ni-Micro Systems

Surveying word-processing software

AUTOMATING THE OFFICE

An MCC Preview

Only one company has the complete range of disks and disk backup—Kennedy

That's right. Ask any other supplier of peripheral products for system backup, and you'll find that some can supply a disk, some can supply a cartridge recorder, others a streaming transport. But none can supply the choice which Kennedy can offer.

Kennedy is the only company that can offer an SMD compatible, 8" 40 MByte disk drive (Model 7300) and an 80 MByte 14" Winchester disk drive (Model 5380). To back them up, Kennedy has a 1/4" cartridge recorder (Model 6450), and Model 6809, 1/2" Data Streamer Tape Transport.

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TI invented the integrated circuit, the microprocessor and the microcomputer.



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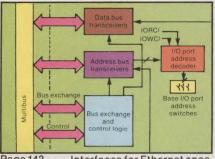




This issue of Mini-Micro Systems takes a close look at the explosive office-automation market, with feature articles on small-business systems, word-processing software, peripherals and a variety of communication equipment. Cover design by Vicki Blake; photography by Steve Grohe; Dasher terminal courtesy of Data General Corp.



Page 65 . . . Tandem's ergonomic terminal



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VBPA

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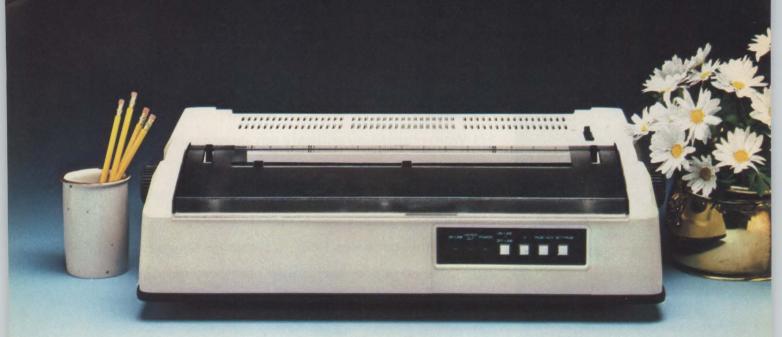
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Breakpoints

DISPLAY MAKER ZENTEC TO BUILD MULTIUSER BUSINESS SYSTEM

Long-time custom video display maker, Zentec Corp., Santa Clara, Calif., will break into the multiuser, small-business-computer systems market at the National Computer Conference in Houston next month. The firm's initial offering will be an 8086-based machine running Microsoft's implementation of the UNIX operating system, XENIX. Called the Series 2000, the hardware is said to handle as much as 1M byte of memory and support either RS232 or RS422 serial interfaces. Provision is made for Intel's 8087 math co-processor, as well. Each Series 2000 central system contains one or two 5¼-in. disk drives—either 378K-byte floppy drives or 5M-, 10M- or 15M-byte Winchesters. The system is designed to operate with intelligent work stations also supplied by Zentec. Each work station uses an 8085 μ p with 16M bytes of RAM. As many as six work stations are controlled by a separate Z80A located in the central processor. OEM prices for the Series 2000 range from \$10,000 to \$20,000.

WANG TO ADD LOW-END VS, PERSONAL COMPUTERS

Wang Laboratories, which recently augmented the high end of its VS line of 32-bit minicomputers with the VS 90, this month is planning to extend the line downward with a VS 25. The entry-level model is expected to start at about \$25,000. The system reportedly has generated a high level of interest among Wang insurance company users, who have been given an advanced peek. Reports from Wang's Lowell, Mass., headquarters also indicate the company's entry into the personal computing market may be next month.

DEC SAID TO BE DEVELOPING BROADBAND NETWORK

One of the more intriguing communication developments under way at Digital Equipment Corp. is a project aimed at incorporating the Ethernet and DEC Dataway baseband channels within a broadband network. "Clearly you can use an Ethernet or a Dataway channel as a sub-channel on a broadband network, and that's one of the things I think we will be producing in the future," says one DEC official. Access to the broadband network will be accomplished through modems now under development.

A new local-area network product is also expected from Hewlett-Packard by early summer. The HP system is a low-speed, low-cost clustered network that eventually will offer a gateway into higher speed networks. Users can choose between electrical or fiber-optic connections.

VISICALC DEVELOPERS EXPECTED TO UNLEASH ANOTHER PACKAGE

VisiCalc developer Software Arts, Inc., Cambridge, Mass., is expected to unveil another software tool, for which the company has high hopes, on May 17. Although details of the product are sketchy, an informed source says the innovative μ c program will open the door to additional professional fields the same way that VisiCalc did for business.

TELEGENIX WILL UNVEIL FLAT-PANEL DISPLAY FAMILY

International and national news and sports off the Associated Press wire will be displayed in the grand ballroom of the Astrodome during NCC on one of the world's largest CRT-emulating AC plasma display terminals. The 10½-ft.-diagonal, 80-character × 24-line flat-panel terminal is one of a five-member family of such products being introduced at NCC by Telegenix Corp., Cherry Hill, N.J. Each display includes a neon planar-gas display panel and a display controller. A detachable keyboard, floor stands and wall mounts are optional. Prices range from \$5000 for the smallest family member—a 48-character × 2-line display measuring approximately 4½ ft. diagonally—to \$52,500 for the 10½-ft. display equipped with options. The terminals display orange characters on a matte black background.

ZILOG OFFERS LOWER PRICED Z8000-BASED UNIX SYSTEM

The price of multiuser, μ c-based systems running the UNIX operating system is dropping. Last month, Santa Clara, Calif.-based Plexus Computers, Inc., introduced its 8-user P/25, a scaled-down version of its 24-user P/40, priced at \$27,000. Later this summer, Zilog, Inc., will introduce 8-user versions of the System 8000, the Campbell, Calif., company's 24-user

Breakpoints

Z8000-based UNIX machine introduced last fall. The new models 10 and 11 will range in price from \$13,000 to \$16,000. Zilog officials say the hardware is about one-third the size of the existing system and is designed to fit under a desk. Equivalent to the model 20 in CPU, memory-management functions, operating system and software, the 10 and 11, however, feature less main memory (as much as 2M bytes) and mass storage (18M bytes on a 5¼-in. Winchester disk drive). Backup is provided by a 5¼-in. floppy drive (model 10) or by a 17M-byte ¼-in. tape-cartridge device (model 11).

CALLAN TO INTRODUCE GRAPHICS UPGRADE AT NCC

Callan Data Systems, a Westlake Village, Calif., supplier of OEM scientific/technical desktop systems built around DEC LSI-11 and Intel Multibus processors, is readying graphics packages for introduction at NCC. The two-year-old firm will offer a Tektronix 4010 graphics emulator with zoom capability on a new system, and as a retrofit for its existing products. The company also has received a \$3-million, second-round venture capital placement led by Capital Management, Menlo Park, Calif.

ETHERNET CONTROLLER FOR S-100 BUS READY BY SUMMER

Perex, Inc., San Jose, Calif., will begin delivering a two-card Ethernet controller said to be the first designed for the popular S-100 bus. David Sear, Perex president, says the boards meet the complete Ethernet and IEEE 696 S-100 bus specifications and plug into any Ethernet-compatible transceiver. The boards run at 10M bps, and include dynamic address recognition, a feature that examines each packet as it comes into a station and decides whether it has reached the right destination. Two versions of the controller are available: one with 16K bytes of buffer memory to handle eight consecutive packets, another with 64K bytes to handle 32 packets. Buffer memory can be partitioned by software to allocate memory for transmitting and receiving. In OEM quantities, the 16K-byte boards are priced at \$1295, and the 64K-byte boards at \$1450.

OKIDATA TO ADD MID-RANGE MICROLINE PRINTERS

Mt. Laurel, N.J., printer supplier Okidata Corp. will release two new mid-range Microline dot-matrix printers at NCC. The new models, the 92 and 93, print 80 and 132 columns, respectively. Print speed is boosted to 150 cps, 25 percent higher than the low-end models, the Microline 82A and 83A. Added features to the 92 and 93 are full graphics capability, word-processing features and correspondence-quality print at about 60 cps in two passes. A Centronics parallel interface is standard, while a serial interface is optional. A 2000-character buffer is optional. Although pricing is not firm, suggested retail is between the low-end 82A and 83A at \$649 and \$995, respectively, and the top end model 84, priced at \$1395.

DESK-TOP OCR UNIT PRICED UNDER \$7000

Prices of optical character recognition hardware appear to be dropping, making the devices attractive to word-processing system builders as input units. The latest device comes from Dest Corp., San Jose, Calif., which has begun deliveries of a desk-top OCR unit priced at less than \$7000. Called the Workless Station model 201 and 202, the hardware is 8086-based and can read any of eight common type styles at a rate of 180 pages an hour. The 201, priced at \$6995, is a single-font device that reads Courier 72 type. On the 202, priced at \$7995, customers can select from seven different fonts, including OCR-A and B, priced at \$495 each. Each device is equipped with an RS232 serial port, which Dest expects to be used for connection to word-processing systems. Text format options (\$1495 each) are available for Wang, IBM, CPT, Exxon and Xerox word-processing hardware.

START-UP POST TECHNOLOGIES UNVEILS ELECTRONIC-MAIL TERMINAL

Compact terminals with ever-increasing capabilities continue to crop up to serve all kinds of markets. The latest hardware comes from year-old Post Technologies, Inc., Menlo Park, Calif. The company will ship evaluation units of the Postmark 300 electronic mail terminal



See the world's only DEC- compatible 5-1/4" Winchester with fully integrated back-up. Come to NCC Booth 4055.

Want the newest DEC -compatible Winchesters? You want Plessey. We're unveiling a 5½". Winchester with completely built-in back-up. In floppy or streaming tape—the only ½" streaming tape device for DEC systems.

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Keep your eye on Plessey. We're growing, With new technology, New products, New ideas. New systems.

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So if you're looking for DEC-compatible Winchesters – or a chance to see something really new at NCC-drop by booth 4055.

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COMPACT SIZE AND PACKAGING FLEXIBILITY. You can design smaller, more efficient systems. The Lark is the width of a floppy disc drive. In fact, you can mount two units horizontally or three vertically in a standard 19-inch rack.

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EXCEPTIONAL RELIABILITY. Since the Lark is totally sealed during operation, no external air is forced across either the fixed module or cartridge disk surfaces.

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CIRCLE NO. 6 ON INQUIRY CARD



GD CONTROL DATA

Addressing society's major unmet needs as profitable business opportunities

Breakpoints

next month, says marketing vice president Bob Strock. Designed to satisfy point-to-point electronic mail "at reasonable rates," says Strock, the 10- × 12- × 3-in. device weighs about 5 lbs. and features a full keyboard, an 80-column thermal printer, a built-in modem, a one-line (16-character) fluorescent display and proprietary software, including a multitasking operating system, a Forth-like interpreter and a text editor. Memory can be expanded internally to 5K bytes or externally to 32K bytes of RAM or ROM, says Strock. A built-in tape-cartridge drive will store as many as 100 typical business letters, which can be transmitted via phone lines at 300 bps, or over TWX or Telex networks, he adds. The unit also includes an RS232 port for linking to most computer systems. Post will sell the terminal directly to large-volume end users, but plans include sales through distributors and OEMs, says Strock. Single-quantity price is \$1195.

DEC WON'T FOLLOW IBM'S ROBOT LEAD

Despite considerable speculation to the contrary, Digital Equipment Corp. will not enter the robot market with its own machines as IBM Corp. did. "We don't have any plans at the present time to actually build robots, but we are developing what we call work stations for the robotic functions," says one knowledgeable DEC source. Those work stations will act as programmable control systems that will bridge a robot's mechanical tooling with a robot system's sensors, electronics and, eventually, with a common factory database. There are no hints about when the development is set for completion. IBM chose to introduce several complete robot systems as its entrance into this still-small market (MMS, April, p. 110).

DATABASE SUPPLIER CSSN CLOSES ITS DOORS

Only seven months after it introduced a series of μc database systems, Computer Service Systems Network, Inc. (CSSN), Boston, has closed its doors. Although the product line, called Dispatch (MMS, October, 1981, p. 15) may have been ahead of its time and needed a period to be accepted in the market, company president David Friesen says CSSN received as many as 300 requests for information on the products. Friesen points to venture-financing problems as a prime reason for the company's April closing, owing more than 200 creditors a total of about \$854,000. CSSN had struck a deal with venture capitalists Venture Founders, Inc., Waltham, Mass., to receive \$750,000. Venture advanced CSSN a \$200,000 loan in light of a business plan for the company to slowly pay off its creditors. However, Venture decided it wanted another partner, Friesen says. When a partnership could not be settled in 30 days, Venture ceased its financing. Friesen says the delays in receiving more money rendered the company unable to produce the equipment, take orders or deliver equipment. Another complexity: The software for Dispatch was to be supplied by MDBS, a creditor that refused to ship software to CSSN until it was paid.

TOROTEL FORMING NETWORK ENGINEERING DIVISION

To assist its planned move into the network systems market, Torotel, Inc., Raymore, Mo., is forming an engineering division called Torotel Systems, Inc. Based in Los Angeles, the new division will have a staff of software and hardware engineers who will help end users design and implement long-haul telecommunication networks. The division will rely on its sister division, Halcyon Communications, Inc., to provide initial customer sales leads and many of the network components. Max P. Beere, president of the new Torotel Systems, says when Halcyon salespeople develop accounts with customers who require engineering help, the salespeople will recommend the services of the new division. Beere expects to have 16 to 18 engineers on board by this time next year. The new Torotel division won't be constrained to Halcyon's line in the networks it configures.

OLIVETTI ENTERS PERSONAL CPU SWEEPSTAKES

The latest entry into the personal computer sweepstakes appears to be Ing. C. Olivetti, S.p.A., which was expected to launch its system at the Hanover Fair in Europe last month. Its U.S. subsidiary's Business Computer Department has set a mid-May introduction for the

Breakpoints

system in the U.S. The system is understood to be the first of its kind to use Zilog's Z8000 16-bit μp . It will sport Olivetti's dual $5\frac{1}{4}$ -in. floppy-disk drives and an entry-level price of \$3000. Configured with an Olivetti-dot-matrix printer, it will come in at less than \$5000, say sources close to the U.S. subsidiary. In addition to a UNIX-like operating system developed by Olivetti, it will be offered with a CP/M-86 soft-card option. Marketing will be through multiple channels, including Olivetti dealers, retail outlets and the Olivetti branches that sell its S-6000 minicomputers.

PRIME 50 LINE TO MULTIPLY

At Prime Computer, Inc., a low-end member of the 50 series minicomputers is due shortly. The 16-bit, 8-user system will be priced at about \$30,000 with a 67M-byte disk drive and 17M-byte cartridge-tape backup, and will be software-compatible with existing Prime minicomputers, including its 32-bitters. Developed under the code name "Rabbit," the system reportedly was due out earlier this year.

RANDOM DISK FILES

NCC PREVIEWS: Look for Longmont, Colo.-based MiniScribe Corp. to unveil industry's first low-profile $5\frac{1}{4}$ -in. Winchester, a %-high drive called the Miniscribe III. Designed for desk-top μ c-based systems and word processors, the new device will store 6M bytes of data on a single platter and will use the company's rack-and-pinion actuator design. Pricing for the drive has not been set, but reportedly it will be approximately 20 percent less than the MiniScribe I, the company's conventional-height, single-platter, 6M-byte $5\frac{1}{4}$ -in. Winchester, priced at \$745 in 1000-lot orders. Evaluation versions of the new drive are set for the third quarter. Also due from MiniScribe is a souped-up version of the MiniScribe I and the company's 12M-byte MiniScribe II. Through the use of an 8-bit μ p-controlled actuator, says one source close to the company, access times will be cut on these drives from 200 msec. to 85 msec. at no increase in price.

Cerritos, Calif., start-up **Rosscomp Gorp.** will show its first hardware offering, a 160M-byte, ½-in. streaming-tape drive called the Rosscomp 160 in Houston next month, and plans to begin delivering evaluation versions of the drive by December. The drive is designed to back up 8-in. Winchesters, and operates at 120 in. per sec. and a transfer rate of 160K bytes per sec. The drive reportedly will be priced around \$1000 and will be the same size as an 8-in. floppy-disk drive.

San Diego, Calif.-based **Data Electronics, Inc.** (DEI), plans to move aggresively into the market for high-capacity, 5¼-in. Winchester backup devices and will unveil the first streaming tape-cartridge drive designed around the physical dimensions of these smaller disk drives. Scheduled to be shown for the first time at NCC, DEI's new hardware will use standard DC-450 cartridges inserted long-end first into a drawer-like compartment. Until now, drives using ¼-in. tape cartridges have found more success as backup devices for physically larger 8-in. Winchesters, whose dimensions permit the media to be inserted edgeways. DEI's new offering, called the Slider series, reportedly will store a total of 10M bytes using two data tracks. Higher capacity hardware is forthcoming. Evaluation unit shipments are due to begin next month, and production is slated to begin during the third quarter. Pricing is set at \$550 in 1000-lot quantities.

Meanwhile, DEI is aggressively protecting the market for its traditional 17M-byte, start/stop Funnel ¼-in. tape-cartridge drive by reducing volume prices approximately 8 percent effective immediately. At the 2500-unit level, that brings the \$1029 Funnel down to \$950.

In addition to removable-only disk-cartridge drives, Fremont, Calif., start-up **SyQuest Technology Gorp.** plans to build conventional fixed small Winchesters (MMS, March, p. 10).
Both products will incorporate an embedded servo system and will map the same 6.38M-byte capacity found on Seagate Technology's ST-506 5¼-in. Winchester onto 3.9-in. thin-film disks scheduled to be built in-house. SyQuest's new drives could make their first appearance at NCC, and will be half the height of an ST-506. Reportedly they will be priced in large volumes to compete with 96-tpi, double-sided floppy-disk drives, with quantity pricing for the cartridges set at \$25 each, according to one source.

Now you don't have to wait for the video terminal you want. C. Itoh's growing family of highperformance video terminals won't leave you waiting for delivery. Or wanting for features.

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If you need an entry level 80-column terminal, we have that too. No waiting, of course. Our CIT 80 has all the important features of DEC's VT* 101, costs less and includes a long list of most-wanted extras the



VT 101 doesn't have. Things like tutorial soft setup, 19.2K baud communications, true half-duplex operation and much more. For increased versatility, there are power supply options and CRT phosphor options.

Both terminals feature modular construction and standard off-the-shelf components (no custom, hard-to-find LSIs are used). And unlike DEC, each is ergonomically designed to reduce operator fatigue.

You get all this performance and flexibility, plus one other important

extra: C. Itoh reliability. You see, C. Itoh's quality standards are the highest in the industry. That's because every C. Itoh terminal must pass a variety of tough tests. Including board tests, power supply tests, sub-assembly tests and a punishing series of temperature, vibration and noise tests that weed out any marginal performers. That's why we're not surprised when field failure rates

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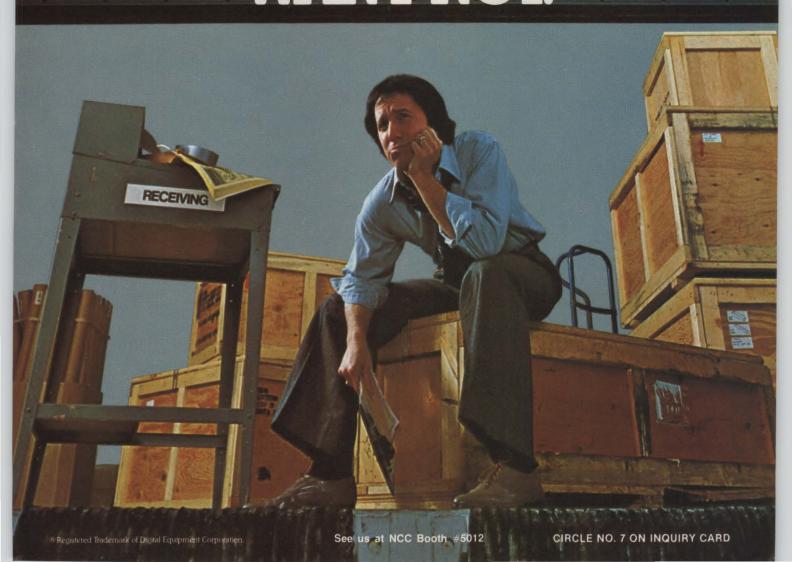
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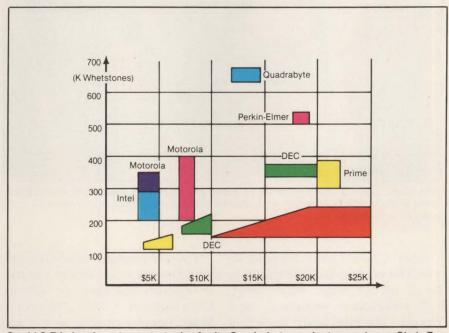
Gould S.E.L. faces competition for 32-bit board systems

The introduction of board-level 32-bit minicomputers, such as Gould, Inc.'s s.E.L. Computer Systems division's Quadrabyte, signals the next generation of supermini systems. That step is happening so quickly, however, that the hottest competition for the new board systems surprisingly may be not from traditional supermini vendors, but from semiconductor manufacturers, whose powerful µps are finding their way into board-level systems.

"The price/performance pressure on the low end will be from Motorola and Intel," notes Jack Weaver, manager of product-line/board sets at the company.

One edge Gould S.E.L. has is that its product is available now. Board-level products based on Motorola's MC68000 µp may not be ready for another one to two years, according to plans revealed by the company. Gould S.E.L. is jumping into a market window with a ready product, but also has longer term strategies formulating through parent Gould, notes James Clark, senior planning analyst at Gould S.E.L. The market window will narrow as companies such as Digital Equipment Corp. release supermini board sets, which are expected soon. In the near term, Gould S.E.L. will compete with the only other such product on the market, Perkin-Elmer Corp.'s model 3210A.

Quadrabyte, which is targeted at OEMs, is based on Gould S.E.L.'s high-end Concept 32/87. Two of the three boards in the Quadrabyte set are the same as those used in the 32/87, says Weaver. Quadrabyte consists of a 32-byte CPU, an I/O processor and an integrated memory module with 512K bytes or 1M byte of ECC MOS memory.



Gould S.E.L. has long-term strategies for its Quadrabyte product, says James Clark. Two of these three boards are identical to those used in the company's high-end 32/87 32-bit supermini.

The company claims the CPU, which is made of 2901 bit-slice processors, executes as many as 660K Whetstones per sec. Firmware floating-point functions are onboard. The CPU's mapped memory-management system addresses as much as 16M bytes of memory and allows multiprocessing. Bit, byte, half-word, word and double-word addressing are included.

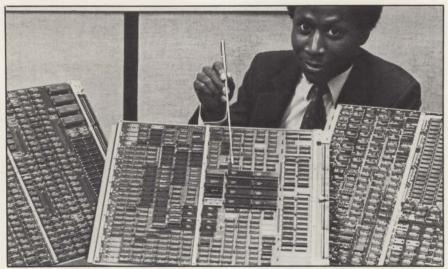
The memory module has as much as 1M byte of dynamic RAM. Memory cycle time is 600 nsec., and read and write cycles are initiated every 300 and 150 nsec., respectively. The integrated memory modules are available in 256K-, 512K- or 1M-byte densities. The board includes 64K-bit dynamic RAM chips that increase memory-module density fourfold over earlier product designs.

The I/O processor operates independently of the CPU. It handles as

many as 16 device controllers and supports as many as 124 devices. The I/O processor board controls the 16-bit multipurpose bus, which has a throughput of 1.5M bytes per sec. The bus is an IEEE 488 version.

The backplane has 15 slots. The system includes FASI, asynchronous and synchronous interfaces. Boards typically are mounted in a 19-in. chassis. The system bus operates at 26.67M bytes per sec. A high-speed data interface allowing as much as 3.2M-byte-per-sec. data-transfer rates is optional. Quadrabyte uses the MPX-32 mapped real-time operating system.

Price for Quadrabyte with the CPU, 0.5M bytes of memory, an I/O processor, chassis and backplane is \$14,000 in OEM quantities of 100. A P-E 3210A processor with 0.5M bytes of memory, chassis, a control panel and two communication lines is priced at \$19,100.



How Gould S.E.L.'s Quadrabyte 32-bit board set stacks up against the competition. Some of the product's strongest competition may come from products configured around powerful µps. Source: Gould S.E.L.

Gould S.E.L. has high hopes for its powerful new product. "We want to be a leader with board-level, high-performance products," says Weaver. The total board market is expected to grow as much as 45 percent annually for the next five years, reaching \$2 billion, according to S.E.L. The company expects more growth for the 32-bit board-set segment of that market. Annual growth of 75-percent is anticipated, with a market potential of more than \$1 billion in the next five years.

One application that could prove lucrative for Quadrabyte in light of other Gould products is industrial automation. Gould S.E.L. says its Modicon subsidiary holds about 40 percent of the programmable-controller market. If Gould S.E.L. adopted Modicon's local-area network for its Quadrabyte product, Gould could be in a good position to piggyback installed industrial-automation products. The company has not revealed a LAN strategy, although a spokesman says broadband technology will be used.

Gould S.E.L. is looking for about 15 to 20 OEMs this year, Weaver says. He adds that the product will not be sold by the Gould industrial or Modicon sales forces. The OEM emphasis is a bold move, says Timothy F. McMahon, computer division manager at Venture Development Corp., Wellesley, Mass. Companies such as P-E and Gould S.E.L. will target OEM markets heavily with 32-bit board-level products, as will Motorola and Intel. Thus, Digital Equipment Corp.'s 16-bit computers, notably

the PDP-11/34, will get squeezed from both sides in one to two years, he says.

McMahon believes Gould S.E.L. is headed in the right directiontoward technical markets-with Quadrabyte, but he sees slow going for them in the OEM business. "The OEMs traditionally are DEC and Data General Corp. OEMs. This will be tough to fight (to attract the OEMs). It's like fighting International Business Machines Corp. in the commercial market," he says. Yet, Gould's mini-maker subsidiary has a lot of Gould's money and power behind it, and he expects to see more from Gould S.E.L. in that market.

Weaver says the company hopes to ship about 500 Quadrabyte products this year. The company has shipped its first system to Aydin Computer Systems, which has signed a two-year agreement for as many as 300 board sets. Aydin will use the board sets in color graphics terminals for an unspecified application for the World Wide Military Command and Control System.

—L. Valigra

Intel aims database machine at small systems

Intel Corp.'s two-year-old Commercial Microsystems Operation has introduced its first product, a relational database processor called the iDBP 86/440. Aimed at a wide range of systems, from low-end µcs to small mainframes, and a wide variety of applications, including small-business or office systems, the processor performs file and database-management functions for applications run by one or more host computers. It will be available as a board set or as a stand-alone system this fall.

The iDBP uses two 8086 µps,

running Intel's iRMX 86 operating system. One 8086 is dedicated to communications with the host CPU. The second handles all operating-system and database-software activity, such as database backup and recovery, transaction logging and data security. This 8086 also controls the iDBP's hardware resources, such as disk and tape drives. It is equipped with 128K bytes of RAM, which can be expanded to 1M byte.

Front-end, host-to-iDBP communications are provided by what Intel calls personality modules. These

modules are the query languages or report or screen-generator software required to tie the host processor to the iddle. Customer marketing manager Joe Huseonica says the company believes these interfaces make up only 20 percent of the job of designing a database processor. Therefore, Intel will not provide the interfaces to OEMs. Instead, the company will offer training on how to design a personality module for a host system.

At the back end of the iDBP, standard interfaces such as those for SMD or Winchester-disk drives are available to handle as many as 16 disk drives. A 1/4-in. cartridge-tape drive interface is also available to handle disk backup if Winchesters are used.

Intel's iDBP provides the kernel of a relational database model. The kernel can manage structured or unstructured files and support hierarchical and networked databases through pointers and linked lists provided by Intel. Other database types, however, must be supplied by a customer.

Huseonica says the iDBP runs two transactions per sec. for eight hosts, and slightly less than that for 16 hosts. A transaction includes 10 to 12 disk accesses plus the related data manipulations, he adds. One iDBP supports eight host interfaces. A typical system, including 0.5M bytes of RAM, an RS232 interface for host connection and an SMD diskdrive interface that supports four drives, sells for \$9500 as a board set or \$15,800 as a stand-alone system. The only competition Intel sees is Britton-Lee, Inc., Los Gatos, Calif. That company introduced a relational database machine for small systems, the IDM-200, early this year (MMS, February, p. 91). Though priced close to \$20,000 in OEM quantities, the IDM200 is a 10to 12-transaction-per-sec. processor. Britton-Lee president David Britton says he's delighted with the Intel entry. "It helps cement the idea [of database machines for small systems] better." He adds, "Now we're waiting for IBM."

Though Intel's idea is priced a few thousand dollars less than Britton-Lee's, Britton doesn't think his firm will drop its price. Britton says, however, that had Intel taken a VLSI approach, that is, bring the price of the hardware down via a chip set, his company would compete in price. Britton adds that he does expect a VLSI version of the idea.

That fits with Intel's plans for the product, as does a VLSI approach for all CMO products, says Vaemond Crane, vice president and general

manager of Intel's Systems Group, of which CMO is a part.

The idbp is only the first in a series of products from CMO. This family will include a transaction processor, expected within a few months; networking systems, possibly ready by year-end; work stations, planned for next year; and new µp development systems, Crane says. CMO's total effort will be to move these and other products to higher levels of integration, he continues. He says parts of the idbp, for instance, will eventually end up on silicon as chips.

-Larry Lettieri

High-capacity Winchesters set performance standards

Even though the market for low-end 5¼-in. Winchesters has yet to hit full stride, drive designers are already looking ahead to new applications for their hardware, and are planning to introduce second-generation high-capacity, high-performance rigid-disk drives with capacities in the 30M- to 50M-byte range around mid-year.

Many of these drives will show up in prototype form at the upcoming National Computer Conference in Houston, with several vendors scheduling evaluation versions for OEMs building systems based on desk-top processors as early as this fall. Production schedules for this new hardware are equally optimistic—some drive makers are planning to begin volume shipments of the new Winchesters during the first quarter of 1983.

The new Winchesters are characterized not only by increased capacities, but by significantly enhanced performance. "The average positioning times associated with the small Winchesters that are



Evotek's line of high-capacity, high-performance 51/4-in. Winchesters range in capacities from 7.8M to 51.6M bytes. The drives operate at access times of 65 msec. using a stepper-motor actuator. Drives using voice-coil motors may be expected later on from the Fremont, Calif., start-up.

now available simply won't cut it in the multi-user environment many systems designers foresee for desk-top μ cs," says Menlo Park, Calif., industry analyst Jim McCoy. "In order to provide the response times these systems need, designers must move up to big-drive performance."



Atasi co-founders Frank Gibeau (right) and Stan Brown and a prototype of the company's first product line—a series of 18M- and 30M-byte 5¼-in. Winchesters. The drives operate at access times of 30 and 40 msec. using an unspecified linear actuator design.

Key to the increased performance McCoy and others see required by these systems is the widespread use of rotary and linear voice-coil actuators to position the read/write heads on the drive, and closed-loop servo systems to keep the heads on track.

Use of voice-coil actuators will significantly reduce seek times in these new Winchesters. Use of closed-loop servo systems will permit designers to boost storage capacities by increasing track densities rather than bit densities, thus maintaining existing data rates and allowing these new drives to be easily attached to the large numbers of controllers now available for Seagate Technology's ST-506 6M-byte 51/4-in. Winchester and for ST-506-compatible hardware.

Average seek times for steppermotor driven Winchesters such as these can hit 150 msec., says Mike Kirby, formerly marketing vice president at Rotating Memory Systems, Inc., Milpitas, Calif., and now head of marketing at Santa Clara, Calif., controller house Data Technology Corp. RMS's yet-to-bepriced second-generation drives using rotary voice-coil actuators will

offer 40M bytes of storage and seek times in the 40-msec. range, however, Kirby adds. The new drives are scheduled to be demonstrated at NCC.

San Jose start-up Atasi Corp., also plans to show a line of high-performance 5½-in. drives around mid-year. Called the 5018 and the 5030, the new drives will offer 18M bytes on three data surfaces and 30M bytes on five data surfaces (with higher capacity hardware to come). Access times range from 30 to 40 msec. using an unspecified linear actuator design, says company president Frank Gibeau.

Other vendors looking to unveil high-performance, high-capacity 5½ -in. Winchesters include Micropolis Corp., Chatsworth, Calif., which plans a 40M-byte, rotary voice-coil actuator drive that will operate at access times in the 30-msec. range. The drive is scheduled to ship in evaluation versions late this year, with production quantities set for early 1983. Pricing is pegged at \$1200 in 1000-lot quantities.

Technology Corp. RMS's yet-to-bepriced second-generation drives reportedly plans a line of 30M- and using rotary voice-coil actuators will 50M-byte 5½-in. Winchesters

equipped with linear voice-coil actuators similar to the ones used in its line of 8- and 14-in. devices. As a result of using this design, however, the Priam drive will be 2 in. longer than most 5¼-in. rigid drives.

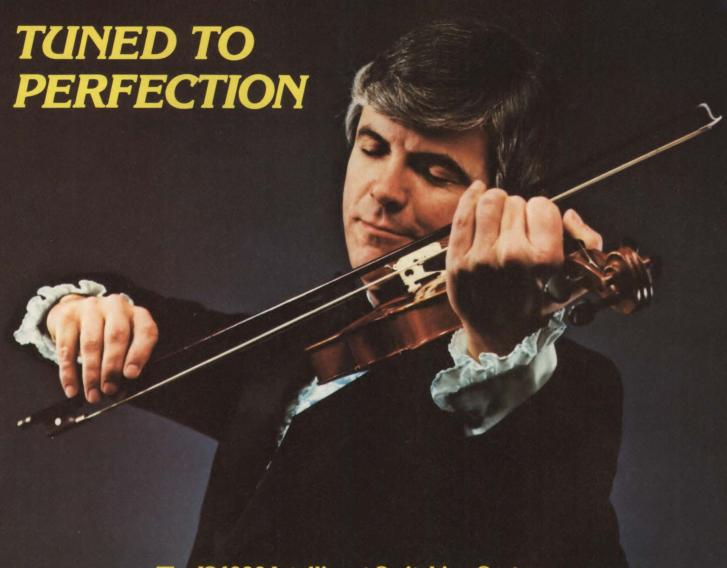
International Memories, Inc. (IMI), Cupertino, Calif., plans to introduce a line of 6M-, 12M- and 18M-byte 5¼-in. Winchesters this quarter, and a line of 25M- and 45M-byte follow-ons early next year. Called the 5000H series, the new drives will use thin-film media and will offer average positioning times in the 40-msec. range, despite a decision not to go with voice-coil actuators.

Instead, IMI plans to use high-precision stepper motors tied to μps to move the heads, and off-track sensors to keep the heads positioned accurately.

Fremont, Calif., start-up Evotek Corp., plans a line of high-performance, 5½-in. Winchesters with capacities ranging from 7.8M to 51.6M bytes (MMS, March, p. 10). Like IMI, however, it is thinking in terms of high-performance (65-msec.) actuators driven by microsteppers rather than by voice-coil motors. The company plans to unveil eight of these drives at NCC—all equipped with thin-film media.

Evotek is taking an aggressive stance as far as marketing their hardware, and plans to be price competitive with 6M-byte, 5½-in Winchesters at the low end, and a major hardware supplier to systems builders using high-performance 16-and 32-bit μcs at the high end. Evotek is forecasting production rates of 3000 drives per month by the first quarter of next year.

Due early next year from Shugart Associates, says one source, are two voice-coil technology extensions to its SA600 line of low-end 6M- and 10M-byte drives. So far undesignated, the new drives will be available in 15M- and 26M-byte versions and will offer average access times of 35



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Company	No. of drives introduced; date of introduction	Model numbers	Capacity (bytes)	Access times	Actuator type	Delivery (evaluation; production)	Price	Notes
Atasi Corp.	2; 2Q '82	5018/5030	18M/30M	30-40 msec.	linear voice coil	2Q '82; 3Q '82		shock mounting
Evotek Corp.	8; NCC '82	58xx/55xxSeries	7.8M-51.6M	65 msec.	stepper motor	3Q '82; 1Q '83	-	thin-film media
IMI	3; 2Q '82 2; 1Q '83	5000H Series	6M-18M 25M/45M	40 msec. 40 msec.	stepper motor stepper motor	2Q '82; 1Q '83 4Q '83	<u> </u>	thin-film media
Micropolis	1; NCC '82	Series 1300	40M	30 msec.	rotary voice coil	3Q '82; 4Q '82	\$1200/100	00
Priam Corp.	2; NCC '82		30M/50M		linear voice coil	4Q '82		
RMS	1; NCC '82	_	40M	40 msec.	rotary voice coil	2Q '83	\$1740/50	0 60M bytes with RLL codes
Seagate Technology	1; 4Q '82	ST-538	38M					
Shugart Associates	2; 1Q-2Q '83	_	15M/26M	35 msec.	rotary voice coil		1.11	
Tandon Corp.			54M					

msec. Tandon Corp.'s efforts, meanwhile, are reported to be focused on a 54M-byte drive.

Small-Winchester pioneer Seagate Technology may also move aggressively into this market, although its first offering of this class, the ST-538, so far remains undefined. The 38M-byte device was originally designed to accommodate thin-film read/write heads and a conventional stepper-motor actuator. Late last year, however, Seagate put its thin-film drive program on hold (MMS, January, p. 17).

The impact of this decision on the unannounced ST-538 remains unclear, although it is reported that the drive will be reannounced with ferrite heads in late 1982.

Despite the move to highperformance, high-capacity 51/4-in. Winchester technology on the part of these drive vendors, however, the size of the market for this hardware is not likely to reach volumes comparable to those projected for lower cost, lower performance, lower capacity drives. Jim Porter, Mountain View, Calif., industry analyst and publisher of Disk/Trend Report projects that only 6000 51/4-in. Winchesters with capacities of 30M bytes or more will be shipped by domestic U.S. OEM vendors next year, 16,000 in 1984.

One reason for the slower growth projected for higher performance, higher capacity drives is the present lack of a large, broadly established base of systems capable of using them in large quantities. Low-end, 6M-byte Winchesters have been greeted enthusiastically by system builders as logical upgrades to the 51/4-in. floppy-disk drives used in single-user, µc-driven, desk-top systems. McCov believes, however. that the market for higher performance, higher capacity hardware will evolve, and that it will evolve quickly. "If you could get a 100M-byte drive to end users for \$1000, the electronics and software needed to support it would be available," he maintains. "If on-line memory is cheap enough and reliable enough, it will be used."

—John Trifari

Low-priced graphics system ready for shipment

A family of CAD/CAM graphics systems with prices starting at less than \$56,000 will be ready for shipment this month from Telesis Corp., Chelmsford, Mass. The systems are targeted for sales to companies that have been price-restricted from automating their design processes.

Product prices range from \$55,500 for a single-station black-and-white system to \$151,000 for a dual-station color system.

Each Telesis system includes a

Digital Equipment Corp. LSI-11/23 computer and the RSX11M operating system. Storage is handled by a 20M-byte Winchester-disk drive and a 1M-byte floppy-disk backup, both manufactured by Shugart Associates. Each system also includes a 19-in.-high Hitachi monochromatic or color display and a 12-in.-diagonal Telesis function screen.

Options include an International Data Sciences 560 matrix printer, a Cipher Data Products, Inc., magnetic-tape backup drive and a Hewlett-Packard Co. 7580A color plotter.

A Pascal-written software engine uses a relational database architecture and provides full computer intelligence rather than simple graphics functions. The architecture allows each step of the design process to be logged into the database and stored for later comparison, revision and updates. That feature, says Gene Robinson, vice president of marketing for Telesis, gives the systems the performance of higher priced systems from Applicon, Inc., Calma Co. and Computervision Corp. at the price of electronic-drafting systems from such companies as

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No matter what your application. the CompuStar can handle it! Three disk storage options are available. A tabletop 10 megabyte 8" winchester-type drive complete with power supply and our special controller and multiplexor costs just \$4995. Or, if your disk storage needs are more demanding, select either a 32 or 96 megabyte Control Data CMD drive with a 16 megabyte removable, top loading cartridge. Plus, there's no fuss in getting a CompuStar system up and running. Just plug in a Video Processing Unit and you're ready to go . . . with up to 254 more terminals in the network by simply connecting them together in a "daisy-chain" fashion. CompuStar's special parallel interface allows for system cable lengths of up to one mile . . . with data transfer rates of 1.6 million BPS!

Software costs are low, too CompuStar's disk operating system is the industry standard CP/M*. With an impressive array of application software already available and several communication packages offered, the CompuStar can tackle even your most difficult programming tasks. Compare for yourself. Of all the microcomputer-based multi-

user systems available today, we know of only one which offers exactly what you need and should expect. Exceptional value and upward growth capability. The CompuStar™. A true price and performance leader!



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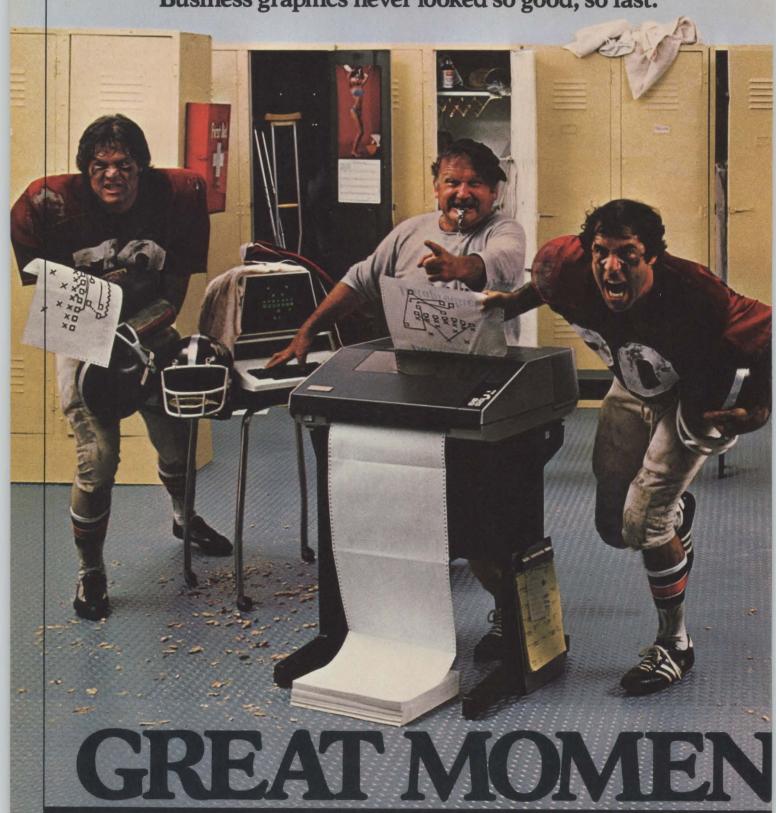
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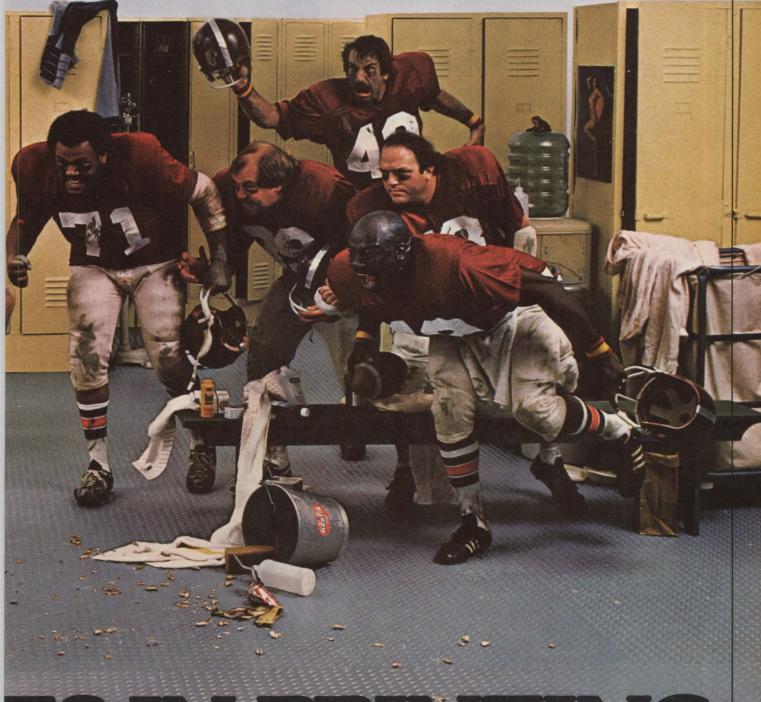
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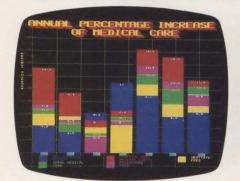
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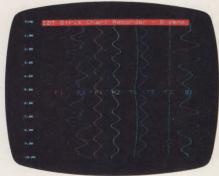


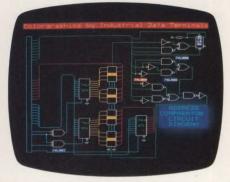
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Bubble Breakthrough





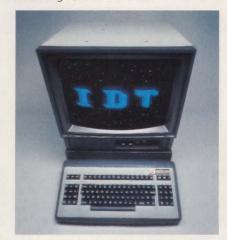




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PLOT 10* software compatibility is now available. A new hardware vector generator draws vectors 10 times faster. New front access design permits easy maintenance, plus room for three full-color display memory planes. IDT 2200 with bubble memory. The newest reason why we're earning a reputation for cost-effective performance in color graphics terminals.



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Telesis Corp.'s first products, a family of six CAD/CAM systems and an applications software package for use in the design of PC boards, are fully compatible and range in price from \$55,500 to \$151,500.

Summagraphics Corp., AM Bruning, Gerber Scientific Instrument Co. and Redac.

Carl Machover, president of Machover Associates, a consulting firm that specializes in computer graphics, says that, while the total CAD/CAM market was worth \$750 million last year, the market for products priced at less than \$100,000 is growing faster, and will be worth \$810 million by 1986. "Traditionally, the typical buyers of CAD/CAM systems were companies doing more than \$50 million worth of business a year," says Machover. "Those were usually Fortune 500 companies that could afford systems priced as high as \$500,000.

Machover says that there are only about 3000 such companies in the U.S. He adds, however, that a company introducing a system selling for less than \$100,000 could tap a potential customer base of 30,000 companies doing \$5 million worth of business or less a year. Such companies, he says, could use CAD/CAM technology, but have been unable to afford it.

Telesis's Robinson says his com-

pany's new systems were designed shared-logic systems. with such users in mind. "Our strategy was to take the design a attributes of larger systems selling for well over \$100,000 and pack those attributes into a low-priced system," he says. "CAD/CAM is no longer the domain only of Fortune 500 companies."

Robinson says that Telesis achieved the low price for its products by entering the market when the CPUs and memory were relatively inexpensive. He says that companies with higher priced products were encouraged to provide four- or five-station shared-logic systems because of the higher price of CPUs and memory when they introduced their products.

"We were able to enter the market on the other side of the scale," says Robinson. "We have the same margins as companies with higher priced shared-logic systems, but we're able to sell our products for less because they're stand-alone units."

Robinson says that by 1983, Telesis will provide networking for its systems and distribute processing power, rather than provide

Initial software for the systems is PC-board-design package, and additional offerings will be available soon, according to company spokespersons.

The company is considering a piping package application that would be provided by a third-party software vendor in Europe. "PCboard design is a stepping stone," says Robinson. "It's not what we expect to be famous for in five years."

Consultant Machover says that the Telesis products are competitive not only because of their price, but also because of their ease of use and ability to be upgraded. "The operator input is very easy to learn and allows users to increase design productivity quickly," he says. "Because of the architecture, the system offers users excellent growth capability. The problem that most people face with small systems is that they hit a ceiling, and they can't migrate into more sophisticated systems. The architecture that Telesis is offering is flexible enough to provide a nice migration path."

-Frank Catalano

Cromemco desk-top system combines MC68000, 8-bit µp

months, Motorola, Inc.'s 16-bit MC68000 µp has shown up with a Z80A µp in a small computer system designed to accommodate the wide base of applications-level software already developed for 8-bit desk-top processors.

Called the System One, the new offering from Cromemco, Inc., Mountain View, Calif., incorporates a single-card dual-processor CPU 4-MHz 8-bit Z80A, both of which are

For the second time in recent with the announcement of the dual-processor system, the company announced the availability of the CPU as a board-level product, a family of memory boards and a memory controller.

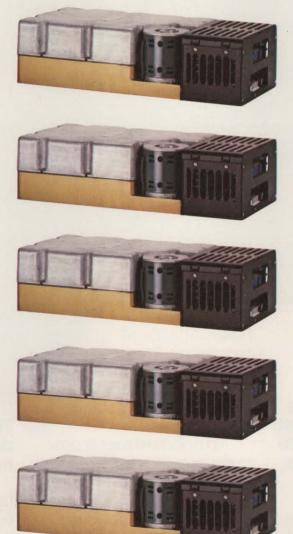
According to Cromemco, the MC68000 enables the System One to handle a wide range of scientific and engineering applications traditionally based on mainframe or minicomputer-level CPUs. At the same based on the 8-MHz MC68000 and a time, use of an 8-bit processor provides an inexpensive upgrade tied to an S-100 bus. Concurrent path for current owners of Cromem-

Which Megavault Winchester has 116 Mbytes?

(And which one has 26...44...62...or 83 Mbytes?)

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to-plug compatible with 14-inch drives offering similar capacities, but costs only \$3190 in quantity 100 orders, with 30 day availability.

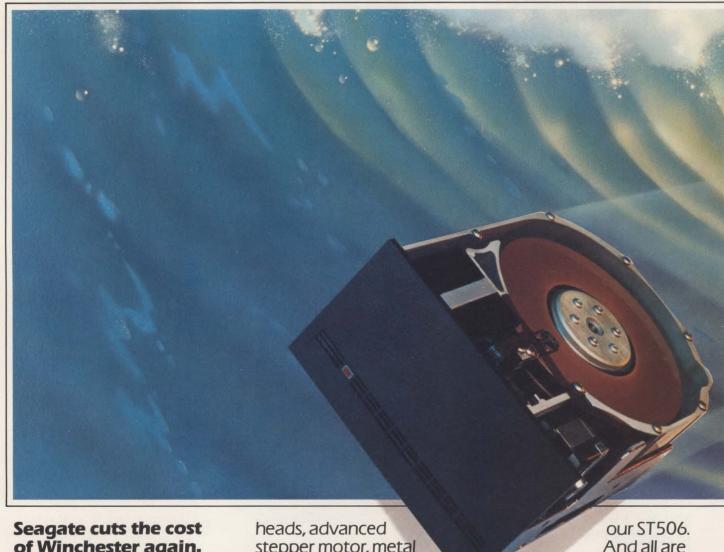
Other people make Winchesters that look just like ours. We let them—so you're second sourced. We'll even let you make them.

How did we get so smart about the Winchester market so fast? We didn't. We're a 20-year-old company that's been making disk drives for some time. With 7 patents and 3 pending. Our drives have always had other peoples' names on them. Now they'll have ours. Megavault.



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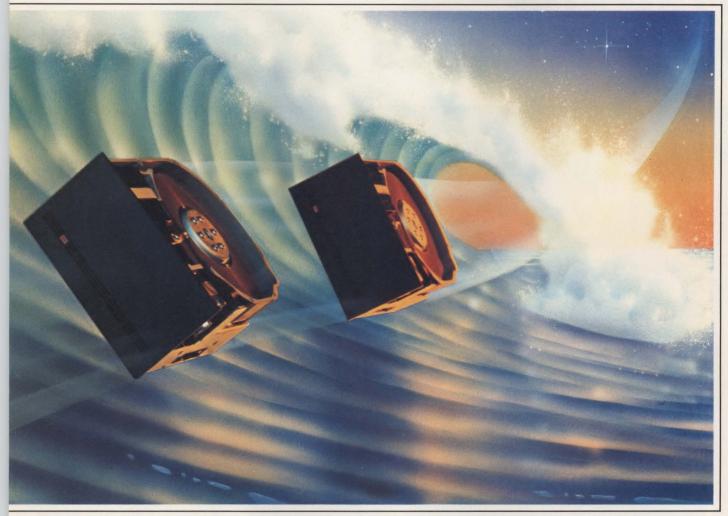
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co systems, say company sources. The previous top-end system was a Z80A-based processor with 512K bytes of main memory.

Cromemco is aiming the System One solidly at high-end OEMs and systems houses, selling into the office-automation and factoryautomation-and-control markets. and plans to support the MC68000's ability to address a full 16M bytes of main memory sometime next year. Presently, the system is configured to support a maximum of 4M bytes. Also due next year is a wordprocessing package. Software support for the system is based on the CROMIX multi-user, multitasking operating system, a proprietary version of UNIX developed by Cromemco. Other software support includes FORTRAN, COBOL, BASIC, C and Pascal.

Cromemco's System One is the second system to combine an MC68000 and a Z80A in the same box and follows the announcement of the TRS-80 model 16 this year by Radio Shack (MMS, March, p. 17).

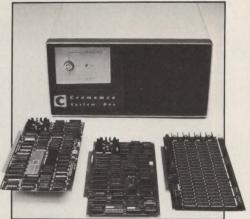
In the TRS-80/16, the Z80A functions as a 4-MHz front-end processor to the MC68000. As a result, the higher speed 16-bit up communicates with the system bus through the slower speed 8-bit device. This arrangement guarantees that software designed for 8-bit systems will run on the newer 16-bit configuration, but limits I/O speeds to the maximum capable of being handled by the Z80A. The MC68000 operates at 6 MHz when it accesses its own 128K bytes of main memory. An additional 64K bytes of main memory are provided for the Z80A, and the smaller processor can access the MC68000 memory in 16K-byte increments, according to a Radio Shack spokesman.

In Cromemco's implementation, both processors are attached asynchronously to the system bus and each operates independently at its maximum rated speed. Bus arbitration in the system is handled through a contention scheme that places the bus under control of the processor using it at the time, locking out the other. This insures that only one program can run on the bus at any given moment, but as an additional protection, Cromemco has designed what it calls a "record level lock" into the operating systems used by both devices. This keeps one processor from altering files assigned to another.

Cromemco's dual-processor design also brings with it some other advantages. The architecture of the System One can permit some simultaneous processing by both the Z80A and the MC68000. For example, the MC68000 could act as a delivery boy, handing over to the Z80A the large blocks of main memory that it can access. While the smaller processor is riffling through this memory, the bus could be freed, allowing the other processor to use the system resources.

The main memory in the new system and in the main-memory add-in boards is based on 64K dynamic RAMs and offers total capacities of 256K and 512K bytes. Both provide built-in double-bit error detection and single-bit error correction via a modified Hamming code. The memory control unit can support up to eight memory boards and will permit the MC68000 to operate in either a word or a byte mode, thus permitting the new dynamic RAMs to be incorporated into existing 8-bit Cromemco systems.

The company's dual-processor board-level CPU also can be inserted



Cromemco's System One is available as a complete boxed system with integral dual 5¼-in. floppy-disk drives or a Winchester/floppy combination (background) or in board form. To the left is the dual-processor CPU containing a 16-bit Motorola MC68000 and an 8-bit Z80A. Center foreground is the company's newly announced memory-control unit for the System One; to the right is a 2M-byte dynamic RAM board.

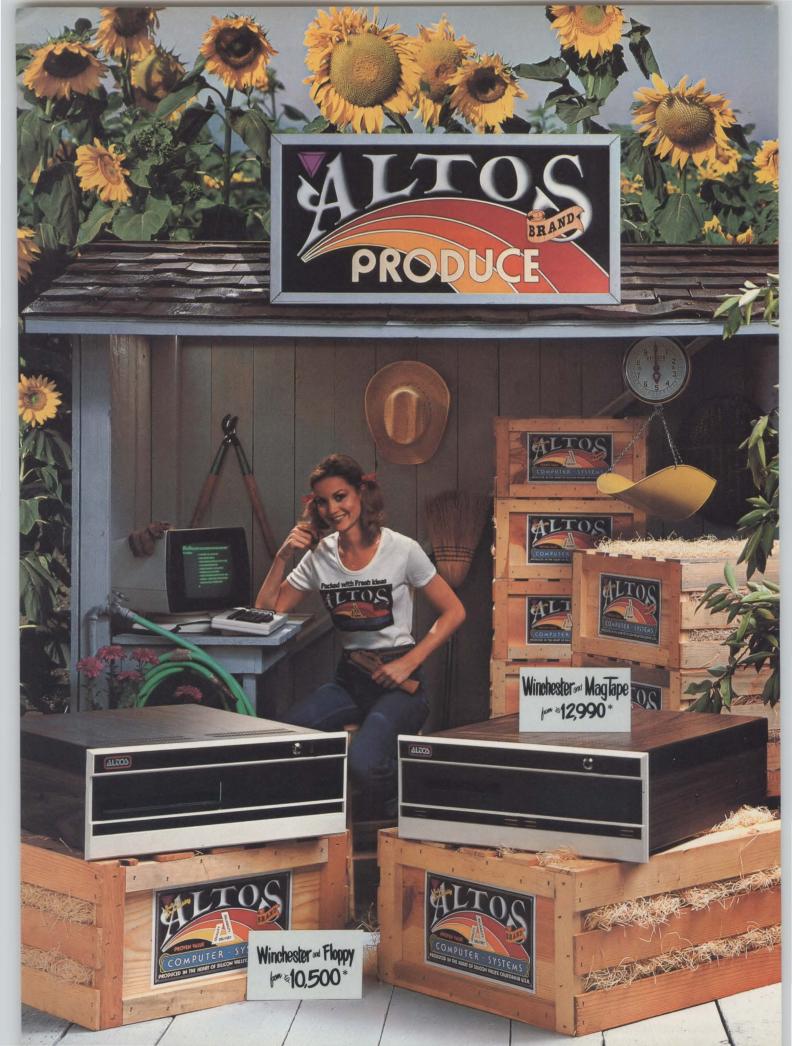
into lower performance Cromemco systems using memories designed for 8-bit processors. In this case, however, the MC68000 will operate at half speed, since it must access data stored in main memory in 8-bit, rather than 16-bit words.

Single-unit prices for a fully configured 256K-byte System One with two 51/4-in. floppy-disk drives are \$5495, and \$6495 for the 512K-byte version. Similar prices for systems incorporating a 6Mbyte, 51/4-in. Winchester are \$8495 and \$9495, respectively. At the board level, Cromemco's dualprocessor MC68000/Z80A CPU is priced at \$995 in single-unit quantities, the memory control board at \$495, the 256K RAM board at \$1095 and the 512K board at \$2995. -John Trifari

Xerox releases electronic printers, graphics software

Two electronic laser printers released by Xerox Corp.'s Printing Systems Division may be the shot in the arm the company needs to gain market share in a comparatively high-priced technology, in which Xerox is a pioneer and leader.

One Xerox product, the 2700, a

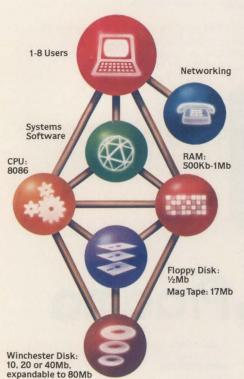


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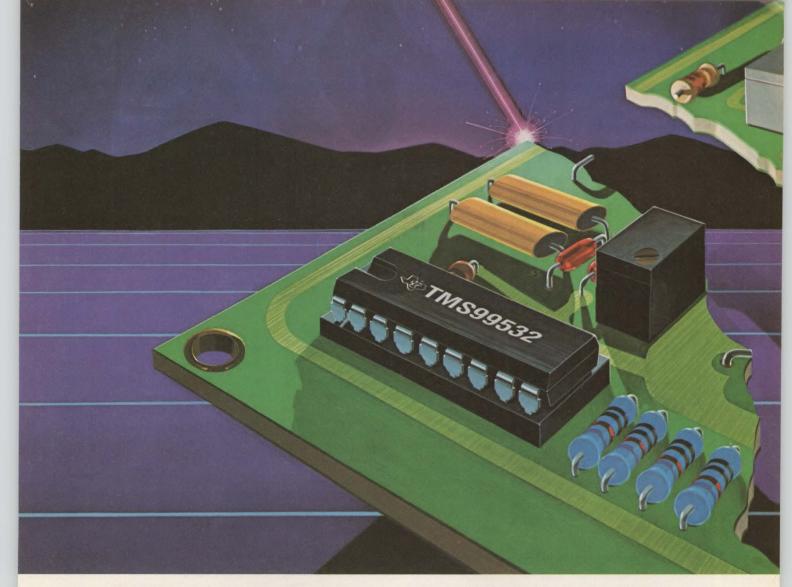
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Mini-Micro World



The operator is starting communications between the 2700 distributed laser printer and a central computer. The small 2700, with prices beginning at \$18,995, also can be used for output with small business or minicomputer systems.

relatively low-priced laser printer compared with the company's earlier offerings, is priced at \$18,995 in single-unit quantities. The product may ultimately attract more small-business and minicomputer OEMs to laser-printing technology. By comparison, prices for the high-end 9700 laser printer start at \$380,000.

The other product, the 8700, is unique in that, when used with new graphics software and a scanner, it handles electronic publishing, the company claims. Thus, many of the costly and time-consuming mechanical steps in publishing are reduced or eliminated. It also expands Xerox's product applications.

The 2700 printer may prove to be the catalyst for Xerox's OEM sales push. "They'd love to do a ton of OEM business," says O. Ralph Finley, vice president of Dataquest, Inc.'s Electronic Printer Industry Service. Even though Xerox has focused, mainly through its Dallasbased Office Products division, on



Complete black-and-white publications can be "published" in hours with Xerox's graphics system. The 1050 graphic-input station (foreground) electronically scans, digitizes and transmits images to an 8700 or 9700 laser printer (background), where graphics are merged with text and printed at speeds as fast at 120 pages per min. The 8700 also can be linked to data processing computers for high-quality printing at up to 90,000 dots per sq. in. resolution.

systems based on the Ethernet local-area network, it also is selling printer engines to competitors. The most recent such OEM contract is with Wang Laboratories, Inc.

Operating at speeds as fast as 12 pages per min., the 2700 prints on plain paper with a resolution as high as other Xerox laser printers—90,000 dots per sq. in. Pages can be printed in as many as five fonts each, and vertical and horizontal print can be mixed.

In distributed-processing applications, the printer uses bisynchronous communications at speeds as high as 9600 bps. When used with small-business or minicomputers, the 2700 is connected through serial bisynchronous interfaces or parallel interface options, including ones for Centronics and Dataproducts devices. Other options include 2770, 2780 and 3780 emulation modes.

One source says the only potential problem for the 2700 is that it may be overused as a line printer with powerful minicomputers, and thus may have reliability problems. The use quoted on a two-year lease is 15,000 pages per month. Finley suspects that a major market for the 2700 is as a replacement for a group of daisy-wheel printers. First deliveries for the product are scheduled for July.

The 8700 has been received by potential customers as the flashier of the two products, especially because it can be configured to handle electronic document publishing. The 8700 laser printer produces copy as fast as 70 pages per min. The printer operates on-line, from most International Business Machines Corp. computers, and is driven by magnetic tape off-line. Resolution on plain paper is 90,000 dots per sq. in.

The printer is controlled by its own processor and operating-system software. It uses two 25M-byte fixed-disk drives to store systems software, electronic forms, fonts, signatures, logos and job descriptions. Type fonts can be changed character by character. The printer will be available in July, with prices starting at \$212,000. Leases also are available.

When used with a 1050 scanner, software to construct images and Ethernet, the 8700 is an output device for publishing, including merged text, illustrations, line art, photographs or computergenerated graphics.

Xerox is betting on a sizable market for its publishing system. "More than 50,000 in-house and commercial printing facilities produce black-and-white documents requiring graphics mixed with text," says Robert V. Adams, president of the Printing Systems division. Xerox quoted one study estimating that in-plant printing is a \$30-billion market, or twice the value of sales generated by the commercial printing segment of the printing and publishing industry.

Xerox claims that a black-andwhite publication can be produced in

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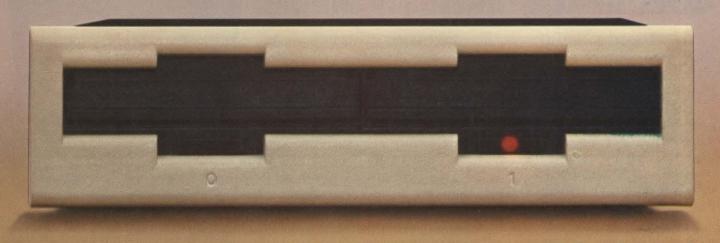
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Graphic information can be placed on the 1050 platen, where images are scanned, digitized and transmitted to 8700 or 9700 printers through Ethernet cable, or it can be merged through an option in the printer.

The 1050 is made of a raster input scanner that functions at 2 ips and has a capacity of 1M bits of images. That option, called graphics handling, enables digital images in the computer to be transmitted to the printer by magnetic tape or over an IBM computer channel.

Xerox introduced two graphics

packages for use with the system: electronic printer image construction (EPIC), which converts computer graphics into print format for the printer, and integrated composition system (XICS), which is used for automated composition and page make-up.

The graphics system will be available for the 9700 in September and for the 8700 in the first quarter next year. Without printer, the graphics system's price is \$30,000 to \$60,000.

-L. Valigra

Concurrent CP/M runs several tasks for one user

Digital Research, Inc., Pacific Grove, Calif., has introduced a multitasking version of its popular single-user, single-task, 16-bit operating system, CP/M-86. Called concurrent CP/M-86, it is said to be the first operating system for 8086-and 8088-based µcs to allow a single user to perform several jobs at once.

Essentially, concurrent CP/M-86 creates several virtual machines at a user's console. Each of these virtual machines (or screens) can be called up by an operator at any time. Using concurrent CP/M-86, for instance, a user can print a file while updating another or while sending a message to a second system.

Additional features of the operating system are a real-time kernel, record and file locking, data and time stamps, password protection, error handling and reporting, network compatibility and multiprogramming capability. Concurrent CP/M-86 is compatible with CP/M-86, the company's multi-user operating system. Further, concurrent CP/M file structures are compatible with all Digital Research operating systems, company officials say.

Programs running under the new operating system can address as much as 1M byte of memory. The software supports as many as 16 disk drives, for a total of 4G bytes of on-line memory.

Concurrent CP/M-86 requires 40K bytes of memory. Company officials believe that most 16-bit microsystems will accommodate the operating system because memory sizes

are usually 128K bytes.

The first implementation of concurrent CP/M-86 will be on the International Business Machines Corp. Displaywriter, an 8086-based word processor, of which nearly 75,000 have been shipped. The company says the operating system will let Displaywriters operate as small-business systems. Industrial control, specifically robotics, and data communications are also likely markets for concurrent CP/M, says Digital Research.

Single-quantity end-user price for concurrent CP/M-86 is \$350.

-Larry Lettieri

Carrier to offer satellite datacomm link for minis

Many companies that tie remote equipment to central-site minicomputers have grown familiar with such value-added networks as Telenet and Tymnet. These networks route data traffic between dispersed sites using leased telephone lines and microwave links. Satellite links, with their potential for transmission at extremely high data rates, are commonly thought to be suited only for powerful, host-to-host communications. But one value-added carrier, Cylix

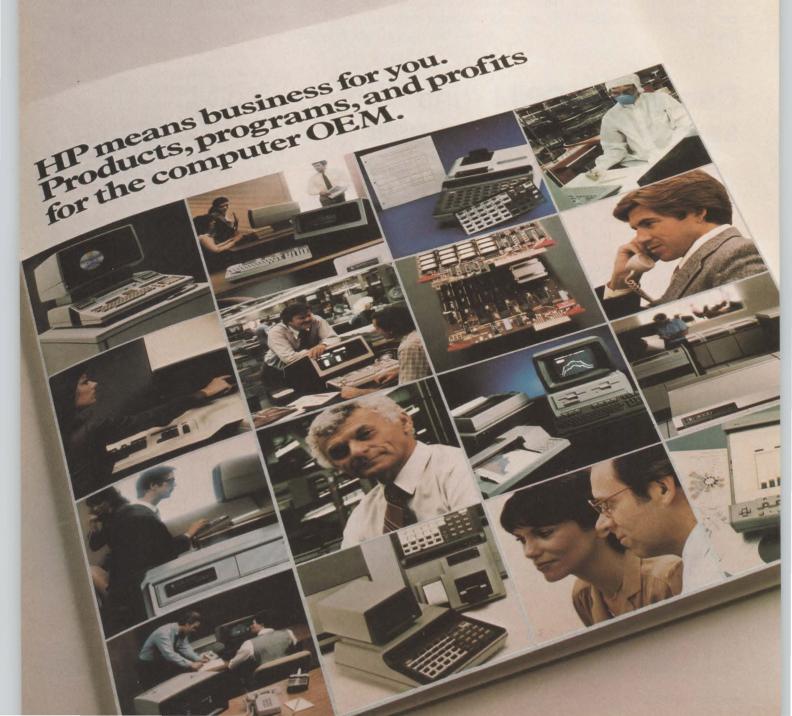
Communications Network, plans to link remote terminals to their minicomputer hosts via its satellite network by this fall.

Cylix, an affiliate of Data Communications Corp., Memphis, Tenn., recently converted its 10-year-old, 65,000-mile terrestrial-line network to a satellite-based configuration. Since the satellite network started operations in late 1981, Cylix has added network support for Burroughs Corp.'s Poll/Select and International Busi-

Hewlett-Packard on OEM profitability

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When you're looking for a supplier, obviously you want the most competitive product available. At a competitive price.

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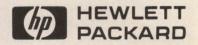
We do a lot more to protect your software investment, too. By making our new products compatible with earlier models. For example, programs developed more than eight years ago for our first HP 3000 still run on our latest generation HP 3000. You can upgrade to a much higher-perfor-

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Mini-Micro World

ness Machines Corp.'s binary synchronous protocols. By this year's third quarter, the company plans to support any systems using the X.25 or SDLC protocols as well.

Because the Cylix satellite channels operate at 56K bits per sec., the network falls in the mid-range of performance between such lowspeed networks as Telenet/Tymnet and the high-speed network planned by Satellite Business Systems. "We don't want the low-speed end of the market or the high-volume CPU-to-CPU transfer business," says Nick Carter, director of marketing resources. "Our network is best suited for remote-terminal to central-host communications."

With satellite channel links, the distance between a user's sites has no bearing on the cost of transmission. A minimum distance exists. below which satellite communications are not cost effective, but above this variable minimum separation, operation costs are determined by the volume of information transmitted each month.

The minimum volume feasible for connection to the Cylix network is about 1.5 million characters per month, Carter says. At this level of service, a user pays \$340 per month per remote-terminal drop. Users also pay a one-time installation fee of \$325 per remote drop. Linking the host computer to the network carries a \$900 installation fee, plus a \$900 monthly charge for each 4800-bps line or \$1100 for each 9600-bps line into the network.

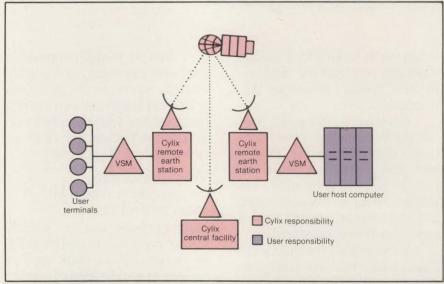
Cylix equipment and personnel handle all communications tasks for network subscribers, leaving the users responsible only for their own terminals and computers. Both the remote terminals and the host CPU connect to the network through a very smart modem (VSM) device provided by Cylix and built by Digital Communications Corp., a M/A-COM subsidiary.

