Mini-Micro Systems

A CAHNERS PUBLICATION

JANUARY 1985

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PRINTERS
- Battles on the retail front
- Choosing a supplier
- The unbeatable daisywheel

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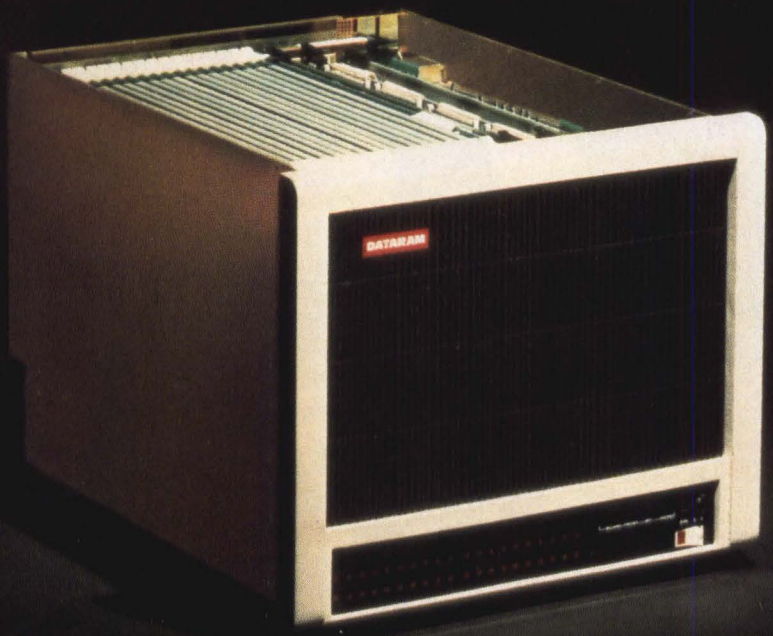

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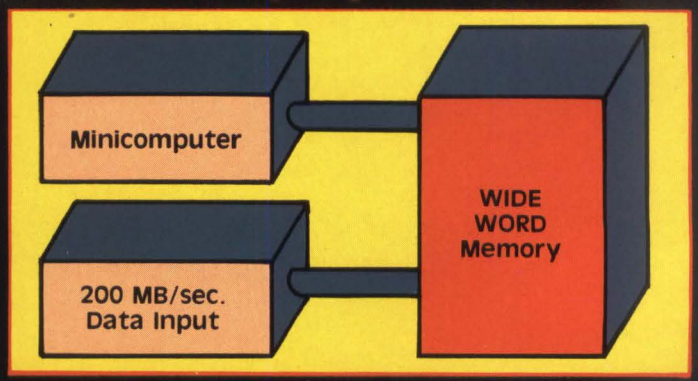

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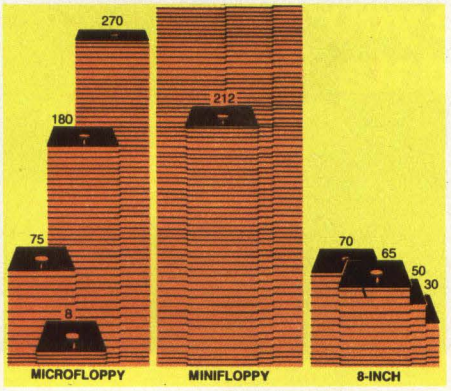

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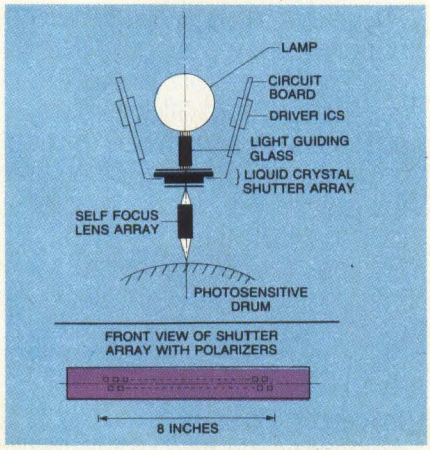

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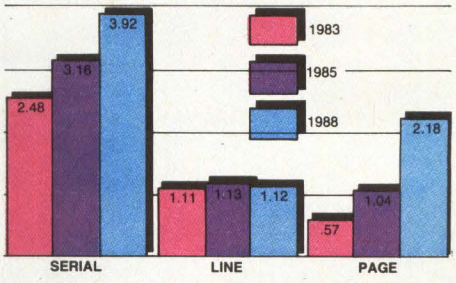

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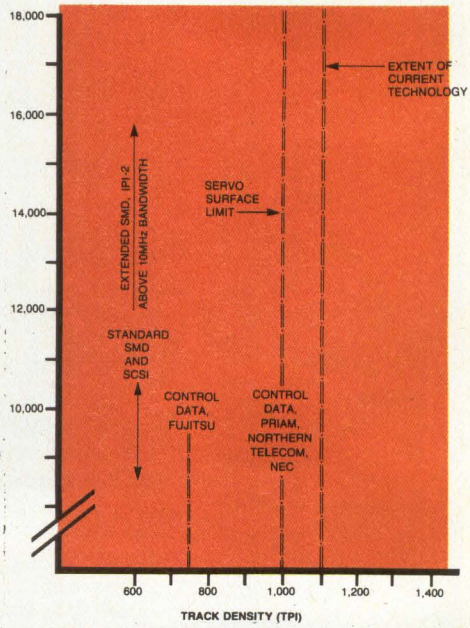

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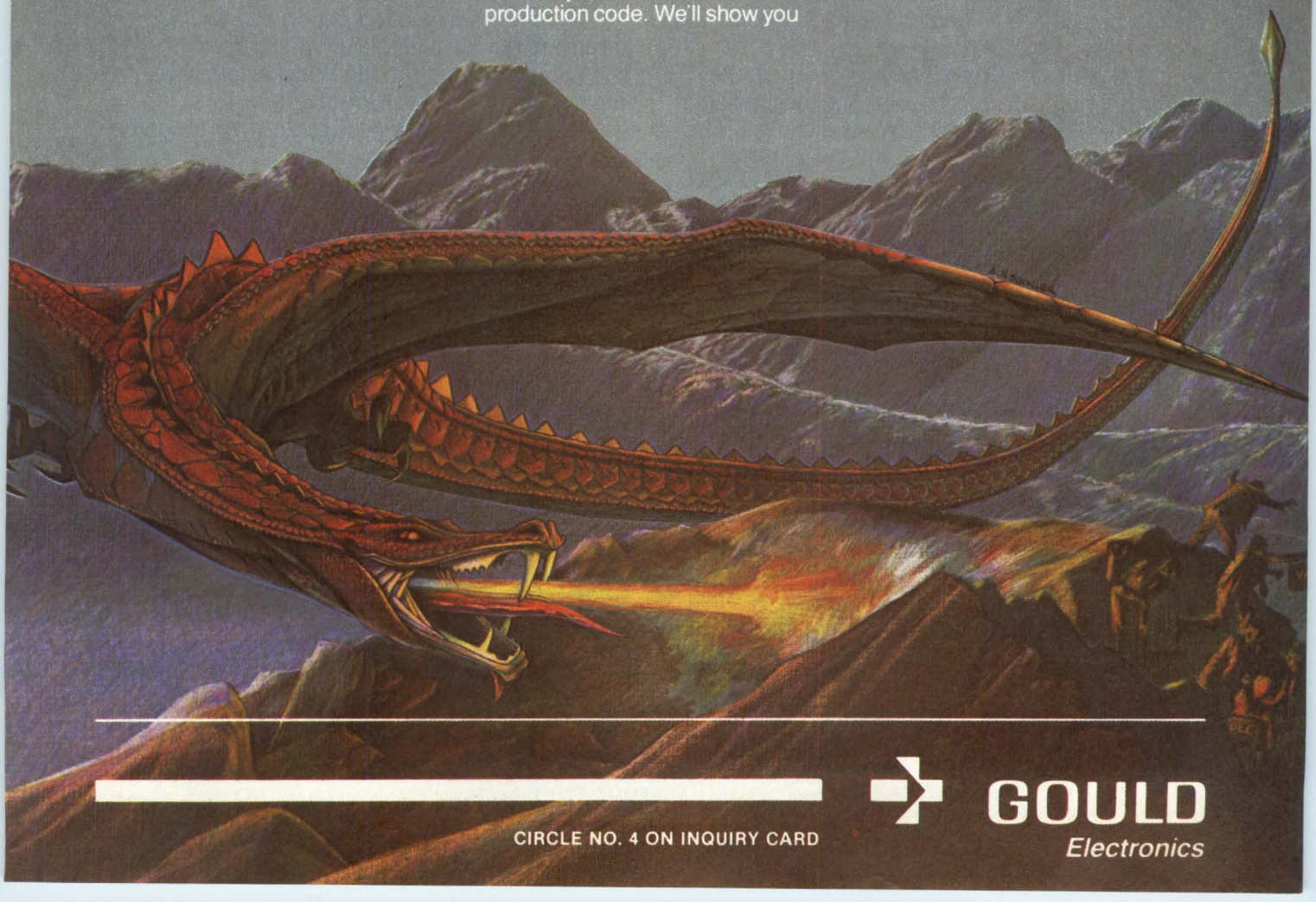

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Electronics

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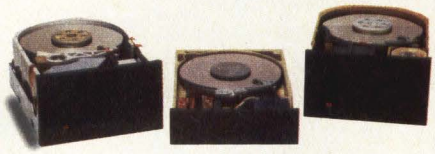

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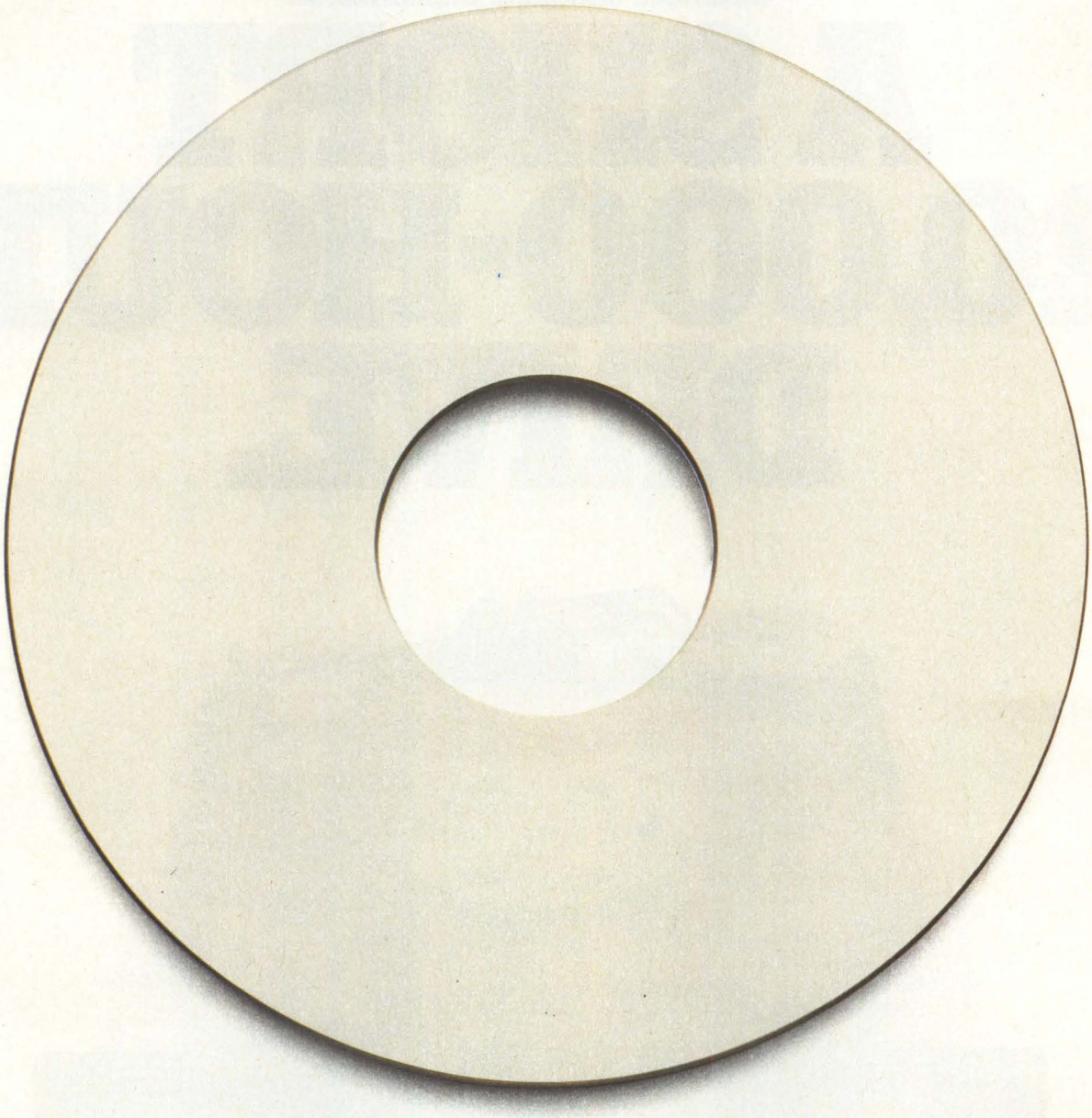

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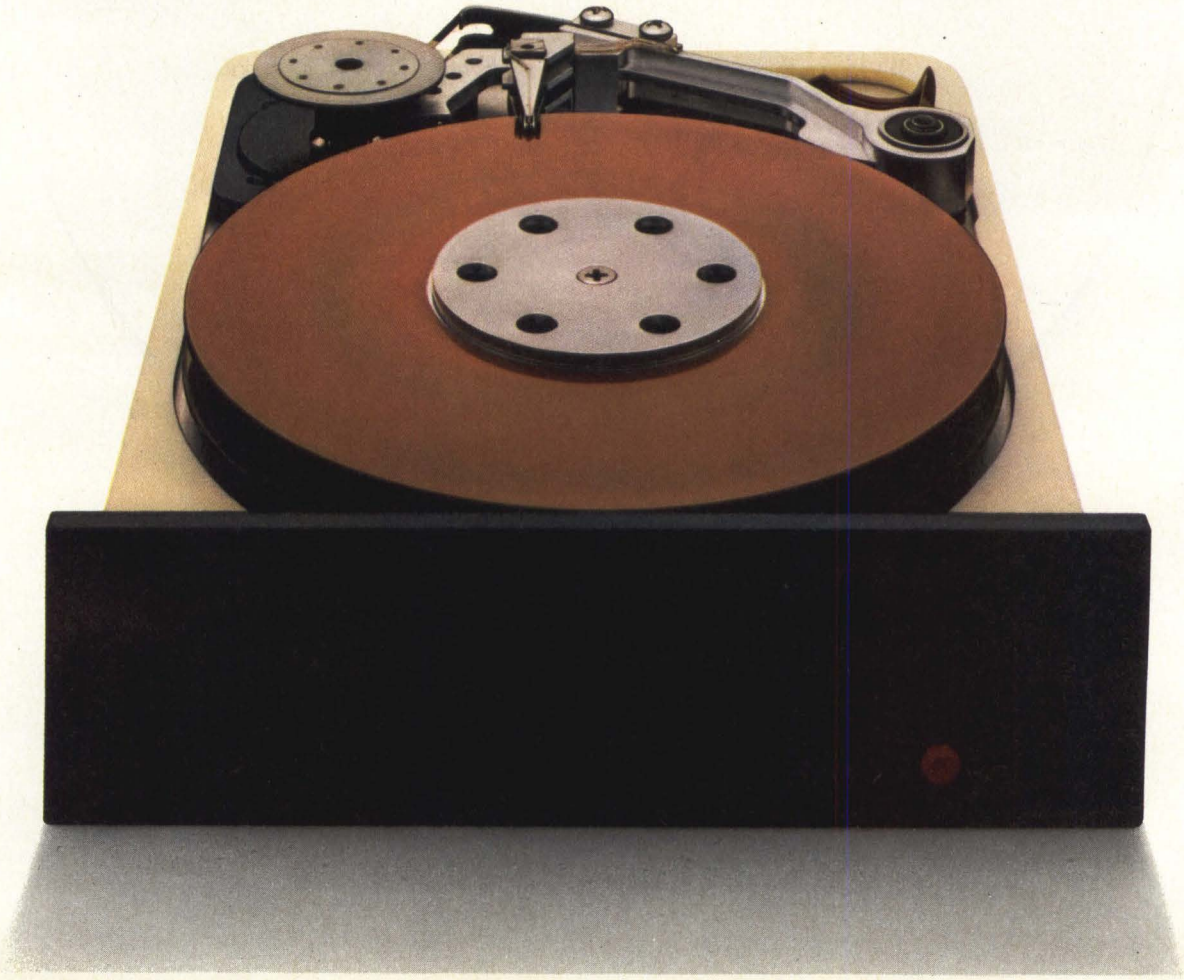

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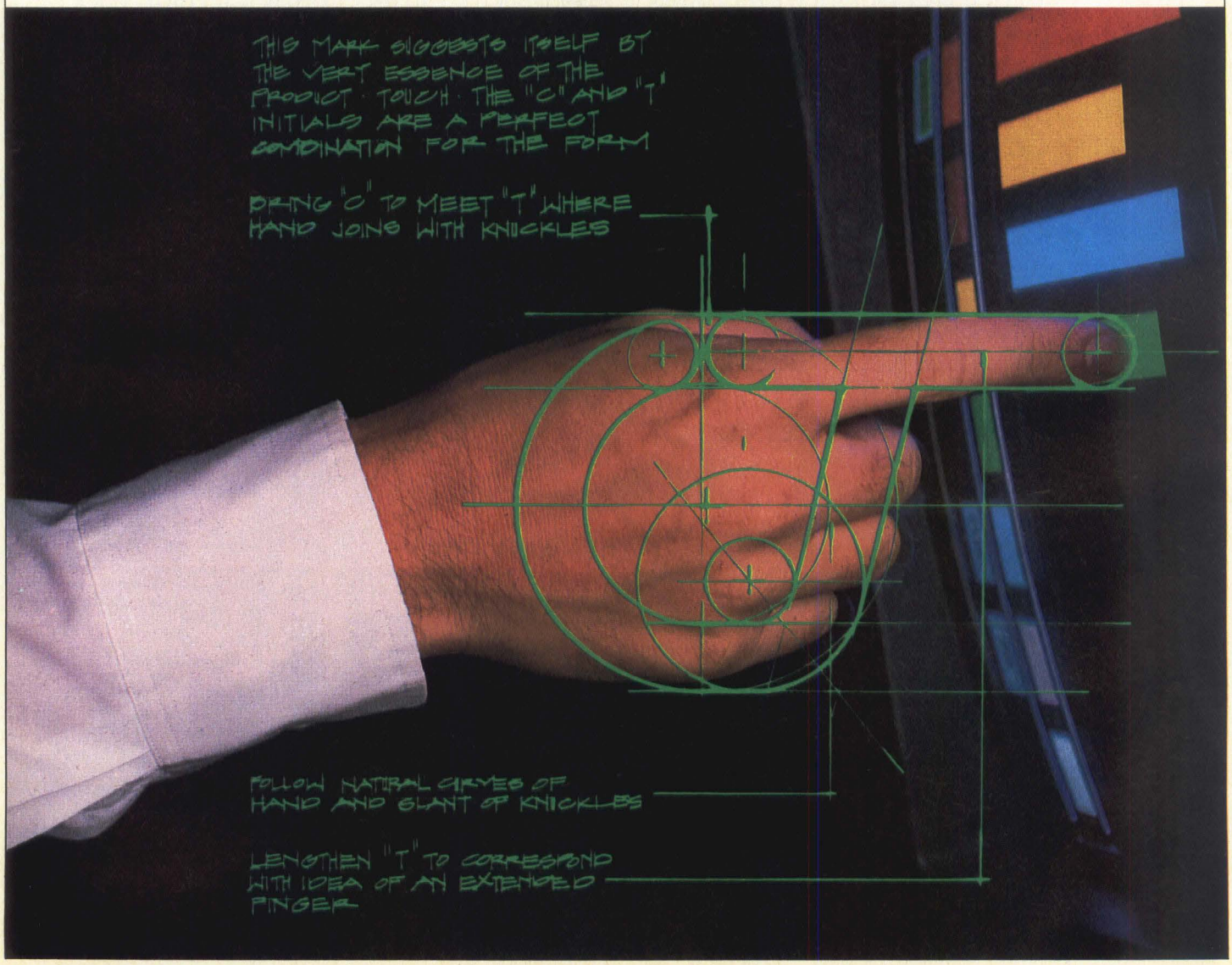


Editorial

Printer market scores impressive gains

In nearly all markets and technologies, printer revenues and shipments established record statistics in 1983. In fact, according to the *1984 Printout Annual* published by Datek Information Services Inc. (Newtonville, Mass.), printer revenues and shipments by U.S. companies during 1983 jumped 32 percent to $5.58 billion and 54 percent to 2.83 million units, respectively. And even though printers closely follow personal computer activities, current sales slowdowns in both areas won't block the achievement of still higher 1984 market levels.

As for overall market share, serial dot-matrix printers continued their dominant reign with 41 percent of the revenues and 66 percent of the shipments. Following far behind were serial, fully formed character printers cornering 25 percent of the market in both revenues and shipments. What's more, in 1983, about 65 percent of installed personal computers were connected to printers. By 1986, printer connectivity to computers, in the estimation of Datek, will leap to 80 percent.

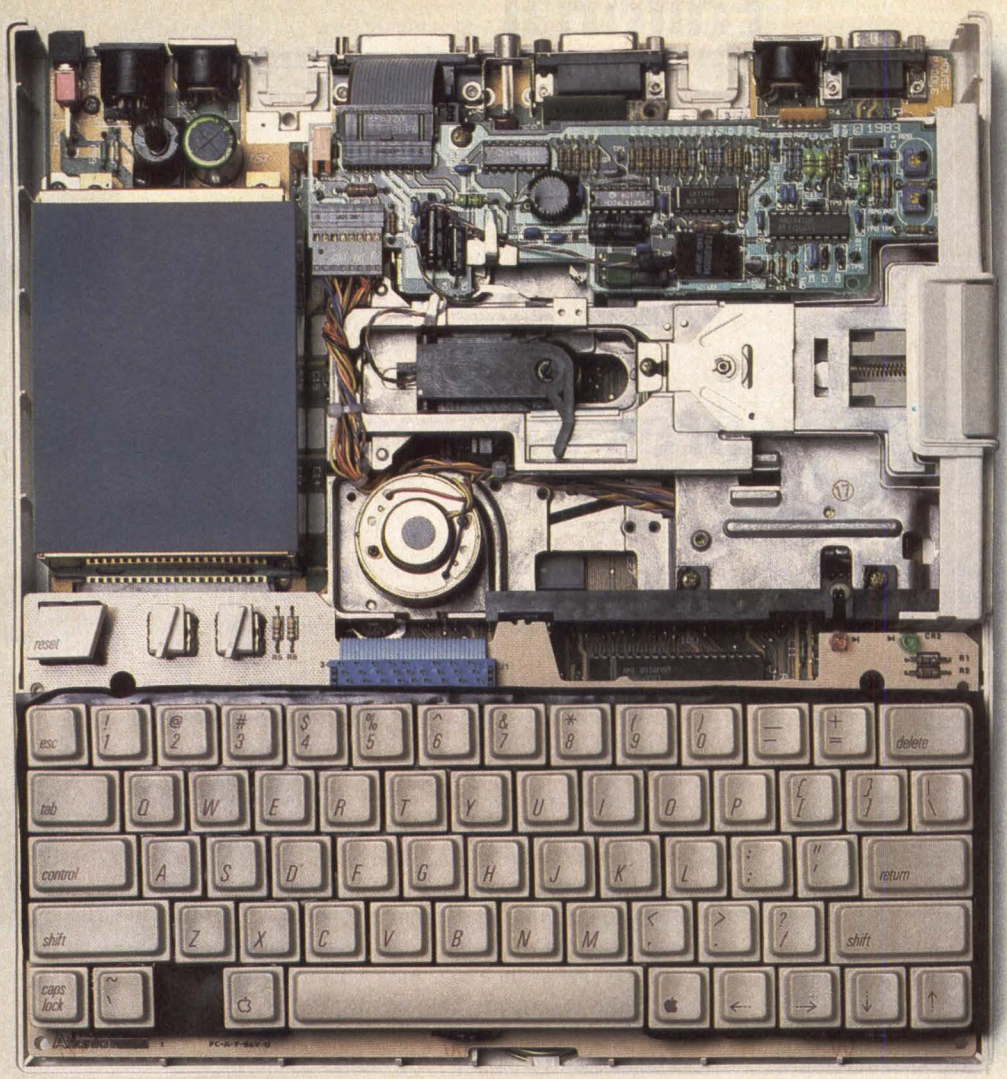
Despite the boom in sales and deliveries, though, many U.S. printer manufacturers found it hard to stay in the profit column. Price cutting ran rampant throughout the printer industry and the resulting thin margins shrank profitability to shaky levels. Indeed, several U.S. printer manufacturers needed financial transfusions from their Japanese owners. Nevertheless, the U.S. printer industry pressed onward and continued to track the personal-computer industry in cost reductions and performance extensions. For example, by year-end 1983, the average price of a daisywheel printer fell nearly 20 percent from its 1982 cost. As a result, low-cost daisywheels now list for under $500.

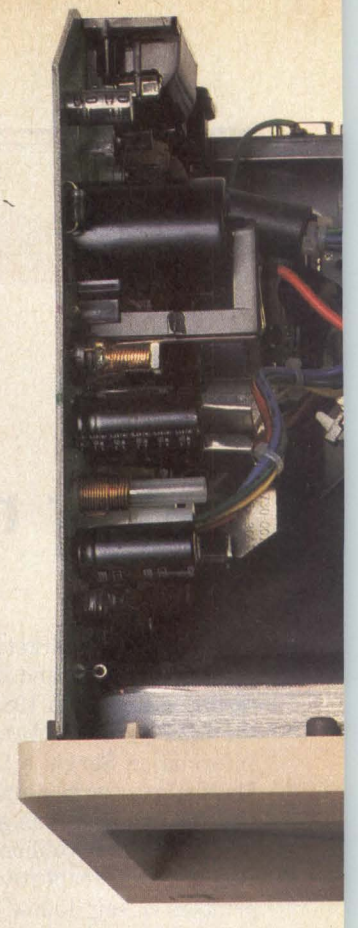
But that's all in the past. What do system integrators have to look forward to in 1985? For one benefit, printer distribution channels should mature. After several years of battling for distribution positioning and visibility, most printer manufacturers have finally learned the values of generous margins, increased warranty periods, expanded ad support, skilled sales support and capable service centers. For another benefit, printer features abound and many once-optional parameters have become standard. The feature list is impressive: friction feed, continuous feed, near-letter-quality output, low noise levels, large print buffers, variable character fonts, dot-addressable graphics and multiple colors. Even the latest technologies sparkle with ink-jet color, non-impact thermal transfer and laser methods.

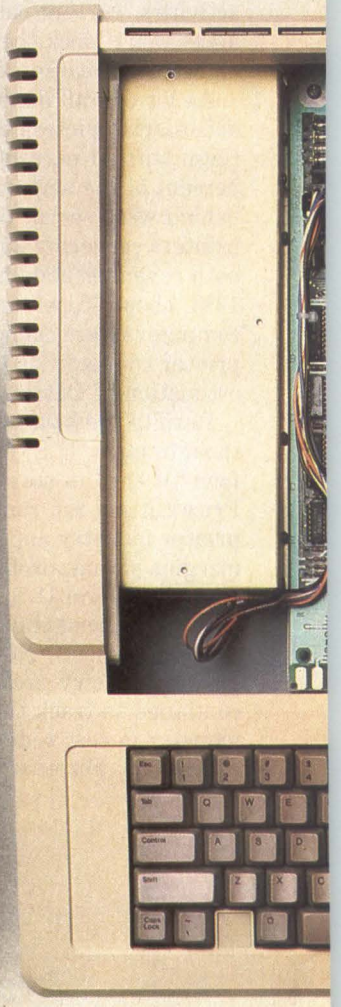
Consequently, printer market growth should advance unabated. For example, over the 1983 to 1986 period, Datek predicts that serial, fully formed character printers should nearly triple in units shipped; serial, dot-matrix printer shipments should increase by 2½ times; serial, non-impact printer shipments should skyrocket by more than 12 times and non-impact page printer shipments should zoom by 13 times. To keep posted on the fast-moving printer market during 1985, refer to this January issue, our annual printer special, and to our April and November Peripherals Digests.

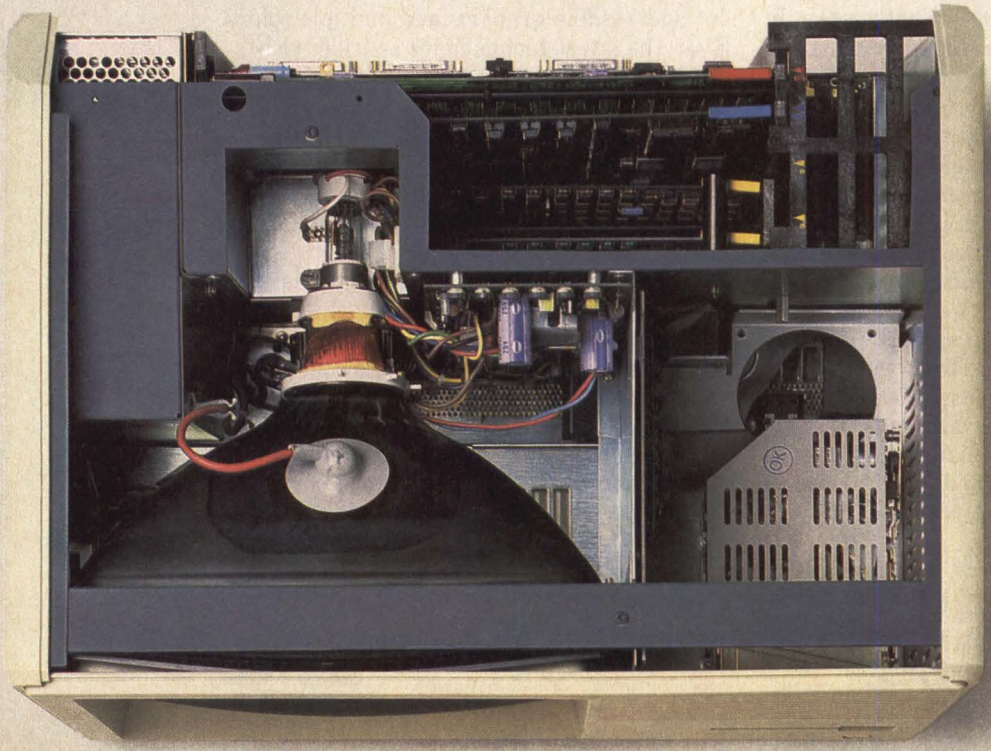
George V. Kotelly

George V. Kotelly
Editor-in-Chief









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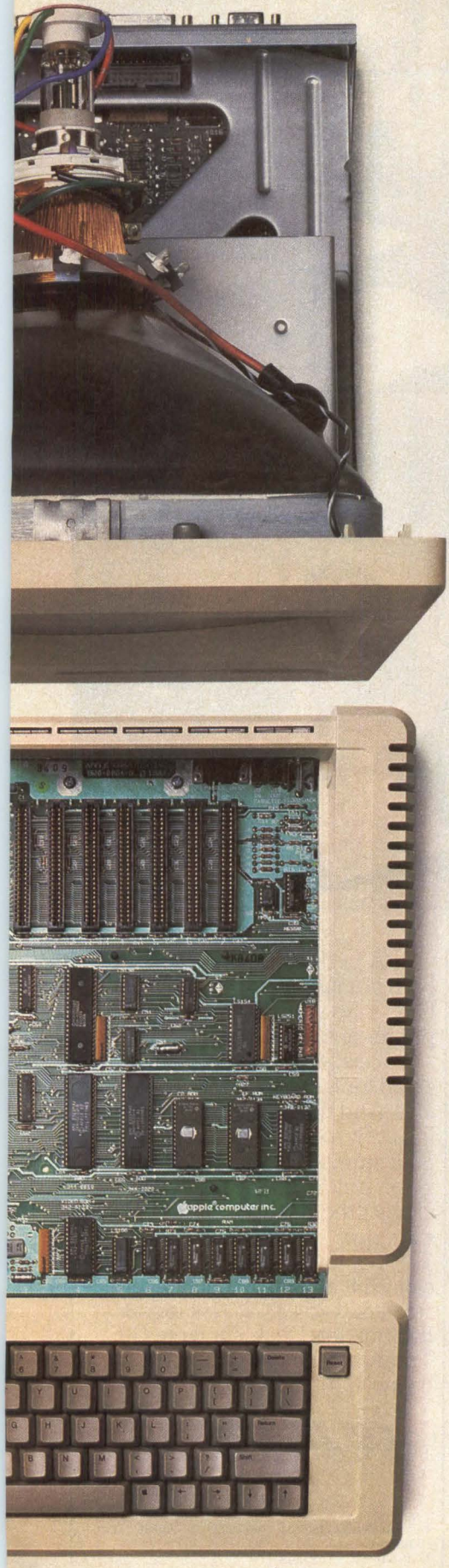

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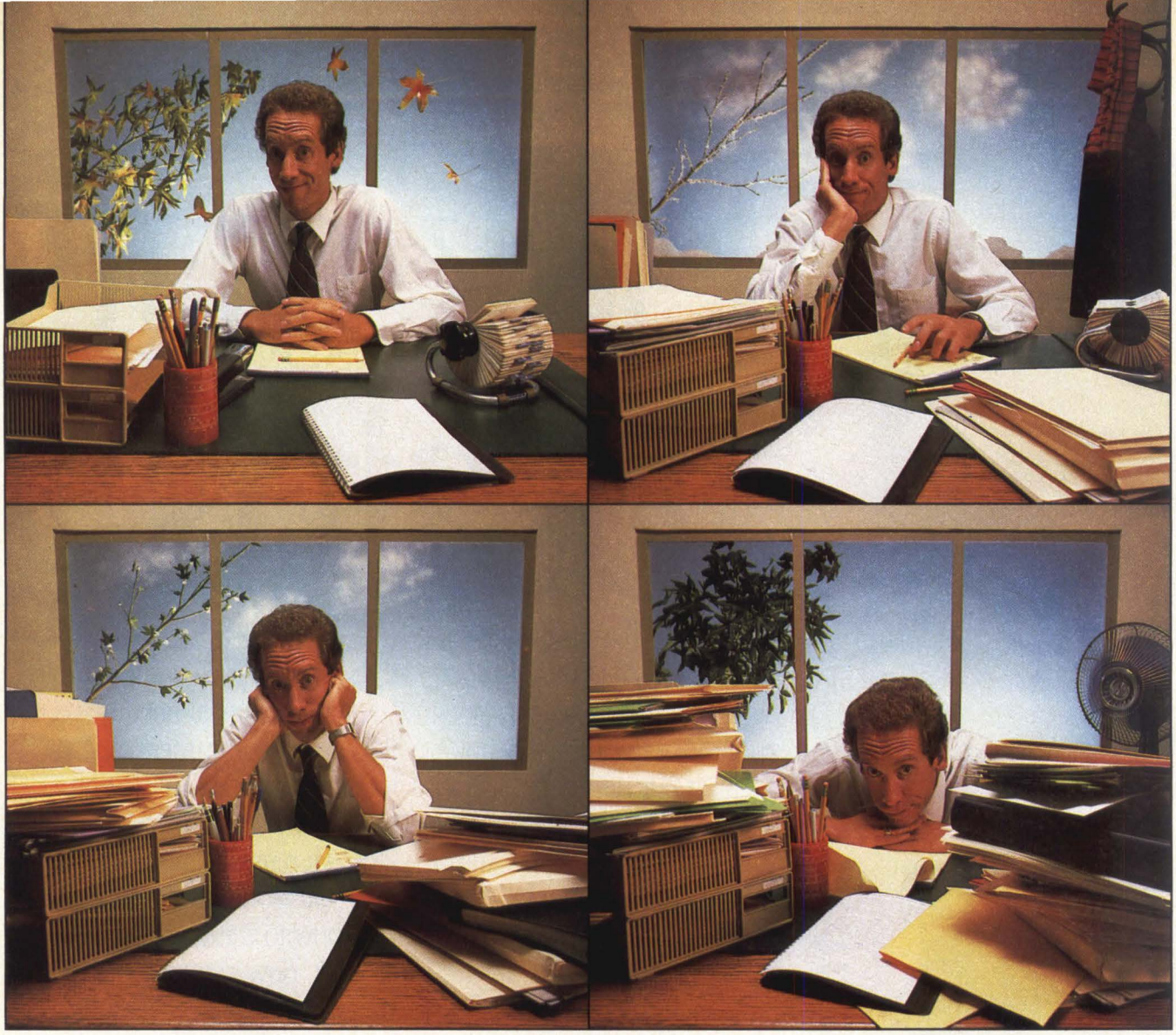

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CIRCLE NO. 9 ON INQUIRY CARD

Breakpoints

PRIME PLANS TO BEAT DEC TO MARKET WITH HIGH-END 4-MIPS SUPERMINI

Several superminicomputer companies are known to be working on machines that will compete with Digital Equipment Corp.'s (DEC's) new high-end VAX 8600 system. Prime Computer Inc.'s offering—a 4-MIPS, ECL-based system priced around $350,000—is expected late this month, according to industry sources. The Natick, Mass., company is also expected to beat DEC to the punch by shipping in volume next month—two months ahead of DEC's schedule. The new Prime system, which is said to be compatible with all other Prime 50 series superminicomputers, reportedly uses hardware refinements such as quadrupled cache memory and Primos operating system enhancements to boost performance by as much as 60 percent over the previous high-end 9950, but for $20,000 less.—D. Bright

IBM SIGNS ON MCDONNELL DOUGLAS AS A CAD/CAM VALUE-ADDED RESELLER

In its drive into vertical industrial-automation markets, IBM Corp. has signed on yet another competitor as a value-added reseller of IBM equipment. McDonnell Douglas Corp., St. Louis, Mo., recently joined Computervision Corp. and Calma Co. as a reseller of IBM equipment. McDonnell Douglas plans to exhibit a system based on IBM's 4361 engineering minicomputer/mainframe at the National Design Engineering show in Chicago in March. McDonnell Douglas' Computer Integrated Manufacturing Technology Co. has reached $105 million in revenue in CAD/CAM systems by using Digital Equipment Corp. and Data General Corp. computers. The company will continue to sell DEC and DG equipment, but it hopes the sale of IBM equipment will add $100 million in revenues over the next two years. The basic McDonnell Douglas CAD/CAM system is about $400,000.—L. Valigra

AT&T'S INTEGRATED VOICE-DATA WORKSTATION BASED ON CONVERGENT SYSTEM

According to documents filed with the Federal Communications Commission, AT&T Information Systems (ATTIS) plans to introduce an integrated voice-data workstation, the PC 7300, that features UNIX System V, advanced telephone features and a "mouse." Manufactured for ATTIS by Convergent Technologies Inc., Santa Clara, Calif., under the name "Safari 4," the workstation uses an MC68010 virtual memory processor and includes 512K bytes of RAM, a detachable keyboard, a 12-inch monochrome monitor and either a 10M-byte Winchester hard disk, or one or two ½M-byte, 5¼-inch floppy drives. Telephone features include call management dialing and line control services. The workstation's telephone circuits provide connections for a telephone headset and two telephone lines. ATTIS declined to comment on the product.—S. Shaw

NEC TO USE CP/M OPERATING SYSTEM IN JAPAN

NEC Corp., Tokyo, Japan, which traditionally uses proprietary operating systems with the hardware it sells in Japan, has signed an agreement with Digital Research Inc., Pacific Grove, Calif., and its Japanese subsidiary, Digital Research, Japan. The agreement is for use of Digital Research's standard CP/M operating system as the basis for NEC's series of

microprocessors. The first stage of the agreement calls for Digital Research to deliver enhanced versions of CP/M for the V-30, a 16-bit processor scheduled to be marketed in May. Later, Digital Research will provide Concurrent DOS-86 and Personal CP/M modules, also enhanced for the V series processors.—I. Kakehashi

XEBEC PLANS TO REDEFINE STANDARDS TO HANDLE OPTICAL DISKS

Controller manufacturer Xebec, Sunnyvale, Calif., is considering redefining interface standards for small computer systems using optical disk drives. According to Phil Devin, Xebec's director of marketing, the company is thinking about redefining the Small Computer Systems Interface (SCSI) for 16-bit bus architectures. Devin claims this will provide a cost-effective alternative to the impending standard Intelligent Peripheral Interface (IPI). Xebec also planned to call together members of the Enhanced Small Disk Interface (ESDI) committee in mid January in Denver to discuss adding to the ESDI standard the proper track, error correction and timing to handle optical drives.—C. Warren

FARADAY TO INTRODUCE HALF-SIZE IBM PC-COMPATIBLE MOTHERBOARD

Faraday Electronics, Sunnyvale, Calif., plans to unveil this month the FE6500, a space-saving, half-size IBM PC-compatible motherboard in a standard IBM plug-in board format. The FE6500 is said to comprise all the functions of the IBM motherboard along with two serial ports and one parallel port. The board comes with 32K bytes of PROM and 64K bytes of RAM with an option for 256K bytes of RAM. Faraday expects to have prototypes available in the third week of January and production quantities in late March. The FE6500 is priced at $495.—T. Moran

EXPANDABLE SUPERMINICOMPUTER SUPPORTS 256 USERS

Pyramid Technology Corp., Mountain View, Calif. will roll out its 90Mx expandable superminicomputer this month. Intended for large software development groups or distributed, computing network users, the master/slave proprietary processors are said to increase throughput 1.6 to 1.8 times over Pyramid's single-processor 90x system. A $221,000, 16-user, entry-level 90Mx consists of the OSx operating system, a 415M-byte Winchester drive, a 1,600-bpi magnetic tape drive, and 4M bytes of RAM. A $420,000 maximum configuration with 32M bytes of RAM and eight 415M-byte Winchester disk drives will support as many as 256 users. Present users of a 90x system can upgrade to a 90Mx for about $75,000.—T. Moran

PROPOSED WORLDWIDE NETWORK WOULD TEST INTERCONNECTION PROTOCOLS

Manufacturers implementing the protocols specified by the International Standards Organization for Open Systems Interconnection (OSI) are being urged to set up a worldwide network to test the protocols by communicating with each others' computers. The National Bureau of Standards (NBS), Gaithersburg, Md., is promoting the network, but the participating companies will fund it, says the head of the NBS systems and architecture division, Dr. John Heafner. He notes that 35 companies have expressed an

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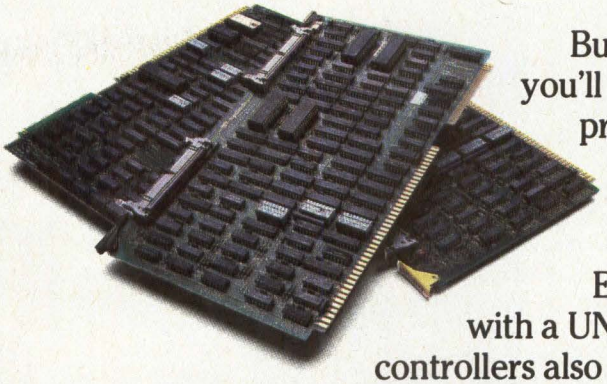

Buy anybody else's multibus* controllers and you'll probably spend a lot of time and money programming them to communicate with your system.

Buy ours and you can start talking right away.

Every Systech multibus controller comes with a UNIX Device Driver.** And because our controllers also contain a self-test program, you can install and check them out without CPU support or software development.

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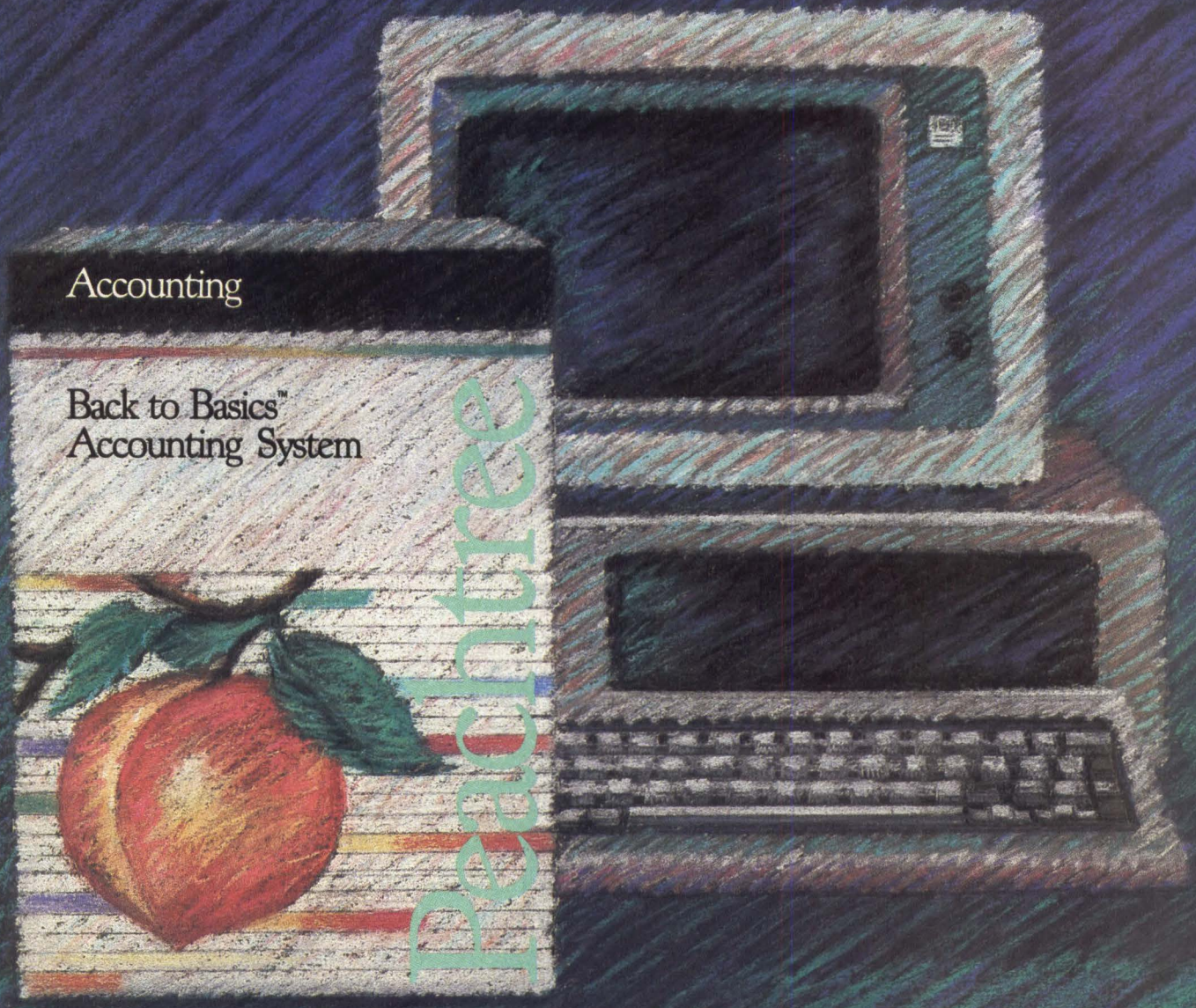

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interest in participating, including those that took part in the demonstration of OSI functions at last July's National Computer Conference. Those companies included IBM Corp., Digital Equipment Corp., Hewlett-Packard Co., Intel Corp. and Motorola Inc.—K. Jones

IBM EMPHASIZES TELECOMMUNICATIONS

IBM Corp. has realigned its Information Systems and Communications Group to emphasize its telecommunications products. The company has named Stephen B. Schwartz, former president of Satellite Business Systems Inc. (SBS), to be assistant group executive for telecommunications products in the newly formed Information Systems and Products Group. Effective January 1, Schwartz will coordinate product development and joint marketing efforts between IBM and recently acquired Rolm Corp. His added responsibilities include managing joint-marketing efforts between IBM and SBS, a satellite carrier in which IBM holds a 60 percent interest.—S. Shaw

COMPLEX SOFTWARE HINDERING MRP SYSTEMS

Three out of four materials resource planning (MRP) systems currently installed—representing about $7 billion worth of hardware and software sales in the past eight years in the United States—are failing to some degree. That's according to a study by International Data Corp., Framingham, Mass. Adam Zais, senior analyst at IDC, says a principal reason for the failures is that the software is too complicated, making the systems too difficult to use. Better software and more predictable systems are on the way, he notes. Manufacturing-information systems, of which MRP is a part, represent a $2.45 billion market that is growing at a compound annual rate of 35 percent.—J. Donohue

JAPANESE SOAP MAKER TO ENTER THE FLOPPY MEDIA BUSINESS

Fifteen Japanese companies making floppy-disk-drive media should be joined by Japan's largest soap maker, the Kao Corp., this spring. Kao plans to manufacture disks of its own design for OEMs, as well as sell them under its own label. A company spokesman dismissed skepticism expressed by several Tokyo-based analysts about the wisdom of Kao's entry. The spokesman refused to detail Kao's sales objectives, which have been estimated by industry sources at around one million disks per month. Japanese floppy media makers expect to sell 85.6 million disks during the fiscal year ending March 31.—I. Kakehashi

PRIVATE COMPANIES TO OFFER DATA, OTHER SERVICES VIA SATELLITE

Private trans-Atlantic data networks carried via satellite have been approved by the White House. That policy decision effectively breaks the 20-year monopoly enjoyed by Intelsat, the 109-country organization formed to provide international satellite services. In addition to data services, private satellite networks will now be able to offer video teleconferencing and corporate voice and digital transmission services, but will not be allowed to compete for public-switched message services. The prospect of competition to Intelsat was first raised two years ago when a Washington, D.C.,

company, Orion Satellite Corp., applied to the government to build and operate a trans-Atlantic satellite system.—S. Shaw

EXXON PUTS UNPROFITABLE VERBEX ON AUCTION BLOCK

Verbex, a Bedford, Mass. vendor of voice-recognition systems, is up for sale by its parent, Exxon Enterprises Inc. Although Verbex is at the forefront of its technology, the emerging voice market has not developed quickly enough for the company to be profitable, says an Exxon spokeswoman. She confirms that Exxon has been talking secretly with potential buyers for several months, but emphasizes that nothing has been finalized and that Verbex will continue operations under Exxon's ownership. Verbex officials could not be reached for comment. In an effort to stimulate sales, Verbex had recently scaled its $25,000 voice-recognition system down to a $4,900 unit that attaches to the IBM PC.—D. Bright

LASER PRINTER EMULATES EPSON AND DIABLO PROTOCOLS

Corona Data Systems Inc., Thousand Oaks, Calif., will offer two printer-emulation software enhancements to its $3,395 Corona Laser Printer, which is based on the Canon LBP-CX print engine. An Epson MX-80 and FX-80 emulation package that will support both text and graphics is expected to be available in the middle of this month, while a Diablo 630 emulation program is projected for February or March availability. Said to be the first of their kind for low-end laser printers, the upgrades will be included in the Corona Laser Printer's basic price. Present owners can receive free updates.—T. Moran

TECH FILES: A QUICK LOOK AT INDUSTRY DEVELOPMENTS

MINI FILES: NYNEX Business Information Systems and **Data General Corp.** have signed a $65 million agreement to market DG's office automation systems in New England and New York. Under the three-year contract, NYNEX will offer DG's Eclipse MV family of superminicomputers, the Desktop Generation microcomputers and the Data General/One portable computer. DG has a similar agreement with PacTel Communications Systems, which, like NYNEX, also is a regional Bell Operating Company.—D. Bright

For the second year running, **Digital Equipment Corp.** (DEC) has sponsored a large exhibition of its own equipment in Boston. While the first DECtown show attracted the company's sales staff and some customers, the DECworld show held last month was aimed at 6,000 to 8,000 large customers. The company used the week-long extravaganza to spotlight its interconnect capabilities: It tied together computers totalling 50 million instructions per second and disk drives totalling 50G bytes via an Ethernet local network.—L. Valigra

COMMUNICATIONS FILES: Intel Corp. recently joined the effort by networking companies to lower the price for local area networks. The company introduced a single-

You won't get over what this 350 CPS printer does for under $2,000.

When you see what the CI-3500 Serial Printer can do, you might not believe it's priced under $2,000.

Besides giving you data processing printing at 350 CPS, the CI-3500 delivers letter quality printing at a rapid 87 CPS—more than twice the speed of most daisy wheel printers.

And you also get the capability for high resolution graphics, up to 240 X 144 DPI.

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CIRCLE NO. 13 ON INQUIRY CARD

chip LAN controller, designated the 82588, that lets users connect to a network for as little as $250 per node, or about one-sixth the cost per user on the Ethernet. The 82588 supports the IEEE 802.3 local networking committee's emerging standard for personal computers. That proposal includes the IBM PC Network and the STARLAN. STARLAN is a low-cost network that uses existing telephone wire installations. The 82588 controller is $45 in quantities of 1,000. Volume production is scheduled for next quarter, but samples are available now.—L. Valigra

MICRO FILES: Phoenix Software Associates Ltd., Norwood, Mass., recently sold its IBM PC-compatible, ROM basic input/output system for the DOS operating system to four manufacturers. The four—Tandy Corp., Kaypro Corp., Wyse Technology and Zaisan Inc.—have developed new IBM PC-compatible computers using off-the-shelf Phoenix firmware. Phoenix reports that it is also working with more than 22 manufacturers in developing 80286-based products. The IBM PC-AT is based on the 80286.—D. Bright

SOFTWARE FILES: Fulcrum Technologies Inc., Ottawa, Canada, is offering the Ful/Text information retrieval package that can locate any word, phrase or word in context in large, document files. The software package builds an index in batch mode of all the text items stored in a file. It is currently available only for UNIX-based systems. The company plans to have a network version and a version for the IBM PC running PC-DOS by March.—C. Warren

French software developer **Memosoft,** Paris, is introducing Memdos/PC and interpretive BASIC for the IBM PC. The new BASIC supports windows and mouse pointing devices and can address the full 640K bytes of system memory. In addition, the language has a binary-coded decimal floating point, a computer-aided software engineering function and an application screen generator. The planned price is less than $100.—C. Warren

RANDOM DISK FILES: Fujitsu America Inc., San Jose, Calif., plans to introduce a new family of disk drives late this quarter. The family will include 500K-byte and 1M-byte, half-height, 3½-inch flexible drives, and a half-height, 1.6M-byte, 5¼-inch flexible drive, says Norman Peterson, senior vice president of Fujitsu's OEM storage division. To complement these products, Fujitsu also expects to introduce a family of half-height, 3½-inch Winchester drives with capacities of 6M, 12M and 20M bytes.—C. Warren

NOTES FROM OVERSEAS: With the blessings and financial backing of the British government, British companies **GEC Plc., Ferranti Computer Systems Ltd., ICL Plc., Plessey Co. Plc., Racal Electronics Plc., Standard Telephone and Cable Plc., British Telecom Plc.** and **Thorn EMI** are reportedly teaming up to challenge IBM Corp.'s effort to develop an advanced computer architecture. The companies' combined effort, code-named "AWSAP" for Advanced Workstation and Systems Architecture Project, is a four-year, $5 million joint venture that is set to kick off in the next few weeks. Member companies will share the results of the common workstation architecture.

The products should conform to international standards and hook into products such as IBM's systems network architecture.—M. O'Gara

The Yokogawa Hokushin Electric Corp., a big supplier of printers for OEM customers in the United States, plans to start offering products stateside under its own brand name. One of the first will be a thermal-transfer printer that can be switched to print either in draft or near-letter-quality mode within a 24-dot-square matrix. The printer works with thermal paper or with plain paper and a thermal-transfer ribbon, printing 60 characters per second. The initial model will take paper 10 inches wide, but Yokogawa Hokushin will follow later this spring with another model that will take 16-inch-wide paper. Prices have not been set yet, but a Japanese version of the same machine is available for ¥148,000 (about $600).—I. Kakehashi

Now that Rolm Corp. has launched its IBM PC-compatible Cedar workstation (MMS, November, 1984, Page 31), Cedar-like machines are ready to flood the market. One of the first to say "me too" is Britain's premier computer maker, **ICL Plc.,** whose entry is called One Per Desk (OPD). Produced in collaboration with Sinclair Research, OPD looks like Sinclair's 68008-RUN QL microcomputer. Both machines run the same word processing, spreadsheet, database and graphics packages. ICL has included an advanced imbedded telephone, a proprietary real-time, multitasking operating system and communications in OPD. ICL claims the $1,450 base price is the lowest in the industry. The product should be available in the United States later this year.—M. O'Gara

The first British-designed, British-built, half-height, ¼-inch cartridge drive for Winchester backup is being offered by the Sintrom Group's manufacturing arm, **Perex Ltd.** Perex wants to capture 20 percent of the European market in the next 12 months. Then it will move into the United States, where it hopes to gain a five-percent market share by the end of 1986. Perex' new 5¼-inch Peristream drive holds 45M bytes of formatted storage using standard tape cartridges, and 65M bytes with the company's new high-coercivity tape. The unit reportedly offers a 90K-byte-per-second transfer speed, or 300K bytes per second from a 2M-byte buffer. In 12 minutes, 45M bytes of data can be backed up. Peristream is hardware- and software-compatible with U.S. Quarter-Inch Cartridge (QIC) committee standards. It will be offered in England for $800 in quantities of 500. —M. O'Gara

By 1986, **NEC Corp.** wants to pull ahead of Fujitsu Ltd. in production of gate arrays for the Japanese market. The demand for such semiconductor devices is now valued at $12.2 million. NEC is building a plant at Sagamihara, which they expect to have ready by September, to raise its production capacity. NEC now holds about 16 to 17 percent of the domestic Japanese gate-array market. The demand in Japan for gate arrays is expected to grow 50 percent in this Japanese fiscal year, which ends March 31. NEC expects to sell about $4.1 million in gate arrays for the fiscal year.—I. Kakehashi

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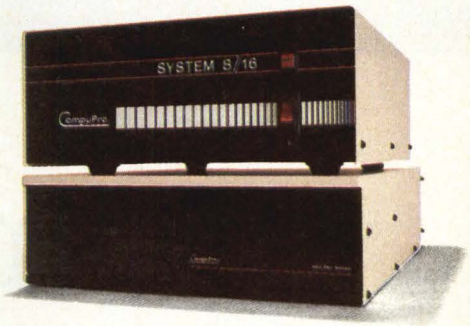

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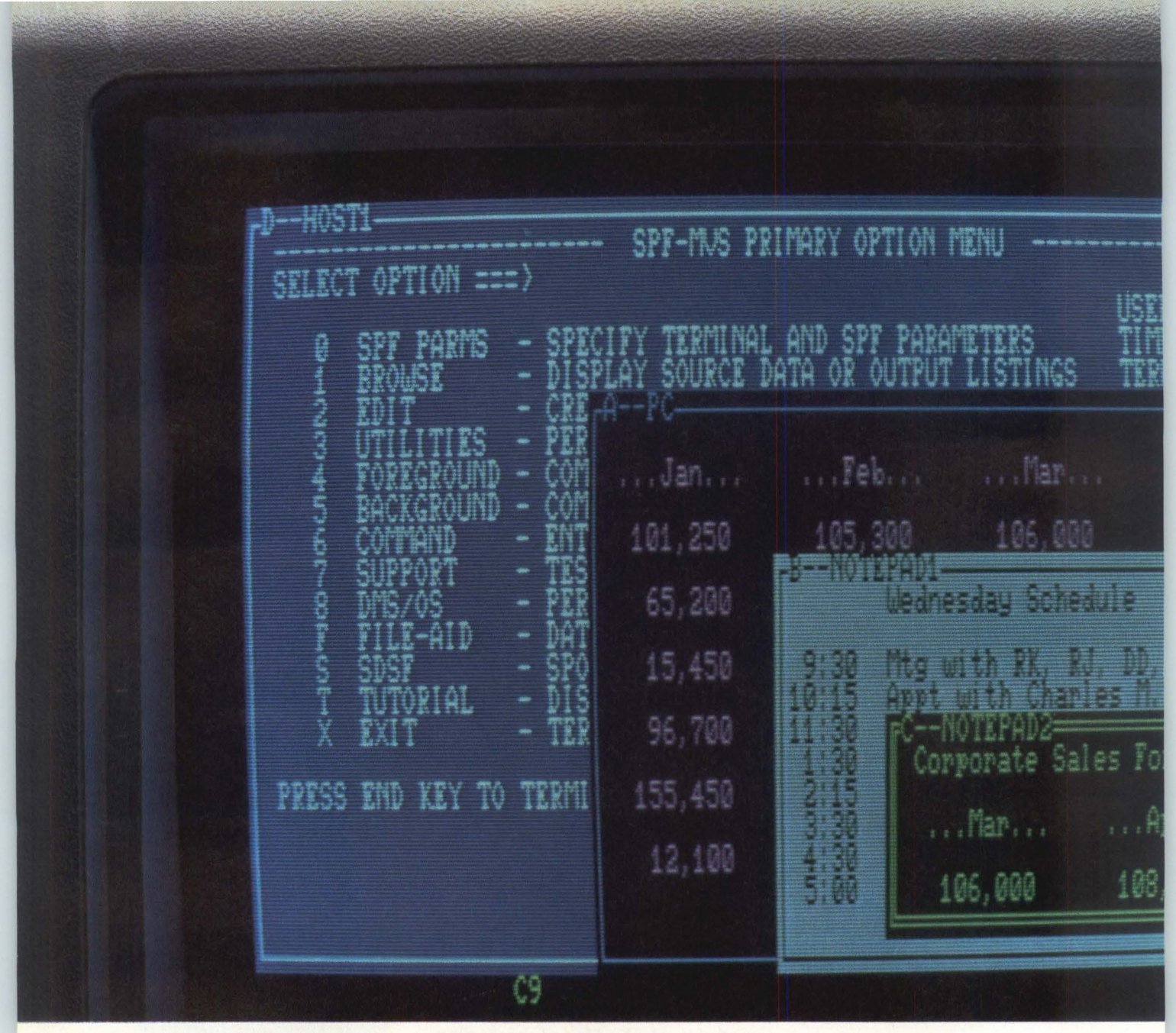
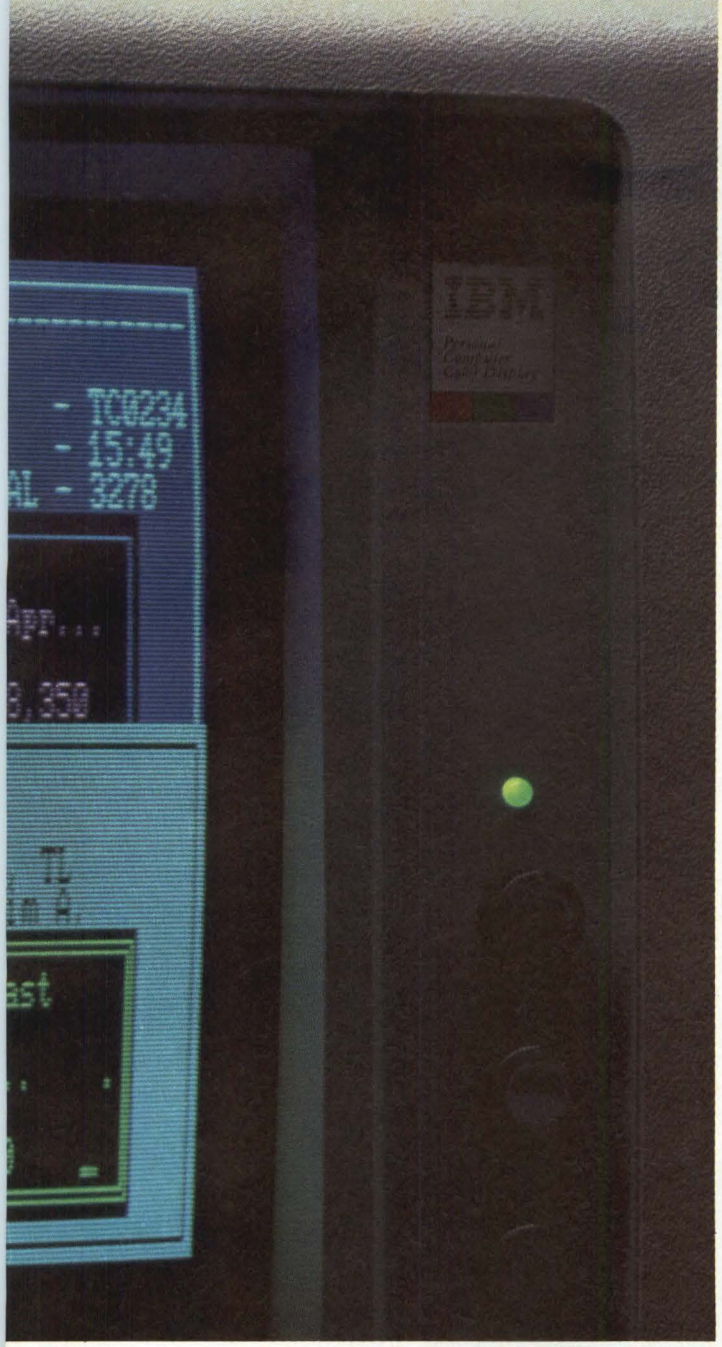


Compared to this, other 3278/79 emulators aren't much to look at.



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This isn't your everyday 3278/79 emulator. Ours gives you much more to work with. Namely, a host session, a PC DOS session and two notepads. All on the same screen. At the same time.

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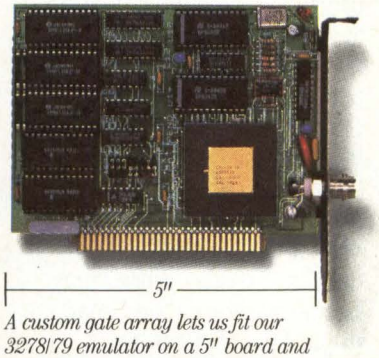
It comes in two versions. Either a coaxial or modem connection. And both versions provide fast, easy file transfers between a PC and a CMS or TSO host. There's even a batch file generator that serves up multiple files with just a few keystrokes.

And for your colleagues overseas, international keyboard mapping comes standard.



A custom gate array lets us fit our 3278/79 emulator on a 5" board and still offer more capability than all the rest.

But perhaps the biggest advantage of our emulator board is its small size. It's just five inches long. (Or short, depending how you look at it.) Which means it fits conveniently into a PC's short expansion slot. Leaving the long slots for the rest of the world.

For those who need additional host sessions, we also offer the CXI 3270 PC connection. It displays five host applications, a PC DOS program and two notepads—simultaneously.

All our CONNECTWARE™ products are available on a 30-day free trial basis. So for a closer look, call 800/221-6402. In California, call 415/424-0700. Or write CXI, Inc., 3606 West Bayshore Road, Palo Alto, CA 94303. Telex 821945.

Because compared to our 3278/79 emulator, there is no comparison.

CXI

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CIRCLE NO. 15 ON INQUIRY CARD

DIGITAL DISPLAYS THE TERMINALS BEST ENGINEERED FOR BUSINESS.

Before you make any investment in business graphics terminals, it really pays to investigate what you'll be using them for.

If you're like most businesses, your terminals will be used approximately 70% of the time for generating text and numbers. And only around 30% of the time for strictly graphics purposes. The October 1983 *Infosystems* article, "How to Buy Graphics Displays," coauthored by Jim Warner, CEO of Precision Visuals, Inc.,® states, "While it may be true that one picture (chart, graph) is worth a thousand words, there will always be the need for words, thousands of words, in the day-to-day activity of the office. Special graphics-only devices can have limited value in a general office environment."

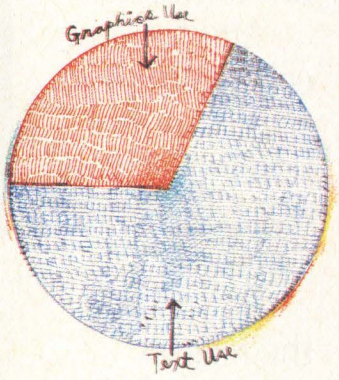
At Digital, the first step in engineering every product we make involves a thorough analysis of who will use it, what it will be used for and which features will help make people more productive in their jobs.

That's been true of every terminal we've designed and helps explain their widespread acceptance and popularity.

And you'll find it's equally true of Digital's latest entries, the VT240™ and VT241™ terminals.

ENGINEERED BEST FOR WHAT YOU NEED MOST.

As the newest members of Digital's family of terminals, the VT240, a conversational

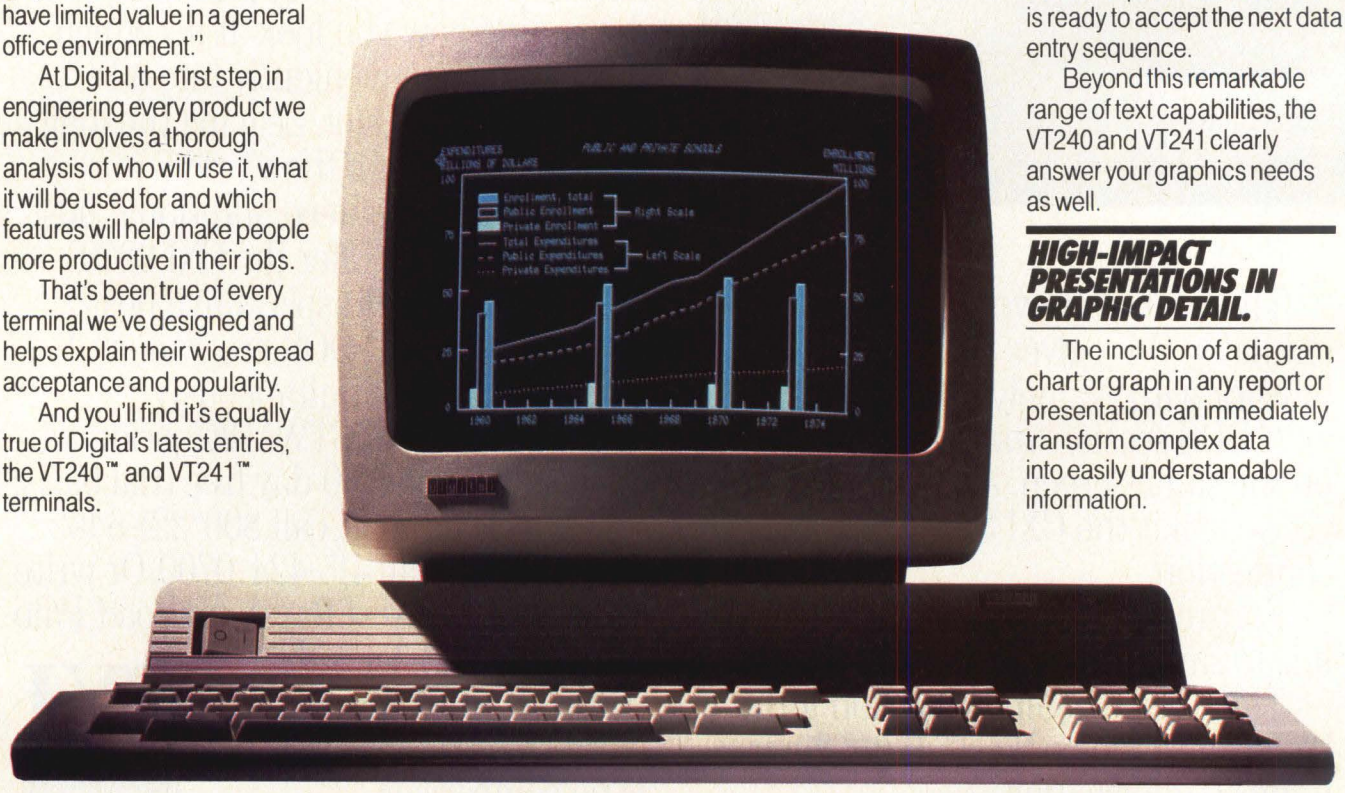


text and graphics terminal, and the VT241, with the added dimension of color, continue the tradition of engineering excellence for performance. They offer full VT100™ compatibility to take advantage of a host of offerings already developed. And to meet the needs of the business environment, you'll find a set of standard text features that are either unavailable on other terminals or may have to be purchased at an additional cost.

These features include bidirectional smooth scrolling, split screen, a choice of 80 or 132 columns per line and a double width/double height format. A highly legible 8 by 10 dot matrix character font displays true ascenders and descenders for exceptional crispness and legibility. If certain information needs to be highlighted, you can select from a combination of bold print, blinking and underlining in either normal or reverse video. For your added convenience, there's even a built-in printer port for printing hard copy.

Both the VT240 and VT241 terminals give you the option of erasing selected character positions on the screen for more efficient communications and increased productivity. For those applications that require data to be entered by filling in the blanks of a form, once the data has been accepted by the host, the filled-in information – and only that – can be erased by means of a single command. The form itself remains up on the screen and is ready to accept the next data entry sequence.

Beyond this remarkable range of text capabilities, the VT240 and VT241 clearly answer your graphics needs as well.



HIGH-IMPACT PRESENTATIONS IN GRAPHIC DETAIL.

The inclusion of a diagram, chart or graph in any report or presentation can immediately transform complex data into easily understandable information.

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touchtype, and an editing keyboard and special function keys that reduce the number of keystrokes to complete an operation. Also, the set-up mode offers a menu in plain language (plain English, plain French and plain German) that leads you through each operation in step-by-step sequence.

All this effort has not gone unnoticed. Digital's video terminals received the International Design Award in 1984. The award is based on ergonomic suitability, safety, design quality, practical useability, technical excellence and practical visualization.

BEST ENGINEERED MEANS ENGINEERED TO A PLAN.

The VT240 and VT241, like every Digital hardware and software product, are engineered to conform to an overall computing strategy. This means our products are engineered to work together easily and expand economically. Only Digital provides you with a single, integrated computing strategy direct from desktop to data center.

For more information and the name of the Authorized Terminals Distributor or Digital Representative near you, call 1-800-DIGITAL, extension 700. Or write Digital Equipment Corporation, 2 Mount Royal Avenue, UP01-5, Marlboro, MA 01752.

Both the VT240 and VT241 terminals generate bit map graphics in a choice of two protocols – Digital's ReGIS™ (Remote Graphics Instruction Set) and Tektronix 4010/4014.™

ReGIS lets you create and store business graphics as simply as producing ASCII text. With VAX-11 DECgraph™ and VAX-11 DECslide™ software, even a novice can prepare graphs and charts and turn them into slides. Self-explanatory icons let you choose a box, circle, line, polygon, triangle or arc.

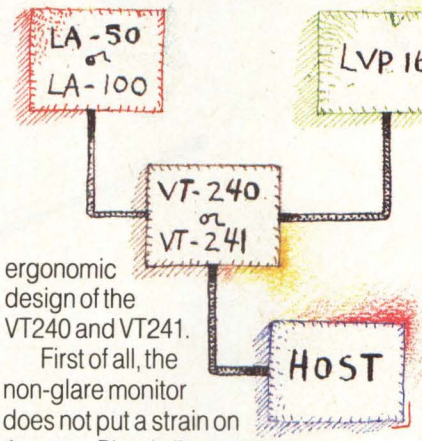
The Tektronix 4010/4014 protocol supports the full array of existing 4010 compatible graphics software. Besides, Tektronix Plot 10,™ TELL-A-GRAF™ and DISSPLA™ from ISSCO® and DI-3000,™ GRAFMAKER™ and GRAFMASTER™ from Precision Visuals are also supported.

When you're using third party software, Digital provides you with the total hardware/software solution: video terminals, hard copy with the LVP16™ Pen Plotter and the VAX™ computer.

THE HIGHEST AWARD FOR ERGONOMIC DESIGN.

Your people have to spend long hours in front of a terminal. It stands to reason the easier they are to use, the more productive the results.

That's why so much time and thought have gone into the ergonomic design of the VT240 and VT241.



First of all, the non-glare monitor does not put a strain on the eyes. Plus, it tilts to adjust to the exact viewing angle that's most comfortable to work with. The detachable keyboard is ruggedly constructed, yet light enough to place on your lap. Even the way the keyboard has been arranged boosts productivity.

There's a standard typewriter keypad so you can

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CIRCLE NO. 16 ON INQUIRY CARD

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CIRCLE NO. 17 ON INQUIRY CARD

HP pursues technical markets with UNIX-based microcomputer

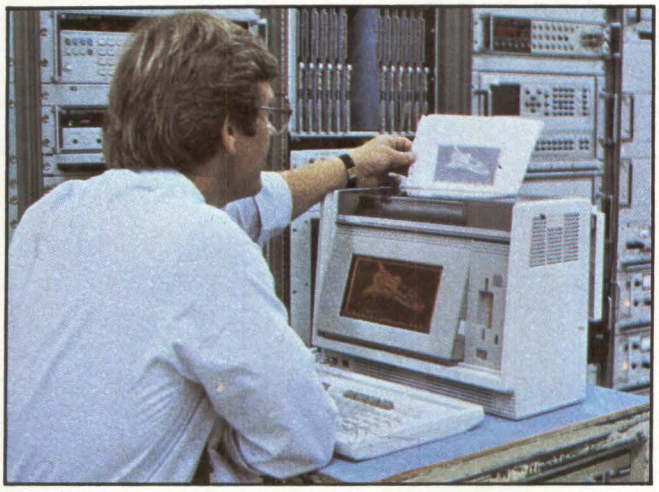
Tom Moran, Associate Editor

Although the number of companies introducing UNIX-based hardware and software is burgeoning, UNIX's bulky code, complex command structure and relatively expensive hardware requirements have limited its general appeal.

Now Hewlett-Packard Co. is rolling out the Integral Personal Computer (IPC), a transportable microcomputer with a UNIX kernel in ROM.

