continuous-roll mode (left) to permit the use of a belt bed for a cut-sheet mode (right).

product line manager for CalComp. this new product line, including the "We've filed over seven patents for sandpaper strips and the optical

Mini-Micro World

NEWS

sensors. This reflects a great deal more innovation going into these products than you will usually see in a new plotter."

CalComp's Cavin claims a significant throughput advantage for his company's plotters, particularly in applications requiring many pen changes. He says the HP device carries its eight pens in a carousel next to the plotting area; the CalComp device carries its four pens along the horizontal axis, allowing nearly instantaneous pen changes. While HP's plotter plots at the same speed in all directions to achieve consistent line quality, he says, CalComp's plotters take advantage of motion on both axes for greater speed when drawing diagonal lines. They compensate for the increased speed by varying the pressure of the pens on the paper.

HP plans to ship the HP7586B this month and estimated delivery time is six to eight weeks. OEM discounts are available.

CalComp is now shipping production units of the 107X series and will ramp up to full production by year-end. OEM discounts for quantities of 100 will be 30 percent for

PLOTTERS WITH CUT-SHEET AND ROLL MEDIA CAPABILITIES				
	HP-7586B	CalComp 1077	CalComp 1075	CalComp 1073
Plot speed on axis (ips)				
on axis	24	37	25	15
on diagonal	24	52	35	21
Maximum acceleration (G)	4	4	2	1
Resolution (in.)	0.001	0.0005	0.001	0.001
No. of pens	8	4	4	4
End-user price	\$21,900	\$24,950	\$19,500	\$14,950

the 1077, 25 percent for the 1075 and 10 percent for the 1073. There's little margin for OEM discounts on the 1073 because the unit is aimed at and priced aggressively for the end-user market, Cavin says.

Cavin admits that the 107X series was developed primarily to help reclaim some of the market share CalComp lost to HP in 1981 when HP introduced its first drafting plotter, the HP7580. "We didn't take that product seriously enough when it was introduced," he acknowledges, "and it cost us some market share. With our 945 and 965 models, we did manage to retain our top ranking in the market, but we

are pricing the 107X family aggressively in the expectation of getting back some of the market share we lost."

While introducing the HP7586B last month, HP also announced price reductions on the other plotters in the 7580 line. The company reduced the price of the HP7580B from \$16,100 to \$13,900; the HP7585B, from \$22,900 to \$16,900. HP officially attributes the reductions to reduced manufacturing costs. The earlier two models in the 7580 series do not provide roll-feed or long-axis plotting capabilities. □

DECtalk simulates human speech

David Bright, Assistant Editor

Digital Equipment Corp. will make its recently introduced DECtalk voice-synthesizer unit available this month. The company claims DECtalk transforms any string of ASCII characters into human-quality speech. The self-contained unit, about the size of a modem, connects to most computers via an RS232C port. It has a variable, 120- to 350-word-per-minute speaking

The DECtalk voice synthesizer (under telephone) converts electronic mail and other ASCII information to human-quality speech.



Engineering and marketing professionals to gather in Palm Springs to discuss I/O standardization:

- disk and tape drives
- printers
- data communications

On Monday, April 2, 1984, and continuing through Wednesday, April 4, computer professionals will gather from around the world to confer with industry leaders about the newest revolution in standardization: SCSI.

In addition to standardization, SCSI promises high performance, ease of expansion, systems growth, and other advantages. Yet many potential implementers have indicated a need for a significant exchange of basic information as developments rapidly overtake current planning.

As a consequence, SCSI FORUM '84 will convene at the Royce Resort Hotel in Palm Springs, California, to provide delegates with the most recent updates on SCSI.

Who Should Attend

Attendees with the most to gain are engineering and marketing professionals in companies involved with:

- controllers and formatters
- peripherals
- computer systems
- systems integration

Costs:

The total package price is \$1,200 single occupancy, \$1,090 per person double occupancy, or \$690 per person double occupancy with one non-attending SCSI FORUM '84 guest. Price includes registration fee, conference materials, three nights' luxury accommodation (all rooms are suites), meals and cocktail receptions, gratuities, and transportation to and from Palm Springs Airport, and then to COMDEX on April 4, should you desire.

Cancellations received before March 15, 1984, are subject to a 10% service charge. Cancellations received after March 15th are subject to payment in full.

Program and speakers subject to change without notice.

Issues And Topics

SCSI FORUM '84 is structured to provide a core of ten sessions on SCSI subjects, seven industry overview sessions on SCSI-related subjects, and four keynote sessions on the industry at large. These sessions will be interspersed with special panel discussions in an open environment. Issues and speech topics include:

- SCSI vis a vis IPI and ISI
- SCSI's impact on computer systems
- The future of SCSI
- Japan's challenge to the U.S.
- Computer shock: technologies for transformation

Speakers

- Bill Bayer, President, Shugart Corporation.
- Bill Burr, National Bureau of Standards.
- Lee H. Elizer, Vice President-Marketing, Cipher Data Systems.
- Bill Roberts, Chairman, Emulex.
- David Tsang, President, Data Technology Corporation.
- Richard Barrett, Founder and President, Adaptive Data & Energy Systems.
- Dr. Edward A. Feigenbaum, Professor of Science and Heuristic Program-

ing Project, Stanford University, and co-author of the current best-seller: *The Fifth Generation: Artificial Intelligence and Japan's Computer Challenge to the World.*

- Charles Lecht, Chairman, Lecht Science Corp., computer futurist and author of *The Waves of Change.*
- Dr. Richard Byrne, Professor, Annenberg School of Communications, University of California, and Founder and Chairman of Springboard.

The Meeting Site

The luxurious, new Royce Resort is an exclusive spa hotel with a superb view of the rambling Santa Rosa Mountains. Golf, tennis and a magnificent health spa are just a few of the activities available to guests.

How To Register

You may register for SCSI FORUM '84 by phoning Julie Ayers 800-824-0114 (in California: 714-594-5858). Visa and American Express cards accepted. Or you may complete the form below and mail to SCSI FORUM '84, 2627 Pomona Boulevard, Pomona, CA 91768.

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With industry forecasters predicting that standardization will eventually make computers as easy to interconnect as stereo equipment, SCSI is now receiving much of the standardization limelight. You will benefit both from an exchange of hard data concerning SCSI's current state and informed estimates of the immediate and long-range future. In short, this is an event your company cannot afford for you to miss.

SCSI FORUM '84 Registration Form, April 1-4, 1984

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CIRCLE NO. 26 ON INQUIRY CARD

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NEWS

rate and can simulate men's, women's or children's voices. Users can specify pronunciation.

Targeted at OEMs, the \$4,000 system is also part of DEC's All-In-1 office-information system. One application for DECTalk is as a communications aid for those with speech impediments. At Children's Hospital, Boston, speaking-impaired children use DECTalk with a menu- or icon-oriented touch screen to "speak." Other applica-

tions include stock- and bank-status inquiries over a telephone, fire-alarm systems and electronic mail.

DEC says DECTalk's greatest value is its ability to read text over the phone, turning the phone into a computer terminal. MCI Communications Corp. plans to integrate DECTalk with MCI mail: customers will have electronic messages "read" to them over the telephone.

DECTalk has a three-step approach to producing speech. First,

it compares ASCII text to a user-defined dictionary of acronyms and pronunciation exceptions. If no match is found, the system makes an educated guess as to correct pronunciation. DECTalk then examines the words and characters surrounding the ASCII text and applies rules for intonation and stress. Finally, a digital signal processor synthesizes voice waveforms using a computer model of the human vocal tract. □

In-Search eases access to Dialog's 180 databases

Tom Moran, Associate Editor

Start-up Menlo Corp., Santa Clara, Calif., is offering In-Search, a software package for use on IBM PCs, PC XTs and PC-compatible microcomputers. In-Search provides users with a single interface to Dialog Information Services Inc.'s Dialog, a "one-stop supermarket" comprising more than 180 databases. Dialog officials say Dialog contains nearly 100 million records that can be accessed by clients in 60

countries. Before In-Search, Dialog users had to page through lengthy manuals containing the logic and commands of the many independently prepared and updated databases.

In-Search's first screen, "database selection," displays information and instructions in four windows (Fig. 1). Selecting a category from the first, "categories," window causes a number of related topics to appear in the "subjects" window. These subjects

correspond to the titles of the cards pictured in the third window, "card index," on the right of the screen.

The card index window presents four index cards stacked one behind the other, each representing a Dialog database. The front card displays a short description of the database's contents, how often it is updated, the number of records and the cost of using the database. On the other three cards, only the subject, name and Dialog number of the database appear at the top of each card. A user moves the cursor to select a category and subject, then uses the information on the index cards to select a database.

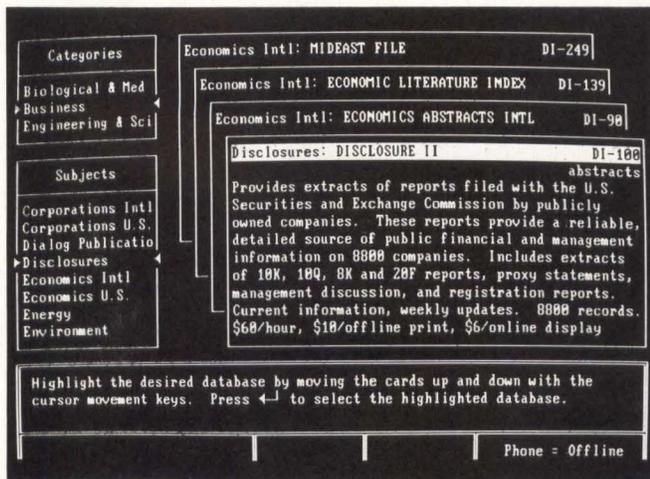


Fig. 1. In-Search's database selection screen indexes more than 180 databases available from Dialog Information Services.

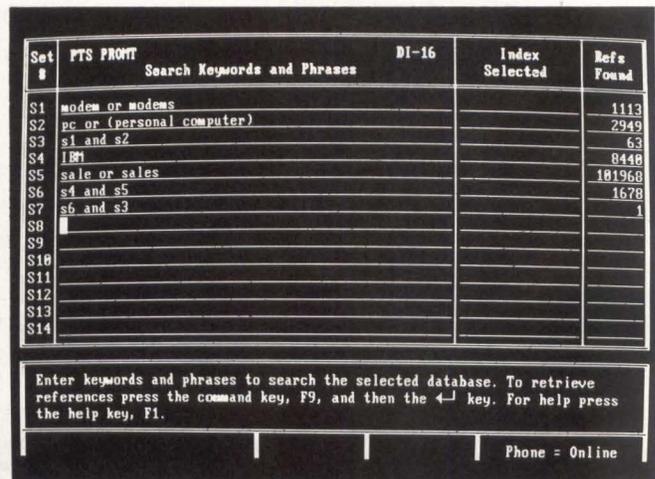
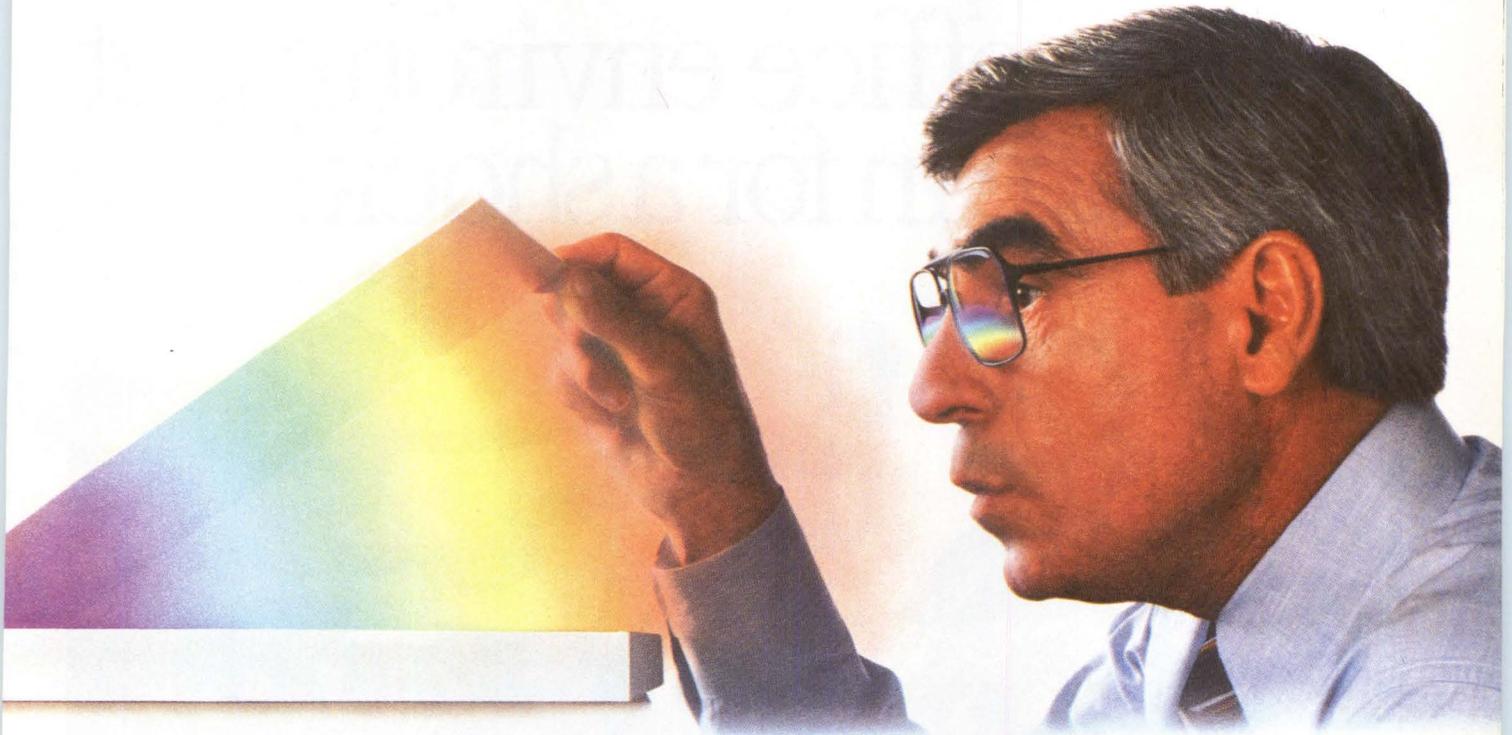


Fig. 2. Using as many as 100 criteria to form a search strategy, In-Search picks records out of a large quantity of information.

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Here's a shocking fact: when someone sets a computer down on a desk, the disk drive inside can be subjected to a pulse shock as high as 30 g's. Obviously, if the disk drive (or any other component in your system) can't handle that kind of shock, your system runs the

risk of breaking down under rather ordinary conditions—like every time there's an office shuffle and people move their computers. What follows is some technical information on how we handle the problem in our high performance 5¼-inch Winchester disk drives.

Shock and vibration: twin problems

Shock, and the closely related problem of vibration, have come under intense study at ATASI Corporation, and for good reason: both can cause loss of data. A severe pulse shock can cause a

AN ENVIRONMENTAL IMPACT REPORT.

drive's head to "slap" against the disk, removing a "divot" of oxide material, along with the data written there. Severe vibration can cause the head to overshoot or undershoot a track, so that the head can't find the data it's seeking. In addition, vibration can fatigue components over time, and perhaps lead to premature failure.

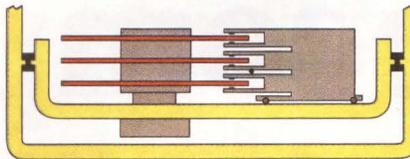


ATASI's 46 Mbyte, 5¼-inch Winchester disk drives are available in production quantities immediately.

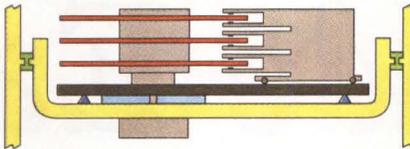
Double shock isolation

In order to sustain high shock loads, the ATASI design incorporates a unique dual system for shock and vibration isolation. Like most disk drives, ATASI drives have isolators between the frame and the head/disk assembly bowl. In addition, ATASI's proprietary design includes elastomere isolators inside the bowl, between the bowl and baseplate on which the head/disk assembly is mounted. A foam pad with high damping properties, also located between the baseplate and the bowl, further protects the head/disk assembly from vibration.

The grommets ATASI uses for isolators are far from ordinary. To handle both pulse shocks and vibration effectively—to avoid a declining spring rate with displacement while maintaining adequate damping properties—ATASI tested 330 different options before



Most disk drives only have shock and vibration grommets (black) between the frame and the bowl.



ATASI's proprietary design also includes isolators (blue) between the bowl and baseplate.

making a choice. These tests involved the use of a laboratory shaker as well as computer models.

ATASI's double isolation system more than protects its drives—and the data they store—from the shocks of the office environment.

Beyond the shock/vibration problem

Shock and vibration engineering is only one of a number of ways ATASI achieves such a high level of data integrity. ATASI drives also feature dedicated "landing zones." Upon powerdown—intentional or emergency—the back e.m.f. of the motor is used to position the carriage over data-free landing zones. A carriage lock then me-

chanically holds the carriage in place, protecting the data field from any head contact.

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 shock and vibration for systems integrators. It discusses test methods and the interpretation of test data in detail.

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PERFORMANCE SPECIFICATIONS

MODEL NO.	3033	3046
CAPACITY	33 MB	46 MB
ACCESS TIME (AVG.)	30 ms	30 ms
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

Available second quarter, 1984.

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Multibus[®] Microcomputer Systems Made Easy

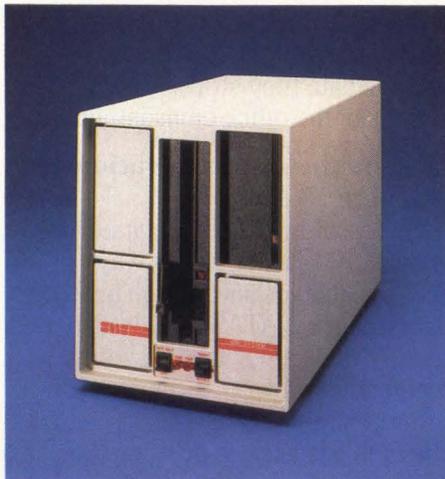
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For large configurations, choose the DSX80000 foundation system with eight Multibus slots, 10, 20, 40 or 80Mb of Winchester storage plus an 8" IBM compatible floppy.

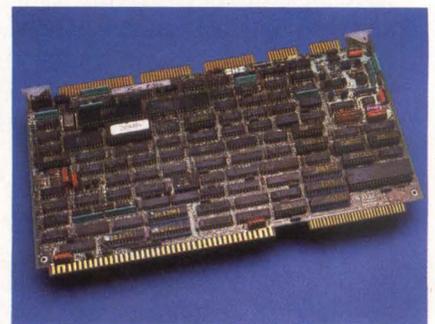
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At the bottom of the screen, a fourth window prompts the user with appropriate commands and displays a status line. A template for the IBM PC function keys indicates help, break, phone, disk, command, mark, data sheet and printer functions. The "help" key accesses In-Search's comprehensive help functions from any point in the program.

The "search keywords and phrases" screen appears after selection of the database (Fig. 2). With this screen, In-Search defines as many as 100 search criteria (keywords and phrases), one per line. Users can employ these criteria in various combinations to construct a complex search strategy. When the user logs onto Dialog, In-Search searches the database for matching references. The number of references to any set of criteria appears on the same line as the set.

In-Search can also perform index searches, locating references occurring only in one publication, for example. After selecting the database and search strategy, the user presses the "phone" function key, and In-Search automatically dials and logs onto Dialog through a modem via a pulse or Touch-Tone line. The connection is made through Telenet, Tymnet or Uninet to avoid long distance charges. In-Search, conducts the search, and a user increases or decreases the number of search criteria to select a manageable number of records. A user employs the function keys to display or print the records. If the user is interrupted or wants to use the same search strategy after the database is updated, he can save search strategies on disk.

In-Search allows users to define search parameters off-line, instead of looking up commands while using time on expensive databases. It also retains commands, search parame-

MODEM SALES TO HOME AND OFFICE PC MARKETS IN UNITS						
	1983	1984	1985	1986	1987	1988
OFFICE	335,000	590,000	940,000	1.4 million	2 million	2.7 million
HOME	720,000	1.3 million	1.8 million	2.5 million	3.3 million	4.2 million

The increasing sales of modems for personal and business computer applications will increase the demand for means to access remote databases.

ters and intermediate search results on one screen.

In-Search is stored on seven floppy disks: two copies of the copy-protected system disk, four "category" disks that drive the interfaces to the various databases and a tutorial disk that Menlo will encourage users to copy. Alternatively, the In-Search program can be stored on a Winchester disk drive. Winchester-based systems can display all four categories in the category window; floppy disk-based systems must display categories one at a time. In-Search uses data-compression algorithms to store more than 200 pages of database instructions and commands on the four category disks. To minimize disk swapping, Menlo duplicated In-Search's command information for some databases on several category disks.

In-Search requires the use of an IBM PC, PC XT or compatible microcomputer with 192K bytes of RAM, versions 2.0 or later of PC-DOS or MS-DOS, two double-sided floppy disk drives, or one floppy and one Winchester disk drive. It supports modems from Hayes Microcomputer Products Inc., Ven-tel Inc. and Novation Inc., as well as acoustic modems.

Menlo is planning to port In-Search to other microcomputers and database services, including Texas Instruments Inc.'s TI Professional. In-Search sells for approximately \$400.

Menlo president and founder Lloyd Kreuzer says modem sales have increased in the past year. He expects modem prices to fall because "the whole printed-circuit board will be replaced by a couple of ICs." He believes users' increasing awareness of modems as an accessory for personal computers is key to the company's goals.

Although Dialog has no contract with Menlo, Dialog officials are enthusiastic about In-Search. "We have about 35,000 corporate accounts and many more indirect users who access through information professionals such as librarians, information brokers and market researchers," says Libby Trudell, marketing manager for Dialog. "We are cooperating with Menlo and supporting its development effort to make sure its software works effectively with Dialog." She believes that In-Search makes good use of the IBM PC's graphics ability and that it will be useful for non-professionals who want to access on-line information directly. □

NEXT MONTH IN MMS

March is data communications month in Mini-Micro Systems. Feature surveys are planned of more than 20 expansion board modems and more than 70 modem support software packages.

Stock, Boston/Bohdan Hrynewych



HEARD ON THE HILL

Trade associations spur improved R&D bill

Stephen J. Shaw
Washington Editor

Four trade associations have earned a round of applause from the computer industry. Acting in concert, they succeeded in introducing federal legislation that could free \$100 million annually for research and development in electronics.

This "Gang of Four" comprises the American Electronics Association (AEA), the Semiconductor Industry Association, the Computer and Business Equipment Manufacturers Association and the Scientific Apparatus Manufacturers Association.

Sponsors of the bill, "The High Technology Research and Scientific Education Act of 1983," are Sens. John Danforth, R-Mo., Lloyd Bentsen, D-Texas, and John Chafee, R-R.I., and Reps. James Shannon, D-Mass., and Bill Frenzel, R-Minn. The bill contains several provisions affecting the computer industry. It:

- Makes permanent the R&D tax credit, now scheduled to expire at the end of 1985, and allows credit for software R&D expenses;
- Extends the credit to start-up companies and corporate R&D joint ventures;
- Allows a modified depreciation schedule of research equipment to be used in calculating the credit;
- Tightens the overall definition of eligible R&D;
- Increases the deduction available to companies that donate money or equipment, including computer software, to post-secondary educational institutions for scientific or engineering training.

The existing tax credit, passed by Congress as part of the 1980 Economic Recovery Act, was responsible for a 9 percent increase in R&D expenditures by electronics compa-

nies in 1982, according to a recent survey conducted on behalf of AEA. The credit is calculated as 25 percent of median R&D outlays over a three-year period. AEA projects that, by permanently extending the credit and including computer software R&D, electronics companies will increase their R&D spending by 20 percent to 25 percent annually. AEA executive Ken Hagerty says that will come to about \$100 million a year.

The legislation narrows the definition of eligible R&D in four principal ways. First, only those R&D activities directed toward functional improvements of a product or process are considered—not just style or design. Secondly, the product or process must be truly experimental. Thirdly, post-production activities can't be included for tax purposes. Finally, software developed for internal use is eligible for the credit only if it's truly innovative.

If passed, the high-technology act would for the first time extend R&D credit to start-up companies and corporate research joint ventures. This provision would allow new companies incurring R&D expenses in their "garage phase" to claim a credit based on 12.5 percent of their first-year R&D costs. The credit would also be applied to the eligible expenses of established companies that are participating in new research ventures with other corporations.

The current three-year accelerated cost depreciation schedule (ACRS) for research equipment is lengthened to five years under the bill. Inclusion of the equipment into the five-year ACRS is the first half of a monetary quid pro quo between the trade group coalition and the U.S. Department of the Treasury. In exchange for the longer depreciation cycle, the yearly

depreciation expense is to be included in the R&D credit calculation.

Title II of the act creates a tax credit for corporate payments and equipment donations to colleges, universities and post-secondary vocational institutions in support of basic research and training. The credit is calculated as 25 percent of corporate educational payments (equipment is valued at 50 percent of fair market value, after depreciation) that exceed a fixed yearly floor. This floor is based on average annual corporate payments over three years, or 1 percent of the corporation's average annual R&D budget over the same period, whichever is greater.

The Treasury Department has given tentative approval to the legislation, S. 2165 and H.R. 4475, and the White House should do the same when hearings are held this spring before the Senate Finance Committee and the House Ways and Means Committee.

Although the bill is receiving widespread support from diverse industry groups, it was largely the creation of the four electronics and computer trade associations. Recognizing the beneficial impact of R&D credit on their member companies, the associations decided a cooperative effort would produce better results and stretch limited budgets and manpower a little further.

They jointly retained a law firm to draft the legislation, held several discussions with officials from the Treasury Department over key items of the legislation and vigorously lobbied members of Congress to sponsor and support the measure. Not only is the act itself of significance to the U.S. computer industry, so is the process by which it came about. □

MARCH 1984

WD reports 134% sales gain, continued solid profitability.

For the fifth consecutive quarter, Western Digital reported successively improving sales and profits. Net sales for the six month period ending December 31, 1983, totalled \$43.9 million, up 134% over that of 1982. Net earnings for the six month period improved by more than \$3.1 million over that of the previous year. "In addition to our strong sales growth, incoming orders for the first half exceeded orders received for all of last year," according to Roger W. Johnson, President and Chief Executive Officer.

Sales of IBM compatibles skyrocket.

Sales of IBM-compatible personal computers skyrocketed last year, from fewer than 10,000 units in 1982 to between 150,000 to 200,000 units in 1983, according to Dataquest, Inc. Now, a new hard disk controller board from Western Digital, the WD1002-WX2, enables system manufacturers to offer hard-disk based systems and subsystems compatible with the IBM-XT, the fast-selling personal computer with a 10 MB Winchester drive. The WD1002-WX2 is both host interface and form factor compatible with the XT and controls up to two 5¼" Winchester drives with the ST506 interface.

Robotics network automates pipe mill.

TAK Automation, Burlingame, California, has developed a highly automated pipe mill system, using a network of robots for handling and storage of materials. The robots are equipped with WD's NetSource/25 X.25 Packet Switching Controllers, which control the flow of data between both fixed and roving robots and a central computer. NetSource/25's media independence permits the use of fiber optic links for communications, or, in the case of roving robots, radio links. Centralized control of the robots boosts quality and productivity, according to a TAK spokesman.

CAD speeds turnaround on custom PCB products.

New applications of powerful computer-aided design systems are enabling disk-based system builders to specify fully customized Winchester/floppy controller boards, and receive first production units in as few as 12 weeks. Western Digital has invested several million dollars over the past few years to extend existing VLSI CAD facilities to support the generation of reliable, optimized printed circuit board designs, rapidly, and at minimum cost. The dual Digital Equipment VAX 11/780 board-level CAD facility, including Calma graphics system, improves manufacturability as well as verifying design correctness.

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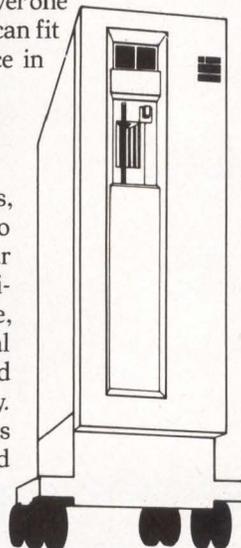
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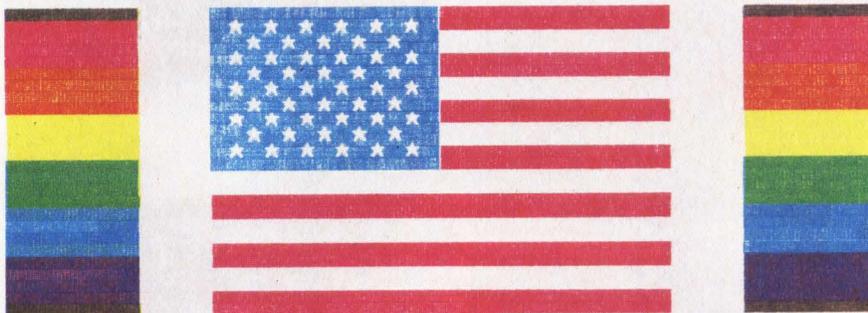
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Anadex announces IBM PC-compatible color printers



In this output sample from the Anadex DP-9725B, horizontal stripes of color were created in one series of passes in a high-speed mode. The paper then returned to fill in the star field on the flag at a higher resolution.

Edward S. Foster, Associate Editor

Printer manufacturer Anadex Inc., Chatsworth, Calif., is the first to announce PC-compatibility with its color serial printers since last November when IBM Corp. announced its 5182 color printer for its PC, PC-XT and PCjr. Anadex is offering a software-enhanced version of its DP-9725B Color/Scribe dot-matrix serial printer for use with the PC. It also plans to introduce the DP-9730B printer in the second quarter of this year.

That model will emulate the IBM printer.

Anthony Lappas, Anadex's vice president of engineering, says the IBM 5182 will create a standard that will cause an explosion of graphics software for the PC-compatible market.

To make the Anadex DP-9725B compatible with IBM PCs, Anadex supplies it with software on a 5¼-inch floppy disk drive. The software converts the IBM protocols to Anadex protocols, permitting a user to print screen dumps of

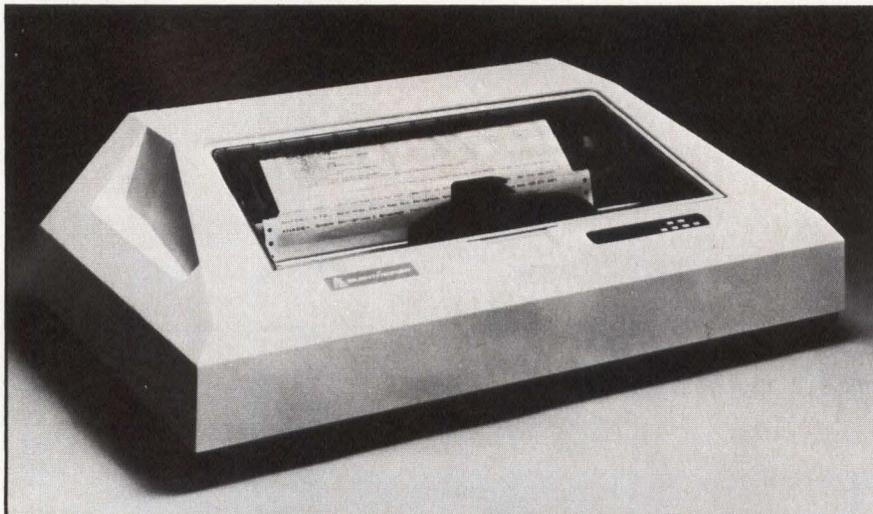
text and graphics on the IBM PC. The DP-9730B will emulate the 5182 without conversion protocols.

Anadex hopes its printers will be price competitive with the 5182, which had a list price of \$1,995 when announced. The price of both printers will be about \$1,600 in single-unit quantities, Lappas asserts. The final price was not fixed at press time.

Anadex's printers have several advantages over the 5182, Lappas claims. "We have a distinct edge in throughput, at least insofar as what has been made public about IBM's printer," he says. The 5182's maximum speed is 200 characters per second (cps); Anadex's printer operates at 240 cps in draft mode, Lappas also claims the DP-9725B's faster carriage, reverse paper feed and direct shifting of color bands on a four-color ribbon will enhance throughput.

IBM uses Dataproducts Corp.'s P-132 color printer mechanism in the 5182. Integral Data Systems Inc., which was later acquired by Dataproducts, introduced the mechanism in its Prism printer. IBM is altering the mechanism mechanically and electrically in its product, which will affect compatibility of other manufacturers' products.

Tom Weaver, Anadex's manager of product development, says, "The Prism printer was the closest thing to a standard for color dot-matrix printers. We've done all the product development based on the Prism we



The Anadex DP-9725B Color/Scribe impact dot-matrix printer uses a four-color ribbon to produce color text and graphics. Anadex includes a 5¼-inch floppy diskette with each printer to provide screen-dumping facilities with the IBM PC.

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Mini-Micro World

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can. Now, we just have to wait and see how IBM implements its product."

Anadex manufactures its own color printer mechanism, including the nine-wire print head. The 9725B and 9730B use the widely available four-color ribbon used by IBM and Dataproducts. The ribbon's yellow, magenta, cyan and black color bands produce multiple colors for text and graphics. Users can select unidirectional printing with graphic resolution of 72 by 72 dots per inch (dpi) or bidirectional with 144-by-144-dpi resolution.

In Anadex's color printing technique, the printing mechanism makes plotter-style passes over an area. Software-controlled reverse-line feed for multiple passes allows for higher throughput. The printer's

firmware includes 15 color-mixing codes that reduce the chance of color contamination between ribbon bands. The printers use ribbons with four primary colors for applications not requiring color mixing and black ribbons that can be accessed on all bands for longer ribbon life in monochromatic applications.

In monochromatic printing, the printers produce correspondence-quality characters at 72 cps. An enhanced-print mode runs at 144 cps at a pitch of 12 characters per inch.

The DP-9730B will be available 30 to 45 days after initial deliveries of the IBM 5182 printer, which are slated for April. □

COMPUTER INDUSTRY MAY REACH \$148.5 BILLION

A Computer and Business Equipment Manufacturers Association study shows that computer industry revenues should increase 14 percent to \$148.5 billion this year from \$129.5 billion last year. Computer manufacturers' investment in R&D is expected to climb 11 percent in 1984 to \$6.4 billion. A 1981 statute allowing computer and electronics companies tax credit for R&D costs will spur this increase, says the American Electronics Association. The study also projects that jobs in the computer industry, including those for systems analysts, programmers, operators and technicians, will increase 7.5 percent to 1.7 million workers in 1984.

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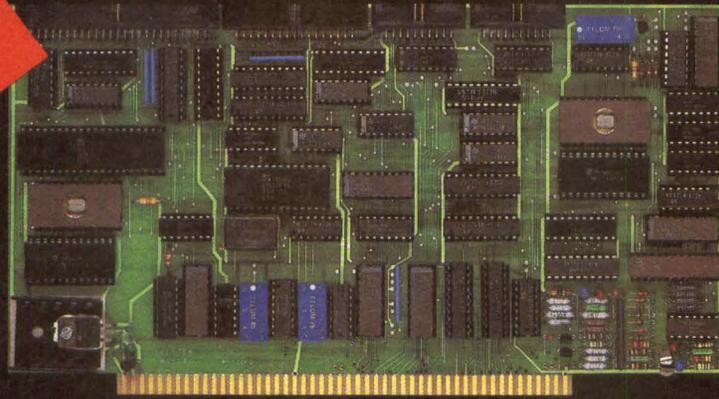
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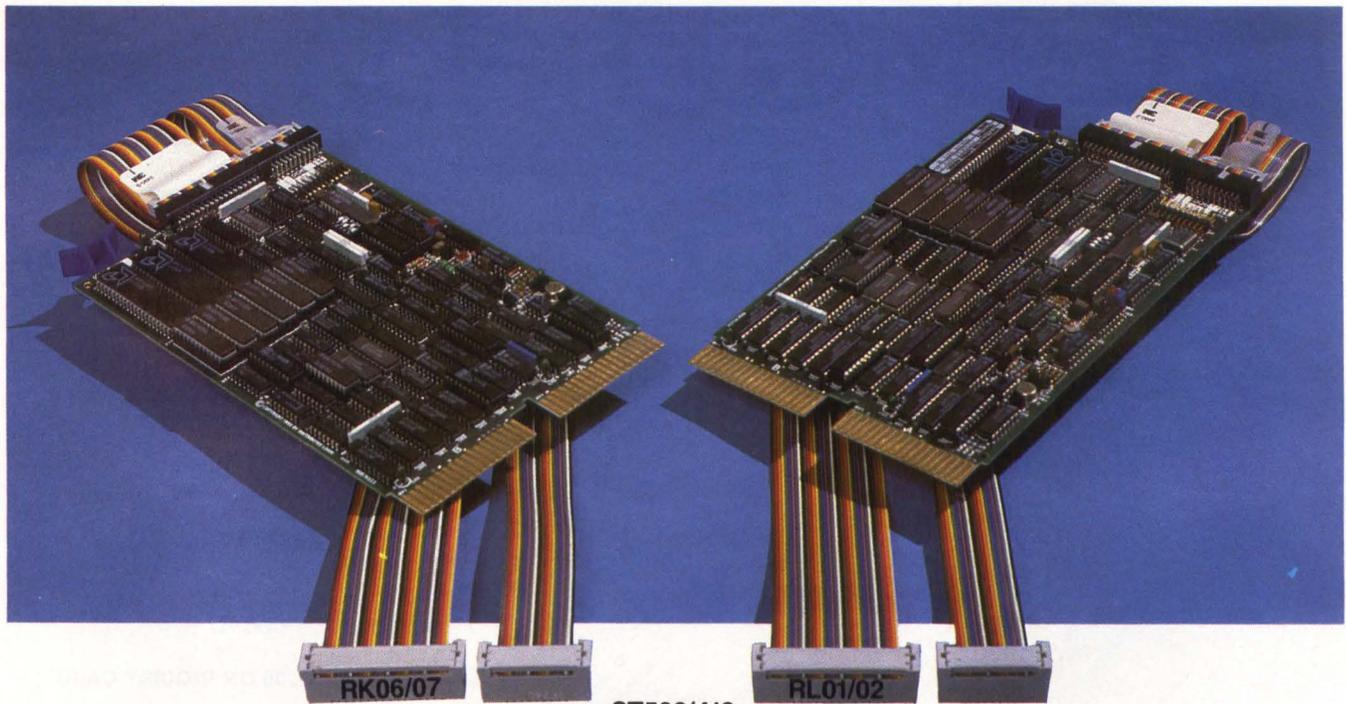
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CompuPro announces iAPX 286-based multiuser system

Tom Moran, Associate Editor

CompuPro Systems, worldwide leader of the market for S-100 bus-based CPU boards, plans to announce a top-of-the-line system, the 816 model 286, this month. The modular system is built around CompuPro's recently announced CPU 286 board, which includes the Intel iAPX 286/10 microprocessor.

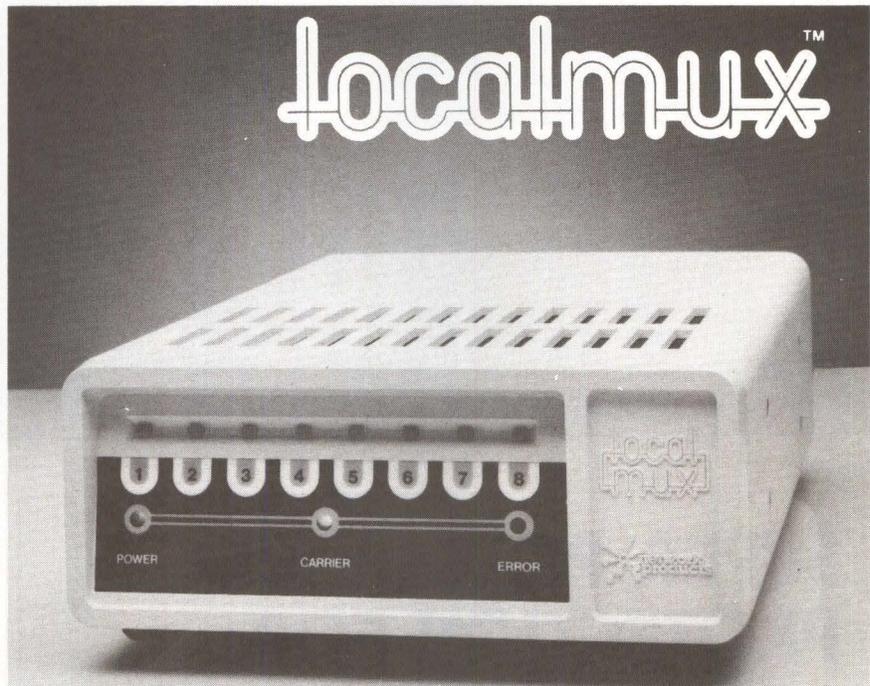
CompuPro chairman and chief executive officer Bill Godbout believes the product represents a 12- to 18-month technological lead over IBM Corp.'s as-yet-unannounced microprocessor-based, multiuser system, which IBM reportedly is showing privately to dealers. That lead may be necessary to keep CompuPro afloat if IBM enters the low-end multiuser market with as much success as it has had in the personal computer arena.

The 286/10 has an integrated memory-management unit, virtual-memory support, a variable CPU clock rate of 6 or 8 MHz and 24 address lines that can access as much as 16M bytes of main memory. The board includes sockets for an optional 80287 math coprocessor and as much as 16K bytes of on-board erasable programmable read-only memory (EPROM). CompuPro will offer CP/M-86, MP/M-86, MS-DOS and its proprietary CP/M 8-16 and MP/M 8-16 operating systems for the board. The company also plans to make UNIX System V available when Digital Research Inc. completes its agreement with Intel Corp. to port System V to the Intel 286 microprocessor.

Like other CPU boards in the mix-and-match 816 series, the CPU 286 can read and write 2 bytes serially to or from 8-bit memory or

I/O components. Prices for the 816 model 286 start at \$14,995.

CompuPro owns 63.3 percent of the worldwide S-100-based CPU board market, according to International Data Corp. (IDC), a Framingham, Mass., market research company. About half of CompuPro's sales are to OEMs and system



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Mini-Micro World

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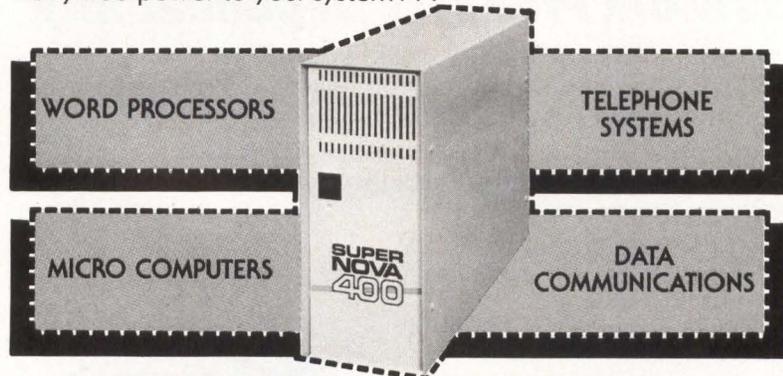
The CompuPro 816 model 286, which uses the Intel iAPX 286/10 processor, is CompuPro's latest effort to maintain a competitive edge in the market for S-100-based, multiuser systems.

integrators, the rest to its system centers and other sales outlets. The S-100 market will peak within a few years, says Lloyd Cohen, IDC's research manager of industry analysis.

IDC predicts U.S. manufacturers of S-100-based CPU boards will have a 40 percent increase in shipments this year worldwide to 227,000 units, compared to 162,000 last year. Says Cohen, "If Godbout can maintain market share, CompuPro will be doing well. He's building a niche and protecting it well."

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DEC 10



IBM PC/XT

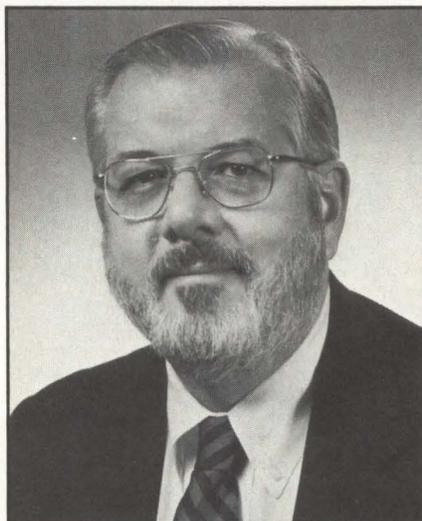
CIRCLE NO. 40 ON INQUIRY CARD

Mini-Micro World

NEWS

An important part of CompuPro's long-range strategy in holding that niche is adding on-site service, Cohen says. CompuPro recently announced an agreement with Xerox Corp.'s Service Group to include the group's Americare service plan with selected CompuPro systems. The plan offers free one-year service within a 100-mile radius of each of the 82 Xerox service centers.

Godbout stresses his products' technological advancement vis-à-vis machines like the IBM PC that dominate the single-user field. A big plus for CompuPro, Godbout maintains, is its use of CP/M-86, MP/M-86 and the proprietary CP/M 8-16 and MP/M 8-16 operating systems, which can run both 8- and



CompuPro president Bill Godbout believes CompuPro's proprietary operating systems, which are based on Digital Research operating systems, give his company an advantage over competitors in the S-100 market niche.

16-bit programs. Godbout downplays MS-DOS because he believes it is less sophisticated. "CP/M-86 is enough of a true operating system that you can throw the hooks in there to run 8-bit tasks under a 16-bit operating system, and the same is true of MP/M-86," he says.

Godbout does not expect any long-term difficulty in obtaining the delayed 286 chip from Intel, and Cohen agrees: "Intel has built the 286 into its forecasts and is expecting a large demand for it."

Intel has also entered the S-100-based system market, but Cohen doesn't see it competing with CompuPro. "Intel is a leader, and CompuPro is a leader, each in their respective bus structure," he says.



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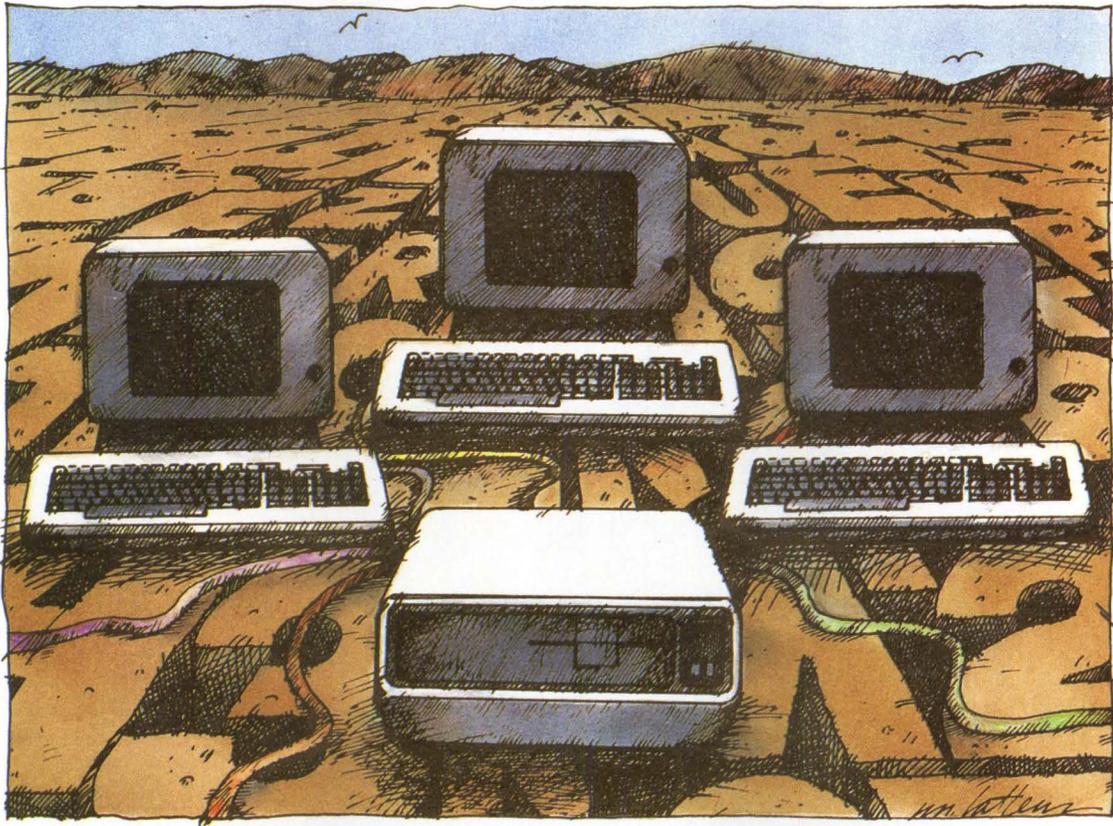
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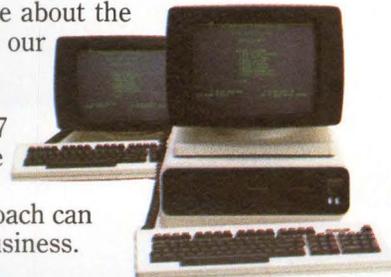


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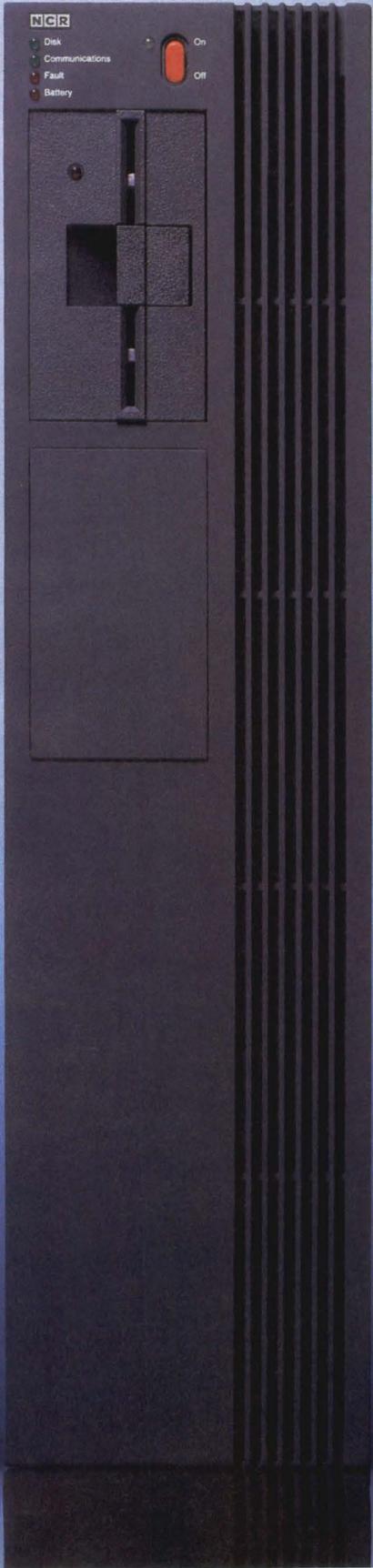


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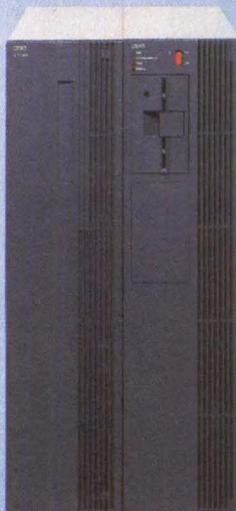
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CORPORATE AND FINANCIAL

Apple, Franklin settle, both claim victory

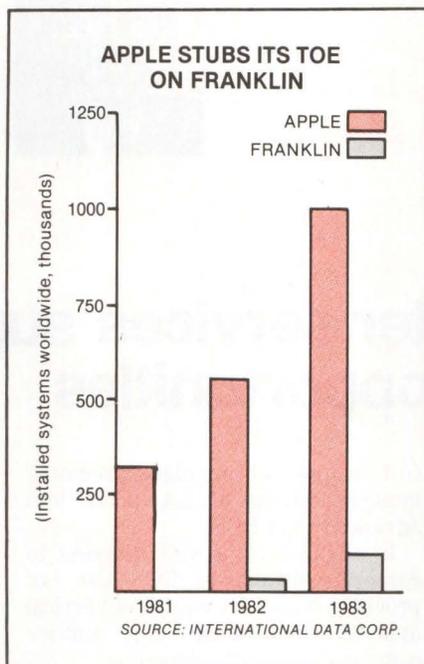
Tom Moran, Associate Editor

It was a fitting end to the long-standing battle between Apple Computer Inc., Cupertino, Calif., and Franklin Computer Corp., Cherry Hill, N.J. Both sides agreed to settle out of court and then claimed victory.

The dispute centered on Franklin's claim that U.S. copyright law could not validly protect operating-system software in ROM. When Apple filed for a preliminary court injunction in May 1982, Franklin had been openly manufacturing Apple II-compatible systems using ROMs containing Apple operating systems.

Apple spokeswoman Barbara Krause says Apple is "very pleased that we have these results." Krause says Franklin agreed to three major stipulations: to stop manufacturing systems containing the copied programs and to sell inventory of such machines by April 1, to pay Apple \$2.5 million and to follow a legally binding arbitration procedure for future copyright disputes that could arise over new Apple-compatible products that Franklin might produce. Krause also notes that Apple never intended to put Franklin out of business.

Franklin chairman R. Barry Borden is pleased with the settlement and points out another aspect: "We both agreed to discontinue our litigation." He adds, "I think [the settlement] is wonderful, and it's good for both companies. We would rather they had left us alone, and they would rather we had gone out of business [without the suit], but this will work out fine for both sides." Borden agrees with Krause that the intent of Apple's suit was



Franklin Computer has grown at a high rate in the two years it has been shipping systems, becoming a problem for Apple.

not to shut Franklin down.

Borden says that Franklin will introduce its own operating systems soon. "The investment in creating our own operating-system programs was substantial. The programs are in various phases of testing, and some are finished. We will replace Apple's operating system with our operating system, and we feel confident that we will be producing an operating system that's substantially Apple-compatible. If we could not have done that, we would not have seen our way clear to settling."

Apple executives believe Franklin settled for another reason. Says Krause: "Originally, the District Court in Philadelphia thought that there was a gray area in the law. The judge did not want to close down a large business over an

interpretation. Apple appealed to the 3rd Circuit Court of Appeals, and it essentially said, 'The law is clear,' and remanded the case to the District Court. At that point, Franklin decided to settle."

Borden does not expect the settlement to have an adverse affect on Franklin or its customers. "There was apprehension, but the settlement allows us to continue to sell Apple compatibles, and the past machines are not an issue." Franklin plans to continue to produce its Ace family of Apple compatibles and to introduce other Apple-compatible products and some IBM-compatible products. The company does not plan Lisa or Macintosh compatibles.

Egil Juliussen, an analyst with research company Future Computing Inc., Richardson, Texas, agrees with Borden that the settlement should be good for both parties. "Strangely enough, I think it helps both Apple and Franklin. Franklin has had a cloud removed from its horizon and has more flexibility in whom they can deal with—companies that would not have dealt with them before, like some of the mass merchandisers. For Apple, it established that they basically won the fight. You can't just copy Apple's copyrighted material. That gives Apple a stick to beat other companies with."

Juliussen believes that the market is now open to other Apple-compatible manufacturers. "I think there will be some other entries which will establish the Apple II as another very strong de facto standard," he says.

Apple is involved in 30 other cases worldwide and intends to pursue them vigorously, says Krause. "The counterfeits that are coming into the country are smuggled in. The U.S. Customs Service has been very supportive, but some companies are getting clever." □

GUEST FORUM

A column for guest experts to speak out



Peter Lines is principal consultant at Input Ltd., the European office of an international planning services company in Mountain View, Calif. Input provides planning information, analysis and recommendations to the information-processing industry.

Remote computer services suppliers must seize PC opportunities

Peter Lines, Input Ltd.

The rapid growth in the personal computer market is broadening demand for personal computers to be linked to remote computer services (RCS), which are typically available only to mainframe users. RCS would enable personal computer users to access corporate databases and mainframe-level vertical application software. They would also provide training and service to small businesses that do not have such services in-house. If RCS suppliers tap the personal computer market, they are in effect gaining access to a market that is threatening their livelihood.

RCS vendors that use personal computers as vehicles for their services will be able to exploit dramatic new opportunities for business growth and profit. Input Ltd.'s research indicates that those RCS suppliers willing to seize the opportunity now will be addressing a market that should reach \$1.8 billion in Western Europe by 1988. This represents an 86 percent annual growth rate for personal computers/RCS. Input expects personal computers to represent nearly half the market for all types of RCS by 1988. There are several hundred RCS suppliers in Western Europe.

Personal computer users implementing in-house local-area networks (LANs) could well be a fruitful market for RCS companies offering a

full range of services because implementations of LANs are less advanced than RCS.

In addition to providing access to corporate databases, RCS also can provide access to a wealth of vertical application software that service companies have developed.

Some RCS suppliers act as value-added resellers to personal computer users. For example, a large French services company with Digital Equipment Corp. mainframes recently entered the personal computer arena as a value-added reseller. The company buys DEC Professional microcomputers, adds its own vertical business software and resells the packaged systems. Users of such systems perform most processing on the on-site personal computer but do larger printing and file-storage tasks on the mainframe at the service company.

A combination of RCS and personal computers will prolong the life of the RCS market, which personal computers are eroding. The reasons business users give for purchasing personal computers—low cost, ability to exercise local control of information and suitability to their applications—parallel those formerly given to justify using RCS. Personal computers take several of RCS' benefits one step further in cost and convenience. But there are many advantages that RCS vendors can offer that suppliers of standalone personal computers

cannot, including access to company-wide databases, program-development capabilities and application expertise.

The success of RCS rests on correcting misassessments of user needs. Input's research indicates users consider access to a company-wide database the most important feature in a personal computer/RCS product. But suppliers of those services give that feature low priority. Thus, it's not surprising that perceptions differ in this developing market. Those differences beg for sound market research to address needs.

The personal computer's assault on traditional RCS offerings will grow during the next few years because of personal computers' dramatic appeal to end users. Defensive marketing tactics such as repricing and repackaging RCS will not ultimately stem the personal computer tide. RCS suppliers can address the personal computer/RCS market at the lowest level by offering software products to run standalone on installed personal computers. At a higher level, they can sell personal computer/RCS products essentially as turnkey products with RCS as a vital part of the application requirements included in a full offering of training, consulting and networking support. Input considers the development of these strategies vital to RCS' long-term success.

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CORPORATE AND FINANCIAL

Perkin-Elmer promotes standards to up supermini market share

David Bright, Assistant Editor

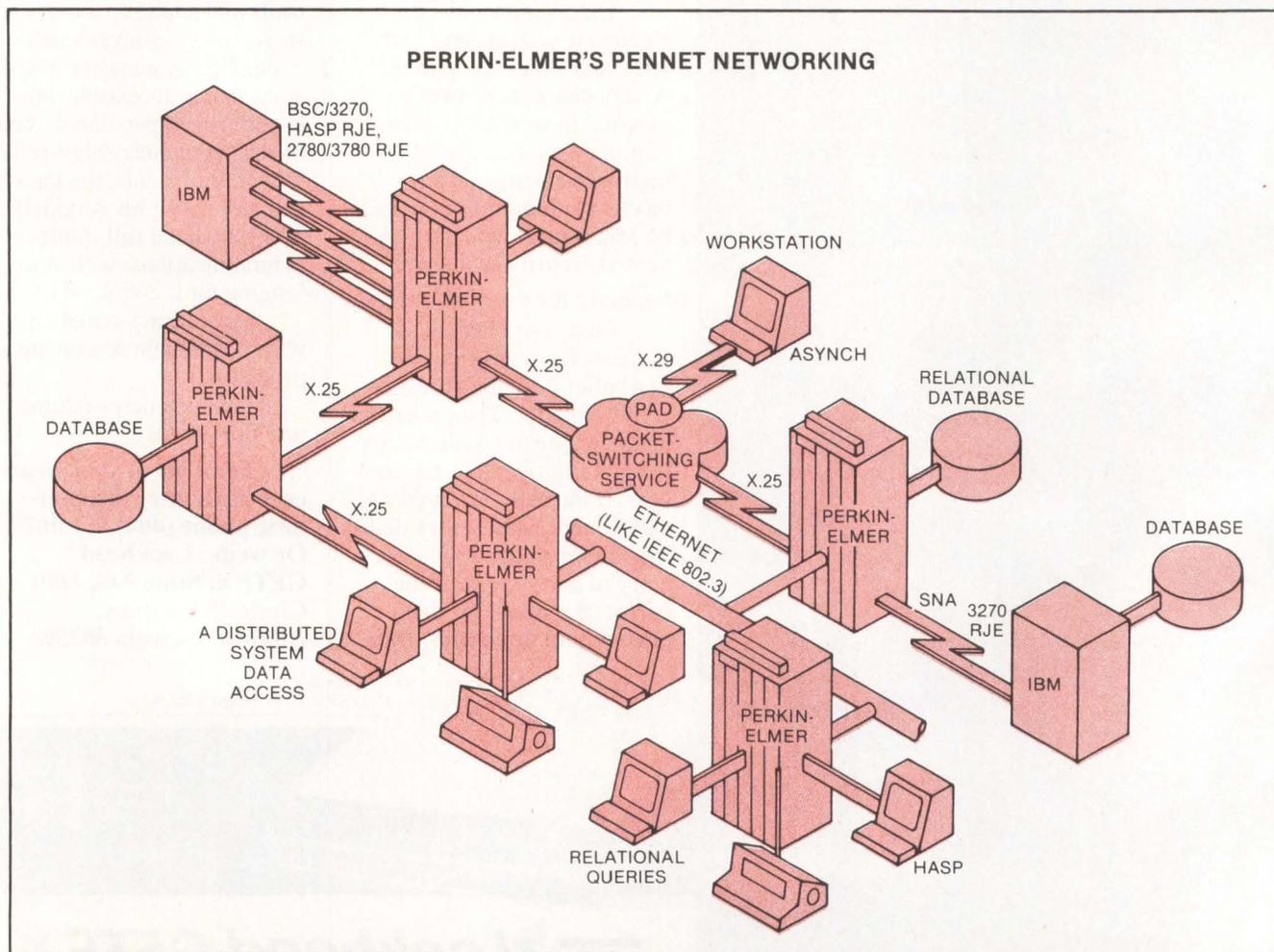
Perkin-Elmer Corp., which helped pioneer the 32-bit superminicomputer market in 1973, is now broadening its approach in that industry to include general business and commercial markets. Most of P-E's previous computer products targeted technical markets and a few vertical business markets.

Although many analysts agree that the 46-year-old company is solid, P-E suffered during the

recession. It is hoping for a return to its record 1981 form, when it recorded revenues of \$1.1 billion and net earnings of \$82.6 million. The company's fiscal year 1983 revenues were \$1 billion, and net earnings were \$50.2 million. This may not be the comeback year. In the first quarter of the current fiscal year, revenues increased to \$247.7 million from \$235.3 million in the same quarter last year, but net earnings dropped 20 percent from \$11 million to \$8.6 million.

P-E president Horace McDonell Jr. sees smooth sailing ahead as the recession continues to abate in the United States and abroad. About 45 percent of P-E's business comes from foreign sources.

Spearheading the marketing blitz is P-E's Data Systems Group's new Everyware software standards support strategy. With Everyware, P-E has attempted to widen its appeal by adding support of many of the major software standards, such as IBM Corp.'s Systems Network



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MINI-MICRO SYSTEMS/March 1984

CIRCLE NO. 47 ON INQUIRY CARD

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One stop shopping for VAX

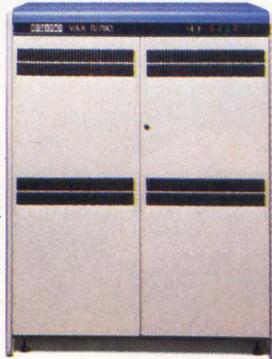
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CORPORATE AND FINANCIAL

Architecture (SNA). Everyware is intended to protect users' investments by allowing them to connect to IBM mainframes and other P-E systems via widely accepted gateways and to provide software that is compatible with all P-E hardware. The company believes that, by maintaining standards, it will be able to maintain long-term viability for its products as the industry advances. "We can't afford to be rewriting all of our software every two to three years as the hardware changes," says McDonell.

With Everyware, P-E supports IBM SNA, UNIX, the International Standards Organization's (ISO's) networking reference model and the X.25 packet-switching network. The company has introduced FORTRAN and C compilers that provide compatibility between the company's UNIX versions of its 68000-based desktop systems and the OS/32 operating system of its 32-bit

machines. P-E has also made a foray into the burgeoning fault-tolerant market with its Resilient system, which is based on its Series 3200 superminis (see "P-E enters growing fault-tolerant market," below).

P-E will not join the ranks of those tapping the high-growth MS-DOS-based personal computer market. Those pursuing that hectic market include IBM, Digital Equipment Corp., Data General Corp. and Hewlett-Packard Co. Says James Sims, vice president and

general manager of the Data Systems Group: "We avoid that [competition for low-cost systems] like the plague."

In superminis, P-E says it is doing well. A solid product is the low-priced model 3205 system, which was introduced in mid-1983. A basic rack-mountable configuration sells for \$10,000. Sims says sales so far are triple what the company projected for the system.

P-E is emphasizing its 68000-based desktop line, to which it recently added the 7350 Profession-

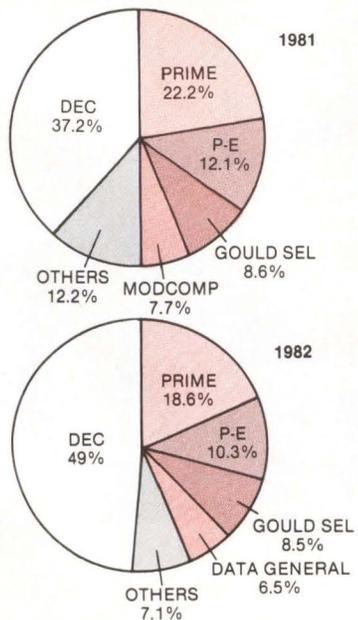
**PERKIN-ELMER FINANCIAL DATA BY BUSINESS SEGMENT
(IN \$ MILLIONS)**

Net sales	1983	1982	1981	1980	1979
Instrument Group	311.5	323.8	328.7	293.3	238.8
Data Systems Group	214.0	210.6	225.3	210.9	166.9
Semiconductor Equipment Group	170.0	165.0	193.8	150.7	88.1
Optical Group	145.4	144.8	162.3	155.8	111.5
Bodenseewerk Geraetetechnik*	107.0	111.7	111.5	92.6	52.7
METCO*	78.1	86.7	100.9	100.3	79.6
(inter-segment)	(10.6)	(5.8)	(6.7)	(7.5)	(4.6)
Total	1,015.4	1,036.8	1,115.8	996.1	733.0
Net income	50.2	62.7	82.6	65.0	46.2
Net income per share	1.15	1.45	1.92	1.59	1.16

Source: Perkin-Elmer Corp.

*Bodenseewerk Geraetetechnik, based in West Germany, manufactures avionic instrumentation and missile systems for European markets. METCO produces thermal spray products.

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UNIT SHIPMENTS**



SOURCE: INTERNATIONAL DATA CORP.

P-E enters growing fault-tolerant market

Perkin-Elmer Corp.'s recently introduced fault-tolerant Resilient System combines redundant Series 3200 superminicomputer hardware with new software designed to detect and correct system failures. P-E is targeting the system for automatic teller machines, electronic funds-transfer systems and timesharing services. Research company InfoCorp estimates the fault-tolerant market will grow from \$500 million last year to \$1.1 billion by 1986.

The Resilient System is implemented in a dual-processor configuration with switched peripherals. It can be installed as a field upgrade to Series

3200 systems. Users can migrate to different levels of resilience according to the amount of hardware and software added to the system. An optional mirror disk capability provides dual images of all files.

The new software comprises a reconfiguration monitor that runs as a continuous task in both processors, with each monitoring the other, under the OS/32 real-time operating system. To take advantage of available power, each system can run separate applications. In the event of a system failure, processing of the higher-priority applications continues.

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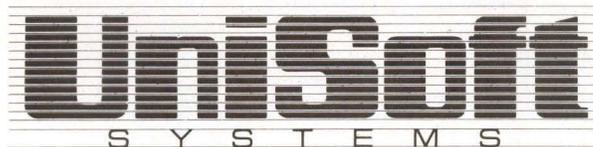
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Mini-Micro World

CORPORATE AND FINANCIAL



One of many products in Perkin-Elmer Corp.'s comeback strategy is the new 68000-based 7350 Professional Computer. The 7350 is designed as a standalone product or as a companion product integrated with P-E's Series 3200 supermini-computers. Applications written in C and FORTRAN can be ported between the 7350's UniPlus operating system and the OS/32 real-time operating system of the larger machines.

al Computer, which runs the UniPlus+ operating system. Single-unit prices of the 7350 start at \$8,400. With FORTRAN and C compilers, the 7350 can act as a standalone workstation or as a companion to the 3200 line.

P-E may not be the most adventurous company in the computer game, but it is generally perceived as making sound decisions. Example: it sold its Memory Products Division to Cipher Data Products Inc. in 1982. "We weren't making any money," explains McDonell.

The Data Systems Group is where the action is for P-E, according to many industry analysts. There is a lot of room for growth. According to International Data Corp., a Framingham, Mass., market research company, the Data Systems Group captured only 10.3 percent of the supermini market in 1982, based on units shipped.

Another major operating division at P-E is the Semiconductor Equipment Group. The group's

growth is limited by its success: its revenues already account for approximately 40 percent of its market. Some analysts criticize the technology behind the products of the Semiconductor Group, which include step-and-repeat alignment systems that print circuit patterns on semiconductor wafers. "They didn't keep up with the technology as well as they should have," says Edward C. White, vice president of brokerage house E.F. Hutton.