The VSM supports multi-dropped terminals off a single line and diagnostics and protocol conversions. A single VSM handles multiple communication protocols on the same circuit using protocolconversion processors (PCPs).

phone lines to the nearest Cylix cautiously slow installation rate, the

performs polling activities, line by the network itself and half by customer-premise equipment." Johnson expects to have an installed base of 25,000 to 30,000 VSMs by

Although the company started its Data travel from the VSM over satellite network growth at a



Connecting remote terminals to central-site host processors, the Cylix satellite network operates 26 nationwide earth stations. Cylix takes total responsibility for networking operation and management, from the remote VSM to the host VSM.

earth station, where the signals are digitized and concentrated onto a 56K-bps data channel. This data stream is encoded and modulated onto a carrier signal, converted to radio frequency, amplified and then fed through a wave guide to the earth station's antenna for transmission to the satellite.

Upon reaching the satellite's transponder, the signal is amplified and sent to the central Cylix control facility in Memphis. There, the data's destination is electronically determined, and the data are retransmitted to the satellite for beaming to the destination earth node.

Cylix operates 26 earth stations, and hopes to have 100 by 1985, with an expanded control facility, says company president Ralph Johnson. "At that point, our investment will total about \$115 million," he says, "with half of the value represented

initial operation has gone well, and Johnson expects to meet a peak goal of 450 new drops installed per month by this October. By yearend, the network, which supports a maximum of 25,000 drops, should have about 3500 drops installed, Johnson says.

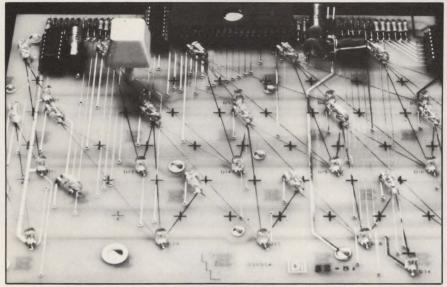
Cylix leases space on Western Union's Westar III satellite as its primary transponder, along with additional space on Westar I.

Three companies have provided financing for Cylix's network-Scripps-Howard Broadcasting Co., Storer Broadcasting Co. and Digital Communications Corp. Cylix is also negotiating for private venture capital to provide additional financing through at least 1985. The company has more than \$7 million in backlogged orders, and Johnson expects Cylix to realize revenues of close to \$100 million by 1985.

-Dwight B. Davis

Optical keyboard design cuts component count

The touch-input technology built into specialized CRT terminals to call up data is now being used by one row and column matrix of LEDs and sensors. The design of the keyboard also cuts power consumption, Theri-



A look inside: Optical Techniques International is using touch-input technology in its line of keyboards. The keyboards use the interruption of light beams passing between LEDs and sensors to detect discrete keystrokes.

Orange County, Calif., firm to reduce component count in a line of keyboards to one moving part per key.

Developed by Optical Techniques International, Santa Ana, the new line of keyboards uses the interruption of light beams passing between LEDs and sensors to detect discrete keystrokes. To cut total component count, each of these LED light sources is pulsed in sequence to an array of photo sensors and is multiplexed with the outputs of other LEDs making up the keyboard.

The net effect of this arrangement, says marketing vice president Bob Theriault, is to reduce the number of LEDs and sensors by two-thirds and to boost reliability compared to other methods of implementing optical keyboards—dedicating one LED and one sensor to each character or establishing a

ault continues, and eliminates the generation of phantom key strokes if more than one key is hit simultaneously.

The new keyboards are available in stepped, sloped or low-profile designs, and are now shipping in production quantities. To cut power consumption even further, Optical Technology plans to introduce an upgraded version of these keyboards using custom infrared (IR) transmitters designed by Motorola in place of the LEDs. That version will be announced at the upcoming National Computer Conference in Houston. First shipments of keyboards with IR transmitters began this quarter to Quotron.

The new keyboards provide variable transmission rates, serial or parallel outputs, multi-character buffer memories and built-in diagnostics. Pricing for both the LED-and the IR-based keyboards is a function of the configuration desired, but is said to be competitive with standard keyboards.

—John Trifari

Engineer, teacher shortage will impact industry, says AEA

A national shortage of engineers and engineering educators threatens to limit the growth of U.S. high-technology industries, including minicomputer and µc industries, says the American Electronics Association. This conclusion was reached by a blue-ribbon committee on engineering education, appointed by the AEA board of directors in 1981 to study the shortage and recommend solutions. As a result, AEA has approved a short- and long-term plan to reduce the shortage.

An AEA nationwide survey entitled "Technical Employment Projections: 1981-83-85" states that, by 1985, there will be a demand for 199,000 electronic-engineering and

computer-science graduates at the bachelor-degree level, but only about 70,000 will be available to meet the demand. Although engineering enrollments are up 7.2 percent from 1980, only one of three qualified applicants are admitted to engineering programs because facilities, equipment and, especially, faculty are lacking.

On the graduate level, AEA figures indicate that, in 1980, MS/EE degrees totaled 3470 (down 400 from 1970), and Ph.D/EE degrees totaled 532 (down 351 from 1970). Factors contributing to this decline include rising tuition costs, low graduate-assistance salaries, fewer graduate fellowships and inadequate facilities. A major disincen-



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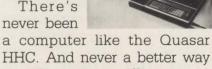
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Mini-Micro World

tive to going on to the graduate level is the traditional high starting salaries for BSE graduates, as opposed to lower salaries in the academic community. The report states that academicians "compare industry's appetite for BSE graduates to that of starving American Indians who, to survive the winter, ate the seed corn needed to plant the next year's crops."

To help the industry get through the "winter," the AEA set up a plan to be implemeted this year. Highlights include:

A proposal to set an industry-

company's R&D expenditures, filtered directly to colleges by companies or through an AEA foundation by way of equipment, teaching chairs, graudate fellowships or grants.

- Establishing regional task forces of AEA Council Engineering Education Committees to act as liaisons between private industry and colleges. Industry executives will provide input on hiring teachers, arranging interviews and assisting in fund-raising for salaries and graduate fellowships.
- Using the blue-ribbon commitwide standard of 2 percent of a tee as a liaison between the federal

government and the President and to guide a standing committee, which will assist the Education Foundation in promoting companies that provide funds and resources to schools.

- Establishing industry lobby networks in states with major electronics industries. These networks will identify and support issues relating to program goals.
- To appoint a manager to assist the Foundation in budgeting and regional task-force goals.

-Nancy Love

Prime adds remarketers for vertical markets

By consolidating its split product line and by adding a new remarketing program, Prime Computer, Inc., Natick, Mass., hopes to increase cooperation between its direct sales force and its resellers, and to strengthen its drive into untapped vertical application areas. Prime's 26 existing dealers can choose to sign remarketer contracts or retain ther dealer status. In terms of benefits, there appear to be no major distinctions between the two plans.

Prime started its dealer program about three years ago when it got seven Microdata Corp. dealers to add the Prime Information series to their lines. Prime's Information operating system is compatible at its base level with the Microdata Pick operating system, so application programs the dealers had developed for their Microdata equipment could also run on the Prime machines. The dealers handled a distinct line of Prime computers-the 1500, 11000 and 15000—that ran the Information operating system and differed from the Primos-based 50-series computers sold through Prime's direct sales force. Both lines of equipment are 32-bit machines, but Information is a highly interactive operating system employing nonstandard languages, whereas Primos runs industry-standard languages such as FORTRAN and COBOL, and is well suited for scientific and engineering applications.

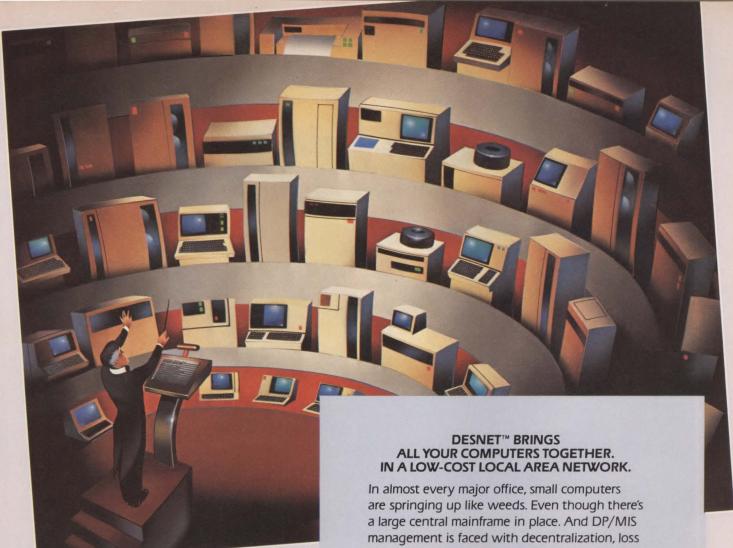
The dealer program has been very successful, says Roy Finney, Prime's director of marketing programs, who says the dealers account for about 20 percent of Prime's domestic revenues. But he believes the program has reached a point at which it may place constraints on some dealers. This concern, coupled with Prime's desire to add resellers who have developed applications software for equipment other than Microdata's, resulted in the formation of the remarketer program, Finney says.

Most Prime dealers initially sold a differentiated product line horizontally within a specific region, Finney explains. "Now, our dealers have evolved to where almost every one specializes in one, two or three vertical markets." With specialized vertical software, many dealers already market their products nationwide, he says, "and they may find the territory arrangement an inhibitor rather than a help to their growth."

Thus, the remarketer program encompasses resellers with vertical products having a nationwide marketing approach. Given their national scope, the remarketers will have higher equipment-selling goals than the dealers, Finney says, but he will not specify the quotas involved in either program. Existing dealers can evaluate their marketing potential, and choose to remain at their current status or to become remarketers.

Regardless of their choice, the resellers will no longer handle the Information series, which is being phase out by Prime. To end confusion about the two product lines and to permit resellers to work more closely with Prime's direct sales force, all parties will now market 50 series machines. Prime remarketers will be able to develop programs that run under Information or the Primos operating system.

As part of the shift to the 50 series, Prime has introduced the model 450-II, designed to run



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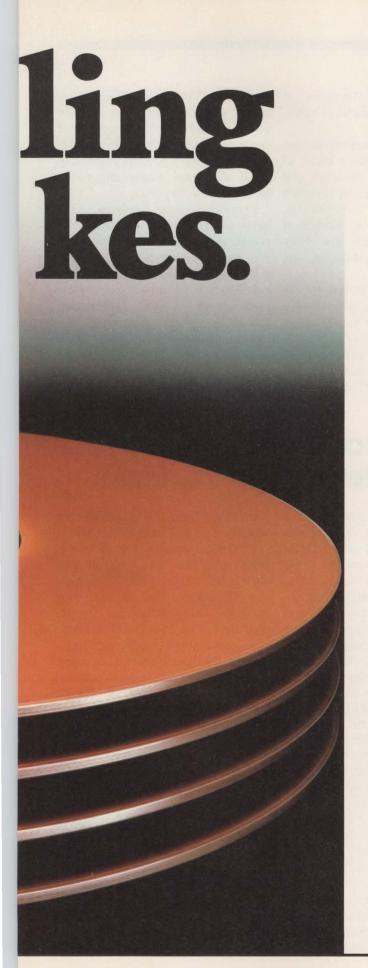
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Information. Priced at \$98,000 to \$200,000, the 450-II supports as much as 4M bytes of main memory and 63 terminals. It reportedly offers 50 percent more performance than the 11000, which it replaces. Prime also announced that its top-of-the-line 850 can now run the Information operating system, along with Primos.

Prime dealer Information Plus, Houston, Texas, may wait awhile before signing a remarketer contract. Bill Tidmore, director of software engineering, says, "We are fairly happy where we are, although we foresee everybody's eventually coming under the remarketing program."

Information Plus markets turnkey systems to manufacturing and oil and gas business. While the firm makes some nationwide sales, most business comes from the Houston region.

Tidmore isn't too concerned that new remarketers will quickly threaten his company's niche. He says new companies just starting to work with Information "will have to go through a pretty stiff learning curve because working with Information takes some advancement in thinking techniques as compared to traditional languages."

One factor that could prove to be a disincentive for Information Plus making the remarketer switch would be the resulting quota increase required by Prime. "Prime has a compensation program for meeting quotas, and we're doing quite well," Tidmore says. "It would seem folly to take on more responsibility and decrease that quota exception."

The quota compensation is a minimal concern of another Prime dealer, GSG, Inc., Santa Ana, Calif. GSG president Ron Williams says his company has always marketed nationally and has sales that far surpass the Prime district quotas. GSG offers a broad scope of software packages, but has strengths in problems. "I'm just a little curious government and educational applications.

Bob Nelson, GSG's executive vice president, thinks Prime's move to increase cooperation between the direct sales force and the resellers "is a very positive step for us. direct salesmen who are very willing to join forces with us," he says.

Any doubts GSG's president has about the new program involve concern about Prime's long-range intentions. Williams cites Microdata as an example of a company that had a strong dealer network, abandoned it and suffered resulting financial

about whether Prime is actually going toward a strong support of the remarketer through this effort, or whether they plan to eventually move the total marketing effort back into the corporation."

Prime's Finney answers, Already, we've seen a number of have no intentions to drop the remarketer program down the road. We are looking for long-term relationships." He points out that resellers will continue to be the only remarketers of the Information operating system, and says, "We have no plans to sell the Information product direct. The remarketer move is a move to strengthen, not to weaken." -Dwight B. Davis

Multibus controller handles Winchesters, floppies, tapes

Mass-storage subsystems builder Data Systems Design, Inc., begins delivering its first non-Digital Equipment Corp.-compatible product this month. Called the DSD 7215. it is a Multibus-compatible controller said to handle Winchester- and floppy-disk drives as well as streaming-tape cartridge drives. The company also will offer subsystems based on the controller that include an 8- or 51/4-in. Winchesterdisk drive and either floppy hardware or tape-cartridge devices.

Last year's \$23 million in sales are proof that the DEC-compatible market is lucrative for the sevenyear-old company. But sitting in the shadow of a giant such as DEC is not always comfortable. "One single, drastic move by DEC could hurt us," says marketing vice president George Fink. "The Multibus market is friendlier," he adds. "Anyone can build products for the bus." The move into the Multibus market. then, serves two purposes. "It makes us less dependent on DEC," Fink says, "and the diversification will allow us to continue to grow."

Product manager David Aronovitz says the 7215 controls two 40M- byte, SA1000 interface-compatible Winchester-disk drives, four 1M-byte, SA850-compatible floppydisk drives or two Archive Corp. 1/4-in. streaming-tape drives. Multiplexing the board enables as many as four rigid drives to be accommodated, says Aronovitz. A 51/4-in. hardware version of the controller, called the 5215, handles the same number of devices.

Both controllers are built around AMD2910 bit-slice processors. An Intel 8085 controls data bus transfers and handles generalhousekeeping functions. It is tied to an on-board 4K-byte data buffer, error-correction circuitry and a hard-disk data separator. The on-board buffer allows data transfers between the rigid disk and the floppy or tape drive without using the system bus, Aronovitz says. He claims this feature enhances overall

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If you were defining the ideal word processor, you'd start with superb human engineering. So did we-with detached 98-key keyboard,

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The six Convergent workstations look similar, but each has a unique combination of features and price. And perhaps most importantly of all, we're delivering all six in quantity right now.

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suddenly becomes a big business, it won't to utgrow the computer—there are many ways to add power and resources. DISTRIBUTED DP Every Convergent system comes with clustering capability built in—just plug the workstations together, with no software modifications. DISTRIBUTED DP Every Convergent system comes with clustering capability built in—just plug the workstations together, with no software modifications. DISTRIBUTED DP Every Convergent system comes with clustering capability built in—just plug the workstations together, with no software modifications. DISTRIBUTED DP Every Convergent system comes with clustering capability built in—just plug the workstations together, with no software modifications. DISTRIBUTED DP Every Convergent system comes with clustering capability built in—just plug the workstations together, with no software modifications. DISTRIBUTED DP Every Convergent system comes with clustering capability built in—just plug that some compact and a lot more attractive. DISTRIBUTED DP Every Convergent system comes with clustering capability built in—just plug that some compact and a lot more attractive. DISTRIBUTED DP Every Convergent system comes with clustering capability built in—just plug that some compact and a lot more attractive. DISTRIBUTED DP Every Convergent system comes with clustering capability built in—just plug that some compact and a lot more attractive. DISTRIBUTED DP Every Convergent system comes with clustering capability built in—just plug that some compact and a lot more attractive. DISTRIBUTED DP Every Convergent system comes with clustering capability built in—just plug that some compact and a lot more attractive. DISTRIBUTED DP Every Convergent system comes with clustering capability built in—just plug that some compact and a lot more attractive. DISTRIBUTED DP Every Convergent system comes with clustering capability built in—just plug that some compact and a lot more attractive. DISTRIBUTED DP Every Convergent system comes with clustering capabil	
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Your problem right now is to get your local area communications network on a track that will take you far enough, fast enough, and in the right direction. With communications technologies branching out and racing off in every direction, it's tough to know where to start, and even tougher to predict where you'll be five or ten years down the line. You need to know you're going to be in the right place, wherever that happens to be.

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dom of choice and independence.

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MULTI-VENDOR COMPATIBILITY. FOR EXAMPLE.

Lots of companies are talking about connecting everybody's information processing devices up to anybody else's. If you have a technical background, you know that's still largely a marketing fantasy. But you do need the freedom to choose equipment based on capability, rather than marrying a single vendor for the sake of compatibility.

So the only kind of local communications system that makes sense is one that can truly make the equipment you already have work together, and allow you the widest equipment

choice in the future.

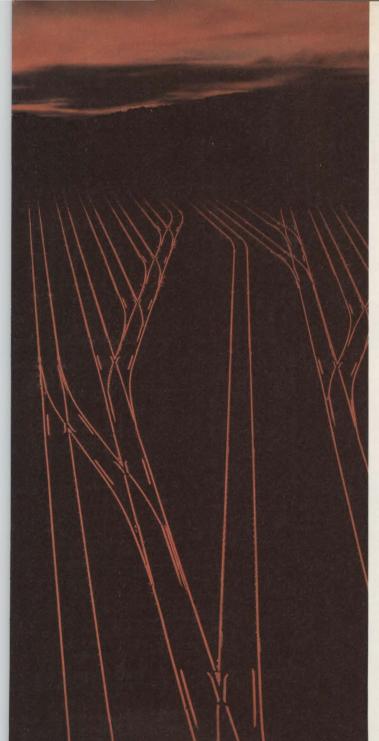
We can't promise you universal compatibility, either. But we can deliver far more compatibility than any other system offers.

THEN THERE IS THE QUESTION OF MEDIUM.

A lot of energy has been spent arguing the merits of broadband vs. baseband. What you need is a system that lets you use whichever medium or combination of media is right for your application. And further, your options should remain open to use other media in the future without investing



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more than you have to now.

So that's how we designed Net/One. It's the only local communications system in the world which lets you choose broadband or baseband or both, with architecture that will allow you to add other media such as fiber optics in the future. With Net/One, you also have the choice of Ethernet compatible baseband or CATV compatible broadband.

NETWORK ADMINISTRATION MADE SIMPLE.

Net/One includes a powerful administrative station that lets you configure the network to talk to your information processing equipment in their own native protocols. And you can select which types of Net/One communication services you want to provide to the attached equipment. All this without writing one line of software.

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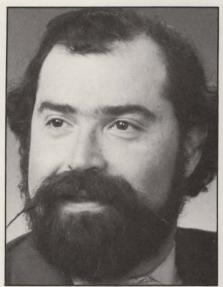
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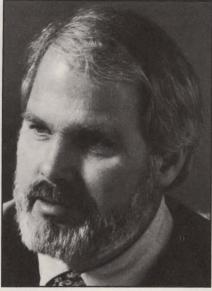


DSD product line manager David Aronovitz says the 7215 controls two 40M-byte, SA1000 interface-compatible Winchester-disk drives.

system performance.

Though most 16-bit Multibus systems are based on Intel's 8086, the DSD controllers are not limited to Intel processors and will run in any Multibus-compatible setup. Further, because the 7215 and 5215 have been built to the IEEE's 796 Multibus standard, they include the 24-bit address lines needed for 16-bit systems using memory-management and virtual-memory techniques. Among such systems, Aronovitz includes those based on Motorola's 68000 and Intel's new IAPX286.

DSD has positioned the new controllers against boards introduced by Intel last March. Unlike the 7215, however, Intel's SBC215A is a single-function controller that handles as many as four 8-in. Winchester-disk drives that use the ANSI X3T9 interface. The ISBC215A is priced at \$2000. A separate floppy-disk controller can be piggybacked onto the ISBC215A. The ISBX218 multimodule floppy-disk controller is priced at \$540. Intel is reportedly developing a streamingtape cartridge controller, but that controller is not expected for some time, says a spokesman for the



George Fink, DSD's marketing vice president: "The Multibus market is friendlier. Anyone can build products for the bus."

company's Hillsboro, Ore., board division.

In the subsystems business, DSD faces competition from Scientific Micro Systems, Inc. The Mountain View, Calif., company, a longtime DEC-compatible storage-system

maker, has been delivering a Multibus-compatible Winchester-/ floppy-disk drive package for a couple of months, says a company spokesman. The FWT8000 series mixes an SA1000-compatible Winchester-disk drive with an SA850type floppy-disk drive. The controller handles two drives of each kind for a total storage capacity of 80M bytes. SMS is adding the 24-bit addressing capability to extend the board into the 68000 and 286 markets, the spokesman adds. Depending on capacity, the subsystem sells for \$6800 to \$9500, including controllers. Controllers sell for \$2000.

DSD prices range from \$6895 to \$9195 for a 7215-based, 19-in. rack-mounted subsystem. Prices for subsystems using the 5215 controller and 5¼-in. hardware have not been set. The 7215 and 5215 controllers sell for \$2200 each. Volume production will begin in June.

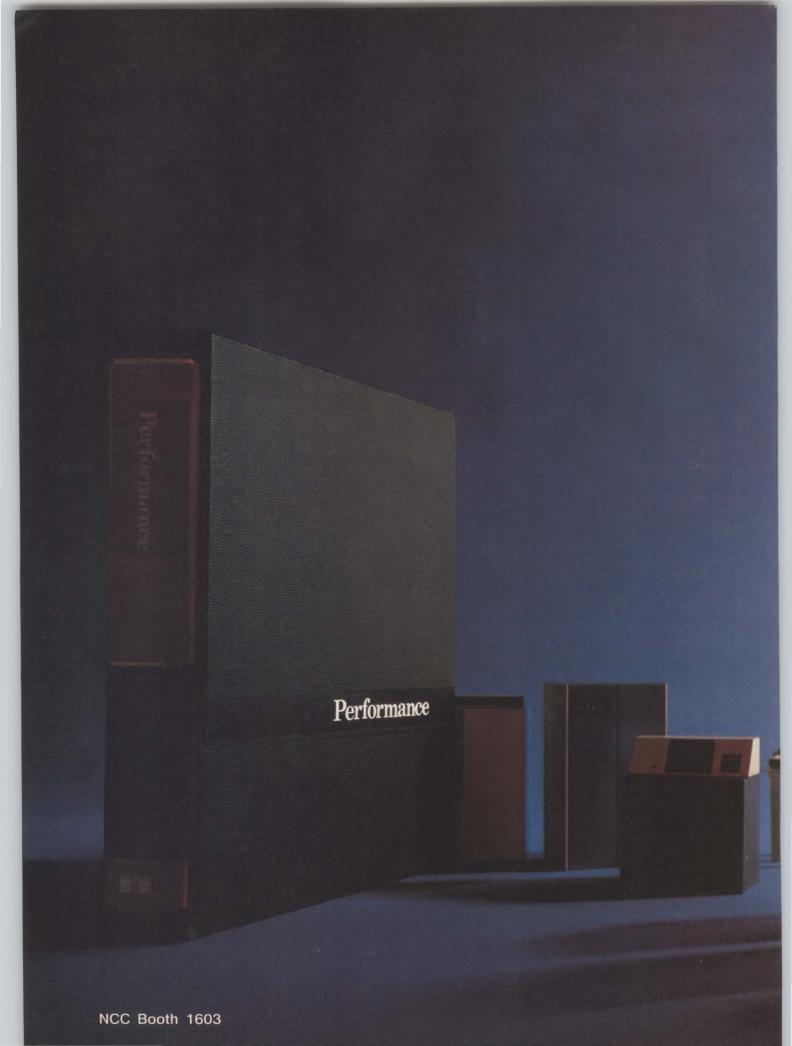
—Larry Lettieri

Semiconductor advances may yield faster computers

Semiconductor memory and logic advances that could make computing systems faster and more economical were described in papers presented by International Business Machine Corp., Hewlett-Packard Co. and others at Februarv's International Solid State Circuits Conference in San Francisco. The IBM advances include three experimental devices—two very high-density memory chips and a high-performance custom logic chip -and mathematical models and design techniques to improve highdensity semiconductors. H-P discussed a six-chip, 32-bit, processing system that includes a high-density RAM.

One IBM chip, a 288K-bit dynamic RAM, is the largest capacity memory chip fabricated by IBM. It uses twice as much area to store four times as much data as that stored in the largest capacity chip (72K bits) in volume production at IBM, the company says. The new chip contains 294,912 memory cells, each of which stores 1 bit of data, for total storage of 32,768 9-bit characters, or about 7000 words. It has four independent memory arrays, each with 73,728 cells. Narrower line widths for patterns defining circuit elements help to make the chip very dense. Access time is 350 nsec., half that of the 72K-bit chip.

The second IBM memory chip,



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Performance

Storage Technology is strongly committed to supplying a line of high-performance, OEM computer peripherals with features that fill a book. We're not only filling the book, we're writing it. We started leading the way in new technologies and design concepts with our very first tape drive. Today, our 50 percent share of the high-performance tape market and 30 percent share of the high-performance disk market clearly proves the industry-wide acceptance of our products.

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Our supermini performance peripherals are setting the standards for tape, disk, printer and card reader products in the OEM marketplace. The 1900 Tape Subsystems brought the first high density tape design to the supermini market. These vacuum column tape drives introduced user selectable tri-density recording; NRZI, PE, and GCR, operating at field upgradeable speeds of 50, 75, or 125 inches per second.

The Model 8775 Single Spindle
Disk provides 673 MBytes of
unformatted data storage with a dual
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The Universal 1000 Family of Band Printers, built by our Documation subsidiary, combines print speeds ranging from 1000 to 1600 lines per minute with operator interchangeable print bands that can be character customized for special applications. In addition to an integrated forms stacker, the 1000 features Documation's easily maintained, patented hammerbank assembly.

Industry standard Documation

Card Readers handle all card reading requirements from hand feeding up to 1000 cards per minute. These readers assure easy handling and reliable reading of OCR, mark sense and punch cards.

For the intermediate system

Storage Technology's intermediate system peripherals include the 4500 Tape Subsystem, the Impact 1500 Family of Band Printers and, our most recent addition, the 8370 Single Spindle Disk Drive providing 571 MBytes with dual actuators and a 1.86 MByte data transfer rate. An average access time of 20 milliseconds, dual port, string switch and media interchange switch are among the many features maximizing usage, flexibility and performance.

For the large system

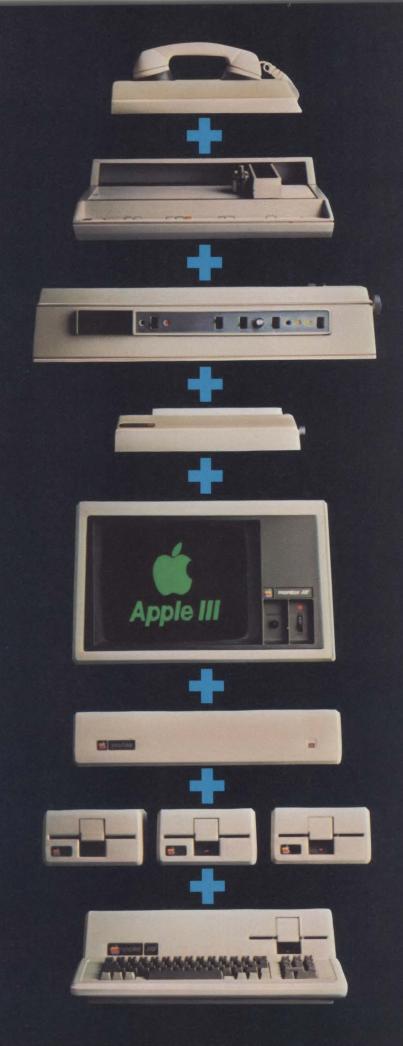
Large system, high-performance tape products are the basis for Storage Technology's quality reputation. The 3400/3600 Series Tape Subsystems transfer data at speeds ranging up to 200 inches per second in NRZI/PE or PE/GCR recording densities.

The Model 8650 Dual Spindle Disk Drive, at 1.2 Gigabytes, introduced a new dual port feature which dramatically reduces data lock-out due to string contention. The 8880 Disk Control Unit allows up to eight channel access with each of two storage directors attached to four independent channels. In addition to a 3 MByte data streaming transfer rate, the 8880 features the flexibility of command chaining and a channel speed matching buffer.

The Documation Impact 3000 Band Printer offers field upgradeable print speeds ranging from 1800 to 3000 lines per minute. Optional features include a 160 print position capability.

For more detailed information about Storage Technology's OEM products, contact Storage Technology Peripherals Corporation, P.O. Box 399 M.D. 3N, Louisville, CO 80027 or call (303) 673-4066. Telex 45690. In Europe, contact Storage Technology Ltd., 2 Rubastic Road, Southall, Middlesex, UB2 5LL, England. Telephone 571-0062.





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The Apple III was designed with an array of built-in connectors and interfaces that leave you room to grow, even when you upgrade to maximum RAM.

Take a bottoms-up tour of the opposite page, and consider the possibilities.

The Apple III Itself. Its standard 128K RAM is twice what some of the most powerful PC's offer as standard. Upgrade to a maximum 256K RAM, and you've still got four unused expansion slots.

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Our new ProFile.™ Mass storage made personal with a very quick, very quiet 5-Mb hard disk. Ideal for software development or data base applications.

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Silentype™ Personal Printer. Very affordable, virtually noiseless, and perfect for rough copy, B&W graphics and quiet offices.

Letter Quality Printer. For professional caliber word processing with Apple Writer III software. The Apple III can drive virtually any printer in any task, from preparing reports to printing forms.

Color Plotter. To make the colorful most of the Apple III's high res graphics in charts, graphs and designs.

Phone Modem. Which, with Access III asynchronous communications software, lets you communicate with other PC's or with mainframes at up to 9600 bps.

Only the Apple III can handle all of the above, all at once, without losing its memory. And even though you may never configure your system just like this, it's important to know how far you can grow. With a couple of OEM Prototyping Cards. Or your own specialized peripherals. Or future technology.

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You'll find that, even with 256K, most of them just can't stack up.

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Call 800-538-9696 (in California, call 800-662-9238) for the authorized Apple dealer nearest you, or for information on our National Accounts Program.

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IBM's 72K-bit bipolar memory chip.

which stores as much as 72K bits, uses high-speed transistor technology, but does not sacrifice high density. Data-access time is 50 nsec., compared with 600 nsec. for a 72K-bit field-effect transistor chip. Called a 72K-bit bipolar dynamic RAM, the 6.13- \times 6.33-mm, product stores information in a twotransistor cell rather than the one-transistor cell used for FET technology. The chip is divided into 10 sections, each having about 8000 memory cells. Nine sections are used, and one is redundant to improve manufacturing yields. Bipolar transistors must be electrically isolated from each other to function faster than FETS, but IBM claims to use new processing techniques that allow bipolar transistors to be squeezed together almost as closely as FETs. Both the 288K- and 72K-bit memory chips were developed at IBM's Burlington, Vt., facility.

The third IBM device detailed is a custom bipolar logic chip with more than 4000 high-performance logic circuits and enough ROM to store 13K bits. As an experiment, a processor function was customized with logic organization built directly into the physical design, achieving a level of customization previously found only in FET technology, IBM claims. Each custom chip has the memory addressing function of a small computer and about as many logic circuits as an IBM 360/model 30



H-P's 32-bit processing system.

mainframe. Programmable logic arrays and the ROM control data flow. The ROM has a 23-nsec. access time and 300-mw power dissipation over an area of 6.82 sq. mm. The chip was a joint project at IBM facilities in Kingston, N.Y., and East Fishkill, N.Y..

Other IBM papers on high-density semiconductor technology revealed:

- A systematic approach to understanding factors limiting memory-chip manufacturing yields. That approach has aided in mass-producing IBM's 64K- and 72K-bit memory chips.
- A mathematical model to predict manufacturing yields of chips with capacities of as much as 256K bits.
- An approach to automating design of high-density programmable logic array circuits that allows faster circuit layout preparation by designers.

H-P discussed a 32-bit processing system based on the 32-bit μp chip the company introduced last year at



IBM's 288K-bit memory chip.

ISSCC. The system consists of six chips—the 32-bit processor, a memory controller, RAM, ROM, an I/O processor and a clock generator. Each chip is implemented in 1-micron NMOS-111 technology, and is said to have three to eight times the circuit density of commercially available processors.

The memory subsystem consists of one card with the memory controller, the clock, 640K ROMS or 128K RAMS. The processor chip, which measures about ¼ sq. in., has a 55-nsec. micro-cycle time. It contains 450,000 transistors with 9.2K of 38-bit words of control store ROM. The RAM has 660,000 devices. Both RAM and ROM have 165-nsec. access times and 110-nsec. cycle times. The chips are bonded to a copper core substrate for higher performance connections and for cooling the memory subsystem.

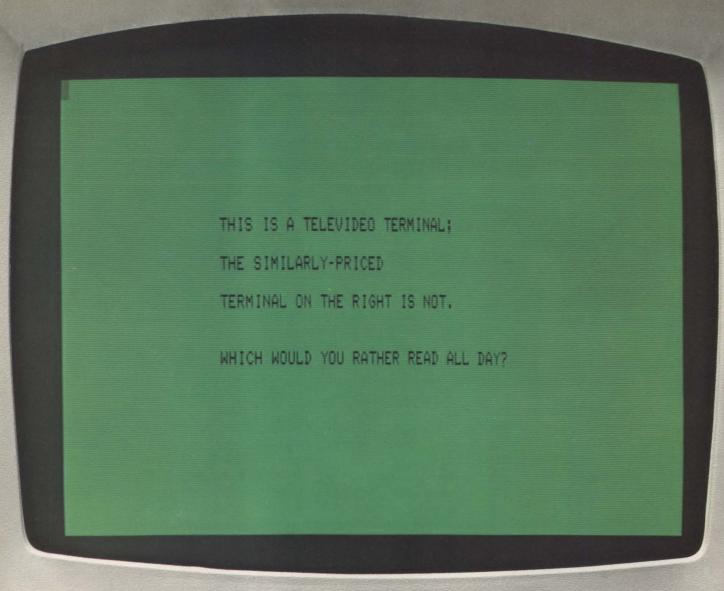
—Lori Valigra

Tandem stresses ergonomics in first in-house terminal

In what could be the first move toward developing its own in-house peripherals manufacturing capability, Tandem Computers Inc., Cupertino, Calif., unveiled an intelligent terminal designed to meet the stringent rules and regulations company officials feel may be

In what could be the first move imposed on hardware vendors in the ward developing its own in-house U.S. to promote operator safety and cripherals manufacturing capabilicomfort.

Designated the model 6530, the terminal is the first peripheral to be designed and built by Tandem, and will be produced at the company's newly established Austin, Texas,





Unretouched photos—identical conditions

Which would you

Our competitor on the right claims high resolution. But what about that glare? The washed-out background? And the black and white screen? It's enough to give you a headache.

The TeleVideo terminal on the other hand, with its finer character dot matrix, sharper background contrast, and a black-on-green non-glare Panasonic screen is much easier on the eyes.

Obviously.

Every TeleVideo terminal has just four basic modules. Each module is the best that can be made.

Every screen, keyboard switch, power supply and video module on every TeleVideo terminal is identical. For the same high reliability. And same ease of service.

None of our competitors can say that.

If you order 200 terminals today, we can ship them tomorrow. If you order 500, we can still ship them tomorrow.

And if you order a 1,000, well, maybe you'll have to wait a day or two.



The 910 PLUS

We put our terminals through five bad days so you'll never have even one bad day.

Our terminals are designed to withstand heat up to



rather read all day?

155°F and shocks that simulate being tossed in the back of a truck. And before any terminal reaches you, every major component goes through a five day series of thermal and power-on cycling tests.

The

The result?

The highest reliability rate in our industry.

TeleVideo sells 50% more terminals a month than our nearest competitor.

Three years ago, TeleVideo shipped its first terminal. Today, we're the number one



The

950

independent terminal supplier. One reason is because our advantages are clearly visible. 8 hours a day.

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All TeleVideo terminals can be serviced by your nearest GE Instrumentation and Communication Equipment Service Center.

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Mini-Micro World



First in-house peripheral from Tandem Computers, Inc., Cupertino, Calif., is designed to meet what company executives feel will be soon-to-come rules and regulations governing safety and comfort of operators of computer terminals. Called the 6530, it incorporates a tilting, pivoting monitor and a two-position elevated keyboard with palm rest among other ergonomic features.

facility. In announcing the hardware in conjunction with the company's recent annual meeting, however, Tandem executives downplayed future peripheral development plans. Instead, they focused on the issue of operator comfort and on the ergonomic features incorporated into the new device.

"Comfort is a key element in operator performance and productivity," explains Tandem president Jim Treybig. "Sitting in front of a terminal all day can be a problem, and if we don't take care of this problem, the unions will." Treybig says this is already the case in Europe, where Tandem hopes to move a lot of the new terminals by offering as many as seven keyboard languages, including U.S. and U.K. English, German/Austrian, French, Spanish and Swedish/Finnish. Language selection is handled through an integral extension to the terminal's configuration menu, and keyboards are available to match. This configuration menu can be accessed anytime by an operator, who can also change the form of the cursor and/or the volume of the bell and specify the column where it is to

MINIBITS

BOOK ABOUT DG COMPUTER WINS PULITZER

A sensitively written book about Data General Corp.'s MV/8000 superminicomputer development has brought its author and the company more attention that either probably expected: a Pulitzer Prize for general nonfiction. Tracy Kidder's *The Soul of a New Machine*, released last fall, soared in sales, reportedly selling more than 100,000 hardcover copies. Excerpts appeared in *The Atlantic Monthly* and *Reader's Digest* magazines, and the book was reviewed in trade and consumer press alike. The book chronicles the development of DG's 32-bitter and details the lives of the engineers dedicated to developing the computer (MMS, August, 1981, p. 85). It is perhaps the most popular account of the secrets of the computer industry. Movie rights are under discussion.

NEW JAPANESE PRODUCTS AT NCC

Nissei Sangyo America, Ltd., Wellesley, Mass., the U.S. OEM sales organization for Japanese manufacturers, will unveil a 16-bit μc and more than a dozen peripherals at next month's National Computer Conference in Houston. The kds-7860 μc has been available in Japan but is new to the U.S. market. Based on Intel's 8086 CPU, the μc has various memory, storage, interface and display options, including color graphics and voice synthesis. The system, aimed at the small-business market, accepts Multibus-compatible peripherals and runs CP/M and Ms-dos operating systems. The price has not been announced but is expected to be around \$1700 in OEM quantities.

COMPUTER FAIRE IN EVOLUTION, DRAWS THOUSANDS

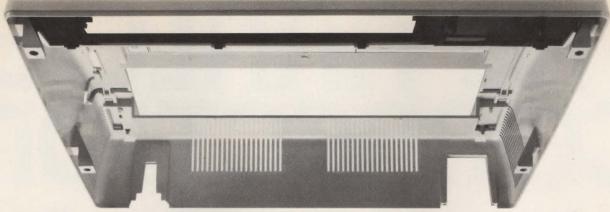
While still primarily a software-oriented get-together of μc enthusiasts and users, the recent West Coast Computer Faire in San Francisco is rapidly turning into a hardware-oriented show attracting system vendors and integrators alike. The changing nature of the show, which reportedly drew 40,000 attendees over three days, was demonstrated on the exhibit floor. Side by side with user groups, open-box component vendors and small software and memory-board operations were an increasing number of peripheral and software vendors whose products were clearly targeted at sophisticated end users and OEMs using personal computers. Also in attendance was CompuPro, Inc., which announced a high-speed operating system based on a proprietary implementation of MP/M-86 that allows simultaneous running of 8- and 16-bit programs. Durango Systems also chose the Faire to unveil full-scale, desk-top, 51/4-in. Winchester-based systems aimed at vertical applications in the insurance and wholesaling industries.

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Demand for electronics executives in the fourth quarter of 1981 remained at 13 percent of total national executive demand, the same percentage as during the third quarter of 1981, according to executive-search firm Korn/Ferry International's 40th National Index of Executive Vacancies. However, there was only a 2 percent increase in demand for the year 1981 over 1980.

"The increase in demand for executives in the electronics industries is particularly noticeable in the Eastern region, where demand rose from 14 percent to 16 percent in the last quarter," says Mark L. Tomchin, managing vice president of Korn/Ferry's High Technology Division. "There is an overall demand for marketing executives and for executives in technology-related disciplines for office automation and for CAD/CAM.

Nationally, senior executive hiring fell 11 percent, the first annual decline in the 10-year history of the index. Moreover, executive salaries gained only 7 to 9 percent, the smallest growth in the past five years.



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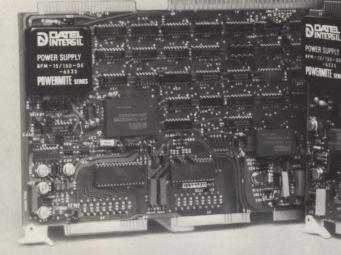
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Mini-Micro World

ring, set the volume of the key click (or turn it off) or set a dotted line between the last and next-to-thelast lines on the display.

Other ergonomic features incorporated into the terminal, Treybig adds, are non-glare finishes and low-contrast colors to ease operator eyestrain, a pivoting monitor with an adjustable tilt angle and swivel to compensate for background glare and for differing operator heights and a detachable keyboard with palm rest and two-position adjustable tilt angle.

To ease operator fatigue caused by eyestrain, the 6530 features a 15-in. non-glare monitor screen with green-phosphor characters displayed on a dark backdrop for enhanced contrast. The screen uses a 60-Hz refresh frequency independent of the power-input frequency to produce a non-flickering display. The new Tandem terminal also features a front-mounted brightness control that allows the operator to compensate for different lighting conditions.

Tandem's hardware is also designed to fit into the company's minicomputer-based transaction-processing systems. "Data integrity is extremely important to us," says Tandem marketing vice president Dave Mackie. "What Tandem has done in its NonStop systems will be incorporated into the new terminal." In this regard, Tandem executives stress that the 6530 is one of the few terminals to incorporate parity checking on its on-board memory bank, although the terminal is not completely redundant. Also subject to parity checks on the 6530 are data buses and communications lines.

The device operates in both multi-point and point-to-point networks and transmits and receives data in conversational or block modes at speeds ranging from 50 bits per sec. to 19.2K bps using synchronous or asynchronous proto-

cols. The terminal offers blinking, reverse-video and underscoring capabilities, and incorporates 16 programmable function keys. It is supported by Tandem software including the company's EXPAND network monitor and its PATHWAY transaction-processing system. Due this year are X.25 block-mode

support and a printer option that will allow the terminal to interface to Tandem's 5508 or 5520 dot-matrix printers, which are supplied by an outside vendor. The 6530 is priced at \$3200 in single-unit orders, and will be available in production quantities this quarter.

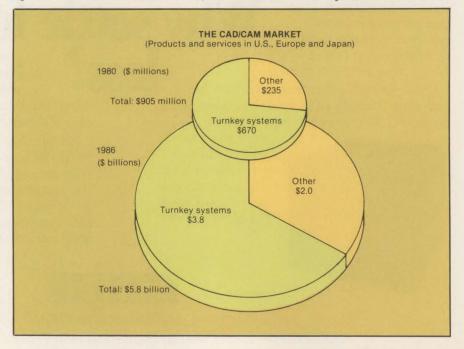
-John Trifari

Turnkey share of CAD/CAM will decline by 1985

Over the next three years, turnkey systems will continue to dominate the CAD/CAM market as it grows at a 43-percent annual compound growth rate. But the market share for turnkey systems will decline from 75 percent to 64 percent as users begin to view graphics hardware as a commodity item and turn to in-house or third-party sources to satisfy increasingly specialized software needs. That was the assessment of Peter Cunningham, president of Palo Alto, Calif., consulting firm Input, in a speech given at Spectrum of Solutions '82, a

conference sponsored by Prime Computer, Inc., and third-party vendors for potential customers of those vendors.

"There is a tremendous opportunity for independent, specialized software vendors in CAD/CAM," Cunningham said. The electronics area of CAD particularly depends on software, he said, and he noted the success of Japanese companies in designing large, complicated ICs. "To develop the kind of chips the Japanese have, they must have very sophisticated CAD software. We can look for them to market their in-house CAD systems within the





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(Char. per Sec.)	12	180	180	_	-	120
	12.5	_	-	150	150	_
	13.3	200	200	-	-	_
	15	_	_	180	180	150
	16.4	_	_	200	200	164
Enhanced	10	_	-	_	-	100
Expanded Print (Double Width)	Yes	Yes	Yes	Yes	Yes	
Dot Addressable Graphics (Dot/In	60/72	60/72	75/72	75/72	72/72	
Max. Line Width	(In.)	8.0	13.2	8.0	13.2	13.2
Audible Alarm		Opt.	Opt.	Opt.	Opt.	Yes
Out-of-Paper Ser	Yes	Yes	Yes	Yes	Yes	
Ribbon, Continu Loop Cartridge (30	30	30	30	30	
Interfacing: Parallel Cent. Co RS-232-C Serial	mp.	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes

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next year." Input is under a nondisclosure agreement with the Japanese companies in question, and Cunningham would not disclose further details.

On the hardware side, Cunningham said he foresees a need for increased compatibility between CAD/CAM systems, as major manufacturers find the technology changing the way they work. He noted that auto manufacturers are trying to force potential vendors of automobile components to submit electronic CAD bids instead of normal written bids, telling potential vendors that "unless you have a ours, we won't consider you a viable network. subcontractor."

a fully developed upward migration path as another hardware problem. "In our survey of users, we found that more than half our respondents were dissatisfied with response time," Cunningham said. He blamed the complaint on the lack of a clear upgrade path for most users, whose only option is to add terminals until they overload their system. The solution of adding machines raises the problem of maintaining a uniform dynamic database while it is continually being updated by users on several remote systems. Cunningham said many vendors have ignored this problem.

Prime has made significant progress with the remote-database problem, Cunningham says, citing Ford Motor Co.'s Primenet network of 35 Prime computers as an example. That network allows interactive CAD/CAM activities between points as far-flung as Detroit, Mich., and Germany.

If companies such as Prime remove the stumbling blocks, Cunningham said, he predicts the CAD/CAM area will grow to \$6 billion by 1985 and \$20 billion by 1990 from \$1 billion in 1980.

-Kevin Strehlo

Corvus broadens Omninet with 'personal work station'

In the three years since it unveiled its first product—an 8-in. Winchester-disk system compatible with the Apple II personal computer -Corvus Systems, Inc., has become the dominant supplier of Winchesters that operate with single or multiple \(\mu cs.\) The San Jose, Calif., company is also making its mark in µc networking, with the shared-disk Constellation multiplexer and, more recently, the design system that interfaces with 1M-bit-per-sec. Omninet local-area

Now, no longer content to link Cunningham also cited the lack of just other vendors' personal computers in its networks, Corvus has announced a sophisticated "personal work station" designed to operate on Omninet or, secondarily, as a stand-alone unit.

> Based on an MC68000 up, the Corvus Concept features an innovative monitor design—the 120- × 56-character display rotates to serve in either a landscape (horizontal) or portrait (vertical) configuration.

> In its basic, network-node version, the Concept consists of the rotating black-and-white monitor, a detachable keyboard, the MC68000 processor, 256K to 512K bytes of memory (using 64K-byte RAM chips), an Omninet communications controller and four peripheral expansion slots. Corvus will market a 1M-byte floppy-disk unit for stand-alone applications, but the company will focus on network configurations, says Mark C. Hahn, vice president of R&D.

> "We don't want to be thought of as the 101st computer company," Hahn says. He believes Corvus is recognized as the top company in the µc networking field, so "It made sense for us to design the Concept primarily as a network node."

Hahn estimates there are about 15,000 installed network nodes on Corvus shared-disk and Omninet networks, and the firm's sales are increasing rapidly. After doing about \$10-million worth of business in fiscal 1981, the company expects to realize sales of \$30 million in fiscal 1982.

The growth outlook for Corvus continues bright for the next several years, says William H. Shattuck, a securities analyst with Montgomery Securities, a San Francisco-based institutional investment firm that was the manager in the offering of Corvus Systems' securities when the company went public in August, 1981.

A report co-authored by Shattuck and James R. Berdell, states that the combined growth of the Winchester-disk and the µc-networking markets should sustain Corvus's growth rate in the 60- to 80-percent range through 1985. "This implies Corvus could achieve sales between \$100 million and \$150 million by 1985," the report says.

Shattuck views the new work station as "a very optimistic sign for the company." "Corvus has historically been strong in networking capabilities," he says, "and this definitely extends their position in the office-networking marketplace by adding ther terminal and work-station capability. I look at it as an extremely important piece of the puzzle that's being filled in."

While Corvus gave much attention to the hardware elements of its work station, the company will rely most heavily on the Concept's software features. The 15-in. display, for example, provides bitmapped graphics to 560 × 720 pixels. Residing in 56K of the unit's memory, the bit-mapped graphics

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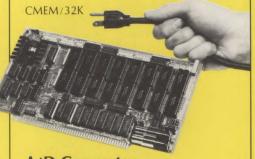
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MITSUBISHI SETS NEW STANDARDS FOR DISK DRIVES

It's harder today to specify the drive your system may need than it may have been only a year ago. Why?

So many manufacturers have marketed the "perfect" drive. More models and styles. But somewhere along the way something was lost. In many instances, the disk drive became just another mechanical assembly.

What makes a MITSUBISHI Disk Drive different? The operating efficiency, reliability, and cost-performance ratios are never taken for granted in a Mitsubishi Disk Drive, or any other high-technology product that carries with it the Mitsubishi tradition of quality and integrity. These are the standards OEM's have waited for.

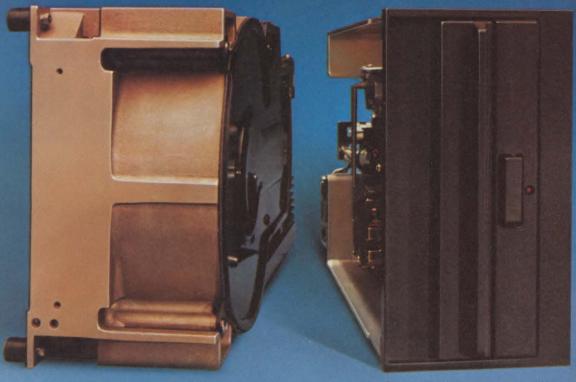
For example, the M2894 8" Double-sided, Double-density Flexible Disk Drive: filled with more than interface compatibility and interchangeability with a Shugart SA85OR. Or, Mitsubishi M2860 Series 8" Fixed Disk Drives with 21.73 or 50.71 MB capacity. Again interface compatible with SMD, Shugart and ANSI.

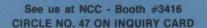
In each, Mitsubishi innovations abound. On the M2894, carefully engineered positioning of the stepper motor to prevent media damage or disk expansion, and SOFTOUCH,TM. a proprietary head-loading design that minimizes media wear. And, on the M2860 Winchester drive, high stability, anti-vibration design is inherent. A Mitsubishi LSI- microprocessor based system performs RAS functions equal to a 14-inch unit. Together, mechanics and electronics join for maximum operation reliability.

NEW 5%" MODELS

Now, ready for OEM consideration, are Mitsubishi's new 5¼" Mini-Flexible Drives. And, there are three new 5¼" Fixed Disk Drives from 3.3 to 10 Mbytes, too. How will these new Mini-Drives fit? Perfect interchangeability!

Call your nearest Mitsubishi Computer Peripherals Representative or write for complete specifications and technical manuals. Whatever the size of your application, let our standards join yours on the bottom line issue...Reliability.



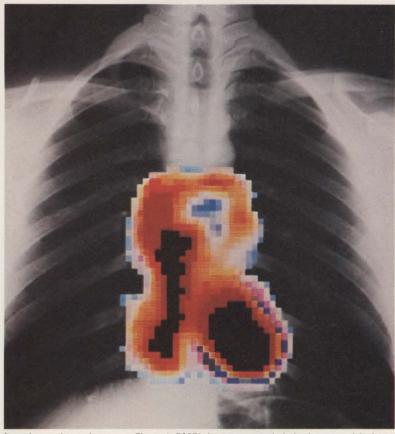




SA851 DRIVE HAS CAPTURED THE HEARTS OF MILLIONS.

And minds. And kidneys. And more. One of the largest manufacturers of nuclear medical computers is equipping its systems with Shugart SA851 double-sided floppy drives.

To help cardiologists reliably store



In nuclear medicine, doctors use Shugart's SA851 drive to store and playback images of the heart (shown here superimposed over x-ray). Photo courtesy of Technicare Corporation.

image data, patient annotation, and other crucial information used in heart analysis.

To help brain specialists accurately

analyze cerebral blood flow.

And to help doctors reap the advantages of putting comprehensive medical histories onto one diskette.

The SA851 offers you twice the capacity of single-sided drives.

And twice the performance. So you can increase throughput and speed up response, without pumping

up the size and cost of your system.

It also saves time and money by reducing the number of diskettes you need to handle.

Most importantly, every Shugart double-sided 8-inch floppy features

a Bi-Compliant™ head design. For complete diskette interchangeability between drives. And maximum life—a full 3.5 million passes on industry standard media.

The sum result: reliability.
And a high-speed, highcapacity drive able to tackle
the most critical applications.

In manufacturing, for example, Shugart doublesided drives help accurately guide laser trimming systems.

And the SA851 is perfect medicine for small business, as well as word processing environments.

There are already over 120,000 of them in the field (more than any other disk

drive company). With over 8,000 shipped every month. All backed by the largest engineering support team in the industry.

For more SA851 details, contact Shugart Associates, 475 Oakmead Parkway, Sunnyvale, CA 94086, (408) 733-0100 (Hamilton/Avnet, authorized distributor).

And start building healthier systems.

Right from the start.

Sales and service locations: Milpitas, CA; Costa Mesa, CA; Thousand Oaks, CA; Minneapolis, MN; Richardson, TX; Framingham, MA; Saddle Brook, NJ, Atlanta, GA, Toronto, Ontario, Paris, France; Munich, Germany.

One of the great masters?

Although the Datasouth DS180 matrix printer may not exactly rate as a work of art, our customers have a very high opinion of its value. Over the past year, we have shipped thousands of DS180 printers to customers throughout the world. Many of our sales now come in the form of repeat business—a strong testimonial to the acceptance of

The success of the DS180 in a very competitive market did not happen by accident; rather through our sensitivity to the needs of the industry. This sensitivity we carry through research and development, production and quality con-

trol and finally to after sales support and service.

Recently we introduced new enhancements to make the DS180 printer even more versatile. Dot addressable raster scan graphics produces output of computer generated charts, maps and graphs at a resolution of 75 x 72 dots per

inch. Variable horizontal pitch selection allows printing at 10.12 or 16.5 characters per inch plus double wide printing at 5, 6 or 8.25 characters per inch. The expanded 2K FIFO print buffer handles a full CRT screen dump at up to 9600 baud without delaying the host system. We also offer transparent mode for isolating communications problems, and for APL users, the dual ASCII APL character set option.

Checkourlist of features and we think you will agree that the DS180 offers the most complete performance package in matrix printers.



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CIRCLE NO. 49 ON INQUIRY CARD

Company	Corvus	Apple	Radio Shack	Fortune	Convergent	IBM
Product	Concept	Apple III	TRS-80 model 16	32:16	AWS	Personal Computer
Processor (bits)	32	8	32	32	16	16
Bus memory (bits)	16	8	16	16	8	8
Memory (maximum)	512K bytes	256K bytes	512K bytes	1M byte	512K bytes	256K bytes
Display (characters)	full page 120 × 56	half page 80×24	half page 80 × 24	half page 80 × 25	half page 80 × 28	half page 80 × 25
Graphics (points)	560 × 720 (included)	560 × 192 (included)	not available	480 × 640 (optional)	not available	included
Network	included	none	future	unknown	included	none
Winchester disk	6M, 11M or 20M bytes	5M bytes	8.4M bytes	5M, 10M or 20M bytes	5M bytes	none
Network work-station price (256K bytes)	\$5000-\$6000	not available	\$5000-\$6000	unknown	\$5000-\$6000	not available
Stand-alone price (256K bytes)	\$6000-\$7000	\$5000-\$6000	\$5000-\$6000	\$5000-\$6000 (without graphics)	\$7000-\$8000	\$5000-\$6000
Stand-alone with Winchester disk price	\$7000-\$8000	\$7000-\$8000	\$9000-\$10,000	unknown	\$9000-\$10,000	not available
Backup	video tape (\$2000)	floppy only	floppy only	streamer tape (not priced yet)	floppy only	floppy only

In the low-cost personal-computer/work-station market, the Corvus Concept measures up well against some established competitors. The Concept is designed to function primarily as a work-station node on Corvus's Omninet local-area network.

require no special circuitry, Hahn says, and the MC68000 "paints" the screen at about 25K bits per sec.

Corvus's first application package, Edword (Editor/Word), takes advantage of the monitor's vertical, full-page configuration. Edword supports multiple display windows and can run multiple active files simultaneously on the screen. Data are stored in a time-audit-trail sequence, and users can go backward and forward through the sequence using Undo/Redo features.

The native-code operating system

NEXT MONTH IN MMS

The June issue of Mini-Micro Systems will profile small business computers. The profile will include analyses of several new businesscomputer products and working descriptions of recently introduced business application packages.

Also scheduled in the feature section:

- Laboratory and industrial small-system applications.
- •How the new 16- and 32-bit architectures affect the small-system OEM.
- New developments in peripherals, memory and networks.

has a suspend/resume capability and permits subtasking, in which one program can stop, call another program, run it and then resume its own operation. The system supports ISO Pascal with UCSD extensions and full FORTRAN '77, and an 8080-chip emulator lets the system run programs written for operation under CP/M.

LogiCalc, a VisiCalc look-alike developed by Software Products International, can display a full, 13-column spread sheet on the horizontal monitor. The spread sheet has limited graphics capability, but Corvus is negotiating to obtain a sophisticated FORTRAN-based graphics package for use on the Concept.

With the Concept, Corvus is also releasing an updated version of its networking software called Constellation II. Supporting as many as 64 nodes on an Omninet network, the software protects and shares data as required, provides a spooled print service and network booting, allows different operating systems to coexist and permits point-to-point messaging.

Hahn says this messaging is not introductory period. true electronic mail because Corvus

does not yet have an integrated database manager that would allow full electronic-mail functionality. Admitting that the lack of such a database utility represents "a bit of a hole in our product line," Hahn says Corvus hopes to offer such a product by year-end.

Other future developments within the Concept/Omninet lines include probable support for Ada and UNIX, compatibility with broadband networks (Omninet operates over twisted-pair lines) and a new tap technology that may be similar to a simple phone-jack connection.

Corvus's primary market for the \$5000 to \$6000 Concept work station is through its network of about 500 U.S. dealers and 50 international distributors. "We will also have a secondary market of OEMs and systems houses," Hahn says, "following a route similar to that of Convergent Technologies." The operating system, Edword word-processing package and CP/M emulation package will initially be included in the system's base price, but the software may sell for \$1000 to \$1200 extra after an unspecified introductory period.

—Dwight B. Davis

Brown ships first 150- to 200-tpi, 5¹/₄-in. diskette

The announcement of the first 1.6M-byte, single-sided, 5½-in. floppy diskette by Brown Disc Manufacturing Inc., Colorado Springs, Colo., and the planned second-sourcing of that product by Dysan Corp., Santa Clara, Calif., may accelerate the release of the highest capacity 5½-in. floppy-disk drives yet to hit the market.

Called the UHR (ultra high-resolution) I, the Brown diskette is designed for 150- to 200-tpi, 10,000-bpi, applications (MMS, October, 1981, p. 9). It qualifies for use with Amlyn Corp.'s model 5850 and A506 high-capacity minifloppy-disk drives.

Although Amlyn is using only the single-sided, 1.6M-byte diskette, a double-sided version of the product is also available.

The UHR I is specified as 100-percent error free at 60-percent missing pulse level, 30-percent extra pulse level and 115-percent modulation level. The diskette has been tested to more than 162 hours of use with continuous read/write-head contact on a single track. Head wear has been tested at less than 25-percent signal reduction for 96 hours of wear revolutions on the outer track.

The UHR I is manufactured using a spin-coating technique, similar to that used for rigid-disk manufacture. Mountain View, Calif., analyst Jim Porter, publisher of Disk/Trend Report, says the process enables a thin, even dispersion of magnetic-oxide emulsion on the mylar disk substrate. Thus, the diskettes are of sufficient quality to handle high-resolution recording. Dysan's version is undergoing qualification testing by Amlyn.

"Although most drives shipped today are in the 48- to 96-tpi range,"

says Ben Brown, president of Brown Disc, "there is a shift under way by which we'll see higher capacity drives and their corresponding media predominate in the future."

Porter says, however, that the ultimate market for high-capacity drives, and the resultant market for 150- to 200-tpi diskettes, will depend on the success of second-sourcing arrangements for the new Amlyn drives and on whether Brown Disc and Dysan promote their media for use on drives from manufacturers such as Micropolis Corp.

At last year's National Computer Conference, Micropolis announced a drive able to accommodate 200-tpi diskettes, but has delayed releasing that product pending large-volume availability of high-density media.

R.J. Pretko, vice president of engineering at Brown Disc, says that other companies, including Qume, Digital Equipment Corp. and Shugart Associates, have such drives on the drawing boards.

Analyst Porter uses the chickenand-egg conundrum to explain the delays drive suppliers face in bringing high-density 5½-in. products to market. "Drive manufacturers have been waiting for some time for a media supplier to jump in and deliver high-density, 5½-in. diskettes in volume," he says. "On the other hand, diskette manufacturers have been waiting for someone to give them 10,000-piece orders before they deliver the product."

A relationship between Amlyn, Dysan and Brown Disc, however, helped solve that problem. Amlyn, a Dysan spin-off, had been working with Dysan in developing a 150- to 200-tpi, 51/4-in. diskette for use on Amlyn's high-capacity drives.

Dysan, meanwhile, had set up an R&D contract with the founders of Brown Disc to spur the development of the diskette and to ensure that, once developed, there would be a second source for the product.

"The arrangement allowed Amlyn to get off to a good start with its high-capacity drives and guaranteed the company a ready supply of media," says Porter.

However, Charlie Cort, a marketing vice president for Micropolis, says that, besides media availability, a major factor in Micropolis's decision to release its 2M-byte drive is media price. "We don't think it's a good idea to promote the shipment of drives that have to use a higher priced media," he says. "One of the primary reasons that a user chooses floppy-disk drives is that he can buy a whole lot of diskettes for about \$3 a piece. If he starts to have to pay \$5 or more per diskette, floppies become unattractive."

Cort says that Micropolis is working with Dysan to decide whether standard media rather than special certified media could be used on the high-capacity Micropolis drive. "We don't want to ship drives until standard media is available at a low price," he says. "If we couldn't find a standard media, we'd just consider our 2M-byte drive a non-product."

While the UHR I lists for \$10 in sample quantities, volume discounts are available. Dysan has not announced the price of its diskette. "When a user looks at the price of our diskettes, he should look at our cost per megabyte," says Brown's Pretko. "A user could pay as much as \$20 for a megabyte of storage using standard-capacity diskettes, but would pay only about \$5 to \$6 for a megabyte of storage with our diskette."

-Frank Catalano

Fact: The best 96 TPI 5¼" floppy is now better than ever.

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It's a recognized fact that Micropolis is the undisputed leader when it comes to 96 Track-Per-Inch 5¼" floppy disk drives. We've delivered over 300,000 — more than all the others combined. And our drives are used by most media manufacturers as reference standards.

We designed our drives for double track density from the beginning, using a multiple step, silent stainless-steel leadscrew for highest positioning accuracy, a temperature compensated loop, and a superior diskette clamping mechanism.

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Our new 1115, second generation 0.5 (single head) and 1Mbyte (double head) floppies have a unique "chassis within a chassis" for unparalleled electrical shielding and reduced mounting stress. We've added a jewel follower to our positioning leadscrew for less friction and wear, and have reduced track-totrack access time to a solid 6 ms. The motor tach is no longer necessary since speed control is taken directly from the spindle pulley. This eliminates the need for an electrical adjustment as well as variations over time from belt and pulley wear.



Another plus—our drive is microprocessor controlled, so there are no electrical adjustments, time drifts or pot settings, and field replacement of the PC board is a snap.

All this means longer life, greater environmental tolerances, higher reliability, faster throughput, less service, and easier upgrading, adding up to one conclusion: With Micropolis you can step up to 96 TPI with confidence.

Twice the Capacity at Less Than 30% More Cost

You can step up from 48 TPI to a solidly engineered Micropolis 96 TPI drive with no packaging or chassis modifications, and minimal hardware and software changes, immediately getting a 100% increase in capacity for less than 30% more cost. And it's easy to do with our new 1115 floppy which has industry standard mounting holes and bezel.

Also, you save valuable space. 1Mbyte in our 5¼" floppy compared to 0.5Mbyte or less in 48 TPI drives.

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Another reason why you can step up to 96 TPI with confidence is Micropolis' ability to deliver field proven double track density 5¼" floppies in very large quantities. Our new 60,000 square foot plant is dedicated exclusively to the production of these drives. We are well on our way to delivering 2,000 each day.

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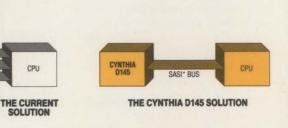
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* SASI** is a trademark of Shugart Associates



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CIRCLE NO. 31 ON INQUIRY CARD

Calendar

MAY

- 19-21 Computer Hong Kong '82, Hong Kong, sponsored by Kallman Associates. Contact: Virginia M. Jensen, Kallman Associates, 5 Maple Court, Ridgewood, N.J. 07450, (201) 652-7070.
- 25-26 Local Area Networks Conference, New York, sponsored by Frost & Sullivan, Inc. Contact: Carol Sapchin, Account Representative, Frost & Sullivan, Inc., 106 Fulton St., New York, N.Y. 10038, (212) 233-1080.
- Trends and Applications 1982, Gaithersburg, Md., sponsored by the IEEE Computer Society, the National Bureau of Standards and the IEEE Washington Section. Contact: IEEE Computer Society, P.O. Box 639, Silver Spring, Md. 20901, (301) 589-3386.

JUNE

- 1-2 Beyond the Advanced Workstation Seminar, New York, sponsored by The Yankee Group. Contact: The Yankee Group, P.O. Box 43, Harvard Square, Cambridge, Mass. 02138, (617) 542-0100. Also to be held June 15-16. Palo Alto, Calif.
- 6-9 The 1982 Canadian Data Processing Education Conference, Toronto, Ontario, Canada, sponsored by the Canadian Community of Computer Educators-Toronto Region. Contact: Tricia Hiley, President, CCCE-Toronto Region, Publicity Chairman, 1982 Canadian Data Processing Education Conference, 392 Kingswood Rd., Toronto, Ontario, Canada, M4E 3P1, (416) 965-2965.
- 7-10 1982 National Computer Conference, Houston, sponsored by the American Federation of Information Processing Societies, Inc. Contact: Deborah Kalbfleish, AFIPS, Inc., 1815 N. Lynn St., Arlington, Va. 22209, (703) 558-3617.
- 13-17 Pattern Recognition and Image Processing 1982, Las Vegas, sponsored by the IEEE Computer Society. Contact: IEEE Computer Society, P.O. Box 639, Silver Spring, Md. 20901, (301) 589-3386.
- 13-17 Third Annual Conference and Exposition of the National Computer Graphics Association, Anaheim, Calif., sponsored by the NCGA. Contact: NCGA, 2033 M St., N.W., Suite 330, Washington, D.C. 20036, (202) 466-5895.
- 14-16 19th Design Automation Conference, Las Vegas, sponsored by the Special Interest Group on Design Automation of the Association of Computing Machinery and the Design Automation Technical Committee of the Computer Society of the IEEE. Contact: Bryan Preas, VR Information Systems, 5818 Balcones Dr., Austin, Texas 78731, (512) 458-8131.
- 14-16 Data Entry Management Association Mini-Conference and Professional Growth Seminars, Minneapolis, Minn., sponsored by DEMA. Contact: Marilyn S. Bodek, Executive Director, DEMA, P.O. Box 3231, Stamford, Conn. 06905, (203) 322-1166.

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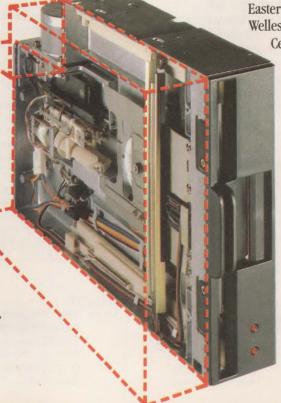
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- 14-18 EUROCON '82, Fifth European Conference on Electrotechnics, Copenhagen, Denmark, sponsored by the IEEE and the Convention of National Societies of Electrical Engineers of Western Europe (EUREL). Contact: Aase Sonne, Conference Office, DIEU, Danish Engineers Post Graduate Institute, The Technical University of Denmark, Building 298, DK-2800, Lyngby, Denmark, 45-(0)2 882300.
- 15-17 Audio-Visual America Show, Chicago, sponsored by The National Audio-Visual Association. Contact: Fred M. Wehrli, IF Associates, 3150 Spring St., Fairfax, Va. 22031, (703) 273-8272.
- 17 21st Annual Technical Symposium, Gaithersburg, Md., sponsored by the Association for Computing Machinery's Washington, D.C., Chapter and the Commerce Department's National Bureau of Standards. Contact: Stan Lichtenstein, U.S. Department of Commerce, National Bureau of Standards, Washington, D.C. 20234, (301) 921-3181.
- 17-19 Quality Control/Assurance Exposition and Conference, Singapore, organized by The Cahners Exposition Group. Contact: Industrial & Scientific Conference Management, Inc., 222 W. Adams St., Chicago, Ill. 60606, (312) 263-4866.
- 28-30 Videotex '82, New York, organized by Online Conferences Ltd. Contact: Videotex '82, c/o Meeting Systems, Inc., 286 Fifth Ave., New York, N.Y. 10001, (212) 563-1000.

JULY

- 18-22 "Communications and the Future" Conference, Washington, D.C., sponsored by the Fourth General Assembly of the World Future Society. Contact: Eric Seaborg, 1982 Assembly Committee, World Future Society, 4916 Saint Elmo Ave., Bethesda, Md. 20814-5089, (301) 656-8274.
- 19-21 1982 Summer Computer Simulation Conference, Denver, sponsored by the ISA and SCS. Contact: Marvin F. Anderson, General Director, SCSC, Department of Electrical & Computer Engineering, University of Colorado, 1100 Fourteenth St., Denver, Colo. 80202, (303) 629-2685.
- 26-30 SIGGRAPH '82-Ninth Annual Conference on Computer Graphics and Interactive Techniques, Boston, sponsored by the Association for Computer Machinery Special Interest Group on Computer Graphics. Contact: Dusty Rhodes, Conventures, Inc., 45 Newbury St., Boston, Mass. 02116, (617) 267-3456.