Initially targeted at engineers and software developers, it represents a long-term effort to hasten the system's move to business and commercial areas. The $4,995 IPC runs unbundled UNIX applications using one 3¼-inch, 710K-byte, Sony microfloppy disk drive, a 9-inch electroluminescent screen and HP's 150-character-per-second (cps) ThinkJet lightweight printer. The IPC itself weighs 24 pounds and measures 16 inches wide, 13 inches high and 7 inches deep. It has 256K bytes of ROM, 512K bytes of RAM. Maximum internal memory is 1½M bytes.

Rich Baker, marketing manager for HP's portable computer division, Corvallis, Ore., stresses that the IPC is not yet a product for the commercial market. "You could think that this is a new wave for the computer market in general, but we will not position it that way—initially, at least." Baker says the transportable will be positioned "first of all for the traditional technical professional market, and second, for the UNIX development market. As the UNIX market develops and commercial software becomes available, then the system will appeal to a broader audience."



HP will initially aim its transportable Integral Personal Computer, *which incorporates a UNIX kernel in ROM, a 9-inch electroluminescent display and HP's ThinkJet printer, at technical markets.*

Applauding HP's conservative strategy for the new machine is Jan Lewis, senior analyst at InfoCorp, a Cupertino, Calif., market research group. The IPC represents "a very smart move for HP, because it's not an opportunistic product; it's part of a long-term strategy," notes Lewis. She predicts that the IPC will lead the technical marketplace, while UNIX becomes more important in the business and commercial environments. As a result, says Lewis, the IPC will uniquely position HP in the growing business/commercial arenas. As Lewis puts it, the new machine "will be a wedge into the commercial market, waiting for the hammer of UNIX business software to strike."

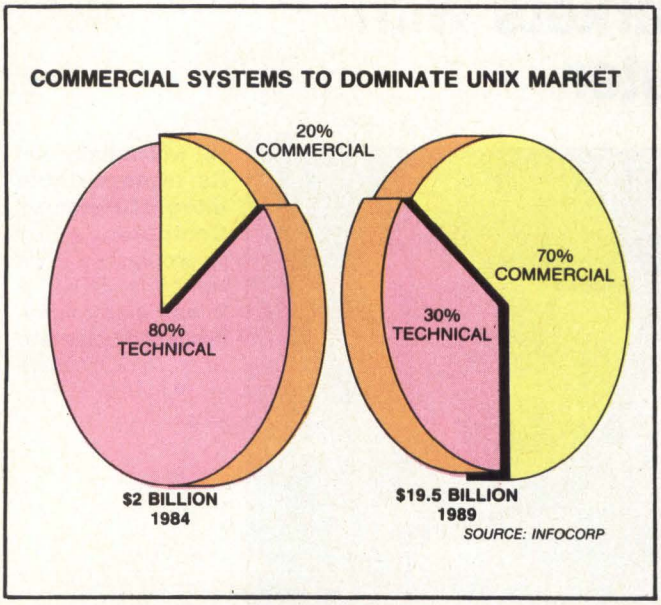
Indeed, UNIX market projections seem to support HP's strategy. According to InfoCorp figures, the worldwide market for UNIX hardware, software and technical support was $2 billion in 1984. The technical sector, with 80 percent of the total sales, ruled the market, whereas the commercial sector accounted for only 20 percent of the total. But by 1989, when the market is expected to swell to $19.5 billion, the commercial and technical areas will have nearly reversed their shares to 70 percent and 30 percent, respectively.

Competition for Tandy

For now, the IPC will primarily compete with machines from Tandy Corp's Radio Shack division, Fort Worth, Texas. InfoCorp estimates that of the 33,500 UNIX-based microcomputer systems priced under $12,000 that were installed in 1984, 40 percent were Tandy Radio Shack systems. Lewis says the IPC should compete head-on with Tandy's $5,499 MC68000-based TRS-80 Model 16 that runs UNIX System III.

Model 16 comes with a 15M-byte Winchester disk drive, which is necessary to run the TRS-XENIX and proprietary TRS-DOS multiuser operating systems. Model 16 contains 256K bytes of RAM, four internal expansion slots, and an 8-inch floppy disk drive with a 1¼M-byte capacity. A non-integral printer is optional.

Although the IPC's transportabil-



Most of the current UNIX sales *are in the technical side of the market, but that should reverse in favor of business by 1989.*

ity might increase the unit's appeal somewhat when compared to desktop machines like Model 16, that will probably not be a major issue. "Nobody needs a transportable," claims InfoCorp's Sandra Gant, associate director of the small-system service. The attractiveness of transportables stems mainly from their integration of components, rather than their mobility, claims Gant. She is enthusiastic over the IPC's performance features, however.

The IPC runs the HP-UX version of UNIX System III on an 8-MHz Motorola MC68000 microprocessor. With the addition of an external card cage, memory can be increased to 5½M bytes. As much as 50 percent of the RAM can be allocated as a RAM disk—a "cache-type" memory that speeds application program performance.

UNIX sits in ROM kernel

The 256K bytes of system ROM contains HP-UX/RO, HP's version of the UNIX kernel necessary to run applications software, HP's Personal Applications Manager, which is the user application interface, and HP's Windows Manager. Software bundled on disk includes a tutorial, system utilities, 31 standard UNIX commands, customer diagnostics, and some standard applications such as editors, games and fonts.

Building the kernel into ROM eliminates the need for a hard disk to house the operating system, explains Kermit Yensen, product manager for HP's personal-computer group in Corvallis. "In an extended system [users] can buy HP-UX [2.1] commands on a microfloppy, and they can build up their development system." Yensen adds that HP has made some enhancements to HP-UX, which is the company's version of UNIX System III. He maintains that software written to run on System III is "very portable to HP-UX" because HP-UX is a superset of System III.

The additions to the operating system include the personal applications manager, which is similar to that of the HP150 personal computer, real-time extensions for response to interrupts, a technical version of BASIC, and series 80 BASIC, which provides high-level language calls to control instruments. Device-independent graphics software libraries give the same instrument-control capability to C, Pascal and FORTRAN.

Yensen thinks there is no danger of the IPC hurting sales of the HP150 desktop system, which runs MS-DOS. "We think the two product lines will coexist. The HP 150 operating in the MS-DOS environment, will clearly [beat the competition well] into the foreseeable future in terms of software availability."

The IPC's bit-mapped, 9-inch electro-luminescent display is the same as the HP150's. The screen contains 255 pixels by 512 pixels and displays 24 lines by 80 characters, although variable fonts and window sizes are available. Users can adjust the screen's viewing angle from 5 degrees to 17 degrees in 2-degree steps. A 16-bit HP-proprietary graphics processor with 32K bytes of dedicated RAM controls the display.

The ThinkJet dot-matrix printer uses thermal ink-jet technology to print 150 cps while producing less than 50 dB of noise. The ThinkJet can use fanfold paper or single sheets.

Interfaces for the IPC comprise one HP Interface Bus and two HP Human Interface Loops for support of devices such as mice and bar-code readers. Two input/output expansion slots are provided.

HP plans to market the IPC through approximately 100 to 200 dealers selected from its current 1,000 retail dealers, and through its direct sales force. The pricing of the various UNIX development systems had not been determined at press time.

The IPC comes with a tutorial disk, a user's guide, a utility disk, a customer diagnostic disk, a UNIX commands disk, a standard applications disk, and paper and ink for the integral printer. □

Once-exclusive modem market niche attracting sudden, heavy competition

Three new entrants *into the full-duplex, 2,400-bps modem market, from left, the $1,295 Concord Data Systems 224, the $899 Hayes Smartmodem 2400 and the $895 Micom Dial Net 3000.*

Stephen J. Shaw
Washington Editor

The breakup of the Bell System, advanced manufacturing techniques and rising demand for faster, more sophisticated equipment has caused a boom in the market for full-duplex modems that transmit information at 2,400 bits per second (bps) over the public telephone network. As a result, a niche that was once the exclusive domain of Concord Data Systems Inc., has recently attracted a spate of new products and vendors.

"We had the market to ourselves for almost two years," laments C. Kenneth Miller, president of the small Waltham, Mass., company. "There's a lot of people coming into the full-duplex, 2,400 [bps] area now."

Miller and his company had used their head start well, recording revenues of $14.9 million in 1984, almost 10 times the $1.5 million brought in during 1982, the first year of operation. But their success and changing times has bred competitors.

Yet, as late as November, only two other manufacturers, Codex Corp., Mansfield, Mass., and Micom Systems Inc., Chatsworth, Calif., were shipping full-duplex, 2,400-bps modems. That situation is about to change dramatically. Several other vendors announced full-duplex, 2,400-bps products at the fall COMDEX show and other recent computer conferences, or have indicated such intentions to industry sources.

Full-duplex wiring is common

The migration of modem manufacturers to the full-duplex, 2,400-bps market is being caused by the convergence of several industry trends, explains Kim Myhre, a communications analyst with International Data Corp. (IDC), a market-research organization based in Framingham, Mass. For one thing, "Private line costs are going up while long-distance (dial-up) rates are dropping," says Myhre. Large users, therefore, are looking at public dial-up switched service as a more economical solution to their data-communications requirements than dedicated, leased lines, he says.

Besides the rates, full-duplex modems, as compared with the more conventional and more available half-duplex 2,400-bps modems, allow simultaneous bidirectional transmission of data through two-wire, rather than four-wire, telephone lines. The four-wire connections for half-duplex modems require that either a private line be leased from the telephone company and dedicated full-time to a customer, or that two dial-up calls be placed to achieve simultaneous bidirectional data transfer. So, although full-duplex modems are slightly

FULL-DUPLEX, MEDIUM-SPEED MODEMS TO SHOW STEADY GROWTH

Market segment (bps)	1983 No. shipped	1983 Value ($ millions)	1984 (est.) No. shipped	1984 (est.) Value ($ millions)	1988 (est.) No. shipped	1988 (est.) Value ($ millions)
0-600	299,500	53.9	351,000	57.6	525,000	58.8
1,200 half duplex	107,750	40.9	117,000	42.1	152,800	42.8
1,200 full duplex	268,600	128.9	370,500	172.6	845,000	334.0
2,400	184,000	119.6	217,000	135.6	420,000	193.2
4,800	129,490	246.0	161,900	291.4	305,900	397.7
9,600	84,000	361.2	107,500	435.4	243,800	768.0
14,400	3,200	35.2	4,600	50.6	11,600	127.6
Short-haul	248,000	86.8	340,000	119.0	625,000	218.7
Total	1,324,540	1,072.5	$1,669,500	1,304.3	3,129,100	2,781.2

SOURCE: INTERNATIONAL DATA CORP.

From 184,000 units shipped *in 1983, the 2,400-bps modem market is expected to grow to an estimated 420,000 units shipped in 1988. But the emergence of the full-duplex, 2,400-bps niche is so new that IDC does not yet separate full- and half-duplex modems at that speed.*

more expensive than their half-duplex counterparts, they can take better advantage of the two-wire telephone connections commonplace in the public network.

Bell breakup slows leasing

Leasing is further impeded by the fact that the breakup of the Bell System has led to increased lead times for installation by AT&T Communications or the now-independent local telephone companies. Anderson-Jacobson Inc.'s (San Jose, Calif.) data-communications product manager, Gunnar Thordarson, reports that some of his company's customers have had to wait as long as 160 days for leased-line installation. The delays have created a market for modem manufacturers and suppliers that offer dial-up equipment as an interim solution.

For Hayes Microcomputer Products, Norcross, Ga., a pioneer in sophisticated, low-speed modems, joining the migration to the 2,400-bps modem for business applications is basically a function of increased data throughput. "We're reacting to user needs, and users have been crying for higher-speed modems over the past year," says Gary Betty, Hayes director of marketing and sales.

VLSI decreases costs

The demand from users for increased data speeds has been matched by decreasing costs for 2,400-bps-level modems by manufacturers due to increased use of very large-scale integration (VLSI) manufacturing techniques and the presence of additional supply sources. Concord Data Systems' first product offering for full-duplex, 2,400-bps modems was priced originally at $1,695 for a single-quantity, end-user purchase. In 1983 the price was dropped to $995 for Concord's basic 224 model, and cut again last September to $845.

Depending on the value-added options included in the new product offerings coming from other manufacturers entering the full-duplex, 2,400-bps arena, prices are expected to range from $795 to about $1,000. According to Lee Schank, president of Case Rixon Communications Inc., another company which has declared an interest in the market, prices should remain stable during the next 12 months. "The price cuts, even though these are introductory prices, have already [in effect] occurred," Schank says.

Overall, the market for 2,400-bps modems is predicted to grow at an annual rate of 18 percent during the next five years, according to IDC. From 184,000 units shipped in 1983, the market is expected to grow to an estimated 420,000 units shipped in 1988. Shipment value in 1983 was $119.6 million and is expected to reach $193.2 million in 1988. But the emergence of the full-duplex, 2,400-bps niche is so new that IDC figures do not separate full- and half-duplex, 2,400-bps modems.

Because the market for these modems is still in its infancy, the keys to success for the new entrants are likely to be their ability to expand their customer bases, take advantage of the growing use of personal computers in the business environment, and differentiate their products by including value-added features, says IDC's Myhre.

Other companies that have indicated their intention to compete in the full-duplex, 2,400-bps modem market include: AT&T Information Systems, Cermetek Microelectronics Inc., Gandalf Data Inc., General Datacomm Industries Inc., Multi-Tech Systems Inc., Novation Inc., Penril/Datacomm Inc., Racal-Vadic Inc. and US Robotics Inc.

On the value-added front, the new vendors are touting such features as network diagnostics including digital and analog self-test programs, error detection and correction, adaptive line equalization and other advanced options in an effort to set themselves apart in the increasingly crowded field. The original supplier in 2,400-bps, full-duplex modems, Concord Data Systems, has already introduced a version of its CDS 224 modem equipped with automatic error detection and correction, a system that the company says guarantees error-free transmission over dial-up telephone lines.

What used to be considered value-added features—auto-dial, auto-answer, limited self-diagnostics—are now considered standard. "As the market starts to mature, we'll see even more exotic value-added features," predicts Case Rixon's Schank. □

PAY VIDEOTEX STATIONS CONSIDERED FOR JAPAN

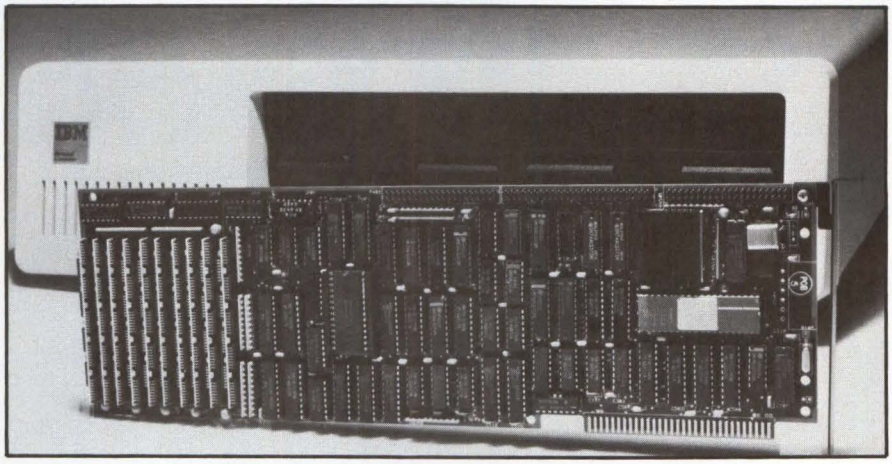
Nippon Telephone and Telegraph Co. is looking at ways to provide a pay-for-use program with its newly instituted Captain videotex system. Captain (which stands for character and pattern telephone-access information network) is now available only at public facilities such as government offices, libraries, banks, and some of the larger railway stations. Individual terminals are available but, at $800 or so, are beyond the range of most consumers. With the proposed service, individual users could draw three minutes of data from the central Captain files for about 12 cents via a pay terminal. The terminal is like a pay phone. Prototypes of the pay station are expected to be ready for testing in the first half of this year.

Amidst glowing PC-AT expectations, the PC/XT wins new market life

Tom Moran, Associate Editor

The Tandy 1200 HD *IBM PC/XT-compatible computer undercuts IBM's price for the PC/XT by as much as $1,400.*

The PC-286 add-in board *from Seattle Telecom & Data Inc. is designed to provide an upgrade to an 80286 processor for owners of IBM PCs, PC/XTs and PC-compatible machines.*



The full market effect of IBM Corp.'s PC-AT microcomputer still hasn't been felt, but industry analysts say the most obvious victim will be IBM's own PC/XT, the former high-end product. The basic AT, at $5,795, is priced $1,400 higher than the XT, but its integral hard disk drive has twice the storage of the XT's, it has almost four times the floppy disk storage and is considerably more powerful.

But, as analysts predict dizzying PC-AT sales (MMS, October 1984, Page 35), the comparatively slow-selling, $4,395 PC/XT may get a mid-life market kicker from several sources. At least two companies, Seattle Telecom & Data Inc., Redmond, Wash., and Wave Mate Inc., Hawthorne, Calif., have introduced boards they claim will make the Intel 8088-based PC/XT compatible with the Intel 80286-based PC-AT, offering a savings for XT owners who would like AT capacity. Also, Tandy Corp.'s Radio Shack division, Fort Worth, Texas, has come out with its XT-compatible Tandy 1200 HD personal computer, which could help maintain interest in the XT and XT-compatible market, at least in the short term.

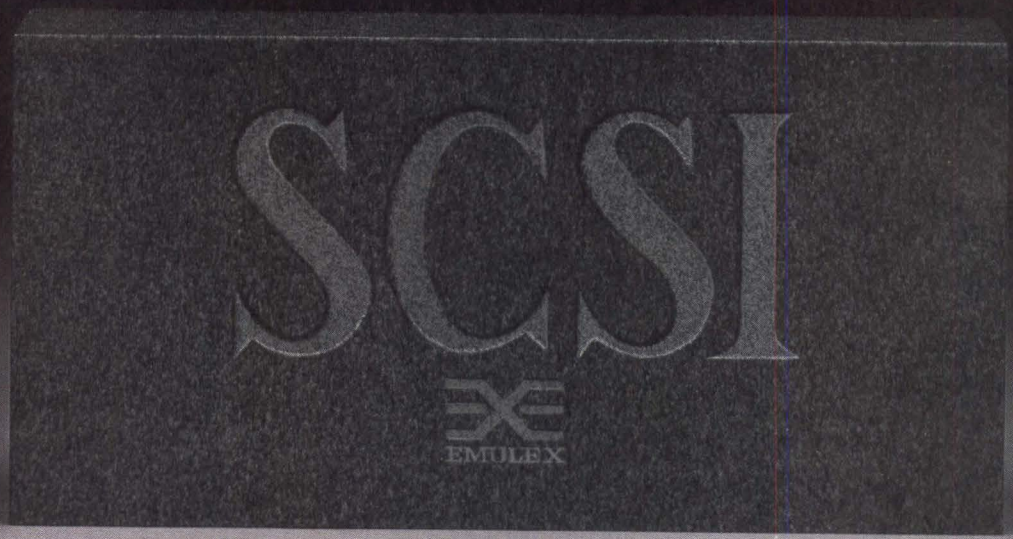
Analysts caution that, while the new offerings may breath new life into the XT market, that life may well depend on the willingness of users to upgrade and how long it will be before the ATs are in ready supply.

Enzo Toressi, senior executive vice president and co-founder of Businessland Inc., a San Jose, Calif., computer store franchise, says the PC-AT would have a negative impact on PC/XT and XT-compatible sales, except that "...it's more an issue of how available the [PC-AT] will be in the next six months." Toressi adds, "All I can say at this point is that [the AT] is in scarce supply right now and, as a result, is not affecting significantly the PC/XT sales."

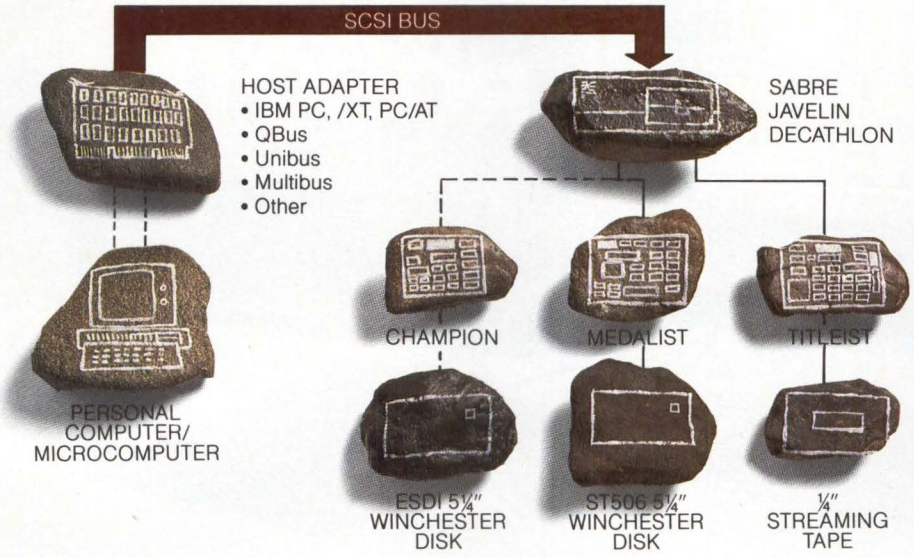
Senior analyst Jan Lewis of InfoCorp, a Cupertino, Calif., market research concern, agrees with Toressi that the PC-AT appears to threaten the life cycle of the PC/XT. "I would think [that] to give the PC/XT a kicker, [IBM] would need to drop its price. That would be consistent with IBM's marketing strategy." Lewis estimates that 30,000 PC-ATs were sold by the end of 1984.

Norm DeWitt, associate director of personal computer programs for Dataquest Inc., a San Jose, Calif., market researcher, had predicted loftier PC-AT shipments: 75,000 PC-ATs and 295,000 PC/XTs. DeWitt does not expect PC/XT sales to

EMULEX HAS THE CORNERSTONE FOR SYSTEM BUILDING FLEXIBILITY.



AND, WE'VE GOT ALL THE OTHER BUILDING BLOCKS, TOO.



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SCSI allows you system building ease and maximum flexibility through the use of a common I/O bus and standard peripheral interface. All Emulex/SCSI-based products feature these enhancement benefits.

FEATURE	BENEFIT
Arbitration	Permits concurrent I/O operations between different devices by prioritizing bus usage.
Disconnect/ Reselect	Maximizes bus utilization by providing devices an orderly scheme to release and regain bus control.
Copy	Permits data transfer between devices without host intervention.
Search Data	Used to search one or more logical blocks for less than, greater than or equal to a specified data pattern.
Reserve/ Release	Device can be reserved for exclusive use by a single host in multiple host configuration.
High Level Command Set	Provides host with device independence for a given type of device.

With Emulex's SCSI products as the cornerstone for your mini/micro computer systems, you can continue to build on your investment. Our SCSI-based products offer you convenient building blocks with which to assemble, update, mix or interchange different types of peripheral storage devices to your computer system. Couple that with the industry's widest range of advanced products and you have the single best source for your system building needs. Products with performance, quality and reliability that's unsurpassed.

PUT MORE INTO YOUR SYSTEMS WITH EMULEX/SCSI MICRO SUBSYSTEMS.
Compact, versatile Emulex/SCSI micro subsystems provide you a variety of cost-effective storage and backup devices. Choose the enclosure you desire—desktop, rack or tower—disk size—36, 67 or 110 MB formatted capacity—and the type of backup most meaningful to your application. Top that off with the ability to interface virtually any CPU type and you have a powerful and complete storage solution.

SABRE, combines on-line storage and file backup capability in a compact unit housing a 5¼" Winchester disk drive and an 8" removable cartridge disk.

Javelin, an extremely versatile storage system designed to satisfy a wide range of OEM and end user applications. Space accommodations for two SCSI peripherals, either one 5¼" disk drive and one 60 MB ¼" cartridge tape streamer, or two disks.

Decathlon, available in a rack mount or an attractive tower/pedestal model, contains up to three 5¼" peripherals, with a choice of Winchester disks and a 60 MB ¼" streaming tape drive.

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Our Medalist and Champion SCSI controllers can interface any ST506 or ESDI 5¼" Winchester disk drive. And our Titleist can interface most ¼" streaming tape drives.

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If you're looking for a solid cornerstone and the widest range of building blocks to put together powerful and efficient mini/micro subsystems, then talk to Emulex.

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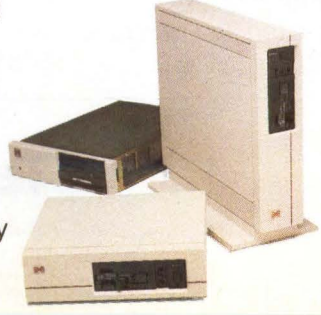

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CIRCLE NO. 18 ON INQUIRY CARD

ARTIFICIAL INTELLIGENCE: TEK INTRODUCES A NEW SOURCE OF POWER.

Tek's new personal 4404 AI development system bypasses one of the last bottlenecks to making artificial intelligence systems commonplace. That bottleneck: the high price and scarcity of AI compute power.

The powerful, 32-bit 4404 supports three major development languages. The Smalltalk-80™ programming environment is standard. Franz LISP and Prolog are available as options. And Tek supports the industry-wide Common LISP standardization effort. Standard configuration also includes virtual memory, expandable hard disk mass storage and much more. Its new window-managed display is everything you expect from a world graphics leader.

But what really makes the 4404 a major new force in AI is its price: at less than $15,000, it is the first personal AI development system.

The power of Tek is behind it. Thanks to Tektronix technology, AI specialists and worldwide service organization, the 4404 is truly the first AI system you can use without reservations. And it is only the beginning of Tek's growing commitment to the AI community.

For more information, contact your nearest Tektronix field office. Or call toll-free 1-800-547-1512. In Oregon, 1-800-452-1877.

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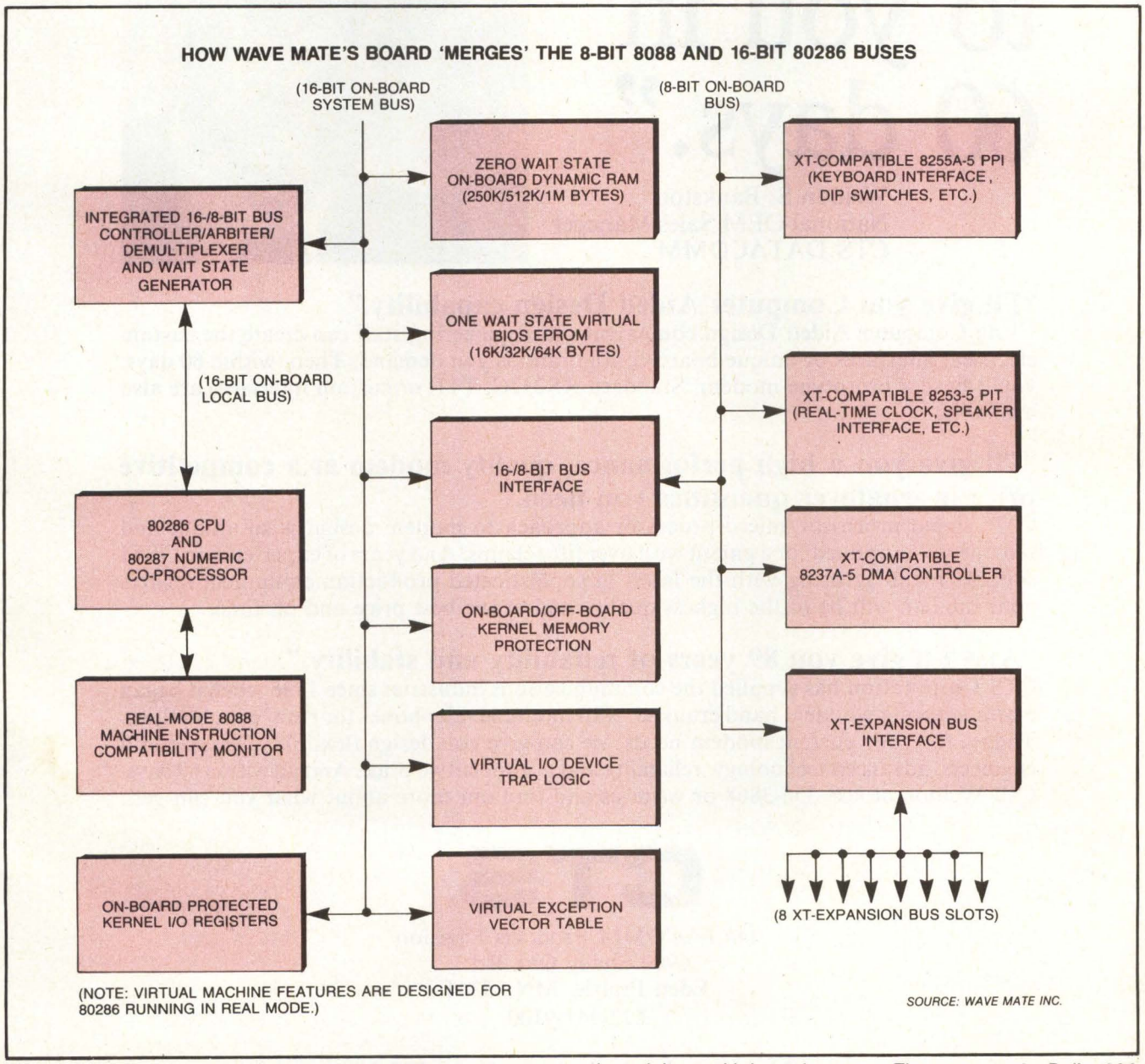
CIRCLE NO. 19 ON INQUIRY CARD

be damaged by the PC-AT in the short term. "Right now I think there's enough of a price differential between the PC-AT and the PC/XT that the PC/XT is still a viable product in IBM's product line. If you take street prices, the differential is even greater. It's not uncommon to see PC/XTs discounted 15 percent to 20 percent."

The $2,999 Tandy 1200 HD personal computer, which is $1,400 less than a PC/XT, still would be $500 less if a PC/XT were discounted by 20 percent. Like the PC/XT, the 1200 HD is built around the 8088 processor and uses MS-DOS and Microsoft BASIC programs. The standard memory, like IBM's, is 256K bytes. Five expansion slots are standard.

Tandy now has a line of IBM PC-compatible computers. Ed Juge, director of market planning for Tandy's Radio Shack division, explains. "The PC-AT is not necessarily in competition [with the 1200 HD.]" Juge maintains that the PC-AT will be more competitive with the Tandy 2000, an Intel 80186-based system



Wave Mate has multiplexed *the 16-bit 80286 bus onto a PC/XT-compatible 8-bit expansion bus; the 16-bit bus is slowed by multiple wait states. The company's Bullet-286 acts as a substitute for the PC/XT's motherboard.*

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introduced in November 1983. The 2000 runs at the same 6-MHz clock rate as the PC-AT, he says. Juge says Tandy will have XENIX on the 2000 eventually, "but we don't see it as a multiuser system. Our multiuser system is the [MC68000-based] Radio Shack TRS-80 model 16."

Boards boost PC/XT

Rather than introduce a line of PC-compatible systems, Seattle Telecom and Wave Mate announced $2,400 to $2,500 products designed to give the PC/XT the performance of a PC-AT. Seattle Telecom introduced the PC-286, an 80286-based add-in board for IBM PCs, PC/XTs and PC-compatibles. According to president Joseph DeCaro, the company will not try to compete with the IBM PC-AT, which is also based on the 80286. "We're trying to offer an expansion path to people who have invested significant dollars in a PC or PC/XT, and who don't want to throw that money away." DeCaro claims that "all the functionality of the AT" is available on the PC-286 board. That board, however, is not compatible with PC-AT expansion cards.

The PC-286 presently runs all PC-DOS, MS-DOS and Concurrent DOS operating system versions. DeCaro maintains that, if XENIX is ported to the PC-286, then "whatever software runs on the PC-AT under XENIX...would run on our board as well." The PC-286 includes up to 640K bytes of RAM and space for an Intel 80287 mathematics coprocessor. It will be priced at $2,395 for single units, with quantity discounts available. The PC-286 should be available now.

Wave Mate also is giving PC/XT users a way to run their systems at the speed of a PC-AT. The company's Bullet-286 board is a 6-MHz 80286-based retrofit for the 4.77-MHz 8088-based PC/XT motherboard. Included are 640K bytes of memory and a socket for an 80287 coprocessor, the same as is offered by Seattle Telecom. Wave Mate has multiplexed the 16-bit bus of the 80286 onto a PC/XT-compatible 8-bit expansion bus. The wait states necessary to multiplex the 80286 bus onto the PC/XT expansion, of course, slow down the 80286's execution speed. The Bullet-286 acts as a substitute for the PC/XT's motherboard, and thus gives PC/XT users some PC-AT compatibility.

Businessland's Toressi says the market for PC-286-type boards would comprise "all of those who already own a PC/XT or PC who might want to upgrade to a PC-AT-type performance, but would not want to reinvest and buy an AT." He estimated that by the end of 1984, close to four million people will have IBM PCs, PC/XTs and PC-compatible machines. While Toressi says products such as the PC-286 make sense, he says Businessland is "very careful [in investigating] the compatibility issues of these add-on products. Compatibility is really the bottom line in attractiveness to consumers." Also, analysts note that some software tied to the timing of the 8088 processor in IBM PCs and PC/XTs may not run on the AT because the clock rate is different from that of the AT's 80286 processor.

InfoCorp's Lewis says there's no price advantage to buying such boards, as opposed to buying the PC-AT. Adding $2,400 to the PC/XT's basic $4,395 price makes the PC/XT, with the boards, $1,000 more than the PC-AT's basic price. "If it [the boards] were compatible with all the existing software for the 8088, you'd get increased performance [with that software]. But whether it would be worth the price would be strictly based on performance." □

RADIO SHACK BEATS IBM's PC/XT BY $1,400

Company	Radio Shack	IBM	IBM
Product	1200 HD	PC/XT	PC-AT
Processor	8088	8088	80286
Memory (bytes)	256K	256K	256K
Floppy disk (bytes)	360K	360K	1.2M
Hard disk (bytes)	10M	10M	20M
Price	$2,999	$4,395	$5,795

IBM PC-AT USERS MAY HAVE THREE UNIX CHOICES

In addition to XENIX, at least two other versions of the UNIX System III operating system should soon be available for the IBM PC-AT personal computer. A system identical to the System III-based PC-IX, which runs on the PC/XT, is being adapted for the PC-AT by Interactive Systems Corp., Santa Monica, Calif. PC-IX is derived from Interactive's System III-based IS/3. And Unisoft Systems, Berkeley, Calif., is planning a release based on one of the Berkeley versions. None of the three versions is based on System V, which is being heavily promoted by AT&T Co.

IBM SUBSIDIARY GETS NOD FOR ESPRIT R&D PROJECT

The European Commission has confirmed that the West German subsidiary of IBM Corp. will take part in two factory automation research and development projects. The Commission will contribute around $2 million worth of funding to the projects, which are part of the Commission's Esprit transnational research program. More than 100 other proposed undertakings in the program have been delayed pending the signing of all contracts.

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HEARD ON THE HILL

Congress rising to needs of high-tech industry

Stephen J. Shaw
Washington Editor

Computer industry associations in Washington are generally pleased with the overall record of the 98th Congress. Association executives say that Capitol Hill has displayed an unmatched degree of sensitivity to issues that are of major concern to the U.S. computer, and other high-technology, industries.

"A few years ago, the Hill didn't know the difference between hardware and software," comments Olga Grkavac, government relations director for the Association of Data Processing Service Organizations (ADAPSO). "There's an increased awareness there now of high-technology and that has resulted in a slew of legislation [on matters] that nobody was concerned with before."

Among the legislative initiatives that have been passed by Congress and were sent to the president for his signature are:

- A computer crime bill designed to prevent unauthorized access to computers used by the federal government, banks and credit bureaus. Deleted was coverage of computers used in interstate or foreign commerce. Sen. Paul Laxalt (R-Nev.) had insisted that additional study was required before including computers used by private industry. As passed, the bill carries a maximum penalty of 10 years in prison and/or a $10,000 fine for unauthorized access to a computer system that contains classified, national-security information, and a one-year maximum prison term and/or a $5,000 fine for anyone who obtains unauthorized access to a computer system owned or operated by the federal government.
- Legislation that clarifies antitrust laws to allow computer and other high-technology companies to engage in joint research and development projects. The bill will allow companies, especially smaller ones, to band together for research they might not have been able to pursue individually.
- The Semiconductor Chip Protection Act, which provides copyright protection for the mask design for semiconductor chips.

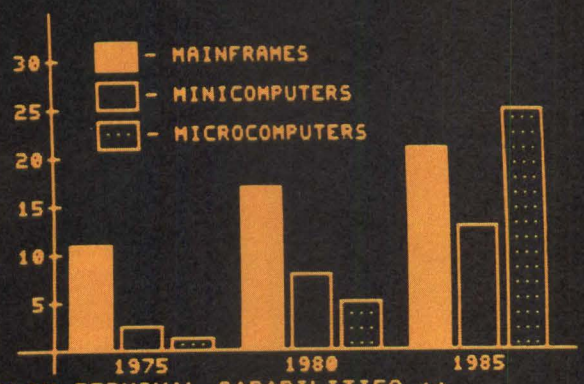
Computer-industry legislative initiatives that failed to pass the 98th Congress, but are expected to be reintroduced in the next session, include:

- Extension of research and development tax credits. That Congress did not extend tax credits for R&D expenses, now scheduled to expire at the end of 1985, was perhaps the biggest disappointment to the computer industry. Legislation to make the tax credit permanent was passed by the Senate and the House, and received the backing of the Reagan administration. But it died in a Senate-House conference committee as part of an agreement between members to pass a deficit-reduction package. Although the legislation is expected to be reintroduced this year, it will face a tougher time in Congress. "Reducing the deficit is going to be the dominant theme of the next Congress. The R&D tax credit bill is going to need more work," comments Ken Hagerty, vice president for government relations for the American Electronics Association (AEA).
- No new Export Administration Act (EAA). Computer industry lobbyists had hoped for legislation to decrease the time involved in obtaining export licenses for sophisticated computer components and systems, and ease export controls on high-technology equipment available from U.S. allies. Despite that loss, computer associations and Commerce Department officials were successful in beating back Defense Department efforts to gain an oversight role equal to Commerce's in granting export licenses. "We could have had two managers of a process that's not working now," comments William Krist, AEA director of international trade. Defense is expected to try again this year. Provisions of the EAA, which expired Sept. 30, are presently in force under the National Emergency Powers Act.
- Legislation to prohibit software distributors from renting out software packages. Initially introduced by Sen. Charles Mathias(R-Md.), the bill would place computer software under the protection of copyright statutes to prevent unauthorized duplication.

New initiatives that are expected to be introduced during that next session of Congress include a bill to establish an Information Age Commission that would gather data on a variety of high-technology issues such as worker displacement, defense and education; and a telecommunications trade bill that would grant authority to the president to negotiate access to foreign telecommunications markets and automatically impose stiff tariffs on imports from countries without agreements.

"It was a good year, but we still have a long way to go," cautions ADAPSO's Grkavac.

A Picture's Worth:



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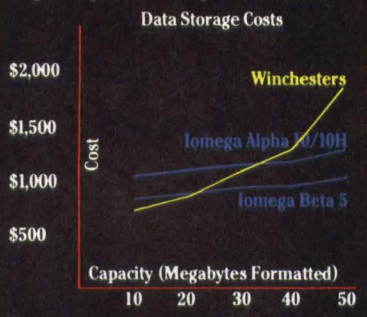
CIRCLE NO. 21 ON INQUIRY CARD

A DECLAR
DATA INDE

When In The Course Of Business Events . . .

OEMs designing systems for today's businesses face two realities. One, data processing is rapidly becoming more decentralized. It is pushing outwards into individualized work units, defined more by job function and applications, performed by more people in more places, demanding more data flexibility—more data independence.

Which brings OEMs face to face with a second reality. Winchesters. Because the prevailing mass storage technology—in the form of large storage units used for access or downloading, or smaller, high capacity desk-top mechanisms—continues to head in the opposite direction. Rather than freeing users to operate effectively in the new environments of distributed data processing, Winchesters keep them device-dependent, keep them tied to a shared system of storage.

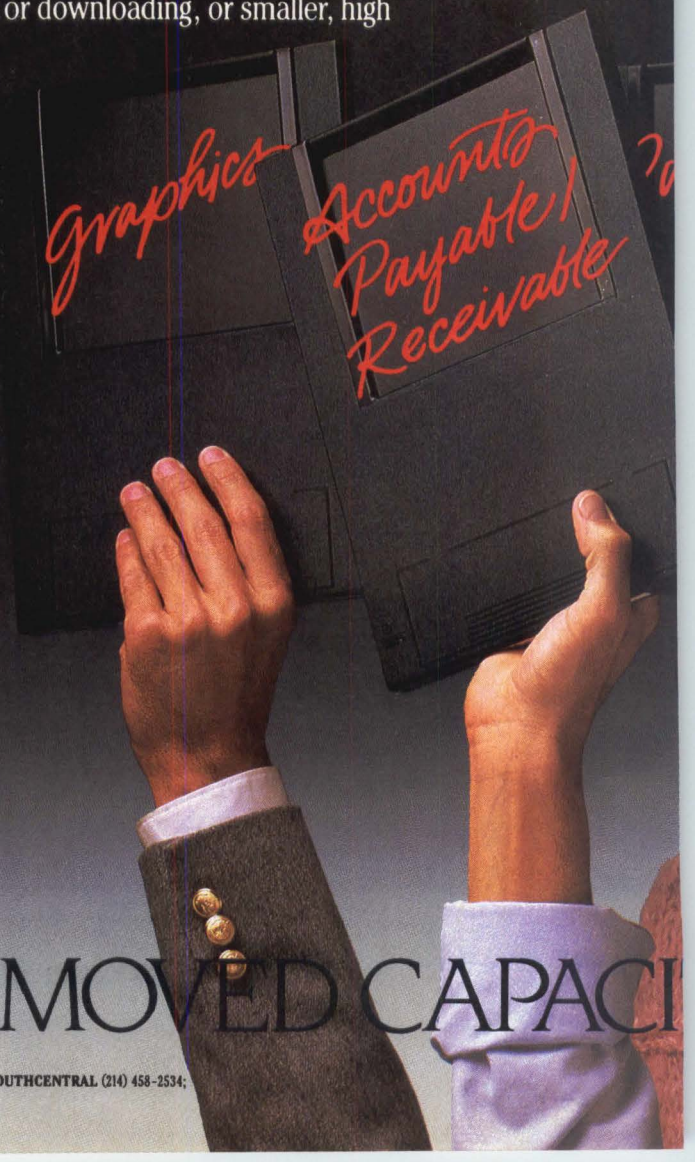


Slavery By Any Name . . .

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

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

Now consider the alternative.



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ATION OF PENDENCE.

IOMEGA's Distributed Data Storage: Freedom Of Information.

The IOMEGA family of data management/storage systems effectively matches today's distributed data processing reality with a new reality: *distributed data storage.* Because IOMEGA's reliability and performance specs often exceed Winchesters, particularly in access times and transfer rates. And they deliver cost-per-megabyte figures that Winchesters cannot figure at all.

	IOMEGA BETA 5	IOMEGA ALPHA 10/10H	TYPICAL WINCHESTER
Formatted Capacity	5.0 Mbytes per cartridge	10.0 Mbytes per cartridge	10.0 Mbytes fixed
Data Transfer Rate	5.0 Mbits/Sec	9.0 Mbits/Sec	5.0 Mbits/Sec
Average Access Time	50 msec includes settling	35 msec includes settling	85 msec
Form Factor	5.25"	8"/8" Half Height	5.25"

The key is "in/out" simple—the IOMEGA cartridge. Think about downloading data and software to a single 5- or 10-megabyte cartridge, then manipulating, updating, and uploading with maximum convenience and cost efficiency. And think about a total enterprise solution, about storing individual applications, complex software programs, or data sets—all of which can be passed along to others without expensive networking resources. And when you need more storage, you use more cartridges, not more hardware.

Accept No Other Alternatives.

IOMEGA's distributed data storage solutions—in full- and half-height 8-inch 10-megabyte solutions, and a 5-megabyte, 5¼-inch version as well—give OEMs Winchester performance and reliability, and floppy convenience and cost efficiency. They are proven, risk-free solutions. And of the few cartridge opportunities on the market today, IOMEGA's—besides being available—are the only ones that are rugged, absolutely interchangeable, and inexpensive. As such, they give OEMs the most precious commodity of all: *the freedom of designed-in freedom.* The freedom your customers require.

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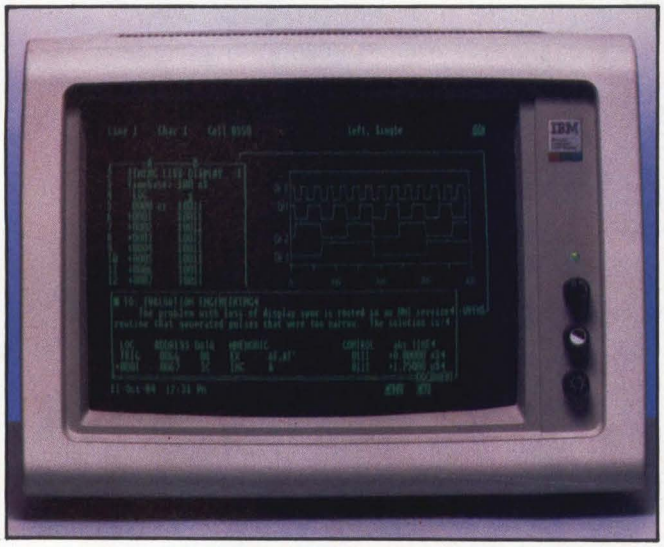
CIRCLE NO. 22 ON INQUIRY CARD

Northwest Instrument melds logic analyzer with IBM PC-AT

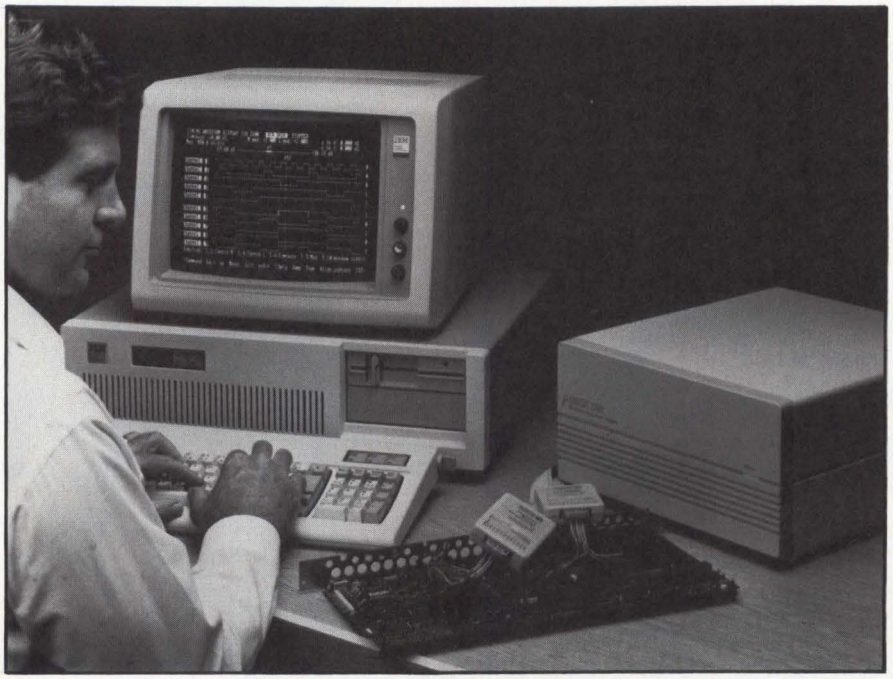
Lori Valigra, Senior Editor

Add-on products from third-party suppliers already are flowing into the arteries and capillaries branching from IBM Corp.'s new mainstream PC-AT computer.

Northwest Instrument Systems Inc., Beaverton, Ore., an IBM value-added dealer, recently announced a PC-AT-based logic analyzer called the MicroAnalyst Logic Analysis Workstation. The $17,900 system combines the 80286-based PC-AT with Northwest's Series 2000 logic analyzer and Lotus Development Corp.'s Symphony integrated program. Shipments should begin by the middle of this month.



The IBM PC-AT-based Northwest Instrument Systems' logic analyzer *lets users view several tasks—such as logic analysis, documentation, and timing—through windows within the Lotus Symphony package.*



Northwest Instrument's MicroAnalyst workstation *marries the IBM PC-AT to a logic analyzer and an integrated application program.*

The company, which has been supplying other personal computer-based instruments, plans to make the MicroAnalyst its main product and to direct it at the burgeoning logic analyzer market. "[We expect] half of the products shipped to include Symphony used with the PC-AT," says Northwest president Larry Sutter.

IBM may crowd the market

The U.S. market for scientific and engineering personal computers was $1.8 billion in 1983, and will be growing about 25 percent yearly by 1990, according to estimates by the market research firm International Data Corp., Framingham, Mass. While the CAD/CAM portion of that market will likely become crowded following IBM's announcement of its own engineering/scientific PC (MMS, December 1984, Page 37), Sutter hopes to find more breathing room in the instrument portion.

"We assume that one in three engineers will have a personal computer on his desk by 1988, and that 12 percent of the logic analyzers and microprocessor development systems sold in 1988 will be personal computer-based," Sutter explains. Five years ago, he says, the test equipment alone was priced at $18,000; now users can purchase a computer *and* logic analyzer for that amount.

Fits into generic lab setting

The typical engineer or scientist uses the personal computer for a variety of applications. In an average workday, Sutter claims, engineers use their personal computers 77 percent of the workday. The ma-

YOUR BRAINS. OUR GUTS.

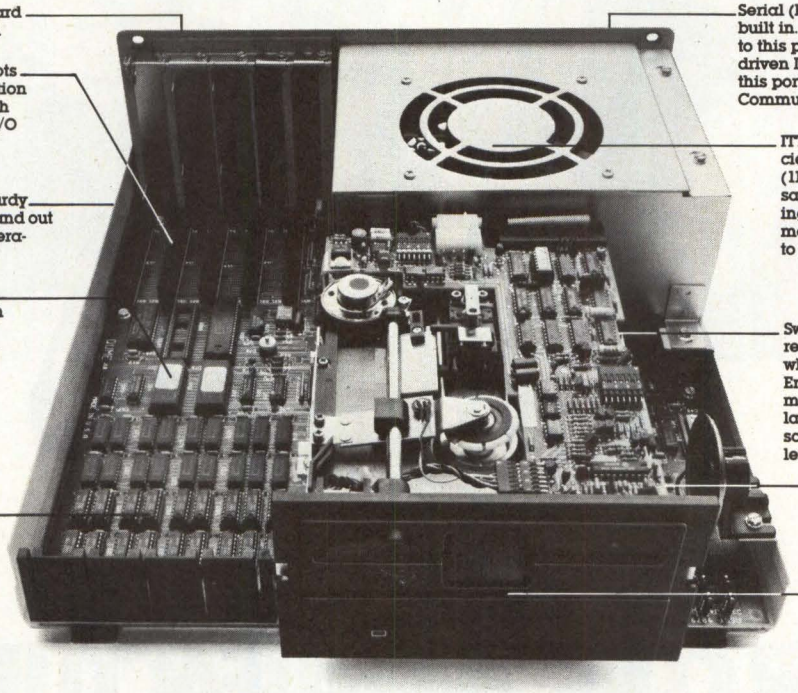
Parallel port included. Standard interface for popular printers.

Five full-length expansion slots for IBM PC/XT compatible option cards. Hard disk machine with 640K, real time clock, three I/O ports and display has two slots free.

Small overall dimensions, sturdy metal case, designed inside and out with horizontal or vertical operation in mind.

ROM BIOS AND MONITOR by ITT: Interrupt compatible with IBM PC/XT and more. Ever-ready menu-driven, diagnostic monitor debugger. Test hardware device by device and channel by channel. Examine registers, alter or dump memory, read or write tracks and sectors. Even set drive timing.

256K byte, parity-checked RAM on planar board. Combo board with one, two and three banks of 128K bytes each. Real time clock and parallel port also available to give 640K RAM total with only one slot used.



Serial (RS-232) communications port built in. Console I/O may be redirected to this port by switch setting. Menu-driven DOS utility (set up) to configure this port or redirect printer I/O to it. Communications program included.

ITT's own heavy duty, high efficiency, switching power supply (115 watts continuous service) saves weight without compromising support for fully-equipped machines. 95 to 132 volts or 180 to 240 volts.

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Floppy disk controller on planar. Saves a slot.

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chine is used for logic analysis 36 percent of that time. The other 41 percent of that time, engineers use the computers for word processing, software development, database management and spreadsheets.

The wide uses of the general-purpose PC-AT, coupled with the logic analyzer, redefine and expand the concept of logic analysis, Sutter says. For example, engineers and scientists can use database software to filter acquired data into user-defined criteria. This might include searching through microprocessor mnemonic data to extract address and instruction combinations.

Lotus' Symphony can support debugging of A/D-based systems. When data from the analog-to-digital converter is acquired in digital format by the logic analyzer, the data can be transferred to Symphony and graphed in an analog format for review by the user.

Northwest's logic analyzer can be purchased separately for $9,970. □

Kodak develops film processes for magnetic media market

Marjorie Stenzler-Centonze
Associate Editor

Eastman Kodak Co., Rochester, N.Y., a dabbler in magnetic media over the past year, has now created an Electronic Media Manufacturing Division and introduced a line of floppy disks.

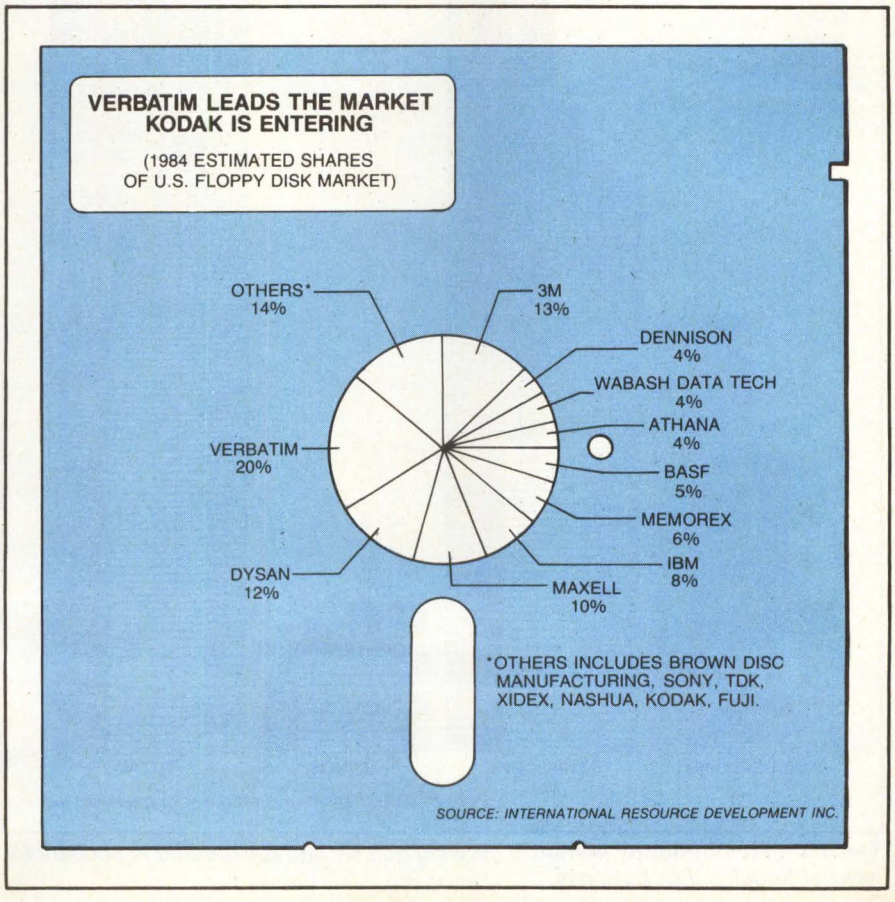
The company will tackle the floppy disk business initially by placing its own label on other manufacturers' products. Then, armed with coating technology from its photographic film business, Kodak plans to begin manufacturing within the next year when new plants in Rochester and Guadalajara, Mexico, are completed. J. Phillip Samper, vice president of Kodak's Photographic Division, says the interim measure will enable the company to quickly enter the market and establish brand recognition.

Kodak to cover all bases

Kodak's Electronic Media Manufacturing Division will offer disk products in 5¼-, 8- and 3½-inch formats. The company will address the 5¼-inch, 300-oersted floppy disk market with a single-sided, double-density disk priced at $3.85, a double-sided, double-density disk priced at $4.85 and a double-sided, quad-density disk priced at $6.60.

Its 8-inch offerings will consist of a single-sided, double-density disk at $5 and a double-sided, double-density disk for $5.80. Kodak's HD600 high-density line includes a double-sided 5¼-inch disk with 17 sectors, which will retail for $16.50, and a double-sided unformatted disk priced at $8.50. The company is also making available a high-density 3½-inch single-sided disk for $8.25.

Kodak's involvement in the magnetic media market has been limited to the production of a 600-oersted,



3.3M-byte, 5¼-inch floppy disk drive, which it licenses from Drivetec Inc., San Jose, Calif., and a 5¼-inch specialty disk for the Kodak version of the Drivetec drive. Kodak markets the drive primarily through Data Technology Corp., Santa Clara, Calif., which manufactures controllers, and by direct sales to major system integrators.

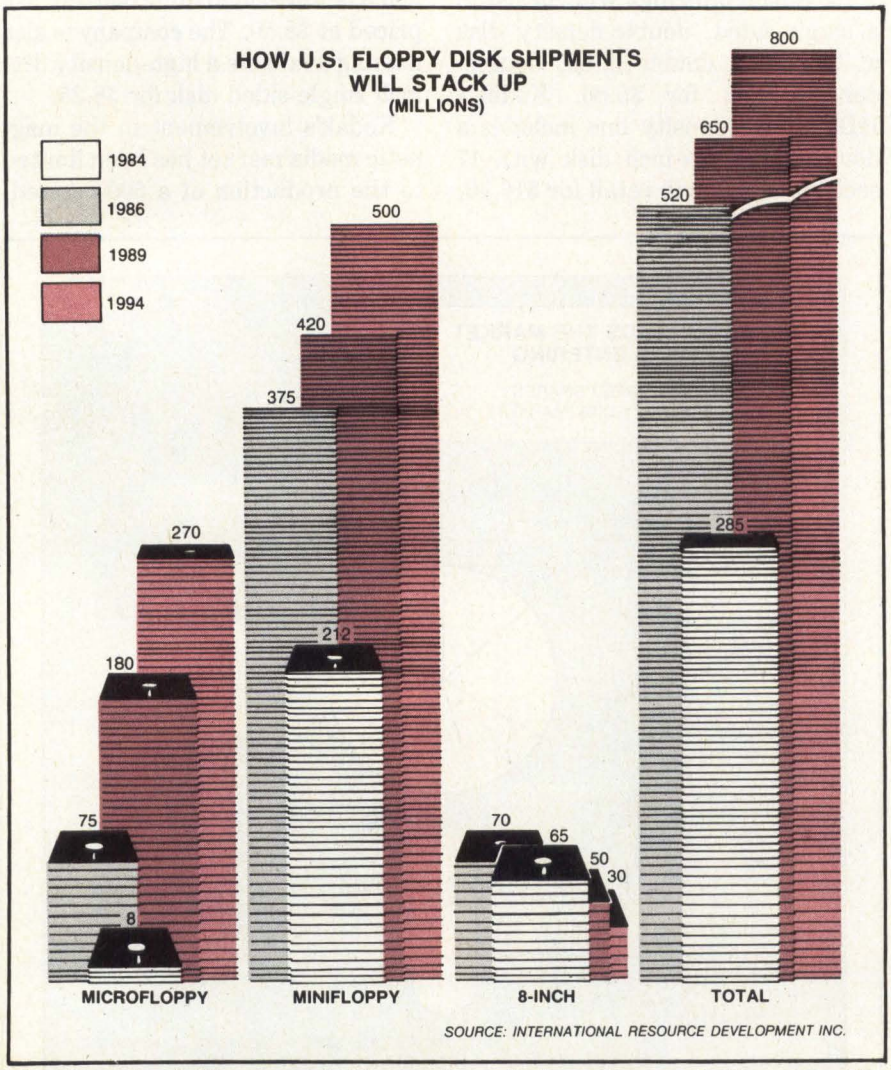
Joan de Regt, senior consultant at the research company International Resource Development Inc. (IRD), Norwalk, Conn., says getting into the floppy disk market is logical for Kodak in light of its longtime mastery of coating technology. "Since Kodak has been involved in this process, it makes sense for them to develop products that use that expertise," de Regt states.

Carving out market share

The main problem for Kodak, de Regt points out, could be timing. The company is entering an intensely competitive market in which other companies already are well-entrenched. She sees Kodak's primary competitors as Verbatim Inc., Sunnyvale, Calif., which currently holds a 20-percent share of the floppy disk market, and Dysan Corp., Santa Clara, Calif., which follows with a 12-percent market share. If Kodak is lucky, according to de Regt, it might be able to carve out a 3-percent to 4-percent share of the business. If Kodak manages to snag a significant share of the market, then it will probably draw some business away from Verbatim and Dysan, de Regt comments. It is more likely, however, that Kodak will slug it out with the assortment of new companies appearing on the scene, including a host of Japanese companies and Polaroid Corp., which has announced its plans to enter this field as well, de Regt says.

IRD estimates that 285 million flexible disks were shipped in the United States during 1984. That figure is expected to reach 650 million disks by 1989. The research company predicts strong growth in the microfloppy category and slackening interest in 8-inch disks. The 5¼-inch category is expected to hold a significant market share in the foreseeable future, even though it could drop from 74 percent of total shipments to 65 percent as microfloppies pick up speed.

Kodak's marketing strategy includes distribution through retail, OEM, system integrator and direct sales channels. □



The 5¼-inch minifloppy market *is growing quickly and is expected to account for most of Kodak's disk business.*

NEXT MONTH IN MMS

The February issue of Mini-Micro Systems examines the Small Computer Systems Interface (SCSI)—one of a number of emerging intelligent interface solutions.

MMS will look at who is supporting SCSI's development and how its use will impact systems integrators, peripherals manufacturers and software developers.

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CIRCLE NO. 24 ON INQUIRY CARD

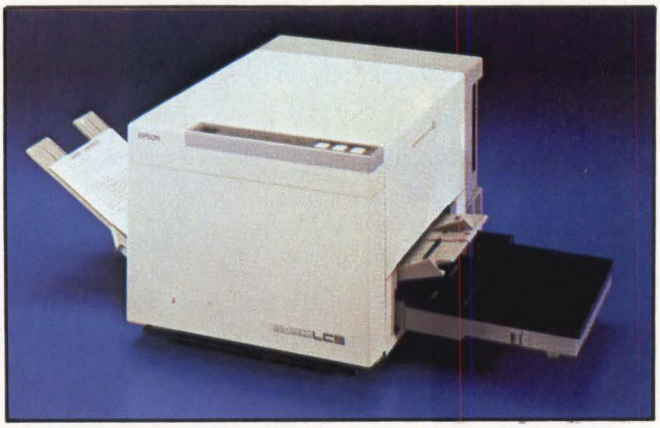
Liquid crystal shutter technology shines new light on page printers

Carl Warren, Western Editor

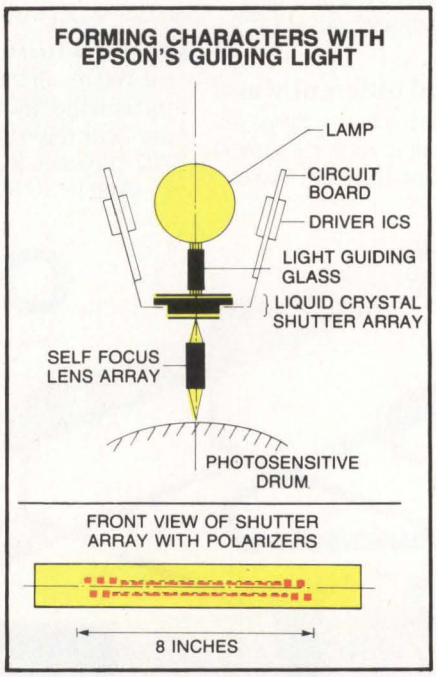
Impact dot-matrix printer market leader, Epson America Inc. of Torrance, Calif., is betting on liquid crystal shutter (LCS) technology to establish itself in the non-impact page printer market.

The LCS technology is built into the newest Epson model, the GQ 3000, which prints at seven pages per minute (ppm). Prices for OEMs are expected to be less than $2,000, including the controller. The end-user price for one unit is less than $5,000.

"Right now we are aiming at the OEM," says Samuel Elias, product manager of Epson's OEM products division. He says that although a number of the units are under evaluation, a full marketing strategy hasn't been set up. "We are looking at the various ways of selling the printer," says Abram Fuks, product support and development manager. "We believe that there are two markets: one for an entire printer, and one for the LCS head mechanism."



The desktop Epson GQ 3000 *page printer produces seven pages per minute at a cost of about 1.6 cents per page.*



Epson's liquid crystal shutter character-writing technology *uses a high-intensity fluorescent lamp beam, which is guided though a glass tube onto a liquid crystal array. Polarizer "shutters" in the array determine how the light will fall onto the drum to form images.*

A twist on technology

The basic GQ 3000 OEM printer works by depositing toner particles on a charged drum to form characters, which is similar to the way magnetic and laser printers create characters. But rather than using a laser or a charged head to write an image onto the drum, the GQ 3000 does it with a series of staggered liquid crystal matrices. A high-intensity fluorescent lamp beam is guided through a glass tube onto a liquid crystal array. The matrices are shuttered with polarizing plates that determine whether or not a given area on the drum surface will attract and hold a character. According to Victor Klimas, product technical specialist at Epson, the GQ 3000 is a positive-image, rather than a negative-image, system. "We only deposit material on the charged-character area rather than [on] the background. This, we feel, gives us a better character clarity." No toner need be scraped from non-charged portions of the drum, eliminating the chance of shadows around the characters.

To ensure a ready market for its product, Epson elected to have the GQ 3000 emulate the Xerox 2700 laser printer which, at $20,000, is one of the more popular low-cost page printers. Klimas explains other emulations are possible, such as Diablo Systems Inc.'s model 630 daisywheel printers. "It depends on what the OEM wants. We can work with them to develop any desired emulation."

Not 'me too'

Canon U.S.A Inc. also has a popular laser page printer that is setting that market's pace for low price. It emulates a daisywheel printer for less than $5,000. But Epson wants to make sure its product isn't considered a "me-too" effort. "We don't want to be lumped in the Canon mass-market crowd.

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That calls for low [price] and short [product] life," Elias says. He notes that Epson's drum should be changed after printing 60,000 pages, but it could print double that number.

But there doesn't appear to be great demand for this kind of printer. Jonathan Dower, vice president of Datek Information Services Inc., Newtonville, Mass., a research firm specializing in printers, notes that the market really hasn't formed. "It's tough to break in with a new technology implementation. Lasers are the dominant force. Currently, page printers command only 1 percent of the entire printer market and OEMs are holding back. It would be unfair, however, to say Epson hasn't a chance. They do—as much as anyone else. As far as technology goes, LCS is as legitimate as anything else."

Competition from many quarters

Even though Epson is keeping an eye on the movements of Canon and other laser printer makers, they will have to consider the impact of other technologies as well. For example, ink-jet technology is receiving a great deal of favor in many quarters, especially for computer-aided design applications and presentation graphics. But Elias claims that is a different area altogether. He says that the GQ 3000 is for applications requiring high-quality, typeset-like printing at a low cost.

The cost of owning one may prove to be a major consideration in whether to buy one. For example, the cost of owning a daisywheel, fully formed character printer, once it's bought, can be as high as 5 cents per page. This figure is based on the cost of ribbons (typically $5 to $10), print wheels ($10 to $25) and maintenance. "The cost of ownership is often forgotten," asserts Fuks. "The cost of producing one page of printed copy can be very expensive." Since Epson considers the cost of ownership an important issue, they have been running comparison tests and claim a cost-per-page for the GQ 3000 as low as 1.6 cents. "We figure in all the costs: $250 for a service call, $750 for toner, a new drum, parts and service time for a three-month period with 60,000 copies," maintains Klimas.

HOW THE PAGE-PRINTER COMPETITION STACKS UP

	Canon LBP-CX	Epson GQ 3000	Ricoh LP-4120	Xerox 2700
Speed (ppm)	8	7	12	12
Resolution (dpi)	240/300	240	300	300
Standard interface	serial video	parallel/serial	serial video	parallel/serial
Unit price (including controller)	<$5,000 (daisy-wheel emulation) <$10,000 (bit-map version)	<$5,000	$9,950 (controller is $4,000 more)	$19,995

Printer employs MC68000

The GQ 3000 LCS printer uses Motorola Inc.'s MC68000 microprocessor and has 128K bytes of RAM (expandable to 256K bytes). At press time, the specifications were subject to review by OEMs, so some features may change slightly. For example, production units may come with 256K bytes of RAM. Also available is 64K bytes of ROM containing four character fonts (expandable to 15 fonts either by Epson or OEMs) and a multitasking operating system. The operating system is responsible for handling all the printer functions, as well as loading various characters and graphics. The LCS is controlled separately by an 8-bit microprocessor.

Currently, the GQ 3000 only permits an 8-inch-wide writing surface because it uses a fluorescent light source. Klimas explains that the light source tends to lose intensity at the ends of the tube, thus the 8-inch restriction. However, future products will use a brighter halogen lamp to permit wider copy.

The GQ 3000 includes an 8-bit Centronics-compatible parallel port and an RS232C serial port. Speed control and protocol characteristics are set via DIP switches located on the interfaces. Additionally, the printer has onboard diagnostics that test all data channels, LCS circuits and paper path controls.

The GQ 3000 is slated for shipment in the first quarter of this year. □

DEC INTRODUCES ITS 'MOST RELIABLE' PRINTER

The new 240-character-per-second Letterprinter 210 dot-matrix printer is the most reliable printer Digital Equipment Corp. has ever manufactured, according to company officials. The $1,595 unit's printhead uses laminated core technology and requires less electrical current than the company's previous printers, resulting in cooler operation, improved print quality and a claimed printhead life of more than 500 million characters. The model has a Centronics parallel interface option and is compatible with all of DEC's computers, as well as systems from more than a dozen vendors, including IBM Corp. and Apple Computer Inc. It emulates the IBM Graphics Printer and the Epson America Inc. MX-80 printer.

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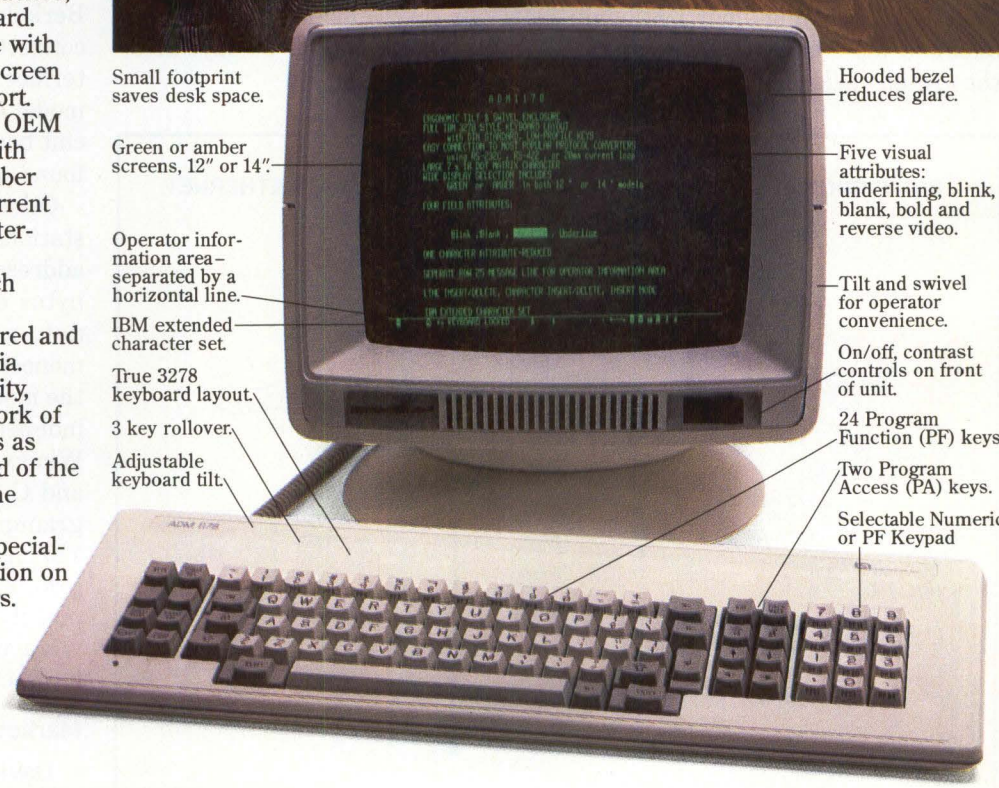

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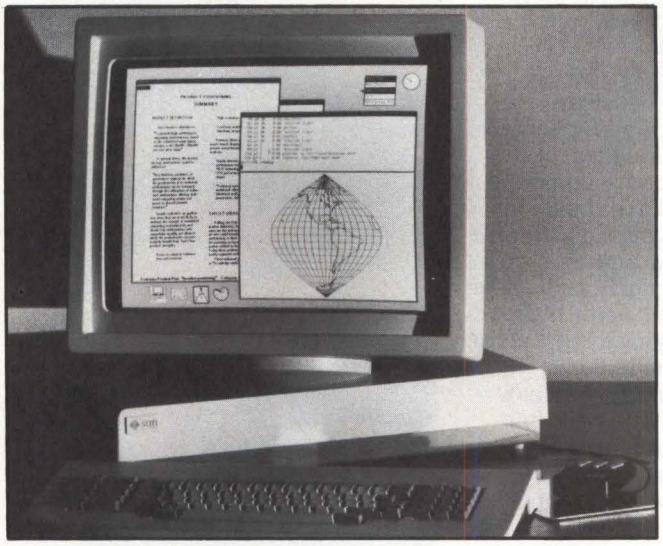
Sun's diskless engineering workstation lowers the cost of adding network users

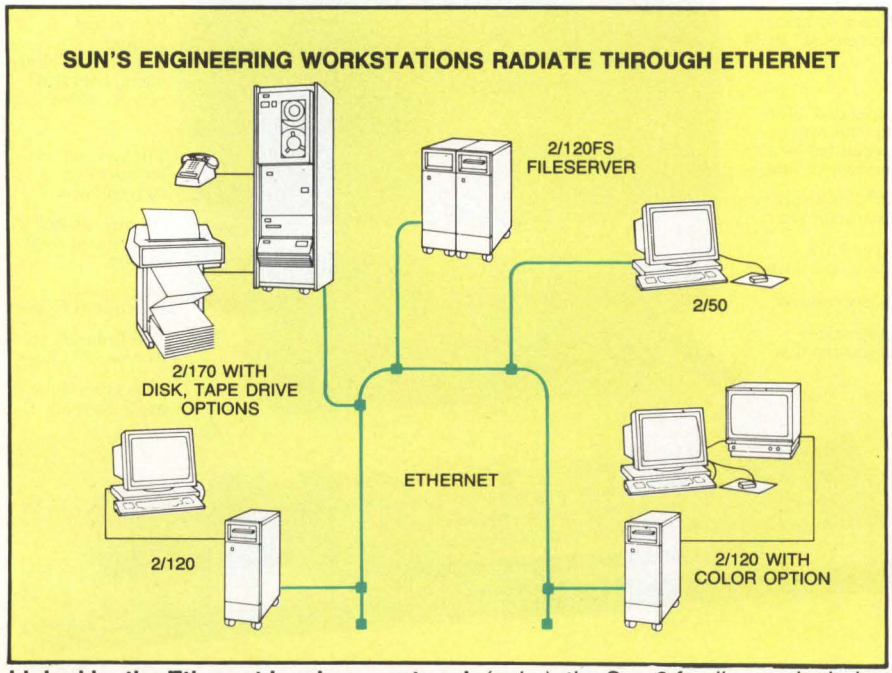
Tom Moran, Associate Editor



The Sun-2/50 from Sun Microsystems, *Mountain View, Calif., shares system-storage devices and eliminates an on-board disk drive.*

To lower the overall cost per user of its distributed-network environment, Sun Microsystems Inc., Mountain View, Calif., has extended its product line with the diskless Sun-2/50 workstation. The model 50 is Sun's first desktop product and is designed to complement and share resources with two previous products, the Sun-2/120 and Sun 2/170, which are pedestal and rack-mount configurations, respectively.

According to Jay Puri, marketing manager for Sun, the model 50 will reduce the cost per user of Sun-2 systems to below $19,000 in OEM quantities. Puri says that figure represents a 30 percent to 35 percent decrease in the cost of adding each user, including amortization of disk and tape storage. Sun expects the retail price of the Sun-2/50 workstation to be about $19,900 for one unit, compared to $16,900 currently for its entry-level workstations. The model 50 was expected to be available 60 days after receipt of order.



Linked by the Ethernet local area network *(color), the Sun-2 family now includes the Sun-2/50, a new diskless node for adding users inexpensively.*

All the Sun workstations are based on Motorola Inc.'s 10MHz MC68010 microprocessor, run Berkeley UNIX Version 4.2 and connect to Ethernet via built-in interfaces. As a desktop unit, the model 50 uses only one printed circuit board, eliminating the Multibus found on the 120 and 170.

Other features of the Sun workstations are: 16M bytes of virtual address space per process; up to 4M bytes of RAM; a 1,152-dot-by-900-dot, non-interlaced, bit-mapped monochrome display (optional on the model 170); the SunCore device-independent graphics library; SunWindows window display manager; and C, FORTRAN and Pascal programming languages. The model 120 has a 9-slot card cage with integral disk and tape options, and the model 170 has a 15-slot card cage with options for rack-mounting large-capacity storage devices.