What should P-E do next? White says the Data Systems Group should attack niche markets, such

as transaction processing and engineering. P-E needs "a clear identification with a specific market segment," he maintains. Although P-E is doing just the opposite by competing against "formidable companies like DEC," P-E's overall picture looks good, he says. The near-term outlook is "a little bit soft," especially considering P-E's expected increased marketing costs. Per-share earnings for fiscal year 1984 will be \$1.25; for 1985, \$1.80, he predicts. Earnings for 1983 were \$1.15. In the first quarter of this year, they were 20 cents. □

PERKIN-ELMER CHRONOLOGY

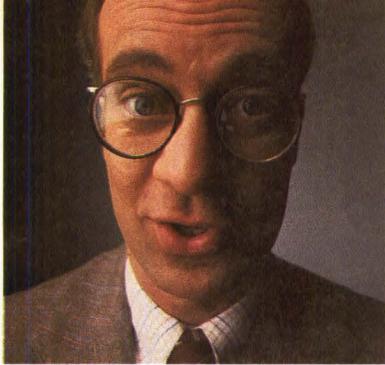
- 1938: founded
- 1973: Interdata Corp. introduced the 7/32, one of the first 32-bit superminicomputers
- 1974: P-E bought Interdata (now the Data Systems Group)
- 1980: Horace McDonell Jr. appointed president
- 1981: sales reached \$1.1 billion
- 1982: sold Memory Products Division to Cipher Data Products Inc.
- 1983: launched Everyware standards support strategy, number of employees: 14,372

BOX SCORE OF EARNINGS

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

Company	Period	Revenues	Earnings	Eps
Analog Devices Inc.	year 10/29/83	\$214,037,000	18,432,000	.97
	year 10/30/82	173,986,000	9,878,000	.55
Avant-Garde Computing Inc.	6 mos. 10/31/83	6,303,000	505,000	.17
	6 mos. 10/31/82	2,771,000	186,000	.08
Cullinet Software Inc.	6 mos. 10/31/83	53,501,000	7,452,000	.49
	6 mos. 10/31/82	34,177,000	4,991,000	.36
Floating Point Systems Inc.	year 10/31/83	100,222,000	13,072,000	1.47
	year 10/31/82	86,591,000	11,546,000	1.32
Mohawk Data Sciences Corp.	6 mos. 10/31/83	198,416,000	6,218,000	.43
	6 mos. 10/31/82	177,719,000	5,831,000	.40
Standard Microsystems Corp.	9 mos. 11/30/83	32,121,000	5,607,000	.55
	9 mos. 11/30/82	18,705,000	1,996,000	.24
Syntrex Inc.	year 10/28/83	41,424,584	2,025,139	.23
	year 10/29/82	31,010,332	2,658,502	.33

Comments: Analog Devices Inc.'s fourth-quarter revenues were \$60.9 million, compared to \$44.2 million in the same period a year earlier. Net income for the quarter was \$6.5 million, or 33 cents per share, vs. \$2.7 million, or 15 cents per share, a year earlier. Cullinet Software Inc.'s second-quarter revenues increased 54 percent from \$18 million to \$27.7 million. During the quarter, Cullinet introduced several products, including personal computer software, which it said were enthusiastically received. Net income for the quarter also improved; earnings were \$3.8 million, or 25 cents per share, vs. \$2.6 million, or 19 cents per share a year earlier.



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MAGNETIC TAPE SYSTEMS 1/4 INCH	MODEL 4000A 1/4" Cartridge 1600 or 6400 bpi Single or Dual Drive									
MAGNETIC TAPE CONTROLLERS	MODEL 1066A Tri-Density GCR 800/1600/6250 bpi For Kennedy 9400									
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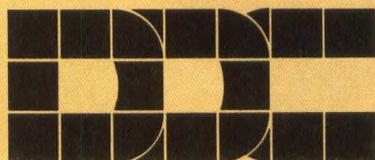
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Mini-Micro World

INTERNATIONAL

Debate intensifies over international standards for digital networks

Stephen J. Shaw
Washington Editor

An international storm is brewing that could hinder the United States' ability to communicate and interconnect digitally with other nations. Swirling at crosscurrents are two approaches to technical standards for integrated services digital networks (ISDNs), all-digital telecommunications networks that are expected to supplant analog-transmission techniques for worldwide data-communications.

In keeping with its pro-competitive philosophy regarding data-communications standards, the United States wants to minimize ISDN standards and allow exact specifications to evolve from the market. In contrast, most members of the International Consultative Committee for Telephone and Telegraph (CCITT) want to tightly regulate ISDN design.

At stake for U.S. manufacturers and system integrators of computer

communications equipment is the increasing export demand for computer and telecommunications equipment. The United States exported \$21.1 billion worth of equipment in 1982, according to Federal Communications Commission (FCC) estimates. If agreement on ISDN standards is not reached, the level of U.S. exports could be curtailed. In addition, exporters could be forced to modify equipment on a country-by-country basis to comply with differing national standards.

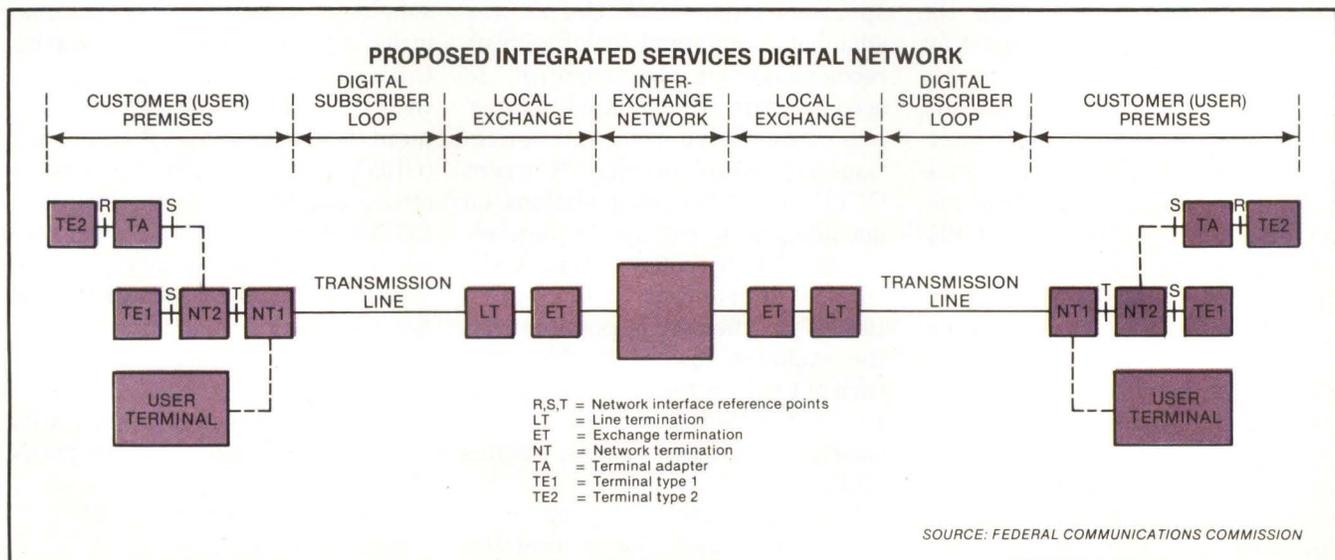
Instead of providing direct, city-to-city communications between countries, the resulting patchwork of incompatible network standards and equipment could force international traffic to go

through what the FCC considers to be unnecessary bottlenecks—domestic termination points—(cities designated by the federal government as international gateways)—or force users to add expensive hardware or software adapters to their terminal equipment.

Driven by advances in digital-communications technology, ISDN represents the next stage in the evolution of telecommunications, said the FCC late last year in a Notice of Inquiry (NOI) requesting industry comments on proposed international ISDN standards.

The FCC believes greater economies can be realized from using one piece of equipment and carrying voice, video and data on one line. Terminal users in one country can

This configuration illustrates an integrated services digital network (ISDN) as proposed by the International Consultative Committee for International Telephone and Telegraph (CCITT). Strong differences of opinion have arisen between CCITT and the U.S. computer industry over whether the network interface point (NT1, NT2) should be considered a part of the network and regulated by government-sponsored posts (bureaus) of telephones and telegraphs or be deregulated and subject to a competitive market, as in the United States. (Source: Federal Communications Commission)



Mini-Micro World

INTERNATIONAL

thus communicate easily with users in other countries. In addition, the digital format allows video and voice signals to be multiplexed and transported with data signals on a single digital-transmission stream.

"During recent years, many national networks moved toward transporting voice and data signals on digital media. This trend toward [digitization] occurred because digital networks reduced costs, increased service quality and provided new services to users," states the FCC's NOI.

Failure to reach international accord would also sacrifice a prime feature of ISDN—the ability of computer terminal users to use their terminals in other countries and immediately access databases through a worldwide ISDN.

"ISDN's terminal-portability feature would allow computer manufacturers to make a limited series of terminals to serve a worldwide market," notes William Sill, a former FCC attorney with the international conference staff.

Sill points out that the ISDN standardization effort has implications outside of international communications. CCITT is attempting to develop a uniform set of technical specifications extending from the network to the equipment used for network access. In the United States, network-access equipment, including the communications interface portion of computer terminals and telephones, is considered customer-premise equipment (CPE) and not subject to government regulation.

In most other countries, however, network-access equipment is strictly regulated by government-run posts (bureaus) of telegraphs and telephones (PTTs). Current CCITT draft specifications for ISDN call for maintaining access equipment as part of the network,

rather than as CPE available separately from a variety of vendors, as in this country.

Pressured by national PTTs and its desire to make the ISDN standards part of national as well as international communications networks, CCITT has recommended that private leased lines—those heavily used by multinational corporations for internal data networks—be incorporated into the public-switched national network.

Comments filed in response to the FCC's NOI indicate this approach is seen as an attempt by the PTTs to recapture the revenue lost to the PTT-run switched networks, due to the growing use of private data-communications systems. However, data communication via a public switched network is considered inferior to transmissions through private, non-switched lines.

Each switch that the digital transmission must pass through, says the FCC's Sill, causes approximately a 1-nsec. delay. Multiple switching delays, therefore, introduce data-transmission errors and increase transmission costs for measured communications service.

In its comments filed with the FCC on the proposed CCITT ISDN specifications, IBM Corp. was adamant in its stand that the draft recommendation be modified to accommodate the United States' pro-competitive telecommunications regulatory policies. "Current CCITT draft recommendations do not adequately satisfy the requirements of U.S. policy.... Unless the current direction of CCITT activities is modified, it is possible that the evolution toward ISDNs could turn out to be a regressive step that restricts rather than increases the satisfaction of user needs," states IBM.

Specifically, the company urges that the United States pressure

CCITT to accept the following specifications in the ISDN network:

- competitive sales of CPE and network interface equipment,
- continued availability of leased private circuits,
- acceptance of the distinction between basic communications services (those that do not alter the form or content of the information transmitted) and enhanced services (those that modify the transmission in such a way as to add value to the information for the end user),
- development of ISDN design that allows cost-based pricing for basic transmission services.

IBM is joined by the International Data Communications Manufacturers Association in calling on the CCITT to adopt the U.S. approach to the sale of computer-terminal and telephone-interface equipment by competitive vendors. The trade association says the key question is what entity owns the network-termination equipment—the network service provider, as outlined in the CCITT-proposed design, or the users, such as those found in U.S. domestic communications networks.

Comments filed by approximately 30 computer and telecommunications manufacturers, equipment suppliers and trade associations, including Motorola Inc., Harris Corp., Northern Telecom Inc. and the Computer and Business Equipment Manufacturers Association (CBEMA), urge the FCC to adopt a strong stance against the proposed CCITT standards. These companies insist that ISDN specifications be kept to a minimum to allow technical flexibility while maintaining compatibility among national ISDN networks.

CCITT is expected to submit its draft recommendations on an ISDN standard at a November plenary session of the International Telecommunications Union. □

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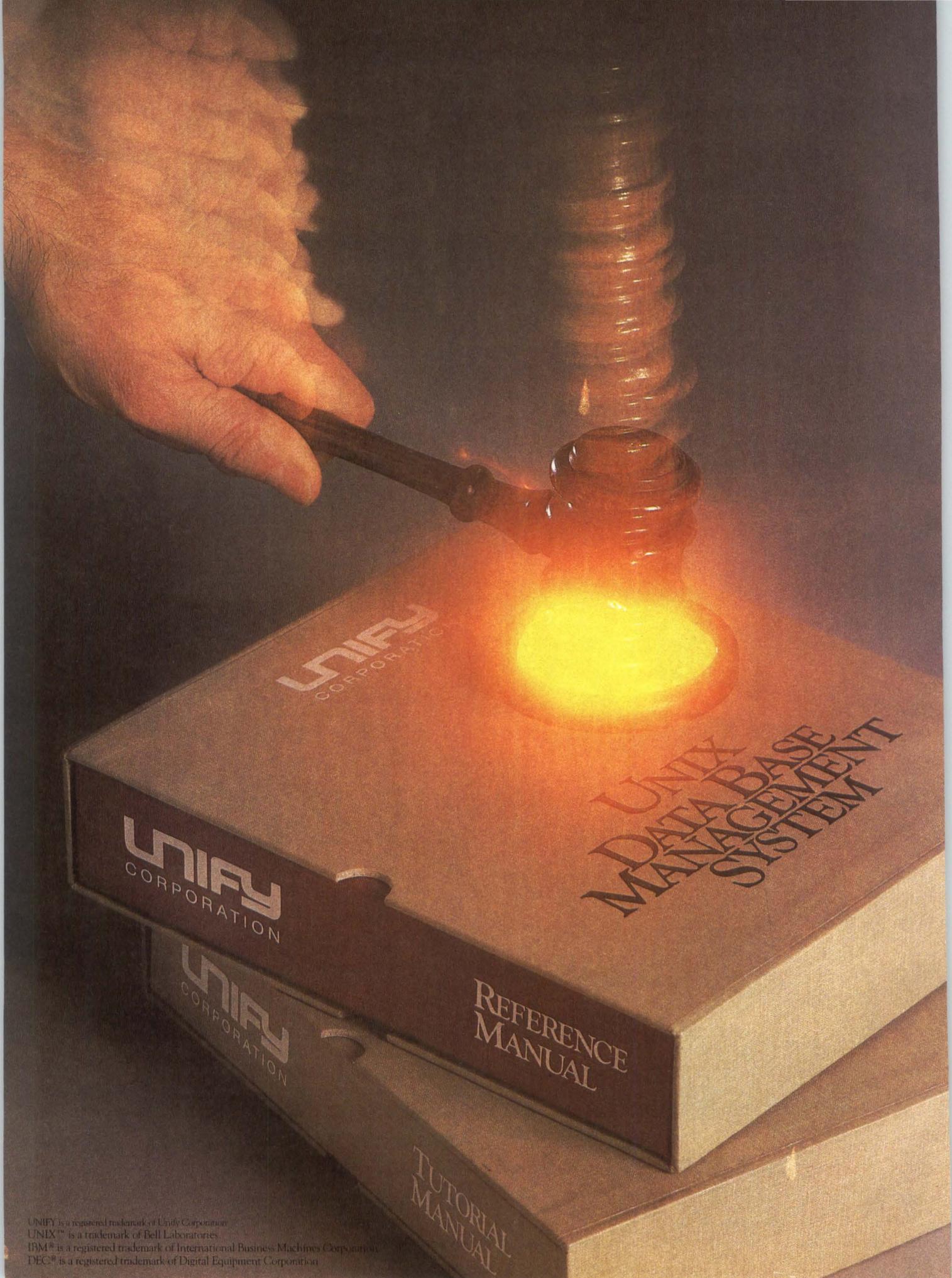
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The Interpreter

An analysis of news, issues and trends affecting the computer industry

Whatever happened to the UNIX supermicro boom?

Geoff Lewis, Contributing Correspondent

Two years ago, if you polled the soothsayers of the microcomputer industry about market opportunities in the mid-1980s, chances are they would have pointed to the burgeoning UNIX supermicrocomputer field. UNIX, the Bell Laboratories operating system, was regarded as the logical choice for a transportable multiuser operating system that could drive the small business microcomputer market in much the same way as CP/M had driven the personal computer market in the late 1970s. Moreover, when combined with advanced microprocessors such as Motorola's MC68000, UNIX could give microcomputer vendors a serious weapon with which to take on minicomputer suppliers whose aging 16-bit systems could not compete with microcomputer prices.

By fall 1981, dozens of UNIX/supermicrocomputer companies were ready to invade the small-business systems market controlled by minicomputer manufacturers. They were even granted a timely favor by American Telephone & Telegraph Co., which announced a new version of UNIX with a pricing structure that made it viable for microcomputer manufacturers. Everything was ready. Only the customers were hanging back. And it wasn't due to a lack of hype or publicity, either. Market analysts and overnight experts by the carload were on hand to declaim profoundly on why UNIX would become the universal operating system from microcomputers to mainframes, generating billions of dollars of hardware and software revenues annually by the mid-1980s.

While the promise of UNIX still looms bright for its dedicated followers, many now concede that they expected too much too soon. "UNIX is still in the application-software development stage," says Bev Josephs, a senior analyst with market research company Gnostic Concepts Inc. She cites the lack of commercial applications as a continuing inhibitor to the growth of substantial UNIX sales. "You don't see a lot of end-user packages, and the vertical applications have not appeared. I can't say with any certainty when end-user sales will really develop."

"A lot of us were caught up in the momentum of UNIX," recalls Warren Blossom, vice president of marketing at CIE Systems Inc., a UNIX/supermicro supplier launched by Japanese trading giant C. Itoh

Electronics Inc. Blossom, a veteran of Basic Four Information Systems and Microdata Corp., adds, "I don't think the average microcomputer manufacturer that elected to go with UNIX then understood the complexity of the operating system. A lot of these people come out of the single-user operating system market and took a simplistic view of UNIX."

In agreement is senior analyst Eileen Skrabutenas of Yates Ventures, a market consulting concern that derived much of its early success from advising UNIX systems suppliers. She confirms that 1982 and 1983 shipments fell below those expected by most manufacturers. "The shipment levels are still low, but they are steady and the retail market is beginning to catch on. Where you'll really see the growth, however, is in the systems houses and OEMs. In terms of the global market, they have a tremendous potential, and in a couple of years they will be doing 60 to 80 percent of UNIX systems sales."

System houses and OEMs that have served as the major marketing channel for the minicomputer suppliers in the past, Skrabutenas reasons, are now committing themselves to UNIX and to the more price-competitive systems on which it runs. "Their end users are tired of paying \$40,000 for obsolete hardware and a proprietary operating system, and the systems house managers are fed up with the minicomputer suppliers shoving hardware down their throats," she says. Perhaps in recognition of this, Skrabutenas notes,

SMALL COMPUTERS RUNNING UNIX

	1982	1983	1984	1985	1986	1987
All micros	6,350	23,000	66,000	115,000	160,000	225,000
All 16-bit	6,300	22,000	63,000	105,000	135,000	160,000
One user	800	4,500	19,000	42,000	64,000	80,000
2-6 users	4,500	16,000	41,000	59,000	66,000	75,000
6+ users	1,000	1,500	3,000	4,000	5,000	5,000
32-bit	50	1,000	3,000	10,000	25,000	65,000
Minis	3,430	5,500	9,000	15,000	20,000	25,000

In 1983, 12 vendors should have shipped at least 1,000 units each of UNIX-based products, judging from sales reports near year end, estimates Bev Josephs, senior analyst for Gnostic Concepts Inc. They are Altos, Apollo, Callan Data Systems, Convergent, Corvus Systems Inc., DEC, Fortune, IBM, NCR, Tandy, Zilog and Sun Microsystems...

The Interpreter

minicomputer suppliers have been conspicuously announcing plans to make UNIX or UNIX-like products available. She questions their commitment to an alien operating system they can't control.

UNIX companies are slow out of the blocks

Among the earliest of the new companies to form around building a UNIX/supermicrocomputer was Plexus Computers Inc., Santa Clara, Calif. Product manager James F. Groff recalls that 1982 "was no bed of roses" as the recession squeezed the minicomputer OEMs that Plexus' sales force had targeted. Shipments of Plexus computers based on multiple Z8000 chips made by Zilog Inc., Campbell, Calif., commenced "very slowly" that January. But it soon became apparent that the company needed to add a processor based on the more popular MC68000 chip from Motorola Inc. Much of the next year was spent in that effort. As a result, first-year sales were disappointing—\$3 million to \$4 million—and the company recruited former Data General Corp. executive Bill Jobe to get the sales effort going. Under Jobe, 1983 sales tripled to nearly \$10 million, and Plexus landed a major OEM contract valued at approximately \$40 million with Philips Information Systems.

"The climate from a year ago is substantially different," Jobe observes. "A year ago, OEMs were struggling, but now, they are extremely positive—especially those with vertical niches." The other significant change, he says, reflects the growing recognition that UNIX is becoming an accepted standard: "When we came into the market we were selling to the UNIX hard core. Now, it is the mainstream minicomputer OEMs we're talking to." The bottom line, Jobe points out, is that shipments and revenues rose to break-even levels in the third quarter of last year.

Another early competitor was the manufacturer of the 16-bit Z8000 microprocessor itself, Zilog, a subsidiary of Exxon Corp. It built a UNIX system around its own chip. Like Plexus, Zilog found rough going in the first two years of UNIX system sales. "We've made slow and steady progress," says Bob Dickinson, formerly the systems division vice president and general manager. However, Zilog's patience is paying off, he says. Last month the company expected to ship its 2,000th system and is gearing up for monthly production in the 150- to 200-unit range. Dickinson says the system division broke even for the first time last October.

"We're a little different from the other competitors," Dickinson comments. "We don't want to get involved in

the small business systems market. We think that will become a commodity market. Instead, we see UNIX supermicrocomputers occupying a distinct position between mainframes and personal computers," he says. As a result, Zilog has successfully targeted small- to medium-sized companies and government agencies, which, Dickinson believes, represent an increasingly important UNIX market. He agrees that the market has finally moved from "the UNIX hackers to the mainstream data-processing world." (After this interview, Dickinson left Zilog to become president of start-up Mouse Systems Corp., Santa Clara, Calif.)

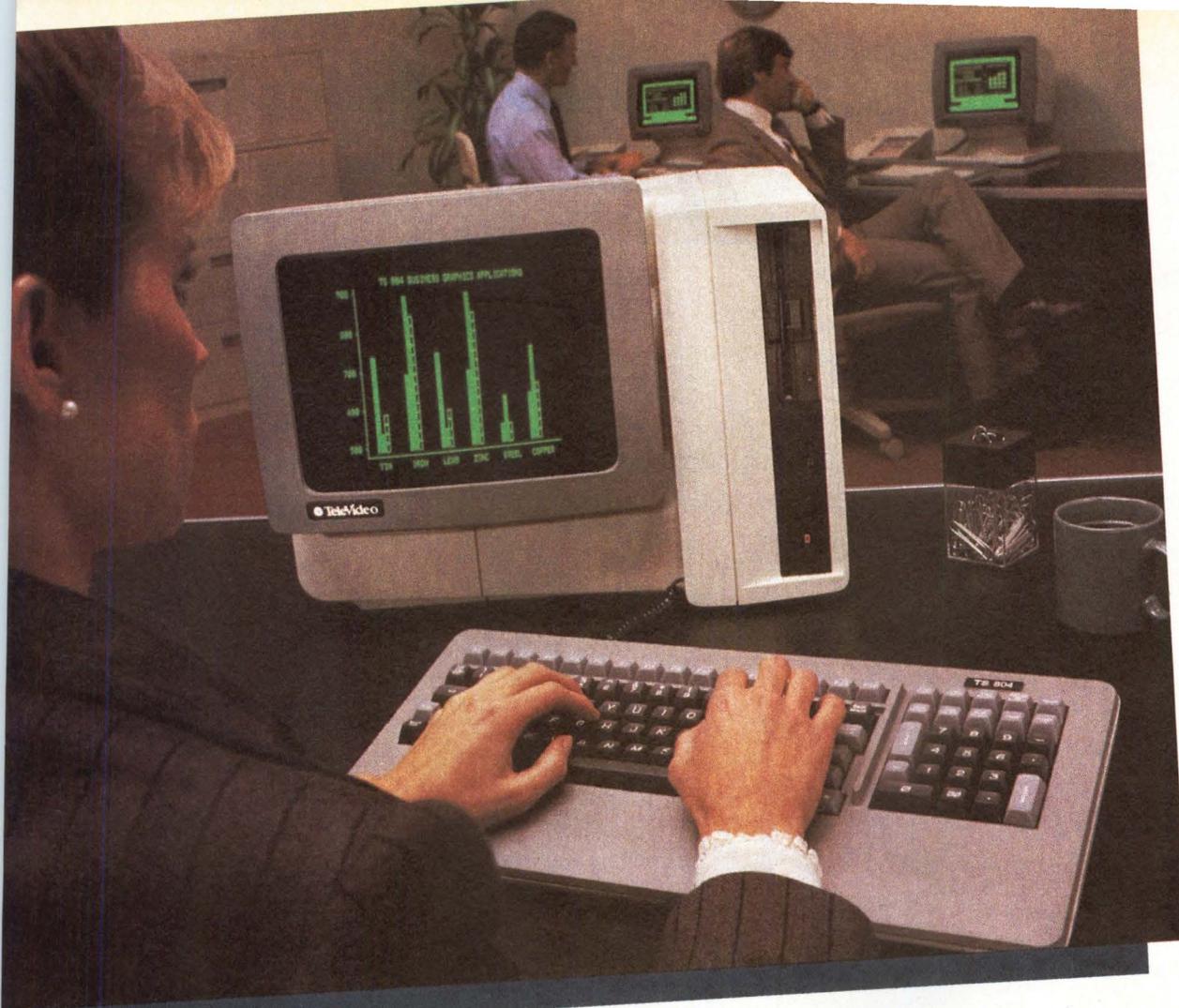
That breakthrough may come too late for many small competitors who expected to see revenues rolling in during 1982 and 1983. Consequently, many analysts are predicting a shakeout, especially in the overcrowded two- to eight-user, desktop segment. In that category, in which analysts Josephs and Skarabutenas see commodity-market conditions emerging, only Tandy Corp.'s Radio Shack subsidiary and Altos Computer Systems are shipping UNIX systems in significant numbers. Both of those companies have bundled the operating system with all their 16-bit models.

Survivors must find a niche

As a sign of an impending shakeout, Gnostic Concepts' Josephs cites the problems encountered by Fortune Systems Corp., Belmont, Calif., another major player in the low end. Fortune, a well-heeled start-up founded by former Intel Corp. president Gary B. Friedman, took the 1981 Comdex by storm with its UNIX box with the then-startling price of less than \$10,000. Fortune has shipped more than 10,000 units, largely to major OEM customers. However, by mid-1983, the performance shortcomings of the system caught up with sales. Despite revamping the computer's operating system, the company is now fighting a tide of red ink that rose to \$9.1 million in the most recently reported quarter and forced Friedman's resignation.

Fortune may be able to recover from its fiscal stumble—with the aid of approximately \$40 million to \$50 million in its treasury from a successful public offering. But the delay in making UNIX a successful commercial operating system has strained the patience of the venture-capital community. At the same time, the slow development has left a window open for some well-financed players to enter a market already pioneered by the up-and-comers of 1981.

The latter category includes both NCR Corp., Dayton, Ohio, and Convergent Technologies Inc., Santa Clara, Calif. And speculation is intense that IBM



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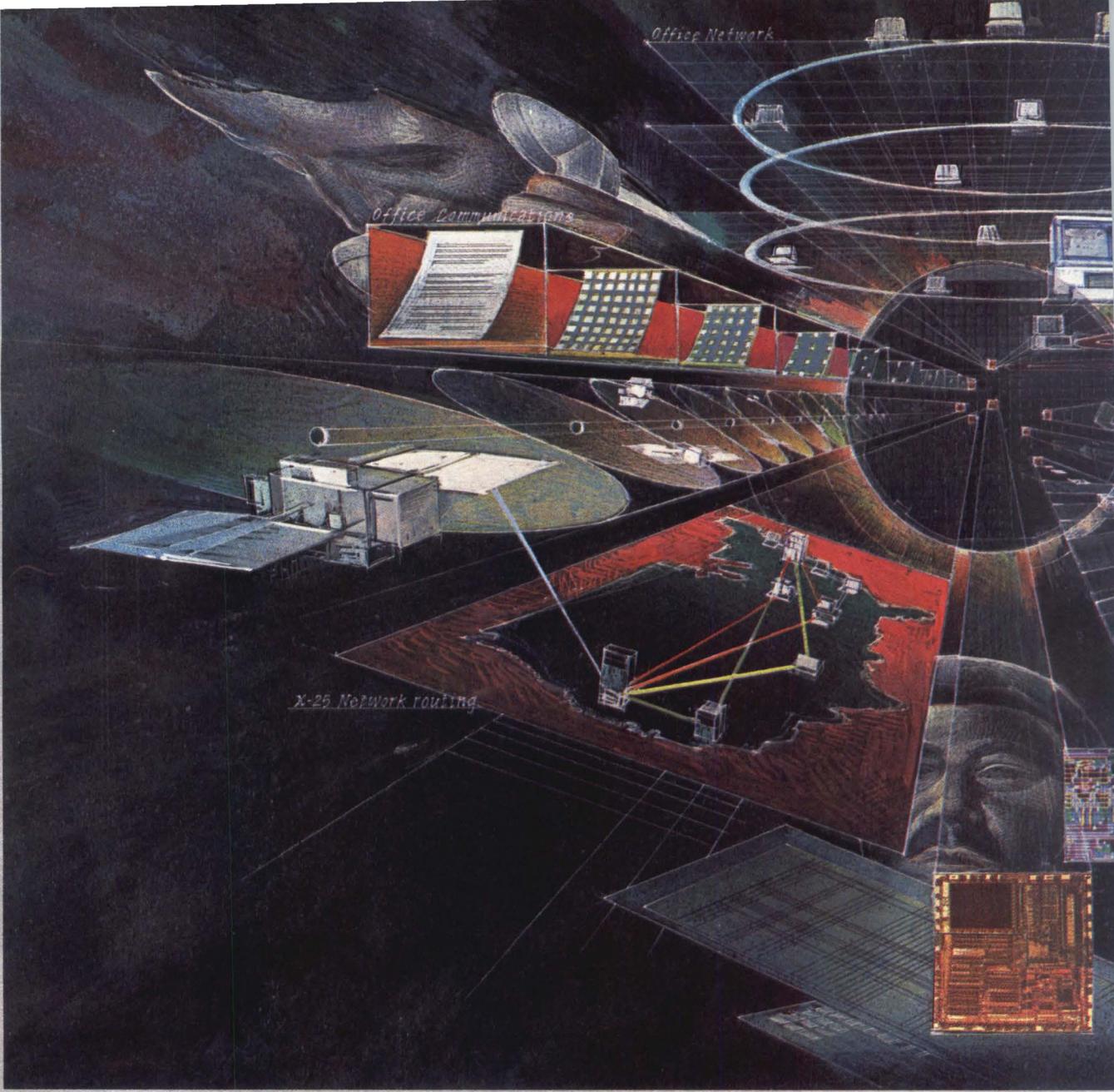


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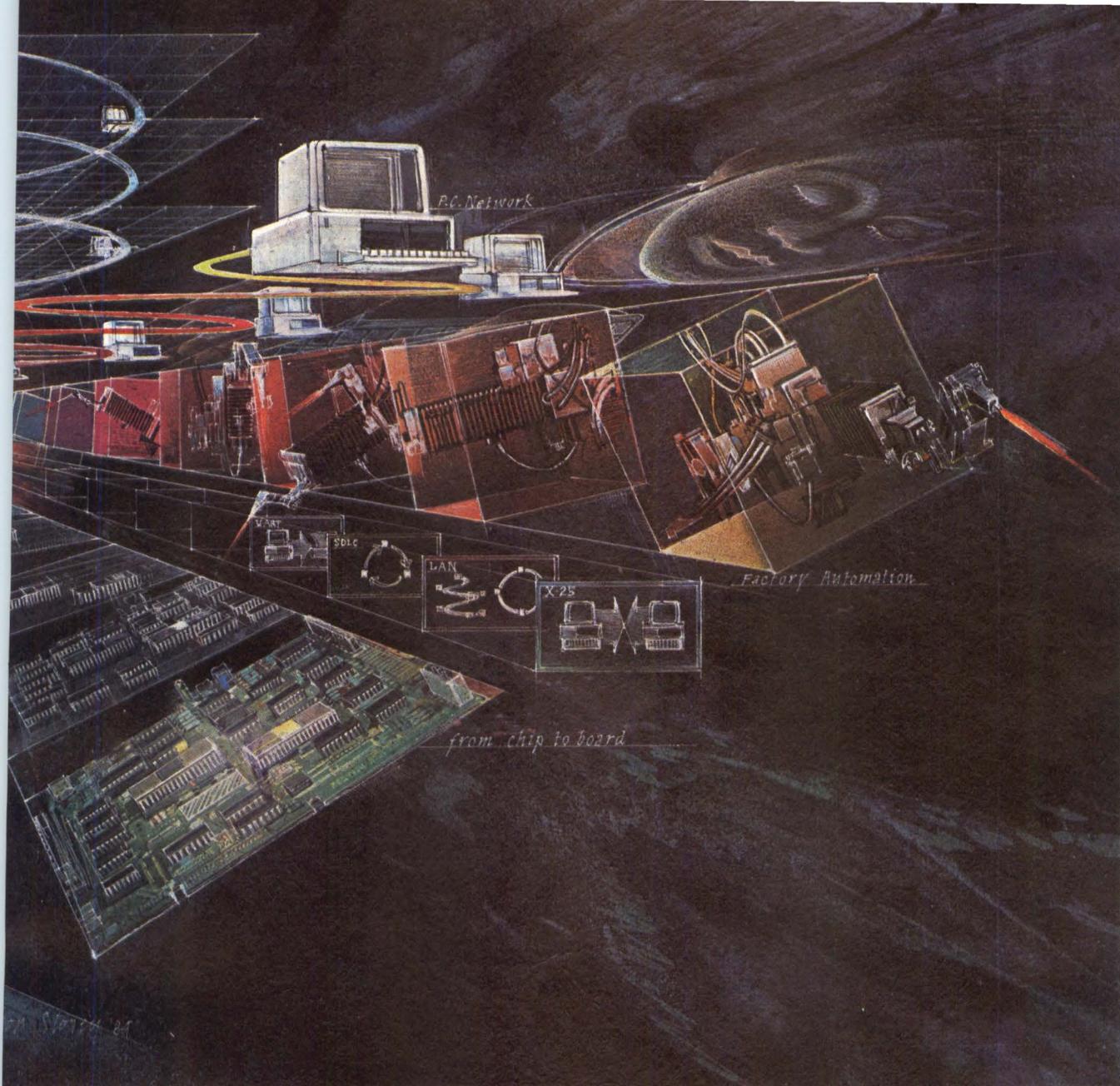
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f. Pre-Comp	19. Verify Format
g. Switch Current	20. Write Sector
1. Drive	21. Re-Write Sector
2. Side	22. Format Track
3. Track	23. Format Diskette
4. Alternate Seek	24. Random Seek, Read
5. Centering	25. Random Seek, W/R
6. Spindle Speed	26. Write Pattern
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*9. Head Load	29. Sequence Selects
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*12. Azimuth	31. Unit Select

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7	6	5	4	3	2	1	0
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Corp. will soon follow with an Intel 80286-based, multiuser upgrade to the PC (code-named Popcorn) that runs XENIX, a version of UNIX developed by Microsoft Corp. and designed to be upwardly compatible with the PC-DOS operating system. Digital Equipment Corp. recently added UNIX for its high-end Professional personal computers, and at least one AT&T operation is expected to introduce UNIX systems based on 3B20 minicomputers, BellMAC micros or the MC68000 as early as this summer.

Over the past year, NCR has been building its first OEM systems operation around a Motorola MC68000/UNIX box and is believed to have shipped more than 1,000 Tower series UNIX systems since August. Convergent has built a five-year order book for its multi-MC68000 Megaframe that could turn into \$1 billion in revenues. A forthcoming "Miniframe" (single MC68000-based) system will take the aggressive Convergent into the two- to eight-user segment, further exacerbating the shakeout threat for smaller players.

Venture capitalists get cold feet

Venture capital investor Charles Moore of Welsh, Carson, Anderson, and Stowe and a backer of UNIX start-up Momentum Computer Systems Inc., says, "I think the prognosis is still the same for the eventual success of UNIX. What has changed is the speed of that success, which has been slowed by a lack of commercial-quality application software." Without readily available software, UNIX hardware sales stalled in commercial markets. As a result, he adds, "in the investment community, I think now there's a lot of caution about UNIX start-ups."

Plexus' Jobe, who talked venture capitalists into a third-round financing of \$6 million last March (taking Plexus' total funding to \$12.6 million), agrees that investors have become somewhat wary of the UNIX hardware companies. "There is a low cost of entry in this market. You can go out and put together a single-board system around an OEM 68000 board, and, for \$1 million, you can launch a product. But when you add more than three users, you'll fall off a cliff," he says. "If you don't distribute UNIX [over several microprocessors as Plexus does], you fall into a hole," he explains, adding that it took two years of intense effort to learn that lesson.

Investors have been made aware of this and are no longer funding the simplistic designs, Jobe maintains. CIE's Blossom adds, "Since the fall of 1982, I've seen a slowing of momentum in some of the start-ups, and there really haven't been a lot of new competitors. A lot of companies are basing their futures on third-round

financing, and venture capital seems to be drying up." Blossom, who declines to disclose how much money CIE has spent in launching its much-delayed 680 series, says C. Itoh, a \$50 billion enterprise, has made a long-term commitment to CIE's success.

Despite the squeamishness of other venture capital companies, Welsh Carson was sufficiently sold on the inevitable penetration of UNIX-based systems to participate in a \$3.25 million second-round funding last summer of Momentum Computer Systems International, Sunnyvale, Calif. Momentum president Ed Marino says the second-round funding, which brought capitalization to \$9 million, was needed earlier and had to be larger than planned because of the delayed development of the market and changing competition. Momentum, which had sales of \$6 million to \$8 million last year, has plowed \$1 million into an automated assembly line and "substantial funds" into a high-resolution business graphics workstation that should give Momentum a niche.

Welsh Carson's Moore points out, "The feeling I get in the investment community is there are N components—maybe 50—in the market and they all can't be winners. Outside of Convergent Technologies, none has a track record. So now we're taking a much harder look at the fundamentals." Moore suggests that the excessive amount of venture capital in the microcomputer business in the past two years has kept some of the start-ups above water longer than they deserved. "The amount of venture capital available has suspended the laws of free market capitalism, which would have killed off the weak competitors by now," he concludes.

Fortune's misfortune, says vice president of planning and co-founder Homer G. Dunn, is attributable both to internal errors—such as the release of hardware and software that fell far short of claimed performance levels—and to the development (or lack thereof) of the UNIX market itself. On the latter score, Dunn blames the success of the IBM PC, which diverted the attention of software developers from UNIX projects. "In 1980 and 1981, if you were an independent software supplier and you wanted to upgrade from CP/M, chances were you would be aggressively pursuing UNIX. But then, with the success of IBM, its PC-DOS (and Microsoft's MS-DOS) became the first choice," he says. Dunn estimates that the PC-DOS/MS-DOS diversion delayed the UNIX market by 12 to 18 months. Dunn also blames IBM's success for Fortune's failure in retail channels. Although the multiuser Fortune product was never positioned as a direct competitor of the IBM PC, Dunn says many of the more than 400 dealers—including parts of the ComputerLand chain—

The Interpreter

turned their attention to the PC. The IBM machine was in extremely high demand and did not require the degree of sales effort associated with the more sophisticated Fortune machine.

Today, the Fortune retail effort is concentrated on the 50 or so outlets that did develop systems expertise for the Fortune 32:16. Fortune's 450 other dealers are mainly small business system dealers, often trained on minicomputer-based hardware. These value-added dealers, who typically provide software support, installation and on-going consulting, are the backbone of Fortune's revamped distribution policy. Dunn now says he does not expect UNIX-based systems to flow through computer retailers until late in the decade.

Despite Fortune's setbacks, company executives maintain they are still 12 to 18 months ahead of most competitors in commercializing UNIX. The company spent \$2.6 million and \$5.9 million in 1981 and 1982 development budgets, largely to make UNIX a user-friendly operating system for data-processing novices. "You can buy a UNIX port [the implementation required for a specific machine] for \$100,000, but making it a commercial system is a different story," Dunn says.

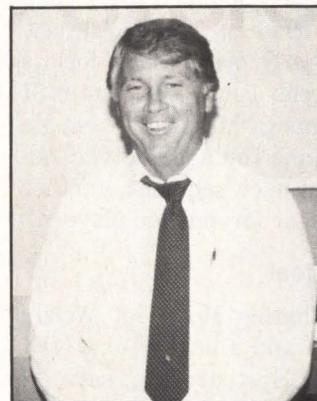
UNIX adapts to the commercial market

Indeed, making UNIX a commercially viable operating system has been a longer, more expensive task than many market participants ever expected. Designed by Bell Laboratories employees in the early 1970s, the operating system was distributed widely to universities and became the development system of choice for computer scientists throughout the United States. Since then, UNIX has had an avid following among academicians, software developers and technical end users such as engineers. With that existing market for UNIX systems among scientific and technical users, companies such as Apollo Computer Inc. and Masscomp have successfully marketed engineering and computer-aided-design/computer-aided-manufacturing systems that combine UNIX and high-resolution graphics. Apollo expects to hit \$75 million in sales for fiscal year 1983, and Masscomp, which is about 18 months behind, according to marketing vice president Allan Wallack, is aiming for about \$18 million. Wallack says much of the minicomputer technical OEM market is up for grabs by supermicro houses and estimates that market is worth \$3 billion to \$4 billion annually.

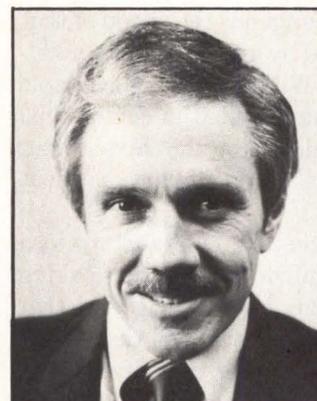
Making UNIX palatable to commercial OEMs, dealers and end-users has been a complex task. It had a cumbersome command structure, an unfamiliar language (C) and a dearth of readily available application



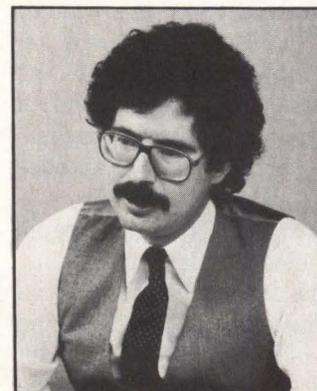
The overwhelming momentum of the IBM PC caused many of Fortune Systems Corp's problems, believes vice president of planning Homer Dunn, because it drew software developers to the PC-DOS/MS-DOS environment and delayed introduction of UNIX packages. In addition, Dunn says many potential dealers were lured by the more salable IBM product.



Entries into the UNIX market are slowing, says Warren Blossom, vice president of sales and marketing for CIE Systems Inc. Although he interprets this as a sign of an impending shakeout, he believes that CIE will be protected by the strength of its parent, the \$50 billion trading conglomerate, C. Itoh Electronics Inc.



The arrival of minicomputer vendors into the UNIX market poses no threat to William D. Jobe, president of Plexus Computers Inc. "I love the idea of going head to head with them and make direct comparisons," he asserts.



Switching to UNIX was a marketing decision for Convergent Technologies Inc., not an admission of problems in its own CTOS operating system, maintains Convergent's product manager Steve Blank. "The only way to get all the business is to give people what they think they want," he declares.

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software. Even horizontal packages such as database management and word processing were underdeveloped. To an unexpected degree, Blossom notes, manufacturers were forced to become software distributors, so that OEMs could get the packages they needed to make sales.

Some of these shortcomings have been remedied. Ryan McFarland Corp.'s RM-COBOL now provides a language under UNIX that is similar to the one used on hundreds of NCR and Texas Instruments Inc. minis. Science Management Corp.'s SMC BASIC emulates Basic Four's Business BASIC. Software Ireland and Omtool manufacture languages similar to DEC's commercial language, DIBOL. And The Office Manager, Inc. markets a BASIC language similar to Wang Laboratories Inc.'s version of BASIC. Yet having those tools at hand does not guarantee success, emphasizes Bob Bozeman, Altos director of marketing. To launch a UNIX product line requires more than languages.

Bozeman estimates that fully 4 percent to 5 percent of Altos' \$74.6 million in fiscal 1983 revenues (ended June 30) were plowed into developing UNIX products (including a roster of 100 applications packages) and planning marketing of those products. "We made a strategic business decision that multiuser microsystems will be UNIX-based," Bozeman says. He recalls that in the past the company had worked with a variety of operating systems such as MP/M (the multiuser upgrade of CP/M), OASIS and Pick and that none promised the universality of UNIX. Bozeman stresses that the cost of not going to UNIX could have been higher. "If we hadn't gone into UNIX—if we'd stayed with our 8-bit CP/M base—we'd be out of business today," he explains, alluding to the more severe problems facing Altos' former competitors such as Vector Graphic Inc.

Altos' sales also suffered after the move to UNIX, Bozeman concedes, but he blames some of the problems on product-line changes. The company's first UNIX system was the Intel 8086-based 8600, which hadn't been tuned for the new operating system and was, he concedes, "a dog." A subsequent MC68000-based system was relegated to a single major distributor because it was not competitive with other MC68000-based systems. The final solution—an 8086-based system with intelligent I/O memory-management systems for UNIX—was delayed by problems in the plastic enclosure.

Lower sales volume in the first and second quarter of this year led to layoffs and flattening of revenues. Company officials maintain they are positioning themselves for the emerging UNIX market next year, and

Bozeman predicts Altos will do \$70 million (out of projected revenues of \$90 million) in UNIX-based systems in this fiscal year. The Altos strategy is beginning to pay off. Bozeman anticipates shipment rates of 700 UNIX systems per month, with each system carrying a price tag of around \$9,000.

Getting up to that shipment level has required a major shift in distribution strategies, not unlike Fortune's. "For years, we grew by signing up anybody who would take the product, and, in the past few years, we had 3,000 different dealers. We looked at the stable core of 600 dealers in that group and started directing a marketing campaign at them to support UNIX," Bozeman says. Most of these dealers are selling UNIX now and are concentrating on small business customers, a market in which Bozeman hopes to continue steering clear of IBM. "We looked at the top 25 cities, and we said we'd like to get 10 percent of the market in those areas. If we can do that, we'll be \$1 billion company," he says.

The computer supplier whose support of UNIX could finally make the de facto standard a true standard is IBM.

Altos is in second place in monthly UNIX systems shipments, trailing Radio Shack, which is shipping more than 1,000 model 16s a month to its captive Radio Shack stores, according to Yates Venture estimates. Yates' Skrabutenas sees a strong future for Convergent Technologies, which she says may soon surpass both Altos and Radio Shack.

High-end systems compete with minicomputers

The success of Convergent in the UNIX market has thus far been in relatively high-end systems, supporting eight to 128 users. Megaframe product manager Steve Blank acknowledges that the line will be extended downward into the Altos/Radio Shack range. The rumored "Miniframe" extension is supposed to be part of Convergent's OEM agreement with Four-Phase Systems Inc., but it has not been officially introduced.

Convergent's entry into the market in 1982 was relatively late. "We had CTOS [Convergent's proprietary operating system], which we think is the best real-time operating system on the microcomputer market, but we used to lose out to UNIX in bids. It was an irrational response, but the customer wanted UNIX," Blank recalls. "We still believe CTOS is a

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better operating system, but we're greedy, and the way to get all the business is to give people what they think they want."

After a brainstorming session at a resort in Monterey, Calif., Convergent executives came up with a design that kept them out of the crowded two- to eight-user market and addressed the needs of OEMs that want a system supporting as many as 128 workstations. The architecture, in which as many as 36 MC68000-based microcomputers can be linked, stems from an abandoned redundant-processor design that would have competed against Tandem Computers Inc. and other manufacturers of fault-tolerant computers. In Megaframe, the multiprocessor design allows extremely flexible configuring for OEMs. So far, the idea has appealed to a dozen OEMs including Gould SEL, Raytheon Co., A.B. Dick Co., Automatic Data Processing and CPT Corp. As Blank points out, "We've built ourselves a built-in market with our workstations."

Making UNIX a commercially viable operating system has been a longer, more expensive task than many market participants expected.

However, it is not known whether major workstation customers such as Burroughs and NCR will look kindly on Megaframe, which has the potential to compete with their own small computers. NCR, in fact, is being drawn into direct competition with Convergent, whose workstations form the basis of NCR's drive into office-automation markets. Robert A. Hahn, NCR OEM marketing director, downplays any possible conflict with Convergent's Megaframe or the Mini-frame, which will be more closely positioned to NCR's Tower.

Hahn has been concentrating his efforts on DEC OEMs, to which he claims he can offer higher performance at half the price of PDP-11 series systems. Many of NCR's early installations have been in the PDP-11/UNIX market, but Hahn maintains there is much commercial development that has not turned into sales yet. "There are a lot of developments under way that will start to emerge this year, and you'll start to see how much growth there really is," he says.

Minicomputer manufacturers respond

Hahn and other UNIX market observers are training their intelligence-gathering efforts among traditional

computer suppliers. In the past year, virtually every major minicomputer manufacturer has, to some degree, made a commitment to offer UNIX as an option. In many cases (at DG and Wang), UNIX will be offered in conjunction with the proprietary operating systems. "They [the minicomputer vendors] view it as an absolute survival tactic," says Yates' Skrabutenas. "If they come out with UNIX products and support them in the next six to nine months, they may hold onto their bases. But if they don't they will lose a lot of business to companies like Auragen Systems Corp. and Pyramid Technology." (Auragen and Pyramid have built UNIX systems with supermini performance characteristics).

Jobe of Plexus, who compares Plexus' systems with DEC's VAX series superminicomputers, welcomes the entry of minicomputer manufacturers into the UNIX market. "It's great, it's wonderful because now we'll have something to compare with directly. We love the idea of going head to head with VAX running UNIX," he declares. Goff adds, "Their whole sales force is trained to sell and support [the proprietary] VMS, and you don't just turn that around overnight."

The computer supplier whose support of UNIX could finally make the de facto standard a true standard is IBM. Rumors of IBM's position on UNIX are rife among UNIX market analysts, but the company itself is not forthcoming with substantive clues. Aside from a limited program on the Series/1 minicomputer aimed at telephone operating companies, IBM supports UNIX directly only on the CS9000 laboratory computer, which is manufactured by the company's Danbury, Conn., Instruments division. IBM has reportedly commissioned UNIX developments on hardware ranging from the PC to the 4300 small mainframe, but most UNIX competitors expect the most significant IBM move to come with the multiuser "Popcorn" microcomputer. That system could appear as early as this winter and is expected to set a price/performance target in the lower end of the UNIX microsystems market.

"The guy who sets the standard is IBM," observes Fortune's Dunn, "When you see Popcorn, that's when you have to position yourself correctly, or it won't matter what your name is." □

Since this article was written, IBM announced that it will offer a single-user version of UNIX, developed by Interactive Systems Corp., Santa Monica, Calif., for the IBM PC.

Geoff Lewis, a former editor of *Mini-Micro Systems*, is an editor of *Electronic Business* magazine.

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Windows battle shapes up

*Software environments open options,
force choices in the personal computer market*

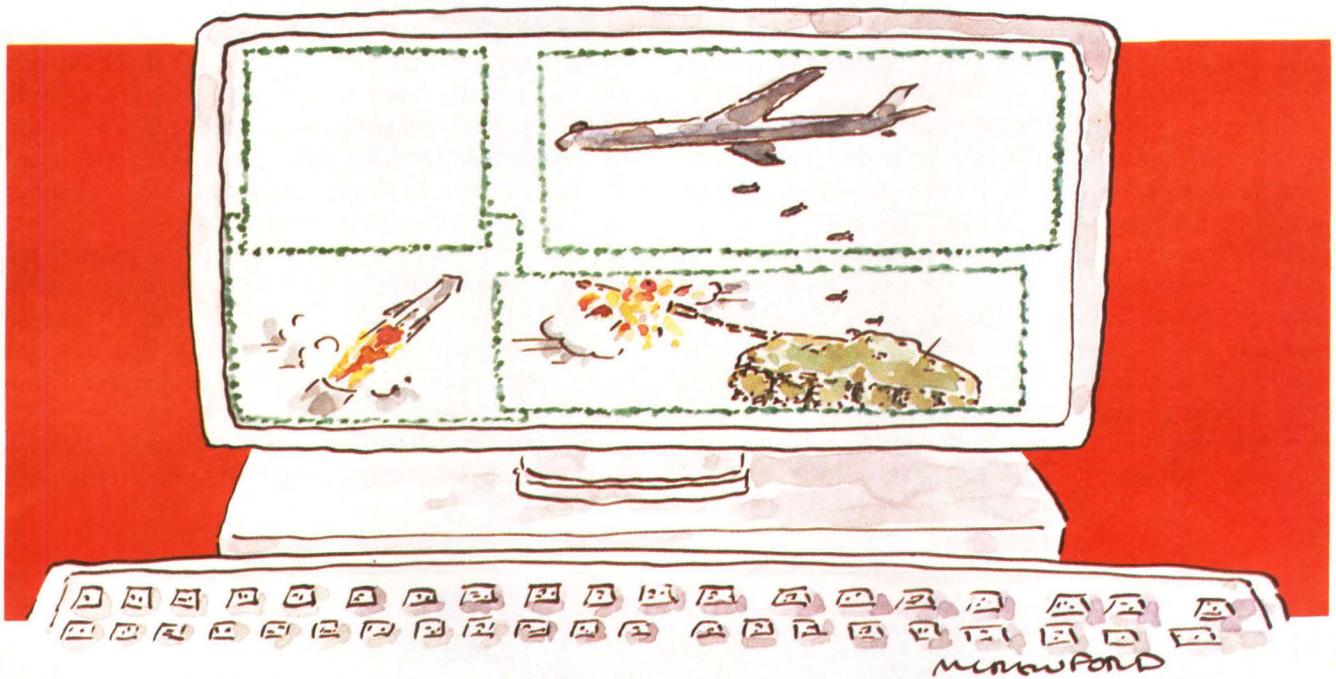


Illustration by Michael Crawford

Not only can software environments break a screen into windows, they also allow the transfer of data from one application package to another.

Sarah Glazer, Senior Editor

Once again, developments are rumbling through the personal computer market that will shake almost all its participants. The heart of the revolution is the software environment that integrates separate application programs, allows them to appear simultaneously on sections—"windows"—of the CRT screen and often incorporates easy-to-use features such as pointing devices to control the CRT display. Software environments' growing acceptance will force a response from every part of the personal computer market. Not only must software suppliers respond to a new level of sophistication but also hardware suppliers and system integrators must decide how to accommodate new devices and the need for complex graphics.

Although easy-to-use systems that allow separate application software to work together are just becoming mainstream products, many of their features appeared some time ago. The Star from Xerox Corp. and the Lisa from Apple Computer Inc. each breaks its

screen into windows and lets a user move data between them. Each also includes a pointing device (Xerox dubbed it a "mouse" because of its size and tail-like connecting cord) that moves the cursor around the screen.

Software packages that integrate a few commonly used applications—such as 1-2-3 from Lotus Development Corp., Cambridge, Mass.—finally sold the public on the advantages of integrated application software. While such packages may satisfy some users' needs for spreadsheet calculation, database management and business graphics, users with other needs must find a more general way to move data between application packages.

Announcements of software environment products such as Visi^{On} from VisiCorp, San Jose, Calif., DesQ from Quarterdeck Office Systems, Santa Monica, Calif., and MS-Windows from Microsoft Corp., Bellevue, Wash., mean that widespread integration of application packages is becoming a reality. Rather than crafting several application packages together, envi-

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ronments provide the underlying mechanism to let any number of application packages exchange data. Some features allow applications to address bit-mapped screens, a hardware requirement for creating the windows that display more than one application on a single screen. Some allow applications to address the pointing device, another piece of hardware new to most microcomputers. Other features include data formats and protocols to support data exchange between applications.

Software environments mean independent software developers don't have to create their own methods for providing sophisticated functions—windows, pointing and file transfer, says Esther Dyson, president of Rosen Research Inc., New York, which analyzes the computer industry. Environments also allow integrated applications to run on a variety of microcomputers without the need for software developers to make modifications. Dyson predicts that, rather than being a special feature offered only by the high-end machines, environments will become fundamental to most microcomputer systems.

Contenders back different approaches

The first major software company to announce the development of an environment was VisiCorp, although Visi^{On} didn't become available until the end of 1983. By then, a number of competitors had announced similar products, among them industry leaders Microsoft with its MS-Windows and Digital Research Inc., Pacific Grove, Calif., with its Concurrent CP/M. Other contenders include Quarterdeck with its DesQ, and Structured Systems Group Inc., Oakland, Calif., with its WindowMaster. The fight for market share will begin to get serious as new products become commercially available throughout 1984.

A company's approach to entering the market will ultimately shape the outcome, believes industry analyst Bill Ablondi of Future Computing Inc., a market research company in Richardson, Texas. In one camp is Visi^{On}, which requires that software developers significantly modify applications before they can run. In the other camp are products such as MS-Windows and DesQ, which let many applications run unchanged,

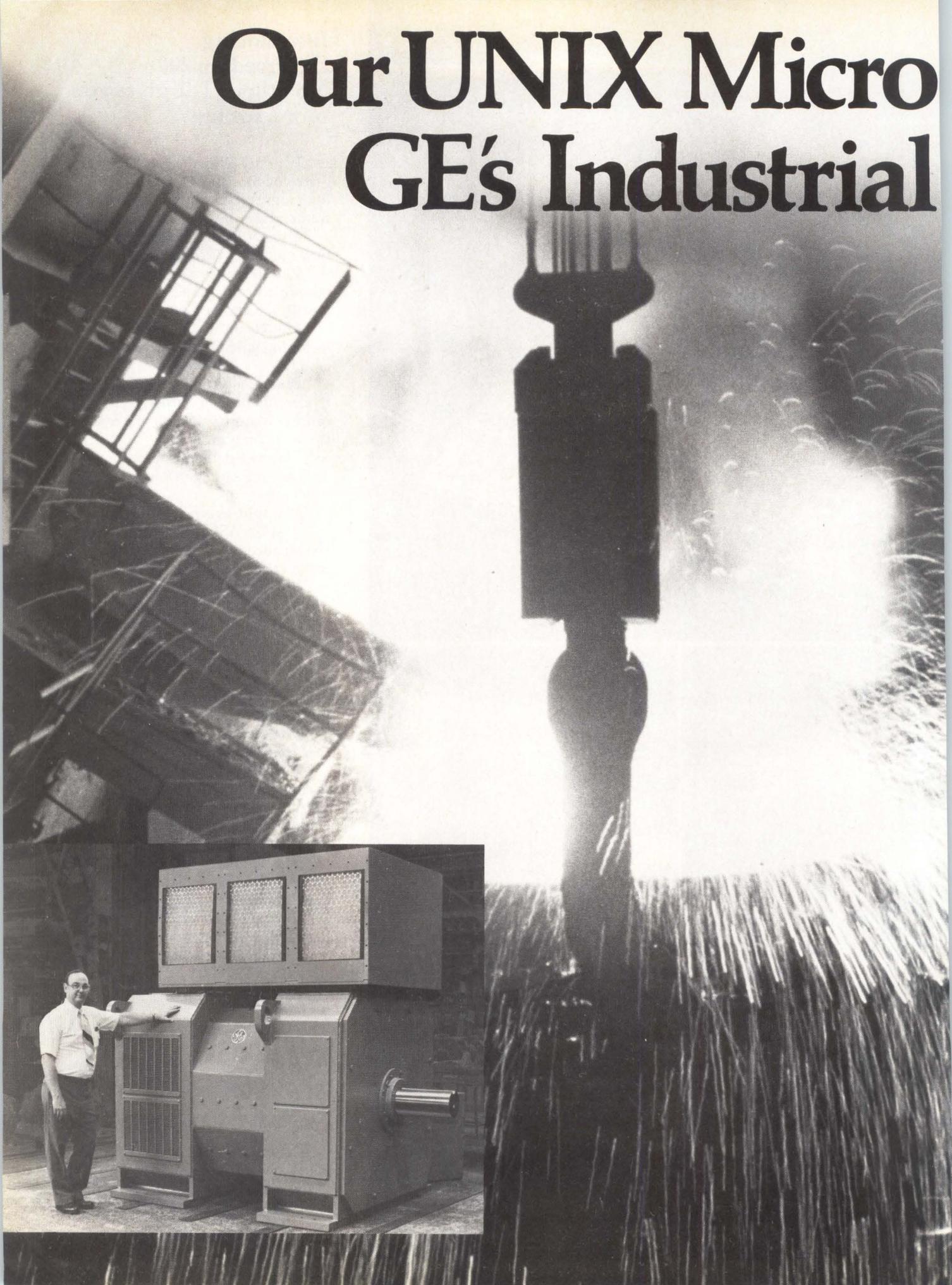
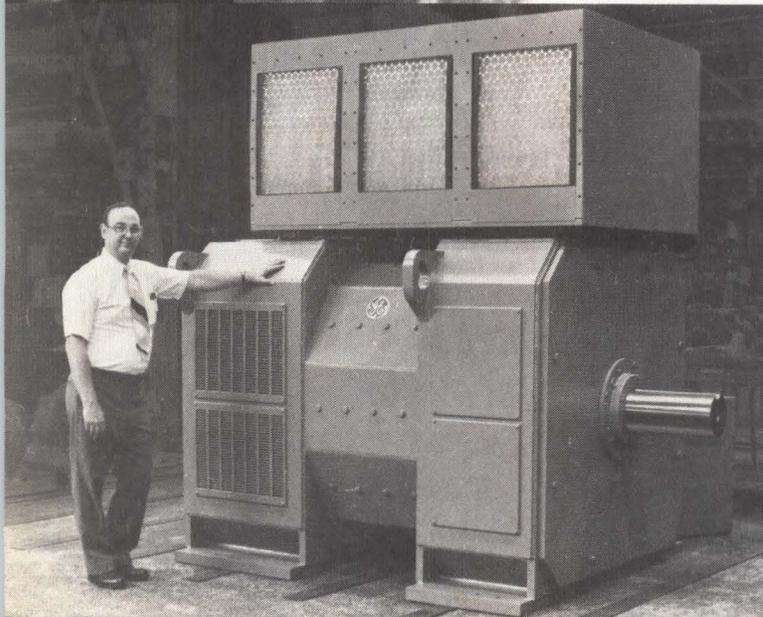
"A number of independent software vendors have stated their intention to adapt their applications to take advantage of Windows," reports Microsoft Corp. chairman Bill Gates. Although the company is encouraging participation of software developers, Gates concedes that "it's up to them to do the work."

The tight integration characteristic of software packages that craft several applications together is missing in software environments, claims Mitchell Kapor, president of Lotus Development Corp.

"Our strategy is that we want to be versatile," says Terry Myers, president of Quarterdeck Office Systems. An application does not have to be rewritten to run under Quarterdeck's DesQ. Instead, DesQ has mechanisms to adapt the application itself.



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even though they can't take advantage of the environment's more sophisticated features. Each approach has strengths, Ablondi maintains, that will make it appeal to a particular market segment.

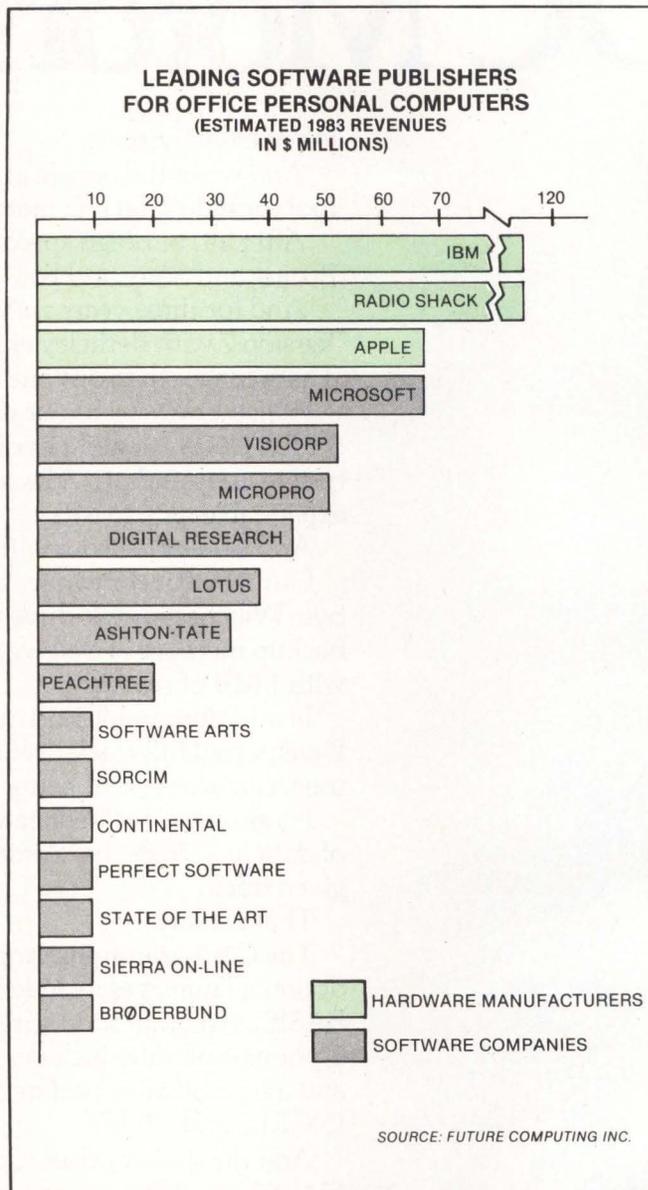
The approach of products that allow current software to run has particular appeal to independent developers. "It doesn't ignore the point of view of the independent software vendor who doesn't want to get tied up with the future of one particular software company," Ablondi explains. "For example, the effort needed by an independent software vendor to put a product on Visi^{On} would be enormous, and the future of that product would depend on the future of Visi^{On}."

In contrast, Visi^{On} would appeal most strongly to big companies with in-house software developers trying to create a corporate library of consistent, compatible applications. "They don't care about buying independent software vendors solutions to a general problem; they want a specific solution for their environment," Ablondi says. Providing strengths to programs in this segment of the market are features that permit close integration, such as consistent application structure, commands and data formats. "Visi^{On} has a very nice internal data-transfer capability that supports a high degree of integration," Ablondi maintains.

By pursuing the big-company market segment through direct sales, VisiCorp could indirectly attract independent software vendors. Once there was a large enough installed base of customers for Visi^{On}-compatible software, independent developers would have the incentive to rewrite applications. Most observers agree that achieving such a substantial customer base will take at least a year. By that time, environments such as Windows and DesQ could have made such an impact on the market through the independent channels that momentum alone would propel them to the top. "A lot of times, what determines the winner in the marketplace is who has the best entry," Ablondi states. "My gut feeling is that the MS-Windows and Quarterdeck DesQ strategy is the best entry-level strategy."

Software developers play vital role

Microsoft chairman Bill Gates confirms the strategy's appeal to independent software developers: "We have had an overload of demand for information and software so people can go ahead and adapt their applications." Gates expects more than 500 software companies to attend a seminar on MS-Windows the company intends to hold for independent software developers early this year. Even though applications written for the MS-DOS operating system will run under MS-Windows, developers will have to modify their packag-



Microsoft Corp. and VisiCorp lead software companies and lag behind only the top hardware manufacturers in revenues from the sale of software used on personal computers for the office. This position gives both companies a strong advantage in a battle for the software-environment market. The ultimate success of Microsoft's MS-Windows environment vs. VisiCorp's Visi^{On} environment depends more on the features of the two products, believes Bill Ablondi, head of market analysis for research company Future Computing Inc.

es to take advantage of data exchange, graphics and the pointing device.

