Mini-Micro Systems

A CAHNERS PUBLICATION

JUNE 1981

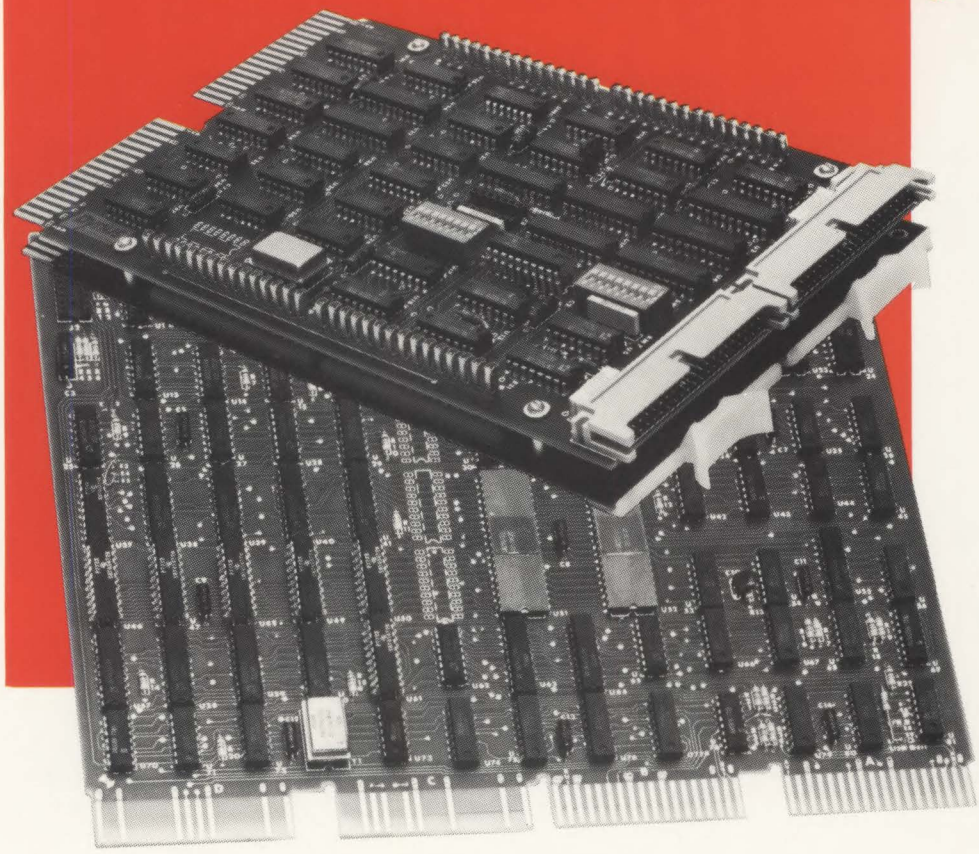
SMALL-BUSINESS SYSTEM SURVEY

nting with
s at Delphax

The minicomputer market at mid-year

DEC®-COMPATIBLE PERIPHERAL CONTROLLERS

ALSO FROM DATARAM
JUST ANNOUNCED
PDP 11/44 MEMORY



Now, from the company that delivers the industry's widest range of DEC-compatible memory products, a family of peripheral controllers that's second to none. From comparatively simple cartridge disk controllers to complex 300MB storage module drive (SMD) controllers.

An impressive array of state-of-the-art controllers, all built around high-speed bipolar microprocessors. All software compatible with the host LSI-11® or PDP®-11 minicomputer...and all available now.

And Dataram's controllers are designed to save you money, and a lot more. Like space — our controllers typically occupy half the space required for the comparable controller from DEC. Doing it with a level of performance that makes any member of this family worth looking at.

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DATARAM CONTROLLER	Magnetic Tape Controller			Cartridge Disk Controller		SMD Controller					
	T03	T04	T34	C03	C33	S03/A	S03/B	S03/C	S33/A	S33/B	S33/C
MINI	LSI-11	LSI-11	PDP-11	LSI-11	PDP-11	LSI-11	LSI-11	LSI-11	PDP-11	PDP-11	PDP-11
COMPATIBILITY	TM11/TU10			RK05		RM02	RK07	RP06	RM02	RK07	RP06

Canada: Ahearn & Soper Ltd., 416-245-4848 • **Finland:** Systek OY, (80) 73 72 33 • **France:** YREL, (01) 956 81 42 •
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Sweden: M. Stenhardt AB, (08) 739 00 50 • **Switzerland:** ADCOMP AG, 01/730 48 48 • **United Kingdom:** Sintrom Ellinor Ltd., (0734) 85464 •
West Germany: O.E.M.-Elektronik GmbH, 07 11-79 80 47 • **Yugoslavia:** Institut "Jozef Stefan", 263-261 • **Australia/New Zealand:** Anderson Digital Equipment, (03) 543-2077 •
India: Infosystems Private Limited, 79281 • **Israel:** Minix Computers & Systems Ltd., 03-298783 • **Japan:** Matsushita Electric Trading Co., Ltd., 06 (282) 5111

CIRCLE NO. 1 ON INQUIRY CARD

In-Flight Commander.

IMMEDIATE DELIVERY

The Goodyear Blimp gets the message across with TI's 743.

Based in Houston, Texas, Goodyear's blimp, the *AMERICA*, becomes an aerial nighttime messenger with the help of TI's *Silent 700** Model 743 Electronic Data Terminal.

Using the compact 11-pound 743 on board, the *AMERICA* can deliver a variety of messages in different size and color combinations. Commands entered on the 743 keyboard produce messages that range from Goodyear's product advertising to public service announcements on behalf of various non-profit organizations. And, the versatile 743 can even print out display coordinates for geometric designs and animated sequences for added visual nighttime effects.

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Both in the air and on the ground, TI's Model 743 is a reliable commander.

TI is dedicated to producing quality, innovative products like the *Silent 700* Model 743 Electronic Data Terminal. And TI's hundreds of thousands of data terminals shipped worldwide are backed by the technology and reliability that comes from 50 years of experience.

Supporting TI's data terminals is the technical expertise of our worldwide organization of factory-trained sales and service representatives, and TI-CARE†, our nationwide automated service dispatching and field service management information system.

For more information on TI's Model 743, contact the TI sales office nearest you or write Texas Instruments Incorporated, P.O. Box 202145, Dallas, Texas 75220, or phone (713) 373-1050.

We put computing within everyone's reach.

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In Canada, write Texas Instruments Incorporated, 41 Shelley Rd., Richmond Hill, Ontario L4C 5G4, (416) 884-9181. In Europe, write Texas Instruments, M/S 74, B.P.5, Villeneuve-Loubet, 06270, France, (93) 20 01 01. In Asia Pacific, write Texas Instruments Asia Ltd., 990 Bendeemer Rd., Singapore 1233. Telex RS 21399, or phone 2581122.

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CIRCLE NO. 2 ON INQUIRY CARD

The DSD 880 can integrate with a VT103 Intelligent Terminal containing an LSI-11/23 to form a complete, powerful table-top microcomputer.

You deserve better data storage than you get from DEC.

For your LSI-11 or PDP®-11, bigger isn't better when it comes to data storage.

DEC® builds great computers. But if you want 7.8 megabytes of data storage, they give it to you in two ungainly boxes 21 inches high. Data Systems Design gives you one compact package 5¼ inches high, with an ultra-reliable 7.8 megabyte Winchester drive *and* a 0.5 megabyte single-sided floppy (or 1 megabyte double-sided) for I/O and integral backup, plus on-board diagnostics and lots of extras.

A superb buy—the DSD 880 DEC-compatible Winchester/Floppy Disk System.

Offering far better value than RX02 and RL01 combos or dual-RL01 or -RL02 disk drives, the DSD 880 provides more bytes per buck than any DEC alternative. And you save in other ways.

Less rack space means lower cabinetry costs.

The 880 backplane interfaces require 70% less backplane space than a similar DEC configuration.

The comprehensive HyperDiagnostics™ panel and library of microprogrammed routines, in conjunction with Data Systems Design's Rapid Module Exchange™ program and HyperService™ service contracts, deliver more uptime for less than half the cost of a DEC service contract.

Fully compatible three ways.

DSD 880 is hardware compatible. It's the *only* high-capacity storage system that integrates with a VT103. And it integrates with any DEC LSI-11 or PDP-11 computer, or any DEC-computer-based system.

It's software compatible. You can use RT-11 or RSX-11 operating systems with RL01 (Winchester) and RX02 (floppy) handlers without modification. The DSD 880 runs all applicable DEC diagnostics and utilities.

And it's media compatible. Its floppies utilize DEC double-density or IBM single-density formats.

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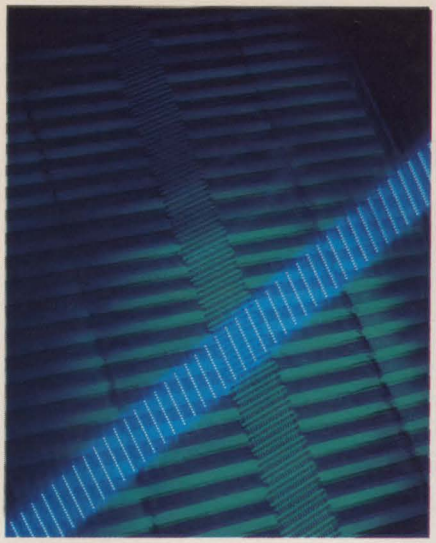
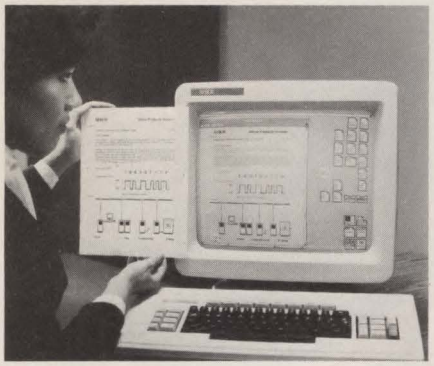
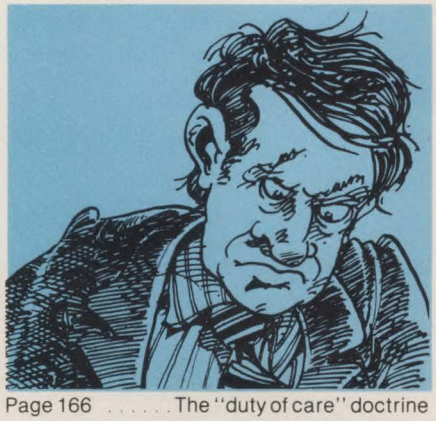
CIRCLE NO. 3 ON INQUIRY CARD



Circuit boards of Dephax's ion-cartridge "Otter" printer show holes through which ions are directed to print characters (see p. 179). Cover design and photo by Steve Grohe, Boston, courtesy of Delphax Systems.



Page 23 . . . . . Xerox's Star work station



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FEATURES

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MINI-MICRO WORLD

DEPARTMENTS

VBPA ☆ABP

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We've got your number in 1981. It's 6450.

Model 6450...

The ¼" cartridge recorder that thinks it's a ½" tape deck.

Kenndey's Model 6450—it's a start/stop drive which is faster than streaming in almost all applications; a drive that has a data reliability rate for soft errors of not less than 1×10^{10} and a hard error rate of 1×10^{11}. The reason? Model 6450's GCR recording technique.

Need Capacity? Model 6450, with a DC 600A cartridge, will store up to 23 MBytes of unformatted data, and over 20 MBytes formatted.

In a hurry? A serpentine head is standard on Model 6450, eliminating time consuming rewinds. **Need simple interface?** Model 6450's intelligent Pico bus interface is not only easy to interface—it's been proposed as an industry standard. If you need a controller, there are a variety for all standard mini-computers.

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CIRCLE NO. 4 ON INQUIRY CARD

Model 6450 shown in service position.

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XEROX TO INTRODUCE MULTI-APPLICATION 'WORM'

Xerox Corp.'s hotly rumored personal computer, code-named "Worm" because it uses Apple Computer software and because it might affect Apple's market share, is expected to be introduced this month, two months earlier than previous estimates. Sources close to the company say the Worm is essentially an engine that can, through software, be used as a word processor, personal computer or small-business computer for accounts receivable. Based on a Z80 μp, it is expected to house 64K to 128K bytes of memory and include 8-in. floppy-disk drives. Price is $2500 to $5000. It will be sold through Xerox retail stores, and may eventually replace the Apple products now sold at the store. One source describes it as a TRS-80 look-alike. Software is CP/M-based, so that a program such as VisiCalc could run on the system.

PDP-11/24-COMPATIBLE SYSTEM BASED ON 11/23

First deliveries of a PDP-11/23-based Q-Bus minicomputer system with the performance characteristics of Digital Equipment Corp.'s recently announced PDP-11/24 will start this month from MDB Systems, Inc., Orange, Calif. Compatible with DEC's RSX, RT-11 and RSTS operating systems, and also able to run UNIX, the system is expandable from 256K bytes to 4M bytes of main memory via a 22-bit memory map. Referred to internally as the MLSI-11/23-1000X, the system is priced at $9900 in single-unit orders for CPU, single-board 256K main memory, two serial ports, bus terminator and clock. Prices for DEC's PDP-11/24 CPU start at $11,000. Packaged systems, including memory, floppy-disk drives, terminal and software start at $19,800. MDB's hardware is mounted in a 5¼-in.-high chassis, and will support as much as 600M bytes of Winchester or SMD disk storage via an optional Emulex controller. Price is $1950 in OEM quantities.

UNIX DESK-TOP SYSTEM WILL BE READY BY AUGUST

Computhink, Sunnyvale, Calif., will introduce a 68000-based small-business system next month. Called the Eagle 32, the system will be available first in a single-user configuration, but the company expects to have a multi-user UNIX-based system ready by August. A spokesman for Computhink says the desk-top machine includes 128K bytes of RAM, expandable to 1M byte, and 5¼- or 8-in. floppy-disk drives. Eight- or 5¼-in. Winchester-disk drives are also available, says the spokesman. The company says a single-user Eagle 32 with two 8-in. floppy drives; 128K bytes of RAM, the firm's proprietary operating system; and BASIC, FORTRAN and FORTH compilers will sell for $8950. UNIX will be priced separately.

PERKIN-ELMER, SEL ENHANCE SUPERMINI LINES

Bell Laboratories' UNIX operating system is becoming widely used on complex 32-bit minicomputers, and Perkin-Elmer Corp. is the latest manufacturer to jump on the bandwagon. At the National Computer Conference, the company demonstrated UNIX on its recently introduced model 3230 mid-range processor. A spokesman from the Wollongong Group, which developed UNIX for both Perkin-Elmer and Digital Equipment Corp., says users can benefit from as much as 20 percent higher programmer efficiency by using UNIX. Lifetime license fee is $20,000, and each set of eight additional ports is priced at $5000. Maintenance is $450 per month, including updates and new releases.

UNIX is not in Systems Engineering Laboratories' plans for its new high-end Concept 32/87 32-bit minicomputer. The 32/87 performs more than 3.6 million instructions per sec., the company claims, because of a CPU that uses emitter-coupled logic for very fast gate-switching times. Prices for the system, which is available for delivery this month, start at $235,000 for a basic unit with 1M byte of memory, 16K-byte cache memory, integral single- and double-precision floating-point processor, diagnostic processor, I/O processor, two floppy-disk drives and a CRT terminal. A similar configuration with a 32K-byte cache memory is $265,000.

Breakpoints

LOW-COST SMALL SYSTEMS BOW

Small-business systems priced at less than $20,000 and based on 8- and 5¼-in. Winchester-disk drives accounted for many of the new-product announcements at NCC. Among the low-cost systems introduced were first system products from Sunnyvale, Calif.-based video-display maker Televideo Systems Inc. The family of Z80-based processors and the CP/M operating system is available in three models. The System I single-user system, which features the company's model 910 display, 1M byte of floppy-disk storage and 64K bytes of RAM, is priced at $3995. The System II supports as many as six users and includes a service processor with a Z80, 64K bytes of RAM, 1M byte of floppy-disk storage and a Tandon 10M-byte micro-Winchester. Each satellite station, based on Televideo's model 950 smart terminal, includes a Z80, 64K bytes of RAM and RS232 and RS422 ports. Satellite stations are linked via 800K-bps RS422 lines. A System II sells for $8995 and includes one satellite station. The System III can handle as many as 16 users with as much as 70.5M bytes of hard-disk storage. A System III with two satellite stations is priced at $19,995.

Westlake Village, Calif.-based Vector Graphic introduced the 5005 Multishare System, which also uses a Z80 as the CPU, and includes 5M bytes of micro-Winchester storage and 630K bytes of floppy-disk storage. The $8995 system supports as many as five users. Additional user stations are priced at $1895. The 5005 runs CP/M and features an editor, debugger, assembler and Microsoft, Inc's BASIC 80 compiler.

Altos Computer Systems, San Jose, Calif., claims that its ACS8000-10 is the first multi-user 8-in. Winchester-based system in the small-business-system market. Three models of the system are available, with prices ranging from $8500 to $10,990. All use a Z80 and have 10M bytes of hard-disk storage and 208K bytes of RAM.

Alpha Micro, Irvine, Calif., unveiled two Winchester-based systems, the AM-1021, an 8.5M-byte systems, and the AM-1041, a 32M-byte machine. Both systems are offering a choice of backup, including floppy disks, magnetic tape or video cassettes. The AM-1021 sells for $15,000; no price has been set for the AM-1041.

COMMODORE UNVEILS HIGH-END PERSONAL BUSINESS COMPUTER

Boasting that its new entry gives it the broadest product range in the μc field, Commodore International Ltd. introduced a high-end personal business computer at NCC. Dubbed the Micro-Mainframe, the computer is based on the earlier 8032 (PET) μc and incorporates a 6809 μp. The system includes a 36K-byte ROM, 96K bytes of user RAM and four language interpreters developed by the University of Waterloo in Canada: Waterloo microBASIC, microPASCAL, microFORTRAN and microAPL. Price, including software, is $1995, and production quantities will be available in early fall.

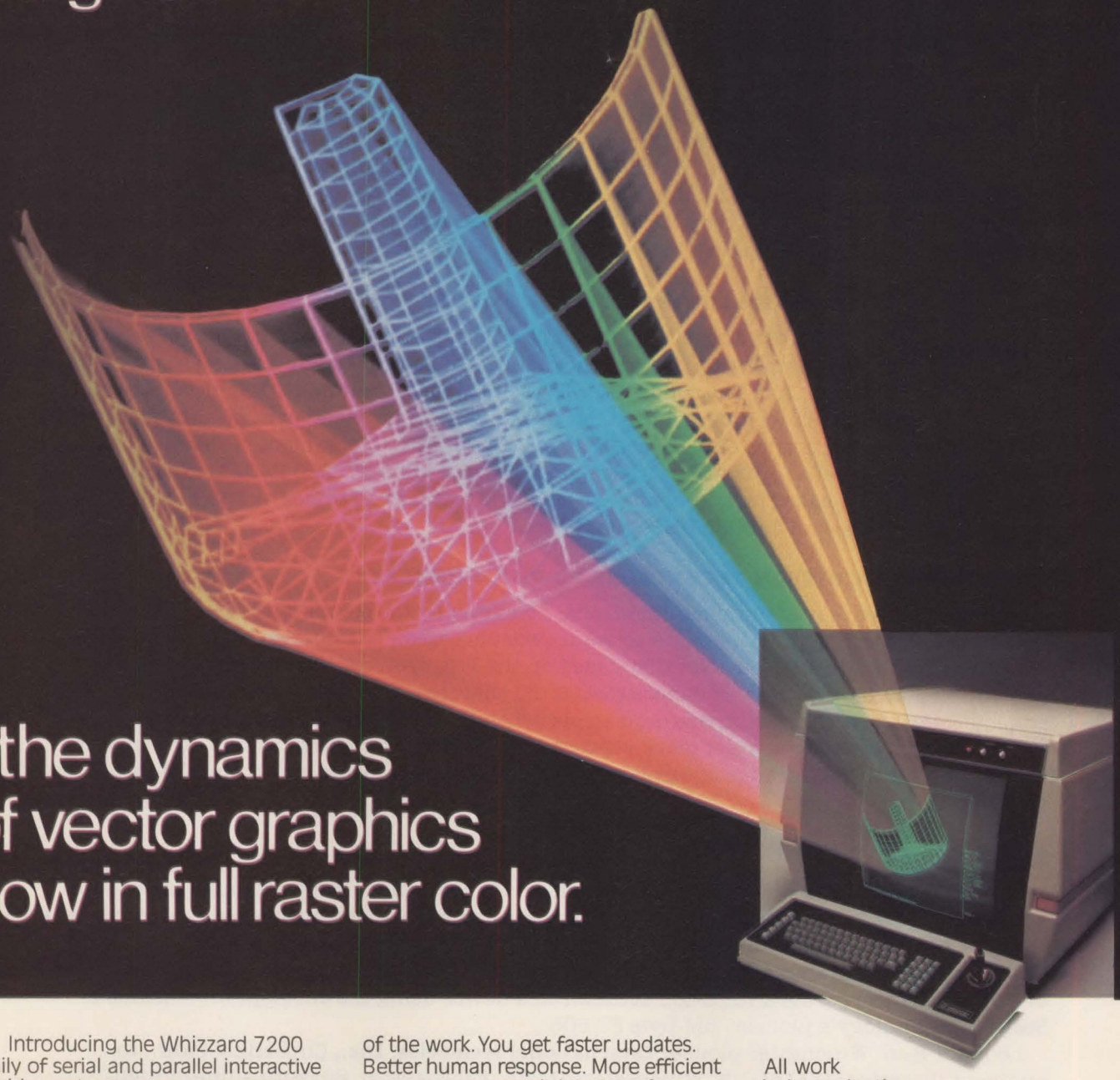
INK-JET MODELS HIGHLIGHT NON-IMPACT PRINTER ENTRIES

Several companies exhibited working prototypes of non-impact printers and finished products based on a variety of technologies. Included were ink-jet printers from Anderson-Jacobson, Inc., Printacolor Corp. and Sharp Corp. Anderson-Jacobson is selling a version of the Silonix ink-jet printer that has been on the market since 1978. The re-introduced end-user printer, the AJ 862, will be priced at about $3500 in single quantities. The 180-cps printer uses drop-on-demand technology, similar to that used in the well-known Siemens ink-jet printer. The printer incorporates a 6800 μp that controls incoming data and ink flow. Sharp demonstrated a prototype 100-cps ink-jet printer, the Sharpwriter model 500. It is intended for use with the company's WD-7000 word processor, but will also be available in OEM versions. Price has not yet been set, nor have availability dates.

A DELUGE OF DOT-MATRIX PRINTERS DEBUTED

A host of dot-matrix printers were introduced at NCC. Many of the more than 15 new products touted high-quality print capability. Printronix, Inc.'s Taskmaster MVP2 matrix printer, available in both OEM and end-user configurations, operates at 80 lpm in high-quality word-processing mode, and 150 lpm in data-processing applications. Anadex, Inc.'s WP6000 Words Plus printer, which incorporates an 18-wire print head, operates at 150 cps,

Imagine...



...the dynamics of vector graphics now in full raster color.

Introducing the Whizzard 7200 family of serial and parallel interactive graphics systems.

Included are two new high-performance color raster Whizzards so fast they can modify complex engineering displays at a remarkably high frame rate — speed that rivals the powerful refresh vector output Megatek is known for.

Choose from over 4,000 colors; 16 can be displayed at any given time.

We've doubled the size of our graphics microcode. New segment header formats. New command structures. New smart interrupts.

The result: More graphics power using less host computing power. Peripheral device electronics do most of the work. You get faster updates. Better human response. More efficient memory usage and data transfers.

Teamed with RS-232C serial interfaces, Whizzard graphics power now moves squarely into the world of time-sharing and distributed processing.

You can configure the Whizzard 7200 family to fit virtually any application simply by changing output circuits. Serial or parallel vector calligraphic. Serial or parallel raster. Or both simultaneously from one electronic chassis! All are driven by one common graphics software package — Megatek's new WAND 7200.

You can add many "intelligent" microprocessor-controlled peripheral devices to boost system capability. All work independently to free both the host computer and graphic processor for jobs they do best.

It's like taking distributed processing one more step.

Continuous real-time pan, zoom, 3-D hardware transformations, and other display capabilities are done in the terminal, not in the computer.

No wonder Megatek is fast becoming the technological leader in high-quality, high-performance refresh graphic systems.

For details, call or write Megatek Corporation, 3931 Sorrento Valley Blvd., San Diego, CA 92121. (714) 455-5590.

MEGATEK/WHIZZARD

COMPUTER GRAPHICS SYSTEMS

Data supplied by Control Data Corp.

CIRCLE NO. 5 ON INQUIRY CARD

and in rough-draft mode at 500 cps. Toshiba Corp.'s dual-speed matrix printer, the TH-2100H, uses a 24-thin-wire head to print at 100 cps for high-quality output and 160 cps for data-processing applications. It will be introduced this fall and will sell for $2000 in 1000-unit OEM quantities. Hitachi America, Ltd., also included a 24-wire dot-matrix printer among its entries. The company's MPR 6060, to be introduced in December, operates at 60 cps and will sell for $4940 in single units, and $2950 in 500-unit quantities.

HAZELTINE, SOROC ENTER LOW-END TERMINAL FRAY

Low-end terminal introductions from Soroc Technology and Hazeltine Corp. represented new and unexpected competition in a price war initiated before NCC by Applied Digital Data Systems and Televideo, Inc. The competition is resulting in a less-than-$700 price plateau being set in the dumb CRT terminal market. Hazeltine's offering, the Esprit, is manufactured in Taiwan by Disco Electronics and features editing capabilities, block-mode transmission and protected fields. It sells for $695 in single quantities and $500 to $550 in OEM quantities. The Soroc IQ 130, a Z80-based terminal, also with editing features, is priced at $650 in single-unit quantities and less than $500 in OEM quantities.

SONY BRINGS TRINITRON TECHNOLOGY TO VIDEO DISPLAYS

Sony Corp.'s drive into the computer arena, bolstered by the company's reputation and market penetration with consumer electronic products, drew the interest of many an NCC observer to a high-resolution color CRT based on the Trinitron color televsion screen. Resolution is 800 × 600 dots, and more than 8000 characters can be displayed. The monitor employs one gun with three beams, and an electrostatic focus lens. Refresh rate is 60 frames per sec. Sony's intent was to get market reaction for the final products, which are slated for introduction in 1982. A range of display sizes will be offered, including 12- and 19-in. versions.

RANDOM DISK FILES

Storage capacities on small Winchester-disk drives continue to soar, although production quantities are only now beginning to approach the estimates made by some manufacturers as recently as two years ago. Due in the first quarter of 1982 from Sunnyvale, Calif., start-up **Rotating Memory Systems, Inc.,** is a 40M-byte, four-platter, 5¼-in. drive that may be the first of its type to incorporate a voice-coil actuator in a device using the envelope dimensions of Seagate Technology's pioneer, 6M-byte ST-506.

Look for 8-in. Winchester pioneer **International Memories, Inc.,** Cupertino, Calif., to augment its series 5000 5¼-in. Winchesters (MMS, February, p. 26) with a line of high-performance, high-capacity 45M-byte hardware later this year. New drives reportedly will use thin-film media and manganese read/write heads.

Irwin International, Inc., Ann Arbor, Mich., is expected to unveil a 20M-byte version of its 10M-byte 510 sometime next year. Like the lower-capacity hardware, the newer 5¼-in. Winchester will incorporate an integral tape-cartridge backup (MMS, November, 1980, p. 45), and may be the first drive of its type to be based on the combination of thin-film media and thin-film heads.

A higher capacity "Finch" 8-in. Winchester may show up shortly from **Control Data Corp.** Now available in evaluation quantities in the 10M- to 30M-byte range, the Finch will get more horsepower later this year in the form of a third platter.

WINCHESTER-DISK CARTRIDGE DRIVES: Anaheim, Calif.-based Xerox subsidiary **Century Data Systems** is planning a removable-only 8-in. Winchester-disk cartridge for 1983, say sources close to the company. The drive will be aimed at the high end of the 8-in. market and will incorporate the 8-in. cartridge developed by media maker Dysan Corp. used on **Data Peripherals'** DP-1000 "Lynx" removable-only drive, and in **Perkin-Elmer's** 32M-byte fixed/removable Vanguard 8C device (MMS, March, p. 79). . . . Both Data Peripherals and P-E were buoyed last month by news that an ANSI committee decided to standardize on the Dysan cartridge used by both firms.