Market to boom as prices fall

David Burdick, senior industry analyst for market research group Dataquest Inc., San Jose, Calif.,

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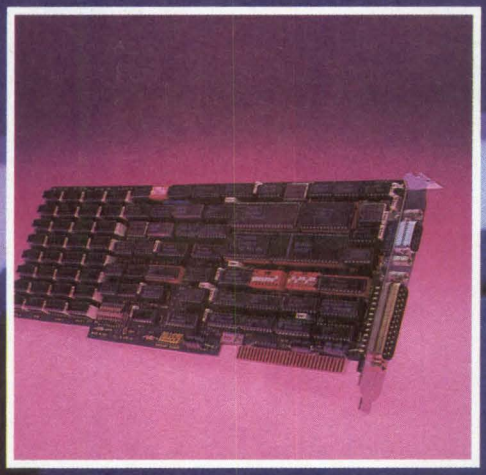

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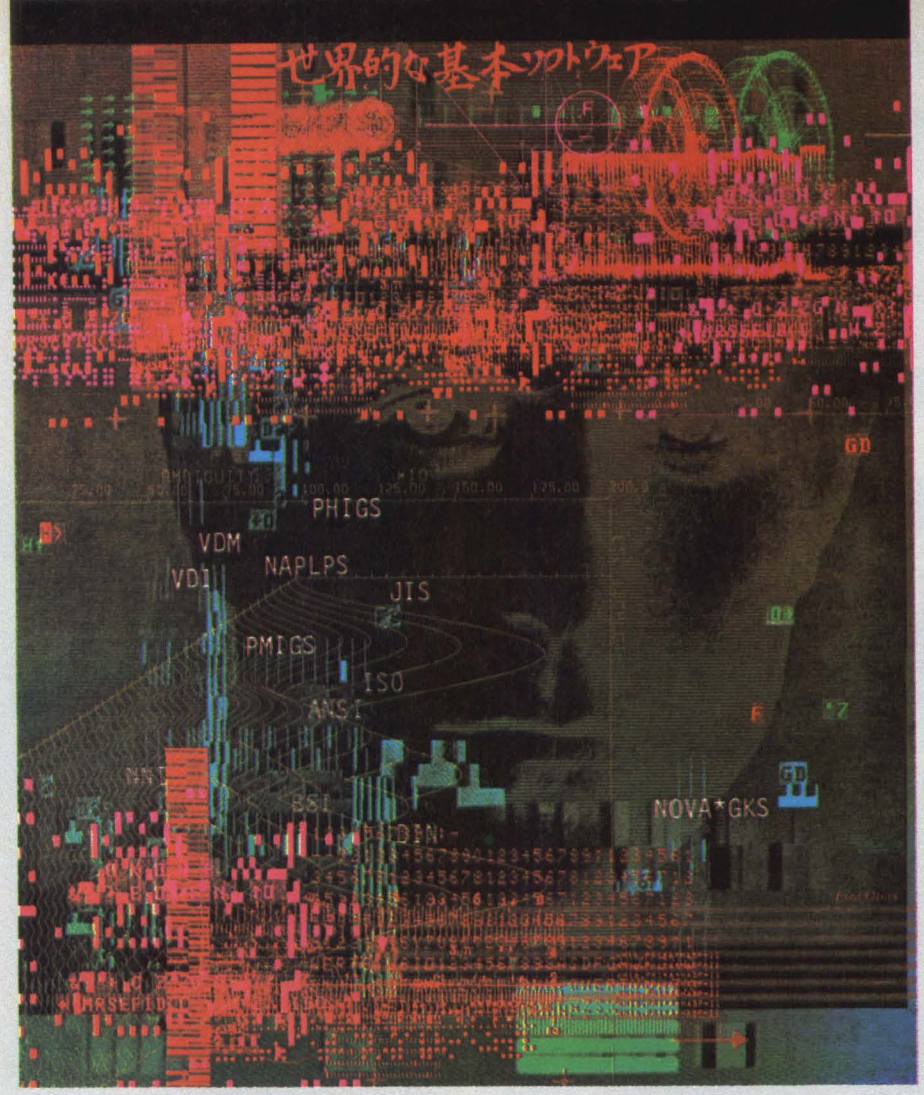

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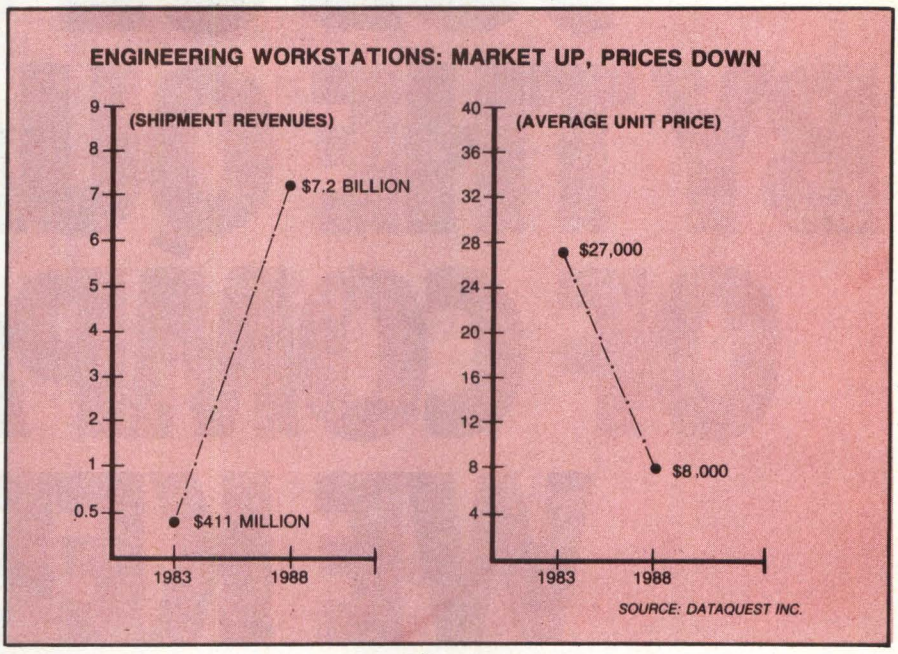
says Sun's strategy with the model 50 is to take advantage of falling prices in RAM, disks and other components. "It appears that they want to be the low-cost producer and to push the upper limit of price/performance."

Dataquest figures show the engineering workstation market growing at an annual compound rate of 78 percent, faster than any other architecture in the design and manufacturing automation industry. Industry-wide revenues from shipments of engineering-workstation hardware, software and peripherals should skyrocket from $411 million in 1983 to $908 million in 1984 and $7.2 billion in 1988, according to Dataquest figures.

Burdick predicts that as the market grows, the price of an average standalone workstation will decline from $27,000 in 1983 to $8,000 or lower by 1988. Factors in that compound annual price drop of 27 percent will include upcoming higher-bandwidth CPUs such as National Semiconductor's NS32032 and Motorola's MC68020, which, when available, will put downward price pressures on the NS16032 and the MC68010. Burdick says increased competition (between Sun, industry leader Apollo Computer Inc. and possible newcomers) will also drive prices down, as will the availability of 256K-bit RAMs.

Burdick sees Sun as a clear number two in the engineering workstation market behind Apollo, of Chelmsford, Mass., which also offers diskless models in its Domain series. "[Sun is] certainly very competitive," Burdick says. "Apollo can't meet all the demand and Sun is positioned to take advantage of that." He expects that Sun and Apollo will be setting the pace for price and performance in the engineering workstation industry. The minimum price for a Domain diskless workstation is $15,900. That includes a 1,024-dot-by-800-dot monochrome display, the AEGIS operating system, 1M byte of main memory and two asynchronous RS232 ports.



An important difference between Apollo's and Sun's approaches is that Apollo uses its proprietary, distributed operating, multiaccess, interactive network (Domain) architecture, as opposed to Sun's open architecture embracing Ethernet and UNIX. (Apollo does offer a version of UNIX called AUX, which is priced separately.) An Apollo spokesman points out that Apollo's token-passing ring topology and software architecture permit users to regard all the disks on a network as a subdirectory sitting on its own local-storage disk.

Sun vice president of marketing Carol Bartz cites Apollo as Sun's main competition. Bartz states that Sun's revenues jumped from about $9 million in 1983 to $39 million at the end of fiscal 1984. She predicts 1985 revenues of $100 million. □

MULTIMATE EXTENDS WORD-PROCESSING SOFTWARE

Multimate International Corp., East Hartford, Conn., has introduced version 3.3 of its Multimate Professional word-processing package. Priced at $495, the new version not only allows file conversion from mainframe systems to microcomputers, but also supports true proportional spacing and ASCII and Teletext file conversion. Additionally, a special cable editor communicates with new printers and takes advantage of special print functions.

DEVICE TESTS DISK DRIVES

For system integrators who need a testing method for disk drives, Computer Programming Services, Glendale, Calif., has developed a series of programs called DISKTEST. The company claims that the programs exercise and test both absolute byte-transfer-rate devices and access times in an operating environment. Currently, versions for the Digital Equipment Corp. PDP-11 and VAX systems are available.

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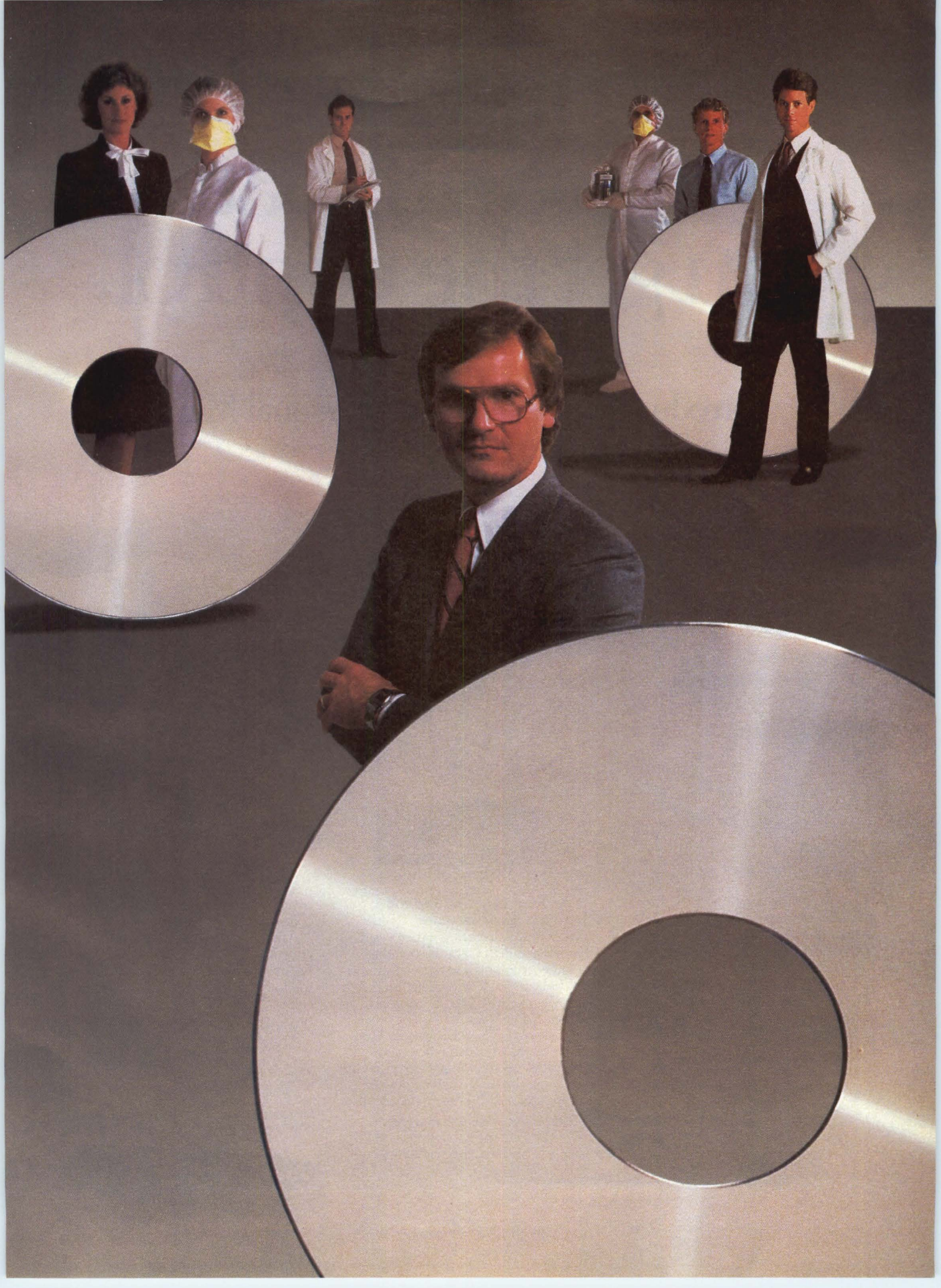

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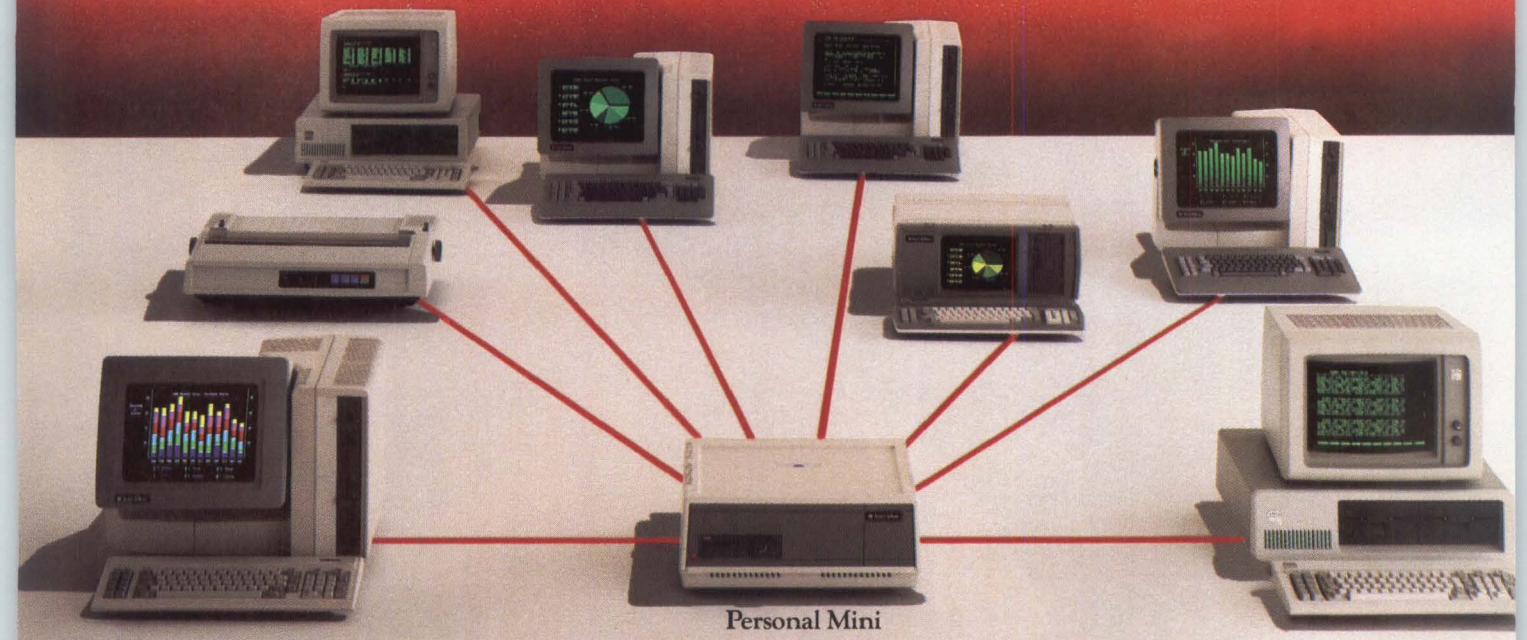

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GUEST FORUM

The voice for guest experts

John J. Davis is a founder and the president of Worldwide Computer Services Inc., Wayne, N.J., which specializes in temporary, on-site assignments of computer, software and communications professionals.

High-tech temporary help booms amidst hiring and wage freezes

John J. Davis
Worldwide Computer Services Inc.

Two different problems can have the same solution: professional high-technology temporary employees. For the worker, becoming a "temporary" can add variety to an otherwise dead-end career. And companies can retain temporary senior professionals on specific projects without being restricted by salary and employment freezes. The companies also would not have to carry excess staff members during slow periods.

In a typical scenario, several staff members leave midway through a project, thereby jeopardizing contract or delivery schedules. To solve the problem, employers turn to temporary professionals who can be on site within two weeks, be operative almost immediately and offer very specific work skills. Upon completion of the assignment, the relationship of the employer with the temporary ends.

The use of such independent "consultants" within the computer industry dates back to the 1960s, when the industry first sought ways to bridge employment gaps during peak activity at a company.

Fueling the interest in consulting are the career crises faced by many engineers and computer professionals: Will their careers continue to progress if they remain with their current employer, or are their current positions really a dead end? Professionals also dislike being pigeon holed or becoming overly qualified in narrow job classifications. And, the potential for a temporary to prevail over salary freezes provides an additional incentive.

The fear of being unemployed is lessened when specialists work through temporary agencies. In some instances, they actually become employees of the temporary agencies. Or they use agencies solely to handle job assignments. By "signing on" with an agency, specialists avoid the uncertainties of being a free agent. The typical assignment lasts from six to 18 months.

Depending on the temporary's skills, the employer and the assignment itself, daily rates range from $250 to $650. The temporary placement firm receives a negotiated portion of the fee.

Employers also benefit financially even though the daily rate sounds somewhat high. Temporaries, who might earn $30,000 to $90,000 a year or more, are not covered by corporate benefit plans that add 30 percent to 40 percent to base salaries. Use of temporaries eliminates additional hiring costs such as employment agency fees or personnel ads in newspapers. And temporaries fill a gap for the three to six months it takes to fill a job following the resignation, firing or promotion of a permanent staff member.

Financings

Los Gatos, Calif., startup company Cohesive Network Corp. recently received $6 million in its second round of equity funding, bringing its total to $7.5 million. At press time, the two-year-old company had not yet announced its first product but claimed it would help integrate voice, data, video and other telecommunications products. The lead investors are Sutter Hill Ventures and Bessemer Venture Partners.

Interleaf Inc., a Cambridge, Mass., developer of office publishing systems, has brought in additional financing of $5.1 million, for a total of nearly $8 million. The funding will be used to expand marketing activities. Major investors include Eastman Kodak Co. and Hambrecht & Quist. Interleaf's systems produce, from start to finish, documents containing multiple typefaces and graphics.

Quarterly reports

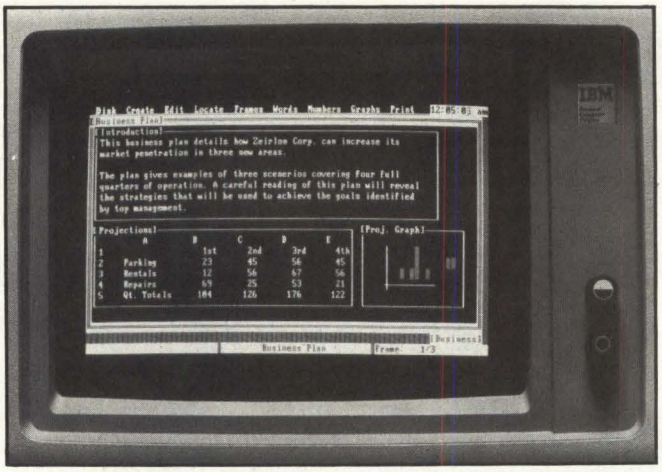
Despite Intel Corp. president Andrew Grove's comment that he expects his company's growth rate to slow because of increased industry-wide semiconductor supplies, the Santa Clara, Calif., company posted a third-quarter net income of $70 million. This was an increase of 118 percent over the third quarter of last year, when net income totalled $32 million. Share prices moved up from 29 cents to 60 cents, while revenues were up 48 percent, from $292 million to $432 million.

Revenues for the first three quarters of this year rose to $1.2 billion, compared to $790 million in the

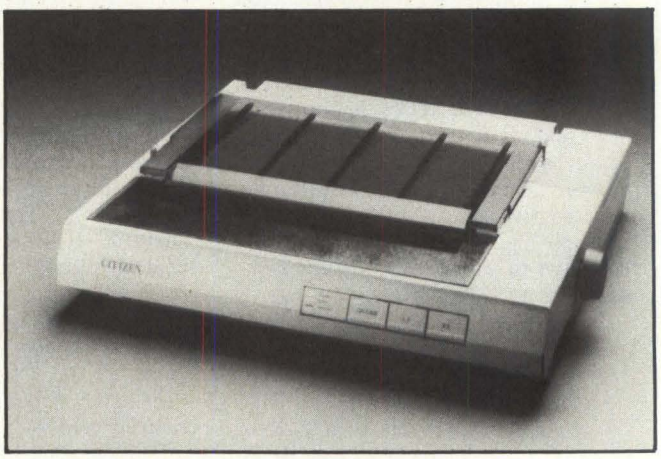
same period last year. Net income for the three quarters also increased, reaching $175 million, or $1.50 per share, as opposed to $69 million, or 64 cents per share, in the earlier period. Grove adds that system sales were weaker than expected.

With competitors rapidly dropping by the wayside, IBM Corp.'s fortunes continue to grow. Nine-month revenues swelled to $31.4 billion, compared to $27.3 billion in the same period a year earlier. Net earnings for the nine months increased to $4.4 billion, or $7.22 per share, from $3.6 billion, or $5.98 per share in 1983.

Total revenues for the third quarter itself grew to $10.7 billion, versus $9.4 billion in the third quarter of 1983. Net earnings for the quarter reached $1.6 billion, or $2.60 per share, against $1.3 billion, or $2.14 per share, in the third quarter of 1983. □



Ashton-Tate will ship *more than $5 million worth of its microcomputer products to Tandy Corp., including the Framework integrated software package.*



Waybern Corp. will distribute *Citizen America's first printers, including the 80-column, 160 character - per - second MSP-10 dot matrix model (shown), and the 136-column MSP-15.*

Contracts

Archive Corp., Costa Mesa, Calif., has been awarded a $3 million contract to supply ¼-inch streaming tape drives to Metaphor Computer Systems. Metaphor will use the drives as backup devices in its database management system, Metaphor Computer....Culver City, Calif., software vendor Ashton-Tate has contracted to ship more than $5 million worth of its microcomputer software packages to Tandy Corp. Tandy will distribute Ashton-Tate's Framework integrated software, as well as the dBASE III and Friday! packages, through its Radio Shack store chain.....Charles River Data Systems is one of the latest vendors to sign a contract with the People's Republic of China. The Framingham, Mass., supermicrocomputer vendor will deliver 275 of its Universe 68 systems, worth an estimated $5 million, to the Tianjin Electronic Computer Factory over an 18-month period. Tianjin will add business and industrial applications software to the systems, which include Charles River's UNIX-like operating system UNOS....Citizen America, Santa Monica, Calif., has chosen Waybern Corp. as one of the first distributors of Citizen's initial line of dot-matrix printers. The $3 million agreement includes the MSP-10 and MSP-15, 80- and 136-column, 160-character-per-second printers, which are both compatible with Epson America Inc. and IBM Corp. printers....Cullinet Software Inc., Westwood, Mass., has signed a development agreement with Digital Equipment Corp. to integrate Cullinet's Information Database software with DEC's VAX superminicomputer systems. The two companies will also cooperate to market existing products and to develop interfaces between VAX systems and IBM mainframe systems....DAVID Systems Inc., Sunnyvale, Calif., and Sharp Corp. have reached an agreement giving Sharp exclusive rights to manufacture and distribute DAVID communication products in Japan. The products from DAVID allow simultaneous transmission of voice, circuit-switched data and high-speed packet data over twisted pair telephone lines....In a $10 million agreement, Bell Atlantic will market and service the proNET local area networks from Proteon Inc., Natick, Mass. The token-ring network provides 10M-bit-per-second host-to-host connections. □

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Large Korean companies lead country's technology drive

After attracting 380 exhibitors *and thousands of buyers, the Korean Electronics Show generated an estimated $750 million in equipment sales.*

Charles Hintermeister
Taiwan Correspondent

The 15th Korean Electronics Show gave clear evidence of what observers of the Korean Computer industry have known for some time: A handful of well-funded conglomerates such as Samsung Electronics, the Hyundai Group and Goldstar Electronics have been aggressively developing and promoting their capabilities and products, while the vast majority of Korean computer firms, struggling with low budgets and making little or no investment in research and development, increasingly find themselves locked into producing low-quality, 8-bit, dual-processor systems.

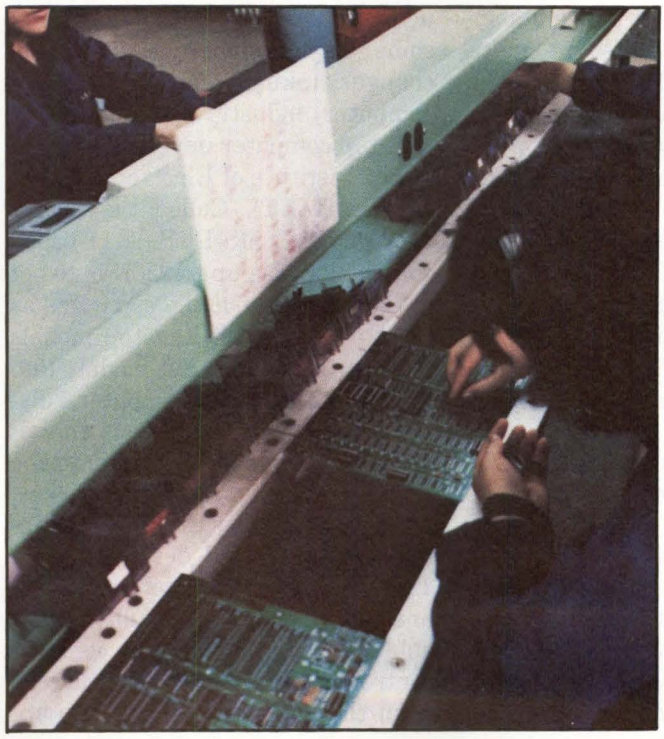
Nowhere was this more evident than in the show displays, which included UNIX-based, 32-bit supermicrocomputers, sleek intelligent terminals, digital switching equipment, optical fiber telecommunication systems and VLSI chips—alongside chintzy electronic trinkets and crude Apple II knock-offs.

The show—held in Seoul, South Korea, October 10th to 15th, as part of the Seoul International Trade Show—was a startling success, its mixed bag of products notwithstanding. About $190 million worth of business was conducted on just the first day, according to the Electronic Industries Association of Korea, which projected that sales generated by the show would reach $750 million.

The Taiwan Electronics Show, held directly before the Korean display, produced only $27 million in orders, although the electronics industries of the two countries are about the same size. Observers speculated that the volume of business done at the Korean show was larger than at the Taiwan show because buyers found it necessary to actually travel to Korea to place orders at the show itself, whereas business with Taiwanese manufacturers can be conducted more easily, via mail and telex.

IBM PC-compatibles compete

As in the recent electronics shows in Hong Kong and Taiwan, many IBM Corp. PC-compatible systems



A line worker assembles printed circuit boards *for Korea's Trigem Computer Inc., which manufactures IBM PC/XT-compatible computers.*

were on display. While a number of such computers had suspicious pedigrees, the majority seemed in no immediate danger of incurring a lawsuit by IBM. Free-on-board (f.o.b.) prices of Korean IBM PC/XT-compatible systems tended to be 10 percent to 20 percent cheaper than those available in Taiwan, but of more varying quality.

Trigem Computer Inc. displayed a system billed as "99.9 percent" compatible with the PC/XT. Known as the Trigem 88, the system uses a BIOS developed by Personal Computer Products Inc. of Los Angeles, Calif., according to S.G. Kang, manager of Trigem's overseas business division.

The Trigem 88's standard configuration, which consists of a CPU with 128K bytes of RAM, expandable to 768K bytes, dual floppy disk drives with a total of 1M byte of formatted storage, and an 83-digit keyboard, goes for as little as $1,000, f.o.b., depending on quantity. Also standard equipment is the "Trigem multivideo card," which offers both monochrome and color graphics support in a single expansion card, and a 128K-byte multifunction card. A 10M-byte hard disk drive may be purchased for an additional $600. The rear panel of the Trigem 88 features an RS232 communications port and a parallel printer port. Trigem, which last year registered total sales of $8 million, is actively seeking OEM buyers for the Trigem 88, says S.G. Kang.

Hyundai Electronics Industries Co. Ltd., part of one of Korea's largest conglomerates, the Hyudai Group, displayed for the first time its Super-16 IBM PC/XT-compatible computer and a 10M-byte hard disk drive. The Super-16, said Hwan-Ik Jung, manager of the firm's international sales department, was completely designed in-house, and does not infringe upon any IBM patents or copyrights.

The Intel 8088-based system offers 256K bytes of RAM, expandable up to 512K bytes on the same board, and two built-in, 320K-byte, 5¼-inch floppy disk drives. Space is provided for two additional floppy drives or two 10M-byte hard drives. The board contains seven I/O slots, and the rear panel sports two RS232 communications ports and one parallel printer port. The system's low-profile keyboard uses 108 membrane-type keys, and includes 10 function keys. The Super-16 offers SNA/SDLC, bisynchronous and asynchronous communications protocols, which enable the system to be used as a local/remote terminal or remote-job entry terminal.

The Super-16 has not yet been marketed outside of Korea, says Jong, adding that Hyundai welcomes OEM business. The f.o.b. price for one standard-configuration CPU and keyboard will be about $1,500, he says.

Korea makes kneetop computer

One of the more interesting products at the show, and one which in some ways symbolizes the rapid changes taking place in Korea's computer industry, was a 16-bit kneetop computer developed by the Korea Institute of Electronics Technology (KIET). Called the Sprite S-1000, the MS-DOS 2.11-based computer packs up to 256K bytes of RAM, but is about the same size as most popular 8-bit kneetop models (NEC 8102A, Tandy model 100, Epson PX-8). The computer, displayed in prototype form, is an ambitious and promising entry into the booming kneetop-computer market, observers say, but has several annoying, unresolved design defects: The angle of the 80-column-by-16-line LCD display is not fully adjustable and does not feature a contrast control, for instance. In its current form the computer contains no application software, but KIET plans to include several popular IBM PC-compatible packages before the machine is released as a commercial product.

KIET, a Korean government-supported research and development organization with a staff of 200 engineers, plans early this year to transfer technology for the Sprite S-1000 to a large, private-sector firm in Korea, according to Jong Soo Shin, one of the KIET engineers who designed the system. The unit will be priced between $1,500 and $2,000, f.o.b., he says.

The Iljin Electronic and Industrial Co. Ltd., an OEM manufacturer for Corvus Systems of the United States, displayed a MC-68000-based workstation it is making for Corvus to market under its own name. The "Concept" workstation features 256K bytes of main memory, a 15-inch, high-resolution, bit-mapped display, an onboard Omninet local area network card and up to 45.1M bytes of hard disk storage. It is designed to handle word processing and business graphics, and can double as an intelligent terminal. Iljin also displayed local area networks for IBM PC computers and Apple II computers, each of which carried a suggested retail price of $600.

Another MC68000-based computer system on display at the show, from Samsung Semiconductor and Telecommunications Co., runs an enhanced version of the UNIX operating system. The multiuser system, called the SSM-16, was developed by Samsung in cooperation with KIET.

Koryo Systems Inc., a subsidiary of the Korea Explosives Group, also introduced a supermicrocomputer at the show. Available in both 16-bit and 32-bit configurations, the KSYS-168 is based on the MC68000 chip family, and can support up to 16 users. The 32-bit version features up to 16M bytes of main mem-

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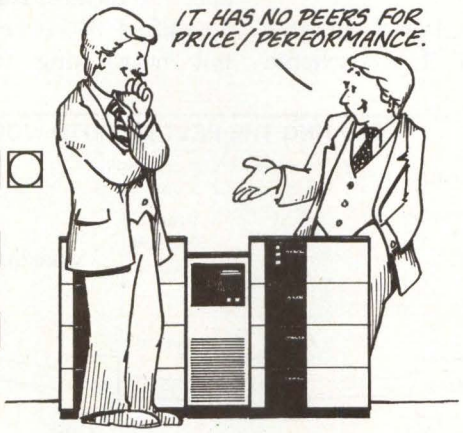

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ory, 1.2M bytes of floppy disk memory and a maximum of 1,200M bytes of hard disk memory. Like the Samsung supermicrocomputer, the KSYS-168 was designed and manufactured in Korea, though many of the components were imported.

The presence of the supermicrocomputers surprised many of the buyers present, many of whom had just come from the Taiwan show. The Taiwan computer industry, which is generally regarded as being two or three years ahead of its Korean counterpart, has thus far not produced a supermicrocomputer. However, two Taiwanese companies, Multitech Industrial Corp. and Mitac Inc., are said to be developing them now.

Korea, home of Asia's second largest electronics industry (Japan is the largest), last year produced $5.6 billion worth of consumer and industrial electronics goods, 54 percent of which were exported. Computer product manufacturing, according to Korean government statistics, reached $207 million in 1983, compared to $47 million in 1982. Major increases in OEM orders by large U.S. firms are expected to substantially increase export figures for this year.

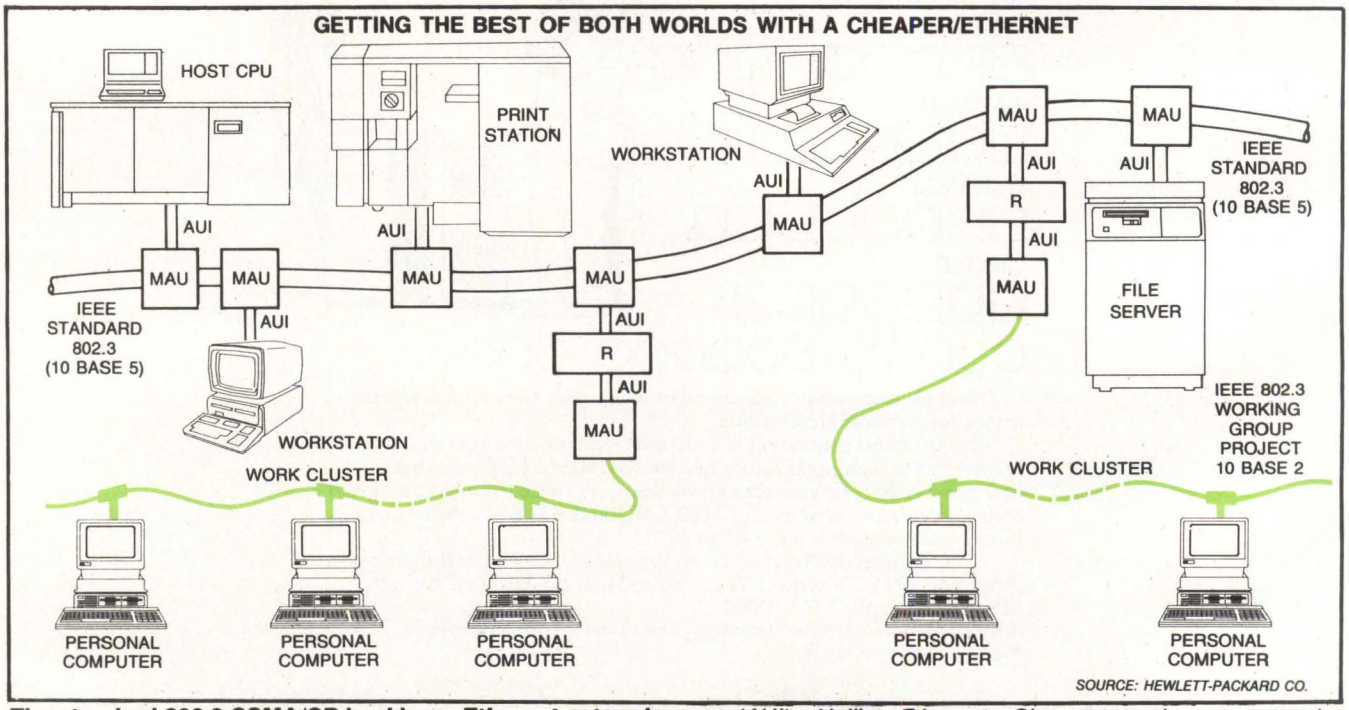
Although Korea's computer industry, like those in Taiwan, Hong Kong and Singapore, strongly encourages OEM business, the country's population of 40 million provides it with a large domestic market. Domestic sales (of both local and imported products) last year accounted for $300 million of the $411 million in total computer product sales. □

Cheapernet makes local area networking more affordable

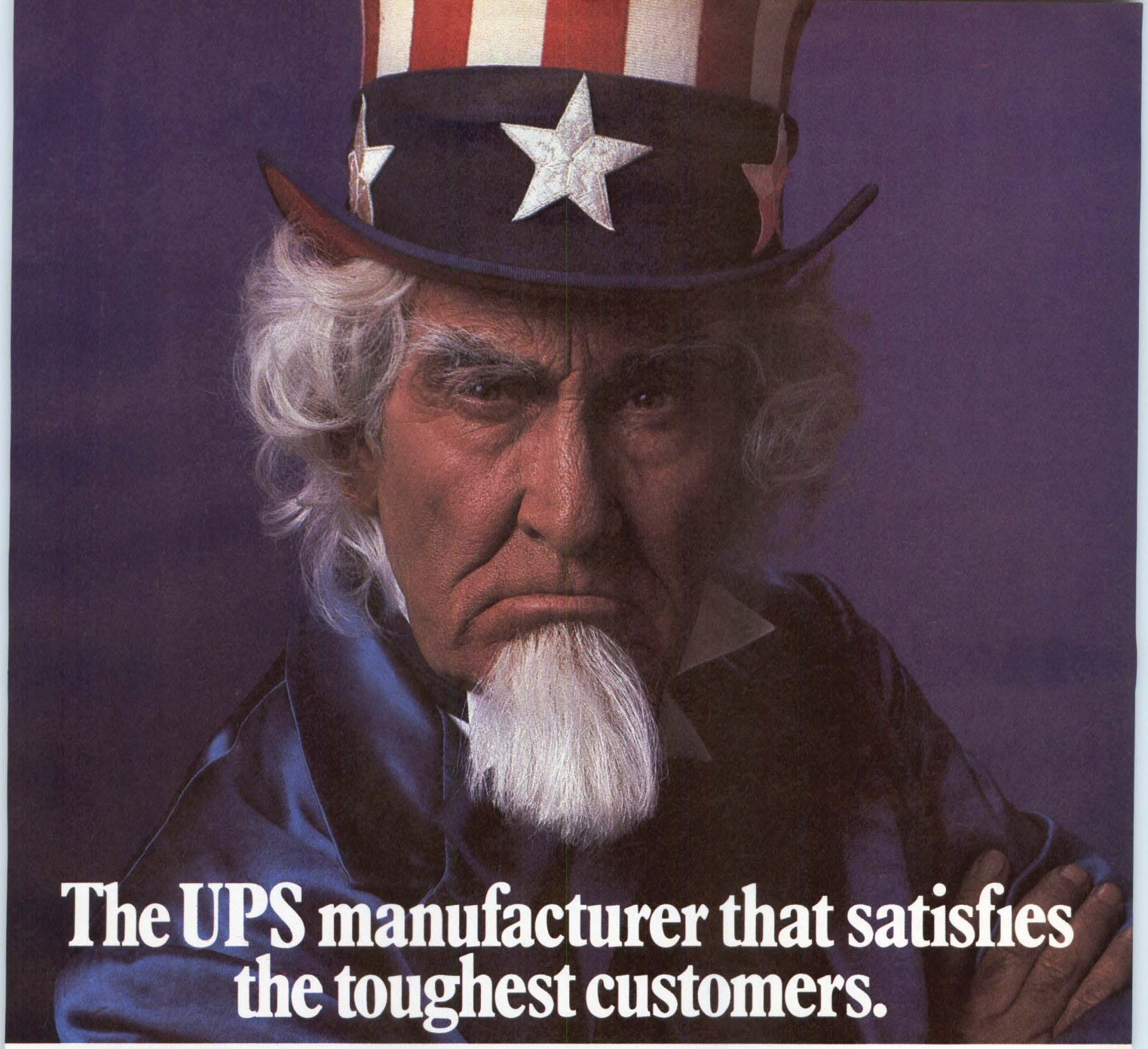
Keith Jones, European Editor

The Ethernet local area network (LAN), a standard LAN scheme gaining popularity in offices, remains too expensive for some prospective buyers. But two lower-cost "modified Ethernets" that would put networking within reach of many more users are now under review by committees within the Institute of Electrical and Electronics Engineers (IEEE).

One of the modified Ethernets is the appropriately named Cheapernet. Its bus technology is being defined by IEEE working group



The standard 802.3 CSMA/CD backbone Ethernet network *and the proposed standard low-cost Cheapernet network (in color), can be attached to form a hybrid local area network through repeaters (R) and attachment unit interfaces (AUI). Unlike Ethernet, Cheapernet does not require external medium attachment units (MAU) housing transceivers. The "10 Base 5" means Ethernet operates at 10M bps on baseband cable and allows 500 meters between nodes.*



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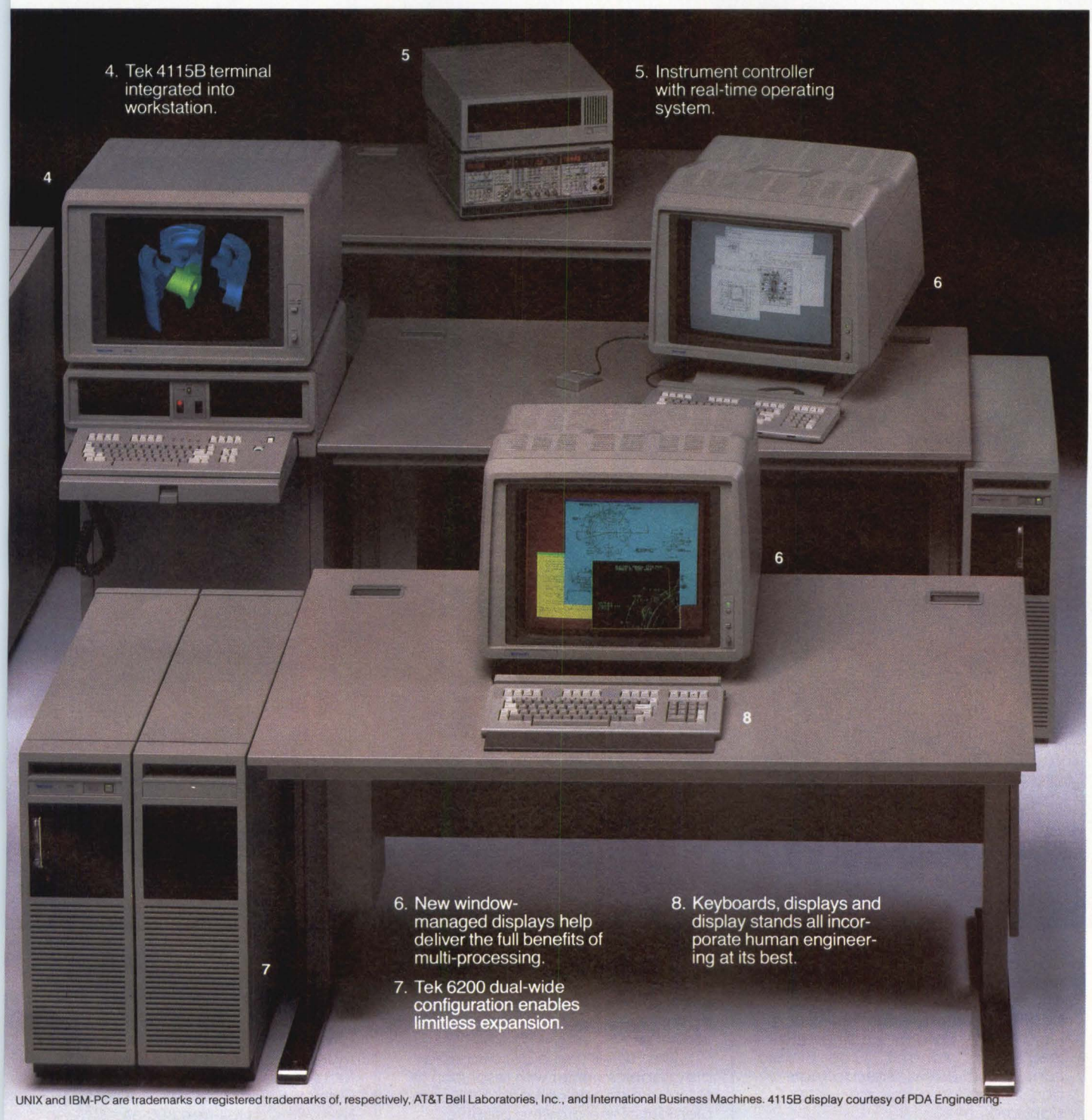

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802.3, and may be approved this year. Cheapernet is less expensive than Ethernet, but it employs the same carrier sense multiple access with collision detection (CSMA/CD) topology specified by 802.3.

Another faction within 802.3 is promoting the Starlan, a much more dramatic modification of Ethernet. While Cheapernet retains Ethernet's basic physical bus structure—a coaxial cable running between the workstations—the Starlan's bus is structurally nothing more than two traces on a printed circuit board. The bus is connected to each workstation by unshielded, twisted pair telephone lines, which limit the data rate to 1M bit per second. But Starlan committee chairman Robert Galin notes that CSMA/CD protocols are still used to resolve contention because the protocols are well defined and supported by available components.

Substantial savings available

Cheapernet is about one-fifth the cost of Ethernet (which runs $1,000 to $3,000 per workstation node) according to 802.3 chairman Donald Loughry, who is also a project manager at Hewlett-Packard Co.'s Information Networks Division, Cupertino, Calif. Loughry stresses that "Cheapernet is also completely compatible at the protocol level with Ethernet."

Loughry explains that Cheapernet's cost savings derive from the substitution of some expensive Ethernet parts with some much more widely used and cheaper parts. Notably, Ethernet's .4-inch, twin-braided coaxial cable is replaced by the standard RG58 coaxial cable used in products like public address systems. The RG58 still requires a medium attachment unit (MAU) incorporating a transceiver, but not one located outside of the workstation. This obviates the need for expensive shielded boxes and

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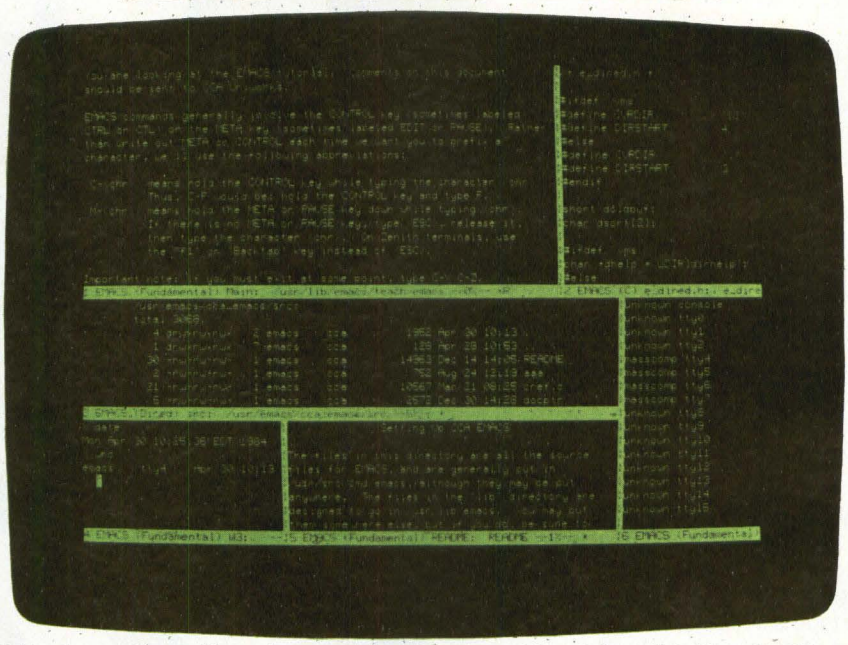

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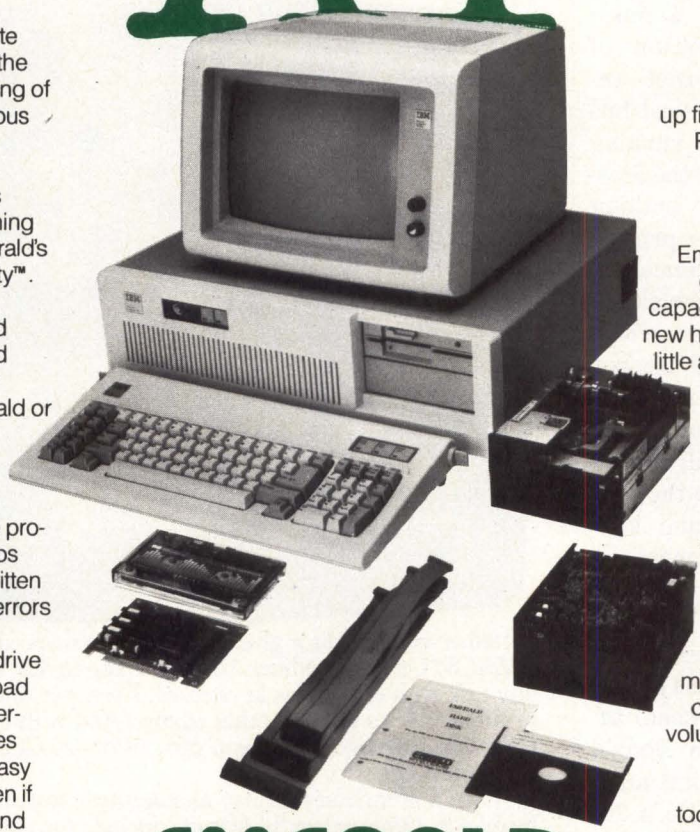

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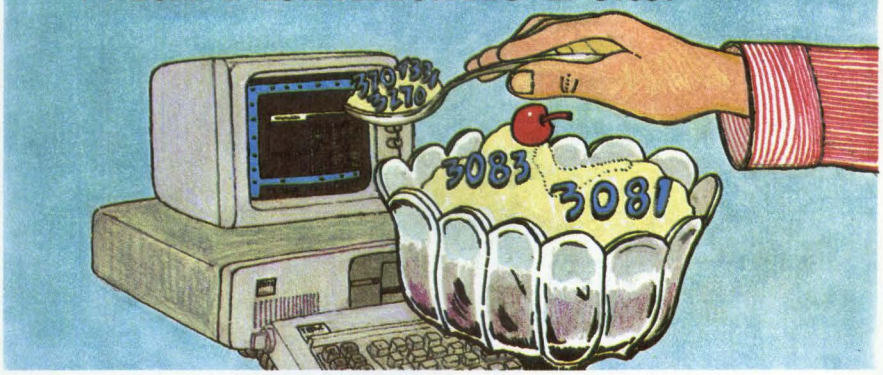
separate power supplies for each MAU, or the D-type 15-pin connection to each workstation. Instead, the MAU can be located inside the workstation and the only external part, other than the cable itself, is a simple connector. "Ethernet takes some expertise to assemble but Cheapernet can be attached by a secretary," claims Loughry, "So there is also a saving in labor costs."

However, users pay a price for the cheaper cable: lower noise resistance and lower attenuation. Additionally, repeaters are needed every 600 feet on Cheapernet as opposed to every 1,600 feet on Ethernet. And the number of nodes per segment is limited to 30, as opposed to 100. But Loughry believes that users will enjoy the benefits of both technologies by constructing hybrid LANs with Cheapernet branches connected to an Ethernet backbone by repeaters. National Semiconductor Corp. offers a set of three integrated circuits said to support both Ethernet and Cheapernet systems.

If Cheapernet is approved by the IEEE standards board this year, it will then be added to the 802.3 standard. Loughry explains that Cheapernet's official designation is "10 Base 2" under the 802.3 committee's scheme for designating types of LAN. The first two digits are the data rate in megabits per second; the second four letters are an abbreviation of the transmission medium (in this case baseband); and the final digit is the distance between nodes in hundreds of meters. Standard Ethernet is "10 Base 5."

Michael J. O'Rourke, director of international sales at 3Com Corp., Mountain View, Calif., notes that Cheapernet-like hardware has been sold by his company for the past two years under the name of Thin Ethernet and offered as part of 3Com's Etherlink hardware. O'Rourke adds that 3Com has participated in the work on Cheapernet

How To Delight Your Lotus With Mainframe Data



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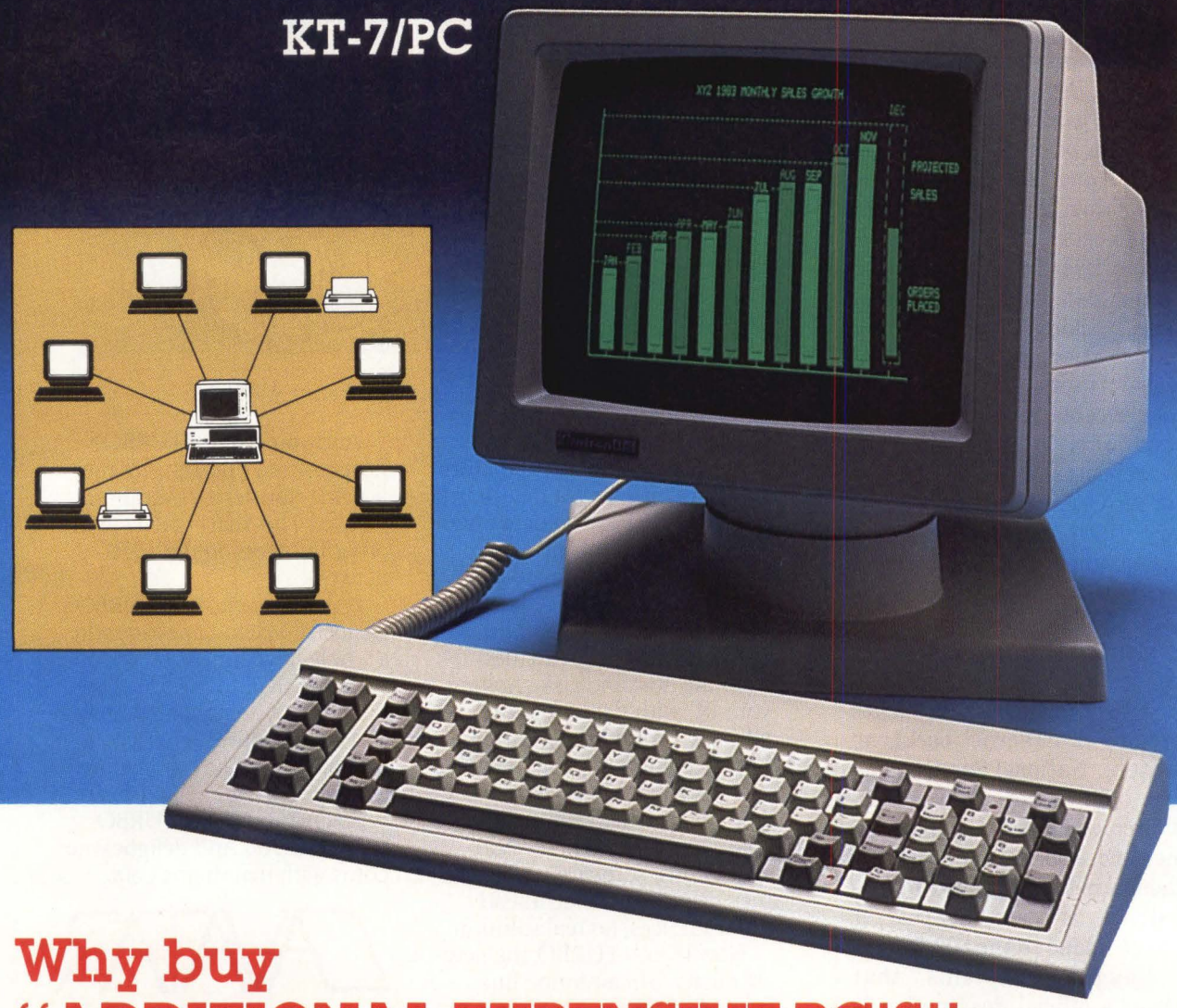

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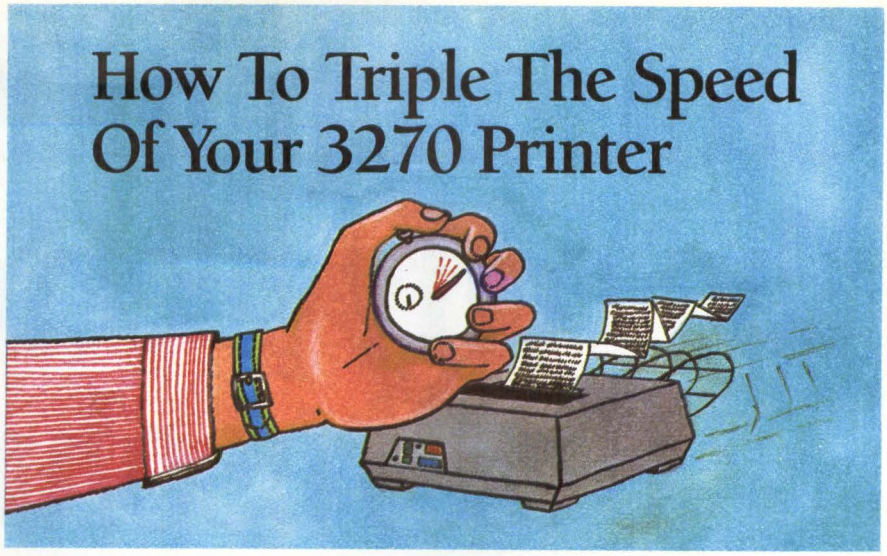
within IEEE's 802.3 committee.

Starlan approval slower

Robert Galin, who is strategic planning manager within the peripheral components operation of Intel Corp., Santa Clara, Calif., notes that the Starlan is much further from formal approval by IEEE than Cheapernet. Galin believes that opposition to the Starlan from Cheapernet supporters within 802.3 is politically and economically motivated. But Loughry says that reluctance to the Starlan standard has been the result of incomplete discussions among 802.3 members.

Galin points to the line-up of powerful Starlan supporters, notably AT&T Information Systems. Galin believes that the Starlan is not a direct alternative to Cheapernet because of its dramatically different topology. He also points to its extremely low cost. Starlan committee member Dr. David White, who is the department head for digital networking hardware at Wang Laboratories Inc., Lowell, Mass., suggests an average cost will be only $50 per workstation, assuming there are about 20 workstations on a hub. These costs do not include installing the actual twisted pair links to the hub, because most offices already have twisted pair bundles with spare pairs. Galin lists other cost savings such as inexpensive twisted pair repeaters and driver and receiver components.

Galin explains that multiple Starlan hubs can be connected in a hierarchy of three levels. In the lowest level, one twisted pair connection in each hub can be linked to a hub in the middle level. One connection on each hub in the middle level can be connected to the highest hub. In the worst case, a transmitted message will need to traverse five hubs before reaching the destination workstation. □



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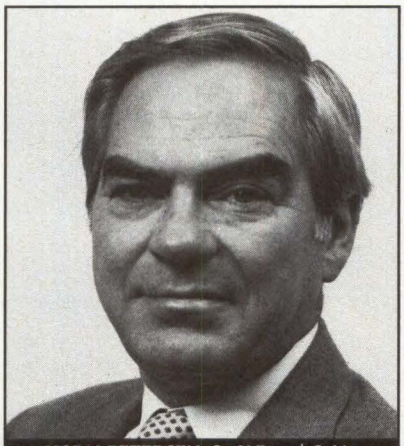

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Scotland battles Ireland for foreign investment

The Scots and the Irish are the class acts in the chase for American and Japanese electronics investment. At the moment, the Scots are ahead

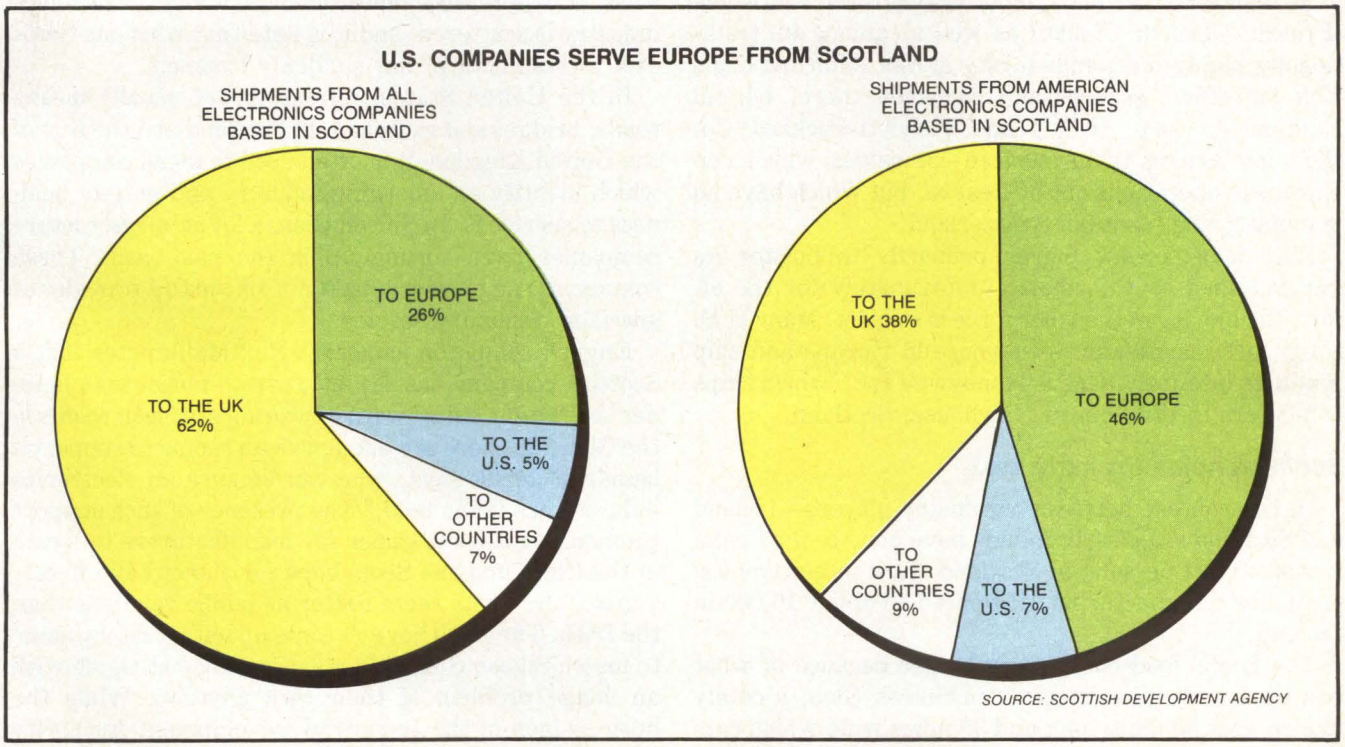
James F. Donohue, Managing Editor

Following Scotland's lead, many European countries in the Common Market are working hard to woo American and Japanese electronics manufacturers. The incentive is straightforward. Companies which manufacture products in Common Market countries can ship to any other Common Market country tariff-free. Annual sales of electronics/computer products in the Common Market are currently valued at about $27 billion and are expected to hit $30 billion next year. Tariffs can be significant: 17 percent for semiconductor products, about 13 percent for computers.

The Republic of Ireland is Scotland's principal competition in this game of industrial seduction, but West Germany, Switzerland and Italy are players, too. Meanwhile, besides Scotland, other parts of the United Kingdom—bedeviled by unemployment rates close to 20 percent—are starting to enter the game. Chief among these is southern Wales and the industrial belt around Birmingham, England.

Nobody is quite as good at the wooing game as are Ireland and Scotland. They're the big-league romancers: the Richard Geres and Robert Redfords. The rest are Woody Allens—clever and resourceful, but suffering deficiencies in raw sex appeal.

West Germany has its own electronics/computer industry and until recently has not pressed hard for foreign investment. Plus, the various German states are on their own when looking for business; there is not



American companies *with operations in Scotland ship a third of their products to the United Kingdom and almost half to the rest of Europe, indicating that U.S. companies consider Scotland an entry point to the Common Market. Non-U.S. companies keep the bulk of their products at home in the UK.*

the same federal coordination as is found in both Scotland and Ireland. Nevertheless, good deals can be made by foreign investors willing to locate in high-unemployment areas like the Ruhr and the Saar coal-mining district and in West Berlin or along the border with East Germany.

West Berlin has suddenly become a serious player. There are unconfirmed reports that West Berlin will cut a very good deal for small (annual sales of less than $3 million) electronics manufacturers. An American electronics maker describes an offer from the city as being "virtually 100 percent." He says West Germany offered to give him land, provide a building, equip it and train a labor force—all at no cost to him. And there would be no tax until some time in the next decade. The electronics maker turned down the offer. "That's not a place where I want to do business," he says. "Too risky politically."

In the contest between the major players, the early rounds have gone to the Scots.

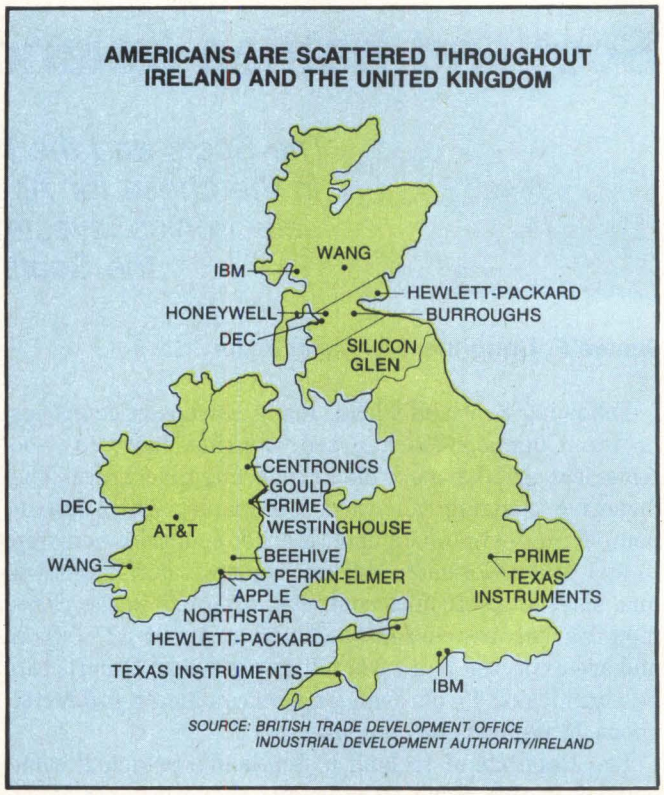
Switzerland is a country split among three languages (French, German, Italian) as well as among its traditionally highly-independent city states. Multinationals look for office workers and salesmen there. Digital Equipment Corp. (DEC) and Hewlett-Packard Co. (HP) are among the American companies which run European operations out of Geneva, but which have no manufacturing plants in Switzerland.

Italy is a serious player primarily to bolster its impoverished south, where, unfortunately for the effort, the quality of the labor force is suspect. Many U.S. companies manufacture elsewhere in Europe and ship products into Italy. One is Honeywell Inc., which ships computers to Italy out of Newhouse, Scotland.

Scotland holds the early lead

In the contest between the major players—Ireland and Scotland—the early rounds have gone to the Scots. About 40,000 persons in Scotland work in electronics/computer manufacturing, compared to about 16,000 in Ireland.

The Scots' lead could grow longer because of what has been happening recently in Silicon Glen, a cutely named area 80 miles long and 30 miles wide which cuts in a band across the middle of Scotland. The centerline of the Glen runs in a diagonal from a point north of Edinburgh in the east to a point south of Glasgow in the west. It is here that almost all of Scotland's electronics industry is scattered, and it is here that what the Scots call "infrastructure" has suddenly bloomed.



In the United States, infrastructure usually means roads, bridges and railroads. In Scotland and the rest of the United Kingdom it is often used to mean companies which identify an emerging industry and go into business to service it. In Silicon Glen, a lot of infrastructure companies have sprung up in the past year. These companies range from a maker of silicon to a provider of specialized laundry service.

English computer journalist Rex Malik notes that a Scottish company has recently set up business to launder the "bunny suits" worn by workers in clean rooms in the Glen. "If there are enough clean rooms to support a laundry," Malik says, "you can be sure an electronics industry has taken hold." The presence of such support companies makes it easier for manufacturers to locate in the Glen, and the Scots hope for a snowball effect.

Also, the Scots seem better at public relations than the Irish. The Irish haven't come up with a catchy name to match Silicon Glen. What's more, they struggle with an image problem of their own creation. While the businessmen of the Industrial Development Authority (IDA) of Ireland try to picture the island as full of industrious workers, the businessmen of the Irish tourism bureau work just as hard to sell the nation as full of

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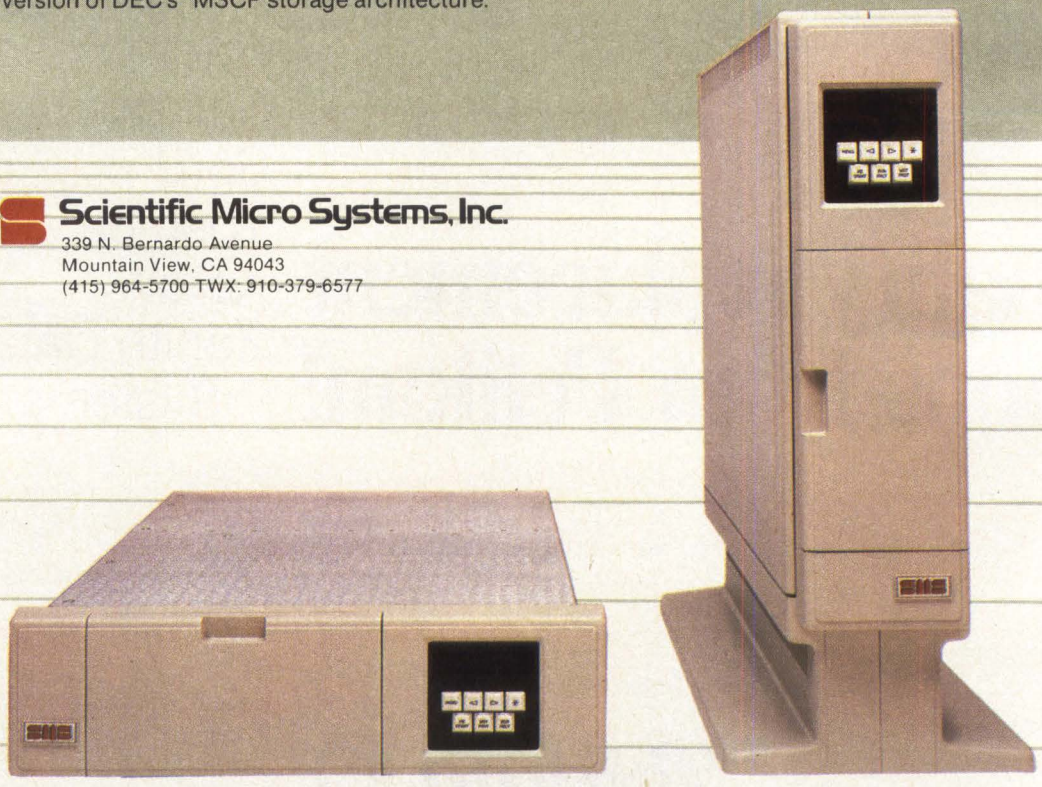

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quaint folk who wouldn't think of leaving their farms.

"Our tourist industry is too good at getting out those posters of jaunting carts and donkeys," says Nick Ryan, vice president of the IDA.

Terrorism not seen as a factor

American industrialists do not seem put off from opening plants in Ireland because of the continuing acts of terrorism in Northern Ireland. Most of their plants are well south of the border in places like Dublin, Cork and Limerick. "Americans seem to understand that what happens in the North stays there and will not come down into the Republic," Ryan says.

The Scots know the value of a good press in the United States and how to get it. This article comes from a tour of Silicon Glen sponsored late last year for American electronics/computer journalists by the Scottish Development Agency (SDA). *Mini-Micro Systems* sent a reporter on the tour. The SDA paid most of his expenses.

The Irish have many economic weapons. Chief among these is their corporate tax rate, one of the most forgiving in the world. Irish-based business pays a maximum 10 percent of its taxable income to the state. The rate is guaranteed to the end of the century, and it helps to bring to Ireland the highest rate of return on manufacturing investment in the world, according to the IDA. "If all you're looking for is return on investment," conceded an official of the SDA, "it's true, then. We can't match the Irish."

Ireland's low corporate rate already has driven Scotland—and the rest of the United Kingdom—to do something about the way it taxes business. Corporate rates are falling fast in the UK. They were 50 percent last year, are 45 percent now, will be 40 percent later this year and will drop to 35 percent in 1986. The Scots will show you how to do a bit of sleight of hand to trim the corporate tax by an additional 10 percentage points, bringing it to 25 percent in 1986.

Ireland has a murderous personal income tax, and that takes some of the sunlight out of its tax picture. The Irish are in the 65 percent bracket long before their taxable income hits $20,000. "We believe the low corporate tax helps us give our people work," explains IDA's

It's tougher to spin off in Silicon Glen

It's called the Silicon Valley effect—that's when workers from one electronics company quit and start another electronics company in competition with the first. The name comes from California's Silicon Valley, where most of the business is a spinoff from somebody else's business.

British entrepreneurs have difficulty working up a Silicon Valley effect. Check around and you'll find only one company mentioned—Rodime Plc. of Glenrothes, Scotland. Paradoxically, the various government-backed development agencies—fat with cash and tax breaks for established companies—are the reason why spinoffs don't do well in the United Kingdom.

Spinoffs don't get much assistance from these quasi-government agencies; instead, they are likely to get discouragement. The agencies are worried about offending the established companies, should they help the upstarts.

Rodime is a case in point. The company began in 1980 when four executives—American Leonard W. Browlow and three Scots—left Burroughs Corp.'s disk drive plant in Glenrothes, north of Edinburgh, and set up shop nearby to make their own brand of disk drives.

According to W.D. Batchelor, managing director of Rodime and one of the company's three Scottish founders, Rodime got no help from the Scottish Development Agency (SDA),

The Rodime case *required caution, says Mike Sandys of the Scottish Development Agency.*

the organization charged with setting up companies in Scotland. Burroughs allegedly discouraged the SDA from helping.

Burroughs denies the charge, and so does Mike Sandys, senior project executive of the SDA's electronics division. But Sandys adds, "There's no doubt that we had to play it cautiously."

Eventually, Rodime got help from the Glenrothes Development Council which, despite the presence of Burroughs in the town, provided a manufacturing plant with a clean room for Rodime and accepted delayed rent. Rodime got $1.5 million from 3i Ventures, a British venture capital company, and launched its line of Winchester drives. Sales of $28.5 million in 1983 about tripled last year. Rodime employees 500 people in Glenrothes.

Burroughs has since shut down its plant in Glenrothes, throwing 400 persons out of work. The company continues other operations in Scotland.

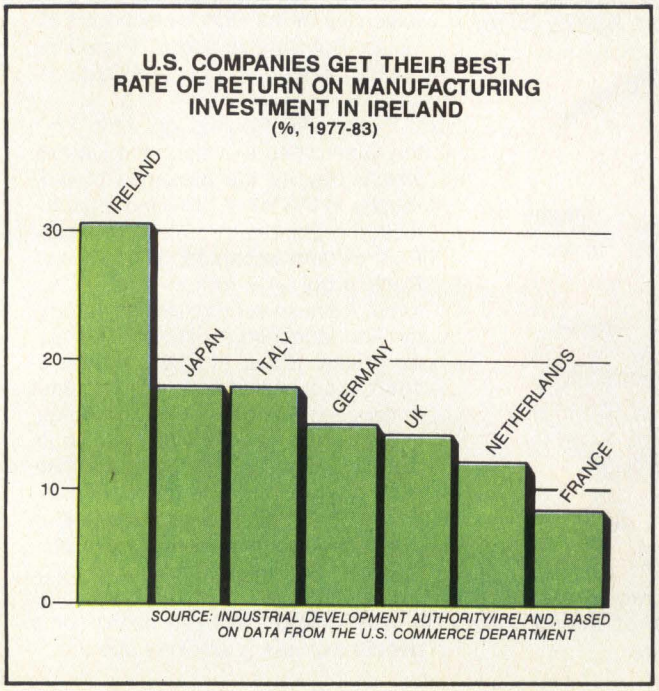
Was Burrough's move out of Glenrothes in retaliation for the town helping Rodime? "It's a moot point," says a town official. "But I've heard some people express suspicions about it."

Ryan. "The high personal tax is how we ask them to pay back the government." In the UK, the rate gets to about 33 percent when annual income reaches $18,000.

For Americans living in Ireland or the UK, the high personal taxes require creative accounting. American executives often receive big expense accounts to live on while their salaries go into an account at home, or they get free housing, cars and other benefits in lieu of high salaries which would be taxed away.

One American, sent to England to manage his company's manufacturing plant, says he received payment as a consultant for the entire time he was in England. He says that form of payment meant he was not taxed in the UK. How long would England have stood for that arrangement? "Oh, maybe 20 years," he says with a grin. "We've got very good accountants."