Gates terms the Windows extension to MS-DOS "very complex," encompassing "data interchange, fonts, character sets, virtual keyboards, software protection, networking, devices and primitives." He reports that Microsoft is adapting its own application

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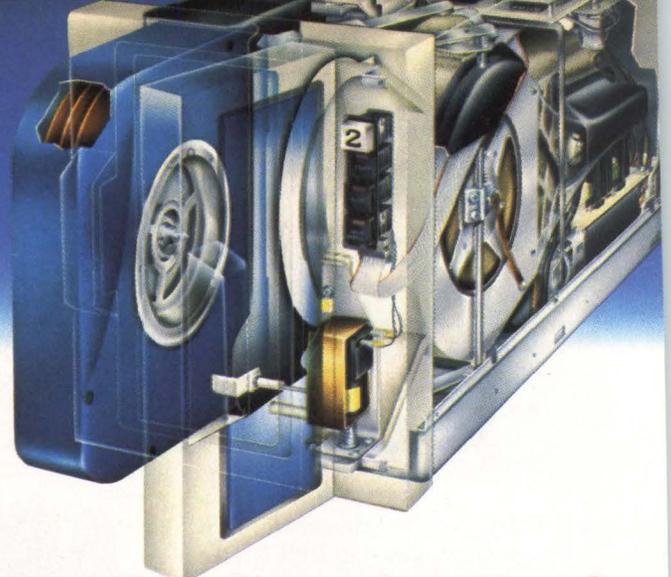
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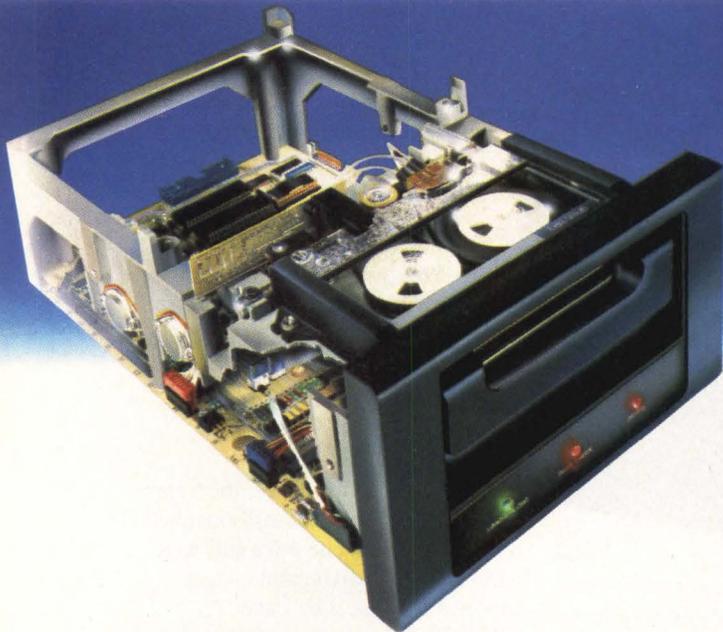
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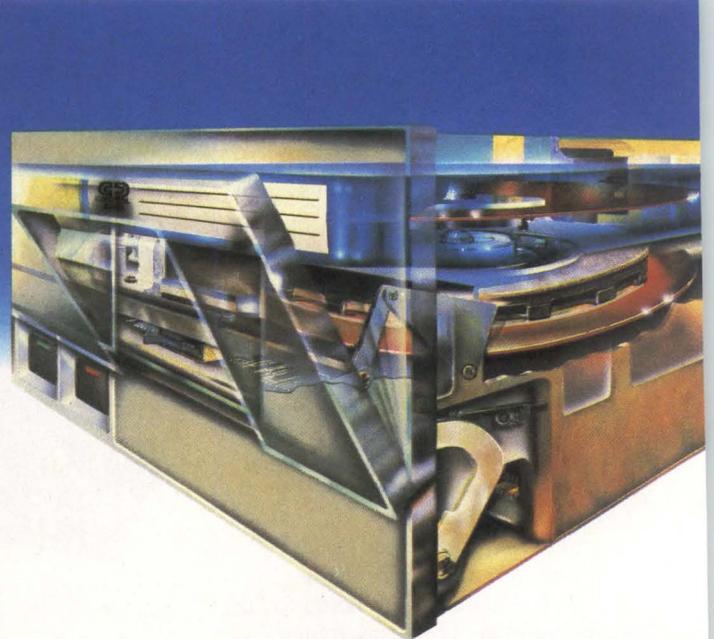
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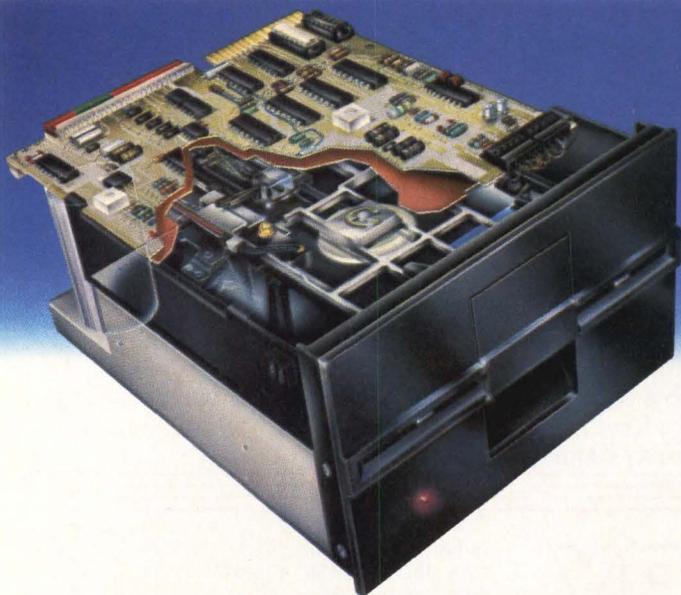
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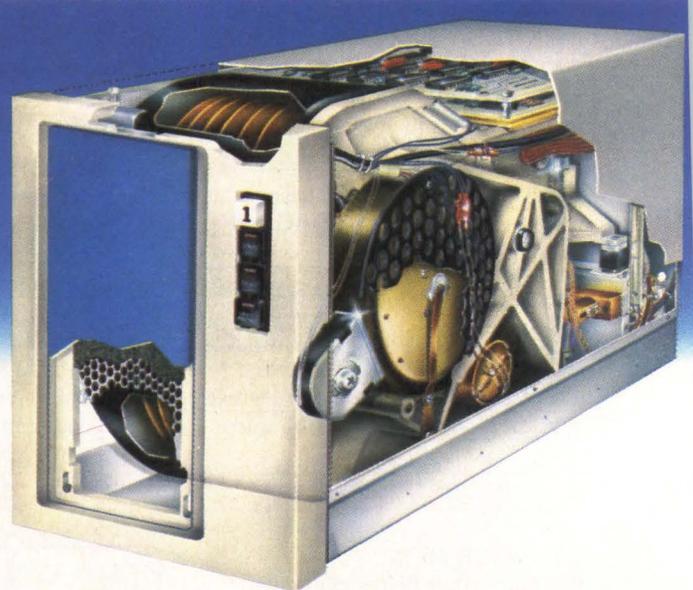
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CIRCLE NO. 68 ON INQUIRY CARD

The Interpreter

packages, Multiplan and Microsoft Word. But the investment in time to rewrite independent applications will fall on application developers. Gates concedes that whether or not his company succeeds in convincing independent software developers to make the investment in time will decide MS-Windows' fate. "The Windows strategy is a high-volume approach," he admits. It won't succeed if most of the applications written under MS-DOS remain unchanged, leaving the packages that require Windows to appeal to only a few MS-DOS users.

Some key application software publishers that announced their intention to adapt packages to Windows at Microsoft's unveiling of the product were Lotus, Software Publishing Corp., Software Arts Inc., Ashton-Tate and Peachtree Software Inc. Although affirming the company's support for Windows, Lotus president Mitchell Kapor is quick to claim that the level of integration possible under Windows can't equal that possible with an integrated package like 1-2-3.

What's more, Kapor says, Lotus plans to introduce a product this year that will offer multiple support for

other software packages. He describes the future product as less comprehensive than Windows, saying, "It's not our intent to go into the system software business." But he maintains that it will allow "open-ended" integration with other packages.

Microsoft's Gates dismisses Kapor's criticism by saying that packages such as 1-2-3 represent only a small part of the integration universe: "We're not really competing; there are going to be a lot of vertical applications." Most integration, he maintains, will take place through the general mechanisms that software environments provide.

The field takes shape

Quarterdeck sidesteps the issue of choosing one structure over another by letting users choose. Based on a high-level query language that Quarterdeck president Terry Myers describes as similar to LISP, DesQ contains mechanisms that adapt applications to work together. It "teaches" applications to use windows and pointing devices, and a user can pattern the format for data exchange to follow structures of current applications.

"You don't have to give up your favorite program to use DesQ," says Myers. Users can set the system up to be compatible with popular packages such as 1-2-3, and software developers can use DesQ to create vertical packages based on other software, she claims. Although this means that users must "teach" new applications to be compatible with the system before they become integrated into it, it also means users "aren't forced to change before they can grow," Myers maintains.

Digital Research Inc. (DRI) also claims to have a product, Concurrent CP/M, that is compatible with both of the most popular microcomputer operating systems—MS-DOS from Microsoft and CP/M from DRI. Although the single-user version of Concurrent CP/M can display multiple applications in windows on one screen, it is far more limited than most other products called software environments because it doesn't let applications exchange data.

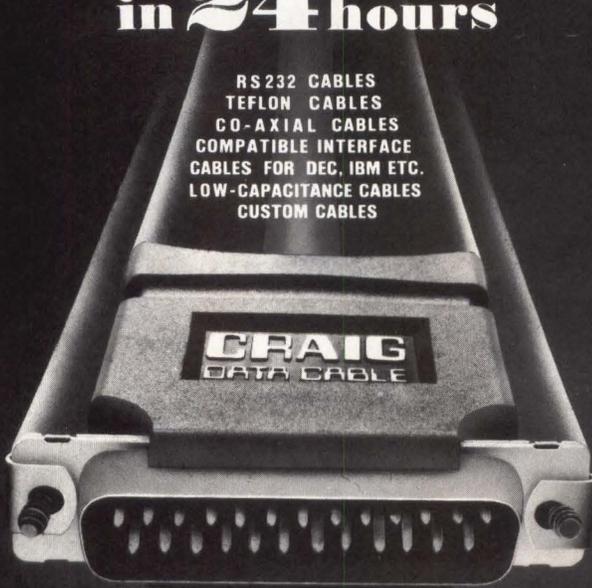
With major environments on the market or very soon to appear, the final outcome may be decided within the next year. Although Visi^{On} has the head start with an endorsement from IBM Corp., its competitors are nipping at its heels. The next few months will be important, believes Future Computing's Ablondi. As to VisiCorp's and Microsoft's approach to the market, he says: "Which will stand up in the long run remains to be seen." □

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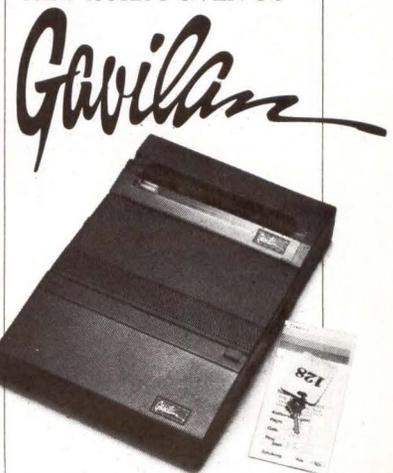
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The Integrator

Applying integrated systems in industry, engineering and commerce

A system integrator's guide to selecting CAE workstations

For computer-aided-engineering systems, workstation hardware should be selected for flexibility in adding value



Illustration by Jon McIntosh

Although choosing the right computer-aided-engineering workstation is far from easy, it can determine the system integrator's chances of success in a very competitive market.

Rattan Dhar, Masscomp

In a market filled with competitors and predicted to be heading for a shakeout, the success of a system integrator of computer-aided engineering (CAE) systems can ride on buying the right workstation technology from outside vendors. The question is: which vendor's hardware and software will dovetail with the integrator's plans to add value, price competitively and address customers' current and future applications?

This important decision is seldom easy. The list of CAE market players now includes vendors of mainframes, minicomputers and microcomputers, plus traditional computer-aided-design/computer-aided-

manufacturing system vendors, CAE start-up ventures, software houses and even suppliers of plotters and graphics terminals. The absence of de facto or legislated CAE product standards has made OEMs' evaluation process even more difficult.

Careful planning simplifies selection

With careful planning, system integrators can choose the best combination of workstation equipment for competing in the booming end-user market. As a first step, they should clearly identify where they will add special value to their systems. Secondly, they should commit to developing superior products that include the latest technology, regardless of how rapidly the

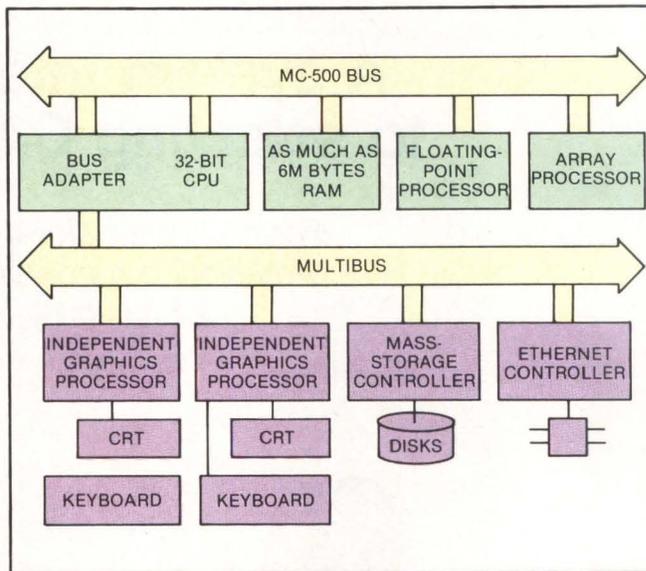
The Integrator

technology changes. Having taken these steps, OEMs can develop criteria for choosing workstations that provide the performance their system customers demand for increasingly complex technical tasks.

OEMs must determine where to add value to their CAE workstations with respect to the end-user market's four key driving forces: computational performance, network communications, graphics and application software. By recognizing the relative speed of technological advances and the availability of new technology in each of these areas, OEMs can decide what to develop in-house and what hardware and software to buy from specialty vendors.

For example, advances in memories, microprocessors and disk storage have far surpassed the technology that traditional minicomputer and mainframe vendors offer. A workstation's architecture should be flexible so that its developer can incorporate changes in these areas. In other areas—backup storage, graphics display monitors and packaging, for example—technology moves more slowly, enabling system integrators to add value and maximize the return on their investments.

CAE system integrators must understand the restrictions imposed by proprietary vendor architectures and protocols. Similarly, they must recognize the



A processor-independent architecture that segments key computational elements allows a CAE workstation to take advantage of the latest technology.

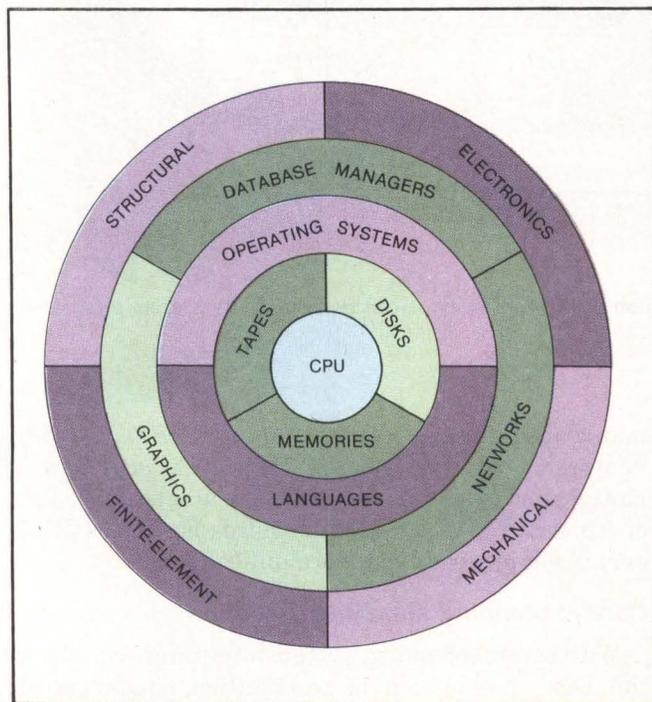
importance of de facto industry standards in workstation hardware, software and networking capability. Other crucial considerations include service and support, quality and competitive pricing. A CAE workstation OEM should choose equipment with a system architecture that addresses these issues.

Apply selection criteria to architecture

Selection criteria that a system integrator applies should ensure that a workstation's architecture will take advantage of the latest technology, provide stable OEM investments, incorporate standards, provide flexible design, address single- vs. multiple-user issues and allow growth and market expansion.

To take advantage of the latest available technology, workstation architecture must be processor-independent. One reason is that leading semiconductor companies force lower-cost, higher-technology components to market quickly. Long-term winners in microprocessor technology are thus nearly impossible to pick.

Incorporating the latest technology is also easier if the workstation architecture divides key application elements. It might, for example, dedicate processors to specific tasks such as computation and graphics display. Then, as different technologies experience different rates of change, the ability to incorporate them quickly does not destroy the integrity and stability of a CAE system. Consequently, the OEM does not have to invest in continual redesigns to prevent product obsolescence.



System integrators must choose the layers of a CAE system to which they will add value. The layers range from the very general—the processor level—to specific engineering applications. Intermediate layers include peripheral devices, system software and general functions such as graphics, networking and database management.

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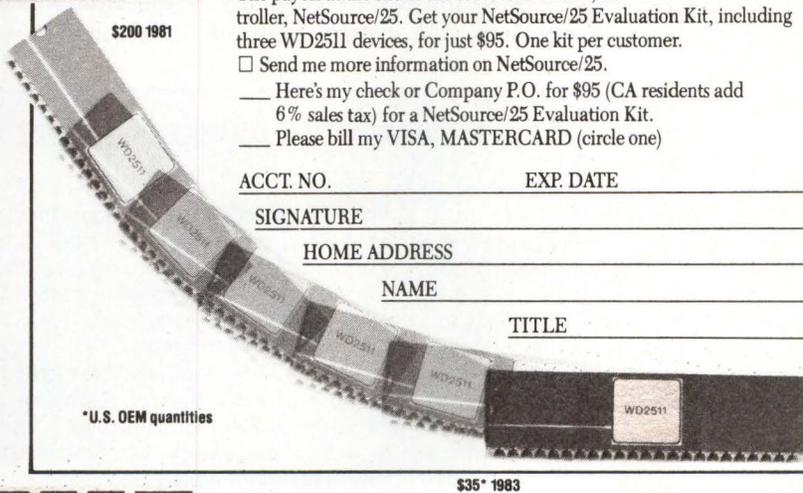
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Standards facilitate adding value

The incorporation of standards in vendor-supplied workstation architectures also simplifies the task of supplying the latest technology to system integrators' customers. Standard operating systems, buses, communication protocols, languages and disk controllers provide a base for hundreds of potential products. Proprietary architectures, on the other hand, lock integrators into system technology. By forcing OEMs to fund and design inflexible products, they drain internal resources and prevent investments in areas that give system customers unique added value.

Standards also provide another type of flexibility: they keep a system integrator from being locked into a vendor and thus dependent on the vendor's success. In addition, standards make an OEM's application software more transportable, providing system customers compatibility with their current systems.

The fallacies of total compatibility and of large customers benefiting by buying from only one vendor are no longer issues. Migration is simpler and easier to implement with standards, and every major OEM buys computers from more than one vendor. The task required of workstation designers, therefore, is to provide an architecture that incorporates the standards in which OEMs' application investments reside and to provide a structure for absorbing the latest technology.

For CAE system integrators, the critical issue of

design flexibility—the ability to add or change peripherals, to incorporate other vendors' software or to change a graphics display monitor—depends heavily on the original architectural design. By allowing the partitioning of technology, product and application elements, a bus-structured workstation presents advantages over a fixed-functionality workstation. Bus structures also facilitate the addition of performance enhancers such as floating-point hardware and array processors.

Fixed functionality has shortcomings

Fixed-functionality workstations suffer additional shortcomings. For example, because functionality is fixed, application software is the OEM's only added value. Fixed-functionality workstations can't be optimized for both current application requirements and future technology advances; they're designed to ride the cost curve on the assumption that applications remain stable and well-understood. Those workstations will eventually approach being commodity products, pitting OEMs directly against their suppliers. With no hardware uniqueness, OEMs can be forced into supplying only software.

A CAE workstation's architecture should also address the issue of single- vs. multiple-user systems. Although the trend today is toward one user per workstation, cost per user is still better in a timeshared environment. Workstation architecture, therefore,

THE CAE WORKSTATION MARKET: A PRIZE WORTH WINNING

Semiconductor companies that wanted to automate IC design helped create the market for computer-aided-engineering (CAE) workstations. Concerned with engineering productivity, creativity and quality, these companies now demand workstations at a rapidly increasing rate.

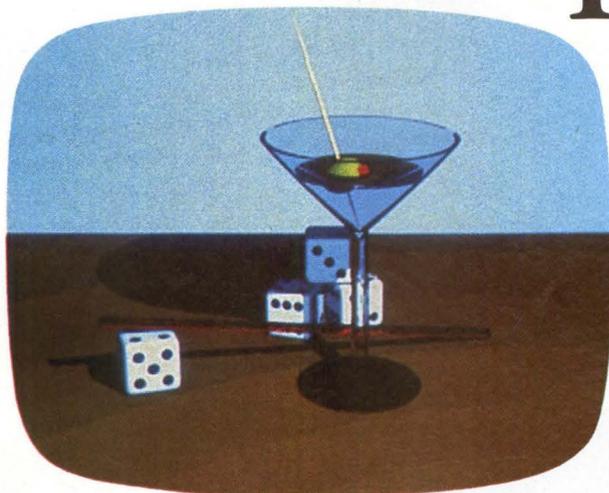
Early CAE programs promised to streamline nearly all IC design phases—from creation to performance simulation. Because processes such as prototype testing are computation-intensive, however, engineers were tied via terminals to mainframe computers—an improvement over pencil and paper, but not an ideal solution. Besides paying the high cost of buying, installing and maintaining mainframe equipment, companies found that exasperated design engineers were competing for computer

time. Backlogged work loads running in batch mode plus an increasing number of terminals sharing a central computer slowed graphics performance and system response time to engineers' design inputs.

The development of 32-bit stand-alone workstations brought about a great improvement, however. With powerful, dedicated microprocessors for local computation and graphics processing, these machines essentially bring the power of a mainframe to a design engineer's desk. With them, engineers not only can create a circuit but also run logic simulations, verify circuit timing, make quick design changes and produce high-quality product documentation—all on a desktop. Networking enables engineers to share peripherals and pass information between workstations.

Driven by high engineering salaries, a shortage of design talent, an increased demand for complex chip designs and calls for increased productivity and quality, IC-design companies are increasingly placing CAE workstations on their shopping lists. Dataquest Inc., a Cupertino, Calif., market research company, predicts an explosion in demand beginning early this year and an increase in annual worldwide sales to 9,000 systems with a value of nearly \$450 million—up from only 200 systems sold in 1982. Another research company, International Resource Development, Norwalk, Conn., predicts that the installed base of CAE workstations will increase from 8,800 in 1983 to 275,000 by 1993.

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Vectrix Midas Color Card

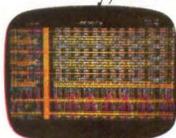


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should allow OEMs to support timesharing, network-resource sharing or standalone workstations. Vendors cannot pre-define OEMs' requirements and applications.

Finally, CAE workstation architecture must address system integrators' concerns about growth and market expansion. As OEMs become larger and their markets expand, their workstation requirements also changes. Their ability to react to these changes depends largely on their initial workstation selection. They should ask how well-assembled the workstation's bus structure is, how large the workstation can grow, how small it can get, whether the software can support more than one graphics terminal, whether array processors and floating-point processors are available and whether they can be integrated as coprocessors for greater performance. Answering these questions requires careful examination of workstations' architectural designs.

Keep an eye on market forces

The four forces that drive the CAE workstation

Recognizing how fast different technologies change helps the system integrator determine what to develop in-house and what to buy from outside vendors.

market—computational power, communications, graphics and application software—also help define an ideal workstation.

Because computational power rides the fastest moving part of the technology curve, workstations should be performance-oriented. Desirable features include microprocessor independence, CPUs with cache memory, multiple computational processors, dedicated special-purpose processors, floating-point processors, array processors, multiple-bus structure and high-performance peripherals. In addition, a workstation's operating system should add functionality and ease of use.

A workstation's networking capability is most useful—allowing communication with machines of various types—if it is based on readily available industry standards, such as Ethernet. It should work with low-performance, disk-less systems as well as disk-based systems and it should work with single-user workstations and workstation clusters.

Because both applications and technology drive

graphics requirements and because no one vendor yet supports the vast range of requirements in resolution, speed, refresh rates and special enhancements, a workstation architecture's graphics support takes on special significance. For instance, a flexible graphics architecture might permit the addition and subtraction of graphics processors or monitors depending on OEM needs. It might also use a separate graphics processor for image drawing. Graphics presents an ideal area for OEMs to add value, especially if the graphics processor can be re-programmed to meet specific applications.

System integrators must determine where to add value to their CAE workstations with respect to the end-user market's four key driving forces: computational performance, network communications, graphics and application software.

Finally, because system integrators supply application software themselves, workstation vendors needn't concentrate on it unless they intend to compete in end-user markets. But, because some OEMs require additional software packages from a vendor to round out their systems, the availability of applications such as word processing and database management can be helpful.

CAE end users demand performance

A CAE workstation must address the technology requirements of an OEM's customers through performance-oriented architecture. In selecting a workstation, system integrators must understand not only their own needs but also the relationships of the driving forces behind the workstation market.

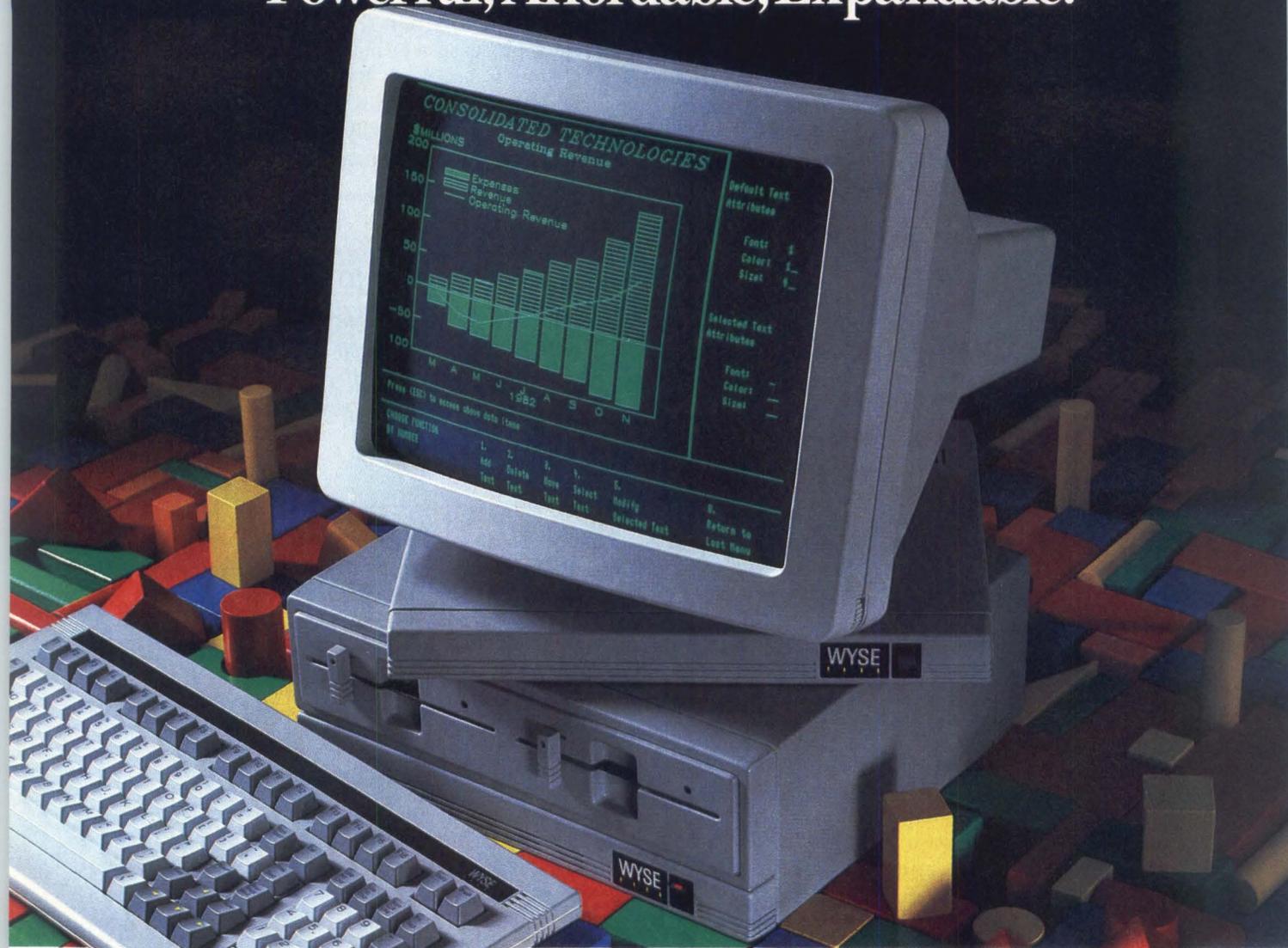
Further, end-user CAE customers are typically engineers who understand and appreciate the importance of effective technology; their personal requirements often outweigh the requirements of their work tasks. Because they know the technology is available, they want virtual personal minicomputers offering far more computing capability than simple workstations offer. □

Rattan Dhar is CAE marketing manager for Masscomp, Westford, Mass.

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CIRCLE NO. 77 ON INQUIRY CARD

The Integrator

Broadband networks prove expensive for interconnecting terminals

Detailed installation-cost analysis tips the scales in favor of conventional twisted-pair systems

Walter A. Levy, Contributing Editor

Broadband local-area networks (LANs) can integrate digital, voice and video data and provide a cost-effective link between terminals and central computers in sophisticated communications systems. In many cases, they can also reduce the cost of wiring business offices for computers. As a detailed study of one end user's requirements shows, in older buildings and environments that cannot be extensively remodeled, a broadband LAN costs more to install than a conventional point-to-point system with similar capacity employing patch panels and twisted-pair wiring or coaxial cables. The survey has other implications that organizations planning to install a large LAN should consider:

- Only a detailed, real-world "apples-to-apples" study comparing competing LAN systems can determine the most cost-effective approach.

- Computer personnel cannot accurately estimate the installation costs involved. Electrical and architectural contractors can provide comparative cost quotations. The contractor's perception of the labor-dominated costs largely determines the job's cost estimate.

- Building conditions and architectural peculiarities can affect costs more than the wiring method and technology employed. It proved less expensive in this case for an electrician standing on the floor to pull a large bundle of wires than to stand on a ladder to install an overhead coaxial cable.

- High-technology LANs are more complex than older systems and place greater maintenance and modification demands on end-user organizations. They are also more difficult than older systems to install in buildings. To justify the additional inconveniences and risks they entail, their benefits should be overwhelming.

ORIGINAL CONVENTIONAL NETWORK PLAN

Capacity

- Patch-panel capacity for 442 terminals
- Riser wire installed for 300 terminals, ducts permit more
- Initial installation for 120 new terminals, must connect cabling for 50 terminals.
- Provides to 10 to 20 IBM 3270 terminals.

Wiring method

- PVC-insulated RG59/U coaxial for all risers, horizontal runs to exterior walls and floor outlets
- Teflon-insulated RG59/U horizontal runs to interior walls

Wiring enclosure

- Rectangular steel riser ducts, horizontal duct on each floor from patch panel to peripheral wall
- Peripheral wall radiator enclosures
- Under-floor cells to reach floor outlets

Active elements

- None

Passive elements

- One BNC/TNC feed-through adapter pair per twin cable at each patch panel
- Two junctions in each cable pair between VS-100 port and terminal

Critical elements

- No single point of failure

Defining the problem

Main Hurdman, a large New York accounting company, commissioned the study comparing a broadband cable-based CATV LAN with a conventional system based on twisted-pair and coaxial cable. The company occupies six adjacent 100-by-200-foot floors in a midtown Manhattan building. The company's computer room is on the lowest floor. The company uses

The Integrator

word-processing systems and report-production systems from Wang Laboratories Inc. and a 4341 computer from IBM Corp. for accounting. When the study was authorized, the company had approximately 40 Wang OIS workstations, was about to install a Wang VS-100 computer and had requirements for 120 more workstations. It also had installed 10 IBM 3270 workstations and expected to install 10 more. Additional workstations would probably be required in the future.

Until the study, Main Hurdman had installed workstations one or two at a time. The building's electrical contractor ran cable between the computer room and the workstations, using RG59/U coaxial cable insulated with polyvinyl chloride (PVC) when possible and with Teflon when the cable had to run through air-circulating plenums. Cost for each run ranged from \$1,000 to \$2,000, depending on the material used and the length.

Main Hurdman had installed cables one at a time even though it was costly and disruptive. But, because

the company planned to add many terminals and because growth seemed likely, the company decided it needed an organized LAN to reduce cabling costs and minimize disruption.

Start with system requirements

Because Main Hurdman was constantly reorganizing its space and moving people between offices, its LAN was required to support the Wang and IBM units to allow flexible interconnection and to provide easy reconfiguration. But it was required neither to interconnect the Wang and IBM units nor to support other

Building conditions and architectural peculiarities can affect costs more than the wiring method and technology employed.

ORIGINAL WANGNET LAN PLAN

Capacity

- Coaxial cable equipped with 342 taps
- Wangnet Peripheral Attach Band support as many as 192 terminals
- Initial installation of 120 new terminals, connect 50 terminals
- No provision for IBM 3270 terminals

Wiring method

- Main CATV cable turn is ½-in. diameter fused disk-insulated, plenum-rated cable
- Drops from taps to all wall and floor outlets are Teflon RG59/U cable

Wiring enclosure

- Cable unenclosed in overhead plenum
- Wall outlets fished through walls
- Under-floor cells used to reach floor outlets

Active elements

- 34 line-extender amplifiers
- One head-end system
- Two power supplies and combiners
- 75 netmuxes (RF modem, converts signals to 2M bps baseband, supports as many as eight terminals)

Passive elements

- Two attenuators, 68 equalizers
- 20 signal splitters, 10 direction couplers
- 342 taps (mostly four-port)

Critical elements

- All active elements except netmuxes are possible points of failure
- Failure of any active or passive element can block large sections of cable

terminals and computers. The LAN also was required to accommodate expansion to 300 terminals without excessive expense and to allow the later addition of a second VS-100.

Architectural and organizational characteristics of the offices and building that had an important influence on networking methods and costs included:

- One or two high-level professionals in enclosed offices would use most of the workstations. There would be no "bullpens" with large clusters of workstations; instead, workstations would be at islands in the middle of the rooms.

- The units would be connected through under-floor ducts and floor-mounted, "monument"-style outlets crowded with telephone wires.

- Baseboard radiators along the exterior walls of the building, enclosed in sheet-metal housing with easily removed panels, provided a convenient and economical raceway for computer terminal cabling and would easily handle large bundles of cable.

- Because the offices were furnished and in use, night-shift work would be necessary to minimize disrupting office routine. Installing cabling would require destroying and then rebuilding some walls and ceilings.

- Like all other major cities, New York requires overhead electrical wiring that passes through an air-circulating plenum to be Teflon-insulated or to be enclosed in steel conduits to pass stringent burn-resistance tests. However, Teflon-insulated cable is more costly and more difficult to work with than PVC-insulated cable.

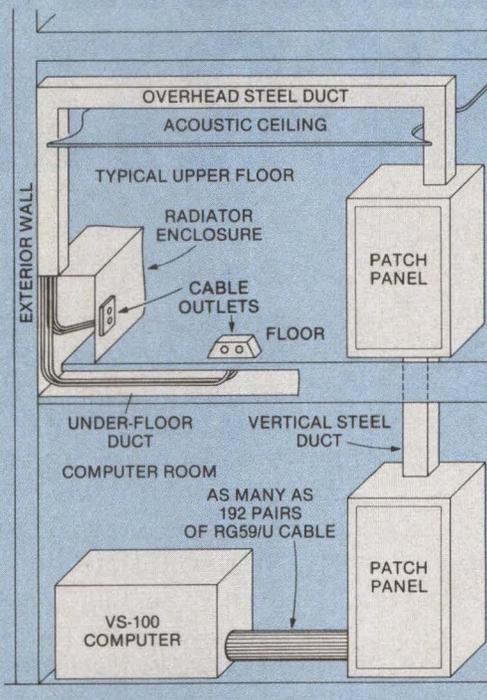
Installing the conventional network and the WangNet system

The conventional network required patch panels to be placed in the computer room and on each of the other five floors. Steel vertical riser ducts measuring 4 by 8 inches connect the patch panels on each floor to a nearby exterior wall and to the baseboard radiator enclosure. Wiring to exterior wall outlets or to the under-floor cells is pulled through the radiator enclosure, as shown in the simplified floor plan. The plan called for PVC vertical and horizontal cables and Teflon cabling to interior wall outlets, which were pulled overhead and snaked through partitions.

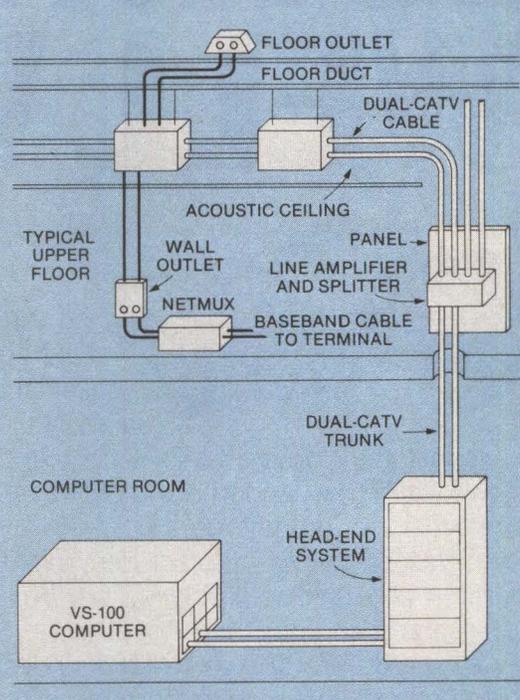
The WangNet CATV head-end equipment is installed in the computer room. The dual-CATV trunk cable runs vertically to each floor and horizontally around each floor in the overhead plenum above the corridor. The plan placed taps at frequent intervals because wall outlets cannot be further from the trunk than 60 cable feet. Wall outlets were reached by snaking drop cable through partitions. Floor outlets were accessed by punching into the duct from the floor below. The CATV trunk comprises plenum-rated cable using widely spaced insulator disks. The drops are Teflon-insulated RG59/U cable. The simplified floor plan shows the original routing method.

System integrators proposed the idea of routing the WangNet CATV cable through the baseboard radiator enclosures but rejected it because of the size of the amplifiers and taps and concern for the effect of radiator heat on the amplifiers. This exterior routing would also have prevented placing wall outlets in interior offices because of the 60-foot drop-cable length limit.

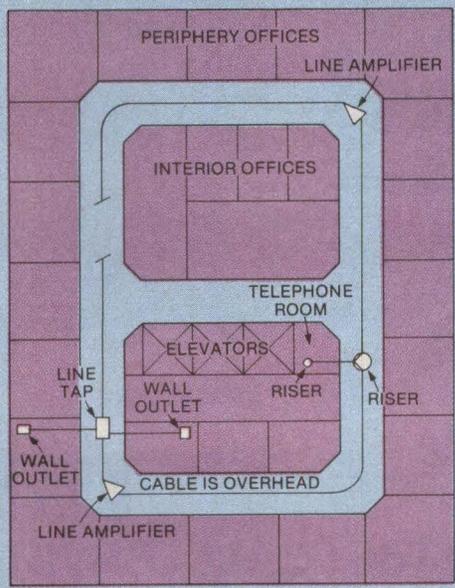
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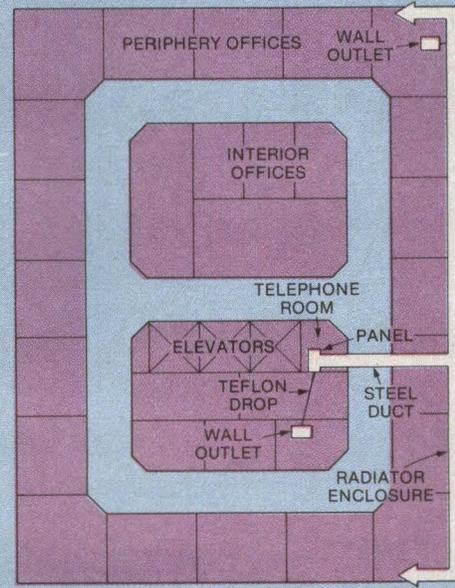
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TYPICAL SIMPLIFIED FLOOR PLAN



TYPICAL SIMPLIFIED FLOOR PLAN



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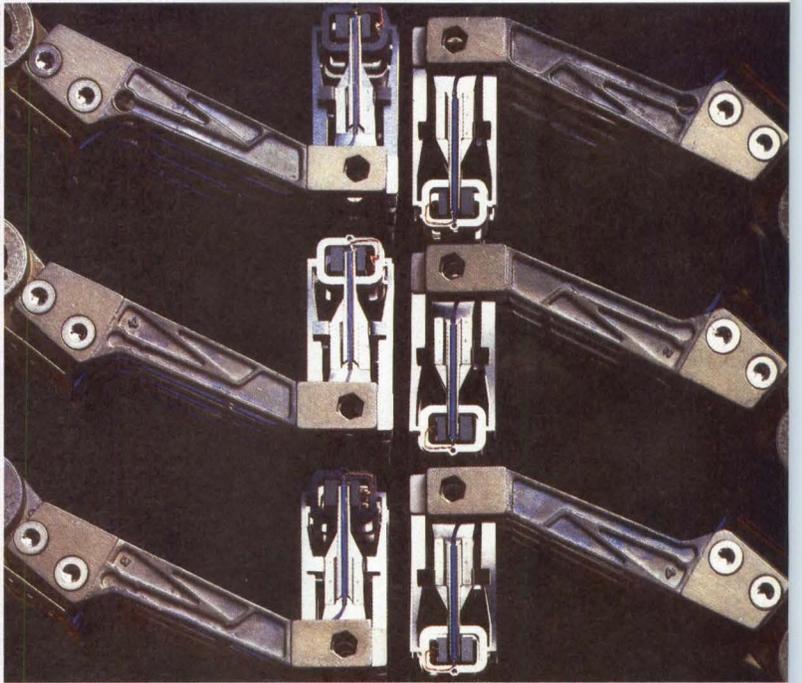
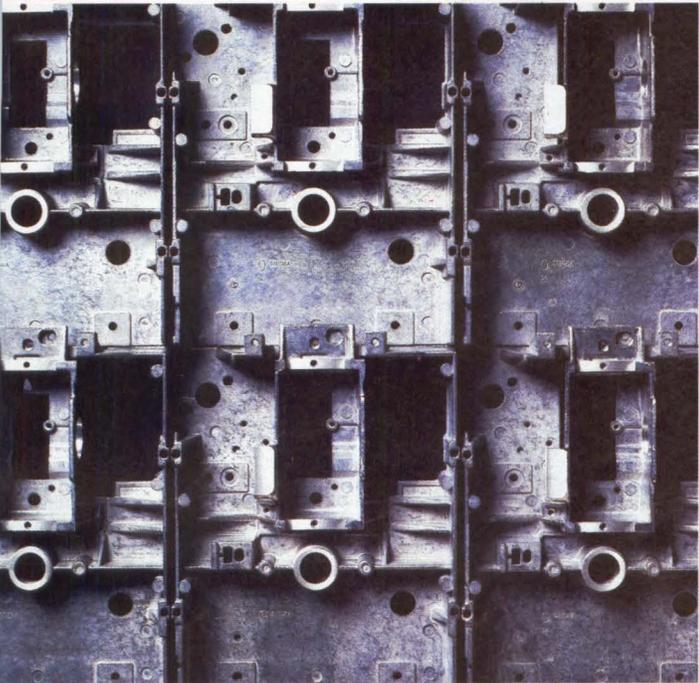
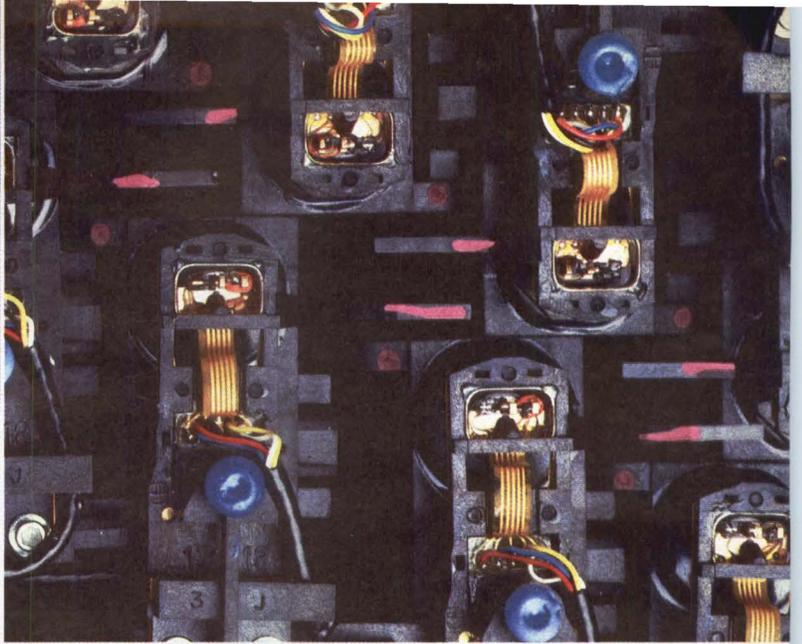
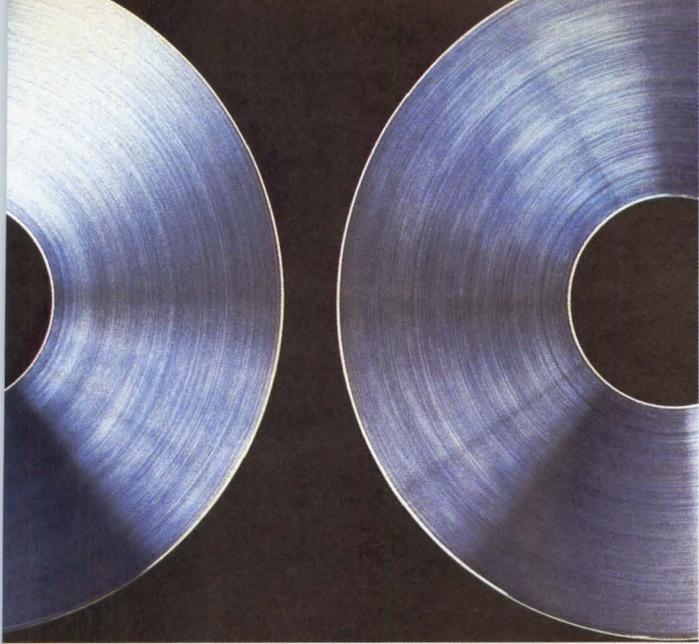
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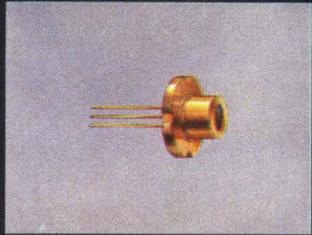
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The fascinating tale behind the world's first* laser video disc player with a semiconductor laser by Hitachi.



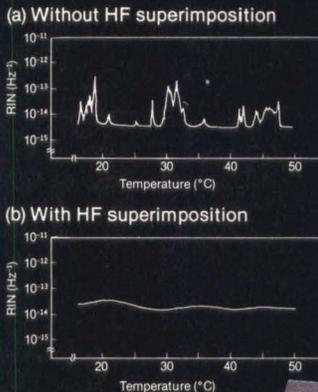
The advantages of the laser video disc are considerable. The same size as an LP record, the laser video disc can hold more information in less space than any other medium today. And that information is rapidly and selectively accessible. Combined with computer programmability, the varieties of interaction between the viewer and the machine are a distinguishing feature of the disc and player.

Until now, large bulky gas lasers were used to track the discs. The advantages of semiconductor lasers were not unknown but they had serious problems.

When the temperature fluctuated, so did the output power of the semiconductor laser. This resulted in noise and seriously interfered with quality laser disc reproduction. Hitachi's research team began a series of experiments to see if the problems could be solved.

Changes in the heat sink temperature resulted in considerable noise [see fig. 2 (a)]. Mirror feedback increased the noise (mode hopping noise) and is represented by the clearly visible peaks.

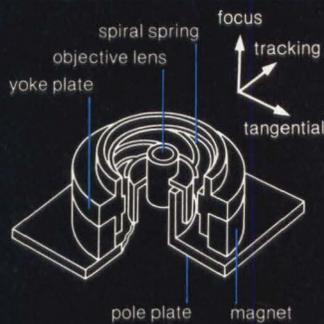
Fig. 2 RIN (Relative Intensity Noise) at various temperatures



The line in fig. 2 (b), however, is remarkably straight. It represents measurements under the same conditions as for fig. 2 (a) but with a superimposed HF (high frequency) sinusoidal current. These experiments clearly show that noise can be virtually totally suppressed by HF current superimposition.

This important breakthrough made a laser video disc player with a semiconductor laser a practical possibility. And Hitachi's technological expertise has made such a high-quality, ultra-compact and light player a reality. Other special features include an exceptionally durable motor, unusual design for rapid servicing, ultra-high speed random access and accurate tracking with a Hitachi-developed 3-directional actuator.

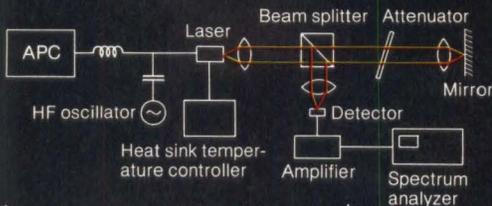
Hitachi's 3-Directional Actuator



Application of this unique and powerful medium is barely beginning. For education, for training, for "living catalogues," and for computer visual programming of amazing speed and flexibility, the laser video disc is unique. And Hitachi's laser video disc player is, perhaps, the first to realize the medium's full potential with greater ease and convenience than has ever been possible before.

* Specifically, the world's first mass-produced laser video disc player with a semiconductor laser. (Production began September, 1982.)

Fig. 1 Measuring Laser Noise



A special configuration to measure laser noise was used. [see fig. 1] An automatic power control circuit maintained a constant power output. A beam splitter deflected part of the output which was focused on a detector. Another part was focused on a mirror and an attenuator controlled the feedback light intensity.



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The Integrator

These factors increase network installation costs over what they might be in a more accommodating environment. Some factors increase the cost of a broadband LAN such as Wang's WangNet in comparison to a conventional approach.

Compare the system alternatives

Main Hurdman considered two approaches in its LAN survey—the WangNet system with Peripheral Attach Band and a conventional RG59/U coaxial-cable-based system. The Wang system, a CATV cable-based trunk system, is compact and easy to install in a finished building, and the RG59/U system uses patch panels for flexibility. Two factors, however, worked against the Wang system. For one thing, Wang could not demonstrate its Peripheral Attach Band at any customer site at the time of the study (the first quarter of 1983), and Main Hurdman did not want to wait for a field test and release of the product. Secondly, WangNet could not support IBM 3270 terminals.

Nevertheless, Main Hurdman decided to obtain cost estimates for both approaches. If the WangNet approach proved significantly less expensive and more flexible than the conventional network, then the company might wait for the release of the Peripheral Attach Band facilities. If not, it would proceed quickly with the conventional patch-panel method. The company drew up two sets of plans, one for each of the cabling approaches (see "Installing the conventional network and the WangNet system," Page 141). It revised the conventional system plan once; the Wang system plan, twice.

Assessing the system

The conventional system could accommodate more terminals and had greater capacity for expansion. It had no active electronic elements and, thus, no possible points of failure, whereas the broadband system had many: 34 line-extender amplifiers, power suppliers and a head-end system. On the other hand, the CATV components WangNet employs have a long history of field use and are inherently reliable.

Because none of the system integrators expected the costs of either approach to be as high as they were, they prepared both plans with few economic considerations. Furthermore, the conventional plan had far more cable and patch-panel capacity than needed. The WangNet approach had taps at every point on the trunk cable. RF modems called network multiplexers, placed close to end users, connected the broadband cable to as many as eight Wang workstations per office. The network multiplexers were used inefficiently, however, because

Costs	Original plan (\$)	Revised plan (\$)
Patch-panels and cable	46,000	26,000
Electrical contractor's cost	282,000	201,000
Ceiling repairs	15,000	15,000
Total	343,000	242,000

Fig. 1. Conventional system cost comparisons show that the revised plan eliminated unneeded panel boards in the computer room and reduced riser wiring—but not duct capacity—from 300 to 150 terminals.

Cost element	Original plan (\$)	Revision #1 (\$)	Revision #2 (\$)
Electrical contractor's costs	173,000	209,000	232,000
Wang-furnished CATV cable components	45,000	25,000	15,000
Netmuxes and racks	75,000	35,000	32,000
Ceiling repairs and improvements	40,000	15,000	15,000
Total	333,000	284,000	294,000

Fig. 2. Broadband LAN cost comparisons show that, in the WangNet plan's first revision, the CATV trunk cable was rerouted to avoid costly ceiling repairs and the network multiplexers were clustered in corners, reducing the number required from 75 to 30. Terminals are connected through radiator enclosures, using low-cost PVC cable. The second revision used the CATV system only in the risers, clustered the network multiplexers in the telephone room on each floor and employed the horizontal wiring of the conventional system.

	Wangnet LAN	Conventional network
Terminals initially installed	120	120 plus 20 IBM 3270s
Maximum system terminal capacity before major renovation required	192	300 to 400
Cost to add an outlet on any floor	\$615	\$300 to \$500 (periphery offices) \$600 to \$1,200 (interior offices)
Cost for extra netmux	\$1,100	not required

Fig. 3. Expansion costs and reserve capacity of broadband vs. conventional network show that one network multiplexer would be required for one to three new terminals installed because of the building configuration. Most of the offices are on the periphery of each floor, reducing the cost of adding a new outlet in the conventional system.

The Integrator

there were typically only one or two workstations per office. Running the CATV trunk above every corridor minimized the amount of cable needed but required destroying large sections of ceiling and constructing many service-access panels to the line amplifiers and other cable components. On the other hand, the installation cost of the conventional system was decreased because the electrical contractor knew how to pull large bundles of PVC cable through the radiator enclosures.

In both systems, a difficult installation task was snaking cables through under-floor cells to the floor pedestal outlets serving the mid-floor islands. The fact that the cells were crowded with telephone wiring increased the costs of both approaches.

When Main Hurdman revised the conventional plan, it eliminated unnecessary panel boards and reduced the riser cabling to handle 150 terminals (300 cables). This made the conventional approach approximately equal in capacity to the WangNet approach.

The system integrators tried two alternative CATV trunk-line methods for the WangNet approach to reduce the number of network multiplexers required,

wiring costs and ceiling repairs. In the first revision, they rerouted CATV trunks to avoid ceiling damage, reduced the number of taps and decreased the number of network multiplexers by clustering them at the corners of each floor and running PVC cable from them to the terminals through the radiator enclosures.

In WangNet revision 2, the integrators used CATV trunk only in the risers, clustered the network multiplexers on each floor at the head of the risers and connected them horizontally to the terminals, using the same distribution scheme as the revised conventional plan.

Some factors increase installation costs over what they might be in a more accommodating environment.

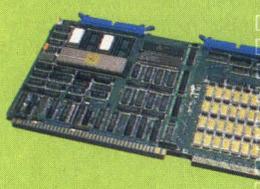
The original conventional network (Fig. 1) and WangNet plans (Fig. 2) were virtually equal in cost, but the conventional plan could handle more terminals. It was less expensive to add terminals using the conventional system unless the new terminal requires an interior wall outlet (Fig. 3). Three-fourths of the offices on each floor are on the periphery, reducing installation costs for the conventional system. In both the original and revised plans, cost of the WangNet system proved equal to or significantly higher than the conventional cable system.

Installation costs dominate

The LAN installation cost-comparison study permitted Main Hurdman to decide if waiting for a new LAN product would result in significant cost savings and provided reliable cost estimates, which could not have been obtained without comprehensive plans. The architectural characteristics of Main Hurdman's building affected the choice of the conventional system. Because the offices had been finished several years earlier, it was not practical to consider new construction methods. Instead, the company selected a plan in which secretarial work areas were located next to a column or wall, reducing cable-installation costs. Installation costs for other coaxial-cable-based LANs would probably not have differed significantly from that of WangNet. System integrators planning a LAN installation would do well to consider the primary lesson of the study: any realistic comparison of LAN systems requires a detailed installation cost study as part of the physical planning process of remodeling and constructing work spaces. □

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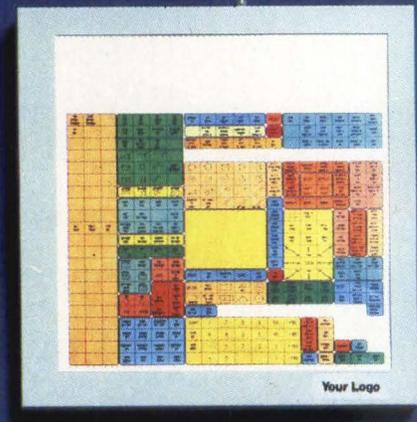
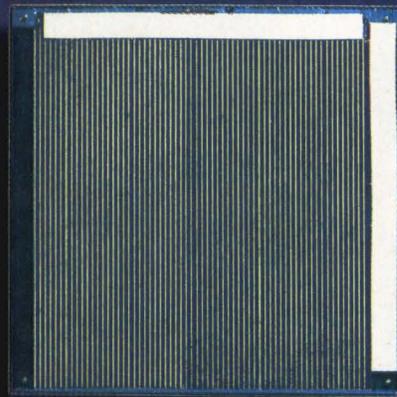
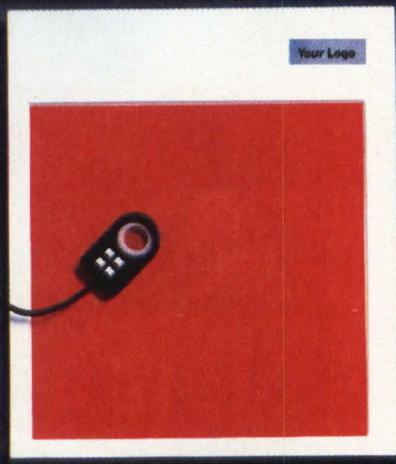
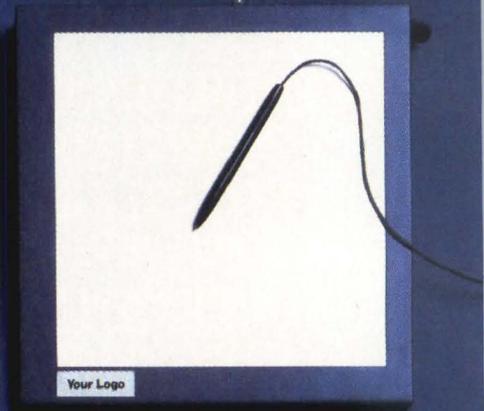
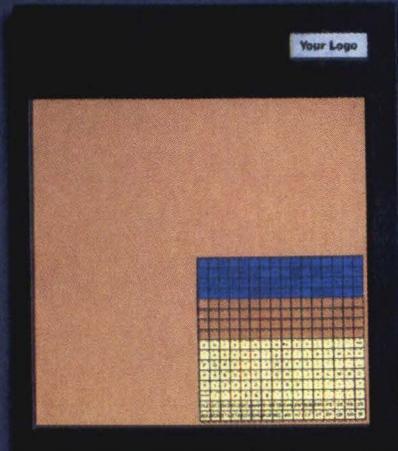
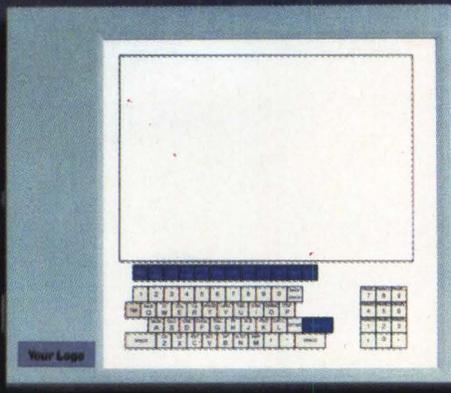
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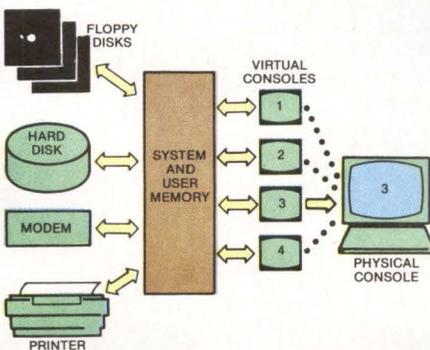
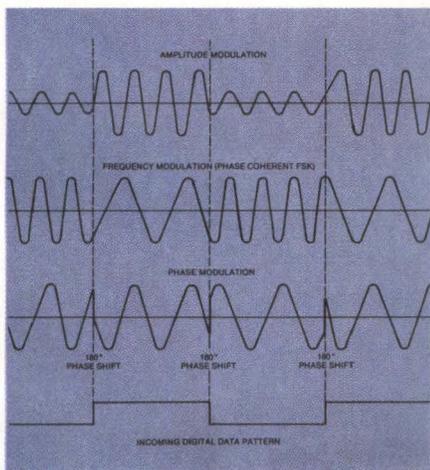
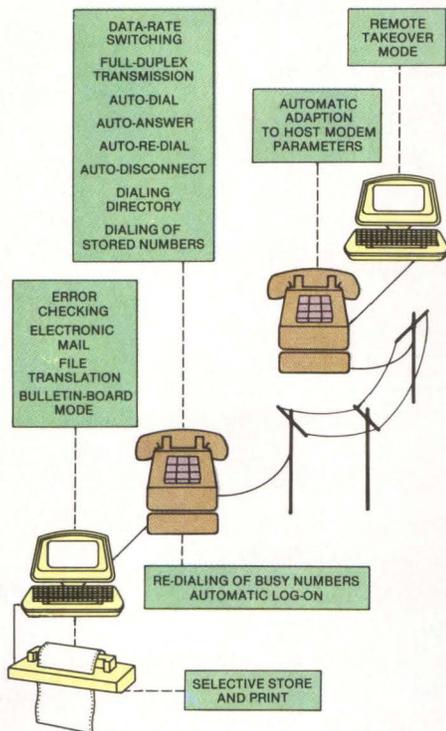
So if the other digitizer tablets on the market have been looking drab to you, take a look at CalComp's

2000 Series. It stands out—even when it's fitting in.

For complete information, call or write: CalComp, 2411 West La Palma Avenue, P.O. Box 3250, Anaheim, CA 92803. In continental U.S., except California, call (800) 556-1234, ext. 156. In California call (800) 441-2345, ext. 156.

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FEATURE HIGHLIGHTS



DATA COMMUNICATIONS: Starting on p. 153, MMS surveys **communications software** for modems connecting micros and minis to a remote computer by means of the dial-up phone network for asynchronous data transfer. The accompanying table, which begins on p. 161, features more than 50 companies and 70 products. . . Gandalf Technologies Inc. has produced a data-over-voice device that combines a local modem and frequency filters to allow simultaneous data and voice transmissions on one telephone-wire pair. The **Line Miser**, detailed on p. 184, works in PBX Centrex and key telephone systems. . . **Modem-expansion boards** represent a fast-growing area of communications equipment. Many computer manufacturers and third-party vendors offer these completely engineered and fully functional modems on a PC card for use with personal and small computers. A survey of 12 of these manufacturers and 20 product offerings starts on p. 193.

SOFTWARE: Software is rapidly becoming important in the battle for communications network supremacy. While some software vendors have allied themselves with a specific network, others seek a **network-independent solution**. uNETix, developed by Lantech Systems Inc., is one such solution. Turn to p. 211 for more information on this UNIX-compatible, multitasking operating system. . . A **concurrent operating system**, which allows several programs to run simultaneously on one CPU, saves time and money and enables system designers to build more sophisticated applications. Details of one such system appear on p. 231.

WORKSTATIONS: The introduction of CAD tools in publishing has made product design a fast and easy process. The documentation process, however, remains a slow manual process and so artwork, which represents 20 percent of a document, consumes 80 percent of the labor involved. A new computer-aided-publishing (CAP) system by Qubix Graphic Systems Inc. promises to speed documentation considerably. See p. 217 for details.

DISK DRIVES: Looking for a floppy drive's single-package advantages without its limitations? Look no further, because DMA Systems Corp. has literally folded a conventional full-height Winchester cartridge drive in half. The model 360, presented on p. 245, is the first major application of folded PC boards in computer peripherals.

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Economical, cost-effective datacomm systems require economical, cost-effective modems. That's why 208s from UDS are the optimum buy.

UDS produces a basic 208A/B which may be adapted for private or public network use. In the private line ("A") configuration, the UDS 208 provides full duplex operation; when configured for the two-wire circuits ("B" version) it is a half duplex device and is FCC certified for direct connection to the dial-up network.

Three simple strapping changes determine whether the unit is in the "A" or "B" configuration. Anti-streaming protection, extensive self-

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UDS 208s are available as free-standing units, OEM cards or basic components of the RM-8 multi-channel package. This version supports up to eight communications channels or a mix of modem, auto-dialer and other support cards. For the ultimate in quality, reliability and economy in 4800 bps data communications, select UDS 208s or RM-8s. Universal Data Systems, 5000 Bradford Drive, Huntsville, AL 35805. Phone 205/837-8100; TWX 810-726-2100.

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Richardson, TX, 214/680-0002 • Englewood, CO, 303/694-6043 • Houston, 713/988-5506 • Tustin, CA, 714/669-8001 • Mountain View, CA, 415/969-3323 • Silver Spring, MD, 301/587-0166



Modem-support software gains in communications capability

From accessing satellite links to supporting error checking, electronic mail and file translation, communications packages can do much more than transfer data to a remote computer

Jesse Victor, Associate Editor

Modem-support packages furnish a wide range of functions for system integrators seeking to expand the capabilities of their computer systems. Communications software permits a microcomputer or minicomputer to access an information utility or database, connect to a timesharing system or transfer files to a remote host computer. Thus, it provides capabilities that range from merely assisting a modem in making a connection on the dial-up phone network to accessing satellite and X.25 links and automatically scheduling communications for 50 or more terminals. Even basic modem-support software—packages selling for less than \$100—can now implement a host of automatic dialing functions, perform error checking and support electronic mail and file translation.

Profiling the packages

The table (Page 161) surveys communications software for microcomputers or minicomputers that assist modems in connecting to a remote computer using the dial-up phone network for asynchronous data transfer between the computers. The table, therefore, covers neither packages for hard-wired links not using phone lines for data transfer nor terminal-emulation packages that are sometimes classified as communications software. The table also does not include bulletin-board packages that cannot transfer files, electronic-mail software, local-area-network software and sophisticated, high-end integrated business-support packages that include a file-transfer utility.

Modem-support software packages function with one modem or modem type or a range of modems, work under one of several widely used operating systems and have prices ranging from less than \$100 to more than \$5,000. Most of the products in this profile sell for \$100 to \$300; many are available for less than \$160.

Typical of the nearly 20 profiled packages available for less than \$100 is Telpac software from U.S. Robotics Inc. The package functions with U.S. Robotics-compatible modems, including products from Hayes Microcomputer Products Inc., Anchor Computer Inc. and Bizcomp Corp. and computers running under the PC-/MS-DOS, CP/M and CP/M-85 operating systems. Able to perform data-rate switching between 300- or 1,200-baud transmission, Telpac is compatible with modems that can simultaneously send and receive data (full-duplex mode) and provides a full repertoire of automatic dialing functions. For example, it can automatically dial a telephone number ("auto-dial") from a

Screen displays, like this one produced by Softronic's Softerm 1, permit end-users to implement modem-support packages' terminal-emulation functions.

TERMINAL FUNCTION DEFINITIONS			
Answerback	\$FF	\$FF	\$FF
Screen clear	\$FF	\$FF	\$FF
Erase to end of screen	\$FF	\$FF	\$FF
Erase to end of line	\$FF	\$FF	\$FF
Inverse video on	\$FF	\$FF	\$FF
Inverse video off	\$FF	\$FF	\$FF
Home cursor	\$FF	\$FF	\$FF
Cursor left	\$FF	\$FF	\$FF
Cursor right	\$FF	\$FF	\$FF
Cursor up	\$FF	\$FF	\$FF
Cursor down	\$FF	\$FF	\$FF
Cursor address	\$FF	\$FF	\$FF
Cursor address type	0		
	0 - column/row		
	1 - row/column		
Cursor row bias	\$00		
Cursor column bias	\$00		

directory of stored numbers, re-dial numbers until connection and support "auto-answer" modems that can automatically accept data down-loaded from the remote host computer.

Time dialing permits automatic call scheduling. The menu-driven package implements automatic adaptation to host-modem parameters and remote-takeover mode that permits control of a remote computer and multiple error checking of transmitted files, including a cyclic-redundancy-check (CRC) procedure. Automatic log-on sequences with such data as password, account number and commands to send or receive files facilitate connection to information utilities and databases. File translation supports changing between file types, such as ASCII, binary and EBCDIC. The \$79 package also supports electronic bulletin boards (with user-defined graphics) and electronic-mail functions.

Low-cost software provides 'high-cost' features

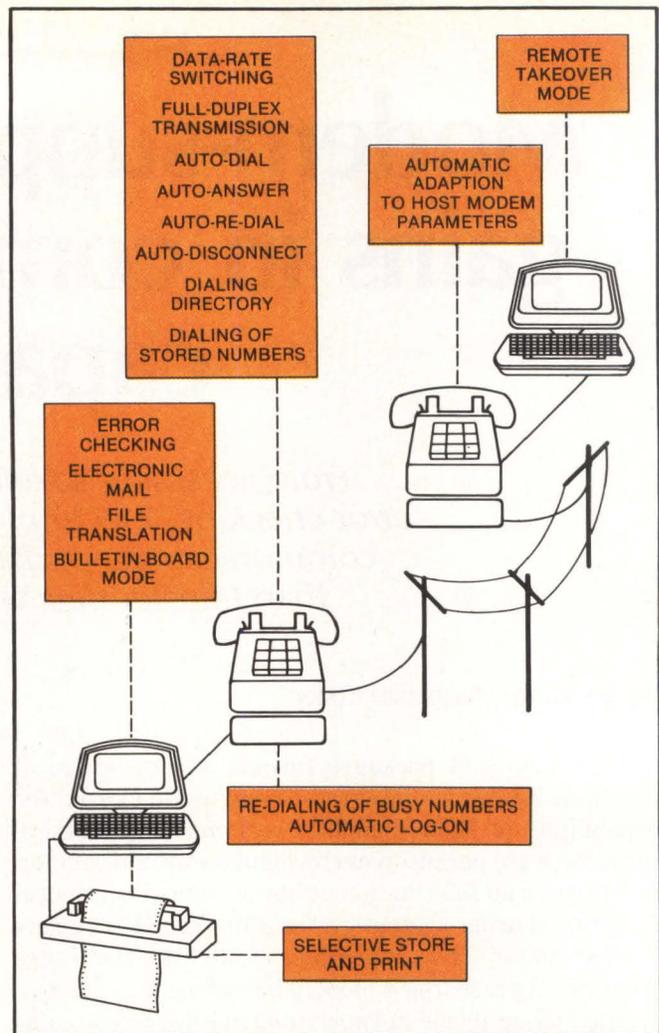
Several modem-support packages selling for less than \$40 provide many of the features of their much higher-priced cousins. Hilgraeve Inc.'s Access, for example, implements user-defined unattended dialing, connection, log-on, file transfer and disconnect sequences and supports remote takeover, re-dialing of busy numbers, "checksum" or CRC error checking and selective storing and printing of files.