PDP-11/03® PDP-11/23®
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FIRST COMPUTER CORPORATION NOW OFFERS MICROCOMPUTER DEVELOPMENT SYSTEMS IN BOTH 11/03 AND 11/23 CONFIGURATIONS.

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	11T03-L	11V03-L	11T23-L	11V23-L
PART #	SRVXLLB	SRVXSSB	SRWXLLA	SRWXSSA
BACKPLANE	KD11-HA CPU 11/03	KD11-HA CPU 11/03	KDF11 CPU 11/23	KDF11 CPU 11/23
	MSV11-DD 32KW Memory	MSV11-DD 32KW Memory	MSV11-DD 32KW Memory	MSV11-DD 32KW Memory
	RL01 Controller	RX02 Controller	MSV11-DD 32KW Memory	MSV11-DD 32KW Memory
	RL01 Controller	DLV11-J Serial (4)	RL01 Controller	RX02 Controller
	DLV11-J Serial (4)	OPEN	RL01 Controller	DLV11-J Serial (4)
	OPEN	OPEN	DLV11-J Serial (4)	OPEN
	OPEN	OPEN	OPEN	OPEN
	OPEN	OPEN	OPEN	OPEN
	BDV11-AA Bootstrap	BDV11-AA Bootstrap	BDV11-AA Bootstrap	BDV11-AA Bootstrap

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CIRCLE NO. 6 ON INQUIRY CARD

Breakpoints

Cartridge standardization of a different sort is going on among several companies building 5¼-in. Winchesters. Instead of relying on an ANSI committee, **Dysan, Seagate** and Santa Barbara, Calif., start-up **DMA Systems Inc.** (MMS, March, p. 5) have formed a club with the aim of developing a standard for this type of media. DMA's fixed/removable drive, the SAGE5, could be announced in the fall; Seagate's plans remain unspecified, although rumors are flying that the Scotts Valley, Calif., firm plans a device later this year that will incorporate thin-film read/write heads and will be compatible with controllers used for its ST-506 and -512 fixed-disk Winchesters.

More 14-in. Winchesters continue to be announced despite the enthusiasm being whipped up for 8- and 5¼-in. drives. **Ampex** took its 3350-technology hardware up to the 160M- and 330M-byte range at NCC with the first showing of its new Capricorn series devices. Prices range from $5900 to $7100 in OEM quantities, with first deliveries slated for this fall. **Century Data Systems'** 80M-byte Marksman 14-in. drive unveiled at NCC will be followed later this year by a 160M-byte version said to incorporate a newly designed rotary actuator driven by a torque motor. Pricing for the 160M-byte device reportedly is set at less than $3000 in 100-unit orders.

SLIMLINE FLOPPY-DISK DRIVES: The move to smaller drives picked up steam last month in Chicago with the first showing of **Remex's** two-thirds-high, 1M-byte floppy-disk drive (MMS, April, p. 168). At the lower end, Anaheim, Calif.-based **Siemens Corp.** unveiled its "BASF-compatible" FD-111-5 125/250K-byte drive, and announced that volume production of the device will begin early next year. Higher capacity hardware is on the way, however, say company sources.

Look for an announcement later this year of the SA810 and the SA860 slimline single- and double-sided 8-in. floppy-disk drives from Shugart Associates. Meanwhile, Chatsworth, Calif.-based **Micro Peripherals, Inc.** (MPI) unveiled the model 41, a half-high, 8-in. device derived from its model 82 first shown at NCC '80 (MMS, July, 1980, p. 58). Pricing for the 41 in 1000-unit quantities is $400 for the double-sided version and $300 per 1000, single-sided. Evaluation hardware will be available later this summer.

High-capacity floppy maker **Micropolis Corp.,** Chatsworth, Calif., has plans to enter the 2M-byte, 5¼-in. floppy-disk drive market. Designated the 1117 series, the drives will be available in 96- and 100-tpi versions, single- or double-sided, all using a lead-screw actuator. Bit densities using media supplied by Dysan will be in the 12,000-bpi range. Prices for the new Micropolis hardware in 1000-unit orders are $315 for the single-sided versions, $395 for the double-sided 2M-byte drives. Evaluation hardware will be ready in the fourth quarter; production versions are scheduled to roll in the first quarter of 1982. . . . Highest capacity floppy-disk drive to appear so far may be **PerSci's** model 899, an 8.4M-byte device that operates at 150 tpi using standard 8-in. floppy-disk media and a track-following servo to compensate for elliptical variations in the media.

Sunnyvale, Calif.-based **Xidex Corp.,** a leading supplier of duplicating microfilm, reportedly was informally contacting drive vendors and other potential customers at NCC about its possible plans to enter the high-density diskette business. Xidex has formed an evaluation group headed by ex-**Memorex** executive Art Launder and is looking to supply diskettes in the 50-μin. and smaller category. That move could pit the company against Dysan in the market for floppy media able to store 2M bytes or more.

FOREIGN COMPETITION: Drive vendors carefully looked at the 3½-in. floppy-disk drive displayed at NCC by **Sony Corp.** (MMS, April, p. 17), although none evinced any intention of offering extra-small floppy-disk drives. Ditto for U.S. media vendors. The first Japanese 5¼-in. Winchesters showed up at NCC in the form of the 6M-byte NP05-6 and the 10M-byte NP05-10 from **Nippon Peripherals Ltd.** The drives store data on 160 cylinders and operate at 8261 bpi, 254 tpi. Hardware is compatible with Seagate's ST-506, with other interfaces available. . . . Small-Winchester competition can also be anticipated from Europe. **BASF Systems'** 6180 series 6M- and 10M-byte drives made their first appearance at NCC, with volume production to begin in this country next year. Start-up **Rodime, Ltd.,** Glenrothes, Scotland, also showed up in Chicago with plans to offer four drives ranging from 4M to 12M bytes (unformatted).

—John Trifari

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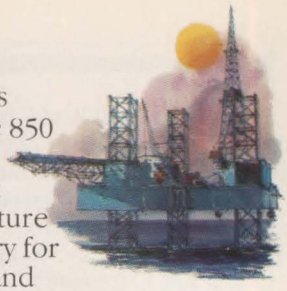

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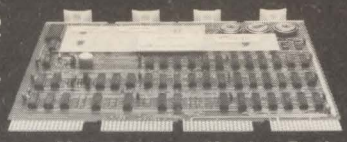

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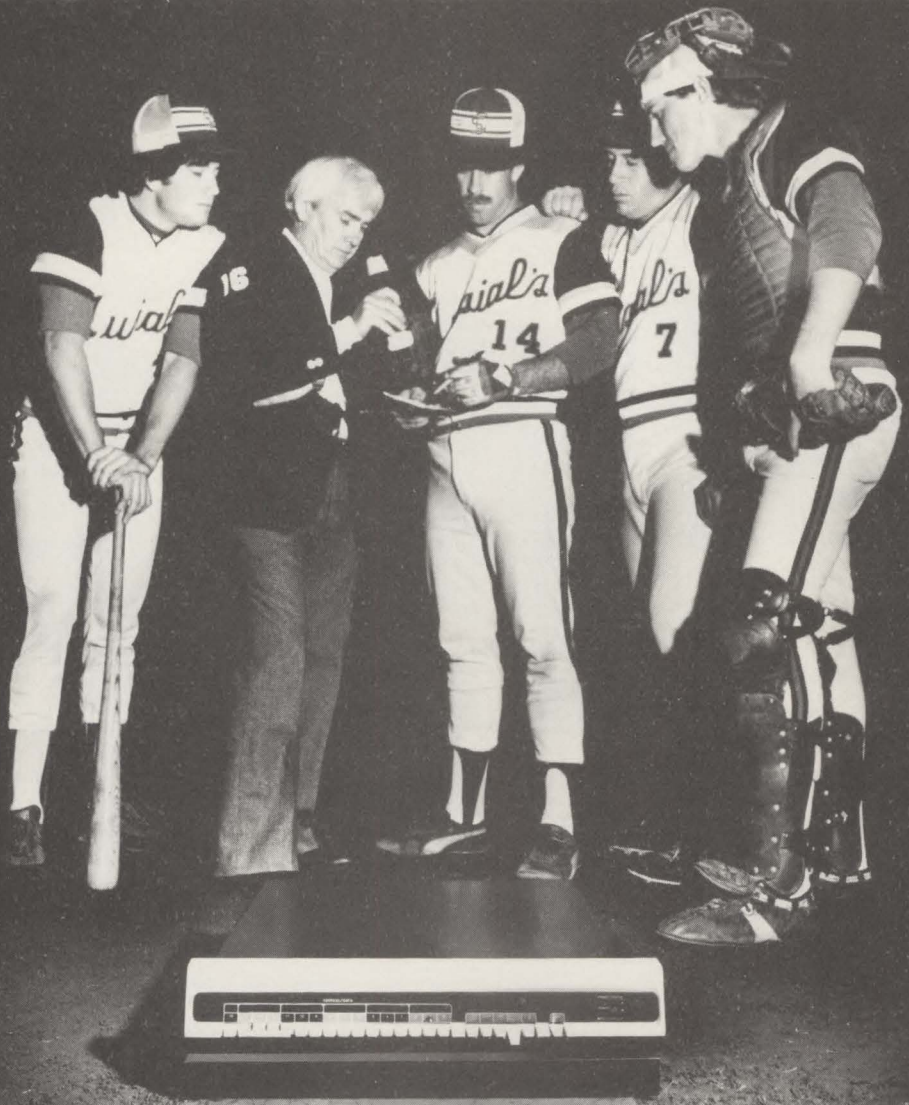

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CIRCLE NO. 9 ON INQUIRY CARD

Prime's 850 supermini uses multi-stream architecture

Continuing its assault on IBM turf, Prime Computer, Inc., has introduced a 32-bit superminicomputer that's claimed to equal the performance of mid-range mainframe systems in large multi-user applications.

The new supermini, designated the model 850, becomes the most powerful computer in Prime's product arsenal. It supports as many as 128 CRT terminals and accommodates 8M bytes of main memory. System prices range from $350,000 to $750,000, depending on the number of terminals, peripherals and communications and software support products specified. The new system is software-compatible with the rest of Prime's 50 series 32-bit computers.

The 850 derives its processing power from a novel dual-instruction stream architecture (see "An inside glance at the 850" p. 15), says Frank S. Madren, Prime's director of product planning and management. Unlike most other computers, which incorporate only one central processor, the 850 contains two processors that share a common memory and operating system, he explains. This enables the 850 to process two instruction streams simultaneously—hence its designation as a "multi-stream" system.

Madren claims that the Prime 850 is the first supermini to implement a multi-stream architecture. "The 850 breaks new ground. There's no other product like it on the market," claims Madren, although he concedes that the concept has already been pioneered on mainframe systems—notably the IBM 308L, which was introduced last November. Madren notes that the multi-stream technique differs from other multiprocessor approaches, such as nonstop systems and attached processor systems, in that the processors are not integrated into a single cabinet and do not share common memory and operating systems.

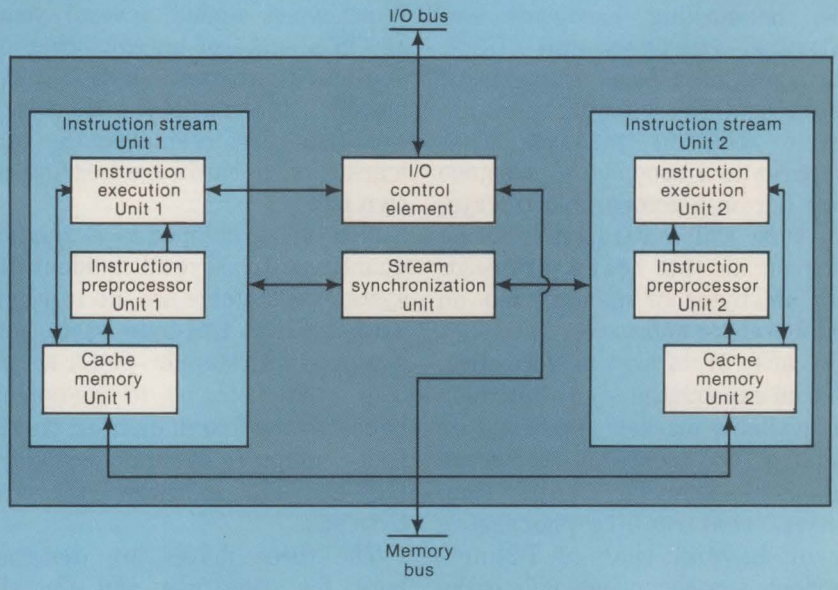
Because of its ability to process two instruction streams simultaneously, the 850 can achieve throughput rates as much as 50 percent greater than other superminis on the market, Madren claims, depending on the work load. For example, the system performs to best

AN INSIDE GLANCE AT THE 850

The 850 has two instruction processors called instruction-stream units, whose operation is coordinated by a third component, called the stream-synchronization unit. Each ISU consists of an instruction pre-processor, an instruction-execution unit and a cache memory. The instruction pre-processor maintains a queue of instructions that have been collected from the cache memory and decoded. The instruction-execution unit processes the queue of pre-processed instructions. This unit also handles process switching.

The cache memory serves as a high-speed (80-nsec.) buffer between main memory and the instruction processor. It holds as much as 32K bytes of instructions and data, which is twice the capacity of the cache used on the Prime 750. This allows the 850 to achieve a "hit ratio"—the percentage of time that instructions are in cache rather than main memory—of 95 percent.

The SSU manages cache memory, coordinates communications between the ISUs and controls memory access. Other features of the 850 include a burst I/O mode that allows 64-bit data transfers at an 8M-byte-per-sec. rate, and hardware support for floating-point and decimal arithmetic and character string operations.



advantage in applications, such as simulation and business data processing, where there are many users or large amounts of computations. "The 850 is a real workhorse in these types of applications," says Madren, who notes that the system's throughput edge derives from its parallel-processing ability rather than machine speed.

He says that Prime's throughput claims for the 850 are based on benchmark comparisons with the company's previous high-end supermini, the model 750, which is comparable in speed to the 850. He says earlier benchmark tests have shown that the 750 itself compares in speed to such competitive high-end superminis as Digital Equipment Corp.'s VAX-11/780 and Data General's MV-8000.

Madren says a user would have to turn to mid-range mainframe systems, such as the IBM 4341-2 or the DECsystem 2060, to obtain performance similar to the 850. "But those systems are substantially more expensive," he claims.

Price comparisons appear to substantiate Madren's claim. For example, a typical 850 system that includes a processor, 4M bytes of memory, 300M-byte disk drive, tape drive, 600-lpm printer, 20 terminals, networking hardware and software, FORTRAN and COBOL languages, data base management system and the PRIMOS operating system sells for $525,000. That compares to a $600,000 to $750,000 price tag on a comparable DECsystem 2060 and a $416,400 starting price on an IBM 4341-2 processor with 4M bytes of memory but no peripherals or software.

Because of its high performance, Madren expects the 850 to "broaden the available market" for Prime by enabling the company to reach customers—primarily large companies—that require processing power beyond that of Prime's previous systems. This will carry Prime deeper into IBM territory, but Madren is quick to point out that the company has already thrived in that market by offering "mainframe power at minicomputer prices"—a strategy that the 850 continues.

Besides being the first supermini to embody a multi-stream architecture, the Prime 850 also marks another milestone—the first use in a computer of 1M-byte memory boards, Madren claims. This enables system memory to be expanded to its full 8M-byte limit without the use of extra cabinets, he says. Prime is able to squeeze 1M byte of memory on a single board by using 64K-bit semiconductor chips—the highest density chips now available. Initial deliveries of the 850 are scheduled to begin next month.

In addition to introducing a new high-end system, Prime has also revamped the rest of its 50 series family, introducing upgraded versions of three systems, the models 150, 250 and 550, and discontinuing two models, the 450 and 650. The new low-end 150-II and 250-II systems support twice as many users (32 versus 16) and provide a 70-percent performance improvement, the company says. A typical three-terminal system starts at $86,000.

The mid-range model 550-II supports 50 percent more users than its predecessor and offers a 35-percent performance improvement for a 5-percent increase in price. The increased performance, Prime says, was made possible by quadrupling cache memory from 2K to 8K bytes, and increasing main memory from 2M to 4M bytes. A typical seven-user system starts at $190,000.

Although the 750 remains basically unchanged, enhancements to the PRIMOS operating system enable it to support 96 users compared to 64 users previously. A typical 15-user 750 system sells for $320,000.

—Paul Kinnucan

3M unveils Winchesters; casts lot with ANSI

3M Co., whose first fling at 8-in. Winchesters ended several years ago in a spate of lawsuits over its one-third interest in disk-drive pioneer International Memories, Inc. (IMI), has reentered the OEM market with hardware bearing its own name.

Now being shipped in evaluation quantities to several unidentified systems customers are the 10M-byte 8431 and the 20M-byte 8432, both equipped with stepper-motor actuators. Slated to be in customers' hands by the fourth quarter are the first samples of the company's high-end 8-in. hardware, the 60M-byte 8533.

The three drives are designed both for 3M's use and for the merchant OEM disk-drive market—a new forum for the company. OEM sales will initially be toward the low-end market now dominated by Shugart Associates with its SA1000 5M- and 10M-byte 8-in. Winchesters, and competing against the offerings

3M's 8533 Winchester-disk drive *packs 60M bytes of data into a three-platter package the size of the industry standard SA850 floppy-disk drive.*

Specifications of 3M's new 8-in. Winchesters			
Model	8431	8432	8533
Unformatted capacity (M bytes)	10	20	60
Transfer rate (K bytes per sec.)	933	933	933.33
Positioning times (msec.) track/track (forward/backward) average	18.6/25 65	18.6/25 65	6/6 29
Rotational speed	3125 rpm	3125 rpm	3125 rpm
Recording density	8649 bpi	8649 bpi	8555 bpi
Track density	219 tpi	219 tpi	693 tpi
Number of platters	1	2	3
Platter size	210 mm. (OD) x 100 mm. (ID)		
Dimensions	4.51 x 8.55 x 14.21 in.		
DC voltages	+24 VDC; +5VDC; −5VDC		
Interface standard	ANSI X3T9/1226		ANSI X3T9.3

of companies such as Quantum Corp.

Primary interest at 3M headquarters in St. Paul, Minn., however, focuses on the high-end 8533, a drive said to be the forerunner of a series of high-capacity drives equipped with voice-coil actuators and slated for introduction during the next few years. "Our product strategy is to develop this type of hardware," says Richard Layer, market development supervisor for all three drives. "Ultimately, the 5¼-in. Winchester will dominate the market for drives in the under-50M-byte categories, while the market for 8-in. hardware will go as high as the 700M-byte level. As a result," he continues, "the 8400 series drives will probably be our first and last low-end Winchesters. We view them essentially as learning-curve devices, and anticipate that low-end applications will constitute a vestigial market for us within 15 months."

Layer points out, however, that these drives have several features not usually found on lower capacity hardware, the most important of which 3M feels is an ANSI interface in place of the de facto standard set for low-end drives by the SA1000. "We've bet the ranch on the ANSI interface," he says. "To use the SA1000 idea would have meant degrading the performance of the drive."

3M's decision to go with the ANSI interface standard—one not commonly used by vendors of 8-in. Winchesters—was reached partly as the result of feedback from potential customers for the new drives, Layer reports. "We've done a lot of market research on this subject, and a lot of our potential customers put a lot of value on the ANSI interface."

The company's research also indicates that customers prize reliability when it comes to Winchesters. One feature incorporated into both drives that promotes reliability is a dual chamber that uses a pressure differential between the head/disk assembly (HDA) and the lower area in which the spindle and actuator motors are located. Layer says higher pressure in the HDA pushes any contaminants coming off the heads and spindle bearings away from the media. The moving air created by the pressure difference also cools the motors, he adds.

Despite these features, Layer will not go so far as to say that 3M's new hardware is more reliable than any other 8-in. Winchester now on the market. He does claim, however, that "3M had better drive designers involved in the project," confirming that all three drives were the work of free-lance designers. "The 8400 series drives are now in our hands, and the 8533 is in the process of being turned over to us," he says. "Future drive developments will come from our own facilities."

The first of these 3M-designed drives could take the form of a 200M-byte three-platter Winchester equipped with thin-film read/write heads, he says. This drive could appear in late 1982 or early 1983, he adds, noting that later versions could be equipped with heads built in-house, a project scheduled to get under way in about two years.

A few enhancements to existing products are due before that, however. Scheduled for the third quarter, Layer says, is a soft-sectored controller for the 8533 and a packaged subsystem comprising the 60M-byte Winchester, a controller and one of the company's 75M-byte HCD-75 ¼-in. tape-cartridge drives for backup.

Prices for these future products have not been set, Layer says. Prices for the 8431, the 8432 and the 8533 in quantities of 50 to 99 are $1695, $1925 and $3745, respectively, including the electronics needed to read and write data, a data separator and an ANSI interface card.

Price of the 8400 series drives with basic control electronics only (what 3M calls a drive module) is $1100 in 50- to 99-unit quantities for the single-platter 8421, $1375 for the dual-platter 8422 and $2570 for the 8523.

"3M is pricing its hardware very aggressively," notes one source, comparing it to the 10M-byte SA1000 ($1500 in quantities of 50 to 99 without a data separator but with drive electronics). "They're a latecomer to the 8-in. market and they'll have to buy their way in."

Layer disagrees. "We do not feel we have to go that route to get market share, and will not accept

the lower margins typical of the OEM business when it comes to selling drives." He says the company anticipates that the as-yet-unnamed disk-drive operation will operate at the same margins as 3M's other divisions. "There is a definite relationship between market share and profitability," Layer adds.

However, Andy Roman, a Newark, Calif., industry analyst and publisher of *Random Access International* newsletter, says, "There is an inverse relationship between the two. If 3M wants both at the same time, they're restraining themselves. They must set some priorities since they're the new kid on the block."

Another West Coast analyst agrees: "The concept of market share and profitability misses the point if you're starting from ground zero like 3M is," he says. "As part of your strategic long-term planning, then, you must be prepared to take horrible margins for a finite period."

Despite 3M's initial pricing schedule for its new drives, this consultant cautions that, in the past, "3M has never had any qualms about raising prices if it had problems with profitability. Any serious customer knows this."

Layer, on the other hand, believes that potential customers for the new drives will look at other considerations besides prices—namely the performance enhancements derived from the use of the ANSI interface, for example, and the higher reliability that he says flows from other design features incorporated into the new hardware. "We've priced these drives for value," Layer says. "If we deliver a good product, it will pay for itself."

—John Trifari

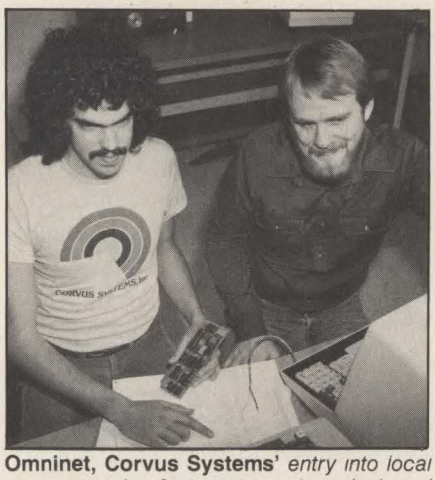
Local area network links μcs via custom interface

While the debate over network standardization continues, competition to provide local area networks for office-of-the-future applications keeps growing. Now, Corvus Systems, Inc., has entered the fray with Omninet, a plan to link personal μcs into a 1M-bit-per-sec. network via twisted-pair cables.

The San Jose, Calif., company says Omninet will hook up to 64 Apple, S-100-bus or LSI-11-based systems and peripherals over 4000-ft. RS422 serial lines at a price less than $500 per processor.

Key to Omninet, says vice president of product development Mark Hahn, is the transporter, an intelligent interface board built around a Motorola 6801 μp and a Corvus-designed gate array chip that handles direct memory access functions. This custom chip is built for Corvus by Interdesign, Inc., Sunnyvale, Calif. There is also a Motorola 6854 serial controller chip on board, as well as specific processor interface circuitry that matches the DMA and bus structures of the processor to the network.

The transporter, says Hahn, implements the first four layers of the International Standard Organization's (ISO) seven-layer network-protocol model. These four layers, called the transport layers, provide the means of moving messages through the network. "All devices on the network," Hahn explains, "must pass through a transporter." All network control is embedded in the interface, he continues, reducing the number of I/O drivers needed in the host while cutting the number of cables necessary to connect the nodes.



Omninet, Corvus Systems' *entry into local area networks, features a custom-designed intelligent interface board, says product development vice president Mark Hahn, (left), shown with Omninet project manager Phil Belanger.*

Omninet is a carrier-sensed multiple-access (CSMA) network, Hahn says. CSMA is a random access scheme in which nodes are handled on a first-come, first-served basis. Some sources claim that such a scheme poses serious drawbacks for heavily loaded networks; messages may collide frequently, reducing the network's efficiency.

Xerox's Ethernet, also a CSMA network, has a collision-detection routine built in. However, Hahn says Xerox has reported a collision rate of less than one percent. For that reason, and because Hahn believes collisions will occur more frequently in heavily loaded systems—not one of 64 nodes such as with Omninet—Corvus did not include collision detection. "Ethernet is a very ambitious network," he says. "They put everything on it they could think of." Hahn expects Omninet's collision statistics to be "at least as good as Ethernet's." There is no full 64-node Omninet running, but Hahn says that, so far, collisions on the six-node network being tested "have been extremely rare."

Omninet moves data in packet formats, says Hahn. Packets do not

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3 MIGRATION FROM 10 TO 60 MEGABYTES AND BEYOND.

The third benefit the 3M Compact Disk Drive family gives you is the migration needed to keep up with user demands. Migration that won't dead-end your customers, or cost them an arm and a leg to obtain.

The 3M 8431 drive offers a total unformatted capacity of 10 megabytes on a single disk, with 8649 BPI and an average track density of 219 TPI. The 3M 8432, with two disks, delivers 20 megabytes, with the same bit and track density. The 3M 8533 offers 60 megabytes on three disks, with track density increased to 693 TPI. Modularly expandable, the drives offer you and your customers cost-effective increases in capacity from 10 to 240 megabytes.

4 THE "SUPER-CLEAN" AIR SYSTEM.

Because reliability is so critical to the operation of a sealed-environment disk drive, the drives have a specially-engineered super-clean air system (patent pending). A cast aluminum deck, for example, separates the heads and media from the motors: a feature that helps make 3M's super-clean air system distinct from ordinary systems. Air is cleaned to 10 particles per cubic foot/minute or less.