Many U.S. computer manufacturers like HP, DEC, Honeywell, Burroughs Corp. and Wang Laboratories Inc. have manufacturing plants in Scotland. Honeywell just celebrated its 21st year of making computers there. But a Japanese electronics company, NEC Corp. of Tokyo, is making most of the news these days. NEC chose the European Solid State Circuits Conference at Scotland's Edinburgh University last year to unveil a 256K-bit dynamic RAM chip that it plans to make at its plant in Livingston in Silicon Glen. At the same time, NEC announced plans for a $95-million expansion at Livingston and said it will employ 650 workers there in 1987 when annual production of the chips hits six million a month. NEC employs 200 persons at Livingston now and turns out 1.5 million chips a month, almost all of them 64K-bit dynamic RAMS.



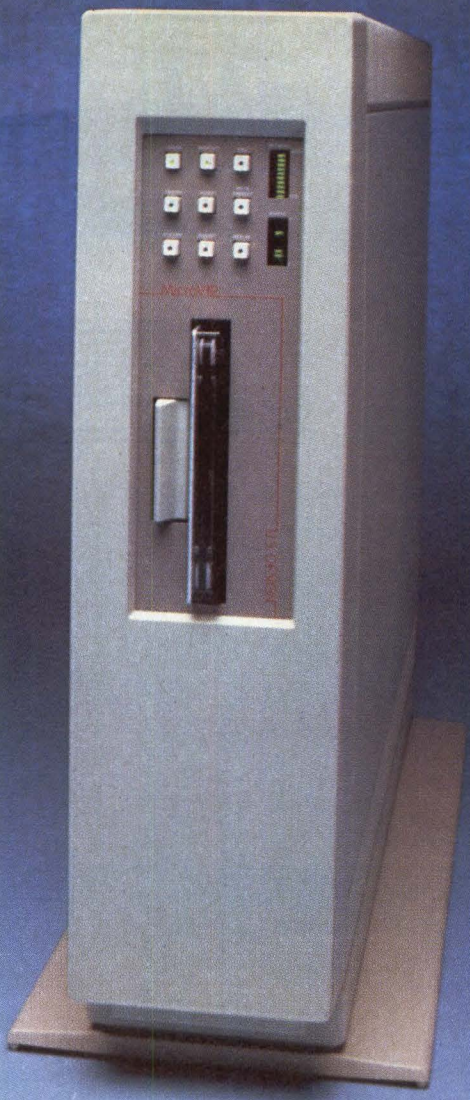
Technical training is available

The managing director of NEC in Scotland, M. Shiraishi, says the company settled there because "it is easy to recruit educated people. There are many universities in Scotland. We are always asking the professors to send good people to us." About 15 percent of the NEC workforce has technical training beyond high school. The company figures it will need a higher percentage in 1987. Shiraishi forecasts no difficulties in getting them. Scotland has eight universities (Ireland has four), 17 colleges and 12 technical schools.

Yet, the statistics on technical education in Scotland are not entirely rosy. The number of people coming out of the universities and colleges with the equivalent of a bachelor's degree in electrical engineering is not high. The Scots forecast there will be 450 this year, up from 241 in 1976.

These low numbers present a problem to Scottish industrial recruiters. "Technical expertise has not grown as fast as the market," says Manuel Yuen, the American managing director of National Semiconductor (UK) Ltd. "We have difficulty in attracting technical people."

Ireland's IDA publishes a brochure of reprinted ads from the Irish Times in which Scottish-based American companies like Wang and Westinghouse Electric Corp.



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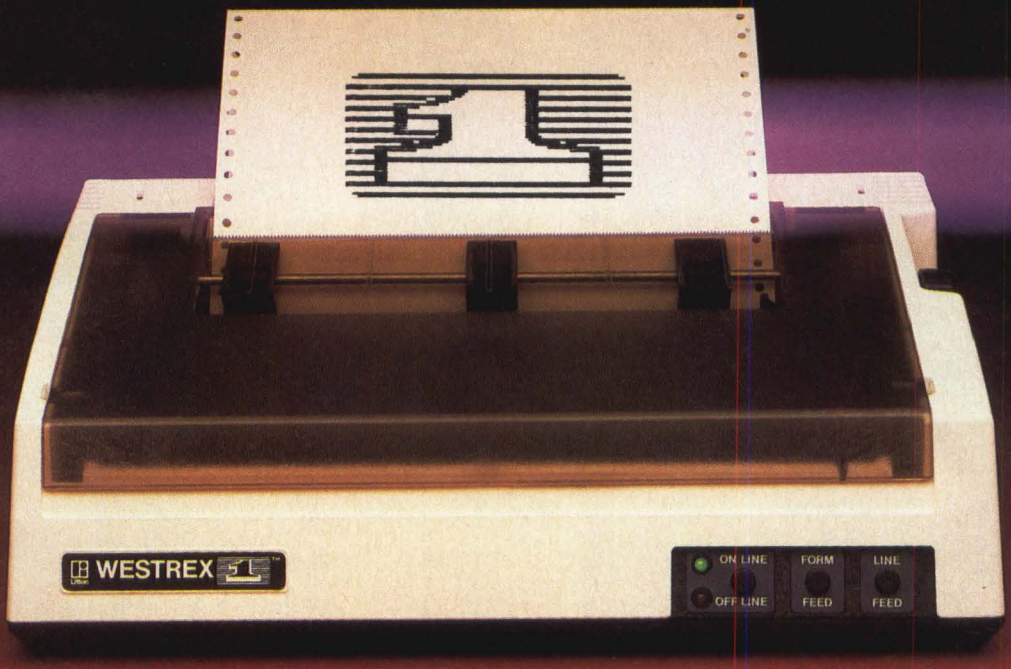

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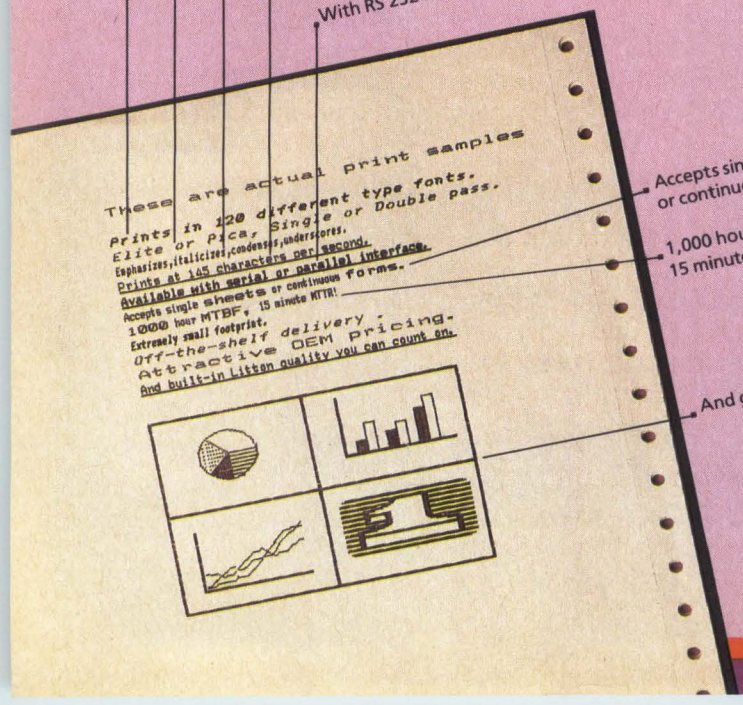

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and an Edinburgh recruitment agency are shown hunting in Ireland for technicians and engineers. The brochure is entitled, "The best hi-tech personnel are easy to find...when you know where to look."

The Scottish workforce gets high marks for dependability from managers of multinational companies. Employee turnover is low: 4 percent to 6 percent a year seems to be the average. "You just don't find headhunters all over the place," says Frank Vincze of Circuit-Wise Inc., a circuit board manufacturer in North Haven, Conn., which does work with Prestwick Circuits Ltd. of Ayr, Scotland. Bill Gold, NEC personnel manager, says the custom in Scotland "is for a person to work with one company for life."

Tamed by high unemployment, the Scottish electronics worker does not readily join unions. Only about a third of multinational companies in Scotland have unions, and these concerns are usually longtime residents. Companies setting up operations for the first time appear to have little difficulty in keeping unions at bay.

National Semiconductor, which recently announced plans to add 1,000 employees at its Greenock, Scotland, wafer plant (there were 1,650 employees last year), is an example of an American company working without a union. "The unions have made attempts at getting in here," says managing director Yuen. "But the attempts have not been all that serious. What you have to do is see to it that your conditions of employment are such that you do not need a union."

There are so many clean rooms *in Silicon Glen that there's a laundry to wash the "bunny suits" worn in them. The picture was taken at Motorola's plant in East Kilbride, Scotland.*

The Irish corporate tax rate is one of the most forgiving in the world, and it's driven Scotland to do something about the way it taxes business.

Strong dollar cuts labor costs

Scottish labor works cheaper than American labor, a fact helped by the strength of the dollar against the pound. The British pound was worth only $1.25 when the electronics writers made their tour. The Irish pound was worth about $1. Yuen pays his production workers at National Semiconductor 115 pounds a week, or about $144 at that time. In the past few years, the British pound had been worth twice its current value against the dollar, so the labor-cost advantage in the UK can change dramatically. "However, at this point," Yuen says, "our salary structure is a help" in keeping labor costs down.

Both Scotland and Ireland claim enormous salary advantages over the United States when it comes to paying engineers. Several Scottish industrialists say they pay an engineer who would command a salary of $60,000 in the United States only about $20,000 (at the $1.25 exchange rate).

Industrial consultants in the United States say that, as a rule, labor costs in the UK and Ireland run about 75 percent of U.S. costs. Larry Nye, a management advisor from Acton, Mass., who works primarily with the Irish, says a payroll of $100,000 in the United States will be about $75,000 in Ireland.

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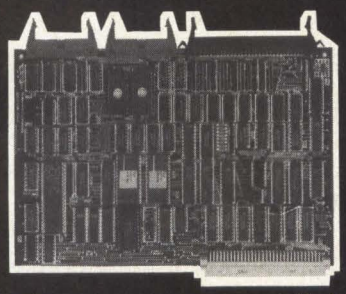

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The Interpreter

Managers interviewed by the American electronics writers on their tour of Silicon Glen were universally happy to be in Scotland. Many companies, like NEC, DEC, Honeywell and HP, are planning major expansions. Even Japanese managers consider Scotland a good place to live, despite its strange customs and food. Many, like NEC's Shiraishi, are avid golfers, and Scotland is the Vatican City of the golf religion. The workforce is described as high quality. Several industrialists say unemployed coal miners, thrown out of work by the collapse of what was once a major industry in Scotland, take especially well to training in electronics.

The language is friendly

In the quest for American companies, Ireland and Scotland have the advantage of the English language over the rest of Europe. A company whose homebase management must learn a new language has a problem, and American managers will tell you they'd rather be in Ireland or the UK than in non-English-speaking Europe. The language barrier is demonstrated by NEC's Shiraishi. Although his English is good (he has lived in Scotland for two and a half years), his expression goes blank and his eyes glaze if you speak English to him too quickly.

The local workers of a company whose management speaks another language have a problem, too. Forty Scots working at NEC's plant are studying Japanese on their own time in order to better work with the eight onsite Japanese managers.

American management often chooses either Ireland or Scotland on the basis of whim—the boss likes Irish horses and settles the company in Ireland—or national pride. Finlay MacKenzie, the Scottish managing director of HP's Queensferry Telecommunications Division near Edinburgh, thinks a factor in HP's move to Scotland from Bedford, England, in the early 1960s was that "the managing director was a Scot."

In favor of Scotland over Ireland, there is the view that the UK is a much bigger market for American companies than is Ireland and that it's better to be in the UK to service it. David Lawrence, an Englishman who is general manager of DEC's plant in Ayr, says DEC, when faced with a need to expand in Europe, chose to open a new plant in Scotland rather than enlarge its existing operation in Galway, Ireland. Says Lawrence, "DEC just decided Ireland was outside the mainstream of Europe." □

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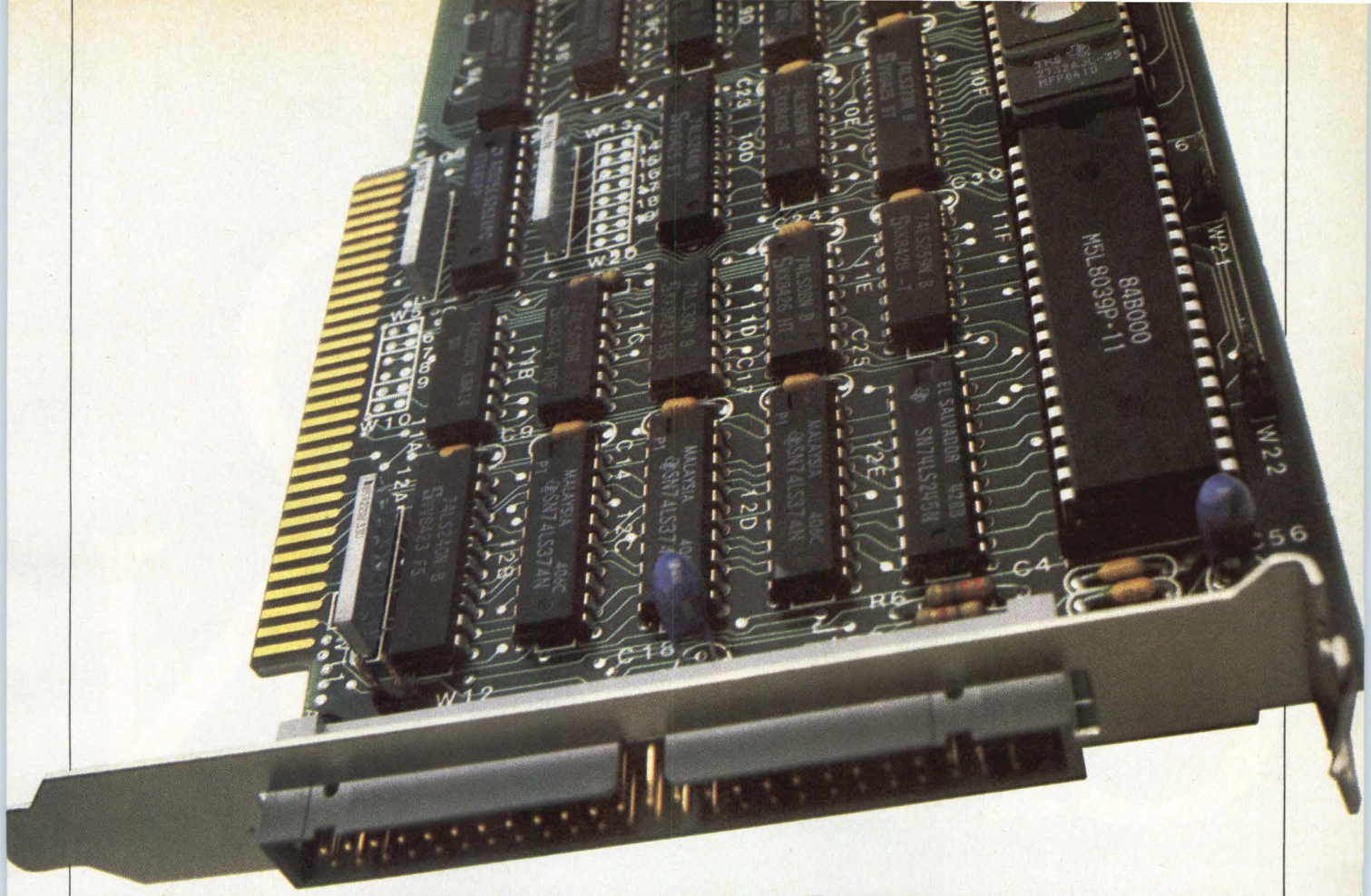

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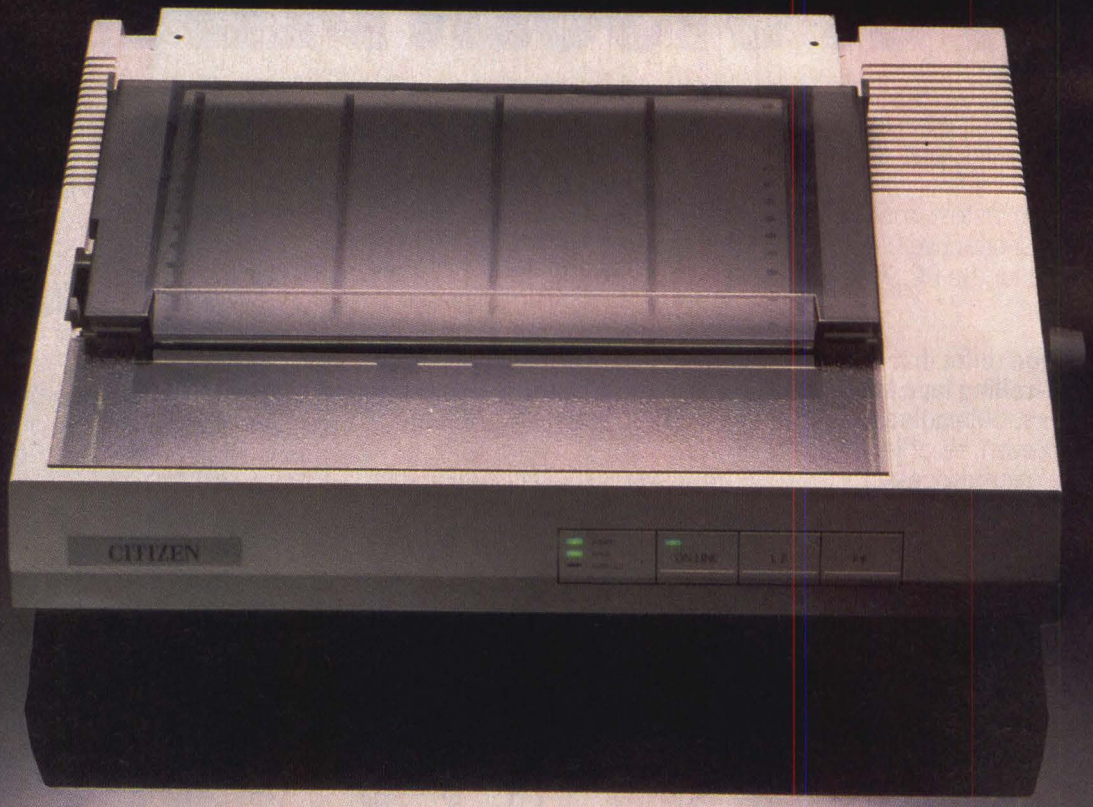

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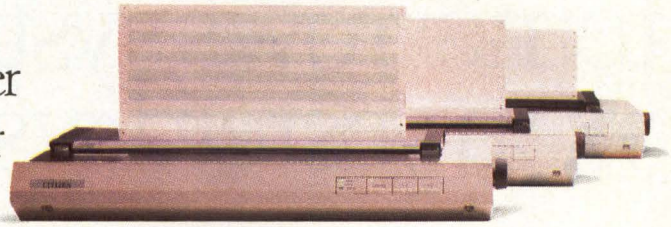

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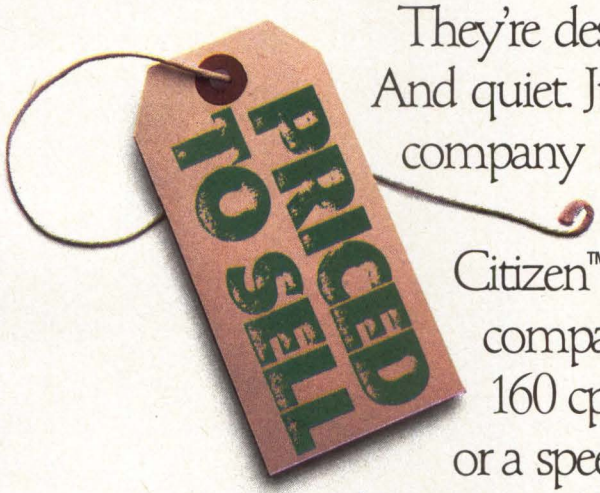

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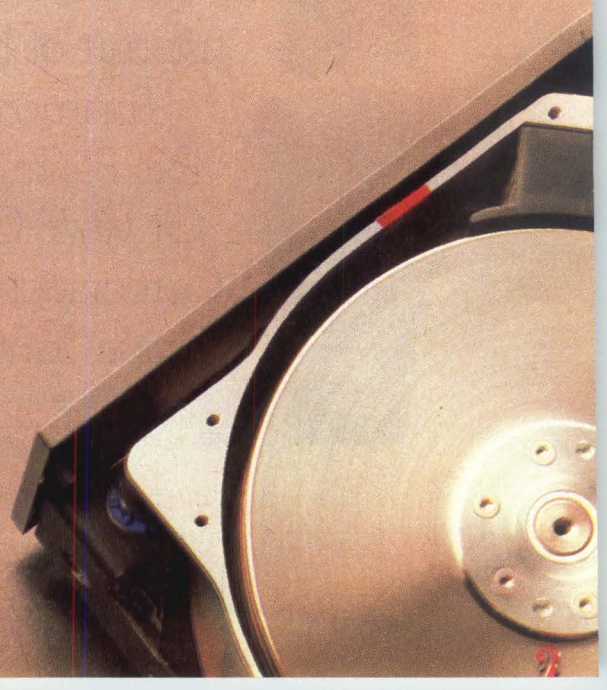

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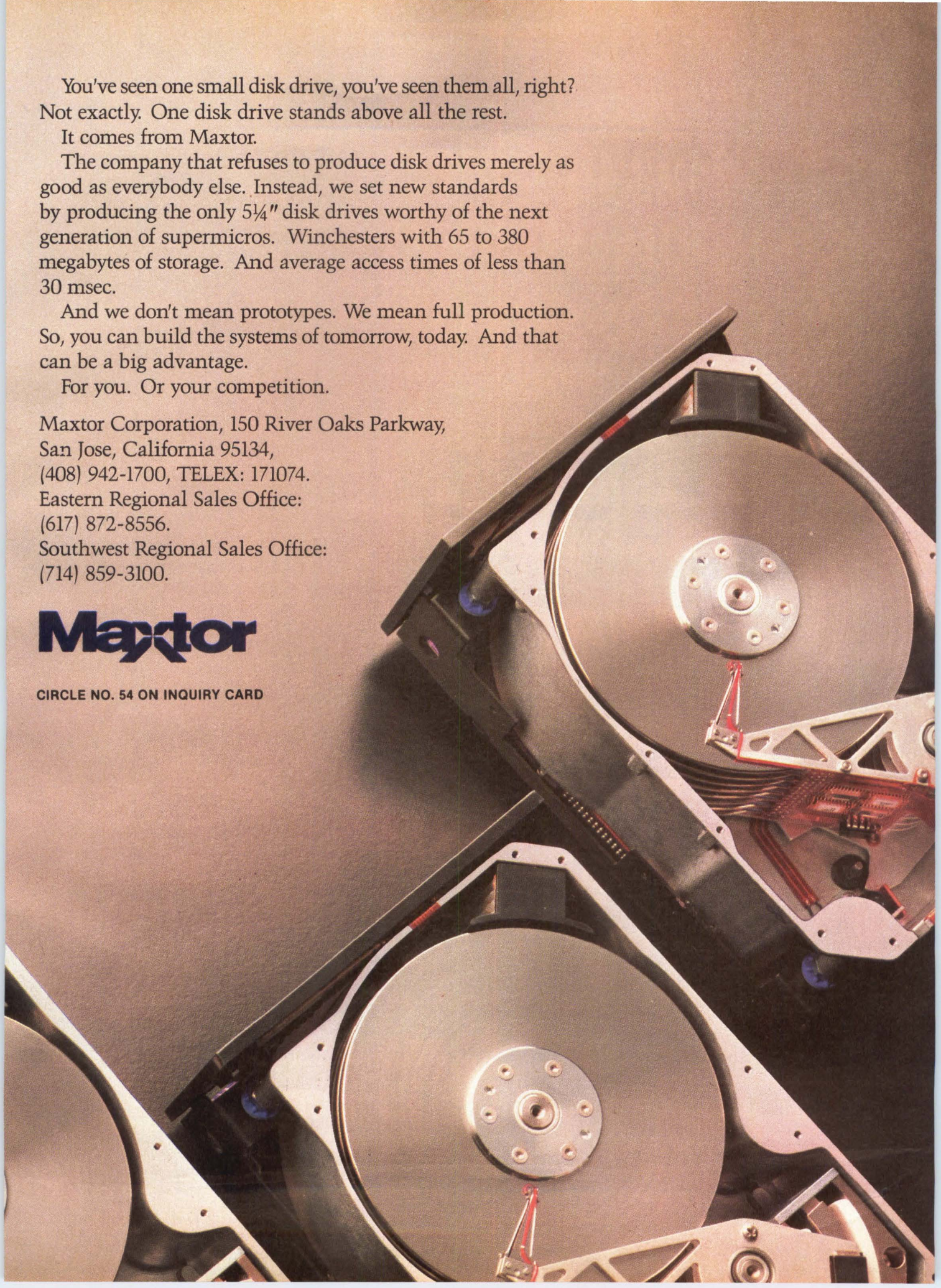

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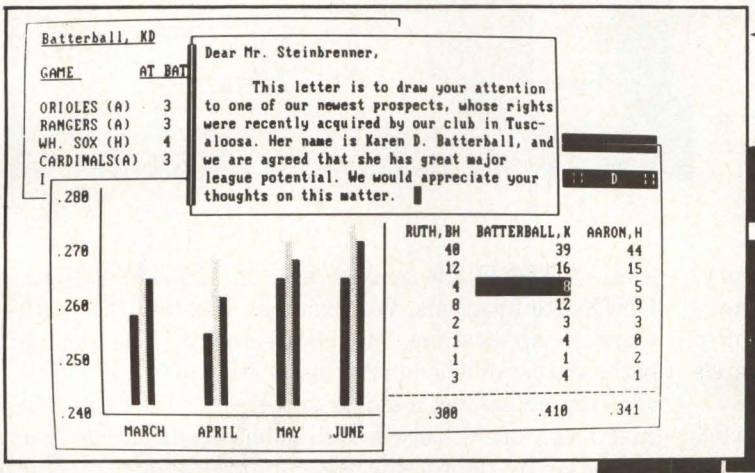
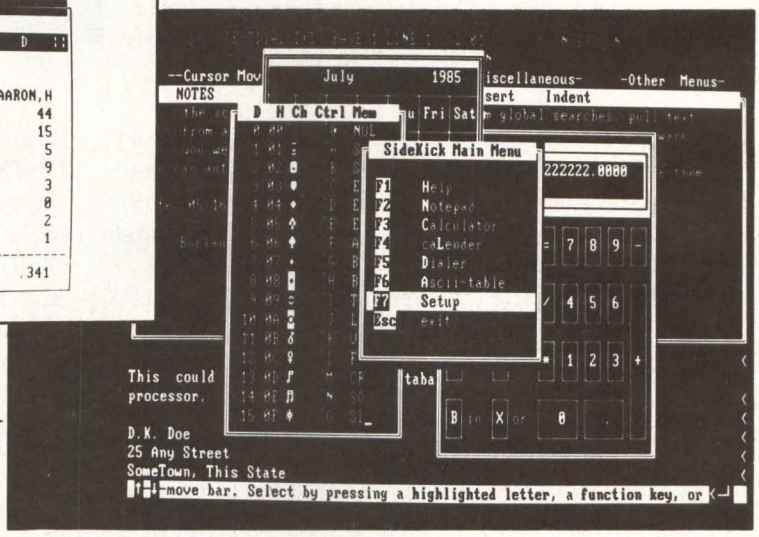
Enhancement programs add features to IBM PC operating system, application software

Software packages let existing programs run more smoothly, or do more...some provide multitasking or levels of security, others add pizzazz to graphics



APX Core provides a manager *for up to eight windows. When a task is selected to be performed, the window in which it resides moves to the foreground.*



Residing in background memory, *Borland's Sidekick serves as an extension to other applications by providing typical desktop functions of notepad, calculator and phone dialer.*

Carl Warren, Western Editor

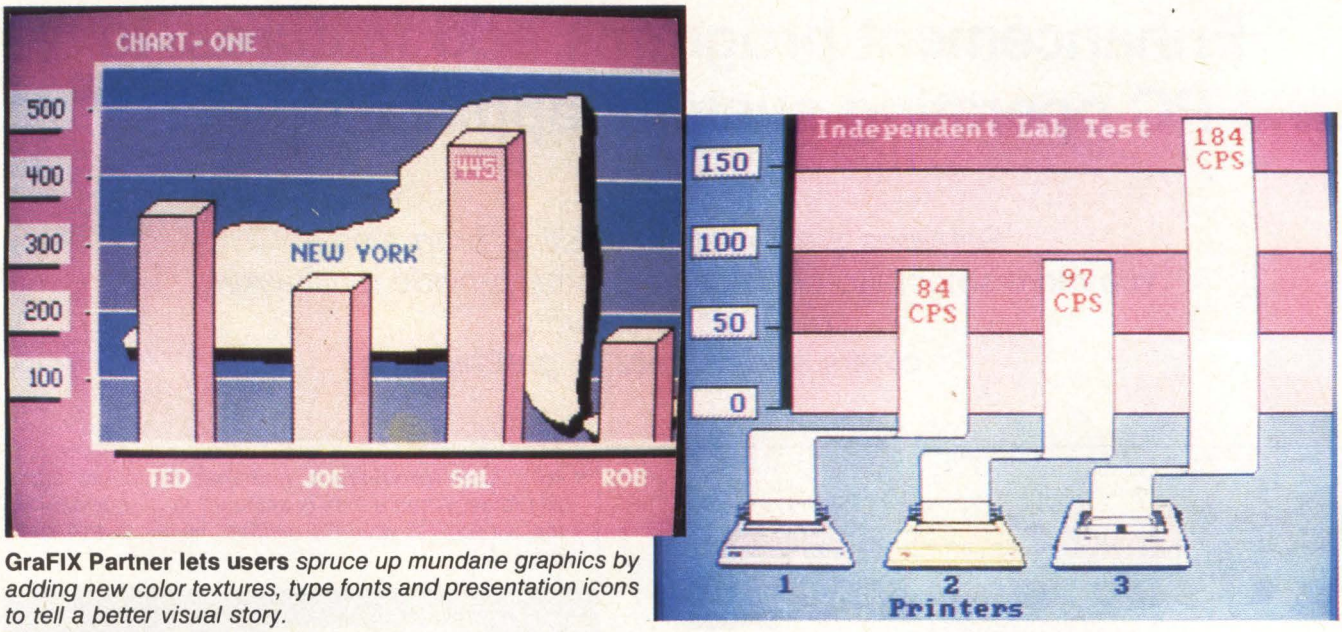
The latest trend in software for the IBM Corp. Personal Computer (PC) and look-alikes centers on enhancement packages that extend the functions of the operating system or add features to existing applications. These new packages can be grouped into two categories: shell packages and application add-ons.

Shell packages provide an envelope, or sleeve, around the operating system. These envelopes—shells—can exist either in the foreground, i.e., as the dominating part of the operating software, or the background, waiting in queue invisibly; they can also run concurrently. *Application add-ons*, though, are usually consigned to the background.

One such shell is APX Core, developed by Application Executive Corp., New York, N.Y. This $95 package provides suspended and time-slice (concurrent) multitasking capability to IBM PCs and compatibles. APX Core does this by dividing memory into segments for use by each application. As a new application is activated, the current one is suspended or moved to the background. Applications are accessed when the user depresses the ALT key on the PC keyboard and touches the number key corresponding to the application block. For example, ALT 3 would switch to the third task in the register queue.

The number of applications supported by APX Core is only limited by the amount of available memory—it requires at least 48K bytes, plus memory over and

The Interpreter



GraFIX Partner lets users *spruce up mundane graphics by adding new color textures, type fonts and presentation icons to tell a better visual story.*

above that, for each application. A 256K-byte memory, for example, can concurrently support two memory divisions and associated applications such as MicroPro International Corp.'s Wordstar and Ashton-Tate's dBase II.

Besides supporting multiple memory tasks, APX Core provides a window manager. An application can be placed in a window that can be moved to any screen location. When a task is selected, the window in which it resides becomes dominant—moves to the foreground. Because the block transfer capability makes APX Core a powerful system tool, data can be transferred task-to-task without special conversions or system utilities.

Establishes password levels

Another package that serves as both a foreground and background shell to the operating system is XTDRIVER. This $180 package, developed by Chas-Moore Inc., Bakersfield, Calif., provides password file security. Several levels of passwords can be implemented to prevent access to files. Moreover, files can be password-encrypted for further security. However, the company's vice president of marketing, Don Maher, warns that XTDRIVER's password protection is formidable: Lost passwords can mean lost access, especially in the case of encrypted files.

To add further functionality to the operating system and the XTDRIVER package, the authors added Disk Operating System (DOS) functions via menus. Consequently, system functions can be performed without forcing the user back to the operating system command level. XTDRIVER makes use of MS-DOS/PC-DOS UNIX-like functions. For example, it establishes pathways to applications in subdirectories. The desired paths are established in the installation of XTDRIVER, allowing access via a single key stroke. Like the DOS functions, users access individual applications from menus or by depressing specific, pre-defined function keys. Both APX Core and XTDRIVER are best employed on "larger" PC systems with, say, 620K bytes of user memory, a hard disk, a real-time clock and DOS 2.1.

Background comes forward

Still in the shell category but moving toward application add-ons is the Sidekick package from Borland International, Scotts Valley, Calif. Occupying 20K bytes of background memory until called to the foreground by tapping the CONTROL and ALT keys, Sidekick provides a series of useful applications tied together by a window manager. Company president Phillipe Kahn calls the package a program within a program: "That's why we called it Sidekick. It serves as a partner to any other application in memory."

Sidekick provides a notepad/editor that operates in a similar manner to MicroPro's Wordstar word-processing package, a calculator, an appointment calendar, an ASCII table and an automatic phone dialer. The dialer function uses a built-in "rolodex" from which numbers are plucked for dialing.

As with APX Core, data can be shared between Sidekick's windows. Moreover, information created in

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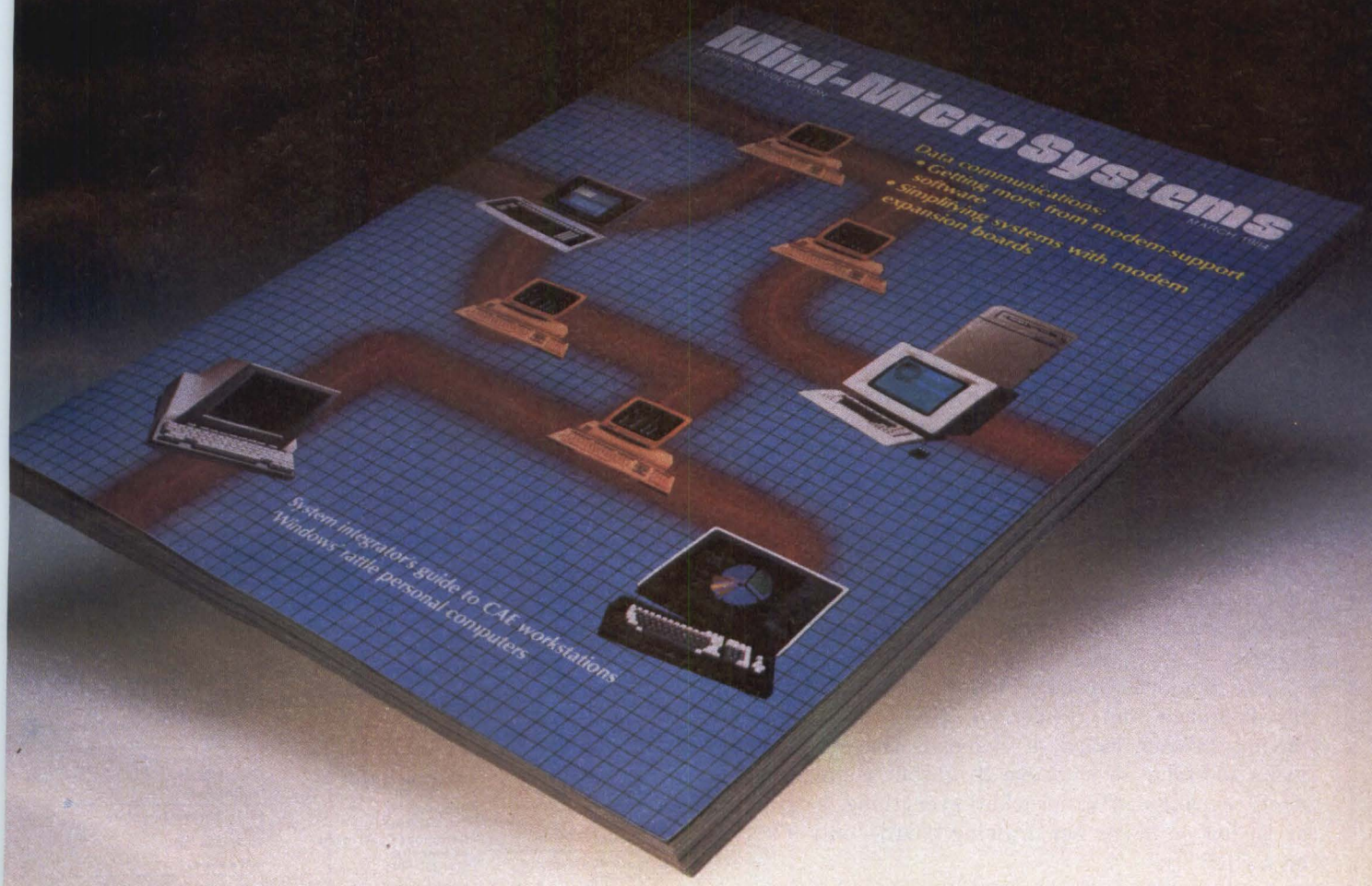

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CIRCLE NO. 56 ON INQUIRY CARD

The Interpreter

Sidekick's notepad is saved in an ASCII format, making it usable by virtually any other application. The package, at $49.95, may be the most inexpensive windowing product currently available.

Enhancing graphics programs

An innovative package from Brightbill-Roberts & Co. Ltd., Syracuse, N.Y., is GraFIX Partner. This $149.95 package is designed solely to enhance other applications packages, such as Lotus Development Corp.'s 1-2-3, Ashton-Tate's Framework, Sorcim Corp.'s Supercalc III and other packages that create graphics. The GraFIX Partner uses bit-oriented raster graphics to create charts and type fonts. Although it can also be used to draw designs, GraFIX Partner's main function is to enhance existing graphics. For example, GraFIX Partner can make a chart drawn by Lotus 1-2-3 more exciting by adding to the color mix and integrating different type fonts or specialized overlays.

The GraFIX Partner software not only allows the drawing of dots, lines, boxes and circles but also provides for area filling—painting, copying objects, creating mirror images, zooming and swapping colors. Additionally, unusual color textures can be created, widening the graphics rainbow. Because GraFIX Partner is a raster-oriented product, it can combine pixels—picture bit elements—in a variety of ways to produce new colors or shading effects. In addition, color precedence can be set; by declaring the color association, objects can be made to appear behind or in front of others.

Like Sidekick, GraFIX Partner is written in assembly language and resides in 26K bytes of system memory. When called, it suspends the primary program and takes over. Steve Brightbill, company president, explains, "We provide everything a graphics artist has on his or her drawing board—only it's done on a CRT."

A shortcoming of the package is that, being raster oriented, it doesn't work with plotters. "This is a tool for creating presentation-level graphics," explains Brightbill. "A user will either want to print it on a dot-matrix printer, as part of another document, or make a photographic slide." Besides allowing the creation of a hard copy version of the graphics, the GraFIX Partner package also has slide show provisions. Each slide can be set up in any sequence and timings set for playback on the system CRT. □

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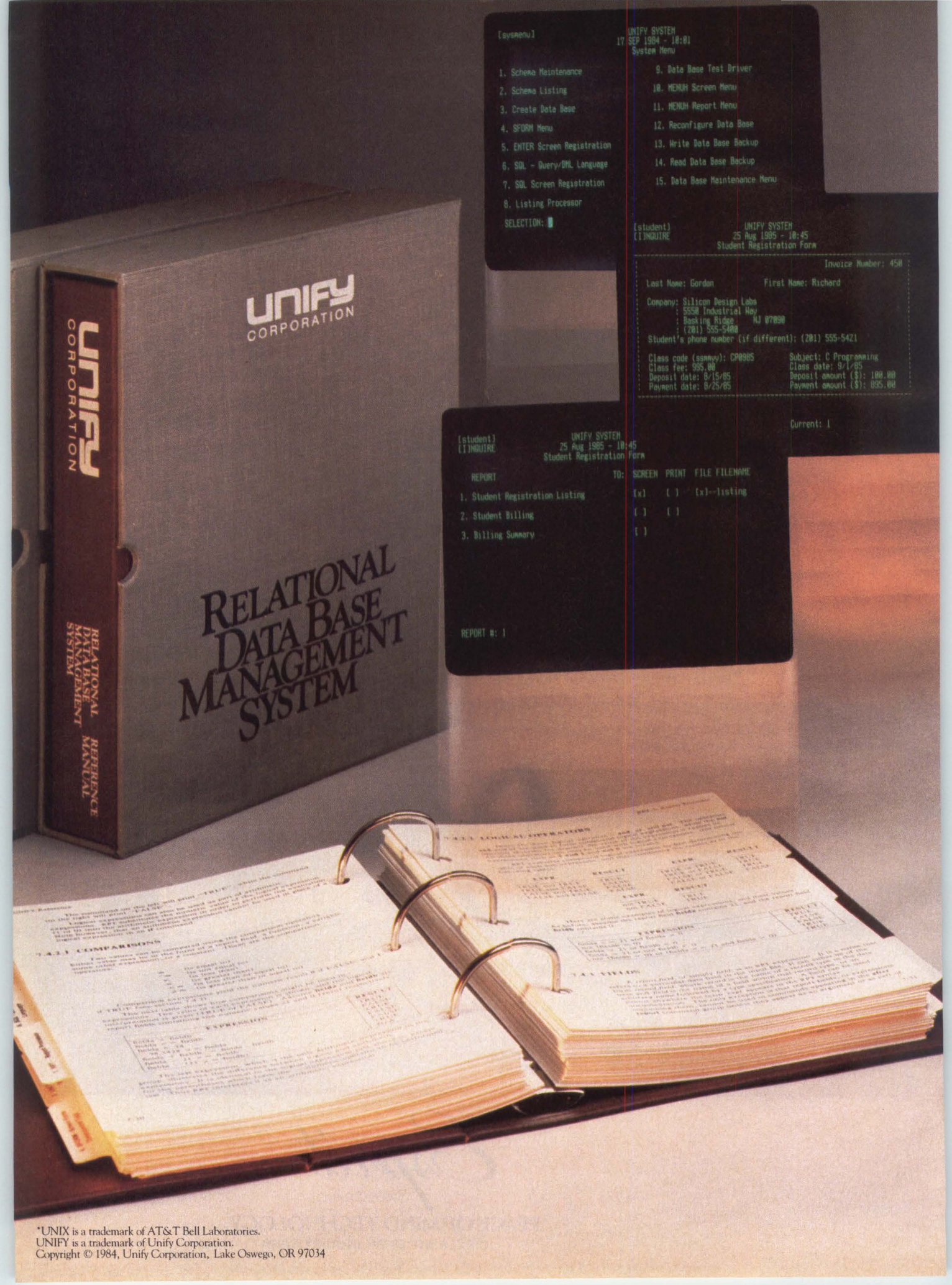

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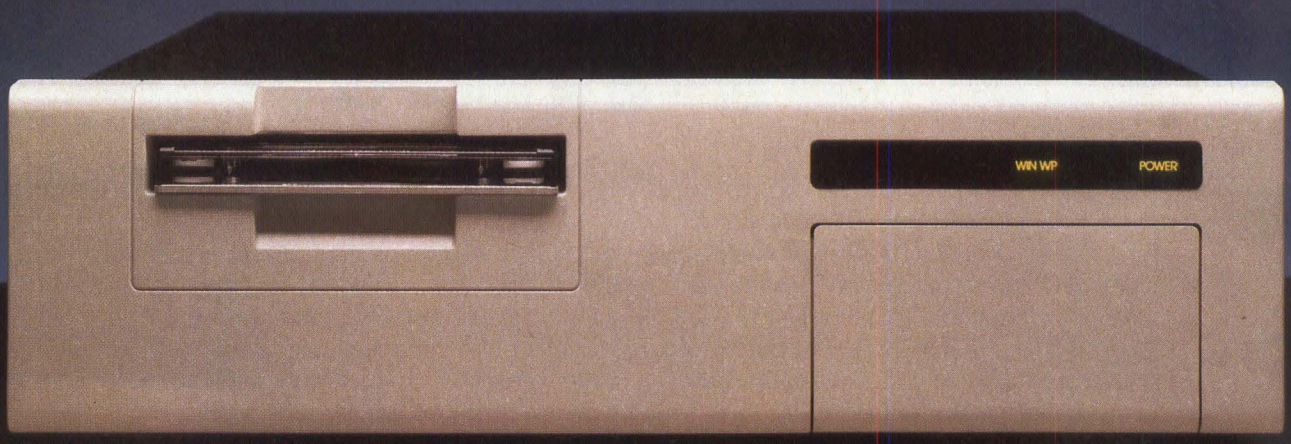

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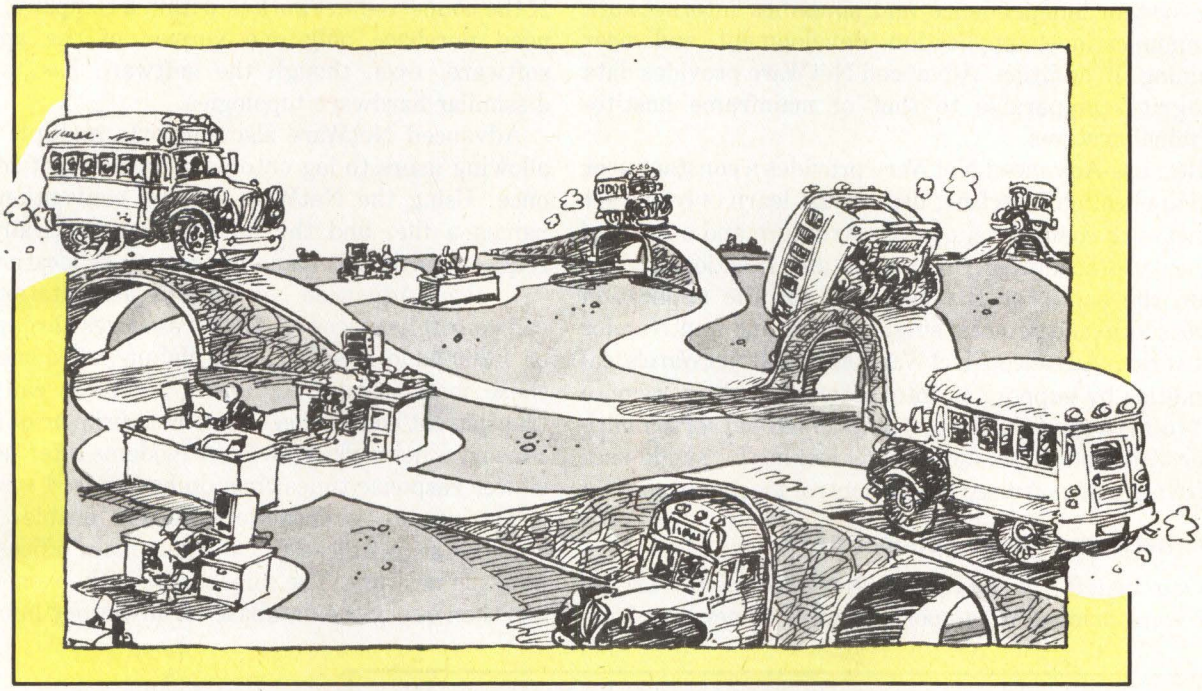


Software bridges provide network-to-network communications *in Novell's Advanced NetWare. An IBM PC bus physically connects the LANs.*

Michael Durr, Network Consultant

The first local area networks (LANs) were small peripheral-sharing systems. Companies that wanted to use them could rely on proprietary network software written by each LAN hardware vendor. These programs supported their own LANs, allowing computers in the LANs to communicate and share peripherals.

But LANs have grown—in complexity of architecture and of application—making it more difficult for users to rely on hardware vendors for LAN programs. This is because many large companies now require two or three LAN schemes to meet the demands of their various departments in the most cost-effective manner. Moreover, multiuser information-sharing has replaced peripheral-sharing as the primary LAN application.

As a result, microcomputer system integrators and users began to wait for a network standard to emerge that would enable them to connect LANs using the same standard hardware topology. Most expected Ethernet, Omninet or another popular LAN to become standard. But, instead of one standard, several protocols—conventions governing message interchange between terminals—have evolved. Each has established its own niche in the market and its own user base.

As an alternative, companies that want to provide information-sharing among departments are now turning to a "standard" software solution, such as Novell Inc.'s NetWare file-server operating system. Novell,

Orem, Utah, has ported NetWare to 18 major LANs for IBM PC/XTs, ATs and compatibles. Its latest release, Advanced NetWare, connects all these LANs. Among them are Corvus Systems Inc.'s Omninet, Standard Microsystems' ARCnet, Gateway Communications Inc.'s G-Net, Novell's S-Net, Proteon Associates Inc.'s proNET, Nestar Systems Inc.'s PLAN 2000, 3Com Corp.'s EtherLink, Orchid Technology's PCnet and Davong Systems Inc.'s MultiLink.

Advanced NetWare connects departmental, or cluster, LANs into company-wide communications systems. It also maintains hardware topology and operating system independence and simplifies internetwork communications, application development and user training. In addition, Advanced NetWare provides data integrity comparable to that of mainframe host-to-terminal systems.

Because Advanced NetWare provides a constant user and application interface, users must learn only one set of network commands, one file structure and one set of security procedures. Commands and functionality remain the same for the user and for the application across local and remote, single-vendor and multivendor networks. Advanced NetWare extends NetWare's capabilities by supporting internetwork bridges, remote PC-to-network execution, value-added servers, multiuser synchronization, default file-locking for single-user software and software usage control mechanisms.

Internetwork bridges connect LANs

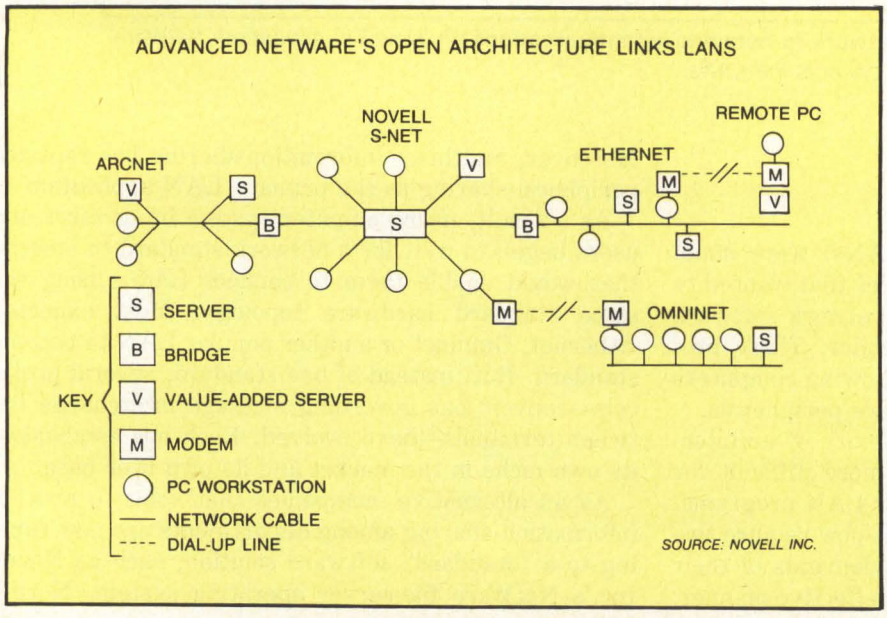
One benefit of Advanced NetWare is its use of software bridges to support network-to-network communications. Novell defines software bridges as any NetWare-to-NetWare connection, regardless of what hardware topology the connection uses. Using an IBM PC bus as the physical connection, a user can make an Omninet-to-Ethernet bridge by installing an Omninet board and an Ethernet board in one PC. With the bridge software and NetWare running on both LANs, users can send internetwork communications and use any of the resources on the resulting network as if they were all local.

This scheme allows all of the supported networks to be connected in whatever arrangement a user wishes. If the connected network is within a company, the user need purchase only one version of the application software, even though the software has to run on dissimilar hardware topologies.

Advanced NetWare also supports multiple servers, allowing users to log onto as many as eight servers at once. Using the NetWare naming convention, a user names a file, and the network automatically routes requests with that name to the proper location.

In some Advanced NetWare implementations, users can remotely access all LAN resources through a 300- or 1,200-baud modem and a dial-up telephone line. In these installations, Advanced NetWare can make a transparent connection of two networks or of a remote PC and a network. However, modems offer noticeably slower response times than do hard-wired systems.

The remote internetwork system enables users in satellite sales offices to call their main offices and log onto the network. The salespeople in the remote offices can then query the database for inventory information,



NetWare's open architecture provides an environment *in which NetWare overlays all networks for inter-LAN communications.*

Why choose a file-server operating system?

Networks can access shared disks via disk servers or file servers. The major differences between the two access methods are:

DISK SERVER	FILE SERVER
Management Responsibility	
A disk-server system places the management responsibility on the application software and each PC workstation.	A file-server system, such as Novell Inc.'s NetWare, places the management responsibility on the network operating system.
Disk Management	
A disk-server approach is "unsynchronized" because each PC tries to manage a directory, a file-allocation table and a disk, with no means of coordinating with other workstations	A file-server approach is "synchronized" because the CPU manages the disk and coordinates, or synchronizes, with other workstations.
Data Integrity	
Because of its inability to coordinate with other workstations, a disk-server system can cause "destructive interaction" between two users' data. For example, if user A and user B were working on the network in the same directory area of a central hard disk, they would both go to the file-allocation table to store their data. The file-allocation table would show the same amount of unused storage space on both users' machines. User A would then store his data, followed by user B, who would store his data in the same area as user A. The result would be destructive interaction—ser B's data would destroy user A's data.	Because a file-server system has centralized directory and file management, only one device reads the file-allocation table and allocates space. Hence, it would not tell two users to store their data in the same area, and no data loss would occur.
File-Locking	
In a data-server system, locking the files before updating them prevents other users from gaining access to the files. However, it does not have any control over storage allocation. Thus, it does not prevent data loss.	In a file-server system, locking the files before updating them prevents other users from gaining access. Because storage allocation is centralized, data loss is not a problem.
Disk Space Pre-allocation	
Software developers can partially relieve the limitations of disk-server systems by including code to pre-allocate disk space in the application. For example, if a user wanted to write a document, he could pre-allocate 8K bytes for storage. If 8K bytes proved insufficient, the user could return to the file-allocation table and request more space. However, it is difficult to write these disk-management features in application software because developers must write code for each supported local area network.	A file-server system does not require pre-allocation because only one device reads the file-allocation table. This relieves the application software of disk-management chores, freeing it to manage multiuser operations and the application itself.
Multiuser/Single-User Support	
Because pre-allocation is a multiuser feature, disk servers cannot support single-user software, except when each user has a private disk partition and directory.	A file-server approach supports single-user software. Advanced NetWare also features default file-locking so that users can share single-user files.
Network Security	
In a disk-server network, low-level PC workstation-to-disk system calls manage the shared disk. A user intent on breaking disk-server security would have an open path to the disk. Once there, he could begin to seek security mechanisms and user passwords.	In a file-server network, the workstation makes high-level file system calls to the server. A user at a workstation cannot read the disk directly. The server itself provides the only direct path into the disk area. Because access to the file server is restricted, it is virtually impossible for a user to break the security on a file-server network.

enter sales made, make shipping requests and update the database with inventory information. The system also supports file-locking and other multiuser data-integrity features, just as if the access were from a local workstation.

In addition, the Advanced NetWare architecture treats all devices attached to a network as objects that can have user-defined properties. This allows software developers to write value-added servers to run on the operating system. Such value-added servers could include communications servers, database back-end machines and peripheral servers. To date, 100 software developers have written approximately 500 multiuser applications that run on NetWare. Applications on Advanced NetWare can communicate with other workstations or with servers. The applications can also queue requests, and the servers can manage each application's queues. Alternatively, the workstation can manage its own queues.

In operation, value-added servers can manage applications that are impractical for conventional servers. For example, a print server could manage a plotter for the network. Attaching a plotter to a conventional print server would be difficult because a plotter cannot operate continuously; users must constantly change the plotter's pens and paper. But, with Advanced NetWare, developers could write a value-added application that would tell the plotter to beep when it is out of paper or pens. It would also allow many users to spool the plotter.

Software can process tasks simultaneously

Because Novell developed Advanced NetWare specifically for networking, it does not run on top of PC-DOS as other operating systems do. Instead, its network-management software resides between DOS and the disk. Other network operating systems, on the other hand, run on PC-DOS, placing DOS between the network-management software and the disk.

Because it does not run on top of PC-DOS, Advanced NetWare does not incur the bottleneck that typically occurs with other network-management software—the inability to process foreground and background tasks simultaneously. This means that Advanced NetWare can, for example, process disk I/O in the foreground while performing other tasks in the background, such as sorting a cache, hashing a directory or "elevator seeking"—evaluating the location of requested files and retrieving them in the most efficient order.

In addition, Advanced NetWare uses the file-server approach to access shared disks. This method differs from the other available method networks can employ —the disk-server approach—in the way it manages network files and directories (see "Why choose a file-server operating system?" Page 119). The file-server method places management responsibility on the network operating system. The disk-server method, on the other hand, places responsibility on the application software and each PC workstation.

Moreover, Advanced NetWare provides several layers of software copy-protection and usage-restriction mechanisms. These techniques discourage software piracy and control the number of users that can simultaneously run an application program on a network. For example, a system integrator can mark a software package installed on a NetWare file server as "execute-only." This means that a user cannot open or use the package's files under program control. Once the file is marked, renaming it will have no effect on its execute-only status. The only way to change the mark would be for the system integrator to erase the file and re-install the package.

Each NetWare file server has a unique serial number, which can be retrieved and checked by an application program running in the NetWare environment. This enables the application programs to query the file server about its identity and to stop execution, should the file server's identity not match the identity the applications are programmed to accept. If the serial number does not match, the file server automatically logs the station off the network—revoking all file-access rights—and returns an error indication to the workstation.

NetWare also includes primitives that allow a package to determine how many stations are using the package at one time. Application software vendors can thus restrict the number of users that can use a single-user or multiuser package simultaneously. Software vendors typically price their packages according to the maximum number of users they support. □

Michael Durr is a network consultant and author of *Networking IBM PCs: A Practical Guide*, published by Que Corp., Indianapolis, and co-author of *Understanding the Law*, published by SRA Publications. Durr received a B.A. in business and technical communications and an M.A. in marketing communications from California State University, Los Angeles.

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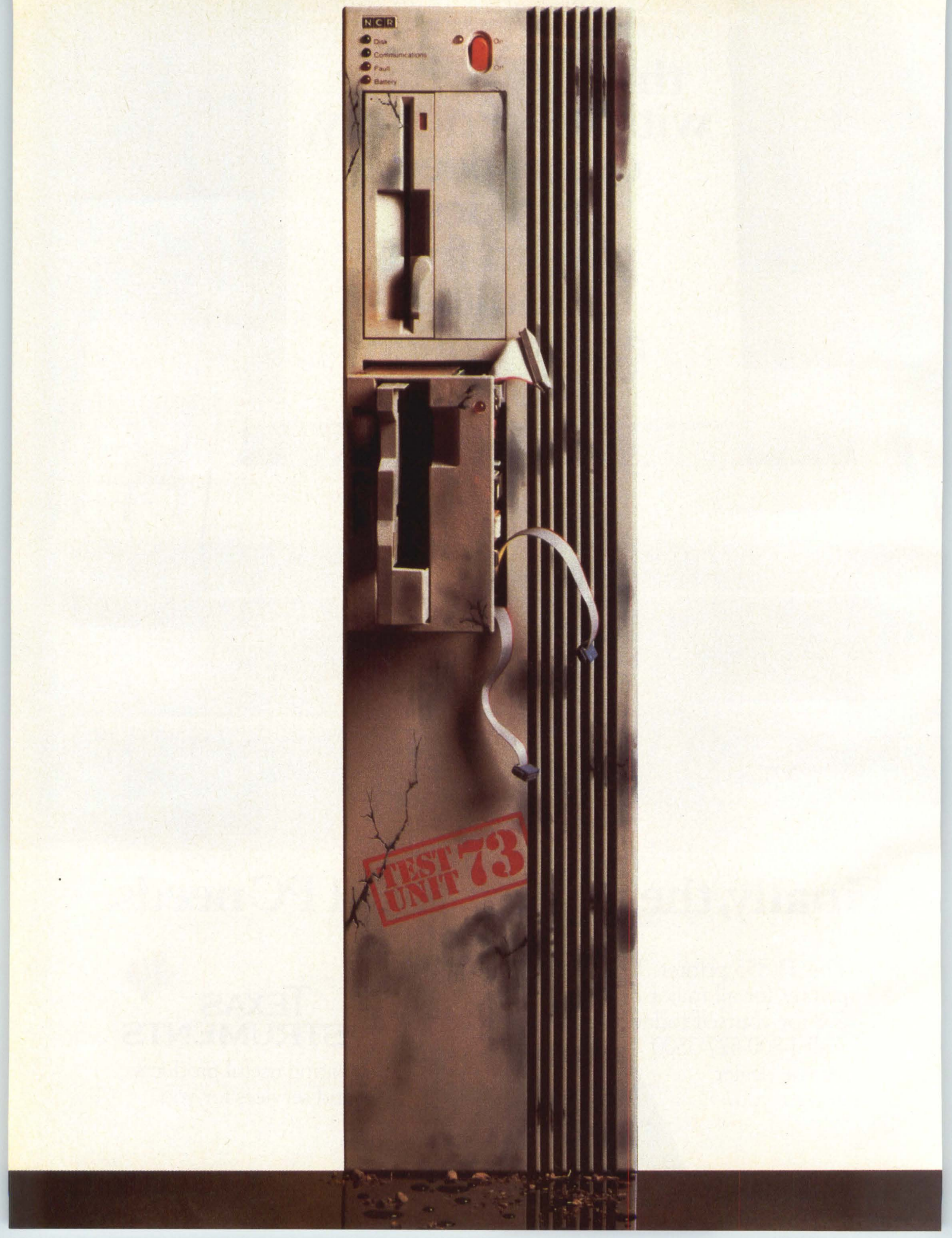
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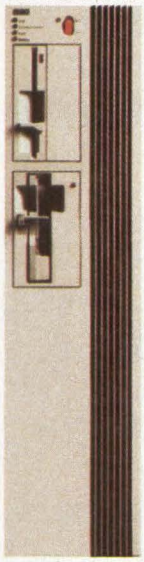

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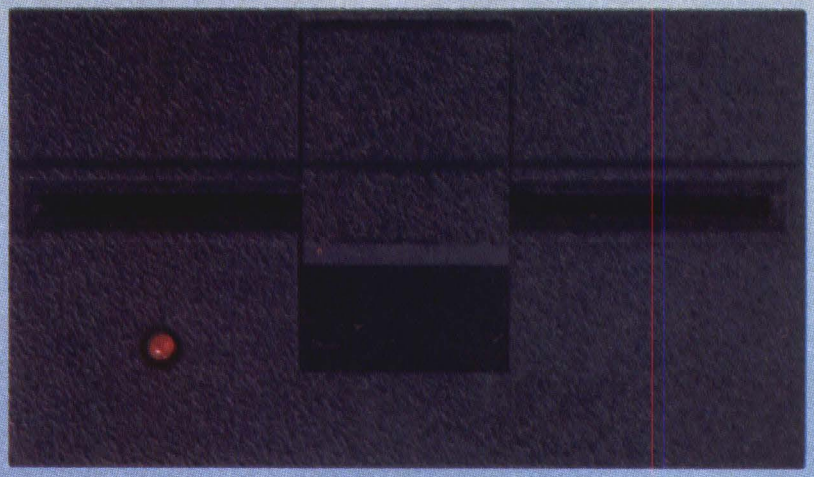

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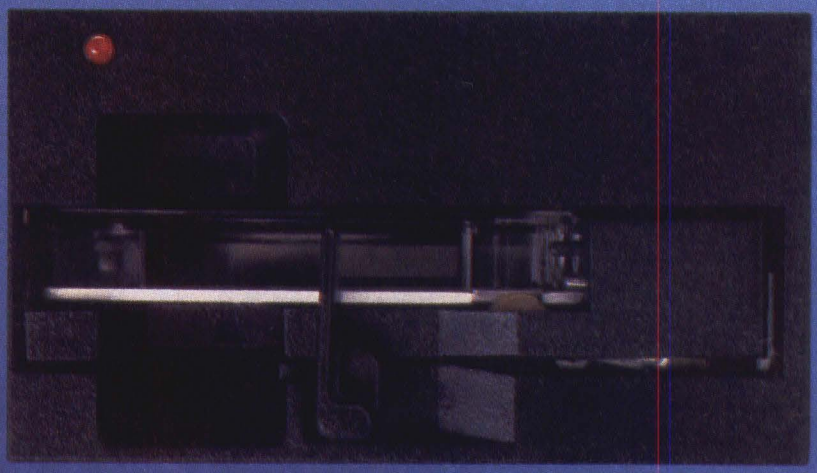

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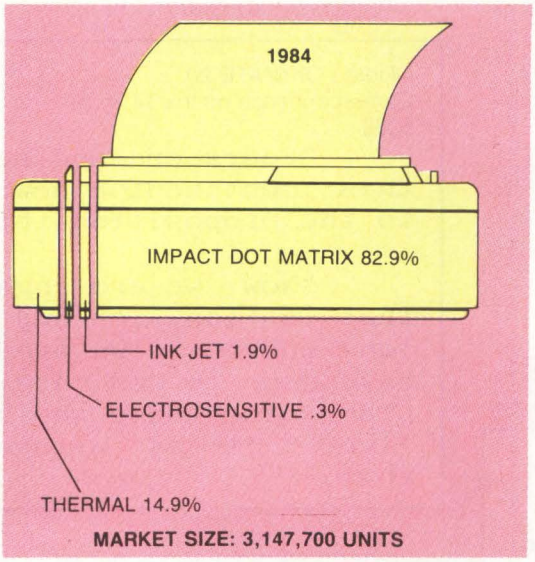
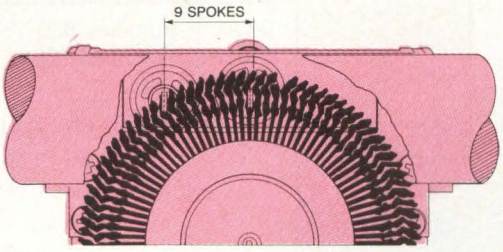


p. 129 . . . . . Retail reshapes market

PRINTERS: All sectors of the printer market will be affected by the rough-and-tumble price/performance battles now being waged by **retail outlets.** Turn to **p. 129** to see just how retail stores are calling the shots.

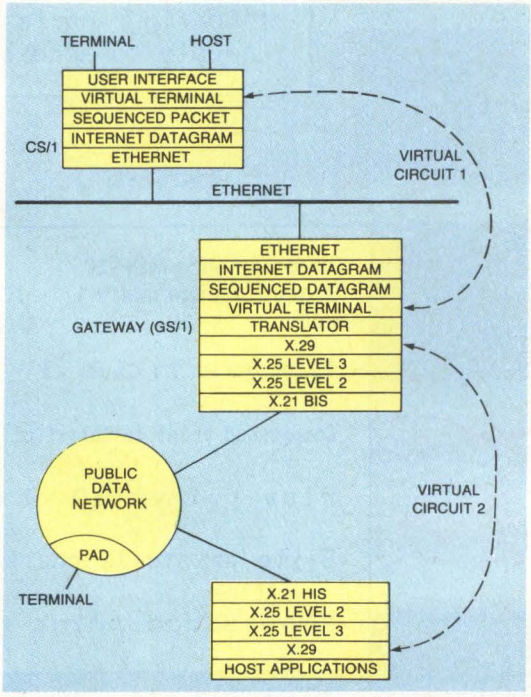
Can **daisywheels** survive the onslaught of new printer technologies? Yes, because the office of the future will still require them. To find out why, see **p. 163.**

The choice of a **printer supplier** directly affects system development marketing strategy and, to choose wisely, one must be aware of several practical rules. Turn to **p. 175** for guidelines.



p. 143 . . . . . Creating artful text

WORD-PROCESSING SOFTWARE: Taking advantage of the display power of the latest computer systems, today's newer, more powerful word-processing programs have gone far beyond simple text editing. Have a look at the newest features and at who offers them, beginning on **p. 143.**

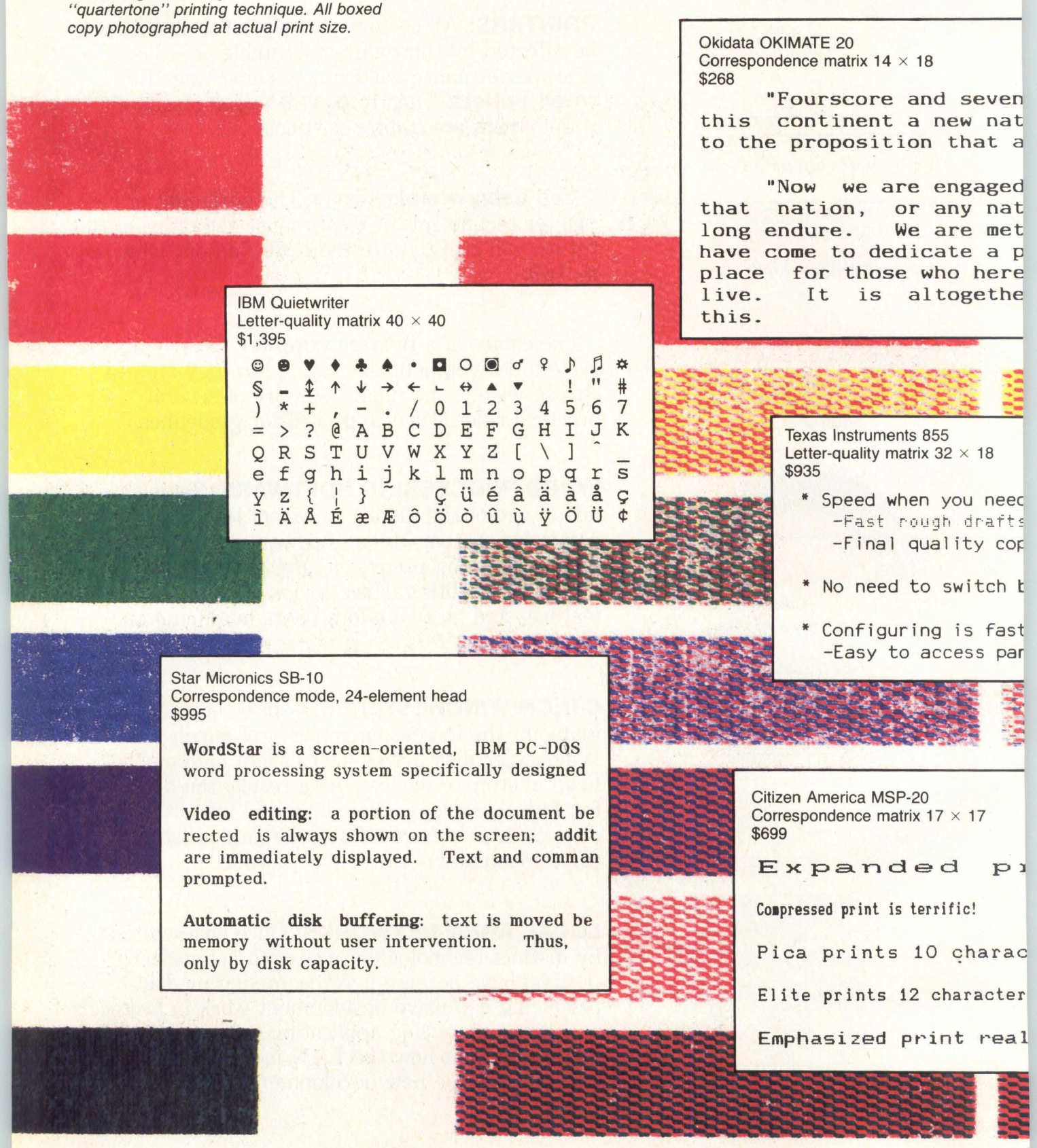


p. 195 . . . . . Hybrid LANs rewrite rules

8-INCH WINCHESTERS: Despite their lack of glamour, the increasing capacity of 8-inch Winchester disk drives keeps them high on the heap of storage devices. As a result, the demand for 14-inch drives is dwindling and may eventually disappear. For more information and a list of 8-inch drive manufacturers, turn to **p. 185.**

LOCAL AREA NETWORKS: Once characterized by distinct technologies, local area networks (LANs) have become hybrids, mixing media, producing extensive development work in protocols and even influencing application software. See **p. 195** to find out how the LAN industry is being shaped by these new developments.

A portion *of Okidata's OKIMATE 20 color selection guide enlarged five times to show "quartertone" printing technique. All boxed copy photographed at actual print size.*



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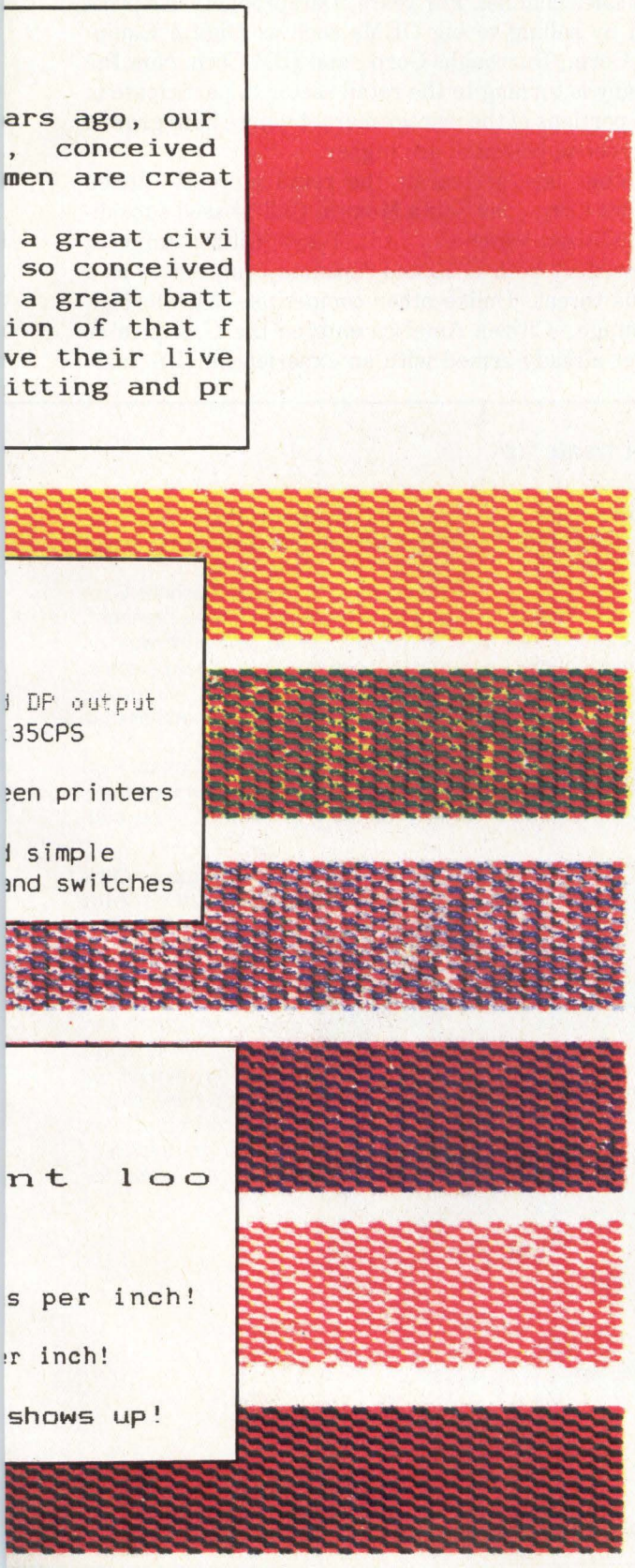


Printer manufacturers elbow for shelf space

Retail price competition is reshaping the printer market, directly influencing system integrators and OEMs

Rick Dalrymple, Senior Editor

All sectors of the printer market are bound to be affected by the rough-and-tumble price/performance battles now being waged on the computer store shelf. Product introductions and pricing tactics aimed at the retail market directly impact the system integrator buying 10 to 50 printers a month. Even the OEM buying thousands of printers per month cannot afford to ignore the points along the price/performance curve —now being set by the retail stores instead of the manufacturers.

A few years ago, companies building printers for the "serious" user viewed the retail channel as the place where one went to buy a "toy" printer. Today, the "serious" user is the retail store's best customer. According to Peter Steiner, director of the Electronic Printer Industry Service at Dataquest Inc., a market research concern based in San Jose, Calif., "A large majority of computer printing requirements can now be met by a printer priced under $1,000 and the most important distribution channel for these products is retail."

The sweeping shift to the retail store is clearly due to the enormous popularity of the personal computer. Even engineering and scientific users, who typically have access to both superminicomputer and mainframe computing power, have turned to the personal computer for tasks such as word processing, budgeting and project scheduling. Of course, personal computer users want their own printing capability and now, with

printers so affordable, their sales volume is closely linked to the sales figures of personal computers.

The system integrator, however, should not jump to the conclusion that the under-$1,000 printer is suitable only for low-duty-cycle applications. Today's 200-character-per-second (cps), 132- to 136-column impact matrix printer is priced under $1,000 and intended for applications where printing volume often exceeds 2,000 pages per month. Although obviously not in the same league as page and line printers, these products, nevertheless, are well suited to the printing volumes of many multiuser minicomputer and microcomputer systems.