AUGUST

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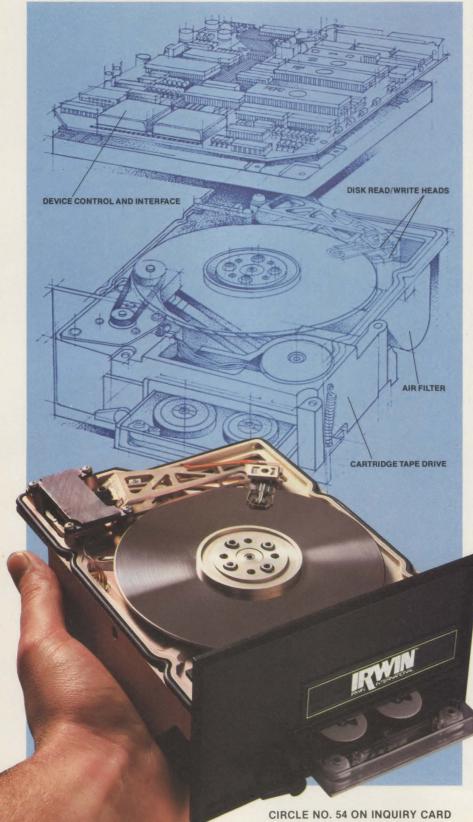
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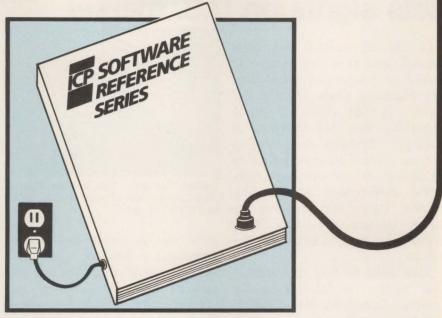
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CIRCLE NO. 55 ON INQUIRY CARD

Logical Machines's new president sets sights on U.S. market

In the 12 months that Stan Mantell has been in charge at small-business-systems maker Logical Machines Corp., Sunnyvale, Calif., he has come to admit something that not everyone is willing to. "Frankly, we screwed up in some places," he says, reflecting on the six-year-old company's lackluster performance in the U.S. market, noting that choosing the wrong dealers and channels of distribution were in large part the reason.

That could be fatal in a market that counts on its dealers for business. Logical builds machines in the \$8000 to \$35,000 price range aimed at first-time users in firms with fewer than 20 employees. Its competition includes International Business Machines Corp., Basic Four Corp. and Qantel Corp., among others, plus the regional systems house for these manufacturers.

Mantell, founder of Qantel, joined a company whose balance of sales strongly leaned toward Europe, the bent of Logical's founder, John Peers, an Englishman. More than 70 percent of last year's \$25 million in revenues came from overseas. Now, Mantell intends to shift that balance. And with resources earned from Logical's international business, he plans to push for a 50:50 U.S.-Europe balance.

Key to Logical's U.S. initiative will be to increase the size of its dealer network. Mantell hopes to double the number of dealers to 40 by year-end, adding a couple of new dealers each month.

A recent dealer profile is expected to bring excellent results. Besides a knowledge of the officesystems market, the company wants dealers whose annual reve-



Logical Machines Corp.'s Stan Mantell plans to focus more attention on U.S., rather than European, sales.

nues are at least \$2 million. Prospective dealers must also employ a staff that will sell and support Logical's hardware and software, after training by Logical. Dealers must also purchase demonstration systems from Logical.

Logical's interest in strong U.S. dealerships does not preclude OEM sales, though Mantell says such sales will be secondary to the dealer buildup. Andrea Skov-Gordon, Logical's director of product marketing, says OEM sales would be a cushion to the dealer program, but she plans to look at no more than half a dozen OEMs over the next year.

The company's product line consists of four systems: Adam, a single-user, hard-disk-based machine, and Logical's first product; David, an 8086-based, single-user, floppy-disk system; Tina, a bit-slice, single-user, floppy-disk system; and Goliath, a multi-user, shared-re-

source network machine built around an 8086 and a high-capacity rigid-disk drive. All the machines work as stand-alone systems or as part of a Goliath network. While the lineup seems to cover the field, Mantell feels there are some weak spots and says the company "is doing a little backfilling in the product line."

The first step in the process will be to phase out the Adam system, says marketing manager Skov-Gordon. The single-user machine will be replaced by a system that handles one to four users and can be upgraded for less than the price of either a Tina (\$15,000) or David (\$8000 to \$12000). The new system is expected to be introduced in June, she adds.

Overall, the company is trying to make its product line more cohesive, Skov-Gordon says. It will be at least another year.

Meanwhile, Mantell thinks Logical will grow between 33 and 35 percent a year in a market whose annual growth rate is somewhat slower—less than 25 percent. The company has been self-funding, he says, but as it grows, he expects to look for capital to help it along. A public stock offering could be one avenue for cash, he says.

-Larry Lettieri

Sorcim's Frank gears up for big year

In March, 1980, consultant Richard Frank took a look at the software available for μ cs and decided that it was all "real bad stuff." It seemed to Frank that people were paying \$1000 for a

package, and then shelling out that much more to get it to work. "It was cheaper for me to write that program than to debug what was bought," Frank says.

Three months later, he founded

Mini-Micro World

Sorcim, Inc., known for the popular Supercalc financial-planning package. Supercalc is to CP/M-based systems what Visicalc is to Apple computers. To Richard Frank, Supercalc is a gold mine. His company had \$8 million in revenues last year all from that one product. Several new products are planned for this year, and Frank think sales for the company could reach \$50 million by 1985. "If we aren't at \$50 million," he says, "we won't be here."

Like many μc software mavens, Frank's background lies in large mainframes. He worked with Seymour Cray in developing Control Data Corp.'s family of number crunchers. In 1976, after trying unsuccessfully to convince CDC officials that there was something to the μp , he left to form a consulting company.

Frank spent four years as a consultant on a variety of software projects. One thing he noticed was that everyone was asking for the same things: assemblers, debuggers and basic programming tools. It was then that he saw the gap he could fill.

After incorporating as Sorcim in June, 1980, Frank's first job was to develop a compiler for Chill, a language specified by CCITT, the international communications advisory committee. The Chill compiler was done for Siemens Corp. Using the revenues from this project, Frank continued to develop software for small systems.

The turning point came in late 1980. Frank was approched by friend and fellow computer guru, Adam Osborne, with a concept for a machine that would soon rock the industry. The Osborne 1 portable personal computer, introduced that year, has a full range of software, of which Sorcim supplies Supercalc.

What is different about Sorcim's arrangement with Adam Osborne is that Frank provides Supercalc in

return for equity in Osborne's company (MMS, May, 1981, p. 18). Frank expects a return on his investment in Osborne in about three years. Frank says, "We're betting on his company."

But Osborne's system showed Frank that a computer that addresses unsophisticated users could be built. Frank thinks the software industry is just now beginning to wake up to that fact.

To Frank, the ideal software package is one that lets a user think he wrote it. He believes Supercalc approaches that ideal.

IBM's personal computer looms large in Sorcim's future. Supercalc runs on the personal computer, and Frank plans to put all Sorcim packages on the machine.

Meanwhile, Frank is readying the company for what he expects to be a big year all around for μc software vendors. He's signed a deal with Hamilton/Avnet, the electronic



Richard Frank, founder, chairman and chief executive officer of Sorcim, Inc., thinks sales for the company could reach \$50 million by 1985, thanks to Supercalc, the popular financial-planning package.

component distributor, through which Hamilton/Avnet will distribute Supercalc and provide customer training and support.

Frank is also strengthening the firm's managerial staff. In February, he named Bob Robertson president. Robertson had been marketing vice president at Houston-based Hartwell's Office World, Inc.

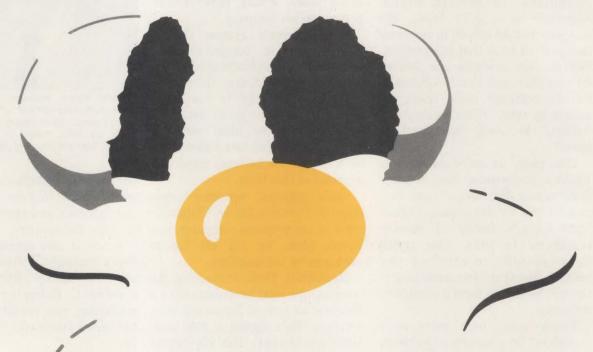
—Larry Lettieri

BOX SCORE OF EARNINGS

This table, which appears every month, lists the revenues, net earnings and earnings per share in the periods indicated for companies in the computer industry and computer-related industries.

Company	Period		Revenues	Earnings	EpS
Corvus Systems	26 weeks	11/28/81	11,238,000	907,000	.12
	26 weeks	11/29/80	2,686,000	102,000	.04
David Jamison Carlyle	3 mos	1/31/82	9,725,232	(13,122)	
	3 mos	1/31/81	6,367,111	297,969	.10
Data Terminal Systems	year	1/31/82	122,133,000	(10,726,000)	(1.89)
	year	1/31/81	118,342,000	(2,954,000)	(.58)
Hazeltine	year	12/31/81	145,514,000	1,865,000	.91
	year	12/31/80	133,799,000	4,840,000	2.37
Interaction Systems	3 mos	12/31/81	366,000	(114,000)	(.07)
	3 mos	12/31/80	226,000	(45,000)	(.04)
Management Assistance	3 mos	12/31/81	94,354,000	2,750,000	.33
	3 mos	12/31/80	77,472,000	3,049,000	.37
Micom Systems	9 mos	12/31/81	35,098,000	5,312,000	.82
	9 mos	12/31/80	22,147,000	2,591,000	.47
Mohawk Data Sciences	9 mos	1/31/82	241,006,000	11,375,000	.85
	9 mos	1/31/81	234,899,000	13,849,000	1.20
Network Systems	year	12/31/81	21,014,000	3,542,000	.36
	year	12/31/80	13,121,000	1,894,000	.35
Paradyne	year	12/31/81	135,413,000	17,508,000	1.36
	year	12/31/80	75,907,000	8,247,000	.74
Savin	9 mos	1/31/82	368,603,000	(10,527,000)	(1.80)
	9 mos	1/31/81	318,508,000	1,160,000	.07
Visual Technology	year	12/31/81	18,044,000	1,978,000	.63
	year	12/31/80	7,534,000	613,000	.23

Compared to Cynthia, most Cartridge Disk Drives are strictly for the Birds.



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While some people
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First there's our fully assembled and tested single-board modem, ready to plug into your system—like the one shown above. Then there's our set of three discrete modules, ready to be designed into your own modem. They allow you to separate transmit and

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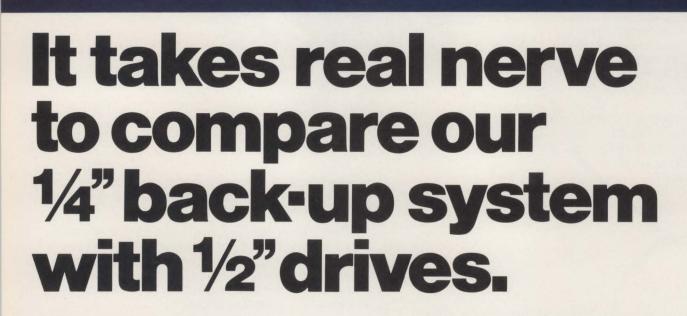
So don't leave your modems on the outside looking in. For information or applications help, call toll free: (800) 854-8099; in California, (800) 422-4230. Or write: Rockwell International, Electronic Devices Division, RC55, P.O. Box 3669, Anaheim, CA 92803.



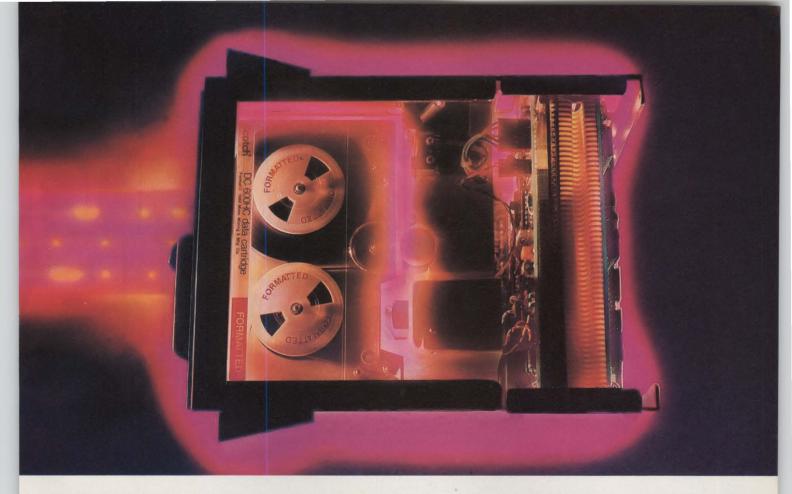
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CIRCLE NO. 57 ON INQUIRY CARD



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Cartridges interchange quickly and

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There's brain to this back-up, too. First, all its functions are handled through its controller. And second, there's minimal host involvement, so host time can be freed up for more critical functions.

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You can run one HCD-75 drive off the controller, or two, or three, or four. You still get all the reliability of the high-priced drives. The HCD-75 runs self-test routines to ensure proper operation. It gives you sophisticated error messages when faults are detected.

Advanced error-detection/correction routines keep working to deliver extremely low error rates. The micro-processor controls the drive functions; so potentiometer adjustments are a thing of the past.

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The whole shooting match—drive, controller, preformatted Scotch DC 600HC cartridges—is ready for immediate delivery. One at a time or in production quantities—you name it. (Also ask about 3M's proven family of 8" Winchester compact disk drives.) Haven't you waited long enough for a reasonable, reliable, truly high-capacity alternative to ½" drives?

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CIRCLE NO. 59 ON INQUIRY CARD

European recession slows computer shipments

The prolonged economic recession in Western Europe is slowing the growth rate of minicomputer shipments. Data General Corp. has been hit more seriously than most suppliers, having recorded European revenues in its 1981 fiscal year ended September 30 of \$167 million, only \$1 million higher than fiscal year 1980.

European public affairs manager, Gull-May Holst, cites the high value of the dollar versus European currency as one factor contributing to the company's poor 1981 performance. But she admits that sales in local currency revenues were also affected. "We had a flat year in France because of worries among customers about the effects of the Mitterand government's nationalization plans, such as directives to buy from the local minicomputer manufacturers, CII-Honeywell Bull and Société Européene de Mini-Imformatique et de Systémes.

Further, says Holst, "Our sales in West Germany slowed because of industrial stagnation, but we also suffered by being late in the 32-bit minicomputer market."

DG European marketing director Michael Acheson, agrees with Holst about the 32-bit market, and says that sales of the MV/8000 and the MV/6000, launched last September, are rising exponentially.

Digital Equipment Corp.'s European revenues had 38-percent growth rate to \$935 million in its 1981 fiscal year ended June 27. But European public affairs manager Rika Bradman says that the growth rate slipped to 28 percent in the first quarter and 27 percent in the second quarter of fiscal 1982. She predicts that DEC will grow by no more than compared with 30 percent in '81.

Hewlett-Packard Co.'s European competitor in free markets." computer business grew by roughly its 1981 fiscal year ended Oct. 31. The growth rate has slowed, but it is no worse that in the U.S., says Tom Cochran, European communications manager for H-P's computer marketing division at the company's Geneva, Switzerland, headquar-

tween the minicomputer markets in Michael Acheson points out that about 65 percent of the company's contracts with system integrators rather than from direct sales to large end users. DEC's Bradman says the overall customer mix in Europe is the same as in the U.S., with large end users, such as multinational companies, just as important as OEMs. H-P's Cochran says his company follows the same strategy in Europe as it does worldwide, deriving one-third of its revenues from OEM business. Sales are divided approximately 50:50 between commercial and scientific customers.

The three companies disagree on how serious the competition of SEMS and Siemens Corp. is in their home markets. SEMS is the leading native minicomputer manufacturer in France, and Siemens is the leading home-based mini builder in West Germany. Acheson sees both as substantial competitors on their home ground, where they enjoy "quasi government protection," despite the General Agreement on Trade and Tariffs. The agreement

outlaws preferential policies by governments, but, says Acheson, "Preference is difficult to prove." He feels the agreement has made no 25 percent worldwide in fiscal '82 difference. But he adds, "Neither SEMS nor Siemens is a major

Bradman says that Siemens is a 14 percent to around \$650 million in strong competitor in the West German technical, but not the commercial, market, while SEMS is strong only in the government sector. "Nobody has a chance there," she says.

Siemens officials deny that the company has preferential treatment for its minicomputer products in the Regarding the differences be- public sector and point out that the West German government has Western Europe and the U.S., DG's never had a policy of preference for domestically manufactured minis. Further, more than 90 percent of European sales come from OEM Siemens's minicomputer shipments are to companies in the private

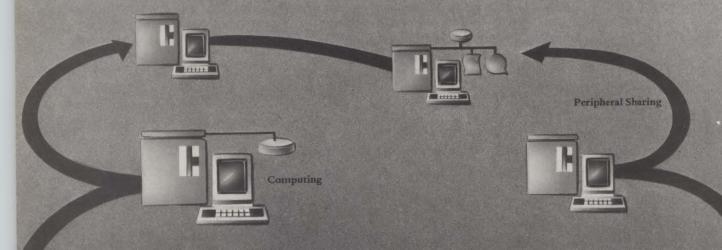
> Although France's SEMS is being nationalized, SEMS officials cite public statements by Prime Minister Pierre Mauroy to the effect that the government does not intend to give preference to nationalized companies.

> Bradman says DEC sees other U.S. minicomputer companies as its main competitors in Europe. International Business Machines Corp. is also a major competitor. Its 8100 distributed-processing system and low-priced 4300 series mainframe provide tough competition for DEC's VAX family.

> H-P's Cochran says that IBM and DEC are the company's main competitors in Europe. The IBM 4300 series competes strongly with H-P's 3000 family of commercial systems, while the DEC VAX line is serious competition for H-P's 1000 series of scientific machines.

> > -Keith Jones

Domain Processing



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Processing Alternatives

	BATCH	TIMESHARING	DOMAIN PROCESSING
Туре	Large mainframe (e.g. Cray)	32-bit supermini (e.g. VAX)	Networks of dedicated high performance computers (Only Apollo)
Typical Use	Very large computations	Interactive, real-time	Interactive and large- scale computations
Applications	Very heavy CPU-cycle applications	Multi-user, low to medium CPU cycle applications	Any number of users in heavy CPU-cycle graphics intensive applications
Typical Entry Cost	\$3,000,000 to \$8,000,000	\$150,000— \$300,000	\$35,000 - \$50,000
Incremental processor	\$3,000,000 to \$8,000,000	\$150,000— \$300,000	\$25,000 - \$50,000

TACKLES THE **BIGGEST JOBS**

Each user's Domain system node has a 32-bit processor, 16 Mbytes of virtual address space, and up to 3.5 Mbytes of high-speed physical memory. That means you can run very large, single-program applications such as NASTRAN, circuit design simulations, architectural/electrical construction applications and many others. Or, with Domain's interprocess communications, you can run multiple program applications. Or, you can configure an entire network for running in a distributed multiprocessing way.



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Domain Processing's high resolution, bit-mapped displays give you multiple windows into different, concurrent processes—as if you were working at your desk with sheets of paper. You can move these windows anywhere, make them any size, and overlay them in whole or in part. Domain System users typically have two or three processes active, although they can display up to fifteen. You also have a choice of a vertically oriented 15-inch display or a horizontally oriented 19-inch display, so you can work in the format that fits your application.

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In most multiuser systems, response time declines as the number of users increases. In Domain Processing, each user gets a consistently high level of performance dedicated to his job.

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With Domain Processing, you get the peripherals, options, and software you need to handle the most demanding applications.

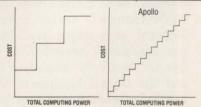
A performance enhancement option gives you cache memory and single and double precision floating point hardware. Disk storage includes 33 Mbyte and 66 Mbyte Winchesters and 300 Mbyte disk drives.

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to support Domain Processing's multi-level interaction. And a growing library of third party software can provide the support for your scientific, engineering, modeling, CAD/CAM, and decision support applications.

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Domain Processing reduces your initial system cost by allowing you to install only the computing power you need. Larger systems typically force you to buy expensive and wasteful excess capacity. A Domain Processing network is expanded in cost effective, manageable increments. With a large system, expansion usually means adding another expensive processor.

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Today's applications demand a different approach to computing. Apollo Computer is the only company to extend demand paging across a network, so you can get information anywhere in the network as fast as you could if it were stored locally.

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Domain Processing seminars are scheduled for Boston, New York, Washington, Philadelphia, Chicago, Detroit, Dallas, Houston, San Francisco, and Los Angeles. To find out what Domain Processing can do for you, or when the next seminar will take place in your area, write or call Ed Zander, director of marketing, at Apollo Computer Inc., 19 Alpha Road, Chelmsford, Massachusetts 01824 (617) 256-6600.

*Distributed Operating Multi Access Interactive Network



The Company That Invented Domain Processing

Wanted: U.S. agent to compress ASCII

Keele Codes Ltd. is seeking a U.S. agent for EAO, which compresses ASCII files in English to about 40 percent of their initial size, the company says. Keele Codes, based on the campus of Keele University, England, says E40 is available for µcs configured around Zilog Inc. Z80 and Motorola Corp. 6502 chips and for Digital Equipment Corp. PDP-11 processors running under RT-11.

Dr. Dennis Andrews, managing director of Keele Codes, says E40's U.S. end-user price will be approximately \$200. A version for μcs based on the Intel Corp. 8086 processor is under development. Each version is written in the

assembly language of the host processor. The Z80 version runs under the CP/M operating system, and Andrews says there will be "no problems preparing an MP/M version."

E40 is available in a module for compressing ASCII information and one for decoding compressed data. The decoding module, EKC, occupies 9K bytes and can, therefore, be stored on each disk holding compressed information, even on the smallest capacity disk, claims the vendor. Apart from halving disk-space usage, E40 also cuts in half transmission time to tape or to a communications line. Each compressed file includes a leader

specifying the size of the file when expanded, and the header can be displayed before expansion.

Keele Codes treats the datacompression method used by E40 as "a closely guarded secret," but reveals that it is based on "the statistical properties of English" and uses "the large redundancy in written language." The company quotes a benchmark compression speed with floppy-disk storage running under CP/M of 1 msec. per character, including disk I/O, and less than 0.4 msec. for CPU processing only. Figures for a Winchester-equipped machine are less than 0.6 and 0.5 msec., respectively.

Andrews says that the U.S. agent, when acquired, will coordinate the activities of local distributors when they are hired.

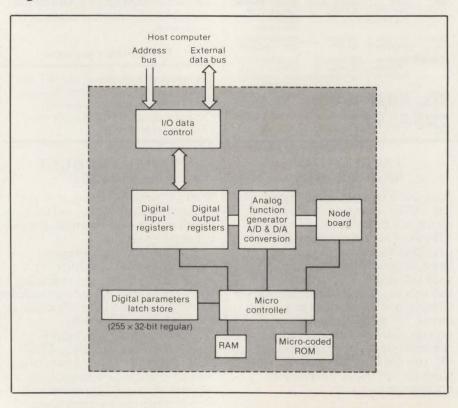
-Keith Jones

English firm says it has developed 10G-byte RAM

Curiosity has been aroused in Europe by a British company that has announced, but not demonstrated, what might be a new form of nonvolatile electronic RAM. The firm, Micro-Xeno Ltd., Birmingham, England, claims that its Charged Packet memory system stores almost 10G bytes of data in a physical space measuring $8 \times 6 \times 6$ in. while offering access times in the range of 200 to 300 nsec. Price will reportedly be \$20,000.

In its technical literature, Micro-Xeno explains that the Charged Packet memory system converts a digital data byte into an equivalent electrical analog charge. This charge is then paired with another electrical analog charge the size of which is determined by a unique numerical identification address generated by a digital counter. Thus provided with an "address," the

How the Micro-Xeno Charged Packed Memory is interfaced to its host computer. Charged packets are stored on the node board.



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CR New Line Mode	STD	NO
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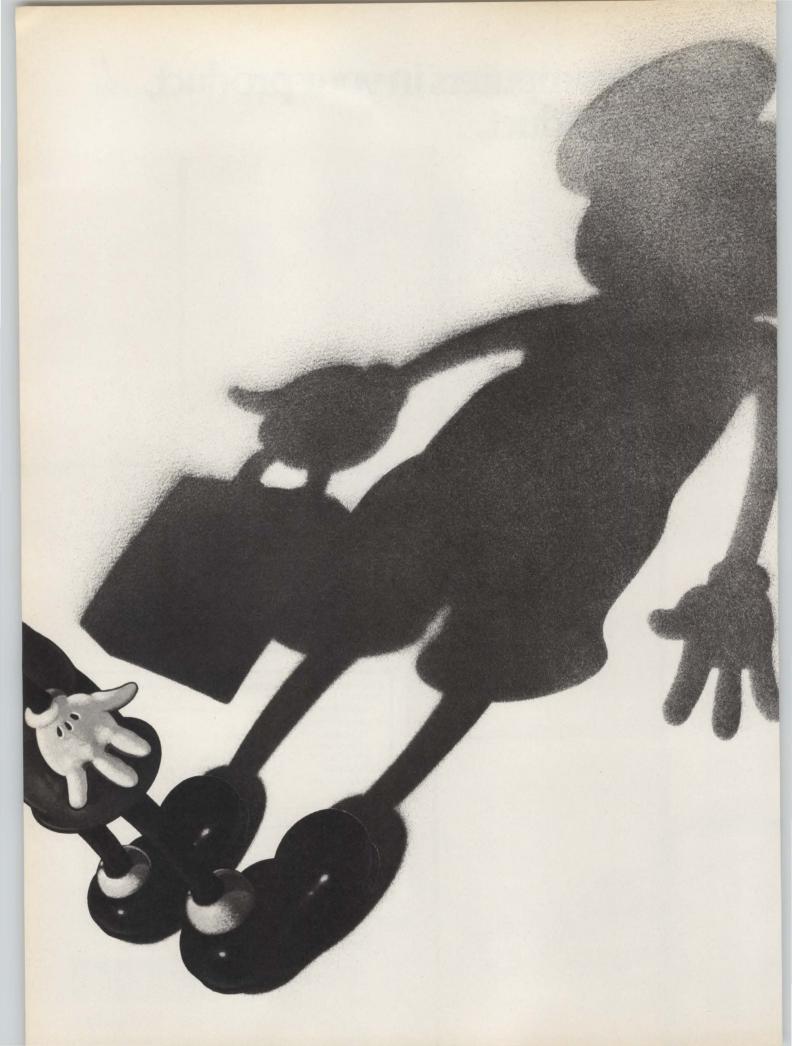
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electrical analog of the digital byte is added to (or "mapped" into) a packet of charges so that it can be accessed in the read operation. In reading, the unique charge value of each data byte is extracted and then analyzed back into the corresponding digital form.

Micro-Xeno notes that individual stored charges have no spacial existence as such. Instead, the magnitude of each charge denotes its address number. The storage unit for each charged packet is called a node and is stored on a system component called the node board.

Operation of the complete memory system is handled by a Micro Controller that executes ROM-based microcoded instructions. In addition to controlling the creation of charged packets, it handles several file and search techniques, according to Micro-Xeno. They include sequential, block, binary and indexed sequential. Random-access speeds are typically 200 to 300 nsec.

Bytes of information are input to and output from the memory via a bidirectional, tri-state buffered data bus. After the digital data have passed through the Micro Controller, the data go to an analog function generator that performs D/A and A/D conversion.

The data held in analog form in the nodes must be constantly recycled and refreshed, according to Micro-Xeno. But when the memory is switched off, the full parameters of the contents are stored digitally in a nonvolatile module called the latch store that has a capacity of 255 parameter registers, each 32 bits long. Micro-Xeno points out that when the memory system is switched on again, the nodes can be replenished within 25 msec. to the full 9.9G bytes, so the memory is effectively nonvolatile.

Micro-Xeno says it has designed its own computer to host the Charged Packet Memory. Called the MX99, the computer provides a 32-bit word length and a resident interpreter for APL. It runs under the EMEX/1 operating system that supports as many as 128 terminals with multiple protocols and Pascal, BASIC and FORTRAN high-level languages.

It is not known when or if the MX99 and Charged Packet memory will emerge as a viable commercial system. -Keith Jones

Europe lagging in electronic mail

Europe lags behind the U.S. in the adoption of electronic-mail systems, even though Europe is leading in the development of public-document transfer networks based on the Teletex standard.

Europe's lack of excitement about electronic mail could stem from a higher satisfaction with existing business communications facilities -voice and Telex-provided by Europe's state-owned common carriers. Also, because Europe has fewer time zones, phone users have fewer problems making direct contact. Moreover, European managers are less adept at using keyboards than their U.S. counterparts, mainly because many European colleges do not insist that essays be typed. In Britain, for example, only 5 percent of managers possess keyboarding skills compared with 50 percent in the U.S. In addition, electronic mail is slower taking off in Europe because companies are typically less advanced in office automation and have less money for new technolo-

These points were made by Dr. Gordon Ross, a senior consultant with the London-based software communications consultancy. Logica Ltd., at the Yankee Group's Electronic Mail Europe 1982 conference in London.

Hall), pointed to several other factors inhibiting the proliferation of electronic mail in Europe, including the lack of suitable reference sites and text-interchange standards.

Standards are what Teletex is all about. But the Yankee Group's European director, Al Dunn, stressed that Teletex is only a special form of electronic mail and lacks one of the key features of a full-blown electronic-mail systemmailbox facilities. Dunn disagreed with the description of Teletex as "superTelex," noting key differences. For example, Teletex remains undisturbed in local mode when it receives a message and cannot support an operator-to-operator dialog.

The use of electronic mail in Europe is encouraged mainly by companies offering U.S.-originated systems. At the conference a paper was presented on Missive, an electronic-mail system marketed in France but based on Comet from the Computer Corp. of America, Cambridge, Mass. Missive is sold by France Cable and Radio, a Frenchgovernment-owned organization. In Switzerland, another public-owned group, Radio Suisse, also sells a system based on Comet. In Britain, the product is marketed by BL Systems Ltd., part of the state-Ross, who is working on a owned car manufacturer BL Ltd. large-scale electronic-mail project The state-owned telecommunicaat the headquarters of the Greater tions common carrier, British London Council (London's City Telecom, markets the electronicmail system developed in the U.S. by Dialcom Inc. British Telecom is retaining an independent British company, Telecom Gold, to sell Dialcom as a service. According to

BT, about 200 mailboxes have been allocated to customers. They can be accessed from any Teletype-compatible terminal over BT's public telephone network. BL's Comet

systems are based on Digital Equipment Corp. PDP-11 machines, while the BT Dialcom service is hosted by powerful Prime Computer Inc., machines.

—Keith Jones

Western Europe moves ahead with Teletex

Western Europe is forging ahead of the U.S. in the establishment of public electronic-mail services complying with the Teletex standard recommendations of CCITT, the international consultative committee of telecommunications common carriers.

The state-owned common carriers, usually referred to as PTTs, in West Germany, Sweden and the U.K. will introduce Teletex services this year, and all of Western Europe should be covered by 1985. Teletex will gradually replace the old international Telex network, offering as much as 30 times the speed of Telex and a greatly extended character repertoire. While the Telex character set is restricted by 5-bit codes, Teletex will employ 8-bit coding typically used by word processors and computers.

Teletex terminals provide extensive text-editing and storage facilities as well as communications functions. European office-equipment suppliers, including Siemens AG, NV Philips and Olivetti SpA, have already introduced these

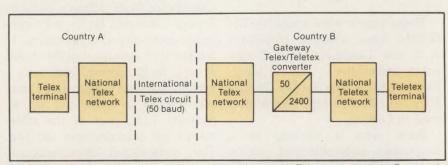
terminals, but the market is also open to word-processing suppliers. Word-processor manufacturers are enhancing their equipment with Teletex interfaces, and at least one major PTT, British Telecom, says it will introduce a black box for interfacing a standard word processor to the Teletex network.

Links between Teletex networks in European countries will initially be achieved via the international Telex network. Character-code conversion from 8- to 5-bit and speed reduction from Teletex's 2400 bits per sec. to Telex's 50 bps will be achieved at gateways between the networks. By mid-1983, Telex users in the U.S. will be able to communicate with Teletex terminals in Europe via these gateways. The gateways will provide storeand-forward facilities to prevent slowing of user terminals and will directly link national Teletex networks, so that users can enjoy all the speed advantages offered by the service.

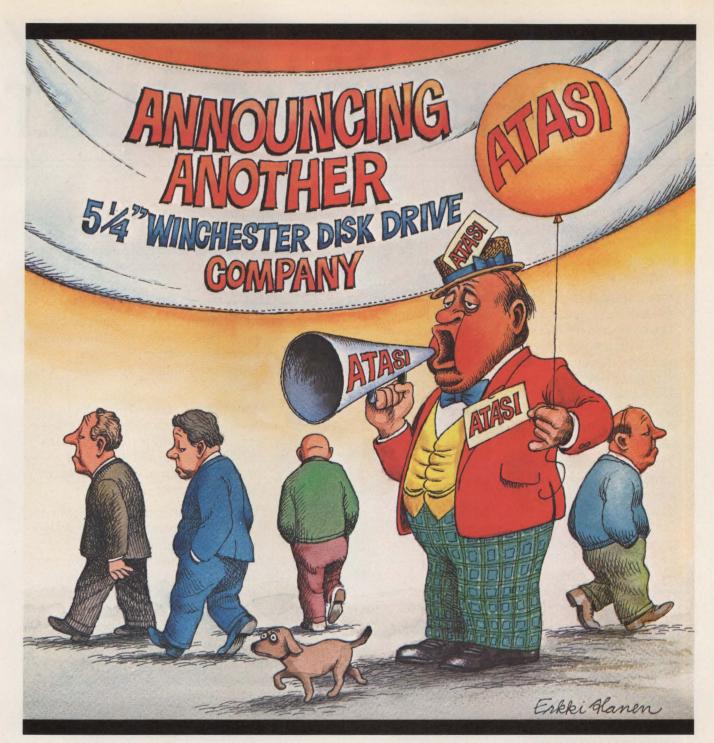
Deutsche Bundespost originated the Teletex concept and is leading the field in its adoption. It expects about 40,000 Teletex terminals to be linked to its national network as early as 1985, and, by 1990, approximately 130,000 Teletex units will be operating out of a total population of 1.2 million. West Germany's population of Telex machines is around 130,000 but is expected to decline to 100,000 by the end of this decade.

A commission set up by the West German government in 1974 to research new forms of telecommunications recommended the introduction of a "telecommunications typewriter service." In 1977, the CCITT began preparing an international standard for Teletex, and the basic recommendations were adopted at the CCITT Plenary Assembly in Geneva, Switzerland, in November, 1980. The recommendations cover the Teletex character set, including upper and lower case; applications protocols, which facilitate the presentation of text at the receiving terminal in a format and layout identical to that of the transmitting machine; and the transport protocols, which allow the PTT in each country to choose the type of network it will use to carry the service, without changing the applications protocols. The PTTs in Sweden and West Germany plan to use existing circuit-switched networks dedicated originally to data to also carry Teletex. British Telecom will use its public circuitswitched service and its packetswitched data network, Switchstream 1. Most other European PTTs will run Teletex on their packet-switched networks.

As to the costs of using Teletex,



Telex users in the U.S. will be able to communicate with Teletex terminals in Europe via gateways that provide store-and-forward facilities to prevent slowing of user terminals.



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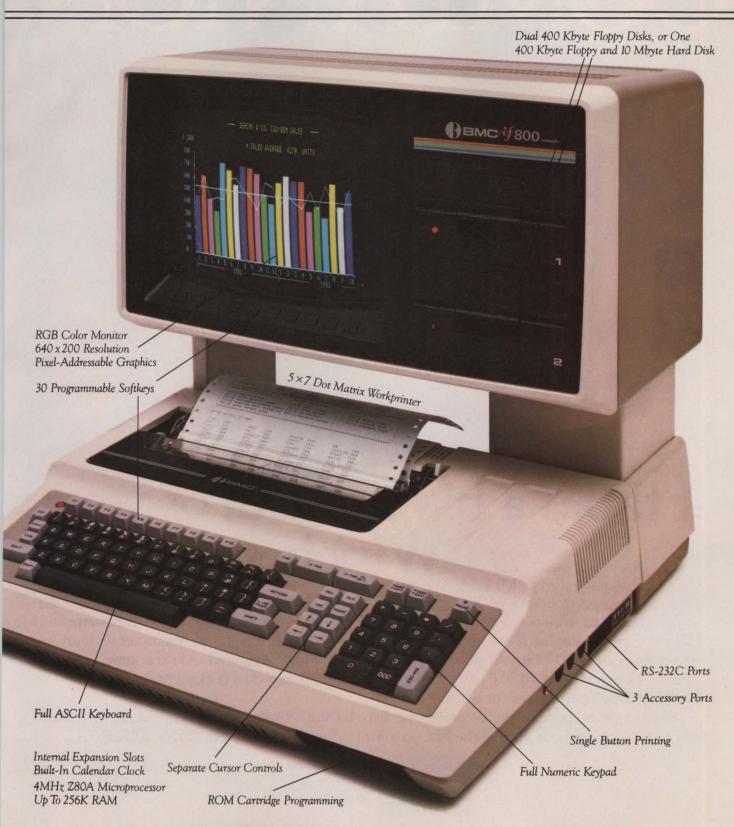
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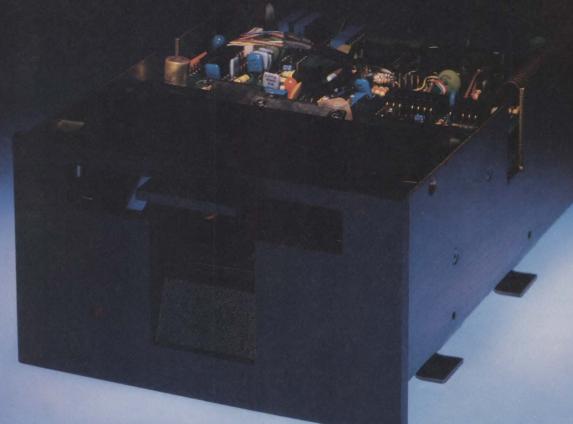
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Deutsche Bundespost charges about \$200 for installation, plus a charge of less than \$100 per month. Customers pay about 0.3¢ per sec. for connections as far as 50 km. and 0.6¢ for longer distances; night charges are one-half these rates. With Telex, a two-page letter consisting of 2000 characters takes 15 sec. to transmit and costs little more than 10¢ at daytime long-distance rates between Munich and Hamburg (about the same distance as between Boston and Washington, D.C.). Transmission of the same

letter by Telex takes 5 min. and costs about \$1.50, while sending it by Bundesposte's Telefax public facsimile-transmission service takes about 6 min. and costs around \$3.

The T4200 text terminal from Siemens will compete for a slice of the market for Teletex attachments in Europe. T4200 includes a 21-line × 80-character CRT screen, removable minifloppy disk storage with as much as 80,000 characters per disk, an automatic paper feeder and a daisy-wheel printer. Under development is a 200-character-per-sec.

ink-jet printer that operates silently and provides instant font selection.

British-based market-research consultancy Mackintosh International Group predicts that sales of Teletex network attachments in Europe will reach 100,000 units by 1987. But the U.S. market will be even larger, with 1987 sales of 150,000. Mackintosh consultant Dr. Ian Galbraith sees Japan as another major Teletex user, with sales of at least 50,000 units and as many as 100,000 in 1987.

-Keith Jones

Logica brings Rapport to U.S. market

Rapport, a portable relational database system that runs on machines ranging from 8-bit μ cs to mainframe computers is being introduced to the U.S. market by Logica, Inc., the U.S. subsidiary of the British software house Logica, Ltd.

Developed for a British government military-research establishment, Rapport was launched in Europe in 1979. It is widely used in scientific and technical applications. Its early appeal to technical users is that it is written in FORTRAN. Rapport product manager Robert Worden sees Boston as a target market for U.S. users because of the city's large number of technical firms. Logica has offices in Boston, San Francisco and New York. The New York facility is staffed with three Rapport specialists.

Worden says he would like to see the U.S. support team further strengthened before going "high profile" in the U.S. market, especially at the San Francisco office. Worden says that direct support for end users is vital.

In March, Rapport-3, an improved version of Rapport and new

Micro Rapport were introduced. Rapport-3, the version for minis, superminis and mainframes will sell for as much as \$50,000, depending on the host machine. Micro Rapport will sell for \$1600, plus \$800 for each additional copy. Any uc supporting CP/M and Microsoft's FORTRAN-80 compiler can host Micro Rapport. Potential host's include the Superbrain, the Zilog, Inc., MCZ and Quinox and Cromemco, Inc., machines. Worden does not yet know how Micro Rapport will be marketed in the U.S., but he rules out direct end-user selling by Logica.

Rapport-3 features an interactive query language for users. Commands for page numbering, headers and footers and the number and width of the lines per page are available for report generation and for formatting individual fields. Other commands control prompts by nontechnical users. Commands for controlling the logic of command sequences, including if, then and else, are also included.

Micro Rapport features a subset of the Rapport-3 query language with data-retrieval-only commands, and support for only one user at a



Rapport product manager Robert Worden says he would like to see Logica's support team further strengthened before going "high profile" in the U.S. market.

time. Each database can have as many as 16 logical files spread across several physical files, and any one file can be organized into as many as 30 fields. There can be 16,383 records in any file with as much as 256 bytes per records. As with Rapport-3, access is facilitated by index files of which there can be as many as 32 for one complete database on Micro Rapport.

The original full Rapport system has already sold enough copies to be included in the ICP list of million-dollar awards for 1982. It can run on Digital Equipment Corp.'s VAX and PDP-11 machines, Data General Corp. Nova and Eclipse systems, Prime Computer, Inc., 400, 550 and 750 computers and others.

-Keith Jones

Ireland tries to lure U.S. software houses

Authority is hoping to repeat its success in persuading U.S.-based computer hardware suppliers, including Apple Computer, Inc., Wang Laboratories, Inc., Digital Equipment Corp., and others, to establish manufacturing facilities for software development in Ireland.

The IDA is trying to attract service firms, and offers financial incentives of as much as \$10,000 for each job created and comparable training grants to U.S. software houses. Grants to cover buildings and machinery investments amount to at least 25 percent, as do assistance payments on rented premises. The Irish government also guarantees that until the year 2000, a tax rate no higher than 10 percent will be applied to corporate profits.

The U.S. companies can also make savings on payroll. The IDA esti-

Ireland's Industrial Development mates that salaries for computer professionals in Ireland are 30 percent lower than in other parts of Europe. A computer-science graduate receives a starting salary of less than \$10,000. An experienced programmer receives as little as \$12,000 a year, while \$20,000 is average for a system analyst.

But these financial incentives are only "the icing on the cake," says IDA Services project manager Jane Williams. She explains that the main attraction will be a plentiful supply of qualified graduates from Ireland's five universities and 10 technical colleges.

Williams says Ireland produces twice as many business graduates as it needs and points to a planned increase from 3200 to 4200 computer and electronics graduates between 1982 and 1985. Primary computerrelated courses will turn out more than 350 graduates in 1985 compared with 200 graduates this year.

Another potential source of personnel is the extensive computer installation base. International Business Machines Corp. and other mainframe suppliers are well established there, while DEC has minicomputer systems at more than 80 installations.

Williams admits, however, there is a shortage of computer personnel with more than five years' experience in Ireland. But she points out that there are many Irish expatriates in the U.S. with computing experience who could be persuaded to return and head the Irish operations of U.S. software houses.

Williams explains that the small group of overseas companies already in Ireland were attracted by a pilot program already in operation. The London-based firm Alterego is the largest software-development company and employs about 30 people in Dublin developing application software for users of DEC PDP-11 series minicomputers. David Joyce, managing director of Alterego Ireland, Ltd., points out, "We develop tailor-made commercialapplications software for turnkey customers in Britain and other parts of Europe. Ireland is a good place for this kind of work, provided there are no problems in working remotely from the customer."

Measurex Corp., a U.S.-based supplier of process-control systems, employs more than 20 people at a software-development center in County Cork. The center produces application software for Measurex systems in Europe configured around DEC LSI-11 and Hewlett-Packard Co. 21 MX machines.

Cincinnati-based Cincom Corp. will open a center in Dublin this year to develop portable systems software for minicomputers and mainframes. Director of finance Ernie Tabler says that the 10 percent maximum tax limit offered by the IDA was the most attractive incentive. -Keith Jones



Trinity College, Dublin, offers courses in advanced programming and system analysis. Ireland plans to increase its output of computer and electronics graduates from 3200 to 4200 between 1982 and 1985.



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MODEL	VOLTAGE/ CURRENT	PRICE (1-24)	MODEL		OUTPUT #1	OUTPUT #2	PRICE (1-24)	MODEL	OUTPUT #1	OUTPUT #2	OUTPUT #3	PRICE (1-24)
5 VOLTS HBS-3/OUP-A HCS-6/OUP-A HCS-6/OUP-A HDS-12/OUP-A HDS-12/OUP-A HES-18/OVP-A HEI2-17-A HCI2-3.4-A HCI2-3.4-A HCI2-6.8-A HEI2-10.2-A	5U @ 3A \$ 32.95 5U @ 6A \$ 54.95 5U @ 9A \$ 74.95 5U @ 12A \$ 49.55 5U @ 18A \$119.95 12V @ 1.7A \$ 32.95 12V @ 5.1A \$ 69.95 12V @ 6.8A \$ 79.95	\$ 54.95 \$ 74.95 \$ 84.95 \$119.95 \$ 32.95 \$ 49.95 \$ 69.95 \$ 79.95 \$ 109.95	HBB15-1.5-A 12V HCC15-3-A 12V HDD15-5-A 12 5 VOLTS PLUS 9 770 15 VOLTS HAA512-A 5V HBB512-A 5V		12V @ 1A OR 15V @ 0.8A 12V @ 1.7A OR 15V @ 1.5A 12V @ 3.4A OR 15V @ 3A 12 TO 15V @ 5A 5V @ 2A 5V @ 3A 5V @ 6A	-12V @ 1A OR -15V @ 0.8A OR -5V @ 0.4A -12V @ 1.7A OR -5V @ 0.7A -12V @ 3.4A OR -15V @ 3.4A (-) 12 TO 15V @ 5A 9 TO 15V @ 0.5A 9 TO 15V @ 1.25A 9 TO 15V @ 2.5A	\$ 54.95 \$ 87.95	HTAA-16W-A HBAA-40W-A HCAA-60W-A HCBB-75W-A CP131-A HDBB-105W-	5V @ 3A 5V @ 6A 5V @ 6A 5V @ 8A	9 TO 15V @ 0.4A 12V @ 1A OR 15V @ 0.8A 12 TO 15V @ 1A 12V @ 1.7A OR 15V @ 1.5A 12V @ 1.7A OR 15V @ 1.5A 12V @ 1.5A	(-)9 TO 15V @ 0.4A OR -5V @ 0.4A A OR -5V @ 0.4A A OR -12V @ 1.4 OR -15V @ 0.4A OR -5V @ 0.4A OR -5V @ 0.4A OR -12V @ 1.7A OR -15V @ 0.7A OR -5V @ 0.7A OR -5V @ 0.7A OR -15V @ 1.7A OR -15V @ 1.7A OR -15V @ 1.7A OR -15V @ 1.7A OR -15V @ 0.7A OR -5V @ 0.7A	\$ 54.95 \$ 75.95 \$ 89.95 \$ 99.95 \$119.95 \$134.95
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Mini-Micro World

NCC will focus on advancing professionalism

The advance registration brochure for the 1982 National Computer Conference, June 7 to 10 in the Houston Astrodome, unfolds to a 22-× 33-in, sheet. On the reverse side of the sheet is a silver-bordered poster entitled "Advancing Professionalism," a striking abstract design prepared on an imageprocessing system at the University of Southern California Institute for Physics and Imaging Science. The design, in pastel shades of green, blue and red, suggests the sudden rush of escaping energy in the aftermath of some cataclysmic event such as a volcano or an eruption on the sun's surface. The brochure explains that the design is intended to "create the force and excitement of this year's program theme."

The burst of energy has long been an excellent metaphor for the computer field as a whole, with its dramatic rate of growth, its mind-boggling technological breakthroughs coming, it seems, almost every day, and the encapsulation of ever-increasing computing power in ever-shrinking packages. Each year, the NCC absorbs some of this energy, stores it and releases it over the four-day period in arresting exhibits and thoughtful technical sessions.

Thus, it should surprise no one that close to half of the 1982 conference is devoted to small system technology and applications. For the first time, a program track is devoted to personal computing. (Each track ties together a series of time-sequenced sessions pertaining to various aspects of a given topic; an attendee with a major interest in one broad subject then has an opportunity to hear all the papers on the subject, or as many as his

stamina will allow.) Personal computing thus abandons the midway—the personal computing festival that has run with NCC in the last couple of years—for the big tent. This move is indicative of the personal computer's rapid maturation as a professional tool and the intensive interest in this segment of the computer industry. That maturation is largely the result of entries over the past year from giants such as Xerox Corp., International Business Machines Corp. and Digital Equipment Corp.

Like many other tracks, the personal-computing track encompasses sessions dealing with hardware, software, the market, systems and applications. One session, for example, is dedicated to discussion of software environments and operating systems in personal computers. Another deals with the more market-related topic of "large-volume software issues," that is, what vendors can do to protect their software packages and keep users from copying the code.

The topic of office systems is hardly a newcomer to NCC. One track was assigned to it in 1980, and another last year. This year, the subject is given a boost by the influence of program chairman Howard Lee Morgan, who is second in command to conference chairman Russell K. Brown. Morgan, a professor of computer science and decision sciences at the Wharton School and Moore School of the University of Pennsylvania, is also chairman of the board at Advanced Office Concepts Corp., Bala Cynwyd, Pa. Amy Wohl, president of Advanced Office Concepts, heads the office systems track.

As in the personal-computing track, the office-systems track

embraces many issues. Two sessions are scheduled to deal with the user interface. This preoccupation with the man-machine interface is an inevitable result of the migration of computing tools into the hands of unskilled users at home and in the office. If that migration is to continue unabated, these tools must be made increasingly easy to

Other units on the office-systems track deal with specific parts of the problem, in one session each—electronic mail, text editing, the combination of image and data processing and electronic document delivery. Along the same track are sessions that treat management issues—strategic planning for office automation, and the effect on worker productivity.

The hardware/computer-architecture track is also sharply tilted toward small-system issues. Two sessions cover advances in single-chip µcs, another focuses on µp systems in CMOS, and another on fault-tolerant architectures.

Other sessions in the hardware/architecture track embrace soft-ware topics, including microprogramming and firmware engineering, single-chip µc programming (two sessions) and data-file compatability for small systems.

Software concerns also are covered in the language and database-processing track, with one session on database-management systems for μ cs, one for FORTH language applications and one on maintenance of Pascal programs. Two other sessions deal with teaching and using Ada.

The theme of the 1980 NCC was "usability of the computer," last year it was "keys to productivity," and this year's theme is "advancing professionalism." It appears that any or all of these labels could fit the 1982 conference equally well.

-Malcolm L. Stiefel

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Sperry Univac finds its future in Disney World

Sperry Univac, which built its reputation selling large-scale computers, is hoping to broaden its market prospects and recognition by supplying equipment for an experimental community of tomorrow near Disney World, Orlando, Fla.

In October, Walt Disney's \$800-million dream of an "experimental prototype community of tomorrow" will become a reality in the form of EPCOT Center. Disney envisioned a community of creative concepts for the future, where the best ideas of industry, government and the academic community could be showcased.

A wide range of Sperry Univac computers will play a key role in that community. Systems from the Blue Bell, Pa., manufacturer will be based at EPCOT, ranging from V77 minicomputers to the high-end 1100 family of large-scale processors. The computers include Sperry's automatic monitoring and control system, which monitors the environment and security systems, and a special event control system. which operates sound and lighting systems. Systems will also be used in such applications as show presentations, guest services, security and information management.

At EPCOT, Sperry will sponsor "The Astuter Computer Revue," at which visitors can see a computer room and learn about computers via English music hall-style song and dance and Disney animation.

Visitors can also use Sperry V77-200, -500 and -800 minicomputers via learning games. For example, an airline game using touch input matches people with luggage, and a roller-coaster-design game uses touch input and CAD technology. In addition, voice synthesis,

voice recognition and robotics will be implemented when visitors play games with a Sperry robot.

The project is the result of almost two years of collaboration between Sperry and WED (Walter E. Disney) Enterprises, the Glendale, Calif.based branch of Walt Disney Productions. Sperry has been the main computer vendor to WED Enterprises since 1972 and provides computers at WED's Glendale headquarters, including four 90/80 model 4 systems, one V77-800 minicomputer and several UTS 400 VDTs. Applications include hotel and travel reservations, film distribution, payroll and inventory. In approximately 17 cities nationwide, Disney Products uses more than 500 Sperry UTS 400 CRT terminals.

Sperry claims that commercial aspirations have resulted from its affiliation with Disney World. More than 1000 visitors per hour are



Disney's \$800-million Experimental Prototype Community of Tommorow, EPCOT Center. The sphere (center) houses Computer Central, run by computers from Sperry Univac. Photo copyright: Walt Disney Productions.

expected to view the company's exhibit. And, because more than half the company's business is done outside the U.S., foreign visitors also are attractive to Sperry.

"We want to make Sperry Univac a household name," says a company executive. "When we were a large-scale computer manufacturer, we had a different market," he says. "Now that we're into word processing and μcs, we have to shift focus and communicate with a broader spectrum of people." —Nancy Love

Professor explores ocean with UNIX-based system

A UNIX-based Digital Equipment Corp.-compatible minicomputer system from ZZY, Inc., San Jose, Calif., helps a physics professor at the University of California, Santa Cruz, learn more about the ocean. Professor Stanley Flatte collaborates with other oceanographers at laboratories nationwide to study storms, internal ocean waves, topography and tides using a Z-11/23-75 system.

The system includes a 165Mbyte Winchester-disk drive, a 75-ips vacuum-column tape drive and 256K bytes of main memory. Text editing, graphics and a ZZY-integrated,

A UNIX-based Digital Equipment UNIX-7-based DYNIX operating system from ZZY, Inc., San Jose, price to more than \$45,000.

With DYNIX, Flattè's system can communicate and share data with other research centers, including the Lawrence Berkeley Laboratory and the Scripps Institute of Oceanography.

Flattè's collaborative study also involves measurement of sound travel within the ocean. The system releases artificial sound from one test site and measures its changes en route to another test site.

-Nancy Love

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Peripherals '82 —a preview

In conjunction with the Cahners Exposition Group, $Mini\text{-}Micro\ Systems$ will sponsor a Peripherals '82 conference and exposition in Anaheim, Calif., Sept. 29 to Oct. 2. We are seeking to create a highly concentrated environment that will focus on computer peripheral technology, products and applications in minicomputer and μc systems.

Peripherals '82 will assemble the major suppliers of disk drives, CRT terminals, printers, tape drives and



other related products in a setting with system integrators and large-volume end-user buyers. We hope a consensus of definitions, language and standards and a continuity of exchange between vendors and buyers will come out of these annual peripheral conferences.

This is the first conference that *Mini-Micro Systems* has formally sponsored or has been associated with in any manner. It has come to our attention that there are still a few people who believe that *Mini-Micro Systems* was and is involved in the management of the Mini/Micro Show. While we have always had nothing but the best wishes for the success of that show, *Mini-Micro Systems* has never been involved in the management of it.

We did not develop the Peripherals '82 conference to compete with anybody. Some people have told me that all computer shows compete with each other, but that's almost like saying that none compete.

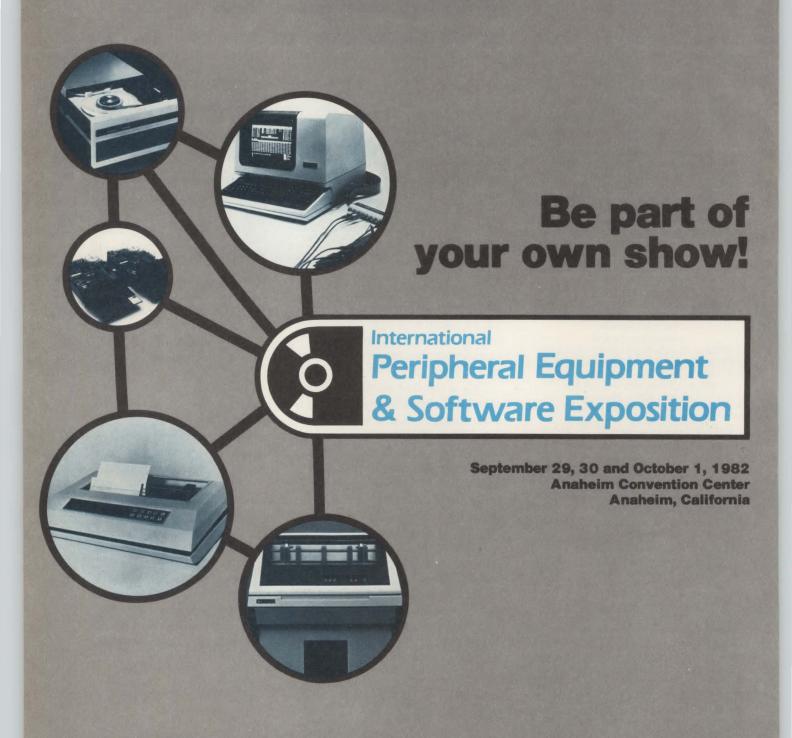
It is our opinion that the Comdex, NCC and Interface conferences are the major, successful, general-industry computer conferences, and that another general-industry show is not needed. Because it is impossible for *Mini-Micro Systems* to participate in every computer show, we have decided to limit our exhibitor participation to the Comdex, NCC and Interface shows as the general-industry conferences and that further conference participation will be in more vertical or highly focused areas.

S. Henry Sacks

Vice President/Publisher

. Leng Sache

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DATAPOINT'S LAN

To the editor:

I would like to comment on the article "Searching for the 'right' approach" (MMS, February, p. 227). In this article, a list was given of the major local-area network vendors, which omitted Datapoint, the largest LAN vendor to date.

The Datapoint ARC network is a coaxial cable network that was first delivered about five years ago. It is a baseband, token-passing network that runs at 2.5M bps and is supported by three vendors: Datapoint, Inforex and Radio Shack. The architecture of the network is a non-rooted tree, with a maximum of 255 nodes per tree. The capability exists to interconnect ARC networks, thus placing no limit on the number of nodes in practice. The

maximum length between the extreme nodes of the network is 6.5 km. There are more than 2000 ARC networks in operation.

Ellis Hillinger Datapoint Corp. Bellevue, Wash.

USEFUL GRAPHICS

To the editor:

When I was recently required to survey graphics technology for an Army program, I found your special graphics issue of December, 1981, comprehensive and very helpful. I was particularly appreciative of Frank Catalano's article on flatpanel displays because of their military implications. Incidentally, the article identified a key Army

display center which I had previously been unaware of and with which—thanks to Catalano—I shall now be communicating.

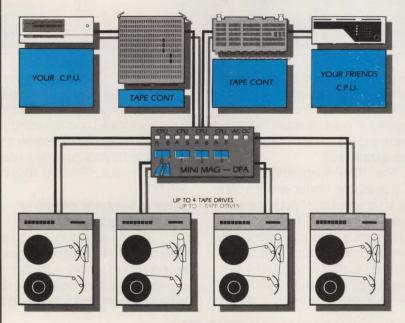
I look foward to keeping up on graphics developments through your presentations.

Theodore J. Wang, Ph.D. Andrulis Research Corp. Bethesda, Md.

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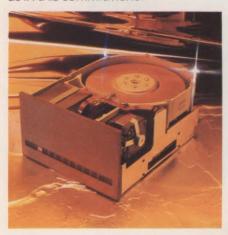
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Mini-Micro Interpreter

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

Ethernet spec spawns diverse group of interface products

By Dwight B. Davis Associate Editor

As the number of vendors supplying Ethernet-compatible equipment grows, one fact is becoming increasingly clear—there is more than one way to build interfaces to this local-area network. This fact is true for any LAN, but the public nature of the Ethernet specification makes it the only networking scheme available encouraging the involvement of independent interface suppliers. Aside from Ethernet's large corporate backers—Xerox Corp., Intel Corp. and Digital Equipment Corp.—at least four other companies market products that can link equipment to Ethernet networks.

Many distinctions exist among the available interfacing products. Prices range from less than \$900 to more than \$10,000 per unit; some products link directly to specific processor bus structures, while others incorporate general-purpose serial and parallel interfaces; functions common to all the products are executed using different techniques and architectures; and the types of functions provided vary in number and sophistication.

To a degree, this interface diversity is driven by targeting different market niches, but some vendors with very distinct products claim to be going after the same customer base. So buyers in any market group may be faced with determining the relative merits of

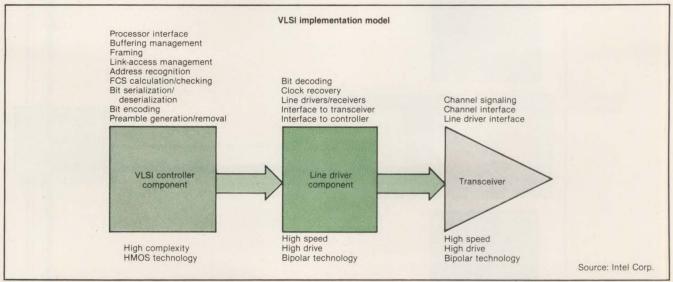
several interfacing approaches. Some buyers may have to compare every minute feature before they make a final purchase decision, but most vendors believe the strengths of their products are based on certain easy-to-identify characteristics.

Systems versus components

The most obvious distinction between vendors supplying Ethernet-compatible interfaces can be drawn between Ungermann-Bass, Inc., and the rest of the field. Ungermann-Bass, Santa Clara, Calif., is a communications system supplier, whereas the other independent companies are component manufacturers selling communications controllers for incorporation into other manufacturers' systems. The Net/One system sold by Ungermann-Bass is available in an Ethernet-compatible 10M-bit-per-sec. configuration and a 4M-bps configuration.

As a communications system supplier, Ungermann-Bass provides complete end-to-end communications, says company president Ralph Ungermann. To offer a total communications system, the company's Network Interface Units (NIUs) provide much more functionality than the component vendors' products, he says.

"The important differences are pretty easy to understand if you think in terms of the ISO (International Standards Organization) seven-layer model," he says. This model contains seven functional layers that



Intel's first Ethernet chip implementation will consist of a data-link chip handling the CSMA/CD access function and a serial-interface chip performing such tasks as Manchester encoding/decoding and bit conversions. This model shows how all interfacing functions can eventually be placed on a single chip using VLSI.

The Interpreter

each define specific communications operations. The Ethernet specification addresses just the lowest two levels, the physical and data-link layers. None of the component vendors yet provide functionality higher than level two on their controller boards, but "The NIU provides all the layers of communications software through level seven," Ungermann claims.

He qualifies this statement by pointing out a semantics problem that sometimes occurs when discussing the theoretical ISO model. "I don't think anyone would claim we don't do at least part of level five," Ungermann says. "The reason I say we also provide six and seven is because I'm talking about communications applications. From a computer vendor's point of view, level seven (application layer) may be the data-processing application program being run in the computer."

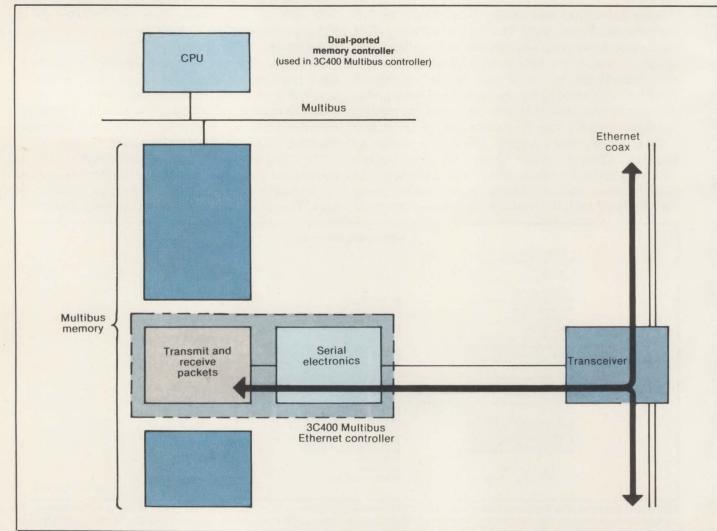
The number of functional layers that the NIU or

another vendor's controller addresses is important because functions not performed by the interfacing device must be performed by the host processor. (In this article, "host" refers to any processors linked to the Ethernet network.) On the high-speed Ethernet network, such communications tasks can place a heavy burden on the host, so off-loading as many functions as possible into the interfacing unit is an important selling point. "You can think of our NIU as a communications front end," Ungermann says.

General-purpose or bus connections

Aside from the system/component distinction between the products of Ungermann-Bass and the other independent vendors, a difference also exists in the physical interfaces employed to link these products to processors. Ralph E. DeMent, manager of strategic planning, distributed systems engineering at DEC, says

3Com claims its dual-ported memory architecture moves data packets to and from the controller's buffers without burdening the processor's Multibus channel in the way a DMA architecture does. Dual-ported memory is used in all 3Com's products and also in the new Unibus-compatible controller offered by Associated Computer Consultants.



two categories of CPU attachment exist—the expedient method and the ideal method.

Ungermann-Bass employs the expedient method, he says, because the NIUs interface to network equipment through general-purpose physical interfaces such as RS232C, IEEE-488 and 32-bit parallel. Such interfaces are less efficient than the ideal method, which interfaces directly to the processor bus "and maximizes information transfer in a way simplest to the operating system," DeMent says.

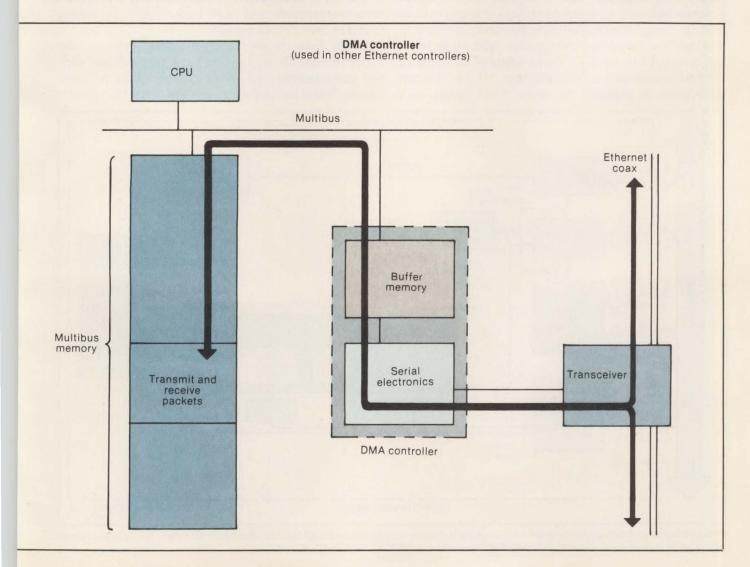
All the independent Ethernet controller vendors link their products directly to DEC's Unibus or Q-bus or to Intel's Multibus, and Ungermann admits this approach surpasses the general-purpose NIU in information-transfer efficiency. He says the NIU can be configured with a direct bus interface, "and as it becomes more appropriate, you can be sure we will be putting the NIUs on the major buses."

However, the problem with Ethernet controllers that offer attachment to specific buses is that they can't

connect other types of devices to the network, Ungermann points out. "The stand-alone NIU is appropriate for the installed base of equipment that doesn't have anything but RS232 or parallel," he says. And he explains that the relatively high cost of the NIUS—\$4700 to \$10,000—is largely because a single box can support as many as 24 physical interfaces. Thus, the cost of connecting each device to the network can be considerably lower than that offered by the controllers, which each support only one processor.

Comparing the controller components

When one moves from the Ungermann-Bass products to the component-level products, distinctions between one device and another become less apparent. Intel and three independent vendors—3Com Corp., Interlan Inc. and Associated Computer Consultants—sell such communications controllers as components. Xerox embeds its own controllers in its Ethernet-compatible equipment and OEMs NIUs from Ungermann-Bass for connec-



The Interpreter

tion of general-purpose devices. DEC's Ethernet controllers, expected to be relatively sophisticated, have not yet been introduced.

3Com, Mountain View, Calif., is generally acknowledged as having the lowest end products in the spectrum of available Ethernet controllers. The company also claims the lowest priced controllers, with 25-unit quantity prices ranging from \$840 for a new Multibus-compatible board to \$1175 and \$1610, respectively, for its Q-bus and Unibus controllers.

To obtain these relatively low prices, 3Com's controllers provide fewer features than the competing products, but president Bob Metcalfe maintains the 3Com line performs the primary information-transfer operation as well as any other device. "We're just choosing more carefully what functions are appropriate for such controllers," he says.

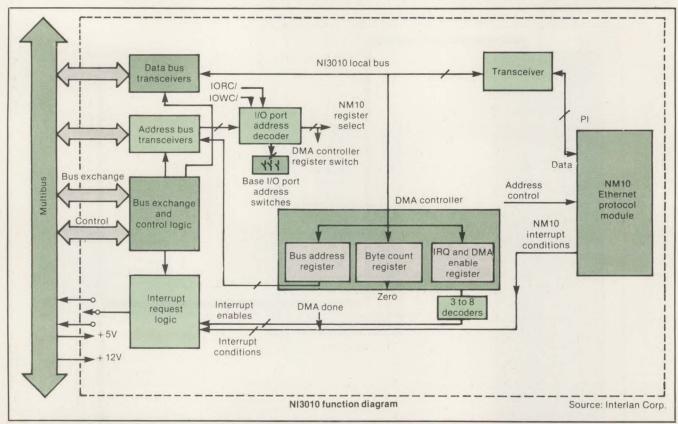
Unlike other controllers, 3Com's products don't incorporate an on-board μp , relying instead on a hard-wiring approach with state machines. Metcalfe believes including a μp on the controller board is often made to design-in manufacturing flexibility, as much as it is used for increased functionality. With an on-board μp , a board can be more easily adapted to changing network specifications, Metcalfe says. "If the Ethernet spec were to change," he says, "we'd design new

controllers that are further down the cost curve, rather than rely upon a general-purpose nature in our implementation."

But in one sense, Metcalfe is going against what the other vendors consider gospel in designing Ethernet controllers. Every vendor but 3Com claims to implement the entire levels one and two Ethernet specification on its boards. 3Com's Q-bus controller doesn't offer hardware address recognition, which many consider an essential controller function. And, although the Unibus and Multibus controllers incorporate address recognition, two other Ethernet-specified functions are omitted—multicast address comparison and random-number generation for retransmission timing.

"These are low-activity functions most economically performed by software," 3Com literature claims, but competing vendors disagree. They collectively argue that, as long as the de facto Ethernet standard exists, the best design route is to put the entire specification on the controllers, both to ease the buyer's programming requirements and to off-load as much processing from the host CPU as possible.

Aside from those functions described by the Ethernet Blue Book, vendors have implemented various architectures and auxiliary operations on their boards. While David Potter, vice president of engineer-



This functional diagram shows Interian Inc.'s approach in designing its single-board Ethernet/Multibus controller. The NI3010 controller incorporates a DMA controller and a module that implements all Ethernet-specified protocols.