5 AND OTHER OUTSTANDING FEATURES.

Like microprocessor-controlled rotary actuators (patent pending), drive modularity, data separation and direct track addressing, and low power consumption. Right now, these new drives are the only ones that give you *all* of these features in one 8" Winchester package. It's time to evaluate them against the competition. For complete information write to:

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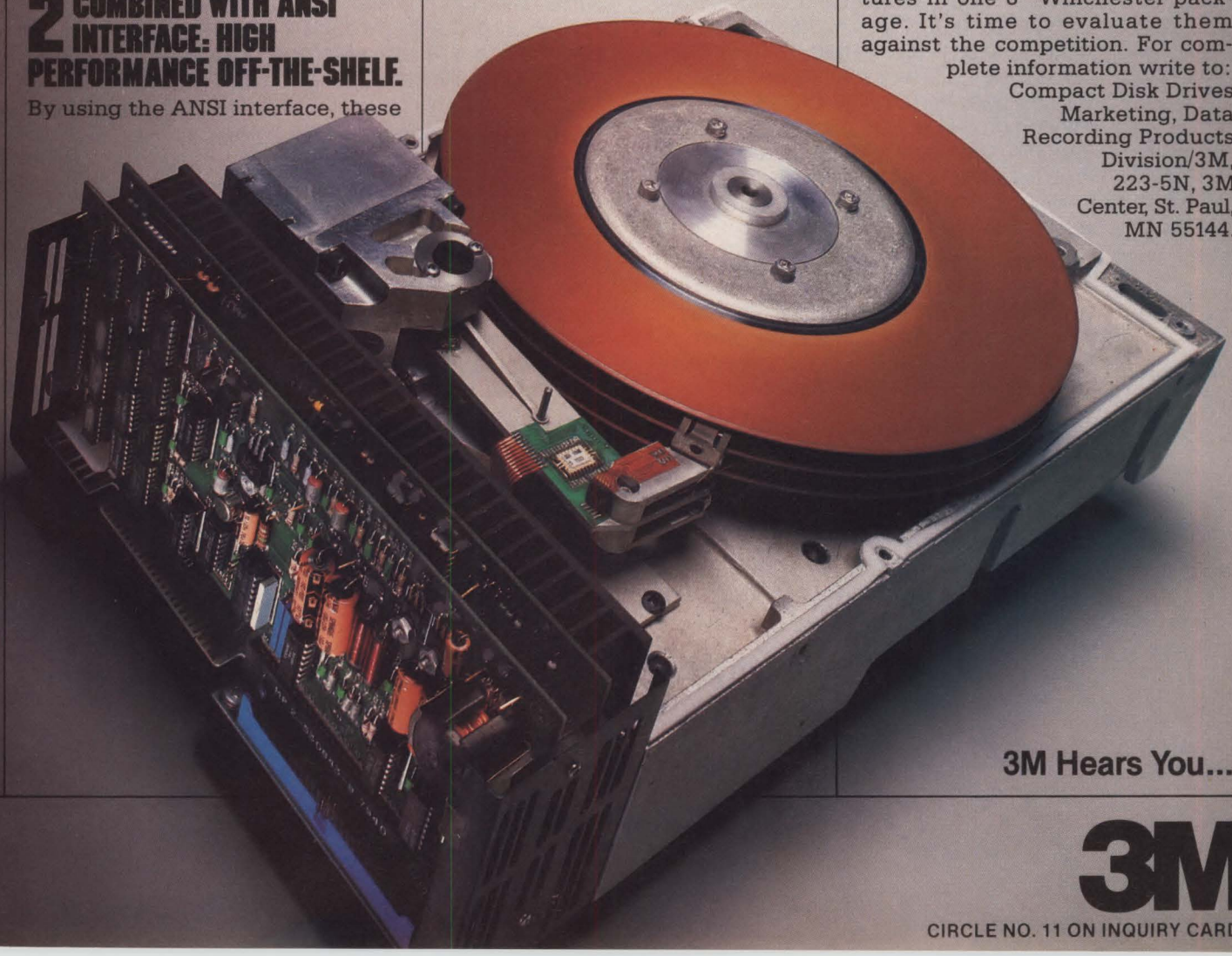

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CIRCLE NO. 11 ON INQUIRY CARD

Sapphire™ 160

Introducing a new standard in 160 megabyte, 14-inch Winchester disk drives.

Replaces the CDC 9730, DEC RM80 and others. Here is a new standard in 14-inch Winchester disk drives — the Sapphire 160 from Tecstor. A 160-megabyte fixed disk drive that is a direct replacement for Control Data Corp.'s 9730, DEC's RM80 and other high density Winchester drives. The Sapphire 160 has an SMD-compatible interface with execution of instructions performed by microprocessor-controlled electronics.

Available now. The Sapphire 160 is a mature product, is in production, and is available now. Utilizing up to four fixed disks, the Sapphire 160 disk drive, with 6400 bits per inch and 600 tracks per inch, can operate in non-air conditioned environments. It is ideal for expanded data storage with today's new generation of minicomputers.

In an ancient tradition. According to Greek legend, the Sapphire gem could preserve its wearer from envy, protect against captivity and serve as the key to understanding the sayings of the oracles. Tecstor's Sapphire 160 disk drive is in the same tradition. It preserves vital data records, it protects through specially designed data security features, and it can be a key element within an OEM system.

Backed by experience. Tecstor was founded by five principals who have many years of experience in manufacturing, engineering and marketing peripheral products, especially Winchester disk drives. They are committed to the OEM marketplace. Dedicated to providing the high quality products and responsive support and service that OEM's expect. And, as a new company, Tecstor has substantial capital financing through a number of blue chip venture capital firms. And, Tecstor has a 32,000 square foot manufacturing facility to handle the most demanding production requirements.

To find out how Tecstor's Sapphire 160 can be your new standard in Winchester disk drives, call or write today to arrange for an OEM evaluation unit.

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CIRCLE NO. 12 ON INQUIRY CARD

have to have the same length, but they cannot be longer than 2K bytes, he adds.

The first Omninet transporter boards are aimed at Apple II and Digital Equipment Corp.'s LSI-11 machines. Hahn says other interfaces will follow by the end of the year and will include boards for the TRS-80, Atari, Commodore PET, Altos and any S-100-based system.

Omninet is also available for licensing, Hahn points out. Corvus has inked the first such license with systems builder Onyx Systems, Inc., San Jose, Calif. An Onyx source says Omninet will be available on the company's 16-bit C8000 systems for Onyx-to-Onyx networks by the end of the third quarter.

Onyx and Corvus will work jointly to develop the C8000 transporter, says the source, which will be available from Onyx. No price has been determined. The source adds that Onyx will design the upper layers of the ISO protocol—the so-called user layers that allow the user to interface to the network. "These are the trickiest issues," says the source, because they involve the system's operating system software.

Onyx's C8000 is a UNIX-based machine, he points out, adding that UNIX is "ideal for network environments." Whatever Onyx does about the user levels, the source concludes, the company will design the software to be transportable to other networks.

Omninet arose from Corvus's involvement in providing mass-storage systems to small, μp-based machines. The company's first network-like product, introduced in late 1980, was Constellation, a back-end system that linked 64 processors to Winchester-disk drives over flat cables. "When your customers are paying about $1000 for a CPU and more than $5000 for disk storage, they ask, 'How many CPUs can we attach to that disk?' not vice versa," Hahn says. "We knew we had to share our disks, but we knew that we needed better communications, too."

Hahn says that Corvus examined Ethernet but saw some fundamental problems with it, such as the high price of coaxial cable. Further, he explains, the transceivers are expensive, and Ethernet's transmission speeds—10M bps—are too fast for the kinds of processors Corvus intended to network.

"The office of the future has to be inexpensive," Hahn declares. "We think it's important that a customer be able to go into a local computer store and buy a processor and the hardware to install a network without having to undergo massive reconstruction of his offices." Twisted-pair cable is inexpensive, says Hahn, and installation is trivial.

Hahn does not think Corvus is guilty of proliferating one more network. "We see no competitive network for personal systems now." Moreover, he claims, "we're very similar to Ethernet."

Omninet transporters are priced at $495 for Apple and S-100 systems, and $750 for LSI-11s. An interface to link Corvus's disk subsystems to Omninet is $990. Hahn intends to offer gateways to Ethernet, IBM's SNA and other networks by next year.

—Larry Lettieri

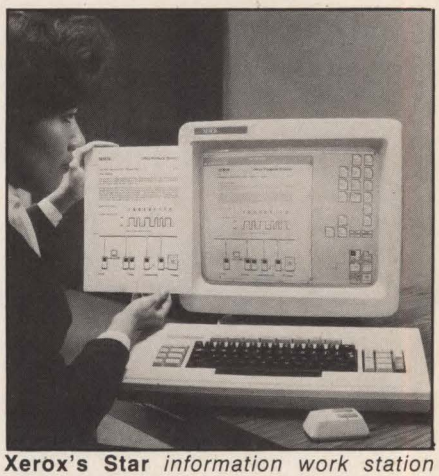
Xerox's 'Star' shines on professionals

Citing a higher return on investment for personal work stations geared toward business professionals than for those designed for executives, Xerox Corp. has aimed its new Star 8010, a mulifunctional office-information terminal, at the white-collar segment.

Other companies, including IBM and CPT Corp., have addressed the office-automation market with products intended for secretaries, while Prime Computer, Inc., and others offer systems for executives and managers. Xerox intends to address those two groups, but is betting heavily with Star that business professionals are a crucial market.

Star represents the largest R & D investment by Xerox to date, says Don Massaro, president of the company's Office Products Division in Dallas. The division is the focal point for Xerox's entry into the office-automation market, and its entire sales force is dedicated to systems for large customers. "Star is a major cornerstone of Xerox's strategy. Products of this class will form the cornerstone of the entire office-automation industry," claims Massaro.

It is, perhaps, fitting that the fruits of the company's largest R & D expenditure, which took eight years, are dedicated to individuals who, Xerox claims, by virtue of



Xerox's Star *information work station includes ease-of-use features such as the "mouse" cursor controller (shown below keyboard) and on-screen pictorial icons, which give users easy selection of system resources.*

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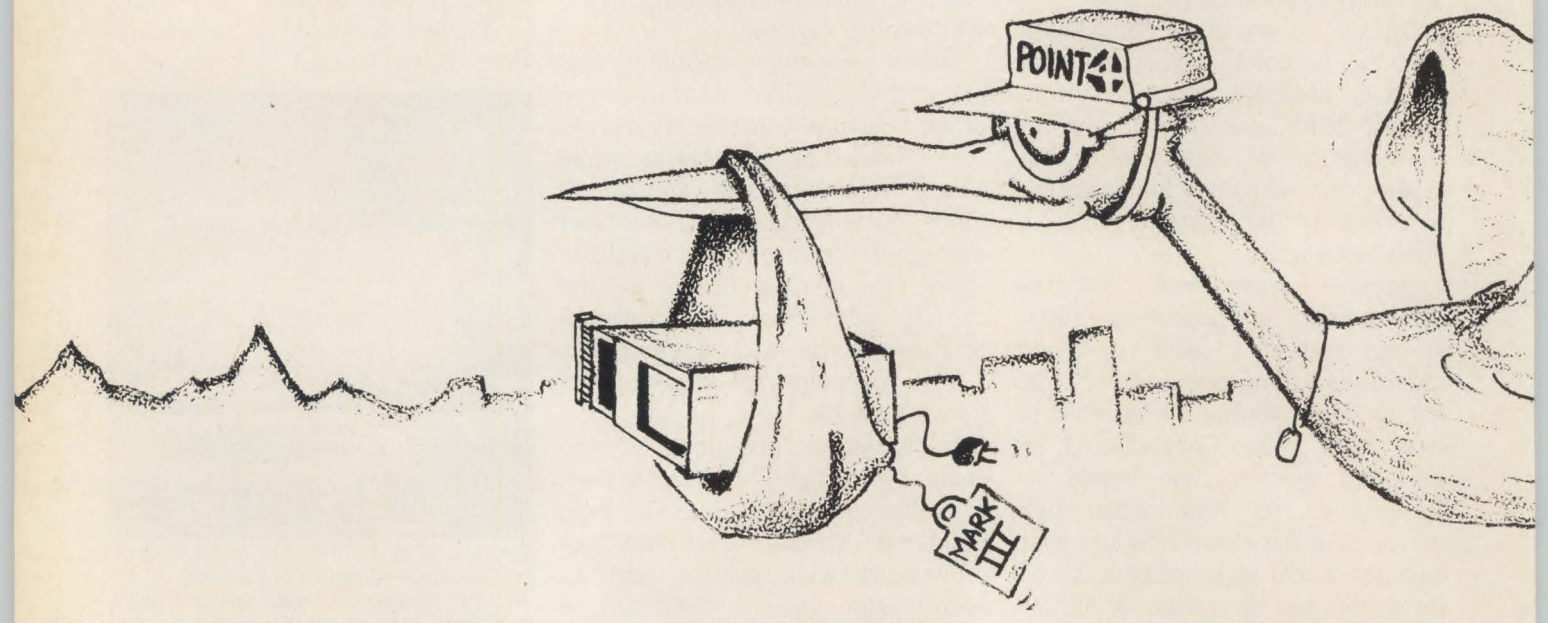

CIRCLE NO. 13 ON INQUIRY CARD

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available peripheral devices. The MARK III features a 600 nanosecond cycle time, up to 64 KBytes of RAM on the same PCB with the CPU, and a revolutionary new Peripheral Interface Board (PIB). This PIB is equipped with a built-in 4-port multiplexer, an integrated SMD/CMD disc controller for both Winchester and conventional disc drives, and a microstreamer tape controller for back-up.

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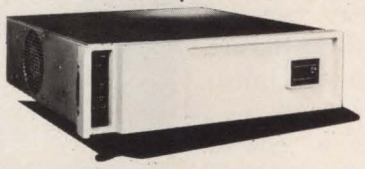

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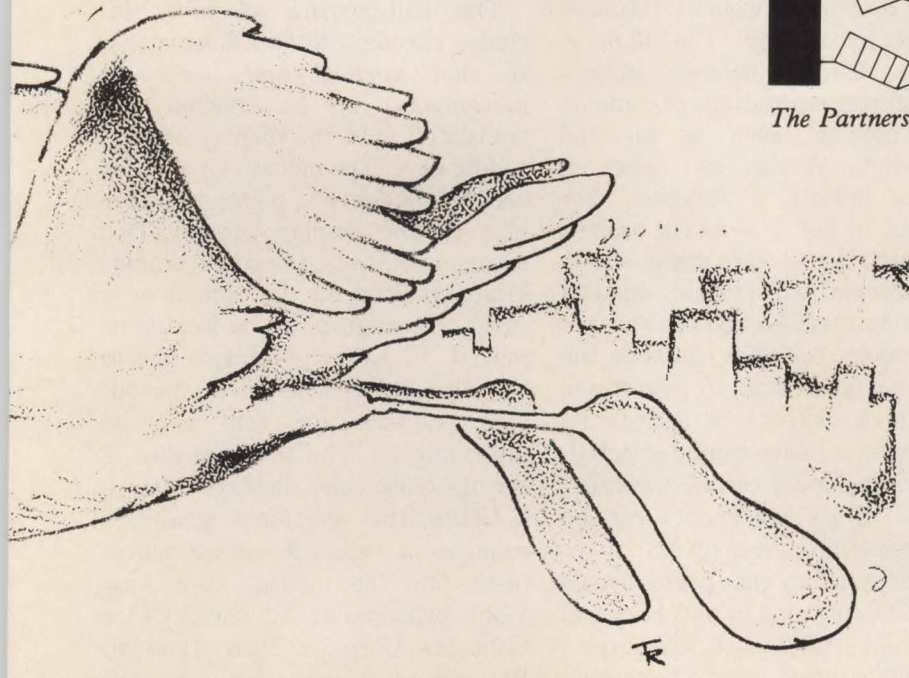

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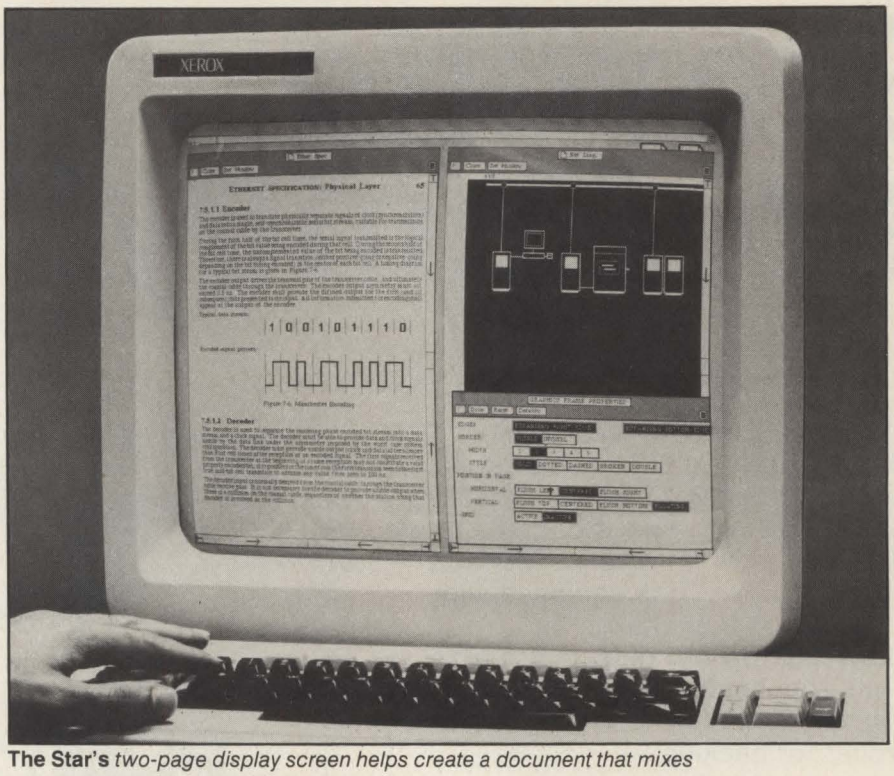
their numbers and high salaries, account for about 80 percent of the cost of office work. Professionals including engineers, accountants and analysts process ideas, but they may not want to type or to learn how a computer works. Output from these people, who earn between $2000 and $5000 a month, includes reports and documentation.

Xerox claims that some of those individuals' work is lost because of time-consuming office procedures. "We are limited in the amount we get from these people by the amount of work that can be squeezed through typists or the art department," says OPD vice president David Liddle.

Star is viewed as a system product that combines computing, text-editing, graphics and communications functions. The system can, for example, produce a report that includes charts and text. It can work on Xerox's Ethernet local area network, which is installed in about five commercial locations, and with other Xerox products on that network, enabling users to access each other's information.

Designed as part of the 8000 network system, which was announced last November (MMS, January, p. 14), Star includes a two-page desk-top display, keyboard, processor and a cursor control device called a mouse, which was developed by Stanford Research Institute. It incorporates a Xerox 8000 16-bit processor with 192K bytes of main memory. Two models are available: the 8011 with a Shugart SA1004 10M-byte, 8-in. Winchester-disk drive, which holds 6M bytes for users, and the 8012 with a Shugart SA4008 14-in. Winchester that stores 29M bytes. Each model has a Shugart SA850 double-sided, double-density, 8-in. floppy-disk drive that holds 1.2M bytes. Each model also contains an internal controller and the cabling needed for connection to the 10M-bit-per-sec. Ethernet network.



The Star's *two-page display screen helps create a document that mixes text and descriptive graphics.*

Price of the standard 10M-byte drive version is $16,595, including basic software. Large-volume discounts will exceed 20 percent, the company says. Printers are priced separately.

The terminal's display and mouse cursor controller promote intuitive thought by a user. The 10.6- × 13.6-in. display includes icons—pictorial representations of common office objects, such as in- and out-baskets. A user can select an icon to initiate a function. For example, he points to an out basket, and that action sends a document on an electronic mail system. Instead of walking to a file cabinet to search for a report, the user can open the electronic file drawer by pointing to the icon. A contents list appears on the screen, a folder can be selected, and the document can be accessed. A total of six documents can be displayed simultaneously.

Liddle explains that professionals would rather point to and select an object, using the mouse, than type a series of instructions on a keyboard. The mouse is approximately the size of a cigarette package, with two buttons on the top and a ball-bearing assembly on the bottom. It literally makes Star a desk-top system, because the mouse must be moved on a desk-top surface.

The ball-bearing assembly includes encoders in two dimensions, so that vertical and horizontal movements can be tracked and translated onto the display screen, Liddle says. The mouse can address each of the 800,000 points in single bits on the display screen. Two signaling buttons, select and adjust, locate an icon on the screen or a word or paragraph to be located or moved. Lines on pre-drawn charts can also be lengthened or moved, and graphics and text can be intermingled. The terminal also is set up to use color displays later.

Using the system's graphics requires a versatile cursor movement like the mouse, says Amy Wohl, principal at Advanced Office Concepts Corp., a Bala Cynwyd, Pa., office-consulting firm. She says

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CIRCLE NO. 14 ON INQUIRY CARD

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Now there's a fast, easy way for you to capture these advantages in your products: the iSBC 254 Bubble Memory Board. It puts from 128K to 512K bytes of Intel's 7110 bubble memory—complete with controller and support circuitry—on a 12 x 6.75-inch Multibus board. That's the same bubble memory and controller that's already storing data onboard ships and on factory floors. All pretested. And ready to run in your system today.

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Add fuel to the fire

What's more, you can complement the performance of the iSBC 254 board in your system with any of a wide variety of Intel® Multibus boards

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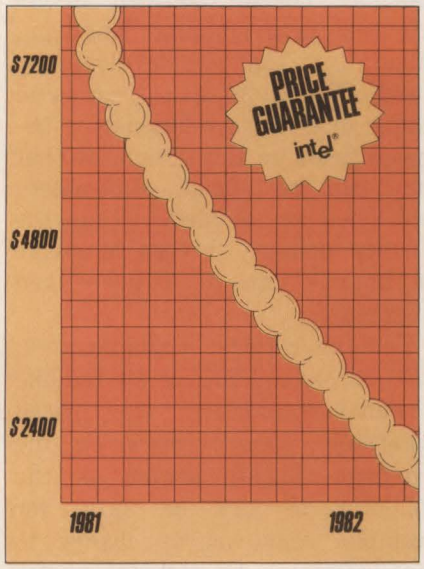

Pricing for the iSBC 254™ board tracks the downward price curve of bubble memory components.

and software products available today. From 8- and 16-bit single-board computers, to analog and digital I/O, to real-time operating systems, complete with software drivers for bubble memory. Or if you want to configure your own board, you can start with Intel's Bubble Memory Prototype Kit (BPK72). It has everything you need to tailor Intel's 1-megabit bubble memory to your product.

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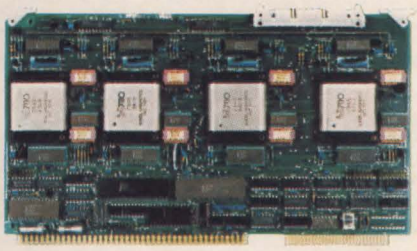

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the mouse is clumsy to use, however, and variations for input might include a joystick, golf ball or CAT (capacitance activated transducer), a touch membrane typically located next to a keyboard. Wohl likes the idea of icons, but says they belong on a different product. "The inherent attractiveness of the icon is for infrequent users," she says. And the icons' simplicity is not insulting to users' intelligence because pictures transmit information more quickly than words do.

Wohl says Star is not a management work station because it is too expensive and complex for general-purpose management use. She says its most appealing use may be with other 8000 series devices, specifically the high-resolution 8044 printer.

The model 8044 print server includes the file server's processor, disk storage, keyboard/display and a 12-ppm, 300-dpi laser printer.

The Star also can access a communications server for inter- and intra-Ethernet communications, and a file server electronic filing cabinet that can be used for electronic mail. The filing cabinet includes a high-speed processor terminal and choice of disk drives. Star terminals also can accept and produce information formatted on a Xerox 860 word processor.

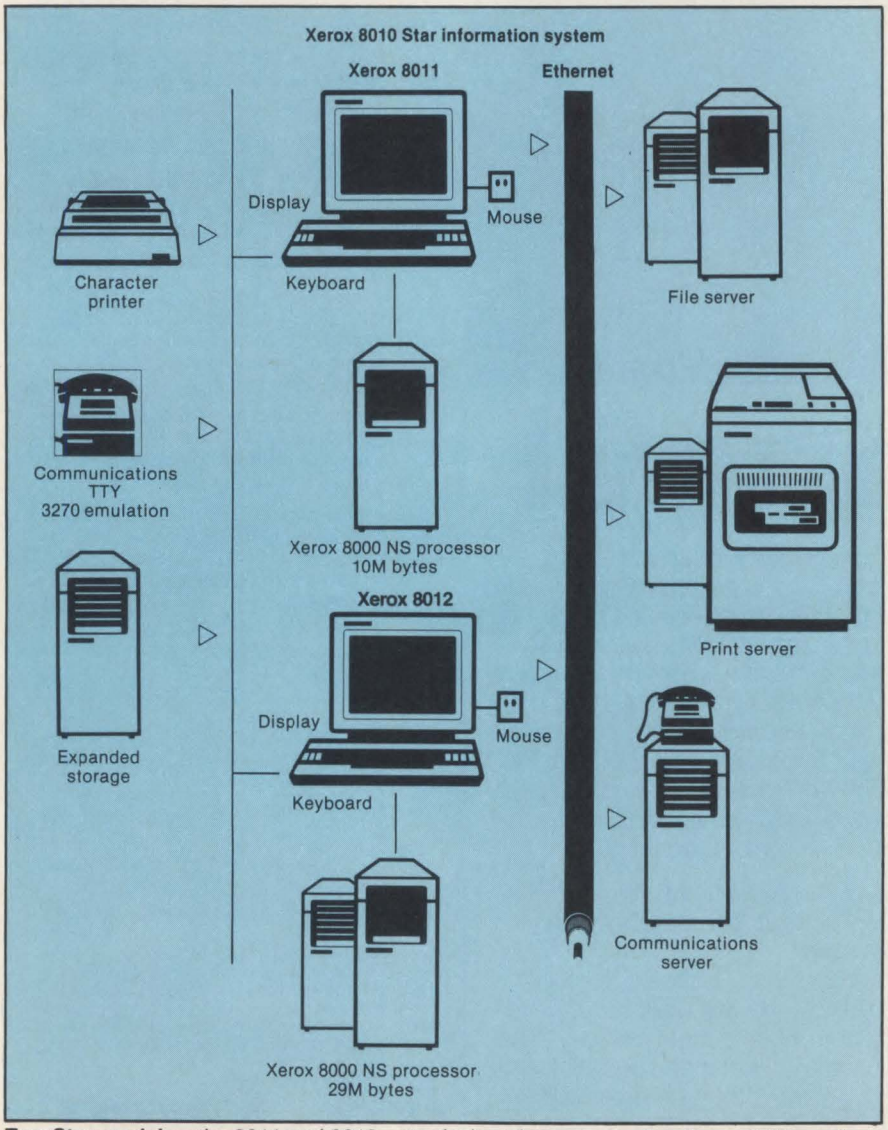
The print server can duplicate whatever appears on Star's screen, including additional typefaces from 8 to 24 points, equation symbols, charts, diagrams and other symbols.

Star's ease of use is partially the result of Xerox's extensive tests of users' needs. Star was tested in-house over the last eight months. Using video tapes, Xerox modified human-interface problems so that the system can be used within 20 min. A user can gain proficiency with the system within four hours using a self-training program.

The difference between Star and its predecessor Alto is that the application and software packages developed on Alto, based on users' reactions, were not developed in an integrated way, Liddle says. Star represents the integration of user-driven applications.

Standard software included in Star's base price includes text editing, graphics, electronic mail, filing, printing on the 8044 print server and aids. Optional software, priced separately, includes records processing, equations, data-driven graphics, foreign languages, a spelling checker and an office-oriented programming language, called CUSP, that was developed by Xerox. With CUSP, a user can write simple arithmetic relationships between fields on the screen, so that they can be added, subtracted, multiplied or divided. Using the bit-map display, foreign language keyboards can be represented on-screen.

Communications, including 2770, 2780, 3270, and TTY or VT-100-like terminal interaction, are priced separately. One window on the two-page display serves as the emulator to TTY or 3270, for example, requiring no change to host software. All terminal emulators will be available by the first quarter.



Two Star models—*the 8011 and 8012—are designed to access other Xerox 8000 products for use on the Ethernet network, such as the print server, communications server and file server, which can act as an electronic mailbox.*

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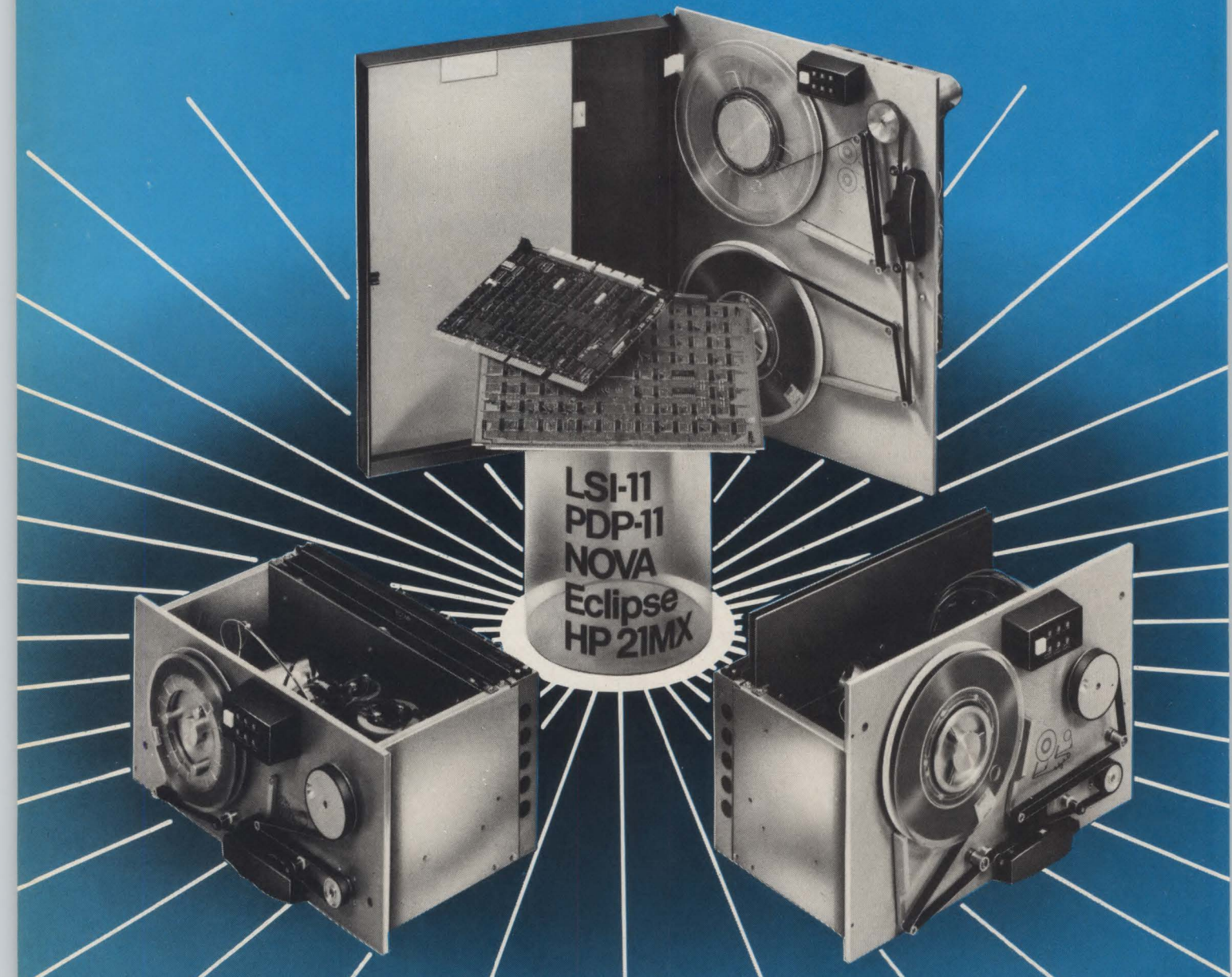


CIRCLE NO. 17 ON INQUIRY CARD

The first Star installation is scheduled for July, and deliveries in 32 metropolitan areas in the U.S. will begin in September. An enhanced customer programming language for automatic updating of records and reports, and additional software, will be available next year.