Recognizing that printers sold at retail are reshaping the printer market, Dataproducts Corp., Woodland Hills, Calif., recently made its move to break into the retail sales channel. For years, Dataproducts has prospered by selling to big OEMs such as Digital Equipment Corp., Burroughs Corp., and IBM Corp. Now the company is turning to the retail sector to participate in those portions of the printer market where both growth and revenue potential are higher.

Another late arrival at the retail store is Citizen America Corp., the Santa Monica, Calif.-based subsidiary of Citizen Watch Co. Ltd., Tokyo. Citizen America is viewed by both U.S. and Japanese competitors as a serious threat. Unlike other competitors with foreign parentage, Citizen America entered the U.S. printer market already armed with an experienced U.S. mar-

Thermal transfer market heats up . . .

This year, thermal-transfer printers are entering the U.S. office in numbers for the first time. Printer-market analysts expect several manufacturers to introduce thermal-transfer products during 1985 but, so far, only three have targeted business users in the United States: Canon U.S.A. Inc., Lake Success, N.Y., Okidata, Mount Laurel, N.J.; and IBM Corp., Armonk, N.Y.

Industry observers seem divided on how U.S. business will view the offerings. Some feel that they will begin to replace printers based on daisywheel and impact-matrix technologies. Others see thermal-transfer printers being rejected because they require expensive ribbons and "funny" paper. Unlike thermal printers, which create an image by burning a heat-sensitive paper with heated pins, thermal-transfer printheads heat a heat-sensitive ribbon and transfer the "melting" ink onto the paper.

IBM has eliminated the paper objection by employing a proprietary printhead and "resistive ribbon" that can print on the papers commonly used by businesses in the United States and Western Europe.

Unlike the smooth-surface business papers typically found in the Far East, business papers in the United States and Western Europe have a textured surface. Paper manufacturers measure the "coarseness" or "roughness" of a paper in what are called Sheffield points. Coarsely textured papers such as ripple finish or linen have a high Sheffield rating.

"Most U.S. business papers fall between 140 and 180 Sheffield points," explains Dennis Jacobson, supervisor of product development and technical sales service, Hammermill Paper Co., Erie, Pa. Says Jacobson, "Hammermill has just introduced a line of smooth-finish papers specifically designed for thermal-transfer printers. These papers, rated at 80 Sheffield points, aim at customers who own printers such as the Canon F-60 and [Okidata's] OKIMATE 20. Because the IBM Quietwriter printer can print on papers rated at 300 Sheffield points or less, almost any paper found in the office will do."

According to Robert Piechnik, Canon's printer division sales manager, "The Canon F-60 will print well on most standard U.S. business papers. However, for best results, we recommend papers that are smoother than high-rag-content bond."

The IBM Quietwriter, Canon F-60 and the OKIMATE 20 carry dramatically different price tags. The sug-

The Okidata OKIMATE 20 color graphics *thermal-transfer printer (left) prints on smooth-surface papers and is priced at $268. The IBM Quietwriter (right) prints on almost all business papers, but only in black and does not offer graphics features. It sells for $1,395.*

keting team, an aggressive product line and the apparent ability to distribute to stores in every key market area in the nation.

Printer-market analysts view the retail side as a game where the price of chips comes high. By stepping into the retail channel, Dataproducts and Citizen America are confronting recently established and formidable competitors. The list includes C. Itoh Digital Products Inc., Epson America, Hewlett-Packard Co. (HP), IBM, Okidata Corp., Star Micronics and Texas Instruments Inc. Like Dataproducts and Citizen America, each of these companies has the financial muscle to participate in an extended retail price/performance war.

Obviously, these manufacturers are not the only participants in the retail marketplace. However, the consensus among them is that collectively they will be the survivors of the battle over the retail channel and that all other participants will eventually be elbowed off the shelf. Generally, the printer consultants agree. However, each has his own "short and private list" of dark-horse manufacturers poised to move up quickly should any of the leading players stumble.

OEM sales linked to retail

The characteristics that make a manufacturer formidable at retail also make him a major force in the OEM channel. The keys to success in both channels, assuming a competitive product, are low price, high quality

. . . U.S. market acceptance uncertain

gested retail prices are: $1,395 for the Quietwriter, $549 for the F-60 and $268 for the OKIMATE 20. Print speeds for the OKIMATE 20 are 80 characters per second (cps) in draft mode and 40 cps in letter-quality correspondence mode. For the Canon F-60, print speeds are 80 cps in draft mode and 20 cps in letter-quality mode. The Quietwriter prints only in letter-quality mode at print speeds that range from 40 cps in 10-pitch type to 60 cps in 15-pitch type.

The OKIMATE 20 uses a three-color ribbon and offers dot-addressable graphics, in color, with a maximum resolution of 144 by 144 dots per inch (dpi). Black printing is available by using a black ribbon. The Canon F-60, however, prints one color and can achieve resolutions up to 360 by 180 dpi. Canon printer users may choose from four single-color ribbons and must change the ribbon to print in more than one color. The Quietwriter prints only in black and has no graphics features.

Given these differences, each printer will probably attract different customers. Buyers will find the quiet operation of these thermal-transfer printers appealing. IBM and Okidata describe their noise level as "53 dBa." Canon rates the F-60 at "45 dB." Those customers who are unwilling to use smoother surface papers have one choice—IBM. On the other hand, those customers searching for an inexpensive color printer will find the OKIMATE 20 attractive.

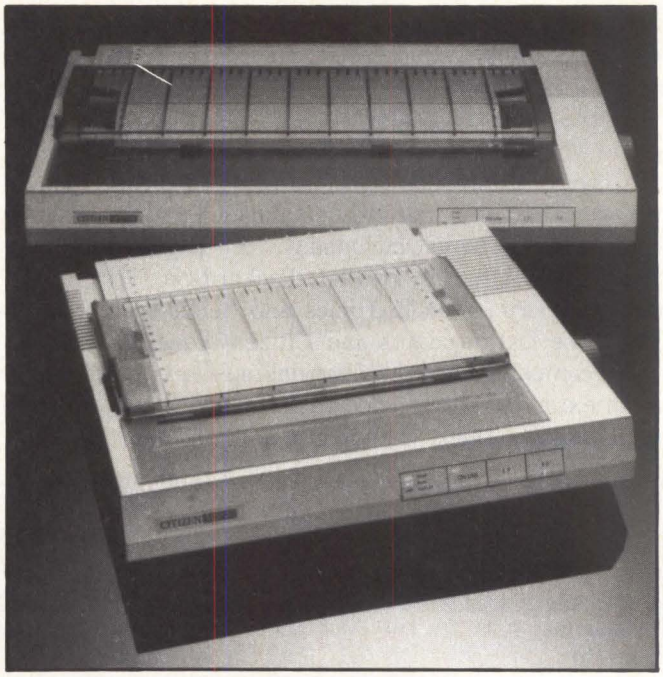
"We are introducing the OKIMATE 20 as a color printer," states Frank Lodge, Okidata's OKIMATE 20 product manager. "Since we expect the OKIMATE 20 to be used in conjunction with either a solid-font or impact matrix printer, we are offering a software switch for the IBM PC that will always direct the color output to the OKIMATE 20 and all other printer output to the standard printer port. Given the low price tags of both the OKIMATE 20 and today's impact matrix printers, the customer can buy both for less than $1,000."

Marketing executives at Canon have a different view of their thermal-transfer printer. They are positioning the F-60 as a replacement product for both solid-font and matrix printers. Given its 36-by-24 dot matrix layout, Canon's sales force will be claiming that its F-60 is the new versatile printer of the '80s, providing the user with both the character printing quality heretofore found only in daisywheel printers and the versatility previously found only in impact matrix printers.

and on-time delivery. Recognizing this relationship, Epson, Okidata and Star Micronics have stepped up their efforts to land OEM business. In Epson's case the effort has even extended to offering its large OEM customers the services of Epson's design engineers, who will custom-design products to the OEM's specifications. Epson's major OEM product line, however, is the CTM series. It is sold exclusively to OEMs.

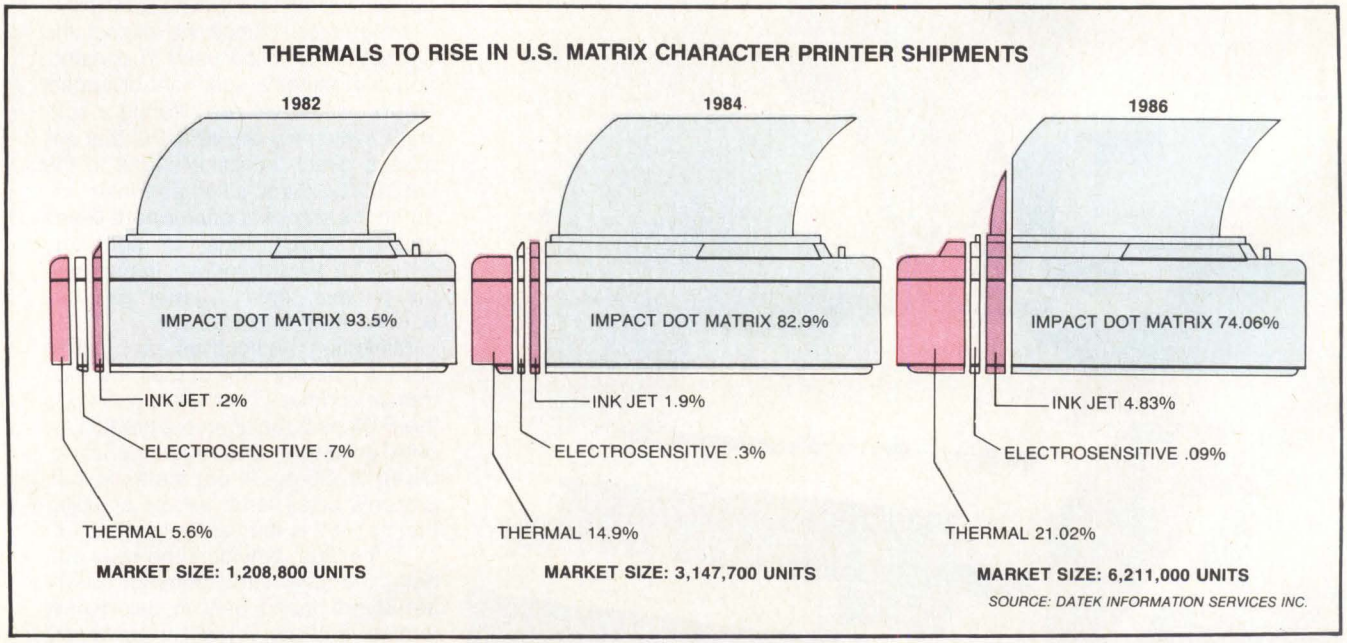
Dataproducts, HP, IBM, Texas Instruments and C. Itoh are all, of course, well versed in OEM marketing. Citizen America, however, is the new kid on the block in both the OEM and retail channels. According to Michael Del Vecchio, Citizen's vice president of sales and marketing, "If we can make an impact on the retail customer, the OEM attention will follow." Del Vecchio sees success in the retail store as his first objective. Anticipating that retail success will come soon, the company has already launched a major promotional program aimed at buyers in the OEM channel.

In their zeal to gain a competitive advantage, those manufacturers in pursuit of the retail customer are lowering prices and increasing performance. In this now classic marketing scenario, seen previously in watches, calculators and television sets, the participants on the retail stage create an environment within which the buyer is always discounting the current products in anticipation of the next price cut or new product introduction. Because these same basic products are also being sold in the OEM channel, a price battle at the retail level spills over into the OEM channel as well.

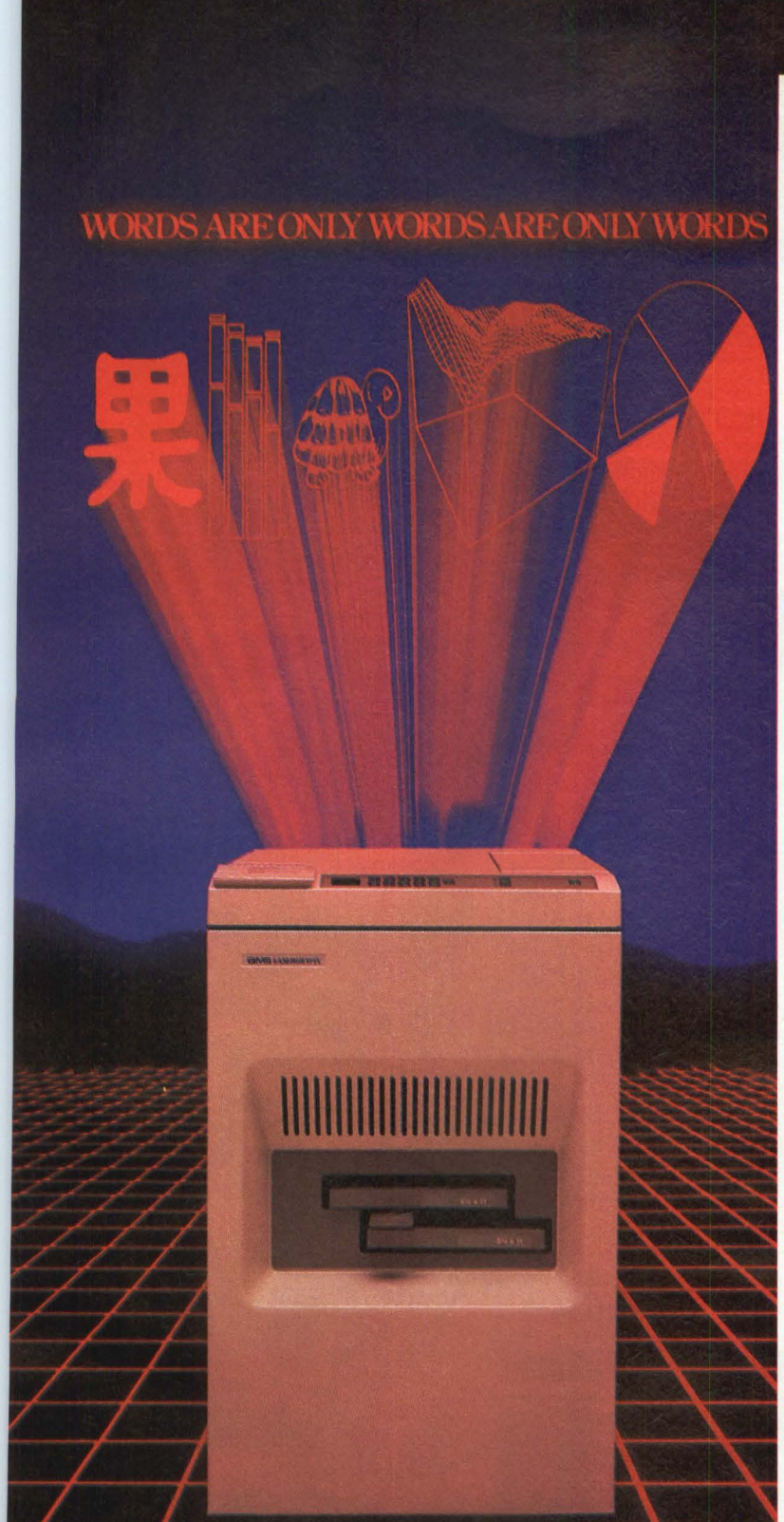


Citizen America's two new *200-cps printers: the 80-column MSP-20, $699(front), and the 136-column MSP-25, $949.*

This situation is likely to spell trouble for small OEM printer manufacturers, who clearly lack the financial resources to participate in the retail market. Both analysts and industry observers agree that all small OEM manufacturers presently offering impact matrix character printers with print speeds under 200 cps are probably going to feel severe competitive pressure.



Market figures *for thermal printers include shipments of thermal-transfer printers. Datek analysts expect thermal-transfer printers to enjoy the major portion of the thermal category in 1986.*



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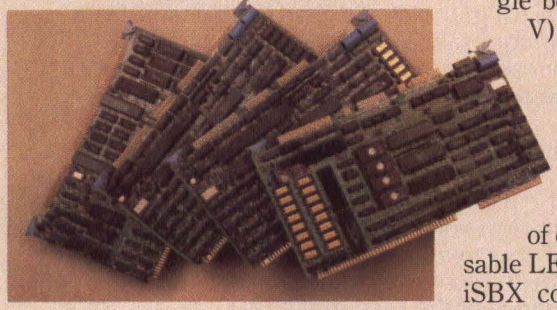

MLZ-91A single board CP/M™ system with on-card floppy disk drive controller, winchester interface, optional AM9511, streamer tape interface, two serial ports, one parallel port, 64K or 128K bytes RAM with parity, two EPROM sockets, and GPIB CONTROLLER.

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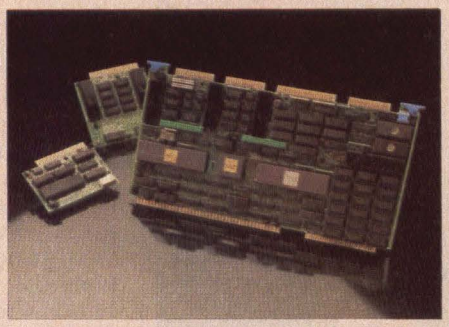

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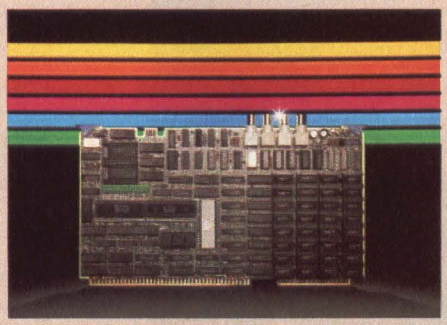

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Many will have to file under Chapter 11 of the bankruptcy laws, others will be acquired and a few will survive in niches left untouched by higher-volume competitors.

IBM introduces new technology

To get a preview of just how competitive the market for character printers is likely to get, the system integrator need only turn to the latest IBM printer introduction. It appears that IBM's new "Quiet" printhead and "resistive ribbon" technology have removed a major market impediment for thermal-transfer printers. IBM's Quietwriter printer and Selectric Quietwriter 7 typewriter print on most office bond papers. All other thermal-transfer printers require a smooth-surface paper and cannot print on the stationery typically used by businesses in the United States and Western Europe (see "Thermal-transfer printer market heats up . . . ," Page 130).

An intriguing aspect of the Quietwriter announcement is the description of IBM's retooled typewriter and printer manufacturing facility in Lexington, Ky. When completed in 1986, IBM will have invested $350 million to build one of the world's most highly automated manufacturing facilities. Already at work inside the 60-percent-completed plant are IBM model 7535 and 7540 robotic systems controlled by IBM Series/1 processors. According to an IBM spokesman, "The production process has been designed to nearly eliminate the need to keep a parts inventory. Parts not produced in the facility are scheduled for delivery to Lexington 'just in time' for assembly."

The characteristics that make a printer manufacturer a formidable foe at retail also make that manufacturer a major force in the OEM channel.

All the manufacturing steps necessary to produce typewriters and printers will be performed in the facility, including automated parts stamping and welding. When all seven of the plant's automated areas are operational, they will be interconnected by an extensive network of conveyors. As a perspective on the size of the facility, the final assembly area alone includes five miles of conveyor tracks.

Given the massive scale of this manufacturing plant, industry observers expect IBM, over time, to introduce other products based on its proprietary thermal-transfer technology. These products will be priced under $1,000 and probably feature higher print speeds, color and point-addressable graphics.

How the Japanese see thermal transfer

The still small, but rapidly advancing, personal-computer market is creating a brisk demand for printers in the Japanese domestic market. Currently that means impact matrix printers; however, the dominant position now held by impact-matrix products is being challenged by non-impact printers. In high-duty-cycle applications, the Japanese customer is starting to buy drop-on-demand ink-jet and laser printers. For lower-duty-cycle applications the alternatives are thermal and thermal-transfer printers.

This year, at Japanese trade shows, printer manufacturers will be vigorously promoting thermal-transfer printers. Because the smooth paper required for these printers is standard Japanese business paper, Japanese manufacturers have a home-market incentive to promote these products on a mass-market basis.

Japanese customers have good reason to consider thermal-transfer printers. Unlike countries in the Americas and Europe, which use alphabet-based languages, countries like Japan and China employ more than 2,000 ideographs in common daily usage. Although a nine-dot square matrix may be acceptable for the draft printing of alphabet characters, it doesn't work for ideographs.

Impact matrix printers produce fuzzy dot patterns that can make an ideograph difficult to read and, unfortunately, solid-font mechanisms such as daisywheels, hammers or golf balls are impractical for so many characters. The result is that Japanese customers are searching for products offering high-resolution character printing along with the versatile printing and graphics features found in matrix printers.

The Japanese printer manufacturers have met these requirements by introducing thermal-transfer printers. Not only are thermal-transfer printers a better product for Japanese users, they are quieter and less expensive than most impact matrix printers.

Several color thermal-transfer products are already on the Japanese market, as are the necessary three-color ribbons. One representative product is the Toshiba TN-5400, which prints one page a minute, making three passes, one for each color, producing a full-color copy with a resolution of 200 dots per inch. The three-color ribbon used with the Toshiba printer will print 160 sheets before replacement is required.

The biggest market for Japanese printer companies is, of course, the export market. Products for export account for aproximately 75 percent of the printers manufactured in Japan, hence the emphasis placed on designing products suitable for other markets. The Japan Business Machine Manufacturer's Association is expecting thermal transfer printers in the United States to grow from an estimated 2 percent share now to about 12 percent by the end of 1985.

—Ichiro Kakehashi
Tokyo Correspondent

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Circle 765

Citizen America Corp.
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Santa Monica, Calif. 90404
(800) 556-1234, Ext. 34
Circle 766

Dataproducts Corp.
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Woodland Hills, Calif. 91365
(818) 887-8000
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Epson America Inc.
Computer Products Division
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Torrance, Calif. 90505
(213) 539-9140
(for retail distribution)
Circle 768

Epson America Inc.
OEM Products Division
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Torrance, Calif. 90505
(213) 533-8277
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Circle 769

Hewlett-Packard Co.
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Circle 770

IBM Corp.
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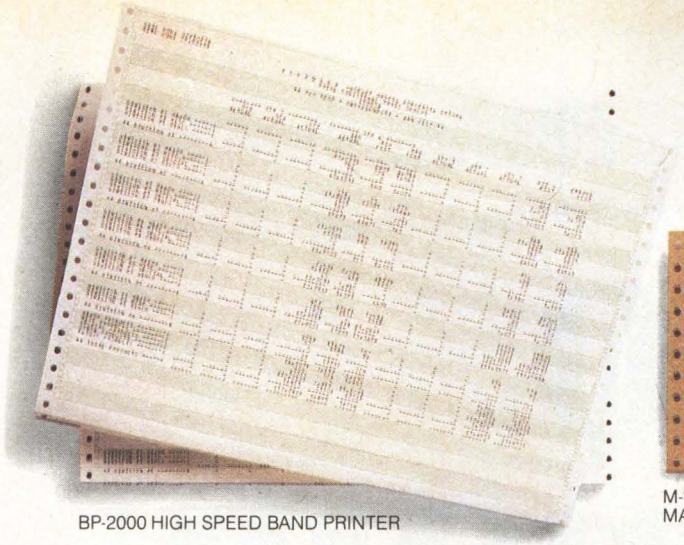
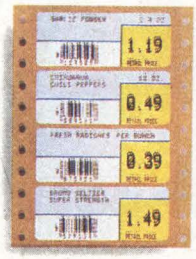
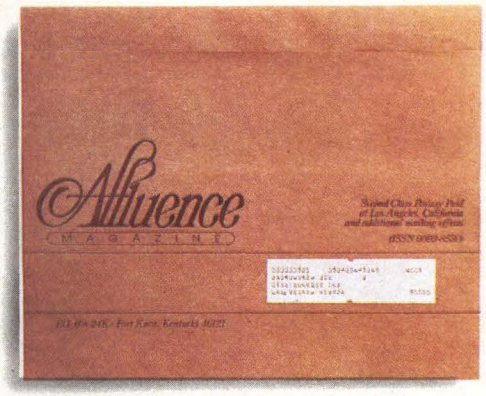


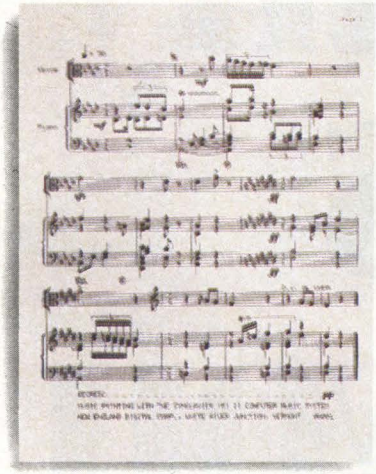
BP-2000 HIGH SPEED BAND PRINTER



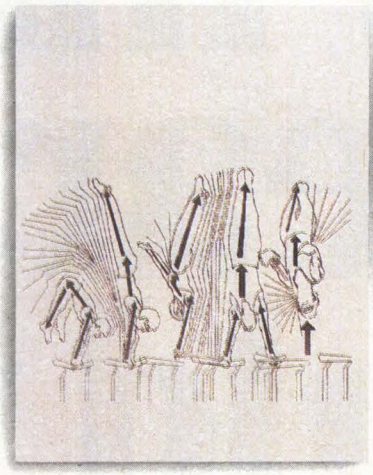
M-100L
MATRIX PRINTER



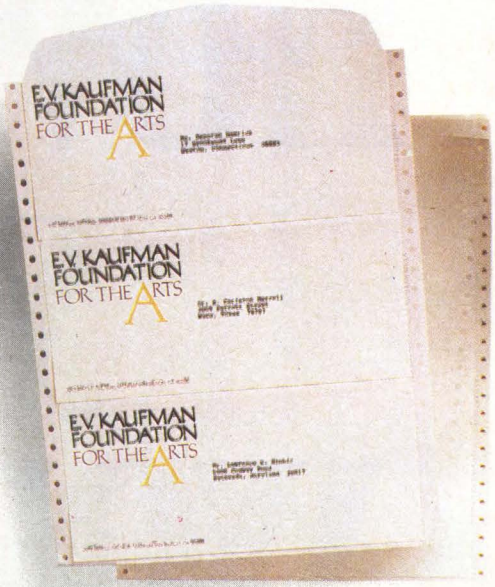
B-600 MEDIUM SPEED BAND PRINTER



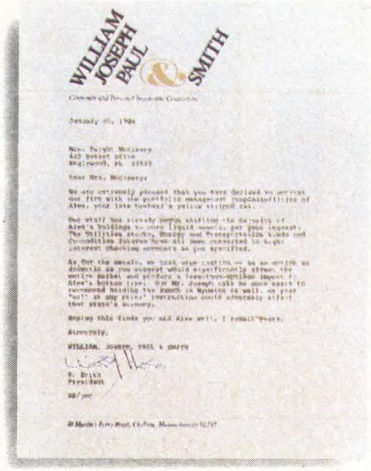
8010 MATRIX PRINTER



8020 MATRIX PRINTER



DP-55 DAISYWHEEL PRINTER



DP-35 DAISYWHEEL PRINTER

8050 MATRIX PRINTER

8070 MATRIX PRINTER

M-120 MATRIX PRINTER

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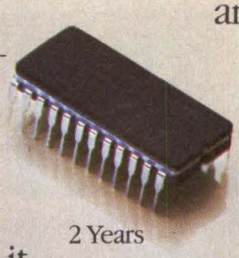

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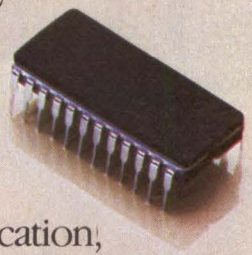
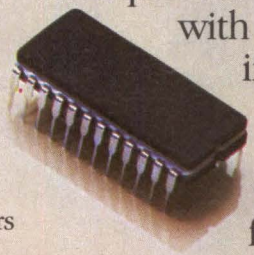
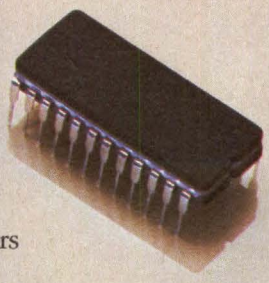


4 Years



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

6 Years



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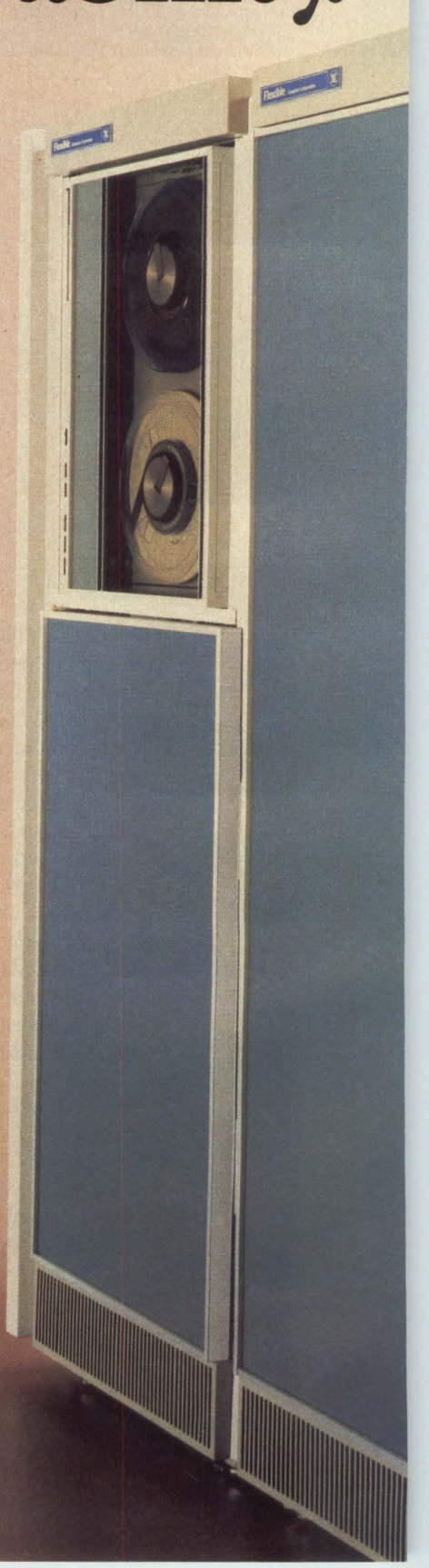

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CIRCLE NO. 70 ON INQUIRY CARD

Word-processing software injects text into pictures

By combining graphics and digitized images and text, word-processing software transforms document processing into an art form

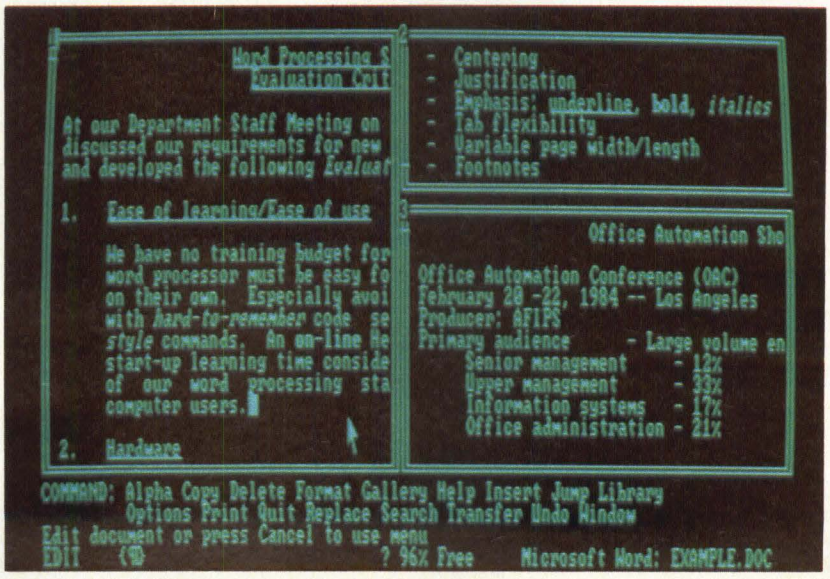
Carl Warren, Western Editor

Word-processing software is helping users create more diversified documents than previously possible.

Taking advantage of the display power of the latest computer systems, these newer, more powerful word-processing programs have gone far beyond simple text editing. They offer such features as multiple windows, integrated spelling dictionaries, graphics and digitized images. Moreover, this latest crop of software displays such character attributes as boldface, underlining, italics, superscript and subscript, and in some cases glyph —for languages such as Hebrew. Graphics and digitized images can be integrated with the text and users can see the "electronic" document much as it will appear on paper. Most software publishers claim this enhancement is high on users' wish lists.

Word processing remains a key element of office automation, but Ronni Marshak, associate editor of *The Seybold Report on Professional Computing*, Seybold Publications Inc., Boston, Mass., says it's being done now on microcomputers, not on dedicated workstations. "Dedicated word-processing workstations didn't really do a whole lot, other than basic text editing," she says. "The microcomputer isn't restricted to one application. It's a better choice over a dedicated word-processing system. What we are seeing is a trend toward the personal typing unit that has multiple purposes."

IBM Corp. apparently shares Marshak's view, because it recently unbundled the Display Writer software from the Display Writer hardware, making it available on the IBM PC series of personal computers.



Serving the singular purpose *of a word-processing system, Microsoft's WORD package employs a tiled-window approach, which displays character attributes on the screen. Word-processing functions are chosen from a menu that is addressed via a mouse cursor.*

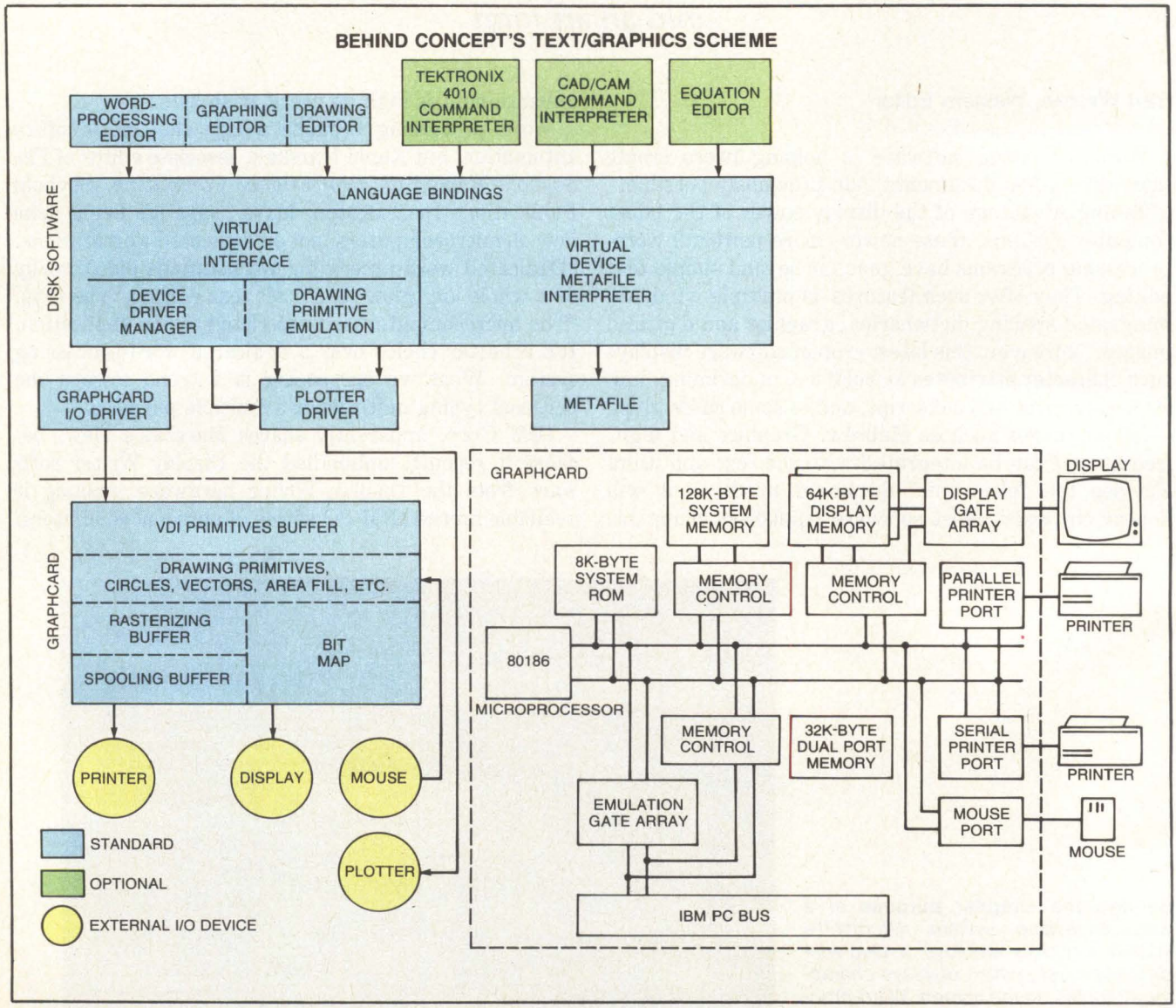
Marshak says this effectively killed the Display Writer hardware as a viable product and established the basis for the personal-workstation trend.

Imposes a style

What system integrators want is word-processing software that is flexible. "All too often, the software developer imposes a single metaphor on the user," says Jean L. Yates, president of Yates Ventures Inc., Palo Alto, Calif. "They either want users to look at the world through a grid, or an outline. People don't necessarily think that way and don't want rules pressed on them. Flexibility in the use of the product is important."

Yates expects a turning away from the traditional multiple-purpose package to single-purpose packages that permit the combination of functions such as spreadsheets, databases and graphics. Apparently, IBM agrees with her because its newest software strategy calls for separate applications linked via an overseeing supervisor package called TopView. The TopView package allows the combination of a variety of applications in handling information.

One publisher taking this single-purpose approach is Microsoft Corp., Bellevue, Wash. Its $195 WORD software offers users a full-function word-processing package, employing windows, character display attributes, and an integrated spelling dictionary. The user guides the cursor around the screen with a mouse pointer, which can be used to mark text or to choose specific editing functions.



Building on standards, *Concept Technologies combines hardware with software to couple text creation with graphics. The entire system relies on the Virtual Device Interface and Virtual Device Metafile proposed graphics standards as the basis of implementing diverse hard-copy and input devices, as well as supporting a variety of graphic images.*

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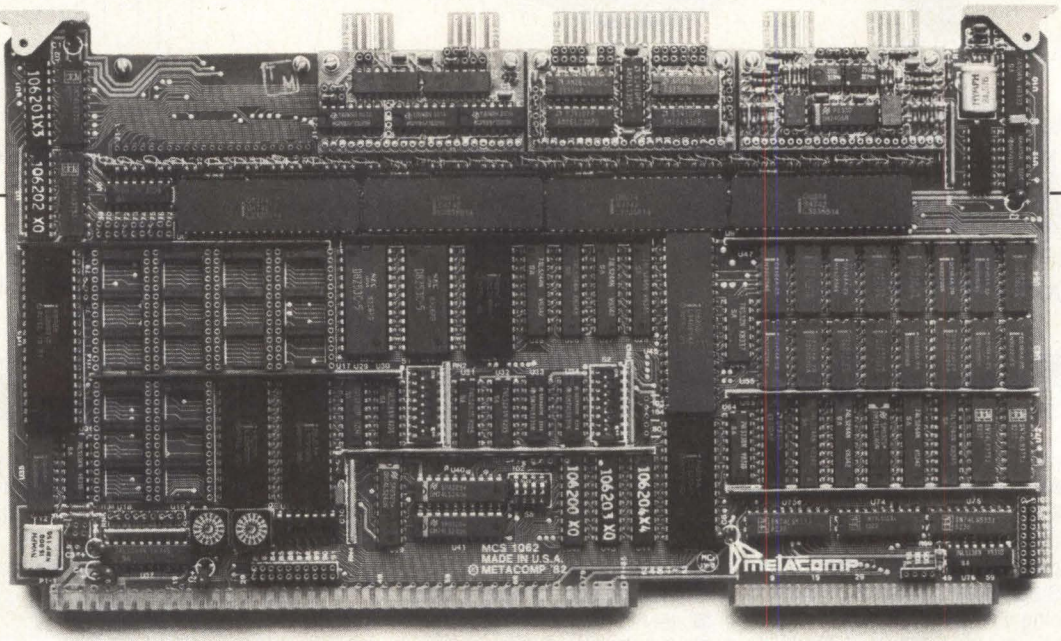

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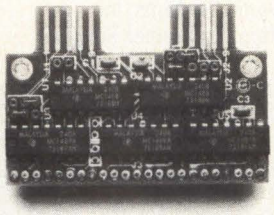

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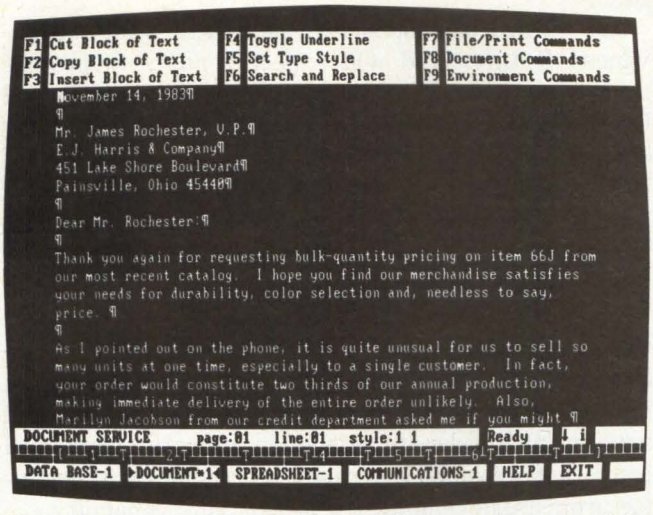
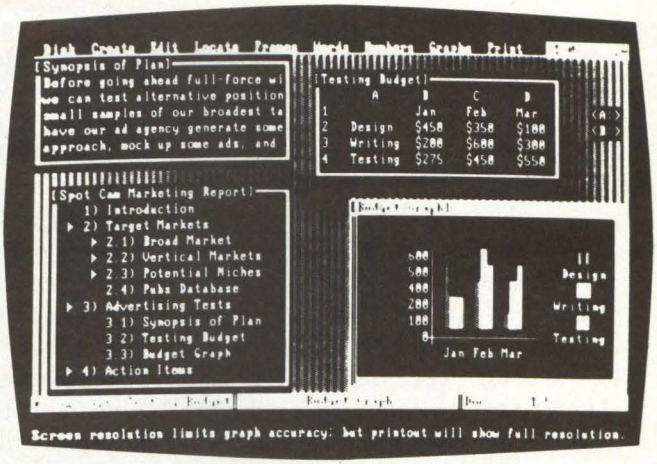


Alpha Software's Electric Desk *makes generous use of the IBM PC function keys (F1 to F9) and display characteristics to provide clear text pictures.*



Building documents from ideas *is the basis of Ashton-Tate's Framework integrated software. Windows, displaying key character attributes and employing pop-up/down menus, help users integrate the various functions into hard copy.*

Although WORD is primarily a single-purpose package for word processing, it can link into other Microsoft applications, such as Chart and Multiplan, for creating more sophisticated documents.

Unlike other facets of the computer market, word-processing software isn't considered glamorous. Some observers consider it a necessary, but ho-hum, product when stacked against other software. "Word processing is a part of a total system and it's hard to classify it as being spectacular," observes Bonnie Digrius, director of the software microcomputer group for Creative Strategies International, San Jose, Calif. She maintains that about 30 packages sell well, and that they cover the range from singular word-processing packages to integrated offerings. "It's really difficult to cull out the sales of word processing when you have to contend with the integrated software on the market," she notes.

Breaking out sales may be difficult, but clearly the market is changing. MicroPro Corp.'s, (San Rafael, Calif.,) WordStar word-processing software, while still considered the number-one selling package, maintains only a marginal lead. "WordStar has the advantage of name recognition," says Yates, "but it is rapidly falling [from favor because] there are better alternatives."

What those alternatives are, however, is subject to debate. For example, Yates believes that growth opportunities for word-processing software are in the UNIX arena. "By being UNIX-compatible, there is the advantage of being able to communicate between machines ranging from mainframes to personal computers. No other operating system offers that far-ranging capability," she insists.

"It's tough to make a sweeping generalization," says Harold Poliskin, of the National Software Testing Labs Inc., Wynnewood, Pa. Poliskin, publisher of NSTL's Software Digest rating newsletter, says, "Not everyone wants the same thing, and virtually every product is different. There is no consistency in word-processing software. I don't have a scientific study to cite, but my impression is that users want simple and powerful products. Price doesn't seem to play a part. We've found that users will pay for what they want."

Another consideration that experts claim to be important is ease of use. Most say that companies don't want to tie their people up learning how to use a package. Seybold's Marshak thinks that ease of use might be the most important feature software developers should aim for.

Making a bid in the ease-of-use category is Alpha Software Corp., Burlington, Mass., with its Electric Desk package. "We're selling an integrated package, but with a singular-task approach. Each application stands on its own," says vice president of product strategy Robert Kutnick. "We don't want the user to fumble around trying to figure out what to do next."

Because word-processing software differs widely in capabilities, choosing the right one can be difficult. Seybold's Marshak suggests an empirical approach: "There are three groups of features users should list when comparing word-processing software: basic functions (need to have); desirable functions (preferable to have); and advanced functions (nice to have)."

The basic group, Marshak says, consists of 11 attributes including: word wrap, whereby the line automatically goes to the next line when the right-hand margin is reached; insert and delete, for adding or removing words; copy and move (also known as cut and paste), to allow word, sentence or paragraph rearrangement; search and replace; line changes; decimal tabs; centering point; automatic indentation; automatic pagination;

system directory access; and paragraph reformation. Marshak says that most products on the market do offer most of these basics; it's the next two levels where differences are the most evident.

For example, the desirable functions of paragraph assembly using repetitive material with "save" and "get" capability and footnoting are important for full word processing. Most higher-level packages offer these. But other functions in this category, such as headers and footers, horizontal scrolling and automatic footnoting, are not included as frequently. For example, WordStar does offer one-line headers and footers and horizontal scrolling to 256 columns, but no footnoting. Although Marshak believes the latter feature is very important, not everyone agrees. James Swanner, president of Wordmovers Inc., Lawndale, Calif., a small systems house, says that it's fine if it's there, but adds that users don't typically ask for it. "We find that users are more interested in being able to print a document that looks as good as a fine-quality typewriter. Everything else is icing on the cake; we don't have users insisting on a lot of bells and whistles," he says.

Marshak, however, contends that with the growing trend toward sophistication, users will want the advanced features and will expect vendors to provide them. She cites such functions as table of contents and index generation, split-screen capability, macros for storing frequently used keystrokes and text, and calculator-type functions for mathematics and spelling verification. "Users are looking for tools that allow them to handle [material] at the highest possible level. The software is getting there," says Marshak.

In addition to the attributes mentioned, proportional spacing, wherein space steps between words are calculated on letter and word widths, is a growing demand; hard-copy devices are becoming more powerful, and users want to take advantage. In order to create hard copy that resembles typeset representations, manufacturers are developing the proportional capability.

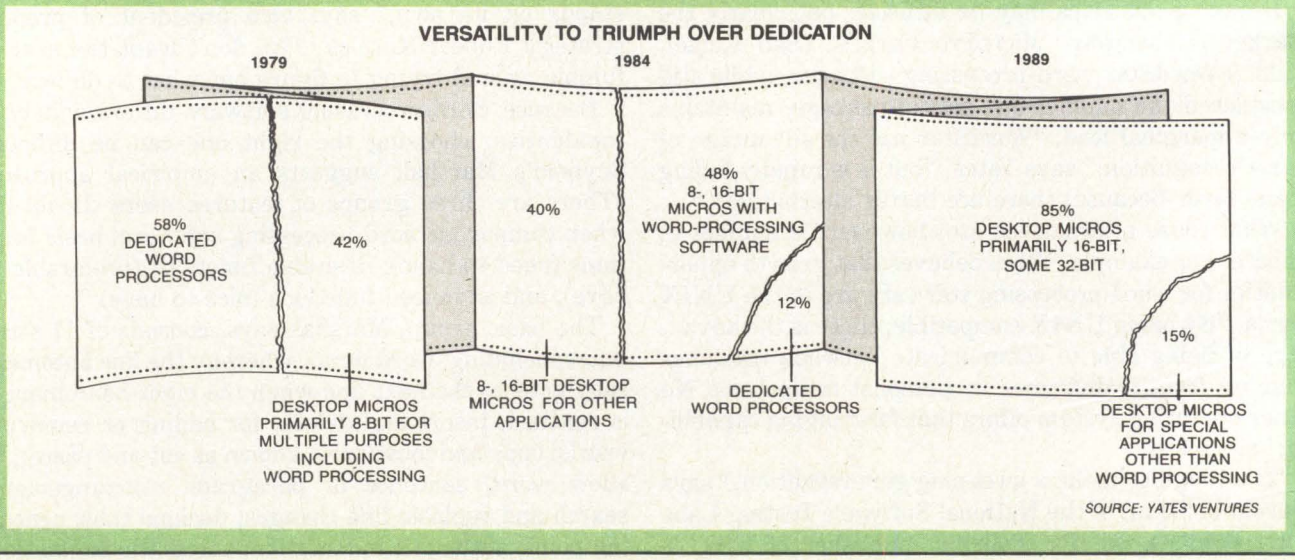
MicroPro was one of the first companies to attempt implementing proportional spacing in Wordstar and, as a consequence, built-in rudimentary forms of proportional spacing tables. Unfortunately, the expected output fell far short on quality. Therefore, Writing Consultants, Fairport, N.Y., took on the task of developing the necessary look-up tables for properly handling

Dedicated word processing market declines

The market for dedicated word-processing systems is rapidly declining, as indicated by studies performed by Yates Ventures Inc., Palo Alto, Calif. According to vice president of research, John Kiefer, word processing is headed for a multipurpose world.

"The market has shifted from 58 percent in 1979 for dedicated word-processing systems to about 12 percent today," says Kiefer. He notes that currently 65 percent of all personal computers sold come equipped with word-processing software. "The question is," he says, "is it used for word processing?" Kiefer thinks that in most cases it is. "Everyone writes something at sometime," says Kiefer. But he declined to estimate the total number of personal computers being used primarily for word processing. Still, Kiefer says that today 48 percent of all microcomputers (8-bit and 16-bit) are employed in some word-processing function.

Kiefer predicts that by 1989, dedicated systems will be a thing of the past. "By then it will be a 100-percent universe made up of 16-bit or 32-bit microcomputers. I would expect 85 percent of available users will have word-processing, but that, more than likely, it won't be the sole function because it's clear that the marketplace wants to do multiple tasks."



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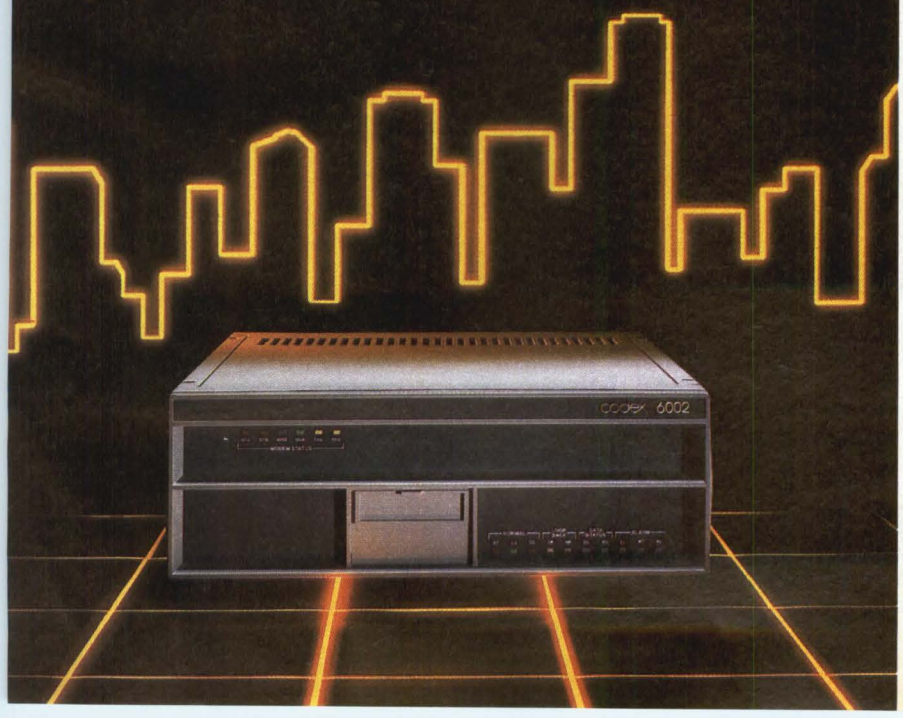

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proportional spacing for WordStar documents. The result is a $75 package called ProportionalStar. "We carefully analyzed what it takes to achieve true proportional spacing with a wide range of printer types. The exercise isn't trivial because specialized drives had to be created that would work within WordStar. We found that proportional spacing and multicolumn printing were the two biggest shortcomings of WordStar, and now for most word-processing software," states publisher Mike Weiner.

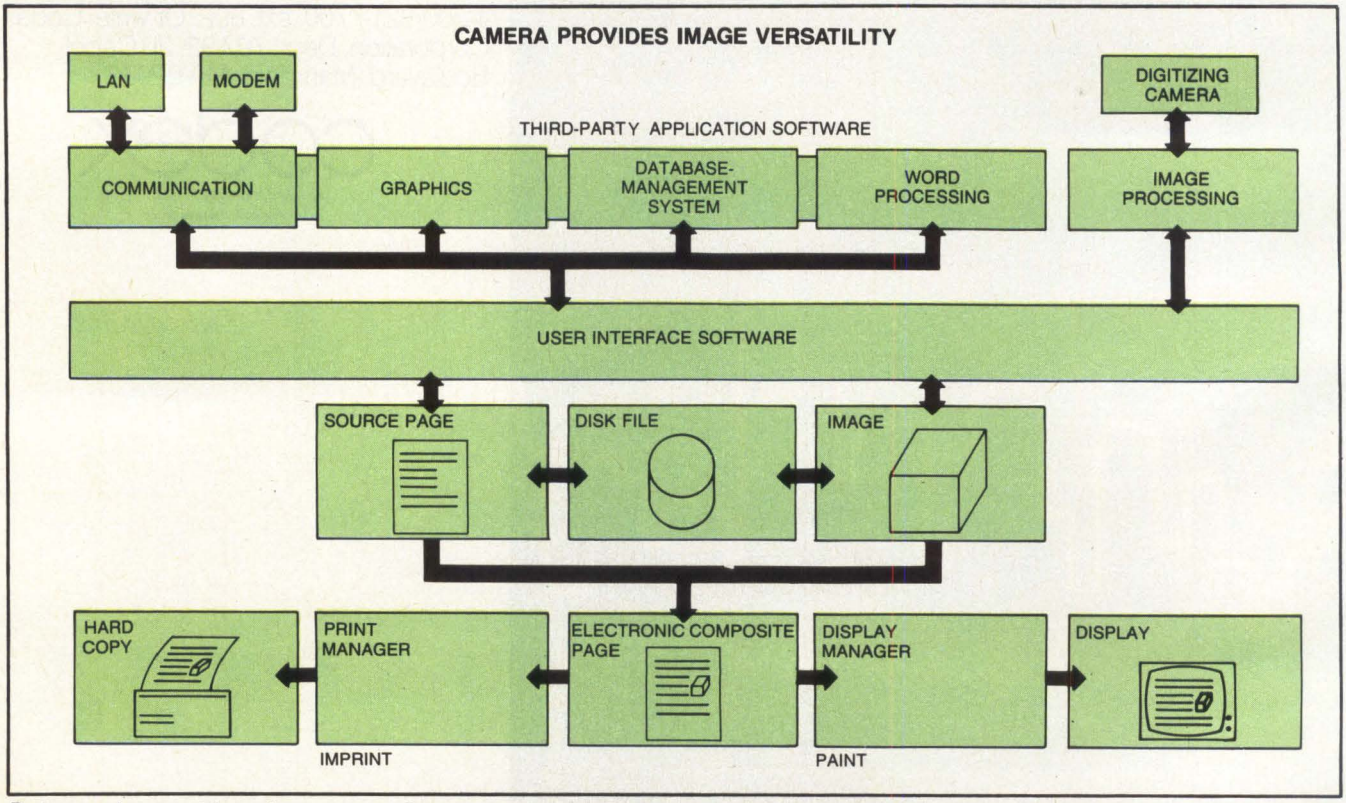
Meets perceived needs

With the perceived needs of users in mind, software publishers began lining up an impressive array of available word-processing software.

Among the newer approaches is that being taken by Syntactics Corp., Santa Clara, Calif., with the CrystalWriter package. According to chairman of the board and company president Erwin Morton, CrystalWriter can't be characterized as another word-processing package. He insists that it is a document-management system. "The office isn't built around spreadsheets or databases. It is, however, built around documents," he asserts, "These documents can be spreadsheets, letters, or names and addresses and graphs. What people want to do is meld these documents into a usable order such as a report."

To achieve these goals, Crystalwriter, priced at $2,500, provides users with a menu-driven system that allows the incorporation of foreign files from databases and spreadsheets. Moreover, the package is specifically designed for the UNIX environment. Morton maintains that UNIX provides the ideal environment for handling multiple users and tasks. "Because our whole metaphor of the office is based on a filing cabinet, we decided that UNIX was the only environment that provided enough drawers and file folders," claims Morton.

Another innovative approach to multifunction word processing is the Word Image Processing System (WIPS) Model 800 developed by Datacopy Corp., Mountain View, Calif. The system, which is priced under $10,000, consists of WIPS software that combines images, text and printing for various dot-matrix and laser printers. For example, the Model 680 graphic scanner uses an integrated electronic digitizing mechanism that allows images of 1728-dot-by-2846-dot resolution to be captured with as many as 256 shades of gray. Model 680 connects to an IBM PC/XT personal computer via the Model 110 Image processing interface. The entire system serves as a front-end peripheral to the



Datacopy's word-imaging processing system *couples a digitizing camera and an IBM PC to produce information other than computer-generated graphics. The system takes a snapshot of the image, compresses it and melds it to the text with word-processing software, databases and other graphics. It also allows the image and total document to be transmitted like a facsimile document.*

REPRESENTATIVE WORD PROCESSING PACKAGES

PUBLISHER/ PRODUCT	BASIC FUNCTIONS need to have													DESIRABLE FUNCTIONS preferable to have						ADVANCED FUNCTIONS nice to have				
	Word-wrap	Insert-delete	Copy and move (cut and paste)	Search and replace	Ability to change ruler line	Decimal tabs	Centering point	Indent	Automatic pagination	Ability to access directory	Paragraph reform	Paragraph assembly (boiler plate) (glossary save and get)	Screen print attributes (underline, bold, super and sub, ital.)	Headers, footers, page no.	Horizontal scrolling	Automatic footnoting	Table of contents and index generation	Split screen and/or windows	Keystroke — macros and text	Spelling verification	Math features calculation style	Mailmerge	Proportional spacing
ALPHA SOFTWARE CORP.																								
Electric Desk integrated package Price: $345 MS/PC-DOS	•	•	•	•	•			•	•	•	•			•			•			•	•			
ASHTON-TATE																								
Framework integrated package Price: $695 MS/PC-DOS	•	•	•	•				•	•	•	•		•	•	•		•	•	•		•	•		
CONCEPT TECHNOLOGIES INC.																								
Concept 100 combination hardware add-in and software Price: $2,195 MS/PC-DOS	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•
LIFETREE SOFTWARE INC.																								
Volkwriter Deluxe word processing only Price: $295 MS/PC-DOS	•	•	•	•				•	•	•			•								•	•		
LOTUS DEVELOPMENT CORP.																								
Symphony integrated package Price: $695 MS/PC-DOS	•	•	•	•				•	•	•			•		•			•	•		•	•		
MICROPRO INTERNATIONAL CORP.																								
Word Star word processing only Price: $495 MS/PC-DOS	•	•	•	•	•	•	•	•	•	•	•	•		•	•									
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Word word processing Price: $195 MS/PC-DOS	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•		•		•			•	
MULTIMATE INTERNATIONAL CORP.																								
Multimate word processing Price: $495 MS/PC-DOS	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	•
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New word word processing Price: $249 MS/PC-DOS	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•				•	•	•	•		
OFFICE SOLUTIONS INC.																								
Office Writer word processing Price: $375 MS/PC-DOS	•	•	•	•	•	•	•	•	•	•	•	•											•	
THE SOFTWARE GROUP																								
Enable integrated Price: $695 MS/PC-DOS	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•		
SYNTACTICS CORP.																								
Crystal Writer document processor Price: $2,500 UNIX	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•		
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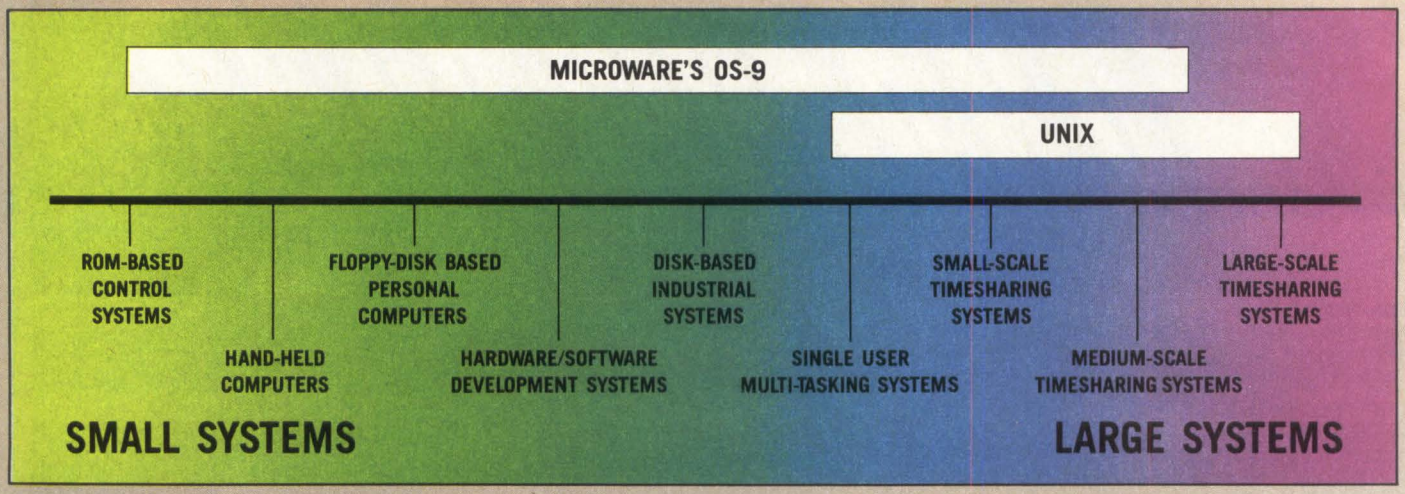

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Microware's C compiler technology is another OS-9 advantage. The compiler produces extremely fast, compact, and ROMable code. You can easily develop and port system or application software back and forth to standard Unix systems. Cross-compiler versions for VAX and PDP-11 make coordinated Unix/OS-9 software development a pleasure.

SUPPORT FOR MODULAR SOFTWARE — AN OS-9 EXCLUSIVE

Comprehensive support for modular software puts OS-9 a generation ahead of other operating systems. It multiplies programmer productivity and memory efficiency. Application software can be built from individually testable software modules including standard "library" modules. The modular structure lets you customize and reconfigure OS-9 for specific hardware easily and quickly.

A SYSTEM WITH A PROVEN TRACK RECORD

Once an underground classic, OS-9 is now a solid hit. Since 1980 OS-9 has been ported to over a hundred 6809 and 68000 systems under license to some of the biggest names in the business. OS-9 has been imbedded in numerous consumer, industrial, and OEM products, and is supported by many independent software suppliers.

Key OS-9 Features At A Glance

- **Compact (16K) ROMable executive written in assembly language**
- **User "shell" and complete utility set written in C**
- **C-source code level compatibility with Unix**
- **Full Multitasking/multiuser capabilities**
- **Modular design - extremely easy to adapt, modify, or expand**
- **Unix-type tree structured file system**
- **Rugged "crash-proof" file structure with record locking**
- **Works well with floppy disk or ROM-based systems**
- **Uses hardware or software memory management**
- **High performance C, Pascal, Basic and Cobol compilers**

microware® OS-9™

MICROWARE SYSTEMS CORPORATION
1866 NW 114th Street
Des Moines, Iowa 50322
Phone 515-224-1929
Telex 910-520-2535

Microware Japan, Ltd
3-8-9 Baraki, Ichikawa City
Chiba 272-01, Japan
Phone 0473(28)4493
Telex 299-3122

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CIRCLE NO. 73 ON INQUIRY CARD

PC for capturing images. According to vice president of marketing and planning, James P. McNaul, the WIPS goes beyond combining images with text. He explains that because the image is in digital form, it can also be sent electronically to other sites. "It's the next level up in information processing," he says.

Because the combination of graphics with text is becoming increasingly attractive to users, a number of approaches are being taken. Concept Technologies Inc., Portland, Ore., for example, has developed a $2,195 combined hardware and software system for the IBM PC that permits the coupling of high-level graphics with text. Called the Concept 100, the package uses an Intel 80186-based intelligent graphics subsystem board that plugs into the PC. The subsystem emulates the IBM monochrome and color display adapters and supports a 50-Hz, non-interlaced display with a 720-dot-by-352-dot resolution.

The word-processing function provides a broad range of capabilities including full-screen attributes of bold facing, underlining and italics. And the system can be used with a mouse input device. The graphics functions are similar to the Tektronix Inc.'s PLOT 10 graphics; users can draw images, or download them from a host computer. To ensure the package's ability to interface with a host of output devices, including the company's own laser printer, the Virtual Device Interface (VDI) proposed graphics standard has been adopted. Like the other packages, the developers claim that data for the document can be combined from other foreign sources such as databases and spreadsheets.

Taking the singular-purpose approach even further is Xywrite from Xyquest Inc., Bedford, Mass. This package was developed for manipulating words and controlling ink on paper. Therefore, besides handling hyphenation and justification, as well as providing multicolumn capability, Xywrite provides device drivers for matching to a variety of printers, including laser printers.

Besides supporting a wide range of hardcopy devices, Xywrite 3.0 is available in a multilingual version, thus allowing the editing of glyph-oriented languages, such as Hebrew. Although the software is priced at $395, users who want multilingual capability will need to invest in Quadram Corp.'s, (Atlanta) QuadVue display board at $450.

The previously mentioned packages do offer a num-

Directory of manufacturers

Alpha Software Corp.
30 B St.
Burlington, Mass. 01803
(617) 229-2924
Circle 775

Ashton-Tate
10150 West Jefferson Blvd.
Culver City, Calif. 91230
(213) 204-5570
Circle 776

Concept Technologies Inc.
P.O. Box 5277
Portland, Ore. 97208
(503) 684-3314
Circle 777

Datacopy Corp.
1215 Terra Bella Ave.
Mountain View, Calif. 94043
(415) 965-7900
Circle 778

Lifetree Software Inc.
Suite 315
411 Pacific St.
Monterey, Calif. 93940
(408) 373-4718
Circle 779

Lotus Development Corp.
161 First St.
Cambridge, Mass. 02142
(617) 492-7171
Circle 780

MicroPro International Corp.
33 San Pablo Ave.
San Rafael, Calif. 94903
(415) 499-1200
Circle 781

Microsoft Corp.
Suite 200
10700 Northrup Way
Bellevue, Wash. 98004
(206) 828-8080
Circle 782

Multimate International Corp.
52 Oakland Ave. North
East Hartford, Conn. 06108
(203) 522-2116
Circle 783

Newstar Software Inc.
1601 Oak Park Blvd.
Pleasant Hill, Calif. 94523
(415) 932-2278
Circle 784

Office Solutions Inc.
5708 Odana Road
Madison, Wis. 53719
(800) 228-0747
(608) 274-5047
Circle 785

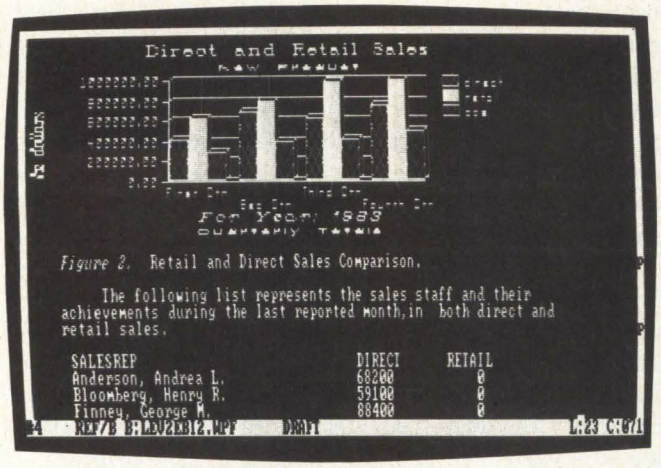
The Software Group
Northway Ten Executive Park
Ballston Lake, N.Y. 12019
(518) 877-8600
Circle 786

Syntactics Corp.
Suite 145
3333 Bowers Ave.
Santa Clara, Calif. 55051
(408) 727-6400
Circle 787

UniSource Software Corp.
71 Bent St.
Cambridge, Mass. 02141
(617) 491-1264
Circle 788

Writing Consultants
11 Creek Bend Drive
Fairport, N.Y. 14450
(800) 828-6293
(716) 377-0130
Circle 789

Xyquest Inc.
119 The Great Road
Bedford, Mass. 01730
(617) 275-4439
Circle 790



The Enable integrated package *lets users slip in graphs, spreadsheet data and text, plus use a variety of fonts for customizing documents on the screen and for hard-copy output.*

ber of attributes, but none currently provide the multiple path (access to sub-directories) permitted in IBM's PC-DOS. However, most industry analysts claim that it is coming. One company with an implementation that does provide at least one level of path access is Multimate International Corp., East Hartford, Conn. The Multimate Professional word processor, priced at $495, supports DOS paths and allows file conversion from mainframes to microcomputers. In addition, mailmerge, spelling dictionary and character display attributes are all basic features of the package. Although Multimate does not currently support footnoting, the company is planning on implementing it in future versions.

Multimate is also paying special attention to user interfaces. According to director of communications Mary Page, a printer cable editor has been added to ease interfacing tasks with special printers. "The newer printers offer specialized features, and users want to take advantage of them. The cable editor allows the proper match-up," says Page.

Not a word processor, but a new generation of idea processor, is KAMAS, developed by Compusophic Systems, Aloha, Ore. According to the company, the package allows users to organize their thoughts in outline fashion. The outline is then translated to a word-processing package to create the final document. The company clearly states that their product can't and shouldn't be confused with word processing.

Can integrated packages stack up?

Publishers of integrated packages are expecting to garner a fair share of the word-processing market. For example, both Lotus Development Corp., Cambridge, Mass., and Ashton-Tate, Culver City, Calif., have taken similar yet diverse approaches to providing word processing in integrated packages. Both are priced at $695 and combine graphics, spreadsheets, communications and text processing in a window-oriented package. However, the similarities end there. Lotus, with the Symphony product, creates a metaphor of a grid and provides general word processing. In contrast, Ashton-Tate's Framework uses as a metaphor the basis of idea processing through outlines. Moreover, Ashton-Tate word processing is more fully featured than Lotus' and provides the ability to handle text and attributes.

Although neither product can be classified as a full-fledged word processor, each can claim full document processing. Thus, database information can be combined with graphics or spreadsheets, and the results put on paper.

Similarly, The Software Group's, Ballston Lake, N.Y., Enable package combines all the features of an integrated package plus word processing without, however, proportional spacing or footnoting. Enable treats each of its function as a separate module. Like Framework and Symphony, Enable is also priced at $695.

In the meantime, MicroPro, according to industry sources, is developing a major integrated package, based on a word-processing code, named Ivan. Reportedly, Ivan is written in C-language, making it possible to port the package to a variety of machines and operating systems. In addition, Ivan is not expected to bear any resemblance to WordStar. MicroPro officials could not be reached for comment.

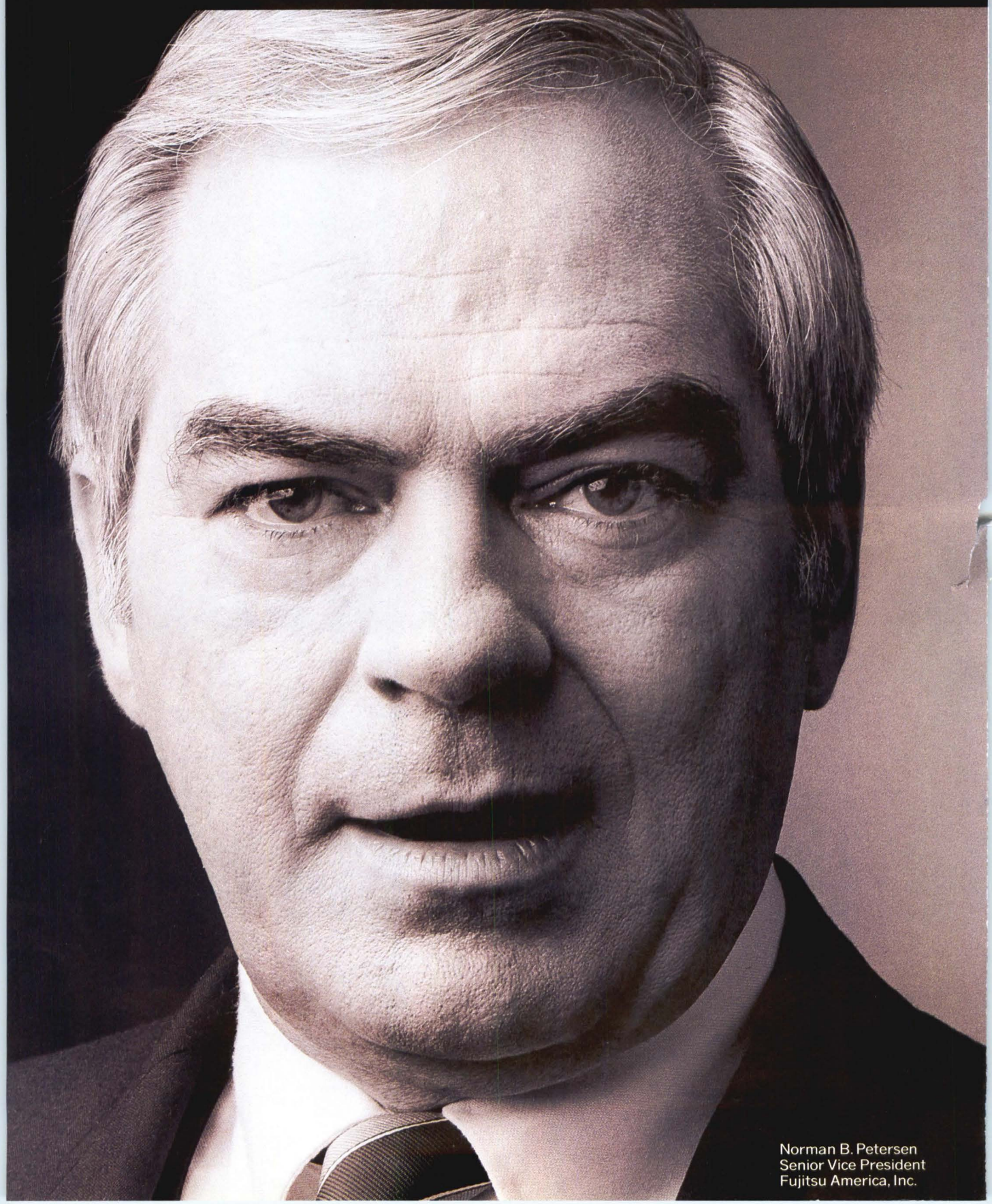
Finally, Alpha Software Corp.'s, Burlington, Mass. Electric Desk, priced at $345, offers task-dependent modules. Electric Desk, like others, also allows the combination of graphics and spreadsheets, as well as databases. The company contends that speed and ease of use are the product's hallmarks, and that switching tasks is possible without losing the context of the overall picture.

Even though most of the integrated packages aren't as glutted with features as standalone word processors, virtually all allow mailmerge and background printing. How they stack up against the standalone word-processing software in the marketplace is subject to conjecture, because sales success depends on the users' needs.

What is apparent, however, is that the technology for creative documentation through word-processing software is beginning to capture the imagination of users and the energies of package makers. The verdict of the marketplace should depend less on price than on how well makers meet users' expectations. □

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

"The question no longer is how Fujitsu drives compare to the other guy's, it's how *theirs* compare to *ours*!"



Norman B. Petersen
Senior Vice President
Fujitsu America, Inc.

"In 10½" drives, the big news is a new high-capacity Eagle with a 2.4 MB/sec. SMD interface."

Fujitsu has done it again.

With the introduction of the new 689 megabyte Eagle, we've set still another standard for disk drive performance—2.4 megabyte-per-second data transfer. We did it by increasing track capacity using proven RLL (Run Length Limited) encoding methods. And we used the same high-speed SMD-compatible interface as we did in our new 336 megabyte 8" drive.

The new Eagle features the same head, media and actuator technology as previous designs. Which means you can take advantage of this new performance standard without sacrificing any of Fujitsu's world-proven reliability.

Both the new Eagle and the new 8" drive have the same track capacity and can attach to a common controller. Off-the-shelf controllers are readily available for both drives.

So if you already have designed-in our 474 megabyte Eagle, you have nothing to worry about. Because the new 689 megabyte Eagle will slip into your design like a hand into a glove! And give you more storage, higher performance, and a lower cost per megabyte.