The \$35 PC-TALK III from Headlands Press Inc. works with most auto-dial modems; runs under PC-DOS and MS-DOS operating systems; supports electronic mail, file translation and terminal emulation; and features 40 programmable log-on strings and character stripping and conversion, eliminating extraneous control characters from transmitted files. The package transmits binary files and has a 60-entry dialing directory.

The least-expensive modem-support package surveyed, Codewright's ZT, is not the least capable. It provides full VT52 terminal emulation, data-rate switching, electronic-mail support, automatic adaptation to host-modem parameters and selective store and print functions. Other less-than-\$40 packages surveyed include MFJ Enterprises' MFJ 1231, which implements file transfers with Apple Computer Inc. computers, Telephone Software Connection Inc.'s Terminal Program, which accommodates keyboard-entered macroinstructions, selective store and print functions and automatic log-on and Volks Micro Computer Systems Inc.'s COMMWHIZ I, which has a remote takeover mode and electronic-mail capabilities.

Defining the mainstream

The mainstream of modem-support software packages provides a middle ground of functions between the



Higher-end modem-support software can automatically assist modems in performing dialing and communications-support functions.

less-than-\$100 products and the higher-end units usually serving more specialized communications functions. Typical of these packages is LogOn from Ferox Microsystems Inc. for the Hayes Smartmodem and the IBM PC and PC XT. It provides functions from data-rate switching to remote takeover and bulletin-board mode. The menu-driven, \$150 product also handles binary and ASCII files and supports electronic mail, file translation and terminal emulation.

Other versatile mainstream products include Computer Development Inc.'s Versacom and Communications Research Group Inc.'s blocked asynchronous transmission (BLAST) package. Working under MS-DOS, CP/M and CP/M-86 operating systems, Versacom integrates error-corrected file transfer, text editing, electronic mail and line graphics. The \$495 package can handle voice and data communications and features data-encryption/-decryption capability. BLAST can function with most computers and most available modems. Supporting the full-duplex transfer of binary and text files, it implements CRC-16 error checking with selective retransmission of data, sliding-window protocol with automatic retransmission upon



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Gandalf's new Line Misers enable you to use your existing phone wiring for **simultaneous** voice and data communications. They function as limited distance modems that pass voice transpar-

ently. Simple bandwidth allocation is used to separate the data from the voice. Should your PBX fail, the data will not be affected.

Line Misers provide a fast, cost-effective means of expanding your data terminal network — up to 18,000 feet. Everywhere you have a telephone, you can quickly and easily add a terminal. It's a plug-in job — all you need is a power outlet and a phone jack. No

more 4-wire dedicated data lines! Asynchronous full-duplex data rates up to 9600 bps can be handled. An option is available for synchronous operation.

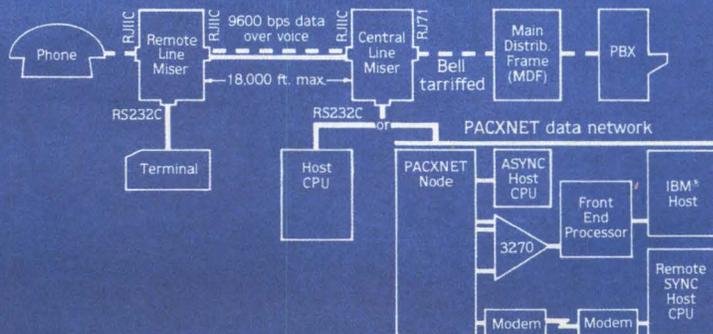
What's more, all Line Misers are FCC registered. Gandalf Line Misers let you create your data-over-voice LAN in record time and at a price you can afford. Call your local Gandalf sales representative for details today.

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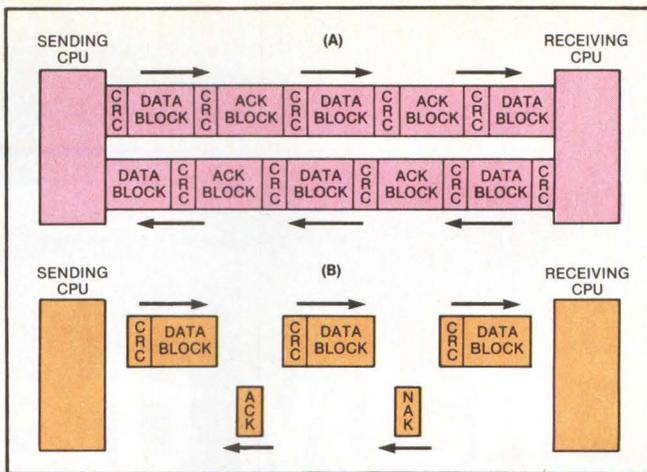
USA: Gandalf Data, Inc. (312)541-6060
 Canada: Gandalf Data, Ltd. (613)225-0565
 Europe: Gandalf Services, S.A. 22-98-96-35
 U.K. Gandalf Data PADGATE (0925)
 Communications Ltd. 818484

Subsidiaries of Gandalf Technologies Inc.

line loss and file translation, electronic mail and terminal emulation. It accommodates communications over satellite links and X.25 networks for specialized applications.

Unique Automation Products Inc.'s UAP-LINK also accommodates a wide variety of computer systems. It can move text or binary files among the IBM PC and mainframe computers; Digital Equipment Corp.'s PDP-11, VAX and Rainbow 100 computers; and Victor Technologies Inc.'s 9000. It provides a layered protocol to correct errors in lines of data, automatic data compression to increase throughput, support of command files, file-protection and terminal-emulation features. For file transfers between Apple and IBM and IBM-compatible microcomputers, the Apple-IBM Connection from Alpha Software Corp. features three error-checking procedures, automatic log-on, selective store and print and a remote takeover mode. The \$250 package also handles electronic mail, file translation and terminal emulation. A \$275 package, Frontier Technologies' COMPAC, provides IBM 3270 emulation for PC-/MS-DOS, CP/M-86 and UNIX systems and supports bisynch, SDLC and X.25 operation.

Finally, one of the surveyed high-end modem-support packages will probably meet the needs of system integrators configuring computers serving more specialized applications. Dialup from Evans Griffiths & Hart Inc., for example, is a comprehensive communications package linking a DEC RSTS/E computer system with a remote computer. Serving block-



A full-duplex sliding-window protocol with selective retransmission can reduce transmission time and costs. Implemented by Communications Research Group's BLAST modem-support software, it supports simultaneous transmission between the sending and receiving CPU (A). Only erroneous data blocks need be retransmitted. In contrast, with packages supporting half-duplex acknowledged/not acknowledged (ACK/NAK) protocols, the one-way transmission must stop and wait until the ACK signal is received before continuing to transmit data (B). Cyclic redundancy checking (CRC) ensures transmission accuracy.

mode file transfers, it permits the setup of complex communications functions for unattended operation using command files and macroinstructions. Macros store text and commands for the remote computer system, save auto-dialing parameters and record frequently called telephone numbers. Small Business Systems Group's NEXUS works with Hayes' Smartmodems to furnish automatic scheduling of file transfers for as many as 50 remote terminals, unattended transfer of binary or text files, CRC error checking, automatic forwarding and security-check capabilities.

Accessing information utilities and databases

Specialized modem-support software provides fast, efficient access to information utilities and databases such as The Source, CompuServe Information Service and Lockheed's Dialog Information Services Inc. Source Telecomputing Corp.'s SourceLink, for example, furnishes one-key access for IBM PC and PC XT computer end users to any of the videotex system's 1,000 information services. It supports simultaneous on-line editing, filing and printing of data from the utility and the uploading of user files to the service's bulletin boards or electronic-mail functions. A gateway utility can list telephone access numbers and communications protocols for as many as five other on-line services.

Business Computer Network's BCN Telecommunications Software is a versatile package that permits

PC-DOS and CP/M computers to access 12 databases, including The Source, CompuServe Information Service, Dialog, Bibliographic Retrieval Service, the I.P. Sharp databases and Newsnet newsletter and business-information databases. The menu-driven software also supports automatic log-on, selective store and print, error checking, electronic mail and file translation. The software is supplied without charge; users pay a small monthly service charge and a charge for connection time on the databases.

Finally, the Philadelphia Consulting Group Inc. supplies enhanced versions of its Post-Term and Post-Plus modem-support software packages for use with Western Union's EasyLink and MCI Communication's MCI Mail electronic-mail services. MCI-Plus and MCI-Term, for example,

have extensive on-disk manuals on MCI Mail's features and automatic log-on to speed entry into the system.

Sign-on customization options menu of the SourceLink modem-support package eases use of The Source information utility.

CUSTOMIZE UTILITY

1. Exit this utility
2. Function-key assignments
3. Account information
4. Telephone access numbers
5. Communication parameters
6. SourceLink options
7. Telenet/SourceNet network address
8. Tymnet network address

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two, four or more μ Ps (and even more oscillators), and still accomplish less.

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This design elegance leads naturally to more elegant performance. Take line status detection, for example. The PC: IntelliModem's adaptive, decision-directed logic monitors line status more closely than other modems. Even at weak or degraded signal levels. So it can make connections with less chance of error, by detecting signals for dial tone, remote ringback, busy and voice—some of which other modems ignore.

Plan ahead with integrated voice and data.

For opening up a whole new world of integrated voice and data applications, there's nothing like the PC: IntelliModem. Literally. Its easy-to-use software package—PC: IntelliCom™—lets you switch repeatedly between talking or listening and sending or receiving data. All at

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- File transfer
- Data capture to diskette
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So if you're designing microcomputer datacomm products—or just looking for a PC/XT modem for yourself, check out the PC: IntelliModem at your local dealer. You'll get the message. And so will they. Or contact: Bizcomp, 532 Weddell Drive, Sunnyvale, CA 94089; 408/745-1616.

Bizcomp: A history of innovation.

1980	Invented first command-driven modem
1981	Introduced proprietary line-status monitoring
1983	Designed first single- μ P 212A-compatible modem
1983	Introduced first integrated voice/data modem for IBM PC
1983	Granted patent on command-driven modem

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MODEM SUPPORT SOFTWARE

Company Package name	Modem required	Operating system required	Communication features								Price (\$)	Notes, features, options	Circle no.	
			Data rate switching	Half-duplex mode	Full-duplex mode	Autodial	Autoanswer	Autoredial	Autodisconnect	Dialing directory				Redialing busy numbers
ADVANCED MICRO TECHNIQUES 1291 E. Hillside Blvd., Suite 210 Foster City, CA 94404 (415) 349-9336													795	
Micro ezLNK	Bell 103 or 212	MS-DOS or CP/M	•	•	•	•	•	•	•	•	•	150(Q1); 90(QOEM)	hooks up to Western Union leased line; automatically adapts to host-modem parameters; error checking	
ALPHA SOFTWARE CORP. 30 B. St. Burlington, MA 01803 (617) 229-2924													796	
Apple-IBM Connection	Hayes	Apple DOS and IBM PC-DOS	•	•	•	•	•	•	•	•	•	250(Q1)	automatically adapts to host modem parameters; automatic log-on, error checking, remote take-over	
AMERICAN INT'L COMMUNICATIONS P.O. Box 9002-116 Boulder, CO 80301 (303) 444-6675													797	
GRAM-A-SYST	Hayes Smartmodems	most CP/M	•	•	•	•	•	•	•	•	•	250(Q1)	handles messages for Western Union net; supports electronic mail, file translation	
BIZCOMP CORP. 532 Weddell Dr. Sunnyvale, CA 94089 (408) 745-1616													798	
PC: IntelliCom	Bizcomp PC: IntelliModem	IBM PC-DOS, MS-DOS	•	•	•	•	•	•	•	•	•	499 (price includes PC:IntelliModem)	supports integrated voice and data; Teletype terminal emulation, telephone number directory	
BUSINESS COMPUTER NETWORK Gill Plaza, Suite 1220 9601 McAllister Freeway, San Antonio, TX 78216 (512) 340-8201													799	
BCN Telecommunications Software	Hayes, Novation, U.S. Robotics Mark VII	CP/M, IBM PC-DOS	•	•	•	•	•	•	•	•	•	included with database service)	connects to 12 databases; automatically adapts to host modem parameters; automatic log-on, error checking	
CERMETEK MICROELECTRONICS 1308 Borregas Ave. Sunnyvale, CA 94089 (408) 734-8150													800	
Modem-Mate	Info-Mate 212PC	IBM PC-DOS, MS-DOS	•	•	•	•	•	•	•	•	•	Price (\$) 495(Q1)	automatic log-on; supports electronic mail, file translation, terminal emulation	
CODEWRIGHT 231 Couch Ave. St Louis, MO 63122 (314) 965-3612													801	
ZT	all RS232C compatible	Z-DOS	•	•	•	•	•	•	•	•	•	25(Q1)	selective store and print, full VT-52 emulation, supports electronic mail	
COMMUNICATIONS RESEARCH GROUP INC. 8939 Jefferson Highway Baton Rouge, LA 70809 (504) 923-0888													802	
BLAST (blocked asynchronous transmission)	most modems	most mainframe, mini and microcomputer OSs	•	•	•	•	•	•	•	•	•	250 (Q1 micros) to 1,295 (Q1 mainframes)	supports sliding-window protocol with selective retransmission; electronic mail, file translation, terminal emulation, X.25	

MODEM SUPPORT SOFTWARE

Company Package name	Modem required	Operating system required	Communication features							Price (\$)	Notes, features, options	Circle no.
			Data rate switching	Half-duplex mode	Full-duplex mode	Autodial	Autoanswer	Autoredial	Autodisconnect			
COMMUNITREE 1150 Bryant St. San Francisco, CA 9403 (415) 861-8733												803
First Edition	Hayes Micromodem IIe, Smartmodem 1200	Apple DOS, IBM PC-DOS, TRS-DOS	•	•	•	•	•	•	•	250(Q1)	automatically adapts to host modem parameters; supports electronic mail, emulates bulletin board	804
COMPUTER APPLICATIONS INC. 13300 S.W. 108 St. Circle Miami, FL 33186 (305) 385-4277												804
Apple Link	Hayes Micromodem II	Apple DOS	•	•	•	•	•	•	•	59.95(Q1)	supports file transfers between Apple II computers; block check error checking with auto retry	805
COMPUTER DEVELOPMENT INC. 6700 S.W. 105th St. Beaverton, OR 97005 (503) 646-1599												805
Versacom	CDI ET and ETC Series intelligent modems and Hayes	MS-DOS, CP/M, CP/M-86	•	•	•	•	•	•	•	495(Q1)	integrated voice/data, text editing, error correction, data encryption/decryption, electronic mail, line graphics	806
CONTEXT MANAGEMENT SYSTEMS 23868 Hawthorne Blvd. Torrance, CA 90505 (213) 378-8277												806
Context MBA	Hayes, Novation and similar units, Hewlett-Packard	MS-DOS	•	•	•	•	•	•	•	695(Q1)	provides six functions; integrates database information into spreadsheet; supports electronic mail, file translation, terminal emulation	807
DIGITAL MARKETING CORP. 2363 Boulevard Circle Walnut Creek, CA 94595 (415) 947-1000												807
Micro Link II	any 300 or 1200 baud unit	CP/M, CP/M-86, MS/PC-DOS	•	•	•	•	•	•	•	99(Q1)	automatic log-on, selective store and print, error checking, electronic mail	808
DYNAMIC MICROPROCESSOR ASSOCIATES 545 Fifth Ave. #602 New York, NY 10017 (212) 687-7115												808
ASCOM	adapts to any modem using patches	CP/M; CP/M-86; MS-DOS; IBM PC-DOS, TURBO-DOS	•	•	•	•	•	•	•	175(Q1)	automatically adapts to host modem parameters; remote take-over, supports electronic mail, file translation, terminal emulation	809
EVANS GRIFFITHS & HART INC. 55 Waltham St. Lexington, MA 02173 (617) 861-0670												809
DIALUP	most modems	RSTS/E 7.0 or later	•	•	•	•	•	•	•	1,700(Q1)	block mode file transfers to RSTS or VAX system; can use macros and command files to automate operation; error checking	

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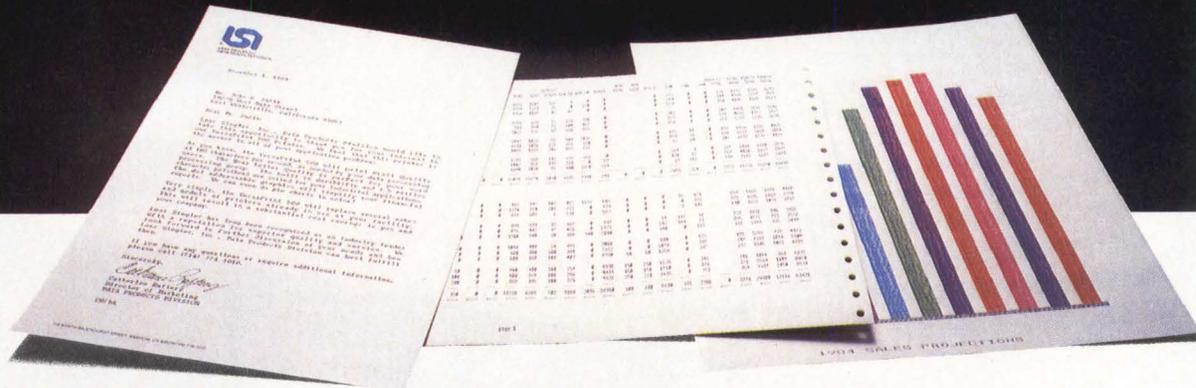
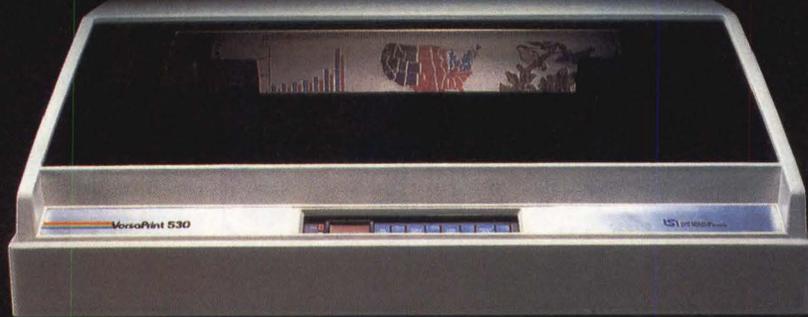
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MINI-MICRO SYSTEMS/March 1984

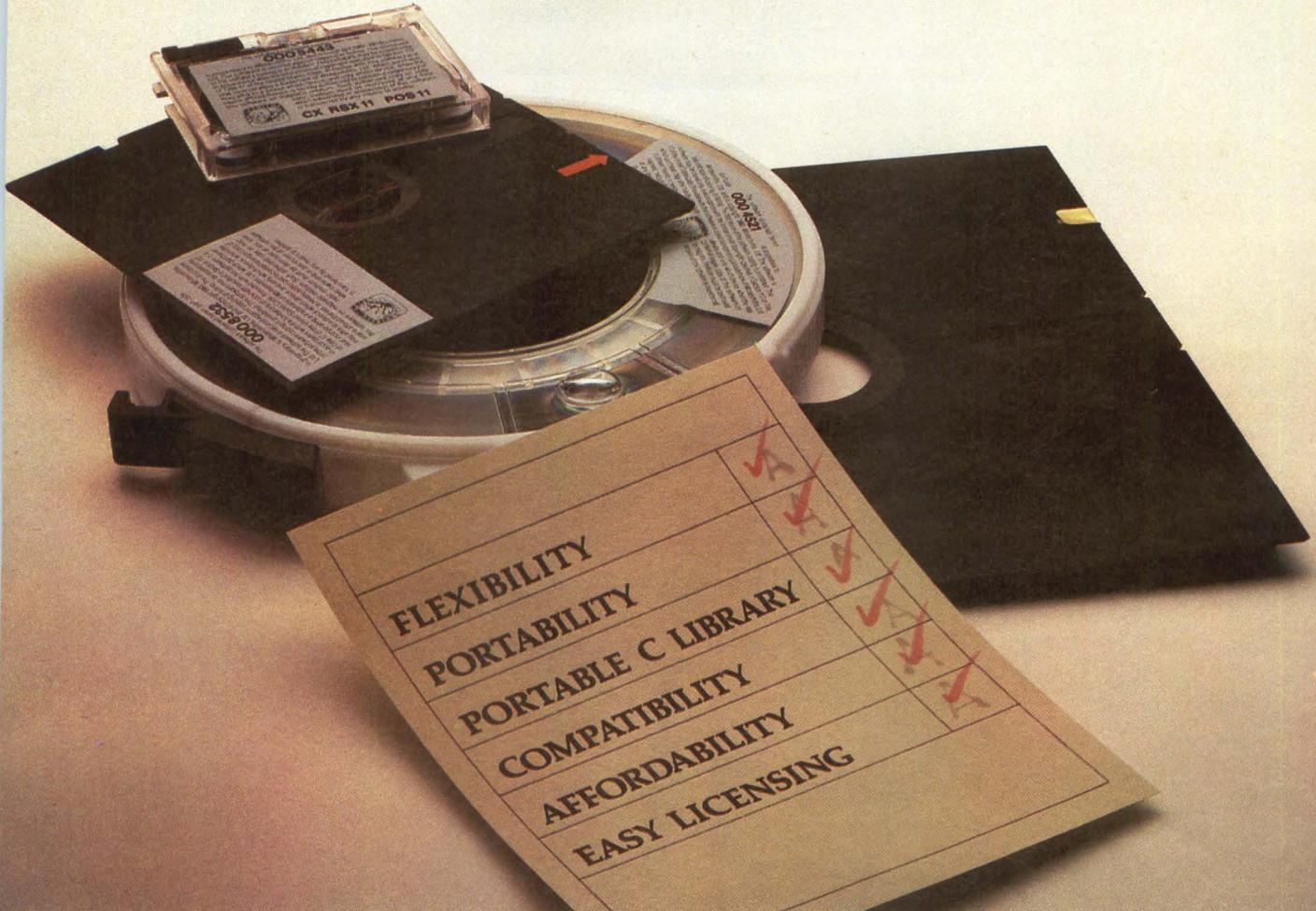
MODEM SUPPORT SOFTWARE

Company Package name	Modem required	Operating system required	Communication features								Price (\$)	Notes, features, options	Circle no.	
			Data rate switching	Half-duplex mode	Full-duplex mode	Autodial	Autoanswer	Autoredial	Autodisconnect	Dialing directory				Redialing busy numbers
FEROX MICROSYSTEMS 1701 N. Fort Meyer Dr. #611 Arlington, VA 22209 (703) 841-0800													810	
LogOn	Hayes Smartmodem	p-System	•	•	•	•	•	•	•	•	•	150(Q1)	automatic adaptation to host modem parameters; error checking, supports electronic mail, file translation, terminal emulation, handles binary files	
FRONTIER TECHNOLOGIES P.O. Box 11238 Milwaukee, WI 53211 (414) 964-8689													811	
COMPAC	Bell 201, 212, 209, etc.	MS-DOS, CP/M-86, UNIX to come	•	•	•	•	•	•	•	•	•	275(Q1)	automatic log-on, 3270 emulation; supports bisync, SDLC and X.25 operation	
GENASYS CORP.(PC Prods. Div.) 11820 Parklawn Dr. Rockville, MD 20852 (301) 770-4600													812	
TELIOS	most modems	PC/MS-DOS	•	•	•	•	•	•	•	•	•	119.95 (Q1); 71.95 (QOEM)	automatic log-on, selective store and print, error checking, command-file processing, screen buffer	
GKE SOFTWARE 236 N. Santa Cruz Ave. Los Gatos, CA 95030 (408) 354-5010													813	
AUTOCOM	Hayes	MS-DOS, IBM PC-DOS	•	•	•	•	•	•	•	•	•	95(Q1)	automatically adapts to host modem parameters; error checking, supports electronic mail, file translation, VT-100/-52 emulation	
HAWKEYE GRAFIX 23914 Mobile St. Canoga Park, CA 91307 (213) 348-7907													814	
COMMx	All Hayes, Novation, U. S. Robotics	CP/M; C-DOS, TURBO-DOS CP/M-86, MS-DOS, IBM PC-DOS	•	•	•	•	•	•	•	•	•	150(Q1)	automatically adapts to host modem parameters; remote take-over, error checking, supports electronic mail, file translation, terminal emulation	
HEADLANDS PRESS INC. P.O. Box 862 Tiburon, CA 94920 (415) 435-9775													815	
PC-TALK III	most autodial modems	IBM PC-DOS, MS-DOS	•	•	•	•	•	•	•	•	•	35(Q1)	automatic log-on, selective store and print, error checking, character stripping and conversion, handles binary files	
HIGH TECHNOLOGY SOFTWARE PRODUCTS INC. P.O. Box 60406 Oklahoma City, OK 73146 (405) 524-4359													816	
NETWORKS II	Hayes Micromodem II	Apple DOS 3.3	•	•	•	•	•	•	•	•	•	99.95(Q1)	automatically adapts to host modem parameters; error checking, bulletin-board mode, supports electronic mail	

MODEM SUPPORT SOFTWARE

Company Package name	Modem required	Operating system required	Communication features								Price (\$)	Notes, features, options	Circle no.
			Data rate switching	Half-duplex mode	Full-duplex mode	Autodial	Autoanswer	Autorectal	Autodisconnect	Dialing directory			
HILGRAEVE INC. P.O. Box 941 Monroe, MI 48161 (313) 243-0576													817
ACCESS	most modems	CP/M or ZDOS	•	•	•	•	•	•	•	•	39.95(Q1)	user defined log-on, file-transfer sequences, selective store and print, error checking, remote take-over	
INTERNATIONAL SOFTWARE ALLIANCE 1835 Mission Ridge Rd. Santa Barbara, CA 93103 (805) 966-3077													818
LYNC	Hayes Smartmodem/ Micromodems, Novation Smartcat, Datec, Micro-Baud IV	CP/M, MS-DOS	•	•	•	•	•	•	•	•	155(Q1)	handles binary files; selective store and print, error checking, remote takeover mode, supports electronic mail, file translation	
LINDBERGH SYSTEMS INC. 49 Beechmont St. Worcester, MA 01609 (617) 852-0233													819
OMNITERM 1	most modems	TRS-DOS	•	•	•	•	•	•	•	•	95-175(Q1)	automatic log-on, error checking, remote take-over, supports electronic mail, file translation, terminal emulation	
OMNITERM 2	most modems	IBM PC-DOS	•	•	•	•	•	•	•	•	245(Q1)	same capabilities as OMNITERM 1 plus VT-100 emulation	
LINK SYSTEMS 1640 19th St. Santa Monica, CA 90404 (213) 453-8921													820
BATALINK	Hayes Smartmodem, Novation 1200 baud, Motorola	Pascal, IBM PC-DOS IBM PC-DOS	•	•	•	•	•	•	•	•	199(Q1)	automatic log-on, selective store and print, error checking, bulletin-board mode; can compute phone charges	
BATALINK	most modems	Pascal, Apple DOS	•	•	•	•	•	•	•	•	99.95(Q1)	automatically adapts to host modem parameters, selective store and print, error checking	
MARK OF THE UNICORN 222 Third St. Cambridge, MA 02142 (617) 576-2760													821
PC/InterComm	most modems	IBM PC-DOS	•	•	•	•	•	•	•	•	99(Q1)	programmable autodial, log-on, selective store and print, error checking; VT-100/-52 emulation	
MICROCALL SERVICE P.O. Box 650 Laurel, MD 20707 (301) 776-5253													822
AMCALL	Hayes 300, 1200 or compatible	CP/M; IBM PC-DOS, ZENITH MS-DOS, MP/M 8-16	•	•	•	•	•	•	•	•	150(Q1)	selective store and print, error checking; supports on-line printing, CP/M commands	
MCCALL II	Hayes 300, 1200 or compatibles	CP/M; IBM PC-DOS, ZENITH MS-DOS, MP/M 8-16	•	•	•	•	•	•	•	•	125(Q1)	functions similar to AMCALL	

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RSX-11	✓	✓	✓	✓
RT-11	✓	✓	✓	
VMS-VAX	✓	✓	✓	✓
UNIX-4.1 BSD	✓	✓	✓	
UNIPLUS	✓		✓	
IDRIS/S68K	✓		✓	
MS/PC-DOS				
CP/M-86	✓	✓		
IBM 370			✓	
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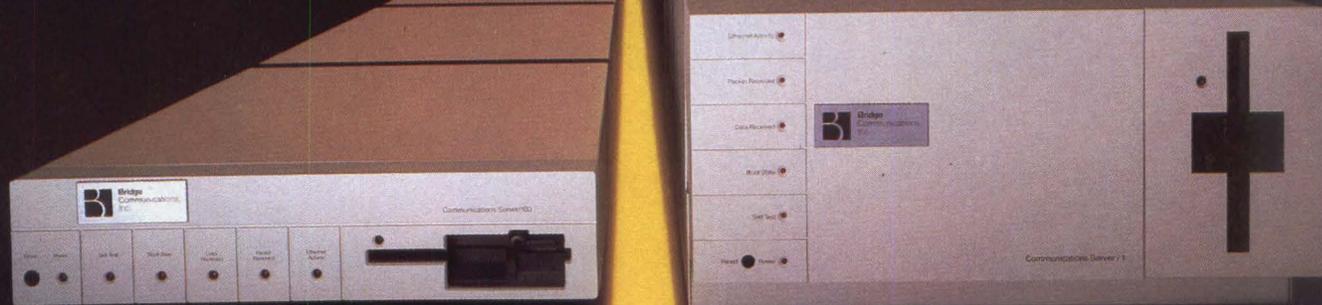


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MODEM SUPPORT SOFTWARE

Company Package name	Modem required	Operating system required	Communication features								Price (\$)	Notes, features, options	Circle no.
			Data rate switching	Half-duplex mode	Full-duplex mode	Autodial	Autoanswer	Autorectal	Autodisconnect	Dialing directory			
MICROSPARC INC. 10 Lewis St. Lincoln, MA 01773 (617) 259-9039													823
Teletext	Hayes Micromodem II, AppleCat II	Apple DOS 3.3	•	•	•	•	•	•	•	•	79.95(Q1)	automatic log-on, selective store and print, error checking, macro capability	
MFJ ENTERPRISES 921A Louisville Rd. Starkville, MS 39759 (601) 323-5869													824
MFJ 1231 Software package	MFJ 1230, 1232, 1233	Apple DOS	•	•							39.95(Q1)	supports terminal emulation	
MYCROFT LABS P.O. Box 6045 Tallahassee, FL 32314 (904) 385-1141													825
MITE/MS	most modems	IBM MS-DOS	•	•	•	•	•	•	•	•	150(Q1 8-bit); 195(Q1 16-bit)	handles binary protocols, automatically adapts to host modem parameters, automatic log-on, error checking, remote take-over	
MITE/80	most modems	CP/M-80	•	•	•	•	•	•	•	•	150(Q1)	handles multiple binary protocols; automatically adapts to host modem, automatic log-on, selective store and print, error checking	
MITE/86	most modems	CP/M 86	•	•	•	•	•	•	•	•	195 (Q1)	capabilities similar to MITE/80	
MICROSTUF INC. 1845 The Exchange, Suite 140 Atlanta, GA 30339 (404) 952-0267													826
CROSSTALK	Autodial Hayes, any Bell compatible modem	CP/M	•	•	•	•	•	•	•	•	195 (Q1)	error checking; supports electronic mail, file translation; autodials only with Hayes modem	
TRANSPORTER	Hayes Smartmodem	IBM MS/PC-DOS	•	•	•	•	•	•	•	•	295(Q1)	automatically adapts to host modem parameters, automatic log-on, error checking; supports electronic mail, file translation; autodials only with Hayes modem	
CROSSTALK 16	most Bell compatible	IBM PC/MS-DOS	•	•	•	•	•	•	•	•	195(Q1)	automatic log-on, selective store and print, error checking; supports electronic mail, file translation, terminal emulation	
MULTI-TECH SYSTEMS INC. 82 Second Ave., S.E. New Brighton, MN 55112 (612) 631-3550													827
MULTI-COM PC	Multi-Modem PC	MS-DOS, IBM PC-DOS	•	•	•	•	•	•	•	•	549 (Q1 including modem)	automatically adapts to host modem, automatic log-on, selective store and print, ADM 3A emulation	
NOVATION INC. 20409 Prairie St., Box 2875 Chatsworth, CA 91311 (213) 996-5060													828
COM-WARE II	Apple-CAT II	Apple DOS	•	•	•	•	•	•	•	•	389 (Q1 including modem)	error checking, remote take-over, binary file transfer, 27K storage	

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Publication	% of Total
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Data Communications	9.55
Datamation	8.12
Computerworld	7.93
EDN	6.89
Computer Design	6.82
Electronic Design	6.76
Electronics	5.72
Electronic Engineering Times	4.68
MIS Week	4.61
Computer Decisions	4.03
Digital Design	4.03
Communications News	3.64
Electronic News	3.25
Business Computer Systems	3.12
Systems & Software	2.99
Information Systems News	2.60
Telephony	2.14
Computer Systems News	2.01
TE&M	1.17

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CIRCLE NO. 91 ON INQUIRY CARD

MODEM SUPPORT SOFTWARE

Company Package name	Modem required	Operating system required	Communication features								Price (\$)	Notes, features, options	Circle no.
			Data rate switching	Half-duplex mode	Full-duplex mode	Autodial	Autoanswer	Autoredial	Autodisconnect	Dialing directory			
PEACHTREE SOFTWARE													829
3445 Peachtree Rd. Atlanta, GA 30326 (404) 239-3000													
TELECOMMUNICATIONS	most modems; Hayes Smartmodem for all features	MS-DOS, CP/M	•	•	•	•	•	•	•	•	150(Q1)	automatically adapts to host modem, error checking; supports file translation, terminal emulation; 10-page help screen	
PERFECT SOFTWARE INC.													830
702 Harrison St. Berkeley, CA 94710 (415) 527-2626													
Perfect Link	most modems	IBM PC-DOS	•	•	•					•	149(Q1)	automatic log-on, error checking, 1-key access to eight databases; handles binary files; supports electronic mail, terminal emulation	
PHILADELPHIA CONSULTING GROUP INC.													831
P.O. Box 102 Wynnewood, PA 19096 (215) 649-1598													
Post-Term	any Bell 103, 212 compatible	CP/M, TRS-DOS, DOS-PLUS, LDOS	•	•	•	•	•	•	•	•	135(Q1)	automatic log-on, selective store and print, error checking; supports electronic mail, file translation, data encryption	
Post-Plus	any Bell 103, 212 compatible	CP/M, TRS-DOS, DOS-PLUS, LDOS	•	•	•	•	•	•	•	•	250 (Q1)	Post-Term capabilities plus ASCII word processor	
ESL-Plus	any Bell 103, 212 compatible	CP/M, TRS-DOS, DOS-PLUS, LDOS	•	•	•	•	•	•	•	•	300(Q1)	Post-Term capabilities plus support for Western Union EasyLink service	
MCI-TERM	any Bell 103, 212 compatible	CP/M, TRS-DOS, DOS-PLUS, LDOS	•	•	•	•	•	•	•	•	185(Q1)	Post-Term capabilities plus support for MIC mail service	
PICKLES & TROUT													832
P.O. Box 1206 Goleta, CA 93116 (805) 685-4641													
LYNC	Hayes Smartmodem, Novation CAT	CP/M, MP/M, TURBO-DOS, IBM PC-DOS	•	•	•	•	•	•	•	•	155(Q1)	automatic log-on, selective store, error checking, remote take-over, bulletin-board mode	
RACAL-VADIC													833
1525 McCarthy Dr. Milpitas, CA 95035 (408) 946-2227													
SPATS	Racal-Vadic SPATS 300, SPATS 1200; Hayes Smartmodem 1200, 1200B	MS-DOS	•	•	•	•	•	•	•	•	90(Q1)	automatically adapts to host modem, automatic log-on, selective store and print, error checking, remote take-over mode	
READIWARE SYSTEMS INC.													834
P.O. Box 680 W. Redding, CT 06896 (203) 431-3521													
Readiterm	most modems	IBM PC-DOS, MS-DOS	•	•	•	•	•	•	•	•	75(Q1)	supports command files, automatic log-on, selective store and print, error checking, emulates Perkin-Elmer 1251	

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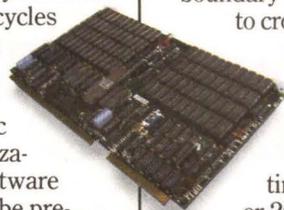
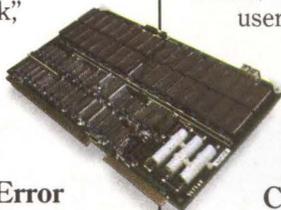
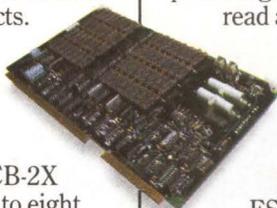
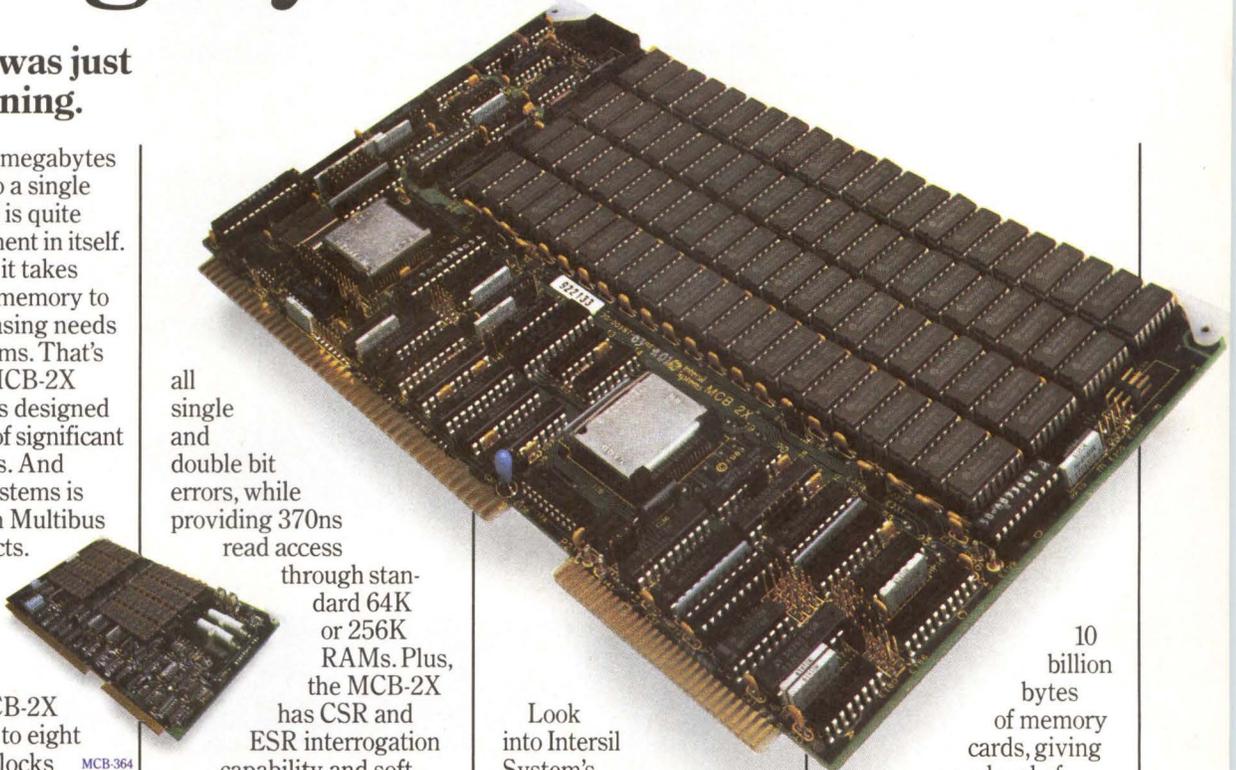
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Board addresses starting on any 4K boundary can be mapped to cross 1 and 4 megabyte boundaries. The MCB-2X can also occupy a continuous 512K or 2048K memory space within its 16 megabyte range.



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MODEM SUPPORT SOFTWARE

Company Package name	Modem required	Operating system required	Communication features								Price (\$)	Notes, features, options	Circle no.	
			Data rate switching	Half-duplex mode	Full-duplex mode	Autodial	Autoanswer	Autorectal	Autodisconnect	Dialing directory				Redialing busy numbers
SANYO BUSINESS SYSTEMS CORP. 51 Joseph St. Moonachie, N.J. 07074 (201) 440-9300													835	
SANYCOM Telecommunications Package	Hayes and nonprogrammable modems	CP/M-80, CP/M-86, MS-DOS	•	•	•	•	•	•	•	•	•	105(Q1)	selective store and print, error checking	
SMALL BUSINESS SYSTEMS GROUP INC. 6 Carlisle Rd. Westford, MA 01886 (617) 692-3800													836	
ST80III	All Bell 103, 212 compatible	TRS-DOS; CP/M; LDOS; NEWDOS;	•	•	•	•	•	•	•	•	•	150-250(Q1)	automatically adapts to host modem, automatic log-on, selective store and print, error checking; supports file translation, terminal emulation	
FORUM 80	Bell 103 or 212 compatible	TRS NEWDOS-80 V.2	•	•	•	•	•	•	•	•	•	350(Q1)	automatically adapts to host modem parameters, automatic log-on, error checking; supports electronic mail, terminal emulation	
NEXUS	Hayes Smartmodems	NEWDOS-80 V.s	•	•	•	•	•	•	•	•	•	5,000(Q1)	automatic file-transfer scheduling, polling, forwarding, security checks for as many as 50 remote terminals	837
SOFTRONICS INC. 3639 New Getwell Rd., Suite 10 Memphis, TN 38118 (901) 683-6850														
Softerm 1	most modems	Apple DOS 3.3; Apple Pascal 1.1, CP/M-80	•	•	•	•	•	•	•	•	•	135(Q1)	automatically adapts to host modem, automatic log-on, selective store and print, error checking; supports electronic mail, file translation, remote take-over	
Softerm 2	most modems	Apple DOS 3.3, Apple PASCAL 1.1, CP/M-80	•	•	•	•	•	•	•	•	•	195(Q1)	Softerm 1 capabilities plus terminal emulation	
SOFTWARE WIZARDRY INC. 122 Yankee Dr. St. Charles, MO 63301 (314) 946-1968													838	
ZLYNK/II	Hayes Smartmodem, U.S. Robotics	CP/M	•	•	•	•	•	•	•	•	•	59.95(Q1)	automatically adapts to host modem, automatic log-on, selective store and print, error checking; supports electronic mail	
THE SOFTWARE STORE 706 Chippewa Sq. Marquette, MI 49855 (906) 228-7622													839	
SOFTCOM Telecommunications Utility	most modems	CP/M	•	•	•	•	•	•	•	•	•	150(Q1)	selective store and print, error checking, remote take-over mode	
SOURCE TELECOMPUTING CORP. 1616 Anderson Rd. McLean, VA 22102 (703) 734-7500													840	
SourceLink	most modems	IBM PC-DOS	•	•	•	•	•	•	•	•	•	149(Q1) (Source subscribers 49)	for access to The Source; automatic log-on, selective store and print, error checking; supports electronic mail	

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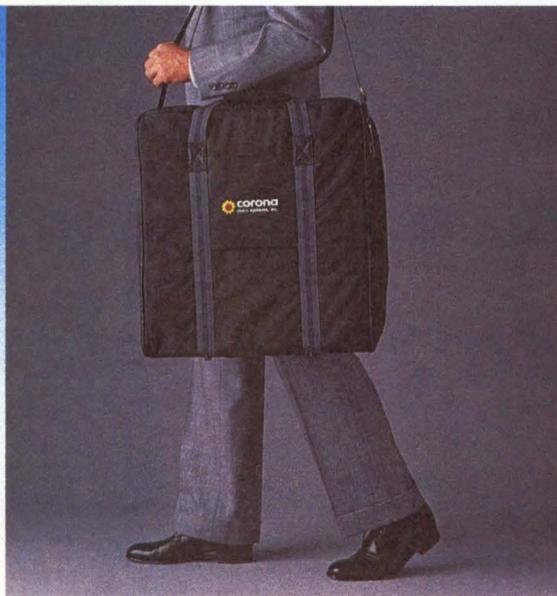
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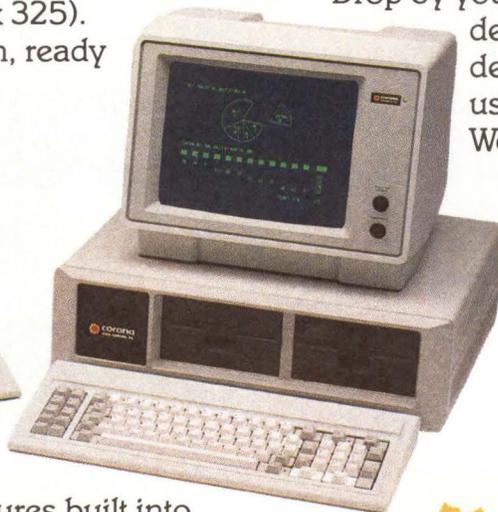
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GW BASIC.² A training course: PC Tutor.³ A professional word processor: MultiMate.⁴ Plus DOS utilities and demonstration programs. Or you can get the p-System⁵ from N.C.I. and write or run portable Pascal packages.

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CIRCLE NO. 93 ON INQUIRY CARD

MODEM SUPPORT SOFTWARE

Company Package name	Modem required	Operating system required	Communication features								Price (\$)	Notes, features, options	Circle no.
			Data rate switching	Half-duplex mode	Full-duplex mode	Autodial	Autoanswer	Autorectal	Autodisconnect	Dialing directory			
SOUTHEASTERN SOFTWARE 7743 Briarwood Dr. New Orleans, LA 70128 (504) 246-8438													841
DATA CAPTURE	Any modems for Apple II, Ile, IBM PC	DOS 3.3; Apple DOS; IBM PC-DOS	•	•	•	•	•	•	•	•	65-120(Q1)	automatic log-on, selective store and print; supports electronic mail	
SUPERSOFT P.O. Box 1628 Champaign, IL 61820 (217) 359-2112													842
TERM II	Hayes, Novation Autocat	CP/M-80			•	•				•	200(Q1)	selective store and print, error checking	
TECHNICAL ANALYSIS GROUP Box 15951 New Orleans, LA 70175 (800) 535-7990													843
COMPU TRAC	Hayes Micromodem II, Smartmodem	Apple DOS 3.3, IBM PC-DOS 2.0		•	•	•				•	1,800 to 1,100 (Q1)	accesses stock or commodities databases; automatic log-on, bulletin-board mode	
TELEPHONE SOFTWARE CONNECTION INC. P.O. Box 6548 Torrance, CA 90504 (213) 516-9430													844
TERMINAL PROGRAM	Hayes Micromodem II, SSM Modemcard	Apple DOS 3.3		•	•	•			•	•	35(Q1)	supports keyboard macros, electronic mail, terminal emulation; 16K capture buffer, automatic log-on, selective store and print	
TELEVIDEO SYSTEMS INC. 1170 Morse Ave. Sunnyvale, CA 94086 (800) 538-8725													845
TeleAsync	Bell 103J, 212A	CP/M, CP.M-86, MS-DOS, MP/M			•	•	•	•	•		150-195(Q1)	handles binary files; command-file support, automatic log-on, error checking; supports file translation, terminal emulation	
TNW CORP. 344 Hancock St. San Diego, CA 92110 (619) 296-2115													846
XPTERM	TNW 103; Commodore 8010	Commodore	•	•	•	•	•	•	•	•	54(Q1)	automatic log-on, selective store and print, error checking with other XPTERM package	
TRANSCEND CORP. 2190 Paragon Dr. San Jose, CA 95131 (408) 946-7400													847
TRANSCEND PC	Hayes, Transcend manual dial	MS-DOS	•	•	•	•	•	•	•	•	189(Q1)	automatically adapts to host modem, automatic log-on, selective store and print, error checking, remote take-over mode; supports electronic mail, terminal emulation	
TRANSCEND I	Transcend, Hayes, Novation, Bell 212A/103/202 compatible	Apple DOS 3.3	•	•	•	•	•	•	•	•	89(Q1)	transfers ASCII files; automatically adapts to host modem, automatic log-on, selective store and print, error checking, remote take-over mode; supports electronic mail	

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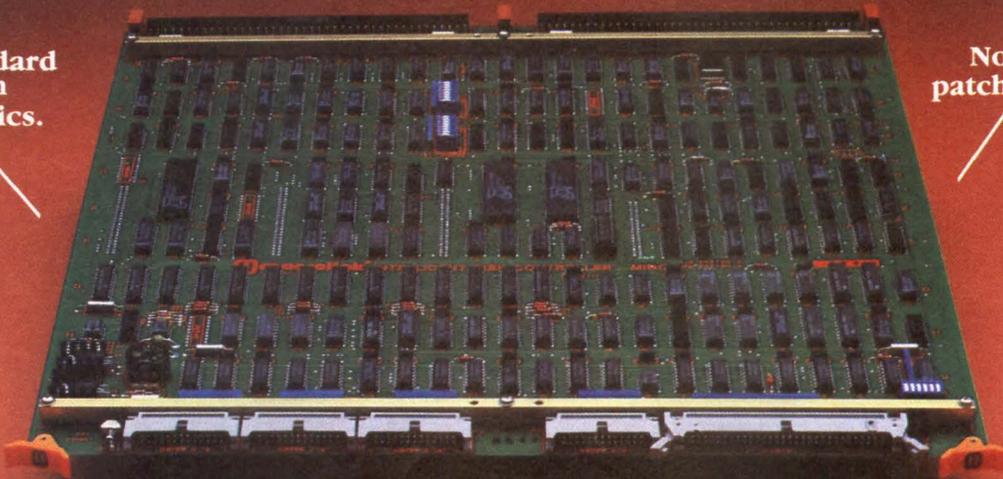
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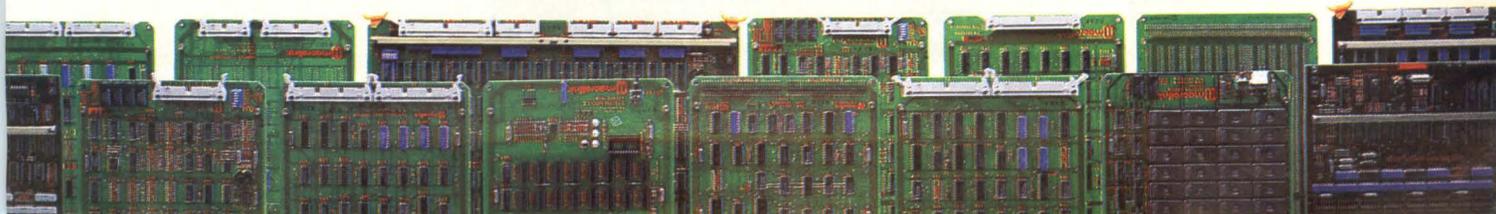
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MODEM SUPPORT SOFTWARE

Company Package name	Modem required	Operating system required	Communication features								Price (\$)	Notes, features, options	Circle no.	
			Data rate switching	Half-duplex mode	Full-duplex mode	Autodial	Autoanswer	Autorectal	Autodisconnect	Dialing directory				Redialing busy numbers
TRANSEND 2	Transend Hayes, Novation, Bell 212A/103/202 compatible	Apple DOS 3.3	•	•	•	•	•	•	•	•	•	149(Q1)	transfers ASCII, Apple DOS, CP/M, Pascal files; other capabilities similar to Transend 1	
TRANSEND 3	Transend, Hayes, Novation, Bell 212A/103/202 compatible	Apple DOS 3.3	•	•	•	•	•	•	•	•	•	275(Q1)	supports unattended file transfer, electronic mail; other capabilities similar to Transend 2	

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Remote Job Entry	201C, 208, leased	RT-11, TSX-Plus, RSX		•	•			•				1,850(Q1)	automatic log-on, error checking, IBM 2780 emulation	
UAP-LINK	Bell 103, 212	MS-DOS, CP/M-86, TSX-Plus, RT, RSX, RSTS, VMS, VM/CMS, TSO, UNIX	•	•	•	•	•	•	•	•	•	250(Q1)	automatically adapts to host modem, automatic log-on, error checking, data compression; handles binary files	
EZSHAR	Bell 103, 212, direct connect	RT-11, TSX-Plus, RSX	•	•	•							from 500(Q1)	personality modules adapt to host computers; supports programmable functions keys, terminal emulation	

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TELPAC	U.S. Robotics, Hayes, Anchor, Bizcomp	CP/M, CP/M-85, MS-DOS, IBM PC-DOS	•	•	•	•	•	•	•	•	•	79(Q1)	automatically adapts to host modem, automatic log-on, selective store, error checking, remote take-over mode; supports electronic mail, file translation, bulletin board	
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RELAY	Hayes, Rixon, Racal-Vadic	IBM PC-DOS	•	•	•	•	•	•	•	•	•	149(Q1)	automatically adapts to host modem, automatic log-on, error checking, remote take-over; can send, receive, edit, print different files simultaneously	
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VOLKS MICROCOMPUTER SYSTEMS

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COMMWHIZ I	most modems (Hayes Smartmodem recommended)	TRS-DOS, LDOS, DOS+, NEWDOS	•	•	•	•				•	•	29.95(Q1)	special character modes; selective store and print, remote take-over mode; supports electronic mail, terminal emulation	
COMMWHIZ II	most modems (Hayes Smartmodem recommended)	TRSDOS, LDOS, DOS+, NEWDOS	•	•	•	•	•	•	•	•	•		automatic log-on, selective store and print, error checking, remote take-over; supports electronic mail, file translation	

MODEM SUPPORT SOFTWARE

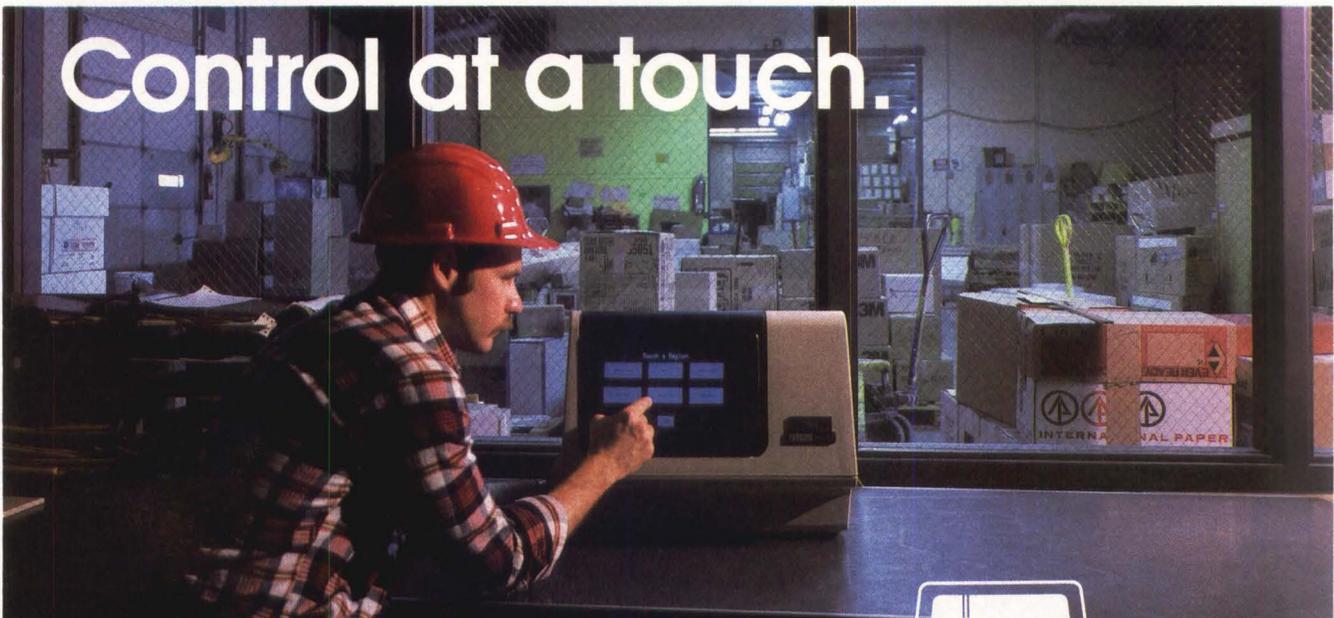
Company Package name	Modem required	Operating system required	Communication features							Price (\$)	Notes, features, options	Circle no.
			Data rate switching	Half-duplex mode	Full-duplex mode	Autodial	Autoanswer	Autore dial	Autodisconnect			

WINDMILL SOFTWARE INC.
 2209 Leominster Dr.
 Burlington, Ontario L7P 3W8 Canada
 (416) 336-3353

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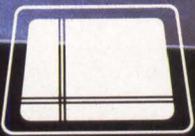
VideoLink 88	most modems	MS-DOS, IBM PC-DOS	•	•	•	•	•	•	•	59.95(Q1)	automatic log-on, selective store and print; supports electronic mail, file translation	
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New from Carroll, an advanced touch input system for the DEC VT100. Ideal for inventory control, process control, dispatching, data collection, training and other uses. No need for keyboarding or special computer skills. For information, contact the leader in touch technology.

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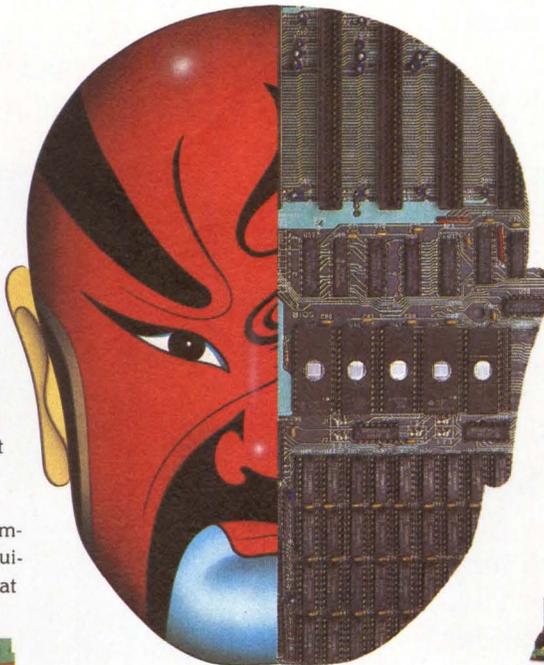


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You're building a 16/32-bit MULTIBUS® supermicro with a high-capacity (20 Mb or more) 5¼" Winchester.

And you're thinking about your back-up strategy.

DSD would like to suggest that you can't back up that much Winchester with floppies.

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It just takes too many floppies—20 or 40 (depending on capacity) to back up a 20 Mb Winchester.

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Winchesters, floppies and tape— all on one board.

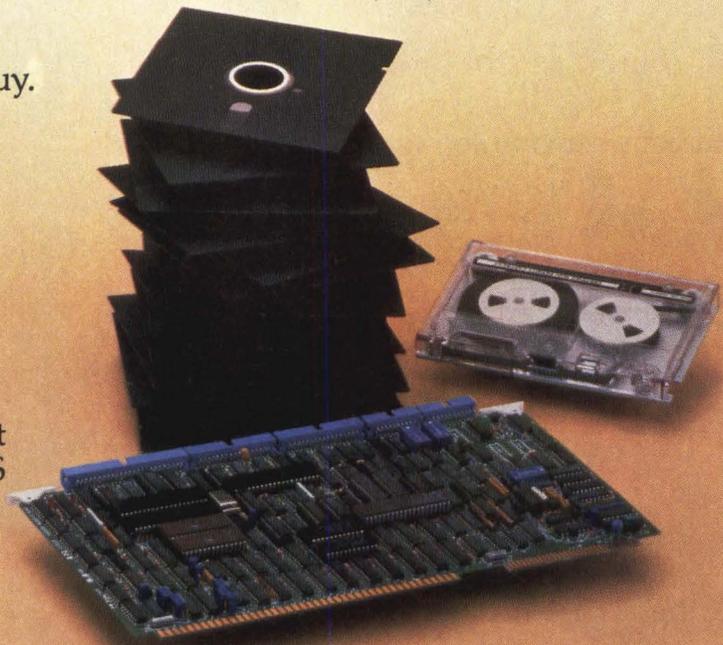
Now. If you're ready to think about the tape alternative for your MULTIBUS system, you'll want to look at our three RAMTRAC™ controller boards.

Each high performance RAMTRAC board includes controllers for Winchester, floppies and tape. You can choose models for 5¼" or 8" media. Or a combination of both. And, of course, all models include ¼" tape.

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HOW TO MAKE YOUR SUPERMICRO LIVE UP TO ITS NAME.

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Now, what are you going to put in the middle? A plain vanilla controller?

That's a little like a Ferrari with a Ford transmission. All show and not much go.

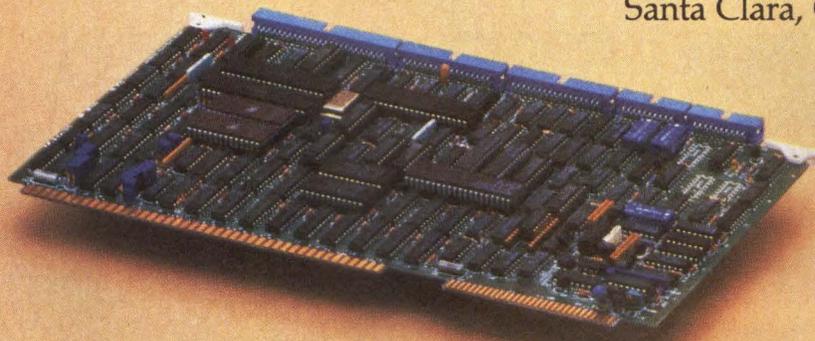
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DSD's RAMTRAC controller.

It controls Winchesters, floppies and tape. All on a single MULTIBUS board.

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CIRCLE NO. 99 ON INQUIRY CARD

Two-wire full-duplex modem simplifies voice and data networking

Data-over-voice unit handles asynchronous or synchronous transmission to 9,600 baud

Hank Morgan, Gandalf Technologies Inc.

Gandalf Technologies Inc.'s Line Miser data-over-voice units combine a local modem and frequency filters to allow simultaneous data and voice transmissions on one telephone-wire pair. The units generate data channels above the voice spectrum and provide full-duplex, 9,600-baud asynchronous or synchronous data transmission through frequency allocation. Line Misers

work in private-branch exchange (PBX) Centrex and key telephone systems and are used in applications that require data-over-voice transmission on a two-wire modem.

How the units work

Line Misers transmit data signals over telephone wires through a phase-coherent, frequency-shift-keying modulation method (see "Methods of modula-

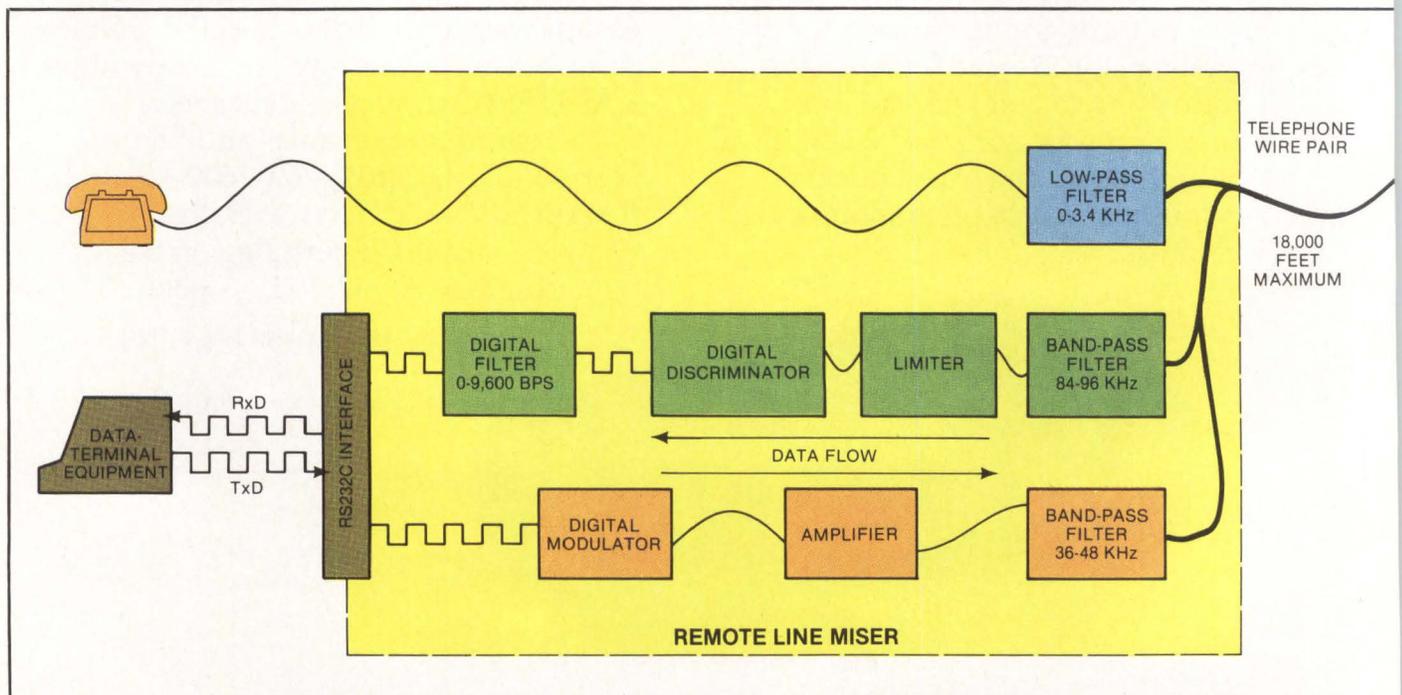


Fig. 1. Line Misers use frequency filters for simultaneous voice and full-duplex data transmissions on a telephone-wire pair. A digital modulator converts data signals into two frequencies (tones)—one for spaces and another for marks. For full-duplex operation, remote units transmit a pair of frequencies different from central units. Band-pass filters differentiate between incoming and outgoing signals, and low-pass filters prevent data from interfering with voice. A limiter

removes excessive amplitude variations from incoming data signals before they enter the digital discriminator, which reconverts the frequencies into the digital data pattern. A digital filter removes digital components higher than 9,600 baud before the data signal leaves a Line Miser. A transient suppressor in the central unit helps prevent telephone-system noises from interfering with data communications.

tion," Page 186). A digital modulator in the transmitting unit changes the digital pattern of the data signals into two frequencies (tones), one for marks (binary 1s) and another for spaces (binary 0s). For full-duplex operation, the remote Line Miser transmits two frequencies different from those of the central unit. A digital discriminator in the receiving unit reconverts

Line Misers transmit data signals over telephone wires through a phase-coherent, frequency-shift-keying method.

the pair of frequencies into the original digital pattern before sending the data signals to their destination.

Tracing data through the system (Fig. 1) shows that digital data signals from the data-terminal equipment (DTE) or host device enter a remote or central Line Miser, respectively, through an RS232C interface. In the remote-to-central direction, a digital modulator converts the signal into a frequency pair of 36 KHz (space) and 48 KHz (mark). In the central-to-remote direction, the frequency pair is 84 KHz (space) and 96 KHz (mark). An amplifier increases the amplitude of the frequency pair and sends it through a band-pass filter that permits the passage of only that pair. Each Line Miser has two band-pass filters of 36 to 48 KHz and 84 to 96 KHz. These filters discriminate between

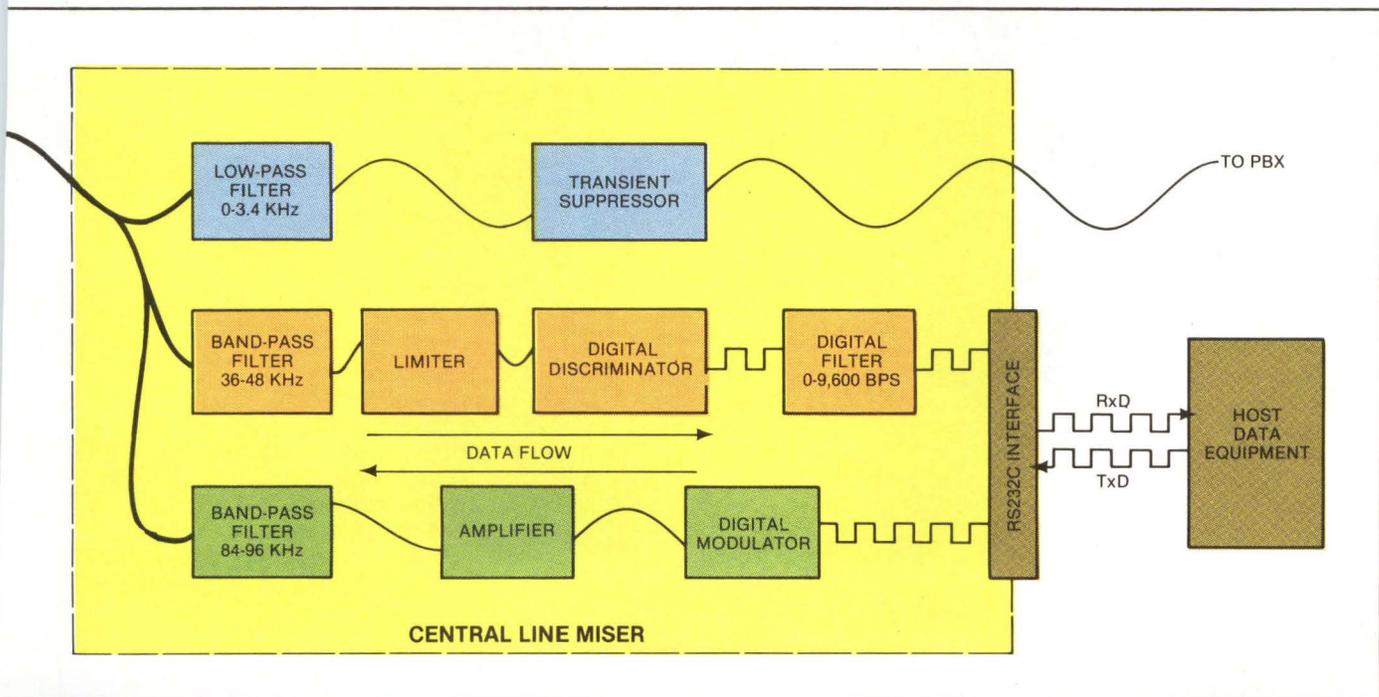


The remote Line Miser measures 5¼ by 11½ by 2¾ inches and fits under a standard desk telephone.

the outgoing and incoming data channels in full-duplex operation.