Three other announcements are expected this year. Industry observers speculate that a lower priced terminal and intelligent typewriters will be among them.

—L. Valigra

Micro-Winchester subsystem is Multibus-compatible

What may be the most unusual application of a micro-Winchester-disk drive to date will be available this month when Anova Corp. starts delivering its Cardisk model 1/2105. The storage subsystem sandwiches a 5¼-in. Winchester between two Intel Multibus-compatible controller boards that will handle two hard disks, four floppy-disk drives and two ¼-in. streaming tape-cartridge drives. The modular unit, say Anova executives, plugs directly into a Multibus card cage and provides as much as 20M bytes of hard-disk storage, 4M bytes of floppy-disk storage and 40M bytes of tape storage.

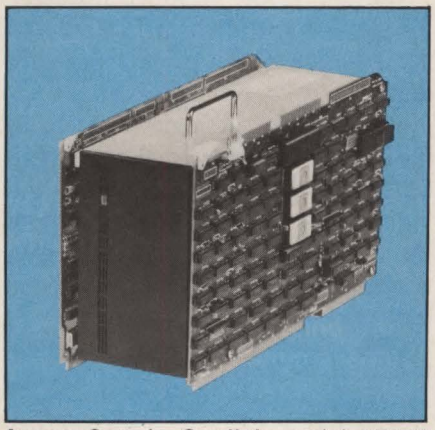
Dale Williams, CEO of the Oakland, Calif., firm, says the model 1/2105 is the first in a series of Multibus-compatible modular subsystems from his company.

The Cardisk package occupies six slots in a standard Multibus card cage, says Williams, although only two slots are needed for the electrical connections. The unit is approximately 4.2 in. wide, he adds.

The 1/2105 uses the Seagate 6.38M-byte ST506 or the new thin-film-head, 12.76M-byte ST512. Moreover, the device will accommodate single- or dual-density 5¼- or 8-in. floppy drives, plus an Archive Corp. ¼-in. streaming tape-cartridge drive.

The electronics to handle these devices are contained on two Multibus-sized boards that fit on either side of a specially designed chassis that holds the Winchester. Handles on the chassis allow field installation of the module.

Anova president David Wyland says the controller boards use a conventional μp, which operates in two modes. One handles error detection and correction, command decoding and other typical controller functions. The other is a microprogrammed mode for disk-drive data messages and Multibus DMA transfers, says Wyland.



Anova Corp.'s Cardisk *model 1/2105 sandwiches a 5¼-in. Winchester between two Intel Multibus-compatible controller boards that will handle two hard disks, four floppy-disk drives and ¼-in. streaming tape-cartridge drives.*

The controller meets IEEE's new Multibus standard for memory addressing, Wyland continues. Therefore, the device can handle 16-, 20- or 24-bit addressing schemes. The system also includes a capability for a second Winchester, Wyland says, but that drive will not be a part of the plug-in package.

Williams doesn't foresee problems with the physical requirements of the module. "Eight, 10, 12, even 20-slot chassis are not unusual today," he says. The average chassis size is about 15 slots, he adds. "Besides eliminating separate controllers for Winchesters, floppies and tapes," Williams claims, "the device adds 10M bytes of storage."

Deliveries are slated to begin this month, says Williams. Price for the 1/2105 is $3000 in OEM quantities.

—Larry Lettieri

ADDS, Televideo unveil low-cost dumb terminals

With two of the top three dumb CRT terminal manufacturers introducing products at prices well below the industry average, a new floor in low-end terminal prices may be developing. Both Applied Digital Data Systems (ADDS), Hauppauge, N.Y., and Televideo Systems, Sunnyvale, Calif., recently announced offerings for less than $700.

First on the market in March, the ADDS Viewpoint sells for $650, in single-unit quantities. Televideo's 910, announced in April and shown at NCC, sells for $699. Both terminals are commodity items aimed at low-end office applications.

As one ADDS spokesman says: "The market is ready for a terminal like Viewpoint with all the

small-business systems, time-sharing and μcs being installed every year."

The LSI-based Viewpoint terminal offers a 12-in. tilting CRT screen, which can display 1920 characters in 24 lines of 80 characters each, and is available with an optional $15 anti-glare filter. A Selectric-style removable keyboard, attached to the CRT via a coiled cable, provides cursor control, a numeric pad and three function keys generating six codes. Viewpoint offers speeds as high as 19,200 bits per sec. and has a 10,000-hr. MTBF, according to ADDS spokesmen.

Televideo's 910 μp-based terminal features a 12-in., non-glare, etched CRT screen, which eliminates the need for "distorting" glare filters, company sources say. Like the Viewpoint, the screen displays 1920 characters in 24 lines. An attached non-movable upper- and lower-case keyboard contains cursor control keys, a numeric pad and 11 function keys. With speeds as high as 19,200 bps, the 910 is switch-selectable to run ADDS, Lear Siegler and Hazeltine programs.

ADDS' Viewpoint terminal, *designed for high-volume applications, offers a movable keyboard with numeric pad and sells for $650.*

Lear Siegler Inc., rated as the leading low-end terminal manufacturer in terms of units shipped, has no terminal on the market priced competitively with the Viewpoint or the 910. The company's lowest priced product, the ADM 3A, sells for $895, in single-unit quantities. "The new terminals are bound to cut into a certain amount of our business," says Del Bridge, manager of dealer and distributor accounts at Lear Siegler. Although Bridge says that his company is "always devoting research to the development of low-priced products," he adds that such a product would not replace the hot-selling ADM 3A.

"There are certain high-volume applications where people stay with a system because of its high reliability," Bridge says. The ADM 3A has an 18-month MTBF.

Gordon Hope, product manager for the ADDS Viewpoint, attributes the terminal's low price to system design and vertical integration.

By reducing the logic to 11 chips, including the custom-designed video controller, and by combining the video control and power supply circuitry on one board, he says, ADDS was able to cut its testing and manufacturing costs.

The video control chip, manufactured by Standard Microsystems, Hauppauge, N.Y., works with a Zilog Z8 μp to translate data from a host computer into signals that drive the CRT monitor and display characters.

Hope adds that his company can further reduce costs by producing all of Viewpoint's components—transformers, plastic molding, circuit boards and monitors—at the company's Draper, Utah, manufacturing facility. Those pieces are assembled at the company's Long Island plant.

"People were shaking their heads wondering how we could produce this product at such a low price and make money on it," says Hope. "The Draper facility is the answer. We make virtually everything."

Richard DuBridge, executive vice president at Televideo, says that economics of scale and partial off-shore assembly aid in lowering the 910's price.

"We buy parts and chassis in the millions and then mass-produce the terminal on an assembly line that is a paragon of the industry," says a company spokesman. The chassis, screen and screen electronics are built in Korea at a Televideo-owned facility and then shipped to the company's Sunnyvale, Calif., plant for assembly with the logic keyboard electronics.

While Televideo spokesmen decline comment on how many 910 units the company expects to ship this year, ADDS hopes to ship 30,000 Viewpoint units and, company sources say, has received distribution orders for more than 5000. Both terminals are available with OEM discounts. *—Frank Catalano*

H-P offers low-cost desk-top system

Five years after Hewlett-Packard Co. introduced its HP 9825 desk-top computer, the company is offering a new version of the popular device. At the same time, the firm's Fort Collins, Colo., desk-top computer division is introducing enhancements to its HP 9845 desk-top series.

Like other 9825s, the new 9826A is aimed at the scientific and engineering computation and graphics markets. However, H-P officials say, the new desk-top computer is geared to individual users and sells for less than $10,000.

The 9826A represents a first for H-P, in that it is the company's first

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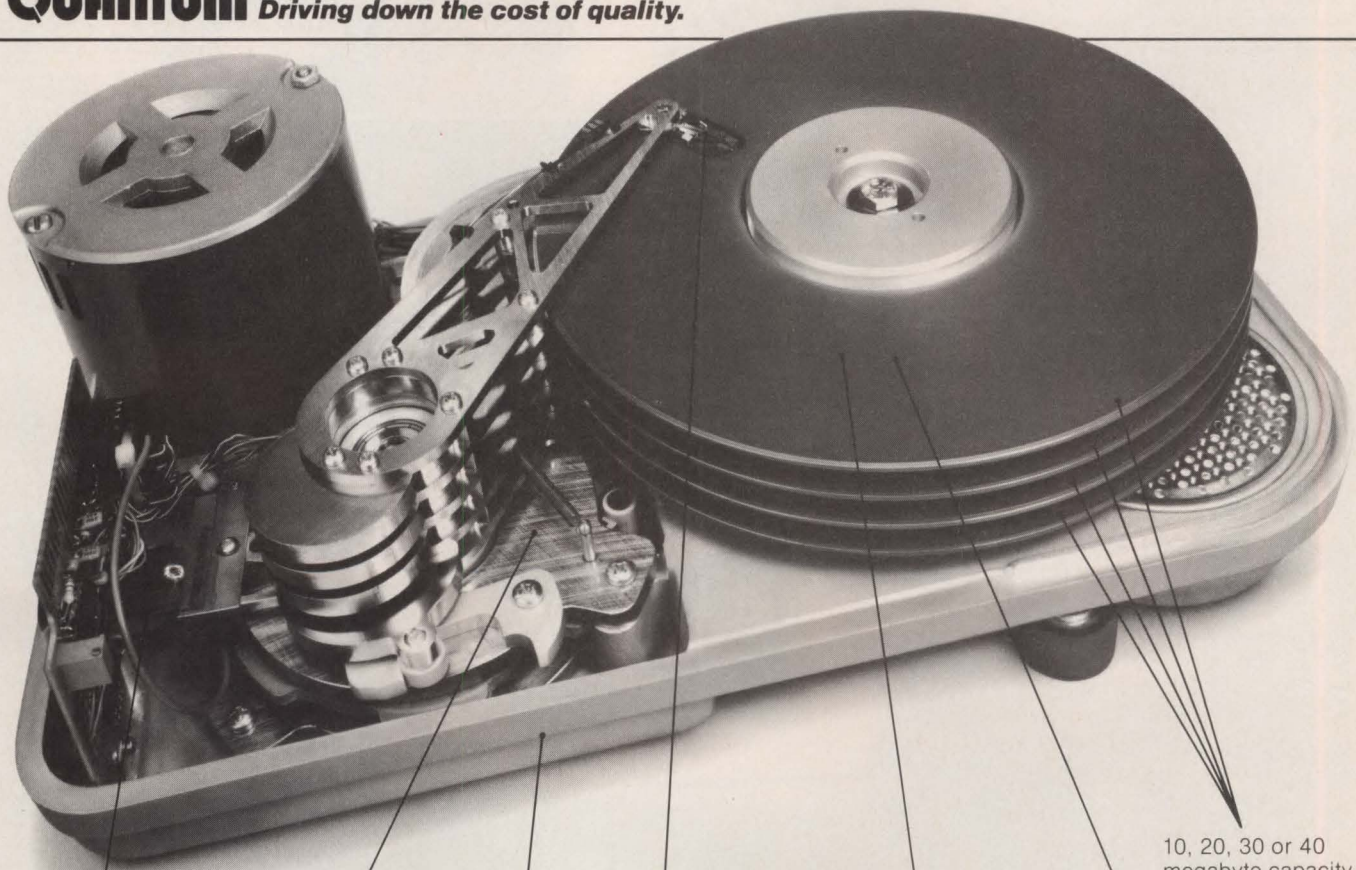

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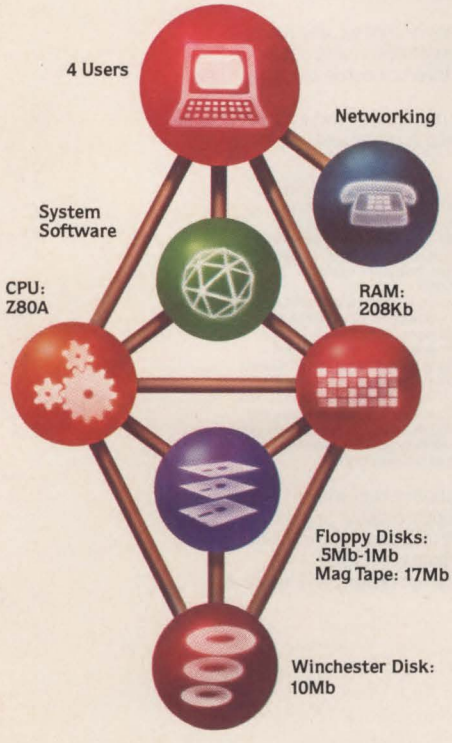

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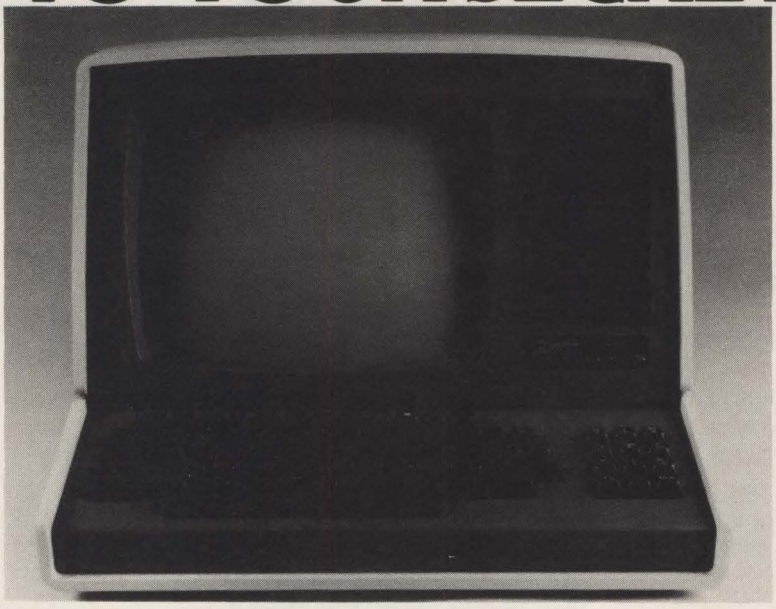

The Zenith Z89 sub-compact: a dual Z80 microcomputer, a video terminal, and a floppy-disk drive . . . all in a single, desktop stand-alone.

The Z89: a subcompact microcomputer that needs about as much space on a desk as a portable TV set.

And needs about as much technical training to operate. Because the Z89 uses the industry-standard CP/M ™ operating system, it accepts a vast variety of existing software. Most microcomputer programmers already know it, and anyone trained on larger systems adapts to CP/M* in a flash. The Z89 also uses standard, currently available software on both 5¼" and 8" floppy disks, yet is capable of more sophisticated operation using extended languages such as Microsoft BASIC, COBOL, FORTRAN, and PASCAL.

The keyboard follows the standard typewriter format, with every touch of a key confirmed by an audible click. Numbers are duplicated in calculator format, with up to 18 decimal-place accuracy. And the large-capacity non-glare video display is easy on the eyes.

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desk-top terminal to incorporate a card cage into which additional RAM, ROM or analog I/O boards can be inserted for expansion, says Fred Bode, marketing manager for H-P's desk-top computer division. The company plans to make several I/O cards available, including a 16-bit parallel general-purpose I/O card, an RS232C card, a BCD digital I/O interface card and a DMA controller card for two channels of I/O transfers. An IEEE-488 (HP-IB) interface is standard.

The system uses a Motorola 68000 μp, which, H-P officials say, contributes significantly to the 9826A's performance. The 9826A comes with 64K bytes of read/write memory, expandable to 512K bytes. A built-in, 264K-byte, 5¼-in. floppy-disk drive is standard. Bode says an external 5¼-in. Winchester-disk drive will be available later.

The 7-in. CRT terminal displays 25 lines of 50 characters, plus graphics. Bode says, "The graphics are intended for data display, and are not aimed at solving design-type problems," a feature of H-P's large desk-top machines.

A rotary-control knob on the keyboard permits scrolling of the screen data, program interrupt, cursor control and graphics drawing. It can also control external instrumentation, says Bode.

Languages available include a choice of a BASIC ANSI standard complier, H-P's version of Pascal, which will be available later in the year, and HPL, an H-P-developed I/O-control-oriented language that has been available on the company's 9825 desk-top systems since their introduction in 1975. H-P officials say all 9825 HPL programs will be compatible with the 9826A.

The company is emphasizing data communications with the 9826A, says Bode. Using one of the plug-in cards, the system can communicate with large H-P computer systems, such as the HP 1000, in asynchronous or in H-P's DSN (distributed systems network)/Data Link protocols. An RS232C serial interface card links the 9826A to non-H-P systems.

The 9826A—with 64K bytes of memory, graphics and either ROM-based BASIC or HPL—is priced at $8950. A disk-based BASIC system is $11,950, and a disk-based HPL system is $8950. Deliveries are expected to begin by early fall.

The HP 9845 desk-top computer has been enhanced with what H-P calls new tops and bottoms—CRT displays and processors, respectively. The systems are designed for engineers and scientists and have considerable computational power. But H-P says it has increased this performance by adding a monochromatic CRT graphics display terminal and by switching to a bit-slice processor for language processing.

The new graphics CRT top can produce 17 shades of brightness for area fill, says Bode. It includes programmable soft keys, optional light pen and high-level graphics for geometric drawing, a capability found on the HP 9845C, H-P's high-end color-graphics desk-top terminal introduced last spring.

Computational power of the 9845 has been increased "at least three times," says Bode. H-P has replaced one of the two hybrid processors in the 9845 with a bit-sliced microprogrammed machine that tackles the computational and language processing-intensive chores. Bode says 25 percent of the performance improvement is attributed to the bit-slice machine, and the remainder, to increased on-board RAM and microprogramming.

The company has also added data-communications software to the 9845. With the new DS/35 and DS/45 software, Bode says, the 9845 can communicate with HP 1000 and HP 3000 computer systems in the company's DS/1000 and DS/3000 distributed networks. These packages are priced at $500 each, but they require a $1000 serial interface card and $525 bisynchronous communications ROMs.

—Larry Lettieri

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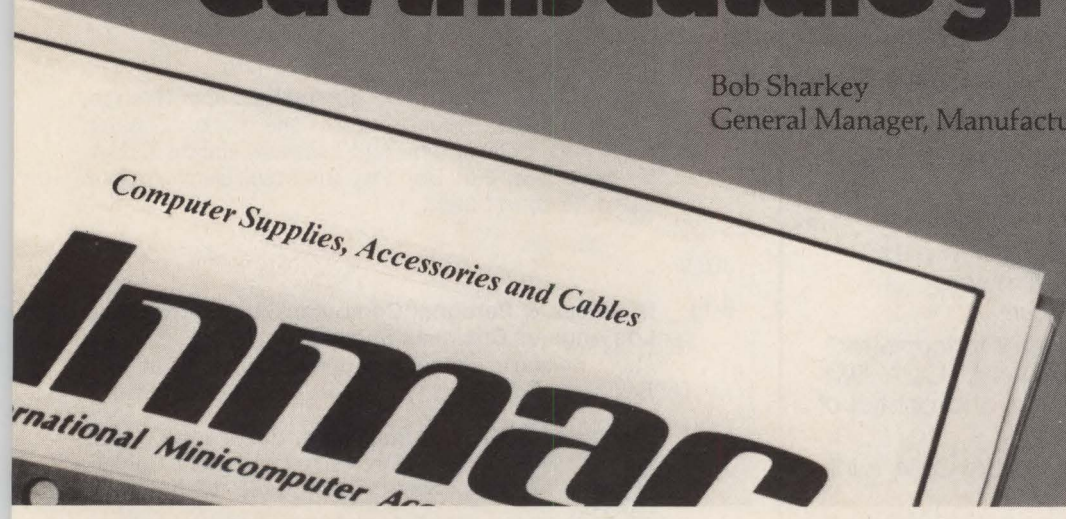

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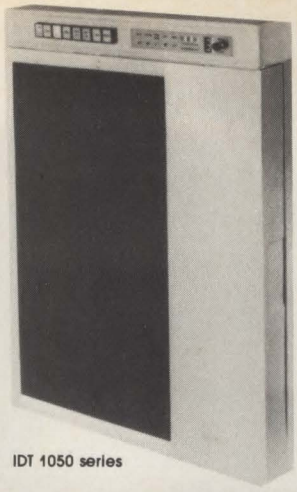

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SHOWS & CONFERENCES

JUNE

22-24 1981 National Software Conference, Boston. Contact: Charles Bozett, AMR International, 1370 Avenue of the Americas, New York, N.Y. 10019, (212) 974-0800.

23-25 COMDEX/Spring '81, New York, sponsored by The Interface Group. Contact: Peter B. Young, The Interface Group, 160 Speen St., Framingham, Mass. 01701, (617) 879-4502.

24-26 Computer Industry Trade Expo (CITE), Atlantic City, N.J., sponsored by the Microcomputer Industry Association. Contact: CITE, 110 Charlotte Place, Englewood Cliffs, N.J. 07632, (201) 569-8542.

JUNE 29-JULY 1

18th Design Automation Conference, Nashville, Tenn., sponsored by the ACM Special Interest Group on Design Automation and the IEEE Computer Society Design Automation Technical Committee. Contact: Robert J. Smith II, Chairman, V-R Information Systems, Inc., 5766 Balcones Drive, Suite 203, Austin, Texas 78731, (512) 458-8131.

JUNE 29-JULY 2

1981 Power Electronics Specialists Conference, Boulder, Colo., sponsored by the IEEE. Contact: William B. Collins, General Chairman, Martin Marietta Aerospace, P.O. Box 179, M/S 8130, Denver, Colo. 80201, (303) 977-3962.

JULY

9-11 Business & Personal Computer Sales Expo '81 & Los Angeles Business Show, Los Angeles. Contact: Mary Bondura, Public Relations, Produx 2000, Inc., Box 2000, Bala Cynwyd, Pa. 19004, (215) 457-2300.

13-17 Computer Statistical Packages, Santa Cruz, Calif. Contact: Adele Wood, University Extension, University of California, Santa Cruz, Calif. 95064, (408) 429-2761.

15-17 1981 Summer Computer Simulation Conference, Washington, sponsored by the Instrument Society of America and the Society for Computer Simulation. Contact: William F. Buchanan, Co-Chairman, Applied Physics Laboratory, Johns Hopkins Rd., Laurel, Md. 20810, (301) 953-7100.

29-31 1981 Microcomputer Show, London, England. Contact: Jeff Wolf, TMAC, 680 Beach St., Suite 428, San Francisco, Calif. 94109, (415) 474-3000 or (800) 227-3477.

AUGUST

10-19 The 20th General Assembly of the International Union of Radio Science, Washington. Contact: Richard Y. Dow, Executive Secretary, National Academy of Sciences, 2101 Constitution Ave., N.W., Washington, D.C. 20418, (202) 389-6478.

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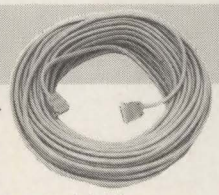

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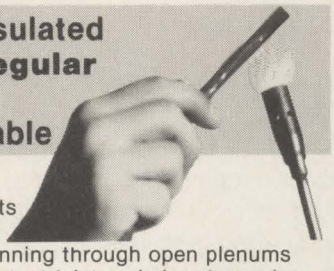

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CIRCLE NO. 26 ON INQUIRY CARD

Calendar

18-20 1981 IEEE International Symposium on Electromagnetic Compatibility, Boulder, Colo. Contact: Charlotte Tyson, Registration Chairwoman EMC '81, IBM, 59Z/025-1, P.O. Box 1900, Boulder, Colo. 80302, (303) 447-5072.

26-29 Fifth Annual National Small Computer Show, New York. Contact: National Small Computer Show, 110 Charlotte Place, Englewood Cliffs, N.J. 07632, (201) 569-8542.

28-30 Personal Computer Arts Festival, Philadelphia. Contact: PCAF-81, Box 1954, Philadelphia, Pa. 19105.

SEPTEMBER

9 NECOM '81 New England Computer Show, Newton, Mass., sponsored by Norm De Nardi Enterprises. Contact: Carol L. Reimer, Show Administrator, Norm De Nardi Enterprises, 95 Main St., Los Altos, Calif. 94022, (415) 941-8440.

9-12 Internepcon/Semiconductor International Taiwan '81 Exhibition and Conference, Taipei, Taiwan. Contact: Industrial & Scientific Conference Management, Inc., 222 West Adams St., Chicago, Ill. 60606, (312) 263-4866.

10-13 Second Annual Mid-West Computer Show, Chicago. Contact: National Computer Shows, 824 Boylston St., Chestnut Hill, Mass. 02167, (617) 739-2000.

14-18 The Impact of Computerization on Social Research: Data Bases and Technological Development Conference, Grenoble, France. Contact: Alice Robbin, IASSIST President, Data & Program Library Service, 4452 Social Science Building, University of Wisconsin, Madison, Wis. 53706.

15-17 Wescon/81, San Francisco, sponsored by the Los Angeles and San Francisco Bay Area Councils of IEEE and Southern and Northern California Chapters of ERA. Contact: Dale Litherland, Educational Activities Manager, Wescon/81 Professional Program Committee, Suite 410, 999 North Sepulveda Blvd., El Segundo, Calif. 90245.

15-24 EMO Machine Tool Trade Fair, Hanover, Germany. Contact: Joachim Schafer, Hanover Fairs Information Center, P.O. Box 338, Whitehouse, N.J. 08888, (201) 534-9044.

21-23 Federal Computer Conference, Washington, sponsored by Federal Education Programs. Contact: Federal Education Programs, P.O. Box 368, Wayland, Mass. 01778, (617) 358-5181.

21-25 International Switching Symposium, Montreal, Canada. Contact: John M. Benet, Chairman, Publicity Program, ISS '81 CIC, P.O. Box 56, Station "Ile des Soeurs," Verdun, Quebec, Canada H3E 1J8, (514) 761-5831.

22-24 Electrical Overstress Electrostatic Discharge Symposium, Las Vegas, sponsored by the IITRI Reliability Analysis Center. Contact: Reliability Analysis Center, RADC/RBRAC, Griffiss AFB, N.Y. 13441, (315) 330-4151.