MODEL	M2351	M2361
CAPACITY (MB) Unformatted	474	689
AVERAGE POSITIONING TIME (msec)	18	18
TRANSFER RATE (KB/sec)	1859	2458
INTERFACE	SMD	SMD
POSITIONING METHOD	Rotary Voice Coil	Rotary Voice Coil

But whichever Eagle you choose, you still get fast data access and the same dedication to quality that has made Fujitsu America one of today's leading OEM disk drive suppliers.

Call Fujitsu America at (408) 946-8777 for more information. And be sure to ask about our new start/stop and streaming tape drive systems, too. Because we believe the best disk drives deserve the best backup systems.

Fujitsu Storage Products. Maximum Performance. Maximum Quality.

FUJITSU AMERICA, INC.

FUJITSU

From 5¼" disk drives to high-performance, low-cost tape systems, Fujitsu America has the data storage systems you need. And they're available today.

Since 1978, Fujitsu America has grown rapidly to become one of the leading OEM suppliers of disk storage products in North America.

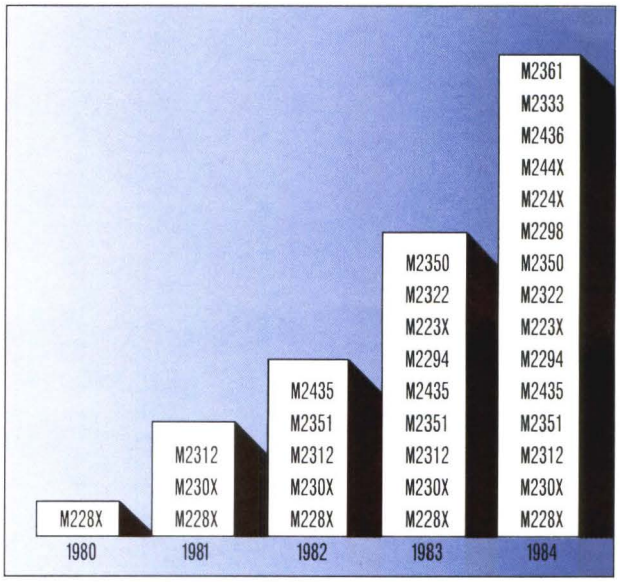
A key reason for this success has been our uncommon devotion to quality. Quality that pays off in maximum reliability for the ultimate user.

The quality has remained a Fujitsu hallmark as we have expanded our product line over the years to reflect continued advancements in data storage technology. Advancements that not only increased performance and capacity, but also helped to reduce overall data storage costs.

Today, Fujitsu America is proud to announce further evidence of our commitment to meeting the data storage requirements of our North American customers.

We're giving you more products to choose from.

First, we've expanded our product line once again. Now you can choose Fujitsu rigid disks from 14" down to 5¼", with capacities from 689 megabytes to 13 megabytes, and the highest performance in the industry. And we now offer high-performance, low-cost streaming and start/stop tape drive systems as well.



NEW PRODUCT INTRODUCTION

And we've boosted delivery capacity to meet today's needs, today.

Secondly, we've increased our delivery capabilities substantially.

For example, two automated manufacturing plants with over a million square feet are now devoted exclusively to Eagle (10½"), 8" and 14" disk drive production. A new plant with 220,000 square feet is dedicated to 5¼" manufacturing. Also, a new U.S. distribution center and a product reconfiguration facility both have recently been completed to help us better serve our OEM customers.

In addition, yet another disk drive manufacturing plant is now under way in

"Fujitsu's 14" disk drives offer you the lowest cost per megabyte available anywhere."

Fujitsu America not only gives you maximum performance and reliability in data storage products, we also continue to provide you with the lowest cost of ownership.

Take our 14" disk drives, for example. Our initial product, introduced in 1980, provided 168 megabytes of storage. Then we introduced the 336 megabyte model, which provided double the capacity and set new industry standards for quality, performance and cost per megabyte of storage.

Today, there's a new leader in 14" disk drives—Fujitsu's 671 megabyte model. Not only does it give you double the capacity yet again, it also gives you the faster data transfer rate of the Fujitsu Eagle—1.86 megabytes per second!

Furthermore, you get this higher capacity and performance in the same form factor as the previous model, making it easy to integrate into your current system design.

MODEL	M2284	M2294	M2298
CAPACITY (MB) Unformatted	168	336	671
AVERAGE POSITIONING TIME (msec)	27	27	27
TRANSFER RATE (KB/sec)	1012	1012	1859
INTERFACE	SMD	SMD	SMD
POSITIONING METHOD	Rotary Voice Coil	Rotary Voice Coil	Rotary Voice Coil

Best of all, this new drive offers you the lowest cost per megabyte of any disk drive available today.

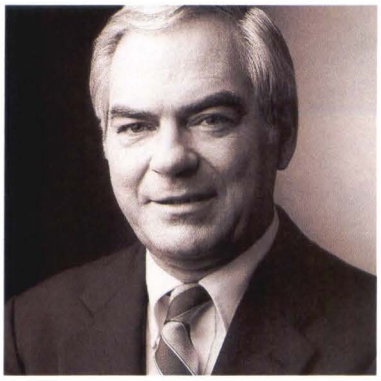
And speaking of availability, the new 671 megabyte model is available, today, in production quantities. With the same field-proven 20,000-hour MTBF reliability that has helped make Fujitsu America one of today's leading OEM disk drive suppliers.

For more information, call (408) 946-8777. And ask about our new streamer and start/stop tape drive systems, too. Because when you buy the best disk drives, you deserve the best backup systems.

Fujitsu Storage Products. Maximum Performance. Maximum Quality.

FUJITSU AMERICA, INC.

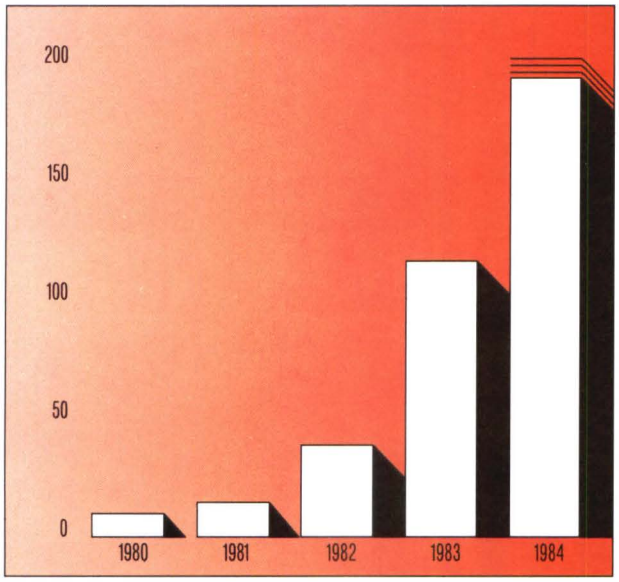
FUJITSU



"Because now, no other storage products supplier can match Fujitsu America in all the key parameters. Performance. Quality. Depth of product line. And delivery."

Portland, Oregon, which will add significantly to our production capacity in 1985.

The bottom line is that we can now deliver a greater selection of data storage products than ever before, and we can deliver them in volume. Today.



SALES GROWTH CHART

The continuing Fujitsu investment in reliability.

And every Fujitsu drive we deliver will continue to reflect our demonstrated commitment to maximum quality and maximum performance. The Fujitsu commitment to quality is rooted in the very core of the way we do business, and is one of the primary reasons why we manufacture virtually every component of every drive ourselves.

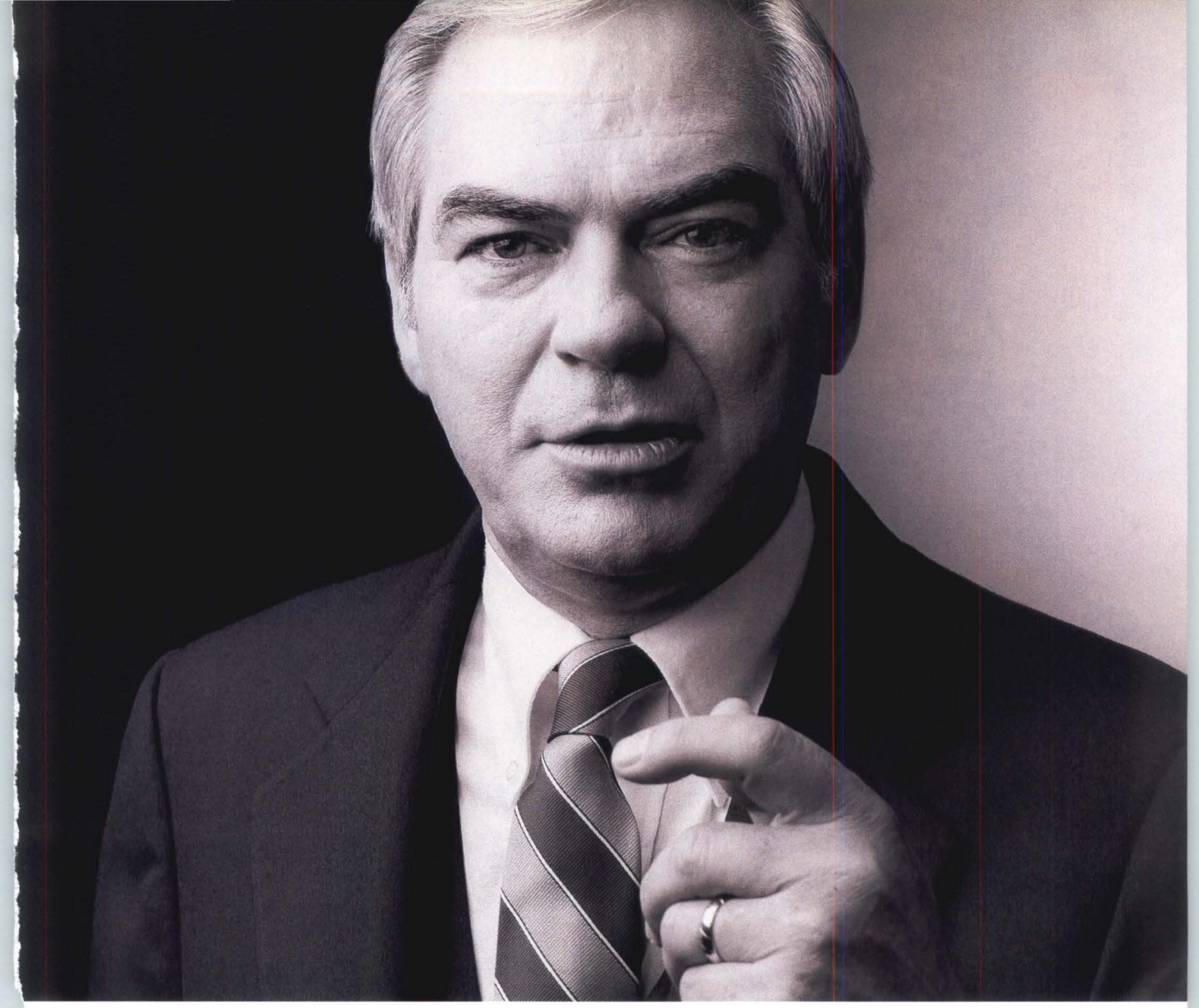
It's also the reason why the very first task of every Fujitsu assembly worker is to QA the work that has gone on before. A very simple step, but one that pays enormous dividends in the care and pride with which every part is manufactured and assembled.

Fujitsu facilities themselves also reflect our investment in quality. Highly efficient clean room filtration systems, for example, are designed to eliminate air-borne particles as tiny as three microns. And the extensive use of robotics in the assembly process further enhances consistent product reliability.

Additionally, every component and completed drive goes through an extensive power-on burn-in. This helps reduce early-life failures and boost reliability. And because of the high reliability of these drives as proven in actual field experience, Fujitsu has recently doubled the MTBF specification for all our rigid disk drives to 20,000 power-on hours.

These are just a few of the many ways in which Fujitsu America is working to serve the industry better. We have led the way with new standards of quality, performance and reliability. And we are continuing to invest in people and facilities to provide still more product choices, along with faster product deliveries, and high quality product service.

So when you think of mass data storage, think of Fujitsu America first.



"At last there's a high-performance 5¼" disk drive with Fujitsu quality. From Fujitsu, of course."

Finally there's a 5¼" disk drive that offers you the kind of high-performance features and quality components generally found only in larger, more expensive drives.

It's from Fujitsu, of course. We worked very hard to perfect this drive, so we could offer you a product that is competitive in price, yet still superior in quality.

So we designed it with proven technology, using standard ferrite heads and oxide recording media.

Then we proved it in the field. And today, based on actual operating experience, we now back all our 5¼" drives with a specified MTBF of more than 20,000 power-on hours.

So you can design them into your system with complete confidence.

You'll get a top-notch performer, too. With from 31 to 86 megabytes of capacity, 33 millisecond average positioning time, and a 625 kilobyte-per-second transfer rate!

MODEL	M2241	M2242	M2243
CAPACITY (MB) Unformatted	31	55	86
AVERAGE POSITIONING TIME (msec)	33	33	33
TRANSFER RATE (KB/sec)	625	625	625
INTERFACE	ST506/ SA4000	ST506/ SA4000	ST506/ SA4000
POSITIONING METHOD	Rotary Voice Coil	Rotary Voice Coil	Rotary Voice Coil

We also offer a full line of stepper-motor, standard performance 5¼" drives. With capacities from 13.3 to 26 megabytes. Plus half-high models with 6.6 and 13.3 megabyte capacities.

To assure you prompt delivery, we have just completed a new plant, adding 220,000 square feet to our 5¼" manufacturing capability.

So give us a call today, at (408) 946-8777. We're Fujitsu America... your one-stop, full-line disk drive supplier. We've got the sizes and the capacities. We've got the performance. We've got field-proven reliability.

And we can deliver.

Fujitsu Storage Products. Maximum Performance. Maximum Quality.

FUJITSU AMERICA, INC.

FUJITSU

"The 8" disk drive contest is over. Fujitsu just doubled the capacity and the transfer rate."

Your best choice in 8" disk drives just got twice as good. Because we took our popular 168 megabyte model and doubled both its capacity (to 336 megabytes) and its transfer rate (to 2.4 megabytes per second). And we did it in the same form factor, using RLL (Run Length Limited) encoding methods and an SMD-compatible interface.

Which means you can now get twice the capacity from a drive with proven technology. It also means you can readily integrate this new maximum-performance drive into your current system design.

This drive is just what you need to help satisfy those complex, multi-user applications requiring fast access and huge amounts of data. You can stack up to four of these drives together in a 19" rack, and thereby provide a total of 1.3 gigabytes of storage, with an average positioning time of 20 milliseconds. Now that's performance!

You also get compatibility with our new 689 megabyte Eagle. They have the same track capacity, the same high-speed SMD interface, and can attach to a common controller. Off-the-shelf controllers are readily available for both drives.

MODEL	M2322	M2333
CAPACITY (MB) Unformatted	168	336
AVERAGE POSITIONING TIME (msec)	20	20
TRANSFER RATE (KB/sec)	1229	2458
INTERFACE	SMD	SMD
POSITIONING METHOD	Rotary Voice Coil	Rotary Voice Coil

But best of all, you get Fujitsu's dedication to maximum quality. And it's our quality which has helped establish Fujitsu America as one of today's leading OEM disk drive suppliers.

Get the full story. Call Fujitsu America today, at (408) 946-8777. We'll show you why the performance contest is over in 8" disk drives.

Fujitsu Storage Products. Maximum Performance. Maximum Quality.

FUJITSU AMERICA, INC.

FUJITSU

"And finally, Fujitsu introduces two tape drive systems with world-proven reliability."

Fujitsu America is proud to announce two "new" tape drive systems that outperform anything in their class. The high-performance M244X GCR streamer, and the 200-ips M2436 start/stop system.

They're "new" only in the sense that they are just now being introduced to the North American OEM market. But we've already proved them in Fujitsu computer systems around the world.

Both are extremely reliable, and have earned the highest MTBF ratings in the industry.

And both are available today.

Our family of low-cost GCR streaming tape drives are performance-matched with our Eagle disk drives to provide the best data storage combinations going. And we have two models, offering a choice of either 100 or 75 ips, to match your price/performance and system requirements.

Then there's the start/stop system which offers state-of-the-art performance and versatility. It'll search through your files at 200 ips, transferring data at 1.25 megabytes per second! And it offers many additional big-system features like auto tape loading and sophisticated self-diagnostics.

MODEL	TAPE SPEED		RECORDING DENSITY (bpi)	RECORDING METHOD	DATA TRANSFER (Max KB/sec)
	STREAM (ips)	START/STOP (ips)			
M2442	100	12.5	6250/1600	GCR/PE	625
M2444	75	25	6250/1600	GCR/PE	465
M2436	n/a	200	6250/1600	GCR/PE	1250

To get the full story on the complete line of Fujitsu data storage products, just call (408) 946-8777. Or write Fujitsu America, Inc., Storage Products Division, 3055 Orchard Drive, San Jose, CA 95134.

Fujitsu Storage Products. Maximum Performance. Maximum Quality.

FUJITSU AMERICA, INC.

FUJITSU

Will the networked office save the daisywheel?

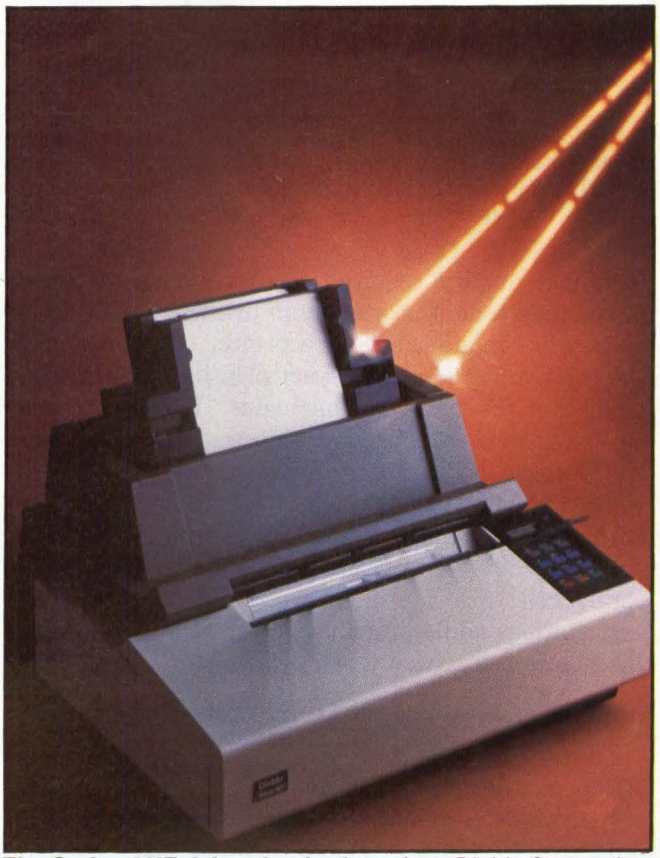
Despite new and exotic printer technologies, office work in the future may still revolve around the good, ol' daisywheel

Don Dempsey, Xerox Corp.

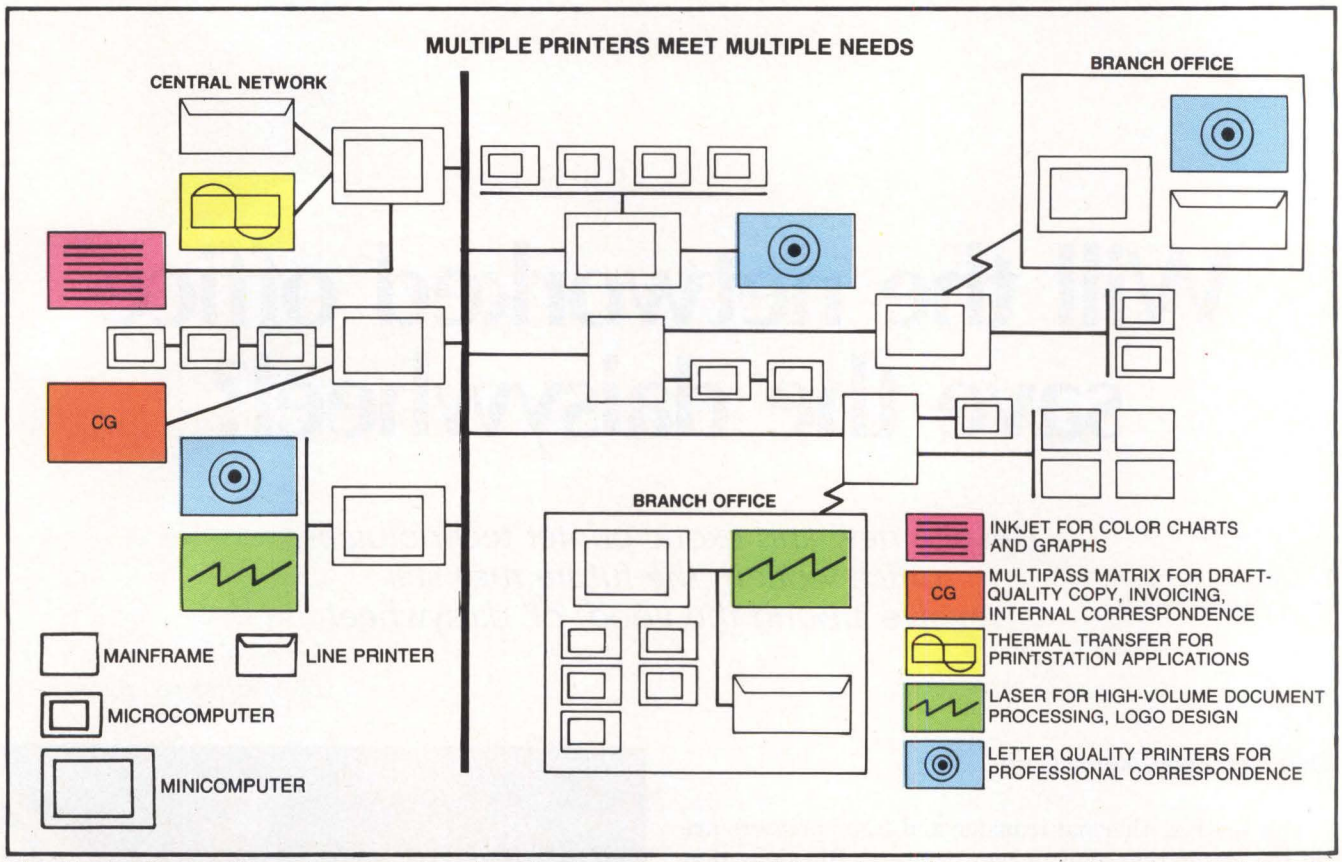
Dot matrix, thermal transfer and laser printers are all far faster than daisywheel printers. But does that spell the demise of the traditional standard of the computer printer business? Not if daisywheels can meet the technological demands of the networked office environment. While it's true that the old, noisy, stand-alone impact word processor is beginning to give way to faster and fancier printers—each of which have their own disadvantages—daisywheels remain unsurpassed for letter-quality printing.

The schematics of the future office have already been determined. Most large- and medium-sized businesses have already laid plans to become networked environments. Offices will consist of several personal computer workstations, both local and remote, perhaps using a single high-speed printer for hard copy output. With the technology available today, this is the most economical, efficient and logical way to design an office. It also, of course, puts a tremendous strain on that single printer—and greatly affects the future of the printer industry, which must somehow produce machines of the necessary speed, quality and reliability.

Traditionally, only dot-matrix printers have been reasonably priced and fast enough to handle the workload of multiple workstations. However, their inability to achieve solid-font printing prevents them from handling many professional-level jobs. And, while non-impact technologies such as thermal transfer and laser printers have been able to produce both the speed and



The Series 80IF daisywheel printer *from Diablo System Inc. is part of a new generation of daisywheels finding a secure niche in the networked office environment. It features dual-hammer design, a wedge capture system and print-on-the-fly capability.*



The ideal office *would contain a number of printer types to meet the various needs of a networked environment. These would include high-speed, dot-matrix printers for draft copy, thermal transfer printers for integrated text and graphics, color ink-jet printers for color graphics, laser printers for high-volume document processing and letter-quality printers for professional correspondence.*

the print quality required for a networked environment, they come at a very high price.

Clearly, what's needed is a printer that can combine the relative economy of impact printing with the print quality of the newer technologies. The best method currently available for achieving that blend is a high-speed daisywheel printer specifically designed for networked applications. One such printer is the Series 80IF, from Diablo Systems Inc., Fremont, Calif., a subsidiary of Xerox Corp. The Series 80IF, when configured with a print server, can handle up to 16 workstations while providing letter-quality print at 80 characters per second (cps).

Printers draw outlines of future offices

The ideal office of the future might combine a number of types of printer to meet varying business needs:

- A high-speed dot matrix printer at 150 cps for draft-quality copy, invoicing and internal correspondence
- Thermal transfer machines for producing high-quality integrated text and graphics, at speeds up to 6 lines per minute (lpm)

Whether the document is a memo to the boss, a letter to a prospective client or a long-overdue report, the ability to put text and graphics on one highly impressive page with one relatively inexpensive device is essential.

- Color ink-jet printers for visually interesting graphs and charts
- Laser printers for processing high-volume documents and logo designs at very high speeds, i.e., 12 pages per minute
- Letter-quality printers for professional correspondence—high-quality documents to be sent outside the company, or to higher levels within the company.

It is in this last category that high-speed daisywheel printers fit particularly well. Whether the document is a memo to the boss, a letter to a prospective client or a

Going out for a drive? Travel light.

Now you don't have to go out of your way to find a complete line of fast, accurate floppy disc drive diagnostic and alignment tools.

Dysan makes them all. And they're all so compact they fit in a briefcase.

Which makes them perfect for field service.

Or (without the briefcase) for your test bench.

For instance, our Digital Diagnostic Diskette (DDD™) with appropriate software lets you zip through digital tests like head positioner linearity. Head radial alignment. Diskette centering. Head azimuth alignment. Index timing. All in just minutes.

And you get the results right on the screen of the machine you're testing.

Our Interrogator™ is a DDD packaged with menu-driven software and instructions that simplify drive tests on the IBM® PC and XT, Zenith Z/H 100 Series, Osborne® 1 (and more to come).

The hand-held Performance and Alignment Tester (PAT-2+™) and the DDD enable you to step through a complete series of drive diagnostic tests. Plus performance tests like read/write data handling capabilities and rigorous head positioner testing.

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Since the networked office environment is, to date, far from standardized, the printer must have "plug and play" compatibility with most host systems on the market.

long overdue report, the ability to put text and simple business graphics on one impressive page with one relatively inexpensive device is essential.

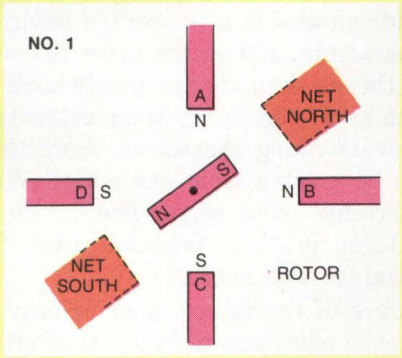
The daisywheel printer that fits well in a networked environment has a number of unique characteristics. One is high flexibility. Since the networked office environment is, to date, far from standardized, the printer must have "plug and play" compatibility with most host systems on the market. Moreover, it must be easily transported from one node in the network to another. The Series 80IF, for example, can function not only in central or local area networks, but also connects with remote (branch office) stations. It also has an All Purpose Interface (API) which combines the RS232C, Centronics and IEEE 488 interfaces.

In addition, it has an integrated—rather than optional—dual-bin-sheet paper feeder for faster throughput and increased efficiency. By incorporating the paper path into the printer mechanism, the printer improves feed-and-eject times while reducing the cost of intelligent paper handling accessories. A bidirectional tractor with optional bottom feed is available for continuous forms processing. The integrated dual-bin sheet feeder provides forward-collated, or "security" (face down) output as a standard feature. Other options include an envelope feeder and adjustable paper trays. The microprocessor control that drives the printer also provides double-precision vertical and horizontal control of the paper and feeder system.

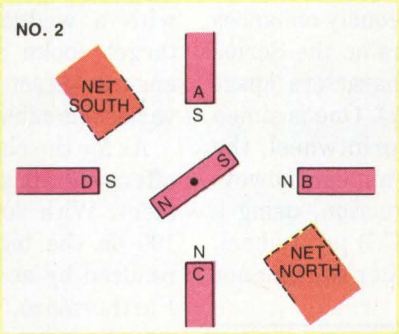
A daisywheel in a networked office should also have a closed-loop stepper motor, because the feedback system of that type of motor allows for more precise monitoring of the system than possible with an open-loop motor. A closed-loop stepper's ability to identify the actual position of the rotor at any time makes it possible to precisely determine the correct time to advance the stator magnet, assuring maximum torque

Closed stepper motors lock in precision

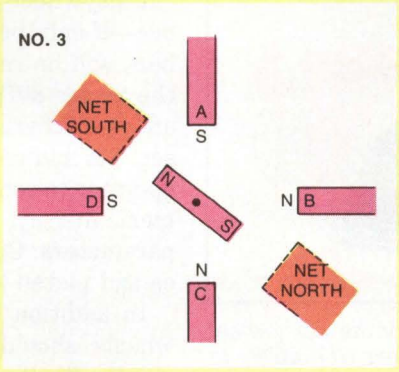
Where an open-loop stepper motor simply moves the rotor forward in regular steps, a closed stepper motor can stop and start the rotor by changing the polarity of its stator magnets.



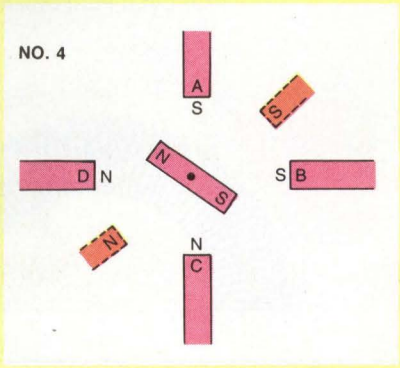
For example, in Number 1, the south end of the rotor magnet is centered between A and B. Assuming A, B, C and D are magnets of equal strength, the net magnetic field vector of these four stator magnets (shown as dotted lines) lies between A and B (net North pole) and C and D (net South pole). The magnitude of the net magnetic field, being the vector sum of those of the individual magnets, is V^2 times that of the individual magnets.



Were the polarity of magnets A and C reversed suddenly, creating the situation shown in Number 2, the net magnetic field would be shifted to the locations shown: "one step" clockwise. The rotor magnet would see a force which would align it with the new magnetic field; in fact, the rotational torque created is at its maximum when the rotor is one step away from the stator's net field location.



The rotor will then move clockwise to eliminate this torque, i.e., it will "follow" the effective rotation of the stator field. The rotation torque goes to zero when the rotor gets to the position in Number 3, but the rotating magnet has maintained velocity at this time.



When magnets B and D reverse their polarity, the situation is that of Number 4.

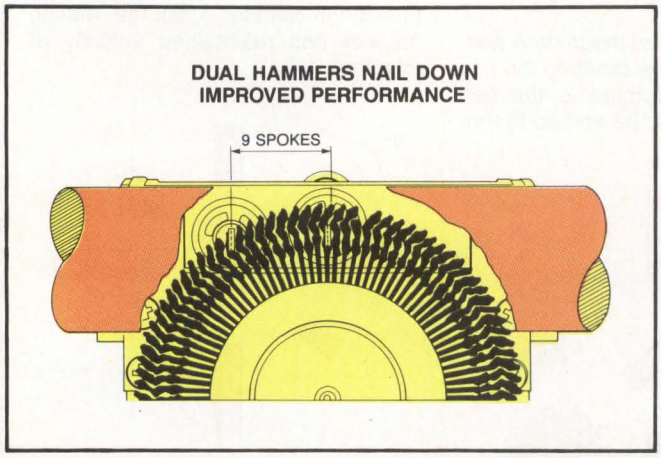
Careful timing of the carriage, printwheel, ribbon and hammer allow a character to be printed without the carriage coming to a complete stop.

and acceleration and minimum time to move a given number of steps (see "Closed stepper motors lock in precision," Page 167).

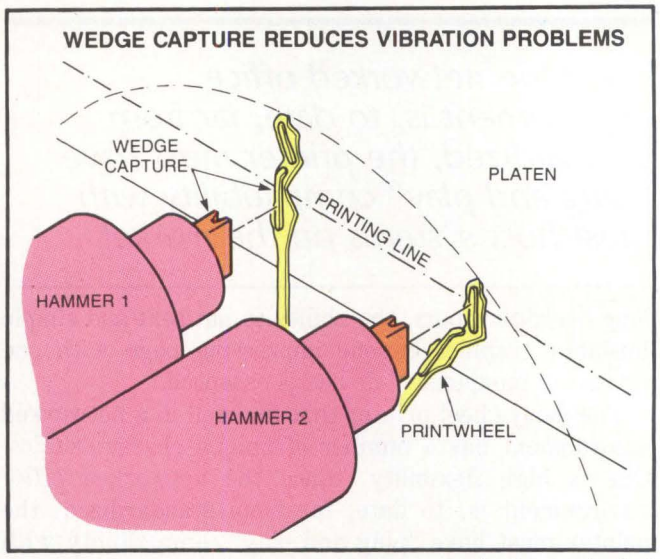
The Series 80IF, in fact, has the ability to "print on the fly." Careful timing of the carriage, printwheel, ribbon and hammer allows a character to be printed without the carriage coming to a complete stop. The printwheel motor seeks the appropriate letter, the ribbon motor steps—or advances—the ribbon, and the carriage remains in motion. Just before the carriage moves to the desired position, the hammer fires. By the time the printwheel spoke hits the paper, the carriage has reached the print position. After the printwheel releases the hammer, the cycle resumes.

Hammers and characters strike a balance

Dual-hammer construction is another important feature of daisywheels in the networked environment. The ability to print two characters simultaneously enhances both speed and reliability. The hammers on the Series 80IF, for example, are spaced nine characters apart (counting the character under a hammer). One is aimed at the outer row of characters on the printwheel, the other at the inner row. Both characters appear, however, on the same printline. This construction, using a double-row, extended-character-set (ECS) printwheel, makes all characters available with neither shifting nor carriage motion, which can both slow printing and cause wear on the machine.



Dual-hammer construction *is important for the daisywheel printer operating in a networked environment. The ability to print two characters simultaneously enhances both speed and reliability.*



Wedge capture design *ensures exact positioning and eliminates minute variations caused by wheel motion. The tip of each hammer is equipped with a wedge-shaped depression which captures the target spoke of the printwheel and steadies it during strikes.*

The printer also makes use of "wedge capture design." This means the tip of each hammer is equipped with a wedge-shaped depression that captures the target spoke of the printwheel during strikes. This ensures exact positioning and eliminates the minute variations caused by the wheel's motion or by vibration.

As for the characters themselves, an ECS printwheel offers significant advantages in a networked environment. With 200 characters, 100 on the outer row and 100 on the inner, the need to change printwheels is reduced by as much as 60 percent by some estimates. Furthermore, by overstriking characters, more than 400 characters can be printed from one wheel. With multiple fonts selectable on a single line, a single printer can meet legal, medical, financial, scientific, foreign-character and teletext needs.

Daisywheel printers of the future must be easy to use—if only because so many non-technical staff members will be required to work with them. To this end, the Series 80IF uses a push-button control panel with an eight-character (or optional 16-character) display set. Its bidirectional communication allows a remote operator to send nonprintable messages to the alphanumeric display, detect error messages and set printing parameters. Conventional DIP switches, rotary switches and platen knobs can therefore be eliminated.

In addition to being easy to load, cartridge printwheels should be automatically identifiable by the printer itself. For example, the bottom of each printwheel cassette can be marked with bar code that

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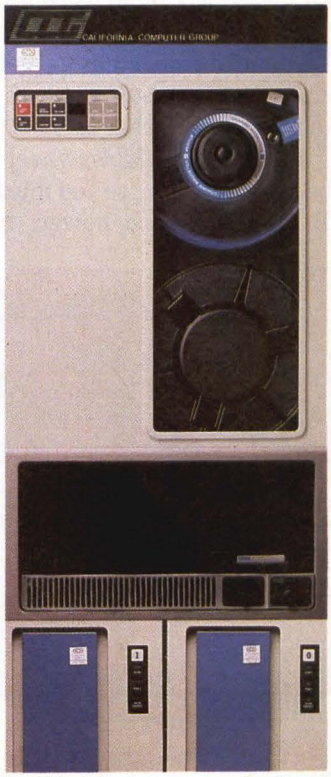

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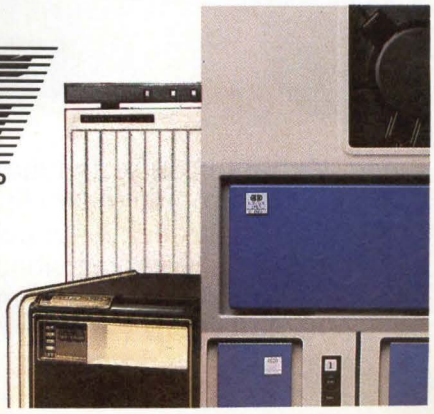

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conveys the type styles directly to the printer's microprocessor. In addition, daisywheels of the future should be pleasantly quiet to work with, operating no louder than approximately 58 dB.

It's also important to be able to expand the buffer size to 1.5K or 64K bytes of memory, allowing the user to move on to other tasks while a document is printing.

Finally, if the daisywheel printers of the future must be user friendly, so too must they be "owner friendly." To compete with newer, but costlier, laser and jet-spray printers, daisywheels must be not only economical to buy, but also economical to own. To this end the Series 80IF has an integrated sheet feeder, eliminating the need to purchase a separate one. In addition, its mean time between failure (MTBF) of 4,000 hours represents a significant achievement, considering the MTBF for most integrated sheet-feeder systems is only half that. Further, the dual-bin feeder is extremely reliable, averaging only one jam every 1,500 sheets.

In short, daisywheel printers are far from obsolete. Indeed, daisywheel printers with dual hammers, wedge-capture capability, closed stepper motors and print-on-the-fly ability may dictate the future of the industry. □

Spec summary

- **Model:** Series 80IF
- **Company:** Diablo Systems Inc., 901 Page Ave., P.O. Box 5030, Fremont, Calif. 94537
- **Print speed:** 80 characters per second (AAA standard)
- **Interface:** All Purpose Interface (API), compatible with RS232C, Centronics and IEEE 488
- **Noise level:** 58 dB
- **Weight:** 80 pounds
- **Size:** 18.17 inches (or 12.74 inches without paper tray) by 23.82 inches by 21.17 inches
- **Cost:** $3,495

Don Dempsey, acting vice president of OEM marketing and sales at Xerox Corp., has been with the company since 1968. He also spent five years in marketing and sales with IBM Corp. Dempsey has a B.A. in mathematics/physics from St. Peter's College, Jersey City, N.J., and an M.A. in mathematics from the University of Detroit.

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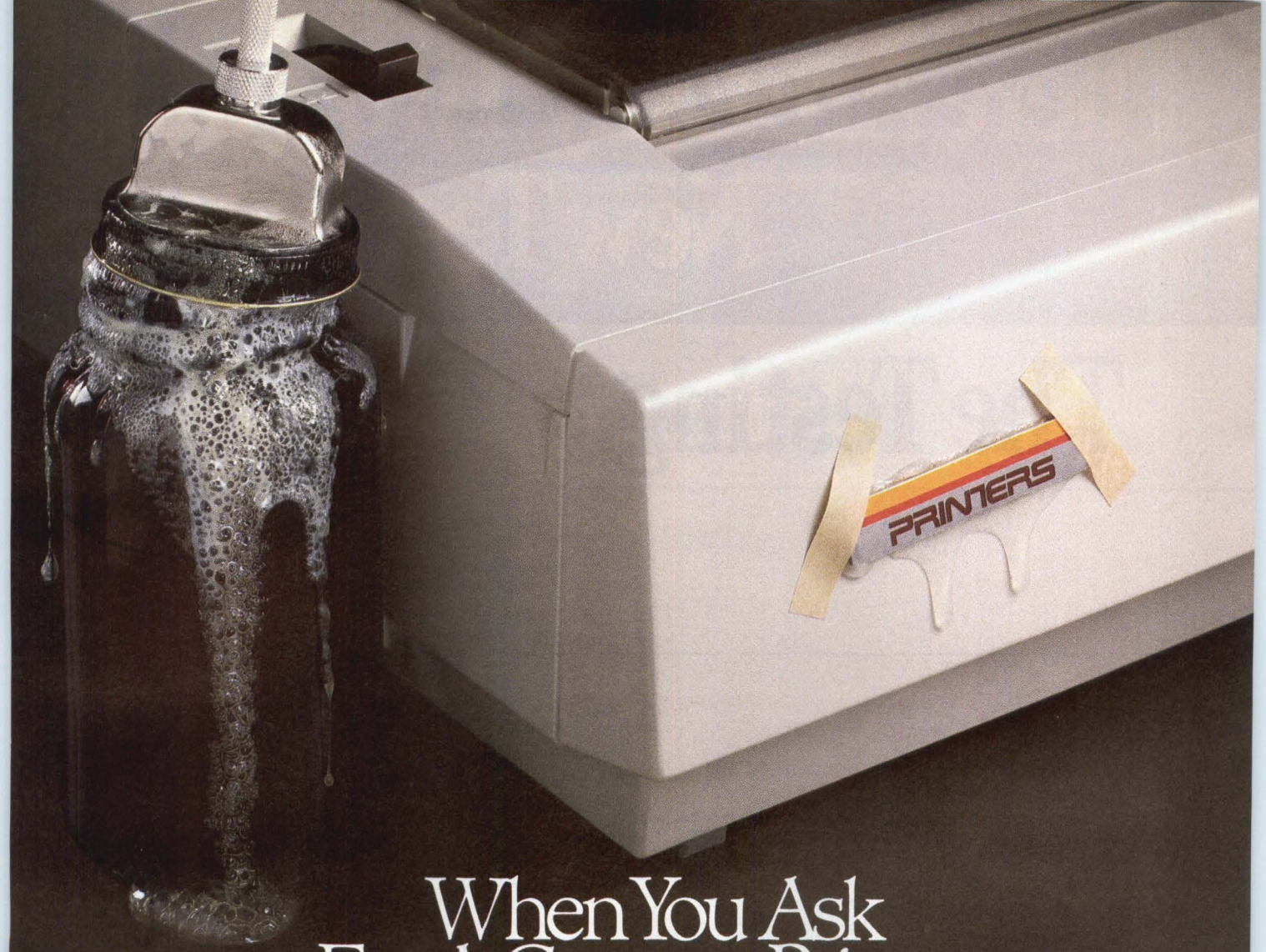

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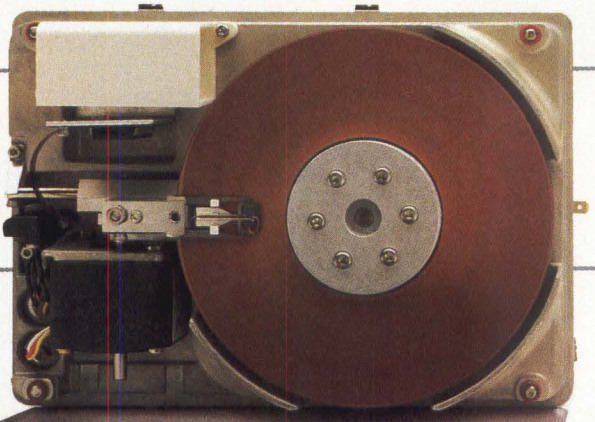

OEMs face major problems trying to decide which hard disk drives to build into their microcomputer systems. What with the wide range of drives, and so many hidden costs associated with evaluation, testing and integration, the process becomes a time-consuming and costly hassle.

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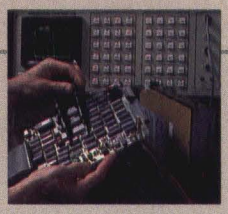

From standard-setting to vertical integration, from heavy investment in computer-aided design to the total commitment to the most automated manufacturing technologies, Xebec has demonstrated its leadership position in supplying microcomputer storage solutions.

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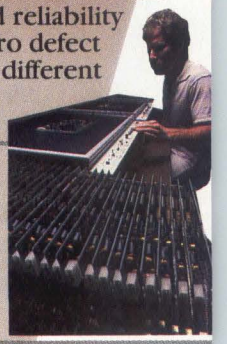

It's simple. Tell us which drives you're considering and we'll test them on Xebec-designed equipment against the most rigorous standards in the industry. Standards we at Xebec have set. Then we'll tell you which of our controllers is the best match for that drive—or we'll customize a controller for you—and accelerate your time to market.

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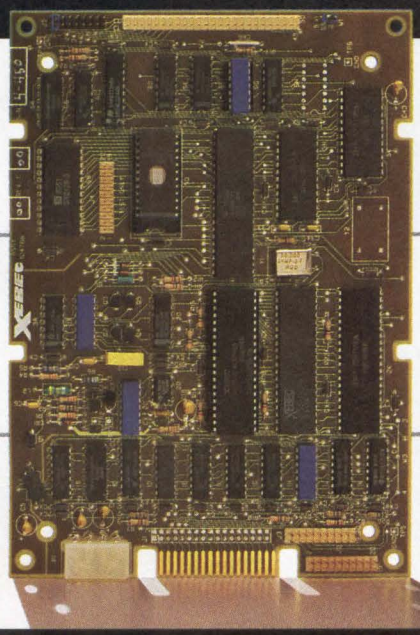

And The Pairing.

command set and other performance and reliability features.

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Xebec can offer its tested pairs service to OEMs because of our commitment to quality. Zero defect quality symbolized by our "Xero D" signature and demonstrated by our superior computer-aided design, manufacturing and testing. Our talented people. Our experience. That's *how* we can provide high-quality products for prices no more than products that deliver a lot less.

Why offer our tested pairs? Why originate a new concept in quality? Enlightened self-interest. Because if we don't, someone else will. Frankly, we want to continue to enjoy the benefits of our leadership position as much as our customers do.

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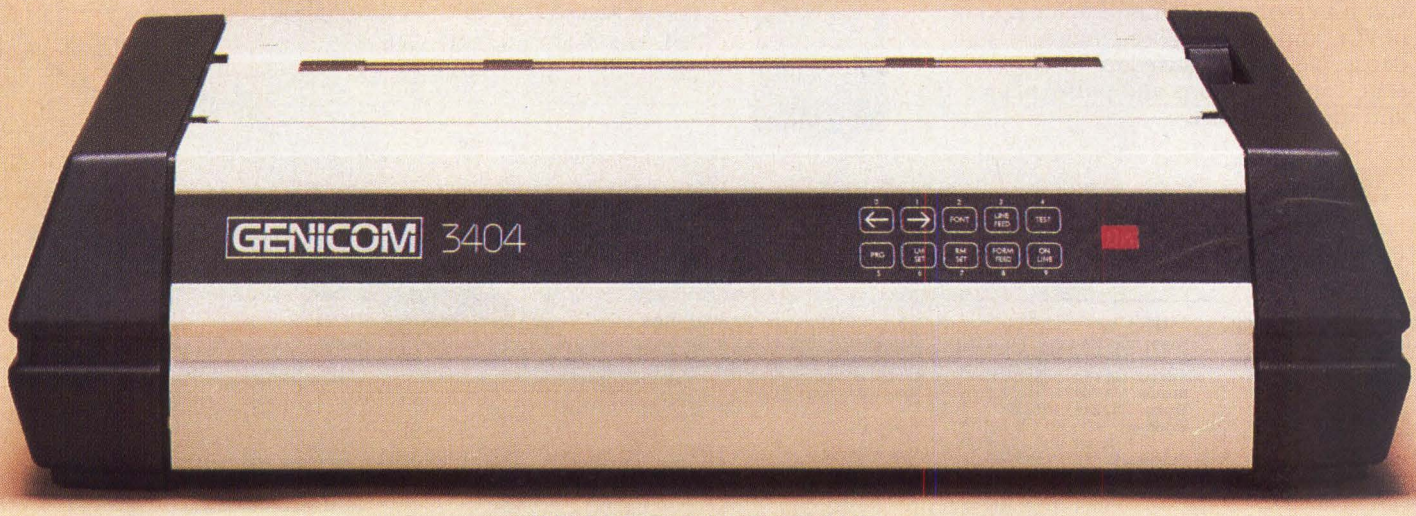

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How to choose a printer supplier

New technologies and a market shift from minicomputers to microcomputers are forcing OEMs and system integrators to re-evaluate peripherals strategies and supplier relationships

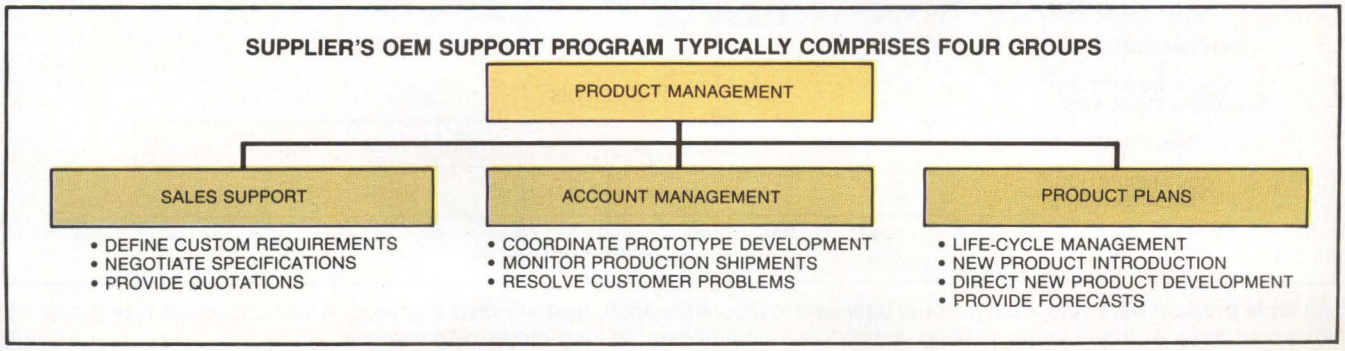
Lex Pietraszkiewicz, Epson America Inc.

An OEM's choice of peripherals and peripherals supplier unavoidably affects system development and marketing strategy. Because the peripherals supplier is so important to the OEM's success, the procedure of evaluating and selecting this partner should not be given short shrift. And, even after the OEM selects the supplier, there are practical rules for a profitable relationship. An OEM may not utilize all the capabilities of a given supplier, but those services germane to the OEM's business should be carefully scrutinized.

An OEM or system integrator who develops and markets computer systems to end users through retail outlets, value-added retailers or through a direct sales force must take a fresh look at peripherals strategy, particularly at what is required from a supplier. A number of factors are accelerating the need for an effective strategy and supplier re-evaluation.

The shift in market emphasis from minicomputers to microcomputers, for example, has radically altered the OEM's competitive situation. This shift decreases the OEM's control over product planning, if he utilizes non-proprietary architectures, processors or operating systems, because of the increased competition fostered by non-proprietary approaches. The shift also places greater emphasis on the OEM's peripherals strategies —such as for printers—because, in the microcomputer world, printers usually represent 25 percent to 40 percent of a system's price. The OEM must also rely more on retail distribution to compensate for the ever-increasing cost of direct sales. Finally, the OEM must depend on third-party software to sell hardware systems for specific applications; when minicomputers reigned, OEMs and manufacturers relied more heavily on their own software to sell hardware.

New technology also has a major impact on the OEM's peripherals strategy—especially insofar as it involves printers. New products often span various application markets and fall within competing price/performance ranges, forcing the OEM to constantly re-evaluate marketing strategies.



The OEM's own peripheral-equipment needs add to the hurdles. If the OEM is a high-volume manufacturer with emphasis on retail sales, attractive volume discounts are important. If the OEM offers an innovative, proprietary system where product differentiation is crucial, a supplier that can respond to unique requirements is more important than are volume discounts.

The OEM's choice of a printer supplier will also be affected by the OEM's method of distribution. Dependence upon third-party sales organizations, for instance, can increase the risk of printer substitutions at the point of sale. The printer supplier's willingness to stand by the OEM's product differentiation and pricing strategies is essential to minimizing such a risk.

What is an 'ideal' supplier?

The most common OEM/supplier relationships are these: The supplier is a "hardware supplier", providing the OEM with a standard off-the-shelf printer; the supplier is a "custom designer", providing a unique or modified-standard printer; or, the supplier is a "partner" in the proprietary design of a new printer technology, and shares research and development costs.

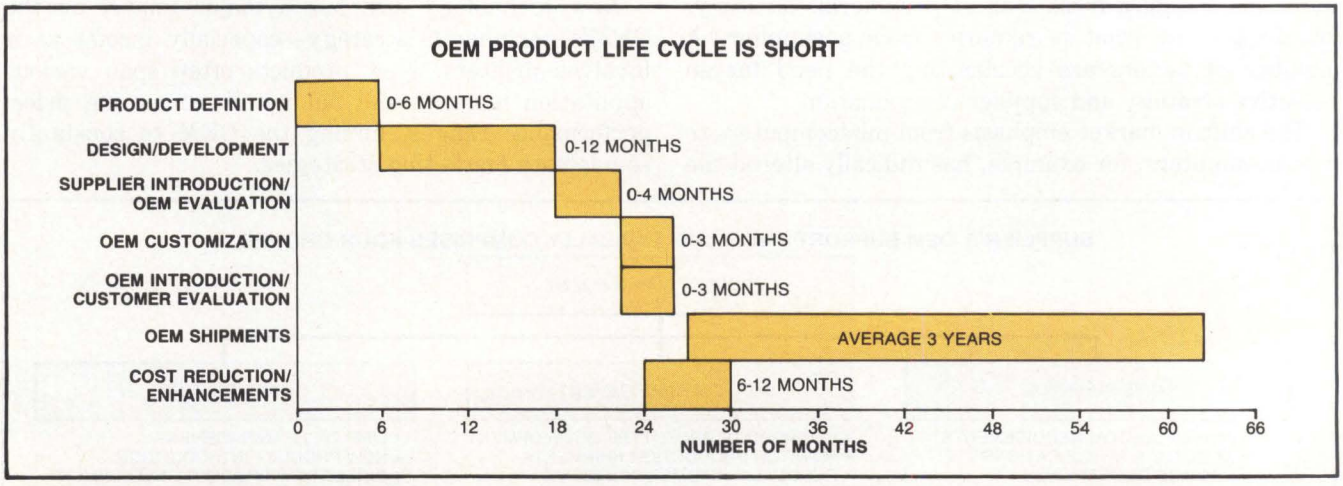
Ideally, a supplier should provide a variety of *services*, including pre-sale, ongoing engineering and marketing consultation and *support*—warranty, service, training, spare parts and documentation. Asking two basic questions about the prospective supplier can usually get the evaluation procedure off to a good start. Can the supplier provide printers that will produce acceptable profit margins as well as the required performance? Can the supplier provide printers that can be easily distinguished from printers sold off-the-shelf through retail channels?

The supplier's level of commitment to the OEM market should be an OEM's pre-eminent concern. Does the supplier also deal directly with retailers and end users? If so, the prospective supplier may also be a competitor, distributing the same printer to the OEM's potential customers, and possibly offering the same features and performance at a lower price. However, there is something to be said for dealing with a supplier involved in both the OEM and retailing business: that OEM is more likely to appreciate the benefits of mass production, proven technology, reliability and market acceptance.

Can the supplier provide printers that can be easily distinguished from printers sold off-the-shelf through retail channels?

Although the OEM and supplier might share a common manufacturing facility, it is essential that the OEM products group have its own engineering and support staffs. Such human resources enable the OEM group to provide the product differentiation essential to price protection and competitive strategy. If the supplier can provide custom design, rather than just a specialized nameplate, the OEM can be confident of protection against product duplication in the marketplace.

If truly committed to the OEM market, the supplier will have performed extensive market research. Getting the benefit of this effort will help the OEM define and specify printer requirements. The OEM should know the criteria on which the target market's price/performance or cost/features criteria is based, as well as other buyer concerns such as reliability and service. In addition, the OEM needs to know the impact of competing technology, and if new technology can be



An OEM product life cycle, *from product definition to discontinuation, typically lasts five years. OEM shipments take place for about three of those years, making a supplier's commitment to long-range planning vital.*

utilized to enhance its own printers throughout the projected delivery commitment. Both parties must agree on later substitution of newer products. Market research can also help the OEM in setting inventory levels for finished products and spares.

Plan for product life spans

An important part of an OEM/supplier relationship is long-range planning. For example, a printer normally has a salable life span of three years, but emerging, competitive technology may severely shorten that period. It's disheartening to see a well-executed product design and marketing strategy torpedoed in mid-life by new technology or a lower-priced, similar product. The OEM's supplier should be in a position to recommend product life spans and to signal probable changeover points. In addition, the supplier should be able to offer information that will help the OEM phase out stock and introduce in new products without having to resort to fire sales or year-end write-offs.

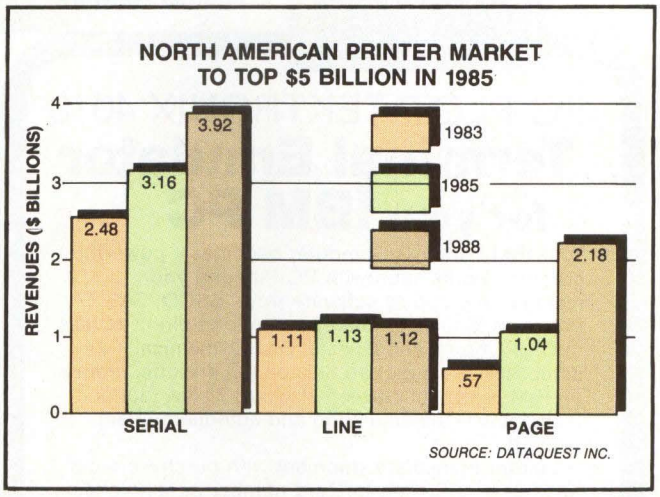
The OEM should also assess the supplier's ability to monitor market developments. An OEM's customers could pass up one printer in favor of another that's available off the shelf, perhaps for less money and with more—or at least equal—performance and features.

OEM volume governs printer choice

To a large extent, the OEM's sales volume governs the freedom of printer selection. If volume is less than 500 units per year, OEM investment in printer development will be negligible. In this case, the OEM would select a standard printer and negotiate the best possible volume discount. If sales volume is 1,000 to 2,500 units per year, the OEM can probably afford minor modifications or customization. If sales volume is high enough—say, 5,000 units per year or more—the OEM may want to commit to the development of a custom printer. This ensures an exclusive product.

The OEM should be aware that printer suppliers that provide a broad range of products have necessarily committed substantial resources to the product line and must be manufacturing in volume. The supplier most likely sells a portion of that volume through retail distribution channels. Thus, the chances of the OEM's customers finding the system printer in a retail outlet are fairly good, unless the OEM has performed minor modifications.

Interface requirements often represent an OEM's strategy to discourage customers from substituting off-the-shelf printers for the OEM's system printer. Thus, the ability of the supplier to furnish the required interface is important. However, cost considerations may force the low-volume OEM to accept a standard interface.



The OEM should assess the supplier's ability to present a variety of hardware options, including cabinet design and appearance, location and function of operator controls, and power-supply configurations. The ability to provide a universal power supply is critical because it can simplify and perhaps eliminate the problems encountered in forecasting separately for international and domestic markets.

The choice of other printer features is a direct function of the OEM's application. The OEM should investigate the ability of the supplier to furnish the right mix of features without special design and development costs.

Check the supplier's support services

An OEM who has dealt with a peripherals supplier has already had a number of good or bad experiences with the business side of the relationship and should be well armed to assess the basics of the final agreement. These basics include warranty provisions, service, drop shipments, local engineering support and account management responsibility.

Most suppliers offer a 30-day warranty on printers. Others, with substantial production experience and installed product bases, are able to offer more. For example, Epson America Inc., offers a one-year warranty.

Service options range from the supplier's in-house departments to third-party service arrangements. If the supplier offers third-party service, there should be provisions for training the third-party maintenance technicians, and for providing them with necessary engineering and service documentation.

When the OEM and supplier agree on custom printer specifications, there is always the possibility that some mechanism, such as firmware or package design, has already been patented by another OEM or manufacturer. In such cases, the supplier should do a patent

search. Suppliers have been known to intentionally leave patent identification clauses out of contracts, and such "oversights" could lead to a lawsuit against the OEM. Some suppliers provide patent-search services for their printers, as well as for the OEM's entire system.

The supplier's level of commitment to the OEM market should be an OEM's pre-eminent concern.

If the OEM works with a supplier whose manufacturing facilities are offshore, it's crucial for the supplier to maintain full-service offices in the United States. Those should include a staff of application engineers, product managers, planners, hardware designers and technicians and service and support personnel. The facility should also be able to produce prototypes of custom-designed printers for pre-manufacturing evaluation.

All these factors provide a good indication of the supplier's commitment to the OEM market. Whatever mix of services and capabilities a supplier offers, the prudent OEM will not overlook the evidence of the supplier's dedication to the OEM market. The attractions of the retail market are strong, and a supplier with limited resources and unlimited ambitions may provide only lip service to OEM customers. □

Lex Pietraszkiewicz is manager of product marketing, printer products, for Epson America Inc.'s OEM Products Division. Previously with Okidata Corp., Scientific-Atlanta Inc. and Simmons Precision Products Inc., he has been involved with the product management of computer peripherals and accessories for several years.

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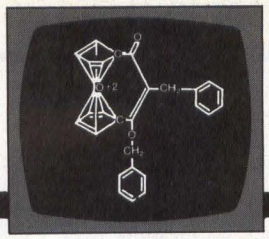

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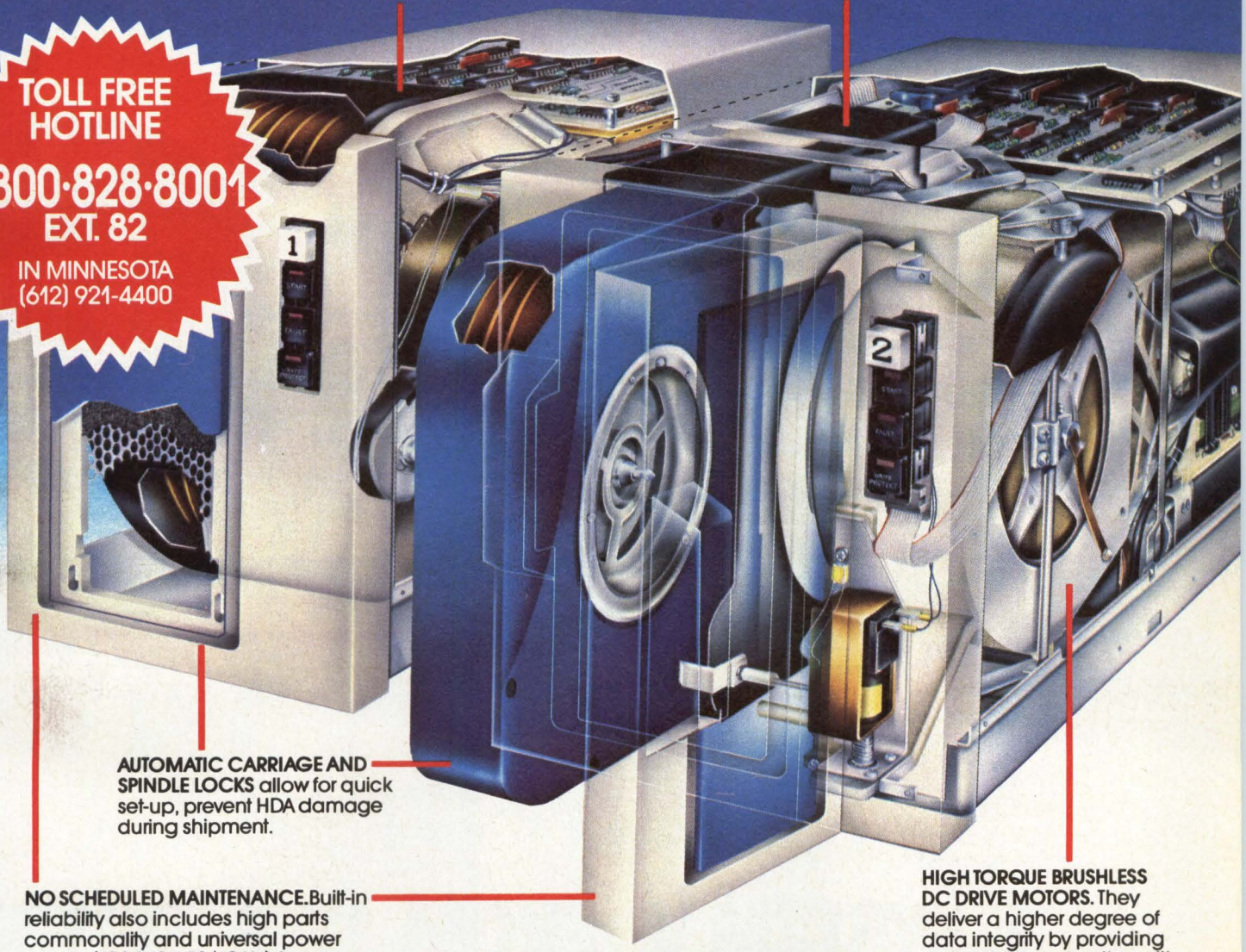

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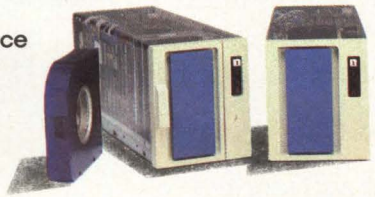

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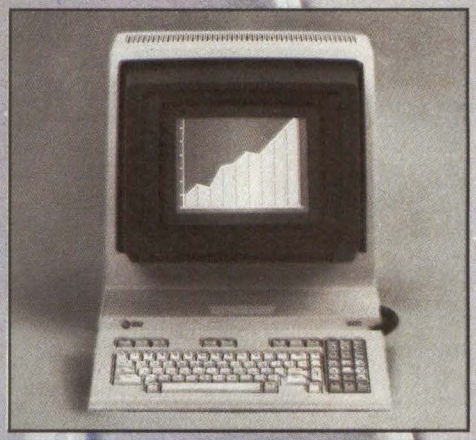

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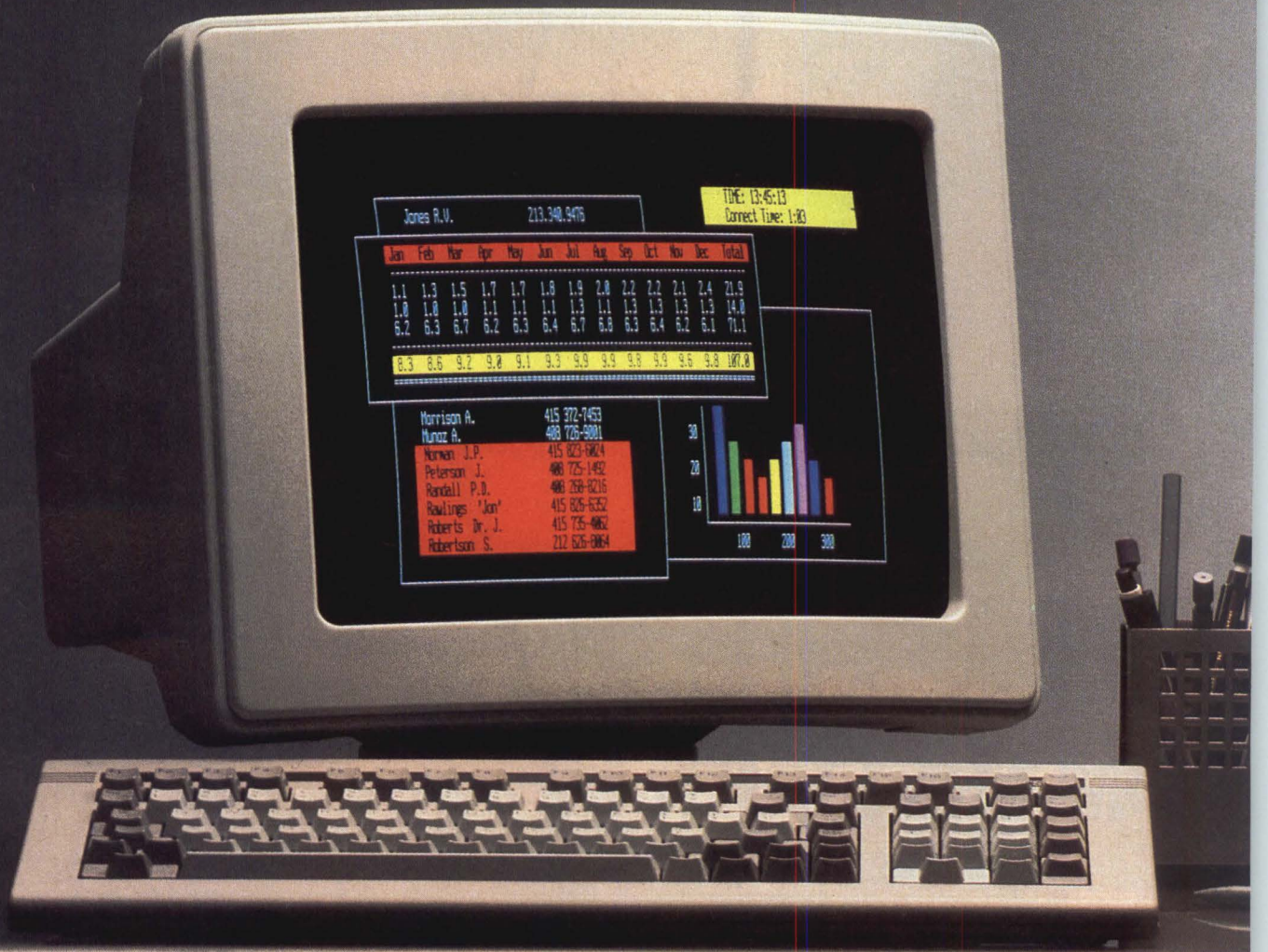

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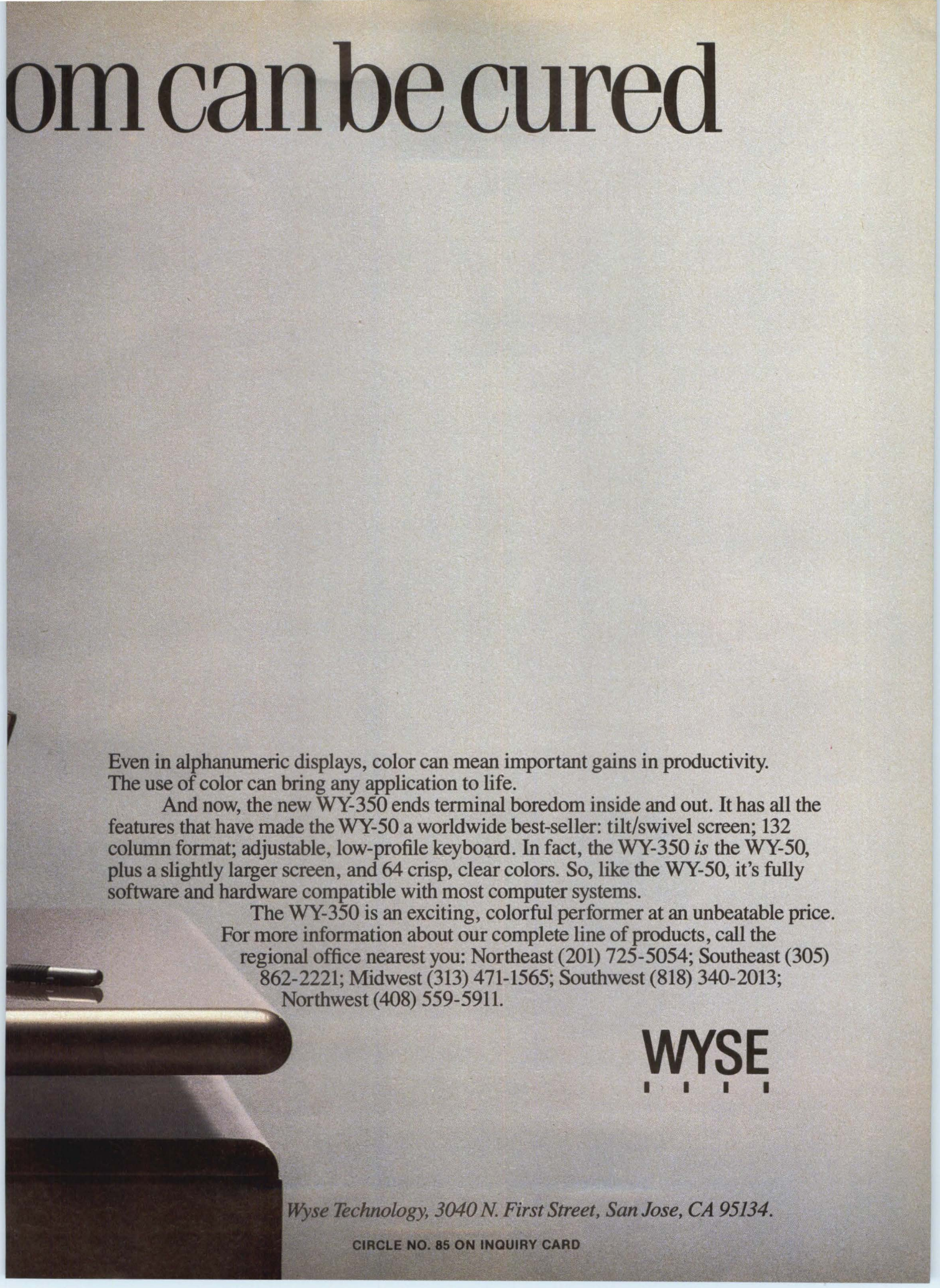

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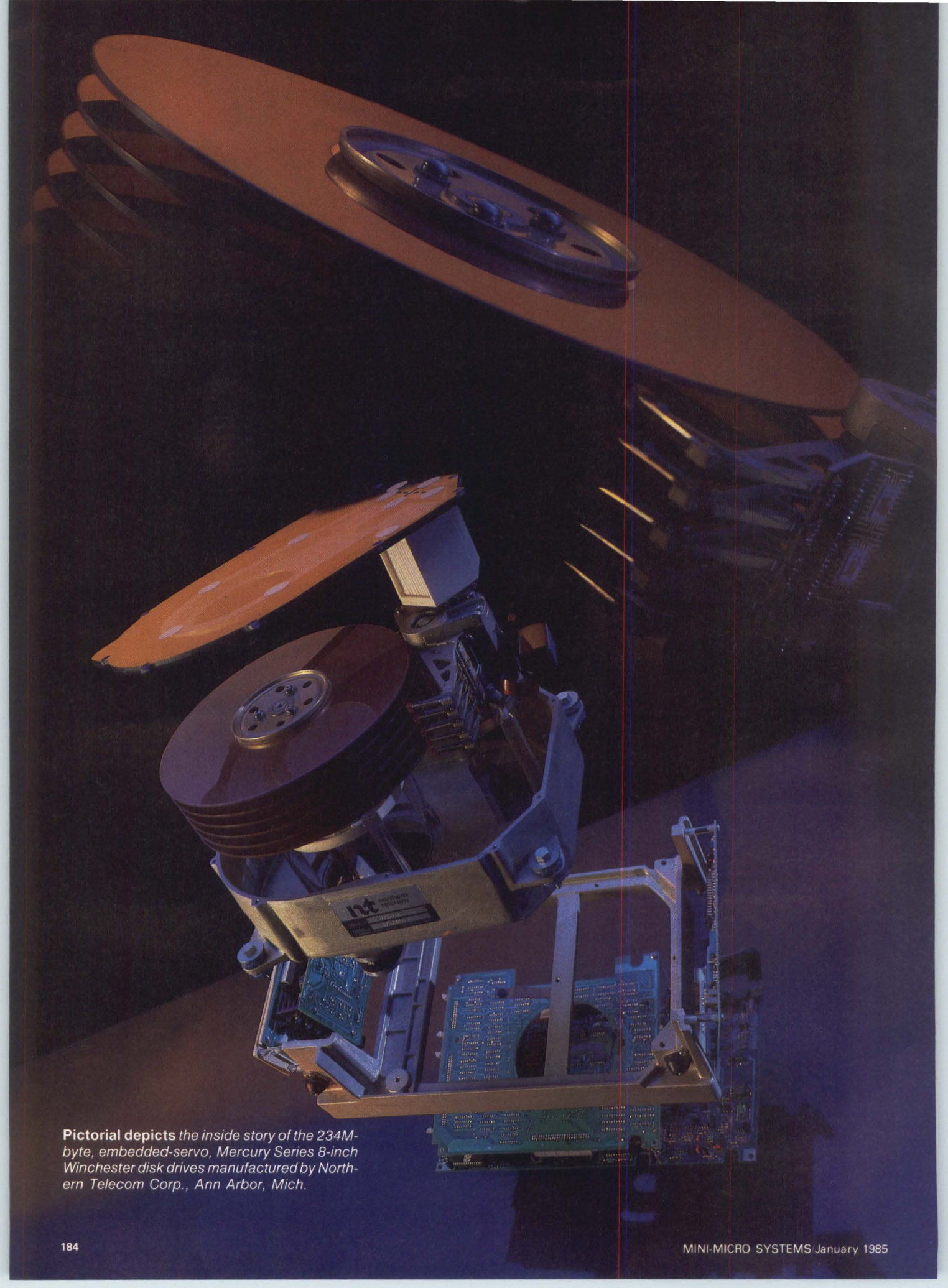


Pictorial depicts *the inside story of the 234M-byte, embedded-servo, Mercury Series 8-inch Winchester disk drives manufactured by Northern Telecom Corp., Ann Arbor, Mich.*

High-capacity 8-inch Winchesters aim to overtake 14-inch market

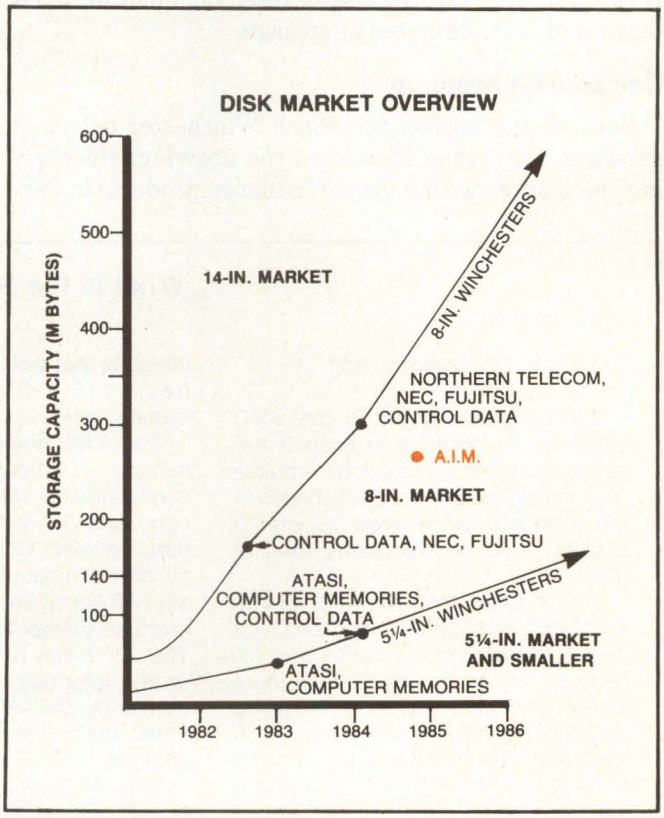
Pushed by 5¼-inch Winchesters, 8-inch drives are breaking past the 160M-byte barrier, supplanting 14-inch models in newer system designs

Carl Warren, Western Editor

Despite their lack of glamour, the increasing capacity of 8-inch Winchester disk drives keeps them high on the heap of storage devices. As a result of being pushed from the low-end by 5¼-inch drives, 8-inch models have grown in capacity from Shugart Corp.'s popular 10M-byte SA-1000 to models ranging from 160M bytes to above 500M bytes. Industry watchers such as James Porter of Disk/Trend Inc., Los Altos, Calif., and Dennis D. Waid of Peripheral Research Corp., Santa Barbara, Calif., see 8-inch capacities expanding into the gigabyte range as storage needs continue to expand.