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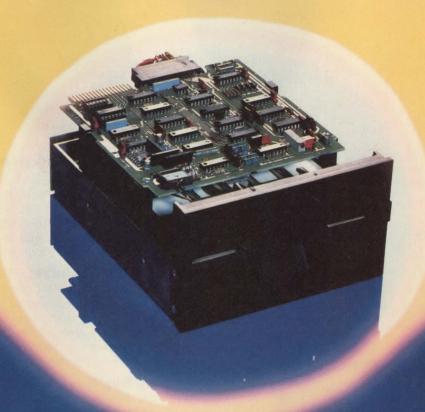
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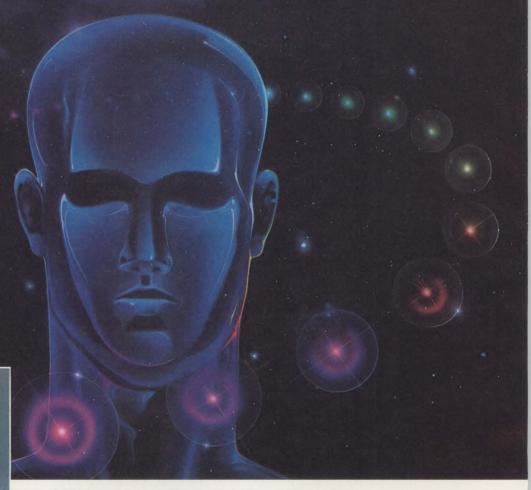
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The Interpreter

ing at Interlan, Chelmsford, Mass., agrees with Metcalfe that such on-board μps add design flexibility, he says the μp also adds functionality to his company's products. Interlan's Multibus, Q-bus and Unibus controllers sell for \$2250, \$2625 and \$2940, respectively, in quantities of 25.

"To a large extent, you could reprogram the μp if you wanted to shift from one protocol to another," he says, "but there were a couple of other things we also wanted to accomplish with the μp ." Two tasks performed by Interlan's integrated μp are board diagnostics and generation of network statistics. These statistics include such information as the number of packet frames received and transmitted, the number of frames received with errors and the number of transmit collisions.

Another important area is the buffer-management scheme used to handle the flow of data packets out of the attached devices, Potter says. "When doing multiple tasks on a computer and at the same time handling Ethernet traffic, the bottleneck that you run into first is the ability of the operating system to keep the controller supplied with buffers," he explains. In a basic buffer-management scheme with a single packet-transmit buffer, the host CPU must be interrupted each time the buffer empties.

Both Interlan and 3Com use a 2K-byte transmit buffer able to hold just one full-sized Ethernet packet. To help diminish the interrupt problem, Interlan designed a cache for as many as 16 buffer descriptors into its controllers. "If we're seeing this buffer-starvation problem," Potter says, "we're saying, 'All right, instead of an interrupt every time we use a buffer, give us the next 16 buffers you're going to want to use, and when we use those up, we'll come back for more." So we cut the number of interrupts at least an order of magnitude over having an interrupt every time you use a buffer."

Host interrupts can also be a problem in the receiving mode if a controller doesn't provide the address-recognition function. In that case, the host must stop and examine each packet coming along the Ethernet cable to determine if the packet is addressed to it. Even if the controller handles this important task, as most do, the size of the receive buffers and the method of moving packets from the buffers to the host differ from controller to controller.

For example, Interlan's products allocate a 16K-byte FIFO buffer for frame reception, and 3Com provides 6K bytes of space for this task on its boards. Both buffers hold multiple Ethernet packets, with the Interlan controllers having an advantage in overall capacity. But another distinction is the way the controllers transmit the received packets to the host. Interlan uses a

direct-memory-access (DMA) method that attains a transfer rate of more than 1M byte per sec., whereas 3Com uses a dual-ported-memory approach it claims places a lower burden on the host and its bus than DMA (see diagram, p.146).

Upgradability as a selling point

The most recent entry into the small field of Ethernet-controller suppliers is Associated Computer Consultants, Soquel, Calif., which introduced a Unibus-compatible product in March. A two-board set, the relatively expensive, \$7800 IF-11/Ethernet package is priced reasonably, says L. Brian McGann, manager, LAN systems, at the company. The relatively high price is justified by the package's modular architecture, programmable data-processing power and the potential to incorporate higher level protocols above the Ethernet layers, McGann says.

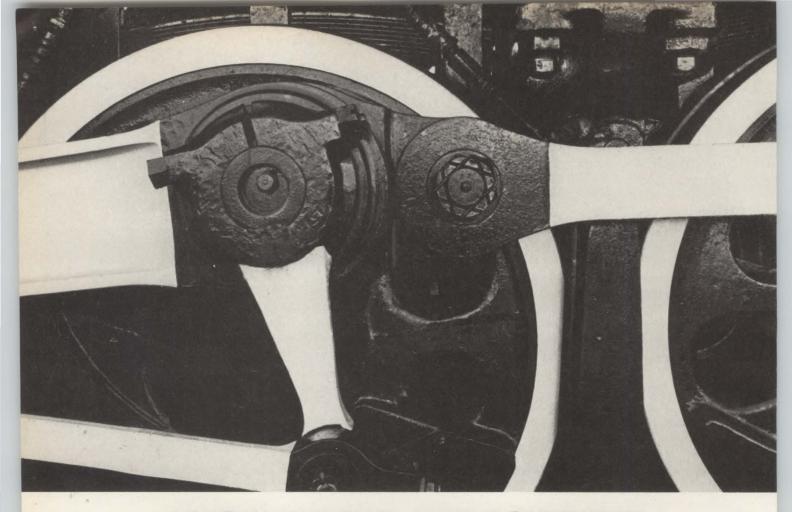
Ungermann-Bass, which provides higher level functions in its NIUs, uses its own protocols at the layers above level two. When DEC announces its Ethernet controllers, they will be operated underneath, and possibly perform some of, that firm's higher level DECNET protocols. Xerox published its NS series of high-level protocols last December, and various standards bodies are working on their own versions of such protocols.

With the arrival of LSI chips incorporating the Ethernet specification, due from Intel this year, all the controller/system vendors will probably modify their products to place the chip set on-board. But the vendors were not willing to wait for the chips before making their move into the Ethernet market.

Even Intel has its pre-chip version of a Multibus-controller, the two-board isbc 550. Joseph Harakal, communications product manager in the firm's OEM Microcomputer Systems division, says the controller was built to serve only as a prototype set, but a demand exists for the product from integrators wanting to incorporate it into their proprietary nets.

Because of this demand, Intel recently cut the price of the isbc 550 in half, from \$4000 to \$2000. Intel also uses the controller internally in its new NDS-II μp -development system. Harakal says availability of the Ethernet chip set, combined with other VLSI improvements, will allow Intel to place the functions now performed by four boards on a single controller board.

While the Ethernet chips will allow all vendors to cut the costs of their interface products, and will make it simple for everyone to provide the full Ethernet specification on their controllers, the non-Ethernet distinctions will remain. And, at this early stage of the Ethernet market, there are no benchmark results to indicate relative controller performance.



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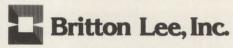
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Modula 2 moves from the lab to the market

By Kevin Strehlo Associate Editor

Although only recently making its commercial appearance as a compiler implemented by tiny Del Mar, Calif.-based Volition Systems, the Modula 2 language from Niklaus Wirth, the Swiss academician who created Pascal, is making a stir in the R&D labs of some of the computer industry's biggest firms, including Burroughs Corp., Hewlett-Packard Co. and NCR Corp. Modula 2 advocates contend Wirth's new language has all of the advantages of Pascal with none of its problems.

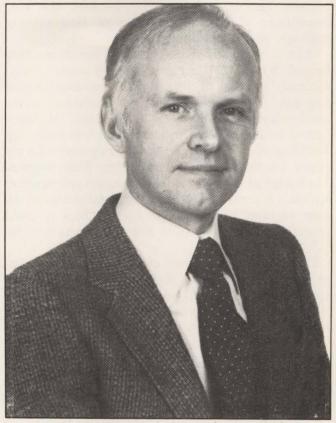
Pascal features, including type-checking, program readability and data abstraction, can reduce program-development time and increase program reliability, but pure Pascal was designed as a teaching tool and suffers from several deficiencies including severely limited I/O, fixed array parameters, lack of separately compiled modules and program abortions when a data error is encountered.

Extended implementations of Pascal were developed for different applications, including Concurrent Pascal for real-time work, Pascal Plus for discrete event simulation and UCSD Pascal for μ cs, but the benefits of standardization were sacrificed. No single extended Pascal could handle all applications, despite a flurry of extensions that, according to Volition Systems staff involved in the UCSD Pascal project, created gigantic maintenance problems. These programmers claim Modula 2 solves Pascal's problems.

Wirth designed Modula 2 to handle all system-programming applications. As implemented by Volition Systems, however, Modula 2 is more compact than UCSD Pascal alone.

Although it allows programmers to access machine codes, Modula 2 is machine-independent. All facilities that involve hard-wired features—I/O conversion routines, storage allocators, process schedulers and the like—are not included in the language itself as in the extended versions of Pascal, but are handled via a library of standard modules. Besides improving portability, this keeps the language small but offers flexibility. In effect, extensions for the language can be written in the language itself.

"A user could write a library module to control multitasking the way one operating system does it," says Roger Sumner, co-implementor of Volition Sys-



Tom DeMaro, an associate at Yourden Inc.: "Whereas Ada is a hodgepodge of different ideas and philosophies, Modula 2 is a pure, harmonious implementation of the same concept: to provide all the facilities to build programs the way you think about programs naturally."

tems' Modula II (Volition uses the "II" rather than the "2" designation) compiler, "or, if another scheduling scheme was more appropriate, a user could write a module to accomplish it that way."

Volition Systems' Modula II compiles to p-codes and requires a 64K Apple II running the UCSD Pascal operating system, but Volition doesn't see the Apple Pascal community as the primary market for the new language. "The Apple II is strictly a cost-effective implementation," says Volition's president, Carolyn Chase. "We hope industrial users and hardware companies will take advantage of the 60,000 Apples running the UCSD p-system to evaluate the language. But our goal with Modula 2 is to work with any manufacturer or OEM that wants to include a native code compiler with their hardware."

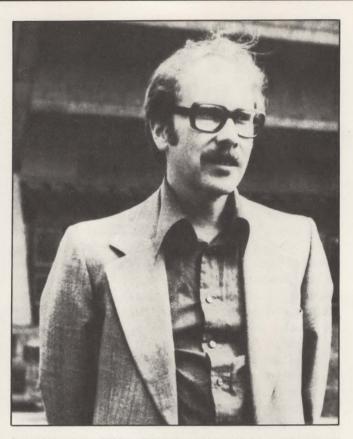
Scenic Computer Inc. offers a modified Volition Modula II compiler on its Z80-based system running UCSD Pascal, and Reno, Nevada start-up Sage Systems (MMS, April, p. 9) will offer Volition's native code compiler for its 68000-based system. But the impact of Modula 2 may be greater than the appearance of

The Interpreter

several compilers from tiny Volition Systems would indicate. Modula 2 is superior to Ada, the U.S. Department of Defense's all-purpose programming language, Ada critics contend.

"Ada is the work of an enormous committee that decided to take Wirth's Pascal and add whatever was necessary to make it an acceptable general-purpose language," says Tom DeMaro, an associate at structured-programming champion Yourdon Inc. "Modula 2 started under the same charter, but it was under the firm intellectual grip of a single, unifying mind—for my money, the finest mind in the industry. Thus, whereas Ada is a hodgepodge of different ideas and philosophies, Modula 2 is a pure, harmonious implementation of the same concept: to provide all the facilities to build programs the way you think about programs naturally."

The most prominent critic of Ada is English computer scientist Tony Hoare, noted for such fundamental contributions as the case statement and the algorithm called Quicksort. In the lecture he delivered as winner of the 1980 ACM Turing Award, he charged that full-blown Ada would be so unreliable as to be dangerous to mankind because D.O.D., its sponsor, planned to use it in applications in which a failure could cause a catastrophe as great as "a nuclear warhead exploding over one of our cities." In that same lecture,



Pascal developer Niklaus Wirth is making a stir in the R&D labs of Burroughs, H-P and NCR with his new language Modula 2.

NCR'S BACK-DOOR P-CODE MACHINE

Computers that sneak in the back way often fail to make it out the front door. But machines developed without official company backing do occasionally succeed, and NCR Corp. hopes its 9010 ALP-2 desk-top system will be one exception. In its initial release-quantity shipments are scheduled for July-the machine is microcoded to execute p-code and includes Volition Systems' Modula II compiler. Volition claims the 9010 ALP-2 runs Modula 2 language as fast as the Lillith computer, which compiles Modula 2 instructions at 10,000 lpm. The 9010 ALP-2 also executes UCSD Pascal 33 to 50 times faster than a Digital Equipment Corp. LSI-11 interpreter, Volition claims.

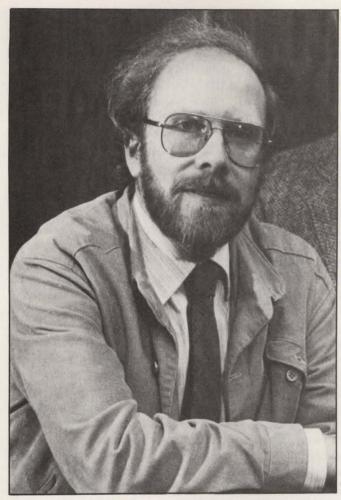
The first iteration of NCR's bit-slice p-code processor was developed at the company's Torrey Pines, Calif., R&D facility by an enthusiastic but unnamed NCR employee on his own time. It was to be a hardware "Band-aid" for an 8080-based NCR hotel reservation system. The system,

partially written in ucsp Pascal, wasn't meeting performance goals. The new board helped, executing p-code 15 times faster than the 8080 interpreter, and NCR consultant Joel McCormack of Volition Systems improved performance further in a redesigned board owing its inspiration to Wirth's Lillith machine. But more speed was needed, and sales of the hotel system couldn't justify the cost of another redesign of the board. So hotel-system project manager Bill Bray sold upper-level management on the idea of spreading the cost by basing another product on what has since been dubbed the ALP-2 (advanced language processor).

Bray thinks the 9010 with the added ALP-2 board has potential as a very fast engine for UCSD Pascal application packages and as a software-development tool for Modula 2. An NCR spokesman at the company's Dayton, Ohio, headquarters says, "UCSD Pascal is not your basic high-volume market." He downplays

the importance of the Modula 2 compiler, and foresees OEMs using the ALP's PLUM (programming language for understandable microcode) to microcode key portions of their proprietary software. The spokesman says the increased performance and the piracy protection afforded by putting applications in firmware are the chief attractions of the 9010 ALP-2. He claims the 9010 ALP-2 is the first small-business system that an OEM can easily microprogram, thanks to Volition's high-level language PLUM microcode compiler.

Software with the new system includes PLUM, the Modula II compiler, Volition Systems' advanced screen editor, version 2.1-compatible UCSD Pascal and a version of VisiCalc that NCR says runs 15 times faster than on the Apple computer. In its basic configuration with 192K bytes of main memory and two double-density, 8-in. floppy-disk drives, the 9010 ALP-2 is single-unit priced at \$13,000, with OEM discounts available.



Richard Ohran, a professor at Brigham Young University and coordinator with Wirth of the Modula Research Center: "The small percentage of programming needs that are satisfied by Ada and not by Modula 2 are extremely complex."

Hoare lauded the elegant but powerful work of Wirth. DeMaro voices similar sentiments: "The size of Ada is terrifying, and the government has said they aren't

going to allow a subset. The result is that the language is difficult to grasp, whereas Modula 2 is glorious. It flies into the mind."

Sumner verifies DeMaro's comparison of the two Pascal-based languages. "When Volition contracted to do some Ada kernal work, I had never worked with the language, and it took me about three weeks to get up to speed," he says. "Modula 2, on the other hand, took me about a day."

Richard Ohran, a professor at Brigham Young University, Provo, Utah, and coordinator with Wirth of the Modula Research Center in Utah, says Ada pays a price for trying to be everything to everybody. "The small percentage of programming needs that are satisfied by Ada and not by Modula 2 are extremely complex," he says. "Such Ada constructs as generic types will have a drastic effect on how the compiler

operates and on the reliability of the code."

Ohran learned Modula 2 at the source, working closely with Wirth at the Federal Institute of Technology, Zurich, Switzerland, to design a bit-slice processor with a microcoded instruction set optimized for Modula 2. The result, the Lillith personal computer, is a complete system that compiles Modula 2 instructions at more than 10,000 lines per min.

Ohran reports intense industry interest in the Lillith and Modula 2. "Originally, we built seven Lilliths just for our own research, but we started getting calls from interested parties. We eventually agreed to build and ship 85 Lilliths to various universities and corporations that would have no trouble supporting themselves," he says. "We sent people the machine, schematics and software, warning them that if they ran into problems, the only support they'd get from us would be a 'gee, we're sorry.'"

The impact of those 85 machines may help the spread of Modula 2. Several industry observers contend the Lilliths are in some major computer firms. Burroughs acknowledges that it has purchased a Lillith, but declines to discuss its plans for the machine. A source close to the company says the company is seriously investigating Modula 2.

The source claims that, "Bob Barton, the guiding genius of Burroughs and of the whole industry, since all computers built today are in some sense Barton computers, gave the Lillith and Modula 2 the strongest possible endorsement before he left Burroughs." The source also says Burroughs may switch its internal systems language from ALGOL to Modula 2 and will decide soon whether to market a Modula 2 machine. "The system Burroughs is building uses Lillith because it has such spectacular graphic capabilities," says the source. "The resolution of the screen is simply stunning."

The Lillith's raster-scan CRT display can be landscape (horizontal) or portrait (vertical) format. The bit map is software controlled for a number of possible configurations. One allows a user to address each point in an 808- × 606-pixel area with 80-point-per-in. resolution. The screen can be broken into windows, allowing several files, perhaps representing several business reports and a chart, to be displayed simultaneously. Character generation is software controlled, so that text in various sizes and fonts can be simultaneously displayed. A graphics mouse—a box with three buttons on top and a slender "tail" that connects it to the Lillith keyboard—allows a user, in effect, to pick up and move the cursor anywhere within the display.

Ohran says the screen and mouse interface of the Lillith is virtually the same as the interface of the experimental Xerox Alto computer. And Wirth acknowledges that Modula 2 owes a debt to Mesa, the

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The interpreter

name for Lillith was MAX, which stood for Mormons main systems language used for the Alto. (The original And Xerox, a tip of the hat to the contributions of BYU and Wirth's year of work at Xerox's Palo Alto, Calif., project.) Xerox poured millions of dollars into the Alto, upon which it based a commercial version called the Star. Meanwhile, Lillith with Modula 2 was in the public domain and available for study and commercial use with a price of only \$15,000.

H-P couldn't pass up such an R&D bargain. A source close to the company says H-P purchased the Lillith computer early and will probably strongly endorse Modula 2. Under development, says the source, is a small-business system with advanced graphics capabilities that allows voice messages to be stored and transmitted digitally. The system is said to be based on the Lillith running Modula 2.

Despite the enthusiasm for Modula 2 among research groups and the academic community, many observers do not expect Wirth's new language to take the industry by storm. "Modula 2 has huge potential," says a spokesman for Sage Computer Systems, "but until people write textbooks about it and teach what its advantages are, I don't see it taking off." BYU's Ohran agrees: "Modula 2 will catch on relatively slowly. But eventually, users will realize it's a very powerful tool and a complete language." He cites the ease with which he wrote a demanding interface between the Lillith and a high-speed laser printer.

Jim Haack, head of software development at Charles River Data Systems, Natick, Mass., sees Ohran's conservative view as overly optimistic. "I see very little real interest in Modula 2," says Haack. "With the government standardization of Ada and the requirement that government suppliers use it, you'll see a number of companies making Ada a dominant force in the industry starting about 1985. Modula 2 will provoke a lot of healthy comparisons between it, Pascal, Ada and C." Haack's opinion of Modula 2 is echoed by a manager involved with NCR's Modula 2 effort, who says, "It isn't the next Pascal." (see "NCR's back-door p-code machine," p.154).

Even some of Modula 2's strongest adherents don't see its having much impact on the Ada market. "Ada is going to become an industry standard," says DeMaro. "It's brought to us by the people who gave us COBOL, one of the few true standards this industry has. What Ada lacks in correctness, it makes up for in clout, since its sponsor is the largest single purchaser of software. Besides, for all its failings, Ada is too damned close to what is needed: a standard, powerful, all-purpose language."

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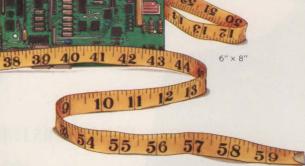
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IBM may open robot sales to system integrators

By Eric Lundquist Associate Editor

The entrance of International Business Machines Corp. into the robot business may mark a new opportunity for system integrators interested in robotic applications, and mirrors the method several large companies are using to gain quick entry into the small but expanding market. In a move similar to those of other large companies including Westinghouse Electric Corp. and General Electric Co., IBM has struck an agreement with a foreign firm for its initial robotic entry, while developing its own robots.

While this potentially lucrative market has spawned many start-ups (MMS, April, p.105), large companies with vast marketing structures and financial muscle will have the most immediate effect on a market that represented only \$155 million in 1981 sales. The market still belongs in large part to Unimation Inc. and Cincinnati Milacron Inc., and IBM is the first major computer company to make a play for it. Other computer firms, especially those with strong in-house robot capabilities such as Texas Instruments Inc., are

expected to follow suit. Tech Tran, Naperville, Ill., projects that by 1991, annual sales volume will reach \$2 billion.

Although the robot market is small and is a minor part of the industrial-automation market, robots are the most publicly visible portion of the components falling under the "factory of the future" rubric, and represent an area in which standards are sorely lacking.

At Detroit's Robot VI show in March, IBM and a host of other vendors displayed the latest in robots and robotic systems to an overflow crowd.

IBM displayed two types of robots, including the model 7535 built for the company under an agreement with Sankyo Seiki Manufacturing Co., Ltd., Japan. IBM's second robot, the RS 1 system, is unusual both in its software and because the normally conservative company showed a product it may not market.

The 7535 presents the most immediate opportunity for system integrators who want to use robots in manufacturing applications. "We would be interested in working with potential value-added resellers, and especially in people who could build applications on the

A CAPSULE LOOK AT IBM'S ROBOTS

IBM 7535 Manufacturing System

Designed for: automatic assembly and insertion of automotive and electrical parts, multiple-point drilling and tapping, repeatable to ±0.002in.

System consists of: a controller with operator panel and servo-controlled jointed arm capable of four degrees of freedom—one horizontal arc for each of the two arm segments with a sweep of 200 and 160 degrees, respectively, a 3.9-in. vertical motion for the unit's gripper/tool and a swiveling motion for the gripper/tool that permits 180 degrees of wrist-like motion in either direction. Arm speeds range from 15 to 57 in. per sec. for loads ranging from 2.2 lbs. to 13.2 lbs.

Control unit: Able to store as many

as five types of multi-point routines or programs, to a maximum of 6000 characters of memory selectable through the operator panel. Multiple 7535s can be programmed with a single IBM personal computer using the AML/Entry version of AML.

Price: \$28,500, with quantity discounts to 15 percent. An IBM personal computer able to program the 7535, with 128,000 characters of memory, is priced at \$4575. AML/Entry carries a license fee of \$1000. Deliveries of the 7535 are scheduled to start in the fourth quarter of this year.

IBM RS 1

Designed for: light assembly, drilling and other industrial operations that require speed, precision and the ability to sense and react to changes

in its work environment.

System consists of: A rectangular metal frame measuring about $6\times4\times3$ ft. housing a hydraulically powered arm that moves a payload of 5 lbs. as much as 40 ips through six degrees of freedom. The arm ends in a two-fingered gripper that can be equipped with tactile and infrared optical sensors. The sensors allow the control program to monitor the device's operations 50 times per sec.

Control unit: The operations are programmed using AML working with a modified Series/1 computer. An application development program written in AML is available for start-up and feasibility studies.

Availability: under a limited testmarketing program.

The Interpreter

system and assist the customer in putting the system into a variety of new applications," says James F. McDonald, division director of industrial automation in IBM's System Products Division in Boca Raton, Fla. "Value-added reseller" is how IBM describes third parties that resell the IBM products to end users. IBM's Boca Raton facility is gaining a reputation as a haven for internal groups willing to use components and peripherals from outside suppliers—an unusual practice in the company, with its history of developing proprietary components, peripherals and systems from scratch. Boca Raton, for example, is the facility where the personal-computer group made heavy use of outside suppliers.

"We are interested in people who will add significant value, and we would move along the lines that we

The IBM 7535 Manufacturing System performs a broad range of industrial tasks. Its jointed arm can move in four directions and can pick up, assemble and load parts such as those shown on the table in the foreground. The robotic system can be programmed with the IBM personal computer (left) using a special version of the AML IBM-developed robotics language.

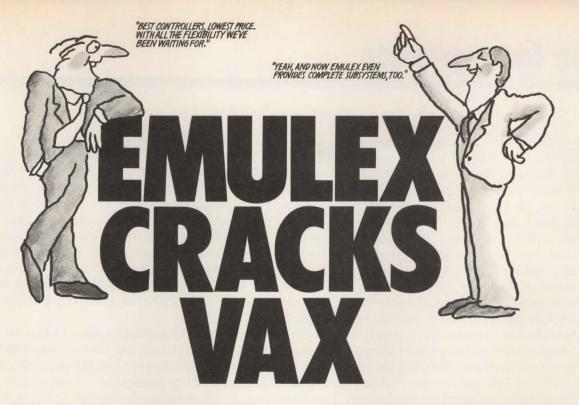
moved with the Series/1," McDonald says. The Series/1 computer forms the core of IBM's value-added remarketer program (MMS, February, p. 123). A modified Series/1 is also used in the RS 1.

The 7535 is aimed at automatic assembly and insertion applications. Priced at \$28,500 with discounts of as much as 15 percent, depending on quantity, the 7535 can be programmed with an IBM personal computer using a version of the IBM-developed AML (A Manufacturing Language). The AML robotics language provides common software that is expected to form the basis of the firm's future robotic efforts. In presenting the 7535 and RS 1, the company placed heavy emphasis on software. "We've bridged both systems (the 7535 and RS 1) with a similar language. We have essentially taken a standard processor-language approach that we believe can be vertically integrated into the factory," McDonald says.

AML is the result of 10 years of research at IBM. AML "is both a good robot language and an excellent computer language, combining some of the best features from ALGOL, APL and LISP in a blend particularly suited to robot programming. AML also provides interactive debugging and has a simple subset suitable for users with limited programming experience. At the same time, AML is an extremely powerful language in the hands of an advanced programmer," says Dr. David D. Grossman, manager of automation research at the IBM research center in Yorktown Heights, N.Y.



This IBM RS 1, an advanced robotic manufacturing system for precision assembly, electronics-parts insertion and other intricate operations, is moving a power screwdriver toward a work station. The arm can move in six directions. It is controlled by an operator using a hand-held device called a pendant. When the operator is satisfied with the arm's movement, he pushes a button on the pendant, automatically setting his instructions in the RS 1's computer memory. The RS 1 then performs the required operation until it is instructed to stop or is programmed for another task.



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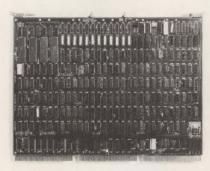
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The Interpreter

The company's research in robotics software can be divided into the areas of explicit text, teaching by showing and model-based systems. Explicit text systems allow a user to specify an application by writing a program on an alphanumeric terminal. Teaching by showing lets a user specify an application by pushing pendant buttons to reach a particular sequence. Model-based systems have 3D solid geometric-modeling programs that understand robot actions.

Grossman noted in his paper that none of the three systems is perfect: "Explicit text requires that the user be a programmer. Teaching by showing is the simplest method of teaching a robot, but you can't teach it very much. Model-based systems need elaborate geometric descriptions of the robot, work station and parts."

AML falls into the text-system category and arises from three other IBM-developed languages: Manipulator Language, Emily and Maple. ML was developed by Grossman in 1973, Emily (ML extended) was developed in 1975, and Maple, described as a "poor man's PL/1,"

The IBM RS 1 robotic system is directed from the unit's computer console by Dr. David D. Grossman of IBM's Thomas J. Watson Research Center. Instructions can be given to the RS 1 through either the system's keyboard/display or the device in Grossman's left hand. The system's arm (center) is holding a small cube in its gripper. The arm can move in six directions at speeds as high as 40 in. per sec. and can perform a variety of precision assembly, parts insertion and other intricate manufacturing operations.

was briefly experimented with in 1976.

When IBM announced that it was entering the robotics business, several analysts—including Laura Conigliaro, a securities analyst with Bache Halsey Stuart Shields Inc.—speculated that IBM was moving early partially because the company wanted to play a major role in setting robotic-system standards.

IBM's McDonald contends the IBM entry was a natural progression. "We've worked on the (robotics) technology, the languages and the systems aspect of it for 10 years. We view IBM's robots as a natural evolution," he says.

McDonald is reluctant to discuss plans for local-area networks in factories, but the company's unannounced approach to networking the Series/1 will probably be incorporated into factory-automation systems. "We will tend to look at things like the Series/1. The Series/1 has been very successful in factory installations, and we will follow the course of the Series/1," McDonald says. There is unconfirmed speculation about IBM that the company will use the "Chat Ring" high-speed broadband loop networking structure that runs in the company's SNA.

While IBM's entrance into the robot business drew large crowds to the company's display at the robotics show, it drew yawns from some of the established robot companies. "I'm surprised IBM had to go to Japan for its hardware technology; I would have thought they had more pride," one anonymous Unimation executive remarked caustically. Several other large firms, including Westinghouse and GE, have taken similar tacks. GE, which in 1981 announced agreements with Italy's DEA and Japan's Hitachi, has also reached an agreement with Volkswagenwerk AG of West Germany for a robot technology exchange. The agreements with DEA and Hitachi are starting to bear fruit: by early March, GE had booked 37 orders for Hitachi robots and seven for DEA robots, says a GE official. Westinghouse has taken a similar stance. This January, the company reached a marketing agreement with Olivetti of Italy. Westinghouse will also market robots under agreements with two Japanese firms: Kamatsu Ltd. and Mitsubishi. While the terms of the agreements vary, the products will be marketed under the Westinghouse or GE names.

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The Interpreter

AT&T's competitors strike back

By Arthur Hill Washington Correspondent

As expected, the House of Representatives is proving to be the forum of last resort for those opposed to the provisions of the consent decree entered into by the American Telephone & Telegraph Co. and the Department of Justice. Judging by the hearings that have been held before Representative Tim Wirth's Telecommunications Subcommittee, the House will be a much more friendly place than the Senate was.

Wirth and several of his colleagues are outspokenly critical of aspects of the Bell settlement that allow the company to operate both regulated and unregulated businesses with no accountability other than the obligations any regulated communications carrier has under federal law. Time and again, Wirth has stated his fears that Bell will use revenues gained from its monopoly services to subsidize the new unregulated telecommunications services that it wants to enter. "Our aim in legislation," he says, "is to assure a level playing field, providing safeguards against cross-subsidy and equitable access to the technical information to interconnect with the network and use it effectively."

The news that Wirth's subcommittee has decided to move forward with legislation even before the proposed consent decree has been accepted by a federal court in Washington angers AT&T officials. "The judicial process should be allowed to work," says Bell executive Morris Tanenbaum. He says that if Congress waited before acting, it could "move with greater certainty to address those areas where legislation may still be necessary to help the industry fulfill its service mission in the public interest."

Wirth believes that Tanenbaum's statement is hogwash, and that Congress—not the courts, the Executive Branch, or AT&T—should set national telecommunications policy. Following the Wirth-Tanenbaum confrontation, a parade of witnesses listed several ways Bell could abuse its monopoly position in the long-distance market at the expense of its competitors in the enhanced services area. For example, Bell could use the information it has gathered about its customers through the years to gain privileged marketing information about their communications needs. It could manipulate the quality of the network to the disadvantage of non-Bell users. Because of its dominance, Bell



Ralph O'Brien, chairman of Mohawk Data Sciences Corp. and of the Computer and Communications Industry Association, says that even if Bell's major competitors grow 200 percent in the next decade, "AT&T Long Lines would be left with a paltry 88 percent of the long-distance business."

and Western Electric could continue to establish de facto standards for the network. Through cross-subsidization, it could raise the price of equipment it sells and use the increased profits to fund unregulated computer services.

"In short," says Fred Lafer of Automated Data Processing, "AT&T could use its historic governmentconferred franchise to support its competitive endeavors in unregulated markets."

Expanding on Lafer's concerns about cross-subsidies is Ralph O'Brien, chairman of Mohawk Data Sciences Corp. and of the Computer and Communications Industry Association. Speculating on the next 10 years, O'Brien says that, even if Bell's major competitors grow 200 percent, "AT&T Long Lines would be left with a paltry 88 percent of the long-distance business."

O'Brien calls for AT&T to spin off its profitable Long Lines business, thereby providing the company's best safeguard against cross-subsidization. But anticipating Bell's opposition to such a step, O'Brien says a spin-off "would clearly be the most logical solution the Congress could mandate."

Tanenbaum and AT&T believe that the long-distance market is not now, nor will be later, dominated by one company, as it has in the past. "This [monopolization] idea is fast becoming obsolete," he says, confirming O'Brien's statement that long-distance competitors such as MCI will capture at least 20 percent of the market in the next five years. O'Brien also says

The Interpreter



Stephen Jerrits, president of Honeywell Information Systems, Inc.: "We will welcome AT&T into the competitive market, but national policy must ensure that all competitors are competing on even terms."

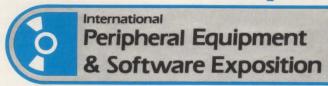
additional competition from satellite carriers and "shifts in business resulting from the consent decree will further whittle down the AT&T presence."

But whether Bell's glass is half-full or half-empty is not the point, in the eyes of its competitors. "We will welcome AT&T into the competitive market," testified Stephen Jerrits, president of Honeywell Information Systems, Inc. "But national policy must ensure that all competitors are competing on even terms."

Despite the growing support from the computer industry for legislation more clearly defining Bell's role, Wirth and his allies in the House face a formidable task in achieving full Congressional approval of a bill modifying the proposed settlement. Central to the effort is the ability or willingness of the Bell operating companies to separate themselves from the parent AT&T in perspective as well as in fact.

While most observers feel that the local companies have much to gain from separating themselves from AT&T as soon as possible, the locals have adopted a decidedly non-partisan stance on the House legislation. Sources speculate that the reason for the reticence is the laborious negotiations with Bell, which will decide how the divestiture will happen.

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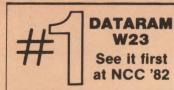
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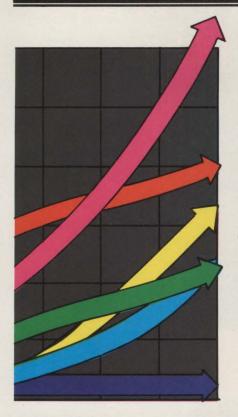
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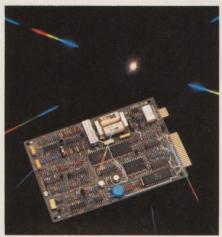




FEATURE HIGHLIGHTS



OFFICE AUTOMATION: Word-processing software for minicomputers and µcs has come a long way in a short time. Starting on p. 171, Mini-Micro Systems surveys more than 75 wordprocessing packages from more than 50 vendors, and the quality as well as the quantity is impressive. Almost all the rapidly proliferating packages share a large set of popular functions that have emerged as word-processing standards. Additional office-automation and advanced word-processing functions that are part of most newer packages should boost office mini and uc sales just as VisiCalc did . . . The potential for a \$1-billion market by 1986 has lured many companies into the serialprinter ribbon market, resulting in complex distribution channels. This complexity can present pitfalls to new buyers and sellers alike. A look at which companies offer what kind of ribbons begins on p. 193... Until recently, providing Digital Equipment Corp.-compatible word-processing software has been the domain of independent software houses and DEC-based OEMs. But DEC has now started to follow other hardware manufacturers by marketing application software directly, and many independent suppliers, in direct competition with DEC, fear losing a substantial source of income. A survival guide for DEC OEMs selling in the word-processing market starts on p. 203.



COMMUNICATIONS: Prime Computer's worldwide network consists of 70 systems that are used by more than 4500 employees to conduct all facets of the company's business. The network is entirely peer controlled; that is, no single system controls it. Although interconnected, each system is an independent entity. To provide communications between the various Prime locations, the system makes extensive use of public packet networks that support X.25 International Standard Packet Switch protocol. A complete description begins on p. 233 . . . A large percentage of business is transacted over the telephone, often resulting in "telephone tag"—calls and messages bouncing back and forth before contact is finally made. Amtel Systems Corp.'s new Messenger II electronic message-delivery tackles this problem three ways: it delivers hard-copy messages via desk-top printers; it hooks up to external networks; and it reduces cost by using existing building electric wiring. See p. 239 for a close look at this system . . . A communication spooler is a software package that, together with a minicomputer and its peripherals, provides simple and efficient links with remote mainframes. A guide to simplifying communication with remote mainframes begins on p. 249.



TECHNOLOGY: Man/machine communications via speech will soon be commonplace in minicomputer- and μ c-based systems. Just as modern visual-output devices that present information on pages of hard copy or through CRT terminals have replaced crude lamp and tape displays, synthetic speech output will supplant bells and buzzers. Speech is the principal means by which people communicate with one another; why not use it with machines? For an exploration of practical speech I/O technology, see **p. 291**.

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OFFICE AUTOMATION

WP software advances rapidly

PATRICK KENEALY, Associate Editor

Word-processing software vendors lead the way by adding general-purpose office functions

Word-processing software for minis and μ cs has come a long way in a short time. When George Cherry looked at WP software for *Mini-Micro Systems* last April, he carefully surveyed 12 major packages and concluded that "some good products are available, but better ones are sorely needed." This month, we take a more general look at more than 75 WP packages from more than 50 vendors and have been impressed by quality as well as quantity.

Almost all the rapidly proliferating packages share a large set of popular functions that have emerged as word-processing standards. The additional office-automation and advanced WP functions that are part of most of the newer packages should boost office mini and μc sales just as VisiCalc did. While many mini and μc vendors write WP software for their hardware, and many turnkey WP vendors sell bundled hardware/software combinations, our survey covers only packages from third-party software houses. These packages run on a wide variety of popular processors, and their price and feature diversity represents the state of the WP art.

Standard WP functions can be divided into four subsets. Document-creation functions are used to enter text onto a system's CRT. Editing functions are used to correct and amend previously entered documents. Formatting functions are used to prepare edited documents for output by various draft-quality, letter-quality and high-speed printers. Utility functions are used to store, copy and merge documents and for printer control. Advanced WP functions include general programming features for integrating variable and preformatted text, and a myriad of special routines for mathematics, graphics, mailing, filing, appointment scheduling and security-sensitive applications. A summary of commands appears in the *Mini-Micro Systems's* Command Checklist on page 177.

Document creation

Document-creation commands are designed to make document composition at the keyboard as easy as



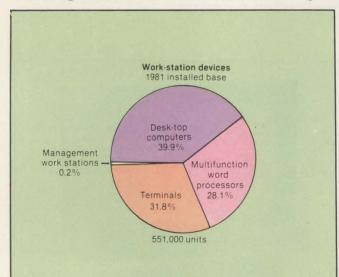
Practical μc security. Thefts of desk-top computers and their components are on the rise. Because processor, graphics and memory boards can sell for more than \$1000 each, and complete system prices often top \$3000, desk-top computers are worth protecting. Companies have been locking electric typewriters to desks for years, and new Anchor Pad from Equipment Environments allows users to lock their desk-top computers in place the same way. The Anchor Pad secures any desk-top computer and its components against theft and unwanted borrowing and unlocks quickly and easily for service or relocation. The unit swivels 360° and allows ventilation of all components. For more information, contact Equipment Environments, P.O. Box 3442, Nashua, N.H. 03061.

possible. Before "writing" begins, a user formats the screen using a menu or a ruler (a typescale displayed on the CRT screen) to set tabs, left and right margins, page breaks, paragraph indents and spacing. On most systems, a user can invoke a word-wrap function that

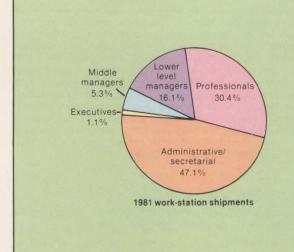
Word processing improves editing efficiency even more than it eases data entry.

acts as an automatic carriage return. The word-wrap function moves any word that crosses the right-hand margin to the next line and adjusts all subsequent text. The function keeps up with even the fastest typists and speeds composition because the user need not watch (or listen) for the end of a line. Some packages offer a similar function that permits the same nonstop data entry by automatically hyphenating words.

Scrolling and cursor-control functions further speed



Hardware for word-processing software: The installed base of office work stations (above) shows that desk-top computers—the machines that run the most third-party word-processing software—account for 40 percent of installed products. Advanced Resources Development, a Medfield, Mass., consulting firm, says, "...general-purpose desk-top computers will supply the rapidly expanding market for low-cost management work stations in the coming five years." Most of 1981's shipments (below) were to administrative/secretarial workers who, according to ARD, should still be receiving most work-station shipments in 1986.



data entry. Scrolling functions allow users to scroll text up and down a line at a time or a screen at a time. Cursor-control keys allow left and right cursor movement by character, word and tab stop, and up and down movement by line, screen and page. Other functions move the cursor to top or bottom of the screen, to the beginning or end of a document, to the start of the next line (return) or to the start of the next screen.

Easy editing

WP software improves editing efficiency even more than it eases data entry. A user can insert spaces, character, words, phrases and boxes of text anywhere in a document and can as easily delete spaces, characters, words, full and partial lines, paragraphs and pages. Selective delete commands can delete everything from the cursor to the end of a document or everything through a specified character.

Block operations work on large blocks of text that are defined by special characters called block markers. Once defined, blocks can be copied, moved, deleted, printed and written to disk files.

Search and replace operations work on word- and phrase-length character strings. A user can find a string, or find a string and replace it with another string. Search and replace operations can be performed individually, repeated at the touch of a single key or performed automatically any number of times. Search and delete commands are also possible. A global search and replace command performs a specified operation on every occurrence of a string with a document. "Wild card" operations use special characters to find similar strings. For example, "FIND *at AND REPLACE WITH bat" would change "Cat", "cat", "hat", "sat", and "rat" to "bat", but would also change "brat" to "bbat." To prevent such errors, most packages offer a selectable "match whole word only" search and replace.

Pre-print formatting

The pre-print formatting routines in most word-processing packages take full advantage of today's full-function letter-quality printers. Once a document has been entered and revised, the user formats it by filling in a checklist of formatting options. Page formats are specified in terms of right, left, top and bottom margins, characters per in., lines per in., paragraph spacing (indented or separated by >LF<s) and physical page length. The user can request automatic page headings and automatic Roman or Arabic page numbers printed in any location or alternating between right- and left-hand corners for "book-style" arrangments. Special format options number paragraphs, force new pages and permit two-column printing.

Justification options are numerous as well. Right, left and right and left justification are almost universally available as are line and page-centering commands. Three newer justification options are hard (unsplittable) spaces for phrases that should not be split by right margins; hard hyphens, which are similar; and automat-

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- 3. Data Security: Does it provide optional data encryption and separate definitions for read/write access to the item level?
- 4. Data Independence: Can the data base structure be modified without changing previous programs?
- Integration: Does the DBMS eliminate data redundancy?
- 6. Performance: Does it allow concurrent multi-user access with active and passive locking? Are response times acceptable even for very large data bases?
- 7. Ease of Use: Can many-to-many and recursive relationships be directly defined? Can programs be written in any major programming language? Are instructions short and simple?
- 8. Query Report System: Can ad hoc queries be easily made with non-procedural, English-like statements? Are sophisticated reports available from pre-defined queries? Nested queries?
- 9. Portability: Does the DBMS run under CP/M™, MP/M, CP/M-86, MP/M-86, PCDOS™, UNIX™? On Z80™, 8086, 8088, 68000, and PDP-11[™]? Does it run with COBOL, Pascal, FORTRAN, PL-7, Compiled BASIC and C?
- 10. Support: Are professional training, regular product updates, enhancements, and professional consulting all available?

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The pre-print formatting routines in most word-processing packages take full advantage of today's full-function letter-quality printers.

ic alignment of columnar decimal data.

The numerous character attributes that most WP packages can specify are the features that take best advantage of WP printers. Characters can be boldfaced, underlined, shadowed (double struck), superscripted, subscripted, overprinted and printed in a second color using a two-color ribbon. Attributes can be used individually or in a combination.

Word-processing utilities

The most important WP utilities are document/file handling routines and printer-control routines. The document handling routines save documents for future editing and printing, maintain document libraries and often generate automatic backup files. They can delete partial, total and multiple files, and can link and merge files to build boilerplate documents.

Printer-control functions allow users to print partial, single and multiple (spooled) documents, often during editing and document creation. Pause commands allow users to change ribbons, paper and printwheels during a print run, and conversion routines convert upper/lower case to all upper case and vice versa.

The programmability features of most WP packages

can also be thought of as utilities. They permit variable fields to be placed in documents and filled automatically from the system disk or manually from the keyboard. Some packages prompt the operator visually or aurally when input is required, and others speed mailing-list creation by automatically copying manually entered variable data onto disk files. Conditional branching features help personalize documents by dynamically selecting strings or text blocks from a library and inserting them into skeleton documents. For example, a package might recognize a 60614 zip code entered by an operator and change a phrase in a letter from "This is important to all Americans" to "This is important to people who live in Chicago."

New capabilities

The new features enhancing today's WP packages boost both functionality and operator convenience. One of the most popular convenience features is the "what you see is what you get" display screen that displays justified, proportionally spaced, enhanced characters in finished page formats complete with headings, footings and page numbers. Pages appear on the screen just as they will on paper. To integrate numerical and textual data, many packages offer math functions via function pads that can be shifted to make them calculator pads. Others offer VisiCalc-type functions that do tabular/columnar math on the CRT screen.

More and more packages include automatic index and table of contents generators and spelling and syntax checker/correctors. These and other new functions

tely under AFCAD software control). Excepnges, this page is printed continuously from operator intervention - there is NO CUT AND P

CH ELITE - 5 LINES PER INCH

core and seven years ago our fathers ht forth upon this continent a new n, conceived in liberty, and dedicated e proposition that all men are created

SHADOW PRINT

en years ago our fathers brought forth upon this cont red in liberty, and dedicated to the proposition that

- BOLD PRINT

even years ago our fathers brought forth upo nation, conceived in liberty, and dedicated t all men are created equal.

PROPORTIONAL SPACE - SHADOW AND UNDERLINE

n years ago our fathers brought forth upon this conti ed in liberty, and dedicated to the proposition that of

MULTI-COLUMN PR

The text on this page is printed completely under AFG top to bottom and no cut and paste. The print font

Fourscore and seven years ago our fathers brought forth upon this continent a new nation, conceived in liberty, and dedicated to the proposition that all men are created equal.

Now we are engaged in a great civil war, testing whether that nation, or any nation so conceived and so dedicated can long endure. We are met on a great battlefield of the We have come to ded portion of that field final resting-place for who here gave their liv that nation might live altogether fitting and that we should do this

But in a larger sen cannot dedicate - we consecrate - we cannot

ment

people

It is rather for us to be here dedicated to the great task remaining before us - that from these honored dead we take increased devotion to that cause for which they gave the last full measure of devotion; that we here highly resolve that these dead shall not hove died in vain; that this nation, under God, shall have a new birth of freedom; and that govern-

The people's government, made for the people, made people.

Daniel Webster Second Speech on Foote's Resolution

Page formats and character attributes produced by Afcad Systems, Inc.'s AFCAD word-processing package. Most of today's word-processing packages can take full advantage of modern letter-quality printers. These examples contain justified, proportionally spaced and enhanced characters; multicolumn text; tabular data; and mathematical expression with line graphics, superscripts and subscripts.

The BENCHMARK (TM)
Word processer, Ver 2:1

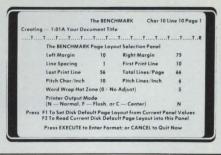
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Monday, November 17, 1980 8:30 AM

Press C — to CREATE a new document
R — to REVIEW a document
F — to FRINT a document
M — for MBRCE functions
D — for DISK procedures

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Menu-driven word-processing packages such as Metasoft's Benchmark use nested menus to guide users from general to specific functions quickly. At left is the Master or "starting" menu, the first thing to appear after Benchmark is loaded. In the center is the Document Information Panel that appears if a user types a "C" at the Master Menu level. On the right is the Page Layout Selection Panel that appears when a user presses an execute key at the Document Information level. Fill-in-the-blank checklists and menus assign character attributes and control most other system functions.

provide productivity improvements beyond normal WP, but the versions on the market are pioneering efforts, and improved versions of all are promised.

Because third-party packages are used on general-purpose minis and μcs , rather than on hardware customized for word processing, they can draw on their host's processing power to provide security features, such as passwords and restricted libraries, business graphics, electronic mail, phone index, appointment calendar and card file functions. With the exception of graphics routines, these functions are all clerical and can quickly make a WP operator into an efficient office manager.

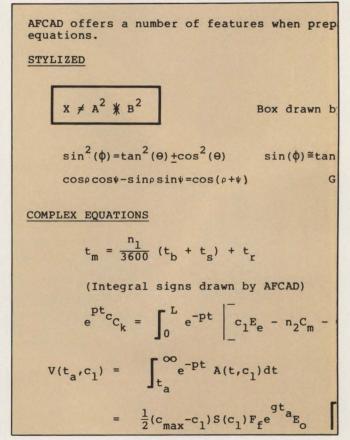
Software selection

Prospective buyers of WP software have more packages and features to choose from than ever before.

Fortunately, software packages have specific host-hardware, operating-system and memory requirements. A user should begin any software comparison (using our product table, for example) by eliminating those packages that don't meet his hardware and software constraints. Only then should feature-by-feature comparisons begin. Using the *Mini-Micro Systems* Command Checklist, or a similar document adapted to reflect individual user priorities, a user can compare the power of a number of packages.

The other major factors that should be part of the selection process are price and documentation. Prices for the packages we surveyed vary from less than \$100 to several thousand dollars, and while most are sold outright, a few are licensed for various periods. Documentation quality determines how easily a package can be learned. In its promotional literature, Para

	FACTORY VA	TABLE ALUE OF TELEVISE IN MILLIONS	ION SHIPMENTS 1	9.
1	YEAR	COLOR	MONOCHROME	
	1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985	1801.2 2428.5 2683.0 2859.8 2464.8 2216.5 2687.3 3185.0 3570.0 3582.3 3544.2 3511.4 3686.5 3513.6 3710.0 3855.6	583.2 738.9 638.3 537.3 466.1 436.2 484.7 507.3 518.5 522.9 547.8 598.4 599.7 612.0 651.1 684.0	
	TOTAL	drew the box a		



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with just the

features

you want

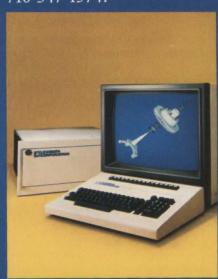
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WORD-PROCESSING COMMAND CHECKLIST

This checklist summarizes the commands offered by popular third-party word-processing software packages. By using it—or a customized subset of it that reflects individual priorities—prospective buyers can compare the power of different word-processing packages. Purchasing should be based on price, vendor reputation and documentation quality. New features appear every day. If you learn of one or have a particularly good or bad experience with a word-processing package, let us know. We'll check it out.

DOCUMENT CREATION			
Cursor Movement		Search and Replace Operations	
move cursor left and right by		find string	000
character/word	000	find string and replace	
move cursor to left and right of		find string and replace with	
a line		verification	
move cursor up and down one line		find string and replace n times	000
move cursor to top of screen		global find and replace	000
(1st character of 1st line)		repeat last find operation	666
move cursor to bottom of screen		ignore a specific string occurence	
move cursor to beginning/end		when searching	000
of document		match only whole words	āñā
move cursor to next screen		search and replace operations	
move cursor to start of next line		using "wild cards"	
move cursor to a specified page		search and delete	777
[18] H. H. S. M.			
Scrolling		FORMATTING	
scroll text up and down one line		Page Layout	
scroll text up and down one screen		set top, bottom, left, right margins	
Screen Formatting		insert page headings	
set/clear all tabs		insert page footings	
set/clear single tab		set heading margin	
set left and right margins		set footing margin	
margin release		set physical page length	
word wrap		set number of characters per inch	
variable word wrap		set number of lines per inch	
reformat paragraph		temporary left margin offset	
automatic page breaks		indent first lines of paragraphs	
manual page breaks		outdent first lines of paragraphs	
automatic hyphenation		number paragraphs	
EDITING		insert <lf> between paragraphs</lf>	
Insertion and Deletion		suppress headings and footings	
insert character		page numbering	
delete character/next character		page number suppression	
delete preceding character		book-style page numbering (odd numbers on right)	
delete next word		force new page	
delete remainder of line		two-column printing	i i i
delete preceding part of line			
delete entire line		Justification	
delete to end of document		right justify	
delete through specified character		center	
delete paragraph		ragged left margin	
Block Operations		hard (unsplittable) spaces	
copy block (of text)		hard (unsplittable) hyphens	
move block		automatic alignment of decimal	
delete block		data	
erase all block markers		Character Attributes	
print block		underline	
hide/display block		boldface	
write block to file		(Checklist continues	on next page)

WORD-PROCESSING COMMAND CHECKLIST (cont.)

shadowed (double strike)	000	print multiple copies of a	
variable intensity boldface		document	
superscript		interrupt/resume printing	
subscript		display/change print format	
overprint		pause and display message	
combined attributes (i.e.		pause for paper insertion	
underlined and bold)		continuous printing of multiple	
ribbon color shift		documents (print spooling)	
proportional spacing		convert to all uppercase	
continuously variable character		convert to upper/lowercase	
spacing		typesetter	
explicit alternate character pitch		Programming	
pitch-independent line lengths		string, integer, dollar and system	
UTILITIES AND SPECIAL FEATURES		variables	000
Document/File Operations		input to variables from disk	
display file directory		input to variables from operator	
save file		(fill in the blanks)	
exit file without saving		prompt operator for input	
save file and continue editing		output variable information to	
save from cursor to end of file		disk (simultaneous WP, data	
automatic backup—one		capture)	
generation		conditional branching	
automatic backup—n generations		Miscellaneous (mostly new)	
read file		Features	
read part of file		draft and finish printer drivers	
delete file		programmer mode	
delete files with "wild cards"		calculator utility	
rename file		business graphics (character	
link/merge WP documents and		graphics)	
non-WP documents (i.e.	000	mail list create/update/select/	
VisiCalc)		sort routines	
move text blocks from document		columnar math	
to document		automatic table of contents	
copy text blocks from document to document		automatic index	
Printer Control		"what you see is what you get"	
		display (print enhancements	
print a specified page		on screen)	Ц Ц Ц
print starting from a specified page		security passwords by library, by document	000
print through a specified page		electronic mail packages	
print starting from cursor		spelling check/correct	
position		phone index, appointment	
print with values from a specified		calendar, card file routines	
disk record		syntax check	
print unitl a specified record is		by Items of the state of the st	
read			
Other features		Secretary to the second secretary to the second sec	
ounce readures			
Company Company and the Company of t			

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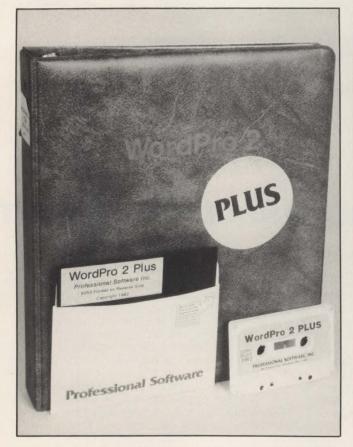
The most important word-processing utilities are document-/file-handling routines and printer-control routines.

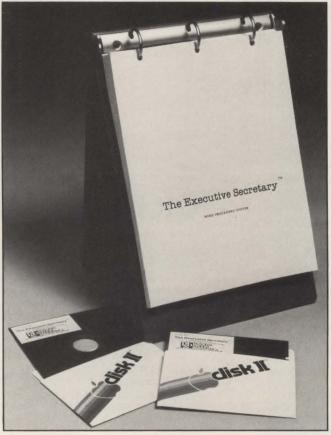
Research, Rockport, Mass., claims that "if you can operate a typewriter and a television set and read, you're overqualified." With well-documented systems, this is only a mild exaggeration; with poorly documented systems, veteran programmers are puzzled. The sales literature and users manuals sent to *Mini-Micro Systems* were surprisingly well organized and well written. Many companies offer diskettes containing training routines, and others offer audio cassette-based training programs.

In all, WP packages are easier to learn, easier to use and more powerful than they were a year ago. Spelling and syntax checkers promise to automate the writing process even further, but most of the new innovations in WP software seem to be supplementary office-automation routines. Word processing's effect on office productivity has been documented, and by building filing, mailing and scheduling routines into their packages, WP software vendors are cleverly leading the way to office automation.

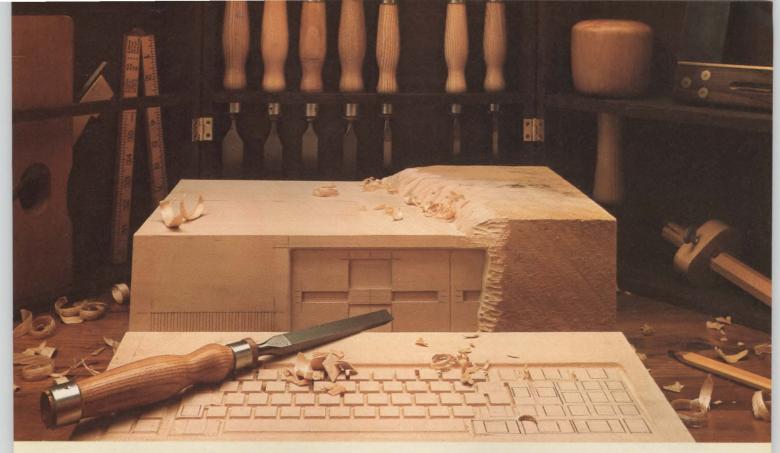


Function keys are used to execute popular commands in most word-processing packages. The keypad above is from a Digital Equipment Corp. VT-100-compatible terminal running Unique Automation Products' EZEDIT/WP, a full-screen text editor used with the company's EZTYPE text formatter to perform word-processing on DEC LSI-11 and PDP-11 minicomputers.





Comprehensive documentation makes word-processing software easy to learn and use. Professional Software's WordPro 2 (left) package is supplied with complete documentation and an audio training cassette. Personal Business System's Executive Secretary (right) is supplied in a binder that doubles as a copy stand for easy reference.



MS-DOS gives you the only complete set of software tools for 16-bit systems. Now. From Microsoft.

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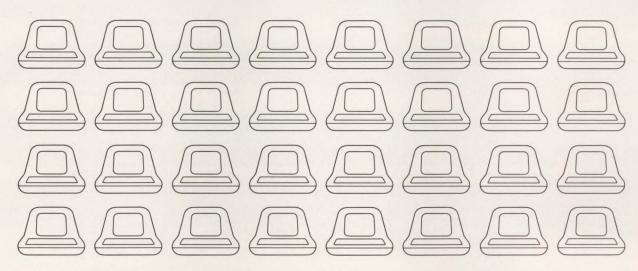
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Manufacturer Package name	Hardware supported	Operating systems supported	Memory required (bytes)	Price	Supplied on	Notes	Circle no.
AccuSoft, Inc. Zword/34	IBM System/34		40K	\$3000		columnar math, data merging,	378
Zword/38	IBM System/38			\$4500		chapter/page numbering standard columnar math, data merging, chapter/page numbering standard	
AFCAD Systems, Inc. AFCAD	Prime	Primos	128K	\$10,000	magnetic tape		379
AICS	LIBAGO GOOG			41005	LID COLL I		380
System 2000 Word Processor	HP1000, 3000, 2645			\$1995	HP 32K-byte memory board with WP firmware in ROM	can function in a terminal as a stand-alone word processor or as part of a computer system	
Applied Business Systems							38
Script Master	Data General microNova, Nova, Eclipse	DOS, RDOS, AOS	64K	\$2000/ single CPU, \$2500/ multiple CPU	diskette or hard disk		
Script Master/Mail Master (integrated)	Data General, microNova, Nova, Eclipse	DOS, RDOS, AOS	64K	\$3000/ single CPU, \$4000/ multiple CPU	diskette or hard disk	WP package integrated with a mailing list management package	
ASRA, Inc. Subscript	IBM Series 1	EDV 2 0 2 1	3EV	61650	diakatta	file angelor mass mailing utility	382
Bellin Computer Systems,	IBINI Series I	EDX 3.0-3.1	25K	\$1650	diskette	file spooler, mass mailing utility standard	383
nc. WPS	Data General	DOS, RDOS	128K	\$2750	, magnatis tana	anti-man and disas at an about	
CARDA Information	Data General	DO3, NDO3	1200	\$2750	magnetic tape	column adding standard	
Systems, Inc. WPS-300	DEC PDP-11	RT-11	56K	\$1000	diskette, magnetic tape,	minor modification allows use with other operating systems	384
Commercial Data Corp.	NCR Criterion	VRX	32K	\$1500	RL01 magnetic tape		385
Commonwealth Systems							386
nteractive Word Processing System Compu-Tome, Inc.	NCR I Series	IMOS 2, 3, 5, IRX	13K	\$1995	cassette, disk	interfaces with existing data files	387
ct*os	DEC PDP-11, VAX	VMS, RSTS, RSX, RT, TSX	56K (stand- alone), 50K/user (multi-terminal)	\$2200- \$2400	cassette, diskette, magnetic tape, RL01, RL02	emulates PDP-8 word processing; list processing, database access standard	30,
Cyex Systems Corp. Visdom II	Data General	DOS, RDOS, AOS	14K	\$1250	diskette standard, hard disk optional	multi-user support, 12000 pages/document, provision to access DP files standard	388
Cy-Globel	Texas Instruments DS990	DX-10		\$6000	magnetic tape or disk	on-line help tutorial, column conversion, row/column arithmetic, provision for access to DP files standard	
Datasoft, Inc. Text Wizard	Atari 400/800 with 810 drive, 850 interface	Atari DOS	32K	\$100	diskette		389
Delphi Data Systems Inc. Multiword	IBM Series/1, HP3000, NCR 8150-8550	EDX, MPE, IDPS, IMOS, IRX, VRX	25K		magnetic tape, user-supplied hard disk, cassette	management report and mail list maintenance routines standard	390
Oynamic Concepts, Inc. Sentex	Data General Nova, Eclipse	BITS (Dynamic Concepts, Inc.)		\$2000	disk		391
EC Systems							392
.EX-11	DEC LSI-11, PDP-11, VAX	RT-11, TSX- PLUS, RSX, IAS, RSTS/E, IDRIS, UNIX,	17K/user, 8K runtime system	\$2500- \$7500	any media	list processing, user-defined function keys, integral calculator, on-screen justification, spelling dictionary, processing of externally	



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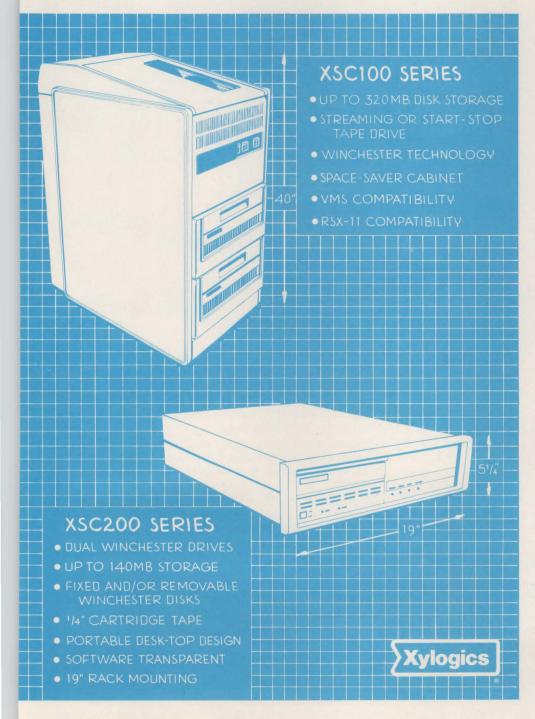


The Supermicro Company™

Manufacturer Package name	Hardware supported	Operating systems supported	Memory required (bytes)	Price	Supplied on	Notes	Circle no.
Exact Systems and Programming							39
Wordbase	Data General, microNova, Nova, Eclipse	DOS, RDOS, AOS	10K/user	\$1250- \$4500	diskette, magnetic tape	a database-oriented word- processing package	
Electric Office	Data General, microNova, Nova, Eclipse	DOS, RDOS, AOS	10K/user	\$1975- \$14,800	diskette, magnetic tape	a filing, mailing, appointment scheduler incorporating Wordbase	
Financial Software Inc. Word Processor/34	IBM System/34	SSP	36K	\$3000	diskette	math and move columns, dynamic file insertion standard	39
Word Processor/38	IBM System/38	SSP	200K	\$4000	diskette	math and move columns, dynamic file insertion standard	
Hamlin, Williams &							200
Associates, Inc. HWA Word Processor	IBM 5110, 5120, S/23		32K	\$475	diskette	mailing routines standard	39
IJG, Inc. Electric Pencil II	Tandy TRS-80 models I, III	TRSDOS	32K	\$90			39
Information Unlimited	models i, iii						
Software	Apple II II Div	Apple DOC	401/	0400	dialente	o 40 column no diseas	39
Easy Writer Easy Writer Professional	Apple II, II Plus Apple II, II Plus, IBM Display- writer	Apple DOS Apple DOS, IBM DOS	48K 48K	\$100 \$175	diskette diskette	a 40-column package	
InfoSoft Systems, Inc. WP Daisy	Altos Superbrain, TRS-80 model II, most	I/OS, UNI/OS, Multi/OS, CP/M	32K	\$375	51/4- or 8-in. diskette	tutorial aids, 36 text buffers standard; custom OEM versions optional	39
	Z80/8080/8085 disk-based systems						
IPT Corp. TIPS	Data General Nova, Eclipse	RDOS, DOS, AOS, AOS/VS, MP/OS, CS	48K	\$1200- \$4800	diskette, magnetic tape	spelling dictionary, proportional pitch, true page display standard	39
Lexisoft Spellbinder		CP/M, OASIS	32K	\$495	diskette	office management, math routines standard	400
M/A-COM OSI							40
WP-3-1	C4P (C100) and other OSI memory- mapped video systems	OS65D	48K	\$150	diskette		
WP-3-2	all OSI serial systems	OS65D	48K	\$150	diskette		
WP-3-3	all OSI hard- disk systems	OS65U	56K	\$150	diskette		
MARC Software							THE STATE OF THE S
i nternational, Inc. MUSE	Prime, Harris, Gould/S.E.L., DEC	Primos, Vulcan, MPX, RSX-11M, VMS, TOPS-10, TOPS-20	120K plus 40K/user	\$6800 (1 to 3 users), \$12,500 (unlim- ited users)	magnetic tape, diskette	scientific typing feature allows 8 levels of super- and subscripts	403
Mark of the Unicorn, Inc.							403
The Final Word	DEC PDP-11, Zilog Z80/ Z8000, Intel 8080/ 8085/8086/ 8088	RT-11, RSX-11M RSTS/E, CP/M-86 MS-DOS, UNIX, ONYX, ZENIX	56K	\$300	diskette	table of contents, footnote, chapter- numbering routines, concurrent editing, printing standard	
Mince (text editor)	DEC PDP-11, Zilog Z80/ Z8000, Intel 8080/ 8085/8086/ 8088	RT-11, RSX-11M RSTS/E, CP/M-86 MS-DOS, UNIX, ONYX,	48K	\$175	diskette	undo key, dual file display, beginner and intermediate documentation standards; written in C	

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		Operating	Memory				
Manufacturer Package name	Hardware supported	systems supported	required (bytes)	Price	Supplied on	Notes	Circ no.
Scribble (text formatter)	DEC PDP-11, Zilog Z80/ Z8000, Intel 8080/8085/ 8086/8088	RT-11, RSX-11M, RSTS/E, CP/M, CP/M-86, MS-DOS, UNIX, ONYX, ZENIX	56K	\$175	diskette	command set is format-oriented to deal with chapters, sections, subsections, footnotes, lists, quotations, etc.; written in C	
Maryland Computer Services, Inc.	LIBOSO	Dusiness	1001/	£1500	diaketta	works with Image databases	41
CP250	HP250	Business BASIC/DBMS	160K	\$1500	diskette	works with Image databases	
Metasoft Corp. Benchmark Word Processor 3	Sharp, Zenith, North Star, Apple, ECS, NEC, Victor, Vector Graphics, Superbrain, IBM	CP/M	64K	\$500	diskette	52 user-defined phases in phrase library standard	40
Micro Architect, Inc. Word-C1	Altos, Xerox,	CP/M 2.2	60K	\$85	diskette	text/data-merging standard	40
	other CP/M systems						
Word-I1	IBM	IBM-DOS	64K	\$88	diskette	text/data-merging standard	
Word-IV	TRS-80, models I, II, III	TRSDOS	32K	\$49	diskette		
Word-V	TRS-80, models I, II, III	TRSDOS	48K	\$79	diskette		
On-Line Systems Screenwriter II	Apple II, II-Plus, III	Apple DOS 3.3	48K	\$130	diskette	index generation standard	(40
Option/1 Systems Word 3	IBM 5110,		32K	\$2000	diskette		40
MLS/3	5120 IBM 5110,		32K	\$1500	diskette	a WP mailing list package	
List/23	5120 IBM System 23		64K	\$1500	diskette	a WP/mailing list package;	
Universal W/P	IBM Series/1	EDX Level 3.1	20K	\$4500	diskette	database access standard	
Para Research Paratext	IBM System/34, System/38	SSP	28K plus 250 blocks of library space	\$750	single- or double-density diskettes	written in RPG II	40
Pensadyne					dionottoo		4
Pensa-Write 2 Plessey Peripheral	Tandy TRS-80 models I, II	TRSDOS	32K	\$80			
Systems, Inc. PWS-1	DEC LSI-11, PDP-11	RT-11, RSX-11M, RSTS/E, TSX, TSX-PLUS	64K	\$2300- \$5000	diskette, magnetic tape, RL02, RK05	spelling correction, auto page/paragraph/hyphenate, menu- driven sort utility standard	4
Professional Computer Resources, Inc.		10.0					41
Nord Power II	IBM S/34	SSP	36K	\$2500	diskette	database access routines, mailing routines standard	
Professional Software,							4
WordPro 1 Plus	Commodore	6502			cassette		-
WordPro 2 Plus	Commodore	6502	32K	\$200	diskette, cassette		
WordPro 3 Plus	Commodore	6502	32K	\$295	diskette		
NordPro 4 Plus	Commodore	6502		\$450	diskette		
WordPro 5 Plus	Commodore	6502		\$450	diskette		
Quark Engineering	1-1						41
Nord Joggler	Apple III	SOS	128K	\$295	diskette	simple mail list and form letter capability standard; spelling checker, mail list package,	

W	ORD-PROC	CESSING S	OFTWAR	E FOR N	IINICOMPU	TERS, μCS	
Manufacturer Package name	Hardware supported	Operating systems supported	Memory required (bytes)	Price	Supplied	Notes	Circle
Radio Shack							41
Scripsit	TRS-80 models I and II	TRSDOS	32K	\$100	diskette	dictionary optional, audio course with training manual standard	
Scripsit 2.0	TRS-80 model I	TRSDOS	64K	\$399	diskette	spelling and hyphenation dictionary: \$199	
Super Scripsit	TRS-80 models I and II	TRSDOS	48K	\$199	diskette	spelling and hyphenation dictionary optional, audio course and training manual standard	
R&B Computer Systems,							41
Inc. Benchmark Word Processor	North Star Horizon or any Z80-based system	North Star DOS, CP/M	48K	\$500	51/4-in. diskette	menu driven; text merge from keyboard and files standard	41
L.D. Ridgeway, Inc.							41
The Information Center	Z80	CP/M	96K	\$5000 (license)	diskette	video-training package standard; combines database management, WP and resource management	
RLG Corp.	O= C0000	11800/1/7	CAV	\$10,000		on office systematics realized	41
OPUS	Onyx C8002, VT-100 compatible CRTs	UNIV V.7	64K	\$10,000	cassette	an office-automation package featuring electronic mail, telephone log, calendar management, electronic filing, calculator standard	
Santa Cruz Educational Software							41
Mini Word Processor	Atari 400/800	Atari	32K	\$20	cassette, diskette		
Silicon Valley Systems Word Handler	Apple II, II+	DOS	48K	\$249	diskette		42
Software Dynamics	Apple II, II+	D03	401	DZ49	diskette		42
Micro Word	6800/6809- based systems	SDOS, SDOS/MT	56K	\$800	single- or dual- density diskette	menu driven; merged text for form letters, built-in spooler and print queue manager standard	72
Type Sedit	0000/0000	2000	101/	0055	to de la		42
	6800/6809- based systems	SDOS, SDO/MT	48K	\$255	single- or dual- density diskette	table of contents routine, merged text form letters standard	
The Software Store, Ltd. Mini Word Processing	CP/M systems	CP/M	48K	\$195	diskette	some mailing-list functions	42
System	with Microsoft BASIC	OI /W	4010	Ψ195	diskette	standard	
Sofsys, Inc.							42
The Executive Secretary	Apple II Plus, IBM Display- writer	Apple DOS, IBM DOS, CP/M	48K	\$250	51/4-in. diskette	index file, electronic mail routines, database access standard; spelling feature optional	
Southwestern Data Systems							42
The Correspondent	Apple II, II Plus	DOS 3.3	48K	\$60	diskette	uses Apple screen for "windowed" editing but can display 80-col. data for pre-print checking	74
SSM Marketing							42
Lazy Writer	TRS-80 models I, III	TRSDOS	32K	\$175			
Systar Corp.							42
WP/1	IBM Series/1	EDX	25K/user	\$2500	diskette	access to database files standard; runs concurrently with other EDX programs	
Technical Analysis Corp.							42
WPS	Data General, microNova, Nova, Eclipse	DOS, RDOS	64K	\$1000 (DOS), \$1500	magnetic tape, diskette	runs under DG Business BASIC, single station only	
WPSII	Data General	DOS BDOS	64K DOS	(RDOS)	magnetic tane	runs under DG/Rusiness RASIC	

64K DOS, 96K RDOS

64K

256K

system

minimum

\$2000

\$1200

\$2900

\$2500

diskette

diskette

DOS, RDOS

ICOS

DX10

MPE-III, -IV

Data General,

microNova,

Nova, Eclipse

Data General,

commercial

Novas, Eclipse

Texas

Instruments

DS990

HP3000

WPSII

Thermeon Corp. WordPro

Timberline Systems

Trident Data Systems

Lastword

R Systems Word Processing



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		Operating	Memory				
Manufacturer Package name	Hardware supported	systems supported	required (bytes)	Price	Supplied on	Notes	Circle no.
Unique Automation Products							43
UAP Word Processing	DEC PDP-11	RT-11, TSX- PLUS		\$1500	diskette	name-list management standard	
Westico, Inc.							43
Word III	Apple III	SOS	96K	\$195	diskette		
Business Application Systems							37
BAS	Texas Instruments 771, DS990	DX10	64K			underline, subscript, superscript	
Digital Marketing							37
Copywriter +	North Star, Superbrain, TRS-80 model II, Vector Graphics	CP/M	54K			word and character spacing	
Small Business Applications, Inc.							37
Magic Word		CP/M	36K				
Michael Shrayer Software, nc.							37
Electric Pencil II	S-100 systems, TRS-80 models I, II	CP/M, TRSDOS	32K		diskette		
Muse Software							37
Super-Text II	Apple II, Apple II+		48K	\$175	diskette		
Saturn Systems Inc.							37
WP Saturn	DEC PDP-11 LSI 11	RT-11, RSX-11, RSTS	12K				
Foxware Products							37
nk Wall 2.0	Apple III	SOS	128K	\$185	diskette	"what you see is what you get" screen, 155 character lines	



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OFFICE AUTOMATION

Serial printer ribbons: a market snapshot

PATRICK KENEALY, Associate Editor

Numerous supply channels and ambiguous advertising make it easy to get tangled in the ribbon market

Some quick mathematics show that the market for serial-printer ribbons is big. Dataquest and other computer-industry market-research houses estimate that there were roughly 2 million serial printers installed by the end of 1981. Assuming that every serial printer used 30 ribbons that year and that an average end-user ribbon price is \$4, the serial printer-ribbon market was worth more than \$330 million in 1981. Serial-printer shipment estimates point to an installed base of 9.5 million units by 1986, which indicates a ribbon market worth more than \$1 billion. These revenues have lured many companies into the ribbon industry, resulting in channels of distribution that are complex, even for a supplies industry. The ribbon industry's complexity presents pitfalls to new buyers

and sellers alike. A look at which companies offer what kind of ribbons will help system integrators consider a strategic move into the ribbon market and could save end users some money.