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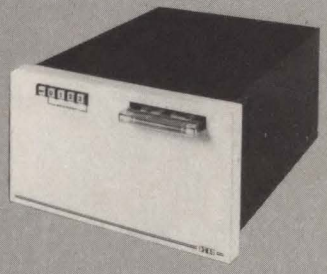

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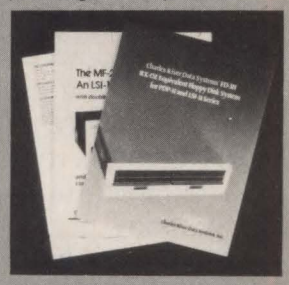

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CIRCLE NO. 28 ON INQUIRY CARD

British software firm seeks U.S. distributor

The appointment of a master dealer to cover the U.S. is one of the top priorities for a new British μc software vendor, Microproducts Software (MPS). MPS has taken over all worldwide marketing and future development of a family of portable COBOL-based commercial applications packages that can run on some 30 different μc systems, plus Digital Equipment Corp. LSI-11 and PDP-11 machines and the IBM Series 1.

With the family name Microcobol, the products were developed in the United Kingdom by CAP-CPP Microproducts, a division of the London-based CAP group, one of Europe's leading software and systems houses. CAP poured £2½ million (about $5.6 million) into their development over five years, spurred by the group's founder and chairman, Alex D'Agapeyeff, who was determined to see Microcobol become a de facto world standard.

But the CAP-CPP Microproducts operation proved a chronic drain on CAP group finances, and early this year, the decision was made to spin off the operation. D'Agapeyeff relinquished his CAP group chairmanship to lead the new independent company, but quit at the end of March even before it started trading. This was because he failed to raise enough capital to realize his plans to achieve dominance of the world μc applications-software market.

CAP is handing over to MPS a line of applications software for customers in the U.S. that includes packages for invoicing, accounts receivable, accounts payable, general ledger, inventory control, client accounting for public accountants, utility billing and accounts receivable for local government, tax-return preparation, a fuel-delivery system for fuel dealers, a file-maintenance system called Autoclerk and a data base-management system called Autoindex.

Preferring not to dwell on the financial problems created by the Microcobol operation, CAP says it was sold off because of increasing "conflicts of interest" with the computer manufacturers for which it carries out software-development work. Many of these manufacturers have their own μc systems-software plans, according to CAP.

MPS is now run by Alistair Jacks, who was marketing manager of the CAP Microcobol operation before the split. Jacks is chairman and managing director of MPS and owns most of the new company, along with four other directors, all former CAP-CPP Microproducts executives. They include Esmond Hart, the chief designer of the Microcobol product line.

Microcobol products are sold in the U.S. on a limited basis through some 20 dealers around the country. They include Norwalk, Conn.-based Durango F85 dealer, Data Dimensions Inc., which has branches in nine major urban centers. Marketing has been coordinated through CAP's two U.S. offices, CAP-CPP Services, New York, and CAP-CPP in Menlo Park, Calif., an arrangement that will continue for approximately six months or so through CAP. By then, a U.S.-owned master dealer should have been found, Jacks says. It will be staffed by U.S. citizens and will work closely with MPS in London on the development of additional applications packages for the U.S. market. MPS will directly manage the network of 30 Microcobol dealers in the U.K.; the U.S. master dealer will control all other U.S. dealers and report to MPS in London.

The key to the portability of the Microcobol products is the Business Operating System (BOS). Developed by CAP-CPP Microproducts, it has so far been tailored to run on DEC LSI-11 and PDP-11 machines, the IBM Series/1 and the following μps—Intel 8080 and 8086, Zilog Z80, Texas Instruments 9900 and the Motorola 6800 and 6809. Jacks says that two more 16-bit μps, the Zilog Z8000 and Motorola M68000, are next on the list for BOS support. BOS's peripheral-handling facilities have been modified for about 30 μcs, including the Pertec PCC 2000, the Tandy TRS-80 model II, the Northstar Horizon, the IMS 8000, the Durango F85 and the Cromenco System-3.

Ironically, BOS could deter some would be Miocrocobol customers because it precludes the simultaneous use on a μc of other systems software, such as the ubiquitous CP/M from Digital Research or the increasingly popular UNIX-based operating systems. Some prospective U.S. customers have apparently also been deterred by the nonconformity of Microcobol with ANSI 74 standard. But Jacks dismisses these objections on the grounds that most μc users should be concerned only about the facilities offered by the applications packages supported by BOS, and not about the systems software itself.

Jacks shares D'Agapeyeff's hope that Microcobol will become a de facto world standard but is giving the product line much more time to

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And now there's TMS9995 — with all the inherent advantages of memory-to-memory architecture, plus 256 bytes of on-chip RAM.

And now there's TMS9995 — for all those tough tasks that demand 16-bit speed and processing power.

And now there's TMS9995 — with on-chip clock, 16-bit timer/event counter and 8-bit data bus for interfacing to everything from a minimum 3-chip system to a 16-megabyte memory system (just add the 99610 memory mapper).

TMS9995. Shrinking chip count and program size. Ready for VLSI.

Logical link

TI's TMS9940 was the first single-chip 16-bit microcomputer — and the first to transcend the limitations of high-speed and high-resolution. TMS9995 adds the ability to address off-chip memory to the TMS9940 — up to 64K bytes. Together they fill the requirements from small microcomputer-based systems to medium-sized systems, using on-board RAM and off-board ROM, to larger systems needing off-board RAM and ROM.

TMS9995 — Key features

- 16-bit CPU
- 12 MHz clock with on-chip clock generator
- 256-byte on-chip RAM
- 16-bit on-chip interval timer/event counter
- 7 levels of vectored interrupts
- instruction prefetch
- automatic first wait-state generation
- MID — macro-instruction detect interrupt
- single 5-V power supply
- 40-pin dual-in-line-package.

Performance plus

Three times faster than the TMS9900, TMS9995 executes a 16x16-bit multiply in just 7.67 µs. A 32-bit number divided by a 16-bit number in just 9.33 µs. TMS9995 can run with currently available fast memories of 120-ns access times, or by using automatically generated wait states, 450-ns access time memories.

256-bytes of fast on-chip RAM is organized as 128 x 16-bit words, allowing a full 16-bit word access in one clock cycle.

And, TMS9995 uses an intelligent pipelined architecture where the op code of the next instruction to be performed is prefetched. For example, the microcode for Branch and Jump instructions direct TMS9995 processors to prefetch the true next instruction instead of blindly prefetching from the next sequential memory location.

And now, a word about memory-to-memory architecture

The innovative architecture at the very heart of the 9900 Family reaches it's performance peak in the TMS9995 thanks to on-chip RAM. Comparison of execution speed benchmarks clearly show the advantages.

Support, support, support.

Necessary for any microcomputer family. TI's 9900 Family is supported by Pascal, Basic and Fortran software and software and hardware development systems, including a low-cost Evaluation Module, TMAM6095, for $800.* TI also offers training, documentation and expert field assistance. Training, service and design assistance are available at Distributor System Centers, and TI's Regional Technology Centers.

Commitment to 16-bit leadership

The continuing introduction of new, advanced, high-performance 9900 Family CPUs, with TI's state-of-the-art technology and production-proven resources, clearly demonstrates a commitment to leadership. A commitment to choice. A commitment to the future.

For more information about the new TMS9995, or any other 9900 Family member, contact the TI distributor or field sales office nearest you, or write to Texas Instruments Incorporated, P. O. Box 1443, M/S 6404, Houston, Texas 77001.

Execution Time Benchmarks

	Automated Parts Inspection (Seconds)	Computer Graphics XY Transform (Seconds)	Bubble Sort (Millisec)	Block Translation (Millisec)	16 Bit Multiply (Microsec)	Single Vectored Interrupt (Microsec)
9995 (12 MHz) w/120ns PROM	0.666	0.863	1.240	1.767	10.00	8.0
9995 (12 MHz) w/450ns EPROM	0.950	1.081	1.956	2.696	12.67	10.67
8088 (5 MHz) w/450ns EPROM	1.596	2.402	2.254	1.522	40.8	77.6
6809 (2 MHz) w/450ns EPROM	9.67	57.1	2.376	3.01	91.9	27.6

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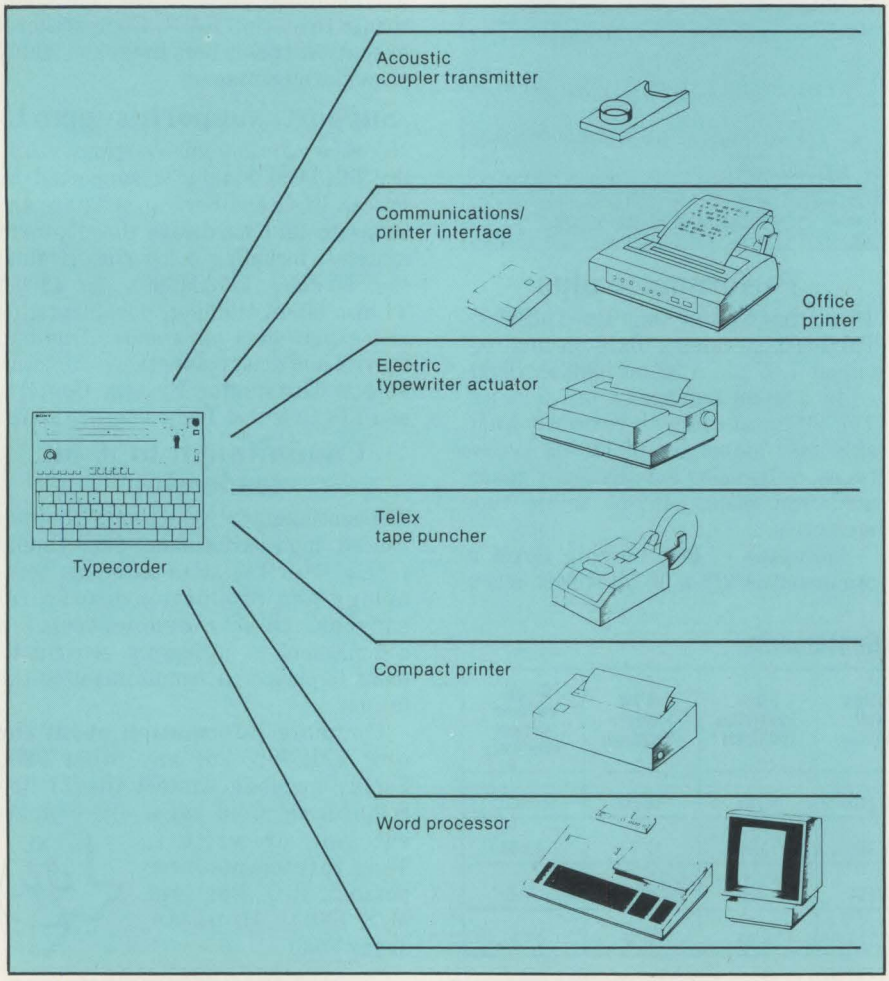
proliferate. His expansion plans for the first year of MPS operation are modest by the standards of the software industry. He is aiming for worldwide sales of £750,000 (about $1.7 million), compared with £600,000 (about $1.3 million) in the last year under CAP ownership.

Recognizing that MPS has a long way to go, CAP is allowing Jacks and his fellow directors 10 years to buy the rights to Microcobol. Annual repayments will be proportional to MPS profits—a form of royalty. The total amount involved has not been publicized, but it "reflects the £2½ million invested in Microcobol," according to CAP. —*Keith Jones*

Japan takes new tack in U.S. office market

While Japanese companies have made some headway in the U.S. office-automation market by selling printers and other equipment as part of other vendors' word-processing systems, they have yet to offer complete systems under their own banner. For example, many customers may not know that some copiers marketed by Savin and 3M are built by Ricoh and Toshiba, respectively. That will change, as at least three Japanese companies—Toshiba, Sony and Fujitsu—make major moves into the word-processor market, offering products under their own names.



Sony's portable *Typecorder typewriter, which accepts voice and types input, may have a difficult time carving out its own market, but it is a ready-made companion to the Series 35 word processor.*

Sony Corp. became the first official entrant of the three when it unveiled its "Peanuts project" office-automation products. Those products are the Series 35 word processor, the Typecorder paperless portable "typewriter" and a 3½-in. microfloppy-disk drive incorporated in the Series 35 that will also be sold through OEM channels (see "Sony enters OEM market with 3½-in. floppy," MMS, April, p. 17).

Prices for the Series 35, including a 55-cps letter-quality printer and two built-in microfloppy drives that hold 230 pages of on-line storage, start at $9000. An optional 15-in. full-page display and a single-line display are available. The system, which uses microcassettes, is based on an 8-bit processor with 64K bytes of RAM.

The Typecorder, which weighs 3 lbs., includes a keyboard, a built-in μp for editing and a single-line display. It can store as much as 120 pages of information and has 8K bytes of ROM program memory and 2K bytes of RAM text memory. It also uses a microcassette, which accepts voice and typed input, enabling it to be used for dictation. Dictation recorded on the microcassette can be printed or processed on the Series 35 word processor or other word processors through a communication/printer interface and punched out on a Telex unit using Sony's Telex tape puncher product. Prices for the system, which will be available by mid-year, start at $1400.

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CIRCLE NO. 30 ON INQUIRY CARD

The Typecorder has probably generated the most interest in the market so far, but many observers believe the product's time has not yet come. "The idea of carrying a box is interesting, but the market for it is questionable. You still can't get people to use dictation equipment. It is probably ahead of its time," says Bob Greenblatt, president of National Word Processing, Inc., a New York office-automation consulting firm. He says a major use of the Typecorder will be as an input to the Series 35.

The market for the Series 35 is unclear, but Sony believes its market will be in word-processing centers (full-page display version) and in smaller secretarial groups, which would use the single-line version. The price of the full system is estimated at $13,000. Both Wang Laboratories and IBM Corp. have announced lower-priced secretarial systems, which house 24- and 25-line displays, respectively. The IBM Displaywriter (MMS, August, 1980, p. 35) includes a floppy-disk drive and a Selectric printer and sells for $7895. The Wangwriter (MMS, February, p. 18) includes a dual-sided, double-density minidiskette drive and a 20-cps daisy-wheel printer. It sells for $7500. Some observers say Sony may have difficulty finding a niche with its comparatively high-priced product.

IBM and Wang already have established names for service and products, explains Greenblatt. He says it will be difficult for a company that does not have a proven service organization or product to enter the market, unless that entry is very inexpensive. He says price, performance, service and spare parts are the keys to the market Sony wants, and that the company will have to go through a period of establishing its name to get customers.

Toshiba will face the same price problems when it enters the word-processing market in July with its EW-100 word-processing system. Four models with IBM 8-in. floppy-disk drives, ranging from single-sided, single-density drives to double-sided, double-density drives, will sell for $8000 to $10,000, says Dawson Frock, marketing manager for reprographic products at Toshiba America, Inc.'s business equipment division, Wayne, N.J.

The EW-100 consists of a 24-line CRT display, a movable keyboard, 64K bytes of main memory and a 45-cps Ricoh bidirectional daisy-wheel printer. The EW-100, available in August, will be initially sold through independent dealers. Frock says Toshiba will expand to 10 retail branch offices starting this month. Toshiba has not decided whether the product will be sold by the business division or the computer division in Los Angeles.

Frock says the EW-100's main features are its ease of use—operators can learn to use it in an hour—and its 920-page storage capacity (two disks). The word processor contains automatic functions, with 32 that are apparent to the operator. In comparison, he says, Digital Equipment Corp.'s word processor, which will also compete with the EW-100, has 200 to 300 functions. Toshiba intends to add communications capabilities later this year. The EW-100 was shown and demonstrated at a

AN ALTERNATE METHOD FOR KEY WORD INDEXING

When Fujitsu's Word Machine enters the market, it will be in the company of an earlier market entrant, Turnkey Sales & Leasing, Inc., New York. Turnkey is offering an on-line litigation support retrieval service that uses a stand-alone word-processing terminal to access a minicomputer data base. The software, called Quest, can use key-word, phrase or truncated word searches. A truncated word, such as author, would identify words such as author, authority and authorization.

Quest is used on an integrated word- and data-processing system called TIP. A basic configuration, selling for $100,000, consists of a Prime 400 minicomputer with 32M bytes of disk storage, 500K bytes of main memory and 16 ports; TIP software that enables an NBI 3000 stand-alone word processor to interact with and create data-processing files through the Prime computer; and a 30-cps General Electric Terminet printer. NBI supplies the word processors separately. Turnkey is a Prime distributor, and, thus, can provide Prime hardware. Quest software, available off-the-shelf, is $75,000.

A company source claims Quest is the only on-line retrieval system working over inverted files on a minicomputer. Inverted files mean that instead of "scanning" documents word-by-word, the computer identifies only a key word or phrase. Quest uses Boolean algebra, which enables it to identify ideas. For example, Quest will locate any legal cases with the words Pinto, explosion and gasoline, but not Chevrolet.

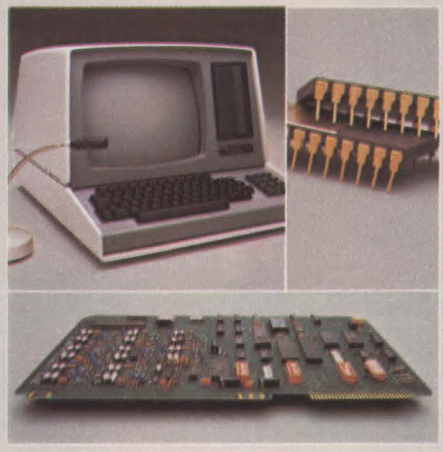
The company claims retrieval times are enhanced through high access speeds. It provides an example of a program with 72,000 documents on file, which would produce 250,000 inverted terms. If a user wanted to find every document with words A,B and C in it, Quest could perform 4000 "hits", or identifications, in less than 15 sec. In comparison, the company says, the same number of hits would take 10 to 15 min. on other mainframes.

The company is aiming the system at Fortune 1000 users that have mixed word- and data-processing applications and need 10 or more devices, including word processors and dumb terminals, that interface to a corporate host. Documents are entered into a Prime minicomputer through a Compuscan optical character recognition system or an NBI word processor. The Prime and NBI products are hard-wired and communicate at 1200 to 9600 baud.

It's easy to add the competitive power of Voice Recognition to your product line. The cost is low and the return on the investment is very attractive. Whether you are an OEM or an end user, Interstate has a Voice Recognition product to suit your needs; terminals and boards for system integration and chips to create your own sub-systems.

Terminals. Interstate standalone Voice Recognition terminals perform voice controlled data and word processing with a vocabulary up to 100 words and 99%+ accuracy. You unpack them, power them, and immediately begin talking to your system. You can develop and execute resident application software using voice data input without going through expensive, time consuming integration.

Boards. Interstate Voice Recognition Q-Bus,™ Multibus,™ and Lear Siegler Dumb Terminal® compatible boards are capable of recognizing up to 100 words or short phrases in any language. They perform all training, updating, word recognition and communication for your selected vocabulary. Accuracy is 99%+.



And if you need voice response we also offer a Multibus board with a 1500 word vocabulary.

Chips. Three separate chip products from Interstate provide Voice Recognition capabilities with 100, 25, and 8 word vocabularies and accuracies up to 99%+ for your commercial, industrial and consumer applications.

Discover the world of voice. Data entry via direct human to computer communication makes voice recognition ideal for a broad range of application areas *including office and factory automation, word processing, small business data processing, computer-aided design, building security and many more.* Whatever your application, the benefits of voice are virtually unlimited.

Talk to the experts. We listen just as well as our computers. Tell us your voice recognition needs. We've got the terminals, the boards, and the chips to meet them. And we've got them now.

Write to: Manager, Marketing, Voice Recognition Products, Interstate Electronics Corporation, 1001 East Ball Road, P.O. Box 3117, Anaheim, California 92803.
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or call toll free
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INTERSTATE ELECTRONICS CORPORATION

Call to attend our nationwide voice seminars.

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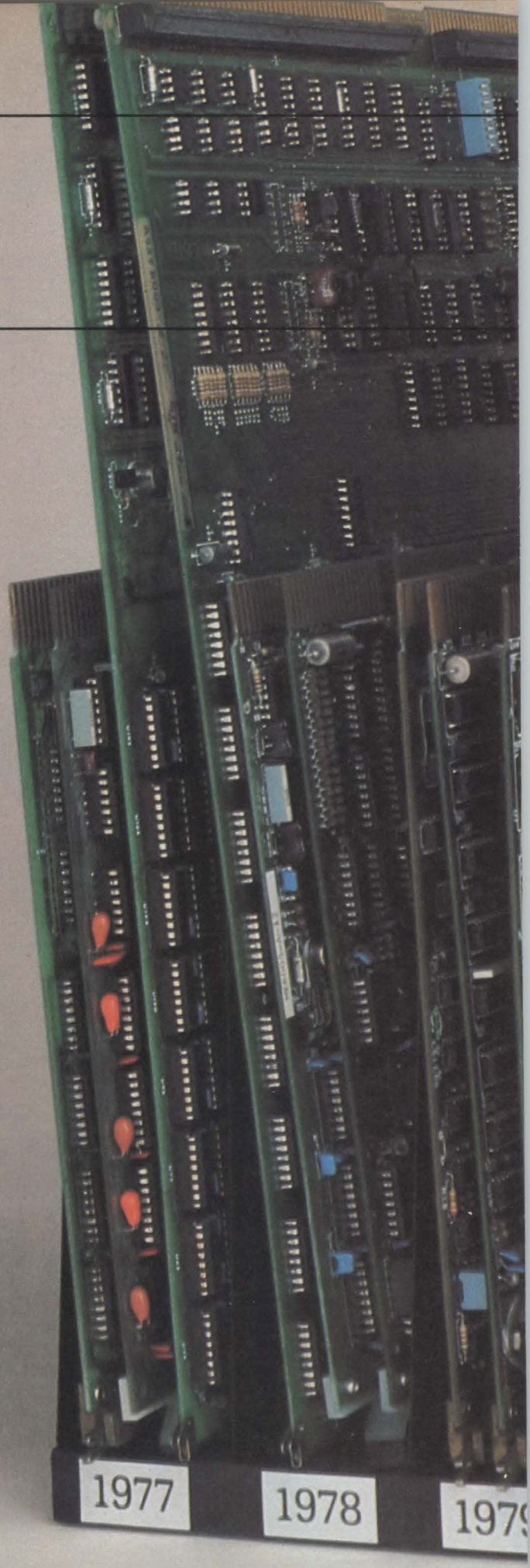
VOICE RECOGNITION BY INTERSTATE

CIRCLE NO. 38 ON INQUIRY CARD

FILLING THE SLOTS FOR DEC AND DG MINICOMPUTERS.



Our first new filler for 1981: MK8070 PDP-11/70 add-in memory.

For the past four years, Mostek has offered an add-on memory system for the PDP-11/70. Now we're offering a new add-in memory system for the PDP-11/70's MK-11 MOS memory chassis—the MK8070. With the MK8070, the PDP-11/70's full 3¾ megabytes of addressable memory can be contained in an MK-11 box. Totally hardware and software compatible, the MK8070 capacity is 64K words x 39-bits (256KB).

The MK8070 is our 14th memory system for DEC and Data General minicomputers over the last five years. We have memory systems for the PDP-11, LSI-11/2, PDP-8, PDP-11/70, and VAX-11/780. DG memory systems include NOVA 3, NOVA 4/X, NOVA 4/S, ECLIPSE, and ECLIPSE S-140.

The point? We're committed to supporting this market. With full product lines. At substantial savings. And with the availability and reliability you'd expect of the world's largest dynamic RAM manufacturer.

Get your quote today on any of our memory systems by calling your Mostek regional sales office:

Northeast: (617) 256-1500
East and South: (201) 842-5100
North Central: (312) 529-3993
South Central: (214) 386-9141
Western: (714) 549-0397
North Western: (408) 287-5081

Or contact Mostek Corporation, 1215 West Crosby Road,Carrollton, Texas 75006; phone (214) 323-8840. In Europe, contact Mostek Brussels, phone 762.18.80.

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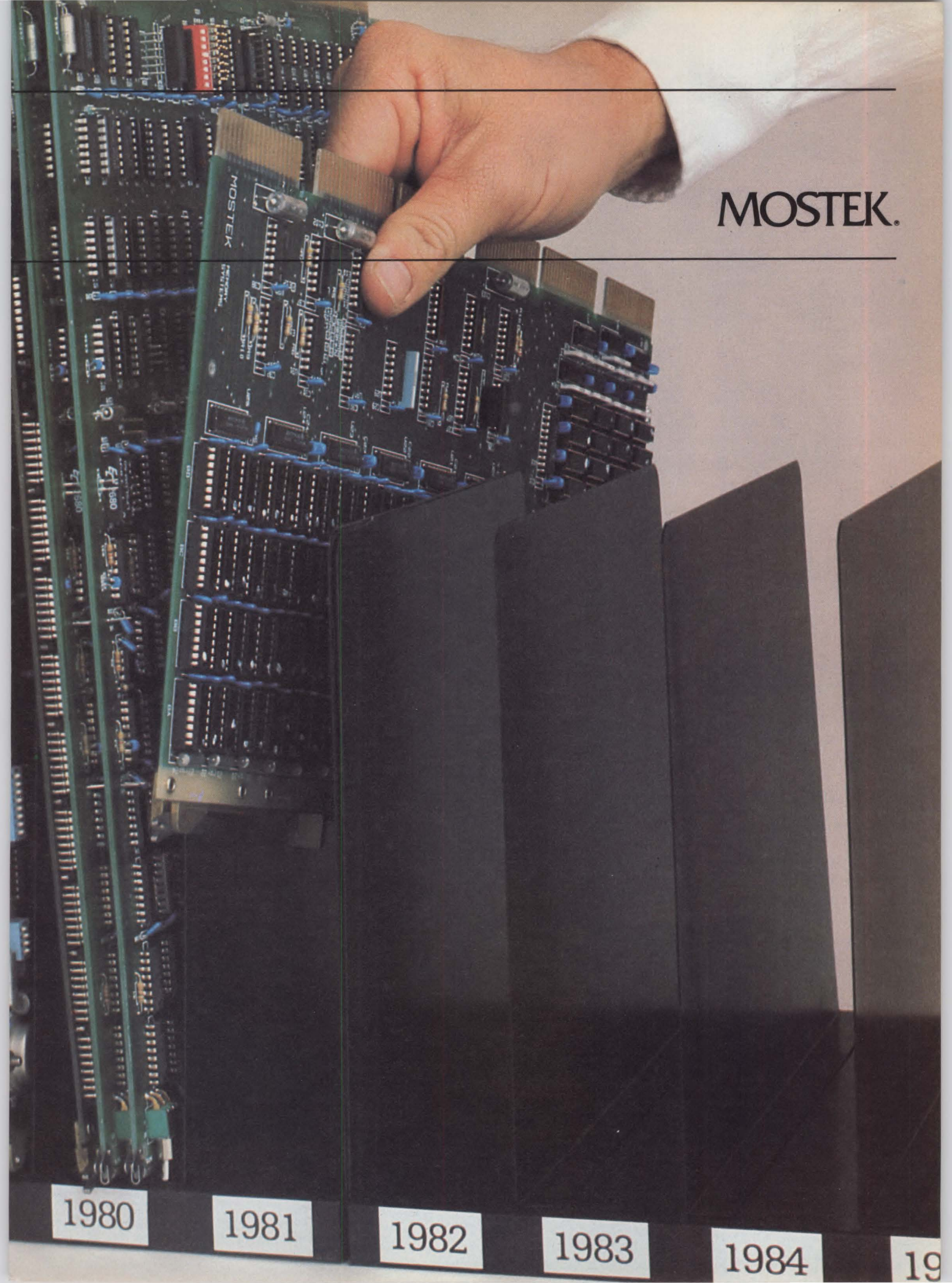
CIRCLE NO. 39 ON INQUIRY CARD


MOSTEK.
1980
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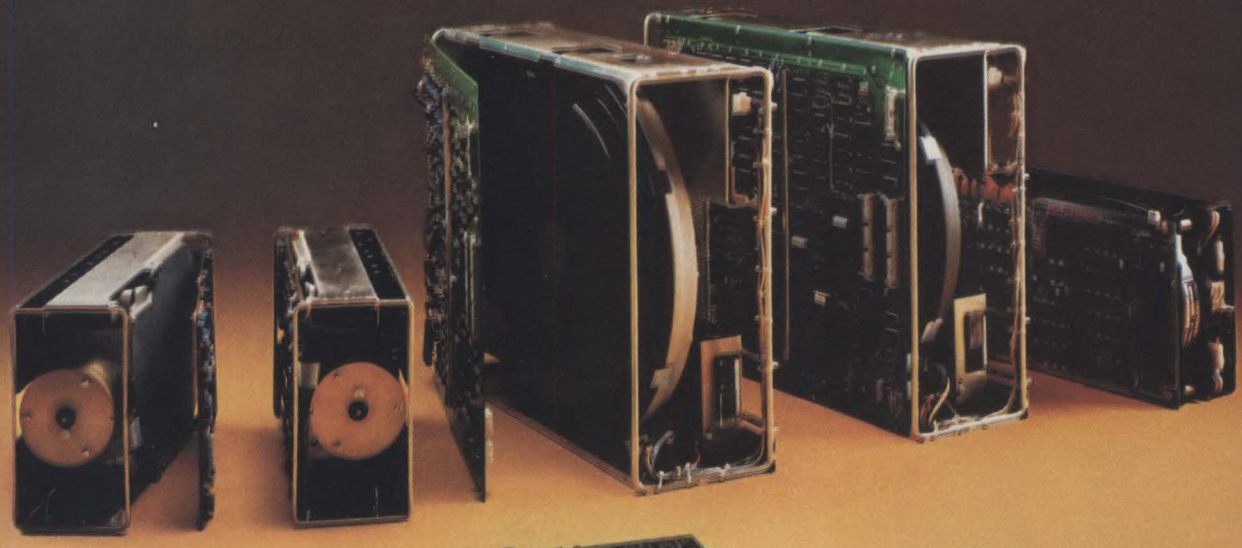
THE SMART SET



Members of this exclusive circle of PRIAM Winchester disc drives have some uncommon things in common. With capacities from 10.8 to 158 Megabytes, they have the same interface. And they all connect quickly and easily to microprocessor I/O busses through PRIAM's SMART or SMART-E Interface.