As 8-inch drive capacities expand, the market for 14-inch drives dwindles and may, say some observers, eventually disappear. According to Porter, the benchmark is the 84M-byte Fujitsu Ltd. 2312 drive that sports a 23-msec average access time. "This drive, which became available in April 1981, offered manufacturers of supermicrocomputers and low-end minicomputers a viable alternative to 14-inch drives," Porter says. As with 5¼-inch implementations, space is an important issue. Therefore, high-performance 8-inch drives offer a reasonable alternative to 14-inch drives in a smaller footprint.

What's more, available technology is still used to increase the capabilities of 8-inch drives. Drive manufacturers have a wide range of media and transducers [read/write heads] and a variety of interfaces from which to choose. "System OEMs have a long list of good alternatives," says Porter, "It's more of a matter of choosing the proper design-in window. Right now there are drives ranging from 16M bytes to over 500M bytes. The OEM only has to determine the specific application requirements."



Eight-inch drives are moving up fast *on 14-inch markets, and most 5¼-inch drives are stabilizing around the 140M-byte range. But newcomers such as Applied Information Memories slip over into the high-performance arena in a 5¼-inch package.*

The system OEM does have an impressive shopping list from which to make a selection. For example, Control Data Corp. (CDC), Minneapolis, Minn., offers the FSD series of sub-14-inch drives that employ 9-inch platters and range in capacity from 160M bytes to 340M bytes. A 516M-byte version is expected soon. These drives have established the performance pace for the entire class of sub-14-inch drives.

Priam Corp., San Jose, Calif., is outstripping its sales of 14-inch products with a series of 8-inch drives. This family ranges in capacity from 35M bytes for the model 3450 to 500M bytes for the model 808. Another contender for a piece of the 8-inch, high-performance pie is Kennedy Co., Monrovia, Calif. The Kennedy model 73160 drive fits the low end, with 165.9M bytes of unformatted capacity and a swift 20-msec average access time.

Amcodyne Inc., Longmont, Colo., is also enjoying success with a series of 8-inch drives. The Amcodyne Arapahoe 7110 cartridge drive has 26.6M bytes of removable storage. To meet higher capacity needs, Amcodyne also has the model 8160 Commanche fixed drive with 165.9M bytes of storage.

Competition heats up

Because the market for 8-inch Winchester drives is growing, the competition is on the upswing. Reentering the market with high-performance products is Pertec Peripheral Corp., Chatsworth, Calif., with the DX series. In the past, Pertec had fallen on hard times with a number of ill-fated designs. But vice president of marketing James Youngblood asserts the company is back in contention. Pertec is tracking the industry closely and is slipping into the storage-module-device (SMD) arena with a full family of drives that range in capacity from 180M bytes to 300M bytes. "We discovered that we had entered the market too late with too little. By the time we had working 8-inch designs, 5¼-inch drives were encroaching on existing 8-inch performance. The market we thought was there vanished and forced us to reevaluate the market and our product strategy," Youngblood explains.

While in the redevelopment phase, Pertec discovered that the market was highly segmented. Manufacturers of 5¼-inch drives served the lower half of the market; CDC had the higher-end [14-inch] domain, but was vulnerable where price/performance requirements could be met with 8-inch designs. Essentially, the market is seeking drives that offer 14-inch performance in smaller sizes, with equal transfer rates and access times, according to both Youngblood and Porter.

It appears that the low end of the 8-inch performance bracket is about 160M bytes; the top end is 300M bytes and improving. Megavault Corp., Woodland Hills, Calif., is readying the models MV-300 and MV-660—331.8M bytes and 660.4M bytes respectively—for the

What is the SMD interface?

Dal Allan, ENDL Consulting

The question, "What is the SMD interface?" is difficult to answer because a brief description requires over-simplification, in part because the interface sometimes seems to consist more of exceptions than of rules.

The storage module drive (SMD) interface has been criticized for over 10 years, yet it endures and will continue to do so for a few more years. The interface is an industry standard, but is adaptable enough so that users have been able to change it to meet the needs of rapidly evolving disk technology.

In its early stages, the SMD interface specified 20,160 bytes per track and a 1.2M-byte-per-second transfer rate. More recently, manufacturers have introduced versions that handle 40,480-byte-per- track data transfers at 2.4M bytes per second, as well as versions that call for 50,400 bytes per track and a 3M-byte-per-second transfer rate.

The SMD interface requires two cables: a 60-conductor "A" cable used primarily for control, and a 26-conductor "B" cable used primarily for data transfer. Control takes place in parallel and data transfer occurs serially. All signal lines are unidirectional and use differential drivers/receivers. The "B" cable is radial to every disk on the interface. In systems with redundancy, the "A" cable may also be radial, but it is more commonly daisy-chained.

The "A" cable contains three buses: Selection (4 signals), BUS OUT (10 signals) and BUS IN (8 signals). The contents of the buses are interpreted according to the setting of one of seven tags. (The standard SMD has only tags 0-3, but extensions have defined tags 4-6.) Tag 5 is a doubly defined signal that is the Selection Bus Bit 3 when tag 0 is not set. Tag 6 is the gated product of tag 4 and tag 5. The tag definitions are:

- Tag 0 and selection bus—Device Selection
- Tag 1 and BUS OUT—Set Cylinder Address and Initiate Seek
- Tag 2 and BUS OUT—Set Head Address and Cylinder Address
- Tag 3 and BUS OUT—Data Transfer or Control Function
- Tag 4 and BUS IN—Report Current Sector Address
- Tag 5 and BUS IN—Report Extended Status (this information tends to vary widely by vendor)
- Tag 6 and BUS IN—Report Access Status and Device Type Status (this also varies widely by vendor)

During the setting of tags 0-3, the contents of BUS IN are always available to advise of drive status conditions.

The "B" cable consists of seven inbound and two outbound signals.

first and second quarters of 1985. Megavault, like Pertec, anticipates the industry will buy more 8-inch, high-performance Winchesters.

The Mercury series of drives from Northern Telecom Inc.'s Memory Systems Division, Ann Arbor, Mich., sport capacities from 71.8 to 378.6M bytes. According to Ray Kavlick, vice president and general manager of the Memory System Division, tough design problems were solved in developing the product. "We aren't pushing the areal density, so we don't push the interface bandwidth. About 2.2M bytes is the maximum boundary of acceptable bandwidth. We went to great lengths to stay within the boundaries of SMD without sacrificing performance." There are various ways to increase areal [tracks per inch (tpi) times bits per inch (bpi)] density. One is to increase the tpi and bpi together. But increasing the bpi speeds up the transfer rate. Another method is to increase the tpi and hold the bpi steady. Currently, most drives hold bpi at about 10,000 bpi and 900 to 1,000 tpi to maintain SMD compatibility.

SCSI predicted

Virtually all the 8-inch manufacturers adhere to the SMD interface. The interface requires a 1.8M-byte transfer rate (see "What is the SMD interface?," below). Even though adherence to SMD is considered important for high-performance drives, none of the manufacturers is ignoring other interfaces.

For example, Northern Telecom's disk product manager, Ken Nisbet, points out that the Small Computer System Interface (SCSI) is now in the SMD area of performance and offers a viable alternative to various system approaches. "But as capacities go up, the transfer rate has to keep going up," Nisbet explains. "In a very short time 15 MHz will be the requirement and that's when IPI-2 [Intelligent Peripheral Interface] will come into play. We are making provisions to handle it as well," he says.

All the manufacturers agree that SCSI is coming. Controller manufacturers are developing host adapters to meet the expected demand. "The whole disk strategy is going to change," says Kavlick. "It is driven by local area networks and multiuser systems. System integrators aren't going to be burdened by primitive disks. As capacities go up, so will the intelligence and transfer rates."

Servoing included

Because the newer 8-inch drives are able to handle so much data and retrieve it quickly, sophisticated tracking (servoing) systems are included in the drive. Two methods are used by drive makers: dedicated surface and embedded. Both offer advantages to users and to manufacturers.

In embedded servo systems, for example, the elec-

Two of the inbound signals—Index and Sector Mark—duplicate those available on the "A" cable BUS IN. It is possible to configure drives to provide these signals on cable "A," "B" or both. Some controllers continuously monitor the Index and Sector Mark signals on the "B" cable of each drive, because it is radial. This requires a lot of logic, but enables the controller to maximize performance because it knows where each drive is positioned by cylinder and sector at all times.

The Unit Selected signal confirms device selection. If it occurs on two "B" cables, this indicates false selection or an improperly configured system. The Seek End signal must be interpreted according to BUS IN on the "A" cable to determine if the seek completed successfully.

Of the five signals used for data transfer, two are paired as Read Data and Read Clock, and two as Write Data and Write Clock. The fifth is the Servo Clock, which is generated by the drive and echoed back to the disks as Write Clock by the controller. Thus the disk controls data timing because it is responsible for clock generation.

Data is transferred in a non-return-to-zero (NRZ) format and is integrated with its corresponding clock to produce valid data. Thus a byte consisting of three zeros followed by four ones and a zero would require processing two data transitions and eight clock pulses.

The controller uses Read Gate and Write Gate on BUS OUT (during tag 3) to toggle when data is to be read or written by the disk. There is a critical timing relationship during all stages of data transfer because of the need for the controller to perform gap management. The timing between disk and controller is critical because not only must the data be clocked but also the phase-locked oscillator (PLO) synchronization, sync-byte recognition, write splicing, and start/end or record tolerances must all be handled.

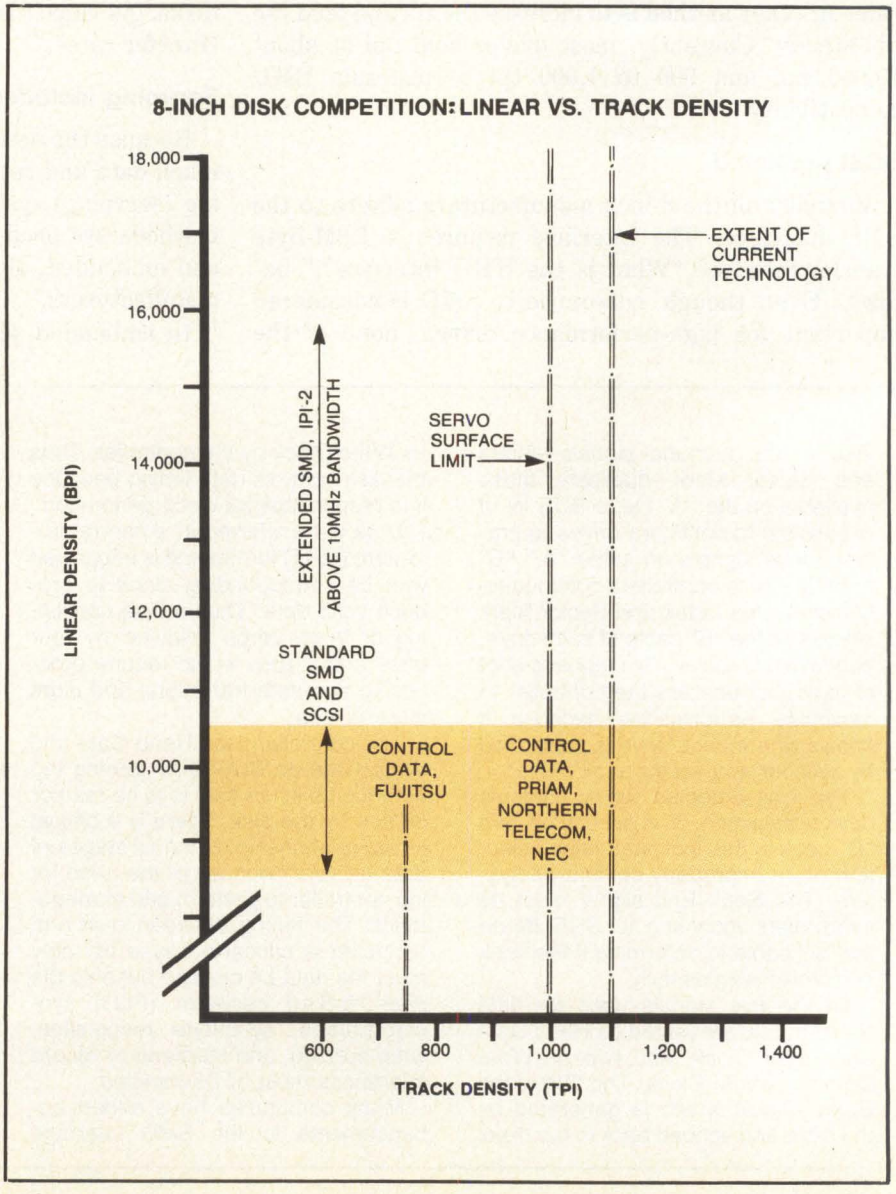
Many companies have added enhancements to the SMD interface since its introduction in the early 1970s by Control Data Corp. The sum of the most popular enhancements and the standard SMD is referred to as the SMD-E interface. The probable successor to SMD—the intelligent peripheral interface (IPI)—incorporates the enhancements found in SMD-E. The device-level implementation of IPI is a higher-performance alternative to SMD. Because it takes a long time for manufacturers to change hardware interface models—and an even longer time to replace existing software interfaces—the replacement of SMD by IPI will be a gradual development.

Dal Allan is the founder of ENDL Consulting, Saratoga, Calif. He is also vice chairman of the American National Standards Committee X3T9.3, which is responsible for peripheral device interfaces.

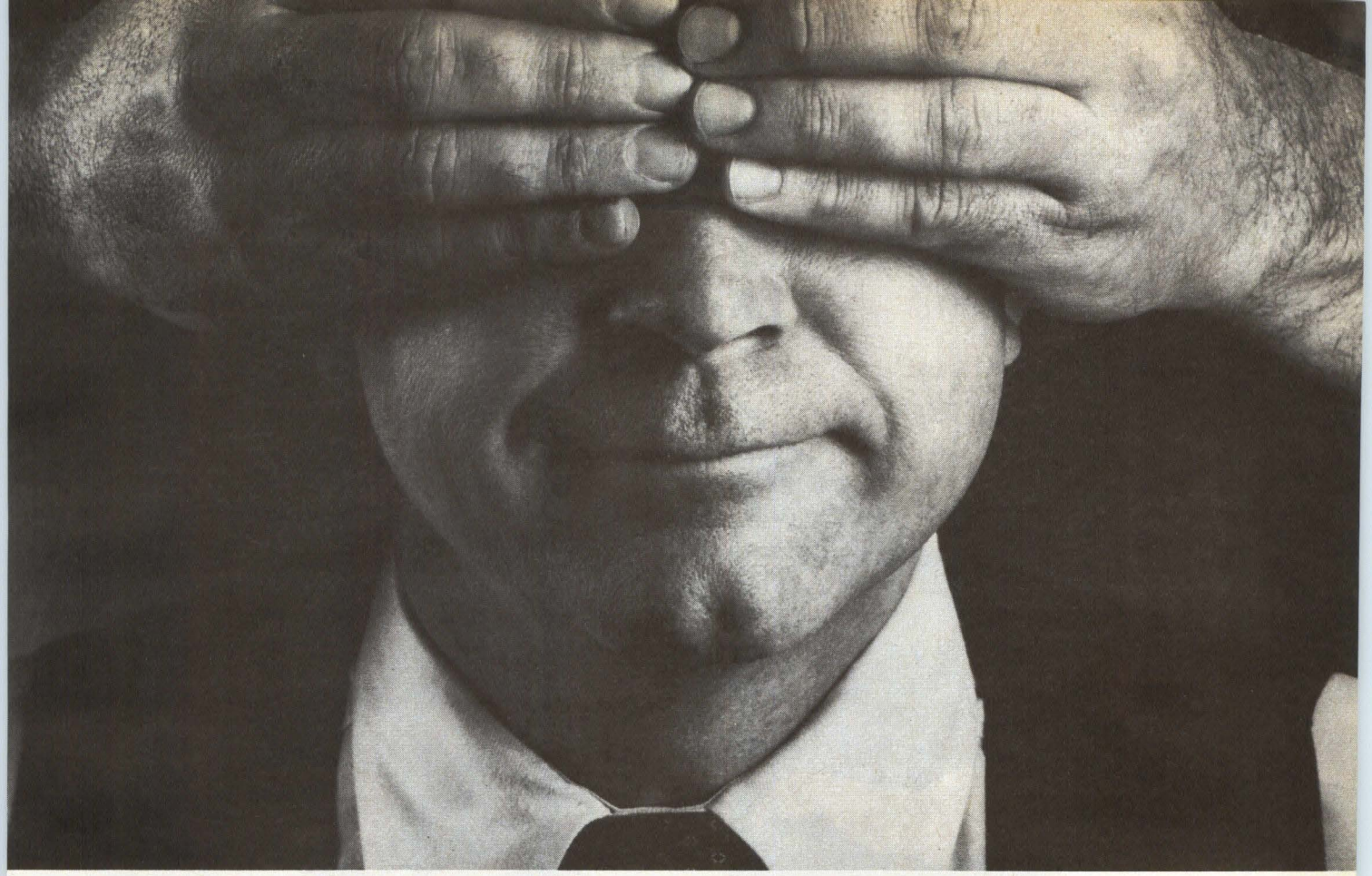
tronic pulses that keep the read/write transducers properly positioned over the data are written on each data surface. With this method, the servo data is continually read with each seek by a read/write transducer. This servo (positioning) information comprises an identification burst and an address mark with a cyclical redundancy check (CRC). The same is basically true for dedicated surface servos except that the positioning information is written on a single surface that uses a read/write transducer to follow the servo information and feed it back to the positioning electronics that guide all the transducers on the head assembly.

Detractors of dedicated servo systems point out they take up an entire data surface and don't take into account movement of the head assembly due to shock or aging. On the other hand, they note that embedded servos always cause the transducers to follow regardless of changes in the drive chassis or media. But embedded servoing doesn't come free. It uses only portions of each data surface (typically less than 2 percent), but it does determine fixed-sector (data area) sizes. These sector sizes can range from 256 bytes to 1,024 bytes. Some system integrators say that they prefer to choose the size, rather than work in fixed limits.

The method of servoing may end up as a non-issue along with the sector sizes, however. Pertec's vice president of engineering, Hossein M. Moghadam, explains that the company chose to use a dedicated servo primarily to ensure absolute adherence to SMD requirements. But he does admit, "A lot of system OEMs question dedicated servos since they can be forced



One can increase areal density *by increasing tracks per inch (tpi) and bits per inch (bpi) together, but increasing bpi speeds up the transfer rate. The tpi can be increased while holding the bpi steady. Most drives maintain SMD compatibility by holding bpi at about 10,000 and tpi at 900 to 1,000.*



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off-track due to shock. We are aware of that possibility and, if we sense an off-track indication, we turn the write gate off so we don't overwrite adjacent tracks."

Most drives using dedicated servos turn off the write gate when an off-track event is sensed. But Northern Telecom's Nisbet insists that isn't sufficient. "Embedded methods let the transducers always follow the tracks. Shock is only part of the problem. Drives age and the characteristics can change, thus causing transducers to go off-track. An embedded design always forces the transducers on track."

Nisbet adds that the forced fixed-sector sizes of embedded servos designs is not important. "All the system integrator wants is a drive that can be plugged in and that will operate. He really only sees the interface connector. As SCSI becomes more popular, everything becomes transparent." Both Nisbet and Youngblood agree that users tend to buy drives of this class based on performance, not price.

The forthcoming IPI-2 interface also promises transparent operation, and newer, speedier—and intelligent—versions of SMD are isolating the user from the internals of the drive. "It is rapidly becoming a plug-and-go business," says Chris Karzag, director of marketing research for controller manufacturer Spectra Logic Corp., Sunnyvale, Calif. Raymond C. Freeman, president of Freeman Associates, Santa Barbara, Calif., a consultant on data storage technology and markets, concurs. "The ideal is to isolate both ends of the system from each other as far as how they operate. That's why developing standardized interfacing methods such as SCSI, IPI-2, ESDI and the QIC techniques are so important: They put the burden on the individual devices so the system OEM can plug them together in a standardized way."

Markets acquire new shapes

Clearly, the Winchester disk drive markets are taking on new shapes. Sub-4-inch drives are pushing the low end of the 5¼-inch drives, which are in turn pushing 8-inch drives. The high-end, 14-inch market, however, appears to be dwindling as system OEMs demand more in smaller packages.

It appears that manufacturers of 8-inch SMD-compatible Winchesters have little to fear from 5¼-inch products. But that may not last. Already, Applied Information Memories (A.I.M.), Milpitas, Calif., has developed the Dart, a 250M-byte, SMD/SCSI, 5¼-inch drive whose performance stacks up to any of the 8-inch models. "This isn't just a shot in the dark," says vice president of engineering William Glover. "The Dart is everything an 8-inch drive [is]...just better packaged."

A.I.M. officials claim that the Dart displays all the characteristics of larger SMD drives, including an 18-msec access time. Glover says the small size gives the added benefits of better shock immunity and lower power consumption as well. Disk Trend's Porter thinks A.I.M. has a solid design, but notes it is only good if it can be manufactured.

The high performance of 8- and 5¼-inch SMD drives doesn't come cheaply. Typically, drives range from $2,500 range for the A.I.M. Dart SQ to as much as $8,000 for drives in the class of the Megavault 600M-byte model.

All of the manufacturers agree that, above 160M bytes, the question becomes one of cost per megabyte. "The greater the performance," says Pertec's Youngblood, "the more it costs. But the cost/performance ratio does decline. Unlike the low-end [5¼-inch] business, this end is immune to price erosion." □

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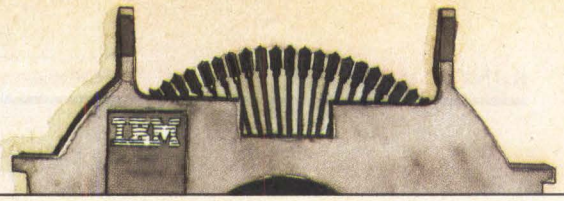

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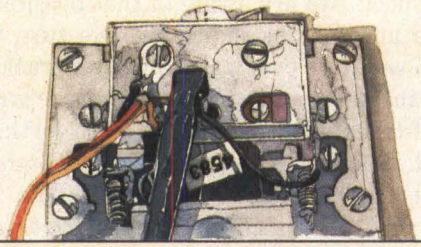

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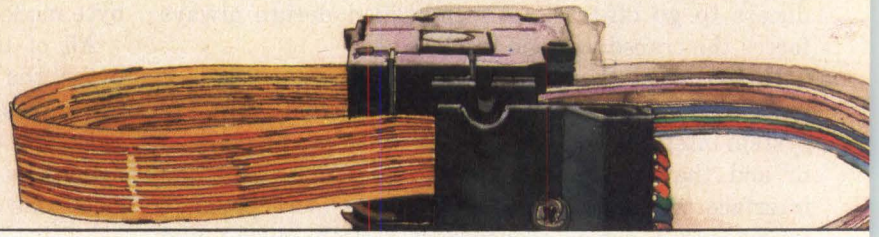

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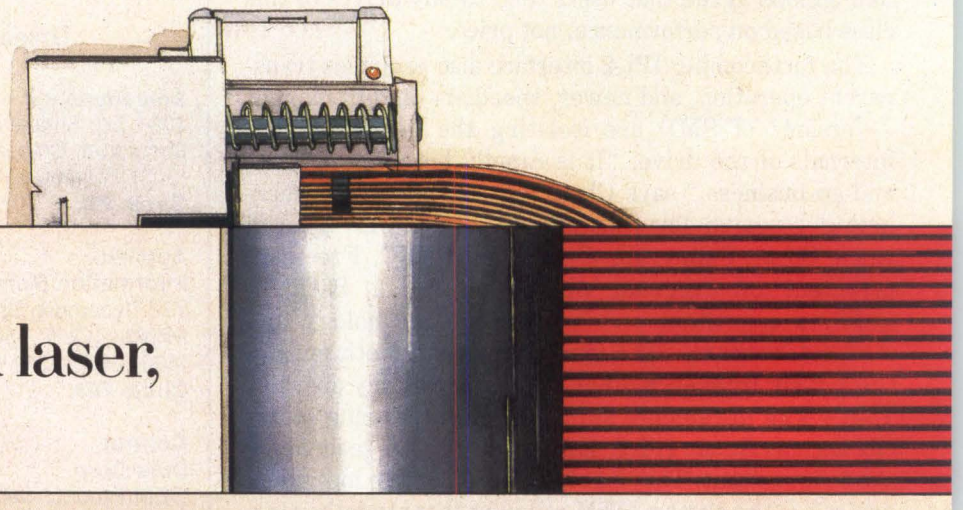

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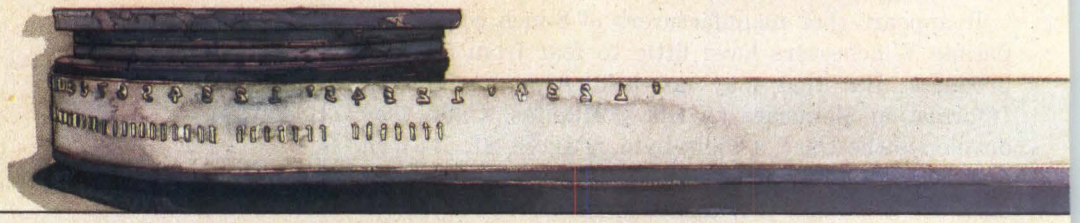

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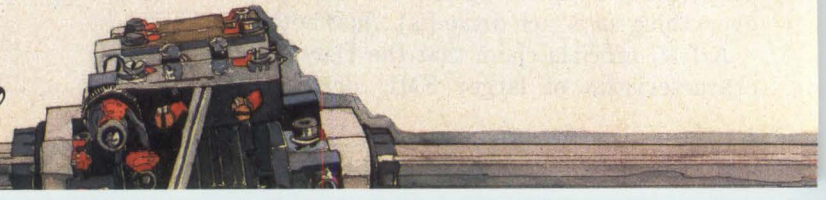

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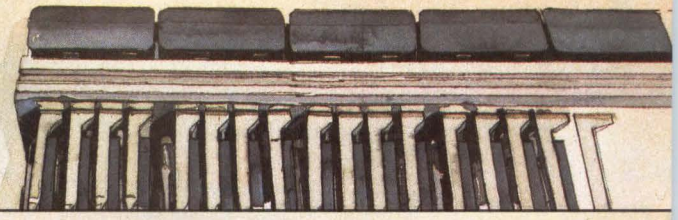
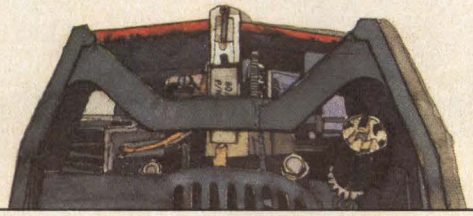


or a color dot matrix,



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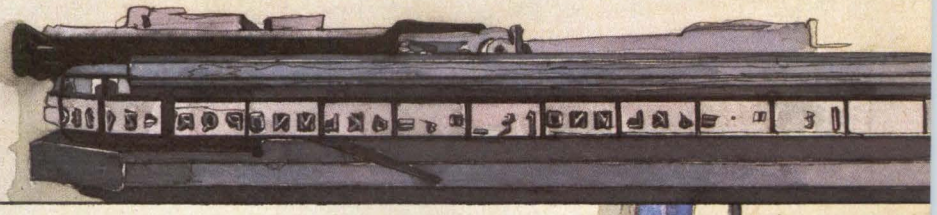

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Hybrid technologies rewrite the rules for local area networks

The LAN industry is being shaped by new applications, new and refined transmission media and old software shortages

Judith Estrin, Bridge Communications Inc.

The current state of the local area network (LAN) arena is perhaps best characterized by the blending of once-distinct technologies—a necessary development for increasingly complex applications linking large, medium and small computers, terminals and other devices. Specifically, the need to integrate personal computers into the corporate environment has led to merging back-end, general-purpose and personal computer networks.

One result is that media not previously used together are being mixed in "hybrid" networks. Another result is extensive work in protocols development. Standardization efforts, which began at the lowest protocol levels, have slowly moved up to the higher layers, with a number of standards being defined, as opposed to the single standard once expected to emerge. Finally, LANs are influencing development even at the application software level, where special features must be designed in to run applications in shared environments.

Applications include three types

LAN technology has become a key element in data communications systems and distributed computing systems. LANs today are being used as highly effective distributed data switches interconnecting personal computers, terminals and peripherals to groups of multivendor, host-computer systems. In addition, LANs are being used as the bus in distributed computing systems interconnecting mainframes to disk storage and workstations, or personal computers to file, print

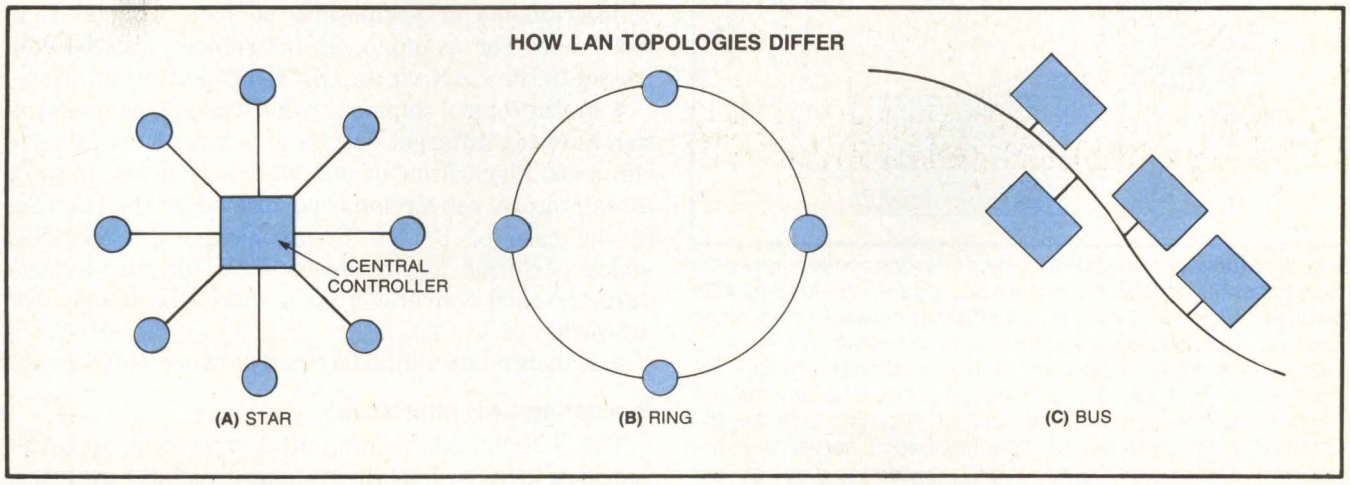


Fig. 1. The three major LAN topologies *currently in use are star, ring, and bus. Star (A) depends on a central controller, which simplifies network management but increases the chances that a single fault will silence the entire system. Ring (B) provides distribution of intelligence and can use point-to-point connections to run at very high speeds. Bus (C) has the ring's advantages of distributed intelligence and is often easier to install and configure.*

and mail servers.

All applications primarily involve the back-end, general-purpose and personal computer networks. Back-end networks provide high-speed file-transfer and shared storage among large mainframes and minicomputers—typically within a small geographic area such as a computer room. Network Systems Corp.'s Hyperchannel, the best known, is a multivendor back-end network with interfaces to most of the common mainframe and minicomputers, including those produced by IBM Corp., Central Data Corp., Sperry Corp., Digital Equipment Corp. (DEC) and Data General Corp. Another single-vendor, back-end network is DEC's cluster system, which provides high-speed transfer and disk sharing among VAX computers. Because these applications are better defined in scope than those of general-purpose networks, this segment has been relatively unaffected by standardization.

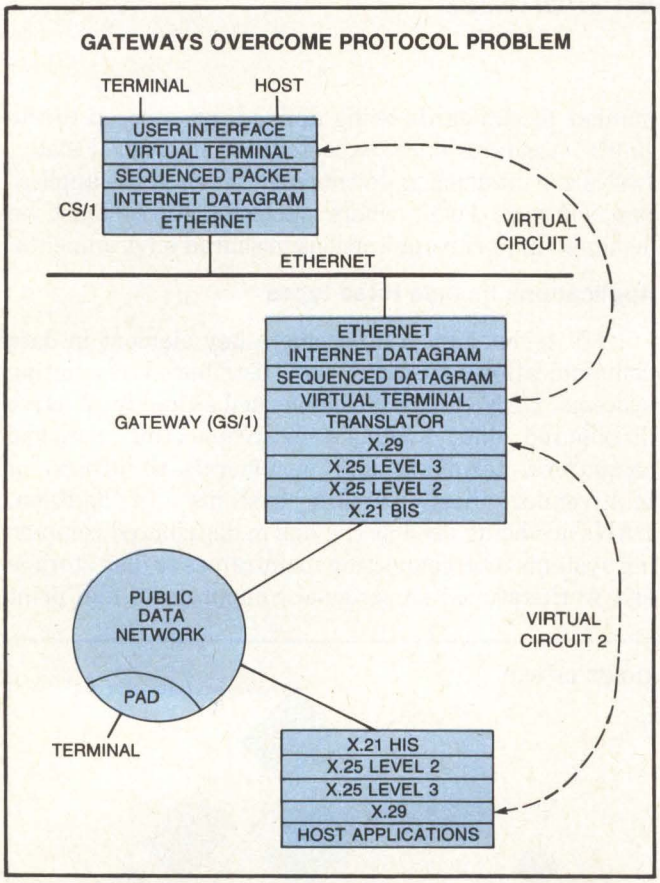


Fig. 2. Gateway translation *allows interconnecting networks with different protocol architectures. Here, an XNS-to-X.25 gateway allows terminals on an Ethernet network to access a host on a public data network and terminals on an X.25 packet assembler/dissembler (PAD) to access an Ethernet host. In this case, for each connection between a terminal and host, there are actually two "virtual circuits": one for the Ethernet side between the communication server and the gateway, and one on the X.25 side between the gateway and the host or PAD. The gateway is responsible for receiving data from one circuit and transmitting it over the second, as well as for mapping and making parameter changes from one circuit to the other.*

The major thrust in back-end networks has been to provide faster datalink speeds. Current products are in the 10M-bits-per-second (bps) range, and several companies have announced projects aimed at the 200M-bps range. Network Systems, for example, is planning a fiber optic-based back-end network with a 275M-bps data rate. The type of media used in back-end networks is typically either baseband coaxial cable or fiber-optic cable. Fiber optics eventually will dominate in this segment due to its inherently greater bandwidth.

General-purpose networks are being used primarily in two areas. The first is as a distributed data switch, where the LAN is used as a data highway providing connectivity via packet-switched virtual circuits among terminals, minicomputers, peripherals, microcomputers and mainframes. These systems provide communication between hundreds or even thousands of devices within buildings or across campuses. Examples are Bridge Communications Inc.'s Ethernet-based Communications Servers, Ungermann-Bass Inc.'s Net/One and Sytek Inc.'s LocalNet System. Each of these consists of a packet-switching computer in a small enclosure with both a network connection and two to 32 serial I/O ports. They act as cluster controllers to their networks.

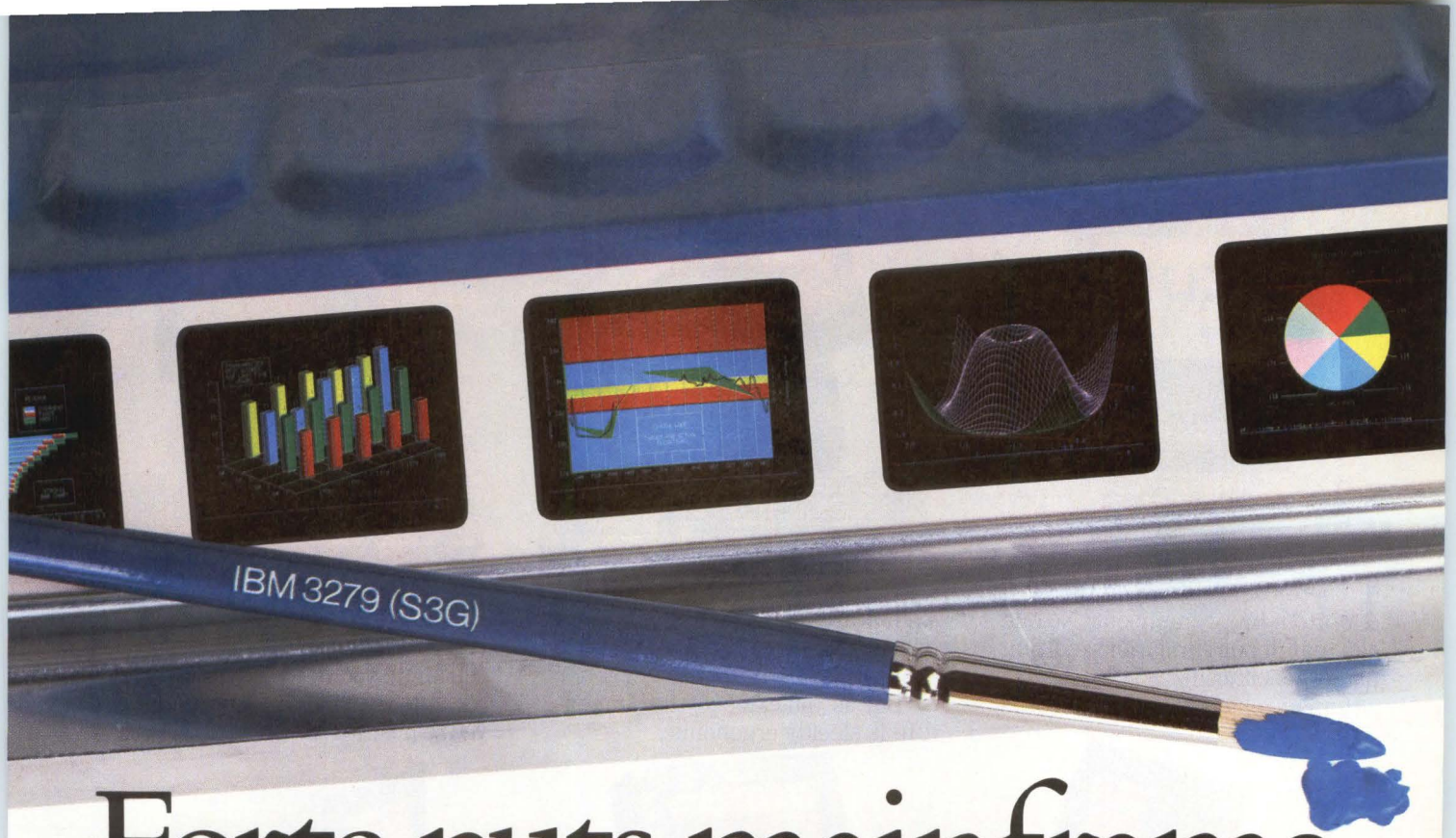
LAN-based data switches provide all the features of a classical data Private Branch Exchange (PBX), plus enhanced functionality. Among the enhancements are:

- Speed intermix (or speed matching), which provides the capability to communicate between devices running at different speeds. For example, a 9,600-bps terminal can communicate with a 19.2K-bps host port and a 300-bps modem without changing speeds.
- Higher-speed interfaces, which allow attachment of instruments or periperhals at speeds higher than 9,600 bps. For example, an instrument may be connected to the LAN via an IEEE-488 parallel interface.
- Multiprotocol support, which allows communication between different classes of devices such as asynchronous, bisynchronous and bit-synchronous. In some cases protocol conversion is performed by the LAN, as in the case of Bridge Communications' CS/1-SNA, which performs asynchronous TTY terminal-to-SNA 3270 terminal conversion on a shared basis over the network.
- Enhanced user interface and network software.

Evaluating LAN interfaces

The distributed building-block approach of LANs provides increased flexibility and reliability over centralized switches. If a single LAN controller fails, it impacts only the devices connected to it.

There are several key factors in the evaluation of



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9 The Lear Siegler ADM 3, ADM 3A, 3A+ or ADM 5*..

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6 But ergonomics are just the beginning. The Ampex 210 is as beautifully engineered inside as outside. With line graphics and a bidirectional printer port as standard features.

10 The Esprit (Hazeltine) 1400, 1410 or 1500.*..

11 ADDS Regent 20, 25 and Viewpoint.†..

12 And Qume's QVT 102.*

16 How can we pack all that into the Ampex 210 for just $549? We're in a position to be competitive. We can take advantage of over 25 years of video, computer peripheral and offshore manufacturing experience.

17 So if you need a well-designed, full-featured terminal, call us at 800 621-0292. Or 800 821-9473 in California. We'll show you how you can be very comfortably situated for just $549.

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18 The Ampex 210 is from the Computer Products Division of Ampex Corporation. One of The Signal Companies

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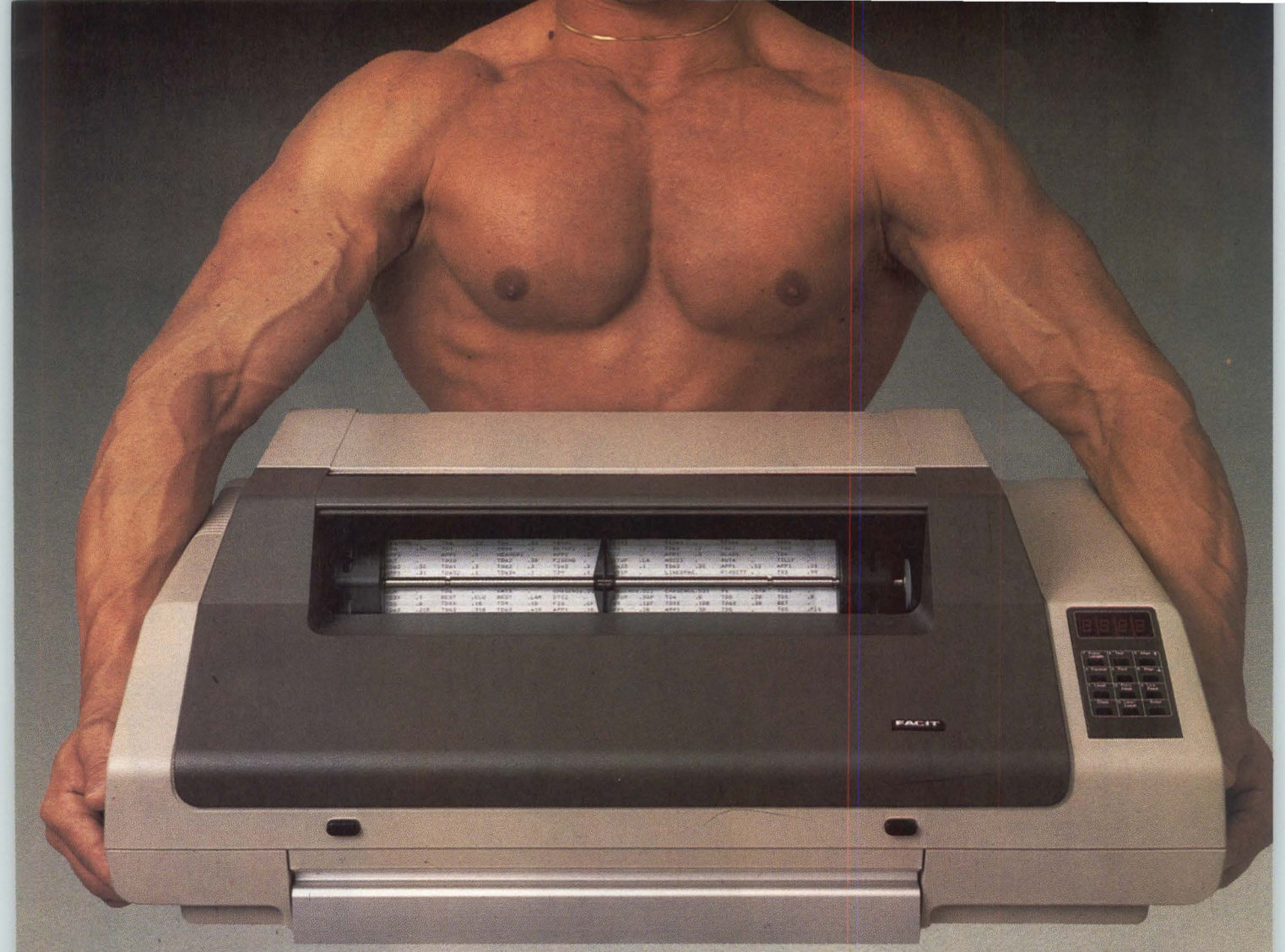

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LAN-based communication systems. The LAN interfaces (Communications Servers or Network Interface Units) must provide standard interfaces to a variety of devices. Ideally these interfaces should be such that the devices being connected to the network need not be modified. The LAN interface is responsible for putting data in packets and transmitting it. Performance of the LAN interface is critical in providing the necessary response time in screen-oriented applications where each character must be transferred over the network and echoed from the host. So as not to restrict future hardware choices, it is important to choose a system based on industry standards. For example, the cable used should allow other equipment to coexist with the current "data-PBX" LAN equipment.

General-purpose network technologies such as Ethernet are also used as backbones or system buses for distributed computer systems. Examples include CAD/CAM systems such as those made by Daisy Systems Corp., Sunnyvale, Calif., or Valid Logic Systems Inc., which use Ethernet to interconnect their workstations and file servers; and Xerox Corp.'s Network System products, which uses Ethernet to interconnect Star workstations to file, print, mail and communications servers. In this type of application, the LAN must provide high performance for both file transfer and transaction processing.

Personal computer networks are similar to back-end networks except that they support small microcomputers as opposed to mainframes. Personal computer networks typically interconnect a small number (in the tens) of personal computers and provide a mechanism to share disks and printers among them. Examples are 3Com Corp.'s EtherSeries, Corvus Systems Inc.'s Omninet and IBM's new personal computer network. Personal computer networks range in speed from 1M to 10M bps and usually are department-level in scope. Their key feature, however, is high-level software that allows sharing of resources.

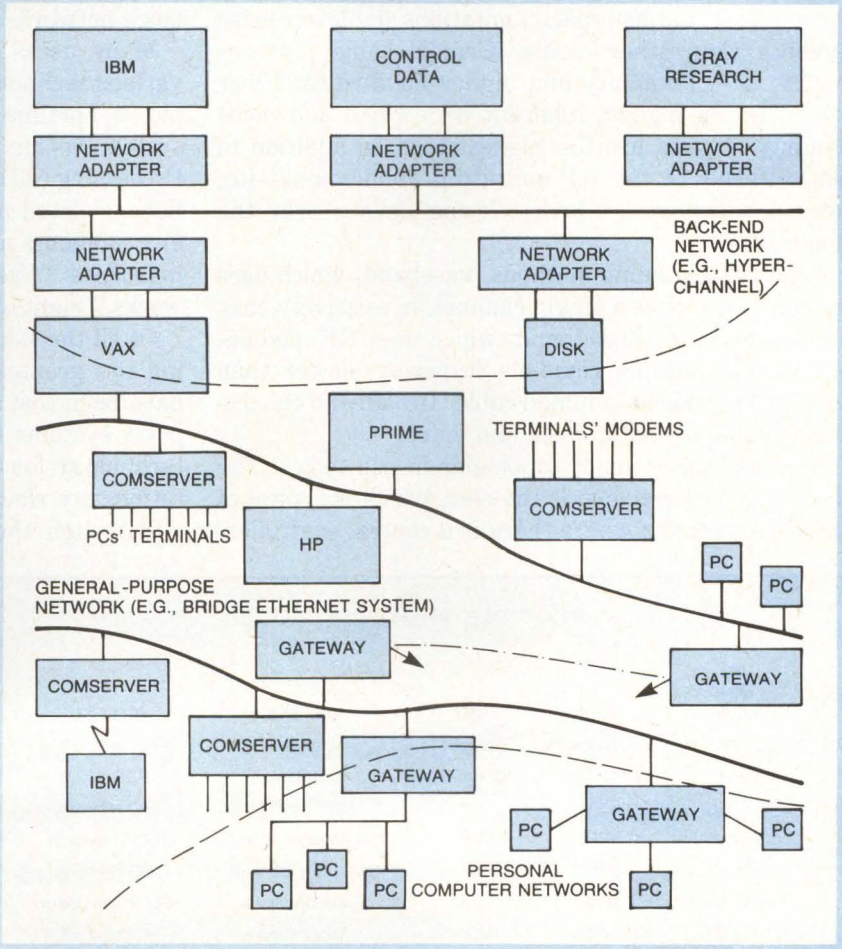
The integration of these networks is being achieved

Integrated networks provide unique benefits

There are several reasons for integrating different network types into a single system. Network installations typically serve multiple applications, and different network technologies are often appropriate for various applications. In addition, the choice of system (computer, workstation, etc.) vendor may dictate a network type should that vendor use a proprietary network scheme.

The diverse networks can be integrated into a large heterogeneous system. In the example, a back-end, high-speed network allows mainframe computers to share data with each other. General-purpose networks interconnect terminals, minicomputers and microcomputers with the mainframes. Personal computer networks generally let a small number of personal computers share resources.

The difficulty of integration derives from the degree of difference between the networks. In cases where the networks use standard media and protocols, off-the-shelf gateway products can often be used. If no such products can be used, integrators look for products that attach to both networks as a gateway. For example, in the absence of a Hyperchannel-to-Ethernet gateway, a VAX is used for which there exists an interface to each network. Similarily, an IBM PC might be used as a gateway from Ethernet to a personal computer network.



by means of gateways between different environments and agreements between different companies to provide compatibility between their products (e.g., 3Com's EtherSeries personal computer network and Bridge Communications' Ethernet System Products' general-purpose network).

Media becomes central to LAN construction

For several years after LANs were first introduced, vendors and customers focused on the media, signaling, topology and media access. These four parameters together describe LAN technology—the method used to transmit packets between stations. Much energy was spent discussing the benefits of baseband versus broadband, coaxial cable versus twisted pair cable versus fiber optics, CSMA/CD versus token, and bus versus ring. As the market and products have matured, it has become clear that there is no one perfect LAN technology, but that different media, signaling, access methods and topologies are appropriate for different applications and environments.

Twisted pair, coaxial and fiber-optic cable are three commonly used media. Twisted pair typically is the lowest in cost, but has speed limitations and lower noise immunity than other media. Coaxial cable provides greater noise immunity and higher bandwidth. Fiber optics has the highest inherent bandwidth and noise immunity. It also has the highest cost, in addition to being difficult to tap for multidrop applications—i.e, those in which many devices communicate over the same cable.

Of the two signaling methods, baseband, which uses digital impulse over a single channel, is relatively easy to install and use. Broadband, which uses RF modulation, allows multiple channels (typically slower than baseband) to share a common cable. Broadband can use a single cable for data, voice and video.

There are three major topologies in use today. The oldest and most common is the star, which is typical of most PBX systems where there is a central controller. Although it simplifies network management, the star's central control also provides a single point of failure. A ring topology provides distribution and has the advantage of utilizing point-to-point connections that can be run at higher speeds and utilize almost any medium. A bus topology also provides distribution and is often simpler to install and configure than the ring. (Fig. 1)

In systems with no central controller, an access method is required to arbitrate the medium. The two common methods are CSMA/CD (Carrier Sense Multiple Access with Collision Detection) and token passing. In a CSMA/CD system all stations listen to the network. If it is free to do so, any station may transmit. If two stations begin to transmit simultaneously (i.e., a collision), they both back off and try again after a random period of time. CSMA/CD is simple and usually economical. It is ideal for bursty environments such as those characterized by heavy terminal-to-host or workstation-to-server interaction. In a token-passing system a "token" is passed from station to station in a specified order. Token passing, while having the advantage of being deterministic (i.e., the maximum delay can be calculated), also has the longer delays associated with large networks.

Many users are beginning to mix and match the various technologies into a hybrid network. For example, a Fortune 1000 company might use a baseband system within the engineering and Electronic Data Processing (EDP) areas, fiber-optic cable on the factory floor, twisted pair (from a PBX) in selected corporate environments and CATV coaxial to interconnect buildings (see "Users blend technology for hybrid networks," right).

Of all the LAN technologies, fiber optics is undergoing the greatest change. The key limitations of fiber have been cost and the ability to use it only in point-to-point systems due to the lack of adequate "tapping" technology for multidrop applications. Both these limitations are slowly being overcome.

Although the medium is important when deciding

ISO PROVIDES PROTOCOL MODEL

	ISO OSI model	XNS	DOD	IBM SNA	ISO STD
1	Physical	Ethernet	Ethernet	Control	IEEE 802.3, 4, 5
2	DataLink	Ethernet	Ethernet	DataLink	IEEE 802.2
3	Network	IDP	IP	Path Control	ISO Network
4	Transport	SPP	SPP	Transmission Control	ISO Transport
5	Session	SPP	TCP	DataFlow Control	ISO Session
6	Presentation	Courier	Telnet	FMD Services	ISO Presentation
7	Application	Application	Application	Application	Application

Fig. 3. The International Standards Organization *reference model describes network protocols so that vendors can meaningfully define their own protocols. Although all the above protocol architectures implement "layering" in some fashion, none exactly follows the ISO model (except for the ISO protocols themselves). The model, however, does make it easier for vendors to build inter-system compatibility into their products and to define the functionality of those products to their users.*

how to wire a building or campus, the key features and benefits gained from a LAN come from high-level protocols. Whereas the LAN technology (i.e., low-level protocols) provides a mechanism to move data packets from one station to another, the high-level protocols establish the communication "session" and provide the flow control that allows devices to communicate effectively over the network. The protocol architecture used dictates such factors as whether or not local networks can be interconnected into a network system spanning longer distances or serving multiple applications. The protocol implementation and the hardware it runs on determine actual end-to-end throughput (Fig. 2).

The International Standards Organization (ISO) has produced a methodology for specifying protocols for packet-switching networks (of which LANs are one type). This methodology, called the Open Systems Interconnect (OSI) reference model, is divided into seven protocol levels. Most protocol architectures in use today can be described in terms of those levels.

There has been significant work in the standards regarding media, signaling and access method—the first two layers of the seven-layer ISO Open Systems Interconnect (OSI) reference model. For instance, the IEEE project 802 has produced a standard or draft standard for each of the key technologies:

- 802.3 CSMA/CD, bus, baseband (broadband in progress), coaxial
- 802.4 token, bus, broadband, coaxial
- 802.5 token, ring, baseband, coaxial and fiber.

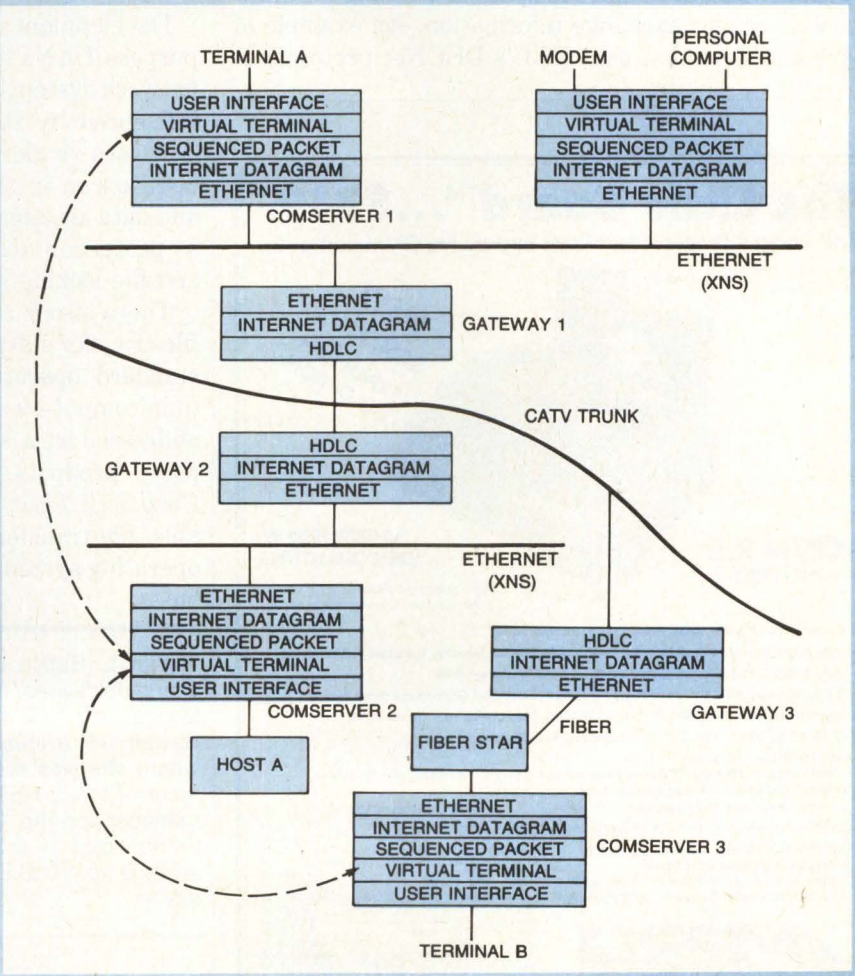
The European Computer Manufacturers Association (ECMA) and ISO are addressing these same areas with standards compatible with those of the IEEE project 802.

Several protocol architectures have emerged as formal and de facto standards: ISO protocols, Department of Defense (DOD) TCP/IP protocols, Xerox Network System (XNS) protocols, IBM System Network Archi-

Users blend technology for hybrid networks

Hybrid networks, like the one shown here, might use baseband coaxial cable within a building, CATV coaxial between buildings, fiber-optic cable on the factory floor and twisted pair for certain corporate functions.

When the same high-level protocol set is used throughout the system, as in the given example, the gateways that interconnect the different media simply need to route datagram packets between the network types. If Terminal A is sending data to Host A, an "end-to-end" connection is established between ComServer 1 and ComServer 2. Each individual packet is routed from ComServer 1 through Gateway 1 and Gateway 2 to ComServer 2. Similarly, if Terminal B connects to Host A, individual packets of the connection are routed through Gateway 3 and Gateway 2. The Xerox Network System (XNS) protocol architecture is an example of a network architecture which supports transparent inter-network routing of packets through its Internetwork Datagram Protocol (IDP) and Routing Information Protocol (RIP).



tecture (SNA) protocols, and DEC's DECNet protocols. The ISO, in addition to its reference model, is working on a set of protocol standards for each level, with help from the National Bureau of Standards (NBS) and ECMA. The DOD's TCP/IP protocols have been in use for several years in the ARPAnet community. TCP/IP is also the protocol architecture used in most UNIX-based scientific and engineering computer systems.

Xerox has defined a set of protocols called XNS-ITP (Internet Transport Protocols) as part of its Network Systems offering. These protocols have been adopted as a de facto standard for many office and EDP network products. Because of their influence on the computer industry, IBM's SNA and DEC's DECNet protocols also have become de facto standards. Although protocol architectures are most often linked to a particular network technology (e.g., IBM SNA to token ring, Xerox XNS to Ethernet), each is layered so that it may be used on any technology (Fig. 3).

Multiple protocol architectures may coexist on a single network, although the systems running different protocols cannot exchange information. An example of this is a system that uses DEC's DECNet protocols to transfer files between VAX computers on Ethernet and also uses Bridge Communications' XNS-Ethernet-based Communications Servers to connect terminals to the VAXs. The Ethernet packet format includes a protocol-type field that allows these protocols to coexist and not interfere with each other.

Advances in chip technology—for example, the advent of VLSI and gate arrays—have made a significant impact on the cost of implementing protocol layers 1 and 2. More than six vendors currently offer or will soon offer chip sets that implement the entire physical and data-link layers for Ethernet. Similar chip sets are under development for other networks such as the token ring. These two-chip sets replace components that formerly used up an entire board. The higher-level protocols (layers 3 through 7) have not been affected by these advances because they are typically implemented in software. Faster microprocessors and 256K dynamic RAMS, however, are helping to bring down the cost of network interfaces without sacrificing performance.

Applications software shortage plagues LANs

Development of application software for general-purpose LANs lags behind that for personal computer network systems, where developers are beginning to be influenced by the emergence of distributed systems. Software vendors are being forced to adapt their products to run in shared environments. When programs and data are accessible by multiple users, features such as protection and security, shared access, and record- and file-locking are required.

There also is a lack of high-performance multivendor file-transfer software, partly because of the shortage of standard operating systems among large computers (minicomputers and mainframes). The problem is being addressed in a simple way by asynchronous point-to-point products such as Communications Research Corp.'s BLAST. BLAST is an asynchronous-based reliable file-transfer protocol that runs under multiple operating systems and transfers files between different hosts. □

Judith L. Estrin is vice president of engineering at Bridge Communications Inc., Mountain View, Calif. Before joining Bridge, she held a technical marketing post at Ungermann-Bass Inc. Previously, she had spent four years with Zilog Inc., where she was responsible for initial definition and development of the Z-NET local area network, and later served as manager for the General Systems engineering group. Ms. Estrin holds a B.S. degree in mathematics and computer science from U.C.L.A., and an M.S.E.E. from Stanford University.

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2. Our ESCAPE key is located above the TAB key, right where you'd expect to find it.

Theirs isn't.

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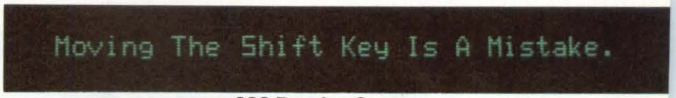
3. Take a look below at the 922 keyboard. That's a true accounting keypad, complete with a Clear Entry, Double Zero and a TAB key. Not merely the numeric keys you get with the VT220.

4. Our SHIFT key is exactly where it should be, so it does exactly what it should do—shift. Their SHIFT key is shoved over by the < and > key to create lots of < and > on the CRT. Of course with a little practice, you could relearn their keyboard. But why, now that you've seen our 922?



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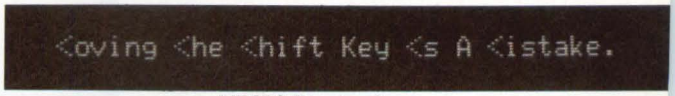

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The 16-inch-by-9-inch-by-20-inch, one-piece Sperry portable computer features one parallel port and one serial port. With a minimum of 256K bytes of RAM, the main system board furnishes graphics, memory and floppy diskette controllers. Utilizing an Intel 8088, 4.77-MHz microprocessor, the system is available in three models. Model SP2 contains two 360K-byte, 5¼-inch floppy disk drives; Model SP1 contains one drive and Model SPX contains one floppy disk drive and one 10M-byte fixed disk drive. All three models provide an 84-key keyboard; a 9-inch, monochrome screen with a 600-dot-by-400-dot density; an MS-DOS 2.11 operating system and GW BASIC software. By adding a color board, the system can display graphics on a Sperry, IBM or IBM-compatible monitor. Models SP1 and SP2 offer four expansion slots; Model SPX offers three slots. From $2,685 to $4,985. **Sperry Corp. Computer Systems,** P.O. Box 500, Blue Bell, Pa. 19424, (215) 542-4213/2504.

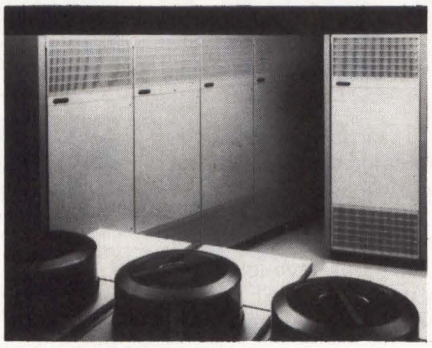
Circle No 300

Workstation incorporates high-resolution display

- 19-inch color display
- 1,664-by-1,248-pixel resolution
- Processes 1.2 MIPS

The Saberstation, an interactive CAE/CAD workstation, features a 19-inch color video display with a flicker-free 60-Hz refresh rate, 180-MHz video rate and 1,664-pixel-by-1,248-pixel resolution. The workstations's application processor uses the National Semiconductor NS32032 that supports a demand-paged virtual memory and a floating-point coprocessor. Running at 10 MHz, it processes 1.2 million instructions per second. The system also offers local area network/Ethernet support, has two 40M-byte disk drives on separate disk controllers and a streaming tape for backup. The graphics subsystem employs a proprietary DMA controller and bus topology with a 20M-byte-per-second data-transfer rate. Berkeley UNIX Version 4.2 comes standard. $40,000. **Saber Technology Corp.,** 2381 Bering Drive, San Jose, Calif. 95131, (408) 945-9600.

Circle No 301



Computer suits on-line transaction-processing

- 80M-byte-per-second bus
- 128K bytes of cache memory
- 2½ to 50 MIPS

Suited for on-line transaction processsing, the Sequoia 32-bit multiprocessor system is compatible with Berkeley UNIX Version 4.2 and System V operating systems. The computer's architecture interconnects as many as 64 processor elements through dual system buses; processing capability ranges from 2½ million instructions per second (MIPS) to 50 MIPS. Main memory can be expanded from 4M bytes to 256M bytes. I/O capacity is expandable from two to 96 channels; each channel supports as many as 16 controllers. Each controller, in turn, supports as many as four disk and tape drives or 16 terminals, printers and other peripherals. Automatic load balancing assigns tasks to the first available processor. As many as 128 memory and I/O elements can be interconnected in combinations through 80M-byte-per-second buses. $290,000 for 2½-MIPS system. **Sequoia Systems Inc.,** Metropolitan Corporate Center, Marlborough, Mass. 01752, (617) 480-0800.

Circle No 302

Business computer handles 28 terminals

- 512K bytes of main memory
- 55M-byte hard disk
- HP 3000-compatible

The Series 37 office computer offers the feature set of the company's HP 3000 and runs identical software. It communicates with larger computer systems, or with smaller personal computers. The system comes with 512K bytes of main memory, a 55M-byte disk with a 30-msec average seek time, cartridge tape backup, systems console, IMAGE database and office cabinet. It supports 28 terminals, 2M bytes of main memory and 2,400M bytes of disk. The processing unit measures 6.14 inches by 12.8 inches by 15.75 inches. $19,950 for basic system. **Hewlett-Packard Co.,** 3000 Hanover St., Palo Alto, Calif. 94304.

Circle No 303

System offers 150 peripheral combinations

- 250W switching power supply
- 8-slot quad-width card cage
- Emulates DEC floppy, hard disks

The configurability of the VQ-11 computer system serves system integrators as a "standard" box to match the application. With suitable controllers, DEC RX02 floppies and RL02 hard disk

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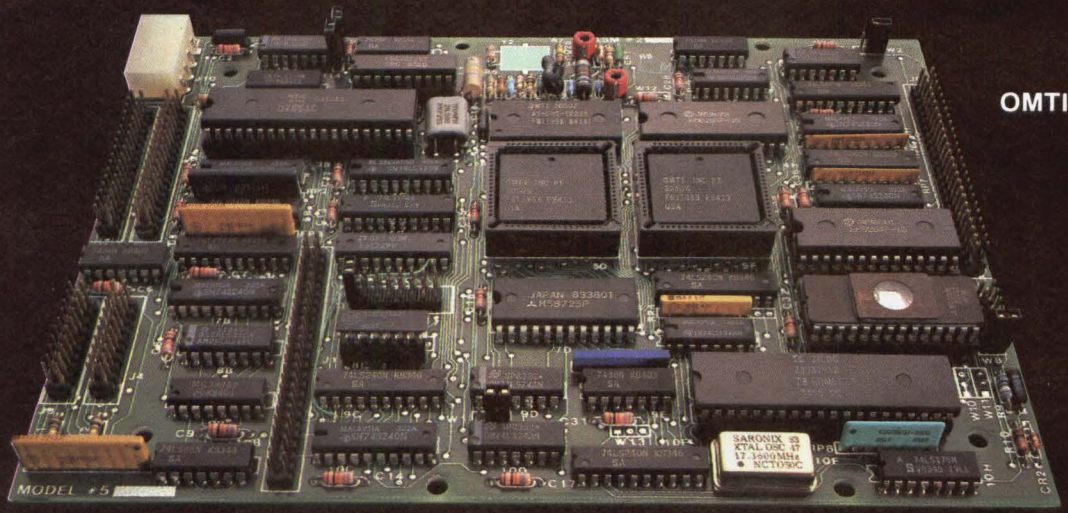

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To learn more about the OMTI Series 5000 data controllers, please contact us for additional information.

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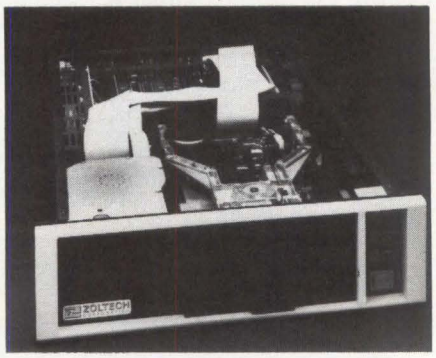
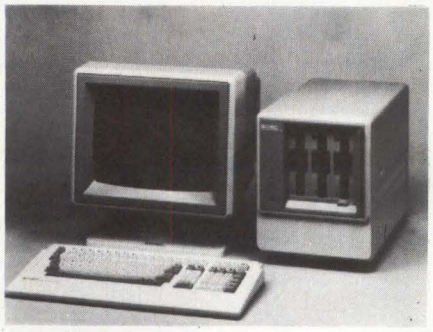
Products

SYSTEMS



drives may be emulated, with self-contained hardware. The modular package consists of a 250W switching power supply, an eight-slot quad-width Q-bus card cage and a modular frame that accepts over 150 combinations of floppies, Winchesters and tape drives. The Q-bus card cage accommodates CPUs from PDP-11/21s to 11/23s or PDP-11/73s as well as controllers and several megabytes of system memory. Graphics and FFT cards and analog interfaces are available. $7,620. **Zoltech Corp.**, 7023 Valjean Ave., Van Nuys, Calif. 91406, (818) 780-1800.

Circle No 304



16-bit computer emulates IBM terminal

- Standard VME bus
- Multiple operating systems
- 8086 processor

The single-user and multiuser, desktop, 16-bit M343SX computer suits measurement, database-access and office-processing requirements and acts as a communications terminal. IBM 3270 emulation allows operation under the 3270/SNA/SDLC protocol. With 512K bytes of memory, the computer runs on the proprietary RMDOS operating system and PIPS electronic spreadsheet. Smaller systems may use the UCSD-P system, MS-DOS version 2.0 and the concurrent CCP-M 3.1 operating systems. Utilizing an 8086 processor, the system operates at 5 MHz; an 8087 coprocessor

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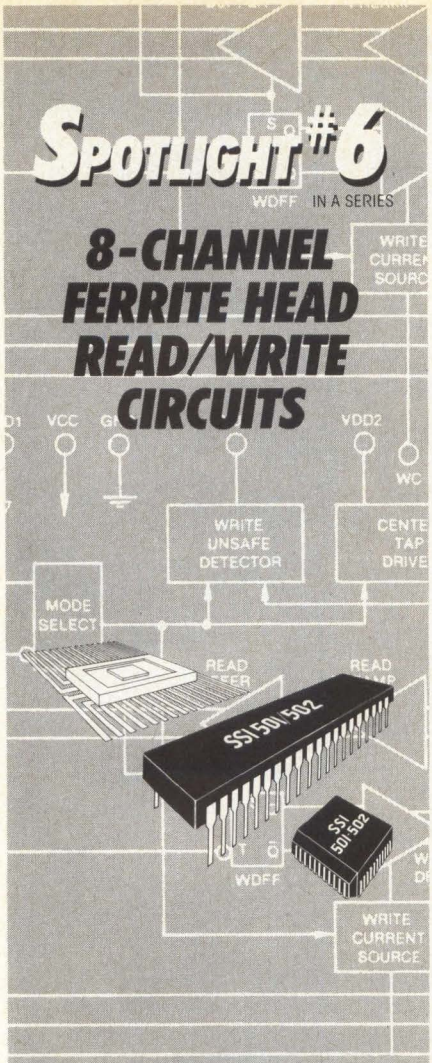
CIRCLE NO. 96 ON INQUIRY CARD



The SSI 501/502 devices are the newest bipolar disk drive integrated circuits designed for use in high capacity, high-performance ferrite-head drives. They provide a low noise read path, write current control, and data protection circuitry for up to eight channels.

The devices operate off standard +5V and +12V power supplies, feature a programmable write current source, and they may be easily multiplexed for larger systems. Control signals are TTL compatible, and both devices have a "write unsafe detection" feature. The SSI 502 differs from the SSI 501 simply by having internal damping resistors. The units are offered in a 40-pin ceramic or plastic DIP, a 32-lead Flat Pack, or a 44-lead Quad plastic package.

For more information on these latest products in a complete line of read/write IC's and related data path, support logic, and motor control IC's for rigid and floppy disk and tape drives, contact: **Silicon Systems,** 14351 Myford Road, Tustin, CA 92680. **(714) 731-7110** Ext. 575.

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New Products

SYSTEMS

for floating-point operations is optional. Main memory is expandable from the standard 256K bytes to 6M bytes. The built-in VME bus allows hardware additions and exchanges. A 12-inch amber screen is standard; the optional 14-inch screen displays 16 colors out of 4,096. The system comes with a low-profile, 109-key keyboard with 21 function keys. $3,690. **Sord Computer of America Inc.,** 723 W. 7th St., Los Angeles, Calif. 90017, (213) 622-0244.

Circle No 305

System furnishes 3-D displays

- 60-Hz non-interlaced refresh
- 1,280-by-1,024-bit resolution
- 16-bit depth buffer

Providing local manipulation and realistic shaded display of three-dimensional objects, the Model One/380 graphics system produces color images at 1 to 3 μsec per pixel. A 1M-byte local Display List memory comes standard, and is expandable to 4M bytes. Flicker-free resolution is 1,280 by 1,024 by 24 bits of image memory at 60 Hz. A 32-bit, 10M-FLOP floating-point processor performs 3-D coordinate transformations and light-model calculations, smooth shading and hidden surface removal. The system generates vector-defined text in vertical and horizontal formats from 8 to 256 pixels and manages multiple local-scrolling alphanumeric windows. Key features include a local debugger, command stream translator, macro programming, local command interpreter, a DMA port and four serial ports at 19.2K baud. The system includes a tower enclosure, 19-inch monitor, keyboard, data tablet and mouse. $41,500. Delivery is 120 days ARO. **Raster Technologies Inc.,** 9 Executive Park Drive, North Billerica, Mass. 01862, (617) 667-8900.

Circle No 306

Portable computer is PC compatible

- 16-color graphics
- 9-inch color monitor
- 256K-byte RAM

The IBM PC-compatible MBC 775 portable color computer runs on the MS-DOS 2.11 operating system and GW BASIC. The unit employs an 8088 CPU and furnishes 256K bytes of RAM expandable to 640K bytes; two 360K-byte, 5¼-inch floppy disk drives and a 9-inch color monitor. An 80-column-by-25-row character format or 40-column-by-25-row format in double-size mode is standard. The system offers 16 color graphic capabilities; resolution is 640 by 200 pixels in color mode or 320 by 200 pixels in black-and-white mode. Key features include an 84-key detachable keyboard, Centronics parallel port and two expansion slots that accept IBM compatible add-on boards and bundled software. $2,599. **Sanyo Business Systems Corp.,** 51 Joseph St., P.O. Box 387, Moonachie, N.J. 07074-1098, (201) 440-9300.

Circle No 307

Symbolic processor handles AI applications

- 32-bit NuBus
- 128K-byte virtual address
- 1,024-by-808-pixel display

Suited for the development and delivery of artificial-intelligence-based applications, the Explorer System single-user symbolic processing computer furnishes a processor, a user interface and a software development environment. It contains a writable control store, a tagged architecture for run-time data typing, hardware-assisted memory management, a 128K-byte virtual address space and a 32-bit NuBus architecture with a 37½M-byte-per-second transfer rate. Key components include an SCSI bus interface; a 112M-byte Winchester disk drive with a 30-msec average access time; a 60M-byte, ¼-inch streaming cartridge tape subsystem with a 90K-byte-per-second transfer rate and 2M bytes of main memory. Features include a 1,024-by-808-pixel, 17-inch landscape display; optical mouse and low-profile keyboard. The system comes with a programming environment that includes the LISP language. Prices start at $52,500. **Texas Instruments Inc.** P.O. Box 809063, Dallas, Texas 75380-9063, (800) 527-3500.