Ribbon alternatives

Serial-printer ribbons are classified by ribbon material as either fabric or film and by packaging as either spooled or cartridge. Fabric ribbons use a specially woven fabric, usually nylon, to carry ink, and are offered both on spools and in cartridges. Fabric ribbons are rarely used in letter-quality applications and are used primarily with dot-matrix printers because they can be used unattended. Typical continuous-loop fabric-ribbon cartridges offer useful character yields of

MAIL ORDER RIBBON PRICES									
			Mail order computer supply companies (price per ribbon/ft. per ribbon)				Ribbon manufacturers that sell by m (price per ribbon/ft. per ribbon)		
Printers	Substrate	Continental Resources	Fidelity*	Misco	Uarco	Visible	Pelikan**	Aspen Ribbon***	
Diablo Hytype II	film fabric	7.60/475 5.45/65	8.95/360 7.95/65	6.25/ 6.25/	5.80/ 5.80/	5.75/ 3.75/	3.67/ 3.85/	4.50/ 4.50/51	
NEC Spinwriter	film fabric	5.80/353 6.00/45	7.95/328 7.95/53	7.50/ 7.50/	6.30/ 8.30/	8.25/ 8.25/	4.24/ 4.24/	5.00/ 5.00/45	
Qume (all models)	film fabric	3.85/295 4.70/46	5.95/43	4.10/ 4.10/	3.35/	4.35/ 3.05/	2.11/ 2.75/	3.50/ 4.00/45	
Centronics 100, 300, 500	fabric	6.75/108	10/2/10	5.75/108	7.20/108	6.45/108			
Digital Equipment LA 30/36, DECwriter II	fabric	4.60/120	5.25/120	3.95/120	4.95/120	4.55/120		3.50/120	
GE Terminet 300, 120, 1200	fabric	2.60/54		3.25/54	3.35/54	_	_	2.50/48	
IBM S/1, S/32, S/34	fabric	2.90/30	4.75/30	3.95/30 * 3-rib	3.60/30 bon minimum	3.85/30 ** 12-rib	2.13/ bon minimum *	4.00/30 ** \$50 minimum	

The mail-order ribbon business offers buyers the same potential economies and risks as other mail-order businesses. Above is a price-comparison chart for popular ribbons and large mail-order companies. Data were supplied to Mini-Micro Systems in companies' catalogs and are subject to change at any time. The ribbon manufacturers in the Color X part of the chart offer lower prices than most but have larger minimum order sizes. Virtually all companies offer dollar-volume and quantity discounts, but as the "feet per ribbon" figures (or their absence) indicate, apples to apples comparisons are difficult.

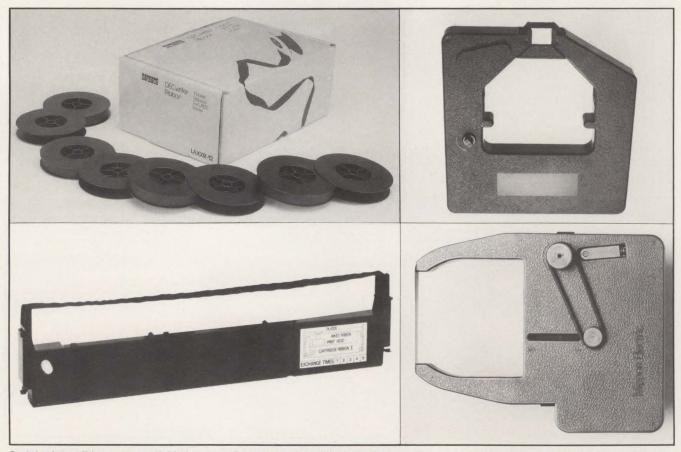
Serial-printer ribbons are classified by ribbon material as either fabric or film and by packaging as either spooled or cartridge.

between 750,000 and 1 million character impressions. Fabric-ribbon cartridges incorporating internal reinking mechanisms claim 200- to 500-percent yield improvements but cost more and have a worse reliability reputation.

Film ribbons use polymer, Mylar or polyethelene films to carry ink and are sold almost exclusively in disposable cartridges. There are two types of filmribbon cartridges: single-strike and multi-strike (the term Multistrike is a trademark of Qume Corp.). Single-strike cartridge ribbons advance a full character space after every strike and provide the crispest, highest quality output. They offer relatively low yield of 120,000 characters per cartridge and are used in only 1 percent of data- and word-processing applications, usually in preparation of camera-ready and OCR originals.

Multi-strike film ribbons advance one-third of a character space each time the ribbon is struck. They offer yields in the 200,000-character-per-cartridge range, but new, thinner substrates such as those offered by Qume and Aspen Ribbons, Inc., have given some cartridges 300,000-character yields. The snap-in convenience of multi-strike film ribbons has made them the most popular ribbon for Qume, Diablo Systems, Inc. and NEC Information Systems, Inc., solid-font serial printers.

A third way of classifying ribbons transcends substrate materials and packaging. Film or fabric, cartridge or spool, all serial-printer ribbons can be classified as brand-name, second-source or remanufactured. Brand-name ribbons such as those from Digital Equipment Corp., Diablo, Qume and NEC are expensive but generally reliable. Second-source ribbons are made by independent ribbon manufacturers as plugcompatible replacements for brand-name products. Second-source ribbon reliability varies greatly from manufacturer to manufacturer, but prices are generally 25 to 35 percent lower than brand-name prices. Remanufactured ribbon cartridges are used cartridges that have been repacked with new ribbons. They sell for 40 to 60 percent less than brand-name ribbons and are gradually overcoming bad reliability reputations. Recycled (re-inked), spooled serial-printer ribbons are available and inexpensive, but serial-printer-spool recycling has never been as popular as line-printerribbon recycling.



Serial-printer ribbons are available in many shapes and sizes. Clockwise from top left are spooled ribbons for a DEC LA120 matrix printer, a 45-ft. mobius loop fabric ribbon cartridge made by Curtis-Young Corp. for Tritel/Quantel/Cado matrix printers, an NEC multi-strike film cartridge for NEC Spinwriter printers and an Aspen Ribbons nylon ribbon cartridge for Commodore Business Machines, Hewlett-Packard Co. and IBM personal computers.

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electronics that provide a level of versatility we call PRINTSTATION PROCESSING. But if beauty is in the eye of the beholder, you should behold the Printstation 350 in operation. For more information

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lower case with business graphics and a choice of keyboards—both of which include typamatic keys, n-key rollover, and automatic tabbing for ease of use.

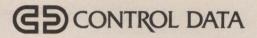
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Addressing society's major unmet needs as profitable business opportunities

CIRCLE NO. 103 ON INQUIRY CARD

If would be easy for a neophyte serial-printer user to conclude that everyone is in the ribbon business.

Distribution channels

It would be easy for a neophyte serial-printer user to conclude that everyone is in the ribbon business. The user can buy ribbons at his local stationer or computer store. He can buy ribbons through the mail from office-supply catalogs or from the new mail-order data-processing-supplies catalogs. Whether he bought his serial printer from a manufacturer such as DEC or International Business Machines Corp., from a systems house or from the local representative of a printer company such as Diablo or Qume, he'll find his printer supplier offering ribbons as well. Finally, he can buy ribbons (in medium and large quantities) from one of the 60 or so independent ribbon manufacturers.

Local stationery or computer retailers sell mostly individual ribbons at healthy retail markups but are convenient in a pinch. Mail-order stationery catalogs offers a few popular ribbon styles as part of their office-supply product line. Mail-order computer-supply companies are a growing group and offer a very wide range of ribbons in larger quantities and at lower prices than retail outlets. They sell ribbons individually, by the dozen or by the gross, and can ship most ribbons

from stock using overnight delivery services. Minicomputer manufacturers and system integrators have the advantage of essentially free sales calls in the form of scheduled maintenance visits and sell ribbons through their hardware sales and service personnel. They offer a buyer delivery and single-vendor responsibility for reliable printer and ribbon operation, but their prices are not low.

The independent ribbon manufacturers such as Aspen Ribbons and Pelikan, Inc., make plug-compatible replacements for virtually all cloth and film, spool and cartridge ribbons, and many have earned good or bad reputations for the reliability of their products. The independents do sell ribbons to end users but often impose service charges on orders that don't meet quantity or dollar-volume minimums.

Selecting ribbons and ribbon vendors

There are some general rules to follow when choosing ribbons and ribbon vendors.

- Tell the supplier whether you will accept brandname, second-source or manufactured ribbons, and check your ribbons when they arrive to make sure they're what you ordered.
- Ask how many character impressions a ribbon will yield, and how many feet of ribbon each cartridge or spool contains.
- Ask about return policies and request written guarantees. There will always be bad batches of ribbons; insist on good support.

		TI EI VENDON OEI	LECTION CRITERIA		
Criteria	Very important	Important	Somewhat important	Not very important	Total respondents
Price	48%	47%	5%	0%	178
Service	80%	17%	2%	1%	177
Prompt delivery	29%	44%	25%	2%	172
Brand names	7%	30%	40%	23%	171
Satisfaction	85%	12%	2%	1%	175

Good service and low prices do the most to attract and keep supplies customers according to a recent survey published by Frost & Sullivan, a New York market-research company. Brand loyalty is a bit more important to ribbon buyers than to general data-processing-supplies buyers because brand-name ribbons have the best reliability reputations.

BUYING RIBBONS FROM A CATALOG —ADVICE FROM AN EXPERT

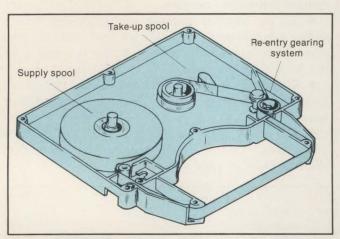
As president of Misco, Inc., a New Jersey-based computer-supplies vendor that sells via a national catalog, Joseph V. Popolo has learned a lot about computer ribbons. He has written about supplies markets for industry journals and has spoken on the subject at the past two Comdex shows. Some of his tips to mail-order ribbon buyers:

"When ordering ribbons, determine in advance whether the supplier is selling you brand-name or brandname-compatible ribbons. Whether you order from IBM or DEC, Misco or INMAC, be sure to check out the warranty. Ask a few customers how fast the ribbon supplier supports them on returnable...just how easy is it to do business with each of the computer supplies companies? As a dealer, we prefer brand-name ribbons. Our only business is computer supplies, and we know the brand-name companies will support their warranties."



DEC and IBM have recently released national mail-order catalogs of programs called DECdirect and IBM Direct.

- Check each supplier's discount structure. Discounts may be based on quantity or dollar volume and may apply for single orders or over extended periods. Ribbon can usually be bought with other supplies to achieve higher discounts.
- Find the supply channel that's best for you and shop around among competitors. Once you've found a dependable source of reasonably priced, reliable ribbons, stick with that supplier. Build a good working relationship with that vendor, but compare prices periodically to keep him honest.



Inside a modern film-ribbon cartridge, there are few moving parts. This Qume Quickload cartridge uses a slip clutch advance mechanism to provide uniform take-up tension for more reliable rewind of used ribbon. Packed with Multistrike III ribbon, the cartridge is said to last for 300,000 character impressions.

All told, the numerous firms and products should inspire caution in systems houses and others considering entry into the serial-printer ribbon market. Industry-wide price competition is nothing short of vicious, and the specialized mail-order computer supplies companies are fierce, efficient competitors whose presence is not felt yet in general-hardware markets. By offering toll-free telephone ordering, nationwide next-day delivery, large inventories and competitive prices, mailorder computer-supply houses are crowding many local data-processing-supplies distributors and system houses out of the ribbon market. DEC and IBM, two large hardware vendors that have historically sold ribbons and other supplies through their sales forces, have recently released national mail-order catalogs under programs called DECdirect and IBM Direct.

Though the program names could spark a recurrence of the DEC/IBM/Wang writer syndrome, a trend is

SERIAL PRINTER RIBBON SUPPLIERS

These companies are active in the serial printer ribbon market. Those listed as manufacturers may not all make their own ribbons from scratch, but all appear to at least package ribbons into cartidges or onto spools. Where possible, companies that only remanufacture cartridges or recycle ribbons have been excluded. The mail order suppliers are the major ones and represent a growing industry segment.

MANUFACTURERS

Aetna Products, 11 Commercial St., Hicksville, N.Y. 11801
Allen Paper, 111 N. Canal St., Chicago, Ill. 60606
AM Office Supplies, 7209 St. Clair Ave., Cleveland, Ohio 44103
Aspen Ribbons, 1700 N. 55th St., Boulder, Colo. 80301
Brough Eaton Allen, 67 Kent Ave., Brooklyn, N.Y. 11211
Bee Coated Film, 26 Daniel Rd. W., Fairfield, N.J. 07006
Budge Carbon & Ribbon, 767 St. Remi St., Montreal, Quebec

Bee Coated Film, 26 Daniel Rd. W., Fairfield, N.J. 07006
Budge Carbon & Ribbon, 767 St. Remi St., Montreal, Quebec H4C 3HI, Canada
Burroughs, 300 Cross Keys Office Park, Fairport, N.Y. 14450
Carter's Ink, 275 Wyman St., Waltham, Mass. 02154
Codo Manufacturing, Avenue B, Leetsdale, Pa. 15056
Columbia-Great Lakes, 35 S. St. Clair St., Dayton, Ohio 45401
Compros Supplies, 507 5th Ave., New York, N.Y. 10017
Compu-Rite Ribbon, 6010 Yolanda Ave., Tarzana, Calif. 91356
Computer Ribbon Specialists, Flowerfield Building No. 1,
St. James, N.Y. 11780
Control Data, 8100 34th St., Minneapolis, Minn. 55440
Curtis-Young, 2550 Haddonfield Rd., Pennsauken, N.J. 08110
Data Packaging, 205 Broadway, Cambridge, Mass. 02139
Data Research Associates, 10 W. Forest Ave., Englewood, N.J. 07631
Dataproducts, 9657 Mason St., Chatsworth, Calif. 91311
Diablo, 24500 Industrial Blvd., Haywood, Calif. 94545
Dura Line, Rt. 2, Flat Rock, N.C. 28731
Fine Line Ribbon, 2405 N. Preston St., Ennis, Texas 75119
Frankel Manufacturing, 285 Rio Grande Blvd., Denver, Colo. 80223
Franklin Ribbon & Carbon, 225 Charlotte Ave., Hicksville, N.Y. 11802
Frye Computer Supplies, 417 E. 7th St., Cincinnati, Ohio 45201
General Ribbon, 6709 Independence, Canoga Park, Calif. 91304
Hurley Ribbon, 198 Rochester Rd., Pittsburgh, Pa. 15627
Inked Specialties, 285 N. 6th St., Brooklyn, N.Y. 11211
International Ribbon & Carbon, 49 Sylvester St., Westbury, N.Y. 11590
Kleen Strike Mfg., 9167 Red Branch Rd., Columbia, Md. 21045
Kores Canada, 905 Rue McCaffrey, Ville St. Laurent, Quebec
H4T IN3, Canada
Leedall Products, 130 Van Liew Ave., Milltown, N.J. 08850
Liquid Paper, Box 225909, Dallas, Texas 75265

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Leedall Products, 130 Van Liew Ave., Milltown, N.J. 08850
Liquid Paper, Box 225909, Dallas, Texas 75265
Majestic Ribbon, 15804 W. 6th Ave., Golden, Colo. 80401
Memorex, 1200 Memorex Dr., Santa Clara, Calif. 95052
Mid-City Ribbon & Carbon, 200 Chemin de l'Anse, Vaudrevil, Quebec
J7V 5V5, Canada
Morley Co., 909 Islington St., Portsmouth, N.H. 03801
National Ribbon, 10 Springdale Rd., Cherry Hill, N.J. 08003
NER Data Products, 307 S. Delsea Dr., Glassboro, N.J. 08028
New Era Ribbon & Carbon, 235 E. Gay St., W. Chester, Pa. 19380
Olivetti, 500 Park Ave., New York, N.Y. 10022
Omarco, Rt. 3, Ennis, Texas 75119
Optimum Tested Products, 30 Jefryn Blvd. W., Deer Park, N.Y. 11729
Pacific Computer Supply, 2601 Middlefield Rd., Redwood City,
Calif. 94063

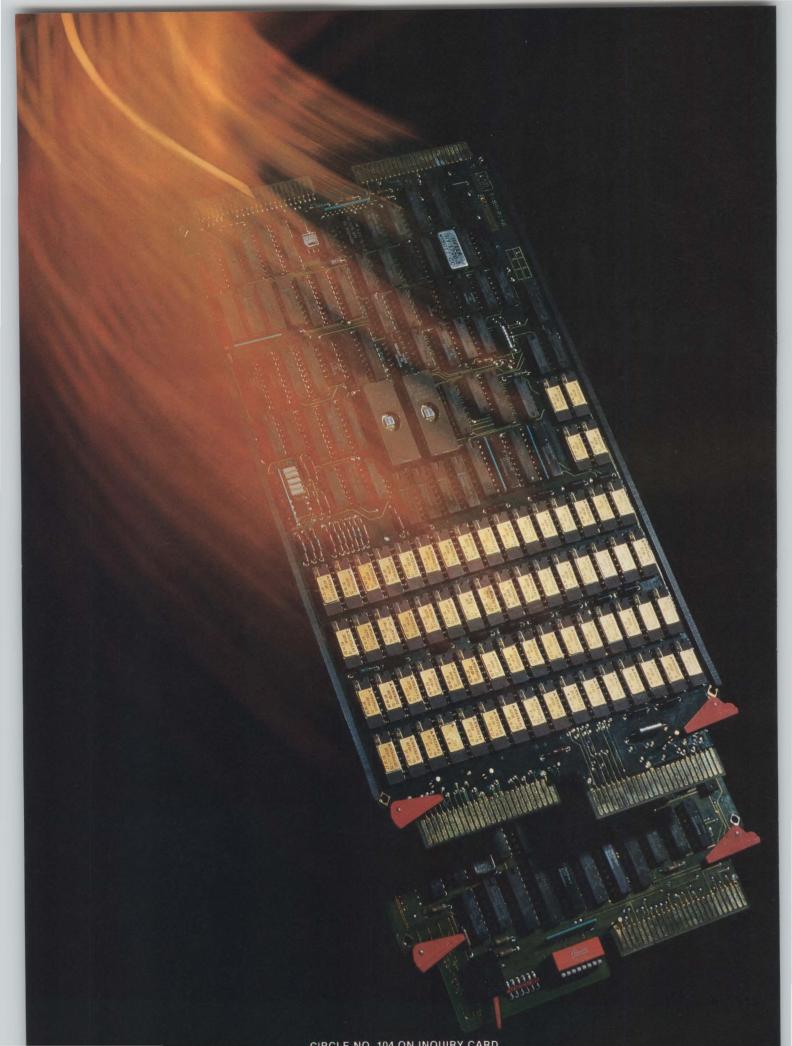
Calif. 94063 Pan American Business Systems, 120 Novner Dr., Cincinnati, Ohio 45214

Ohio 45214
Polypore, 4601 S. 3rd Ave., Tucson, Ariz. 85714
Roytype, 150 New Park Ave., Hartford, Conn. 06106
SCM Corp., 65 Locust Ave., New Canaan, Conn. 06840
Sercomp, 21624 Marilla St., Chatsworth, Calif. 91311
Standard Manifold, 333 W. Lake St., Chicago, III. 60606
Sten-O-Mate Products, 128-30 N. 10th St., Philadelphia, Pa. 19107
H.M. Storms Co., 167 41st St., Brooklyn, N.Y. 11232
Tru-Rite, 43 Hall St., Brooklyn, N.Y. 11205
Typewrite Ribbon Mfg., 38-04 48th St., Long Island City, N.Y. 11104
Wordex, 1965 Adams Ave., San Leandro, Calif. 94577
Wyomissing, Box 742, Reading, Pa. 19603

MAIL ORDER COMPUTER SUPPLY VENDORS

Continental Resources, 175 Middlesex Tpk., Bedford, Mass. 01730 Devoke, 3780 Fabian Way, Palo Alto, Calif. 94303 Fidelity Products, 5601 International Pkwy., Minneapolis, Minn. 55440 Inmac, 2465 Augustine Dr., Santa Clara, Calif. 95051 Misco, Box 399, Holmdel, N.J. 07733 Uarco, 121 N. 9th St., DeKalb, III. 60115 Visible Computer Supply, 3626 Stern Dr., St. Charles, III. 60174 Wright Line, 160 Gold Star Blvd., Watertown, Mass. 02172

evident. Catalogs are an efficient way to sell commodi- have become commodities and are manufactured, ties in a competitive market. Serial-printer ribbons advertised and priced accordingly. Caveat emptor. If you're looking for an OEM microcomputer with real-time software, we've got one that's just your speed.



A million instructions per second.

Announcing the HP 1000 A Series.

At 1 MIPS, the new A Series is a classic example of microcomputer hardware designed to take full advantage of high-performance, real-time software. With four megabytes of main memory and an innovative memory management scheme, the A Series puts almost no limit on the kinds of applications you can build.

DBMS, networking, graphics and more.

You may have to remind yourself that the A Series is "only" a microcomputer. For starters, it's available with HP's award-winning IMAGE data base management system. Our advanced DSN networking software. And our interactive 3D Graphics/1000-II package.

As a compatible member of the HP 1000 family of computer systems, the A Series also gives you a choice of FORTRAN 77, real-time BASIC, Pascal or Macroassembler programming

languages.

But the software story doesn't stop there. We gave the A Series a powerful real-time operating system and a memory mapping scheme usually found only on much larger, more expensive computers. For example, the memory management scheme lets you put data arrays of up to 1.9 Mb into main memory. And the virtual memory design lets you access data arrays of up to 12.6 Mb between main memory and disc—transparently.

But for all its performance, the A Series has a price you can afford: \$2176 for a two-board, 128 kb set.

Boards, boxes, systems.

Thanks to our modular component design, you can get the A Series in the configuration that makes the most sense for your applications, from boards to packaged systems. So you pay only for what you need. And you can also select a broad range of HP peripherals, from flexible and hard discs (including the new 5" mini-Winchester), to terminals and printers.

The new HP 1000 A Series. We don't think you'll find a better combination of speed, software and power for the price. To arrange a demon-

stration, call your local HP sales office listed in the White Pages.
Or come and see the A Series in action at our Productivity '82 Seminars (watch your local newspaper for details). You can also send for our free OEM booklet. Write to Hewlett-Packard,

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asked the company president.

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too much," snapped the vice president of finance.

"Quite untrue," replied Holmes. "In fact, Zeµs2 offers the best price-performance ratios in the industry - with a price-tag so low some deem

"But how, dear man," I interjected, "did you deduce that a power glitch was to blame for last night's loss of data?'

"Elementary, my dear Watson," he said, puffing contentedly on his pipe. "Elementary."

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SOFTWARE

Surviving in the DEC-compatible word-processing market

MERCIA J. DICKMAN, EEC Systems and ROBERT BISMUTH, Redkite Software

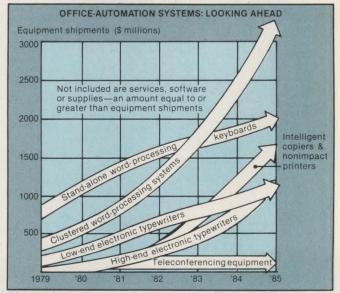
Independent software suppliers can continue to prosper by adapting to changes and providing services DEC lacks

There is a lucrative market for Digital Equipment Corp.-compatible word-processing software. A DEC spokesman reveals that word-processing software is required by almost half the jobs put up for bid by large DEC OEMs. That's a significant need when the more than 200,000 PDP-11 machines in existence and the steadily growing VAX-11 market are considered. And with DEC's growth record, these numbers are sure to increase during this decade.

Until recently, providing software has been the domain of independent software houses and DEC-based OEMs. But DEC has now started to follow other hardware manufacturers by marketing applications software directly, and many of these suppliers, in direct competition with DEC, fear losing this substantial source of income. The DEC OEMs selling in the word-processing market need not panic. Independent software/system suppliers have three survival routes: system integration, the add-on market and vertical customization of packaged software.

The giant takes steps

In its effort to close the competitive gap, DEC has recently announced DECWORD, a word-processing software package that runs under RSTS/E, which supports as many as eight users on a typical PDP-11/34 system. For single-work-station applications, the recently announced VT18X personal μc supports CP/M and Wordstar, a popular μc text-editing software. For large-system users, several text-editing systems such as SCRIBE for the DECsystem 20, are available through DEC's External Applications Software (EAS) library. But these announcements seem to be DEC's way of buying time.



Clustered word-processing systems will predominate by the mid-1980s, and should provide a fertile sales ground for DEC equipment. Source: International Data Corp.

DEC does not directly supply any word-processing software for all PDP-11 and VAX computers/operating systems, nor does the company market a PDP/LSI-11 business-oriented minicomputer/μc system, complete with word processing, financial-modeling and accounting software. However, DEC reportedly will fill this gap with three personal computers based on a μc version of the PDP-11 to be announced at the upcoming National Computer Conference. DEC will probably also develop its own word-processing software for all its machines and operating systems. Reliable sources say this is the only major feature missing from a total office-management software package for VAX and PDP. DEC is

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CIRCLE NO. 106 ON INQUIRY CARD

A word processor comes into its own in applications involving selection and information retrieval.

demonstrating the PDP software to major clients, with release projected for this summer.

System integration

Independent software/systems suppliers can blunt the effect of DEC's efforts in several ways, one of which is system integration. Vendors wishing to put together systems with word-processing functionality should consider a number of hardware and software interrelationships. Of primary importance in configuring a system are the number of concurrent interactive users and the types of simultaneous activities an end user requires. Given the market demand for small systems, it is crucial to assess how much disk and memory storage the software components of the system need, and the total terminal character-per-sec. activity.

Word-processing software in the DEC market varies in efficiency, and the required amount of disk storage for system software ranges from 300 to more than 2000 blocks. Storage and efficiency both depend on efficient data-storage techniques, such as indexing.

Disk-I/O speed is an important design consideration in word-processing applications because the response time of most word-processing software depends particularly on the speed with which information can be

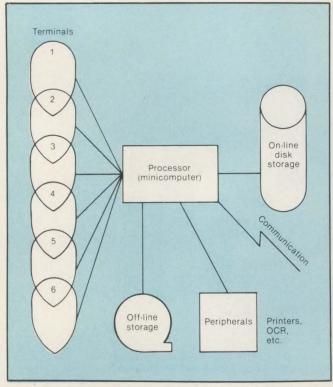


Fig. 1. Shared-logic systems allow all users access to the CPU, storage units and peripheral devices. This configuration costs less than a shared-resource system, but CPU failure can cause total breakdown.

retrieved from the disk. For example, suppliers may have to balance the fast performance of the RM02/3—as opposed to the RL01/2—series disks against overall system pricing. Similarly, a processor/memory combination should be carefully chosen: a 128K-word, 11/23based system can handle five concurrent users, but a sixth user may severely degrade the overall system. On the other hand, the cost of a 4M-byte, 11/70-based system may shrink the target market to those end users who can afford the "Rolls Royce" of the DEC range. The processor component of this equation must include the maximum character interrupt bandwidth possible, and physical memory must be adequate for all simultaneous tasks. If not, one task will be dropped without warning by the operating system, which periodically transfers the task of lowest priority to disk, later replacing it with another.

Suppliers configuring an optimal multi-user system for their customers must choose between shared-logic and shared-resource systems. A shared-logic system (Fig. 1) is more economical to configure because several dumb terminals share the logic/facilities of a centralized minicomputer. This advantage is balanced by the risk to an end user. If the central unit fails, the whole business operation may grind to a halt.

In a shared-resource system (Fig. 2) the intelligent information is distributed by interconnected intelligent subsystems. This reduces the risk of total system failure resulting from a subsystem's breakdown, but it may be too expensive to establish the network, access and subsystem hardware needed per active work station. A DEC OEM may be able to provide an optimal hardware configuration with the lower shutdown risks of a shared-resource system, while maintaining the lower cost of a shared-logic system. For example, it might be more cost-effective in some applications to network several 11/23 Plus processors, each having as much as 4M bytes of local main memory and sharing each other's disk-storage facilities.

With the variety of operating systems supported by DEC, and the vast amount of off-the-shelf software packages, the choice of which to use as a base for a business system is difficult. For an operating system for word-processing/business software, VMS is a good choice because, with VAX-11 hardware, it provides an efficient, fast, interactive task environment. However, the initial cost of the hardware and operating system renders this choice viable only for installations of 32 to 64 users. Smaller installations should choose a 22-bit PDP-11 running either RSX-11M or RSX-11M+ host operating system. This combines low-cost hardware and low-cost operating-system software in a package suitable for the real-time response needed in a word-processing system.

Apart from the hardware considerations in choosing or writing word-processing software, software vendors should consider their end-user clients' future needs. Because DEC hardware can be easily upgraded, suppliers should choose software that functions on the whole

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Ultimate clarity and illumination.

No matter where you measure on the screen, the 2400 offers a .35 mm spot size, and the light intensity of each spot has been increased by nearly 50%.

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And the system user gets a monitor that can be upgraded by the simple change of a switch, instead of replacing the monitor.

New versatility in applications.

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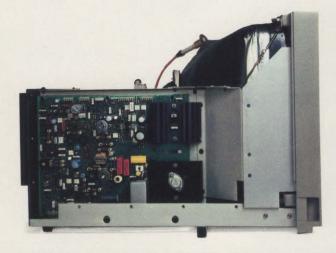
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See us at the National Computer Graphics Association (NCGA) Show in Anaheim. California, June 15-18. Also see us at Siggraph in Boston, July 26-30.







Independent software/systems suppliers can blunt the effect of DEC's efforts in several ways, one of which is system integration.

range of the PDP-11 and VAX hardware. OEMs usually know that their customers may upgrade their hardware, so it is important to choose word-processing software that not only works on all operating systems but also works the same way for the word-processing operator. Retraining of word-processing staff is costly.

Add-on market

A second avenue for DEC OEMs to explore is the PDP-LSI and VAX add-on software market. Having purchased a system, an end user wants to expand the applicability of hardware rather than purchase hardware dedicated to word processing. In choosing word-processing software packages, end users are primarily interested in text editing or auxiliary programs that are often integrated into software, providing multifunctionality. Hence, OEMs should give careful thought to how a customer will use the software, both now and later. Add-on software should be both flexible and user-friendly.

Word-processing software that can support almost

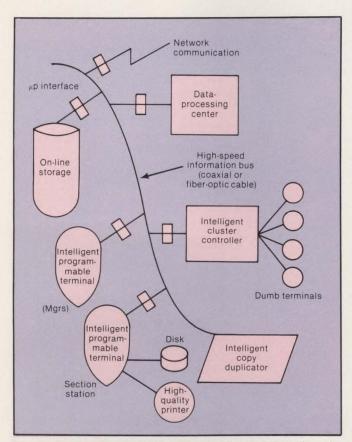


Fig. 2. A shared-resource system distributes information via interconnected intelligent subsystems. This Xerox Ethernet-like configuration reduces the risk of total system failure, but is more expensive to establish than the shared-logic scheme.

any terminal that the vendor's customers may be using is economically advantageous. Furthermore, if the software allows switching from one kind of terminal to another without programmer support and for a variety of terminals to be used concurrently, a word-processor user gains both economically and in ease of operation. Likewise, word-processing software that can run under operating systems already purchased makes a cost-effective choice.

The core of all word-processing operations is easy editing, including user-friendly single keystrokes for all operations, line wrap, abbreviation recall and automatic justification. Full-screen editors allow editing anywhere on the screen, not just on the bottom line. A good word-processing system should also display the text on the screen in exactly the same format as it would appear on paper. This allows an operator to check the right-margin justification before printing. In batchprocessing word-processing systems, a document is prepared with visible word-processing commands embedded in the text. These commands are not interpreted at the time of creation, so it is impossible to see the document in its finished form until it has been run through the run-off-like post-processor. This means that corrections, layouts and pagination can be corrected only after processing, adding considerable time to the operation.

Not all full-screen editors offer all the features needed by an operator. For instance, only some editors have true multiple-column text entry (multiple columns side-by-side on the screen via rulers with right- and left-margin makers). Good column handling, coupled with cut-and-paste facilities, greatly increases the throughput and efficiency of a user, while reducing system overheads. Columns are also the starting point for calculating facilities. A good word-processing package should have an integral calculator able to handle rows and columns of figures. For example, in financial applications, moving text or columns horizontally and vertically is advantageous. Financial reports and studies can be directly entered and updated with support documents.

If word-processing software produces standard ASCII text files without hidden embedded control characters, all text generated can be output to standard printers and transferred between systems using DECNET or another networking facility. Programmers can then edit or create any programs using word-processing-system software, using the extensive editing and recall features without compilation errors resulting from hidden characters.

External applications software should be linkable to the word-processing package, with a return facility also available. Thus, any special software could be linked into the software, possibly by use of function menus, and appear to a user as part of the software. A vendor can then customize software for a client and could also use it as an entry point for the sale of other application software.

A word-processing package should be coded mainly in a tightly structured language that lends itself to easy modularity.

Software vendors should look for soft-coded word-processing packages because they are generally more flexible. An end user can define or modify a soft-coded package's input and output interfaces to use a variety of peripheral equipment. Thus, the user needs only to specify the control sequences to use any of the features of a terminal, such as cursor positioning or special function keys.

A software package that also allows users to store any sequence of keystrokes an operator makes for later recall and execution, coupled with some conditional abilities concerning the existence of documents or the existence of strings within documents, is a package that virtually contains a programming language. A programmer or word-processing operator could use this language for standard form entry, basic office data-

processing systems and associated functions. Apart from text editing, word-processing software products offer a variety of auxiliary integrated programs that allow greater flexibility and scope of operation. One of these is a keystore library for storing repetitive words or phrases, or in some cases, macro programs, for instant recall. List processing is an extension of this information retrieval, providing for manual and automatic retrieval control, with creation of specified record formats, multiple selection criteria to pick out information and perhaps automatically merging this with other text.

A word processor comes into its own in applications involving selection and information retrieval. Almost all systems have at least one type of sort-and-select feature, if only for nominating specific entries from a master file for use in a mailing list. More sophisticated systems allow a system to store additional information, such as a client's credit rating, receivables due, discount rates and product interest. This facility then permits an end user to construct automatic mass mailing using selection criteria based on stored information. For example, a letter could be sent to all

Manufacturer Package	Computers	Operating systems	Printers, terminals	Memory requirements	Editing features	Training, support	Special features	Price
Compu-Tone CTOS	PDP-11, VAX, LSI-11	RSX-11M, RSTS/E, VMS	VT52, VT100 terminals; most printers	56K bytes for single station	menu-driven; full-screen editing; ASCII characters; user-defined keys	1-yr. phone support; train- ing is \$95/per- son per diem	list processing; stored text library	\$3600 for RSX-11M, RSTS; \$420 for VMS
Glenn A. Barber and Associates FASTEXT	LSI-11, PDP-11	RT-11, TSX- Plus, RSX-11M, RSX-11M +	VT52, VT100 terminals	about 9K words per user	full-screen editing; ASCII characters overtype	1-yr. free maintenance including phone support; training is \$500 per diem (20 persons)		\$750 for RT- TSX-Plus pe site; \$950 fo RSX per site
EEC Systems LEX-11	LSI-11, PDP-11, VAX	RT-11, TSX- Plus, RSTS/E, UNIX, RSX- 11M, IAS, RSX- 11M + , IDRIS, VMS	most terminals, printers	about 15K words per user; 300 blocks of disk space for sys- tem software	codeless, commandless ASCII charac- ters; single key-stroke functions; full- screen editing; menu-driven; user-defined keys	training in- cluded; 30-day free phone support; further support at extra charge	desk diary; graphics; cal- culator; changeable menus; forms; spelling dic- tionary; list and data processing	\$2500 for RT- \$3000 for TS Plus; \$5000 f UNIX, RSX 11M, RSTS/8 \$7500 for VM
Marc Software International MUSE	DEC20, VAX	VMS	most terminals, printers	140K bytes per user; 40K bytes subsequent users	menu-driven; full-screen editing; codeless; commandless	90 days free support	scientific formulas	\$6800 (1-3 work station
Satum Systems Saturn WP	LSI-11, PDP-11, VAX	RT-11, TSX, RSX-11M, VMS RSTS/E	VT52, VT100 terminals; most printers		embedded commands; control charac- ters; ASCII characters; full-screen editor	1-yr. free main- tenance and phone support	list processing forms; spelling dictionary; sort	\$2500 for TS RT-11; \$5000 for RSX-11M RSTS/E, IAS VMS
Unique Automation Products UAP W.P.	PDP-11	RT-11, TSX, TSX-Plus	VT52, VT100 terminals				keystore library	\$1500; addi tional termina \$100 each
Data Processing Design WORD-11	PDP-11, LSI-11	RSTS/E, RSX- 11M	VT52, VT100 terminals; most line printers; special keyboard	about 21K words per user; 2000 blocks	bottom-line editing; programmable function keys	6-mo. phone support; train- ing included	list, data pro- cessing; spell- ing dictionary; arithmetic in list processing	\$7500 for RS 11M; \$8500 for RSTS/E



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\$50. The next real question is whether you need conversational or block mode operation.

Dumb is conversational. Smart is conversational/block.

Dumb has limited editing capabilities. Smart has full editing capabilities.

Dumb doesn't have any shiftable function keys. Smart has 8.

Dumb has a gated extension port. Smart offers a printer port.

Dumb offers reverse video, reduced intensity, and combinations. Smart offers those plus blink, blank, underlining, and full screen reverse.

Smart also offers protected fields, international character sets and popular terminal emulations.

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An end user can define and modify a soft-coded word-processing package's input and output interfaces to use a variety of peripheral equipment.

customers in a sales area who have a credit limit higher than a specified figure, whose outstanding balance is within a given range, who have spent more than a certain amount in the last year, who are interested in a product line and who have not ordered it within the past year.

Software vendors should also consider the language in which a package is written because this can make a considerable difference in speed and functionality. The language determines the ease with which new features can be implemented and bugs can be fixed. A balance should be struck between ease of development and portability using a high-level language, and the efficiency of the code generated by the compiler for that language. For example, a language such as BASIC might be viewed as a poor choice for a word-processing package because of the large demands it places on processor time for interpretation, while others may view it as a good choice because of its portability and ease of debugging.

A word-processing package should be coded mainly in a tightly structured language that lends itself to easy modularity, an attribute that could be used to split functionality into separate component programs. This is not always the best approach. Word-processing software written as a series of programs/tasks that intercommunicate via the operating system can place a heavy load on the executive pool space of the operating system, drastically slowing response time. On the other hand, a single program offering all desired features may contain too much code; the overhead in memory can severely limit the number of users of the package or impinge on other host-system applications. A compromise of these alternatives is use of a single program in which modules are overlayed to share the same program address space. This solution is practical because most programs are composed of modular sections that do not interact with each other, but provide totally separate facilities.

An OEM that acts as a consultant or a supplier to end users shopping for add-on word-processing software should appreciate the subtle differences between word-processing software packages. Vendors who develop this expertise will add value to DEC equipment that otherwise would not be available to end users.

Customizing packaged software

The third avenue for DEC OEMs to explore is customizing off-the-shelf word-processing software to provide vertical application packages for customers. Hardware vendors maintain that they offer only "plain vanilla" application packages. However, DEC itself offers a variety of application-software packages, such

as construction management, dental-office management and accounting, for its DECmate word processor. DEC will offer similar software packages soon for its PDP-11 and VAX computers, so vendors should use a general-purpose application package that can be customized. This strategy avoids "reinventing the wheel" and provides customized software at a relatively low cost.

Managers look for business-automating software packages. Software vendors could take advantage of this situation because word-processing software is available with the user-definable forms, menus and function keys necessary for a general-applications package. Such systems are easily adaptable without the use of highly qualified programmers. A trained operator with some general clerical experience can typically produce the required "custom application package."

The pressure is on for OEMs to sharpen their vertical market software offerings, but they will need a new kind of employee—one with the business acumen to understand the computerized application possibilities of a large variety of businesses. Because custom software is generally too expensive and unprofitable for OEMs, DEC vendors that can modify a general-purpose package will provide a service that allows them a competitive foothold in the market.

There will be an industry shakeout in the next few years, during which many OEMs will be squeezed out of business because of decreased profitability on hardware, soaring interest rates and increased competition from DEC. Vendors will no longer be able to sell customers the first word-processing package that comes along. Users are becoming more sophisticated. Word-processing-software vendors must become experts to keep pace. While most users are concerned only with word-processing capabilities, more are requesting that their word-processing software can be integrated with other office-automation functions. Most predominant are requests for phototypesetting and electronic-mail facilities. DEC OEMs will need both depth and breadth of knowledge, because many customers prefer to deal with as few vendors as possible.

Another trend is transportability: software will probably be written in a language such as C, which would enable it to be transported to a wide variety of vendor machines, unlike a language like MACRO-11, which restricts the package primarily to the DEC PDP-11 family. Industry reports are optimistic about UNIX, indicating that software vendors should keep updated on quality word-processing products available under UNIX and assorted look-alike operating-system products. There is still an important role for DEC OEMs in the office-automation and word-processing market, but only the best-informed will survive.

Mercia J. Dickman is marketing director at EEC Systems, Wayland, Mass., and **Robert Bismuth** is software engineering director at Redkite Software, Ltd., Swansea, Wales, U.K.



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One offers standard non-embedded attributes plus reverse video. The other offers that plus blink, bold, underline, reduced intensity, and protected fields.

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Comparing today's teleprinters

PATRICK KENEALY, Associate Editor

Features sway buyers facing narrow price and speed ranges

The consolidation in the teleprinter industry (MMS, January, p. 173) has severely reduced the number of teleprinter models offered to minicomputer and µc users and OEMs. End-user teleprinter prices have stabilized at about \$2800, with most priced at \$995 to \$3500. Speed, the most popular raw measure of teleprinter performance, is tightly clustered around standard levels (30, 45, 120, and 200 cps) and does as little as price to differentiate between modern teleprinters. Even considered together, price and performance data shed little light on teleprinter comparisons because, while fewer teleprinters are on the market

this year, the number of features has never been greater. The stereotypical slow, mechanical teleprinter has been replaced by a new generation of machines that represent surprising communications values in this age of shared printer/display clusters. By looking at the new teleprinter features, users might stumble on a bargain.

Size is a major specification

Size has emerged as a valid way to classify teleprinters. While teleprinters were once distinguished mainly by printing method into matrix and solid-font classes,



Fig. 1. Desk-top teleprinters resemble office typewriters. Their styling, quiet user-friendly operation and reliability are geared toward office applications. These units offer programmable character and forms attributes, and an array of user-convenience features, including numeric keypads, dedicated editing and communications keys and lighted status displays. Clockwise from top left are the Texas Instruments Inc. 840, the Hewlett-Packard Co. 2635B, the Diablo 630, the Mannesmann-Tally 1612, the General Electric Terminet 200 and the Teletype 43.

While teleprinters were once distinguished mainly by printing method into matrix and solid-font classes, today's units can be divided by size into desk-top and portable classes.

today's units can be divided by size into desk-top and portable classes. The desk-top class includes office typewriter-sized units (Fig. 1) such as those from Diablo Systems, Inc., and Digi-Data Corp., and pedestal-mounted units such as the Digital Equipment Corp. DECwriter and the Data General Corp. Dasher. The portable class includes those units designed for remote use and carrying ease. Because no portable teleprinter produces solid-font characters, teleprinters can be classified as desk-top solid font, desk-top matrix or portable matrix units.

Only a few companies including Diablo Corp., Qume Corp. and NEC Information Systems, Inc., make desk-top solid font units. Solid-font teleprinters use daisy-wheel or print-thimble mechanisms that produce the letter-quality output needed for word-processing

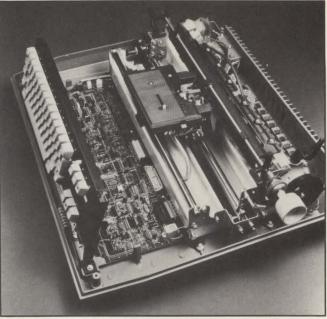


Fig. 2. Daisy-wheel teleprinters have become more reliable over the past three years. This Qume Corp. Sprint 935 has single-board electronics and 30 percent fewer parts than its predecessor. A recent 20-percent increase in adjustment tolerances brought the unit's MTBF to 3000 hours. Competitive daisy-wheel, print-thimble and matrix units are also in this range, but as electromechanical devices, all teleprinters need periodic tune-ups.









Fig. 3. Portable teleprinters account for one-third of all models. These units weigh less than 20 lbs. but offer a variety of features. The Texas Instruments model 765 (upper left) offers an integral modem/acoustic coupler and bubble memory. The Execuport 4120 from Computer Transceiver Systems, Inc. (upper right), can sustain 120 cps throughput and print two 24 × 80 format pages side by side on wide paper under host software control. The Qwint Systems, Inc., KSR 744 (lower left) is the smallest 132-cpl line impact teleprinter and connects directly to a phone outlet via a telephone jack. The Lexicon Corp. Lex-21 (lower right) offers 40-column thermal printing, telephone-jack hookup and an 8½-×11-in. footprint.

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The daisy-wheel and print-thimble mechanisms that give desk-top solid-font teleprinters their high-quality print also limit their speed and lead to electromechanical reliability problems.

applications, and each vendor offers more than 100 print elements for APL, financial, scientific, proportional-spacing and foreign-language applications. Most solid-font units support standard or optional charactergraphics firmware with resolutions around 120 horizontal dots per in. \times 96 vertical dpi.

Precise carriage control supports an array of character variations, including underlined, subscript, superscript, bold, shadowed and proportionally spaced characters at 10-, 12- and 15-cpi pitch. Form functions control top, bottom and side margins and permit right and left justification at 3, 6 and 8 lines per in. Editing/composition memories (as opposed to line buffers) are common, and sophisticated word-processing functions, such as character, word and line insert/delete and search/replace, are becoming more commonplace.

The daisy-wheel and print-thimble mechanisms that give desk-top solid-font teleprinters their high-quality print also limit their speed and lead to electromechanical reliability problems. While vendors have been unable to push solid-font speeds higher than 55 cps, they have succeeded in increasing their products' reliability (Fig. 2). Bruce A. Thatcher, director of peripheral product marketing at NEC, says that, until

	Avera	age cost pe	r page
Supplies	Thermal paper		paper White standard
Paper [average carton prices, 3 major suppliers, mix of equal number large rolls (desk-top applications) and small rolls (portable applications)]			
Thermal \$6.57 per 300-ft. roll, \$2.67 per 100-ft. roll)	2.12¢		
White bond (\$3.68 per 350-ft. roll, \$1.28 per 90-ft. roll)		1.03¢	
White standard (\$2.12 per 350-ft. roll, \$0.96 per 90-ft. roll)			0.64¢
Replacement print heads			
Thermal (average price: \$117.50 for 30M characters or 15K pages) 0.78¢		
Impact (\$99 for 100M characters or 50K pages)		0.20¢	0.20¢
Ribbon cartridge (\$12 for 10M characters or		0.045	0.044
5K pages)		0.24¢	0.24¢

The cost of expendables influences matrix-teleprinter operating costs and should be considered with purchase price and service costs when calculating ownership costs. Comparisons between thermal and impact matrix printing should also consider output quality, fading, reliability and multicopy requirements.

Teleprinters		
Manufacturer	Model	First Customer shipment
Anderson Jacobson, Inc., San Jose, Calif.	AJ630	4/74
	AJ830 Series	5/75
	AJ860	4/77
Computer Devices, Inc., Burlington, Mass.	Mini- term 2300	1Q, 1982
	Mini- term 2200	1Q, 1982
	Mini- term 2320	1Q, 1982
	Mini- term 1206	6/78
Computer Transceiver Systems, Inc., Paramus, N.J.	4000	8/78
	4000 Sher- lock	12/81
	4080	12/78
	4120	1/82
	440	1/82
	430	1/82
Data General Corp., Westboro, Mass.	6/94	6/81
Dataproducts Corp., Woodland Hills, Calif.	D-50	4/79
Datasouth Computer Corp., Charlotte, N.C.	DS180	7/80
Diablo Systems, Inc., Hayward, Calif.	630	4/80
Digi-Data Corp., Jessup, Md.	2516	12/80
Digital Equipment Corp., Maynard, Mass.	LA34	11/78
	LA120	1/79
Extel Corp., Northbrook, III.	AL-11-R	1975
	4000 Series	1980
	B318 Series	1979
	B315 Series	1978
Fujitsu America, Inc., Santa Clara, Calif.	SP830	10/81

Maximum speed (cps)	Printing Method	Maximum forms width (in.)	Charac- ters per line	Graph- ics Capa- bility	Port- able	End-User Price	Comments	Circ
30	5x8 thermal matrix	15	140	N	N	\$995	diskette, APL characters, optional	434
45	daisywheel	15	132/158	N	N	\$2995	diskette, 32K non- volatile memory optional IBM 2742- compatible	
120	5x9 impact matrix	15	132	Y	N	\$2600	diskette optional	
160	5x10 dot thermal matrix	8.8	80/132	Y	Y	\$1885	built-in modem/coupler standard; 300-baud unit	435
160	5x10 thermal matrix	8.8	80/132		N	\$1585	no modem or coupler	
160	5x10 dot thermal matrix	8.8	80/132	Υ	Υ	\$2585	integral modem/coupler; 120- cps, 1200-baud throughput; function keys; 2K- to 16K-bytes	
50	5x7 dot thermal matrix	8.8	80/132	Y	Y	\$4585- \$11,700	intelligent terminal; modem/ coupler, bar-code reader, diskette storage optional	
30	5x7 dot thermal matrix	14.8	136	Y	Y	\$3495- \$3795	model 4000 is IBM 4741- compatible; 4000D plugs into RJ11C telephone jack; 4000G is for graphics applications	436
30	5x7 dot thermal matrix	14.8	136	N	Y	\$4995	data encryption/decryption terminal for ASCII and APL applications	
30	5x7 dot thermal matrix	8.8	80	N	Υ	\$1975	print position indicator, APL characters, data logger and self test standard	
120	5x7 dot thermal matrix	14.8	136/233	N	Y	\$3295	1200-baud operation, multisize fonts, self test, answer-back memory standard	
80	impact matrix	8.5	132	Y	Y	\$1195	compressed print, answerback, selectable intensity, print buffer, answerback, current loop, autodial standard	
80	impact matrix	8.5	132	Y	Y	\$995	compressed print, selectable intensity, current loop, buf- fer, answerback standard	
180	7x9 dot impact matrix	15	220	Y	N	\$4250	bidirectional printing, multiple character sets, multisize fonts, user-defined characters standard	437
47	daisywheel	15	132/158	Y		\$2454		438
180	9x7 dot impact matrix	15	132	optional	N	\$1595	APL, foreign, multi-size fonts, parallel and serial interfaces optional	439
40	daisywheel	16.5	132/158/ 196	optional	N		proportional spacing, 9600-baud operation standard	440
200	7x9 dot impact matrix	15	176	N	N	\$1990	260-character buffer standard; 2308-character buffer optional	441
30	7x9 impact matrix	15	132/158/		N	\$1750	128-character buffer standard	442
180	7x7 impact matrix	180	132/174/ 217		N	\$2800	1K to 4K buffer	
30	5x7 dot impact matrix	8.5	80	N	N	\$1500	integral modem standard	443
30	5x7 dot impact matrix	8.5	80	N	N	\$1665 and up	integral modem and auto radial	
30	5x7 dot impact matrix	8.5	80	N	N	\$3170 and up	built-in modem standard	
30	5x7 dot impact matrix	8.5	80	N	N	\$3685 and up	32K-byte memory, auto-dial and word/character editing	
80	daisywheel	16	136	Y	N	\$2120	96- and 127-character print wheels can be used inter- changeably; bidirectional tractor, sheet feeder optional	444

Portable units offer a large subset of desk-top matrix features, including most character attributes and editing and graphics functions.

recently, "An OEM buyer could expect to pay at least one-and-one-half times the printer purchase price to cover three years of product, including test, shipping, installation and maintenance." Reduced parts counts, single-board electronics and increased adjustment tolerances have put most desk-top solid-font teleprinter MTBFs in the 2000- to 3000-hour range.

Desk-top matrix units add speed to versatility

Desk-top matrix teleprinters borrow matrix serialprinter technology, just as desk-top solid-font teleprinters borrowed from their read-only brethren. As a result, desk-top matrix units use mostly impact mechanisms and a few thermal ones. Desk-top matrixteleprinter speeds range from 30 to 200 cps. Lower speed units are intended for Telex, TWX, DDD and

TWO NEW TELEPRINTERS

Since the accompanying manufacturers listing was prepared, two teleprinters have been announced, by Digital Equipment Corp. and 3M Co.

Their specifications:

DEC's Correspondent: first customer shipment, 6/82; maximum speed, 150 cps; printing method, impact dot matrix; maximum forms width, 8.5 in.; characters per line, 132; graphics capability, yes; portable, yes; enduser price, \$1995. Notes: pin or friction feed, bidirectional printing, telephone plug coupling standard.

3M's Whisper Writer 1000: first customer shipment, 7/81; maximum speed, 40 cps; printing method, thermal dot matrix; maximum forms width, 8.5 in.; characters per line, 40/69/72/80; graphics capability, no; portable, yes; end-user price, \$1090. Notes: line selector, acoustic coupler optional; for TWX and DDD networks.

300-bps modem applications, but units in the popular 120- to 180-cps range can sustain 1200 bps throughout.

Desk-top units use seven-wire print heads, but most newer units use nine-wire heads that allow true descenders and underlining. Functions are programmed from the keyboard into nonvolatile memories that also store APL, scientific, italic and other special-character sets. Diskette or cassette off-line storage for text editing and preparation is a popular option, and a few desk-top units still offer paper-tape-reader/punches.

As higher density, two-pass serial printer heads catch on, near-letter-quality character sets will make desk-top matrix teleprinter output acceptable for word-processing applications and word processing functions such as those in desk-top solid-font teleprinters

Teleprinters		
Manufacturer	Model	First Customer shipment
General Electric Co., Waynesboro, Va.	2030	9/80
vayitosoot, va.	2120	6/81
	200	4/78
Hewlett-Packard Co., Vancouver, Wash.	2635B	5/80
Honeywell Information Systems, Inc., Waltham, Mass.	TWV1001	3/78
	TWV1002	3/78
	TWV1003	3/78
	TWV1005	3/78
	TWV1901	8/78
International Business Machines Corp., White Plains, N.Y.	2740-1, 2	
	2741 3767-1	
	3767-2	
	3767-3	
	3771-1	
	3771-2	
	3771-3	
International Entry Systems, Inc., Seattle, Wash.	Data- corder I	1/80
Lexicon Corp., Ft. Lauderdale, Fla.	LEX-21	9/81
Mannesmann Tally Corp., Kent, Wash.	MT 1612 KL	1982
NEO Information Contains	MT1612 K	6/77
NEC Information Systems, Lexington, Mass.	Spin- writer 3500	1981
	Spin- writer 7700	1978
Qume Corp., San Jose, Calif.	9/35KSR	
Qwint Systems, Inc., Northbrook, III.	740 Series	8/81
Siemens Corp., Iselin, N.J.	PT-80	1977
	T-1000	1977
Teletype Corp., Skokie, III.	43MPPL	9/80
	43 buf- fered	3/79
	43	5/78
Telex Terminal Communications Inc., Raleigh, N.C.	TC241B	

Maximum speed (cps)	Printing Method	Maximum forms width (in.)	Charac- ters per line	Graph- ics Capa- bility	Port- able	End-User Price	Comments	Ci
60	7x9 dot impact matrix	15.4	132/217	optional	Y	\$1250	built-in modem, APL characters, line buffers optional	44
150	7x9 dot impact matrix	15.4	132/217	optional	Y	\$2195	built-in modern, APL characters, line buffers optional	
200	9x7 dot impact matrix	16.5	136/224		N	\$2350	9x9 matrix, red/black printing, parallel and current loop interfaces, memory and alternate fonts optional	
180	7x9 dot impact matrix printing	15.8	136/227	N	N	\$4300	foreign, line-drawing and math character sets standard	44
30	7x9 impact matrix	15	132	N	N	\$2470		44
120	7x9 impact matrix	15	132	N	N	\$2950		
30	7x9 impact matrix	15	132	N	N	\$2850		
120	7x7 impact matrix	15	132	N	N	\$3600	1K buffer standard	
120	7x9 impact matrix	15	132	N	N	\$4500	960-character buffer standard	
15	selectric	15.5	130/156	N	N	\$3400	model 2 offers line buffer and split paten	44
15	selectric	15.5	130/156	N	N	\$2880	integral modem optional	
40	7x8 impact matrix	15	132	N	N	\$4790	magnetic stripe reader optional	
80	7x8 impact matrix	15	132	N	N	\$5490	512-character buffer standard; magnetic stripe reader optional	
120	7x8 impact matrix	15	132	N	N	\$6795	1024-character buffer standard; magnetic stripe reader optional	
40	4x7 impact matrix	15	132	N	N	\$6615		
80	4x7 impact matrix	15	132	N	N	\$6930		
120	4x7 impact matrix	15	132	N	N	\$8190		
240	5x7 dot electro- static matrix	5	80	N	Y	\$2200	prints only upper-case characters; integral modem/ coupler optional	44
30	5x8 dot thermal matrix	4.5	40	N	Y	\$1195	notebook-sized terminal with built-in modem/coupler	45
200	7x9 or 40x18 dot impact matrix	15	132/218	N		\$2545	near letter quality; prints six foreign character sets	45
200	7x9 dot impact matrix	15	132/218	N	N	\$2295	prints six foreign character sets	
35	impact fully formed character	16	136/163	N	N	\$1475- \$2030		45
55	impact fully formed character	16	136/163	N	N	\$2535- \$3495		
35	daisywheel	15	132/158/	limited	N	\$2270		45
80	7x7 dot impact matrix	8.5	69/132	Υ	Y	\$995- \$1495	editing, programmable and RO versions available	45
60	9x12 impact matrix	8.5	80	N	N		ink-jet version, paper- tape ASR versions optional	45
15	daisywheel	8.5	72	N	N		paper-tape ASR version, CRT display optional	
30	7x9 dot impact matrix	12	80/100/ 132	N	N	\$3050	16K buffer and poll/select standard	4
30	7x9 dot impact matrix	12	80/100/ 132	N	N	\$2997	16K buffer standard	
30	7x9 dot impact matrix	12	80/100/ 132	N	N	\$1558	integral modem, and answer- back optional	1
40	daisywheel	15	132/158	N	N	\$4800	IBM 2740-compatible	45

world's best printer is a plotter.

The Versatec V-80 is three times better than a conventional printer. It prints more than three times faster—1000 vs. 300 LPM for comparably priced matrix

impact printers. It prints with three

> the character resolution -256 vs. 81 points to

define a standard character. Three machines in one—a printer, a plotter, a hard copy device for display terminals —V-80 does all three jobs without compromising speed or quality. And it does them all quietly, without the nerve-racking clatter of hammers.

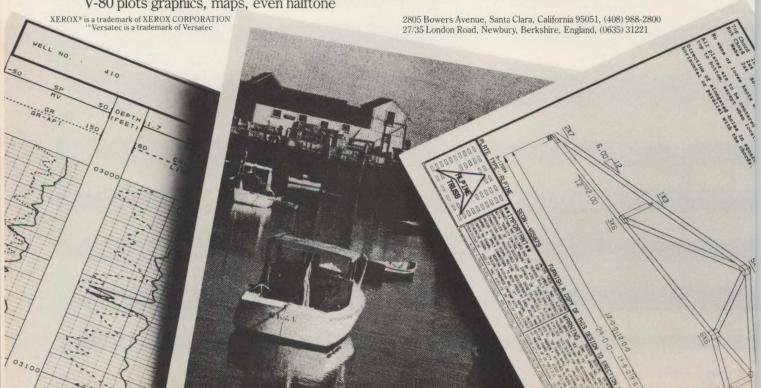
times

V-80 plots graphics, maps, even halftone

pictures, with resolution of 40,000 points per square inch. A simultaneous print/plot feature allows you to generate reports that combine words and pictures without cutting and pasting. And no matter how complex the plot, each page is produced in just seven seconds.

Interfaces and intelligent controllers for all popular computers and display terminals. Supported by the world's largest electrostatic printer/plotter sales and service network. Circle our readers' service number for a free fullcolor brochure. See the V-80 at NCGA CIRCLE NO. 116 ON INQUIRY CARD





Welcome to the coronation. New PRINTEK full-function printers reign supreme in data processing, yet provide multiplicity of purpose and generation-ahead reliability.

Model 920 prints up to 340 cps with its 18-wire head and model 910 prints up to 200 cps with its 9-wire head. Both are bidirectional and logic seeking and both feature 1800 character buffers as standard equipment with an additional 6k as an option.

And both offer 96 ASCII characters, 7 foreign character sets, 8 character pitches, caps and lowercase, concurrent underlining, plus both are downloadable to accommodate your unique character needs.

DIODE, RECT 1A 100V, 1N4002	EA	B	1575	
2732A BLANK 32K EPROM	EA	B	1769	
2732A BLANK 32K EPROM	EA	B	1769	
PCB MOTHER BOARD	EA	B	1783	
PCB MOTHER BOARD	EA	B	1783	
LABEL NAME PLATE 920	EA	B	1759	
DIODE, RECT 3A 200V, MR502/S3A2				
NUT 6-32 X ,25 HEX PLTD				
CHASSIS, POWER SUPPLY LINEAR	EA	B	1398	

PRINTEK data kings also provide up to 227 columns at 16.7 ch./in (136 col. at 10 ch./in) on continous forms to 16" wide with up to 6 copies,

parallel/serial interfaces, and 300-9600 Baud rates.

And these monarchs do much more. Like graphics with 144x144 dots/inch resolution at up to 4000 dots/second speed. Plus text-quality correspondence with the unique PRINTEK method of overlapping dots for high legibility that is remarkable for a multi-function printer.

At the leading edge of design, these new PRINTEK printers have all the reliability and features you'd expect. No periodic adjustments or maintenance, out-of-forms and forms motion detection, self-diagnostics, office-quiet operation, compact size, cartridge ribbons, complete operator controls and status indicators. Model 910 \$1925, model 920 \$2595.

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THE KING OF DATA 340 cps, 227col., up to 8k buffer



CIRCLE NO. 117 ON INQUIRY CARD

Desk-top solid-font printers are suited to remote applications such as small sales offices in which access to a central database and letter-quality output are needed, but space and budgets preclude display-terminal/serial—printer configurations.

will appear in desk-top matrix units. Hewlett-Packard Co.'s HP2635 offers 90-cps, two-pass, high-resolution character sets, and General Electric Inc.'s Terminet 2000 series offers an optional 32K-byte editing word-processing board.

Portable units offer full-sized functionality

Portable matrix teleprinters are available in a wide variety of shapes and sizes and offer thermal, impact and electrostatic printing (Fig. 3). Portable units offer a large subset of the desk-top matrix features, including most character attributes and editing and graphics functions. Size restrictions limit forms-handling hardware, and because the portable units' low-resolution output is not suitable for word processing, advanced word processing functions are usually not offered.

"Portable" formerly referred to a unit weighing less than 40 lbs., but today's nonmilitary units weigh less than 30 lbs., and most popular ones weigh less than 20 lbs. Most portable teleprinters fit in cases roughly the size of a slim attaché case, but units such as the Qwint KSR 740 series and the Lexicon Corp. Lex-21 illustrate the trend toward even smaller portables. Most portables print full 80-character lines on 8½-in. paper with normal characters, and 132-character lines on the same paper with compressed characters. Portable units such as the Computer Transceiver Systems Inc. 4000 series accept 14½-in. paper and print 220 cpl and more. CTSI's units can print two 80 × 24 pages on the same paper under host control.

Despite their size and weight, all portable units contain integral modems, and one-half include acoustic couplers. The units without couplers tie into the phone system using small snap-in phone jacks, reducing terminal size and weight and providing more reliable transmission. But until telephone jacks become as standardized as telephone handsets, only acoustic couplers can guarantee universal telephone-system compatibility. And because portables print 120 cps and faster, most of their integral modems are dual-mode 300-/1200-bps units.

Portable units from Computer Devices, Inc., Texas Instruments Inc. and International Entry Systems, Inc., offer integral off-line storage in the form of cassette drives or bubble memory. IESI'S Datacorder I (Fig. 4) is a truly intelligent teleprinter, and CDI bills its 1206 as a portable computer.

Teleprinters		
Manufacturer	Model	First Customer shipment
	TC767	
Telpar, Inc., Addison, Texas	T48C	2/78
	T80C	1/82
Trans-Lux Corp., Norwalk, Conn.	TLT	1/75
	300	5/79
Texas Instruments Inc., Houston, Texas	743	1/76
	745	1/76
	763	
	765	
	767	
	783	10/80
	785	10/80
	787	10/80
	820KSR	1/79
	840KSR	7/81

Overall feature trends

While all three major teleprinter categories offer the combination of interactive communications and integral hard copy that makes them self-sufficient remote terminals, different features fit different applications. Desk-top solid-font printers are suited to remote applications such as small sales offices in which access to a central database and letter-quality output are needed, but space and budgets preclude display terminal/serial-printer configurations. Desk-top matrix units provide faster, lower quality output and reduced communications costs (by virtue of their speed), and are best for remote programming and Telex, TWX and DDD. Portable matrix units are compact at the expense of relatively few desk-top matrix features and are suited for use by salesmen and other traveling users.

All three classes of teleprinters are becoming more office oriented. They boast streamlined styling and operate quietly—typically at 60 dBa or less. Many vendors offer optional noise-abatement cabinets to make their units even quieter. Status lights keep nontechnical users advised of keyboard-programmable spacing, character-set and communications parameters

Maximum speed (cps)	Printing Method	Maximum forms width (in.)	Charac- ters per line	Graphics Capa- bility	Port- able	End-User Price	Comments	Circle no.
40	daisywheel	15	132/158	N	N	\$5700	IBM 3767/2740- compatible	
30	5x7 dot thermal matrix	5.5	48	N	N	\$939	prints 96-character ASCII alphabet	458
120	7x11 dot thermal matrix	8.5	80	N	N	\$1200	prints 96-character ASCII alphabet	
15	5x7 dot impact matrix	8.5	69	N	N	\$2695	prints upper-case only; integral modem, 4K buffer, auto-dial standard; Telex terminal	459
33	5x7 dot impact matrix	8.5	72	N	N	\$2865	prints upper-case only; modem, 16K buffer, and auto dial standard; Telex terminal	
30	5x7 thermal matrix	8.5	80/136	N	N	\$1195		460
30	5x7 thermal matrix	8.5	80/136	N	Υ	\$1695	answer-back memory optional	and the
30	5x7 thermal matrix	8.5		N	Y	\$2695	bubble memory standard	
	5x7 thermal matrix	8.5		N	Y	\$2995	integral modem, bubble memory standard	
	5x7 thermal matrix	8.5		N	Y	\$3995	integral modem, bubble memory standard	
120	5x7 thermal matrix	8.5	80	N	N	\$1795		
120	5x7 thermal matrix	8.5	80	N	Y	\$2445	acoustic coupler, 545- character buffer, answerback standard	
120	5x7 thermal matrix	8.5	80	N	Υ	\$2895	buffer, answerback standard, coupler optional	
150	9x7 impact matrix	15	132	N	N	\$2165		
75	9x7 impact matrix	15	132	Y	N	\$1245	15x9 printing optional	

and paper and ribbon supplies. The lifespans of expendables, such as matrix print heads, print wheels, print thimbles and ribbon cartridges have increased with the help of competition from independent suppliers. Ribbons may last for weeks, print wheels for months and impact matrix print heads for years. Messy, spooled ribbons have given way to snap-in cartridges, and users can change daisy-wheel, print-thimble and even dot-matrix print heads without tools.