With a simple adapter your system can have the remarkable reliability of Winchester disc drives. And PRIAM's DISKOS drives give you the lowest cost-per-megabyte for your system database.

SMART Gets Smarter!

With its own sophisticated pre-programmed microprocessor, PRIAM's SMART Interface gives you comprehensive disc subsystem functions, including:

- Control of any combination of one to four PRIAM Winchester disc drives.
- Automatic alternate sector assignment for disc-defect transparency to the host processor.

In addition to all SMART functions, PRIAM's new SMART-E Interface provides ECC, streamlined software, sector interleaving, a 2048-byte buffer, and logical-sector addressing. Both the SMART and SMART-E come to you on a single 8" × 14" printed circuit board that is powered from the drive. And it piggybacks on the drive or mounts separately.

Meet The Elite! PRIAM's High-Capacity, Low-Cost 14-Inch Drives

PRIAM's high-technology 14-inch disc drives have capacities of 34, 68, or 158 megabytes, and they all fit in the same 7" × 17" × 20" package, including optional power supply. Fully servoed linear-voice-coil head positioning is reliable and fast—45 ms average for the 34 and 68 megabyte drives and 40 ms for the 158 megabyte version. Track to track is 8 ms.

Brushless DC spindle motors in all PRIAM drives assure mechanical simplicity, precise disc speed control, and operation anywhere in the world without change. No relays, mechanical brakes, brushes, belts, or pulleys. Pure, reliable electronic control. Elegantly simple.

The Talk Of The Town: PRIAM Eight-Inch-Disc Drives!

Debut a Winchester disc drive in place of a floppy disc with PRIAM's DISKOS 3450 and 7050, expanding your database to 35 or 70 megabytes. Thoroughbred performance goes with their linear voice-coil positioners; seek times are only 40 ms average and 8 ms track-to-track.

If you need an even lower-cost drive, the DISKOS 1070 gives you a 10.8-megabyte capacity with stepper-motor positioning. Seek times are 73 ms average and 23 ms track-to-track. And they're just as SMART as other PRIAM drives when used with PRIAM's SMART or SMART-E Interface.

More Basic Interface Options!

To those who have their own controller plans, PRIAM offers lower-cost drive-level interfaces. PRIAM's bit-serial NRZ data interface, similar to the evolving ANSI standard, has an 8-bit bidirectional control bus for easy connection to popular 8 and 16-bit microprocessors. Data separation is included in all PRIAM drives.

And if you have a Storage Module controller, you can use it and your software with PRIAM's SMD Interface to update your system with Winchester drives quickly and inexpensively.

For complete information about the SMART and SMART-E Interfaces and PRIAM's SMART SET of Winchester disc drives, RSVP by telephone or write to:

PRIAM

3096 Orchard Drive San Jose, CA 95134
Telephone (408) 946-4600 TWX 910-338-0293

CIRCLE NO. 40 ON INQUIRY CARD

word-processing show in February.

Frock says Toshiba intends to gain a major market share with the product and says there are more products scheduled for this year. They include optical character recognition systems, an electronic filing system and minicomputers, all of which are available in Japan. Intelligent laser printers are also on the agenda. The word processor will initially be manufactured in Japan, but may be assembled in the future in the U.S. from components, says Frock. Greenblatt explains that part of the reason for high-priced items from Japan may be import costs, which will decrease if components are sent to the U.S. to be assembled.

The electronic filing storage and retrieval system uses laser technology to store a large amount of data, explains James Hartke, an analyst with John Muir & Co., New York. Hartke believes this product may later be used with the EW-100. He does not expect Toshiba's products to make an impact immediately, and he explains the high-price of Japanese word processors as follows:

"The Japanese invented the game of discount pricing. The high prices are where they start the discount. In the final sale, they could offer a very attractive price to the dealer. That is why the price might be high. The dealer feels he is getting a good deal," he says. He says the most successful marketing approach for Japanese companies has been to enter the market through an American company. Among the companies worth watching closely, he says, is Fujitsu, which he cites as the most organized of Japanese electronics companies. Fujitsu recently entered a joint venture with TRW, Inc., which gave the company access to a very large independent maintenance force.

Fujitsu is entering the very high-end word-processing market with its Word Machine Group, in Scarsdale, N.Y. This past year, Fujitsu acquired the Word Machine, which interconnects word processors to IBM mainframes, from DPF, Inc., Hartsdale, N.Y. The Word Machine includes text/data base manager, electronic mail and telecommunications monitor software. The software packages will be installed in the host IBM 370 CPU for $10,000, including the software license charge. Additional software maintenance charges are $100 a month. The product also includes an intelligent terminal based on an Intel 8085 μp, which sells for $8500. The terminal stores approximately 96K bytes and houses a menu-driven full-page display. It functions as a stand-alone word processor that also archives and uses the host system's storage. Unlike other Japanese companies, Fujitsu is manufacturing the terminals in the U.S.—in Melbourne, Fla. A source at the company expects typical orders to be 50 to 300 units. He says Fortune 500 companies have shown considerable interest in the product. Some of those companies may buy as many as 3000 terminals for their mainframe systems.

The Word Machine enables the terminals to be run on the host without "bogging down" the 370. It incorporates its own telecommunications monitor, which transfers large blocks of text from the terminals through the IBM CICS telecommunications software to the host's CPU without increasing response time.

The text/data base manager software uses key word indexing to access several hundred thousand pages of documents in the 370's data base (see "An alternate method for key word indexing," p. 54). The software automatically indexes every word in a document, enabling words, phrases and ideas to be retrieved. Word processing on the Word Machine is performed on-line, giving managers access to huge electronic files of information.

Although the Fujitsu source says there is no direct competition yet for the very high-end product, he says Wang will include keyboard indexing and data base managers in its next level of OIS products and in some VS systems. —*L. Valigra*

Sony's Series 35 *word processor is the newest entry into the low-end market, which was made popular by the Displaywriter and Wangwriter.*


LOCAL FORM FEED
ALERT
ON LINE
OFF LINE
SELF-TEST

DECprinter III.
The only printer with a writer's reputation.

You already know about the DECwriter III. It's the largest selling 1200-baud KSR terminal on the market. With an impeccable reputation for reliability.

Now say hello to the receive-only version of the same terminal. Digital's new 1200-baud DECprinter III. Utilizing the proven technology of DECwriter III and built to the same tough standards.

LEDs indicate status of DECprinter III from control panel securely located under terminal top panel.

Which makes it reliable. Economical. And fast.

DECprinter III combines 180 cps speed with smart, bidirectional dot matrix printing to meet the exacting demands of 1200-baud communications. Some call it maximized throughput. You can call it no waiting for your data.

You won't waste time setting up the DECprinter III, either. A wide range of setup parameters can be selected from permanent or temporary storage in the nonvolatile memory.

As for reliability, that's been achieved with such features as automatic self-test diagnostics, to completely check the terminal every time it's powered up.

But downtime shouldn't be a concern. DECprinter III is quality controlled throughout production. Chances are you won't have to see a service representative until your DECprinter III has produced more than 50,000 pages of data each with 2000 characters.

When servicing becomes necessary, all components and subassemblies are easily accessible. And you get a choice of service either direct from Digital, with 14,000 service professionals worldwide, or through one of Digital's local terminals dealers.

For OEMs, Digital provides a full range of support services including full documentation, a Digital warranty, special training, quick spares, and field service worldwide.

To buy the DECprinter III, contact your Digital terminals dealer. For the names of dealers nearest you, call 800-225-9378 (outside the Continental U.S. and in Massachusetts call 617-467-7068) between 8:30am and 5:00pm Eastern time, or contact your local Digital sales representative.

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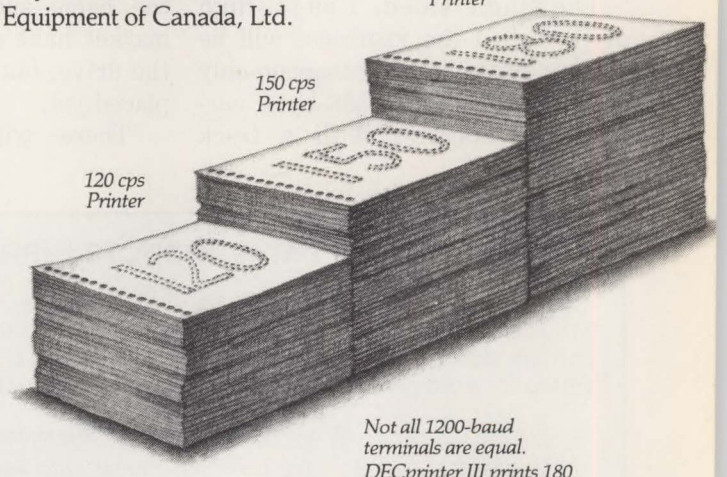
Digital Equipment of Canada, Ltd.



Not all 1200-baud terminals are equal. DECprinter III prints 180 characters per second for higher throughput.

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We change the way the world thinks.

CIRCLE NO. 41 ON INQUIRY CARD

Alps unveils 'super-slim' 5¼-in. floppy-disk drive

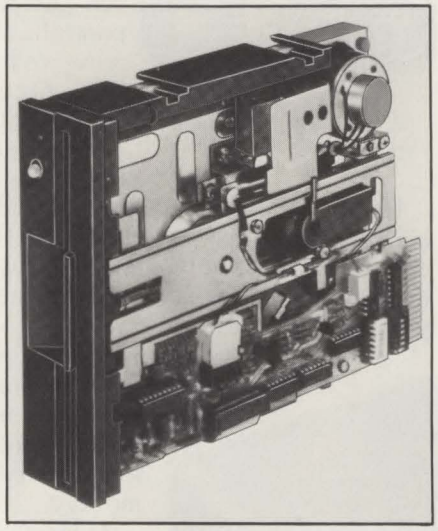
The slimmest of the new breed of "slimline" 5¼-in. floppy-disk drives will be available in sample quantities this month from Alps Electric, Inc., and may be the first in a series of such offerings from other manufacturers.

Alps sources say two of the super-slim units can fit into the slot space required for one 125K- or 250K- byte Shugart SA400 drive, thus holding twice the memory of the Shugart drive without using additional space or power.

The single-sided, 1.69-in.-high drive, called the FDM2000, will be sold to OEMs as a mechanism-only unit in 125K- and 250K-byte versions. It operates with a track density of 48 tpi and has an MTBF of 8000 hrs. The drive incorporates a belt and spindle actuator and has a ceramic head that is positioned with a metal band.

Alps, a Japanese company with U.S. headquarters in New York, is scouting the U.S. for sales representatives who will be organized by the time the drive is made available in production quantities in July, company sources say. Floyd Makstein, U.S. vice president of marketing for Alps, says that several companies in the home and business computer market have expressed interest in the drive, but no orders have been placed yet.

"There will be an increased



Alps Electric's FDM2000 *is the slimmest of the new breed of "slimline" 5¼-in. floppy-disk drives.*

DATAPRODUCTS IMPROVES DOT-MATRIX QUALITY

In a move the company claims will raise the quality of dot-matrix printers closer to the standards required for word-processing applications, Dataproducts Corp., Woodland Hills, Calif., has unveiled a 128-character, 132-column printer using a 9×9 matrix format. Called the M-100, the newest member of the company's M-series printer family operates at 140 cps and offers an optional raster-graphics capability.

M-100 matrix printer specifications

Print speed	140 cps, bidirectional, logic-seeking
Throughput	56 lpm at 132 characters per line; 96 lpm at 72 cpl; 145 lpm at 40 cpl
Interface	8-bit parallel standard; RS232 or current loop optional; Centronics-compatible optional
Character font	9 × 9 half space, superscript, subscript, true lower case
Character set	128 (96 ASCII, 32 commonly used international characters)
Number of columns	132
Copies	Original plus 5
Dimensions	
Height	8 in. (20.32 cm.)
Width	26.6 in. (67.2 cm.)
Depth	23.4 in. (59.5 cm.)
Weight	60 lbs. (27.1 kg.)

M-100 product manager Bill Kershaw says the new printer will be marketed through direct sales as well as a distribution network, and is geared toward three major applications. The first is general-purpose word-processing applications, which Kershaw says is not first-class letter quality, but better than a 5×7 format because a daisy-wheel printer would be too slow. "And, because of its 1320-dot raster (dots per line), the M-100 can truly represent foreign languages," says Kershaw. The third application is business graphics, such as labels and codes used in supermarkets.

Price of the M-100 is $2200 in OEM quantities; price of the graphics option is $250. Deliveries are slated to begin in three months.

— Nancy Love

A few years ago, you bought DEC controllers or you took chances.

Time was you couldn't trust anyone. Price was often lower. Delivery was sometimes faster. But let's just say quality, reliability and service left lots to be desired (if the product even worked at all).

Times change. Enter Emulex.

First we decided that price shouldn't be the only reason to buy our controllers even though they cost less. The design goal of every tape, disk and communications controller we make is to go DEC one better. Emulex controllers actually optimize the DEC systems in which they're installed.

Emulex controllers would also be easier to install – plug 'em right into a backplane – hardware and software transparent.

We decided, also, to concentrate our expertise on DEC. We know DEC computers and designed products to improve them. Others didn't. You wouldn't remember their names.

In the last two years one Emulex success has led to another. Today, Emulex provides OEMs and end users with the industry's broadest line of controllers that improve DEC performance across the board. If we did anything wrong, it was in setting a new standard. Competitors stopped imitating DEC and started trying to imitate us.

So even today, unless you're careful, you can still take chances. There's a big difference between an imitation DEC controller and a genuine Emulex.

Emulex. The genuine alternative.

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CIRCLE NO. 42 ON INQUIRY CARD

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CIRCLE NO. 43 ON INQUIRY CARD

floppy drive, you haven't found us yet.

Hard to believe, perhaps, but no one ships as many 5¼" floppy drives as we do. No one builds a 5¼" rigid drive with as much storage. No one knows more about high-volume, high-quality electromechanics. And no one else designs and produces their own head from start to finish. In fact, no one, but no one, builds as much of their own product. You see, at Tandon, we simply make more of what we make. Tandon. 20320 Prairie, Chatsworth, CA 91311, (213) 993-6644. **Tandon**

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INFOSCRIBE 1000.

The Next Logical Step.

It's a Giant Step

And now the **INFOSCRIBE 1000**: a smarter, faster serial matrix printer with a host of features system designers crave but seldom get at a price they like. Plus the bonus of complete compatibility with its sister printer, the INFOSCRIBE 500.

Outpaces the Competition

INFOSCRIBE 1000 uses a closed loop servo for precision head positioning and quieter operation. Throughput is significantly increased by vertical and horizontal tabbing, two-way logic seeking, and a printhead that cruises at 180 cps. Good vertical and horizontal resolution lets you print a broad range of graphics. And the ability to download character sets from the host CPU offers all kinds of versatility.

More in Store

What you want is what you get from **INFOSCRIBE 1000**. Like unlimited duty cycle; 9 x 9 matrix for better character quality; double-wide printing; correspondence-quality printing; 10, 12, and 16.5 cpi; subscripts; superscripts; true underlining; serial, parallel, or communications interfacing; and software control by the host processor, to name a few.

Print On It, Then Count On It.

Thanks to its elegant design and genuine craftsmanship, **INFOSCRIBE 1000** prints almost ad infinitum. It's built for simple, straightforward maintenance, but it seldom needs anything but paper and ribbons. You can even change the printhead yourself, by removing two screws, but not until it's given you hundreds of millions of characters.

Our Growing Family

INFOSCRIBE 1000 joins the 500 in our family portrait. When the picture's complete, we'll have the broadest line of serial matrix printers available from one supplier. And that's good news, because there's no need to switch brands as your system grows. Coming soon is an exciting multifunction printer for both letter quality and DP quality characters. Watch for our birth announcements.

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Distributor/Representative inquiries welcome, too.

INFOSCRIBE™

Handing You a Line

CIRCLE NO. 44 ON INQUIRY CARD

demand for half-sized drives down the line, particularly in the smart typewriter market, which is seeing an awful lot of activity from companies like IBM, Qyx, Olivetti and Triumph Adler," says Jim Porter, Mountain View, Calif., consultant and publisher of *Disk/Trend Report*. "In that market, you have a small-form concern greater than what you have in the CRT work-station market."

Qyx, Lionville, Pa., has developed a half-sized device, which is incorporated into one version of a smart typewriter. While the company is the only one on the market using such a drive, the unit is not available on an OEM basis.

Porter says that half-sized drives may also find applications in providing more memory to systems with drive slots large enough to accommodate a single, standard-sized 125K- or 250K-byte 5¼-in. floppy. "In that case," he says, "two half-sized units lend themselves to replacing a single standard-sized unit without messing up the form factor."

Porter adds that some of the suppliers of 2.1-in.-high 5¼-in. drives have half-sized units under development.

One of those companies, the Remex Division of Ex-Cell-O Corp., Irvine, Calif., introduced a 2.1-in.-high 5¼-in. drive last month at the National Computer Conference and is said to be readying a smaller unit.

"Half-sized drives are the wave of the future," says Chuck Ouelette, marketing director for Remex. He adds, however, that 2.1-in.-high units are more marketable because systems have already been designed and manufactured with slots to accommodate them. Ouelette will not comment about when Remex will release a half-sized unit.

The Alps FDM2000 drive will sell for about $300 in single-unit quantities and $150 or less in quantities of 1000 or more.

—Frank Catalano

CHIP MAKERS JUMP ON ETHERNET BANDWAGON

The proposed Ethernet local area network standard has received additional support with the announcement by two semiconductor makers that they will supply Ethernet-compatible interface chips. Under terms of a recently concluded cross-licensing agreement, Advanced Micro Devices, Inc., Sunnyvale, Calif., and Mostek Corp., Carrollton, Texas, will both supply two Ethernet interface chips intended to link computers, CRT terminals and other peripherals to the Ethernet coaxial cable bus.

The two chips are a data-management device that assembles data into Ethernet packets and handles error-detection and collision-management functions, and a bus transceiver that sends or receives data in Manchester code at 10M bits per sec. as specified by the Ethernet standard.

The MOS-VLSI data-management chip will replace about 400 MSI/SSI TTL chips, while the bipolar transceiver chip will replace about 20 TTL devices, says Jim Vittera, program manager for local area networks at Mostek. He says that when the chips become available in quantity sometime in 1983, they could drive the price of an Ethernet interface down from the current $1000 to as little as $100.

Slated for initial sampling in 1983, the two chips are intended to serve as an interface between a 16-bit μc, typically installed in an Ethernet station, and an Ethernet bus transceiver installed at a cable tap.

The MOS-VLSI data-management chip was developed by Mostek, while the bipolar transceiver was designed by AMD. Both companies received design assistance from Digital Equipment Corp., an originator of the Ethernet standard along with Intel Corp. and Xerox Corp., which developed the original Ethernet for internal use.

Vittera says Mostek and AMD decided to announce the chips early to give potential customers a head start in planning for Ethernet-compatible products and to express "our faith in Ethernet as an industry standard." He says the AMD/Mostek chips will be functionally compatible, though not plug-compatible, with similar chips reportedly under development by Intel.

—Paul Kinnucan

MINIBITS

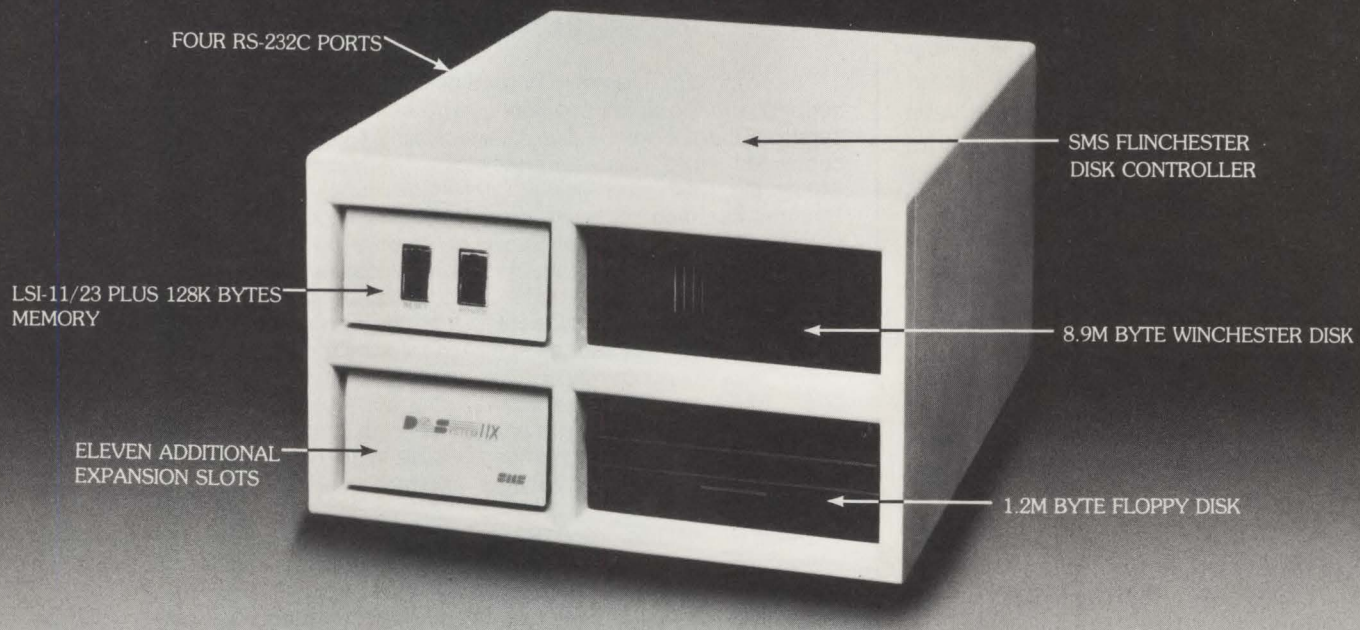
DG UNVEILS SNA SOFTWARE FOR 32-BIT MACHINES

Data General Corp. has become the first non-IBM vendor to offer SNA compatibility on a 32-bit system with the introduction of new DG/SNA software. The software can run simultaneously with DG's X.25-based Kodiac networking software and can operate under AOS/VS on the firm's 32-bit Eclipse MV/8000 computer. The software is also available to run on 16-bit Eclipse systems. SNA, System Network Architecture, is a communications network to which IBM is committing its new products.

TYMSHARE PLANS TO MARKET FRENCH TERMINALS

Tymshare, Inc., Cupertino, Calif., plans to market personal computer terminals for managerial desk-top use, personal and home applications and point-of-sale communications for retail merchandisers. Under terms of a multi-year contract, MATRA, a French manufacturer of telecommunications equipment, will provide Tymshare 100,000 personal computer terminals, each priced in the $500 to $700 range. Tymshare sources say the terminals, the first of which will be available this summer, are expected to complement the computer information and communications services offered by the company, bringing Tymshare information-management applications directly to the executive's desk. The contract represents the first step in the collaborative agreement announced last fall between Tymshare and Intelmatique, the promotional arm for France's telecommunications products and services.

DEC® COMPUTER SYSTEMS COME IN SMALL PACKAGES!!



The SMS Disk System 11X is a powerful table top DEC computer system. Using the latest Winchester disk storage, DEC's RT-11 and RSX-11M operating systems run without the expense, inconvenience, and space requirements of DEC's RL01/RL02 disk cartridge peripherals. Weighing only 80 pounds and requiring only 10½" of table top or rack space, it also offers the following benefits:

MAXIMUM PERFORMANCE AND CAPACITY

- 8.9M bytes of formatted Winchester disk storage plus 1.2M bytes of usable floppy disk storage.
- Fast data transfer of **427K bytes/sec** for Winchester and 63K bytes/sec for floppy.

INDUSTRY COMPATIBILITY

- Automatic recognition of **DEC** RX01, RX02 and **IBM** diskette formats.
- Increases performance of DEC's RT-11 and RSX-11M operating systems.
- Emulates DEC RX02 floppy disk system.

CONVENIENT "MINUTE-PER-MEGABYTE" BACKUP

- Only **40 seconds** required for Winchester backup onto 1.2M byte floppy diskette.
- Standard RT-11, RSX-11M, and SMS utility software supports partial or selective file backup and load operations.

UNSURPASSED RELIABILITY

- Modular construction and minimal parts count ensure **long MTBF** and **short MTTR.**
- Offline system and drive test.
- On board **self test** verifies correct Flinchester controller and disk operation.
- CRT based **interactive diagnostics** ease system test and fault isolation.
- **Automatic bootstrap** tests CPU, memory and Q-bus operation before software loading.

EXCEPTIONAL DATA INTEGRITY

- Winchester disk **flaw management** deletes permanently flawed disk areas.
- Automatic **error retry** recovers soft or temporary errors.
- **ECC (Error Correction Code)** recovers corrupted data without system shut down.
- Patented PLL circuitry requires no field adjustments and provides maximum margins for worst case bit shifted data recovery.

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AVAILABLE SOON!!!

Look for 20M byte and 30M byte DEC computer systems in the near future.

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Tincler heads newest Centronics management team

Having appointed the third president in less than two years, Centronics Data Computer Corp. chairman Robert Howard believes he now has a good management team in place.

Howard, once president of the rapidly growing printer manufacturer in Hudson, N.H., stepped aside last May to bring in former Xerox Corp. executive Michael Kaufman in an attempt to reorganize the company for growth. Despite another attempted reorganization in mid-March (MMS, May, p. 41), the company appears to have outgrown Kaufman, who will remain with Centronics on special assignment. Kaufman was succeeded by John Tincler, former executive vice president in charge of operations, who was named president in late April.

Centronics's chairman Robert Howard *(right) feels his company now has a good management team in place, headed by new president John Tincler.*

Howard says the management team is "a most professional group of people. The focus of the company must be to bring forward all new product lines in various stages of preparation for production, and to continue to operate in an efficient, effective way." The reorganization is complete, except for a person Tincler will appoint to fill his former slot.

In Tincler, Howard believes he has found a person with the skills the company needs. He says Tincler is "experienced in manufacturing, engineering, marketing and field service, and has managed all facets of those functions for Raytheon Data Systems." Tincler is a 24-year Raytheon Co. veteran who joined Centronics in August of 1980. Howard says one of Tincler's strengths is that he focuses on details and can quickly assess options and make decisions. Tincler also has experience with OEMs, which was one issue leading to Kaufman's exit.

Howard does not say whether he assumes the blame for Kaufman's failure to fill the position, but he does not discredit Kaufman. Others in the industry, however, question Kaufman's ability to meet the needs of the fiercely competitive OEM business.

"It is not all his (Kaufman's) fault. The production problems in the Miniprinter's were there before he joined the company," says Peter Wright, an analyst with the Gartner Group, Inc., Greenwich, Conn.

Wright sees Kaufman's replacement as a positive move for the company, however, because Kaufman "is not a strong operations guy and had not worked with products in an extremely competitive market" when he was at Xerox. Wright says Kaufman may have been unfairly saddled with some of the results of the earlier production problems that have sapped the company's profits.