The frequencies then go out over the telephone lines, where the amplitude of the data-signal level decreases in proportion to the distance the signal travels. The receiver sensitivity of Line Misers permits the recovery of signals having a loss as great as 55 dB. This allows for a separation distance between the remote and central units of 18,000 feet.

When the transmitted frequency pair reaches the



receiving unit, it passes through the band-pass filter for incoming frequencies. A limiter removes excess amplitude variations from the signal, so that a relatively constant voltage level enters the digital discriminator. The digital discriminator detects the two frequencies

used by the incoming data signals and converts them into the original digital data pattern. A digital filter removes digital components higher than 9,600 bits per second before the data signals leave the Line Miser through the RS232C interface.

Simultaneous voice and data transmissions are possible because the data channels carrying the frequency pairs are above the 4-KHz audio band. Low-pass, 0- to 3,400-Hz filters maintain the integrity of voice communications because the data-frequency pairs on the telephone circuit do not pass through them. Thus, the data signals do not interfere with the voice signals. The

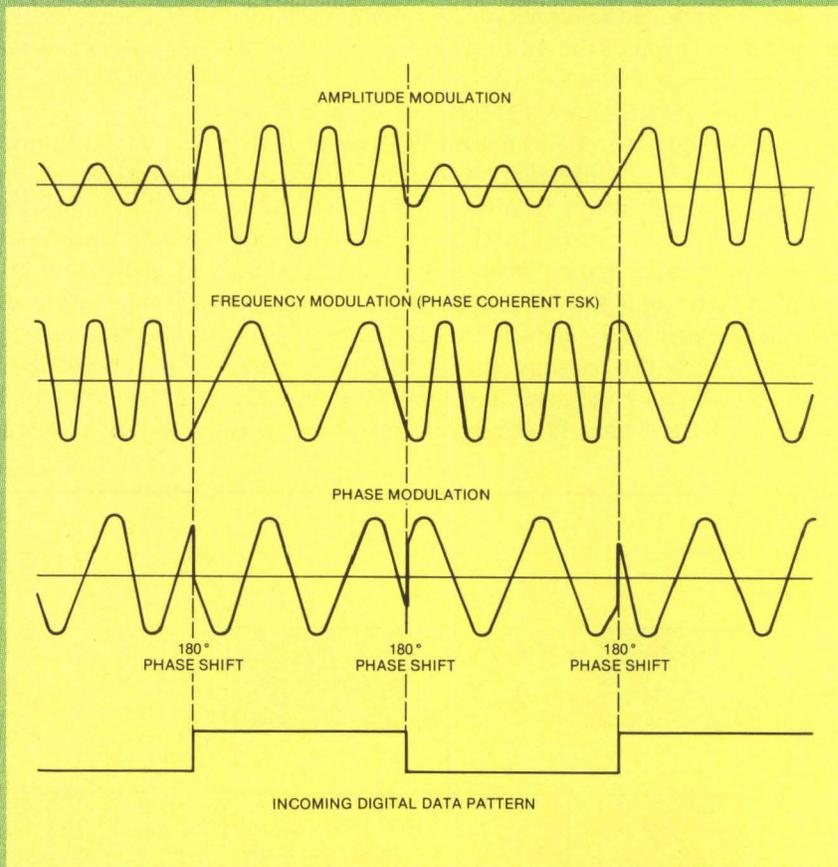
Methods of modulation

Modulation is the process by which a characteristic of one sine wave is varied in relation to that of another sine wave. In the case of data transmissions via modems, a characteristic, such as amplitude, of an analog sine wave varies in accordance with the digital pattern of the data signal. At the simplest level, two variations of the characteristic are used, one for a space (0) and another for a mark (1).

The three basic modulation techniques are amplitude modulation (AM), phase modulation (PM) and frequency modulation (FM). Most modems use one or a combination of these techniques. The main advantage of amplitude modulation is its low implementation cost. However, AM is not common in modems because it typically requires a large bandwidth and is suitable only for low-speed transmissions. AM also has a low noise tolerance. AM can sometimes be used as a variable with another modulation technique to speed a data transmission within a bandwidth.

PM, which varies the phase of a frequency carrier, has good noise immunity but requires a large bandwidth. Encoding—transmitting several phase shifts rather than one phase for marks and another for spaces—is normally used to reduce the bandwidth and allow high data rates. Each shift represents two or more data bits, and the degree of the shift corresponds to the information contained in the data signal.

For example, phase shifts of 90, 180, 270 and 360 degrees could be used to transmit 00, 01, 10 and 11, respectively. The receiver must detect each phase shift as it occurs to permit transmissions at reasonably fast data rates. The receiver detects each shift by referencing the original carrier phase. PM modems are best-suited for synchronous data transmissions because the modems must operate at



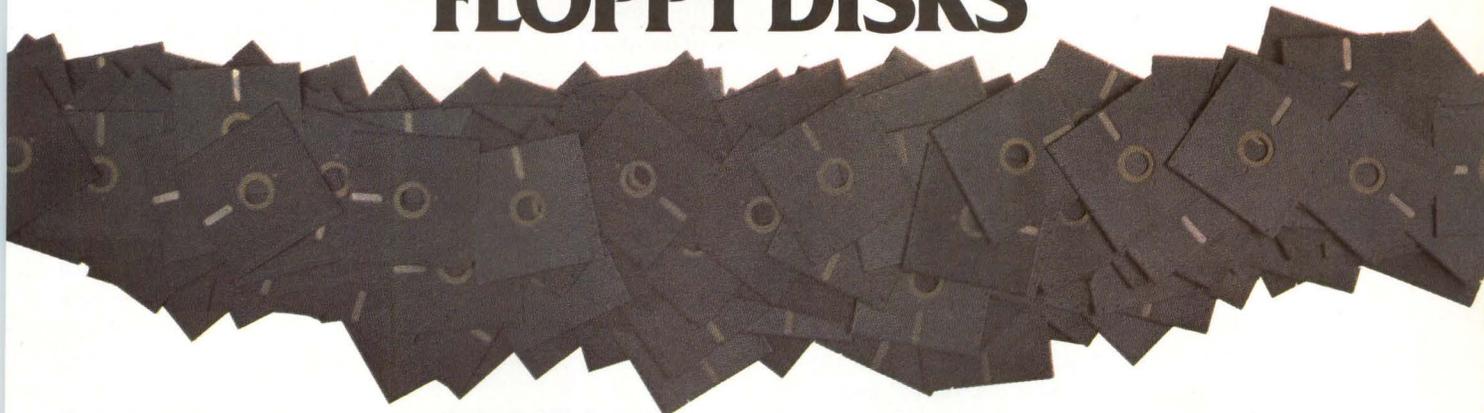
fixed data rates and be synchronized with each other to permit rapid shift detection and decoding. In addition, the complexity of the decoding and detection circuitry results in high implementation costs.

FM is achieved by shifting frequencies above and below a given center frequency while maintaining a virtually constant amplitude. FM uses a lower bandwidth per data rate without encoding and is considerably less expensive to implement than is PM. Modems using FM are relatively simple to design for operation above voice frequencies. Most modems use the frequency-shift-keying (FSK) FM

technique. In an FSK modem, the carrier simply shifts between two frequencies (tones)—one for mark and the other for space. FM modems need not be synchronized.

Phase-coherent FSK occurs when there is no forced phase change in the carrier signal when the frequency changes; any new frequency that is generated follows the phase of the previous frequency. The frequency components resulting from phase changes are thus eliminated. Higher data rates are possible because phase-coherent modems can detect frequencies with a minimum number of cycles, sometimes as few as one.

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CIRCLE NO. 100 ON INQUIRY CARD

filters also help to limit interference to the data from ringing and dialing signals, PBX switch noises and on-/off-hook operation. A transient suppressor (a filter that removes transient, or odd, frequencies) in the central unit and the band-pass filters in both units assist in this function.

Modems link network resources

Environments employing Line Misers typically use a pair of the units to provide computer access to a terminal. This configuration is practical when a terminal's location makes installing cables physically or economically impractical. A rack-mounted Line Miser sells for \$245; a standalone version, \$295.

In a large environment, multiple pairs of units can provide computer access to DTE dispersed throughout a building, a building complex or a campus. A telephone need not be present for the DTE to use the telephone lines for data transmissions; Line Misers can connect

directly to telephone lines and can be used strictly as two-wire modems.

Line Misers can also be used with data-switching devices to provide DTE with access to all the resources of a data network. When installed with a data PBX, for example, Line Misers are gateways to data-networking resources such as local and remote computers, word-processing equipment and X.25 networks (Fig. 2). Line Misers also provide access to the resources interfaced to other local and remote data PBXs in a network. The data PBX/Line Miser systems can be added in parallel to analog voice PBXs, an application that may be more cost-effective than upgrading to integrated voice/data PBXs. □



Hank Morgan is a product line manager for transmission products at the marketing division of Gandalf Technologies Inc., Wheeling, Ill.

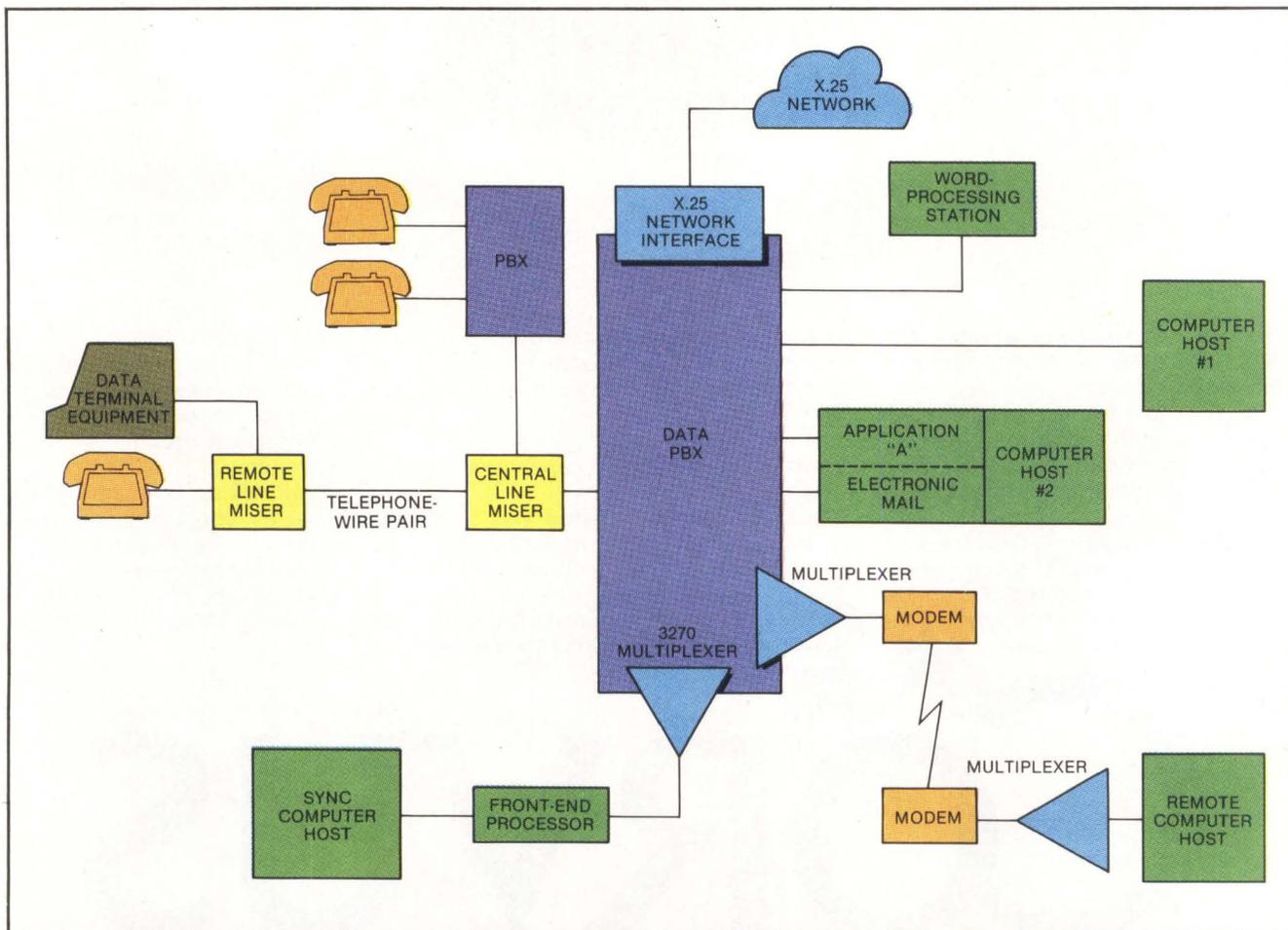


Fig. 2. Line Misers and a data private-branch exchange link data-terminal equipment (DTE) to various information resources over a pair of telephone wires. A data PBX is a data-switching device that

provides switching and contention-handling for DTE seeking access to information resources. Line Miser-equipped DTE can access any resource in such a network.

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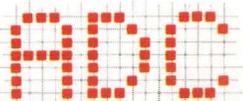
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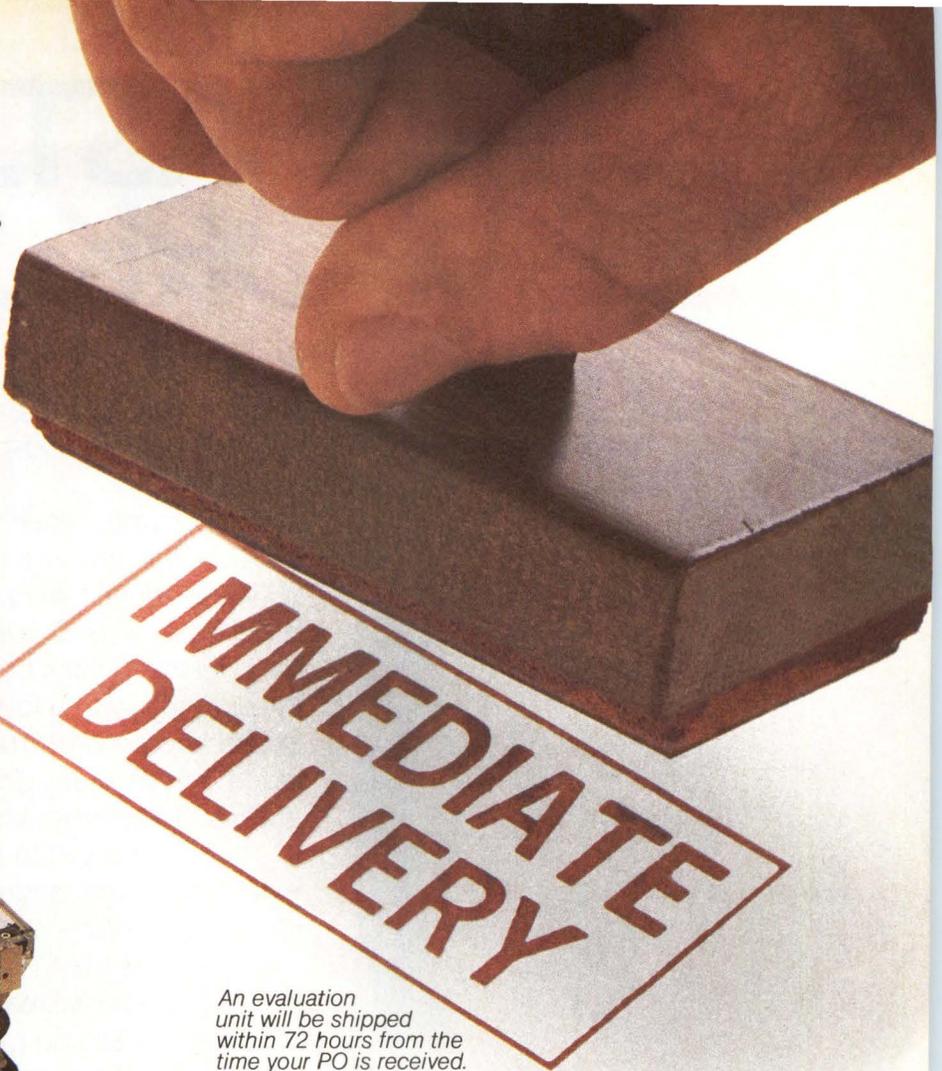
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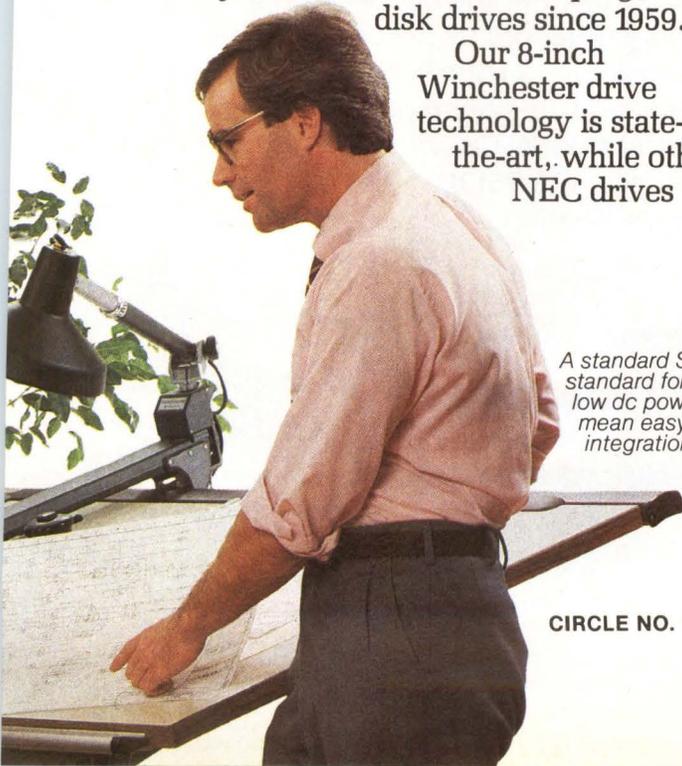
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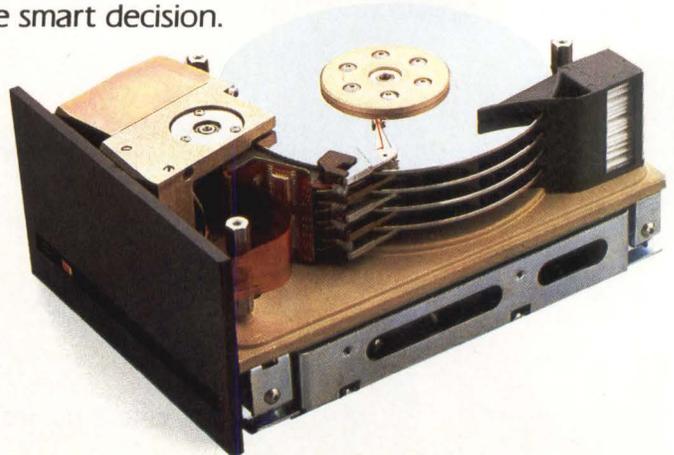
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CIRCLE NO. 103 ON INQUIRY CARD

Modem-expansion boards simplify system integration

Reflecting PC-driven technology, modem-expansion boards offer system integrators increased communications capacity, wider flexibility and easier interfacing

Dan M. Bowers, Bowers Engineering Co.

One of the fastest-growing areas of communication equipment is modem-expansion boards, which the personal and small computer markets are increasingly affecting. Many computer manufacturers and third-party vendors offer these completely engineered and fully functional modems on a PC card for use with popular computers. The PC cards, which are physically-electrically- and software-compatible with the associated computer, plug into an empty slot that the computer manufacturer provides.

Selecting a modem-expansion board

Today's digital data-communications systems perform the same functions as primitive hand-designed systems did in 1962. However, today's systems perform these functions less expensively, an order of magnitude faster and much more reliably and accurately. They also perform them according to standards that have evolved over the past 20 years. Standards committees legislated some of these standards; major companies imposed others.

Several factors are important in choosing a modem, including baud rate, interface compatibility, intelligence and package content. Users selecting a modem for system applications should consider data communications as a subsystem within the computer system. They should then make specifications of and trade-offs with that subsystem, just like any other. After they define the system, they should view each subsystem as a separate problem in system design.

A data-communications subsystem typically includes modems, communications processors, multiplexers, concentrators, remote-terminal interfaces, a central processor interface, communications links, systems, procedures and personnel protocols.

What's in a modem?

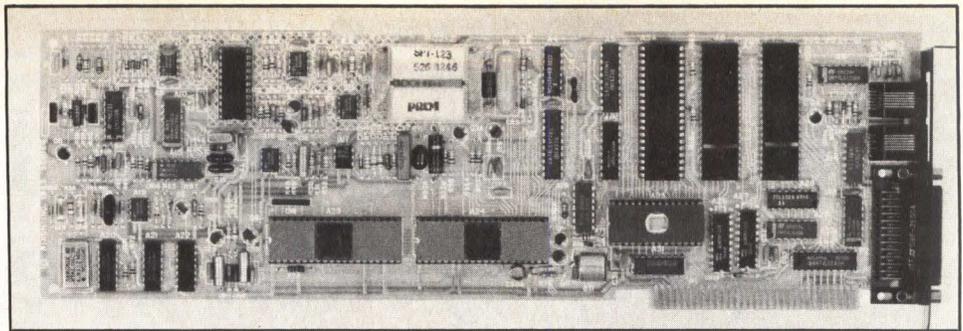
Users should choose a modem by analyzing system requirements, regardless of the modem's physical specifications. Features important to system performance might not be as readily available in modem-expansion boards as in modem modules. Accordingly, a trade-off in integration occurs when the user weighs performance against physical form. To solve a communications problem by brute force, a user could simply buy fast modems and lines, large buffer memories and separate communications processors. The integration challenge, though, is for users to select the lowest-priced, most reliable system for their jobs. They should consider three primary system characteristics: the basic system functions for which the modem is needed, the additional features, such as easier integration, that might enhance the modem's performance and options that are necessary in some situations but not in others and, thus, perform functions that another part of the system could perform if necessary.

Evaluating basic functions

Users should also evaluate eight basic functions when comparing modem-expansion boards: transmission speed, connection means, modulation method, transmission mode, line and network compliance, interface protocols, communications line and cost.

• **Transmission speed.** Manufacturers offer hundreds of modems that transmit at speeds as high as 1,200 baud. Such systems offer virtually unlimited physical configurations and functional features. Several manufacturers offer 1,800- and 2,400-baud units. They claim these systems operate reliably over the dial-up network, but users should be cautious. New modems incorporate automatic adaptive equalization for better reliability. Operation at 2,400 baud over dedicated lines is successful. For at least six years, manufacturers have

Fig. 1. Modem-expansion boards, such as Rixon Inc.'s PC212A LSI card unit, typically plug directly into a personal computer such as the IBM PC. The PC212A features an integral modem dialer and two asynchronous serial interface ports in one card slot.



been providing modems that operate at 4,800 and 9,600 baud over dedicated lines. Modems in carefully controlled environments can transmit at 19.2K baud, but most minicomputer and microcomputer systems do not require these high speeds.

- **Connection means.** Quick-connection/-disconnection for portable or occasional use generally calls for acoustic couplers and 300-baud modems. However, manufacturers are now offering wired-in modems using standard telephone jacks, which are easily connected and removed. Most modems use continuous-duty and fixed equipment, which are hard-wired to the lines.

- **Modulation method.** From a user's viewpoint, the asynchronous and frequency-shift keying methods are effective at low speeds because those methods are easier to accomplish than synchronous and phase-shift keying (PSK). Synchronous and PSK methods are used at high speeds because they achieve higher data rates. System integration and programming considerations might make one method more desirable.

- **Transmission mode.** Users seldom select the simplex transmission mode because it does not provide acknowledgement from the other end, which most communications system require. The advantage of the full-duplex mode over the half-duplex mode is that full-duplex more than doubles the data rate. But, since it requires the equipment on both ends to have separate

transmit and receive data channels, it also causes a modest increase in cost and complexity.

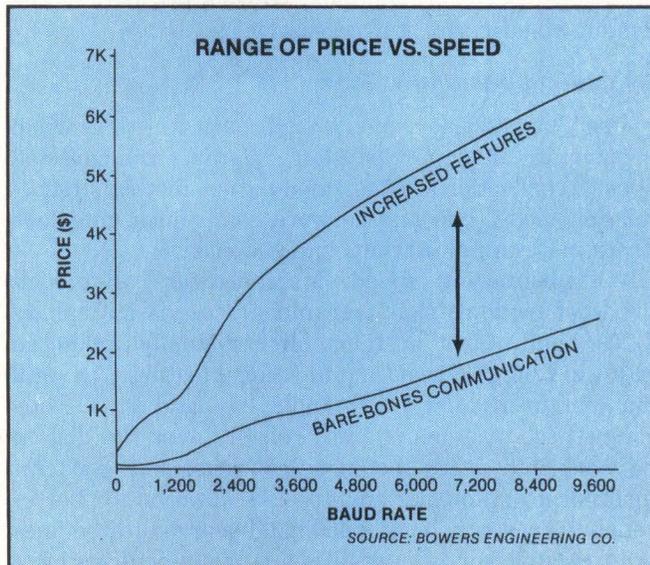
- **Line and network compliance.** Compliance with American Telephone & Telegraph Co. standards is useful in general-purpose applications because it improves the odds of finding a compatible modem on the other system's end. If an application requires specific networks to be accessed, compliance with their standards and protocols is needed. But a user can choose his own line protocols if the communications system is entirely within the user's domain. Federal Communications Commission (FCC) certification also addresses electrical-connection compliance problems. For example, if a modem is not FCC-certified, a user must insert a data-access-arrangement (DAA) box—that can cost half as much as the modem—to connect to the public telephone system.

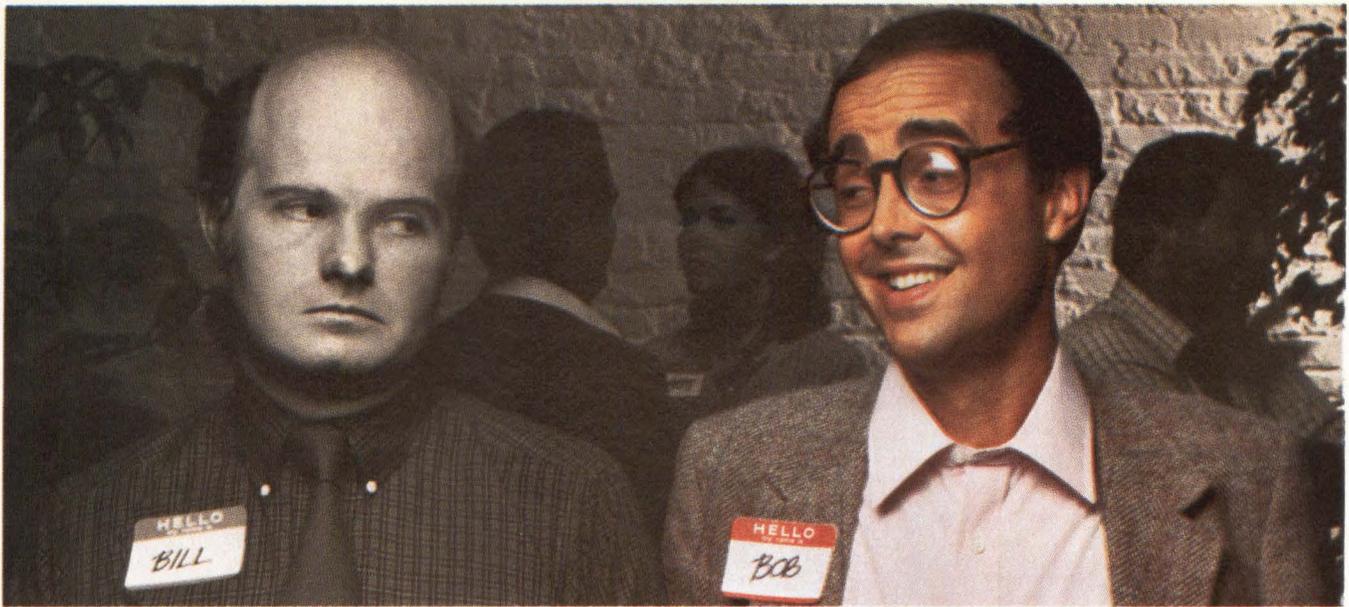
- **Interface protocols.** Modem-expansion boards are interfaced to specific computers. Some manufacturers also offer modems for particular computers, but most modems offer the standard RS232 interface that is available on virtually all computers.

- **Communications line.** Manufacturers of mainstream and modem-expansion boards provide units that work on the public direct-dial telephone system. Other modems find use on dedicated telephone lines, private lines, twisted-pair wire, microwave links and fiberoptic links. In choosing a modem to operate on the direct-dial network, the user need not consider line parameters because they are already defined, but he must specify whether the equipment will operate on the common push-button or on the rotary dialing system. In any direct-line system, he must also evaluate line-conditioning requirements, line turnaround time, filtering and equalization methods, transmission distances and projected error rates.

- **Cost.** Data-communications cost is a combination of modem cost, line costs and computer system resource values that support the modem and line. For example, a \$1,000 modem with buffering and auto-dial might result in a lower-priced total system than a \$300 bare-bones modem that requires more processor time. Typical single-unit prices for functional modems (excluding chip sets and built-ins) are: 300-baud acoustic coupler: \$200, bare-bones 300-baud modem module: \$300, 300- to 1,200-baud modem-expansion board: \$400, bare-bones 1,200-baud modem module: \$500, 300- to 1,200-baud modem module with added options: \$800,

Fig. 2. Prices as a function of modem speed or baud rate vary. Modem-expansion boards cluster in the 1,200-baud and lower zone.





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2,400-baud module: \$1,000, 4,800-baud module: \$2,500, 9,600-baud module: \$3,500.

Examining additional features

Additional modem features for a user to examine depend on system requirements. One such feature is automatic answering, which is available at little additional cost and proves useful in most applications. However, if a user selects this feature, he must make sure that the receiving system is prepared to handle the interruption of incoming calls. Automatic dial-up is another convenient and useful feature, although not as widely available as auto-answer. In some sophisticated modems, a file of numbers to be called resides in the modem rather than in the computer. Some modems allow the choice of manual or automatic dialing.

Filtering and equalization are also significant developments. The telephone company incorporates analog circuits into modems to accommodate the data signal and the electrical characteristics (capacitance, inductance, resistance and delay) of the telephone lines and the connected equipment. However, electrical characteristics differ—sometimes widely—for each connection. Modem-equalization circuits were until recently designed to represent average line characteristics,

making communications over poor line connections impossible. The simplest solution was to play “telephone roulette”—break off, re-dial and hope for a better connection. Some new modems offer dynamic and automatic equalization, in which the modem senses the line conditions and adjusts equalization.

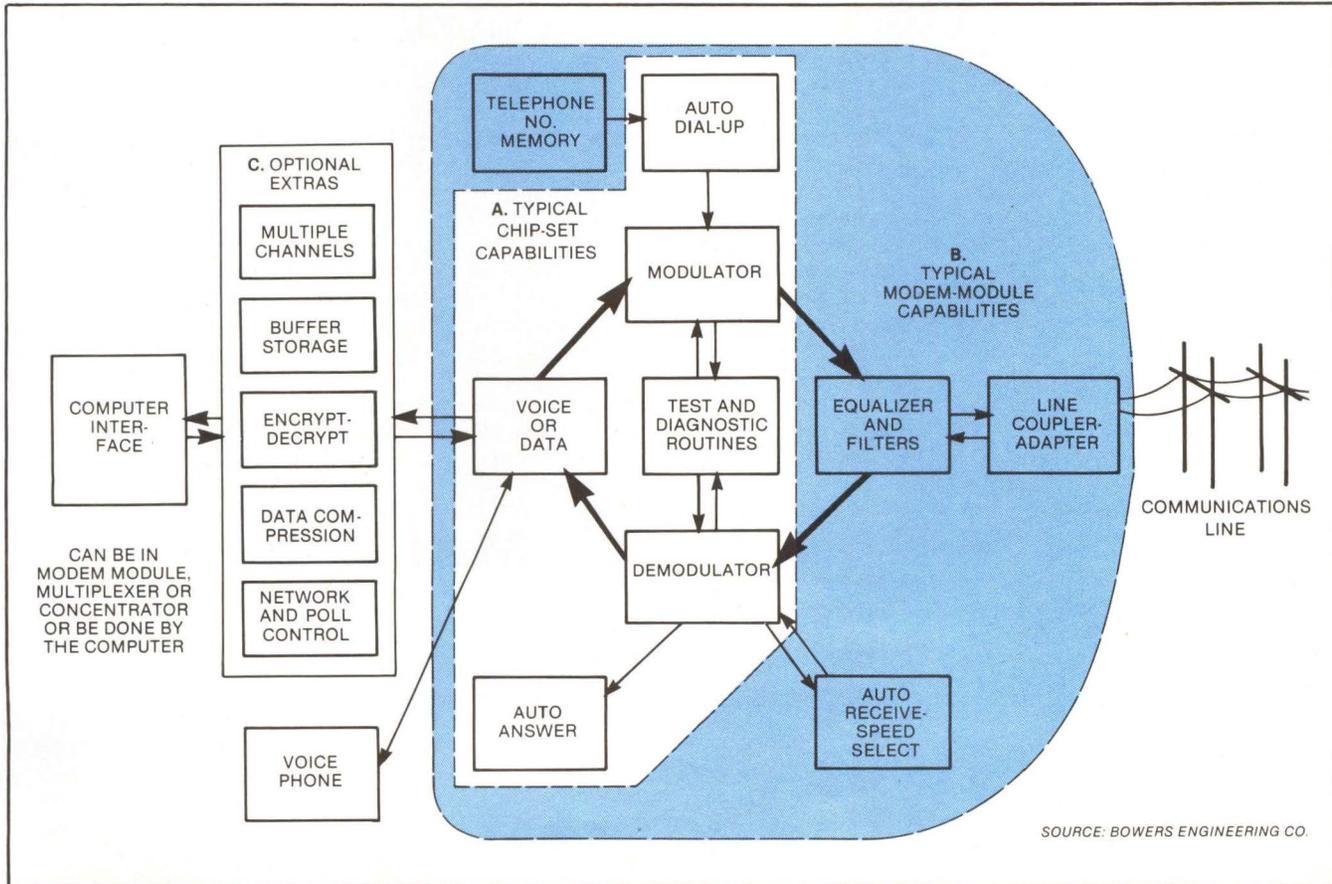
Another feature, automatic receive-speed selection, lets some modems adapt to any incoming data rate. It is useful if an application requires communication with a variety of networks and databases but not in a typical captive system.

Adding channels to a modem can be a mixed blessing. Although modems have for decades used a low-speed reverse-signaling channel to acknowledge messages and to signal errors, some current modems offer low-speed forward channels that operate simultaneously with the principal high-speed channel. But, because other means of accomplishing this task—multiplexing, for example—are available, this feature is useful only in special situations.

Another capability of current modems is transmitting simultaneous voice and data using two lines. The decision to incorporate this feature into a modem is purely cost-based: line costs vs. increased modem cost.

Most modems have simple test facilities, and micro-processor-based versions have sophisticated diagnostics. System integrators should decide whether the modem or the computer should provide diagnostics and test capability.

Fig. 3. Functional categories of a modem show chip-set capabilities as a subset of typical modem capabilities (B).



The list of modem capabilities, options and expansions, is lengthy. Others include buffer data storage, encryption, decryption, data compression, network control, polling control and automatic changeover to a redundant modem.

Analyzing modem-expansion boards

A survey of the modem-expansion board field reveals:

- Personal computers are the principal driving force behind modem-expansion boards. Most modems are made for the IBM Corp.'s PC and PCjr; PC-compatibles, such as those from CompaQ Computer Corp., Columbia Data Products Inc. and Corona Data Systems Inc.; and Apple Computer Inc.'s Apple II and IIe. A few modems are available for Hewlett-Packard Co. systems and the S-100 bus.

- Most modems operate asynchronously at 300 or at 1,200 baud in full-duplex mode. Fewer than half of available products operate in half-duplex mode. Most

offer such extras as stored dictionaries of as many as 99 phone numbers and their communication parameters and automatic adjustment to received-data characteristics. All modems offer manual, pulse and tone dialing.

- Most modems come with the necessary software; others are host-dependent, requiring no separate software.

- Diagnostics range from non-existent to excellent, without correlation to price.

- Prices range from \$239 to \$689, with most selling for around \$450. Options can bring the price to \$1,100.

- About half of all modem manufacturers offer standalone versions of their modem expansion-boards.

- Manufacturers claim modems' consumption of power ranges from "negligible," "not worth mentioning" and "unknown" to 3W to 5W. Users are responsible for ensuring that the power consumed by the modem plus the power consumed by expanded memory boards, disk controller boards and the like do not exceed the computer's power-supply capacity.

Looking at typical applications

Modem expansion-boards fill a niche in computer system integration for personal computer users needing only to communicate data with no desire to design

Modem development was evolutionary

It has been more than 20 years since Bell Laboratories made digital data communications over telephone lines commercially available. It has been 15 years since the decision in Carterfone vs. American Telephone & Telegraph Co. legalized the use of non-Bell equipment. During its first five years, the breadbox-sized modem operated in half-duplex mode over private lines and squeezed data transmission at 1,200 baud with reasonable accuracy—if there were no electrical storms, nearby trolley lines or sunspots. Users could double equipment and lines for full-duplex mode.

Users approached the dial-up network cautiously. These modems—true modulator-demodulators—converted all input digital data to two-tone analog form for transmission over the voice telephone lines and reconverted it to digital form at the receiver. System designers had to solve the problems of data synchronization, character coding, redundancy checking, error checking, poll-response protocols, answer-back and acknowledgement because standard conventions and software packages did not exist.

Since the Bell System then owned the phone lines, users could connect only Bell equipment to those lines.

The first device to circumvent Bell's monopoly—the acoustic coupler—converted digital data to two-tone acoustic form, which was then coupled to a standard telephone handset. The acoustic coupler made no electrical connections to the Bell lines and enabled voice-frequency data to be sent over lines intended for voice only. However, users were not satisfied with the acoustic coupler's 100- to 300-baud data rates. Bell then began offering 1,200 and 2,400-baud modems for private-line use.

The years following the Carterfone-vs.-AT&T decision saw Bell and numerous independent companies improving modem speed and reliability and reducing cost. Reliable private-line operation became available at 2,400, 4,800 and 9,600 baud, with dial-up-line technology costing about half the top private-line rates. Cost was reduced to 50 cents to \$1 per bit per second. Manufacturers limited the features and conveniences of modems to full-duplex, reverse signaling, automatic answering and elementary test facilities, but they also offered a wide variety of multiplexers and concentrators that provided convenient packaged-system features. Manufacturers and OEMs packaged modems to fit into terminals, processors and peripherals.

Despite the ready availability of wired-in modems, though, the slow acoustic coupler survived because of its low cost and convenience in portable applications.

The mid-1970s' microprocessor revolution came at the right time for the modem industry. Because of the mature communications technology and the solid, rapidly growing computer market, manufacturers could offer modems enhanced with many on-board features using micro-computer technology.

New developments took three forms. First, improved modem features included multiple channels, physical and data compatibility with various computers and terminals, digital filtering and equalization, combined voice and digital communication, automatic receive-speed selection and automatic changeover to a redundant modem. Second, modems took over some features multiplexers and concentrators had once handled. They included buffer storage and data compression. Third, modems took over some functions that the computer formerly handled. They included line- and network-protocol handling and polling, error checking and data redundancy, automatic dial-up, encryption, decryption, diagnostics and testing.

Will Fujitsu's SCSI INTERFACE Please Stand Up?

For some time now, the disk drive industry has talked about the SCSI Interface. But all this talk has resulted in very little action. Until now. Today a leader in the SMD market is offering their OEM customers the

option of the SCSI Interface. That leader is Fujitsu America Inc.

SCSI, the ANSI-approved small computer systems interface, is a byte wide intelligent interface designed for host computer systems and peripheral units and can transfer data at up to 2MB/s. The computer and peripherals are inter-

connected on an eight port matrix bus, which enables any port to initiate communication to any of the other seven ports.

Fujitsu America now offers the state-of-the art SCSI interface option on the high performance 8" M2312 drive which has a capacity of 84 MB and an average positioning time of 20ms. Previously this drive was only available with an SMD interface.

A significant advantage of the SCSI interface is that it reduces the cost of interconnecting the drive to a computer. The integral SCSI controller replaces the need for an SMD controller. The only other requirement is a low cost host adapter.

Fujitsu America is committed to keeping you on the leading edge of disk drive technology. So whether you stand up for SCSI or for SMD, you can always count on Fujitsu... for innovation, for technical leadership, and above all for enduring quality.

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CIRCLE NO. 106 ON INQUIRY CARD

systems. Other solutions include using acoustic couplers, freestanding modem modules and integral modems.

Modem-expansion boards cannot meet the needs of applications involving high data rates, sophisticated networking protocols or complex networks of terminals or computers.

Systems and equipment that are custom-designed for particular applications and intended to be manufactured and sold in volume generally deserve custom-designed and -packaged integral modems based on chip sets, even though modem-expansion boards could meet their functional requirements. Manufactured in sufficient volume, custom-designed integral modems yield higher profit margins than modem-expansion boards. Further, design engineers might not buy a packaged modem when they could instead create products to exact system functional requirements.

Modem market consolidates and grows

Although the modem industry is mature, it is not static; four trends could alter its landscape.

The first trend is toward faster modems. Use of captive in-house coaxial lines, microwave links or

fiber-optic networks could provide data rates of tens of kilobauds. But mainstream applications use 2.7-KHz-bandwidth public lines. Using a 1,200-baud modem, a user must wait 16 seconds for a standard CRT screen fill; using a 2,400-baud unit, it takes 8 seconds. Higher speeds should spawn circuitry and device improvements, digital correlation and pattern-processing techniques. Once the effective data rate over the dial-up network reaches about 4,800 baud, pressure for further improvement should wane.

The second trend is toward one-chip modems. Manufacturers will be able to build such modems into all equipment, and independent modem manufacturers will fall on hard times.

Third, many single-product, simple-modem vendors should disappear. Broad-spectrum communications equipment manufacturers, however, will survive and strengthen because of their expertise in sophisticated systems. A market will still exist for independently supplied, unsophisticated modems from communications equipment manufacturers.

Finally, modems will provide more sophistication at lower cost. Competition in the high end among a handful of companies will produce the same results. □

Dan M. Bowers is an engineering consultant with Bowers Engineering Co., Fairfield, Conn.

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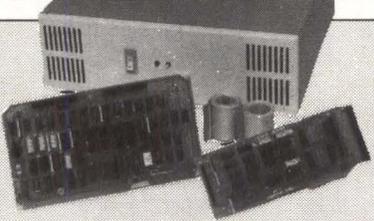
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EMULEX TALKS DEC

10

BIG SURPRISES COME IN SMALL PACKAGES...

Response to the Emulex SABRE™ keeps getting better all the time. Originally intended for LSI-11 and LSI-11/23 PLUS, this "do-it-all" storage subsystem is now being welcomed with open arms by users of the just-introduced MICRO/PDP-11.

Why all the excitement? A quick glance at the specs tells all... DEC offers 10 megabytes on a 5¼-inch Winchester, the RD51. SABRE gives you over three times the capacity—31.2 megabytes on a 5¼-inch Winchester—and an access rate that's twice as fast. For backup, DEC offers the RX50 dual 400-kilobyte diskette, while SABRE has a unique 10.4-megabyte 8-inch cartridge drive. Not only is its transfer rate five times faster than the RX50, but it holds 20 times more data.

And how does SABRE stack up to streaming ¼-inch tape? It offers the advantages of a random access device. What's more, unlike floppies or tapes, the SABRE cartridge can double as primary storage whenever you are pressing the upper limit of your fixed-disk capacity. These benchmarks are discussed in detail in a special Emulex report. Write to us for your free copy.

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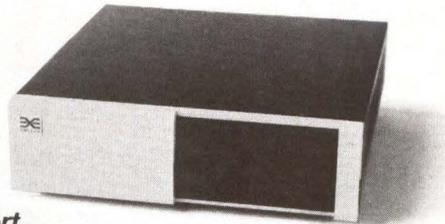
The removable part of the SABRE is a flexible disk with Bernoulli heads. It gives you floppy-type economy, with Winchester-type capacities and transfer rates. That makes it perfect for program loading, data exchange, fixed-disk backup and data storage. Couple this to SABRE's other advantages and you have a system that's equivalent to a fully expanded, four-drive RL02 cartridge subsystem. In one-eighth the space. Requiring only one-fourth the power. With significantly increased flexibility.

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SABRE is a compact desktop enclosure with its own integral power supply. This makes it an ideal add-on device for end users (dealers and distributors take note!). For OEMs there's the advantage of a single SCSI interface for both SABRE subsystem devices. And OEMs can purchase the SABRE in a variety of configurations, with or without drives. The SABRE bipolar, microprocessor-based host adapter—a single quad-wide board embedded in the QBus backplane—can, in fact, support up to five additional SCSI-compatible peripherals on the same bus. Completely transparent to all the standard LSI-11 operating systems, including RT11, RSX11M and RSTS/E, and nearly all standard UNIX device drivers.



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Company Model	Calling functions					Communication features						Automatic recognition of:			Price (\$)	Notes, features, options	
	Computer(s) supported	Data rate (bps)	Modulation method	Synchronization	Transmission mode	Manual keyboard dialing	Pulse dialing	Tone dialing	"Blind" dialing	Dials numbers from modem dictionary	Communication parameters stored with phone number	First dial tone	Busy signal	Secondary dial tone			Dead line
ANCHOR AUTOMATION 6624 Valjean Ave. Van Nuys, CA 91406 (213) 997-6493 Circle No. 853																	
Mark VI	IBM PC and compatibles	300	FSK	async	full duplex	•	•	•	•	•	•					239(Q1); 139(Q100)	price includes software; Bell 103 compatible
ANDERSON JACOBSON 521 Charcot Ave. San Jose, CA 95131 (408) 263-8520 Circle No. 854																	
AJ1212-2B01	IBM PC	0-300; 1200	FSK, QAM	async, sync	full duplex	•	•	•	•	•	•	•	•	•	•	425(Q1)	price with Crosstalk or AJ software, \$495 (Q1); board includes serial port so that both modem and serial printer share one expansion slot; full diagnostics; Bell 212 and 103 compatible
BIZCOMP CORP. 532 Weddell Dr. Sunnyvale, CA 94089 (408) 745-1616 Circle No. 855																	
PC: Intelli-Modem	IBM PC/XT	110, 300, 1200	FSK, PSK	async	half and full duplex	•	•	•	•	•	•	•	•	•	•	499(Q1)	PC: IntelliCom software included, supports Crosstalk and PC-TALK III; 99 name telephone directory; self test, local analog and digital loopback; Bell 212 and Hayes compatible
CERMETEK MICROELECTRONICS INC. 1308 Borregas Ave. Sunnyvale, CA 94089 (408) 734-8150 Circle No. 856																	
Info-Mate 212PC	IBM PC/T and compatibles	110, 300, 1200	FSK, PSK	async	half and full duplex	•	•	•	•	•	•	•	•	•	•	495(Q1)	includes MODEM-MATE software; 8 diagnostic test modes; automatic recognition of voice answer; Bell 212A and 100 series compatible
CTS, ELECTRONIC PRODUCTS GROUP 400 Reimann Ave. Sandwich, IL 60548 (815) 786-8411 Circle No. 857																	
CTS 212AT	TTL bus level interface	300, 1200	FSK, PSK	async, sync	full duplex	•	•	•	•			•	•	•		249(Q1)	no software included; full diagnostics; Bell 212A, 103 and 113 compatible
CTS 212AR	RS 232 bus	300, 1200	FSK, PSK	async, sync	full duplex	•	•	•	•			•	•	•		259(Q1)	no software included; full diagnostics; Bell 212A, 103 and 113 compatible
MICRO-BAUD 3393 Dela Cruz Blvd. Santa Clara, CA 95050 (408) 727-5275 Circle No. 858																	
80512	TeleVideo CRT Terminals	0-300, 1200	FSK, PSK	async	full duplex	•	•	•	•	•						550(Q1); 375(Q100)	no software included; self test; Bell 212A compatible

EXPANSION-BOARD DDD MODEMS

Company Model	Calling functions					Communication features					Automatic recognition of:				Price (\$)	Notes, features, options
	Computer(s) supported	Data rate (bps)	Modulation method	Synchronization	Transmission mode	Manual keyboard dialing	Pulse dialing	Tone dialing	"Blind" dialing	Dials numbers from modem dictionary	Communication parameters stored with phone number	First dial tone	Busy signal	Secondary dial tone		

MICROCOM INC.

1400 A Providence Highway
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(617) 762-9310
Circle No. 859

ERA 2	IBM PC/XT/PCjr; Apple IIe	1200, 0-300	FSK, DPSK	async	full duplex	•	•	•	•	•	•	•	•	•	•	429(Q1)	includes software; local analog loopback; Bell 212A and Hayes command compatible
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NOVATION INC.

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Chatsworth, CA 91311
(213) 996-5060
Circle No. 860

212 Apple-Cat II	Apple II, II+, IIe	0-300, 1200	FSK, PSK	async	half and full duplex	•	•	•	•	•	•	•	•	•	•	725(Q1) 508(Q100)	includes Com-Ware II software; self test; local analog loopback; Bell 103, 113, 202, 212A compatible
Apple-Cat II	Apple II, II+, IIe	0-300, 1200	FSK	async	half and full duplex	•	•	•	•	•	•	•	•	•	•	389(Q1)	includes Com-Ware II software; selftest, local analog loopback; Bell 103, 113, 202 compatible
PC1200B	IBM PC/XT and compatibles	300, 1200	FSK, PSK	async	half and full duplex	•	•	•	•	•	•	•	•	•	•	595(Q1)	includes Crosstalk XVI software; full diagnostics; Bell 103, 113 and 212A compatible

RIXON

2120 Industrial Parkway
Silver Spring, MD 20904
(301) 662-2121
Circle No. 861

PC 212A	IBM PC	300, 1200	FSK, PSK	async	full duplex	•	•	•	•	•	•	•	•	•	•	499(Q1)	software included; full diagnostics; Bell 212A, 103 and 113 series compatible
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TRANSEND CORP.

2190 Paragon Dr.
San Jose, CA 95131
(408) 946-7400
Circle No. 862

AMC 300	Apple II, IIe	110, 300	FSK	async	half and full duplex	•	•	•	•	•	•	•	•	•	•	325(Q1)	TRANSPACK software sold separately; local analog loopback; Bell 103 compatible
PC ModemCard	IBM PC	300, 1200	FSK, DPSK	async	full duplex	•	•	•	•	•	•	•	•	•	•	549(Q1)	TRANSPACK PC software sold separately; local analog loopback; Bell 212A, 103J compatible; 300-baud version \$349(Q1)

U.S. ROBOTICS

1123 W. Washington Blvd.
Chicago, IL 60607
(312) 733-0497
Circle No. 863

S-100 Modem	S-100	0-300/1200	FSK, PSK	async	full duplex	•	•	•	•	•	•	•	•	•	•	449(Q1) 295(Q100)	software not included, recommends USR TELPAC software; no diagnostics; Bell 103, 113, 212A and Hayes compatible
IBM PC MODEM	IBM PC and compatibles	0-300, 1200	FSK, PSK	async	full duplex	•	•	•	•	•	•	•	•	•	•	449, 699, 1149(Q1); 297(Q100)	includes TELPAC software; no diagnostics; Bell 103, 112, 212A and Hayes compatible; options include 64K and 256K RAM, battery backup and real-time clock

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Company Model	Calling functions					Communication features						Automatic recognition of:				Price (\$)	Notes, features, options
	Computer(s) supported	Data rate (bps)	Modulation method	Synchronization	Transmission mode	Manual keyboard dialing	Pulse dialing	Tone dialing	"Blind" dialing	Dials numbers from modem dictionary	Communication parameters stored with phone number	First dial tone	Busy signal	Secondary dial tone	Dead line		

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 Santa Clara, CA 95051
 (408) 727-5721
 Circle No. 864

PCMP	IBM PC and compatibles	300, 1200	FSK, PSK	async	full duplex	•	•	•	•	•	•	•	•	•	•	689(Q1)	includes Crosstalk XVI software; full diagnostics; Bell 212A compatible
PC Modem	IBM PC and compatibles	300, 1200	FSK, PSK	async	full duplex	•	•	•	•	•	•	•	•	•	•	499(Q1)	includes Crosstalk XVI, full diagnostics; Bell 212A compatible
PC Modem Half-card	IBM PC and compatibles	300, 1200	FSK, PSK	async	full duplex	•	•	•	•	•	•	•	•	•	•	549(Q1)	includes Crosstalk XVI software; full diagnostics; Bell 212A compatible
HP Internal Modem 150	HP bus compatible	300, 1200	FSK, PSK	async	full duplex	•	•	•	•	•	•	•	•	•	•	425(Q1)	no software; full diagnostics; Bell 212A compatible

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With VMEbus, you have no limit on the number or types of processors you can use. You can add as many bus masters as you need, when you need them . . . and you can mix 8-16-and 32-bit processors in the VMEbus backplane. It operates asynchronously at high speed, providing seven interrupt and four bus arbitration priority levels for total flexibility. Couple its multiprocessing capability with its reliability and integrity features, its multiple sourcing, and its 20-megabyte-per-second performance, and you see why it's today's international bus of choice.

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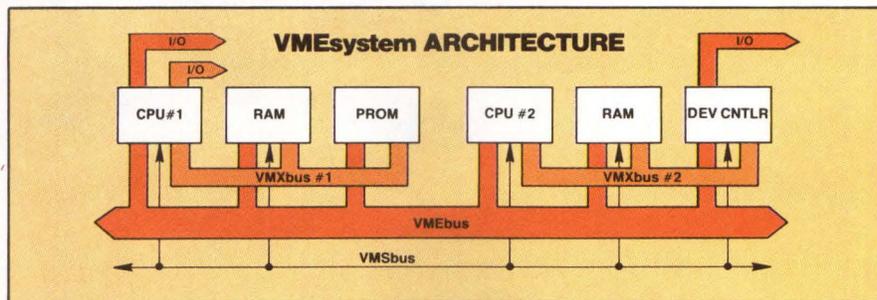
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fications will be expanded throughout 1984 to meet demand, and products will be available soon to take advantage of these new architectural features.

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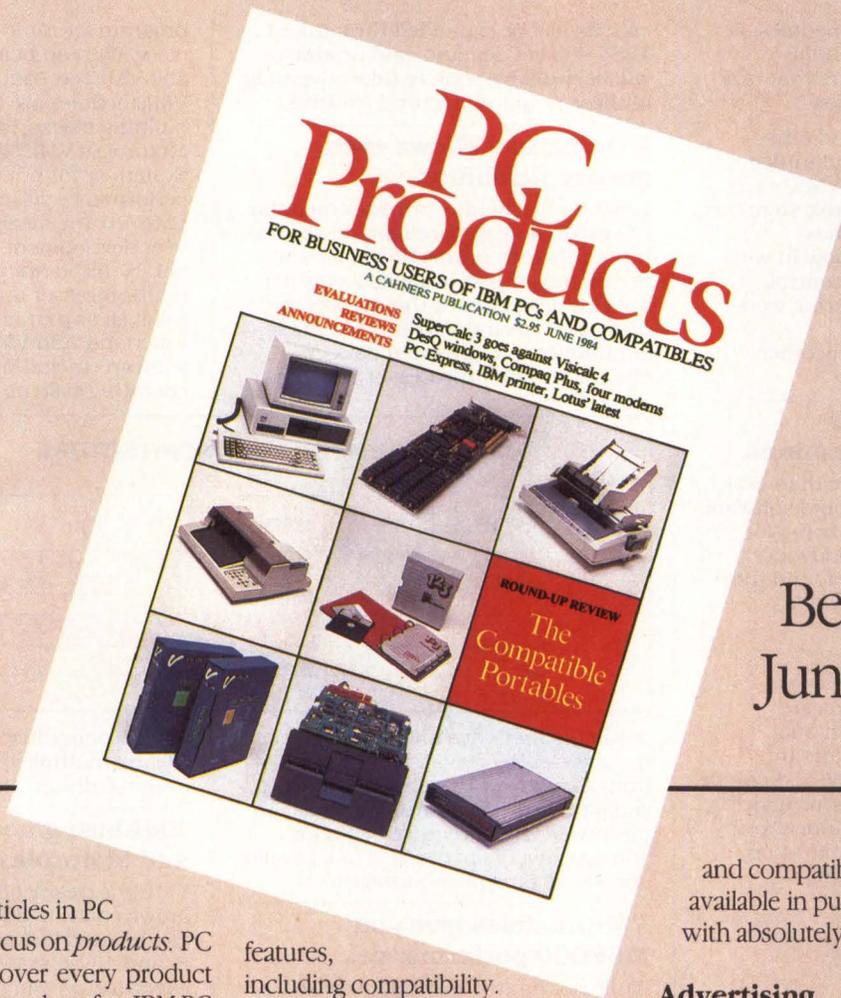
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Beginning
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CIRCLE NO. 112 ON INQUIRY CARD

UNIX-compatible networking operating system provides virtual-file access

uNETix concurrently runs PC-DOS and UNIX packages in multiple, active windows

Fig. 1. The uNETix operating system allows as many as 10 active windows to be displayed simultaneously on the screen. The user can transmit data directly from window to window and can expand and contract windows as required. The user can run a PC-DOS-based application package in one window and UNIX-based package in another window, transferring data between the two.

The following is a list of features associated with 8086/8088-based personal computers capable of including the IBM Personal Computer.

Kernel:

1. single-user with multi-terminal asynchronous communications port
2. multi-tasking: both multi-foreground and multi-background
3. programming models supported: I/O with the large model to follow standard UNIX conventions
4. inter-task communication: pipes (to be used with the file system). (Pipes to be used with the file system)
5. suitable for real-time applications

Descriptions	Actual Current Month
Sales	\$123,000.00
Returns	\$2,999.00
Net Sales	\$120,001.00
Misc. Income	\$2,000.00
Total Income	\$122,001.00

Expenses	\$60,000.00
Misc. Expenses	\$3,000.00
Total Expenses	\$63,000.00

Income	\$59,001.00

F	S	UID	PID	PPID	NICE	ADDR	S
IF	R	0	0	0			
OF	S	0	1	0			
OF	S	0	9	1			
OF	S	0	5	1			
OF	S	0	6	1			
OF	S	0	7	1			
OF	S	0	8	1			

The stock market was up today despite news that the announced new measures to tighten the nations money. Lantech Systems Inc. showed another year of impressive market analyst attribute the strength of the company's vastly superior operating system uNETix. Gold futures reached an all time high today of \$1,200.

17-Aug-1983 7:56 18

Dr. Derrell Foster, Lantech Systems Inc.

As hardware vendors continue to battle for networking supremacy, software is rapidly becoming equally important. Some software vendors ally themselves with specific networks, and others, such as Lantech Systems Inc., strive for a network-independent solution. Lantech's uNETix is a multitasking network operating system that is compatible with UNIX, offers transparent remote-file access

and dynamic load balancing and operates on virtually any network. The uNETix operating system runs on 8086-/8088-, 68000- and NS16032-based systems and is compatible with PC-DOS. It is available in a standalone version, a small-network distributed-system version and a large-network virtual-file-access version.

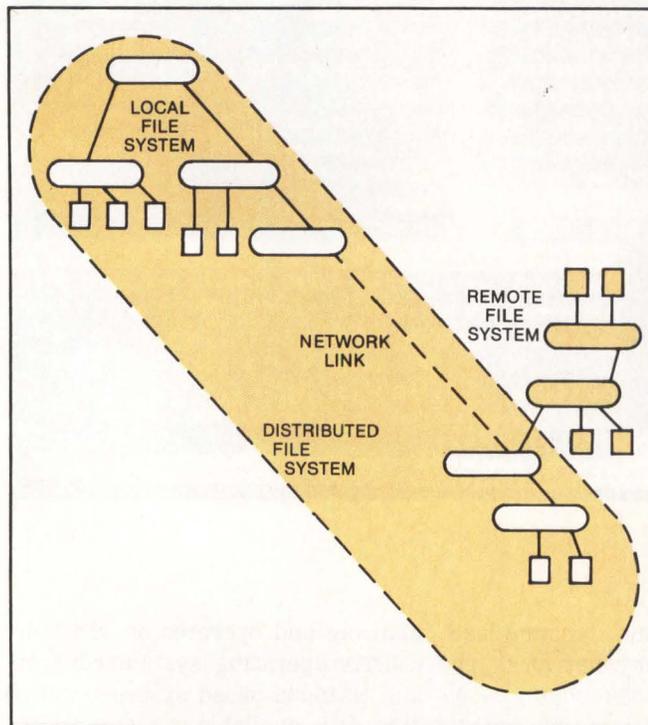
Multitasking through multiple active windows

The uNETix system provides true multitasking through multiple active windows (Fig. 1). The uNETix

kernel contains a screen driver that lets the user configure as many as 10 windows per screen. (The number 10 is chosen as a practical limit based on the fact that the IBM PC has 10 function keys. The number of possible windows could be higher, depending on screen space.) Each window can be active simultaneously. An operator can expand or contract the windows to adjust the screen space allocated to a task.

The uNETix multitasking capability differs from other multitasking operating environments that permit multiple windows to be displayed on the screen but with only one active at once. Such environments require a user to write data from the first process to hard disk before activating a second process. The uNETix environment pipes data directly from one process to another and does not require writing to hard disk.

The user can transfer data or text that appears in one window to another window with a few simple commands. The user can also program the system so that the operating system automatically transfers data at specified points in the source program. Thus, applications can be "self-integrating." In other words, several applications not written as an integrated package can



The uNETix-DFS (distributed-file system) supports network access to files and devices on other computer systems through a distributed-file system. The user sees only a single logical file system that extends over all files in the network. With uNETix-DFS, the user must know the location of the file to be accessed; with uNETix-VFS (virtual-file system), the user need only ask for the file by name, as though it were stored locally. Access of the requested file is transparent to the user.

run concurrently in different windows, and data can be transferred among them.

A microcomputer-to-mainframe link can be implemented through a virtual terminal capability. A "v tty" command links the microcomputer directly with a mainframe or minicomputer. To the mainframe, the microcomputer looks like any other terminal. The user can then take advantage of uNETix's data-transfer and self-integrating abilities. For example, data could be called up in one window from the mainframe database and transferred into another window running a microcomputer application package. This involves no modifications to application software.

Self-integration is available to any end user of uNETix, but application-program vendors and system integrators will prepare the most effective integrated packages. Software vendors can link programs to build custom application packages. The output of a process running in one window can be transferred automatically to be the input of a process running in a second window. For example, selected output of an electronic spreadsheet can be automatically transferred to a graphics package displayed in another window, dynamically updating the graph.

The uNETix operating system contains an MS-DOS (PC-DOS) emulator, which significantly increases the number of available applications. Unmodified PC-DOS programs run as a task under the system shell (command interpreter). The user does not have to load PC-DOS. All PC-DOS Version 1.1 and several of the Version 2.0 commands and features are available. PC-DOS and uNETix applications can run concurrently, providing the user with a migration path from PC-DOS to UNIX.

The uNETix kernel is a proprietary implementation of Bell Laboratories' UNIX operating system. It is fully compatible with UNIX Version 7 and contains many of the enhancements of System III. Users can run UNIX applications and utilities and use standard UNIX calling conventions. The uNETix file system is compatible with the standard UNIX file system.

The kernel is written for the Intel 8088 microprocessor with versions for the NS16032 and the Motorola 68000 due in early 1984. As with most versions of UNIX, 85 percent of the uNETix kernel is written in C. Of the remaining 15 percent, which is hardware dependent, two-thirds is written in C, and the remaining one-third is written in assembly language.

The uNETix system also includes an intelligent disk cache that stores frequently-used information in RAM rather than on disk. The operating system automatically loads the data into RAM and writes it back to disk as required.

Two networking versions are available

The uNETix-DFS (distributed file system) provides transparent remote-file and device access, but an operator must know the location of the requested file. The uNETix-VFS was developed jointly by Lantech with

HOW uNETix WORKS

When a user process issues an "open-system" call to access a file, the uNETix kernel collects all appropriate information. This includes the path name of the file to be opened, the access privileges of the user process, the name and location of the user's current directory and the mode in which the file is to be opened (read, write or update). The kernel packages the information into a message that is sent to a file system dispatch process (FSDP) in the local node's operating system. The FSDP then dispatches a process to perform the "open" operation.

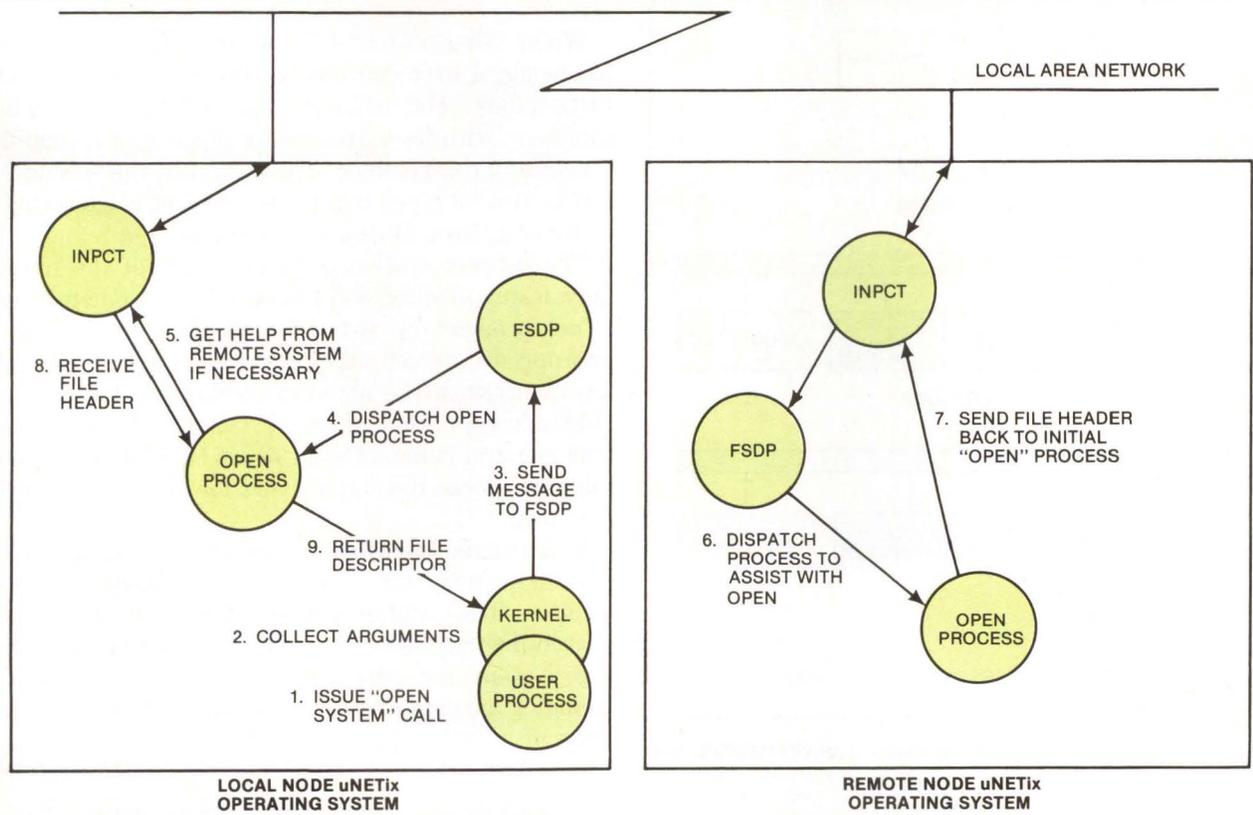
The "open" process parses the pathname and sets up any data structures necessary to access the requested file. If the file exists on another node, the local "open" process requests assistance from an "open" process on the remote node. Even if the file exists on another node, descriptor information about the file is returned to the node requesting the open. This information (the file header, or "i-node" in UNIX language) contains the addresses (or block numbers) of the data in the requested

file. By keeping the file header of the requested file at the local node, the local operating system can cache the most-recently-used data from the requested file. This decreases access times by putting data in local RAM rather than manipulating it at the remote node. The size of the cache is user-programmable.

The inter-process communication between the system kernel and the FSDP is implemented using special system calls that place the destination mailbox name (or process identification (ID), if known) and the destination node number in the message to be sent to the FSDP. If the destination file or process is on the local node, the operating system deposits the message in the mailbox queue of the appropriate process. If the destination file is not on the local node, the system deposits the message in the inter-node process communication task (INPCT), which sends the message along the network to the INPCT at the destination node. The INPCT at the destination node forwards the message to the destination process via the remote FSDP.