Teleprinter keyboards (Fig. 5) reflect the new functionality of teleprinters and the human-factors engineering that has revolutionized display-terminal keyboards. Numeric keypads, editing keys and communication keys supplement familiar typewriter, TTY and IBM data-entry keyboard layouts. Diablo offers a choice of seven attached keyboards for its model 630, and Tel-Par, Inc., and Trans-Lux Corp. offer teleprinters with detachable keyboards.

The accompanying table shows that prospective buyers can still choose from dozens if not hundreds of teleprinters. While many firms left the teleprinter market, and still others discontinued many models, the remaining manufacturers have strong product lines and



Desk-top matrix teleprinters borrow matrix serial-printer technology. As a result, matrix teleprinters use mostly impact mechanisms—and a few thermal ones.

are committed to their market. To choose among models, a prospective buyer should decide on major specifications only. They include quality and speed, size and single- and multi-unit price. The user should then consider each unit's convenience, character set, storage, editing/word processing and reliability. Feature lists are long, but once a buyer has narrowed his alternatives to one teleprinter class—say, desk-top impact matrix units—he can consider features more carefully. Features often seem unimportant, but collec-



Fig. 4. Self-sufficient portable teleprinters are a kind of intelligent terminal. This International Entry Systems, Inc., Datacorder I packages a modem/coupler, minicassette recorder, 16-character display, 80-column 5 × 7 electrostatic printer and a Z80 μp with 16K to 32K bytes of RAM in a 5½- × 17½ × 18½-in. briefcase. Computer Devices and others offer similarly powerful units.

tively, a teleprinter's secondary features are what make it friendly or unfriendly.





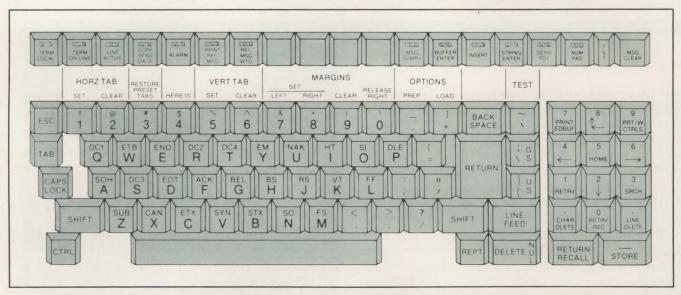


Fig. 5. Teleprinter keyboards are good indicators of terminal functionality. The top keyboard is a detatchable modem from the basic and inexpensive Telpar, Inc. Second is the keyboard from a portable, buffered Texas Instruments Silent 700. Third and fourth are keyboards from Teletype 43BSR and General Electric Terminet 200 desk-top impact matrix units. Less stringent cost and size constraints let them include numeric pads, editing keys and communicatons keys. Comprehensive, user-friendly keyboards are almost universal on desk-top teleprinters. Status lights and displays are also included.





The difference is more than clear!

"Perhaps the finest quality 132 column display on the market today..." See for yourself. Send for your FREE unretouched, actual size photo of the TAB 132/15. Place it by any other terminal. Compare the non-glare 15 inch screen. the crisp, clear 132 characters per line with the large 7 x 11 dot matrix resolution. Even with just a photograph, you'll see the difference... and more!

More productivity, more throughput. Give people a better tool and they'll produce more—whether they're the president, accountant, engineer or order entry clerk. An easier to read, easier to use terminal means more effective, error free throughput.

More data, larger screen. Display data in the same 132 column format you're used to seeing on your printer. Reduce or eliminate slow, expensive printed reports. Break away from the old 80 column display limitation. Whether you're involved with inquiry, interactive or word processing applications, the TAB 132/15 can give you the display flexibility you need.

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More than compatible. ANSI and DEC1 VT521, VT1001 and VT1321 compatibility, plus a special TAB mode for even more capabilities. All standard. The TAB 132/15 also gives you four page memory, 14 function keys, status line and English prompts on the screen. With options like printer port and current loop.

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Design Tomorrow into your system. The Sapphire 160 is a 160 megabyte, high density 14-inch Winchester drive, with SMD compatible interface. Simplicity of design and advanced technology give you much more for less than any comparable unit.

Less weight. Rare earth magnets are used in the positioner instead of larger ceramic magnets. This permits a major reduction in positioner size, and helps cut overall weight from a typical 140 to only

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Less danger of head damage during trans-

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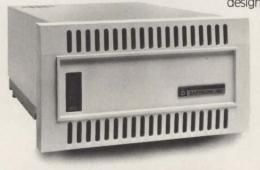
More data security. Critical data security is assured through MFM recording with PLO clock, and the use of peak shift compensation.

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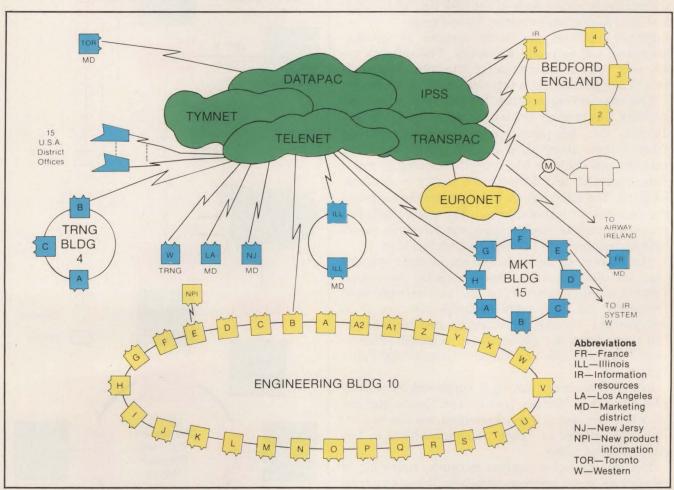
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Communication on Prime's orate network

THOMAS B. DOYLE, Prime Computer, Inc.

Public packet networks play a primary role in data exchange between Prime locations

Prime's worldwide network consists of 70 systems terminal for every three employees, and the amount of that are used by more than 4500 employees to conduct computing power is more than 50 million instructions all facets of the company's business. There is one per sec. That's equivalent to all the world's computing



Prime Computer's engineering and marketing networks. The engineering network (yellow) links 28 local systems and five in Bedford, England, that use Prime node controllers with 10M-bit coaxial-cable network capability. The packet switched link to Telenet permits communication with any other system attached to a public packet-switching network anywhere. The engineering network also serves as a high-speed electronic-mail facility. The marketing network (blue) consists of eight systems accessible from the outside through packet switching. It serves more than 200 employees who use it for word-processing and management-communications functions, as well as for benchmark and software demonstrations. Both systems use packet networks.

The terminal-to-engineer ratio is approximately 2:1, with some engineers having terminals in their homes for off-hours use.

power in 1963, or equal to 10 or 11 International Business Machines Corp. 3033 multiprocessor systems.

The network is entirely peer controlled, that is, no single system controls it. Although interconnected, each system is an independent entity.

To provide communications between the various Prime locations, the system makes extensive use of public packet networks that support the X.25 International Standard Packet Switch protocol. All Prime computers support an off-the-shelf version of this protocol, first used in 1978. No special software or hardware is needed.

The engineering network in Prime's Framingham, Mass., facilities consists of a local ring of more than 30 systems that use Prime node controllers with a 10M-bit coaxial cable local-area-network capability. Any user of a system on the local network can directly and transparently access data on the disk files of 15 other systems. A ring can comprise 255 systems.

Prime engineers use their systems to develop hardware, software and microcode. The terminal-toengineer ratio is approximately 2:1, with some engineers having terminals in their homes for off-hours use.

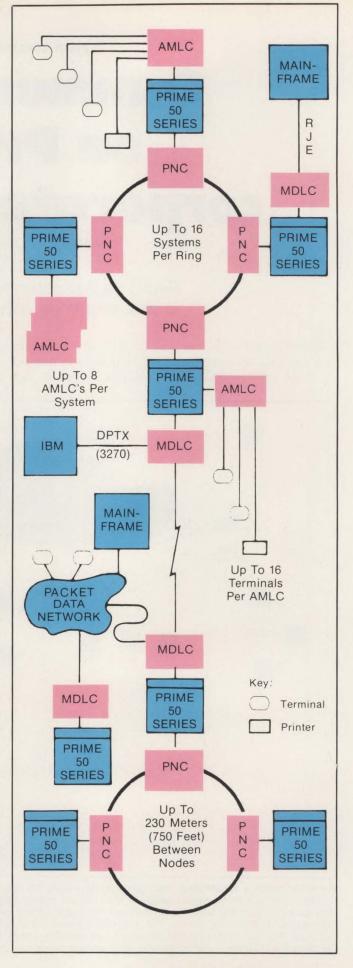
The engineering network has two lines to outside systems. The primary link is a packet-switched one into Telenet. This link permits communications with any other system attached to a public packet-switching network anywhere in the world, including a major Prime research and development facility in Bedford, England. The other outside link connects the engineering network to manufacturing. The packet-switched network transmits communiqués, status reports, object code and source code between the two facilities.

The marketing network consists of eight systems that are also accessible through packet switching. Prime's 15 U.S. district offices use that network most frequently but field representatives also use it to demonstrate products to prospective customers and to test new software before it is released. Packetswitching nodes also link Toronto, Canada, and Paris, France.

Prime's customer training is supported by a localarea network in facilities near Boston. Course curricula, when completed, are transmitted via the packetswitched network to Prime training locations in Los Angeles and Chicago.

The information-resources network, consisting of 28 systems in six locations, supports Prime's internal

Hardware used in Prime's corporate network. Each local host (Prime 50 series) requires a Prime node controller to manage its local ring. Asynchronous multi-line controllers support attached terminals. Multiple data-link controllers manage the high-speed synchronous links between local rings.



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The information-resources network, consisting of 28 systems in six locations, supports Prime's internal data-processing needs.

data-processing needs. Concentrated in Natick, Mass., the systems link via private synchronous lines to Telenet and Tymnet packet networks and to systems in Prime's Framingham manufacturing facility. The manufacturing systems also connect to a PC-board assembly plant in Puerto Rico via an RCA satellite facility.

The company's sales-administration system, into which orders from around the world are entered, is also connected to Telenet. All domestic, regional and district sales organizations interface into Telenet, except for the Canadian group, which interfaces into Datapac. All European sales orders are gathered in Hounslow, England, and transmitted via a public packet network to the sales systems. Australian orders are transmitted through an Australian subsidiary that can access Tymnet and then Telenet.

Orders are collected and consolidated daily, and the appropriate transactions move via Primenet from the sales system to the manufacturing configurator system. This system delivers sales orders to the factory, and interfaces with other systems such as the material system. These other systems, in turn, interface with

the real-time inventory, labor-reporting and bill-of-materials/parts master file systems.

The information-resources department also has two office-automation systems with more than 80 terminals used for electronic mail, scheduling, word processing and personal computing.

The information-resources network can integrate internal function-processing requirements through the combination of local-area networks via the Primenet node controller; packet-switched networks via the multiline data-link controller; and public packet-switched networks, such as Telenet, Tymnet, Datapac and local synchronous transmission via Primenet.

Prime's corporate network also connects the company's final-assembly and test facilities in Ireland and Massachusetts. Inventory transactions, material changes, labor reporting and other information can be transmitted daily to and from Ireland.

During the next five years, major corporations will increasingly require large distributed systems, such as Prime's corporate network. Prime's R&D efforts in networking and data communications are leading to technological advances that make networks affordable to a growing number of companies.

Thomas B. Doyle is director, corporate communications, Prime Computer, Inc., Natick, Mass.

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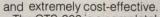
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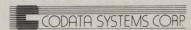
specifications are impressive. The 68000-based system features 1.5 mega bytes of unsegmented memory that's built into an innovative architecture which includes 5.25" floppies and Winchester disks. cartridge tape, large SMD disk drives, and ANSI/ IBM compatible 1/2", nine-track tape. It's modular, versatile,



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COMMUNICATIONS

μC-based phone relay issues hard-copy messages

DONALD McCOOK, Amtel Systems Corp.

Interoffice communication system features individual desk-top printers

A large percentage of business is transacted over the messages bounce back and forth before a contact is telephone. One side effect is an increasing level of finally made. And the problem extends beyond the frustration resulting from "telephone tag:" calls and telephone: a TWX message that takes only minutes to

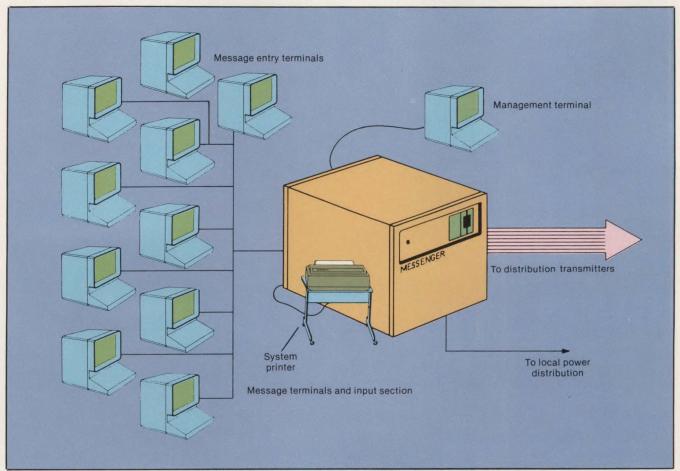


Fig. 1. Messenger II system comprises a CPU, a disk drive, a line printer and as many as 16 message-entry terminals. A management terminal controls system functions, provides backup and sorts directory lists. An operator enters data at the terminal, then activates one of three keys to store the message in a recipient's file, print it at the recipient's disk or notify him of callers on hold.

All messages are stored on Messenger II's 14-in. Winchester, so a user who is out of the building can call and ask an operator to recall to the screen and read all messages that have come in since he left his office.

cross the country, may then sit in the company mailroom for hours before it's delivered to its intended destination—a desk 100 yards down the hall.

Amtel Systems Corp.'s new Messenger II electronic message-delivery system tackles telephone tag in three ways. First, it delivers hard-copy messages via desktop printers instead of by messengers or by querying an electronic-mail system. Second, it hooks up to external networks such as TWX and Telex, providing instant delivery of messages from those communications channels. Finally, it reduces cost by using existing

building electric writing, creating a power-line localarea network.

What it does

A Messenger II system consists of a central equipment group (CPU, disk drive, message-entry terminal(s) and line printer), distribution transmitters, and desk-top printing terminals (Fig. 1). Message delivery begins with the message-entry terminals; the system accommodates as many as 16 of these, allowing independent operator entry of messages. After entering data on the screen, an operator depresses one of three keys: FILE, which stores the message in the intended recipient's file but does not transmit it to his printing terminal; SEND, which files the information and transmits it to the recipient's terminal for printing at his desk; or SEND QUERY, which issues priority messages to notify the recipient of callers on hold.

When one of these keys has been pressed, the input section of the CPU takes over. The Messenger II computer, based on a 4-MHz, 8-bit, Z80A µp, has 256K

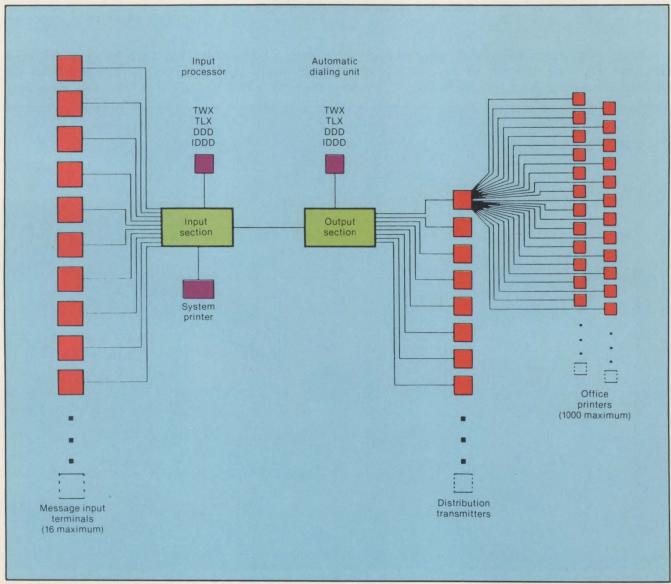


Fig. 2. Messenger II computer. Messages from input terminals are stored in a recipient's user file and placed by the output station in a queue on the Winchester disk. The output station then formats the message to the recipient's output device and transmits it at 300 bps.

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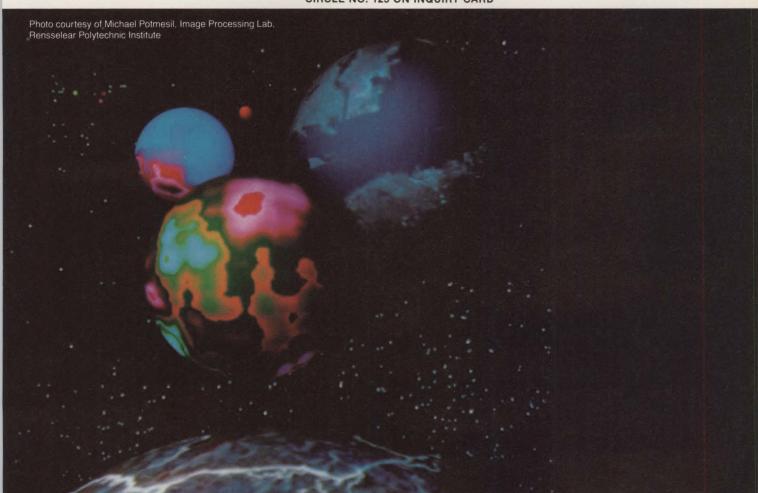
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COMPUTERVISE, INC.

4006 East 137th Terrace Grandview, MO 64030 816 765-3330 A message-routing feature forwards messages to a location and prints those messages in a recipient's office.

bytes of main memory, 340K bytes of removable flexible-disk storage and 18M bytes of Winchester

storage. The system has a printer port and can accommodate 16 input ports and as many as eight output ports. An integral 1200-VA regulator provides protection from power brownouts, transients and power-line interference. Central equipment also includes a control terminal to run system utilities and self-tests, start and stop the system and run off-line programs such as management-information reports on message traffic.

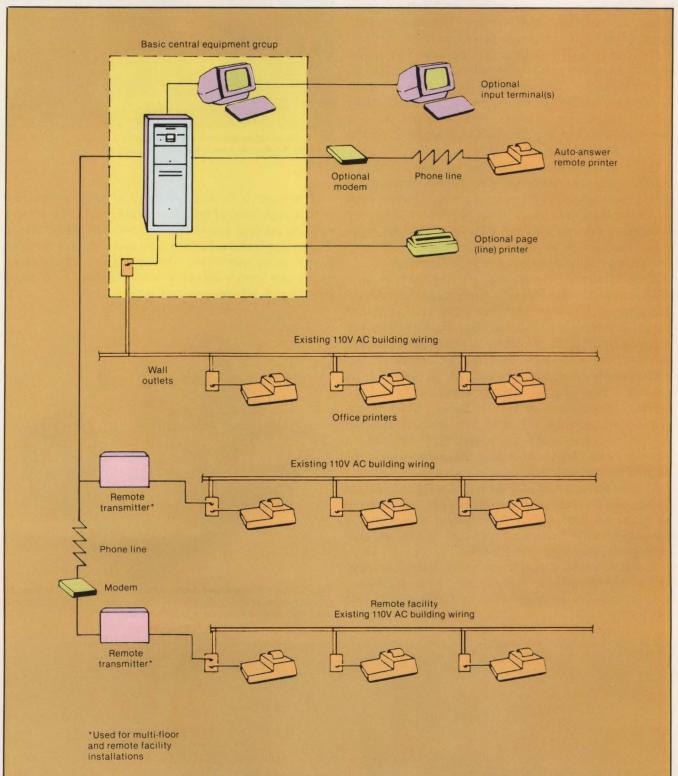


Fig. 3. The power-line communications network links several floors within a building. Distribution transmitters divide message-sending into areas. Each transmitter sends to all devices in its area, but only the device addressed prints the message.

A message from the input terminal is stored in a recipient's file and placed by the output section into a queue, or spooling file, on the Winchester disk.

A message from the input terminal is stored in a recipient's file and placed by the output section into a queue, or spooling file, on the Winchester disk. Queuing prevents the output processor from overloading during peak message-traffic periods. The output section cross-references the addressed user to an output file containing information on the type of output device the addressee has (printing terminal, page printer or remote printer). The message is then formatted and channeled through a transmission port at a rate of 300 bits per sec. (Fig. 2).

When a large area or number of floors within a building is to be connected, distribution transmitters divide message-sending among a group of areas, thus providing high throughput (Fig. 3). Each transmitter broadcasts the received message to all devices in its area. The device to which the message is directed responds to its address and prints the message.

Each Messenger II desk-top printing terminal contains an 8-bit μp that manages communication protocols and printout. The terminal plugs into a 110V AC power outlet, receiving serial digital data via a transformer coupling to its input circuitry. It prints 33 characters per sec. on a 5 \times 5 thermal dot matrix in an automatically paginated format of 12 lines \times 32 columns. The compact unit is available in a basic version measuring 4 \times 10½ \times 10 in., which issues printed messages, a unit with four buttons allowing canned responses such as "please hold" or "take a message" and a keyboard version that allows a recipient himself to originate messages.

This combination of hardware and software enables Messenger II to handle 1000 messages per hour, serving as many as 2000 users. The system stores 30,000 messages, with maximum message length of 1120 characters, plus header and trailer.

Based on a central-equipment group price of \$32,950, and a desk-top printer price of \$575 each, a 200-user system provides message delivery for less than \$750 per user.



Fig. 4. Message is entered via a keyboard at a video terminal that provides a standard form (inset) for the purpose.

Messenger II is most effective in large companies with a high level of telephone traffic and time-critical decision making: industry, commerce and government. Typical applications include sales and customer service, warehousing operations, wholesale goods distribution, credit and foreign-exchange bank divisions, brokerage groups and data-processing departments.



Fig. 5. Printed messages from central computer are issued at recipient's desk and contain name of caller, date and time of call and each recipient's message-sequence number.

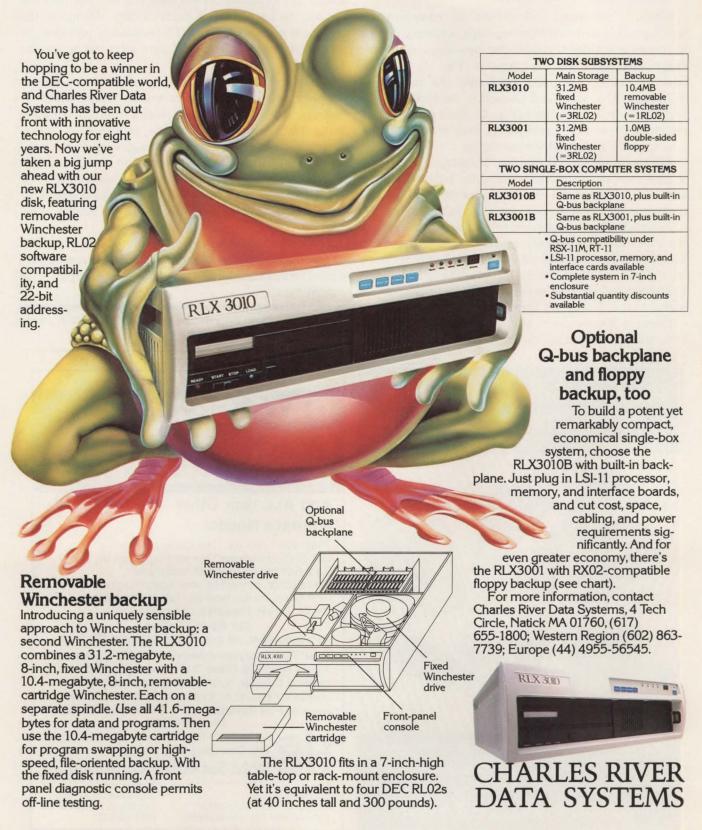
MESSENGER II POWER-LINE COMMUNICATION

Amtel's Messenger systems use a narrow-band mode with µp-controlled phase-locked loop receivers in each remote receiving station. The system is thus able to use AC power wiring within a facility for local-network communication. Data are modulated over AC power wiring and

directed from a central 8-bit μc to as many as 1000 independently addressable office printers via remote-distribution transmitters.

Messenger systems use a 200- to 400-KHz carrier at a low level; the carrier is FSK-modulated in a narrowband arrangement and coupled to the AC power-distribution system. This results in an RF signal having a level low enough to prevent its interference with other electronic devices, such as computers, word processors and calculators—yet sufficient to allow selective receipt without interference.

Getting the jump on DEC*compatible Winchesters



^{*} DEC is a registered trademark of Digital Equipment Corporation

The system stores 30,000 messages, with maximum message length of 1120 characters, plus header and trailer.

Procedures and capabilities

When a telephone call cannot be completed, a message attendant takes the message, entering it via a keyboard at a video terminal that provides a standard, easy-to-use form for the purpose (Fig. 4). Seconds later, a central computer transmits the message—including date, time and sequence received—to the recipient's desk-top printer (Fig. 5). Each printer has a unique address that provides its user with a private communication channel for messages.

All messages are stored on Messenger II's 14-in. Winchester, so a user who is out of the building can call and ask an operator to recall to the screen and read all messages that have come in since he left his office.

Based on a hard-copy message containing the name of the caller and the subject, a user who is occupied can decide whether to accept an incoming call or to return it later. This can dramatically increase the usefulness of the "camp-on" signal of most automatic PBX systems—a signal that is frequently ignored and unacknowledged.

Because Messenger II uses power-line communication, the printer plugs into a wall outlet (see "Messenger II power-line communication," p. 244).

A message-routing feature can forward messages to a location while still printing those messages in the recipient's office. Users attending a meeting, for instance, can have their messages routed to the conference-room printer. And when a user is to be away from the building for awhile, his status, whereabouts and expected arrival time are entered into the system, to be displayed automatically whenever the attendant keys in his name. This capability provides the attendant with an instant, informative reply for the caller.

Messenger II can also disseminate memos or announcements to individuals or groups within a facility, and can store standard, frequently used distribution lists. Thus, employees can be informed of news, changes in holidays or staff meetings without the need for duplication and hand-delivery of memos. An optional gateway processor allows instant delivery of TWX/Telex message text from word-processing systems or other electronic-mail networks, with no human intervention.

The system can also store specified dates and times as much as a year in advance, and at the appropriate times, issue reminders to individuals or groups.

Donald McCook is vice president of marketing, Amtel Systems Corp., Sunnyvale, Calif.





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A communication spooler is a software package that, together with a minicomputer and its peripherals, provides simple and efficient links with a number of remote mainframes. Sophisticated spoolers also reduce mainframe overhead by providing local editing and storage facilities. Above all, the spooler system allows input to be submitted, results printed and the data buffered while it is in the system.

How spoolers help

Consider the following example: A department has

communication lines to two or three remote mainframes (Fig. 1). It uses these lines for submitting batch jobs produced locally and off-line. On the end of these communications lines is dedicated hardware from various manufacturers, some of it minicomputer-based but providing only one function. Replacing a diverse system with a single communication spooler system running on one minicomputer has several advantages (Fig. 2). The system becomes more flexible. Many more peripherals can be mixed and, when more than one is provided, the peripherals allow a higher throughput or

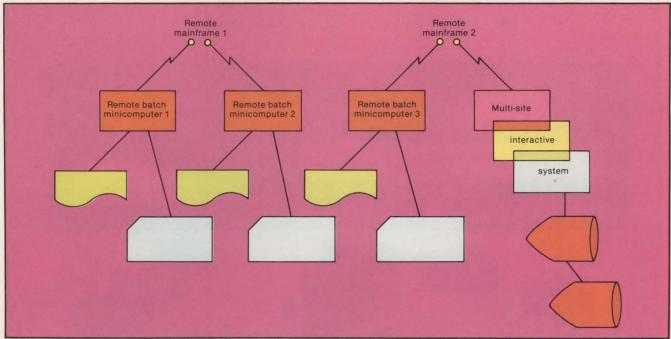


Fig. 1. Typical non-spooler systems consist of card readers, terminals and displays from various manufacturers. The card readers, terminals and displays communicate with two or more mainframes via separate minicomputer controllers. Peripherals in this type of system cannot be flexibly reorganized.

If a suitable minicomputer system is available, local program development and multi-terminal interactive emulators can be run simultaneously with the communication spooler.

provide for backup. Storage and editing can be done locally; jobs can be prepared, submitted, edited and resubmitted at lower cost and reduced line usage. This means higher overall throughput for a communications line or the same throughput on a slower, less expensive line. And expansion becomes simpler; adding a software module and one or two hardware interfaces enables the system to support an extra communication line.

This type of system can be expanded in another direction. General-purpose computing power becomes available between the user interface (display terminal, card reader or line printer) and the mainframe. This can be used in information expansion and dynamic code conversion needed to support a graphics terminal, with no extra hardware or mainframe software.

If a suitable minicomputer system is available, local program development and multi-terminal interactive emulators can be run simultaneously with the communication spooler. This can further reduce the overhead of trivial operations on the mainframe.

Dissecting the spooler

A requisite for a spooler system is a series of emulators to handle communication with the mainframes. These emulators usually vary in the operator

facilities they provide—based on the hardware they replace—and this in turn affects the degree of control that can be applied to a job.

The spooler system can be logically divided into four basic modules: the disk interface, the line-printer/data-entry interface, the emulator interface and the terminal/command module (Fig. 3).

The disk interface controls information transfer to and from the disk, and is the most important module for several reasons. It provides central storage, is usually the limiting factor in spooler performance and must cope with a great diversity of information requests. A dynamic, flexible algorithm must be used in space allocation to allow for a large variation in file size. This is particularly true of output files, which can vary between tens of bytes and hundreds of thousands of bytes. Design considerations for this module are the maximum number and size of concurrent jobs that will reside in the spooler system at any time (allowing for future expansion), which affects the disk size and space allocation algorithm; the size and operational speed of the disk system; and the inter-task I/O request-handling capability of the computer/operating system used, which affects overall system throughput.

The line-printer/data-entry interface module provides input to the central disk area from the data-entry device and sends print from the disk area to the line printer. This I/O operation often needs no operator intervention. Design considerations for this module are the number and speed of the data-entry devices/line printers being used, noting device priority and I/O throughput.

The emulator interface module transfers data between the various emulators and the central disk

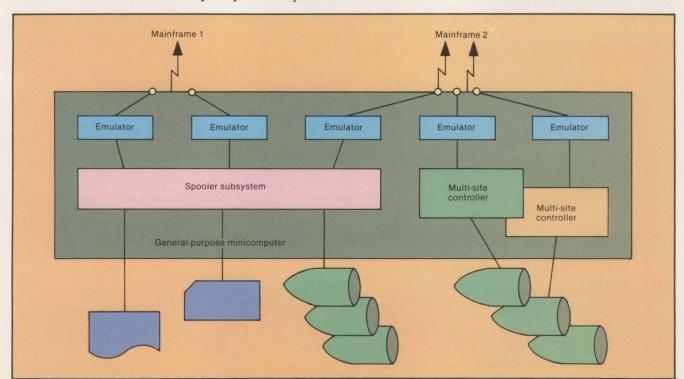


Fig. 2. Spooler systems add flexibility by allowing any available peripheral to be brought on-line. Central to system operation is a series of emulators that handle communication between a single minicomputer and remote mainframes.

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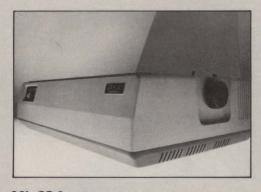
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The emulator interface module transfers data between the various emulators and the central disk area.

area. It also keeps track of the status of the emulators and their respective communication lines as well as servicing protocol requests and handling unattended operation. The emulators make the minicomputer look like one of its standard terminals, ensuring that no hardware or software changes are needed at the mainframe. This module also passes on information/control requests and replies between an operator and an emulator. Design considerations for this module include the number, function and throughput of the logical channels into and out of the emulator and, most important, the error states that can occur at this interface and the necessary procedures for recovery.

The terminal/command module provides information and control to the operator on the status and operation of the spooler system and the emulators/mainframes (when the link protocol supports this). The status information that an operator requires about the spooler system includes the amount of free disk space available, the number and names of input and output jobs with their operational status and the status of the various items of peripheral hardware. Control requirements for the spooler system cover peripheral devices, jobs on their way through the spooler system and the overall system during exceptional error circumstances. Some emulator protocols allow both control and information at an emulator/mainframe level, and in this case, this module must provide the operator interface.

Design considerations cover the number of terminals and operators required for the system, the type of emulators and protocols and the number of emulators attached or likely to be attached to the system. These items affect the I/O loading of the system.

Using the spooler system

Both operators and users interact with a system. Operators have full access to the system and know its control and operation; users see only input submitted and output returned.

System operation should proceed without operator intervention. A user prepares a card deck for submission to a mainframe. The first card in the deck identifies the mainframe, the job name and other details that the spooler system needs to process the deck. The next cards concern program, data and job control, followed by an end card for separation purposes. The card deck is placed into the card reader and automatically read into the spooler system. The spooler system stores the job in its disk area, identifies the emulator/link required and ensures that the link is open to the mainframe and opens the link if necessary. The spooler system then submits the job via the emulator, and when the job has been completed, the spooler removes the job from the disk area. The mainframe processes the job later and

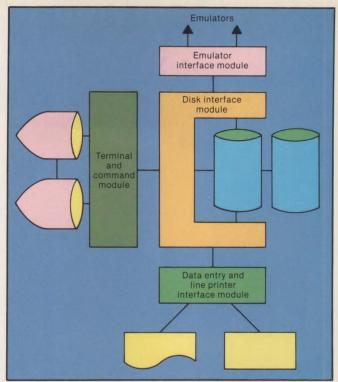


Fig. 3. Spooler structure consists of four basic modules. The disk interface provides central storage; the line-printer/data-entry interface transmits data to and from the central disk area; the emulator interface transfers data between the emulators and the central disk area, tracks emulator status and services protocol requests; and the terminal/command module gives the user status information and control of the spooler system and each emulator and mainframe.

sends the output back to the disk area via the emulator. The spooler system then stores the data. As soon as a line printer becomes available, the data are taken from the disk area and sent to the line printer. Several operations would be performed simultaneously in a system with multiple emulators and I/O devices. Mundane operations are automatic and do not need operator supervision. To reduce bottlenecks, jobs can be held in the spooler system until a mainframe clears its job queues or until an output device returns on line. The operator can also change the priorities of jobs as they transit the system, get warning of the requirement for a paper type (such as labels or multipart paper) for a job and holding that job in the system until a printer has the correct paper.

The abilities of spooler systems can be enhanced in several ways. For instance, if continuous operation must be guaranteed, a duplicate backup system can be linked in. The spooler system can also be used as a node in a public network such as Euronet or PSS or a private network using, for example, X25 or Maxnet. Finally, a spooler can run simultaneously with another application, such as a data-acquisition package, thus providing a comprehensive research tool.

Tim Ostley is technical marketing analyst, Modcomp, Fort Lauderdale, Fla.

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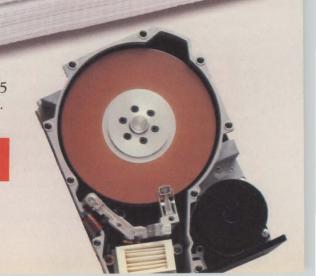
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NEW SYSTEMS

Making processing fail-safe

ROBERT FREIBURGHOUSE, Stratus Computer, Inc.

Any number of modules, each configurable to be fully redundant, achieves 'continuous processing' for the Stratus/32

Buyers who must have a computer system that continues to function despite failures have not had much of a selection, but their choice has been broadened by the introduction of the Stratus/32 system from Stratus Computer, Inc., Natick, Mass. With 4M bytes of memory, dual 143M-byte disks, a 600-lpm printer and magnetic tape, a typical Stratus/32 sells for \$172,000, including COBOL and VOS software licenses. Based on COBOL benchmarks, the system's performance equals or surpasses that of several popular superminis.

The Stratus/32 multiprocessor, fault-tolerant system for commercial applications supports on-line transaction processing, batch processing, word processing and

interactive program development. It uses a combination of hardware and software that provides continuous processing of user programs during computer failure without checkpoint/restart programming at the user or system level. Central to the system's fail-safe operation are processing modules, each of which has redundant logic and communication paths, logic and CPU boards and main and disk memory. Twin components operate in parallel with each other; when one fails, its partner carries on.

Architectural overview

The Stratus/32 processing modules are connected via

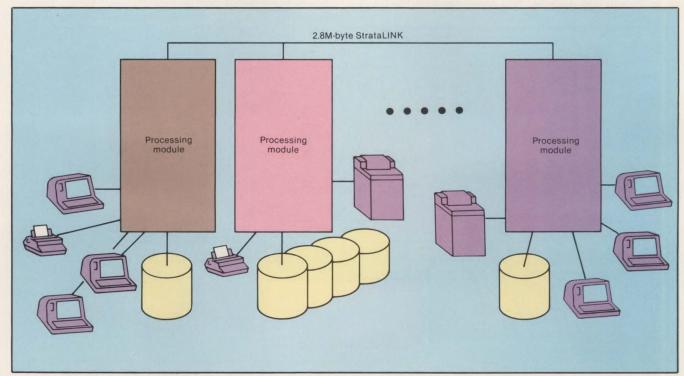


Fig. 1. A Stratus/32 system consists of as many as 32 processing modules connected by a high-speed coaxial link. The modules can be located anywhere within an office building or can be adjacent to each other.

Each processing module can be configured as fully redundant, partially redundant.

the Stratalink high-speed coaxial link. Each processing module consists of memory, two Motorola Corp. 68000 CPUs, at least one disk and various peripheral controllers and devices (Fig. 1). Both 68000 CPUs are visible to the operating system, and each executes its own instruction stream using a shared memory.

Each processing module can be configured as fully redundant, partially redundant or non-redundant. The degree of a module's redundancy determines the module's resistance to hardware failure. A fully redundant module can withstand failure of essentially any component in the module without performance or data loss and without user program interruption. Multiple modules are used only to achieve greater system capacity; they never serve as backup for other modules.

Stratus's distributed virtual operating system (VOS) runs in each of the processing modules. All modules are equal and can operate independently, but through the use of transparent local networking software, VOS makes the entire set of processing modules appear as a single computer system to programs, programmers and application users.

Although each peripheral device is attached to a processing module, VOS makes all devices available to programs running in any module. Similarly, a program running in a module creates processes to run in the same module or in others. An interactive terminal user can create processes to execute commands or to run programs in any module. The users need not be aware

of the module they are using. Likewise, batch jobs can run anywhere in the system.

All vos service requests have a uniform interface that is independent of the processing module on which the work will be performed. For example, a request to open a file has the same form and arguments regardless of where the file resides. vos examines the file name, looks in a device table to determine the module that owns the device and performs the requested operation or makes a network request over the Stratalink to the vos running the owning module. The requesting program does not see the network request. Consequently, user programs are unaware of the location of files or devices and see the multiple-module network as a single virtual-computer system (Fig. 2).

Examining the hardware

A processing module includes one or more cabinets that contain a complete computer with a logic-board chassis, dual power supplies, peripheral devices and and terminal port. A single cabinet holds a fully redundant module consisting of two 143M-byte disk drives, a magnetic tape, 16M bytes of memory, redundant CPU boards and a set of redundant peripheral controllers (Fig. 3).

A high-speed bus with a 125-nsec. cycle time is central to processing-module organization The bus—virtually two buses operating in parallel—has two sets of data and control-logic paths. The data path on each bus is 32 bits wide, and data can be put on the bus every bus cycle. This results in a potential bus rate of 32M bytes per sec., although processor/memory boards now run at 16M bytes per sec. By comparison a VAX/11-780 bus runs at 13M bytes per sec.

Each logic board that can be attached to the bus can

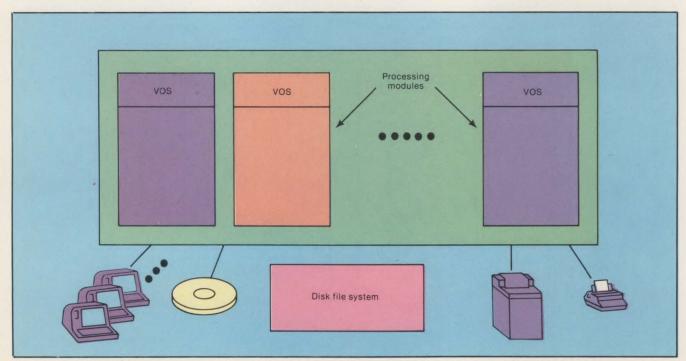
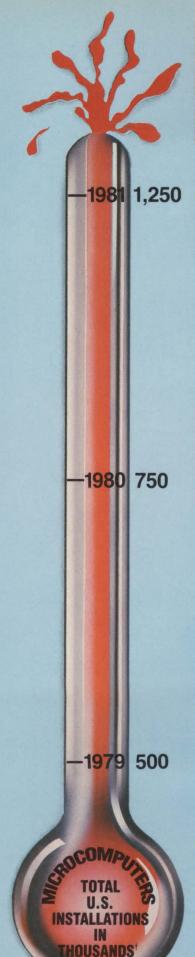


Fig. 2. The Stratus/32 virtual operating system (VOS) makes all processing modules appear as part of a single virtual system in which all devices, files and system resources are accessible as if it were a single computer.



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The bus—virtually two buses operating in parallel—has two sets of data and control-logic paths.

detect its own failure and shut itself down. It can also run with a redundant board that continues to operate in the event of its partner's failure. Neither logic board is primary, and neither is aware of the other. The pair of boards appears collectively to other system components as a fail-safe entity.

The self-checking technique used by each type of board differs slightly, but generally involves the use of two sets of logic on a board. Each set performs every operation in parallel with the other. When data are to be sent to the bus or to a device, the results produced by the two sets of logic are compared. If identical, the result is sent onto the bus or to the device. Dissimilar results indicate a board failure, and no data are sent. In this case, a red LED on the board is lit, and an interrupt signal is sent on the bus. Until the board is tested and logically reconnected by maintenance software, it remains off-line. The board's redundant partner continues to operate, and no other component of the system is aware of the failure (Fig. 4).

The CPU board contains two complete sets of logic

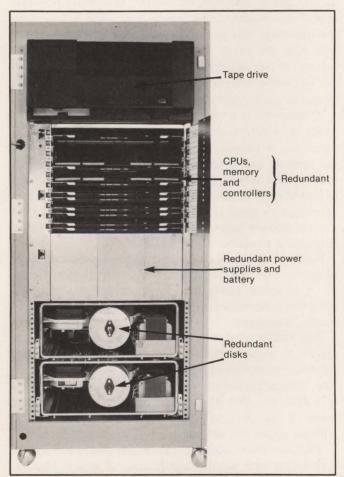


Fig. 3. A Stratus/32 processing module can contain 16M bytes of memory, a full set of redundant controllers, two 143M-byte disks, a tape drive and two software-visible CPUs. (Additional disks and tapes are held in adjacent cabinets.)

and is self-checking. Four Motorola 68000 processors provide each board with two processors visible to the operating system (Fig. 5). A redundant partner CPU board ensures continuous processing in the event of a failure of a CPU board. At a component price of approximately \$100 for each 68000, this is a cost-effective solution to continuous processing that was not practical until the availability of VLSI technology.

Redundancy is achieved by using a pair of logic boards for each logical entity in the system. Each board is attached to both halves of the bus, and both boards operate in parallel, performing identical operations. The output of both boards is placed on the bus at the same instant and is guaranteed to be identical.

Memory is duplicated in a redundant system so that N megabytes of program-visible memory is implemented using 2NM bytes of physical memory with N megabytes attached to each of two memory controllers. When data are written to a given memory location, both memory controllers respond and write the data into their memory. When data are read from memory, both controllers respond and read from their memory.

The controllers and the memory are synchronized and appear to the rest of the system as a single logical entity. Memory subsystems are not paired with CPUs, bus halves or other system components. Memory is implemented from 64K RAMs and is packaged on 1M- or 2M-byte boards. It has a 375-nsec. read-cycle time and is four-way interleaved. A typical processing module has 4M or 8M bytes of memory. In packaged configurations, Stratus sells memory for \$5000 per megabyte. A 2M-byte array board lists for \$20,000.

The memory system can be dynamically reconfigured to be redundant or non-redundant. This allows a module to use all available memory when full redundancy is not needed. Reconfiguration can occur on-line without affecting running programs.

Disks cannot run completely synchronized with each other; they require help from the operating system to provide continuous processing. Each disk can be configured to have a duplicate. The mirror disk is attached to a separate controller to protect from controller failure. When a program writes a record to a redundant disk, the operating system writes records to the disk and to its mirror. When a program reads from the disk, the operating system reads from the disk that is not busy or whose heads are best positioned to read the record. If a read error occurs, the record is read from the other disk.

An error-correction code stored with each disk record detects media failures during a read. A read error from a redundant disk results in reading the same record from its partner. Non-redundant disks are vulnerable to total disk failure, but are protected from media failures by vos, which verifies each write. A record that cannot be verified is rewritten to another disk block, and the bad block is removed from the available disk space.

Stratalinks, like disks, cannot run synchronized.

The CPU board contains two complete sets of logic and is self-checking.

However, the operating system has sufficient software error detection to run dual Stratalinks as separate parallel links until one fails. Failure of a link is detected, and data are retransmitted over the other link without affecting users of the link. A link failure could cause some performance loss because a dual link has a 2.8M-byte-per-sec. transmission rate, while a single link has a 1.4M-byte-per-sec. rate. But because most links do not operate even close to their maximum rates, it is unlikely that an application would notice the performance difference.

A failure scenario

When a logic board or an attached peripheral device fails, it puts itself off-line, lights a red light on the board and transmits an interrupt to the operating system. Maintenance software in the system then tests the failed board to determine if the failure was transient or

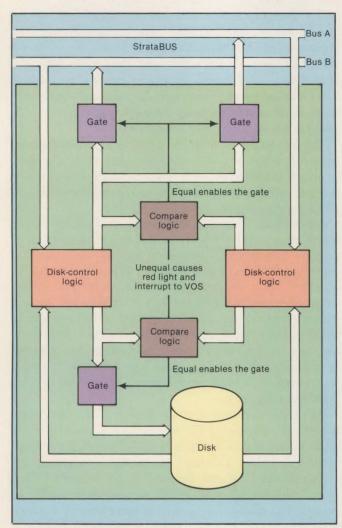


Fig. 4. Self-checking disk controller. Two sets of logic operate in parallel with each other. If their results differ, a warning light goes on, and no data are sent until the situation is corrected.

hard. In either case, the failure is noted in a hardware-failure log file, and selected terminals are notified of the failure. If the board passes the maintenance-software check, it is resynchronized with its redundant partner and put back on-line, and its red light is turned off. If the board fails the software check, it remains off-line, and a red light on the system control panel is lit.

A failed board can be replaced in a running system by a nontechnical person without special tools and without affecting any user's program. VOS dynamically reconfigures itself when a board is added or removed from the system.

Operating-system software

Each processing module contains two softwarevisible 68000 processors and a software-visible Z80 µp on each peripheral controller. The vos off-loads detailed I/O processing to the Z80s and uses one of the 68000s to respond to interrupts and to execute the word processor. The other 68000 executes user code and non-interrupt-driven system code. For example, a user program that calls vos to perform disk I/O has the user 68000 enter vos and set up the disk-I/O command chain. The user 68000 is then rescheduled to execute another user's program. The disk-I/O operations are executed by the z80 on the disk controller, and when the disk operation completes, the "executive" 68000 responds to the interrupt and posts a notification to the scheduler that this I/O event is complete. Depending on the setting of the scheduler's parameters, the user 68000 can be rescheduled to execute the user's program then or at the next scheduling interval.

A "process" is a virtual CPU and a 16M-byte address space in which a sequence of user programs can be executed. A process is created when a user logs onto the system, and is terminated when a user logs off. A process can create additional processes that operate independently of the creating process. VOS uses system processes to monitor terminals for log-in requests, to run the spooler and to perform requests made by other processing modules.

Each process has an address space consisting of 4M bytes for VOS and 12M bytes for a user program (Fig. 6). A program consists of any number of separately compiled subroutines, which can be written in different source languages.

The 16M-byte virtual address space is divided into 4096-byte pages that are mapped into physical memory pages by an address-translation map on the CPU board. The translation occurs within the 125-nsec. clock cycle and does not slow the CPU. The user's program and most of the programs in VOS see only the virtual address space and are unaware of the translation.

The hardware address-translation map informs the scheduling and paging algorithms of which physical pages were recently used and which virtual pages of each process were recently used by that process. Thus, it is possible to determine quickly the real working set

MORROW DESIGNS

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What EDN said: "The (Disk Jockey™ DMA floppy-disk controller) offers two to three times the performance of comparable controllers." And that's for either 5¼" or 8" floppy-disk drives operating from an S-100 (IEEE-696) bus.

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DMA Transfer (Burst Mode). The Morrow Direct Memory Access Hard Disk Controller (HDC/DMA) picks up commands from the host processor via memory on the system bus. Commands are accessed and data is transferred during DMA cycles. Commands and data transfers may occur anywhere in the 24-bit address range.

Interrupts. The controller can generate an interrupt at the end of each command and/or at the end of each command chain.

Imbedded μ P. An on-board 8X300 supervises data transfers between the Winchester drive(s) and main memory. Microcode in this 7 MHz bipolar microprocessor implements the command structure of the controller.

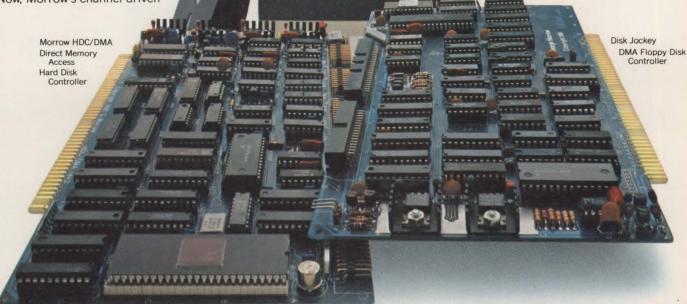
Expansion. The HDC/DMA addresses one to four drives, one to 16 drive heads and an unlimited number of tracks. These capabilities allow system upgrades to additional platters and tracks as Winchester technology advances.

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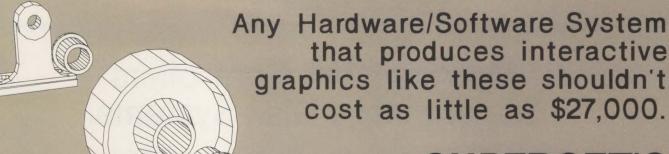
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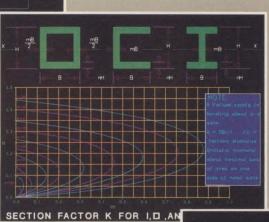
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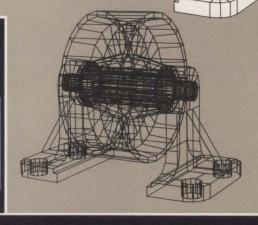


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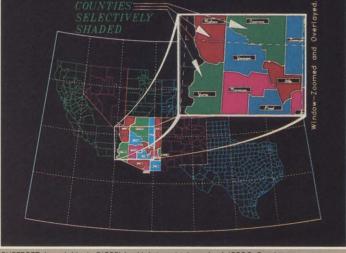


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When data are written to a given memory location, both memory controllers respond and write the data into their memory.

of each process and which physical page of memory to replace when a new page is required.

Sharing and protection.

Each page of a process's address space has an associated access code that allows execution, read/write or read-only. The processor has supervisor and user execution states, and, for each state, it has potentially separate access codes for each page of the address space. These access codes are stored in the address-translation map used to translate virtual to physical addresses, and are enforced for every memory reference in both user and supervisor states.

All users share the physical pages of vos and appear in the address space of each process. Likewise, user programs are shared if executed by more than one process. Sharing user programs and system commands and utilities requires no action on the part of a user and occurs with no visible effect to the user. All code produced by Stratus compilers is pure and reentrant.

A user's program is protected from destruction because each page of program instructions is given an execute-only access code. A user's data are protected from other users because they exist only in the address space of the user. The data are also protected from execution to aid debugging of users' programs.

Inter-process communication facilities of VOS allow a multi-process application to be developed on a single-module configuration and run later without modification on a distributed configuration consisting of multiple processing modules, or even on multiple Stratus systems connected by Stratanet. Consequently, the mechanisms used to start, stop or synchronize processes do not use shared memory; they use the file system as a high-level shared memory.

Every file in the file system has an associated lock and an associated event. In addition, each record in a file has an associated lock. Locks synchronize file access between two or more processes and can be set or reset to indicate reading or updating of the file or records.

Simple notification and waiting for events between processes are performed using event counts. An event count is a large integer that is incremented each time that it is notified by a process.

Most inter-process communication is related to files and consists of notifying processes that data are available to be processed or of waiting for data to arrive for processing. The use of events and locks associated with files is consequently natural and efficient.

User-visible software

The Stratus/32 was introduced with a host of native-mode software, including:

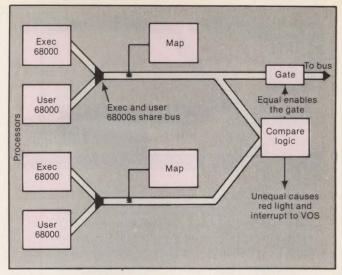


Fig. 5. A single Stratus/32 CPU board contains four Motorola 68000 processors that provide two software-visible processors. The board is fully self-checking and contains redundant virtual/physical address-translation maps.

- CRT menu-oriented commands. The vos command interpreter accepts all commands in two forms: a conventional line-oriented form suitable for use on hard-copy terminals or from within command language programs called command macros, and a CRT menu form that displays all command options and their default values. The CRT menu form is invoked by typing the name of the command followed by a function key. A command reference manual is unnecessary.
- Five industry-standard languages. These include COBOL 74, FORTRAN 78, PL/I-G, Pascal and BASIC. All languages are supported by optimizing compilers that share an optimizer and a code generator that produces highly optimized relocatable binary code. Subroutines written in all languages can be combined into a program, and all languages can call all VOS service subroutines. All compiled code is pure and reentrant.
- Program debugging. Program development in any high-level language can be done entirely within that language without the programmer's knowing the instruction set, data formats or register arrangement of the 68000 processor. For all languages, the debugger can set breakpoints on statements, display variables, make assignments to variables, execute calls and functions, execute gotos, step through the program and execute conditional breakpoints. The debugger can be entered to start execution of a program, when a program fails or to examine a snapshot of a program that has failed.
- Data security. Each file has an access-control list consisting of pairs of user IDs and associated access rights (execute, read or read/write). Access rights can be specified by a user or groups of users and are enforced by the VOS I/O system. Access-control lists provide file security without embedding passwords into programs. The lists operate on the basis of people or groups who access the file; consequently, they are easy to administer and use. Security is provided regardless



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of what programs or system commands are used to access files.

• Networking. Stratanet permits two or more Stratus systems to run as if they were one system. Just as users of individual processing modules of a system have access to their entire system, users of a networked system have access to the entire network without any network-oriented requests or commands. Normal file operations and inter-process communication operate transparently to the user's program.

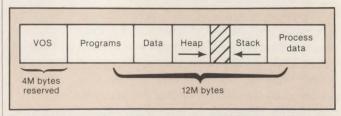
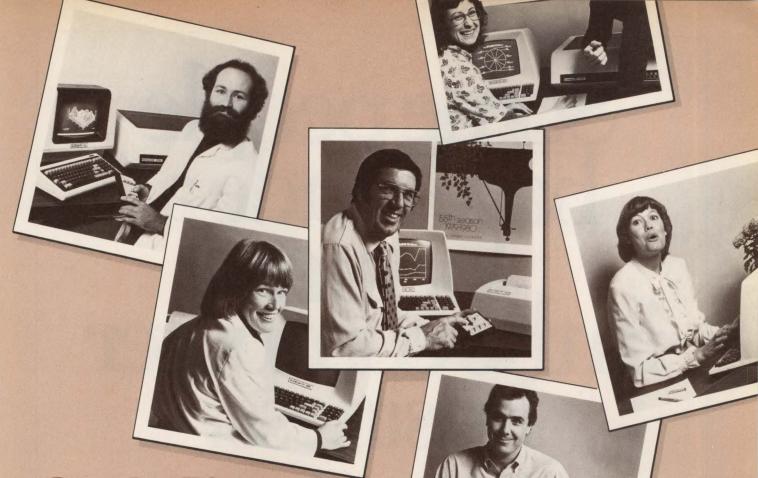


Fig. 6. Stratus/32 virtual address space provides as much as 12M bytes of program and data space per user program. The stack is the interrupt directory; the heap is handy for temporary data that must be stored randomly. Both expand and contract as needed. User programs and system code are shared without user involvement, and no segment limits are imposed on programs or data.

• Transaction processing. Vos supports the development of transaction-oriented applications by providing CRT forms-design utility and forms I/O statements in all high-level programming languages, multi-terminal transaction control in all high-level programming languages, individual record and file locking, multi-key indexed file access, queued file access and file-system operations to ensure the integrity of transactions.

Data representing a transaction can be processed directly by a user-written transaction-control program, or data can be written into a queued file to be processed by other programs, called transaction servers, which operate asynchronously with respect to the transaction-control program. Transaction servers can run in any processing module, not just modules running the transaction-control program. Likewise, transaction-control programs can run in several modules. The number and distribution of transaction servers can be dynamically altered in response to changes in the transaction rate.

Robert Freiburghouse is co-founder and vice president of software engineering, at Stratus Computer, Inc., Natick, Mass.



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CACHE MEMORY

What does cache buy for you?

EFREM G. MALLACH, Honeywell Information Services, Inc.

Cache memories are increasing the performance of all kinds of minicomputers; here's how they work

Pity poor Henry. He doesn't have a desk or a table. He has to do all his work on his lap. Henry's employer saves money, of course; desks are expensive. But Henry can't get much done because he's always running back and forth to the filing cabinet. If Henry is a really slow worker and spends a long time on each piece of paper he pulls out, the extra time probably doesn't make much difference. But if he can really zip along, he could get a lot more done if he had a desk to lay out his papers.

Most computers have the same problem. They can keep lots of data in main memory—several million

Central processor

100 nsec./4 bytes

Cache memory (8K bytes)

750 nsec./4 bytes

Main memory (512K bytes)

Fig. 1. Cache is super-fast memory located between a computer's CPU and its main memory. Caches store 1K byte to 64K bytes and are usually five to 10 times faster than their host's main memories.

letters or digits in today's larger systems—but only a few items in the CPU, usually in registers. There's nothing in between.

This state of affairs is fine as long as a system's processor and main memory run at about the same speed, as is the case with today's slower, less expensive minis and with most μps . Once you have a faster processing unit, though, it's not so fine any more. The faster processor spends a lot of time waiting for data from memory.

One solution to the problem would be to install faster memory. But this can be an expensive proposition. As a result, super-fast main memories tend to show up only in super-fast, price-is-no-object, multi-million-dollar systems. The rest of us need another answer.

Very often, the answer is to buy Henry the electronic equivalent of a desk: a second, smaller memory using super-fast technology. While this technology is too expensive for the entire main memory, it's quite affordable in smaller sizes.

This new module is called "cache memory." It sits between a CPU and a main memory (Fig. 1). Cache memories typically hold several thousand characters of information, with products available ranging from 1000 (the Perkin-Elmer 3220) to 64,000 (the International Business Machines Corp. 3081) characters.

Cache memories work by saving a duplicate copy of the most recently used data. When the CPU asks for a data element, cache control circuits check to see if the element is in the cache. If it is, the CPU gets it quickly because the small cache memory is very fast. Otherwise, it comes from the slower (but larger) main Cache memories typically hold several thousand characters of information, with products available ranging from 1000 to 64.000 characters.

memory. When that happens, the cache copies it so it will be available quickly the next time.

This procedure is effective because most computer programs have "locality," that is, they tend to work with a small group of items for a long time. The group is too big to be held in registers, but fits quite nicely into cache. Cache is very effective with programs that have high locality, and less so with programs that don't. On the average, about 85 percent of the processor's calls in a typical system for data are satisfied by the cache, referred to as a hit rate of 85 percent. In systems with very large caches, the hit rate can approach 95 percent. The cache is typically five to 10 times faster than main memory, say 100 nsec. versus 700 nsec. Combining the hit rate and the faster access time means the effective memory speed of the combination is typically three or four times faster than is main memory alone. While effective memory speed is not the only factor in system performance, a difference of this magnitude is visible at the system level.

A few technical questions

• How can the control circuits tell what's in the

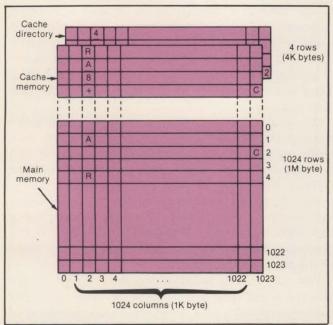


Fig. 2. Cache organization parallels main memory organization. In this example, main memory contains 1M byte of data divided into 1024 rows of 1024 bytes. The cache memory holds 4K bytes of data in four rows of 1024 bytes. Data transferred from main memory into cache always stay in the same column, so the cache directory must store row numbers only to keep track of what's in the cache. The cache above is four rows deep and data read from main memory are read into cache columns on a FIFO basis, with new data replacing the oldest data in each column. For example, copying the letter "R" from main memory location 2052 (column 2, row 4) into cache puts a 4 into column 2 of the cache directory.

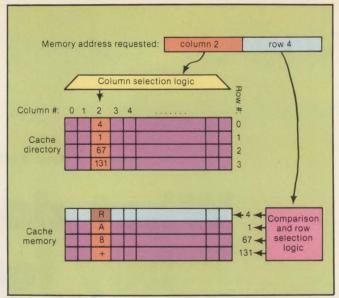


Fig. 3. The cache directory monitors the contents of cache. In this example, a request for data from location 2052 (column 2, row 4) comes to the cache. Directory column 2 is checked to see if it contains a 4. It does, in directory row 0. Cache column 2, row 0, is then known to have the desired data; the "R" is extracted and sent to the processor. If no column 2 directory cell has a "4," it means that location 2052 was not copied into the cache. A request then goes out to the main memory for its contents. Because the locality principle says it is likely that location 2052 will be needed again, it is brought into the cache at the same time that it is sent to the processor.

cache? They keep a "cache directory" that usually works by dividing the cache into many sections with as many as a few dozen items in each. The address of a word or byte in memory determines into which of these small sections it must go. It is relatively easy to check the directory for just the few locations in that section.

A typical cache organization, with the directory, is shown in Fig. 2. Because the main memory size is 1M byte, a 20-bit address label is needed to specify a location. These 20-bit labels are separated into two sections of 10 bits each. The first 10 bits select a "column," and the second 10 identify a "row." The cache memory is similarly divided into 1024 columns, and when a byte from memory goes into the cache, it always stays in the same column.

Because the cache in this example holds 4096 bytes, each column holds 4 bytes. The cache directory structure mirrors the cache structure; there is one directory cell for each cache cell. Each directory entry must be 10 bits long to hold the row number of the location copied into the corresponding cache cell. Because the column number is the same for cache and main memory, it does not have to be recorded. Fig. 3 shows the cache directory in action.

Fig. 2 is a slight oversimplification in that each directory location needs one more bit, called a validity bit. This bit indicates whether the contents of that cache cell are valid. If the corresponding main-memory location has just been read from a disk, for instance, the contents might not be valid.

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Cache is very effective with programs that have high locality, and less so with programs that don't.

cache? Because cache sizes are fixed, when the processor brings a new item into the cache, something else must be deleted to make room for it. The cache control circuits decide what to discard. The ideal approach is to discard the data element that has gone unused for the longest time. This means remembering when each of several thousand data elements was used; the circuitry gets very complicated. Therefore, most designs use a round-robin, or first-in-first-out approach, in which the cache discards the oldest item. If the oldest item is still being used, it will be brought back in the next time it is called for, and something else will be tossed out. This occasional wheel-spinning is a small price to pay for a big design simplification.

FIFO adds still another element to the cache directory. Each directory column needs a "pointer" to the row that will be used when the next item enters. In the example, because each cache column has four rows, the pointer must be 2 bits long. Each time a new item comes in, it enters the row indicated by the pointer, and the pointer is incremented to point to the next row. After row 3, it resets at 0.

- What happens when the CPU stores a new value in a main-memory location? A potential difficulty is that the data element can be in cache and main memory. The cache control circuits must ensure that anyone who refers to the element gets the updated, correct value. Three basic approaches include:
- 1. Changing both the cache and main memory,
- 2. Changing main memory and removing the item from the cache directory by clearing the validity bit of the cache cell.
- 3. Changing only cache, but changing main memory when the item is discarded from the cache, meaning yet another directory bit is necessary.

Any of these approaches can work; the last one is potentially fastest but is the most difficult to manage if several parts of the system can access memory independently.

- How does input affect the cache? The cache control circuits must watch to see if the new values are read into any locations that have copies in the cache. When this happens, the cache copy must be corrected or marked "not valid." This is quite similar to a processor store operation.
- How about output? Since output means getting data from memory, it is similar in principle, but not in practice, to the CPU's requesting data. The problem is that the CPU must get at the cache with maximum speed. If the output circuits share the same access path, a "traffic cop" is needed to keep them out of each other's way. The electronic traffic cop slows things, so output usually uses a separate channel to get to

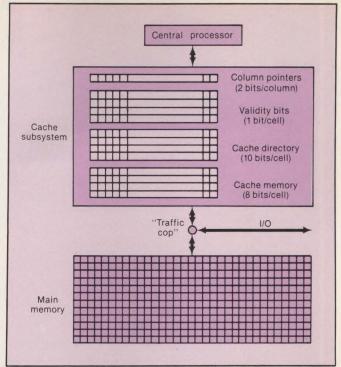


Fig. 4. The complete cache subsystem has many components, but remains an affordable system feature on most high-performance minicomputers. The cache subsystem's cache directory maps cache contents, the validity bits make sure the cache reflects the latest main-memory contents, and the column pointers are used to decide what cache data gets erased as new cache data are written from main memory.

memory. If main memory is not up-to-date, an error can occur. The solution is closely connected to the way a store operation is treated. The complete cache subsystems (Fig. 4) can be built into affordable minis.

• Who uses cache memory? The first production system with cache memory was the International Business Machines Corp. 360/85 in 1969. Use of cache was limited to large mainframes until 1975, when the Data General Corp. Eclipse series with cache was announced. Most minicomputers higher than medium performance use cache, as do most mainframe systems and virtually every supermini. The reason is simple: it makes sense to buy Henry a desk!



Dr. Efrem G. Mallach is director of strategic planning for Honeywell Information Systems, Inc., Billerica, Mass.

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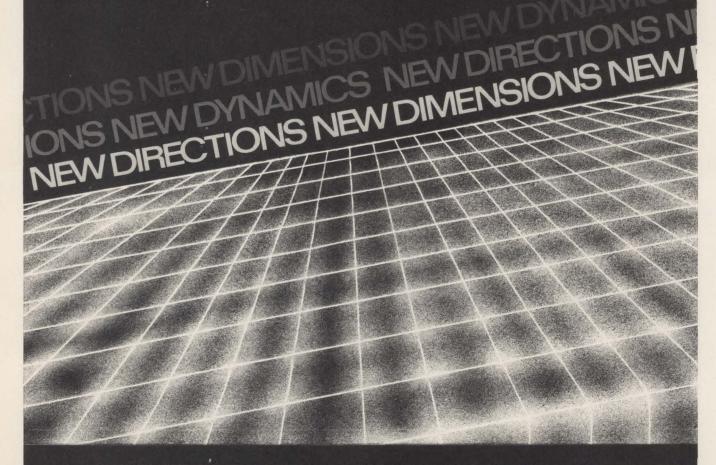
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SYSTEM INTEGRATION

Direct-connect modems reflect LSI advances

CARL WARREN, Western Editor, EDN Magazine

Modular packaging and flexible-interconnect provision are among the attributes that should attract system integrators

Although direct-connect modems have been available since the mid-1970s, the latest advances in LSI technology are allowing modem manufacturers to develop new, more compact and lower priced versions of these devices. The new direct-connect modems exhibit several attributes that greatly simplify their integration into system designs:

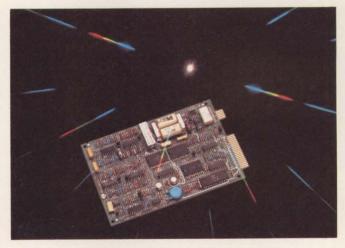
- Modular subsystem packaging
- Flexible interconnects via both cable and pins
- FCC certification
- Automatic dialing and answering, plus storednumber features.

System integrators can derive several key benefits from these modems. First, they make it possible to design-in a modem with relative ease. They typically reduce overall system complexity by eliminating the extra cable and circuitry required for RS232 interconnection and the extra power supply usually required for that purpose (most operate from the standard voltages available within a system). Second, the modular designs offered by such firms as Novation and Rockwell allow use of a modem to fit space and operational requirements.

Modular-modem choices

The Novation module series, for example, consists of a low-speed modem (P/N 490280-X) and a phone-line interface (P/N 490278). The modem module's 300- and 1200-bps, two- and four-wire Bell 202-compatible version (designated by -2) sells for \$74 in 500-unit quantities; the phone-line interface is similarly priced.

The LSI-based, crystal-controlled modem module operates in half- or full-duplex mode, and features answer/originate capability, self test, dial-tone/busy-filter mode and programmability through a µp or switches. Adding the phone-line interface provides



Developed for logic designers, Rockwell's R24DC 2400-bps single-board direct-connect modem offers auto-answer/originate capability and FCC registration for \$450.

FCC certification plus automatic pulse and tone dialing with an external μp .

Rockwell International offers a similar capability in its R24 2400-bps integral modem package. This synchronous serial dual-phase-shift-keyed (DPSK) modem is implemented in three modular building blocks: a \$118 transmitter module (T) and two \$218 receiver modules (R1, R2). A complete kit sells for \$395.

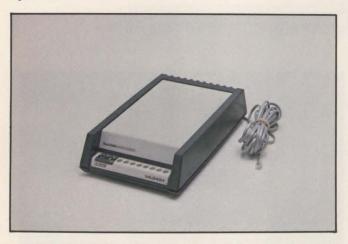
The Rockwell package allows integrators to implement a modem using only the modules necessary for their design. Like the Novation modules, it features FCC registration and Bell 201 B/C and CCITT V.26 compatibility.

Not all applications require the modularity provided by the Novation and Rockwell devices. Therefore, Rockwell also offers the R24 fully configured on a board with auto functions, FCC-certified direct-connect functionality and line equalization. This version is priced at As important as modularity in many systems designs is modem size, and manufacturers continue to develop modems that occupy as little real estate as possible.

\$450 and is designed for OEMs who want to add modem capability without investing a great deal of design time.

Modem size shrinks

As important as modularity in many system designs is modem size, and manufacturers continue to develop modems that occupy as little real estate as possible. The modular board-level designs are one of their approaches (see table), and also noteworthy are some new box modems designed to plug into a terminal or system.



Combining three types of compatibility—Vadic VA3400, Bell 212A and Bell 103—in one package, the Racal-Vadic VA3450 sells for \$350 in 25-unit quantities.

For example, the Universal Data Systems model UDS 202 LP, a 0- to 1200-bps, half-duplex, two-wire unit, comes in a slim-line package that fits directly under a telephone. It sells for \$265 in 25-unit quantities. Its designers achieved its small size by deriving power from the telephone line.