The March reorganization was part of a so-far unsuccessful attempt to remedy some of the company's manufacturing and delivery problems. "The circumstances leading to the change (to a new president) are complex. A simple answer is that it did not work out," says Howard. He says that in the initial company reorganization planned two years ago, the position of president was profiled. It took a year to fill that position, and the profile changed during the two years. Howard says Tincler is better suited for the job as it is now structured than Kaufman was.

—L. Valigra

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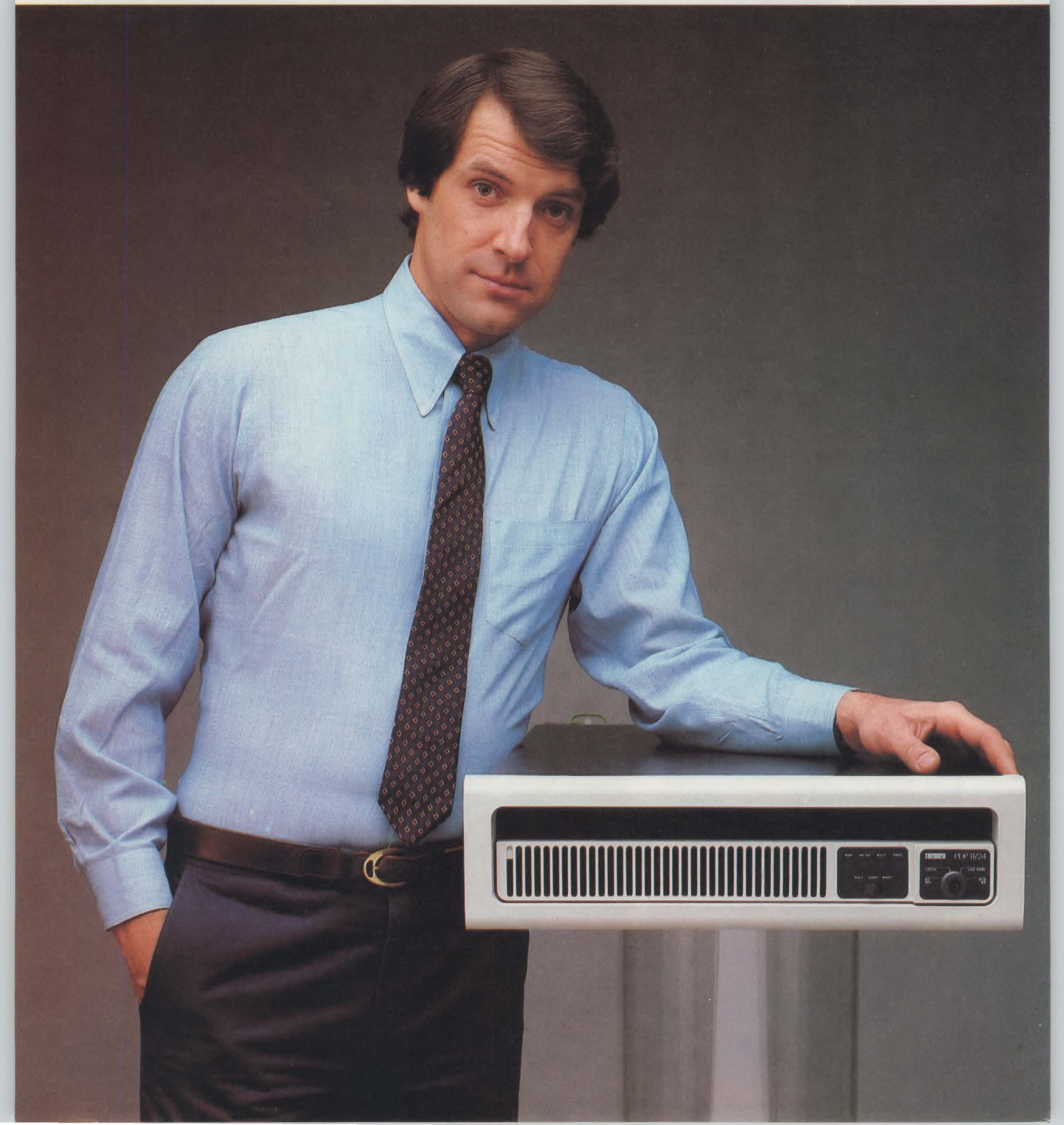

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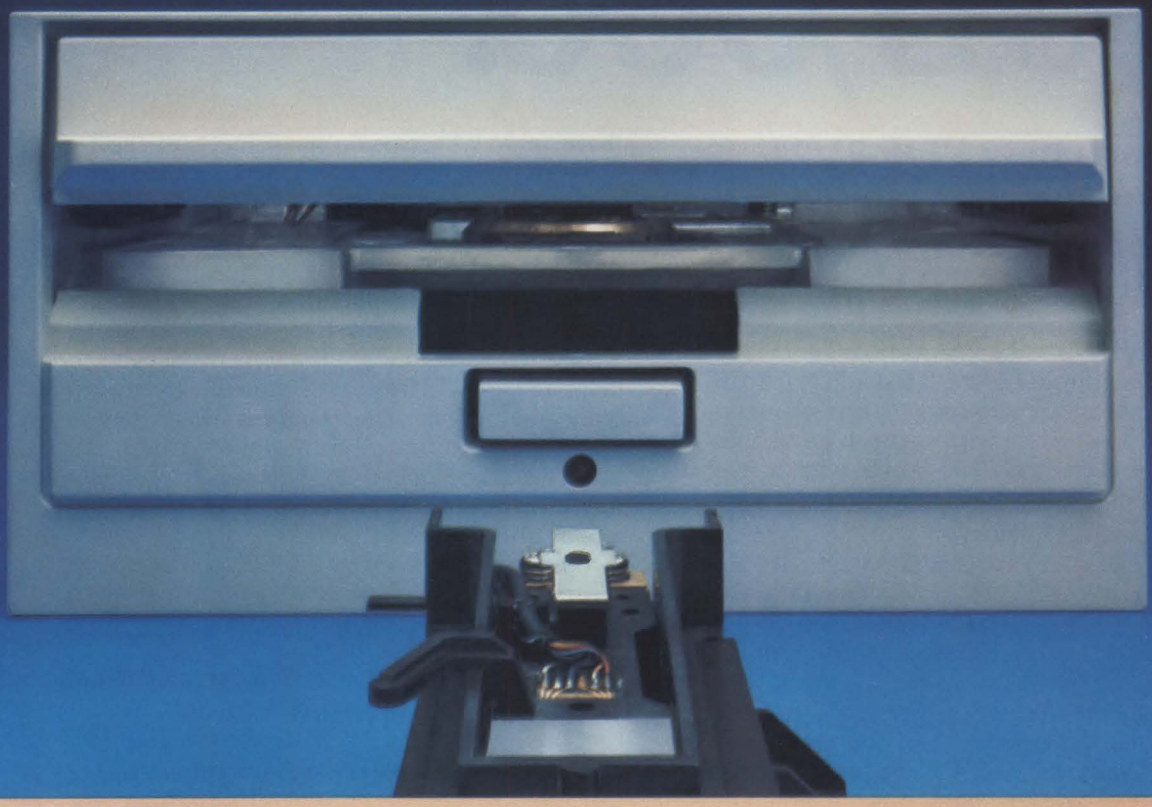

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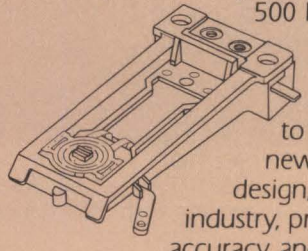

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CIRCLE NO. 47 ON INQUIRY CARD

Sanders is back on track with new financing, products

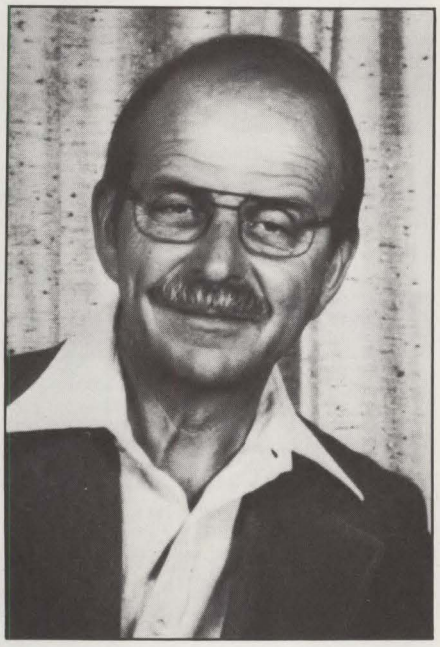
Those who were optimistic and bet that Sanders Technology Systems, Inc., would emerge from Chapter XI bankruptcy protection might be wise to spend a night at the races, because they were right. The Amherst, N.H., printer manufacturer has come out of that protection with new management, new financing, an agreement with Diablo Systems, Inc., to license STS's infinite-matrix printing principle and a new family of products in the works.

After encountering production problems and user acceptance of its Media 12/7 dot-matrix printer, which will be gradually phased out, STS ran into an even bigger problem. In the first quarter of last year, the company lost more than $800,000 because a German company renegotiated a $46-million contract, stretching it from three to six years. These setbacks caused the company to file for Chapter XI bankruptcy protection last May (MMS, September, 1980, p. 69).

STS founder Royden Sanders Jr. is relieved by the outcome, and says he has learned from the experience. "It's like escaping from purgatory. I look forward to a normal life," he says. "There is no question that anyone who successfully emerges from Chapter XI is all the wiser. I don't recommend it, even though it's a broadening experience."

That "broadening experience" has brought at least one new face into the company: new president and CEO J. Chuan Chu, who joined STS last November from a management position at Wang Laboratories, Inc. Chu and his family invested some $500,000 in STS in exchange for a new class of preferred stock.

About $2.5 million was raised to get out from under Chapter XI,



Royden Sanders Jr., *whose company recently emerged from Chapter XI bankruptcy protection, has the company back on track with new financing, a new president and a new family of printers.*

Sanders says. All of the $1.25 million of certificates of indebtness issued by STS during Chapter XI and held by 40 to 50 people have been exchanged for 625,000 shares of common stock. Additionally, all unsecured creditors voted to receive a preferred stock, which amounts to about 10-percent ownership of STS. Anyone owed $250 or less was paid in cash.

Sanders, Chu and two venture-capital firms will control 51 percent of STS. Chu, his family and the two ventures—Urban National Corp., Boston, and Venturetech Capital, Inc., Baton Rouge, La.—infused STS with $1.25 million. The money was exchanged for a new class of preferred stock that is convertible into common stock.

With the new financing and an agreement with Diablo to license STS's infinite-matrix principle, Sanders is looking forward to making sure the company's new product, the model 7/24, gets out on time. Each company can manufacture jointly developed products. Diablo will license STS's patent, although Sanders can also sublicense the technology to other OEMs. The Diablo/Sanders exchange is subject to approval by Diablo's parent company, Xerox Corp.

The 7/24 is the first member of a new family of high-quality dot-matrix printers. It will have a lower price than the Media 12/7 and improved throughput. The 12/7 ranges in price from $2500 to $4000, depending upon configuration. The new printer is expected to operate at 240 cps at 10-pitch in one pass.

The 7/24 incorporates a new print head, as well as electronics and software modified from the 12/7, which also uses the new head now. The new printer is built around the Diablo model 630 mechanism, which Sanders says has one of the best designs for production. A similar printer is in development for Diablo, he says.

Undaunted by the prospect of competing with well-established Diablo, Sanders says, "In a new technology, it is important, especially to large OEMs, to have an alternate source for the product." He adds that affiliation with Diablo should improve the acceptance by users of a product that was "very much in doubt when it was first introduced." —*L. Valigra*

People in the news....

Ronald J. Mion has been appointed director of marketing programs at Micro Five Corp., Irvine Calif., with responsibility for marketing communications, vertical market planning and coordination of all support materials and trade shows.

Richard Melmon has been appointed manager of product market-

ing for Personal Software Inc., Sunnyvale, Calif. Melmon's responsibilities will include product marketing, strategic market planning and management of the company's advertising and public relations activities. Since 1979, Melmon had been a vice president at Regis McKenna, Inc.

Richard D. Dixon has joined Dest Corp., San Jose, Calif., as vice president, marketing. Dixon will manage U.S. and international sales and marketing.

Kenneth J. Jones has been appointed vice president of the systems technology division of the computer technology group at Tymshare, Inc., Cupertino, Calif. He is responsible for directing the development, enhancement and support of computer resources. He joined Tymshare in 1972 and most recently was division manager of systems technology.

Robert E. Didion, formerly executive vice president and chief operating officer at Micro Peripherals Inc., Chatsworth, Calif., has been promoted to president and general manager. He succeeds **Pawitter Sidhu,** who will become chairman of the board.

Norman B. Petersen has been appointed vice president, OEM storage equipment, of Memorex Corp., Santa Clara, Calif. He will be responsible for OEM marketing and sales, customer interface and support services.

Loren Warburg has been named general manager for U.S. operations, responsible for the Northeast and Midwest operations. He has been with Modcomp since 1976, most recently as director of North American sales.

Luis Zuniga has been named general manager for U.S. operations responsible for Southern and Western operations. He joined the company in 1972, and was most recently regional sales manager for the Southern region.

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
Apple Computer	6 mos.	3/27/81	146,400,000	16,600,000	.30
	6 mos.	3/27/80	43,100,000	5,400,000	.12
Audiotronics	9 mos.	3/31/81	6,144,000	188,000	.18
	9 mos.	3/31/80	6,074,000	217,000	.23
Aydin	3 mos.	3/28/81	1,700,000	1,700,000	.49
	3 mos.	3/28/80	1,496,000	1,496,000	.43
Beehive International	6 mos.	3/31/81	19,327,055	2,050,777	.80
	6 mos.	3/31/80	14,114,478	658,270	.26
Compuscan	9 mos.	2/28/81	11,936,000	126,000	.04
	9 mos.	2/28/80	12,952,000	(1,040,000)	.44
Computer Automation	9 mos.	3/31/81	56,610,000	1,215,000	.60
	9 mos.	3/31/80	58,816,000	3,012,000	1.51
Computer Sciences	53 wks.	4/3/81	600,593,000	24,725,000	1.82
	53 wks.	3/28/81	452,634,000	22,698,000	1.70
CPT	9 mos.	3/31/81	68,922,000	8,582,000	1.74
	9 mos.	3/31/80	39,676,000	4,287,000	.97
Dicomed	3 mos.	3/31/81	1,675,211	152,760	.12
	3 mos.	3/31/80	974,770	120,392	.15
Docutel	3 mos.	3/31/81	13,062,000	991,000	.28
	3 mos.	3/31/80	11,433,000	905,000	.28
Four Phase Systems	3 mos.	3/31/81	51,890,000	1,769,000	.33
	3 mos.	3/31/80	45,635,000	1,127,000	.22
General Datacomm Industries	6 mos.	3/31/81	31,337,000	2,478,000	.39
	6 mos.	3/31/80	25,123,000	1,944,000	.36
Genisco Technology	3 mos.	3/31/81	5,733,008	346,015	.18
	3 mos.	3/31/80	4,068,805	398,929	.21
Informatics	12 mos.	3/31/81	127,833,000	5,124,000	2.26
	12 mos.	3/31/80	116,252,000	4,523,000	2.04
Intel	3 mos.	3/31/81	184,619,000	2,120,000	.05
	3 mos.	3/31/80	203,873,000	24,086,000	.55
Lear Siegler	9 mos.	3/31/81	1,111,344,000	52,324,000	3.25
	9 mos.	3/31/80	1,048,360,000	46,964,000	3.03
LogEtronics	3 mos.	3/31/81	7,082,000	1,167,000	1.04
	3 mos.	3/31/80	7,743,000	489,000	.44
NBI	9 mos.	3/31/81	39,101,000	4,825,000	.56
	9 mos.	3/31/80	22,526,000	2,215,000	.33
North American Philips	3 mos.	3/31/81	706,869,000	14,546,000	1.10
	3 mos.	3/31/80	592,379,000	15,920,000	1.22
Plantronics	39 wks.	2/28/81	68,934,000	9,208,000	1.43
	39 wks.	3/1/80	59,230,000	5,889.000	.93
Prime Computer	3 mos.	3/29/81	85,043,000	8,510,000	.28
	3 mos.	3/29/80	52,123,000	5,889,000	.21
System Industries	3 mos.	3/29/81	12,024,000	1,441,000	.89
	3 mos.	3/30/80	8,009,000	94,000	.22
Tandem Computers	6 mos.	3/31/81	88,026,000	11,138,000	.94
	6 mos.	3/31/80	45,703,000	4,575,000	.47
Tandon	6 mos.	3/27/81	21,662,000	1,804,000	.22
	6 mos.	3/27/80	8,911,000	553,000	.09
Timeplex	9 mos.	3/31/81	22,789,735	1,327,826	.35
	9 mos.	3/31/80	12,164,354	983,624	.32
Tymshare	3 mos.	3/31/81	76,774,000	7,886,000	.68
	3 mos.	3/31/80	63,288,000	6,108,000	.63
Verbatim	9 mos.	3/31/81	36,763,000	(369,000)	(.17)
	9 mos.	3/31/80	38,079,000	1,705,000	.77
Wespercorp	9 mos.	3/31/81	9,901,200	908,000	.67
	9 mos.	3/31/80	7,610,800	715,500	.59

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ADM-42 (8 page buffer avail.)	2035	120
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1420 (dumb terminal)	895	63
1421 (Consul 580 & ADM-3A comp.)	850	63
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LA 120-AA DECwriter III (forms pkg.)	2095	135
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TI 785 (port/built-in coupler)	2270	128
TI 787 (port/internal modem)	2595	143
TI 810 RO impact	1760	105
TI 810 RO Pkg.	1950	110
TI 820 KSR impact	2025	100
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TI 820 RO Pkg.	2025	100
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CIRCLE NO. 49 ON INQUIRY CARD

Letters

MISLEADING QUOTE

To the editor:

I would like to comment on a possibly misleading quotation in "An industrial computer that can't fail" (MMS, March, p. 29). The president of August Systems, in discussing the fault-tolerant computer systems manufactured by his company, said, "Computers now control everything from the family car to nuclear plants worth billions of dollars." Computers may control billion-dollar nuclear plants, but not in this country. The NRC does not permit computer control of nuclear plants; computer unreliability is usually the reason given.

Instead, electronic analog control systems are used for nuclear steam system control.

Bruce J. Benedict
Babcock & Wilcox Co.
Lynchburg, Va.

WELL-DOCUMENTED PROGRAMS

To the editor:

I disagree with Edwin Lee, just as Robert D. Grappel does ("Debunking the debunker," MMS, March, p. 145), but I take strong exception to his statement that a functioning program is its own documentation. Source listings, object code and memory dump do not constitute an industrial program documentation. His version of documentation allows the program to be duplicated and/or reloaded. It is not enough to be able to do just that.

In my situation, documentation must convey the engineering and process information of the process or machine that is being controlled. No industrial process endures forever, nor do programmers. Software and hardware must change. A revision to one part of a program can destroy another part of a program. Documentation is not complete until the process engineer

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The Dual-Mode 200 accepts standard daisywheel print commands for word processing system compatibility.

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See opposite page for distributor listing.

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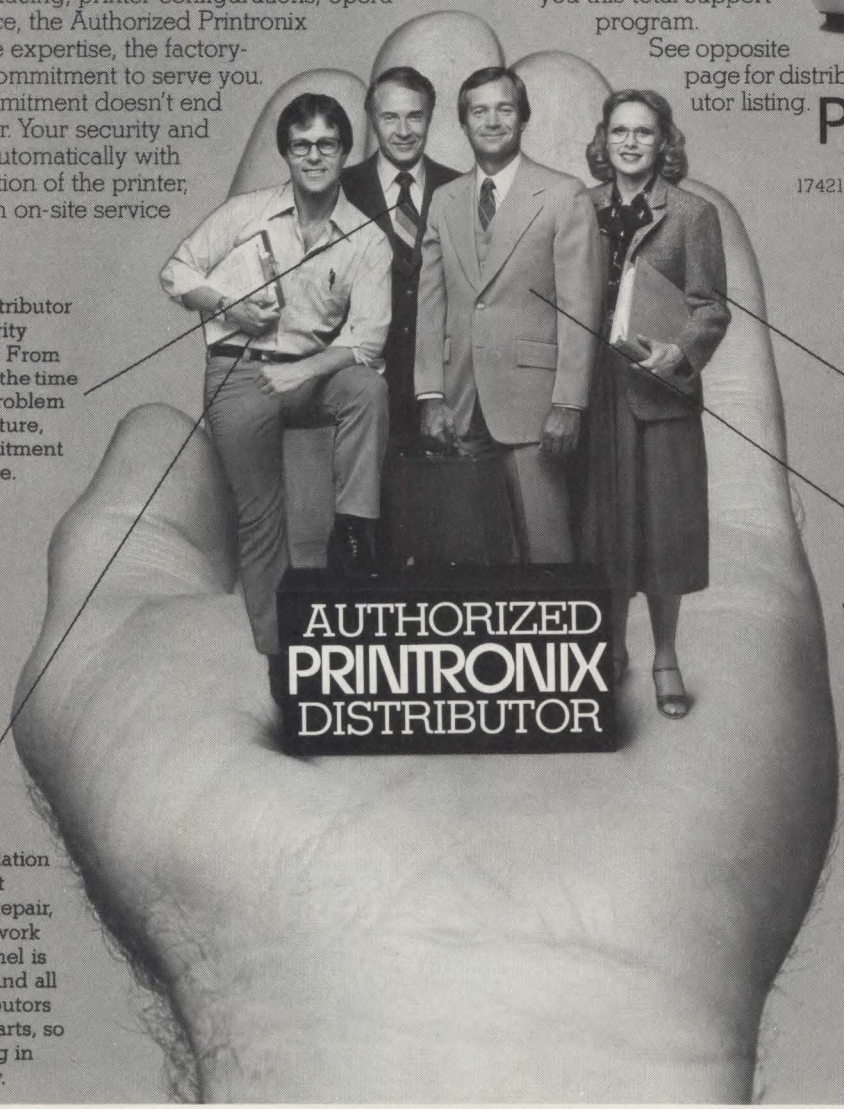

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BFA CORPORATION
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Northern Illinois, Indiana, Iowa, Wisconsin

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G&S COMPUTERS
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GENTRY ASSOCIATES, INC.
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GROUP III ELECTRONICS
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LOWRY & ASSOCIATES, INC. (313) 227-7067
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MESA, INC.
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PRINTRONIX

Letters

can read it and can understand the reasons and the intricacies of the program in every last detail. There must be full bilateral communication between the programmer's successor and the process engineer's successor, and documentation is the way it is done.

I require all programs to be written in our standard high-level language, adequately commented, and supported by flowcharts understandable by the process engineer. I allow only a miniscule number of terse mnemonics; I insist that all labels and declarations be fully understandable by not later than a second reading. I prefer a germanic style concretion of several words into a single word that conveys immediate understanding as opposed to a terse three-letter symbol that saves seconds of typing but is misunderstood 7 times out of 10.

Joseph E. Van Acker, P.E.
Senior Project Engineer
M & M/Mars
Hackettstown N.J.

PLUG-A-BUBBLE PRICING

To the editor:

There was a slight misunderstanding concerning pricing on Intel's Plug-A-Bubble system (MMS, April, p. 16).

The Plug-A-Bubble system will follow the price cuts as established by Intel's bubble-component pricing, resulting in guaranteed lower prices over the next two years. However, typical of any system, prices will follow a slightly different curve because of non-component hardware costs, such as system interface circuitry, assembly and test. As component prices decrease, they comprise an increasing smaller percentage of the total system cost, and this is reflected in a different system price slope than that for components. At some point, the system price then does become "relatively stable." For example, the price of the 128K-byte Plug-A-Bubble cassette is $1915 in quantities of 100. By mid-1982, the price will be $1100 in similar quantities and then will fall to $950 by mid-1983.

Thank you for your continued coverage of the growing bubble market. Generally, confusion over pricing subtleties is not of high concern. But the issue is extremely important in the emerging bubble market, especially in light of Intel's commitment to guaranteed bubble price reductions.

Christy Robbins
Product Marketing Manager
Intel Corp.
Palo Alto, Calif.

CORRECTIONS

In "Down-scaling DBMS to the microworld" (MMS, April, p. 187), Mini-Micro Systems made three errors that may have misled some of our readers.

Micro Database Systems, Inc., the company that developed MDBS, is located in Lafayette, Ind. (Its location was not listed in the story.)

In an accompanying article, "Explaining the evaluation matrix" (p. 190), MDBS was inaccurately referred to once as DBMS.

The evaluation matrix table (p. 193) carried the wrong caption. The table was a rating of MDBS and was not an example of a program using DBMS, as the caption stated.

In the article "Controversy hits market for local area networks" (MMS, March, p. 18), Steve Randesi was incorrectly identified as the president of Computer Solutions, Inc. Randesi is head of Communications Solutions, Inc., San Jose, Calif.

MMS, October, 1980, p. 157 erroneously report that Integrated Software Systems Corp. manufactures a computer. The section discusses the Virtual-Memory FORTRAN engine. ISSCO, however, does manufacture the DISSPLA software package.

Mini-Micro Systems regrets the errors.

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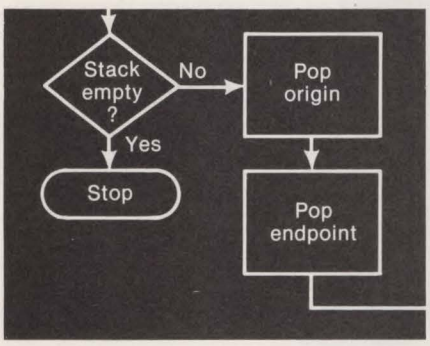
CIRCLE NO. 53 ON INQUIRY CARD

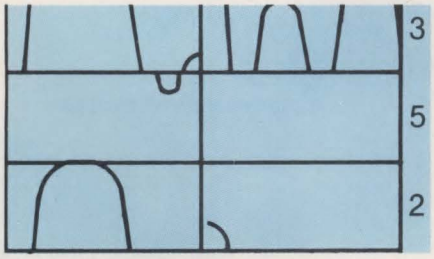
FEATURE HIGHLIGHTS

87 The spectacular growth of the data-processing business in the last 25 years has been intimately tied to the extraordinary power and versatility of the computer as a tool for business applications. The market is awash with hundreds of systems, ranging from μc-based single-user systems to superminicomputer-based installations with close to 100 terminals. Between these extremes are hundreds of models, mostly aimed at companies with fewer than 500 employees. Contributing editor Malcolm L. Stiefel takes an in-depth look at this middle ground, helping potential buyers evaluate the options and trends in small-business computer systems.

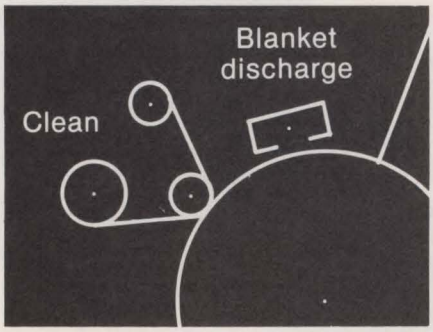
109 How did the minicomputer industry fare during the economic downturn of 1980? Most sectors of the small-computer industry came through it with delivery levels and balance sheets almost unscathed. But backlogs are substantially lower than they were a year ago, making suppliers vulnerable to an extension of the recession past mid-year. That's one of the key findings in this mid-year market evaluation.



129 A picture might be worth a thousand words to some, but to a small system user it can be worth much more. Until recently, graphics capability was the domain of minicomputers and mainframes because it requires a great deal of support from a host in terms of memory, computation and hardware. Consultants Robert Grappel and Jack Hemenway explain how the introduction of graphics-controller chips has made truly powerful graphic displays practical for μcs.



139 Communications protection for voice and/or data messages requires the use of a variety of technologies, depending on specific application requirements. In this first story of a two-part series, author and consultant J. Michael Nye takes a look at two technologies—scrambling and digitizing—to protect voice messages.



179 Many manufacturers are trying to address the promising minicomputer-printer market with a variety of technologies. The latest bid comes from Delphax Systems, whose new non-impact page printer mechanism is featured in our New Products section. The "Otter," based on an ion-deposition principle, incorporates fewer mechanical and more electronic parts to improve reliability. A printer using the Delphax mechanism could carry a price less than half—or about $35,000—that of its competitors, the company claims.