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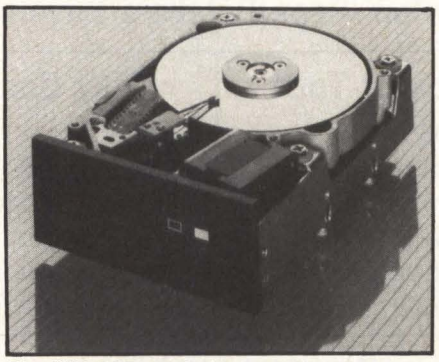
CIRCLE NO. 98 ON INQUIRY CARD

High-capacity disk drive suits portable systems

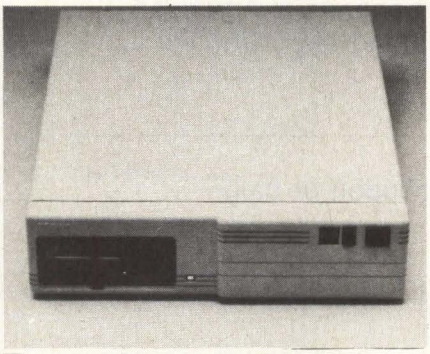
The Microscience International Corp. HH-325 3½-inch Winchester disk drive is designed for office, factory and military environments where size, weight and power are considerations. The drive stores 20M bytes (formatted) on thin-film media and transfers data at 5M bytes per second. Average access time is 80 msecs. Requiring only 9W of power, the drive can run from the microcomputer system's supply. A proprietary closed-loop, servo-positioning system steps the heads to the center of the data track, despite hysteresis or mechanical wear and thermal expansion of the motor.

Using just one printed circuit board, the HH-325 eliminates interconnections via LSI circuitry, which in turn reduces heat dissipation. Noise is reduced by employing a PLL-controlled, brushless, DC spindle motor. A linear actuator-band stepper motor system maintains accurate movement under stress conditions by placing the single-band section at the rear of the carriage/head assembly. An onboard microprocessor performs continuous drive checks during powerup and operation. A front-panel LED provides status reports and error messages. The drive weighs 2¼ pounds and measures 1.62 inches by 4 inches by 5¾ inches. Approximately $900. **Microscience International,** 575 E. Middlefield Road, Mountain View, Calif. 94043, (415) 494-9111.

Circle No 309



The HH-325, *a 3½-inch, half-height Winchester disk drive, holds 20M bytes and uses a closed-loop servo positioning system and plated media.*



Tape subsystem backs up 20M-byte hard disk

- Employs ¼-inch tape
- Streams at 25 seconds per megabyte
- Compatible with HP computers

The Sponge, a ¼-inch tape subsystem storing 20M bytes, provides a low-cost backup solution without requiring a computer or an extra software driver. It backs up HP or Bering hard disks below 100M bytes in capacity at a streaming rate of 25 seconds per megabyte. In backup mode, the subsystem becomes the active controller of the HP-IB bus. Supporting four types of HP disk emulations, it runs like a hard disk and includes a 64K-byte cache memory. The 4.2-by-15½-by-17½-inch unit features a ½-msec average access time (in cache). $2,380. **Bering Industries Inc.,** 1400 Fulton Place, Fremont, Calif. 94539, (415) 651-3300.

Circle No 310

Tape transport runs in dual mode

- 45 ips in start/stop mode
- 100 ips in streaming mode
- 160K-bps transfer rate

The Model 9600 ½-inch, reel-to-reel tape transport automatically threads tape under microprocessor control and operates in start/stop mode at 45 ips for file-management operations or streaming mode at 100 ips for high-speed disk backup. Start/stop time is 8.3 msecs at 45 ips with a 0.6-inch interrecord gap. Rewind is 200 ips. In both modes, the nine-track, read-after-write transport achieves an 800- or 1,600-cpi data density using Non-Return-to-Zero Inverted (NRZI) or phase-encoding (PE) techniques. Data transfer rate is 160K bps in PE and 80 bps in NRZI at 100 ips. Packaged as a drawer-mounted transport, the unit measures 8¾ inches by 17 inches by 22 inches and weighs 70 pounds. $3,400, 500-unit quantity. **Kennedy Co.,** 1600 Shamrock Ave, Monrovia, Calif. 91016, (818) 357-8831.

Circle No 311

Tape backup systems work with IBM PC-AT

- 27M-byte or 60M-byte capacity
- 90K-byte-per-second transfer rate
- IBM DOS 3.0 compatible

The AT-Filesafe Tape half-height, internal backup models for the IBM PC-AT offer capacities of 27M bytes (four tracks) and 60M bytes (nine tracks). The FSTI27-AT and the FSTI60-AT are compatible with the IBM DOS 3.0 and with networks supported on the PC-AT such as the 3COM Ether Series, Novell, Orchid PCnet and Nestar. At a 90K-byte-per-second transfer rate, the tape units back up an PC-AT 20M-byte hard disk in streamer mode in less than ten minutes and can restore files. Tape speed is 90 ips. Model FSTI27-AT, $1,595; model FSTI60-AT, $1,695. **Mountain Computer Inc.,** 300 El Pueblo Road, Scotts Valley, Calif. 95066, (408) 438-6650.

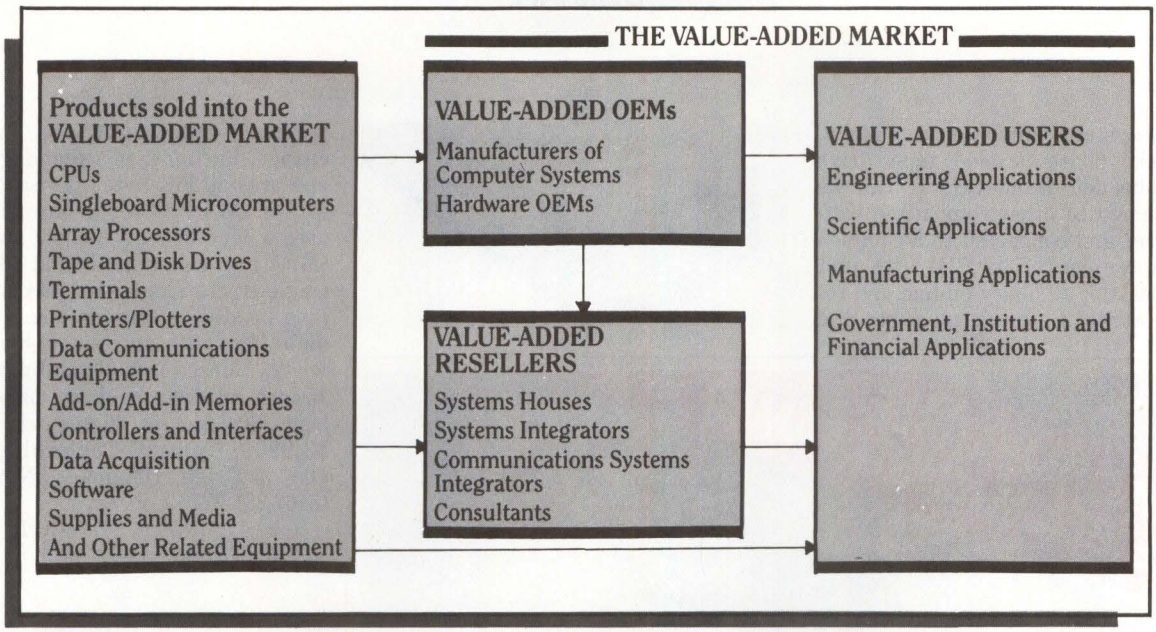
Circle No 312

Cartridge subsystem stores 67M bytes

- MFM recording method
- Reads, writes at 2M bytes per minute
- Records at 10K bpi

The model UT9000 ¼-inch cartridge

Mini-Micro Systems



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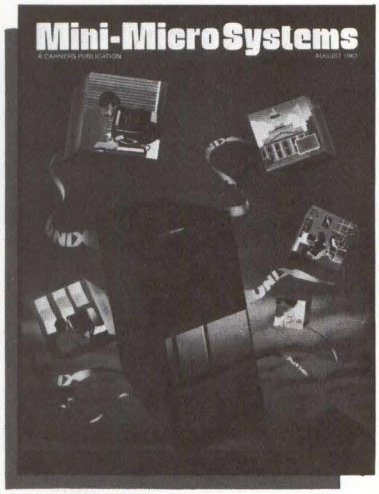

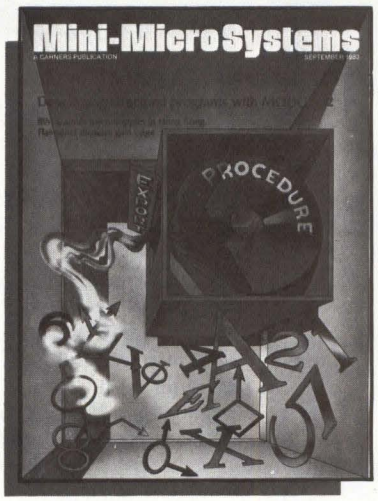

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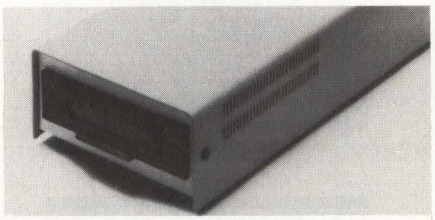
tape subsystem emulates a ½-inch, nine-track, phase-encoded tape drive with embedded formatter. It can be daisy-chained to other compatible half-inch drives and connected to a common host-adapter card. The 67M-byte unit serves backup, auxiliary on-line and removable archival storage purposes and



performs data logging and data interchange functions. In streaming mode, it operates at 35K bytes per second at 60 ips, or 2M bytes per minute. The drive uses a Modified Frequency Modulation (MFM) recording method at 10K bpi. A single-track, single-gap precision stepping head with straddle erase provides data integrity and single-block overwrite. Housed in a 9-inch-by-5-inch-by-15-inch cabinet, the drive loads and unloads 600 feet in 80 seconds (90 ips). $2,990. **Upland Technologies,** 80 Davids Drive, Hauppage, N.Y. 11788, (516) 231-0770.

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CIRCLE NO. 100 ON INQUIRY CARD

Tape subsystem offers two recording modes

- Features Group Code Recording
- Stores 140M bytes on one reel
- Backs up DEC VAX systems

The TU81, a Group Code Recording (GCR) streaming tape subsystem, suits applications such as disk backup, data archiving and data recording. The subsystem features 6,250-bpi and 1,600-bpi industry-standard recording, GCR and Phase Encoding on a 9-track magnetic tape. Designed for backing up DEC's Unibus VAX superminicomputers, the unit offers a streaming mode at 75- and 25-ips speeds and a start/stop recording mode at 25 ips. It stores 140M bytes on a 2,400-foot reel and allows the mounting of a disk in the tape cabinet. The tape drive uses the Digital Storage Architecture protocol, which permits prefetching commands from the CPU. $25,500. **Digital Equipment Corp.,** 146 Main St., Maynard, Mass. 01754, (617) 897-5111.

Circle No 314

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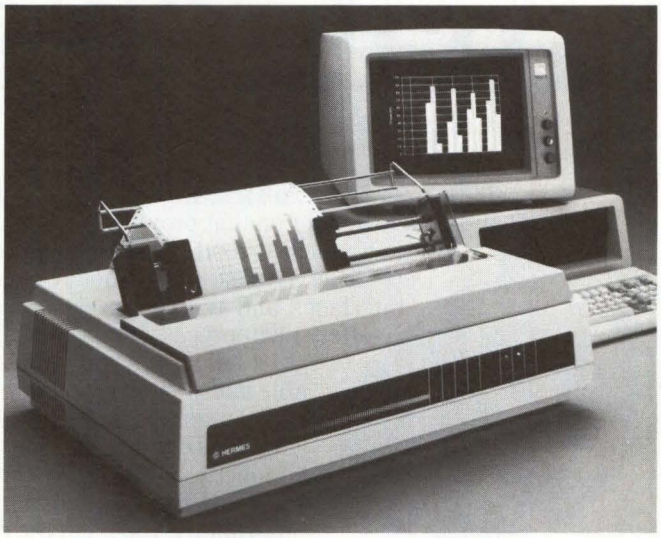

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CIRCLE NO. 101 ON INQUIRY CARD

While others are simply making promises about high-capacity storage peripherals, we're actually making deliveries.

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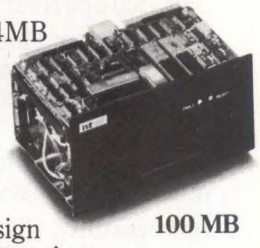
234 MB

Now, we can do both. Send us your order, and we can send you our Mercury* 234MB Disk Drive that features embedded servo technology, a choice of SMD or SCSI interfaces, and average access times as low as 20 ms. Our disk drive also offers microprocessor control, assuring you of fail-safe operation.

Or tell us you want the highest capacity ¼-inch streamer available and we'll ship you the Flashback* 100MB Tape Drive. It has QIC-2 interface and QIC-24 or 11 interchangeability.



100 MB

With either drive, you get the same outstanding reputation for design simplicity, data integrity and reliability that comes with Memory Systems' 16 years of design and manufacturing experience. But maybe most importantly, you'll get the drives themselves. For more information, or to order an evaluation unit, call 1-800-521-3278, Telex #810-223-6011.

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The Mercury 234MB Disk Drive and Flashback 100MB Tape Drive. These high-capacity storage peripherals are available today.

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New Products

TERMINALS

Data terminals transmit at 9,600 bps

- Three data speeds
- 15-inch screen
- Eight-page memory

The 8000 series of standalone data terminals provides one EIA RS232 port and one Centronics printer port and emulates other protocols via backpack module and keycaps. Each ergonomic terminal has an anti-glare, flicker-free 15-inch screen, a front-mounted on/off switch, brightness control and keyboard with palm rest. Model 8015S uses Bell 8A1 protocol to send and receive asynchronous data at 1,800 bps and synchronous data at 4,800 bps. Providing multiple format storage, the unit offers eight pages of memory with cursor selectable page numbers, line and column position. Time and data are inserted on the screen by depressing one key. Model 8220S uses Univac protocol for synchronous transmission to 9,600 bps. Reverse video, low intensity, underline, blink and blank functions and bidirectional scrolling are provided. $2,550, both models. **Racal-Milgo,** 8600 N.W. 41st St., Miami, Fla. 33166, (305) 592-8600.

Circle No 315

ANSI-based terminal works with UNIX

- Transfer speeds to 19.2K bps
- 38 function keys
- 80-or-132-cpl formats

Compatible with the UNIX operating system and the DEC VT102 and DEC VT52 terminals, the Teletype 5425 ANSI 3.64-based terminal suits editing, programming and data processing applications. The 12-inch, diagonal white, green or amber screen features full-screen windowing, scroll mode and horizontal split screen. The display has a 78-line memory with 80 cpl or a 54-line memory with 132 cpl in a 7-by-9-dot or 5-by-7-dot-matrix format. The detached tilt-adjustable keyboard has 38 downloadable function keys. Data transfer speeds can reach 19.2K bps. Other features include ASCII code with vertical parity generation and detection options, auto answer, audible alarm, self-diagnostic test routines, 2,000-character line buffer, EIA RS232C modem interface and a buffered EIA RS232C printer port. Weighing 32 pounds, the unit measures 15¼ by 16¾ by 13¼ inches. $1,400. **AT&T Teletype Corp.,** 5555 Touhy Ave., Skokie, Ill. 60007, (312) 982-3189.

Circle No 316

There is a band printer with an MTBF of up to 6000 hours.

What more do you need to know?

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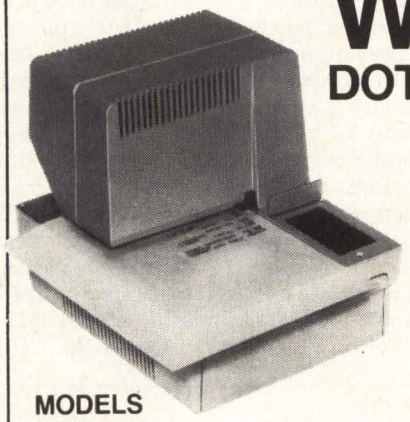
CIRCLE NO. 103 ON INQUIRY CARD

Desktop printer replaces TI model 850

- 35 cps, letter-quality mode
- 9-by-9-inch dot matrix
- ASCII 96-character set

The PLCQ55 dot-matrix printer features letter-quality printing capabilities plus raster and mosaic graphics. Suited for correspondence, drafts and graphics, the lightweight desktop printer prints 150 cps in draft-quality mode and 35 cps in letter-quality mode. Offering an ASCII 96-character set, the bidirectional printer operates in a 9-inch-by-9-inch dot-matrix and 32-inch-by-18-inch, double-pass dot-matrix format. Word-processing capabilities include three user-selectable font modules, Epson-compatible escape sequences and Qume- and Diablo-standard data processing. Raster graphics permit horizontal dot densities of 60, 72, 120 and 144 dpi and vertical dot densities of 72 and 144 dpi with an 8-bit vertical input. Mosaic graphics consist of a 64-character set. Serial transmission rates range from 300 baud to 9,600 baud. $765, OEM quantities. **Plessey Peripheral Systems Inc., Distributor Products Division,** 15542 Mosher Ave., Tustin, Calif. 92680, (714) 731-2440.

Circle No 317



WESTREX
DOT MATRIX PRINTERS
NEW! STAND-ALONE, 150 CPS SLIP/DOCUMENT PRINTERS
8000 SERIES

MODELS 8400/8410

Model 8400 and Model 8410 are new, packaged, stand-alone, alphanumeric, bi-directional, flat bed, Slip/Document dot matrix printers. They print up to 40 columns at 12 characters per inch at 3 lines per second. Both models provide side or front form insertion; top and bottom-of-form sensors and adjustable Slip/Document Stop. The print head employs a 7-needle vertical array that permits selection of fonts and characters (5 × 7, double width, etc). The character set is fully alphanumeric under software control. The 100% duty cycle print head life is rated at 100 million characters.

Model 8400 and Model 8410 are complete with control and drive electronics. Serial RS-232C or TTY and parallel interfaces are available. Both units can provide multiple print lines and carbon or pressure sensitive copy.

Model 8410 additionally features a stepping motor paper drive system which permits variable and programmable forward/reverse line spacing for applications requiring line selection and or unique form indexing.

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IN SWEDEN — WESTREX OEM PRODUCTS, Box 3503, S-17203 Sundbyberg, Sweden 46 8 + 981100 TELEX: 12139

CIRCLE NO. 104 ON INQUIRY CARD

Low-cost ink-jet generates 150 cps

- eight character sets
- 5- to 17-cpi, programmable pitch
- 9-by-9 dot matrix

The Model TDP 8800 ink-jet, matrix printer offers eight character sets including international, USASCII and English. Its bidirectional print speed is 150 cps; print rate is 100 lpm based on a 60-character line with 10 cpi. Character fonts are built within a 9-by-9 dot matrix with provisions for descenders and underscoring. A 165-character data buffer, expanded print, programmable pitch (5 to 17 cpi), proportional spacing and horizontal and vertical tabulation are standard. A paper-feed system accepts fanfold, roll and single sheets. A replaceable ink cartridge yields an average of 5 million characters. Raster scan and bit-image graphics output, an expandable receive buffer of as much as 4K bytes and a loadable character generator are optional. $895. **Tandberg Data Inc.,** P.O. Box 99, Labriola Court, Armonk, N.Y. 10504, (914) 273-6400.

Circle No 318

Ink-jet printer features 45 font styles

- 176 cps in draft mode
- 88 cps in letter-quality mode
- Eight standard print sizes

Ensuring reliable operation, the SQ-2000 non-clogging, drop-on-demand, letter-quality ink-jet printer initiates a 10-second cleaning cycle when shut off or turned on. In draft mode, the unit prints 176 cps with a 15-by-17-dpi resolution; in letter-quality mode, 88 cps with a 37-by-17-dpi resolution. Also featured are nine bit-image graphic modes

with densities from 60 to 240 dpi. The printer provides 45 standard font styles and 96 ASCII, 96 italic, 32 international and 128 downloadable user-selected characters. Manual friction-feed and eight print sizes, including elite, proportional and proportional super/subscript, are standard. Column width is 13.6 inches. $2,500. Delivery is 90 to 120 days ARO. **Epson America Inc., OEM Products Division,** 23600 Telo Ave., Torrance, Calif. 90505, (213) 534-4500.

Circle No 319

Matrix printer operates at 700 cps

- 350-cps correspondence-quality
- 136-column carriage width
- Dot-addressable graphics

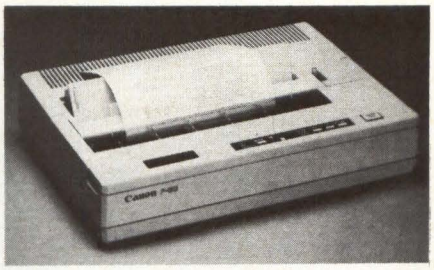
Meeting high-volume output needs of data-processing environments, the OT-700 prints matrix characters at 700 cps. Furnishing nine foreign character sets, the printer's carriage width is 136 columns with adjustable sprocket feed tractors. Machine configuration is via menu-driven program commands. The printer also offers correspondence-quality printing at 350 cps and two dot-addressable graphics modes: 50-by-90 dpi for high speed output or 100-by-69 dpi for higher resolution copies. Paper feed is from the front or bottom of the case; the control panel features membrane switches and LED indicator lights. $1,595. **Output Technology Corp.,** 606 110th Ave. N.E., Bellevue, Wash. 98004, (206) 453-9794.

Circle No 320

Thermal-transfer printer operates quietly

- 360-dpi graphics
- 36-by-24 dot-matrix format
- 20- to 80-cps print speed

In 36-by-24 dot-matrix format, the F-60 thermal-transfer printer produces letter-quality text and graphics. Near-



letter-quality text appears in a 28-by-24 dot-matrix format; in draft mode, a 9-by-24 dot-matrix format. Graphics are formed at 360 dpi. The unit prints on transparencies, or on thermal paper 11.7 inches wide, with a maximum of 110 cpl in standard mode; 55 cpl in enlarged mode and 188 cpl in condensed mode. Print speeds vary from 20 to 80 cps. An interchangeable cartridge provides seven typestyle options. An 8-bit Centronics parallel interface comes standard. The typewriter-size printer runs at a 45-dB noise level. $545. **Canon U.S.A. Inc., Printer Division,** One Canon Plaza, Lake Success, N.Y. 11042, (516) 488-6700. **Circle No 321**

There is a band printer which sets new standards in price/performance.

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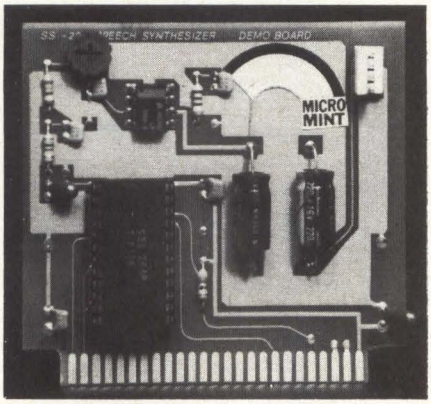
CIRCLE NO. 105 ON INQUIRY CARD

New Products

DATACOMM



Synthesizer interfaces with Apple computers

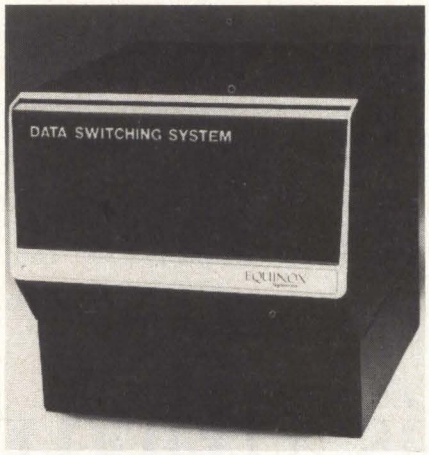
- 50- to 70-bps data rates
- 4,096 pitch variations
- Five 8-bit internal registers

Based on the SSI 263 integrated circuit from Silicon Systems Inc.(SSI), the Sweet Talker II speech synthesizer can be configured for various levels of intelligibility. Intonation, inflection and filtration are user-controlled, and 64 phoneme values, each with four different duration settings, are set on the five 8-bit internal registers. Intended for the Apple II+ or Apple IIe, the unit provides analog output for music, sound effects and continuous speech with 4,096 pitch variations and at data rates of 50 to 70 bps. The synthesizer is compatible with voice software intended for SCI 263-based Apple products. Measuring 3 inches by 3¼ inches, the unit features three control inputs for address mapping with several buses, four handshaking modes, eight articulation rates, 16 speed settings and 16 amplitude levels. $104. **Micromint Inc.,** 561 Willow Ave., Cedarhurst, N.Y. 11516, (516) 374-6793. **Circle No 322**

Protocol converter links ASCII devices, IBM host

- Supports 100 asynchronous terminals
- Supports 19.2K baud rates
- Eight port configurations

Suited for computer facilities with numerous remote sites that employ only one or two IBM 3270 terminals per site, the MC 800 protocol converter allows 24 asynchronous ASCII devices to communicate with an IBM or equivalent host computer. Using either SNA/SDLC or BSC protocols, the converter appears to the host computer as an IBM 3274 or 3276 communications controller with IBM 3278/3279 terminals attached. The unit features full screen mapping; data displayed on the terminal is the same as that on the IBM. Available in port configurations of five, seven, eight, nine, 12, 16, 20 and 24 ASCII ports, the converter supports over 100 different types of asynchronous terminals, teleprinter devices and personal computers. It is user configurable to support standard asynchronous baud rates of 19.2K baud. $3,600, 5-port unit. **Innovative Electronics Inc.,** 4714 N.W. 165th St., Miami, Fla. 33014, (800) 327-3955. **Circle No 323**



Data PBX links computers, terminals

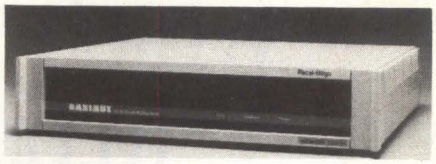
- 360-line capacity
- Expandable to 1,320 lines
- Connects 24 to 1,320 computer ports and terminals

Less than one-sixth the size and one-seventh the weight of conventional port selectors, the Data PBX (Private Branch Exchange) employs programmed array logic. It provides user-controlled switching among computers, port contention and access control and network management. At 9,600 bps, from 24 to 1,320 asynchronous computer ports and terminals can be connected simultaneously. The system uses standard telephone PBX-type connectors and cabling for easy installation. Modular in construction, the basic central unit has a 360-line capacity, is expandable to 1,320 lines and occupies 17½ inches in rack height. Each line board handles 24 lines, which can be individually configured as terminals or ports. $8,800. **Equinox Systems,** 12041 S.W. 144th St., Miami, Fla, 33186, (305) 255-3500. **Circle No 324**

Modem provides error-free transmission

- 2,400-bps data transfer rate
- ARQ error recovery
- Automatic adaptive equalizer

The 2,400-bps, full-duplex CDS 224 modem with ARQ (Automatic Request for Repetition) error correction, doubles the data throughput of 1,200-bps modems, providing error-free data transmission over telephone lines. It automatically adapts if a remote modem is not similarly equipped with ARQ or is a Bell-212 type. The ARQ feature utilizes a bit-synchronous protocol to transfer binary files. The modem's automatic adaptive equalizer feature compensates for telephone line interference. Diagnostics include Loop 2 (Digital Self Test) and Loop 3 (Analog Self Test) and an internal test pattern generator and checker. Features include an automatic answer or an originate and/or manual answer mode. The modem comes in rack-mount and tabletop models. $1,295. **Concord Data Systems Inc.,** 303 Bear Hill Road, Waltham, Mass. 02154, (617) 890-1349. **Circle No 325**



Multiplexer cuts synchronous line costs

- Half- or full-duplex operation
- 1,200- to 3,200-bps data rates
- EIA RS232C and CCITT V.35 interfaces

The Omnimux TDM56 time division multiplexer reduces synchronous line costs by dividing wideband DDS circuits into low-speed channels for economical data transfer. It supports standard synchronous protocols and operates in either half- or full-duplex mode. To increase channel capacity of megabit multiplexers, eight low-speed channels can be combined over a single synchronous channel. Data rates from 1,200 to 3,200 bps are individually set for each channel. The standard EIA RS232C and

CCITT V.35 interfaces support aggregate link speeds from 9,600 bps to 7,200 bps. All parameters are entered via DIP switches. Remote channel parameters are down-line loaded from the local multiplexer. $3,200. **Racal-Milgo,** 8600 N.W. 41st St., Miami, Fla. 33166, (305) 592-8600. **Circle No 326**

Data compression unit doubles transfer rate

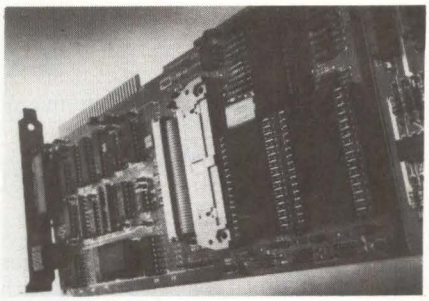
- Transfers data over 1,200-, 2,400- or 4,800-bps telephone lines
- Employs X.25 protocol
- ASCII or EBCDIC character set

The Accelerator Series 21 asynchronous data compression unit doubles data transfer rates over 1,200-, 2,400- or 4,800-bps point-to-point telephone lines while providing error-free transmission and data security. It can be employed with dial or dedicated lines, in multiplexed configurations and transparently, where there is no complementary device. The unit is installed between modem and terminal at each end of a circuit. A modified X.25 protocol uses CRC-based logic to ensure the detection or transmission errors. A four-digit Network Security Code assigns each Accelerator on a host's network. Either EIA or In Band flow control is supported. Modems can be asynchronous or synchronous, fixed rate or autobaud; ASCII or EBCDIC character sets; data transmission, character or block mode. Starts at $695. **Telebyte Corp.,** 215 Oak St., Natick, Mass. 01760, (617) 653-3995. **Circle No 327**

Modem board plugs into IBM PC or XT

- CCITT V.29 and V.27 ter interfaces
- Synchronous, half-duplex mode
- 9,600-bps data transfer rate

The FAXT-96 modem board plugs into an IBM PC or XT adapter slot and provides data transfers at 9,600 bps over dial-up telephone lines. It features



auto dial, auto answer and fallback speeds of 7,200, 4,800 and 2,400 bps. Bundled with a software package, the board connects to the telephone line by modular jack and to a serial adapter card with included cables. The synchronous, half-duplex modem works with a two-wire, dial-up, switched network and conforms to the CCITT V.29 and V.27 ter standards. When two FAXT-96 modems are used in an end-to-end link, they automatically test the circuit and select the best transmission speed. $1,995. **Gamma Technology Inc.,** 2452 Embarcadero Way, Palo Alto, Calif. 94303, (415) 856-7421. **Circle No 328**

There is a band printer that operates at an acoustic noise level of 55dBA.

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CIRCLE NO. 106 ON INQUIRY CARD

Packages suit Toshiba printers

- Works on IBM-compatible microcomputers
- 10 different type styles
- Downloads to the Toshiba P1351 printers

Three font disk software packages with 10 different type styles work with IBM and IBM-compatible microcomputers and download into Toshiba P1351 dot-matrix printers. The Toshiba Font Disk offers the Toshiba Original for serif print in proportional spacing, the Letter Gothic for a standard typewritten appearance and the Bold Face Italic. The disk includes American English, British, German, French, Swedish and Norwegian characters. The Fonts America disk features three type faces in serif, sans serif and stylized fonts — Micro 1, Italic 1 and Italic 2. Greentree Software offers four fonts; Courier (IBM extended) and IBM PC (IBM extended elite), and Graph 10 and 12 (elite) for graphics shapes. Toshiba Font Disk, $49.95; Fonts America, $49.50; Greentree Software, $34.95. **Toshiba America Inc.,** Information Systems Division, 2441 Michelle Drive, Tustin, Calif. 92680, (714) 730-5000. **Circle No 329**

Graphics tools package implements GKS standard

- Supports 80 graphics peripherals
- Contains 190 subroutines
- Features on-line debugging

The GK-2000, available for the DEC VAX, most UNIX CPUs and IBM mainframes, meets and exceeds the GKS (Graphical Kernel System) standard. The graphics tools package is compatible with Precision Visuals' device-intelligent drivers and supports 80 graphics output devices. With 190 user-callable subroutines, the package develops 2D applications that are independent of an output device. Included are GKS-standard features plus 2D image manipulation, support for 11 concurrent device drivers, 24 stroke-precision fonts, 256 line types, graphics input devices, extended error processing, on-line debugging, pause function and file-name control. Starts at $4,500. **Precision Visuals,** 6260 Lookout Road, Boulder, Colo. 80301, (303) 530-9000.

Circle No 330

Graphics package displays 16 colors

- Five pull-down menus
- Mouse-driven
- Thirty backgrounds

The PC Paintbrush enhances and prints graphics and text created by programs such as Wordstar, SuperCalc 3 and Lotus 1-2-3 using 14 tools, five pull-down menus and 30 backgrounds. The mouse-driven program runs on seven color cards, one with 720-by-704 resolution for four colors and one with 640-by-400 resolution for 16 colors. For display on a monochrome monitor, each of the 30 backgrounds is transformed into black and white texture. Six available text fonts can be manipulated in seven styles and sizes from 9 to 72 points. The program determines the height, width and margin for printing, and prints either a selected portion or a full image. The package requires an IBM PC or PC-compatible, 192K bytes of RAM, and MS-DOS 2.0. $139. **International Microcomputer Software Inc.,** 633 Fifth Ave., San Rafael, Calif. 94901, (415) 454-7101.

Circle No 331

Entry system reduces programming time

- Automatic syntax checking
- Edits IBM PC Pascal and C
- Structure manipulation

The Entry System for Programs (ESP), a language-oriented editor for IBM PC Pascal and C users, helps programmers learn Pascal and C. The program entry environment combines the text-manipulation function of a general purpose editor with the syntax checking function of a compiler. The system operates on individual language structures; it is context-sensitive and creates program structures with one keystroke. Programs are automatically formatted. Three methods of input— stream mode, abbreviation mode and expand/view

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Portal allows you to quickly and easily introduce a comprehensive switching system that will handle terminals, printers, modems, CPUs and other RS232 compatible devices. Up to 32 ports can handle 16 simultaneous connections.

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CIRCLE NO. 107 ON INQUIRY CARD

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MODEL	LPM (64 char. set)	MTBF (HRS)	SIZE (H x W x D)	NOISE (dBA)
M3040	300	6,000	41.7 x 26.8 x 35.4	55
M3041	600	6,000	41.7 x 26.8 x 35.4	55
M3042	900	4,000	41.7 x 26.8 x 35.4	55
M3043	1200	4,000	41.7 x 26.8 x 37.8	55

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CIRCLE NO. 108 ON INQUIRY CARD

mode—work simultaneously. The environment offers automatic creation of program structures, crash resistance, structure manipulation and on-line help. Required are an IBM PC, XT and other IBM PC-compatible or MS-DOS computers with 192K bytes of RAM, an 80-column display, one disk drive and a language compiler. Pascal only, $249; C only, $349; Pascal and C, $399. **Bellesoft Inc.,** 2820 Northup Way, Bellevue Wash. 98004, (206) 828-7282.

Circle No 332

File-transfer program links 70 files

- 4,800-bps data transmission rate
- Employs RS232C serial port
- Transfers spreadsheet models

The asynchronous file transfer software, BLAST, permits computers with incompatible operating systems to transfer and exchange data. The program links more than 70 different models of microcomputers, minicomputers and mainframe computers through asynchronous ports over telephone lines, satellites or local-area networks. Using a multibuffering technique and a full-duplex line, transmission efficiency is improved 80 percent with a selective retransmission function. The system uses an RS232C serial port and communicates with an ansynchronous modem at 4,800 bps; direct connection enables a 9,600-bps transmission rate. $250. **Anderson Jacobson,** 521 Charcot Ave., San Jose, Calif. 95131, (408) 945-9030.

Circle No 333

Software serves dual purposes

- Emulates 24 terminals
- Operates at 9,600 baud
- Accesses information services

Softerm PC, a communications manager and terminal emulation program for the IBM PC, functions as a standalone program or as an extension to the PC-DOS operating system allowing communications access while using other programs. It accesses information services, bulletin boards, electronic mail systems and other computers, and emulates keyboard and display functions of 24 terminals, supporting conversational and block modes. Operating at 9,600 baud, the program allows a personal computer to hardwire locally to a host computer for high-speed operation, or remotely through manual or auto-dial modems. Written in assembly language, it provides management of multiple serial and parallel ports for communications. The package includes support for the XMODEM protocol and auto-dial modems and modem cards, a menu-driven format, a built-in phone book, character protocol for text files with user-defined parameters, built-in disk and file utilities, patch utilities and a 24-hour online update service and bulletin board system. $295. **Softronics,** Suite 10, 3639 New Getwell, Memphis, Tenn. 38118, (901) 683-6850.

Circle No 334

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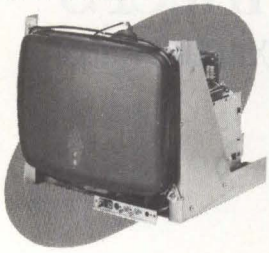
FTC Series •Housed in lightweight, impact-resistant Cabinet. •Hi-Contrast (Black Face), Hi-Brightness CRT displays a crisp, sharp image. •Limitless colors can be displayed through Analog Input.

Versions / CRT Size	RGB Version	NTSC Version	PAL Version	NTSC & RGB Version	PAL&RGB Version	IBM PC Compatible only
12" (CRT Pitch)	FTC-1208-R (0.28mm Dot trio) FTC-1203-R (0.38mm Dot trio) FTC-1201-R (0.47mm Stripe)	FTC-1201-N (0.47mm Stripe) FTC-1200-N (0.63mm Stripe)	FTC-1201-P (0.47mm Stripe) FTC-1200-P (0.63mm Stripe)	FTC-1201-NR (0.47mm Stripe)	FTC-1201-PR (0.47mm Stripe)	FTC-1208-F (0.28mm Dot trio) FTC-1203-F (0.38mm Dot trio)
14" (CRT Pitch)	FTC-1455H-R (0.31mm Dot trio) FTC-1428H-R (0.39mm Dot trio) FTC-1423H-R (0.42mm Dot trio)	FTC-1410H-N (0.52mm Stripe) FTC-1416-N (0.64mm Stripe)	FTC-1410H-P (0.52mm Stripe) FTC-1416-P (0.64mm Stripe)	FTC-1410H-NR (0.52mm Stripe)	FTC-1410H-PR (0.52mm Stripe)	FTC-1455H-F (0.31mm Dot trio) FTC-1428H-F (0.39mm Dot trio)
Applications	IBM PC•PC jr Apple IIc, IIe* RGB TTL & Analog	IBM PC•PC jr, Apple IIc• IIe, Commodore C-64				IBM PC wirh card

FTC-12" Series

CDM-14" Series



*with RGB card FTC-1203-R, FTC-1203-F "Non-Glare"

CDM Series (Unit for OEM)

Model	CRT Size	CRT Pitch
CDM-1208-R	12"	0.28mm Dot trio
CDM-1203-R	12"	0.38mm Dot trio
CDM-1201-R	12"	0.47mm Stripe
CDM-1455H-R	14"	0.31mm Dot trio
CDM-1428H-R	14"	0.39mm Dot trio
CDM-1423H-R	14"	0.42mm Stripe
CDM-1410H-R	14"	0.52mm Stripe

•OEM versions include Color 6"-26" in addition to the above, Monochrome 3"-26", CRT Pitch 0.64mm - 0.21mm, Horizontal frequency less than 64kHz, Non-glare to meet your requirements.
•Green/Orange CRT Displays are also available. (Included IBM PC Compatible.) CRT size: 9" or 12".
•We are looking for reliable and established distributor worldwide.

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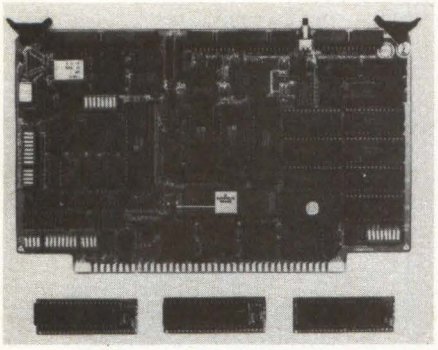
New Products

SUBASSEMBLIES



Single-board computer offers 16-, 8-bit CPU

- 65K bytes of memory
- 20 I/O ports
- 6 inches by 9¾ inches

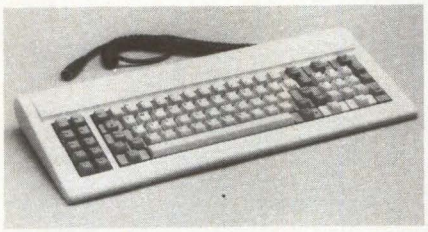
The 6-inch-by-9¾-inch GMS6507 single-board computer provides either a 68008 16-bit microprocessor with 8- and 10-MHz operation or an 8-bit 6809, Z80, 6502 or 9900 CPU with 1 or 2 MHz. The module offers two RS232C ports with 15 programmable baud rates; two parallel printer ports; a GPIB or IEEE-488 controller/talker/listener port; and 20 bidirectional and buffered I/O lines capable of driving 30 mA. A 65K-byte, onboard, static CMOS memory eliminates the need for additional external memory. The memory section provides eight byte-wide sockets, which accept 16K-byte or 64K-byte static RAM or ROM/EPROM devices. Each device, or the entire memory, may be disabled under software control to allow bootstrapping. Priority-level interrupt logic eases programming. $685. **General Micro Systems Inc.,** 1320 Chaffey Court, Ontario, Calif. 91762, (714) 621-7532.

Circle No 335

Package integrates text and graphics

- Utilizes an Intel 80186 coprocessor
- 720-pixel-by-352-pixel graphic resolution
- IBM PC/XT compatible

Requiring an IBM PC with hard disk or an IBM PC/XT, the Concept 100 document processing system consists of an Intel 80186-based intelligent graphics subsystem, a graphics editor, a Mouse Systems mouse and a set of basic fonts. Capabilities include word processing, system documentation, data-driven chart making, zoom and pan, crosshatching, color output and creation of block diagrams, circles, polygons, graphs, maps and text with diagrams. The subsystem board increases resolution for ANSI Graphic Kernel System (GKS) applications using the Virtual Device Interface (VDI). It supports a 720-pixel-by-352-pixel, 25-row-by-80-column monochrome graphics display and concurrent graphics printing. Serial and parallel printer ports are provided. $2,195. **Concept Technologies Inc.,** P.O. Box 5277, Portland, Ore. 97208, (503) 684-3314. **Circle No 336**



Keyboards plug into IBM PC

- ASCII compatible
- DIN standards
- 30-character buffer

The PC-84 keyboard plugs directly into an IBM PC or system emulating the IBM PC. The PC-83 model features the IBM (international) keyboard configuration. The PC-84A and PC-83A keyboards provide 300-baud TTL ASCII output and are identical to the IBM keyboard style. A passive contact system common to all models isolates the contact force from the actuation force. All meet ergonomic (DIN) standards and feature a 30-character buffer, sublimation-printed keycaps and a keyswitch life of 100 million cycles. $57.19, quantity 10,000. **NMB/Hi-Tek Corp.,** 7274 Lampson Ave., Garden Grove, Calif. 92641, (714) 898-9511.

Circle No 337

Controller contains 128K-byte cache RAM

- 5¼-inch form factor
- Expandable to 16M bytes
- 1M-byte average data rate

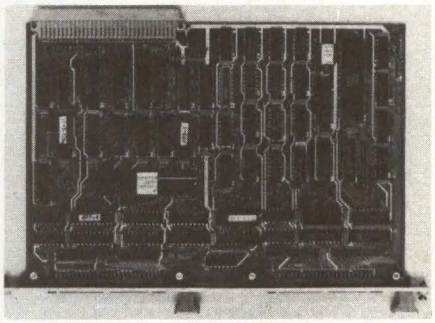
The PM-3010 single-board disk controller with an integral 128K-byte cache RAM can be expanded to 16M bytes. The controller uses a true sector caching algorithm, whereby 128,000 sectors are individually stored in cache with an access time under 400 μs, and a one-page, one-sector architecture. The 5¼-inch, form-factor board controls four ST506, SA1000 or SMD Winchester drives plus four floppy drives. An SCSI interface links the controller to the host computer and accommodates an average data rate of 1M byte per second. $740, OEM quantities. **Distributed Processing Technology,** 132 Candace Drive, Maitland, Fla. 32751, (305) 830-5522. **Circle No 338**

Printer controller features universal interface

- Serial or parallel port
- MC68000 microprocessor
- Handles 8 ppm to 60 ppm

The Pixel 300 intelligent laser printer controller uses an MC68000 L10 processor to accept data from the host computer or word processor through an RS232 or parallel port. It interfaces with word-processing systems and host computers and features a VME bus-based architecture. Type fonts can be downloaded. The controller system provides expandable fixed fonts, pixel address and text, forms and graphics merge and is configurable to three levels of performance: 8-ppm to 15-ppm machines, 18-ppm to 60-ppm machines and graphics capability offering a 4,000-character, full-page bit map at 0.6 seconds. $3,000, OEM quantities. **Electronic Machine Corp.,** #500, 417 South Hill St., Los Angeles, Calif. 90013-1169, (213) 687-9681.

Circle No 339

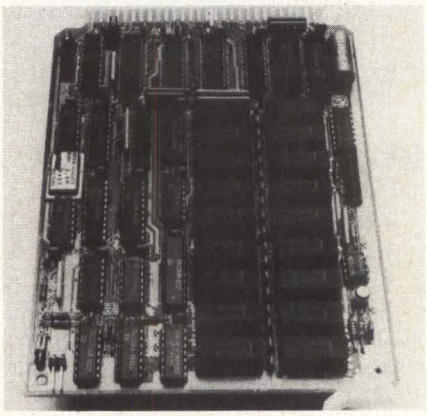


Board links VME bus, disk drives

- DMA controller
- Two RS232 serial ports
- 64K-byte transfers

The IoVME402 bus master interfaces the VME bus to 9-track tape drives, an SCSI interface, dual RS232 I/O ports and vectored interrupts. The interface

features an AM9516-based dual channel Direct Memory Access (DMA) controller, which performs 24-bit addresses, 16-bit transfer counts, 8- or 16-bit data transfers, byte-to-word funneling and end-of-process conditions. The controller transfers 64K bytes in one operation. The 9-track interface consists of a formatter control, command and status ports, and a double-buffered read/write data port. The SCSI/SASI interface allows communication to Winchester and floppy disks. Data is transferred between the host and the SCSI controller in either DMA or programmed I/O mode. The two asynchronous RS232 communications ports use the Signetics 2681-40 DUART device, which features programmable baud rates for each channel and a 16-bit timer/counter. An interrupter circuit prioritizes interrupt requests from the SCSI, 9-track tape, serial I/O interfaces and DMA controller. $1,850. **Io Inc.,** Suite 105, 1806 W. Grant Road, Tucson, Ariz. 85745, (602) 792-0969. **Circle No 340**

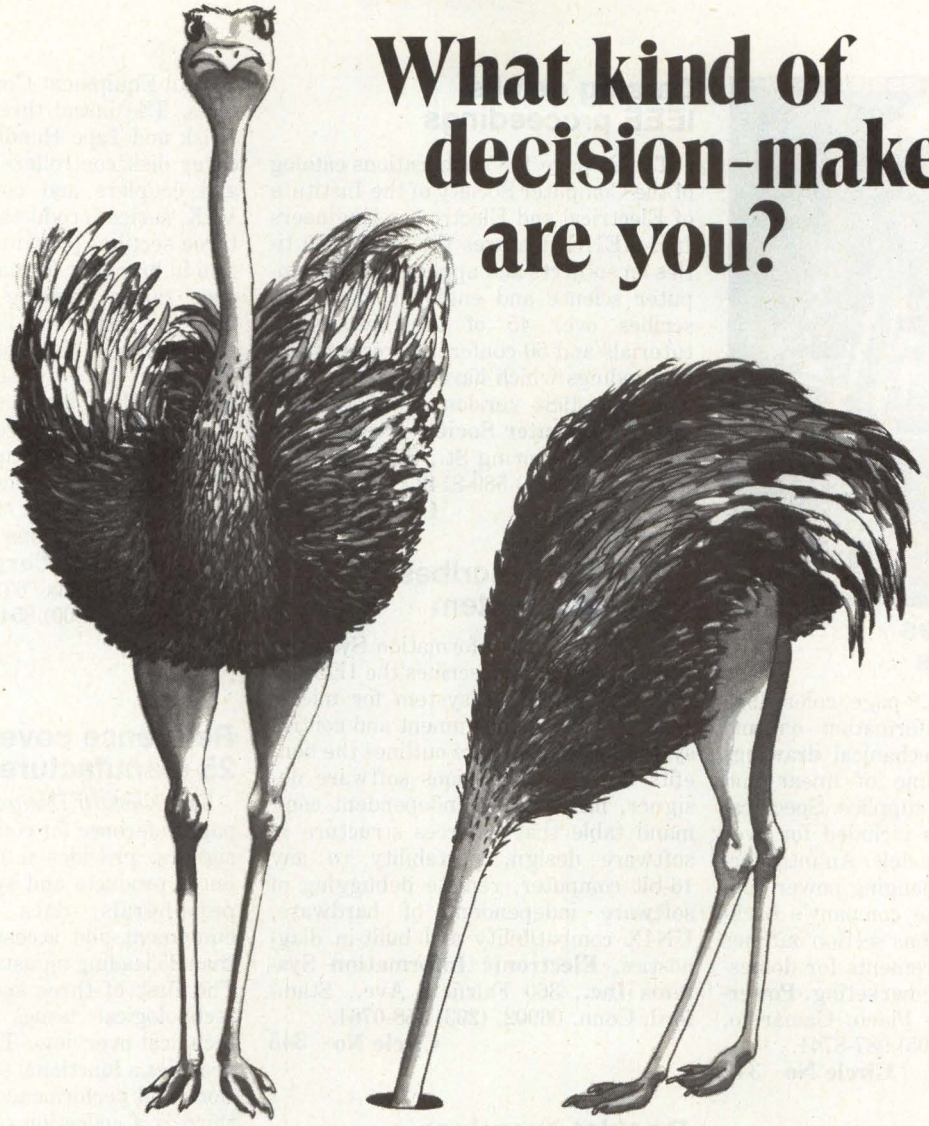


DRAM card operates without wait states

- Compatible with 8088, 8085A CPUs
- Dual 4-bit decoder
- 64K bytes to 512K bytes of memory

The Model 7712 DRAM card eliminates software overhead caused by wait states during RAM refresh and missing RAM refresh during hardware resets. Compatible with 8088 5-MHz and 8085A 6¼-MHz CPU cards, it features memory expansion from 64K bytes to 512K bytes in four densities: 64K bytes or 128K bytes populated with 64K by 1 DRAMs and 256K or 512K bytes with 256K by 1 DRAMs. Onboard refresh circuitry enables transparent refresh of DRAMs during push-button resets, extended wait periods, DMA transfers and normal MPU operations without software overhead or hardware degradation. The controller circuitry eliminates wait states during read or write access and automatically initiates refresh during DMA operations; the three refresh modes are asynchronous, synchronous and forced refresh. The parity-detection circuit activates an interrupt in the event of a parity error. An onboard dual 4-bit decoder allows the card to use the full 20-bit address from a 8088 CPU, or it can be latched to steer data to the 64K-byte memory block during a 16-bit DMA address transfer. From $490 to $1,750. **Pro-Log Corp.,** 2411 Garden Road, Monterey, Calif. 93940, (408) 372-4593. **Circle No 341**

What kind of decision-maker are you?



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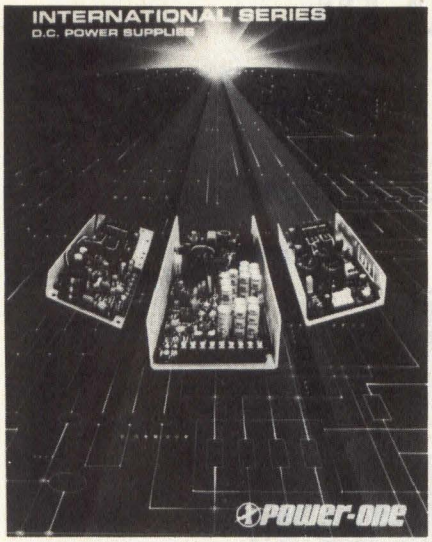


Catalog outlines power supplies

The "Power-One" 28-page, color, 1985 catalog provides information on and photographs and mechanical drawings of the company's line of linear and switching DC power supplies. Specifications and prices are included for over 200 "off-the-shelf" models. An introduction discusses the changing power supply industry and the company's background and applications section outlines safety agency requirements for domestic and international marketing. **Power-One Inc.,** 740 Calle Plano, Camarillo, Calif. 93010-8583, (805) 987-8741.

Circle No 342

Catalog lists DEC Q-bus components

The 1984 "Microcomponents Product Catalog" for system designers, integrators and engineers lists the 16-bit processors, modules, chips, peripheral equipment and software that make up DEC's Q-bus family of products. The 45-page catalog describes operational capabilities and applications of the Micro PDP-11 computer; LSI-11/73, LSI-11/23-PLUS and LSI-11/23 central processors; Falcon and Falcon-PLUS single-board computers; and J11 and T11 chip-level microprocessors. Included are memory management and floating point options; add-on memory modules; and multifunction, communication, network and I/O interfaces. Q-bus-compatible storage devices are also discussed. **Digital Equipment Corp.,** 146 Main St., Maynard, Mass. 01754, (617) 897-5111.

Circle No 343

Catalog details IEEE proceedings

The 24-page 1985 publications catalog of the Computer Society of the Institute of Electrical and Electronics Engineers Inc. (IEEE) features the latest 200 titles on subjects and applications in computer science and engineering. It describes over 45 of the best-selling tutorials and 60 conference records and proceedings which have been published since the 1984 version of the catalog. **IEEE Computer Society Press,** Suite 300PR, 1109 Spring St., Silver Spring, Md, 20910, (301) 589-8142.

Circle No 344

Brochure describes operating system

The Electronic Information Systems' 12-page brochure describes the IES-110 real-time operating system for microprocessor-based instrument and control systems. The brochure outlines the benefits for the applications software designer, including an independent command table that enforces structure in software design, portability to any 16-bit computer, remote debugging of software independent of hardware, UNIX compatibility and built-in diagnostics. **Electronic Information Systems Inc.,** 360 Fairfield Ave., Stamford, Conn. 06902, (203) 358-0764.

Circle No 345

Booklet examines protocol conversion

The booklet "Timeplex Technical Backgrounders: Protocols And Protocol Conversion" examines protocols and discusses the utilization of protocol conversion within the data communications network. Topics covered include SNA and protocol converters, the differences between protocols, and protocols for new information services. Diagrams are provided. **Timeplex Inc.,** 400 Chestnut Ridge Road, Woodcliff Lake, N.J. 07675, (201) 930-4600. **Circle No 346**

Handbooks contain integration information

Two illustrated handbooks provide hardware, software and systems integration information for connecting Emulex Corp. mass storage and data communications peripheral products to Digital Equipment Corp. computer systems. The initial three sections of the "Disk and Tape Handbook," 264 pages, cover disk controllers, tape controllers and couplers and controllers for the VAX series products. The remaining three sections present product information in brochure format and cross-reference tables showing compatibility of tape and disk controllers with non-captive drives, giving application and performance data by specific make and model. "The Communications Products Handbook," 120 pages, explains data communications multiplexing processes, covers communications products and offers information on the STATCON series communications subsystems. $5 each. **Emulex Corp.,** 3545 Harbor Blvd., P.O. Box 6725, Costa Mesa, Calif. 92626, (800) 854-7112.

Circle No 347

Reference covers 25 manufacturers

The *Kierulff Designer's Guide,* a 350-page reference for computer system designers, provides information on computer products and systems, software, peripherals, data communications equipment and accessories from more than 25 leading industry manufacturers. The first of three sections details the technological issues associated with technical overview. The second section provides a functional survey of specifications and performance features and the third is a collection of data sheets and photographs on each manufacturer's product lines. $75. **Kierulff Electronics Inc.,** 2585 Commerce Way, Los Angeles, Calif. 90040, (213) 725-0325.

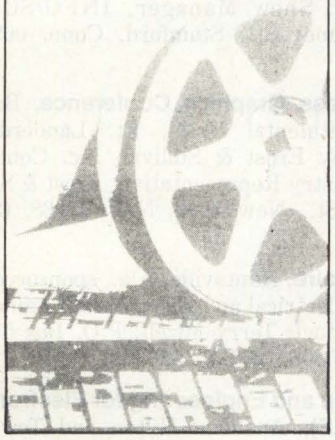
Circle No 348

Report discusses CAD/CAM technology

A 110-page report, "Computer-Aided Manufacturing" by Siltran Digital examines the changes required to implement CAD/CAM technology and pinpoints the key issues and trends for the computer system vendor and manufacturer. Issues include system and software selection, sculptured surfaces, laser machining, process control, the use of networks, robotic systems, robotic programming and planning the system. $450. **Siltran Digital,** 2250 Monterey Road, Atascadero, Calif. 93422, (805) 466-3209. **Circle No 349**

Classified Ads

This Publication is available in Microform.



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FEBRUARY

4-6 **OAC '85, 1985 Office Automation Conference,** Georgia World Congress Center, Atlanta, sponsored by the American Federation of Information Processing Societies Inc. (AFIPS). Contact: Helen Mugnier, AFIPS, 1899 Preston White Drive, Reston, Va. 22091, (703) 620-8926.

5-7 **Mini/Micro West,** Anaheim Hilton Exposition Center, Anaheim, Calif., sponsored by San Francisco Bay Area Council and Los Angeles Council, IEEE and Northern and Southern California Chapter, ERA. Contact: Tim Parrott, Director of Sales, or Jeannie Oldendorph, Sales Manager, Electronic Conventions Management Inc., 8110 Airport Blvd., Los Angeles, Calif. 90045, (213) 772-2965.

20-22 **INFO/CENTRAL and INFO/SOFTWARE,** O'Hare Exposition Center, Chicago, sponsored by INFO/SOFTWARE. Contact: Show Manager, INFO/SOFTWARE, 999 Summer St., Stamford, Conn. 06905, (203) 964-0000.

20-23 **Computer Business Graphics Conference,** Bonaventure InterContinental Hotel, Ft. Lauderdale, Fla., sponsored by Frost & Sullivan Inc. Contact: Carol Every, Industry Representative, Frost & Sullivan, 106 Fulton St., New York, N.Y. 10038, (212) 233-1080.

22-23 **IEEE Computer Faire,** Huntsville, Ala., sponsored by The Institute of Electrical and Electronics Engineers Inc. (IEEE). Contact: Terry Mizell, P.O. Box 5188, Huntsville, Ala. 35805, (205) 532-2036.

26-28 **Automated Design and Engineering for Electronics Exposition (ADEE),** Anaheim Hilton and Towers, Anaheim, Calif., sponsored by Cahners Exposition Group. Contact: Michael Indovina, Cahners Exposition Group, Cahners Plaza, 1350 Touhy Ave., P.O. Box 5060, Des Plaines, Ill. 60018, (312) 299-9311.

MARCH

4-7 **FOSE Software '85 Conference and Exposition,** Washington, D.C. Convention Center, sponsored by National Trade Productions Inc. Contact: Rosalind Boesch, National Trade Productions, Suite 400, 2111 Eisenhower Ave., Alexandria, Va. 22314, (800) 638-8510 or (703) 683-8500.

18-20 **Intercontinental Computer and Telecommunications Conference, COMTEL '85, INFOMART,** Dallas, sponsored by Hamman, Crume and Co. Contact: COMTEL '85, Director of Communications, International Computer & Telecommunications Conference, 5080 Spectrum Drive, Suite 707E, Box 17, Dallas, Texas 75248, (214) 631-6482, or Ed Warren, Hamman, Crume and Co., Suite 208, 1230 River Bend, Dallas, Texas 75247, (214) 637-4526.

Calendar

25-28 IEEE Infocom '85, Washington, sponsored by the Technical Committees for Computer Communications of the Societies. Contact: Tom Stack, Program Chairman, IEEE Infocom '85, P.O. Box 639, Silver Spring, Md. 20901, (301) 589-8142.

26-28 European Information Technology and Office Automation Exhibition (INFO), Olympia, London, sponsored by B.E.D Exhibitions Ltd. Contact: Sandra Paul, British Information Services, 845 Third Ave., New York, N.Y., 10022, (212) 752-8400.

26-28 COMDEX-in-Japan, Harumi Exhibition Center, Tokyo, produced by The Interface Group Inc. Contact: Peter B. Young (U.S.A.) or T. Shinohara (Japan), The Interface Group Inc., 300 First Ave., Needham, Mass. 02194, (617) 449-6600 or (800) 325-3330; in Japan: Kashiwabara Bldg. 2F, 1-3-3, Kyobashi, Chuo-Ku, Tokyo 104, Japan, 03-271-0246.

27-30 PBC Show '85/Infotech '85, Hong Kong Exhibition Centre, organized by Hong Kong Exhibition Services Ltd. Contact: Overseas Exhibition Services Ltd., 11 Manchester Square, London, W1 M 5AB, England, 01-486-1951.

28-29 Minnesota Joint Computer Conference (MJCC), Radisson South Hotel, Bloomington, Minn., sponsored by the Association of Systems Management (ASM), the Association of Computing Machines (ACM) and the Data Processing Management Association (DPMA). Contact: Mick Williams, c/o Standard Iron, 4990 N. County Road 18, New Hope, Minn. 55428, (612) 533-1110.

31-(3) SOFTCON, Georgia World Congress Center, Atlanta, sponsored by Northeast Expositions. Contact: Northeast Expositions, 822 Boylston St., Chestnut Hill, Mass. 02167, (617) 739-2000.

APRIL

2-4 1985 IEEE Microprocessor Forum: "Pathways to Design Productivity," Bally Park Place Casino Hotel, Atlantic City, N.J., sponsored by the Philadelphia Electric Co. Contact: Gerald W. Gordon, Philadelphia Electric Co., 2301 Market St., N3-1, Philadelphia, Pa. 19101, (215) 841-4676.

14-18 Computer Graphics '85, Dallas Convention Center, Dallas, sponsored by National Computer Graphics Association. Contact: Christine Radiske or Sheila Donoghue, National Computer Graphics Association, Suite 601, 8401 Arlington Blvd., Fairfax, Va. 22031, (703) 698-9600.

18-19 Network Management/Technical Control Show, Marriott Copley Place, Boston, sponsored by CW/Conference Management Group. Contact: Judie McDaid, National Sales Director, Box 880, 375 Cochituate Road, Framingham, Mass. 01701, (617) 879-0700 or (800) 225-4698.

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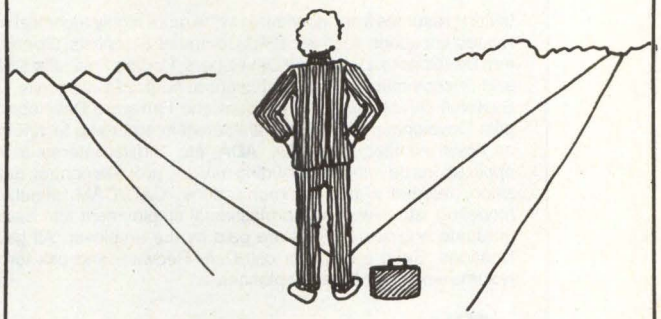

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Market Track

Sharon Hassell
Assistant Editor

Shipments surge in disk drive industry

With the production of half-height 5¼-inch disk drives increasing steadily, full-height versions with capacities lower than 30M bytes will experience peak shipments this year reaching 1.562 million, according to a recent report by Disk/Trend Inc., Los Altos, Calif. The report on rigid and flexible disk drives also predicts that 3½-inch drives will lead other small, fixed-media drives in worldwide shipments by 1987, accounting for 54 percent of the total market.

Drives expected this year from IBM Corp., such as a double-density version of the 3380, a new 5¼-inch drive for small, multiuser systems and a 3½-inch drive for single-user personal computers, will jolt the previously stable disk drive industry, the report states.

Other report highlights include a prediction that the total worldwide shipment of high-end OEM 5¼-inch Winchester drives will jump from 41,200 units shipped in 1983 to a projected total of 647,000 in 1987.

The share of worldwide OEM unit shipments held by U.S. manufacturers is expected to drop from 80.9 percent in 1983 to 62 percent in 1987. James Porter, author of the report, attributes this decrease to the inability of U.S. manufacturers to stay competitive with Japanese manufacturers.

Better design boosts attachment industry

Users' desire to upgrade their display terminals to more intelligent devices is expected to trigger a 30 percent increase in shipments of personal computer attachments in the next two years. According to a market study by Advanced Resource Development (ARD), Medfield, Mass., shipments will reach 13,000 by 1987.

ARD defines personal computer attachments as microcomputer intelligence and storage devices that hook up to non-intelligent display terminals, converting them to workstations. Most are boxes housing a CPU and a disk drive, with cabling to link the box to a terminal's communications port.

The attachments offer design improvements ranging from PC compatibility to concurrent operation as a terminal and a personal computer. According to the study, the design improvements are the major force behind the market's expected growth.

Large companies such as Digital Equipment Corp. (DEC) and IBM Corp. originally offered attachments with their terminals. However, when the attachments failed to catch on due to design problems and lack of publicity, DEC and IBM abandoned the market, says Mary Owen, author of the study. This exodus allowed smaller companies, such as Solaris Computer Corp., Personal Micro Computers Inc., Morrow Designs Inc. and Paradise Systems Inc. to create a niche.

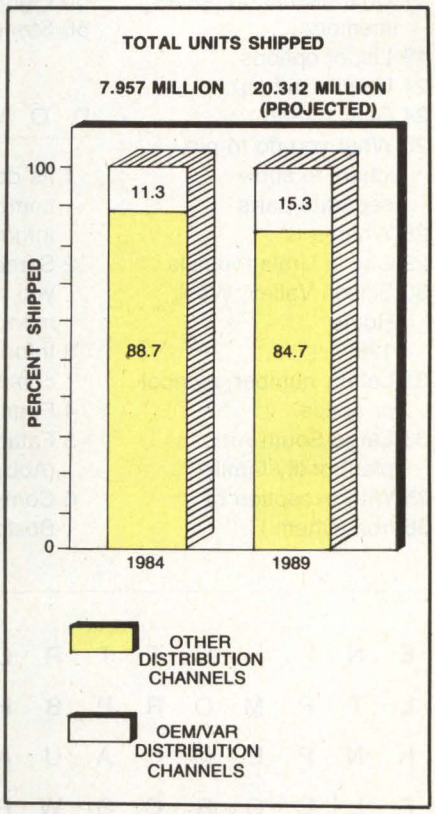
According to Owen, the attachments will be sold on an OEM basis to terminal manufacturers, who will market them as their own products.

VAR market shifts distribution channels

Microcomputer manufacturers, reacting to retail market saturation and increased direct sales from major vendors, will increasingly use the value-added market to distinguish their systems, according to a study by Venture Development Corp. (VDC), Wellesley, Mass.

The study predicts that the number of personal computers and supermicrocomputers shipped through OEM and value added reseller (VAR) channels will represent 15.3 percent of the total units shipped by 1989. This is an increase from 11.3 percent of the total shipped last year.

Distribution channels will gravitate toward low-end, minimal-support dealers or toward high-end, problem-solving VARs. This trend, according to Sharon Berman Kern, computer division project director at VDC, will bury computer specialty stores, which sell off-the-shelf personal computers and small business systems, because these stores lack the vertical-market expertise required to support and service specialized end users.



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- Network and communications software/electronic mail
- Network terminals
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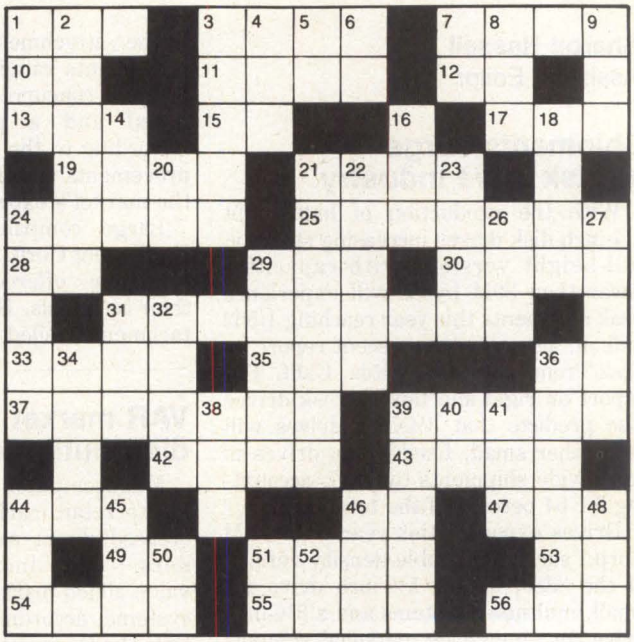
ACROSS

1 Microcomputer's heart
3 Graphic function
7 Storage for information unit
10 Land of Opportunity State (Abb.)
11 Network terminal
12 Logical operation
13 Permanent computer memory
15 Afterthought in letter
17 Changeable computer memory
19 List of options
21 Unable to hear
24 Dual screen
25 What you do to pie chart to show separate parts
28 When it is
29 City in Urals foothills
30 Silicon Valley, West; Route 128, _____
31 Letter, number, symbol or space
33 Large South African plant of lily family
35 With exception of
36 Iron (Chem.)
37 Computer bed data
39 Business data processing language
42 Talk in loud, wild way
43 Assyrian god of war
44 Common command
46 Integrated circuit
47 Texas college (Abb.)
49 Exist
51 Direct and table access = _____ ed
53 At the time that
54 Recording medium
55 Eight bits
56 Strings in music (Abb.)

DOWN

1 Its dashboard now gives computer-controlled information
2 Screen message tells you to select option form menu
3 Information fed into computer
4 Function
5 Fatal excess of narcotic (Abb.)
6 Compass direction of Boston from NYC



7 Prefix meaning "together"
8 Lose precision
9 Moon vehicle (Abb.)
14 Pure honey
16 Need plotter to produce
18 (.)'s
20 Nickel (Chem.)
21 Preset value for variable
22 Highly accurate
23 Run away from unpleasantness
24 Days of youth and inexperience
26 Blade for rowing boat
27 Her name means "noble"
29 City characteristic
31 Minor part worker plays in computer industry
32 Person legally entitled to inherit
34 High speed printer
36 Instruct computer to set up document for printing
38 Multiterminal screen-handling facility
39 Storage place
40 Bone
41 Wires connecting different sections of computer
44 String in tennis rackets
45 Communications software lets you _____ into databases
46 Suffix meaning "a person skilled in"
48 Function
50 Yours truly
51 Backfield football position (Abb.)
52 What those in favor say

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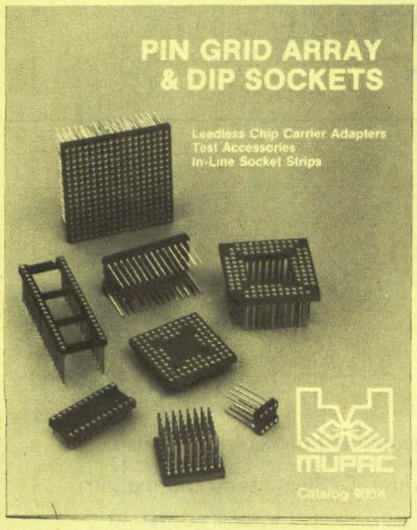

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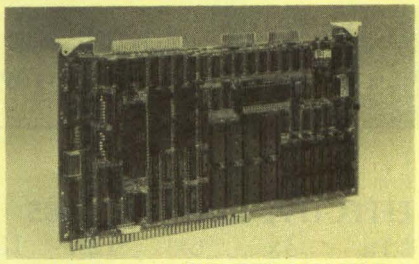

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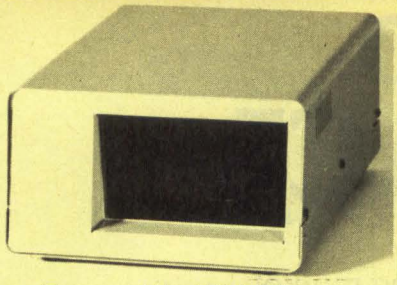

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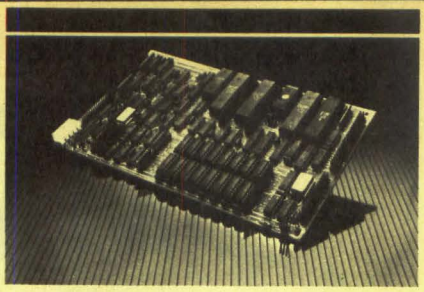

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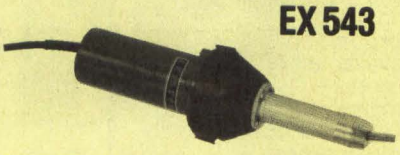

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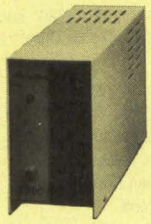

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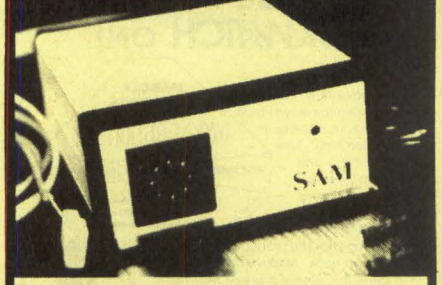

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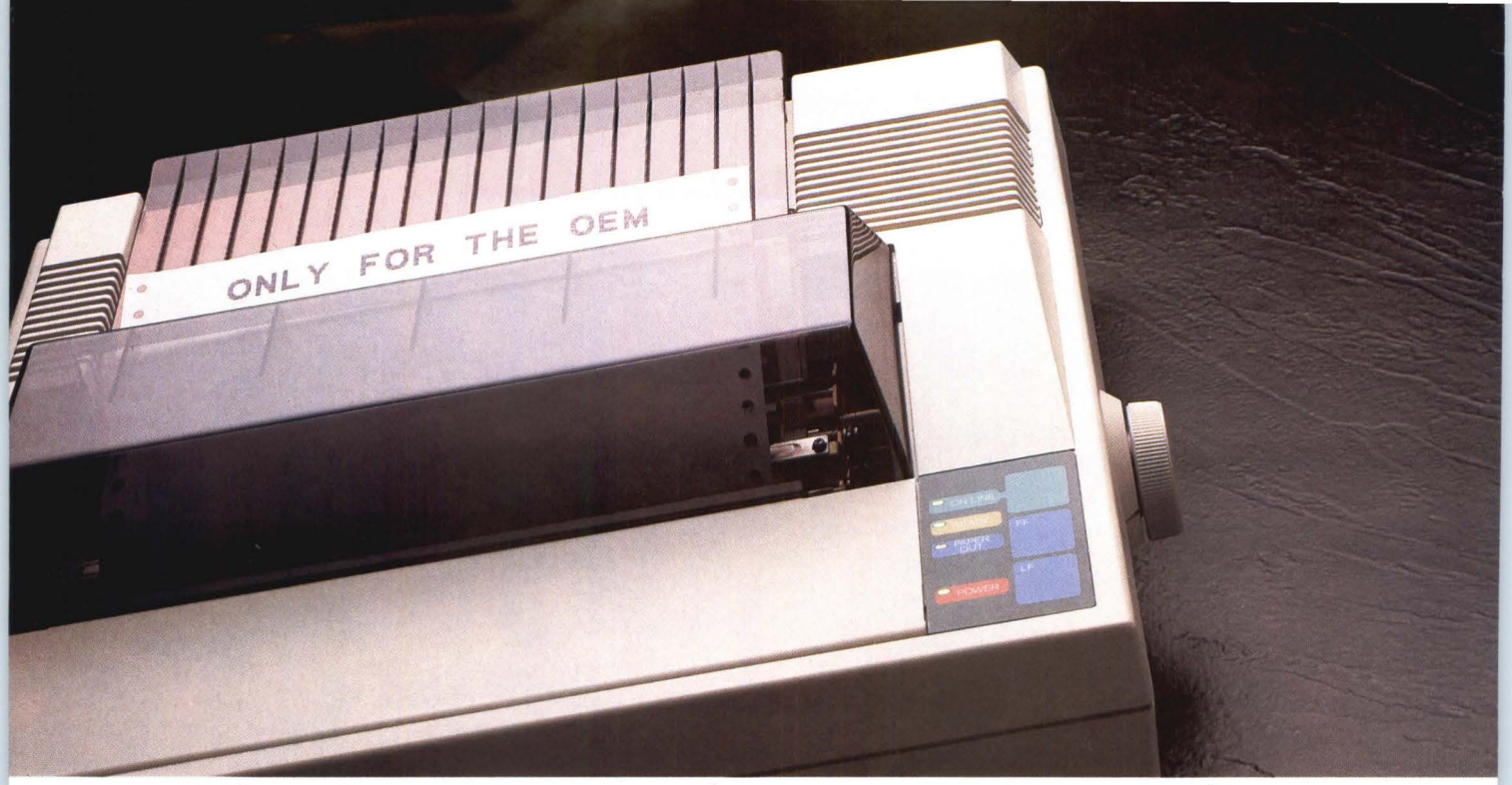

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