This type of modem, which is also available as a board-level product, aims to combine hard-wired-unit functionality with acoustic-coupler portability—a goal that has become much easier to achieve with the relaxing of requirements for a direct-access arrangement (DAA) for using the Bell switched-network system.

All companies producing modems with innovative packaging don't use the same design philosophy, though. The Microperipheral Corp., for example, offers a slim-line 300-bps modem for personal computers, priced at \$199.50 and available with a \$79 auto-dialing option. This modem fits neatly under a telephone, but unlike the UDS unit, it requires a small 5V power source (attached to the AC line) rather than using phone-line voltages.

Abundant choices are available

Depending on the application, designers might also choose from among one of the many offerings from Astrocom Corp. For specialized applications, such as database manipulation, for which users might want to send and receive data at widely different speeds, there is model 140-0, which transmits at 150 bps and receives at 1200 bps in asynchronous, four-wire, full-duplex mode, or model L40-A, which transmits at 1200 bps and receives at 150 bps. Astrocom offers those modems either boxed, for plugging directly into a system, or as cards, for integrating into OEM equipment.

If a systems designer is looking for a modem that offers such features as 1200-bps operation, auto-dialing and auto answering, Touch-Tone signaling and the ability to understand direct or system commands, he might consider the model 1012 intelligent modem from Bizcomp Corp. This \$895 device features user-programmable answer-back, the ability to store the last number dialed, FCC certification and automatic speed sensing. Bizcomp also offers the product in a board-level version.

Another notable design is Racal-Vadic's VA3450 series of triple modems. These units, which sell for \$350 in 25-unit quantities, provide Vadic VA3400 and Bell 212A and 103 compatibility in one package and operate synchronously or asynchronously. The Vadic- and 212A-compatible portions employ a quadrature AM four-level, phase-shift-keyed modulation scheme, while the 103-compatible portion uses binary phase-coherent, frequency-shift keying. The VA3450 series also features receiver sensitivity of -50 dBm when receiving with an equalizer in place, and in the 103 mode it operates at a nominal -45 dBm.

Similar in many functions is Prentice's model P-V.22. This \$1034 unit meets CCITT V.22 standards, has two-wire, full-duplex capability and achieves data rates of 1200 and 600 bps in synchronous mode and 1200-, 600- and 0- to 300-bps operation in asynchronous mode.

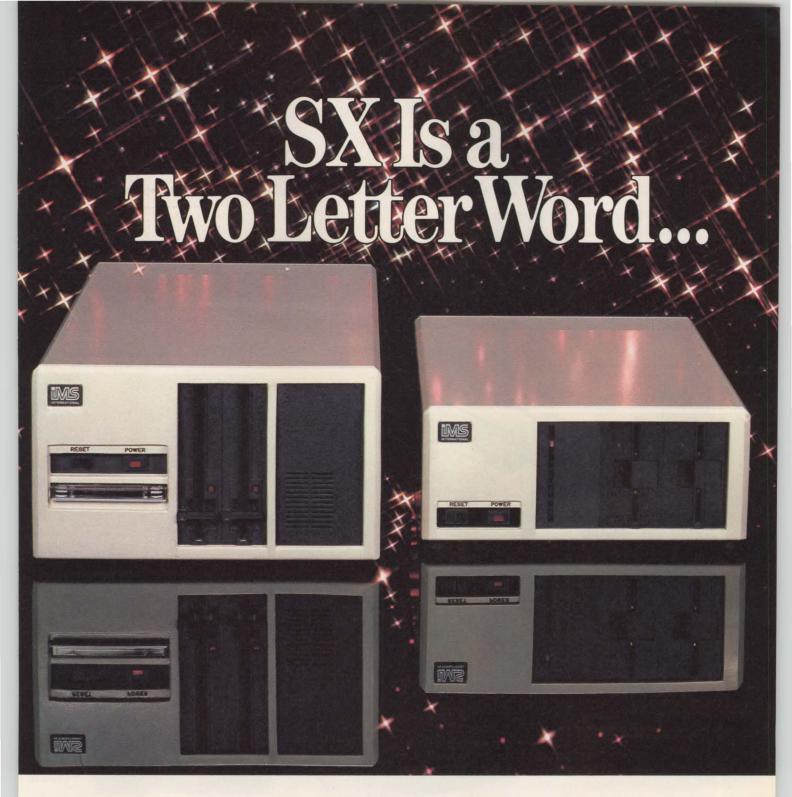
Need high speed?

If an application calls for speed greater than 1200 bps, the Codex model 5208R data modem might fill the bill. This \$2450 unit furnishes strap-selectable switching between Bell 208A (leased-line) and 208B (dial-upline) modes. Additionally, it provides self testing and condition reporting via front-panel LEDs.

Another high-speed modem is the Kinex µp data modem, model K9600. This \$3950 unit meets CCITT V.29 standards, operates over four-wire, unconditioned, domestic and international, leased voice-grade lines and offers user-selectable fall-back data rates from 4800 to 7200 bps to accommodate severely degraded lines.

The K9600 is unusual in that firmware implements all functions, including filtering. This feature, explains company president Carl Nordling, means that all product updates can be accomplished in the field at very low price.

Not strictly a direct-connect modem but nonetheless



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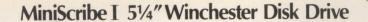
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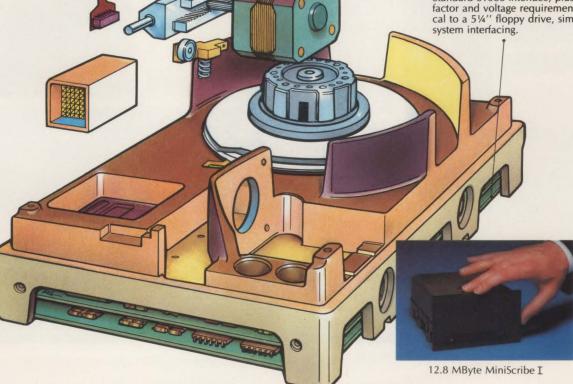
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*OEM price in quantities of 1000.

Another spur to rapid innovation in modem design is the increasing use of dial-up databases such as those offered by CompuServe and The Source.

noteworthy is Paradyne's model T-96, which sells for \$2515 in 100-unit quantities. This 9600-bps modem is intended for use in full-duplex point-to-point applications and features a 253-msec. training time (the time required to equalize the line and ensure adequate bandwidth; this operation occurs at the beginning of each transmission). It also provides fall-back operating rates of 7200 and 4800 bps and CCITT V.29 compatibility. Like other modems in its class, it furnishes built-in diagnostics and permits local or remote testing.

The 300-bps connection

Although data rates of 1200 bps and greater are rapidly assuming great importance for high-speed transmission in commercial applications, 300-bps modems are still well entrenched in personal-computer applications. And one innovative design in this field that meets the dual requirements of direct-connect operation and low price is Tek-Com's model TC 4007.

This \$495 modem has a dynamic range of -10 to -56 dBm, is FCC certified and furnishes a built-in dialer with automatic re-dial capability. In addition, it permits field programming of an auto-dial function, either via its built-in keypad or with μc software.

Also serving the personal-computer market, BC

Electronics offers an interesting design built around the Motorola 6860 modem chip—the BC-103 300-bps modem. Priced at \$225, this unit offers auto-answer and auto-dialing functions. It's strictly a hobby modem, though, and is sold through Heath Electronic Centers along with the optimized HDOS operating system designed to supervise it.

Possibly the leader in 300-bps modems for personal-computer systems, though, is Hayes Microcomputer Products. Its most recent introduction is the Hayes Stack Smartmodem, designed to operate in any system equipped with an RS232 port and controllable by any language using ASCII character strings.

The FCC-approved \$279 modem furnishes built-in diagnostics and a system-monitor program that controls its functions. It also supports Touch-Tone or pulse dialing and can work through a PBX.

Smaller and less expensive

Even though the foregoing products represent several advances in modem design, more are on the way. Universal Data Systems marketing vice president George Grumbles expects that, in 1985, OEMs will want speeds as great as 9600 bps at 300-bps prices.

Moxon president Jim Jordan agrees and adds that future modems will be implemented almost entirely on one chip. At the same time, though, the nonintegrated portions of these modems will reside on several boards to minimize crosstalk and other technical problems; it will probably be some time before single-board modems totally supplant multiboard units. (Such single-board units will eventually occupy less than 20 sq. in. of real estate.)

INNOVATIVE MODEM SUITS LOCAL NETWORKS

Systems designers establishing a local-area network (LAN) should consider a new modem design from the Microperipheral Corp. This as-yet-unnamed modem operates at 4800 bps, has no filters and will sell for approximately \$75 in OEM quantities. It does not meet Bell and CCITT requirements.

Chief engineer Don Stoner explains that the device encodes data on the half cycle. One bit of data transmitted at 4800 bps, for example, is equivalent to using one half cycle at 2400 Hz. This fact and the use of zero-crossing detectors in the receiver allow the modem to use the time domain between the zero crossings to convey digital information. Signal amplitude is, therefore, unimportant; in-line conditioning circuitry and training sequences are not necessary.

Even though the modem doesn't conform to accepted standards, Stoner believes that personal-computer users will find it acceptable, because with it they can inexpensively set up high-speed networks. He also believes that time-sharing houses will find the modem useful because an unlimited number of the devices can be connected, controlled by the clear-to-send (cTs) line. The technique is much like using a hard-wired network system equipped with masters and slaves.

Because this modem approach is so similar to the network-server concept, it requires software to arbitrate line collisions and set priorities. The firm is now working on such software.

The modem is expected to be in full production by early next year.

CONSIDER THE STANDARDS

Virtually all modems available conform to the standards established by Bell or to those established by the Consultative Committee for International Telephone and Telegraph (CCITT). The latter are rapidly becoming the accepted alternative because of increased worldwide data communication; even Bell is moving toward using the CCITT definitions.

The standards describe how signaling must occur over a line; bandwidths, scrambling and training sequences are laid out to provide modem compatibility. Design criteria for modems operating over the switched network or private 3002 series lines require compliance with these standards.

Although desirable in the sense of avoiding chaos in the communications world, compliance isn't cheap. Meeting Bell 212 standards for 1200 bps operation, for example, increases modem cost because extra circuitry is required.

Although data rates of 1200 bps and greater are rapidly assuming great importance for high-speed transmission in the commercial world, 300-bps modems are still well entrenched in personal-computer applications.

With the increasing combination of LSI-based modem designs and $\mu ps,$ the price of a full-duplex Bell 212-compatible modem could fall to much lower than \$400 as early as the first quarter of next year; 4800- and 9600-bps units could tumble below \$600 by early 1983.

Databases push modem growth

Another spur to rapid innovation in modem design is the increasing use of dial-up databases, such as those offered by CompuServe, Columbus, Ohio, and The Source, McLean, Va. Such applications, with their implication of large numbers of unsophisticated users, will call for very specialized smart modems with very low prices.

Additionally, a report from the Yankee Group, Cambridge, Mass., forecasts that 65 percent of U.S. women will have full-time jobs by 1989, leaving 60 percent of all metropolitan households unattended during school hours. This development could fuel demand for home-security systems and remote-controlled appliances—all of which will require modems. In

addition, services such as Qube, Columbus, Ohio, Viewtron, Coral Gables, Fla., and Hi-Ovis, Osaka, Japan, will become commonplace, offering the public two-way communication for handling functions ranging from banking to shopping. The result? Further increased demand for specialized communication devices.

Systems such as Microperipheral Corp.'s "public modem" (a variation on the Bell 202-type device) will also see increased use. This unit, like the Astrocom unit cited earlier, accommodates continuous data reception at 1200 bps while simultaneously sending data at rates as high as 150 bps. It can, for example, interconnect with a terminal at 9600 bps and, through speed-changing circuitry, reduce the transmission speed over the line to 150 bps. The public modem is priced at \$199.50 with a \$49 auto-dialing option.

Microperipheral Corp. chief engineer Don Stoner explains that developing modems with low transmission speeds but high receiving rates lowers prices. He expects that similar techniques will be employed even as LSI prices decrease. Therefore, it shouldn't come as a surprise if less-than-\$200, full-duplex, 1200- and 4800-bps modems appear as early as 1983.

Carl Warren is western editor for EDN magazine, which published this article in its Nov. 11, 1981, issue.

FOR MORE INFORMATION...

For more information on the modem products discussed in this article, contact the following manufacturers directly or circle the appropriate numbers on the Information Retrieval Service card.

Astrocom Corp. 120 W. Plato Blvd St. Paul, Minn. 55107 (612) 227-8651

BC Electronics 1001 W. Kristal Way Phoenix, Ariz. 85027 (602) 869-9650

Bizcomp Corp. Box 7498 Menlo Park, Calif. 94025 (415) 966-1545

Codex Corp. 20 Cabot Blvd. Mansfield, Mass. 02048 (617) 364-2000 Hayes Microcomputer Products Inc. 5835 Peachtree Corners E. Norcross, Ga. 30092 (404) 449-8791

Kinex Corp. 6950 Bryan Dairy Rd. Largo, Fla. 33543 (813) 541-6404

Microperipheral Corp. 2643 151st Pl. Northeast Redmond, Wash. 98052 (206) 881-7544

Novation 18664 Oxnard St. Tarzana, Calif. 91356 (213) 996-5060 Paradyne Corp. 8550 Ulmerton Rd. Largo, Fla. 33541 (813) 530-2000

Prentice Corp. 266 Caspian Dr. Sunnyvale, Calif. 94086 (408) 734-9810

Racal-Vadic Inc. 222 Caspian Dr. Sunnyvale, Calif. 94086 (408) 744-0810 Rockwell International Electronic Devices Division Box 3669

Box 3669 Anaheim, Calif. 92803 (714) 632-3729

Tek-Com Inc. 2142 Paragon Dr. San Jose, Calif. 95131 (408) 263-7400

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Separate Function Keys	9	3	1	1	11
Insert/Delete Line Key(s)			~		
Insert/Delete Character Key(s)	1	- Chap	~		1
Clear EOL/EOP Key(s)			~		-
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SPEECH TECHNOLOGY

Exploring practical speech I/O

TOM BRIGHTMAN and SHARON CROOK, Texas Instruments Inc.

Minicomputer-based speech-development systems and LPC allow designers to trade naturalness for storage

Man/machine communications via speech will soon be commonplace in minicomputer- and μc -based systems. Just as modern visual-output devices that present information on pages of hard copy or through CRT terminals have replaced crude lamp and tape displays, synthetic-speech output will supplant bells and buzzers. Speech is the principal means by which people communicate with one another; why not use it with machines?

Technology bridges the gaps

Market analysts predict a glowing future for speech-I/O products (Fig. 1), but gaps in technology have delayed the introduction of speech into intelligent systems. Mechanical tape and disk drives using analog recordings are expensive, bulky, power consuming and failure prone. Further, they can play back only prerecorded information sequentially. Methods of providing synthetic-speech output based on digital LSI chips address these problems. Several digital methods allow designers to trade off limited vocabularies of realistic-sounding speech for less natural-sounding, but unlimited, vocabularies.

Advanced semiconductor technology, efficient modeling of the human vocal apparatus and innovative digital filters based on linear predictive coding (LPC) techniques have been blended into chip sets that deliver practical synthetic speech output. Practical speech output can be produced by waveform synthesis, constructive synthesis or analysis synthesis.

Waveform synthesis

Waveform synthesis recreates the original speech waveform by sampling the input at appropriate intervals. The most popular sampling rate is 8 kHz, corresponding to a 4-kHz speech bandwidth. Quantizing each of these samples into 8 to 12 bits results in data

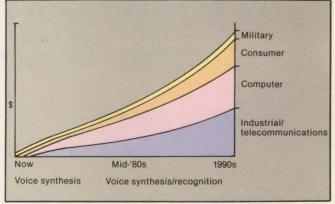


Fig. 1. Speech-I/O growth in each market. During the latter half of the decade, algorithmic and fast signal-processing chip break-throughs will provide the foundation for practical systems that can listen as well as speak. Industrial/telecomm and computer products will supply the original volume and interest needed to spur on the cost-sensitive consumer-product sector. Meanwhile, military applications will grow slowly but steadily.

rates from 64K to 96K bits per sec. These rates make unaided waveform synthesis impractical because too much information must be stored. The data for each sample are stored sequentially, eventually to be reformed into an analog signal via a digital-to-analog converter. Pulse-code modulation (PCM) is a commonly used example of waveform synthesis.

Data rates and storage requirements can be reduced drastically while maintaining excellent speech fidelity by electronically modeling the vocal tract. These techniques do not attempt to preserve the character of the input waveform. Rather, the raw input data are processed into parameters that control an electronic model of the vocal apparatus. Texas Instruments Inc.'s LPC technique models the human voice mechanism by a 10-pole time-varying, digital lattice filter with excitation for voiced and unvoiced speech (see "Linear

LINEAR PREDICTIVE CODING

Linear predictive coding is an efficient way to compress data that represent speech. LPC also provides a reliable, accurate method for estimating a set of parameters that closely characterize a linear, time-varying model of human speech production. The basis of LPC analysis is that, over a finite interval, a speech sample can be approximated by a linear combination of its previous samples. Minimizing the sums of the squared differences between actual speech samples and appropriately weighted linearly predicted values determines a unique set of prediction coefficients.

Speech can be readily synthesized from LPC parameters by the same model or representation of human speech production that was used for the analysis. Synthetic speech is generated in frames corresponding to the original samples. These frames are recreated by linearly combining previous speech samples that have been weighted by the prediction algorithm.

LPC's success in generating low data-rate, high-quality speech de-

pends on the accuracy with which its fundamental model applies to the physical process that produces human speech. Hence, the anatomical mechanism (a) in which vocal cords excite the resonating mouth and nasal cavities is the touchstone. This leads directly to the simple two-unit functional description.

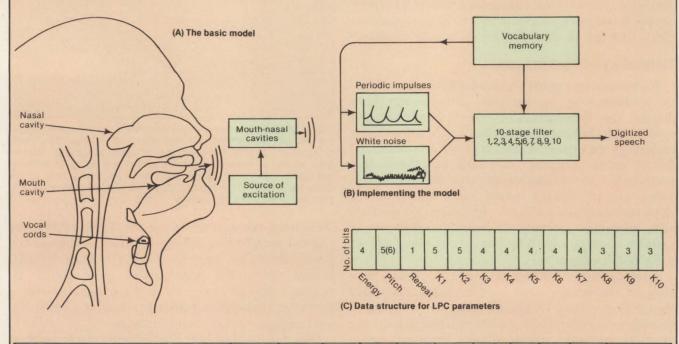
In the more complete representation (b), the composite spectral effects of radiation, vocal tract transfer function and glottal excitation are included in the steady state of the time-varying linear filter. This representation is excited by an impulse train to simulate voiced speech or a random-noise source to simulate unvoiced speech. Slowly varying parameters control the synthesizer: pitch period, voiced/unvoiced switching, gain or energy value and 10 prediction (k) coefficients. These 10 K-parameters are also the reflection coefficients of the 10-pole lattice filter that models the vocal tract.

An impulse generator excites voiced sounds by producing a fixed amplitude pulse at the start of each

pitch period. A white-noise generator excites unvoiced sounds by producing uncorrelated but uniformly distributed samples with unity standard deviations and zero means. The model's voiced/unvoiced control selects between the two excitation sources, while the gain control determines excitation amplitude.

LPC speech is sampled over frames, and LPC vocabulary is stored in the same frame format. Each frame contains data that represent amplitude, pitch or frequency and reflection coefficients. The data structure for each parameter in an LPC frame (c) indicates that as many as 49 bits are needed to represent a frame of voiced speech. (Series 5200 synthesizers require a 50th bit.) For the worst case—voiced speech—the maximum data rate is 40 frames per sec. x 49 bits per frame or 19.6k bits per sec.

Frame lengths can be shorter, however. Unvoiced, repeat, silence and stop-code frames (d) all require far fewer bits than do voiced frames. Average LPC speech typically requires 11.5K bits per sec.



	Energy		Pitch	K1	K2	КЗ	K4	K5	K6	К7	К8	К9	K10	Bits required
Voiced frame	XXXX	0	XXXXX(X)	XXXXX	XXXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXX.	XXX	XXX	49(50)
Unvoiced frame	XXXX	0	00000(0)	XXXXX	XXXXX	XXXX	XXXX							28(29) 10(11)
Repeat frame	XXXX	1	XXXXX(X)									1000		10(11)
Silence	0000													4
Stop code	1111										150			
	Ly.											Marie V		

^{() =} used with 5200 Series processors

⁽D) Frame data requirements

- Z - Z - Z - Z - Z - Z - Z -Z-Z-Z-Z-Z-Z-Z-Z-- Z - Z - Z - Z - Z - Z - Z - Z Z-Z-Z-Z-Z-Z-Z-Z-Z - Z - Z - Z - Z - Z - Z - Z - Z -- Z - Z - Z - Z - Z - Z - Z - Z Z-Z-Z-Z-Z-Z-Z-Z-Z - Z - Z - Z - Z - Z - Z - Z - Z - Z - Z - Z - Z - Z - Z . - Z - Z - Z - Z - Z - Z

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Analysis synthesis accurately preserves the character of the speaker's voice, including intonation, accent, dialect and pitch, in any language.

predictive coding," p.292). The bit rate of the coded data for pitch, energy level and the 10 filter parameters is typically 50 to 100 times lower than that needed for waveform synthesis.

The power of LPC for synthesizing speech stems from the accuracy of its representation of the human vocal apparatus. Because the model contains so much of the information also in the speech waveform, only time variations must be stored; the model provides the rest of the speech signal. It accounts closely for composite spectral effects of radiation, vocal-tract transfer function and glottal excitation.

Constructive synthesis

Constructive synthesis techniques generate speech output from a library of token sounds under the guidance of a set of rules. Every spoken language can be broken into less-than-word-sized speech tokens called phonemes. English, as spoken in the U.S., divides into 42 such building-block sounds. Using a set of rules, a language's phonemes can be strung together into any word. But phonemes are only approximations of all the sounds used. Words fashioned from so few basic sounds do not sound human.

TI's constructive-synthesis implementation expands the original 42-phoneme set into 128 allophones. These are fine variations of the basic sounds to allow for slight differences in them as they occur in different words. Allophonic speech sounds more human, but still unnatural. Only speech synthesized from actual human input, as in analysis synthesis, sounds truly natural. However, allophonic rule sets are constantly refined for more naturalness.

A useful technique for building words via constructive synthesis is called a text-to-speech vocabulary-building arrangement, in which text representations of the words to be output serve as input (Fig. 2). To create a vocabulary for a product, a user at a CRT terminal of a speech-development system keys in individual text words. The system's translator dissects them into appropriate LPC-coded allophones stored in the library. Storing the allophones as LPC parameters cuts the required memory size. The parameters representing these segments of speech sounds are then concatenated, or strung together, according to the system's rules. The LPC representation of the allophonic word approximation is then put into an LPC speech-synthesizer chip.

The text-to-speech system operator listens to the resulting synthetic-speech output to decide whether the word is pronounced properly. If not, several options for adjusting the output sound are available. A simple and effective technique for tweaking output words is

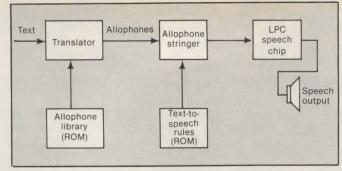


Fig. 2. Text-to-speech systems provide unlimited vocabularies in any language. Though the output is mechanical, its flexibility can be useful in non-repetitive situations. TI's TTS system uses relatively fine-grained speech tokens called allophones that are strung together under a set of rules for the language. The rule set can be enlarged to account for such variables as dialect or intonation.

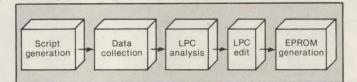


Fig. 3. Analysis synthesis vocabulary development is performed in five steps. A script of the required words and phrases is generated off line. Data are collected from a spoken rendition of the script. The raw data undergo LPC analysis, then are edited by auditioning. Approved vocabulary data are committed to EPROMs for prototyping.

deliberately misspelling the input text.

Analysis-synthesis vocabulary development follows a different routine (Fig. 3). The first step is an off-line process in which the complete vocabulary for a product is written into a script. This script contains all the words that will be used and repetitions of words that are to be used in varying contexts. In addition, phrases that must be spoken in a special way can also be included in the script.

After the script is generated, a recording session takes place. In this step, data derived from a speaker's reading of the script are collected. Typically, the speaker is a celebrity whose image enhances a product.

Next, data undergo LPC analysis, in which data are transformed from direct analogs of speech waveforms to LPC-10 parameters. LPC analysis extracts energy, pitch and K-parameters (the reflection coefficients for the 10-pole time-varying lattice filter). The LPC param-

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The June issue of Mini-Micro Systems will profile small business computers. The profile will include analyses of several new business-computer products and working descriptions of recently introduced business application packages.

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Contextual recording of words and their subsequent selective concatenation inject natural stress and inflection throughout a phrase.

eters are then played into a speech-synthesizer chip, and the resulting output is auditioned. During this step, the LPC-10 data can be edited or tweaked to improve their quality or compress them further. LPC analysis and editing compress the raw audio-input pattern data rate of about 100K bits per sec. to an average of 12.4K bits per sec. If the required editing becomes too extensive or cannot produce the required speech output, the speaker must be rerecorded.

Once the vocabulary meets all the requirements and is approved by the customer, it is committed to EPROM for inclusion in product prototypes. High-volume applications could cut vocabulary-storage chip cost by masking the LPC vocabulary data into less expensive ROMS.

COMPARING VOICE SYNTHESIS TECHNOLOGIES				
	Analysis synthesis	Constructive synthesis		
Vocabulary development process	Generates acoustical speech signals using models of human speech-production mechanism	Builds word by stringing together basic tokens of speech using a set of rules		
Vocabulary source	Human speaker	Software program		
Vocabulary size	Limited	Infinite		
Speech quality	Sounds natural	Sounds mechanical		
Data storage requirement	1150 bits for each sec. of speech	80 bits for each sec. of speech, plus 5K bytes for core library of allophones		

Analysis synthesis accurately preserves the character of the speaker's voice, including intonation, accent, dialect and pitch, in any language. Many applications demand a sense of urgency, authority or other nuances that the complex signals of natural speech contain. Also, along with single-word inputs, entire phrases and sentences can be processed to preserve authentic personal inflections. Hence, analysis synthesis delivers the most natural-sounding speech. However, because someone must utter the vocabulary before it can be auditioned, the technique is more time-consuming than others.

Construction versus analysis synthesis

Compared with analysis-synthesis methods, constructed speech sounds somewhat mechanical. Rather than the phonetic accuracy of each speech token, the major limitation on the quality of phonemic, or even allophonic, speech is the number of tokens used and the size of the rule set. The number of speech tokens can be increased almost indefinitely to account for coarticula-

tion effects that occur in natural speech. Also, more rules can make the output sound more natural. Constructive-speech systems offer unlimited vocabulary, however.

Another consideration in deciding between analysis and constructive synthesis is their respective data-storage requirements. The natural-sounding speech of analytic methods requires more data storage. For example, a typical analysis-synthesis system produces 1 sec. of synthetic speech at a stored-data cost of 11.5K bits. The storage requirement increases proportionately to the required speech duration.

By way of contrast, a constructive-synthesis vocabulary derived from a 256-element allophone library might need to call up only 80 bits to produce a corresponding 1-sec. utterance. Thus, the data-storage requirement is slashed by 150 times. However, storing the core library of allophones requires an additional 5K bytes.

Developing product vocabularies

Analytic and constructive systems also differ markedly in the way their vocabularies are developed. Constructive synthesis has an advantage because its sequences of phonemes, allophones or other speech tokens can be edited manually for immediate review and production. Conversely, analysis synthesis demands sophisticated data acquisition and analysis before the synthetic speech is produced.

Constructive systems use text-to-speech algorithms that reduce development time by directly and immediately converting into the appropriate data sequences typed descriptions of the words to be output. Hence, audition is immediate. Text-to-speech algorithms can be highly accurate; Ti's system produces 97 percent correct phonemes on the first pass.

With continuing development, differences between methods of speech synthesis will narrow. LSI and VLSI chips will play important roles in the future of both methods. Lower cost encoding systems will unburden the vocabulary-development process for analytic systems; dedicated ICs will facilitate real-time encoding enabling speedy generation of high-quality analytic vocabularies. Concurrently, text-to-speech generation will migrate from software-based minicomputer emulations to low-cost LSI or VLSI hardware.

A hybrid approach to developing product vocabularies is practical. High-quality but limited vocabularies that remain fixed throughout a product's life cycle call for analytically synthesized LPC; larger and more flexible but unnatural sounding vocabularies are the province of constructive synthesis. In both, LPC-10 modeling and coding can reduce data-storage requirements. Many applications could benefit from a combination of the two methods. To this end, TI offers development systems based on the 5220 speech-synthesis processor chip. These systems can produce, separately or together, constructively or analytically synthesized vocabularies. Such development systems

Regardless of the synthesizing method used, the resulting data are referenced and addressed in common.

provide a wide range of voice-synthesizing capabilities.

Regardless of the synthesizing method used, the resulting data are referenced and addressed in common. In addition to generating vocabularies, speech-development systems should provide mass-storage and management facilities for filing and accessing speech

code. In this way, libraries of speech output can be developed.

The major hardware components of a speech-recording and analysis system, the signal-processing path and a director monitoring a script rendition by a speaker in a sound-isolation area are shown in Fig. 4. The director's console displays frames of newly generated LPC data for editing.

The system can also be equipped via appropriate software packages with text-to-speech vocabulary-generation facilities. In Ti's system, data can be entered in an appropriate form at the text, phonemes,

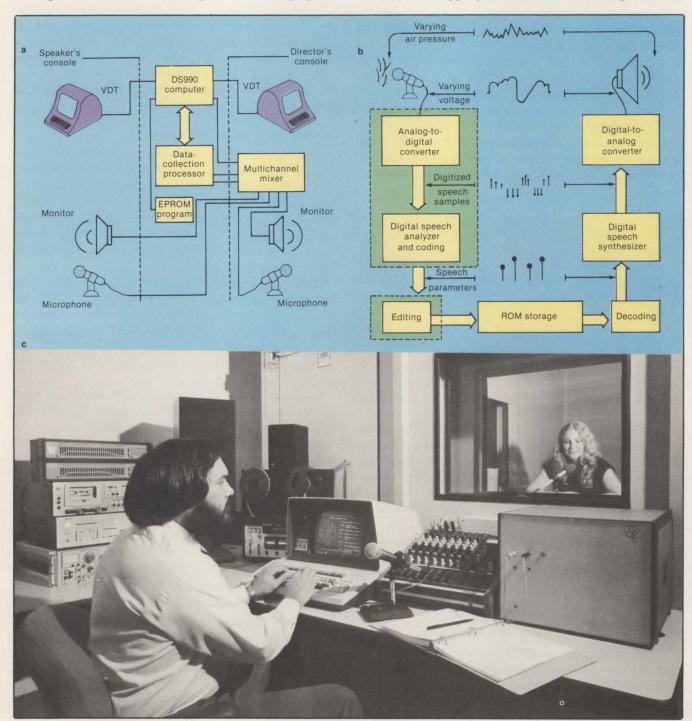


Fig. 4. Developing vocabulary for analysis-synthesis systems is best done under studio conditions. (a) Minicomputer-based speech-development system facilitates the five-step process described in Fig. 3. LPC synthesis reverses the steps of LPC analysis. (b) Analysis synthesis signal-processing path. (c) Console displays frames of newly generated LPC data for editing, as speaker reads from script.

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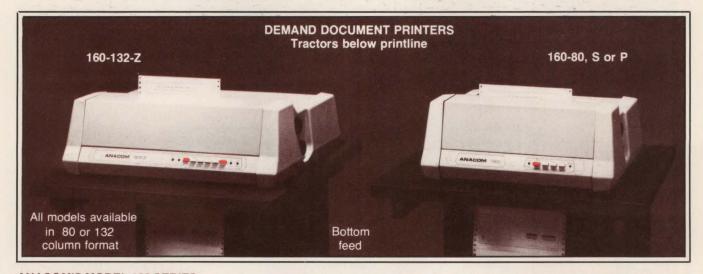
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The major determinant of which controller-chip series is appropriate for an application is the system-bus width.

allophone or LPC-10 parameter level (Fig. 5). When editing is required, an operator can call on the CRT descriptions of the utterance in the four levels.

The screen representations of text, phoneme, allophone and LPC-10 versions of the word "edit" are shown in Fig. 6. The coarsest representation breaks the word into four phonemes. The allophonic version consists of six parts, each of which invokes a more specific sound than do the corresponding phonemes. These six allophones give rise to 28 frames of LPC-10 data.

In each data frame, the LPC model requires as many as 12 parameters, representing energy, pitch and 10 reflection coefficients, K1 through K10. Unvoiced sounds (those with an energy parameter of zero) such as are made when enunciating "s," "f," "sh" and "t" require only four of the 10 reflection coefficients. The only unvoiced sound in "edit" is the t at the end of the word. Thus, in frames 22 through 28, only the first four K-parameters are needed.

The binary-data representation (Fig. 6) indicates a method for additional compression of data to be stored. Setting the repeat bit indicates that the values of the 10 reflection coefficients in one frame are identical to those in the previous frame. The slowly varying character of actual speech allows the repeat bit to be used often. This single bit eliminates the need to store all other data for its associated frame.

In addition to traditional design considerations such

as cost, packaging and hardware/software trade-offs, speech output raises some unique system-level and support questions. Analytically or constructively synthesized vocabularies must be chosen. Also, linguists and human-factors specialists, often better then computer professionals, understand that product-specific speech must be tailored for its intended user population. To this end, ranges for end-user's age, education, geographical and employment background are only some of the factors in determining how to convey intended information. In addition, pitfalls must be avoided, such as offending users by implying that they have done something incorrectly.

How well a total message must be spoken must be considered in addition to the choice of analysis synthesis versus constructive synthesis. If each word is recorded in only one of the several possible contexts that a product can use it, phrases will be monotonic and, therefore, fatiguing to the listener. A rising and falling pitch, appropriate to the context, conveys more information, compels greater attention and is more pleasant to the ear.

The process of contextual recording provides further grounds for serious consideration. Storing entire phrases exactly as they are to be output is highly memory intensive when many words are duplicated in several phrases. Instead, system designers can store individual words pronounced appropriately for the contexts in which they will be used. For instance, a word at the beginning of a phrase should be emphasized, while at the end, the word should contain less energy. Contextual recording of words and their subsequent selective concatenation inject natural stress and inflection throughout a phrase.

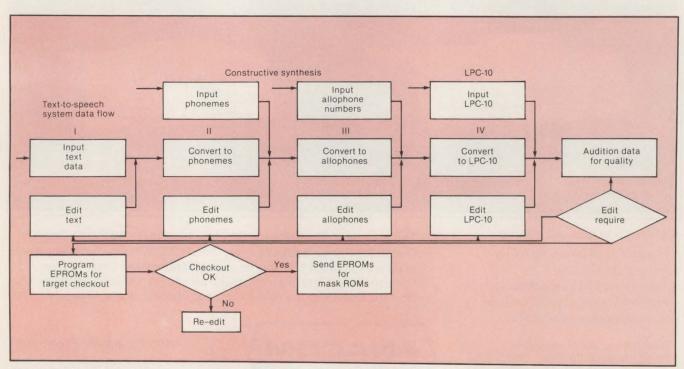


Fig. 5. Text-to-speech processing path. Data can be entered into and edited on TI's system at four levels: text, phonemes, allophones and LPC.

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More mundane design considerations also apply, but with speech-related emphasis. Time and cost can sometimes be traded off against one another. Simple brute-force recording of all the required phrases can shorten vocabulary-development cycle time at the expense of memory space. Using standard vocabulary ROMs that are preprogrammed with canned words can be the quickest and least expensive option if a

ready-made vocabulary matches a product's needs.

For specialized vocabularies, masked ROMs provide the lowest cost in high-volume applications. However, the typical eight-week delivery time for masked ROMs can delay a product's introduction. EPROMs, though more expensive, can be available immediately. A compromise is to introduce a talking product with EPROM-based vocabulary and follow it with less expensive masked-ROM versions.

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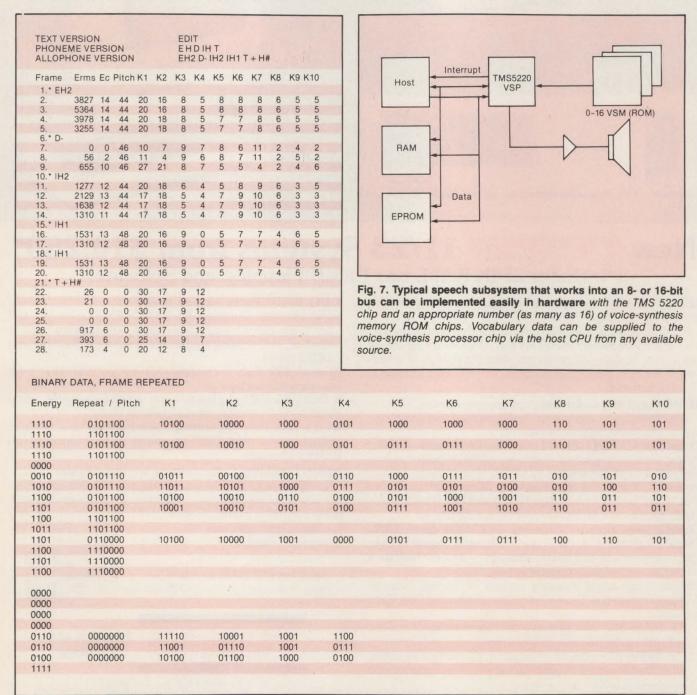


Fig. 6. Five versions of the word "edit" on TI's development system: text, phonemes, allophones, decimal LPC-10 and binary LPC-10. The text word expands to four phonemes, and then to six allophones for better prosody. Much more storage capacity is needed to accommodate the LPC data of 28 frames, but this form provides natural, recognizable speech.

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the commands reset, load address, read and branch, speak, test talk, read bit and output. Series 5200 chips also offer an interrupt. Reset synchronizes a command sequence or halts speech; load address sends the VSP a phrase's VSM address; read and branch indirectly addresses a lookup table of phrase addresses; speak initiates voice output, which continues until a stop code is detected in the speech-data stream or reset occurs; test talk notifies the controller that the VSP is talking; and the output and read bit commands strobe out memory data.

In series 5200 devices, interrupt informs the controller of the VSP s status, eliminating CPU-polling operations. Both series of VSP chips handle the VSM interface during command execution. Also, series 5200 chips respond to a speak-external command that allows the controller to provide the synthesizer data for sources other than a VSM. Series 5200 synthesizers provide an on-chip 128-bit FIFO that buffers speech-data inputs.

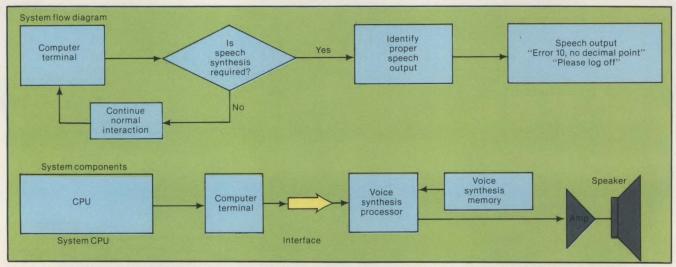
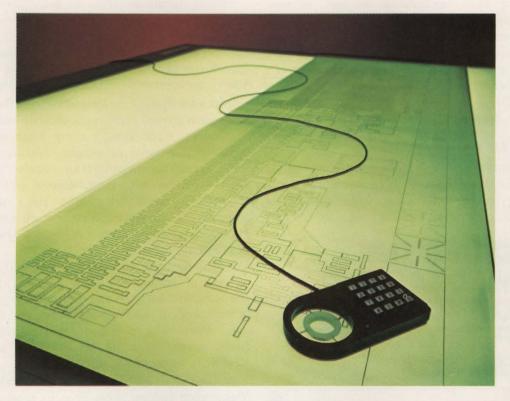


Fig. 8. Talking terminals can provide procedural instructions to inexperienced operators and can dictate errors so that operators do not have to look up error codes. The speech facility is a simple adjunct to normal terminal operation that need not affect its other functions.



Fig. 9. "What's this word, Mama?" is a question handled by Connectron, an electronic learning aid used in Western Publishing's "New Dimensions in Learning" program. When Connectron's wand is used to scan the bar code printed under each word, the word is spoken in a friendly voice.

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automobile instrumentation to intelligent machines on factory floors to talking terminals, speech output can help people to learn faster and better, produce more, get service promptly, make fewer mistakes and easily spot potential trouble.

Speech capability to guide trainees through the proper system-operation procedures will be a welcome addition to minicomputer-based terminals. Speech output could be coordinated with visual and tactile tasks, enabling an inexperienced operator to use touch, vision and aural prompts for task. In addition, an operator's pace could be gradually increased by shortening the time between voiced instructions. Even the speech within an instruction can be speeded. New software packages could come with appended speech-output programs to train operators.

Talking terminals (Fig. 8) can implement highly interactive man/machine interfaces for over-the-phone credit-status reporting and verification. Speech can also be used for generating error messages. Text-to-speech can provide valuable feedback to an operator. The system CPU or terminal-local µcs can easily manage a speech subsystem without affecting other duties.

Machine control represents another important voice application. Even though many machines in today's factories run under μc control, operators must tend them. Speech output can tell an operator that a machine needs attention, what must be done, where to look for replacement parts and whether the required task is satisfactorily completed. Making machines more intelligent and communicative can reduce the skill levels required of operators.

Most industrial processes can be monitored in terms of sets of parameters such as time, temperature, pressure, viscosity, ph and colors. Each time a process is executed, a machine can compare the resulting parameters with a set of normal values. Out-of-tolerance results could be called to an operator's attention, along with instructions

A stand-alone system from Western Publishing, New York, called Talking Books (Fig. 9), teaches children to read. With the system, a child passes the unit's reader over an identifying bar code under each word as he reads it. The unit then pronounces the word that the child is reading. At the end of the book, the unit tests the pupil's comprehension.

Well-planned speech-development programs should pay back handsomely. The markets for synthetic-speech I/O are already numerous for products that talk, and there will be just as many markets by the mid-'80s for intelligent devices that can listen as well. Modern synthetic-speech chips should spawn an industry that will produce billions of dollars worth of voice-I/O equipment in the 1990s.

Tom Brightman is advanced engineering manager, and Sharon Crook is speech technology market strategy manager at Texas Instruments Inc., Midland, Texas.

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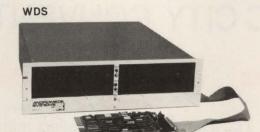
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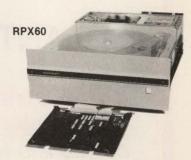




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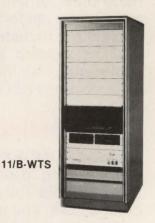
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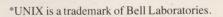
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SUMURU: a network configuration for the future

EINAR STEFFERUD, Network Management Associates, Inc. DAVID FARBER, University of Delaware RALPH DEMENT, Digital Equipment Corp.

The merger of single-user, multiple-user and remote-utility systems in networks provides the information-handling environment of the future

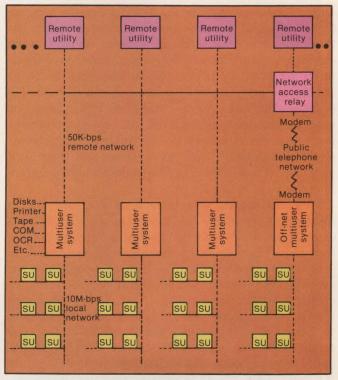
The predicted revolutionary impact of networks on minicomputers is finally coming into focus. In the distant future (10 to 20 years), large and small minicomputers will be everywhere, connected through networks when connection is sensible. The challenge is to find ways to build on systems and facilities to reach the network environment of the future.

The network of new minicomputers and µcs need not be cast in totally new roles; they can be acquired to augment existing systems. Examples already exist in dedicated applications for laboratory-control systems, small office computers, personal home/office computers, word processors and intelligent terminals connected to remote computers. Some are more advanced than others, but all are forerunners of future applications.

The component roles

Three roles can be readily identified for computers in future network environment architectures: single-user, multi-user and remote-utility systems.

- Single-user (SU) systems based on powerful µcs will provide local computation and narrative textediting capabilities. They will also provide terminal interface facilities for access to other computers, and they will be used by all manner of office workers.
- Multiple-user (MU) systems based on powerful minicomputers will serve groups of 20 to 30 local users in offices, laboratories and production facilities. They will also support SU systems with software program libraries, central office files and communications among SU, MU and other computer systems.
- Remote-utility (RU) systems, which for many years have provided for institutional data banks and heavy-duty computation, will continue to be based on



SUMURU architecture interconnects single-user, multiple-user and remote utility computers. Multiple-user local networks use 10M-bps lines; remote utility networks use 50K-bps lines.

needed, and should be available via network connections from MU and SU systems.

All three components—sus, Mus and Rus—either exist or are being developed. Minicomputers are used regularly in numerous shared-use applications, and mainframes have been used for years in large timesharing computing systems to provide remote utility mainframes. High-capacity central services will still be services. What will be different is how they will be

Single-user systems based on powerful µcs will provide local computation and narrative text-editing capabilities.

organized into a network of distributed-processing systems as computing power migrates toward individual users and their SU systems. This power shift will stimulate continued development of the SU/MU/RU network configuration.

With this evolving spectrum of computing power, interconnecting the machines to meet a broad array of requirements becomes the problem. What kinds of networks should be established to incorporate the computers? Fig. 1 is a schematic diagram of what will probably be the architecture of the future. It will likely become the basic design for interconnectivity among people and systems, mobility of information in our systems and interoperability among systems, the three basic functional requirements for a future systems and facilities architecture.

Working in combination

The SU, MU and RU computers are interconnected with a local-area network (LAN) and a remote network (RN). The local network provides close coupling between several SUs and an MU in a local work environment such as an office, laboratory or production facility. The MU holds software libraries and files (both shared and private) for SUs. The LAN must be capable of rapid data and program transfers. For example, it must be able to complete a full main memory refreshment from the MU software library in less than 1 sec. SU µcs will depend on their MU systems and their local network for access to large files of data and to program libraries.

This SU/LAN/MU arrangement is not new. Some distributed-processing configurations already use dedicated laboratory minicomputers as SU systems, while high-speed communication links provide local-network connection to a central facility that is essentially an MU system. Each distributed processor serves an entire cluster. Xerox Corp.'s Palo Alto, Calif., Research Center has connected powerful personal minicomputers to Ethernet, a high-speed local network of the type required by the SU/LAN/MU cluster complex. High-speed ring networks have also been used to organize minicomputers into an integrated distributed-processing environment, and recent developments have placed digital PABXs squarely into the competition.

The remote network provides access and data-transfer paths among geographically separated MUs and RUs. The Arpanet, used by the U.S. Department of Defense, is an example of a prototypical full-function remote network. Commercial value-added networks such as Telenet, Tymnet and Uninet promise to provide remote network-type services, but are used mostly for terminal-access connections. If no other alternative is available, the public-switched telephone network

(PSTN) might be used as a remote network.

The combined local network and remote network requirement is for three fundamental types of connection:

- Terminal-access services provide transparent access paths from an SU (or other device such as a portable terminal used through a telephone connection) to any network-accessible MU, RU or SU computer to conduct an interactive work session on the remote computer. The terminal-access connection mediates hardware and software differences between the terminal and the remote computer system.
- File-transfer services transport designated blocks of data from one RU, MU or SU computer to another, with error control and verification without proofreading by the user. The transfer process is commanded by a user who has gained appropriate read/write access (with a logged-in user job) to the required file spaces at both ends of the transfer. This is analogous to truck-rental operations in which the user is involved throughout. Direct access to private file space is required for both pickup and delivery.
- Computer-mail services provide a capability beyond file-transfer services to accomplish transfers without direct user read/write access privileges at both ends of the transfer. With computer mail services developed in operational prototype systems, the sender can enclose selected data in an "envelope" with a computer network delivery "address" and "post" it for automatic delivery to the addressee's computer file mailbox without user involvement beyond the posting operation.

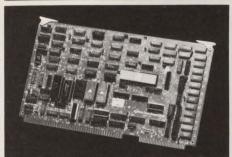
The three basic services promise to provide the basic ingredients for a vast array of future application systems. All of them need facilities for data entry, collection, processing, storage, retrieval and presentation. With database-management software housed in network computers that are interconnected in the SUMURU architecture, most new application systems should be capable of rapid implementation with interoperational interfaces and off-the-shelf components.

A user planning for a SUMURU network should think in terms of an evolutionary process—one that involves gradual, thoughtful and systematic acquisition of replacements and additions to systems that are already in hand. The elements of SUMURU architecture are computing and communication systems that may be familiar, but the means for organizing them into a distributed-processing network to achieve interconnectivity, mobility and interoperability are not yet fully understood. Considerable work and planning will be necessary before the projected full-function environment becomes a reality.

Einar Stefferud is president of Network Management Associates, Inc., Huntington Beach, Calif. **David Farber** is professor of electrical engineering at the University of Delaware. **Ralph Dement** is product-strategy manager at Digital Equipment Corp., Maynard, Mass.

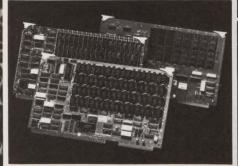
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A Dynamic Memory Board allows the user to add from 32K to 128K of dynamic RAM to a system. Automatic refresh and parity checking are standard. 32K - \$420, 64K - \$535, 96K - \$645, 128K - \$775.

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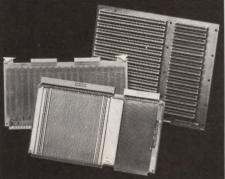
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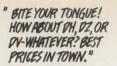
All quoted prices are single unit, effective March 1, 1982 and are subject to change. Quantity prices are available upon request.

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Terminal provides database access

A design that brings to bear the human interface used in successful electronic games on portable terminals is the IXO Telecomputer, a hand-held terminal with a single-line scrolling LCD that sells for \$300 in 1000-unit quantities.

The Telecomputer, which incorporates a Bell 103-compatible modem and a one-button automatic dialer, plugs into a modular phone jack to conduct asynchronous ASCII communications at a 300-bit-per-sec. baud rate. The unit's 1K × 4 bit memory with battery backup is used to down-load as many as 10 sets of access information, including telephone number, log-on procedure, keyboard setup, displaymanagement options and odd or even parity. The down-loaded information simplifies use of public databases such as the Dow Jones News/Retrieval Service and permits English responses to access a user's database.

The Telecomputer's keyboard has 61 positive-action keys in typewriter layout, plus keys with the messages YES, NO, DON'T KNOW, HELP, GO BACK, CLR CHAR and CLR ENTR. In IXO's Standard English Dialogues, these keys are used to respond to prompts that guide a user through accessing a database. A custom software module on a host computer generates these prompts and translates the unit's English commands.

"Consumer reaction to the IXO machine has been very positive," says a spokesman for E.F. Hutton Inc., which is evaluating the machine for use in a marketing scheme that would provide consumers with electronic access to the company's financial services. "For one thing, people don't need an instruction book to use it. And the sample database dialogues IXO has set up—prototypes for consumer access to a simulated airline-



reservation system and an on-line daily TV-program schedule—are the best approach to database access we've seen."

IXO expects the Telecomputer to be used in turnkey database systems and to be added to corporate database systems for applications such as field order entry. The Telecomputer can also be used as a standard ASCII terminal. The system also includes a port for driving four optional peripherals—a 20-column, 40-cps thermal printer; a 32- × 16-character video interface; an RS232C interface; and an acoustic interface. The Telecomputer is available now. IXO, Inc., 6041 Bristol Parkway, Culver City, Calif. 90230. Circle No 325

-Kevin Strehlo

Teleray announces 'user-definable' terminal

Teleray's model 16 smart (buffered-editing) display terminal features four standard and four optional pages of volatile or nonvolatile display memory and uses excess display memory as function memory. Users can redefine logical-line and page lengths, and as many as 64 (32 shifted/unshifted) keys can be redefined with ESC sequences to represent alternate characters, codes or sequences.

The model 16 generates and displays 96 ASCII and 32 control characters, 64 mosaic graphics and 64 line-drawing and special-symbol characters. The characters are displayed on a 15-in., P4 gray phosphor screen (a P31 green phosphor is optional) in an 80-column × 24-line format, and the display can be horizontally and vertically scrolled. A 25th status line displays terminal status, setup mode, computer-transmitted messages, time of day or elapsed time and calculations when the terminal's numeric pad is used in calculator mode.

Alpha-only and numeric-only



modes and protect-mode operation are standard. The system displays five hidden attributes-dim, underline, blink, inverse video and blank (security fields)-and smoothscrolls up and down, at six or 12 lines per sec. It also has a screen-saver feature that automatically decreases display brightness to zero after 10 min. of terminal inactivity. Upon receipt or entry of any data, the screen's brightness returns to normal without losing displayed information.

The ANSI X3.64-compatible model 16 operates half- or full-duplex (with or without local echo), and transmits in block mode-line, message, window, page or memory and character mode. It has a bidirectional auxiliary I/O port.

The system weighs 30 lbs. and draws 40W of power; metal, rack-mounted and executive-style enclosures are also available. Prices start at \$1545. Deliveries have begun. Teleray Division of Research Inc., P.O. Box 24064, Minneapolis, Minn. 55424.

Circle No 326

ICOT announces virtual terminal systems

The model 352 virtual terminal systems emulate terminals, making them appear to a mainframe as native terminals. The system supports a mix of 12 ASCII terminals, emulating IBM 3270 display stations and printers. The ASCII terminals can be attached locally or remotely through dial-up or leased lines. The 352 also supports automatic speed Springfield, N.J. 07081. and word-format detection for all dial-up applications. It communicates using BSC, but provides SNA-like capabilities. Multiple logical-control-unit addresses can be assigned to each of two physical controllers, allowing the system to appear as multiple controllers on each line. This permits an attached ASCII terminal to access multiple applications that may be operating in the connected hosts. Price is \$7600, with quantity discounts available. ICOT Corp., 830 Maude Ave., Mountain View, Calif. 94043.

Circle No 327

QEI announces data-acquisition system

The Quics III master station, for supervisory control and data acquisition for electric substations; water and waste-water treatment facilities; gas-distribution systems; oil, product and chemical pipelines; and



large microwave networks, contains two ups and an auxiliary hardware math processor. Other features include an on-line editor that enables a user to modify the system's graphic displays and data tables while on-line and a userprogrammable math package that allows on-line development and execution of calculations. The system has as much as 256K bytes of dual-ported bubble memory and a floppy-disk drive for backup. The system includes a single or dual master, each with one or two eight-color CRT terminals and operator panels; one to three keyboard/ printers for logging, event recording and editing; and as many as 63 remote terminals. Price is less than \$100,000. QEI, Inc., 60 Fadem Rd.,

Circle No 328

Portable terminal transmits **Touch-Tone signals**

The Alpha-Tone portable alphanumeric data-entry terminal transmits Touch-Tone signals. It features 44 keys and 100 characters of user-programmable storage for data, telephone numbers and product codes. Stored data can be recalled and transmitted. The unit is powered by a 9V battery, couples acoustically to a standard telephone handset and is fully compatible with all Touch-Tone-activated, tone, and voice-response systems. The Alpha-Tone, including battery and coupler, sells for \$225 in single-unit quantities. Interface Technology Inc., 10500 Kahlmeyer Dr., St. Louis, Circle No 329 Mo. 63132.

CDC unveils Series/1compatible displays

The up-controlled Certainty 610-12 and 610-16 display stations, for use with the IBM Series/1 minicomputer, include a data-entry keyboard layout (model 610-12) or a typewriter keyboard that includes a 10-key numeric pad and 24 function keys (model 610-16). Both models interface to the Series/1 using a display-station attachment card housed in the processor or in the I/O expansion unit. The displays feature a 12-in. diagonal screen that contains as many as 1920 alphanumeric characters in a 24-line × 80-character format. The screen also displays a 25th status line. Model 610-16 allows data to be entered and displayed in upper- and lower-case EDBDIC characters. Both models provide system writable business graphics. The displays sell for \$2960 each in quantities of 10 to 24 units, with quantity discounts available. Control Data Corp., Box 0, Minneapolis, Minn. 55440.

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Peripherals

Danyl introduces terminal-use recorder

The System 80 terminal controller provides data-terminal users with a record of a terminal's usage, including the user's ID and application and the time used. Users enter,



via keypad or badge, one or more ID codes that open the CRT and allow it to transmit. User ID, applicable accounting codes and transaction time are recorded on a cassette tape. The device connects via RS232 ports. Danyl Corp., Pennsauken, N.J.. Circle No 331

Autech announces data-acquisition system

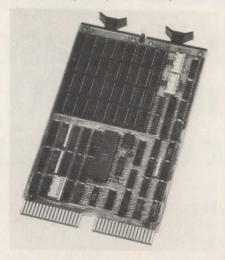
The model 600 Process Master remote process system provides error-free process data to a user's host computer. The system can be installed in a hostile environment near process sensors. It offers signal conditioning, sensor checking and compensation, continuous data-



validity testing, engineering-unit conversion, limit checking and alarm, data-integrity tagging, multi-level sequence-of-events processing, automatic fault verification of field cables and interconnections, high-voltage protection, high-noise rejection and data-fault analysis. The system also includes Aide software, which offers a conversational setup method. A typical model 600 with 128 process I/O points is priced at \$15,000 to \$20,000. Autech Corp., 1301 W. Copans Rd., Pompano Beach, Fla. Circle No 332

RAM module is DEC MSVII-LK equivalent

The model VML 128P RAM module provides as much as 256K bytes of dynamic parity memory on a



dual-height card. The board features full parity, allowing the processor to locate and isolate an error to within a 2K-byte segment of memory, using an on-board parity control and status register. The module, functionally equivalent to the DEC MSVII-LK memory, features on-board refresh, 22-bit addressing and 5V power requirement. An LSI circuit provides all RAM timing from a crystal-controlled reference frequency. Addressing and logical depopulation in 8K-word increments is performed via on-board DIP switches. The device is compatible



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for more information.



Peripherals

with LSI-11 and PDP 11/03 processors. Single-unit price is \$1250. With an LSI-11/23 processor and MMU, the device sells for \$3150, with OEM discounts available. Computer Extension Systems, Inc., 17511 El Camino Real, Houston, Texas 77058. Circle No 333

Mass memory has 834K-bps transfer rate

This mass-memory system for the Gould-S.E.L. 32 series minicomputer includes Dataram's bulk semi memory and a single- or dual-port



interface card. The system sustains a maximum transfer rate of 834K bps from two simultaneous HSD II cards. The memory is available in a 7- or 153/4-in, vertical chassis. The 7-in, chassis accommodates 0.5M to 8M bytes, and the 153/4-in. chassis accommodates as much as 32M bytes of error-correcting NMOS memory. Two chassis can be daisy-chained to accommodate as much as 64M bytes. Battery backup is optional. Applied Data Sciences, Inc., P.O. Box 344209, Dallas, Texas 75234. Circle No 334

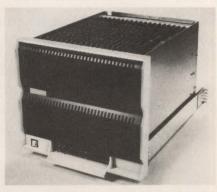
MSC introduces mass storage for H-P computers

The 9800 series 5M-byte Winchester-disk storage subsystems for 08512. personal computers consists of a Seagate Technology 51/4-in. Winchester-disk drive, a single-board 64K-byte RAM controller based on the 9000 series

error detection, 11-bit error correction, a 256-bit data buffer, singlecommand disk initialization and switch-selectable bus device address. When used with an H-P desk-top computer, the 9800 emulates two H-P 9895 floppy-disk memory units (four 8-in. floppy disks) on an HP-IB device address. Maximum formatted storage is 5M bytes. The drive uses only DC voltage provided by the power supply, which can be configured to run 100V to 120V and 200V to 240V. Microcomputer Systems Corp., 432 Lakeside Dr., Sunnyvale, Calif. Circle No 335 94086.

Dataram offers bulk semi module

The 2M-byte bulk semi array 64K RAM module can be used in the vendor's bulk semi systems with fixed-head disk emulation. With the module, 7- and 153/4-in. systems can contain 8M and 32M-bytes, respectively. The 2M-byte system is organized as 512K × 43 bits. A 39-bit version is also available.



Cycle time is 550 nsec., and access time is 260 nsec. Prices are \$12,650 in single-unit quantities for the 512K × 43 unit, and \$11,000 for the 512K × 39 version. Dataram Corp., Princeton Rd., Cranbury, N.J. Circle No 337

Chrislin announces

The CI-S100 dynamic RAM module micromodule and a 115V/230V power for S-100 bus µcs requires no wait supply. Features include 22-bit states at 2 or 4 MHz. The memory

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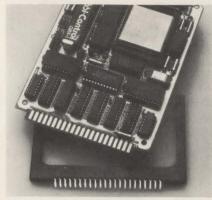
Peripherals

features expandability to 0.5M byte, bank select that allows a user to select as many as eight 64K-byte memory cards and on-board hidden refresh. The module is addressable in 4K increments to 513 bytes. It is available with battery backup. Single-quantity price is \$450 for 64K × 8. Chrislin Industries, Inc., Computer Products Division, 31352 Via Colinas, #102, Westlake Village, Calif. 91361.

Circle No 338

Bubbl-Tec offers universal memory system

The GBI-1 bubble-memory system, for computer peripherals, office equipment, machine tools, process-control apparatus, communication equipment, military systems and scientific instruments, is based on a universal bubble-memory interface, which defines a



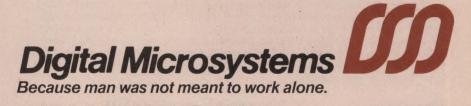
high-level protocol for communication between a host processor and the bubble-storage medium. The hardware interface uses a 44-pin edge connector and requires four control signals and eight data lines. The device's software interface uses seven commands. Data are organized in blocks, and read and write operations require a block number to define the data to be transferred. The system provides 128K bytes of nonvolatile mass-storage on a 41/2- × 6-in. PC module. The system is priced at \$1408 in quantities of 10. Bubbl-Tec, 6800 Sierra Court, Dublin, Calif. 94566.

Circle No 339

The cunning new computer from Digital Microsystems.



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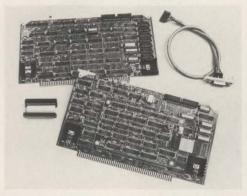


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ETHERNET and the S-100 Bus



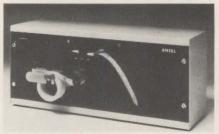
Now, it's possible for any S-100 Bus Microcomputer to plug into the high speed, 10 megabits per second ETHERNET local area network. The FILTABYTE S 2.0 plugs into any standard S-100/IEEE 696 bus and allows the user to collect, from the ETHERNET, up to 8 or 32, two thousand byte message packets, back-to-back. · Available in either 16K or 64K dual ported memory · Memory may be used for data or program storage if not used for buffering . Polled or vectored interrupt modes available • Controller's address inserted automatically • 32 bit CRC • Meets DEC, INTEL, and XEROX ETHERNET specifications version 1.0 • Connects to ETHERNET using any transceiver which conforms to the ETHERNET specification • \$1,295 in OEM quantities

1798 Technology Drive, San Jose, CA 95110 Perex, Inc. (408) 280-7566, TELEX: 171-647, TWX: 910-338-7067

Peripherals

Electronic-mail system gains paper-tape reader

This paper-tape-reader option to the vendor's Messenger II electronic-mail system reads messages from tape and delivers them in hard-copy form. The reader enables users to have incoming or archived messages



delivered directly to recipients. The reader accommodates five-, sevenand eight-level format punchedpaper tape and ASCII, Baudot or RCA codes. The device accepts tape from a spool or in loose form. Price is \$4995. Amtel Systems Corp., 1293 Anvilwood Ave., Sunnyvale, Calif. 94086. Circle No 340

Plessey introduces 8-in. Winchester subsystems

The PM-FSV06 8-in. Winchester subsystems are DEC LSI-11 hardware compatible and software transparent. Each Winchester drive is logically configured as two 14M-byte RK06 units for 28M bytes



of data storage. Each PM-FCV06 controller interfaces as many as four drives for a total subsystem capacity of 112M bytes. The PM-FSV06J, with 28M bytes of storage in a 51/4-in. chassis, sells for \$6468. The PM-FSV06JJ, with two 8-in. Winchesters providing 56M bytes of storage, a 912K byte-persec. transfer rate and a 42-msec. average seek time, sells for \$10,812. The PM-FSV06ZJ, with 28M-byte

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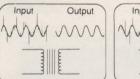
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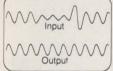


Line-to-load isolation shields computer from sharp. destructive voltage spikes

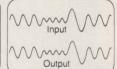
Output

Without isolation computer is exposed to spikes even when power is supplied by voltage regulator.

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Peripherals

fixed-Winchester storage and a 1.2M-byte, double-sided, dual-density floppy for backup, a quad-wide Winchester controller, a dual-wide floppy controller, a power supply and 51/4-in. chassis, sells for \$7964. The PM-FSV06TJ, with a 28M-byte, 8-in. Winchester with 1/4-in. streaming tape for backup, including power supply, controllers and 51/4-in. chassis, sells for \$8496. Plessey Peripheral Systems, 17466 Daimler, Irvine, Calif. 92714. Circle No 341

Systems Group announces cartridge-tape drive

The 20M-byte TD 2802 single-drive cartridge-tape subsystem, an S-100 bus add-on, uses the Archive streaming cartridge-tape drive and operates in streamer and file-copy modes. In streamer mode, it backs

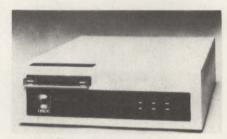


up 10M bytes in 6 min. Formatting enables 97-percent tape use. The device's controller, PBTI-100SC, includes cables, EPROMS and software. The TD 2802 sells for \$3580, and the controller sells for \$925, with quantity discounts available. Systems Group, 1601 Orangewood Ave., Orange, Calif. 92668.

Circle No 342

Mass-storage system has 35M- or 70M-byte disk

The CSS-800 mass-storage system contains a 35M- or 70M-byte Winchester-disk drive with a 17M-byte cartridge-tape drive for backup. The system includes two integral controllers with multiported memory that allow simultaneous disk and tape operation. It is



configured with a compatible host interface for the Q-bus, Unibus or Multibus. In DEC-compatible configurations, it emulates DEC's RK07 disk drive and TE-16 drive. The device uses a up-controlled dualport cache memory. The device's disk controller relocates and keeps track of data transparently to the host. The system detects and corrects read and write errors as much as 8 bits in length. Diagnostics check peripheral devices and the controller. Test results are displayed on front-panel LEDs accessible from the host. A 35Mbyte CSS-800 is priced at \$9300, and a 70M-byte version sells for \$10,300 in 100-unit quantities. U.S. Design Corp. 5100 Philadelphia Way, Lanham, Md. 20706. Circle No 343

Qualex announces tape streaming H-P

The streaming version of the vendor's Group 3000 tape system is a triple-density 800-, 1600- or 6250-bpi or dual-density 1600/6250-



bpi tape subsystem supports H-P's series 64, 44, 40, 30 and 33 computers. The streaming capability incorporates two 16K buffers that enable continuous disk-to-tape data transfer and enables the tape system to do a 100M-byte write in approximately 3 min. The system provides 125-ips tape speed and 590K-byte burst rate. Price is \$45,500. Qualex Technology Inc., 31220 La Baya Dr., Suite 110, Westlake Village, Calif. 91362.

Circle No 344

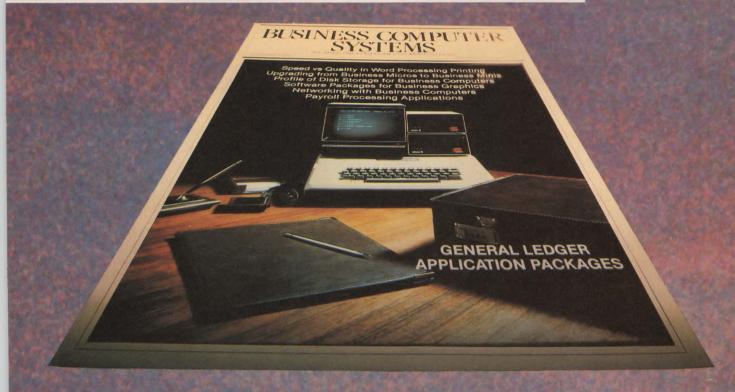
Cardamation announces 80-column punch

The PC200/51 80-column card punch for Data General minicomputers and general-purpose systems provides speeds of 100 to 250 cards per min., based on the location of the last column punched. The input



hopper and output stacker have a capacity of 1000 cards each. Card-punch verification is accomplished through echo-check error detection. A 100-card-capacity reject stacker automatically selects cards that do not pass the echo-check verification. Control software is compatible with Data General operating systems. The punch also includes an interface cable and controller board that plugs directly into the backplane of the DG Nova. Price is \$12,500, with

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OEM discounts available. Lease price is \$357 per month for five years. Cardamation Co., Box 746, Frazer, Pa. 19355. Circle No 345

Norand introduces enhanced data-entry unit

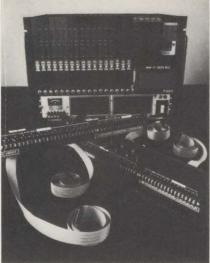
An enhanced version of the hand-held 101XL data-entry unit for the vendor's Route-commander portable route accounting system includes 24K-byte EPROM storage with 116,000-character memory storage, a removable battery pack, an internal memory-protection battery and a 16-character LED display.

Norand Corp., 550 Second St. S.E., Cedar Rapids, Iowa 52401.

Circle No. 346

Standard Engineering offers data-acquisition system

The Quantrol distributed dataacquisition-and-control system in-



cludes Digital Equipment Corp. LSI-11/2 or LSI-11/23 μ ps, computer peripherals, communications modules, I/O modules, field-wiring terminal panels and control buses. The system, which meets the IEEE-583 international standard for computer-automated measurement

and control, interfaces most sensors and actuators. IEEE-488 interfaces also handle stimulus generators, transient recorders and other instruments. The system features a 1M-bps intelligent data link controller that allows a small, local system in a single location to be connected to form a large network system serving as many as 255 nodes over distances as far as 30,000 ft. Other features include high-density packaging; high-level, low-level analogand digital-signal functions in a single-chassis; and serial and parallel buses. The system accepts 16 to 400 points per chassis and handles as many as 100 PID loops per chassis. Standard Engineering Corp., 44800 Industrial Dr., Fremont, Calif. 94538. Circle No 347

Intermec introduces bar-code printer

The model 8610 thermal bar-code

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- DU 215 RK06/07 emulating SMD disc controller with 56-bit ECC, universal formatting, optimal device for Winchester and CMD applications. RSX, RSTS and VMS software compatibility.
- DU 218 RM02/05 emulating SMD disc controller for SMD and Winchester applications with full software transparency under RSX and RSTS as well as Media compatibility when used with 80 and 300 MB SMD (CDC 9762/9766) compatible disc drives.