The operating system sets up virtual circuits between INPCTs on a demand basis. Once opened, the circuits remain open until the request is completed. This reduces the overhead when two independent processes on different nodes wish to communicate with each other. The INPCT is not dependent on the actual physical network. The system integrator or user can adapt uNETix to any network by adding the appropriate network device driver.

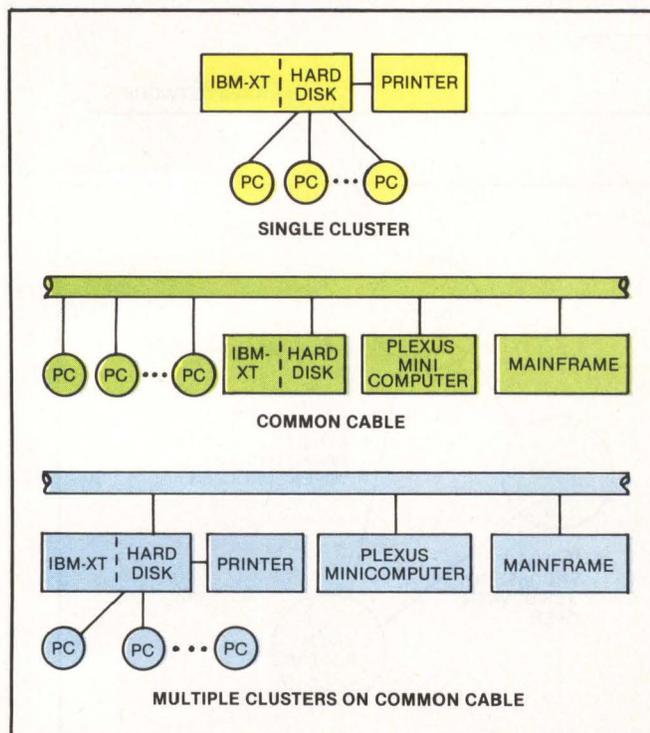
The uNETix-VFS (virtual-file system) appears to the user as a single UNIX hierarchical file system. A user normally does not know where the files are stored, and the files can be distributed throughout the network. The operating system can move files from node to node without having an effect on the logical file system structure. Therefore, intelligent file-assignment algorithms can make decisions, based on statistics kept by the operating system, as to where to put files in the network to decrease file-access times. The operating system moves the files without affecting application programs.



Plexus Computers Inc. and is fully compatible with Plexus' System III network operating system. The uNETix-DFS is adequate for small networks, but, for larger networks, it is impractical for a user to remember the location of the node on which a file is stored. To solve that problem, Lantech will offer uNETix-VFS (virtual-file system) for large networks in early 1984.

To illustrate the power of a virtual-file system, imagine a network with 2,000 files and 600 microcomputers. If a user on a non-virtual network wanted to view a sales report filed in 1978, he would have to search through the directories of each memory node in the network to find the one that contained that file. If the network used a distributed-file system such as uNETix-DFS, the user could then remotely mount that storage device if it were off-line and have direct access to its files. The uNETix-VFS, however, relieves the user of file-management responsibility. The user asks for the file by name as though it were stored locally, and the system retrieves it from wherever it is stored in the network. The process is transparent to the user.

In a virtual-file system, the user's file directory is decoupled from the physical storage of the files. Remote files appear on each local file directory. The



Topological diagrams of typical networking environments. The uNETix network operating system supports clusters via Lantech's "SwitchBoard" cluster controller. For common cable-based networks, uNETix supports a variety of physical interfaces, including Ethernet from Xerox Corp./3Com Corp., Omninet from Corvus Systems Inc. and PerComNet from Percom Data Corp.

user requests the file by name without considering where it is stored or whether it is on-line or off-line.

The operating system assigns files to storage in a manner that balances the file-access load and decreases retrieval times. Users can also move files. Network "thrashing," or file-moving contention, can be prevented by assigning all file-relocation responsibility to the operating system.

The uNETix operating system moves infrequently-used files to an archive server attached to tape drives. However, the file entry is not removed from the user's directory. Upon subsequent retrieval, the user simply notices a delay while the file is retrieved from magnetic tape.

Because the operating system keeps track of each movement of a file in the network, it can make decisions through the use of proprietary algorithms about where files should be stored. This optimizes network performance by balancing the file-access load and decreasing access times. To control file access, the system administrator can generate an audit trail of any file that is accessed by a user and can control each user's ability to copy files onto local floppy diskettes.

Lantech will offer dynamic load balancing with the uNETix-VFS operating system in mid-1984. Load balancing decouples the user process from an individual CPU. The operating system moves the process to the CPU in the network that can best serve it, provided that both CPUs execute the same instruction set. However, the work load can be balanced at discrete times, such as at compile time, for CPUs with different instruction sets.

When using a virtual-file system and dynamic load balancing, a user can invoke true parallelism through UNIX pipes. For example, one CPU can execute a compiler, with its output being piped to a second CPU executing an assembler. The output of the second CPU can in turn be piped to a third CPU that is executing an order. All three CPUs run in parallel.

The uNETix system is independent of the physical networking medium and thus can be implemented with a non-proprietary network interface by adding an appropriate driver (the part of the software that interfaces with the network hardware). Lantech provides drivers for Ethernet, Corvus Systems Inc.'s Omninet and Percom Data Corp.'s PerComNet. System integrators can develop drivers for virtually any other network.

The uNETix operating system requires 256K bytes of system memory and 3M to 4M bytes of storage for UNIX utilities. The utilities can be stored on one central, shared-memory device. Price of the standalone operating system for 8086-/8088-based machines is \$299 including a C compiler, price of uNETix-DFS is \$449, and price of uNETix-VFS is \$599. □

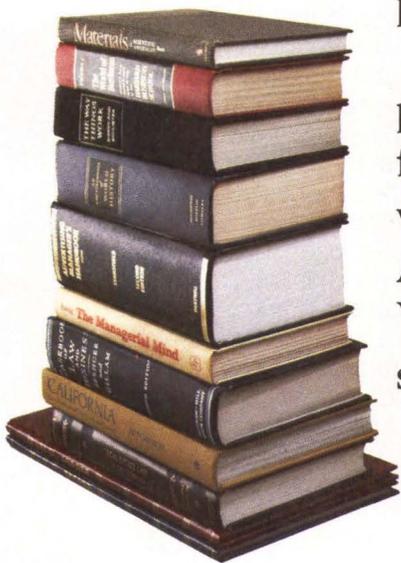
Dr. Derrell Foster is vice president of research and development at Lantech Systems Inc., Dallas.

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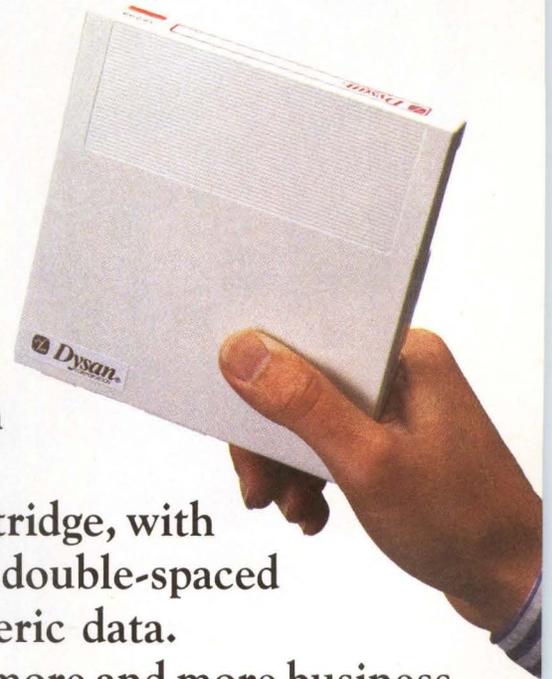
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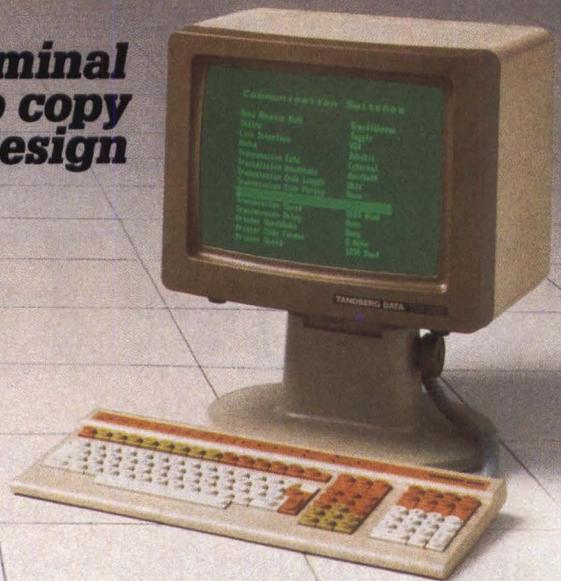
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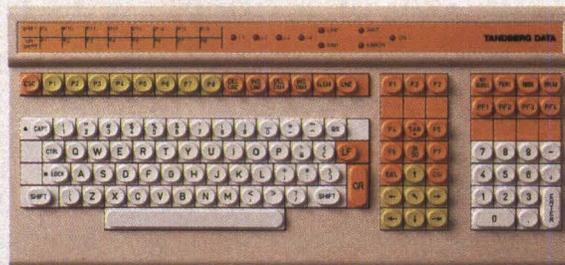
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Like its predecessor, the TDV 2200S also features sixteen soft switches called PUSH keys that recall previously stored words, phrases or code sequences; a simplified menu protocol that cuts set-up time in half; and character, page, block or line/field transmission. No other terminal on the market today can match all of these features. But, they are probably trying.

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Workstations for computer-aided publishing

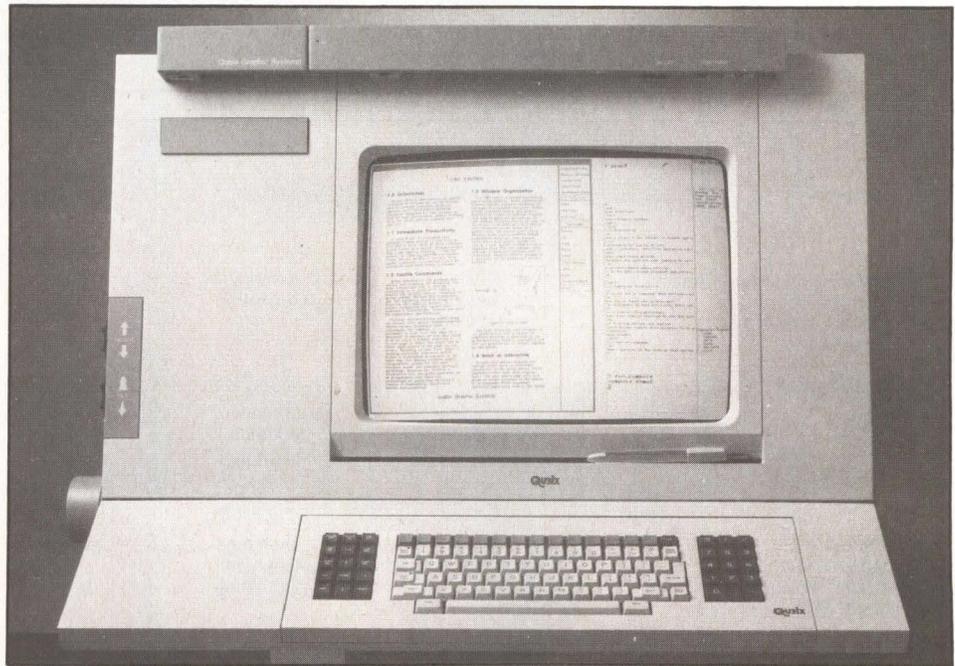


Fig. 1. Screen view of a Qubix graphic workstation. The presentation pane (right) displays a typical composed page, including illustrations, in actual size (8½ × 11) and actual fonts (section heads: 14 pt. Futura Bold; text: 9 pt. Bookman Light; and head/foot: 7 pt. Geneva).

OEM publishing system simplifies multicycle technical documentation, combining text, vector line art and 4 million-pixel displays

Robert S.M. Wulff, Qubix Graphic Systems Inc.

When product design was primarily a manual process, the time lag between design and technical documentation was annoying but tolerable. But, with the introduction of computer-aided design (CAD) tools, product-design time typically has been reduced by a factor of three while the documentation process has remained the same, intensifying the delay problem. Documentation is slow because technical illustrations must be altered, resized and repositioned to correspond to text changes and vice versa. Although artwork typically constitutes less than 20 percent of a technical

document, it consumes as much as 80 percent of the labor in document preparation. In even the most advanced computer-aided publishing (CAP) systems employed by in-house technical publishing departments, changing artwork usually is a laborious manual cut-and-paste process.

To solve these problems, Qubix Graphic Systems Inc.'s CAP system automates the handling of artwork by integrating text and art into a single database and allowing art to be represented in either vector or raster form. The system is designed for OEMs in mainframe, minicomputer and CAD systems; word processing and office automation; and CAP.

PRODUCT SUMMARY

- **Name:** Qubix model I, model II and model IV computer-aided publishing (CAP) systems

- **Manufacturer:** Qubix Graphic Systems Inc., 18835 Cox Ave., Saratoga, Calif. 95070, (408) 370-9229

- **Price:** \$70,000 to \$200,000 (single-unit quantities)

- **Market:** OEMs in mainframe, minicomputer and computer-aided-

design (CAD) systems; word processing and office automation; and CAP

- **Hardware:** one to three MC68010 microprocessors, 2M to 8M bytes of RAM, one to four graphics workstations, one to eight alphanumeric terminals, 80M to 320M bytes of Winchester storage, nine-track tape backup (optional streaming cartridge tape) and an Ethernet-oriented multi-processor network

- **Operating system:** UNIX

- **Graphics display:** 11½-by 15½-inch monochrome screen, 2,240 by 1,680 pixels

- **Font size:** 4.5 to 120 points

- **Interfaces:** Text input: various word processors via media-conversion devices such as Shaffstall Mediacom; CAD input: IGES, Versaplot, custom interfaces; output: any laser or CRT device that supports graphics

Company	Product	Market	Number of workstations	CPU	Graphics input
Bedford Computers Corp. Tirell Hill Rd. Bedford, N.H. 03102 Circle 863	Real Time Composition System	Commercial typesetting	1-3 text	68000	None
Camex 210 Lincoln St. Boston, Mass. 02111 Circle 862	Super Setter System	Newspapers, technical publishing	1-2 graphics, 2-4 text	PDP-11/34	Scanner, tablet
Impress Inc. 3303 Northland Dr. Austin, Texas 78731 Circle 860	System 500	Drafting, technical publishing	1 graphics	8086	CAD, scanner, tablet
Information International 5933 Slauson Ave. Culver City, Calif. 90230 Circle 861	Automatic Illustrated System 2000	Newspapers, commercial typesetting	2-6 graphics, 2-8 text	68000	Scanner
Penta Systems International 1 East Chase St. Baltimore, Md. 21202 Circle 859	Pentavision	Newspapers	12 graphics	Minicomputer	Scanner
Qubix Graphic Systems Inc. 18835 Cox Ave. Saratoga, Calif. 95070 Circle 864	Model I, Model II, Model IV	Technical publishing	1-4 graphics, 1-8 text	68000	CAD, scanner, tablet
Textet Corp. 236A Broadway Cambridge, Mass. 02139 Circle 858	Document Machine	Technical publishing	1-3 graphics	68000	CAD, scanner, tablet
XYvision 52 Cummings Park Woburn, Mass. 01801 Circle 857	XYview, XYtext	Technical publishing	1-2 graphics, 1-2 text	68000	Scanner

The computer-aided publishing (CAP) market. Of the approximately two dozen companies in the market, these eight typify the mainstream.

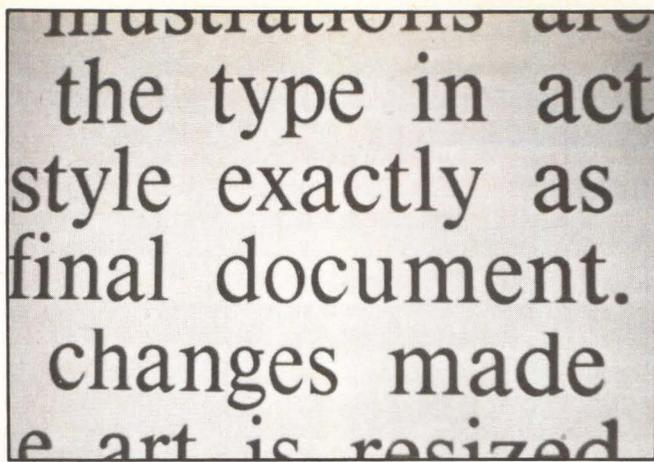


Fig. 2. A blowup of part of Qubix's workstation displays actual rather than generic type fonts. The screen contains 10-point Times Roman type in the exact shape and size of the type in a final document. Times Roman is the most difficult font to reproduce accurately on a raster system because its thin stems—for example, the right side of "y" and middle bar of "e"—require very high resolution.

Pixels; fonts	Comments
642 × 762; generic	Originally based on PDP-11, system has been redesigned for multiple 68000s
1,024 × 800; actual	Includes 2100 BitCaster raster-image processor
700 × 1,100; generic	Supports line drawings and area fill; no sizing facility
Actual fonts	Multiprocessor architecture; graphics and text stored in separate databases
1,280 × 1,024; generic	No keyboard; performs vertical but not horizontal justification
2,240 × 1,680; actual	Stores graphics in either vector or raster form, graphics and text combined in single database
1,110 × 1,500; generic	Scanned illustrations can be positioned and cropped but not scaled or rotated
1,024 × 2,000; generic	Shows actual character size and position, supports 12 generic fonts

Existing CAP techniques are inadequate

The problems with current approaches to CAP are apparent after examining a typical product design cycle. At each design-review meeting, managers, supported by periodically updated documents, discuss the progress each has made on one aspect of the design. In parallel with the design effort, technical writers develop documents that are updated as changes occur during and between the design-review meetings. But, because much of the documentation relating to layout and artwork is still manual, developing the documentation typically takes 50 to 75 percent longer than developing the product itself.

Many of the computer-based composition and pagination systems now on the market were developed for applications such as publishing price lists, parts lists and other highly formatted information (see Table, left). Such systems have two basic limitations. First, they are text-oriented: they incorporate the latest developments in processing, displaying and printing text, but artwork is handled as an afterthought. The art is usually processed separately and incorporated into the text at the end of the editorial cycle. Second, such systems are oriented toward "single-cycle" applications in which documents undergo changes to both art and text before but not after publication. Publishers have used these single-cycle systems with some success in newspapers, magazines and books but with less success in technical documentation, in which manuals are updated and republished frequently. Technical publishing managers who have tried to apply a single-cycle CAP system to serve their multicyle needs have had problems with artwork. In most CAP systems, art is scanned and stored in raster form and cannot be easily edited. Raster images can be sized, cropped and rotated but only with difficulty. Moreover, raster storage requires large amounts of memory: a 512-by-512-pixel image requires about 0.5M bytes of memory in most applications.

Because of the deficiencies of most CAP systems, many technical documentation managers have attempted to process art by using CAD systems that store images in vector rather than raster form. In such systems, an artist enters a drawing via a digitizing tablet, and the CAD system stores it as vectors that can be edited, sized, cropped and rotated. A tangible benefit is the ability to reuse parts for new drawings. Most important, because only the display list that describes the vectors need be stored rather than the entire screen image as in the raster approach, the amount of memory required is reduced by almost 100 times. When a user wants to view a stored image, a display processor converts the vector data to raster form.

Buying a CAD system to complement a text-oriented CAP system is expensive and complex, but it does solve the art problem. A user can reduce the time required to create an original illustration and, in many instances, improve the finished product by using the computer to

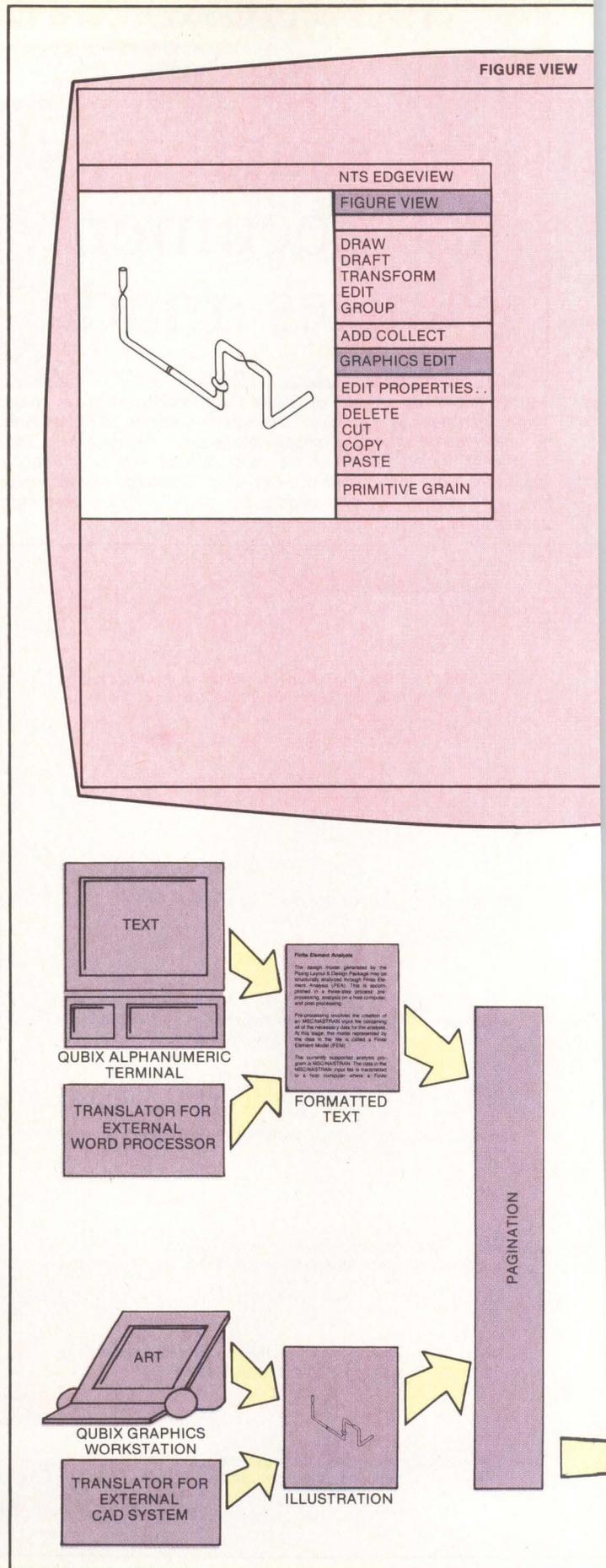
generate lines, angles, circles and cross sections. But, while CAD systems effectively produce line drawings, they do not address a basic issue of multicyle documentation: integrating the art and text on one page.

Merging art and text

Qubix's publishing system (Fig. 1) combines the capabilities of CAD with the software to do the CAP functions of word processing, text editing, pagination, composition and layout. It merges art and text into a single database that lets a user see completed pages containing both. The Qubix system accepts input from external word processors (text) and CAD systems (art) as well as from its own alphanumeric and graphics workstations. For text, it displays actual fonts in true sizes (Fig. 2) and sends them to a typesetter without any intermediate makeup or photographic steps. The system combines full batch pagination and composition features with interactive editing of finished pages (Figs. 3, 4). For art, the system creates and stores graphics in vector form, as in CAD systems, and uses high- or low-resolution scanning to scan and rasterize illustrations and photographs.

High-resolution scanning is used to incorporate photographs and detailed illustrations that will be preserved in the published document. Low-resolution scanning saves system memory when converting photographs and illustrations to line drawings. In low-resolution scanning, a photo or illustration is displayed on the graphics workstation monitor as a "ghosted" image over which a user traces and inputs to the system in vector form. Once the vector representation is in the system, the low-resolution raster information can be discarded. The Qubix system also accepts graphics input from drawings stored in external CAD systems. External drawings can be stored in either raster or vector form, depending on whether the user wants to preserve full detail.

Fig. 3. In processing a technical document, text is input with generic coding from an external word processor or directly from a Qubix alphanumeric terminal. Artwork is input from an external CAD system or a Qubix graphics workstation. Illustrations and formatted text are merged during batch pagination. The results of the merge and pagination can be displayed on a Qubix workstation as fully composed pages containing heads, feet, footnotes and tables. A user can display one of several "views" to perform various functions: a "figure view" for graphics modification (A), a "composed view" for editing text (B) and an "exception view" for examining a log of errors to be corrected (C). When a document is completed, the system stores it for viewing or further editing. When the user is ready for document output, he selects the "device view," which allows access to laser proofers and typesetters. The document can be stored on the system indefinitely or transferred to magnetic tape for future use.



SOURCE MANAGER VIEW

COMPOSED VIEW

PAGE 8: PIPING LAYOUT AND DESIGN PRODUCT SPECIFICATION

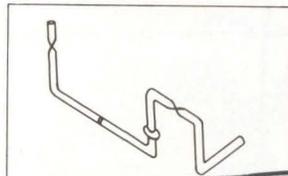
SOURCE MANAGER VIEW

Chapter II Technical Description of Piping Layout Design Package

Pipeline flow direction is established at the time of pipeline element creation. Flow reversal is performed by simply selecting the pipeline elements which are to be directionally reversed. Flow direction can be reaffirmed by using the direction display option.

Points and pipeline elements may be selected in any viewport, but they will be displayed not-to-scale only in viewports which contain not-to-scale pictures. All points, pipeline elements and picture-dependent geometry are the only items

Cross-section orientation angles of any number of pipeline elements can be modified. The rotated element is automatically re-displayed if one of the edgeview display modes is active.



In addition to orientation angle modifications, pipe, valve and fitting cross sections may be displayed in a not-to-scale mode for the purpose of enhancing design and viewing clarity. The mode which may be changed includes the thickness and any of the pipeline element lengths.

Not-to-scale Pipeline Generation

Sometimes, it is necessary to modify the display of several items out of the viewports or to scale down long piping details on either end more readily examined. The not-to-scale feature is a means of doing this at the same time retaining true dimensions of the design model.

- COMPOSED VIEW
- MANUSCRIPT VIEW
- LAYOUT VIEW
- TYPEADJUST VIEW
- OPEN
- EDIT TAGS
- EDIT TEXT
- TEXT EDIT
- DELETE
- CUT
- COPY
- PASTE
- INSERT
- FIND/REPLACE...
- LABEL...
- MARK...
- SELECT TO MARK
- WORD GRAIN

- UTILITY VIEWS
- WINDOWKEY VIEW
- HOMELIBRARY VIEW
- CUTSHEET VIEW
- INSTALLATION VIEW
- UNIX SHELL VIEW

EXCEPTION VIEW

PIPING LAYOUT AND DESIGN PRODUCT SPECIFICATION

SOURCE MANAGER VIEW

which contains all of the property data for each pipeline

- "al" is misspelled

[subsetion "Edgeview Display"]
The edgeview display of a pipeline represents the true

- unknown tag [subsetion]
- unknown parameter "Edgeview Display"

[pp
Valves and fittings are subsequently inserted at designated locations along the pipeline.
Breaks (points) must exist at the locations in the pipeline selected for fitting insertion.
[fig_ref V&F_Insert]

- unknown parameters Valves and fittings
... through ...
[fig_ref V&F_Insert]

- OUTLINE VIEW
- PAGEKEY VIEW
- LAYOUTKEY VIEW
- FIGUREKEY VIEW
- EXCEPTION VIEW
- INSTANCE OF VIEW
- SPELLING ERRORS
- TAG ERRORS
- ALL ERRORS
- CONTEXT
- TEXT EDIT
- DELETE
- CUT
- COPY
- PASTE
- INSERT
- FIND/REPLACE...
- LABEL...
- MARK...
- SELECT TO MARK
- WORD GRAIN

- UTILITY VIEWS
- WINDOWKEY VIEW
- HOMELIBRARY VIEW
- CUTSHEET VIEW
- INSTALLATION VIEW
- UNIX SHELL VIEW

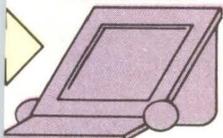
- GLOBAL FUNCTIONS
- UNDO
- CANCEL
- HELP
- SAVE
- RESTORE
- EXIT

FIGURE VIEW

COMPOSED VIEW

EXCEPTION VIEW

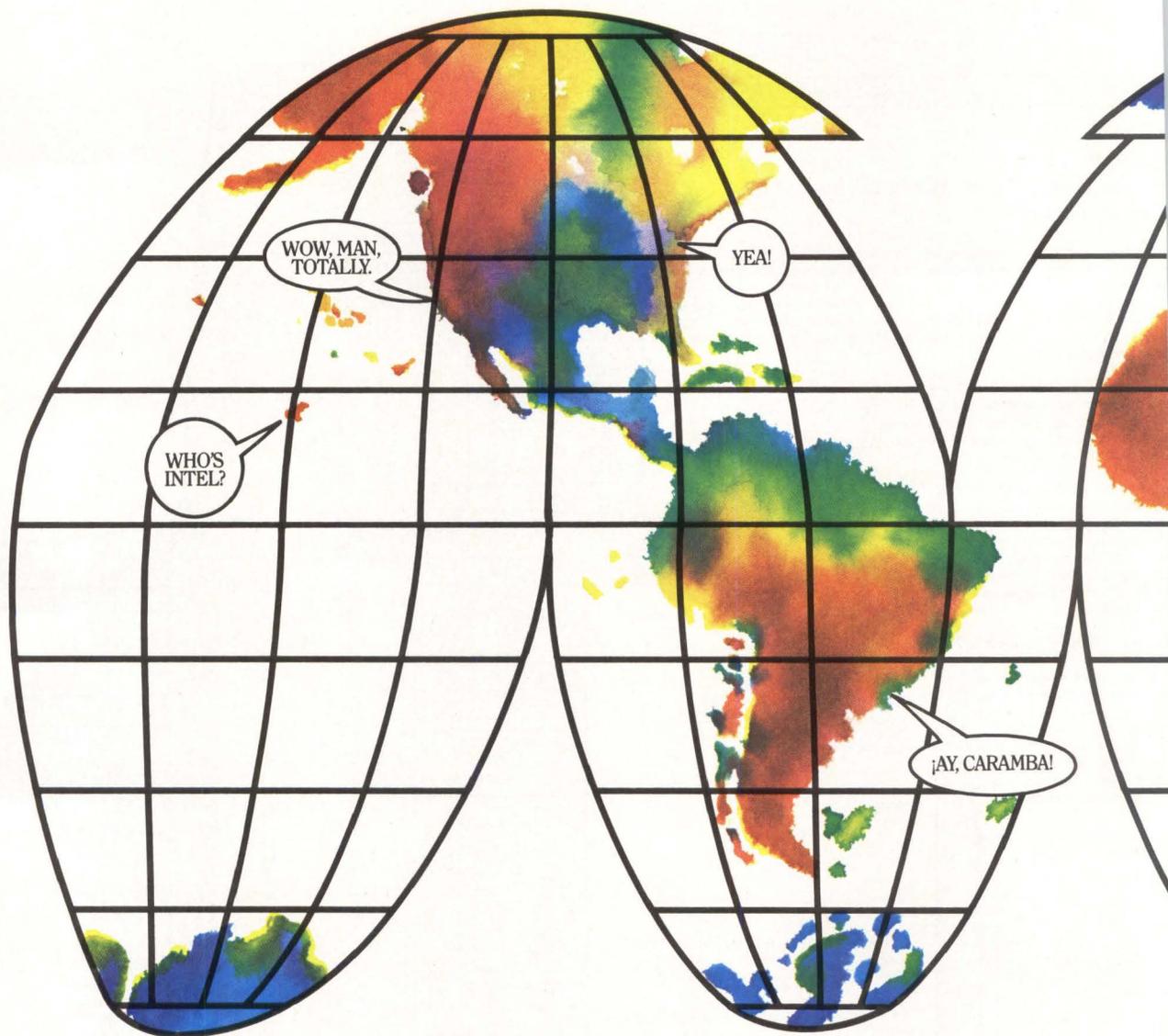
QUBIX GRAPHICS WORKSTATION



DEVICE VIEW

TYPESETTER DRIVER

WHEN WE INTRODUCED OUR PEOPLE HAD



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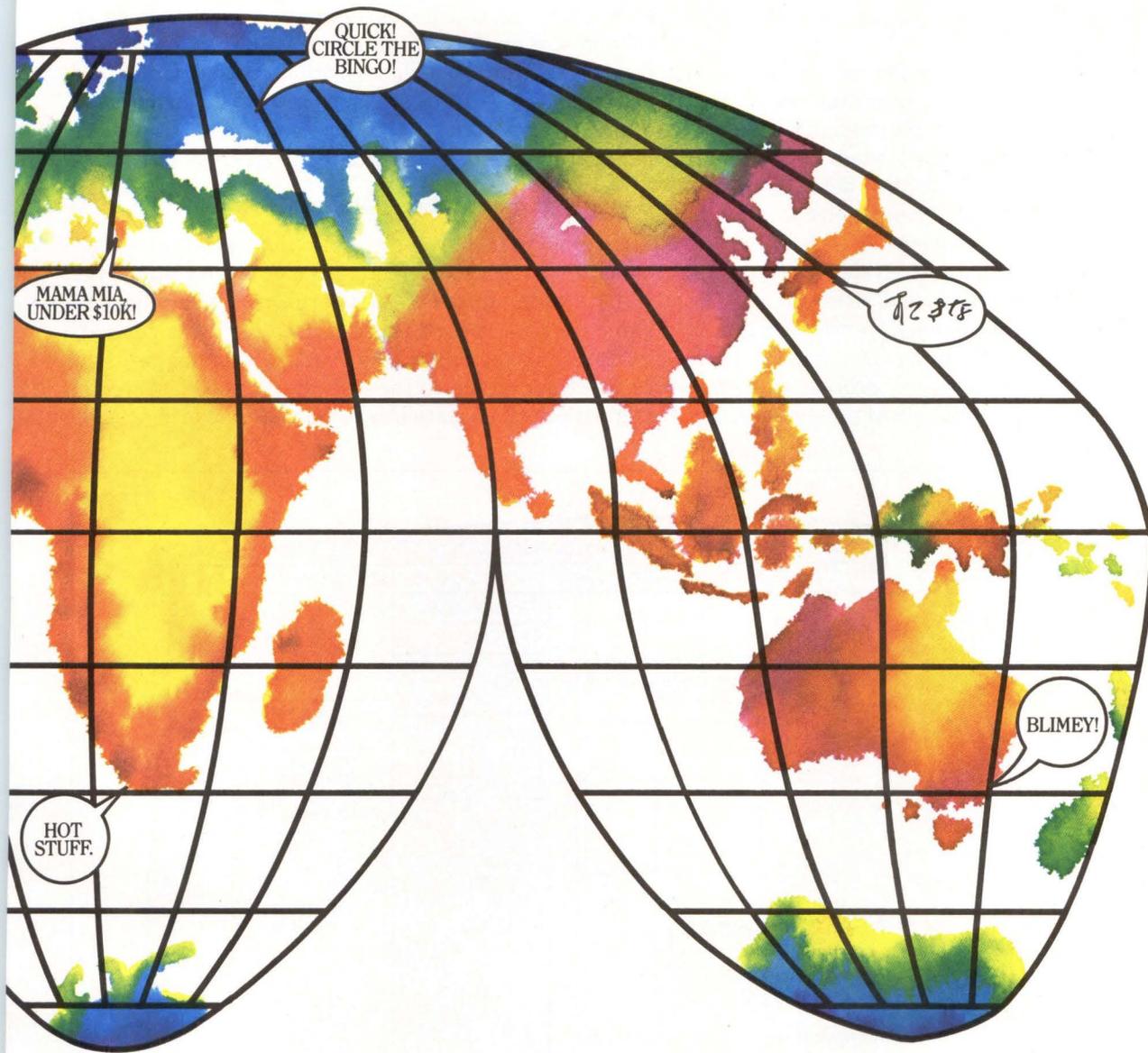
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CIRCLE NO. 115 ON INQUIRY CARD

Graphics information input at a Qubix workstation is processed by a figure-translation program and entered into a figure database stored on the system's Winchester disk. Line art entered into the system via a scanner also is sent to the figure database after being converted from raster to vector form. Photographs are stored directly in raster form in a separate location on the disk. Graphics from external CAD systems are passed through a translator interface and entered into the same database. While the system is processing graphics, it can accept input from its own alphanumeric terminals or from external word processors. After accepting input from external word processors, the

system passes the text through a translator interface. Also contained on the disk is a style database that consists of rules defining document style for a user of the system, such as the technical publishing department (see "Creating a document style," right). The style database usually includes such specifications as column size and length, figure size and the relation of figures to text. This information is coded into the database from a Qubix alphanumeric terminal or via an interactive style editor that allows the user to lay out a page directly on a Qubix graphics workstation.

Dealing with exceptions and errors

On many CAP systems, resolving exceptions consumes as much as 90 percent of a user's time. But, in the Qubix system, this process is performed in parallel with batch composition and pagination. Exceptions generated during graphics, text and style processing are sent to an exception file on the disk. During the last step of pagination, all exceptions are tagged to a specific page

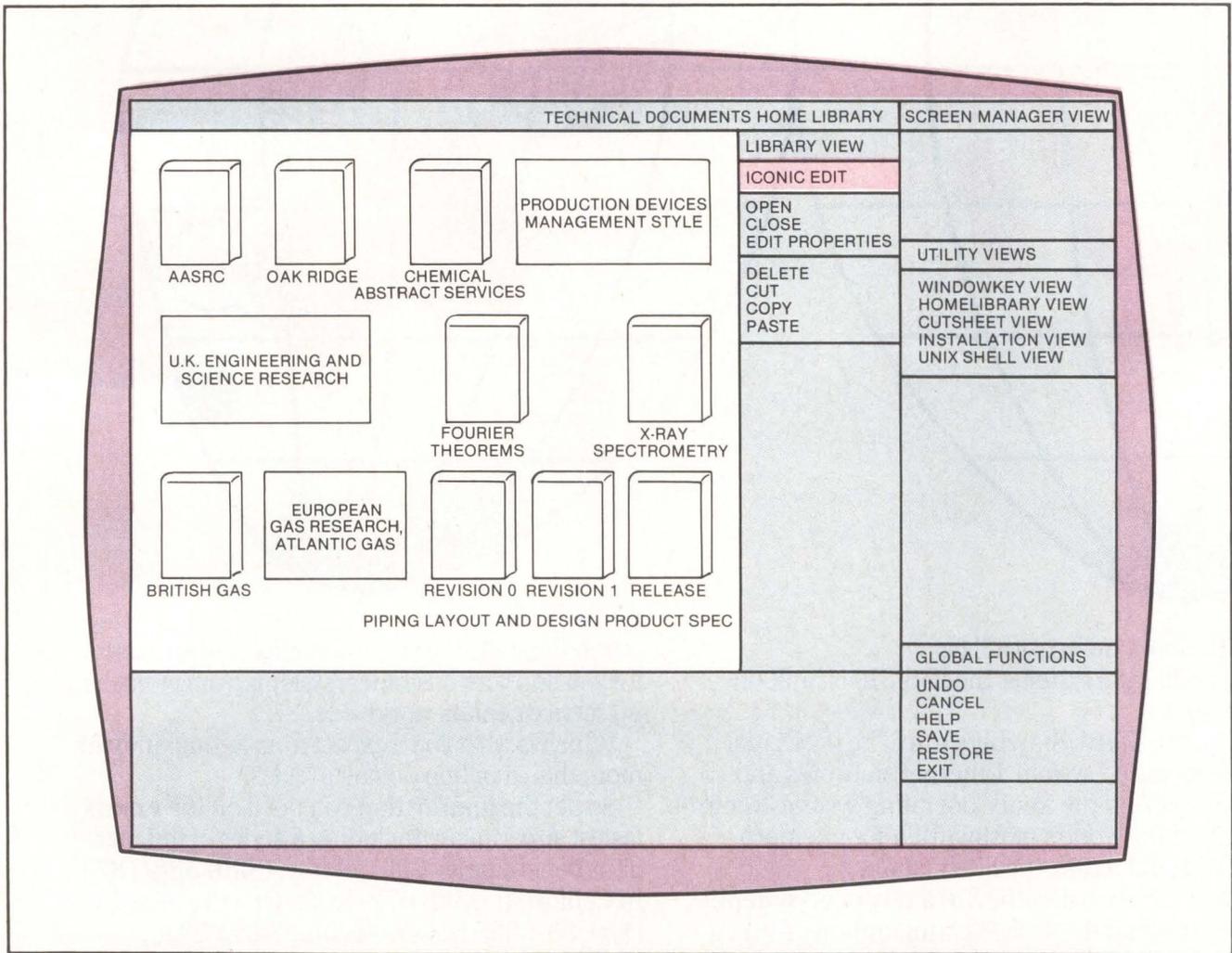


Fig. 4. The "Home Library View" is the first view a user sees after logging on. Various icons represent classes of objects: the book icons represent individual documents, and the rectangles represent sub-libraries that may contain documents or additional sub-libraries. When a user touches the pointing device to the appropriate icon, all other icons disappear, and the system displays an expanded version

of the icon selected, divided into documents, chapters or sections. The process is repeated down to the page level. The user can determine the way in which he wants to look at the document at any point by selecting from a page view, outline view, layout view, figure view, exception view or instance view, which lists "instances of" something important to the user.

CREATING A DOCUMENT STYLE

The process by which a user of Qubix Graphic Systems Inc.'s computer-aided-publishing (CAP) system creates a document style is similar in many respects to the manual method by which an editor lays out a page. Instead of drawing on paper with a ruler and a pen, the Qubix user employs a touch-activated stylus to draw the layout on the outline of a "piece of paper" on a graphics terminal. As the user draws vertical and horizontal lines with the stylus, the system interprets the lines as

boundaries of the columns on the page. It is not necessary to instruct the system to calculate measurements in picas because the measurements are made automatically and displayed in small windows at the bottom of the screen.

Instead of looking up the desired typestyles and writing the corresponding symbols, the user goes to the command window on the screen, which contains all of the approximately 20 sub-elements of a page layout. The user simply points to the

appropriate sub-element with the stylus and moves to another window on the screen that allows him to scroll through a list of available fonts. At the top and bottom of this window are arrows. Pointing to the top arrow scrolls the window up, and pointing to the bottom arrow scrolls the window down. Once the desired font appears (24-point Helvetica boldface, for example), the user points to it with the stylus and then points to the *execute* command.

MULTIPLE 68010 PROCESSORS SHARE SYSTEM FUNCTIONS

Qubix Graphic Systems Inc.'s computer-aided-publishing (CAP) system has a multiprocessor architecture consisting of MC68010 virtual-memory microprocessors that share as much as 8M bytes of RAM and are linked by an Ethernet-oriented multiprocessor network. A single cluster (configuration) can consist of as many as four graphics workstations, eight alphanumeric terminals and 320M bytes of Winchester disk storage. Each cluster contains a multitasking controller consisting of three 68010 CPUs: one background processor and two interactive processors.

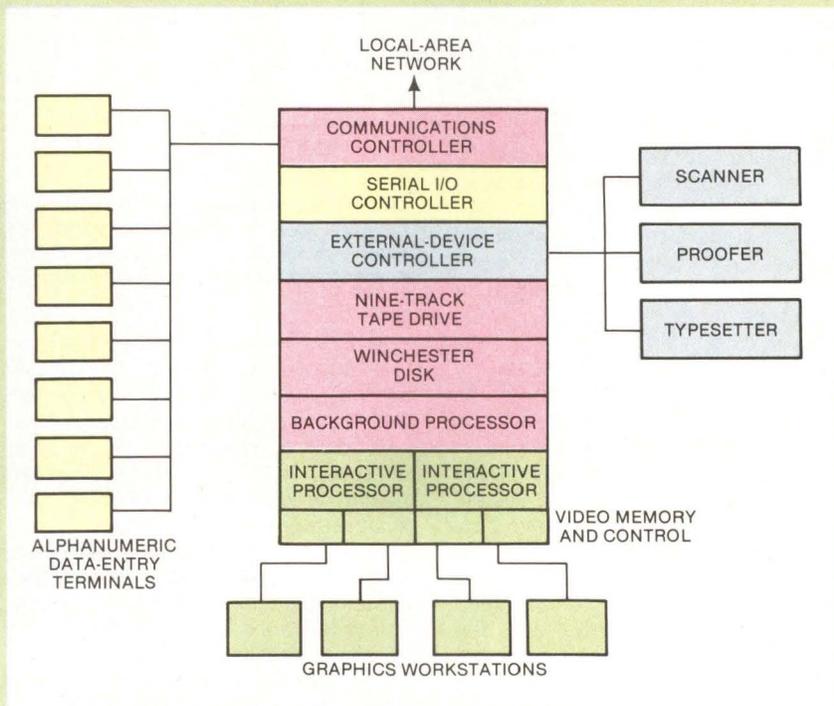
The background processor manages the system's disk and tape files and its 9,600-baud alphanumeric terminals. An eight-port serial interface board links the alphanumeric terminals to the background processor. Communication between the background and interactive processors is via an internal Ethernet network. To avoid overloading the background processor, the disk controller, tape controller and serial interface boards are configured for direct memory access (DMA). Additional spaces in the 14-slot Multibus rack are available for interface boards to a proofer, phototypesetter and one or more scanners.

Because the interactive processors lack disk drives, the background processor handles program storage for graphics. It converts continuous-tone images to screened halftones and translates the Qubix database to the proper format for proofers and phototypesetters. These operations are performed in batch mode; they can take several minutes to several

hours, depending on how often they are interrupted by interactive tasks. The background processor also handles scanning and printing. In scanning, the system converts raster input from an external device to ASCII character data. Printing converts vector and ASCII data to raster hard-copy output.

The interactive processors drive the graphics workstations. They contain eight serial I/O ports for the keyboard and digitizer of each graphics

workstation and interface boards for the 10-MHz internal Ethernet bus. The interactive processors' tasks are assigned priorities that take into account a user's expectations. Operations such as deleting a word or a line, which a user naturally expects to occur rapidly, are performed in milliseconds. Functions such as "turning a page" usually take less than 3 seconds. Moving to another "chapter," "volume" or document takes successively longer.



Qubix model IV cluster contains three MC68010 virtual-memory, 10-MHz CPUs (one background, two interactive), a video board for each of four graphics workstations and interfaces to a scanner, a proofer and a typesetter.

or line, and an exception list is generated and sent to the user's workstation.

To resolve exceptions, the user requests the system to list the exceptions and display them with their page numbers. When the user touches the workstation stylus to an item on the list, the page on which the selected exception occurs appears on the screen. At the page level, each of the exceptions is highlighted in reverse video. If the exception relates to a line drawing, the user touches the stylus to the *graphics edit* verb in the command window. He then moves the stylus to the

location on the page that the figure occurs and edits the drawing.

If one of the exceptions is a missing figure, the user touches the stylus to the *missing figure* entry. The user then views a list of master figures and selects the appropriate figure by touching the stylus to the *photostat* command, which places a copy of that figure in the appropriate location on the page.

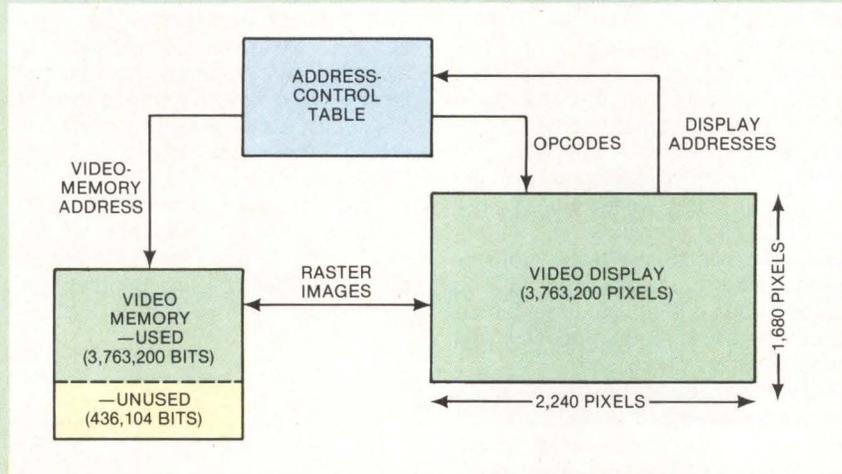
If the exception is textual, the user touches the stylus to the *text edit* entry. When the presentation window appears, the stylus is moved to the appropriate paragraph, line, word or character, and the correction is entered via the keyboard. □

Robert S.M. Wulff is vice president of research and development at Qubix Graphic Systems Inc., Saratoga, Calif.

PATENTED VIDEO BOARD DRIVES 156-MHz RASTER GENERATOR

In raster-scan systems, the graphics processor must furnish bit-mapped display information that may bear little relation to the order in which lines, points and characters are specified in the internal database. To accomplish this, most raster systems insert a "refresh" buffer, which stores an intensity level for each pixel between the display and the CPU. The problem with this approach is that even low-resolution screens contain many pixels, most of which must be modified to change images on the screen. Thus, sophisticated display operations such as zoom (changing the view size), pan (moving the view horizontally or vertically over the image) and scroll (moving the view one line at a time vertically) traditionally have required specialized graphics processors to achieve clock rates that allow the operations to be performed interactively.

Qubix Graphic Systems Inc. has addressed the speed issue by designing a video board that operates much like a stored-logic computer. Key to this board's operation is an address-control table that indexes the 64K-word video memory. The system groups the 2,240 bits representing the pixels on a horizontal display line into 64-bit words. By scanning a line using 64-bit words, the video memory need operate only at 2.2 MHz—1/64th the clock rate of the screen's 156-MHz raster generator. Further, because the video memory can be driven at twice this speed, it is dual ported with interleaved cycles, some going to the interactive CPU via the 16-bit Multibus



Qubix's video board uses an address-lookup table to index the 64K by 64-bit video memory, speeding execution of zoom, pan and scroll operations. The "unused" portion of video memory temporarily stores previously displayed menus, so that they can be re-displayed without re-creating the raster images.

and some to the 64-bit video bus.

Zoom operations with the Qubix system involve only the change of data in the address-control table. For example, to double the height of a character that is 16 raster lines in height, without losing definition, the system repeats the address of each line. Similarly, to double the size of an image in the horizontal direction, the system loads the control word of each line to halve the pixel rate. The result is a bit transition every two clock states, which stretches each pixel in the designated area to twice its original width.

To perform pan and scroll operations, the Qubix system employs a

special data word that holds address offsets. Rather than incrementing or decrementing all of the display addresses, the system need modify only one word per raster line. The Qubix system also allows display menus to be removed and re-displayed in microseconds or even nanoseconds. Such "instantaneous" operation is possible because only 90 percent of the system's video memory is used to address the raster display at once. While most raster systems must erase a display and then recreate it, Qubix's system merely changes a display's address from the used to the unused portion of video memory and vice versa.



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By combining a distributed architecture concept with the latest VLSI technology, the

Typical performance examples of geophysical, medical imaging and signal/image processing applications.

Application Example	AP-120B	FPS-5410	5420	5430
1. Demodulation/Signal Analysis	13.8 msec.	6.5 msec.	N/A	N/A
2. Tomography Preprocessing	60 sec.	25 sec.	16 sec.	12 sec.
3. Multispectral Image Classification (512 x 512 pixels 8 Bands, 4 classes)	49 sec.	25 sec.	13.3 sec.	10.5 sec.
4. 2D FFT (512 x 512 complex)	3.4 sec.	1.4 sec.	.7 sec.	.5 sec.
5. Matrix Multiply (100 x 100)	439 msec.	177 msec.	96 msec.	71 msec.

Based upon specifications subject to change.

FPS-5000 Series sets a new standard for cost-effective computing, breaking the \$2,000 per MFLOP* barrier—the first time this has been achieved in any floating-point computing system.

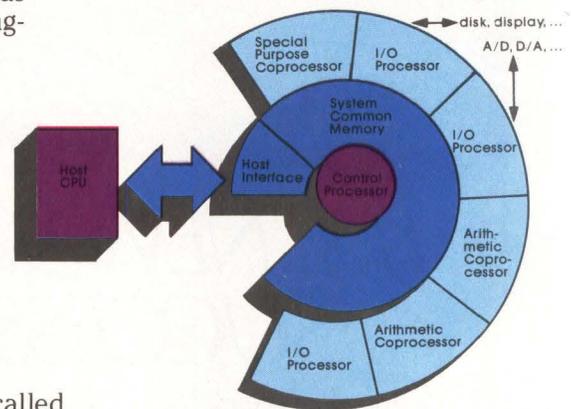
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The FPS-5000 Series is a distributed processing system that maximizes throughput by allocating the computational load to a set of high-performance, independent, floating-point processing elements called

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FPS-5000 Series Architecture



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by a combination of independent I/O Processors and the central Control Processor.

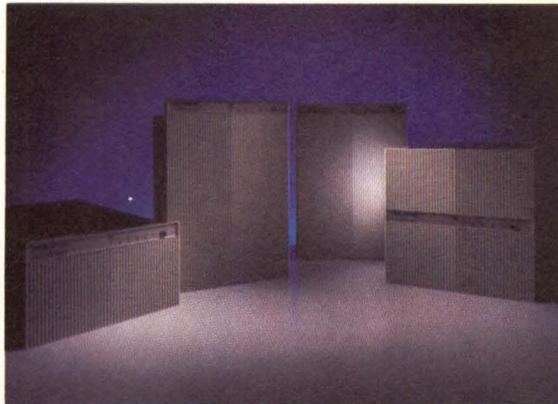
Each Arithmetic Coprocessor, with synchronous architecture to allow simple application debugging, functions as a self-contained unit.

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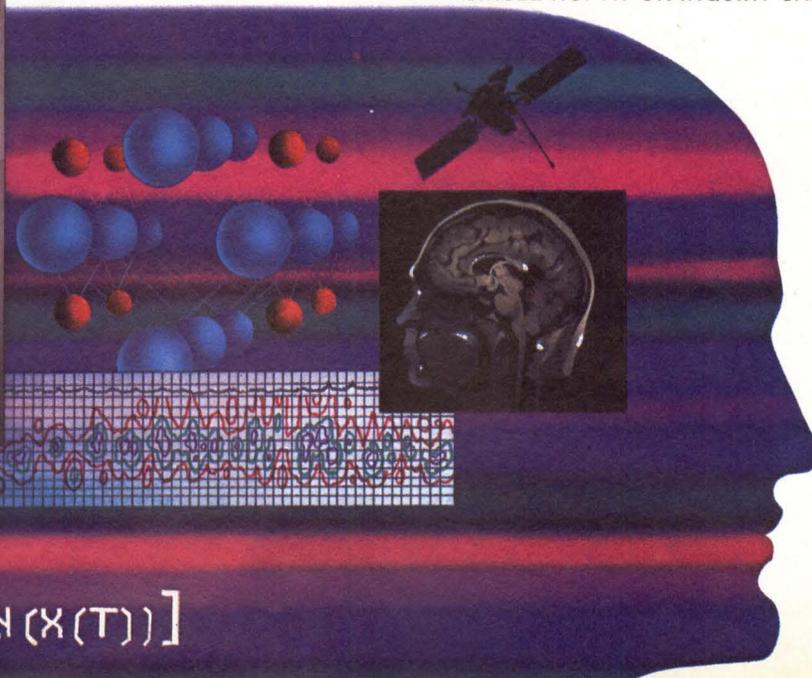
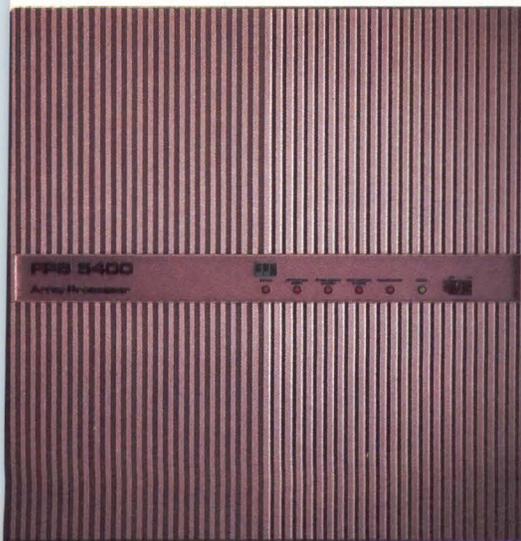
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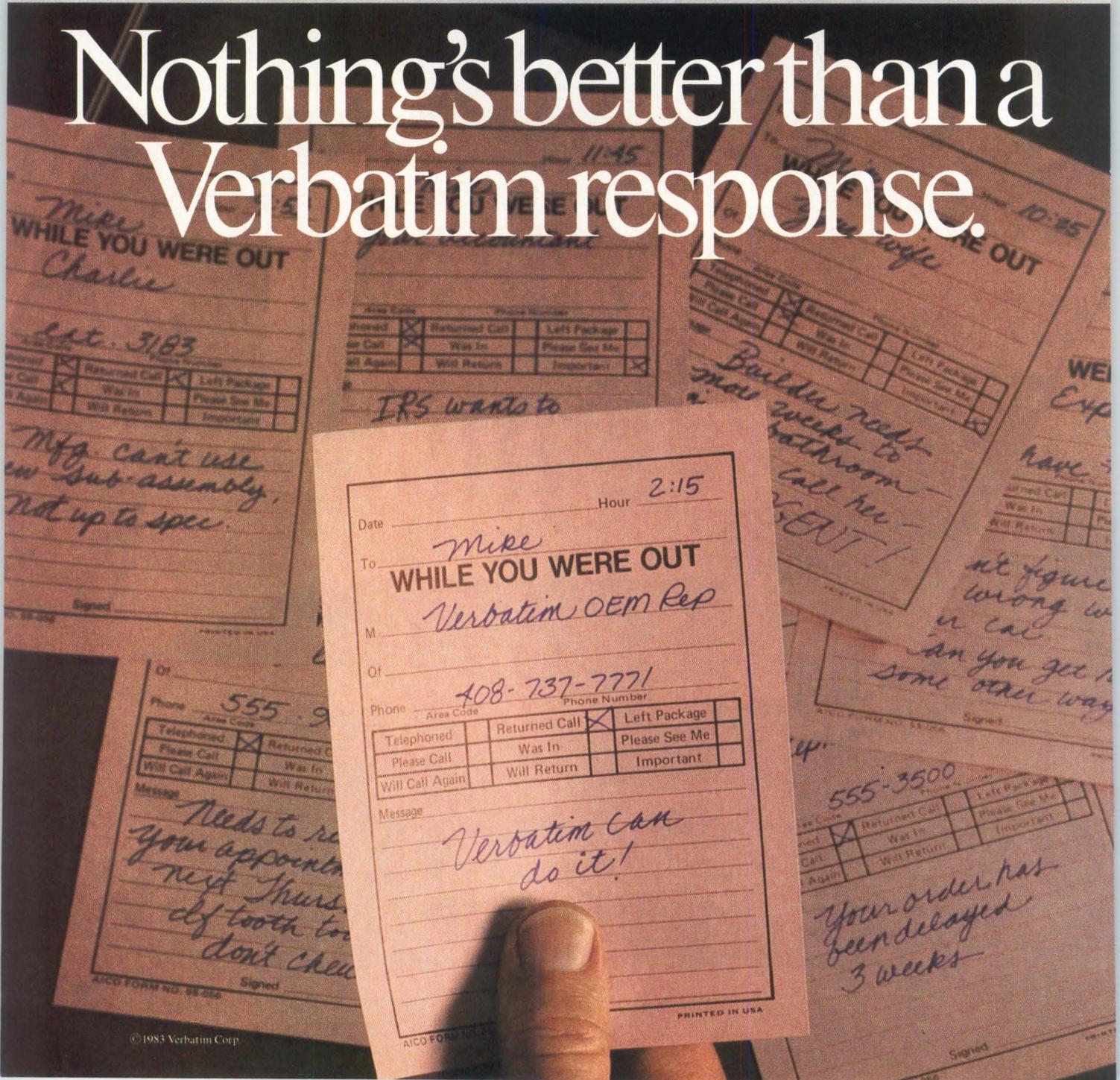
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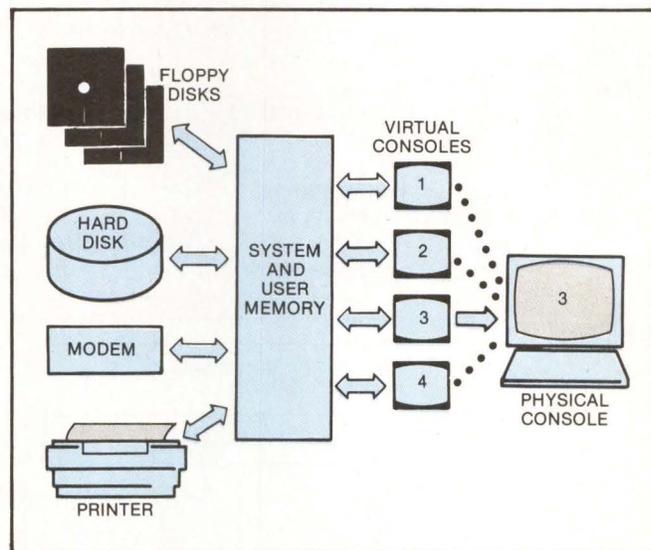
Concurrent CP/M drives multiple 'virtual consoles'

Single-user operating system allows interaction with four executing tasks on one terminal

**Frank Holsworth and
Joe Guzaitis, Digital Research Inc.**

A concurrent operating system can run several programs simultaneously on one CPU. Unlike simple task switching, in which a user monitors one program that continues running while the other programs are suspended, concurrency means that each program can execute independently of the others whether or not it is monitored.

Fig. 1. Virtual consoles are logical CP/M machines, each containing an executing process. In the figure, the process running in virtual console 3 is the one currently displayed on the physical console. Virtual consoles can share all system resources and peripherals, but a console "owns" a peripheral while it uses it.



PRODUCT SUMMARY

- **Product name:** Concurrent CP/M-86
- **Manufacturer:** Digital Research Inc., 160 Central Ave., Pacific Grove, Calif. 93950, (408) 649-3896.
- **Price:** \$350 (\$150 for IBM PC version)
- **System compatibility:** most 8086-/8088-based microcomputers; most 80186-/80286-based microcomputers in real mode
- **Memory requirement:** 256K bytes
- **Software compatibility:** runs most CP/M-86 programs, data files compatible with all CP/M family operating systems

MAKING USERS MORE PRODUCTIVE

A concurrent operating system does not increase the throughput of underlying hardware. In fact, for programs that involve no user interaction, or disk i/o the overhead of task switching makes it take slightly longer to run a set of programs "concurrently" than to run the same programs sequentially. Thus, it might seem that a concurrent operating system reduces system performance. The flaw in this reasoning is measuring performance in terms of CPU time instead of user time.

Because an operating system can switch tasks three orders of magnitude faster than a user can enter a character from the keyboard, a concurrent system can perform a substantial amount of processing while a sequential system waits idly for user input. When viewed in terms of *human* productivity, concurrency will perhaps be as important to application users as the advent of high-level languages was to system and application programmers.

—R.R.F.

Concurrency allows a microcomputer to perform several jobs at once. It aids users by making more productive use of their time, allowing them to continue working interactively during time-consuming tasks such as printing a file or compiling a program. Concurrency also benefits software designers and system integrators by allowing them to build more sophisticated applications.

Concurrent CP/M transforms each executing application program into a *process* by augmenting it with system code and housekeeping data that keeps track of the state of the program. This allows the system to

When a user wants to monitor a process, the system assigns that process' virtual console to the physical console, and the process' output is displayed on the screen.

interrupt and reinstate a process at any time—a necessary capability for multitasking. Although multitasking means that each process moves through the

TUNING APPLICATIONS FOR CONCURRENT CP/M

New applications that fully exploit the capabilities of Concurrent CP/M will take time to develop. In the meantime, software vendors and system integrators can incorporate existing applications as long as they exercise care, particularly with respect to memory usage.

Concurrent CP/M has been implemented on the 8086/8088, and it is planned for other 16- and 32-bit microprocessors. The 8086/8088 can address 1M byte of main memory, which is enough for most sophisticated applications such as interactive

graphics. However, Concurrent CP/M with four virtual consoles can run on a system with as little as 256K bytes of memory. The operating system occupies 90K bytes with full screen buffering. By reducing the number of virtual consoles or by eliminating buffering, an OEM can reduce memory requirements to as little as 32K bytes but there is a significant loss of utility.

Memory management in Concurrent CP/M is based on "an extended fixed-partition" model in which the OEM determines the partition boundaries. Memory is allocated to each

process when an application program is loaded. A process can request additional memory using system calls during execution, and it can return memory to the system when the memory is no longer needed.

Some programs, including spreadsheets, have a major flaw: they grab all available memory as soon as they are loaded. A way to "work around" this flaw is to load these programs last in a series of programs to be run. Programs that create temporary files occasionally cause problems because, if several copies of the program are run concurrently, the temporary file of one copy may overwrite the temporary file of another. The solution is to place each copy of the program in a separate sub-directory or "user number" so that the multiple copies do not collide.

If sufficient memory is available (usually 128K bytes extra), Concurrent CP/M can create a virtual disk in RAM. It is up to the OEM to implement this option. The RAM disk, typically used to store system utilities and temporary files, can improve system responsiveness as much as five times.

Both programmers and users will welcome Concurrent CP/M's error-handling facilities. Although the dreaded "BDOS error on x:" message is still standard, application programs can now handle physical and logical disk errors in as simple or sophisticated a manner as a developer desires. When a user encounters a disk error, he can be given a choice of "try again," "abort" or "replace disk." Application programs can now exit gracefully from disk errors without losing data.

TRANSIENT PROGRAM AREA (USER SPACE)	166K	
OTHER RESIDENT SYSTEM PROCESSES	36K	
VIRTUAL CONSOLE 4	1K	} VIRTUAL CONSOLE MANAGER 7K
VIRTUAL CONSOLE 3	1K	
VIRTUAL CONSOLE 2	1K	
VIRTUAL CONSOLE 1	2K	
PHYSICAL INPUT PROCESSES	2K	
DISPLAY BUFFER - CONSOLE 4	4K	} PHYSICAL I/O SYSTEM 29K
DISPLAY BUFFER - CONSOLE 3	4K	
DISPLAY BUFFER - CONSOLE 2	4K	
DISPLAY BUFFER - CONSOLE 1	4K	
EXTENDED I/O CODE AND DATA	4K	
SYSTEM DATA	4K	} LOGICAL OPERATING SYSTEM 26K
BDOS	9K	
CHARACTER I/O	2K	
MEMORY MANAGER	3K	
REAL-TIME MONITOR	4K	
OS SUPERVISOR	4K	
INTERRUPT VECTOR	1K	

Memory map for a minimal configuration of Concurrent CP/M with four virtual consoles and full screen buffering. The operating system (everything except the transient program area) occupies 90K bytes, leaving 166K bytes for user programs and data in a 256K-byte implementation.

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SUPER. MICRO.

CPU sequentially, the task slices are sufficiently short so that processes appear to the user to be running in parallel.

Each executing process is usually attached to a virtual console (Fig. 1). However, if the output from a process does not need monitoring (for example, print-spooling), the process can be detached from its virtual console, freeing it for another process. In effect, a virtual console is a logical CP/M machine. When a user wants to monitor a process, the system assigns that process' virtual console to the physical console, and the process' output is displayed on the screen.

There are two screen output modes: dynamic and buffered. In dynamic mode, the system continuously updates a process, but a user sees only the cumulative changes when he monitors the process later. In buffered mode, a user can see the step-by-step execution of a process from the time it was last monitored. If this were compared to watching television, the following scenario could occur. A viewer could be watching the movie "Gone with the Wind" on one

channel, watch Atlanta start burning and then switch channels to watch the news. If Atlanta has burned to the ground when the viewer returns to the movie 30 minutes later, that's like dynamic mode. But, if the viewer switches back to the movie and sees Atlanta still burning, that's like buffered mode.

Concurrent CP/M allows software designers to set the priority of each process, so processes with the highest urgency can pre-empt the CPU (Fig. 2). Because the

In buffered mode, a user can see the step-by-step execution of a process from the time it was last monitored.

system's scheduling algorithm is event driven, processes waiting for an asynchronous event such as I/O do not consume CPU time. While they are waiting, other processes occur in round-robin fashion in order of their priorities. A programmer can set process priorities by using system function calls. Some system activities, such as multisector disk I/O, cannot be interrupted by any process doing disk I/O, allowing data transfer to occur at hardware speeds and all but eliminating disk latency.

BUILDING ON MP/M-86'S MULTIUSER DESIGN

Concurrent CP/M 86 evolved from MP/M-86, Digital Research Inc.'s multiuser, multitasking operating system for 8086-/8088-based systems (MMS, February, Page 253). The two systems share many features, including a CP/M-86-compatible basic disk operating system (BDOS), so all CP/M-86 programs and data files can run under either system. In addition, 8-bit CP/M data files can be transported to Concurrent CP/M-86, CP/M-86 or MP/M-86 without modification because all CP/M family operating systems have compatible file structures.

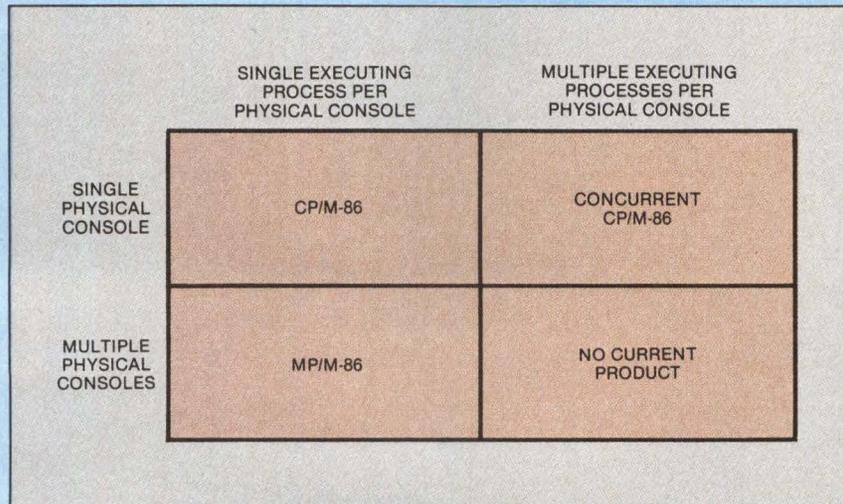
Concurrent CP/M-86 includes all CP/M-86 and most MP/M-86 utilities. It also contains two new utilities: *systat*, which shows the state of all virtual consoles and system resources, and *vcmode*, which displays and sets the background data mode (dynamic or buffered) for each virtual console.

Both Concurrent CP/M-86 and MP/M-86 protect files and directory labels with encrypted passwords. Both systems also handle file integrity in the same way. Users can open files in one of three modes: locked, unlocked or read only. Locked is the

default mode. Once a file is opened in locked mode, all requests for that file by other processes or users are denied. If a file is opened in unlocked mode, file requests by multiple processes or users are allowed; however, records or record groups may be temporarily locked. Opening a file in read-only mode allows all

processes and users to read the file but denies any attempt to write to the file.

Concurrent CP/M-86 supports many other features of the CP/M family of operating systems, including virtual RAM disks, start-up files, multisector I/O date/time stamping and automatic diskette log-in.



The CP/M family of operating systems for 8086- and 8088-based microcomputers.

After a few Northern

TI's Chicago Regional Technology Center saved Northern Telecom time and money with three logic-array prototypes.



Easy to design with, TI's TAL004 logic arrays are used in Northern Telecom's high-capacity MERCURY 8-inch Winchester disk drive (right) and in an optional controller for its advanced FLASHBACK tape drive (left).

Twice, Northern Telecom's Memory Systems Division relied on the nearby Texas Instruments Regional Technology Center in Chicago for semicustom circuits. And twice, TI came through.

First, with a TAL004 logic array to perform the data-integrity function in a Winchester disk-drive controller.

And second, with two TAL004 logic arrays to provide both the data/tape interface and data-integrity functions for an optional intelligent cartridge-tape controller.

Both controllers were going into state-of-the-art products. Northern Telecom's MERCURY™ 8-inch Winchester disk drive—90-225 MB capacity, less than 25-ms average positioning time. And

◀ Working side by side, TI and customer engineers run simulations to debug designs. Teamwork like this enabled Northern Telecom to do a month's work in four days at TI's Chicago Regional Technology Center. And thereby accelerate its product development schedule by three weeks.

days with Texas Instruments Telecom saved three weeks.

its FLASHBACK™ ¼-inch streaming cartridge-tape drive—nine-track (45/75 MB) or 12-track (60/100 MB).

Reduced IC count, costs, and time

Each semicustom TI logic array replaced 12 to 25 MSI chips for Northern Telecom. This allowed extra functions to be added at no extra cost in boards or parts.

Fewer ICs, fewer interconnects, a smaller board, and simpler manufacturing

all combined to reduce costs by 50% to 75% vs. conventional SSI/MSI parts.

Custom LSI chips, too, would have been far more expensive. And would have taken 50% longer to design.

As little or as much support as you need

Northern Telecom selectively used the capabilities of TI's Regional Technology Center. In one case sending an engineer there to work alongside TI designers for

two weeks. In another, they simply provided TI with the schematics, a functional description, and diagrams. TI engineers ran the simulations, identified bugs, and consulted daily with Northern Telecom engineers.

In both instances, Northern Telecom got "what it wanted, when it wanted it" from TI's Chicago Regional Technology Center. And plans to rely on the TI Center in the future. ■

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I/O Signals	29	42

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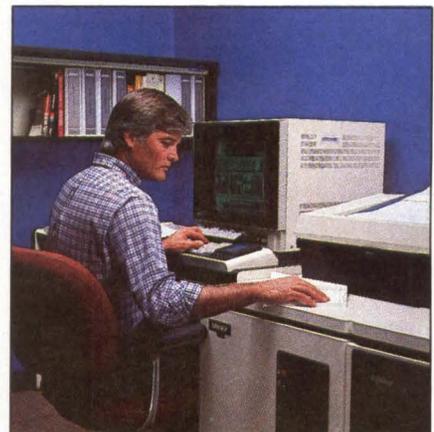
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TEXAS INSTRUMENTS

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Another feature of Concurrent CP/M is inter-process communication. This feature allows data transfer between processes by means of queues that are similar to "pipes" in UNIX. Also, if a user is running the same application on several virtual consoles and they are attached to the same disk drive, the processes can share files. For example, the process running on console 2 can read files generated by the process on console 1. This is particularly important in networking applications.

Users adapt quickly

The user interface to a concurrent operating system involves a distinction between foreground and background processes. The foreground process is the one a user is monitoring at the terminal; all others are background processes. A user can switch back and forth between processes by pressing a "screen switching" key so he is never more than a keystroke away from any executing process.

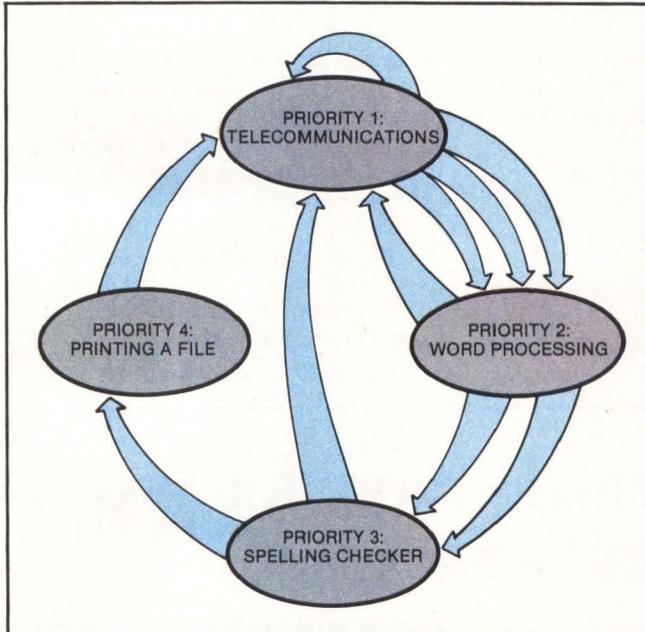


Fig. 2. Process priorities can be set by application programs. The processes and priorities shown are typical of a four-virtual-console business environment. Depending on how fast each process runs, the system might select any of the four colored paths. For example, if the highest-priority process—telecommunications in the example—fully occupies the CPU, no other process will run until the high-priority process is waiting for more I/O.

STRUCTURING VIRTUAL CONSOLES WITH DYNAMIC WINDOWS

Dynamic windowing allows a user to monitor the processes executing on several virtual consoles while working on a separate main task. The user can define the size and shape of the windows by simple commands that permit him to fit the windows to the desired view, taking as little space away from the main-task display as possible. It is also possible to configure windows in color, providing for dramatic display possibilities, especially when the foreground and background colors of each window are complementary.

A command file to create the window display shown in the lower right photograph would typically look like this:

```

OVERLAP.SUB
WINDOW CHANGE, N=3, PR=2,
PC=14, NR=16, NC=65
WINDOW CHANGE, N=2, PR=4,
PC=10, NR=16, NC=65
WINDOW CHANGE, N=1, PR=6,
PC=6, NR=16, NC=65
WINDOW CHANGE, N=0, PR=8,
PC=2, NR=16, NC=65
  
```

The file name is OVERLAP, the file type is SUBMIT, and the command name is WINDOW CHANGE. N is the virtual-



console number (0, 1, 2, 3). PR and PC are the row and column coordinates of the upper-left corner of each window, and NR and NC are the number of rows and columns. PC and PR are staggered to allow for overlap. NR and NC are constant because all windows in this display are the same

size. The command file normally is entered from Console 0, so it is displayed with that console's window on top. However, the command file can explicitly specify which window is on top; alternately, the user can enter the command file from another console.

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CIRCLE NO. 122 ON INQUIRY CARD

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Users adapt quickly to screen switching and concurrency because it is a natural way to think.

A significant aspect of the Concurrent CP/M user interface is the status line. A typical status line looks like this:

CONSOLE=3 DYNAMIC PRINTER=1 WORDSTAR 5:25:43 CAPS NUM'S AM*

Here, CONSOLE=3 indicates the virtual console being viewed (the foreground process), DYNAMIC is the current console data mode, PRINTER=1 indicates which printer is usable by the application, and WORDSTAR is the name of the application running on the foreground console. Following is the clock, which can be set by the OEM in either 12- or 24-hour modes, CAPS, showing that the keyboard is locked into capital letters, and NUM, indicating that the numeric keypad has been programmed for special functions. The 's indicates that the user has invoked a Control-s to stop scrolling. AM*

specifies which disk drives have open files. Digital Research Inc. encourages a comprehensive status line, reasoning that the more a user knows, the fewer mistakes he'll make. However, the status line can be toggled off, so it need not intrude.

Users adapt quickly to screen switching and concurrency because it is a natural way to think. Consider the average day for an "interrupt-driven" office worker. Phone calls, reports and meetings force a worker to switch from one task to another, respond to requests and then return to the task at hand. Most people are so good at keeping track of several processes at once that they rarely even think about it. □

Frank Holsworth is a senior staff engineer in the Operating System Division, and Joe Guzaitis is a senior technical writer at Digital Research Inc., Pacific Grove, Calif.

LOOKING AHEAD IN MMS

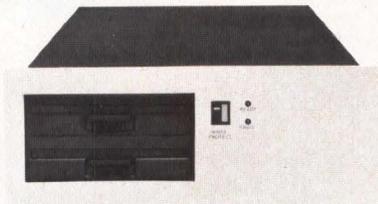
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- Office automation will be spotlighted in May.
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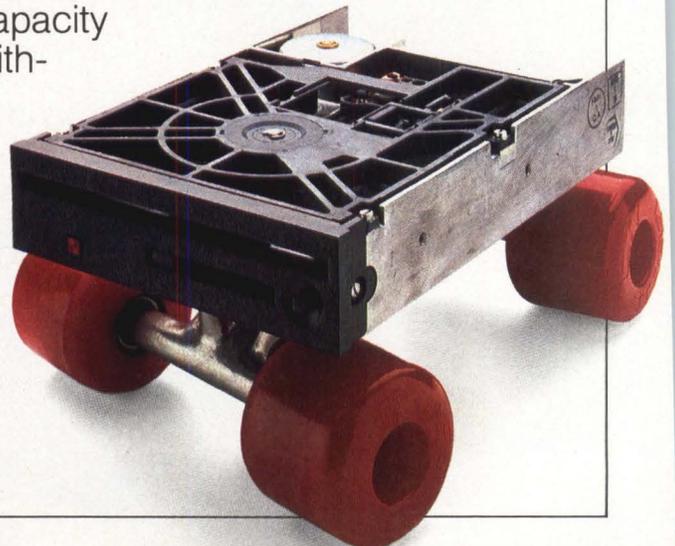
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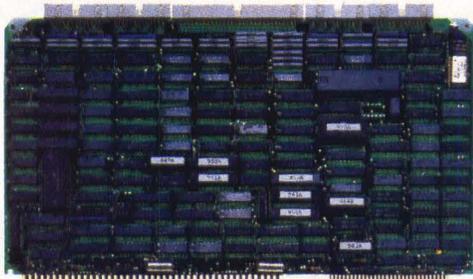
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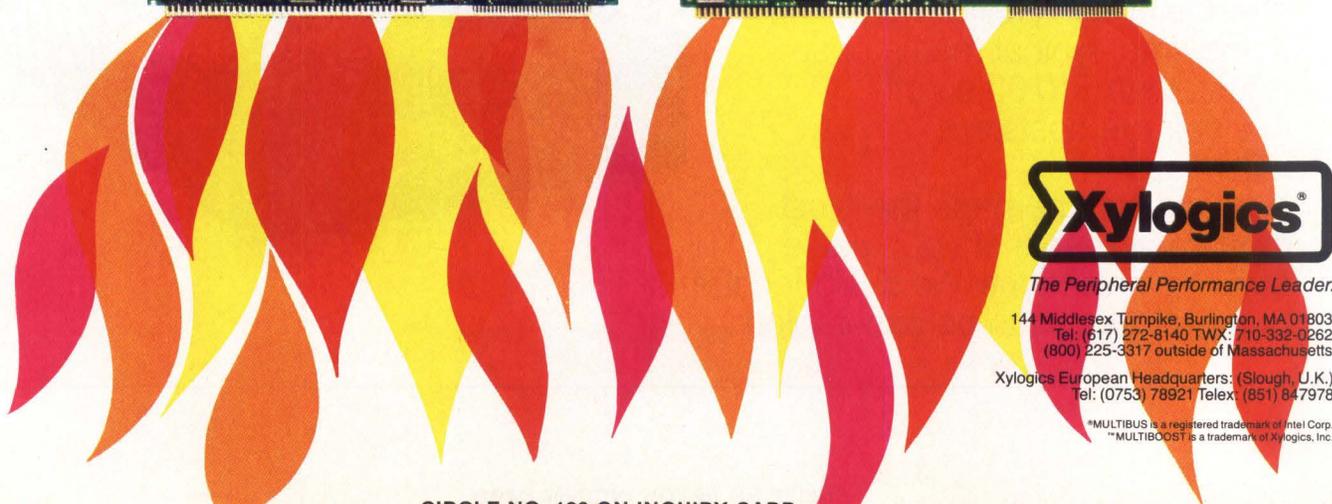
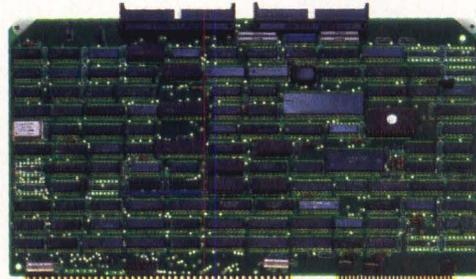
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CIRCLE NO. 126 ON INQUIRY CARD

Removable-cartridge Winchester triples performance-to-volume ratio

Hard disk drive folds and squeezes electromechanical and electronic devices into a space-saving package

David Sutton, DMA Systems Corp.

A low-cost, half-height, folded 5¼-inch Winchester disk drive with removable media offers the floppy disk drive's single-package advantages without its limitations. In the model 360, DMA Systems Corp. literally folds a conventional full-height Winchester cartridge drive in half—the first major application of folded PC boards in computer peripherals. The company uses a half-size drive motor, a pumpless-purge type of contamination control, full-head retraction on cartridge insertion and a pullout drawer for loading and removing the Winchester cartridge.

The result: a true floppy drive replacement with Winchester performance, including high capacities, fast transfer rates, random data access and removable media. More important, though, the 360's package size reduces to one third the volume of that for conventional 5¼-inch Winchester cartridge drives.

Occupies less space

Cutting the drive height in half cuts the volume to one third. The half-height size (Fig. 1)—1.625 inches rather than the full-size height, 3¼ inches—however, is misleading. Behind the drives are standard 5¼-inch-type, hard disk cartridges that fit both units. Subtracting the ¾-inch cartridge thickness from the two drives' vertical dimensions leaves a restricted space for the drive mechanism and electronic circuitry. In fact, the volume shrinks by almost two-thirds—from an ample 177 cubic inches to a tight 65 cubic inches.

The depth behind the panel is equally restricted. A standard floppy drive footprint allows 8 inches. When fully inserted, a cartridge occupies a 5½-inch depth,

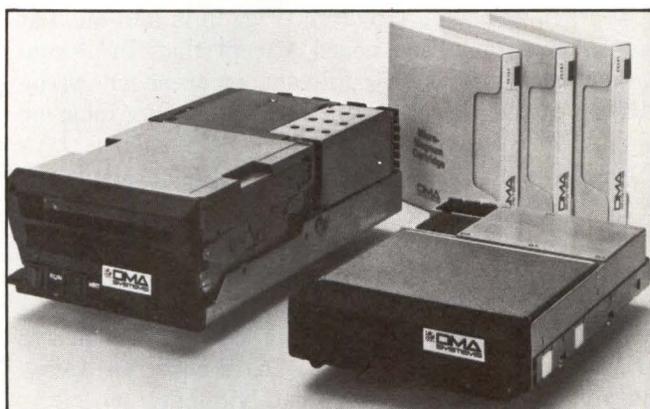


Fig. 1. A typical removable-cartridge Winchester disk drive, like the DMA Micro-Magnum (left), has a standard height of 3¼ inches. The new model 360 1.625-inch drive (right) is only half as high. Cartridges (right rear) occupy a higher percentage of the space as the drive size is reduced (right), requiring new packaging approaches.

leaving 2½ inches for circuitry, power and signal connectors, an air filter for removing airborne contaminants and an actuator for moving the heads across the disk.

DMA could have developed a smaller but more expensive cartridge to allow more space for drive components. However, only the standard, 5¼-inch single-disk cartridge is currently being produced in volume. Several drive packaging innovations, therefore, were necessary to accommodate its use in the half-height drive.

PC board folds around components

In today's disk drives, space exists for a rectangular PC board above, below or behind the electromechanical components. But, in half-height cartridge drives, little

room exists for the spindle motor and other essential elements. Thus, the electronic components fit in between and around the drive components.

The conventional solution employs an array of small, oddly shaped PC boards linked with connectors or short cables to edge connectors. But connectors and cables take up space, incur parts and assembly costs and reduce overall reliability.

To avoid these problems, the model 360 drive mounts nearly all of the control and signal-processing electronics on a single PC pattern without intervening connectors. The circuitry differs in that it is printed on both sides of a flexible film bonded to smaller pieces of conventional PC board. Strips of unsupported film between the PC-board sections act as hinges, allowing the PC assembly to fold and fit around the principal drive components.

In practice, folded circuitry (Fig. 2) is laid out flat like a conventional PC board, except that, in placing components, limited and oddly shaped areas where the stiff board sections back up the flexible film must be taken into account.

A proprietary technique, developed for the automotive industry, is used to apply the double-sided circuitry and plated-through holes. The film is 1½-mil Kapton (Dupont) high-temperature polyamide. One-ounce copper plating on each side adds 5 mils thickness to the printed film. An additional 1½ mils of adhesive for bonding the film to the PC-board substrate raises the total thickness to approximately 8 mils.

Film dimension sets the maximum thickness for the PC-board material. To provide a double-sided set of edge-connector contacts, printed film is wrapped

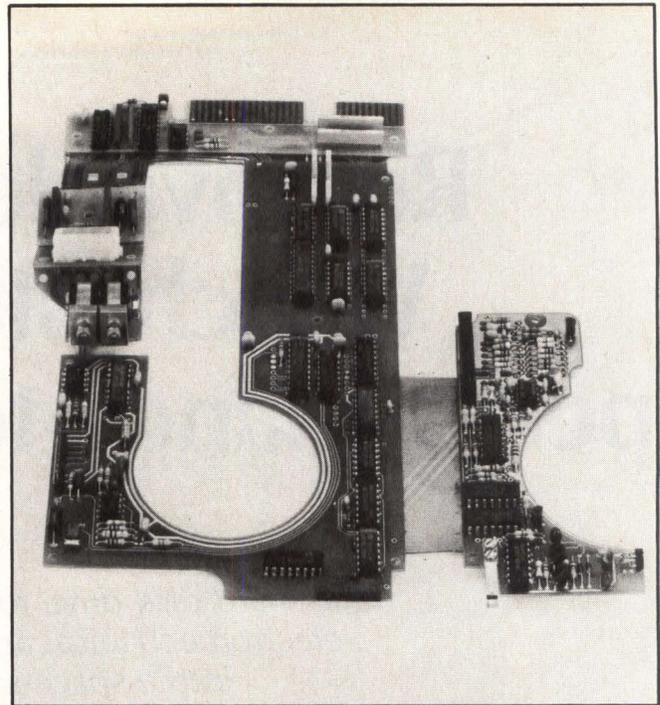


Fig. 2. A folded PC consists of a flat sheet of flexible film bonded to oddly shaped PC-type boards. Component insertion, flow soldering and circuit tests are performed before the PC boards are snapped out of a flat sheet of PC material. Unsupported film acts as flexible hinges (lower right), allowing the folded PC to bend, so that the two component sides face each other. This "double-decker" PC board assembly is then fitted around the drive components; the drive motor fits into the hole area.

around the edge of the board where the connector fits. Subtracting two layers of film (16 mils) from the standard 0.063-inch connector dimension leaves a board thickness of 0.047 inch—more than adequate for mounting and holding components.

The substrate sections start as a continuous, pre-drilled flat board, much like a standard PC card. The section outlines are perforated-stamped so that they can be easily "snapped out" from the surrounding board after the flexible circuit material is bonded to one side. Before the sections are separated, however, components are inserted into the board side and flow-soldered

No-frills innovation cuts cost

Drive and media costs can be cut to affordable levels. System integrators and end users pay a premium for Winchester capacities and performance characteristics. But what price is too high?

A conventional, full-height cartridge Winchester drive with 5M bytes of removable storage sells for \$900 to \$1,000—(less than \$250 per megabyte), which compares favorably with the per-megabyte cost of a half-height floppy drive. But a \$4,000 system cannot afford a \$1,000 drive. This ratio is why the new half-height,

10M-byte cartridge-drive is priced at less than \$500 (\$50 per megabyte).

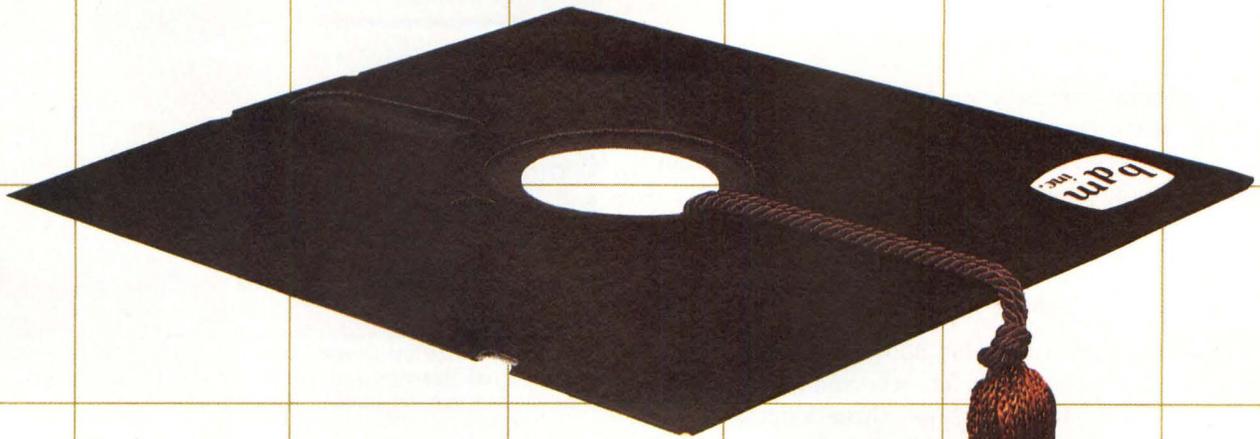
Size reductions cut cost, due to the use of a small, less powerful drive motor; a single folded-PC board, which reduces assembly costs while maintaining Winchester-level reliability and the elimination of a separate fan assembly for cartridge purging.

Equally important, however, is a no-frills, innovative approach to every aspect of the drive. Instead of custom heads, for example, a mass-produced head assembly has been modified for dynamic loading as the arm extends

out from its retracted position. A low-cost stepper motor that controls heads within 1/20th of the distance between adjoining tracks simulates an expensive servo-controlled, voice-coil actuator.

Eliminating the need to write embedded servo data on each cartridge disk before shipment reduces media costs. Instead, user-written servo patterns are added when data is first recorded on a disk. The cartridge can then be played back on any other drive or reinserted in the same drive.

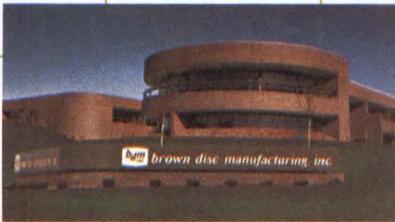
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to the flexible circuitry on the other side. Standard assembly procedures are used until the final assembly step—folding the circuitry and mounting it in the drive. In fact, standard jigs and automatic equipment are used to load components, solder them in place and test the assembled circuits.

Motor height is halved

The flexible-PC technique allows circuits to enclose the bulkiest drive component—the spindle motor. The lower circular cutout wraps three-fourths of the distance around the motor. The larger cutout in the folded-over board fits around a wider diameter section of the motor housing. The wraparound design allows the motor to occupy the space available from the base of the drive to the lower surface of the top-loaded cartridge. This tight but adequate fit accommodates the specially designed, permanent-magnet DC servo motor.

Motor height has been halved from 2 inches to less than an inch (Fig. 3). But size comparisons tell only half the story. A rigid, 5¼-inch-diameter metallic disk, spins at 3,600 rotations per minute atop the spindle assembly when a cartridge is loaded and the motor is activated. Dynamic stresses on the motor's 1-inch shaft are severe, yet the disk must remain stable for the heads to follow the tracks accurately during read/write operations.

To assure stability, precision ball bearings have been added to both ends of the motor shaft. These bearings add to the motor's bulk and cost but also represent a necessary trade-off to achieve an economical but reliable half-height cartridge drive.

Pumpless purge uses fewer parts

Deleting the fan impellers commonly used to purge the inserted cartridge with filtered air before loading the heads on the spinning surfaces aids substantially in reducing the motor's power and size. In fact, the drive is self-purging. The rotating disk serves as its own self-cleaning pump, circulating air through the cartridge and a filter to the rear of the drive. A containment ring and duct within the cartridge housing collect the centrifugal airflow near the surface and direct it toward the outlet.

Air circulates through a single sheet of 3M electret media, which provides adequate filtration of airborne contaminants. This filtration method, though, does impose a much lower pressure drop than that needed by conventional pleated-paper media. Extensive tests have proved particle-count reductions to a safe level with a purge cycle of 23 seconds, including more than 10 seconds for the disk to come up to speed.

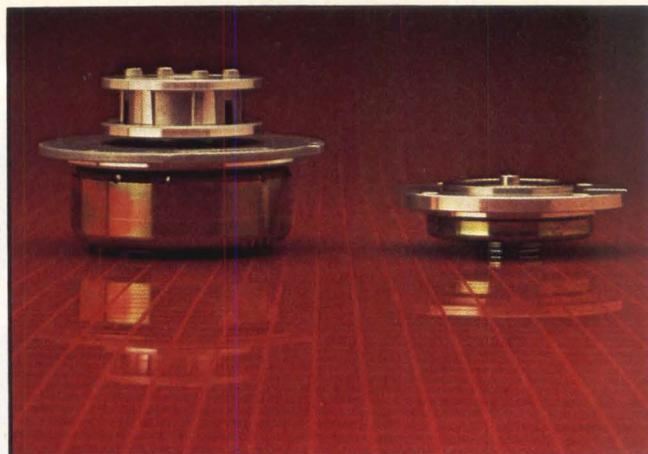


Fig. 3. A half-size low-power motor (right) drives the cartridge disk. Precision ball bearings stabilize the spinning disk clamped to the short motor shaft and spindle assembly.

Pullout drawer aids safe operation

The technique for cartridge-loading combines safe, reliable operation with space-saving design. Heads fully retract from the cartridge area before the media can be inserted or removed. This retraction avoids head or media damage if the cartridge is mishandled or defective. The heads are loaded on disk surfaces only after the disk is spinning at full speed; a protective air layer exists between the disk surface and the heads.

Retractable heads mean that a more reliable top-loading method for inserting the cartridge can be used. Consequently, the drive is configured as a pullout drawer for access to the loaded cartridge. An angular, spring-loaded, metal sleeve that pre-positions the cartridge further simplifies the loading procedure.

The sleeve acts as a shield to prevent a user's fingers from touching the read/write heads in their retracted position. It also provides electromagnetic shielding from the drive motor of the storage device located directly above the cartridge drive. The sleeve helps position the disk hub as the hub lowers onto the spindle. A magnetic clutch then clamps the disk in place.

Full retraction of the heads makes these packaging innovations possible but imposes a major space penalty toward the rear of the drive. The linear head actuator must move the heads across the recorded tracks, completely off the disk and out of the cartridge. Adding the space for the cartridge, the front closure and the rear-connector assembly does not leave enough space in the 8-inch floppy footprint for this much head/arm movement. The solution is a space-convenience trade-off. The drive extends 1¼ inches in front of the mounting panel, providing the user with a convenient "handle" for pulling out the drawer to load or unload the removable media. □

David Sutton is vice president of engineering at DMA Systems Corp., Goleta, Calif.

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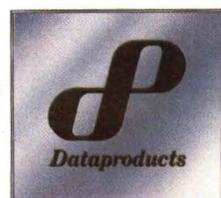
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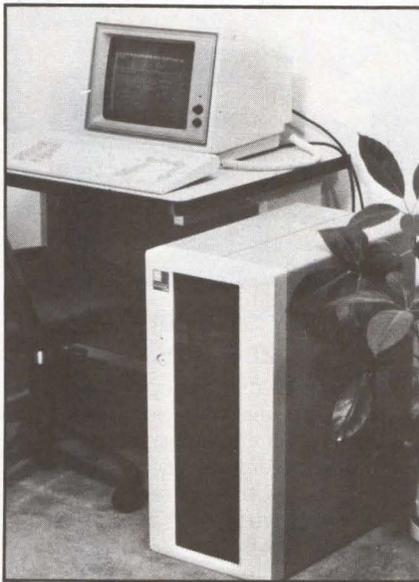
New Products

SYSTEMS

PC XT-compatible micro supports multiple users

The multiprocessor, multiuser Dimension computer system supports as many as 12 workstations, each running a different IBM PC XT business application. It employs a microprocessor-based Intel 80186 single-board computer and a 13-slot IBM bus. Each user has a dedicated 8088-2-based workstation processor board that connects to the IBM bus. The Dimension's operating system, compatible with IBM PC-DOS 2.0, has built-in electronic-mail capability for 12 users. It provides each user with the equivalent of an IBM PC XT with networking and shared access to resources such as fixed disks, printers and communications devices.

The Dimension system includes a 360K-byte floppy disk drive, a 15M- or 30M-byte fixed disk drive and add-in spaces for a second fixed disk and a 45M-byte tape backup system. The 80186-based server processor board comes with 256K bytes of RAM, expandable to 512K bytes. This RAM, used as cache memory, provides high-speed interaction between users and the hard disk. Each workstation board includes 128K bytes of RAM, which is also expandable to 512K bytes.



North Star Computers' Dimension is an IBM PC XT-compatible microcomputer that can accommodate as many as 12 users.

Workstations also include a local RS232 interface to connect a local printer or mouse device, a 12-inch monochrome video display that offers an IBM-

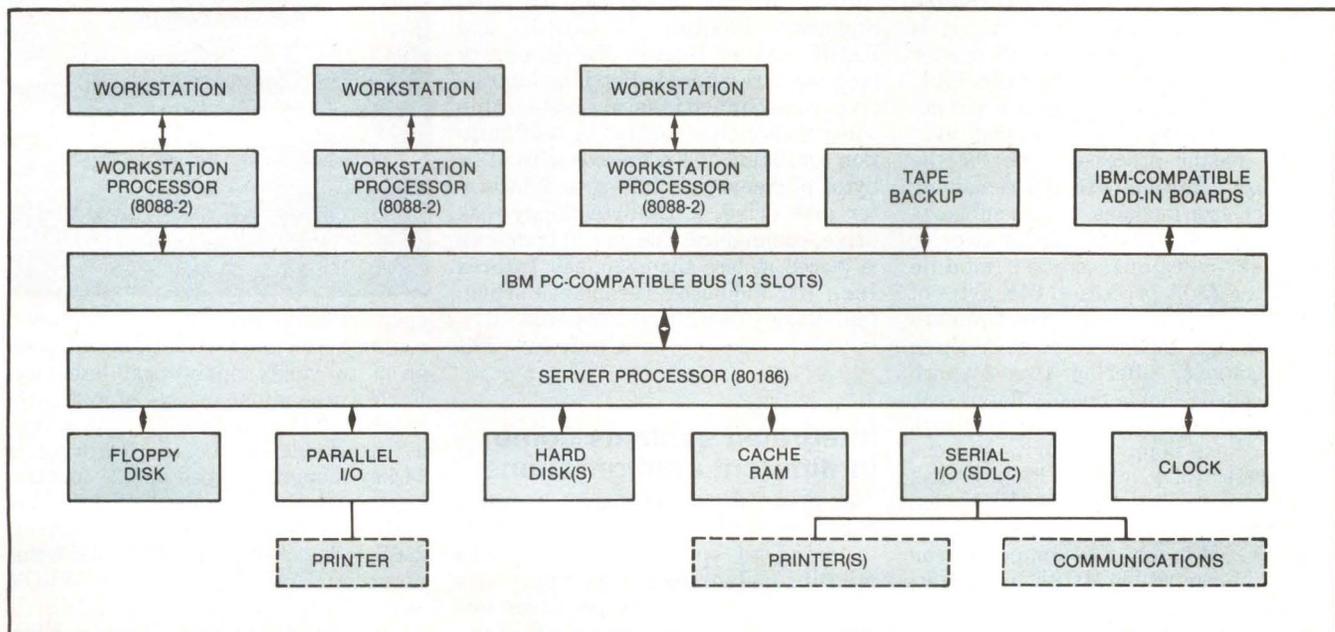
compatible, 640-by-200-dot graphics mode and a detached keyboard. Options include communications links to main-frame computers such as a 3270 cluster controller.

A Dimension with a floppy disk drive, a 15M-byte hard disk, two workstations and the operating system is priced at \$7,000. Each additional workstation sells for \$1,500. North Star Computers Inc., 14440 Catalina St., San Leandro, Calif. 94577, (415) 357-8500.

Circle No 300

Computer performs industrial-control tasks

The PPM 86-50 Multibus industrial-control single-board computer includes a 5-, 8- or 10-MHZ 8086 or 80C86 microprocessor, a CP/M-86 V1.1 operating system in silicon, as much as 128K bytes of EPROM in 32K-byte increments, as much as 128K bytes of CMOS static RAM in 16K-byte increments, 96 buffered I/O lines, a 19.2K-baud full RS232C asynchronous port, a real-time calendar/clock with alarms and two programmable time-base interrupt gen-



Dimension uses a multiprocessor system architecture. Each system user has his own dedicated 8088-2-based workstation processor, memory and input/output. The 80186-based server

processor controls shared resources and responds to requests from workstation processors.

New Products

SYSTEMS

erators. For number-crunching data-acquisition or numerical-control applications, the proposed IEEE floating-point standard is implemented in hardware. The board supports a maximum of eight non-bus-vectored interrupts (edge or level sensitive). For battery-powered standalone applications, the PPM 86-50 is available with low-power CMOS ICs. Prices start at \$695. **PPM Inc.**, 23945 Mercantile Rd., Cleveland, Ohio 44122, (216) 292-6006.

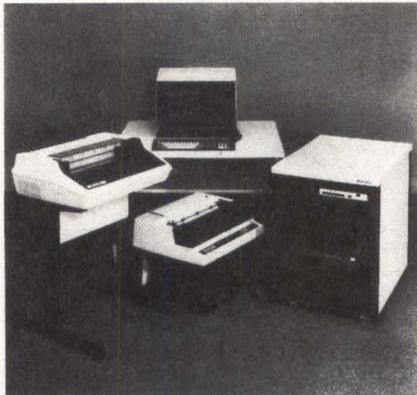
Circle No 301



Computer features modular design

The Zeus5 multiuser, multiprocessor modular computer system can be assembled to a user's specifications and requires only a terminal or I/O console to enable immediate operations. It is controlled by a two-board Z80A master processor located in the basic CPU module. This module contains a six-slot motherboard, with two slots dedicated to the master processor, one for the hard disk controller and the remaining three for user modules. It also supports two to 12 users. Available in two- or four-user versions, a user module contains a Z80A processor, 64K bytes of RAM and two I/O ports. The system's mass-storage module comes in three configurations, offering two 5¼-inch double-sided, double-density floppy disk drives or two 5¼-inch Winchester disk drives or one floppy disk drive and one Winchester disk drive. Floppy disk drive capacities are 500K bytes; Winchester disk drives store 6M, 12M, 19M or 25M bytes. The computers run the CP/M-compatible MUSE 5.0 operating system. Prices start at \$5,595. **OSM Computer Corp.**, 665 Clyde Ave., Mountain View, Calif. 94043, (415) 961-8680.

Circle No 302



Data-entry system operates in centralized environments

The Gen-V data-entry system features a 32-bit microprocessor with 512K bytes of memory, expandable to 2M bytes. Storage options include Winchester disk drives that store 10M to 120M bytes, a 1M-byte floppy disk drive and nine-track phase-encoded tape drives. The system supports as many as 24 terminals and performs concurrent foreground and background tasks. The multifunctional terminals display 2,000 characters. Typewriter- and keypunch-style keyboards are available. Gen-V's menu-driven software provides integrated data entry, file management, report writing and multiple communications protocols. American National Standards Institute 74 COBOL and BASIC and an English-like data-entry language are offered. Batch or interactive communications are selectable using a check-box format. A configuration consisting of a processor with 512K bytes of memory, a 10M-byte Winchester disk drive, a 1M-byte floppy disk drive, communications and 10 terminals is priced at less than \$35,000. **Inforex Inc.**, 186 Middlesex Turnpike, Burlington, Mass. 01803, (617) 272-6470.

Circle No 303

Integrated systems come in different configurations

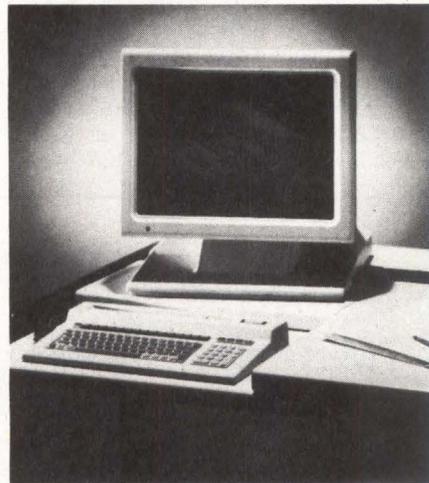
System 86/310, available in three hardware configurations, allows OEM tailoring to specific markets. The microprocessor-based systems use Intel's 8086 16-bit microprocessor and 8087 numeric coprocessor. Systems 86/310-2 and 86/310-3 include a 10M-byte, 5¼-inch Winchester disk drive and a 320K-byte, 5¼-inch floppy disk

drive. System 86/310-1 omits the Winchester disk drive. Systems can be expanded using Multibus boards through the expansion slots or through standard I/O communications ports. System 86/310-3 with four Multibus expansion slots and 640K bytes of RAM: \$8,700, System 86/310-2 with five expansion slots and 256K bytes of RAM: \$7,700, System 86/310-1 with six expansion slots and 128K bytes of RAM: \$4,995. **Intel Corp.**, 3065 Bowers Ave., Santa Clara, Calif. 95051.

Circle No 304

Graphics workstation incorporates GKS

The S6100 series of color and monochromatic raster graphics workstations implements the Graphics Kernel System (GKS) standard through local firmware. It operates in the Lundy native mode and the Tektronix 4014 emulation mode. Circle, arc and other complex curves are displayed via single



operator commands. Internal diagnostic routines execute automatically at power-on to verify operational integrity. Each workstation consists of a 20-inch, 1,449-by-1,024-pixel resolution monitor; a detachable keyboard featuring a 14-key numeric keypad and 24 function keys; and an electronics module that houses an MC68000 control processor, 256K bytes of dynamic RAM, 4K bytes of static RAM, 48K bytes of EPROM and 1K byte of EEPROM. Price is approximately \$22,000. **Lundy Electronics & Systems Inc.**, 1 Robert Lane, Glen Head, N.Y. 11545, (516) 671-9000.

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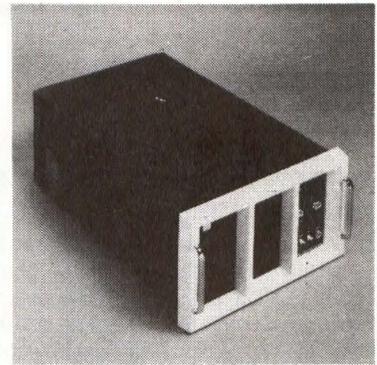
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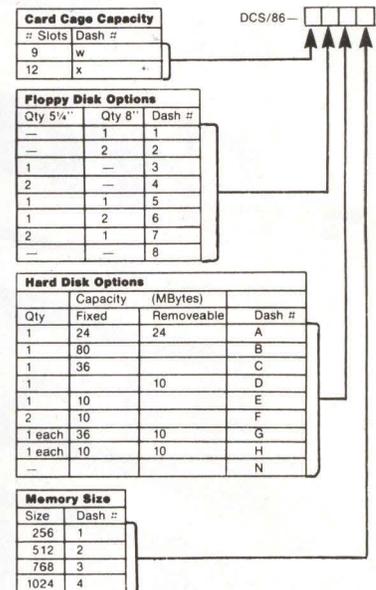
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CIRCLE NO. 152 ON INQUIRY CARD

New Products

SYSTEMS

Portable computer targets industrial markets

Designed for use in factory and laboratory environments, the 35-pound, portable INDY Industrial PC comes in a hinged enclosure for access to internal parts. Featuring Multibus architecture, it integrates a 16-bit 80186 CPU, as

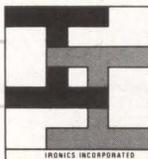
much as 512K bytes of parity RAM, a 9-inch green CRT screen, two 3½-inch, 409K-byte floppy disk drives, parallel and serial ports and the SCSI interface. Software includes the iRMX-86 and CP/M-86 operating systems, four language compilers (FORTRAN, Pascal, BASIC and C), a full-screen CRT editor, an assembler/linker and a PROM

programmer. A packaged system with the CP/M-86 operating system and 128K bytes of RAM is priced at \$4,875; the same configuration with the iRMX-86 operating system is \$5,475. **Monolithic Systems Corp.**, 84 Inverness Circle E., Englewood, Colo. 80112, 1 (800) 525-7661.

Circle No 306

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CIRCLE NO. 131 ON INQUIRY CARD

Portable computer features 132-column screen

The Execuport XL series of portable computers features the 8-bit Z80 and the 16-bit Intel 80186 microprocessors. The computers support the CP/M, CP/M-86 and MS-DOS operating systems. A row of 22 keys provides as many as 44 user-defined, single-keystroke functions. In addition, all keys are programmable within the operating system. The Execuport XL has 80K bytes of RAM and a 9-by-5-inch green phosphor screen that displays as many as 132 columns by 24 lines. Dual 5¼-inch floppy disk drives offer 400K bytes of formatted storage each. The Execuport XL+ adds a 16-bit coprocessor and associated 128K bytes of RAM. Perfect Calc, Perfect Speller, Perfect Writer and Perfect Filer software are bundled with the computers. Execuport XL: \$2,495, Execuport XL+: \$3,295. **Computer Transceiver Systems Inc.**, P.O. Box 15, E. 66 Midland Ave., Paramus, N.J. 07652, (800) 526-9068.

Circle No 307

VME system is based on CP/M-68K

The VME9000 single-user software-development system based on CP/M-68K suits 68000 software development in assembler and C, real-time data acquisition, data processing and process control. Hardware features include a 68000 CPU module, a 128K-byte dynamic RAM module, a quad-port serial module, a floppy disk controller, dual 5¼-inch, double-sided, double-density floppy disk drives and three single-height expansion slots. The system provides Archive, DUMP, Relocation, SIZE 68 and SENDC68 programming utilities and assembler, linker, C compiler and C processor programming tools. \$3,995. **Mizar Inc.**, 302 Chester St., St. Paul, Minn. 55107, (612) 224-8941.

Circle No 308

Qume's new graphics terminal can be all business. Or get technical.

Introducing the QVT 211 GX™ graphics terminal from Qume. It's the one graphics terminal you can afford to use for both business and technical work.

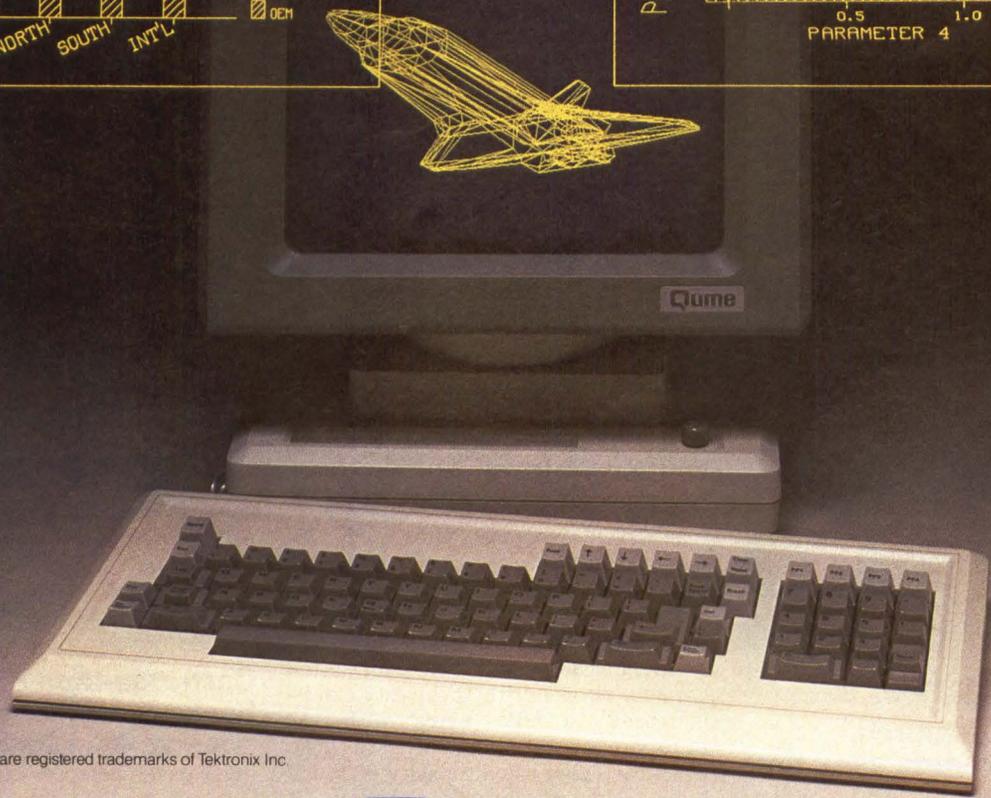
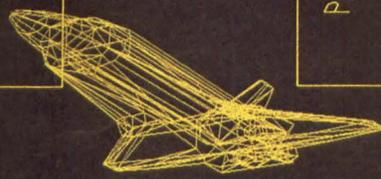
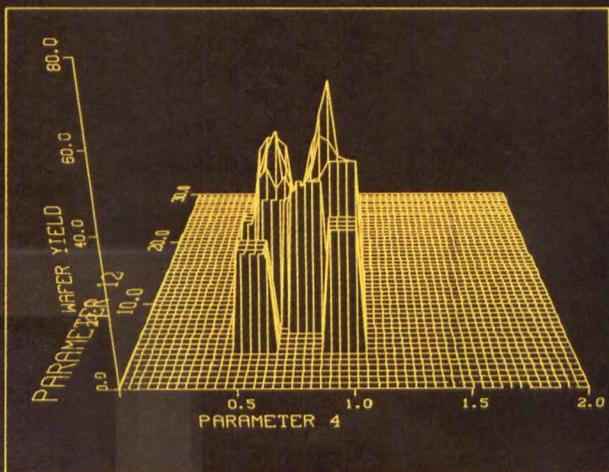
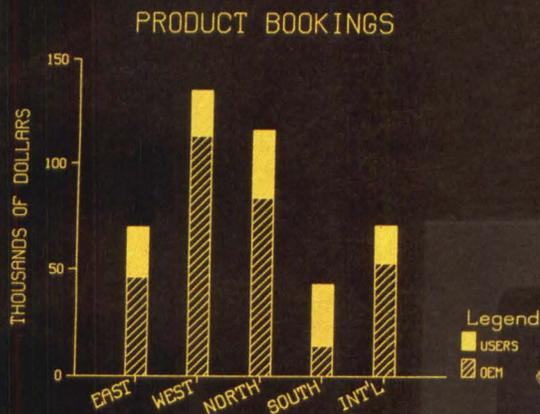
The QVT 211 GX puts the full spectrum of business and scientific graphics within reach of micro, mini and main computer users. Advanced vector graphics reduce graphic programming to just a few strokes of the keys. Arcs, circles, lines and boxes can be generated with a few commands.

And since the QVT 211 GX emulates the Tektronix™ 4010 and 4014* command sets, it's

ideal as a preview terminal for CAD/CAM applications — or any graphic rendering application.

Best of all, the QVT 211 GX costs thousands less than the graphics terminals it emulates. Even the 14-inch tilt-and-swivel screen is standard.

If you're searching for affordable business, scientific and engineering graphics, take a close look at the QVT 211 GX terminal from Qume. Contact your local dealer or distributor today. Or write: Qume Corporation, 2350 Qume Drive, San Jose, California 95131.



*Tektronix 4010 and 4014 are registered trademarks of Tektronix Inc.



For more information call
800-223-2479

CIRCLE NO. 132 ON INQUIRY CARD

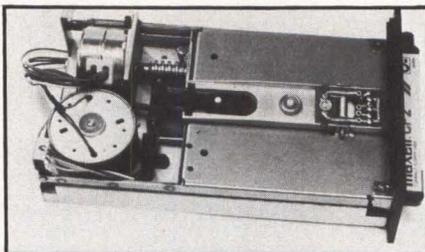
New Products

DISK/TAPE

Floppy disk drive stores 600K bytes

The MFD-80 microfloppy disk drive stores as much as 600K bytes of data on a 3-inch floppy disk cartridge. The drive is plug and format compatible with standard 5¼-inch minifloppy disk drives. The MFD-80 measures 3.54 inches wide by 1.58 inches high, including electronics, and four MFD-80s can be placed vertically in a 5¼-inch footprint.

The drive records double density, double sided (by manually flipping the disk) on the standard Matsushita/Hitachi/Maxell 3-inch disk cartridge at 100 tracks per inch. The unit permits the use of all 48 tracks on each side of the disk to provide as much as 300K bytes of storage per side or 600K bytes of storage per disk. In the standard 40-track-per-side mode, the drive stores



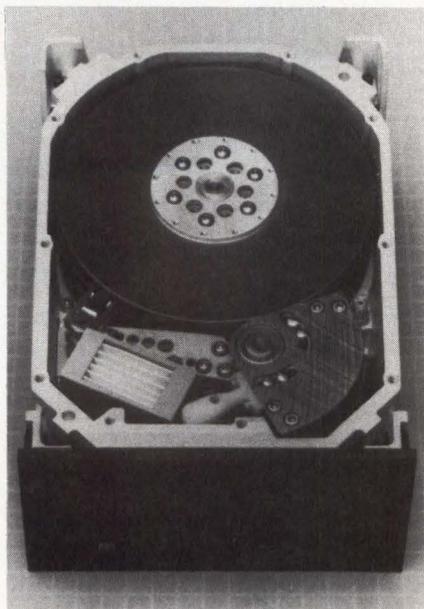
The mechanics of the Janome MFD-80 3-inch microfloppy disk drive give it high reliability at low cost. The barrel cam used with the head carriage assembly eliminates the most common causes of error in band-drive positioners, such as capstan run-out and contamination.

250K bytes per side, or 500K bytes per disk.

Designed for high reliability, the

MFD-80 employs a DC servo-controlled high-torque indirect-spindle drive, with spindle speed sensed at the disk, a high-torque motor, a cam-controlled read/write head carriage assembly and a simple pivoted-sleeve disk-handling mechanism. Motor start time is specified as 800 msec. Mean time between failures is estimated at 8,000 hours; mean time to repair is estimated at 30 minutes.

The drive's speed is 300 rotations per minute, and data is recorded at a 250K-byte-per-second transfer rate. Average seek times are 245 msec. in the 40-track format and 272 msec. in the 48-track format. \$125 (OEM quantities). **Janome Sewing Machine Co. Ltd.**, 1-1 Kyobashi 3-Chome, Chuo-Ku, Tokyo 104, Japan. **Circle No 309**



Winchester features 25-msec. average seek time

The model 1305 5¼-inch, 83M-byte Winchester disk drive features a 25-msec. average seek time, including settling. The drive supports the ST-506/412 interface, offers audible noise levels below 51 dBA and incorporates the vendor's FASEEK

positioning system. The unit also employs a die-cast chassis-within-a-chassis construction that isolates the head/disk assembly from shock and vibration. Other features include a rotary voice-coil positioner, an automatic positioner lock, a disk brake and head retraction to a data-free landing zone. \$1,635 (OEM quantities). **Micropolis Corp.**, 21329 Nordhoff St., Chatsworth, Calif. 91311, (213) 709-3300.

Circle No 310

Unit combines disk storage, tape backup

PC-STOR combines a 5¼-inch, 38-msec. average access time Winchester hard disk for data storage and a 6,400-bpi file-oriented cartridge-tape backup unit. The Winchester drive is available in 33M- or 43M-byte formatted capacity versions. Total capacity can be increased to 86M bytes with the incorporation of a second hard disk. Each cartridge has a capacity of 16.5M bytes. Data-transfer rates as high as 1M byte per minute can be achieved under control of the vendor's proprietary tape-interchange package software. In addition to the IBM PC, PC-STOR operates with personal computers made by Compaq, Columbia Data Systems



and Eagle Computer and with the Texas Instruments Professional. 33M-byte unit: \$4,995, 43M-byte unit: \$5,995. **Alloy Computer Products**, 100 Pennsylvania Ave., Framingham, Mass. 01701, (617) 875-6100.

Circle No 311

Cartridge-tape drive backs up Winchesters

The PC-BACKUP cartridge-tape drive gives personal computer users a low-cost medium for Winchester disk backup. The cartridge drive is a four-track, 6,400-bpi unit that can accommodate 16.5M bytes on a 555-foot-long cartridge tape. The unit is available with PC-TIP (tape interchange package) software that operates

Buy of the Century



Century Data Systems' New 590 Megabyte Winchester Disk Memory

AMS 571—our largest, fastest disk memory—is loaded with value. New thin film heads and oxide media put 590 megabytes into a very compact, very economical package. To enhance system performance we've increased the data transfer rate to 1.98 megabytes per second while reducing the average head positioning time to 19 milliseconds. All for OEMs. And all at a very competitive price!

What's more, the AMS 571 gives your system a record low cost of ownership. Combining traditional Century Data Systems quality with inherent Winchester reliability,

we've created a disk memory with an MTBF in excess of 10,000 power-on hours. A disk memory with quality built in for a lifetime of reliability.

Here's a terrific disk memory with great flexibility. Design your controller to pack all this new performance into your system—or to emulate practically any other Winchester disk memory.

Find out how the buy of the Century gives you a strong competitive edge in quality, capacity, performance, and price. Contact: Century Data Systems, 1270 N. Kraemer Boulevard, Anaheim, CA; (714) 999-2660.

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CIRCLE NO. 133 ON INQUIRY CARD

New Products

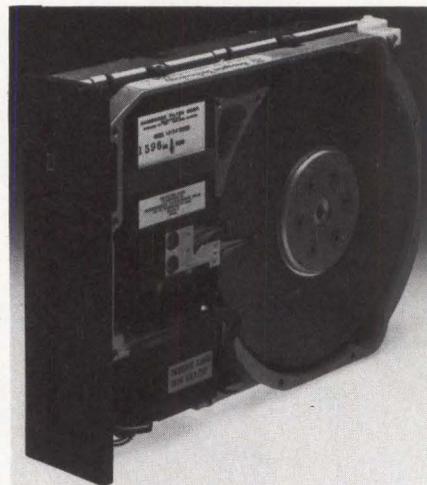
DISK/TAPE

under PC-DOS or CP/M-86. The TIP package controls reading, writing and dumping operations and provides utilities that enable a user to customize drive operations. \$2,195. **Alloy Computer Products**, 100 Pennsylvania Ave., Framingham, Mass. 01701, (617) 875-6100.

Circle No 312

Half-height drive holds 12M bytes on one platter

The single-platter, 12M-byte, half-height, 5¼-inch ST-212 Winchester disk drive incorporates low-mass mini-slider ferrite read/write heads. Suiting portable computers and small desktop systems, the drive withstands a 40G



shock. It is configured with an oxide-coated disk and four read/write heads—two per surface—each of which addresses 306 cylinders. The drive operates at an average access time of 65 msec. using a stepper-motor-driven actuator. A proprietary off-track compensation system permits operation at track densities of 550 tpi. The drive has 612 tracks per surface, divided into two 306-cylinder bands. \$690 (1,000 units). **Seagate Technology**, 920 Disc Dr., Scotts Valley, Calif. 95066, (408) 438-6550.

Circle No 313



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Power Conditioner

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Noise, transients, brown-outs and black-outs . . . power problems that can be solved by these two units from Jefferson Electric.

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SIZES/ RATINGS:	VA	250	500	750	1000
	Min.*	45	30	15	7

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Available with by-pass static switch for high in-rush.

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SIZES/ RATINGS:	10	60VA-30KVA
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Side-loading streamer backs up Winchesters

Serving as high-capacity backup for Winchester disk drives in multiuser business computer systems, the side-loading Flashback ¼-inch streaming cartridge-tape drive comes in two models. One model stores 45M or 75M bytes using nine tracks of a 450- or 600-foot standard cartridge tape. The second model stores 60M or 100M bytes using 12 tracks of a 450- or 600-foot tape. Both drives operate at 30 or 90 ips. Using the 12-track model and a 600-foot tape, 100M bytes of disk capacity can be backed up in 19 minutes. The drives come as an Archive-compatible primitive deck or with a QIC-02-compatible controller that features extended functions and self diagnostics. Nine-track model: \$920 (25 units), 12-track model: \$1,038 (25 units). **Northern Telecom Inc., Memory Systems Division**, 100 Phoenix Dr., Ann Arbor, Mich. 48106, (313) 973-4000.

Circle No 314

CIRCLE NO. 134 ON INQUIRY CARD

MINI-MICRO SYSTEMS/March 1984

ESCAPE FROM THE REEL WORLD.

If you're faced with backing up today's high-capacity disks, you know the available alternatives haven't been too attractive.

Until MegaTape came along.

The inexpensive, book-sized MegaTape cartridge stores 330 megabytes in both streaming and start/stop modes. And unlike the 8 reels of conventional 9-track tape it replaces, it gives you 30-second average access to any file in the cartridge.

Best of all, the compact MegaTape drive costs under \$3,000 in OEM quantities, and uses standard controllers. And the design is so elegantly simple, reliability is outstanding. It's fast becoming the new industry standard for high-capacity backup.

So if you're looking for an escape from all the problems of the reel world, call MegaTape today. We'll show you the easy way out.



**Call Gary Webb, Vice President,
Marketing at (213) 357-9921**

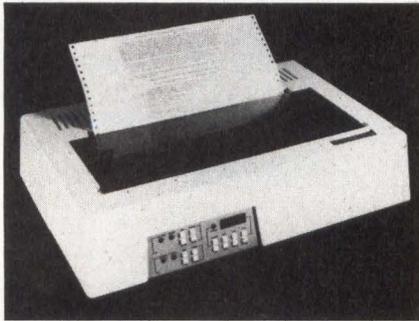
MegaTape Corporation, P.O. Box 317
1041 Hamilton Road, Duarte, CA 91010-0317

MegaTape
The great leap forward in backup.

CIRCLE NO. 135 ON INQUIRY CARD

New Products

PRINTERS



Multimode printer targets OEMs, system houses

The model DS220 multimode printer serves the needs of OEMs and systems houses by providing correspondence-quality printing for word-processing applications, draft-quality printing for data-processing applications and a dot-addressable graphics capability. In the 40-character-per-second (cps) correspondence mode, the printer generates an 18-by-48 dot matrix using a two-pass technique. For print-intensive applications, it operates at 220 cps using bidirectional, logic-seeking printing. In this mode, the printer offers a 9-by-7 dot matrix and a selection of 10, 12, and 16 character-per-inch pitches. The printer also features front-panel controls for access to 50 programmable features, such as forms control, print mode and communications. \$1,995. **Datasouth Computer Corp.**, 4216 Stuart Andrew Blvd., Charlotte, N.C. 28210, (704) 523-8500.

Circle No 315

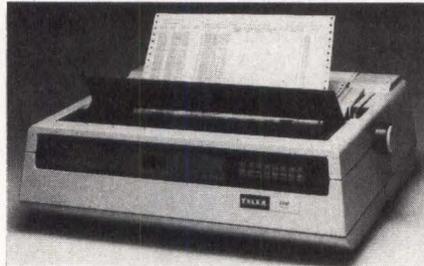
Dot-matrix printer offers correspondence quality

The model LCQ50 dot-matrix printer operates bidirectionally at 150 cps in draft-quality mode and at 90 cps in correspondence-quality mode. It contains an ASCII character set and supports 24 print font combinations, including standard, compressed, double-width, enhanced, double-strike and emphasized. The printer prints 80 characters per line, includes a 256-character receive buffer and is compatible with serial and parallel interfaces. \$535. **Plessey Peripheral Systems Inc., Distributor Products Division**, 2632 Du Bridge Ave., Irvine, Calif. 92714, (714) 540-6288.

Circle No 316

Daisy-wheel printer operates at 80 cps

The model 286F daisy-wheel printer accommodates 127- or 96-character plastic and metallized print wheels. The unit prints bidirectionally as fast as 80

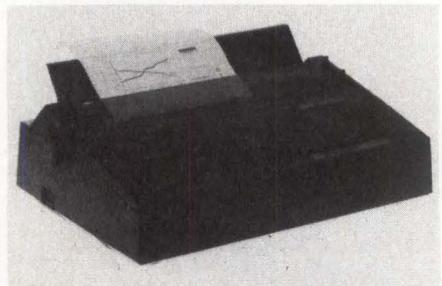


characters per second, depending on the application. It is plug-compatible with IBM Corp.'s 3287 and attaches to the vendor's 174/274C/276 or IBM 3274/3276 controller. The printer's operator console configures line spacing of 6 or 8 lines per inch with 10 or 12 characters per inch (cpi). In addition, 132 print positions at 10 cpi and 158 print positions at 12 cpi are operator selectable. A friction-feed platen is standard; pin-feed unidirectional and bidirectional forms tractors are optional. \$5,350. **Telex Computer Products Inc.**, 6422 E. 41st St., Tulsa, Okla. 74135, (918) 627-1111. Circle No 317

Band printers achieve 6,000-hour MTBF

The M304X series of second generation band printers has achieved a mean-time-between-failure rate of 4,000 hours at 1,200 lines per minute (lpm) and 6,000 hours at 600 lpm as a result of its simplified mechanical design, reduced adjustment requirements and LSI circuitry. Four models are offered that provide 390-, 750-, 1,090- and 1,300-lpm print speeds with a 48-character set and 300-, 600-, 900- and 1,200-lpm print speeds with a 64-character set. The printers feature 136 print positions per line, switchable 6- or 8-line-per-inch vertical spacing and a 55-dBA operating noise level. They accommodate 3- to 17-inch-wide paper and can print six-part forms. Each model is offered with one of three interfaces: Centronics, Dataproducts or RS232C. 1,200-lpm model: \$8,000 (OEM quantities). **Fujitsu America Inc.**, 3075 Oakmead Village Dr., Building 3, Santa Clara, Calif. 95051, (408) 988-8100.

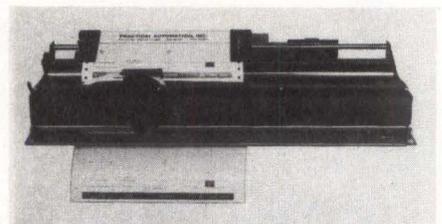
Circle No 318



Daisy-wheel printer has 35K-byte buffer memory

The DTC Style Writer, a bidirectional daisy-wheel printer, features a 35K-byte buffer memory and multicopy capability. It offers automatic proportional spacing; a Centronics interface; graphics plotting, red and black printing; and momentary pause for paper, print wheel and ribbon changing. Options include a forms tractor, a bidirectional cut-sheet feeder and 17 type fonts. \$899. **Data Terminals and Communications**, 590 Division St., Campbell, Calif. 95008, (408) 378-1112.

Circle No 319



Printer mechanism has free-flight head

The model 15-PMC bidirectional, logic-seeking, impact matrix printer mechanism accepts 3- to 16-inch-wide perforated paper, prints at 275 characters per second, handles one- to six-part forms and prints as many as 132 or 242 characters per line. It incorporates a nine-needle free-flight head. Driven directly from the carriage motor is a stationary ribbon cassette containing 55 yards of 1/2-inch ribbon that produces more than 15 million characters. Paper advance is by stepper motor at 35 msec. per line at 6 lines per inch. The mechanism measures 22 by 7 1/4 by 4 3/8 inches and weighs 8 1/4 pounds. \$243 (1,000 units). Delivery is eight weeks. **Practical Automation**, Trap Falls Road, P.O. Box 313, Shelton, Conn. 06484, (203) 929-5381.

Circle No 320

2710 Walsh Avenue
Santa Clara, California 95051
Telephone: (408) 988-2800
TWX: 910-338-0243
Telex: 334421

VERSATEC EUROPEAN MARKETING
27/35 London Road
Newbury, Berkshire, England
Telephone: 44-635-42421
Telex: 847259

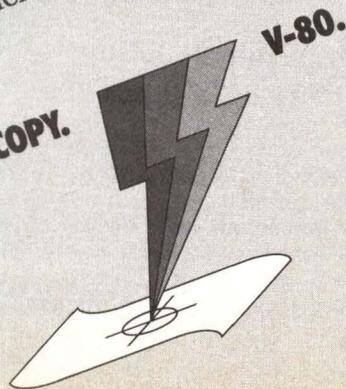
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Why wait? Give your workstation a V-80. Get the high resolution hard copy you want—complex graphics, software generated text, maps, even halftone pictures. And get it fast—an 11-inch wide page in just 8.5 seconds. Plot drawings in A-size, B-size, or any length. Print 132-column listings at up to 1000 lines per minute. On a wide selection of paper or film media. An electrostatic V-80 costs half as much as the typical laser device. And one V-80 can serve several users without contention. Quickly. Quietly. Reliably. Versatec interfaces, including IEEE-796 (multibus) and IEEE-488 (GPIB), intelligent controllers, and multiplexers link V-80 with many popular workstations and computers. Versatec support and supplies are available throughout the world.

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V-80.

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CIRCLE NO. 136 ON INQUIRY CARD

New Products

TERMINALS

Workstation performs voice/data communications

The ES.1 voice/data workstation integrates a telephone, a data terminal with a 9-inch CRT, an internal 300-baud, full-duplex modem, a detachable, full-travel, step-sculpted keyboard and personal business-support software in a desktop package. The ES.1 performs simultaneous voice/data communications using two telephone lines. It has a telephone directory with single-keystroke dialing (able to incorporate numbers for long-distance services, including individual authorization codes as well as database log-on procedures) and automatic re-dialing of the last 15 telephone numbers dialed. Users can maintain a personal calendar/reminder file and can generate and send electronic messages and memos.

The data terminal displays 25 rows of 80 characters, each of which is 7 by 9 in a 9-by-12 cell. The keyboard includes 10 function keys. The control panel has a standard touch-tone telephone keypad with 13 programmable executive telephone function keys and eight dynamic soft keys for menu selection.

The ES.1 comes with two modular telephone plugs (RJ11C). It uses a Z80

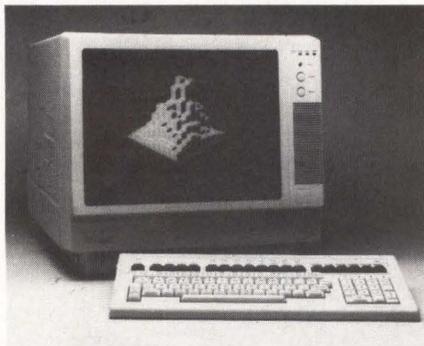


Zaisan's ES.1 voice/data workstation puts information at a business professional's fingertips. While speaking on the telephone, a user can access corporate databases as well as external computerized information sources.

microprocessor with a 32K-byte ROM containing the operating system and 8K bytes of battery-backed CMOS RAM. In addition to the traditional telephone handset, the product features a full-

duplex speaker phone, a day/date clock and a parallel printer port. \$850. **Zaisan Inc.**, 13910 Champion Forest Dr., Houston, Texas 77069, (713) 580-6191.

Circle No 321



Color terminals serve business needs

This series of color graphics display terminals suits business, scientific and engineering applications. The GR-1104 desktop terminal offers 1,024-by-780 resolution and on-screen display of any eight colors from a palette of 512. The vendor's proprietary 14-inch, 60-Hz non-interlaced monitor displays a

bright, stable, non-flickering image. A selectable color alphanumeric capability allows superimposition and scrolling of independent file listings over a graphics display. The GR-2414 terminal draws at 25,000 vectors per second. It has a resolution of 1,280 by 1,024 on a 60-Hz, non-interlaced, 19-inch monitor and offers 1,024 simultaneously displayed colors from a palette of 32,768 colors. Local interactive processing supports 2-D transformations for scale, rotation and translation; clipping functions; zoom; scroll; positioning; rubber banding; and drag. A graphics processor generates circles, arcs, rectangles, polygons, grids, fans, hatchings and paintings. Both terminals are supported by the DISSPLA, TELL-A-GRAF and Template software packages. GR-1104: \$4,950, GR-2414: \$18,950. **Seiko Instruments U.S.A. Inc.**, 1623 Buckeye Dr., Milpitas, Calif. 95035, (408) 943-9100.

Circle No 322

Terminal features varied emulation modes

The model 2427 color graphics terminal incorporates a 16-bit Z8002 CPU dedicated to graphics processing functions such as area fill and polygon drawing. A dedicated 8-bit 8085 microprocessor supports an ANSI X3.64 control system and handles all alphanumeric terminal functions. Graphics resolution is 560 by 288. The terminal has a 64-color palette from which eight colors can be displayed concurrently. It emulates the Tektronix 4010 and 4014 and is compatible with the Tektronix 4027. In the terminal mode, the 2427 emulates the DEC VT100 and has an alphanumeric screen format of 80 characters by 24 lines. \$1,995 (100 units). **Intecolor Corp.**, 225 Technology Park, Norcross, Ga. 30092, (404) 449-5961.