NEW LSI-11 CONTROLLERS

- DQ 212/215 SMD interface. Universal formatting allows mixing or matching two 8" or 14" drives with different characteristics and without component changes for up to 220 MB of software transparent formatted capacity. 56-bit ECC, RP02/03 or RK06/07 emulations.
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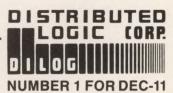
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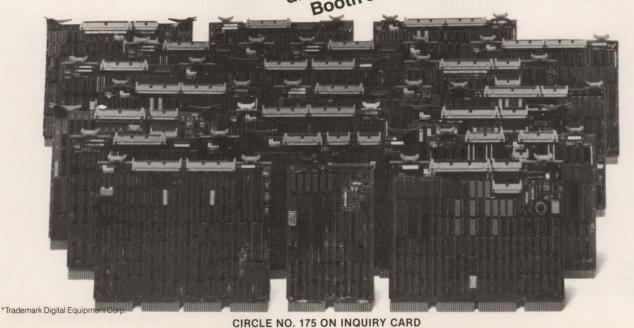
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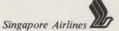
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printer dispenses single bar-code labels and prints eight switchselectable bar codes. Two lines of readable text with three character fonts accompany the bar code and bar-code interpretation line. Labels are printed by moving thermally sensitive label stock past a fixed thermal head. Printed labels are

proportional spacing; and built-in self-test. Other features include LSI design, a universal power supply, a digital positioning system, formlength select switch and optional bidirectional-tractor, cut-sheet guide with auto load, front inserter,

asynchronous interfacing; automatic adapter and demand document tractor. The 3500 provides a standard program mode that allows use of special characters and a graphics mode. The model 7700 provides this feature as an option. Southern Systems Inc., 2841 Cypress Creek Rd., Fort Laudersingle-bit cut-sheet feeder, dual-bit dale, Fla. 33309. Circle No 349



stripped from a liner. The upcontrolled device operates on-line with scales, controllers and computers or directly from a CRT terminal using a prompting mode. Data input is via current-loop or RS232C interface. Price is \$1695. Interface Mechanisms, Inc., P.O. Box N. Lynnwood, Wash. 98036.

Circle No 348

Southern Systems offers letter-quality printers

The up-controlled models 3500 and 7700 series letter-quality printers print at 33 and 55 cps, respectively. Both are interfacecompatible with DEC, DG, H-P, P-E, Burroughs, Modular Computer, Honeywell, TI and others. They offer single-board electronics; parallel or serial, synchronous or





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Destek adds network controllers for IBM, Intel machines

The Destek Group, Mountain HDLC protocol and use the carrier personal computer to the DESNET network and an interface for placing its boards. Multibus-based systems on-line.

Like the first DESNET products, the IBM-PC and Multibus boards are designed to operate over a different network medium (MMS, March, p. 67). Users can specify interfaces that link to baseband (RG-58U coaxial), broadband or fiber-optic media or, via a modem, to telephone

View, Calif., has added two sense multiple access (CSMA) methinterface boards to its local-area od to place information on the networking product line, announced network. Although Destek initially last fall. Joining a stand-alone indicated it would also offer a network module and an S-100- token-passing access scheme on its compatible add-in controller are an network, Charles Wegrzyn, vice interface to connect the IBM president of R&D, says the company will offer only the CSMA protocol on

Destek targets the IBM personal computer as one of its markets, Wegrzyn says, because the IBM available in four versions, each machine has received little attention so far from other networking firms. and because it was relatively simple to design an interface for the personal computer's bus. Interfaces to other vendors' equipment, including the more-complex Digital Equipment Corp. Q-bus and Unibus Both interface boards run the processors, is forthcoming, he says.

The DESNET/IBM-PC board fits into one of the five slots in the personal computer's card cage. In the baseband version, the interface will sell for less than \$1000 in single-unit quantities.

The DESNET/Multibus interface. also a single-board product, meets the IEEE P796 physical and electrical specifications. The board, priced at less than \$2000 in single-unit quantities, functions as a bus master in a multiple-master environment.

OEM discounts are available for both products, which are available 90 days after receipt of order. The Destek Group, 1923 Landings Dr., Mountain View, Calif. 94043. Circle No 350

-Dwight B. Davis



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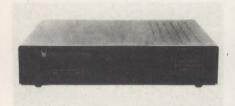
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Four-channel module supports async traffic

The M-IAD four-channel module for the Microplexer family of statistical multiplexers/data concentrators supports asynchronous traffic and is interchangeable with existing synchronous/asynchronous modules. The module supports all Microplexer supervisory and network-management features, including the network configurator and extended diagnostics options. Versions are available for RS232, MIL STD 188C and MIL STD 118-114 operation. Other features include data speeds from 50 to 9600 bps; operation with 5-, 6-, 7- or 8-bit asynchronous codes, including 9-bit graphics terminals; odd, even or no parity; dynamically allocated buffers with user-selected priority; in-band or out-of-band traffic control; flyback buffering; and automatic, noninterfering, down-line loading of channel parameter changes. Single-unit price is \$750, with quantity discounts available. Timeplex, Inc., One Communications Plaza, Rochelle Park, N.J. 07662. Circle No 351

Fiber-optic multiplexer has eight to 32 channels

The eight-channel CMX-832 fiberoptic time-division multiplexer for short-haul applications to 3 km. is expandable to 32 channels. It has asynchronous or synchronous data



rates of 1.2K to 19.2K bps, a bit error rate of less than 1 in 10⁻⁹, electrical isolation, data security and freedom from EMI radiation or pickup. The CMX-832 is transparent to the character structure of the data patterns. Each channel operates independently with no interac-

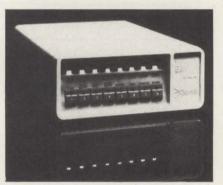
tion or waiting. The electrical channel interface at each end of the communications line is a full-duplex EIA-compatible RS282C connection with EIA handshaking ability. Single-unit price is \$2700, with quantity discounts available. Canoga Data Systems, 21218 Vanowen St., Canoga Park, Calif. 91303. Circle No 352

Compre Comm announces four- to 32-port multiplexer

The DX series statistical multiplexer provides four, eight, 12, 16, 20, 24, 28 or 32 terminal ports on a 19.2K-bps network. Each four-port circuit card provides switchselectable Xon/Xoff or CTS flowcontrol speed, asynchronous character format and autoanswer. The device provides optional auto-echo, remote settings and a secondary control channel for each port. The device operates at 9600 bps over satellite links. Interface is RS232C/ V.24. Compre Comm, Inc., 3200 N. Farber Dr., P.O. Box 3570, Champaign, Ill. 61820. Circle No

Network Products announces multiplexer

The Babymux statistical multiplexer has two color LED indicators and transparent operation. The device can be expanded to eight lines. Terminal-port rates can be set as high as 19.2K bps. The composite

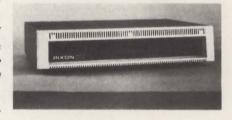


line is supported through a DMA interface that allows it to operate at 19.2K bps in synchronous mode or 9600 bps in asynchronous mode.

Babymux supports options in baud rate, parity, flow control, stop bits and character length. Other features include buffering; stripping and recreating the start, stop and parity bits; and data compression. A two-port unit sells for \$1350. Each three-port expander kit is \$475, with quantity pricing available. Network Products, Inc., Progress Center, Research Triangle Park, N.C. 27709. Circle No 354

Rixon announces 4800-bps data modem

The model TA208A/B Bell-compatible, 4800-bps data modem transmits and receives synchronous serial binary data half-duplex over the two-wire DDD switched network



or full-duplex over four-wire private lines. Switch-selectable options enable changing from private-line operation to DDD switched-network operation. In the private-line mode, optional alternate voice/data equipment can be added when used with a modified 565 telephone. The DDD mode features automatic answer under control of the data terminal. In this mode, use of a 500 or 565 phone enables use of the alternate voice/data option without additional equipment. Six push-button switches used with eight LED indicators on the front panel enable isolation of a data-communications system malfunction. Test features include analog loopback, digital loopback and local end-to-end self testing. The modem is compatible with Bell 208A and 208B, and the vendor's T208A, T208B and T208A/B modems. Rixon Inc., 2120 Industrial Parkway, Silver Spring, Md. 20904.

Circle No 355

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CIRCLE NO. 182 ON INQUIRY CARD

Dalacomm

Micom introduces inverse multiplexers

These additions to the Micro100 series of inverse line multiplexers support data rates as high as 64K bps and operate at 14.4K bps. The devices split a data stream onto as many as six slower communications lines, using modems speeds or 4800 of 9600 bps, or as many as four lines operating at 14.4K or 16K bps. Applications include DDS backup, an alternative to wideband circuits and fail-soft communications. The units continue full-duplex operation at reduced speed when one telephone line is cut and automatically return to higher speed transmission when the failed line is returned to service. Prices start at \$4300 for twochannel units. Micom Systems, Inc., 20151 Nordhoff St., Chatsworth, Calif. 91311.

Circle No 356

H-P announces communications package

The Series 80 data-communications package expands the capabilities of Hewlett-Packard Co. Series 80 personal computers to communication with both large mainframe computers and H-P hand-held computers. The package includes the 82950A Series 80 modem and software. The modem plugs into any of the four ports in the back of the personal computer and has two jacks for direct connection to the phone line and the telephone. It is FCC licensed and usable on any U.S.



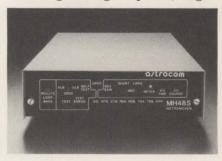
public telephone system. The modem is Bell 103-compatible, with auto-dial and auto-answer features and operates at 50 to 300 bps.

Software supports automatic logging on, re-dialing, self-testing, maintaining a phone directory, setting configuration files that set frame parameters and transferring files. It uses the RS232 interface to communicate with a host computer at data rates as high as 9600 bps. Price for the modem is \$395, including phone cord, software and owner's manual. Software, including owner's manual, sells for \$200. Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, Calif. 94303.

Circle No 357

Astrocom offers medium-distance modem

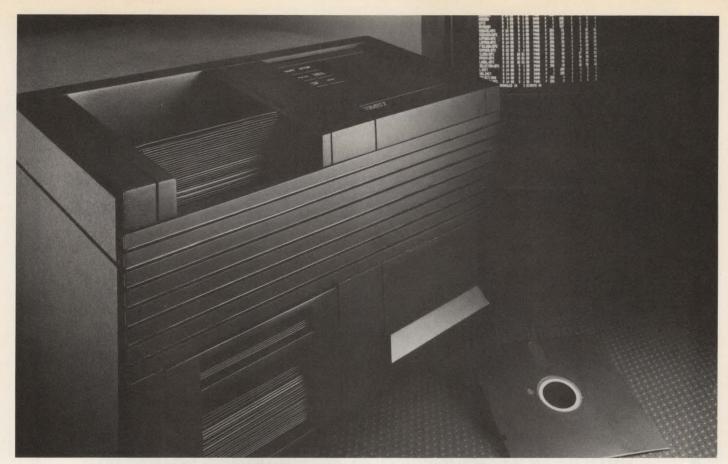
The Metromodem transmits synchronously at speeds of 2400 or 4800 bps over distances as far as 50 mi. The device offers operational displays and self-test and analysis, including analog loopback, digital



loopback and a control for placing the remote modem in digital loopback from the local Metromodem. The modem is compatible with Western Electric 3002 load wire pairs and the T1 carrier network. It is available stand-alone or rack-mounted with an eightmodem nest. Other options include two- or four-wire operation, external or internal timing and carrier control or constant carrier. Astrocom Corp., 120 W. Plato Blvd., St. Paul, Minn. 55107. Circle No 358

Compre Comm announces modem eliminators

The ME-2 series modem eliminators, for applications in which both ends of a network are relatively



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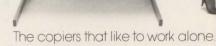
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close, supports all synchronous standard data rates as high as 38.4K bps, and additional rates between 56K and 316.8K bps. The devices buffer data, timing and control inputs and outputs and support halfand full-duplex operation with programmable request-to-send and clear-to-send delays. The ME-2D provides a standard RS232C/V.24 interface, and the ME-2C provides an RS449 interface with RS422 balanced electrical specifications. A standalone ME-2 sells for \$325, and a rack-mounted version, which allows as many as 10 ME-2D or ME-2C cards to be added, sells for \$500. Compre Comm, Inc., 3200 N. Farber Dr., P.O. Box 3570, Champaign, Ill. Circle No 61820.

UDS offers 212 LP modem

The model 212 LP modem. powered from a telephone line, requires no external AC power and offers full-duplex 1200-bps asychronous operation. The device, for



desk-top application, is FCC certified for direct connection to the dial-up network, and is compatible with Western Electric 212A. Price is \$495 in single-unit quantities. Universal Data Systems, 5000 Bradford Dr., Ala. 35805-9990. Huntsville, Circle No 360

Multiplexer provides port switching

The model DCX850 switching multiplexer offers error-free data transport, user port selection, port contention, network management and supervision of as many as 240 asynchronous inputs over as many as 14 composite links. Multiple DCX850s can comprise a network to support more than 15,000 ports. The device uses a low-speed channel module, an automatic-repeatrequest module, a buffer module, a DCX850. Each channel module systems-test-and-configuration module, a user switching-option many as four asynchronous inputs. module and a bus-extension module. Input data rates range from 50 to The modules are housed in a 9600 bps in 5-, 6-, 7- or 8-bit code. power supply. As many as five way, frames can be integrated in a

occupies one card slot and accepts as 17-card-slot frame with an integral Rixon Inc., 2120 Industrial Park-Silver Spring, Circle No 361

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Spread sheets blanket the landscape

If imitation is the sincerest form of flattery, then the folks over at VisiCorp (née Personal Software, Inc.), developer of the ubiquitous VisiCalc "electronic spread-sheet" program for μ cs, must feel themselves up to their eyeballs in compliments. In the last few months, a fistful of large and small companies have announced VisiCalc look-alikes that execute on minicomputers and μ cs.

Each program offers standard spread-sheet functions: it allows a user to enter numbers into a matrix and define mathematical relationships among the entries in the rows and columns of the matrix. The program then performs user-specified arithmetic and displays the results. The user can change one or more entries in the matrix, and command the program to repeat the computation with the new values, to see how the changes affect the totals. Primary applications are in budgeting, financial analysis and planning and resource allocation.

NEC Home Electronics USA offers an electronic spread sheet as one of the first offerings for the NEC PC-8000 personal home computer. The product provides a new wrinkle—the ability to define data and perform calculations in 3D. (VisiCalc supports only 2D.) Access Software Inc. introduces the Wedge, a spread-sheet program running on as-yet-unnamed µcs. SuperSoft Associates calls its program Scratchpad, for µcs running under the CP/M operating system.

Unisoft Inc. takes a comparable tack, implementing its \$400 View-Comp package on minicomputers and mainframes running under the UNIX operating system. ViewComp features a convenient procedure for copying information from one location to another, and a macroproces-

sor that enables an advanced user to define constants, formulas with arguments and references to elements on a work sheet. The screen can be split vertically and horizontally simultaneously into four windows of different sizes.

Meanwhile, Finar Systems Ltd. introduces Worker, a spread-sheet tool for Digital Equipment Corp. PDP-11 and VAX computers, selling for less than \$5000. Worker can be upgraded to the vendor's Finar analysis and reporting package if more sophisticated analytical techniques are needed. Supercomp, from Technical Analysis Corp., executes on Data General Corp. computers and provides, along with basic spread-sheet functions, the ability to read files produced in FORTRAN, COBOL and BASIC programs. Minicomputer Modeling Inc. has adapted its Data*Model package, already in operation on Datapoint Corp., DEC, Hewlett-Packard Corp. and Prime Computer, Inc., computers, to run on Wang Laboratories, Inc., OIS, VS and 2200 series machines. Data*Model handles as many as 30,000 rows and 500 columns, and features data-projection and financial routines. Permanent licenses start at \$3000, and rentals start at \$300 per month.

Microsoft claims that its Multiplan spread-sheet package runs in a variety of hardware systems. It allows as many as eight windows to be open simultaneously.

Not to be outdone, VisiCorp has been busy as well, introducing a version of VisiCalc for the International Business Machines Corp. Personal Computer that uses as much as 214K bytes of main memory. In addition, VisiCalc interfaces are available for a number of printers, from IBM, Centronics Data Computer Corp.,

Epson America, NEC, International Data Sciences, Anadex Inc., Diablo Systems, Inc., and Qume Corp. A new companion program, called VisiSchedule, allows a user to create an on-screen schedule of projects and tasks.

-Malcolm L. Stiefel

Access Software Inc., 2381 Mariner Square Dr., Suite 180, Alameda, Calif. 94501. Circle No 362

Finar Systems Ltd., 6000 E. Evans, Suite 2-300, Denver, Colo. 80222. Circle No 363

Microsoft, 10800 N.E. Eighth, Suite 819, Bellevue, Wash. 98004. Circle No 364

Minicomputer Modeling, Inc., 1222 Lakeview Blvd., E., Seattle, Wash. 98102. Circle No 365

NEC Home Electronics USA, 1401 Estes Ave., Elk Grove Village, Ill. 60007. Circle No 366

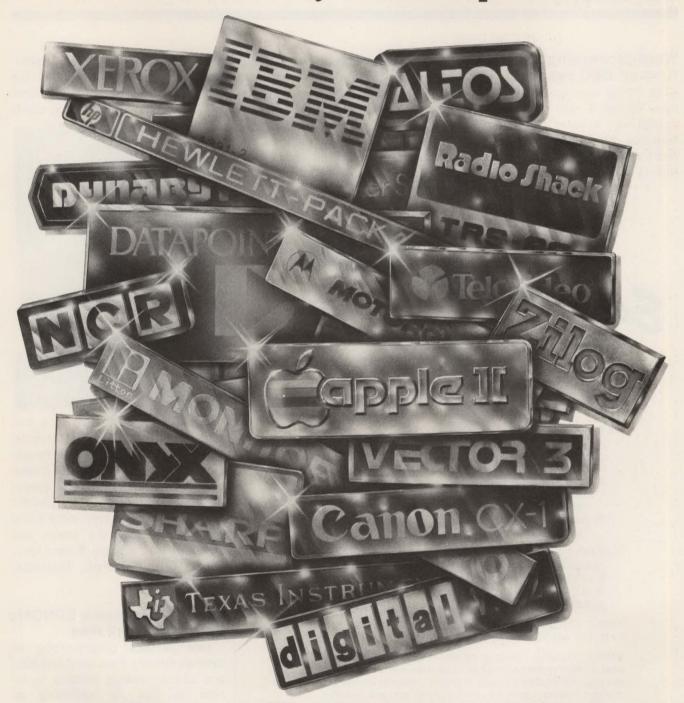
SuperSoft Associates, P.O. Box 1628, Champaign, Ill. 61820. Circle No 367 Technical Analysis Corp., 120 W. Wieuca Rd., N.E., Atlanta, Ga. 30042.

Unisoft Inc., 510 W., End Ave., New York, N.Y. 10024. Circle No 369 VisiCorp, 2895 Zanker Rd., San Jose, Calif. 95134 Circle No 370

Program copies Series/1 data files

The EDX V3 high-speed copy program, running on IBM Series/1 minicomputers, allows data to be copied at the device, volume or data-set level with little operator intervention. The program supports IBM standard interchange and extended-format diskettes, single or double density, with 128, 256, 512 and 1024 bytes per sector. Diskettes formatted with other IBM Series/1 operating systems, such as RPS, also can be used with EDX software. A license fee is \$495. Control Data Corp., Miniperipheral Systems Division, 2200 Berkshire Ln. N., Plymouth, Minn. 55441.

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The Compiler Company

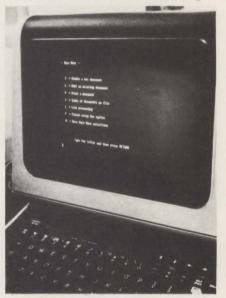
HEADQUARTERS: RYAN-McFARLAND CORPORATION, 609 DEEP VALLEY DRIVE, ROLLING HILLS ESTATES, CA 90274, (213) 541-4828

Word-processing software runs on DEC systems

The CT*OS word-processing package, Version 4 runs under its own operating system for single-terminal use and RSTS/3, RSX-11M and VAX-VMS for use on DEC LSI-11, PDP-11 and VAX systems. Written in

MACRO-11 machine language, CT*OS presents a minimal overhead load for simultaneous word- and data-processing operations, in single- and multiple-station configurations. A single-station system requires 56K bytes of memory. A menu-driven system, CT*OS functions include

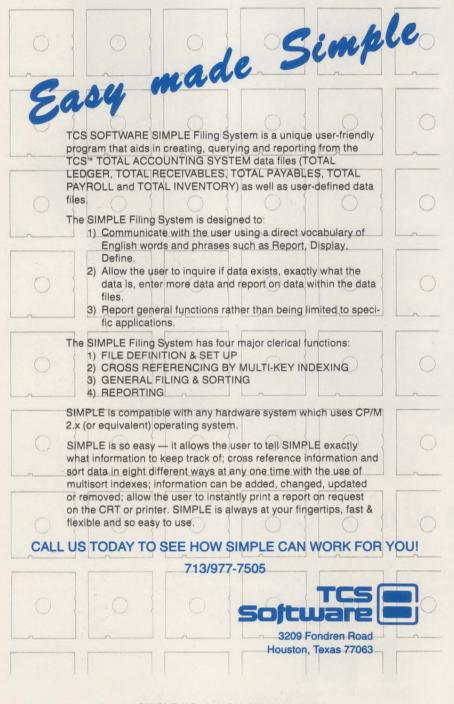
global search and replace, cut-andpaste files, list processing, ASCII file handling, 132-column document width, stored text libraries, right-



justified margins, subscripts and superscripts, centering, automatic pagination and a nesting arrangement of user-defined keys to invoke user-written subroutine-like operations. Price for the single-CPU license package is \$2200, RSTS/E and RSX-11M versions are \$3600, and VAX is \$4200. Compu-Tome, Inc., 234 E. Colorado Blvd., Pasadena, Calif. 91101.

Package programs EPROMs from CP/M disk files

EPM permits programming of EPROMs directly from CP/M disk files and allows existing EPROMs to be read to disk for archiving or duplication. EPM interfaces with EPROM programming systems, including SD Systems' PROM-100 board, Cromemco's Bytesaver and Pro-Log. The menu-driven program automatically verifies EPROM erasure before programming, confirms successful program transfer and reports discrepancies to the operator. A HEXROM utility provides hex file conversion. The program runs under CP/M version 2.0 or later with at least 24K of RAM. EPM, on 8-in. single-sided, single-density disk-





With minicomputers, terminals, word processors, disk memories and high-speed printers, you often get instructions to put in a "dedicated" power line. But, instead of breaking through walls, cutting trenches in floors, laying special conduit, pulling lots of wire and adding more breakers and switchgear to get reliable power, why not simply plug a portable Sola Power Protector into the outlet that's already there?

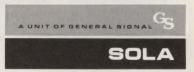
Dedicated lines can add anywhere from \$1200 to \$8000 or more per machine, even in new construction. For a fraction of that cost, a Sola Micro-Minicomputer Regulator not only replaces the dedicated line but does what dedicated lines can't do. It raises and lowers voltage to compensate for line fluctuations and brownouts. It blocks out electrical noise, and destructive power dips or surges. Our new Mini-UPS goes one step further. Its built-in battery maintains power when your electric utility fails. This keeps your electronics running smoothly until your generator comes on line. Both units are available in 60 Hz or 50 Hz.

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	spikes and faults momentary sharp volt- age peaks or split- second power outages	dips and surges short-term high or low voltages due to load start-up or shut-down	line noise . common-mode · transverse mode		Brownout	Blackout
			Unwanted voltage due to bad groun or radio-type inte line-to-ground interference	ding, switching,	Planned voltage reductions in response to high demand	Total loss of line power
Dedicated Line (with dedi- cated ground)	some, internal only	some, internal only	some, internal only	some, internal only	No	No
Ultra-Isolation Transformer	No	No	Yes	No	No	No
Sola Micro- Minicomputer Regulator	Yes	Yes	Yes	Yes	Yes	No
Sola Mini- UPS	Yes	Yes	Yes	Yes	Yes	Yes

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Software

ettes, sells for \$75. Dantek Software, Inc., 4550 Schoolhouse Rd., Batavia, Ohio 45103.

May/Partners offers System/34 package

Monitor/34, a job-cost-accounting

system for the IBM System/34 computer, captures CPU and print time by work station, user ID, job name, application code and user/work-station combination on a daily basis. This information allows managers to monitor the cost per minute of each job, user, terminal or

application. Monitor/34 also maintains year-to-date and month-to-date totals by work station, user ID, job name and application code. Price is \$500, including installation, documentation and 30-day moneyback guarantee. Genesis Software Corp., 1408 140th Place N.E., Bellevue, Wash. 98007.

Mesta unveils IBM 3270 host emulator

The RSX-11M 3270 protocol emulator allows tasks running under the RSX-11M operating system to present a DEC PDP-11 as an IBM host to multi-dropped 3271 control units. and allows communications between the PDP-11 and 3270-plug-compatible systems. The package, written as a loadable device driver under RSX-11M, controls as many as four synchronous lines. Each line appears to the 3271 as an IBM host communicating via an IBM 2701 data adapter unit or an IBM 2703 transmission-control unit operating in BSC mode. All aspects of the protocol, except limited conversational mode, are supported. Mesta Computer Services, 400 Penn Center Blvd., Suite 100, Pittsburgh, Pa. 15235.

APC unveils BASIC for North Star users

APC BASIC is upwardly compatible with North Star BASIC, requiring virtually no modification. Written in z80 code, the package operates with DOS, CP/M or APC DOS. Features include scan, renumber, global search and replace, trace, trace on condition, overlays, code deletion, chain-passing variables and file buffers, bit functions, dynamic formatting, multiple file buffers, expanded string and numeric functions, advanced assembly-language interface, direct-mode execution of any executable statement and program compaction. Price is \$400, and a manual sells for \$48.



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Ada: The View From Abroad

NO. 2 IN A SERIES

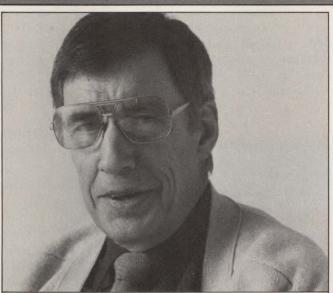
When the Department of Defense published the proposed Ada standard in July, 1980, it was one step behind an aggressive Swedish group. Dr. Jonas Agerberg, heading the Swedish Defense Research Institute's Ada evaluation team, scooped the world with the first published version of the standard document. The fact that the Europeans beat their U.S. colleagues to the punch is one indication of the intense European interest in this new language. Another indication is Dr. Agerberg's Ada in Sweden group, an organization that now numbers over one thousand members. We spoke with Dr. Agerberg at his Stockholm apartment to learn more about European Ada activities and how Ada will affect Europe.



66 National pride was the biggest obstacle to European adoption of any one language. Ada is the solution, a genuine international effort. 99

WD: You've been one of Ada's more active supporters. What first attracted you to the language?

AGERBERG: I began looking for Ada long before it existed. As a specialist in automatic control, I was searching for a modern alternative to FORTRAN. I, and my colleagues on various European committees, began to examine the options—HAL,



66 If Western Digital succeeds in running full Ada on a small machine, the SuperMicro, you'll silence many of the language's critics.
9

JOVIAL, CORAL 66, PEARL and others. They all had limitations. More important, though, it became apparent that national pride was the single biggest obstacle to Pan-European adoption of any existing language or development of a new language. Ada is the solution to this Gordian Knot. Although it was U.S. funded, it was a genuine international effort. WD: Do you think all of Europe will embrace Ada? AGERBERG: Eventually. For a simple reason. Ada is a reality. There has been talk in every country of developing a standard, highly portable industrial language. Now the Long Term Procedural Language efforts in Europe, America and Japan - the Purdue Workshops - have voted to invest their energy in developing successful Ada programming environments. The Council of the **European Communities** stopped funding language development and is supporting Ada. Those of us who have been close to the search realize that Ada is an excellent solution, and that we must

throw our weight behind it or we'll go on searching forever. WD: A few critics have charged that Ada is both too complex and yet incomplete. **AGERBERG:** Perhaps there is no perfect language. Yet, I ask, what's better than Ada? It is a large language, but very carefully constructed. It has features I find in no other single language, such as high level tasking, separate compilation, generics and standard packages. Is it too large? Last December I conducted the world's first hands-on Ada course, as you well know, using Western Digital's 16-bit SuperMicro system and MicroAda. If you succeed in running full Ada on such a small machine, as you say you will, the critics will be silenced.

wD: Since you mentioned our SuperMicro system, we can't resist asking, how do you rate it as an Ada machine?

AGERBERG: Well, so far I've run only your MicroAda subset

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Irvine, CA 92714.

on it. Still, the SuperMicro has the architecture to become an efficient, low-cost Ada learning tool. And for many users, it will be the logical program development system.

WD: One final question:

What is Ada's future likely.

What is Ada's future likely to look like?

AGERBERG: The sky is the limit. Today the world is awaiting a full and complete Ada compiler that will run on some fairly accessible machine. Given that, Ada



46 Ada is much more than a language. It's a new technology that will provide the foundation for a proliferation of markets and products. 99

becomes much more than a language. It becomes a new technology that will provide the foundation for a proliferation of markets and products. The future is bright - and near enough to touch. Western Digital expects to be first with an Ada compiler validated by the DoD. However, you can begin your own evaluation of Ada today, using our SuperMicro system and MicroAda subset of the language, then upgrade to full Ada as soon as it's available. For full details, or to place your order, call 714/966-7769. Or write: 2445 McCabe,

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oftware

American Planning Corp., 4600 Duke St., Suite 423c, Alexandria, Va. 22304.

Apple II tool helps application development

The Tool for the Apple II provides an entry screen generator, a database manager and a report report generator offers on-screen formatter. The entry screen generator handles screen editing; field formatting; and entry validations, formats and defaults. The Tool operating system allows files to span multiple disk drives, with sequential and random access and as many as 15 million records. The

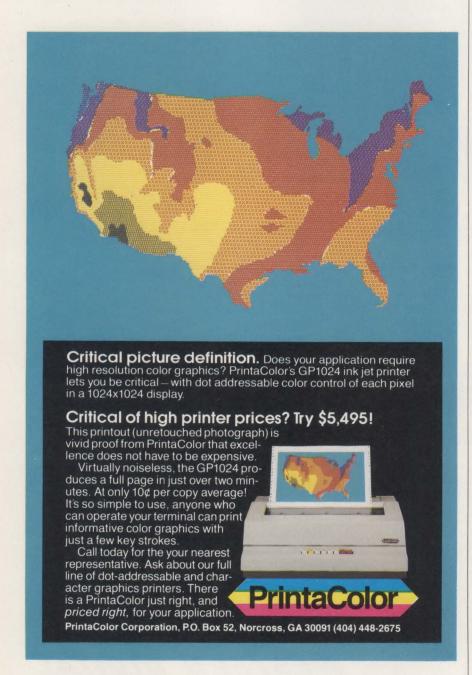
report definition, multiple column widths, COBOL pictures, calculations at print time, totals, paging, subtotals, page numbering, headers and titles. The Tool works with user programs written in BASIC. Introductory retail price is \$395. High Technology Software Products. Inc., P.O. Box 14665, 2201 N.E. 63rd St., Oklahoma City, Okla. 73113.

Office Manager offers Wang VS productivity tool

Speed II, a productivity tool/ database-management system for Wang vs computers, intended to reduce software applicationdevelopment time, can use Wangsupplied programs and utilities and standard Wang files. The installation-control subsystem permits access control at the company, menu, job and field levels. The interactive file-management subsystem permits specification of location and initial size of files, and provides file creation and monitoring. The application-design subsystem supports a data dictionary containing attributes of files and fields as well as user and technical documentation. The Office Manager, Inc., P.O. Box 66596, Seattle, Wash. 98166.

Source-code animation helps debug software

Cobol Animator animates a program by displaying its source listing on the screen and moving the cursor from statement to statement as execution proceeds. The programmer can run the program one statement at a time or continuously and can watch the execution path the program takes. In continuous animation, the programmer can choose a speed to match his reading pace. During debugging, the programmer sets execution breakpoints and changes the path of execution at will. He can also halt execution and examine or alter the value of a data item. Micro Focus Inc., 1601 Civic Center Dr., Santa Clara, Calif. 95050.

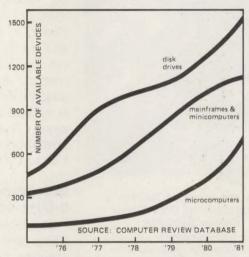


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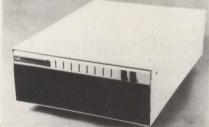
Sage offers Z80-based computer

The Sundance zso-based uc incorporates a 51/4-in. rigid-disk drive, a single-board processor and a 10M-byte cartridge-tape drive. The system is fully integrated into a terminal with 80-character or selectable 80/132-character line length. It also features a 4-MHZ Z80A CPU with 158 instructions, including memory-to-memory block transfers, 16-bit arithmetic and addressing modes. Sundance uses 64K dynamic RAM using 16K chips. Parity is automatically generated and checked on each transfer and can be disabled under software control. Bootstraps and self-test diagnostics reside in 4K ROM, which is mapped out of the system address space after initialization. Sage Distribution, 5711 Slauson Ave., Culver City, Calif. 90230.

Circle No 316

IBC introduces 6-MHz computer system

The Super Cadet system uses a Zilog Z80B 6-MHz CPU and a 150-nsec. RAM. The system features 64K RAM chips, allowing 256K bytes of memory in a 4-in.-sq. matrix. The

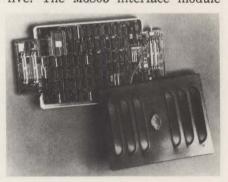


memory can bank switch within any 4K block, and bank sizes are switch selectable. The system uses single-board construction and can be expanded to include 10 I/O ports, SMD disk drives and reel-to-reel or cartridge tape. The vectored interrupt-driven system uses an intelligent disk buffer that allows processing during disk operations. The system sells for \$5595, with volume discounts available. Integrated Business Computers, 21592 Marilla St., Chatsworth, Calif. 91311.

Circle No 317

Motorola introduces μc development system

The MC146805G2 hardware/ software development system supports the MC146805G2 CMOS 8-bit μc. The system consists of a μc emulator module, cable and a relocatable macro assembler. The uc module connects to the M6805FIM interface module that resides in a EXORciser or EXORset system. The module allows the programming and debug capability of the EXORciser or EXORset to be applied to the user system development. This includes a user system emulator plug that can be connected to the target system. The system enables a user to execute prototype software in real-time or single-step mode and to set breakpoints, examine memory and verify program operation. The MCU module for debug and emulation of the MC146805G2 chip on 316 Exorciser and Exorset, including relocatable macro assembler diskette, USE cables and a user's guide, sells for \$1400 in quantities of one to five. The M6805 interface module



sells for \$1600. Motorola Semiconductor Products Inc., P.O. Box 20912, Phoenix, Ariz. 85036.

Circle No 318

Franklin unveils personal computer

The ACE 100 personal computer is hardware and software compatible with the Apple II. The system includes 64K of RAM, an upper- and lower-case keyboard and a character generator. The keyboard includes a 12-key numeric pad, an alpha shift lock key and special keys

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Franklin Computer Corp., 7030 Colonial Highway, Pennsauken, N.J. 08109.

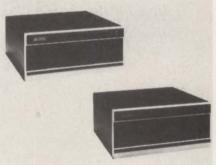
Circle No 319

Dataram announces LSI-11/23-based system

The M23 LSI-11/23-based system includes the Q-map memorymanagement system that enables a user to access the 4M bytes of the LSI-11. The system provides I/O mapping, an 18-bit bus and a 22-bit bus for main-memory addressing. The Q-map emulates DEC's KT24 memory management and operates with RSX11-M, RSX11-M PLUS, RSTS and other DEC operating systems that support the KT24. The system has a 1M-byte memory, expandable to 4M bytes, and 27 DEC dual slots. A basic configuration, including an LSI-11/23, OCU, two SLUS, Q-map memory management, bootstrap and diagnostics and 1M-byte of memory, sells for \$9400 in singleunit quantities, with OEM discounts available. Each additional 1M byte of memory sells for \$3400. Dataram Corp., Princeton Rd., Cranbury, N.J. 08512. Circle No 320

Altos introduces three-user µc family

The Series 5 family of multi-user μ cs enables three users to share a database. The system is compatible with CP/M, MP/M and OASIS operating systems. Two versions are



available. Series 5-15D has dual 5½-in. floppy-disk drives with storage of 1M byte each, and series 5-5D has a 5M-byte, 5½-in. Winchester-disk drive and a 1M-byte floppy-disk drive for backup. Both systems feature a 4-MHZ Z80A CPU with 196K bytes of RAM (three blocks of 48K bytes each and a fourth block of 48K bytes for utility

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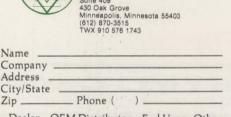
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MM/582

and operating-system programs), a double-density, double-sided floppy-disk drive, four RS232C I/O ports and a parallel I/O port. Each can be upgraded with an additional 5Mbyte, 51/4-in. Winchester-disk drive. The Series 5-15D sells for \$3990, and Series 5-5D sells for \$6990. Altos Computer Systems, 2360 Bering Dr., San Jose, Calif. 95131.

GE offers search-and-retrieval system

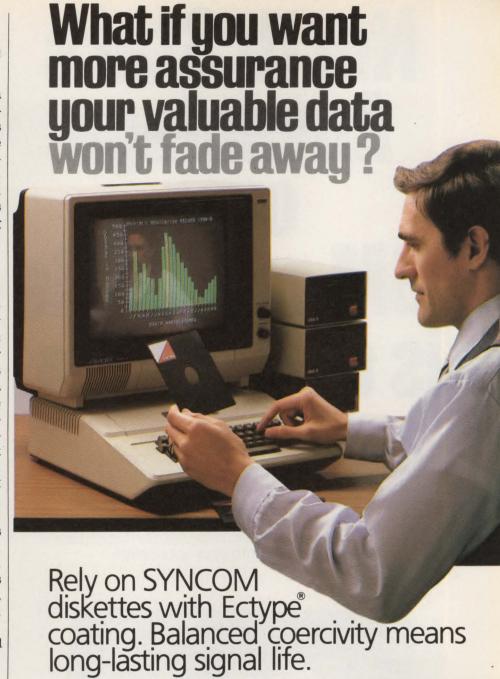
The Gescan 2 search-andretrieval system uses a text array processor that scans as many as 2 million characters of digital data per sec. without indexes, key-word lists or abstracts. The system includes a minicomputer with a 128K-byte memory, two 10M-byte disk cartridge drives, a nine-track magnetic-tape drive, an 80M-byte disk drive, a printer and a user terminal. The array processor, based on LSI technology, permits independent, parallel processing of queries, allowing multiple simultaneous searches of the database. Price, including documentation, software, installation and user training, is \$249,750. General Electric Co., 1755 Jefferson Davis Highway, Arlington, Va. 22202.

Circle No 321

Novell announces computer network

The 2000 series computer network is based on the vendor's network processor, which accommodates as many as 24 remote 2010 terminal computers. Each terminal is a CP/M-based work station with 64K bytes of RAMguard-protected memory. The network processor uses the Motorola MC68000 µp and





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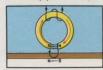
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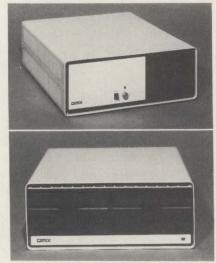
14440 Catalina Street, San Leandro, California 94577 CIRCLE NO. 196 ON INQUIRY CARD

Systems

additional ups for communications at distances as far as 3000 ft. The network includes as much as 32M bytes of usable Winchester-disk storage. A data streamer for backup is optional. Other features includes a proprietary network-control program and a CP/M operating system that offers file sharing, data integrity, control for multiple records and file protection on a shareable or non-shareable basis. The system software uses diskcaching techniques and memoryresident file directories. The network processor operates as many as five printers. Novell Data Systems, Inc., 1170 N. Industrial Park Dr., Orem, Utah 84057. Circle No 322

Gimix introduces multi-user Winchester system

The 120K-byte 6809 system supports as many as four terminals and features a 2-MHz 6809 CPU, 120K bytes of static RAM, a 19M-byte (unformatted), 5½-in. Winchester disk, a 1M-byte (unformatted), 5½-in. floppy disk and four serial I/O ports. Memory is expandable to



632K bytes. Additional memory, mass-storage capacity and I/O for additional terminals and peripherals are optional. The system can select between two operating systems under software control. Other features include OS-9 level 2, a UNIX-like, multi-user, multitasking

operating system, and the OS-9 debugger, text editor and assembler. Languages available for OS-9 include BASICO9, Pascal, CIS COBOL and C. The system also includes the GMXBUG/FLEX monitor/operating system, a single-user, 56K-byte operating system, able to run any software written for FLEX. The 6809 sells for \$8998.09, including software. Gimix Inc., 1337 W. 37th Place, Chicago, Ill. 60609.

Circle No 323

Apollo announces enhancement board

This performance-enhancement option contains a cache memory and a floating-point processor on a 16-sq.-in. PC board. The board is software and hardware compatible with the vendor's Domain network computational nodes. The 4K-byte memory acts as a buffer between main memory and the CPU. The write-cache uses a two-way set associative structure and retains LRU information. The floating-point processor uses 2900 bit-slice technology and conforms to the proposed IEEE floating-point standard.



It performs 32- and 64-bit floatingpoint arithmetic functions, registerstate save and restore and a polynomial evaluation primitive. Typical execution times range from 2.8 µsec. for single-precision addition to 15.5 µsec. for doubleprecision division. Single-unit price of the performance-enhancement board is \$4000. Apollo Computer, Inc., 19 Alpha Rd., Chelmsford, Mass. 01824. Circle No 324

Computer combines MC68000 with UNIX

The System 83 computer is

configured around an 8-MHz Motorola MC68000 μp and is IEEE-696/ S-100 compatible. The system executes approximately 1 million instructions per sec. The CPU provides 16-bit data paths and a 32-bit internal architecture, and supports as much as 16M bytes of



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From this survey information, we can accurately project what our readers spend each year on minicomputer and microcomputer equipment, and the specific quantities they will be purchasing during the year. For example, in 1980, our readers spent more than \$10 billion* for minicomputers, microcomputers, CRT terminals, printers, tape and disk drives, data communications equipment, and a variety of peripherals, software and services. No other industry publication knows more about its readers purchasing plans, or the minicomputer and microcomputer markets, than we do. To prove it, call your Mini-Micro Systems regional sales manager and ask to see our latest Market Report. It'll put us #1 on





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Systems

directly addressable memory. As much as 4M bytes of memory can be added. The system uses the UNIX Version 7 operating system, which includes C-shell, a Visual Editor, a C compiler, a 68000 assembler and a linker/loader. Optional languages include a FORTRAN 77 compiler and an ISO standard Pascal compiler.



System 83 versions range from floppy-disk based systems at \$8295 to the multi-user/multitasking System 83/40 with a DMA controller and 40M bytes of memory on a Winchester disk. The System 83/40 has hardware and software to support eight ports and is priced at \$23,950. Dual Systems Control Corp., 720 Channing Way, Berkeley, Calif. 94710.

Point 4 offers Mark 3 enhancements

These enhancements to the Mark 3 minicomputer include a memoryexpansion board that provides 64K bytes of memory via a piggyback, plug-in board that is positioned on top of the main CPU board. The option doubles the Mark 3's memory capacity. A port-expansion board adds three asynchronous ports that are functionally identical to the system's other four ports. All ports are independently baud-rate strappable to 9600 bps, and all communications are DMA with no interruption of processing. The memory-expansion board is priced at \$1200, and the port-expansion board is priced at \$900, with quantity discounts available. Point 4 Data Corp., 2569 McCabe Way, Irvine, Calif. 92714.



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Components

Interface simplifies on-line typesetting

Ideally, typesetting should be the final step of a fully automated process, yet it has always been a separate procedure because interfacing to typesetters has always been too expensive and complex. Information Design, Hillsboro, Ore., attacks this problem with its new Series 1000 interface, which provides an on-line communication link between the Addressograph-Multigraph Comp/Set and Comp/Edit series of phototypesetters and a computer or word processor.

The Series 1000 accepts data from a standard RS232C data port on most word processors and computers. The interface is connected via cable to an optional general-purpose interface port on the typesetter. Data can be typeset on-line from the interface or written to a typesetter diskette for editing and typesetting.

The interface also provides data buffering and handshaking to reduce host overhead. Data can be accepted at all standard baud rates from 110 to 9600 bps, with automatic XON/XOFF handshaking. (XON and XOFF characters are switch-selectable.) The Series 1000 also supports Bell 103-type modems for remote operation.

Installation requires no modifications to the typesetter, whose keyboard can still be used normally. On Comp/Edit typesetters, data from the computer can be written onto a diskette for subsequent typesetting while the local keyboard is in use.

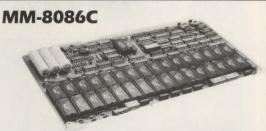
The Series 1000 makes the typesetter an on-line peripheral. This type of connection combines the specialized power of dedicated word-processing systems and the flexibility of general-purpose computer systems. And it eliminates the time-consuming and error-prone manual intervention needed with most other interfacing techniques.

Typically, the central computer is

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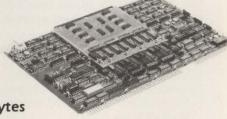
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Components

connected to the typesetter through the Series 1000. A CPU can be a µc or stand-alone word-processing system handling input from a single terminal or a minicomputer or mainframe with many input stations. As a result, a variety of word processors and terminals can share the power of the CPU and typesetter. Stations can be tailored to a user's needs, and the CPU can provide all stations with common services, including:

• Output spooling for the typesetter, allowing many users to request output simultaneously. The host keeps a priority-ordered queue of these requests, processing them as the typesetter becomes available.

• File-sharing and protection services. Files can be safeguarded from other users or shared as required.

• Large high-speed mass storage, in addition to any local mass storage the station may provide, available to each user.

• Output to conventional printers for rough drafts or approval copies, which reduces use of expensive phototypesetting paper.

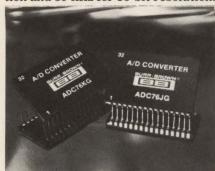
• General-purpose data processing, accounting and database management not available on many dedicated word-processing systems. These services are available to all users without diminishing the performance of the satellite word-processing stations.

The host computer also converts input to the codes required by the typesetter. Most modern phototypesetters use a superset of the standard ASCII code. Many codes for alphanumeric characters are the same, but special codes are added to access the extra characters available on the typesetter. Additional codes are also assigned for the control functions and commands of the typesetter. Character conversion is usually performed with simple table look-up routines in the computer.

A step-by-step guide to creating routines and look-up tables is provided with the interface. It covers everything from the basic table look-up routines to the more advanced techniques. Example programs are written in FORTRAN and PDP-11² assembly language. The Series 1000 is priced at \$1495. **Information Design,** P.O. Box 68, Hillsboro, Ore. 97132.

Burr Brown introduces 16-bit A/D converter

The model ADC76 16-bit hybrid A/D converter features a 67-KHz throughput rate for 14-bit resolution and 59 KHz for 16-bit resolution.



Specifications include 15-µsec. conversion time for 14-bit resolution and ±0.003-percent-FSR maximum linearity error. Gain drift is ±15 ppm/°C, and offset drift is ±10 ppm of FSR/°C (bipolar). Selectable analog input ranges are ± 2.5 V, ± 10 V, ov to +5v, ov to +10v and ov to +20v. The device is available in two models, the 13-bit linear ADC76JG and the 14-bit linear AD676KG, which sell for \$165 and \$191, respectively, in 100-unit quantities. Burr-Brown, Data Conversion Products, Box 11400, Tucson, Ariz. 85734.

Andromeda offers Q-bus board

The model EB11 switchable extender board for Q-bus systems uses banks of miniature switches to isolate each data and control line on

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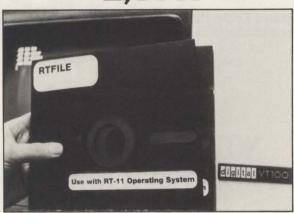
Components

the bus. The device includes pull-up resistors on the card side of the switch to maintain a high (negated) state if the line is controlled by the system. All q-bus control signals points—one on the Q-bus side of the isolation switches and the other on

the board-under-test side. The device is available in quad widths (EB11) or dual widths (EB11/2), each priced at \$250 in single-unit quantities, with quantity discounts are brought to two rows of test available. Andromeda Systems, Inc., 900 Eton Ave., Canoga Park, Calif. 91304.

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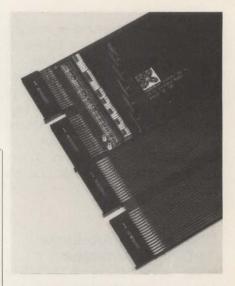
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Q-bus products support 22-bit addressing

The Q-22 product line supports DEC's 22-bit addressing LSI-11/Q-bus and board. The OEM line includes the SLCC, a card cage and backplane assembly that accommodates eight quad-width or 16 dual-width cards: the MEM11 series of memory cards, which includes 22-bit address recognition logic and capacities from 8K to 256K bytes; the WDC11 series of Winchester-disk controllers, which emulates the DEC RLV12 controller, providing as much as 40M bytes of storage with 51/4- or 8-in. Winchester-disk drives; and the 11/A-E system chassis. A typical configuration, the 11/B23-W12.5, includes the LSI-11/23 CPU, 256K bytes of



memory, 12.5M bytes of Winchester-disk storage, 0.6M bytes of floppy-disk storage, four serial channels, a video terminal and the RT-11 operating system. Singlequantity prices are \$350 for the

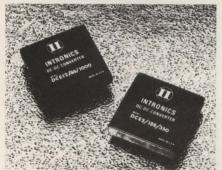
8LCC card cage, \$1400 for the MEM11-128X 256K-byte memory, \$2000 for the WDC11 disk controller, \$1358.50 for the 11/A-E system chassis and \$13,500 for the 11/B23 W12.5 Winchester/floppy system. Quantity discounts are available. Andromeda Systems, Inc., 9000 Eton Ave., Canoga Park, Calif. 91304.

Lambda introduces modular power supply

The LD series of five-yearguaranteed power supplies with laboratory-grade DC outputs are intended for breadboards, prototypes and low-noise analog circuits. Specifications include regulation of 0.005 percent for wide-range models and 0.01 percent for fixed-voltage models. The series includes 12 wide-range DC output models and 24 fixed-output voltage models in four package sizes. Wide-range models have output as high as 32V DC and load currents as high as 9.5A. Single-quantity prices start at \$210. Fixed-voltage models have outputs as high as 28V and currents as high as 22A. Single-unit prices start at \$200. Lambda Electronics, Division of Veeco Instruments Inc., 515 Broad Hollow Rd., Melville, N.Y. 11747.

Intronics announces DC/DC converters

The DCE series of DC/DC converters is available in 23 models. Inputs of 5V, 12V, 24V, 28V and 48V DC convert to single outputs of ± 5 V, ± 12 V and ± 15 V DC and dual outputs of ± 12 V and ± 15 V DC. Current





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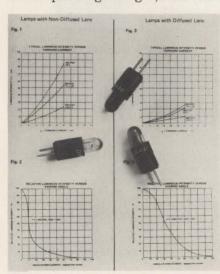
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Components

ratings range from 1A for the +5V DC converters to 150 mA for the dual-output ±15V DC units. Outputs are isolated from the inputs to provide floating power that permits isolation of the output from the DC bus. The devices offer 0.02-percent error-regulated output with 1 mV RMS. Prices in quantities of one to nine units are \$87 for single-output units, and \$73 for dual-output units. Intronics, 57 Chapel St., Newton, Mass. 02158.

Bi-pin LEDs include narrow-angle version

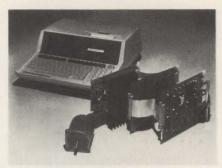
The 560 series bi-pin LED indicator lamps for mounting on PC boards and replacing incandescent indicator lights are available in seven operating voltages, from 3.6V



to 24V. The series includes a narrow-angle, non-diffused version and a wide-angle, diffused intense light source. Both versions, in red, green or yellow, include integral current-limiting resistors. Price is 75 ¢ in quantities of 1000. Dialight, 203 Harrison Place, Brooklyn, N.Y. 11237.

System links computer with stepping motors

The RS232C and IEEE-488 Modulynx interface cards enable owners of Apple, HP85, Commodore, IBM and other small-business computers



to use their keyboards to control stepping-motor speed, direction, distance, acceleration/deceleration, pause times between moves and axis designation. Each card controls as many as six axes of machine motion, allowing a user to create multi-axis machine control systems. Memory storage is 1K byte, expandable to 4K bytes. Using 20and 50-pin daisy-chain interconnecting cables, both cards interconnect with other Modulynx cards, such as a digital indexer and a variety of stepper power driver cards. B & B Motor and Control Corp., Apple Hill Commons, Burlington, Conn. 06013.

Eaton offers push-button switches

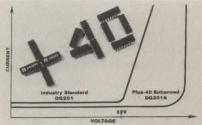
The Compu-Lite series 580 illuminated push-button switches with silver-plated contacts are rated for 0.25A at 25V AC or with gold-plated contacts for low-voltage levels. The models 580 and 583 mount directly on a PC board on 0.685-in. minimum centers. Push-button caps are 1/2 sq. in. with translucent or matte finishes. Illumination is supplied by one TI 3/4 wedge base lamp. Nonilluminated SPST switches, including push-button cap, are priced at 87¢ each in quantities of 1000; illuminated SPST switches, including push-button cap, are priced at 96¢



each in quantities of 1000. Eaton Corp., Selma Plant, Preston St., Selma, N.C. 27576.

Siliconix unveils analog-switch ICs

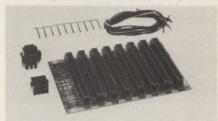
The Plus-40 family of CMOS analog-switch ICs can withstand power-supply surges as high as 44V. The line includes 26 analog-switch ICs and six 5040 series devices. The ICs are intended for rugged airborne data-acquisition systems, process-control systems, instrumentation



and automatic test equipment. Most of the devices are JAN-qualified for military systems. Each IC is pin-compatible with its industry-standard counterpart. Siliconix Inc., 2201 Laurelwood Rd., P.O. Box 4777, Santa Clara, Calif. 95054.

Motherboards have eight or 16 slots

These motherboards, available in eight- and 16-slot configurations, have etched circuits for active termination and Faraday ground shielding on all bus lines. They meet



all STD-bus requirements, including interrupt priority lines. The boards are available assembled with installed receptacles, bypass capacitors and separate power connectors; as kits; and as bare boards. The boards are fabricated of 0.0625-in.-thick FR4, G10 epoxy-glass material with solder-tinned copper cladding.

In single-unit quantities, the bare eight-slot model 4610-8-3 is priced at \$29, and the 16-slot model 4610-16-3 is priced at \$38, with quantity discounts available. Vector Electronic Co., 12460 Gladstone Ave., Sylmar, Calif. 91342.

IDS announces data-communications tester

The Hawk 4020 data-communication test-set analyzers for field service combines six test sets. It performs interactive troubleshooting and passive monitoring of serial data associated with the RS232 digital interface. Data traffic is displayed on a 1-line, 20-character alphanumeric readout. Interactive and monitoring functions are configured from a menu selection format that displays system parameters.



Other features include passively monitoring and trapping of on-line data, performing bit or block error rate tests and simulating data-terminal and data-communications equipment to communicate interactively with local- and remotenetwork components. The unit can also be configured to transmit or reply to polling messages, generate or check CRC and measure RTS/CTS or RTS/DCD delays. The system sells for \$3595. International Data Sciences, Inc., 7 Wellington Rd., Lincoln, R.I. 02865.

IDS announces interface breakout panel

The model 70 current interface breakout panel, a battery-powered, hand-held instrument, monitors and breaks out a Bell 303-type current interface between a modem and a



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Components

terminal. The device allows access to 14 signal conductors as specified for the Bell 303 high-speed coaxial connector. The current conductors are monitored by series current sensors that drive LED indicators. The two RS232 signals are monitored by high-impedance voltagesensing circuits and have LED indicators. The device has 14 switches that allow all interface signals to be interrupted for testing and monitoring. The model 70 is priced at \$1635. International Data Sciences, Inc., 7 Wellington Rd., Lincoln, R.I. 02865.

Indiana General offers magnet tester system

The PMT-1000 up-controlled magnet test system permits magnetizing permanent magnets to saturation in a test circuit that simulates actual use. The unit displays the numerical value relative to the tested magnet quality and provides a BCD output for use with external instrumentation. After testing, the magnet is demagnetized. A cycle takes approximately 4 sec. Options include printout of test value, segregation by quality level, end-toend test and automatic feed.



Indiana General Magnet Products, A Division of Electronic Memories & Magnetics Corp., 405 Elm St., Valparaiso, Ind. 46383.

USI introduces green display monitors

The Pi-1 9-in. (44-sq.-in.) and Pi-2

12-in. (75-sq.-in.) green phosphor display monitors for use with small-business and personal computers feature a resolution of 1000 lines. Pi-1 has a minimum 64character × 16-line display, and Pi-2 has an 80-character × 24-line display. Both units feature brightness control, an anti-reflective screen and an LED power indicator. Connection is via a standard SO-239 connector or an RCA phone jack. The units include a cable adapter. Bandwidth is 20 MHz, and horizontal rate is 15.6 KHz. Pi-1 sells for \$249, and Pi-2 sells for \$275, with volume discounts available. USI International, 71 Park Ln., Brisbane, Calif. 94005.

IEE unveils graphics display

The series 4400 programmable multi-image graphics display displays one to 12 messages in 1.8 sq. in. The units measure 1.5 \times 1.2 \times 4.14 in. Message size is 0.75 sq. in. Messages are selected by illuminating one of 12 incandescent lamps.



The devices need no filament adjustments and feature modular assembly. Message brightness is 100 foot Lamberts. Price is less than \$1 per message in quantities of 10,000. Industrial Electronic Engineers, Inc., 7740 Lemona Ave., Van Nuvs. Calif. 91405.

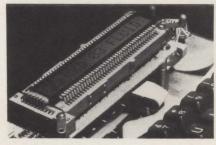
Bascom-Turner offers graphics plotter

plotter provides graphical output nects to the graphics display

for any computer system with an RS232C port. Features include X-Y and strip-chart plotting modes, an ASCII character generator with size and rotation control and an internal vector generator. The plotter uses X and Y stepping motors, has resolution of 0.005 in., repeatability of 0.002 in. and plotting speed of 2½-in. per. sec. It uses continuous z-fold paper, disposable fiber-tip pens and is available in 115V and 230V AC, 50 to 60 Hz. Bascom-Turner Instruments, 111 Chapel St., Newton, Mass. 02158.

GE announces dot-matrix LCDs

These 5 × 7 dot-matrix multiplexed LCDs of numbers, letters, symbols and words are available in 8-, 16-, 20-, 32- and 40-character formats. Character height is 3/10-in., and a 5/10-in., 16-character, singleline LCD is also available. The 8- and 16-character displays are available in edge-mount verions for elasto-



metric connection or DIPs for PC boards. The 32- and 40-character displays are available in elastometric configurations. The LCDs include a choice of transmissive back lighting (white on black), reflective (black with a light background) or transflective (reflective in most light conditions and back-lit for night-time viewing) modes. General Electric Co., Liquid Xtal Displays Operations, 24500 Highpoint Rd., Cleveland, Ohio 44122.

Camera connects to computer, TV monitor

The Videoprint 3400IS8 camera The up-based model 1100 digital system for business graphics conmonitor of the vendor's ISC 8000 desk-top computer or to a TV and provides photographic hard copy in formats including Polaroid SX-70, 35-mm., $3\frac{1}{4} \times 4\frac{1}{4}$ in. and 4×5 in.



The device features digital RGB color input resolution and a rearpanel, 10-position, push-button switch that adjusts film speed and color characteristics. Single-unit price is \$4490, with OEM discounts available. Image Resource Corp., 2260 Townsgate Rd., Westlake Village, Calif. 91361.

Digilog announces remote line monitor

The remote protocol monitor provides a troubleshooting facility on remote data-communication lines from a central site. It is transparent to the system and operates with any modem, multiplexer or protocol. The device allows central-site users to see and analyze data/control sequences on remote lines. The system consists of a master unit at a central site and a slave unit at a remote site. The slave can be connected to the master via a dial or leased data-communication line. It scans the transmit and receive data channels and the clock and control signals of the line under test. Scanned data are stored in a 16K-byte RAM and sent to the central-site slave unit. The units can trigger or trap on a specific character or an RS232 interface event. Digilog, Network Control Division, 1370 Walsh Rd., Montgomeryville, Pa. 18936.

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IDT has never met a computer it couldn't provide with IBM compatible ½" mag tape.

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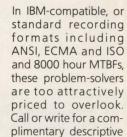
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Industrial products described in brochure

A line of industrial products, including lamps, magnifiers and other specialized lighting, is described in a 12-page catalog. The publication, aimed at quality-control, production, assembly and machine-tool applications, details miniaturized lighting fixtures. Roxter Inc., 10-11 40th Ave., Long Island City, N.Y. 11101.

Brochure features 2002 MetalsMaster system

The 2002 MetalsMaster system is featured in a six-page brochure. The brochure highlights the system's economic benefits, including a payback period of less than two years, reduced raw material use, and increased productivity; its modular design; and its advanced generation of sensors and control strategies for automatic mill management. The publication includes color photos, diagrams and schematics. **Measurex Corp.**, One Results Way, Cupertino, Calif. 95014.

Network processing systems described in brochure

The capabilities of syfa distributed-network-processing systems are described in a brochure. The 16-page, color brochure describes the system's answers to distributed business application needs, growth compatibility, support and return-on-investment. The brochure also describes the system's SNA/SDLC PU Type 2, X.25, 3270, 3780, HASP/RJE and RS232C facilities. Computer Automation, 2181 Dupont Dr., Irvine, Calif. 92713.

Catalog describes μc software programs

More than 100 μc software programs designed to support the NEC PC-8000 series personal computers are featured in a catalog. The



catalog covers languages, systems tools, word-processing systems and aids, language application tools, data-management systems, financial accounting packages, mailing-list systems, numerical problemsolving tools and professional and office aids. Lifeboat Associates, 1651 Third Ave., New York, N.Y. 10028.

Microsystem emulator described in brochure

The 9508 Micro System Emulator, an 8-bit stand-alone in-circuit emulator, is described in a 20-page brochure. The brochure details the emulator's ability to develop hardware, debug software and integrate both into a working system. full-speed emulation of 8080A, 8085A-2, Z80A, 6800, 6801, 6802, 6803, 6808, 6809, 6809E, 8021, 8035-8, 8039-6, 8040, 8041A, 8741-6, 8048, 8748-8, 8049 and 8050 ups and μcs. The brochure also describes real-time trace, in-line assembler/ disassembler, complex breakpoints, memory mapping, register display/ modification and debug command set. Millennium Systems, Inc., 19050 Pruneridge Ave., Cupertino, Calif. 95014.

Brochure features printer, terminal

The MXT 1200 line of TEMPEST RO printers and message terminals is described in a four-page brochure. The brochure details the MXT 1200 family's matrix head design, character generation, ribbon cartridge,

auxiliary control panel, keyboard and visual display. The literature also contains product specifications. **Dataproducts New England, Inc.,** Barnes Park North, Wallingford, Conn. 06492.

Brochure features disturbance analyzer

The Series 626 universal disturbance analyzer is featured in a brochure. The six-page, color brochure describes typical power-line



disturbances and how the 626 detects and analyzes those disturbances. The publication details plug-in modules for monitoring single-phase AC, three-phase AC, single-channel DC, common-mode (neutral-to-ground) AC, logic events and event time accumulation. The brochure also illustrates connections of the 626 to such computer room devices as UPSs, transfer switches, CPUs, peripherals, air conditioning and security devices. Dranetz Engineering Labs, Inc., 1000 New Durham Rd., Edison, N.J. 08817.

Software applications described in guide

Software applications for the DECmate work-processor system are featured in a guide. The guide lists more than 150 application

programs for accounting, agriculture, architecture, construction, distribution, finance, general business, insurance, job costing, law, manufacturing, medicine, personnel, property management, retail, services and word processing. Each listing provides a general description, a vendor's name, cost, documentation, equipment information, support, training, warranties and ordering information. Digital Equipment Corp., MK1-1/G28, Continental Blvd., Merrimack, N.H. 03054.

LITERATURE THAT COSTS

Book features introduction to Pascal

An introduction to programming in Pascal is provided in the book Speaking Pascal: A Computer Language Primer, by Kenneth A. Bowen. The 10-chapter book, written in nonmathematical language, requires no technical background or programming experience on the part of the reader. After an introduction to computer structure and language programming, the \$11.96 book explains various components of Pascal. It covers elementary and complex data types and the use of control structures, procedures and functions. The book also includes exercises at the end of each chapter, examples and an appendix on usco Pascal. Hayden Book Co., Inc., 50 Essex St., Rochelle Park, N.J. 07662.

Reference guide features VIC 20 home computer

Information about programming the vendor's vic 20 home computer is included in "The vic 20 Programmers Reference Guide." Designed for use by first-time computerists and experienced programmers, the \$16.95 guide has almost 300 pages, and includes illustrations, instructions, charts, programs and a schematic of the vic 20. Commodore Business Machines, Inc., Computer Systems Division, 681 Moore Rd., King of Prussia, Pa. 19406.

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Endpoints

Wet Ink Dept.: Word-processing system manufacturer Micom Co., Montreal, has ordered more than 1000 Micro Disk 1220 Series 8-in. Winchesters, valued at \$2 million, from Micropolis Corp., Chatsworth, Calif., for use in its 2002 Cluster word-processing system. Micropolis also signed a \$3-million contract for its 96-tpi MegaFloppy disk drives to be used in the ABC80 desk-top µc manufactured by Luxor AB, Motala, Sweden....Micro Peripherals, Inc., Chatsworth, will provide Hayward, Calif.-based Osborne Computer Corp. with its model 51 51/4-in. floppy-disk drive for use with the Osborne I portable personal computer. Osborne's bill: \$9 million....Tandem Computer, Inc., Cupertino, Calif., will integrate some \$18 million worth of B-600 and B-900 band printers and M-200 matrix printers from Dataproducts Corp., Woodland Hills, Calif., into its NonStop Computer systems....\$1 million worth of \$1410 controllers from Sunnyvale, Calif.-based Xebec will be integrated into Lanier Business Products's Computereze small-business system....More than \$10 million worth of Miniscribe 51/4-in. Winchester disk drives have been purchased by controller house XCOMP, Inc., San Diego, Calif., for use in its memory subsystems....Two Northern Telecom SL-1 businesscommunication systems, valued at \$1.3 million, have been installed at the Justice Center in Boulder, Colo.... A \$4.2 -million computer acquisition places New York's Rochester Institute of Technology as a leader in academic computing, says the university. RIT will receive six VAX-11/780 minicomputers and 300 GIGI color-graphics terminals from Digital Equipment Corp....Computerland's 240 stores will distribute the Fortune 32:16 desk-top μc after signing a multimilliondollar contract with Santa Clara, Calif.-based Fortune Systems Corp....Santa Clara, Calif.-based Ramtek, Inc., has contracted with Science Applications, Inc., McLean, Va., for RM-9400 color-display generators to be used in its military command and control systems. Price tag: \$2.8 million.

Ground-Breakings: Computer-graphics systems manufacturer Oratech, Inc., Ottawa, hopes to penetrate the U.S. market with a new sales/service facility in Santa Monica, Calif...Business/personal-computer software distributor Softsel Computer Products, Inglewood, Calif., plans to broaden its market base with its first regional sales office, slated for New York. Offices in Dallas and Chicago will follow...CRT-terminal manufacturer Emulog, Inc., recently christened its new 26,000-sq.-ft. facility in Fremont, Calif....Circuit/component manufacturer Precision Monolithics, Santa

Clara, Calif., will add a 29,000-sq.-ft. corporate headquarters, across the street from its main plant....Technology Industries, Inc., Santa Clara, Calif., has acquired all stock of Forth, Inc., Hermosa Beach, Calif., via an exchange of its own stock....Cupertino, Calif.-based Tandem Computers, Inc. has opened another branch sales/service office, its 53rd, in Des Moines....Software supplier Alpine Datasystems, Beaverton, Ore., has been acquired by international investor group Hanover Information Services....Software supplier Software Publishing Corp. has moved into its new 7000-sq.-ft. facilities in Mt. View, Calif., with an additional 7000-sq.-ft. option....Computer services company Saztec Corp. has moved from Marina del Rey, Calif., to Rolling Hills Estates, Calif....Storage Technology has formed a Louisville, Colo., subsidiary, Ultimacc Business Systems, Inc., to supply the small-business computer market with systems that are compatible with IBM 370/43xx systems....Oak Industries, San Diego, has formed a subsidiary in Rancho Bernardo, Calif., Oak Satellite Corp., which the company hopes will make it a leader in satellite communications.

Moneytalk: Intel Corp. has reduced prices 13-38 percent on eight of its Multibus products, including the ISBC 012B 512K-byte RAM board and the ISBC 86/12A 16-bit single-board computer.... Year-old Bridge Communications, Cupertino, Calif., maker of products for local-area networks including Xerox's Ethernet, has raised \$1.4 million to complete its first round of financing....NNC Electronics, Huntington Beach, Calif., has cut prices as much as 7 percent on its system 80 and 80W S-100-based line of µcs....Andromeda Systems, Canoga Park, Calif., has cut prices as much as 30 percent on its LSI-11/23-based systems, selected floppy- and Winchester disk systems and some of its LSI-11 board sets and RAM boards....Micom Systems has cut prices by as much as \$1300 on several Micro 8000 Concentrator Modem models....Corvus Systems, Inc., San Jose, cut as much as 15 percent from its 6M-, 11M- and 20M-byte Winchester disk system prices....A 50 percent price cut on its 16K-byte NMC27C16 CMOS EPROM has been announced by National Semiconductor Corp.

Randomly Speaking: The Lynx 8-in. Winchester disk drive from Sunnyvale, Calif.-based **Data Peripherals** now equals the storage capacity of DEC's RL02 10.6M-byte 14-in. cartridge drive. The change will affect all new Lynx drives, with no price change. —Nancy Love

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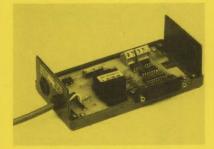
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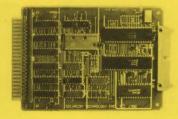
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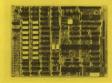


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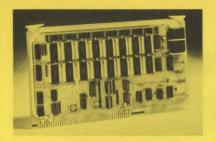
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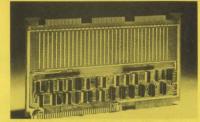
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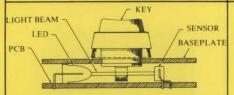
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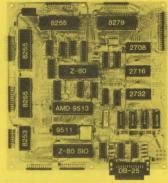
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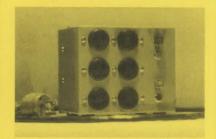


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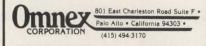
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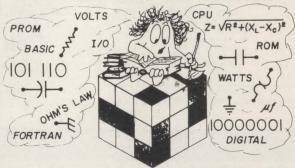
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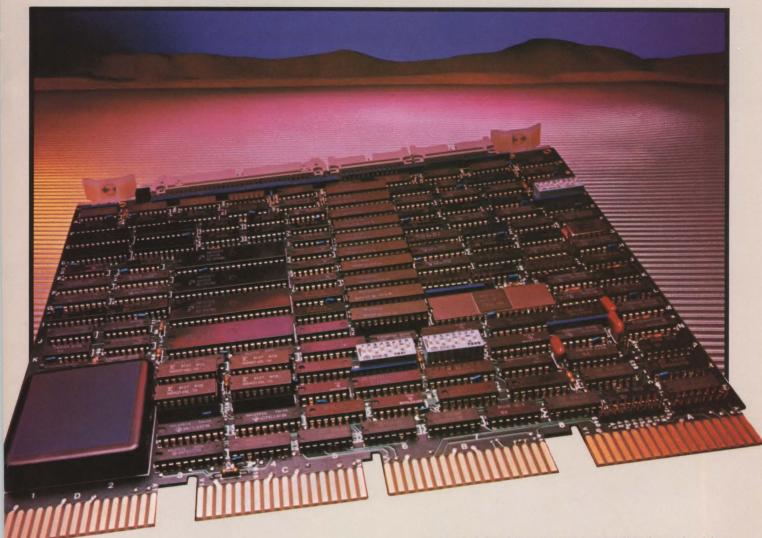
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