Circle No 323

THE WY-50. PRETTY PRICE

A NEW GENERATION OF LOW-COST TERMINALS FROM WYSE.



Never before could you buy so much terminal for such a small price. It took revolutionary design to do it. Design a lot of people couldn't accomplish for the price. But we did.

In fact, the WY-50 introduces a new standard for low-cost terminals. You get a compact, full-featured design that meets the most advanced European ergonomic standards. A larger screen with 30% more viewing area. And a price tag that won't break the bank.

The WY-50 sells for only \$695.00.

FEATURES:

- 14" screen.
- 80/132 column format.
- Soft-set up mode.
- High resolution characters.
- Low-profile keyboard.
- Industry compatible.
- Only \$695.00.

For more information on the revolutionary design, outstanding features

and unique good looks of the new WY-50, contact WYSE TECHNOLOGY and we'll send you a brochure filled with everything you need to know.

The WY-50. More than just a pretty face.

CIRCLE NO. 137 ON INQUIRY CARD

WYSE

Make the Wyse Decision.

WYSE TECHNOLOGY 3040 N. First St., San Jose, CA 95134, 408/946-3075, TLX 910-338-2251, Outside CA call toll-free, 800/421-1058, in So. CA 213/340-2013.

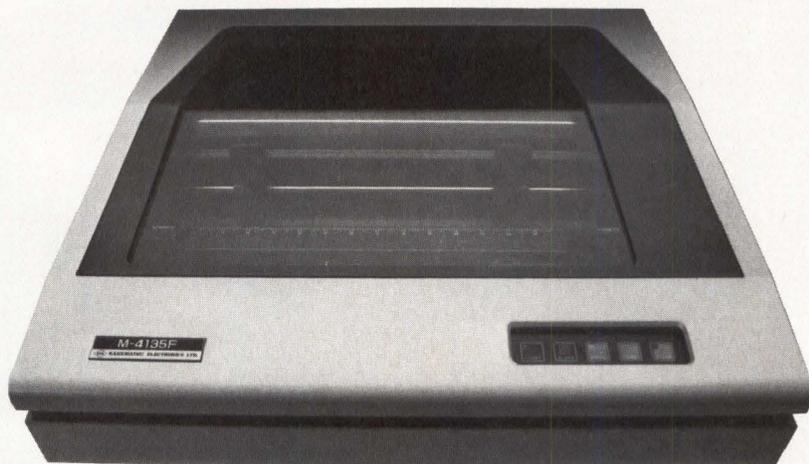
New Products

TERMINALS

Terminal acts as workstation

The Metamorph graphics workstation has a 15-inch, 640-by-808-pixel non-interlaced monochrome display that can simulate an 8½-by-11-inch sheet of paper. Characters can be drawn in any size or font with fixed or proportional

spacing reading in any direction. Figures and bit maps can be drawn and displayed intermixed with characters. The product's display hardware features a 128K-byte display memory under the control of the 7220 graphics processor. The visual display acts as a window into the display memory and can be panned and scrolled under software control.



Meet the KEL Model 4135F Dual-Function Printer

A label and bar code printer that goes where the work is

You can't put your computer, with all its labeling data, where your labels are actually used. But the KEL Model 4135F Printer, connected to your computer through its RS232C or Centronics-compatible interface, lets you apply that data just about anywhere it's needed. On the next floor. In the next building. Across town. Or across the country.

The Model 4135F Printer not only goes where the work is, it works harder when it gets there. The 4135F Printer has its own label, bar code and character generator, so it takes over many of the chores other printers leave to your computer. Label production will be faster, more efficient. Data transmission time to a remote site could be reduced for the typical label from minutes to just a few seconds. Label printing whizzes along at 2300 dot lines per minute with 160 dot-per-inch resolution.

Model 4135F labeling features include character magnification up to 255 times normal; reverse character printing; precise positioning of horizontal and

vertical characters, lines, and boxes; rotation of bar codes; generation of non-standard characters; selection of up to eight popular bar codes; and user specification of bar code size.

In its spare time, a high-resolution line printer

Even when there aren't any labels to produce, the Model 4135F will keep right on working. With its 130 lines-per-minute printing speed, 136-character line width, and 96 ASCII character set, the Model 4135F can be used anytime as a conventional line printer.

KEL Model 4135F. The one printer for all your work. For complete information, use this magazine's reply card or contact KEL directly.

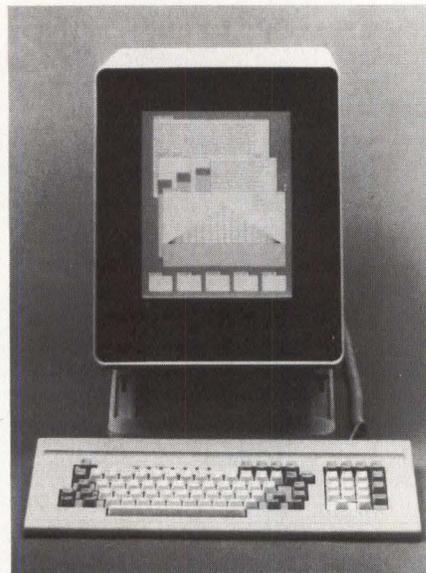


KEL, INC.

400 West Cummings Park
Woburn, MA 01801 (617) 933-7852

KEL, INC. is a subsidiary of Kanematsu Electronics Ltd., one of the leading Japanese suppliers of computer products.

CIRCLE NO. 138 ON INQUIRY CARD



The graphics controller draws dots, lines, rectangles and arcs at 1.35 million pixels per second. The Metamorph's system controller is based on the 8088 processor with 64K bytes of RAM. Host RS232, screen printer and auxiliary RS232 interfaces and a parallel port are standard. Firmware in the Metamorph allows it to emulate the DEC VT100 text terminal as well as the Tektronix 4010 graphics terminal. \$3,495, 120-day delivery. **Companion Computer Corp.**, 7404 Washington Ave. S., Eden Prairie, Minn. 55344, (612) 944-5022.

Circle No 324

Terminal operates in Datashare system

Developed for use with Digitex computers or Datapoint Corp.'s Datashare and DOS systems, the model 1182 video display terminal features a detachable keyboard, screen tilt and rotate and five styles of cursor display. The terminal displays 24 lines of 80 characters and a 25th status line on its 12-inch green screen. It also emulates the ADM-3A, ADM-5, TeleVideo 910, Hazeltine 1420 and ADDS Regent 25. Under these modes, the terminal provides seven cursor control, five editing and five function keys and supports normal and half intensity, reverse video, underline and blinking. An RS232C interface comes standard. \$995. **Digitex**, 2044 Armacost Ave., Los Angeles, Calif. 90025, (213) 826-4500.

Circle No 325

MINI-MICRO SYSTEMS/March 1984

NO DEC IS AN ISLAND.

Able's new Easyway/E Ethernet port controller makes tying together networks of UNIBUS PDP-11 and VAX computers easier than ever.

Easyway/E provides DEC systems with plug-in access to IEEE 802.3/Ethernet LAN's, with less CPU overhead and less network software than other Ethernet ports.

That's because Easyway/E implements ISO/OSI protocol layers 1 thru 4 on a single board occupying one UNIBUS backplane hex slot. Much of the potential LAN software you need is already in the firmware. So, your initial network development time and costs for DEC systems with VMS and RSX won't drag you under.

And this lifesaving implementation of protocol on-board also offloads the CPU, freeing up the processor to handle other tasks.

What's more, Easyway/E meets IEEE 802.2, 802.3 and NBS-4 standards for ISO/OSI layers 1 thru 4, so current and future communications with other DEC systems will be smooth sailing.

In fact, Easyway/E's architecture is designed to accommodate future networking needs. The single board is comprised of two modules, so tomorrow's protocols can be implemented quickly with less expense. Additional protocol support including X.25, SNA and TCP/IP will soon be available, as will software support for DECnet and UNIX.

Able offers a broad range of devices for DEC computers providing communications, memory expansion and inter-processor connectivity. All complying with FCC regulations.

So, to keep from getting stranded, pick your port carefully. Easyway/E. The standardized IEEE 802.3/Ethernet port for today and tomorrow.



The communications specialists.

CIRCLE NO. 139 ON INQUIRY CARD

1732 Reynolds Avenue, Irvine, California 92714. Call toll free: 800-332-2253. In the Irvine area: (714) 979-7030. Or, TWX: 910-595-1729.

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New Products

DATA COMM



Limited-distance modem features auto speed

The DCP3055 limited-distance modem has auto-speed capability that facilitates changes in operating speed at unattended, remote sites. The unit operates synchronously at 1,200, 2,400, 4,800, 9,600 and 19,200 bps. Using metallic circuits, it provides full-duplex transmission over four wires. Transmission range depends on data rate and wire size; 10 miles at 1,200 bps is typical. The unit provides an RS232C interface and conforms to Bell publication 43401 requirements at speeds as high as 9,600 bps on the line side. Other features include built-in diagnostics (local and remote loopback capabilities), front-panel indicators and a choice of RTS/CTS delays (0, 9, 18 and 35 msec.). \$440 to \$550, depending on quantity. **Datatel Inc.**, Pin Oak & Springdale Roads, Cherry Hill Industrial Center, Cherry Hill, N.J. 08003, (609) 424-4451.

Circle No 326

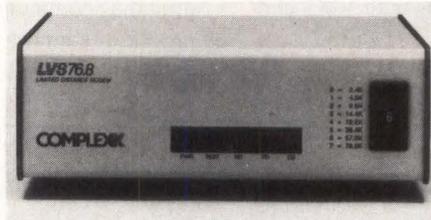


Modem works over Public Switched network

The 9,600-bps model 9600A/B standalone modem functions over the Public Switched telephone network and over four-wire, unconditioned 3002 or equivalent leased lines in point-to-point applications. In leased-line operation, the modem is compatible with CCITT Recommendation V.29. In leased-line and Public Switched operating modes, the unit conforms to CCITT Recommendations V.24 and EIA standard RS232C. Fall-back rates of 7,200 and 4,800 bps accommodate faulty line conditions. Automatic adaptive equalization minimizes data-transmission er-

rors. Diagnostic features include self test, local analog loopback, local digital loopback, remote analog loopback and remote digital loopback. \$2,995. **Prentice Corp.**, 266 Caspian Dr., P.O. Box 3544, Sunnyvale, Calif. 94088, (408) 734-9810.

Circle No 327



Modem has selectable transmission modes

The LVS 76.8 limited-distance modem allows a user to select from eight synchronous speeds (2,400 to 76.8K bps) via a thumb-wheel switch. At 76.8K bps, the modem can send data 16,250 feet on 22-gauge wire. Transmitting at lower speeds or on heavier-gauge wire attains greater distances. The unit also operates in a Bell 43401-compatible mode. It uses a proprietary bi-phase modulation technique. The modem provides standard EIA and line loop-back testing and has LED indicators for power, data transmission, data reception, carrier detection and testing. An RS232C or a V.35 interface is standard. RS232C interface version: \$650, V.35 interface version: \$725. **Complex Systems Inc.**, 4930 Research Dr., Huntsville, Ala. 35805, (205) 830-4310.

Circle No 328

Data switch networks computers, peripherals

Combining the benefits of a local-area network with data switching, the Robin desktop data switch links terminals, microcomputers, mainframes and peripherals into networks. It contains control electronics, 64K bytes of memory, configuration control, a cable connector for attachment to other Robins, four RS232 ports and a Centronics-compatible parallel port. Each port can be locally or remotely configured for a specific device. The RG 62 cable can be extended to 1 km. Signaling rate is 2M bps; maximum aggregate user data rate is 1.8M bps. The network uses a variable time-division multiplex protocol. Multilevel



addressing permits multiple name identification of any port. \$1,950. **Metapath Inc.**, 737 Lincoln Centre Dr., Foster City, Calif. 94404, (415) 345-7700.

Circle No 329



Converter joins devices to coaxial ports

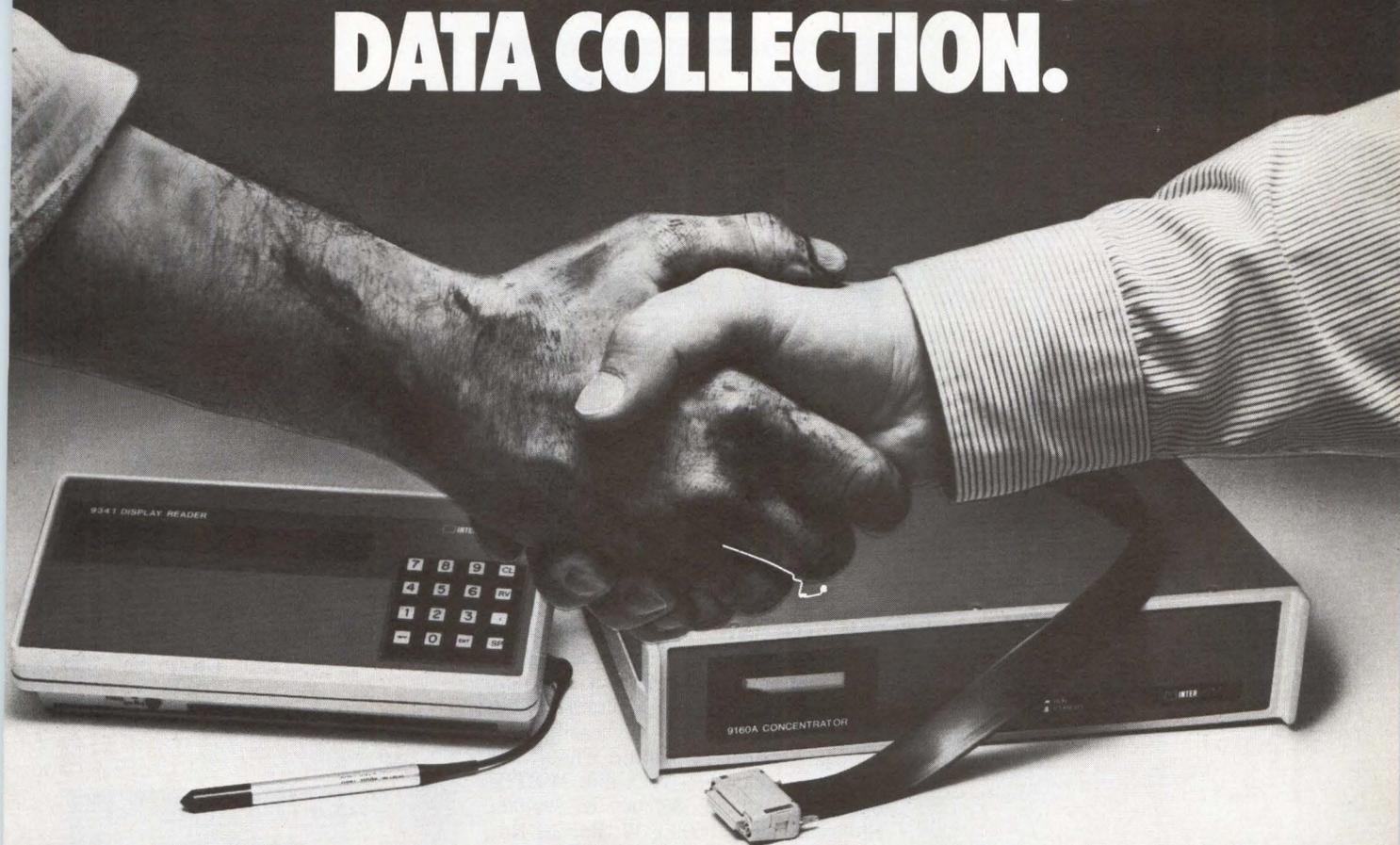
The InterLynx/3278 standalone converter attaches an asynchronous ASCII CRT or personal computer to IBM 3274/6 controllers emulating the IBM 3278-2 display station. The device connects to type A coaxial ports and converts the coaxial interface to an RS232C ASCII interface. It supports 33 primary asynchronous terminal personalities and 70 secondary terminal types. It features clear-to-send and x-on/x-off flow control, automatic baud rates from 300 to 9,600 bps, support for a 25th status line and a 12-character password. \$1,395. **Local Data**, 2701 Toledo St., Suite 706, Torrance, Calif. 90503, (213) 320-7126.

Circle No 330

Message switch offers multiple switch functions

The 68000 microprocessor-based Micronet Message Switch desktop store-and-forward system operates as a network node, electronic mailbox and data-collection system at 50 to 56K baud. It can be configured with as many as 24 ports and accommodates popular communications protocols. It features automatic speed, code and protocol conversion, serving as a bridge to switched or non-switched, synchronous or asynchronous networks. Basic com-

THERE ARE TWO SIDES TO BAR CODE SHOP FLOOR DATA COLLECTION.



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INTERMEC 9341 industrial data collection terminals are improving productivity in work-in-process tracking, inventory and production control, shipping and receiving, labor reporting, quality control and more.

The compact 9341 not only virtually eliminates data errors, but also eliminates the need for on-line CRT terminals. Its 32 character display provides prompt, computer response and status, time and wandling feed back and is readable from 10 feet. An adjustable volume beeper also provides operator feedback. You won't get faster, more accurate first-read rates than from INTERMEC.

You won't find a tougher, industrial data collection terminal than the 9341. Encased in a heavy aluminum casting with a mar-resistant, polycarbonate face panel and sealed keyboard, the 9341 keeps functioning in spite of the abuse industry hands out.

THE MIS GROUP NEEDS A SIMPLE HANDSHAKE WITH THE HOST COMPUTER.

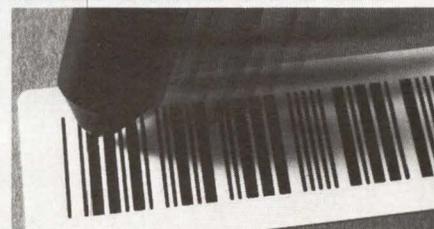
MIS managers need no longer dread the thought of designing, programming and implementing bar code data collection.

The INTERMEC 9160A Port Concentrator minimizes both the costs and headaches of interfacing. The 9160A handles bidirectional data traffic between your host computer and up to 16 INTERMEC bar code readers and/or printers. All polling and error checking for each channel is automatically controlled, and data storage expandable to 64K of RAM is available.

The 9160A provides superior system diagnostic and debug capabilities with the equivalent of a data line monitor built in. The 9160A is compatible with most minicomputers including the IBM Series/1, HP 3000, DEC PDP-11 and IBM Systems 34 or 38.

Whether you're an OEM designer or end-user, for more information on shop floor data collection tools that integrate easily and work well, contact INTERMEC, 4405 Russell Road, PO Box C-N, Lynnwood, WA 98036-0694. Call 206/743-7036. TELEX: U.S. 152447. INT'L 4740080.

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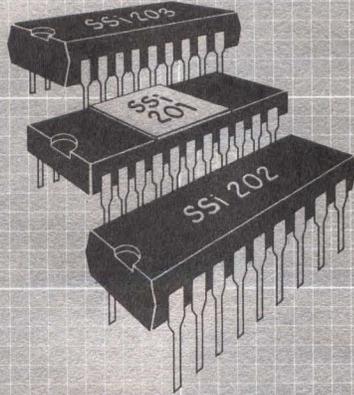
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FIRST IN TOUCH-TONE[®] RECEIVERS



The SSI 201 DTMF receiver is the industry-standard one-chip solution for many telecom applications. It detects a selectable group of 12 or 16 digits, with no front-end filtering required. And its innovative design eliminates the need for all external components except a 3.58 MHz crystal and an inexpensive resistor.

The SSI 202 incorporates the features of the SSI 201 in a low-cost, 18-pin, plastic package. This lower cost unit also dissipates lower power and operates on 5 volts, making it compatible for use with microprocessors and suitable for consumer electronics. An additional "early detect" feature is provided in the SSI 203, the newest unit in SSI's growing line of Touch-Tone circuits.

To find out more about the industry's First Family of DTMF receivers, contact: **Silicon Systems**, 14351 Myford Road, Tustin, CA 92680. (714) 731-7110 Ext. 575.

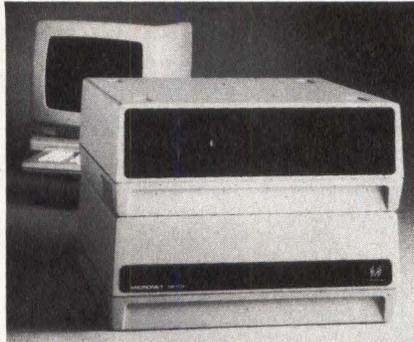
*Touch-Tone is a registered trademark of AT&T

silicon systems
INNOVATORS IN INTEGRATION

CIRCLE NO. 140 ON INQUIRY CARD

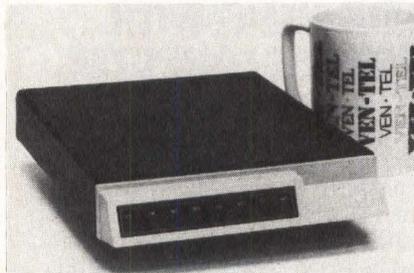
Products

DATA COMM



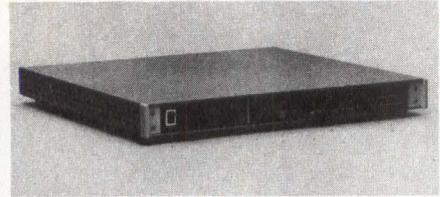
communications functions include network management, message processing, store-and-forward switching, forced delivery, electronic mail and front-end processing to a mainframe. System hardware consists of the control unit with 16-/32-bit architecture, 512K bytes of RAM, the console controller and as many as four communications controllers; a mass-storage unit with a 5M- to 80M-byte hard disk drive and a 1.2M-byte floppy disk drive; a supervisory console featuring a 12-inch, 25-line-by-80-character, tiltable video display with detached keyboard; and a 120-cps dot-matrix printer. The switch uses the vendor's UNIX-like M-STOS operating system. \$65,000 to \$95,000. **Sidereal Corp.**, 9600 S.W. Barnes Rd., Portland, Ore. 97225, (503) 297-5531.

Circle No 331



Modem replaces Hayes 1200

The 1200 Plus, a 1,200-/300-baud, auto-answer, auto-dial standalone smart modem, replaces a Hayes Smartmodem 1200. It operates in full- or half-duplex modes. In auto-answer mode, the modem automatically detects the speed of incoming data. It includes an internal speaker and LED status indicators. The unit is supported by Crosstalk-XVI and PC Talk III and Personal Investor financial packages. \$499. **Ven-Tel Inc.**, 2342 Walsh Ave., Santa Clara, Calif. 95051, (408) 727-5721. Circle No 332



Synchronous data modem transmits at 2,400 bps

The 2,400-bps model 2420 synchronous data modem conforms to CCITT V26 and V26 bis and has diagnostics for point-to-point, multipoint and switched network applications. Operating modes are full-duplex over four-wire lines and half-duplex over two-wire lines. A 1,200-bps fall-back speed can be used on severely degraded lines. Diagnostics include a built-in test-pattern generator and local and remote analog and digital loopbacks. \$1,095. **Lynch Communication Systems Inc.**, 204 Edison Way, Reno, Nev. 89520, (800) 421-0068.

Circle No 333



Multiplexer supports 16 full-duplex channels

The eight- or 16-channel OMX-1900 series fiber-optic time-division multiplexers are plug-compatible with standard RS232C data-communications equipment. Each multiplexer channel supports the EIA handshaking protocol and can operate in full-duplex data-transmission mode. Operating modes can be asynchronous with handshaking, internally clocked synchronous with handshaking or the vendor's triple-channel mode. Each channel is transparent to the data rate in asynchronous mode at data rates as high as 19.2K bps. In internally clocked synchronous mode, each channel can be independently programmed by rear-panel switches for data rates of 1,200, 2,400, 4,800, 9,600 and 19.2K bps. The triple-channel mode configures the multiplexer to pass 24 bits (OMX-1908) or 48 bits (OMX-1916) parallel. OMX-1908: \$1,295, OMX-1916: \$2,395. **Phalo/OSD Corp.**, 65 W. Moreland Rd., Simi Valley, Calif. 93065, (805) 522-3333.

Circle No 334

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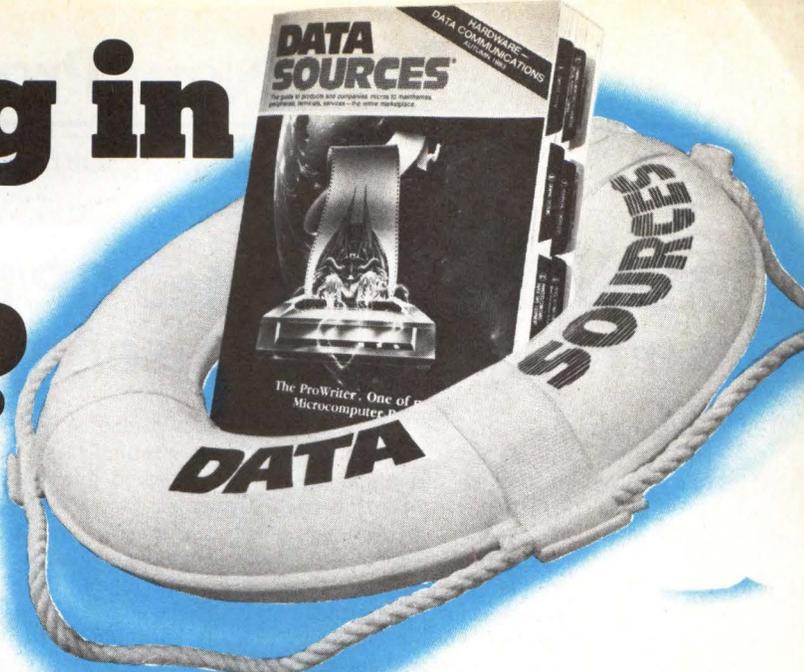
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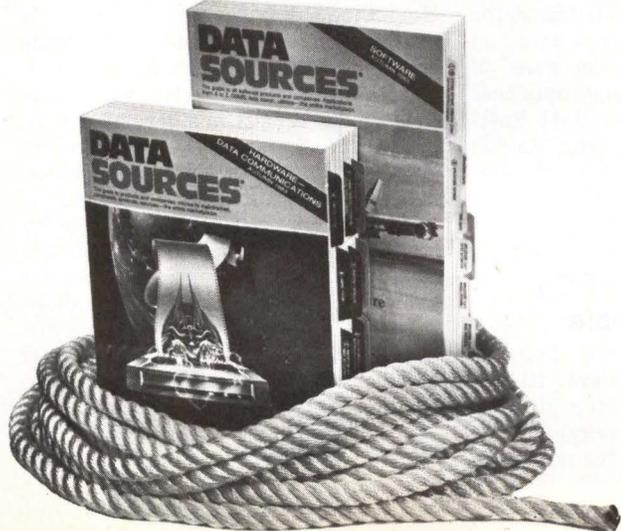
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T216



New Products

SOFTWARE

Molecular integrates CP/M software on multiuser system

Running on its CP/M-based supermicro system, Molecular Computer's application tools for office management (ATOM) integrated-software package handles as many as 32 users. ATOM, developed by Hermet Inc., San Francisco, is among the few integrated packages for a multiuser system. It combines word processing, electronic mail and a spreadsheet with the Menu Master set of menus and sub-menus as the user interface. Menu Master eliminates the need for CP/M commands and has extensive help facilities, notes Molecular product marketing manager Jerry Braun.

Braun describes ATOM's word processor, M/WORD, as a superset of MicroPro International Corp.'s WordStar, with added functions such as multiple windowing and an abbreviation dictionary. ATOM's M/CALC spreadsheet is similar to Microsoft

Corp.'s MultiPlan but easier to use, claims Braun. He says ATOM provides "considerable integration, such as the transfer of spreadsheets to the word processor." File transfer between users is accomplished transparently through use of the menu.

Off-the-shelf CP/M programs can easily be added to the menu, and options, such as a relational database manager, graphics and data communications will be available in the first half of this year, Braun adds.

Price of the basic ATOM will range from \$1,200 to \$1,400. Ian Garbutt, Hermet marketing director, says it is possible that the ATOM software will be tailored to other multiuser CP/M-based systems such as OSM Computer Corp.'s Zeus.

Molecular Computer, 251 River Oaks Parkway, San Jose, Calif. 95134, (408) 262-2122. **Circle No 335**

programming on most host computers to transfer ASCII files. The product supports a subset of HP 2648A vector graphics plotting sequences and HP 2624B block mode for compatibility with most HP 3000 software. All operations are selected from a menu by using the IBM PC's function keys. VDTE 2 supports two serial ports with seven pages of off-screen scrolling memory per port. It offers 10 communications speeds from 75 to 9,600 baud. \$200. **Inner Loop Software**, P.O. Box 45857, Los Angeles, Calif. 90045, (213) 645-5162.

Circle No 338

Cross assembler runs on DEC computers

REX/SMA/186 is a relocatable, macro cross-assembler software package that supports Intel iAPX-86/87/88/186/188 microprocessor application development. The package contains five utility programs including a macro assembler, a cross linker, an absolute object-code locator, an object-code librarian and a menu-driven user interface. All programs operate on Digital Equipment Corp.'s PDP-11 or LSI-11 computers under the RSX-11M or UNIX operating systems or on the VAX-11 computer under the VMS operating system. The macro assembler supports type checking, structures, records and macro processing language. Object codes produced by the assembler are compatible with Intel object module format. Any object-code modules and object-code libraries produced by Intel language processors can be linked and located using the REX-SMA-186 package. Prices start at \$3,250. **Systems & Software Inc.**, 3303 Harbor Blvd., Costa Mesa, Calif. 92626, (714) 241-8650.

Circle No 336

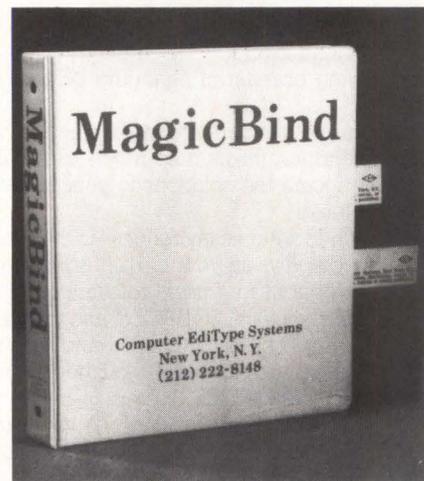
C cross compiler for NS16032

This C cross compiler package for National Semiconductor's NS16000 series of microprocessors comprises a native code generator for the host development machine and a code generator for the NS16032. The package also includes a cross assembler and a cross linker that facilitates construction of RAM/ROM combination systems. The compiler can also be used with the vendor's BASTOC BASIC-to-C translator to support multiple dialects of BASIC on the NS16032. The C compiler runs on VAX/VMS, RSX-11M, UNIX and IDRIS host computer systems. \$2,500. **JMI Software Consultants Inc.**, 1422 Easton Rd., Roslyn, Pa. 19001, (215) 657-5660.

Circle No 337

Packages lets IBM PCs emulate HP terminals

VDTE 2 allows an IBM Personal Computer to emulate HP2624, HP2648 and DEC VT52-type video display terminals. VDTE 2's general-purpose file-transfer system requires no special

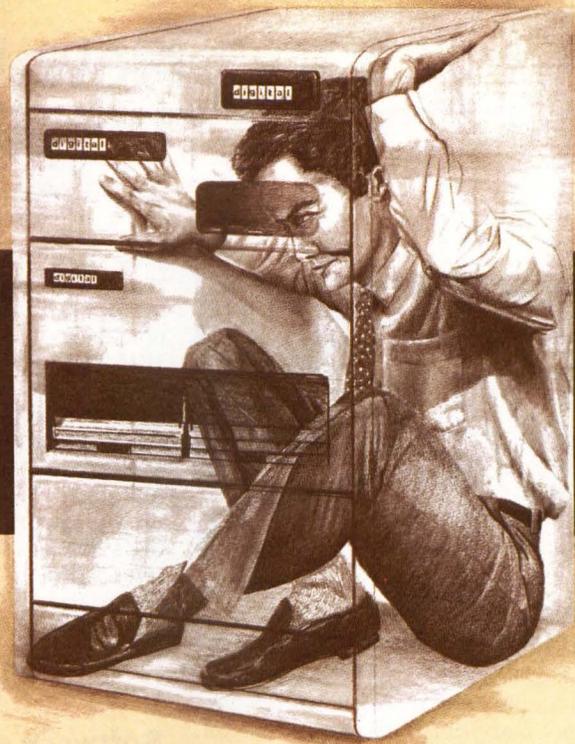


Software upgrades word processors

MagicBind upgrades word-processing programs such as WordStar, MagicWand and Electric Pencil by augmenting their capabilities. In addition to basic word-processing functions such as boldfacing, underlining, accenting and superscripting/subscripting, MagicBind provides more than 70 print-formatting functions, text-editing aids and file-processing capabilities. It features on-screen text previewing to check page breaks and format errors, proportional spacing with kerning, automatic footnotes with user-defined designations, automatic handling of widow/orphan lines, multicolumn printing, flexible page heading and footing and automatic numbering of chapters and paragraphs. The product also allows print-time record selection and verifies data file accuracy. \$250. **Computer EdiType Systems**, 509 Cathedral Parkway 10A, New York, N.Y. 10025, (212) 222-8148.

Circle No 339

Feeling Limited?



OEM'S: Give your PDP*-11/23 system "a new lease on life" with ALCYON'S 68000 based A68KPM, and REGULUS*. An enhanced "UNIX*" compatible operating system

Increase Your Performance!

ALCYON CORPORATION A68KPM

Single Board Computer

Replace your present PDP*-11/23, CPU with ALCYON'S A68KPM to experience a three to five time increase in through-put. The ALCYON A68KPM and REGULUS* are compatible with all your present controller and peripheral devices. A68KPM on-board features include:

- MC68000 10 MHz microprocessor
- Two MC68451 memory managers with up to 64 segments of associatively mapped address translation
- 512 KB byte parity memory expandable to 4 MB on "fast bus"
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- Four programmable RS-232 ports
- Centronics compatible parallel printer port
- Date and time of day clock with battery back-up
- LSI bus adapter
- REGULUS* — An enhanced UNIX* compatible operating system, with real-time and business oriented extensions

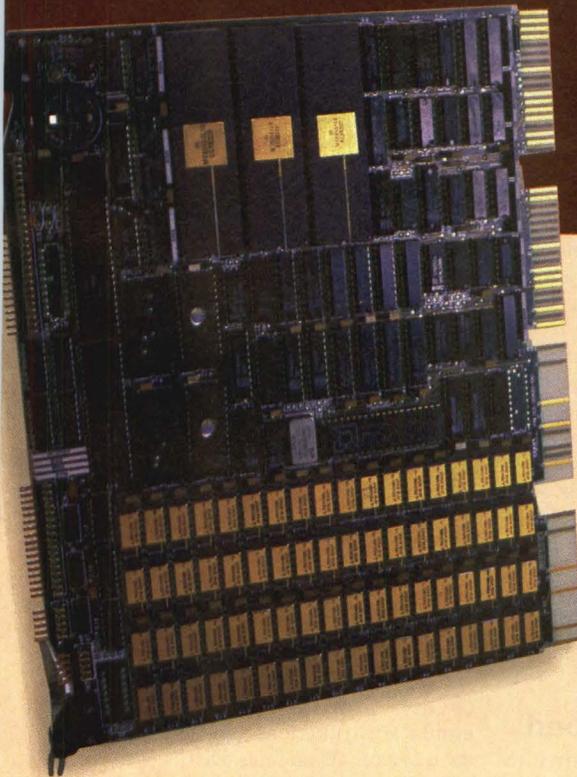
Yes I am interested in additional information concerning the A68KPM

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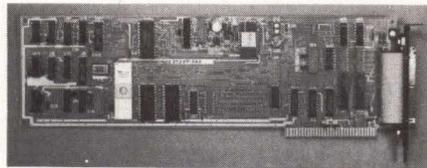
New Products

SUBASSEMBLIES



Timing analyzer reacts to IBM PC

Controlled by an IBM PC, the model 2200 interactive timing analyzer provides users with data-acquisition, -analysis, -processing and -control capabilities for pinpointing hardware faults during microprocessor- and microcomputer-based system design. The 2200 complements the company's model 2100 interactive state analyzer, a software-debugging and -analysis tool. The model 2200 has 16 timing input channels with a maximum 100-MHz sample rate that uses a transitional timing mode. High-impedance probes and 5-nsec. glitch detection aid high-speed capture. Nine trigger modes include modes for triggering on setup- and hold-time violations, the beginning or end of a pattern and pattern or pulse durations at 10-nsec. resolution. The device comes on two plug-in cards that fit into the company's μ Analyst 2000 chassis. \$2,995 including probes. **Northwest Instrument Systems Inc.**, P.O. Box 1309, Beaverton, Ore. 97075, (503) 297-1434. **Circle No 340**



Data-acquisition board is IBM PC compatible

The DT2808 data-acquisition and -control board includes analog and digital inputs and outputs, an on-board programmable clock and an on-board microprocessor. Providing 16 channels of A/D with 10-bit resolution, two channels of D/A with 8-bit resolution and 16 lines of digital I/O, the board suits applications ranging from industrial control, data logging, product testing

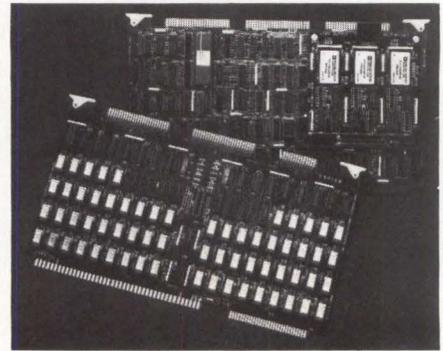
and quality assurance to home energy management and security systems. The product is compatible with the IBM PC, IBM PC XT, Compaq portable, Eagle PC and DEC Rainbow 100. Microcode within the on-board controller simplifies access to the board's functions and allows programming in scientific languages. The board can also be programmed using PCLAB, the vendor's library of BASIC-callable subroutines. \$295 in OEM quantities. **Data Translation**, 100 Locke Dr., Marlboro, Mass. 01752, (617) 481-3700. **Circle No 341**

Software system converts computers

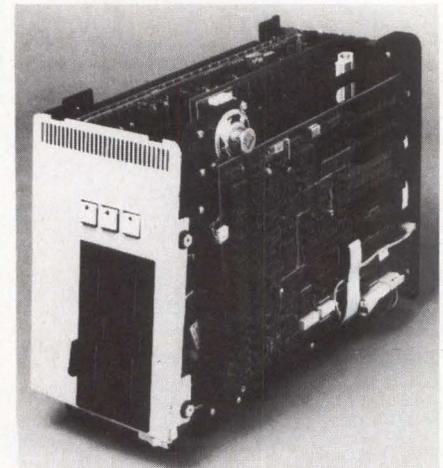
The Sphere real-time, ROM-based software system handles the Intel 8086 and 8088 and Motorola 68000 microprocessors. It combines the functions of an operating system, a multitasking executive, a high-level language, a native assembler and development tools in one package. With Sphere, a single-board computer becomes a single-board development system that directly produces application programs within the final controller product without cross-development tools. The software can work on small systems and needs 16K bytes of ROM, 2K bytes of system RAM and a terminal port. For each supported microprocessor, the vendor provides a programmer's kit that includes a single-board computer with Sphere ROMs on the board, a backplane, a PROM programmer and documentation. Prices begin at \$3,000. **Infosphere Inc.**, 4730 S.W. Macadam Ave., Portland, Ore. 97201, (503) 226-3515. **Circle No 342**

Board set draws 45,000 vectors per second

Suited for 100-MHz video bandwidth color monitors, the model 1024 Multibus graphics board set supports 1,024-by-1,024-pixel screen resolution and provides 60 Hz non-interlaced refresh. It can be configured in four or eight video planes with programmable lookup tables. The set includes the NEC 7220 VLSI graphics processor and contains a proprietary multiple-plane write circuit. The circuit allows the NEC 7220 to write in eight video planes simultane-



ously in a single cycle. Drawing speed is 45,000 vectors per second. Software support includes the CP/M-86 operating system and a C-language subroutine library for 68000 UNIX-based workstations. Tektronix emulation is available with a full-screen cross-hair graphics cursor for use with GIN mode. \$3,709. **Phoenix Computer Graphics Inc.**, P.O. Box 52667, Lafayette, La. 70505, (318) 234-0063. **Circle No 343**



Unit emulates IBM PC for DP terminals

The Personal Computer Emulator (PCE) provides local, IBM PC-emulation functions to asynchronous data terminals such as DEC's VT100. It translates IBM PC console commands into character strings that drive the terminal. A single keystroke permits a user to work on-line with the mainframe or directly as an IBM PC with the PCE system. The screen data and the terminal configuration are preserved when switching between local and remote systems. The PCE contains an 8088 CPU, 128K bytes of RAM and two 5¼-inch, 360K-byte floppy disk drives.

It runs 16-bit MS-DOS software as well as CP/M-86. \$2,795. **Solaris Computer Corp.**, 2797 Park Ave., Santa Clara, Calif. 95050, (408) 244-6214.

Circle No 344.

Product implements virtual MS-DOS micro

Bridge/86, a DEC VAX-based microcomputer software-development system for MS-DOS and CP/M-86 microcomputers, includes Bridge software, a license to MS-DOS or CP/M-86, the vendor's 88-Board and software-development utilities. MS-DOS or CP/M-86 code runs on the 88-Board, which features two 8088 microprocessors, 512K bytes of dynamic RAM, serial ports and a bit-slice controller. Bridge software runs on the VAX and maps all MS-DOS or CP/M-86 output onto VAX peripherals, allowing an MS-DOS programmer to use VAX debugging and monitoring tools to instrument code running on the virtual microcomputers. Written code is stored in VAX files. \$7,500. **Virtual Microsystems Inc.**, 2150 Shattuck Ave., Suite 720, Berkeley, Calif. 94704, (415) 841-9594. Circle No 345

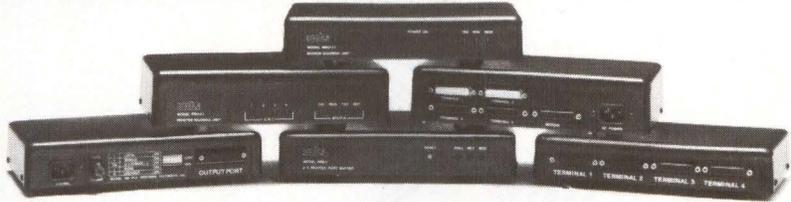
System supports personal computers

The MICROBASYS integrated distributed-control and data-acquisition system features the I/OBASIC I/O-oriented software package. I/OBASIC offers automatic conversion to engineering units and is preprogrammed for thermocouple, load-cell and flow-meter inputs. The distributed hardware for MICROBASYS is the vendor's model 3200 backplane/card-cage/power-supply assembly with or without an enclosure. The six-slot assembly contains a DEC SBC-11/21 Falcon microcomputer and four user-selectable LSI-11-compatible I/O cards. In its maximum configuration, MICROBASYS can support 64 high-level analog inputs, 128 low-level inputs, 16 analog output channels, 128 discrete bits of digital I/O and four serial I/O lines. The IBM PC and DEC Professional 350 can host the system. Prices start at \$3,990 for MICROBASYS and at \$500 for communications utility software. **ADAC Corp.**, 70 Tower Office Park, Woburn, MA 01801, (617) 935-6668. Circle No 346



SWITCHING TERMINALS A PROBLEM?

WTI has a lineup of low cost solutions...RS232 Switching Devices!



AB MiniSwitch \$89

End the hassle of plugging and unplugging data cables. MiniSwitch lets you manually switch between two RS232 devices and a common device such as a Modem and a Printer sharing a Minicomputer.

TM-41 4 Port Push Button Switch \$295

Switch ports electronically from the Terminal by pressing a button instead of flipping switches on a common AB Switch box. Selectable operating modes include—equal priority lockout, multiple and single port select.

CAS-41 4 Port ASCII Code Activated Switch \$395

Your Computer may select one or any combination of up to 4 RS232 ports by a user selectable code sequence.

CAS-161 16 to 64 Port Code Activated Switch \$795

Your Computer may select between any one of 16 ports by a two character ASCII code sequence. The unit is field expandable to 32, 48, or 64 ports.

SMRT-1 8 Port "Smart Switch" \$895

This flexible microprocessor controlled 8 port switch allows a user on any port to communicate with an RS232 device on any other port. Up to 4 pairs of users can communicate simultaneously. "User Friendly" commands aid in port selection, port status and sign off. The unit's so smart, it even signals you when the port you wanted is no longer busy! Each port can be configured for DTE or DCE by pressing a button.

PSU-41 Printer Port Sharing Unit \$395

Allows up to 4 CRTs to share one Printer automatically without software changes! The PSU-41 scans each CRT and locks on until the screen has been sent to the Printer, then resumes scanning.

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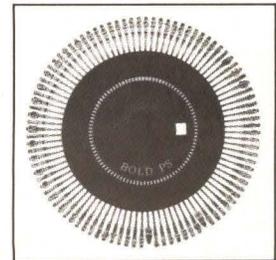
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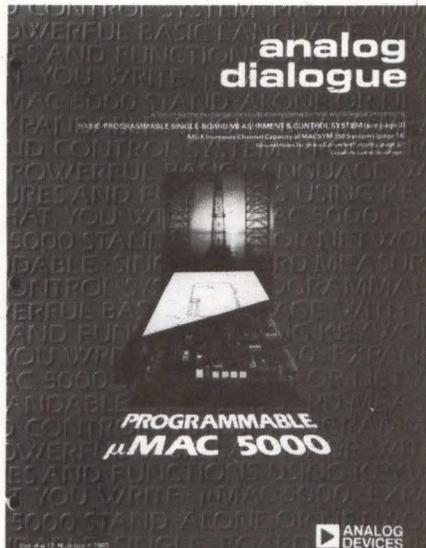
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New Products

LITERATURE



Technical journal covers data-acquisition systems

Analog Dialogue, Volume 17, No. 3 is a technical journal on data-acquisition systems and components. This issue discusses a single-board data-acquisition system that offers industrial signal conditioning and a high-level BASIC programming language. Other application articles cover software for industrial measurement and control, a data-acquisition information system and ground rules for high-speed circuits. The booklet also covers a monolithic RMS-to-DC converter, a high-precision instrumentation amplifier and a thermocouple amplifier/compensator. **Analog Devices**, Route 1 Industrial Park, P.O. Box 280, Norwood, Mass. 02062, (617) 329-4700. **Circle No 347**

Casebook solves datacomm mysteries

This 40-page, color guidebook to data communications describes the company's line of modems, acoustic couplers and intelligent communication processors for solving data-communications problems. The book proceeds from examples of simple data-communications problems to the more complex, describing a typical situation and how it can be solved using the company's products. **Digital Equipment Corp., Installed Base Group**, DECdirect MK01/W83, Continental Boulevard, Merrimack, N.H. 03054. **Circle No 348**

Brochure details array processor

An illustrated, 12-page, color brochure describes the Mini-MAP 32-bit, floating-point processor, which is configured as a four-board set for use with DEC's LSI-11, PDP-11 and VAX-11 computers. The brochure covers applications, system architecture, performance, software, configuration options and support services. **CSP Inc.**, 40 Linnell Circle, Billerica, Mass. 01821, (617) 272-6020. **Circle No 349**

Catalog describes STD-bus cards

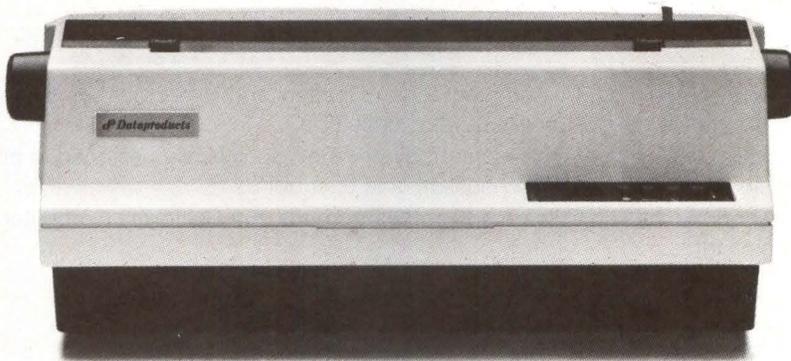
This full-color, 24-page short-form catalog contains functional descriptions and architectural diagrams for the Pro-Log STD-bus card line, including processor, memory, digital and industrial I/O and peripheral-interface cards. A memory-selection guide helps users choose the memory and processor cards

best-suited to their applications. The catalog also covers STD-bus subsystems, card racks and systems such as the ABL-1 microcomputer. It also lists the company's sales representatives and worldwide distributors. **Pro-Log Corp.**, 2411 Garden Rd., Monterey, Calif. 93940, (408) 372-4593 or (800) 538-9570. **Circle No 350**

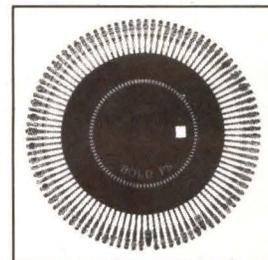
Handbook covers storage-management products

This 486-page storage-management products handbook describes the company's floppy disk controller devices, floppy disk support devices, Winchester disk support devices, Winchester board products and main-memory products. The handbook details the features, functions and applications of more than 40 products. **Western Digital Corp., Literature Department**, 2445 McCabe Way, Irvine, Calif. 92714, (714) 863-7726. **Circle No 351**

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CIRCLE NO. 145 ON INQUIRY CARD

New Products

LITERATURE

Guide lists independent service companies

The Guide to Independent Service lists companies that offer third-party, on-site maintenance and depot repair to OEMs and end users. The directory contains a geographic index of independent service companies. For each

company, the guide lists the name and title of the senior corporate officer, number of service employees, service revenues, years in business, hardware maintained (computers, peripherals, communications and office equipment), software maintained (operating and application software) and services offered (depot repair, on-site repair and

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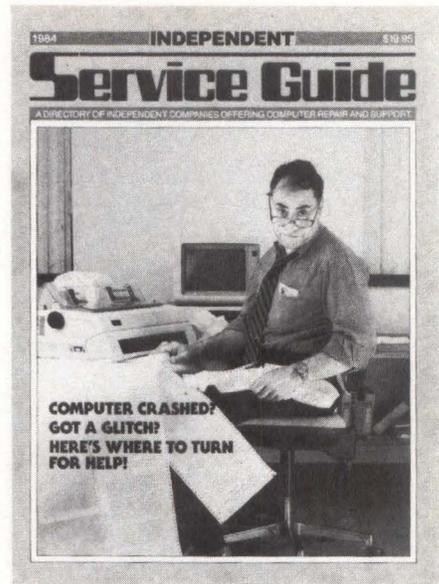
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remote diagnostics). The directory notes if a company has centralized dispatch, or an automated parts inventory and if the company offers telephone support. The directory also includes information on each company's service contracts, minimum rates and charges and average response time. \$19.95. **Computer/Electronic Service News**, P.O. Box 428, Peterborough, N.H. 03458, (603) 924-9457.

Circle No. 352

Study profiles Japanese micro industry

A report entitled "The Japanese Microcomputer Industry" forecasts the market through 1988 for the European, Japanese and U.S. markets, with respect to Japanese companies in the market and discusses technology and distribution trends. The report also discusses the competitive environment and profiles key companies. \$1,450. **Creative Strategies International**, 4340 Stevens Creek Blvd., Suite 275, San Jose, Calif. 95129, (408) 249-7550.

Circle No. 353

Resource covers robotics technology

Robotics and Industrial Engineering: Selected Readings, edited by Edward L. Fisher of Purdue University's School of Industrial Engineering, deals with robotics technology as it relates to industrial engineers. The

268-page publication covers animation, vision systems, end-of-arm tools, decision aids, productivity-prediction models, retrofitting robot systems, CAD/CAM and safety issues. The book contains 31 articles and papers from *Industrial Engineering* magazine and proceedings of conferences. It includes an index and a glossary of more than 350 robotics terms. \$34.95. **IIE Publication Sales**, 25 Technology Park/Atlanta, Norcross, Ga. 30092, (404) 449-0460.

Circle No 354

Report analyzes software publishing

The 215-page *Software Publishing and Distribution* analyzes the software-publishing and -distribution industry. The study discusses software publishers and distributors, distribution channels, software markets and products. It provides 10-year forecasts for software sales to various markets, profiles 50 companies and examines key marketing and technological issues including operating systems, integrated software, bundling, piracy, copyrights, teledistribution, prices, storage media and support. \$1,850. **International Resource Development Inc.**, 30 High St., Norwalk, Conn. 06851, (203) 866-6914 or (800) 243-5008.

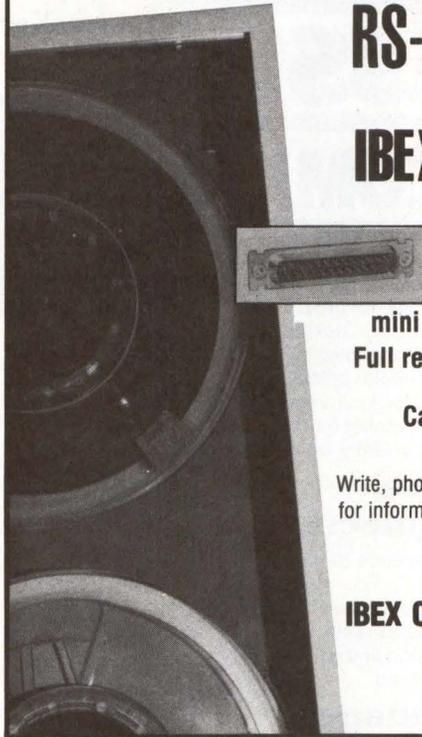
Circle No 355

Manuals detail UNIX System V

Intended for system operators and administrators, these technical documents describe the UNIX System V operating system. A \$20 product-release documentation lists the major features of UNIX System V and contains appendixes itemizing added capabilities. The \$10 transitional-aids documents assist the move from System III to System V. A \$35 user's manual lists the commands, system calls and subroutines of System V. A \$15 administrator's manual supplements the user's manual with commands and descriptions for system administrators. A \$10 "Error Message Manual" describes error messages and the appropriate actions and references for each. **IDC Commercial Sales, Western Electric**, P.O. Box 26205, Indianapolis, Ind. 46226, (317) 634-5478.

Circle No 356

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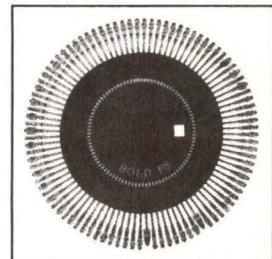
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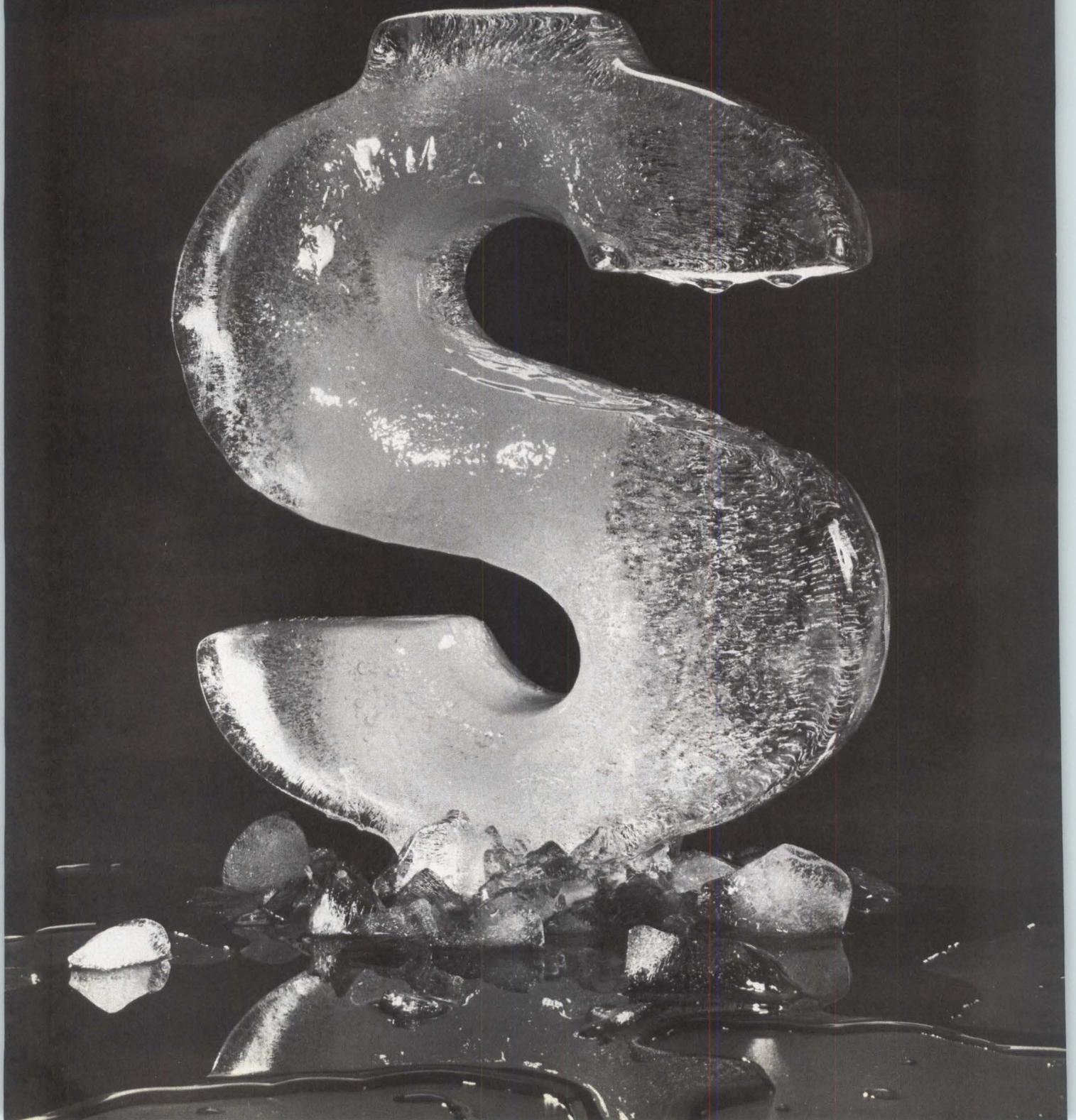
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CIRCLE NO. 250 ON INQUIRY CARD

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cold, hard facts
on computer salaries?**



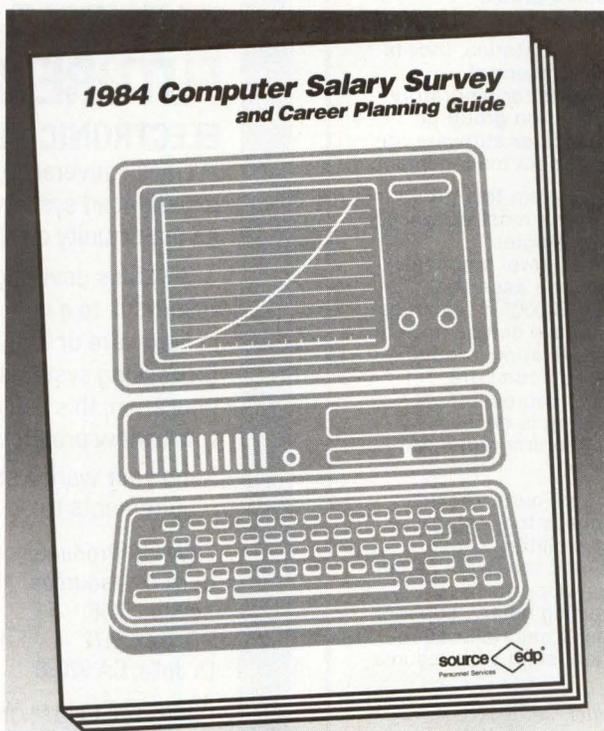
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For the above positions, send your resume to: David Kanagawa, (714) 863-3300, Ford Aerospace & Communications Corp., DIVAD Division, Professional Placement, Dept. A875-501, 2801 Kelvin Avenue, Irvine, CA 92714.

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To aid the database administrator in the design and implementation of databases. Your responsibilities will include schema and subschema generation, the development of new user views maintenance and control of the data dictionary, and enforcement of database standards in an IBM IDMS/CICS/ADS-0 shop. A minimum of two years experience in programming and system development is required. Experience in the use of database software and a knowledge of COBOL or Assembler is desirable.

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14-16 Dataquest Technology Telecommunications Conference, Fort Lauderdale, Fla., sponsored by Dataquest Inc. Contact: Gail Van Tubergen, Conference Coordinator, Dataquest Inc., 1290 Ridder Park Dr., San Jose, Calif. 95131, (408) 971-9000.

15-16 "Personal Computer Local Networks" Seminar, Atlanta, sponsored by Architecture Technology Corp. Contact: Architecture Technology Corp., P.O. Box 24344, Minneapolis, Minn. 55424, (612) 935-2035. Also to be held on March 22-23 in Minneapolis, March 29-30 in Washington and April 12-13 in San Francisco.

19-22 Eighth Annual Federal Office Systems Expo (FOSE '84), Washington, produced by National Trade Productions Inc. Contact: Jacqueline Voight, National Trade Productions Inc., 9418 Annapolis Rd., Lanham, Md. 20706, (301) 459-8383 or (800) 638-8510.

19-22 Office Automation Society International Annual Conference (OASI), Chicago, sponsored by OASI. Contact: Tina Dyer, 2108-C Gallows Road, Vienna, Va. 21180, (703) 790-0490.

20-23 "Digital Image Processing" Course, Baltimore, sponsored by Integrated Computer Systems. Contact: Ruth Dordick, Integrated Computer Systems, 6305 Arizona Place, P.O. Box 45405, Los Angeles, Calif. 90045, (213) 417-8888.

26-29 "Personal Computer Interfacing and Scientific Instrument Automation" Course, Blacksburg, Va., sponsored by the Virginia Polytechnic Institute and State University. Contact: Dr. Linda Leffel, CEC, Virginia Tech, Blacksburg, Va. 24061, (703) 961-4848.

27-29 "Multiplexing and T-1" Seminar, Tampa, Fla., sponsored by Timeplex Inc. Contact: William Flanagan, Public Relations Manager, Timeplex Seminars, 400 Chestnut Ridge Rd., Woodcliff Lake, N.J. 07675, (201) 930-4600. Also to be held April 3-5 in San Francisco, April 24-26 in Chicago, May 15-17 in Toronto, June 5-7 in Boston and July 17-19 in Washington.

28-30 Sixth Annual Computer Graphics Conference, Miami Beach, Fla., sponsored by Frost & Sullivan Inc. Contact: Carol Sapchin, Account Representative, Frost & Sullivan Inc., 106 Fulton St., New York, N.Y. 10038, (212) 233-1080.

APRIL

3-6 DEXPO East '84, Boston, sponsored by national independent DEC user group IRUS and Expoconsul International Inc. Contact: Steven Barth, Expoconsul International Inc., 55 Princeton-Hightstown Rd., Princeton Junction, N.J. 08550, (609) 799-1661.

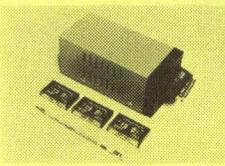
4-11 Hannover Fair '84, Hannover, West Germany. Contact: Hannover Fairs Information Center, P.O. Box 338, Route 22 East, Whitehouse, N.J. 08888, (201) 534-9044 or (800) 526-5978.

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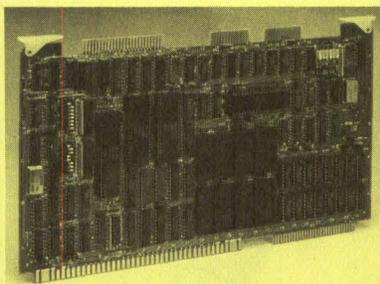
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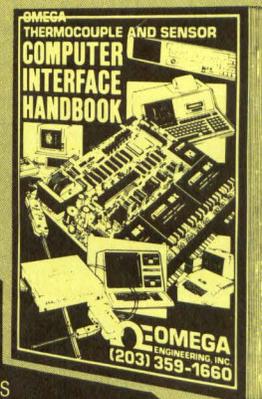


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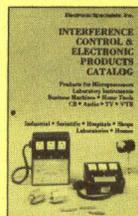
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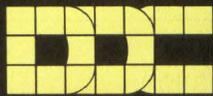
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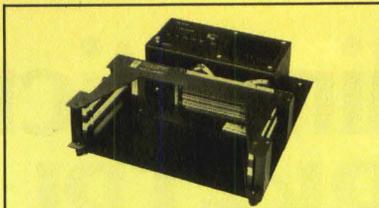
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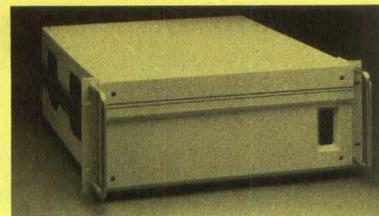


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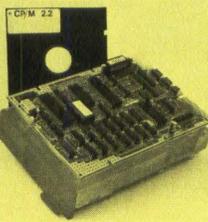
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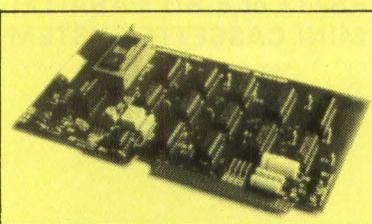
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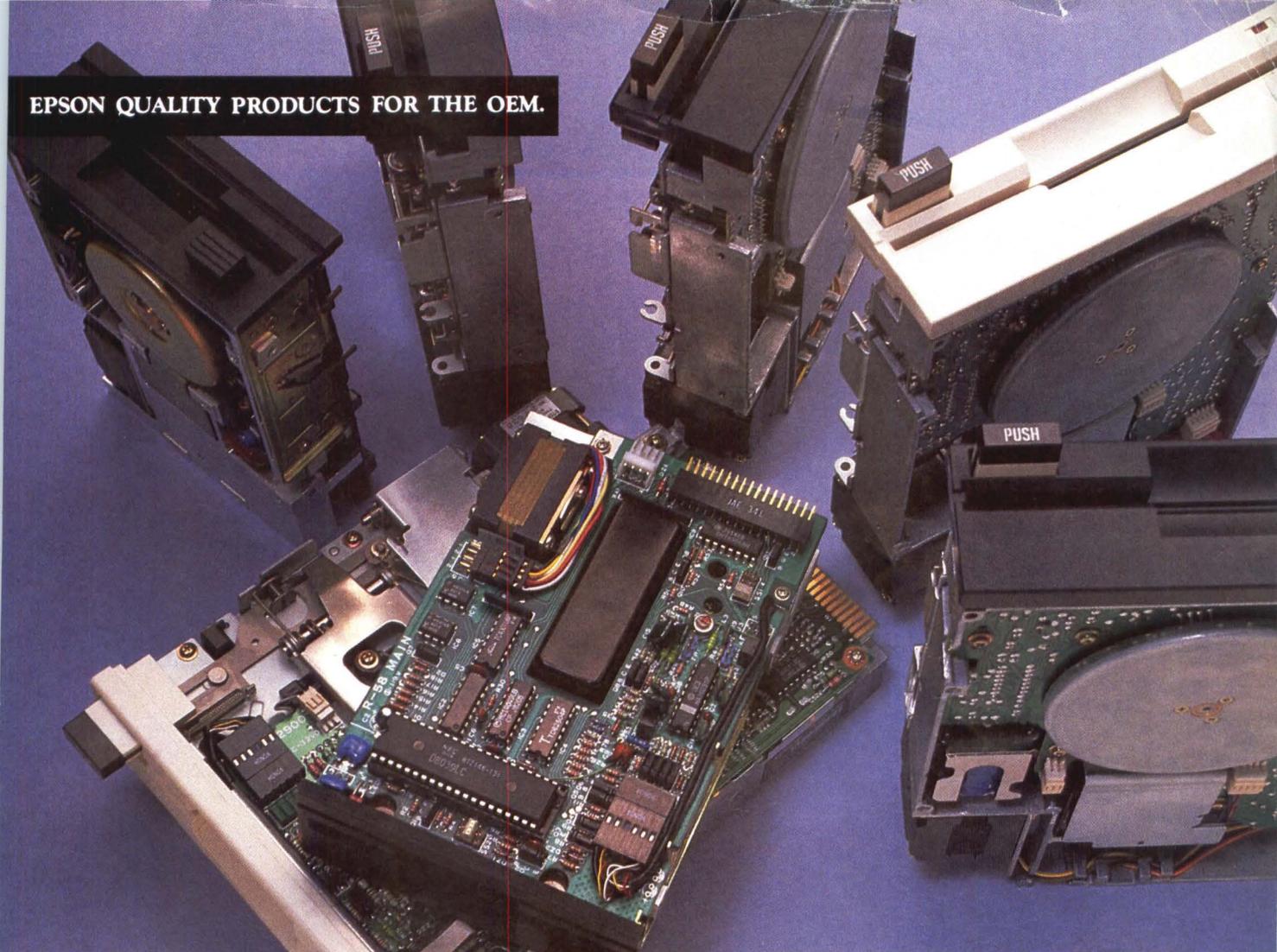
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	4" x 1.57" x 5.98"		5.75" x 1.6" x 7.68"			5.75" x 11" x 9.27"
Max. Capacity (2 Sides) (Unformatted)	500 KB	1000 KB	500 KB	1000 KB	1604 KB	500 KB
Drive Motor Speed	300 RPM	300 RPM	300 RPM	300 RPM	360 RPM	300 RPM
Track Density	67.5 TPI	135 TPI	48 TPI	96 TPI	96 TPI	48 TPI
Access Time	6 msec	3 msec	6 msec	3 msec	3 msec	15 msec

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