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CIRCLE NO. 54 ON INQUIRY CARD

PRODUCT PROFILE

Choosing a small, multi-user business computer

MALCOLM L. STIEFEL, Contributing Editor

A wide range of architectures, multi-user capabilities and available software makes the selection a difficult one

The spectacular growth of the data-processing business in the last 25 years has been intimately tied to the extraordinary power and versatility of the computer as a tool for business applications. It is not surprising, then, that the small-business computer market has blossomed as technology has improved and costs have fallen.

The market is awash with literally hundreds of vendors, offering systems that range in capacity and throughput over three or more orders of magnitude, from μc-based single-user systems with 32K bytes of memory and a 1M-byte floppy disk to mammoth superminicomputer-based installations with close to 100 terminals, 2M bytes of main memory and perhaps

Digital Equipment Corp.'s *Datasystem 540, introduced in late 1979, is a PDP-11/44-based member of the company's popular Datasystem 500 line of business computers.*

The wide variety of prices and models is at once a blessing and a curse for users; the small-business computer market is a technological maelstrom, with emphasis shifting from power to reliability.

2G bytes of disk storage. In between these extremes are hundreds of models, mostly aimed at companies with fewer than 500 employees.

Storage prices continue to erode

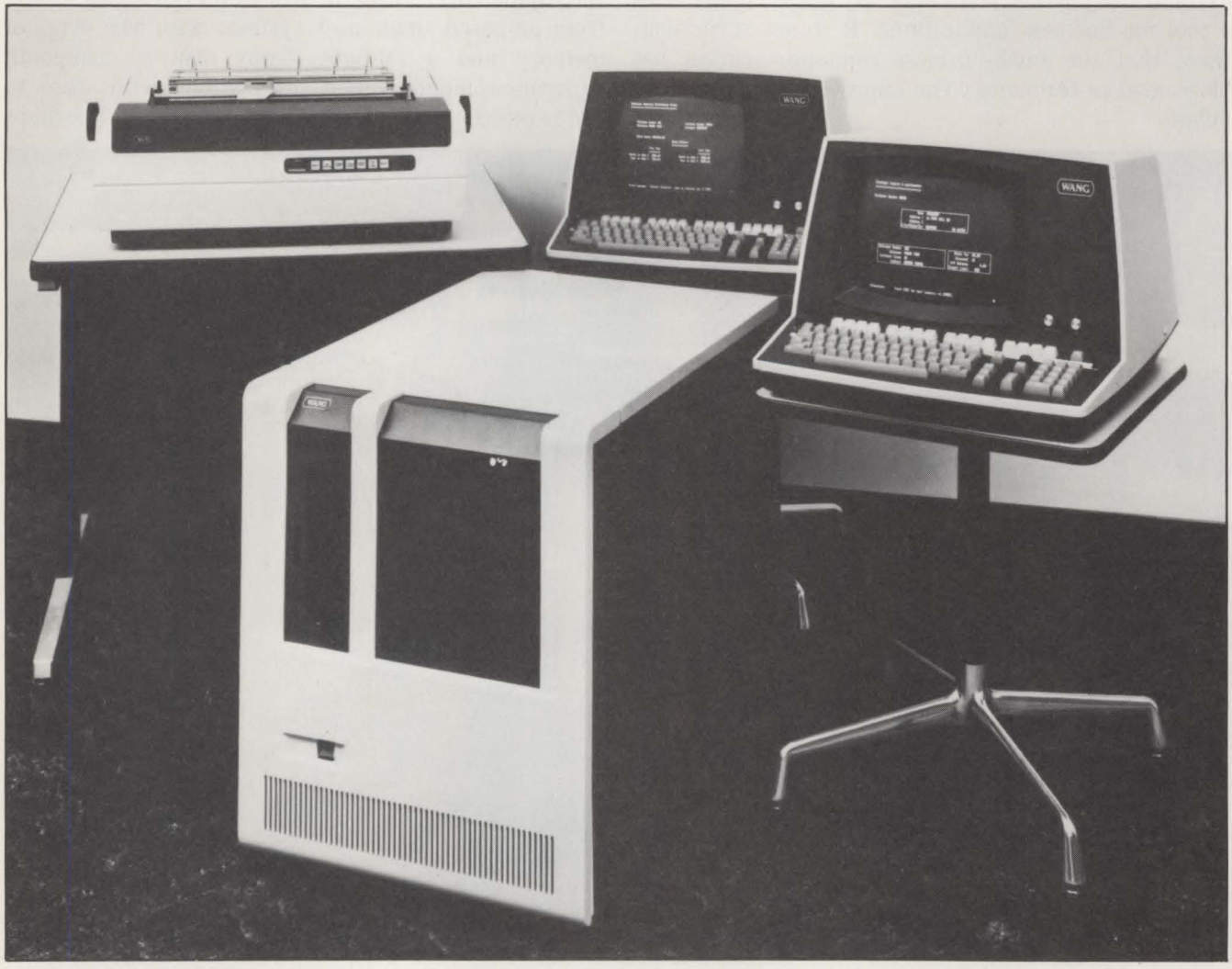
This wide variety of models and prices is at once a blessing and a curse for users, because the small-business computer market is a technological maelstrom. Distributed architectures are proliferating, competing with the classic centralized systems. Families of computers abound, giving users that all-important upward mobility. Emphasis is shifting from raw computing power and encyclopedic storage to increased reliability and maintainability. Better software-development tools are appearing as interest swells in programmer productivity and as software costs begin to dominate hardware costs. The integrated office system—a smorgasbord of data-processing, word-processing and electronic-mail applications—is just around the corner. Meanwhile, prices for processors, memory and secondary storage continue to erode.

The potential buyer is dazzled by all of this and is left in a bit of a quandary: Should he buy now or wait until there is another generation of equipment, reducing prices still further? Should he opt for a distributed system or a centralized system? Is a fault-tolerant architecture an absolute must? Are remote diagnostics required, or is the vendor across the street? The dilemma eventually is resolved when the user comes to grips with the requirements, choosing those that are most important to his company, and narrows the choices to systems that best meet the top-priority criteria.

This article will dig into some of these options and trends in small-business computer systems.

The move to distributed architecture

The trade press has been buzzing for years about distributed system architectures. It appears that the market is large enough—customers are fairly large

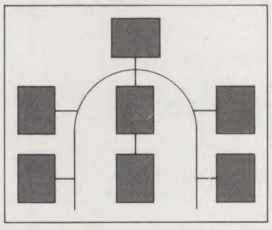


Wang Laboratories' *2200 LVP uses a 1M-byte, double-sided, double-density diskette and a 2M-, 4M- or 8M-byte fixed disk. User memory is expandable from 32K to 128K bytes.*

Nestar Is Growing a Local Network for You.

Centralized data processing is under pressure. Managers compete for computer time and complain about the lengthy justification process for new applications. Individual users at their terminals are frustrated by unacceptable response times. When the system goes down, everybody's DP-dependent work grinds to a halt.

High Productivity
Nestar's Cluster/One, Model A is a local network of Apple® computers that lets people get on with productive work instead of waiting in line. Since every user station is a computer in itself, response time is fast, and downtime problems are restricted to single individuals. The net result: productivity grows as your network grows.



More for Less
Nestar's Cluster/One is a true local network, not merely a limited function shared disk system. This means your company enjoys the benefits of shared data, station-to-station communication (including electronic mail), *and* the reduced costs of shared peripherals. Since Cluster/One is microcomputer-based, its cost-per-station is dramatically lower than other systems with similar capabilities, including mini-based systems. And the more people on the network, the greater your savings!

We're Growing Our List of Applications
Cluster/One is working right now — in banking, manufacturing, the travel industry, schools, and many other institutions and businesses. Software for the application you have in mind may also exist right now — literally thousands of programs have been written for Apple.

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We're ready to ship immediately. So if you're working on the problems of DP overload, consider the Cluster/One from Nestar. It's a solution that grows on you. For more information, contact us at: Nestar Systems, Inc., 2585 East Bayshore Road, Palo Alto, CA 94303, 415/493-2223

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CIRCLE NO. 55 ON INQUIRY CARD

Most vendors are sticking with stand-alone small-computer systems, with communications a standard or optional feature.

companies, interested in replacing mainframes with minicomputers—to attract several vendors.

Datapoint Corp., for one, advertises its Attached Resource Computer architecture. The ARC system uses standard Datapoint processors and peripherals, dedicating some processors to application program execu-

Manufacturer	Model number	Word size; main memory size	Number of users	Disk storage capacity
ABC Computers	Dekchester	16 bits; 64K to 256K bytes		20M bytes
Advanced Information Design	System 3000	8 bits; 32K to 1M bytes		10M to 300M bytes
AIS Data Systems, Inc.	AIS-10	16 bits; 64K to 16M bytes		32M bytes
Alpha Micro	AM-1000 Series	16 bits; 64K to 2M bytes	24	2.4M to 2400M bytes
AM Jacquard Systems	J100, J500	16 bits; 32K to 128K bytes	29	12M bytes
Anderson Jacobson, Inc.	System 1500	16 bits; 32K to 64K bytes	4	40M bytes
Applied Data Communications	Event 2000 Series	8 bits; 48K to 64K bytes		10M bytes
Basic Four Corp.	410, 510, 610, 730	8 bits; 40K to 256K bytes	8 to 32	40M to 300M bytes
Basic Time	B-200	16 bits; 64K bytes		10M bytes
BTI Computer Systems	5000/ES	16 bits; 64K bytes	32	10M bytes
Burroughs Corp.	B80 Series	8 bits; 32K to 124K bytes		65.6M bytes
Business Systems Products, Inc.	Adviser II	16 bits; 64K to 608K bytes	24	40M bytes
Cascade Data Inc.	Concept II, Concept III	16 bits; 32K to 128K bytes	24	10M bytes
Century Computer Corp.	300, 400, 700, 900	8 bits; 32K to 512K bytes	24	300M bytes
Computer Automation, Inc.	Syfa Series	8 or 16 bits; 64K to 304K bytes	4 to 32	32M to 2700M bytes
Computer Hardware, Inc.	3230, 4250	16 bits; 32K to 2M bytes	8 to 32	10M bytes
Computer Interactions	Compro II, Wordpro II	12 bits; 128K to 1M bytes		40M bytes
Computer Technology Ltd.	8020	16 bits; 128K to 256K bytes	4	9.6M bytes
Control Data Corp.	Cyber 18 Series	16 bits; 32K to 512K bytes	64	400M bytes
Cybertek Computer Products, Inc.	1600, 3200	16 or 32 bits; 64K to 1M bytes	48	600M bytes
Data General Corp.	CS/40, CS/50, CS/60	16 bits; 64K to 256K bytes	3 to 9	10M to 760M bytes
Data Terminals & Communications	DTC Micro 210, Taskmaster	8 bits; 56K to 64K bytes	4	5M to 150M bytes
Datapoint Corp.	1150, 1500, 3800 Series, 4500 Series, 4600 Series, 5500	8 bits; 24K to 120K bytes	2 to 24	4M to 120M bytes
Dataram Corp.	Bulk Mini	16 bits; 32K to 4M bytes		
DDC Computer	System 220	16 bits; 64K to 512K bytes		280M bytes

tion and others to data storage and retrieval, with an interprocessor bus tying the units together. All users can access common data files, printers and other devices, no matter where they are physically located. There is no central facility, and additional elements can be attached to an existing system as needed.

Printer speeds	Programming languages	Typical price
	BASIC, FORTRAN	$12,435
120 to 600 lpm	COBOL, FORTRAN, RPG	$9950 to $19,800
300 to 1200 lpm; 180 cps	BASIC, COBOL, FORTRAN, RPG	$24,950
900 lpm	BASIC	$17,835 to $23,675
300 to 1200 lpm; 45 to 55 cps	BASIC	$10,200 to $17,500
300 lpm; 45 to 200 cps	BASIC	$12,100
300 lpm; 120 cps	BASIC	$14,790 to $28,250
150 to 600 lpm; 80 to 160 cps	BASIC	$32,500 to $95,100
64 to 450 lpm; 150 cps	BASIC	$19,995
300 to 900 lpm	BASIC	$29,950
160 or 250 lpm; 60 or 180 cps	COBOL, RPG	$19,000 to $30,400
300 or 600 lpm; 120 or 160 cps	FORTRAN	$38,700
125 to 600 lpm; 45 to 160 cps	BASIC, COBOL, RPG	$22,000 to $26,900
120 to 600 lpm; 80 to 88 cps	BASIC, COBOL, FORTRAN	$5000 to $35,000
300 or 600 lpm	FORTRAN, SYBOL	$29,950 to $45,000
220 or 300 lpm; 60 or 180 cps	BASIC, COBOL, RPG, FORTRAN, Pascal	$18,000 to $50,000
125 to 660 lpm; 50 cps	BASIC, FORTRAN	$13,000 to $35,000
300 lpm; 45 or 150 cps	COBOL, FORTRAN	$26,130 to $49,000
300 to 900 lpm; 180 cps	COBOL, FORTRAN, RPG	$15,300 to $18,300
300 to 900 lpm; 55 cps	BASIC, COBOL, FORTRAN	$57,680
240 to 900 lpm; 60 to 180 cps	COBOL	$29,865 to $47,300
200 lpm; 45 cps	BASIC, COBOL, FORTRAN	$16,990
300 to 900 lpm; 30 to 160 cps	BASIC, COBOL, FORTRAN, RPG	$6550 to $34,500
	APL, FORTRAN	$9865
300 lpm; 340 cps	COBOL	$40,964

FourPhase Systems offers distributed-processing software that allows its processors to operate as data entry and retrieval stations attached to a central IBM or Four-Phase computer. Data files may be transferred between computers using the same software, called Data IV.

Computer Automation provides a "virtual network" architecture for its SyFA data-processing system that interconnects geographically distributed computers. Any terminal user can access any data base on any system in the network. The system restricts access by giving each user an authorized menu of funtions that the user is permited to invoke. Thus, only some users are permitted to use compilers, data management routines or other utility software. SyFA has another neat wrinkle: a "floating" console. System console operations can float among all terminals to be used when and where needed. This feature is not likely to catch on elsewhere; it must be used carefully to avoid causing havoc in the system.

Most vendors are sticking with the good old stand-alone system, with communications a standard or optional feature, but without a specific orientation toward distributed processing. And much has been happening to stand alones as well. Consider just a few of the changes seen in the last few years. Just three years ago, a fully expanded system would have had no more than 128K bytes of main memory; today, many can grow to 1M or 2M bytes. Disk storage capacity has gone from perhaps 500M bytes in the top-of-the-line systems to 2G or 3G bytes in the same three years. And at the low end, there were really no μp-controlled business systems on the market at all in 1978. Now they can be found in shopping malls. Our product table lists close to 80 vendors of multi-user systems, and it doesn't really touch the low end of the market. Most of the listed configurations typically sell for $30,000 to $50,000, while a typical μp-based unit is less than $15,000.

Another fascinating trend is seen in the Qantel product line. The company sells a family of compatible systems, with as many as 64 interactive terminals, as much as 200M bytes of disk and 1M byte of main memory. But the line printer runs at only 300 lines a minute. That isn't a mismatch at all. The design emphasizes use of the terminals, not the printer, for

A NOTE ON THE TABLES

Data for the accompanying tables were obtained primarily from the extensive on-line files of GML Corp., Lexington, Mass., publisher of *Minicomputer Review*. Sort criteria included: system price typically under $50,000; storage to include hard-disk capability and a minimum of 24K RAM; and field service availability. Ambiguous cases or those too close to call were decided "on the side of the angels" by risking errors of commission over omission. We did, however, delete some systems from broad product lines where we felt that those listed were typical.

In addition to use of GML's computer, we acknowledge assistance from Datapro Research Corp., Delran, N.J., and Management Information Corp., Cherry Hill, N.J.

Small-business systems are lagging behind mainframes somewhat in improving programmer productivity, but vendors are clearly trying.

entering and retrieving data; the printer is superfluous in many applications.

Still to be seen is an on-line microfilming system. Mainframes have had them for years, but not small-business systems. Perhaps someone will offer them in the future as more users manage to wean themselves

Manufacturer	Model number	Word size; main memory size	Number of users	Disk storage capacity
Digital Equipment Corp.	Datasystem 320, 330, 350, 530, 540	16 bits; 32K to 256K bytes	3 to 32	10M to 300M bytes
Display Data Corp.	Insight 4001	8 bits; 64K to 128K bytes		20M bytes
Durango Systems, Inc.	F-85	8 bits; 64K to 256K bytes	5	24M bytes
Eco-Computer Gmbh & Co.	System 7700	16 bits; 48K to 2M bytes		200M bytes
Ferranti, Ltd.	Argus 700 Series	16 bits; 32K to 512K bytes		240M to 2760M bytes
Four-Phase Systems, Inc.	IV/40	24 bits; 24K to 96K bytes	16	23M bytes
Fujitsu, Ltd.	Facom System 80	192K to 384K bytes	8	100M bytes
General Automation, Inc.	GA-16/460, GA-16/480	16 bits; 64K to 2M bytes		
Harris Corp.	1650	16 bits; 64K to 192K bytes	15	176M bytes
Hewlett-Packard Co.	250, 300, 3000 Series	16 bits; 32K to 1M bytes	4 to 32	490M bytes
Hitachi, Ltd.	Hitac-E-800; Hitac-L Series	32 bits; 32K to 2M bytes		
Honeywell Information Systems	DPS-6 Series	16 bits; 32K to 128K bytes	16	160M bytes
IBM Corp.	System/34, 8130	8 bits; 32K to 1M bytes	8 to 16	35M to 192M bytes
ICL Ltd.	ME 29 Model 45, System ten 320	8 bits; 60K to 1M bytes	2 to 24	40M bytes
Infotecs, Inc.	Control Ctr 2	12 bits; 32K to 1M bytes	16	67M bytes
International Systems Corp.	Antares 300, Antares 400	16 bits; 64K to 256K bytes	8 to 16	32M bytes
Logabax Informatique	LX5200	16 bits; 64K to 128K bytes		40M bytes
Mael Computer	5100, 5300, 5500	16 bits; 64K to 128K bytes	3 to 5	400M bytes
Mercator Business Systems	Series 4000	16 bits; 128K to 1M bytes	4 to 12	240M bytes
Microdata Corp.	Express III, Reality Series	8 or 16 bits; 16K to 512K bytes	8 to 32	5M to 600M bytes
Mini-Computer Systems, Inc.	Micos 100, Micos 200	16 bits; 64K to 256K bytes	8 to 12	37M to 325M bytes
Mnemonics Inc.	Tabmaster	16 bits; 128K to 2M bytes	16	1600M bytes
Modular Computer Systems, Inc.	Classic 7830	16 bits; 128K to 2M bytes		
Mohawk Data Sciences Corp.	21 Series	8 bits; 48K to 256K bytes	4	65M bytes
Mylee Digital Sciences, Inc.	3000	16 bits; 88K to 288K bytes	16	
NCR Corp.	8150, 8231, 8251	16 or 32 bits; 48K to 256K bytes	4 to 24	5M to 20M bytes
NEC Information Systems, Inc.	Astra 230, Astra 250	16 bits; 128K to 384K bytes	4 to 16	80M to 160M bytes

from the printer, using their terminals on-line and using microforms for off-line examination of data.

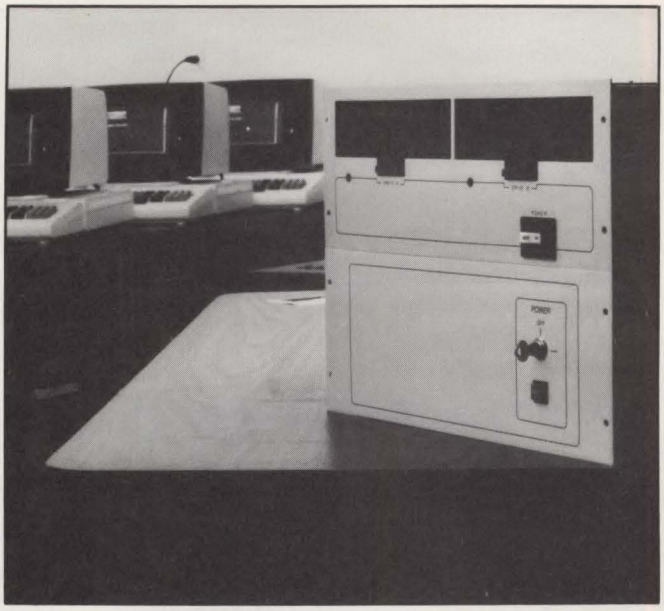
Processor families abound

Qantel is only one of several vendors that offer families of processors. A family is a set of CPUs with a variety of execution speeds and I/O capabilities that share a common instruction set and architecture or provide upward-compatible instruction sets; that is, the instruction sets of the more powerful members of the family are supersets of those of the weaker members.

The notion of families is nothing new; it has been around for 20 years. Still, it is only recently that a significant number of small-system vendors have begun offering families of processors. The availability of an upward growth path is vital to a user with an expanding company, because it is likely that such a firm will outstrip its data-processing facilities in a matter of months or a few years. Then the question is, what happens to the investment the user has made in application software when the new system comes along? If the replacement system is compatible with the original system at the instruction level, it may be possible to transport the application software to the new hardware literally overnight, assuming that the operating systems of the two are also compatible. In some cases, it may require the reassembly or recompilation of programs, or the transfer of data files to new peripherals, but the switchover should be no great problem.

On the other hand, if the conversion is to a system with a non-compatible instruction set (or, worse, to one with a different instruction set and a different word length from the original), the user is in for some work. At best, such a conversion will require a modest amount of recoding after programs are recompiled. But all job control statements must be rewritten and, in many cases, file formats must be changed. Even if the application programs are written in a higher level language such as COBOL, conversion can be aggravating. Each vendor prepares its own extensions to the standard version of the language (if there is one), and

Printer speeds	Programming languages	Typical price
240 to 1200 lpm; 30 to 180 cps	APL, BASIC, FORTRAN, DIBOL, COBOL, RPG	$3100 to 54,000
150 to 600 lpm; 30 to 150 cps	None	$20,000 to $29,700
165 cps	BASIC, COBOL, FORTRAN	$11,975
150 to 900 lpm; 45 to 180 cps	BASIC, COBOL, FORTRAN, RPG, Coral 66, Pascal	$7554 to $21,000
300 or 600 lpm; 10 to 165 cps	FORTRAN; COBAL	$5655 to $11,700
120 to 1000 lpm; 55 or 165 cps	COBOL, RPG	$37,440
120 cps		$41,667
120 cps	BASIC, FORTRAN, COBOL	$11,000 to $35,900
300 to 1250 lpm		
200 to 1250 lpm; 30 to 180 cps	APL, BASIC, COBOL, FORTRAN, RPG	$23,000 to $49,750
	COBOL, FORTRAN, BASIC, RPG	
300 to 900 lpm; 60 to 160 cps	COBOL, FORTRAN, RPG	$4800 to $18,110
150 to 650 lpm; 40 to 120 cps	COBOL, FORTRAN, RPG	$26,460 to $47,365
125 to 400 lpm; 165 or 330 cps	ALGOL, BASIC, COBOL, FORTRAN, RPG	$17,300 to $26,850
300 lpm; 55 to 340 cps	HIBOL	$11,500
1200 lpm; 30 to 200 cps	BASIC, COBOL, FORTRAN	$13,000 to $22,000
140 or 300 lpm; 80 or 180 cps	LOBOL	$44,000
200 to 600 lpm; 120 or 180 cps	BASIC, COBOL, FORTRAN, RPG, Pascal	$16,000 to $28,400
	BASIC	$18,000
150 to 600 lpm; 120 to 165 cps	COBOL, FORTRAN, PL/I, BASIC, RPG, English	$31,500 to $38,850
300 or 600 lpm; 150 cps	BASIC	$7300 to $46,700
30 to 180 cps	FORTRAN	$12,180 to $50,000
	COBOL, FORTRAN, CORAL, Pascal	$25,500 to $33,350
90 to 300 lpm; 45 cps	COBOL, MOBOL	$7035 to $18,973
		$20,950
50 lpm	COBOL	$14,755 to $36,250
300 to 600 lpm; 55 to 120 cps	BASIC, COBOL	$17,080 to $38,980



OSM's Zeus System *consists of one master processor with 32K bytes of RAM and as many as 64 single-board user modules, each with a Z80A CPU, 64K bytes of RAM, two serial and two optional parallel I/O ports.*

IO—in this case, the integrated office—is one direction in which the small-business computer system of the future may evolve.

the parts of application programs that use the extensions must be rewritten in just about every case.

Taken another way, this means that once a user signs up with a given vendor, it is in the user's interest to remain with the vendor as long as possible to protect the user's software investment. Vendors have recog-

Manufacturer	Model number	Word size; main memory size	Number of users	Disk storage capacity
Nixdorf Computer, Inc.	280, 380, 600 Series, 8870 Series	16 bits; 48K to 510K bytes	8 to 32	5M to 132M bytes
Northern Telecom Systems Corp.	445	8 bits; 64K to 256K bytes	8	70M bytes
Northrop Data Systems, Inc.	4000, BDS Series 1000	16 bits; 24K to 512K bytes	4	10M to 512M bytes
OSM Computer	Zeus	8 bits; 64K to 768K bytes	1 to 12	2.4M bytes (floppy); 34M to 600M bytes (Winchester)
Perkin-Elmer Data Systems Corp.	Sixteen Series, 6/16, 8/16E	16 bits; 32K to 256K bytes	16	380M bytes
Pertec Computer Corp.	XL20, XL40	16 bits; 80K to 512K bytes	4 to 16	80M bytes
NV-Philips Electrologica	P430, P4500	8 bits; 32K to 1M bytes	7 to 32	40M bytes
Plessey Peripheral Systems	System 04, System 34	16 bits; 64K to 256K bytes	12	10M to 300M bytes
Qantel Corp.	Series 100, Series 200, Series 300, 960, 970, Series 1450	8 bits; 48K to 1M bytes	2 to 64	300M bytes
Randal Data Systems, Inc.	250, 540	32K to 128K bytes		40M to 200M bytes
Raytheon Data Systems Co.	RDS-5000	16 bits; 64K to 6M bytes		300M bytes
Rexon Business Machines Corp.	RX30	16 bits; 64K to 128K bytes	8	40M bytes
RMD & Associates, Inc.	VM-50	256K to 1M bytes		450M bytes
R2E of America	Micral 80/50	8 bits; 24K to 64K bytes		80M bytes
Scan-Data Corp.	2280/2	16 bits; 128K to 256K bytes		70M bytes
Sentinel Computer Corp.	models 30, 40, 50, 80	16 bits; 96K to 1M bytes	17 to 19	330M to 416M bytes
Southwest Technical Products Corp.	S/09	8 bits; 128K to 768K bytes	16	16M bytes
Sperry Univac	BC/7 Series, V75-1000, V76, 11/62-E, 1900 CADE	8 or 16 bits; 32K to 8M bytes	8 to 16	5M to 40M bytes
STC Systems, Inc.	Ultimacc 2010	16 bits; 32K to 64K bytes	3	48M bytes
Systems Engineering Labs, Inc.	32 Series	32 bits; 128K to 16M bytes	64	80M bytes
Texas Instruments Inc.	DS990 Series	16 bits; 64K to 2M bytes	8	200M bytes
Ultimate Corp.	4303	16 bits; 32K to 2M bytes	256	1200M bytes
Wang Laboratories, Inc.	VS-50, 2200 Series	8 or 32 bits; 32K to 512K bytes	4 to 12	8M to 2300M bytes
Westinghouse Electric Corp.	2500-06	16 bits; 64K to 8M bytes		
Xmark Corp.	Mini Cluster	64K bytes		2M bytes

nized this point of view and have been offering families of small-business computers to exploit it.

Data General Corp., for example, has its CS series of systems. Models CS-20 through CS-70 use compatible processors. The CS-10, however, the smallest member of the group, is not upward-compatible with its big brothers. The CS-10 is sold through independent computer retailers, and the others are sold through DG's in-house distribution network. But the CS-10 competes in the $10,000-and-under market, where price is the most important consideration for the buyer. Other parameters, such as upward compatibility, carry far less weight in selection of very small-business systems.

Printer speeds	Programming languages	Typical price
300 to 900 lpm; 45 to 165 cps	COBOL, BASIC	$13,228 to $46,200
300 or 600 lpm	BASIC, COBOL	$2200 to $25,080
	BASIC	$45,526
60 to 1000 lpm	M and C BASIC, Pascal, FORTRAN, COBOL, FORTH, C, PL/I, Assembler	$6000 to $35,000
200 to 600 lpm; 15 to 180 cps	BASIC, COBOL, FORTRAN	$5040 to $33,450
900 lpm; 160 cps	COBOL	$20,560
400 lpm; 100 cps	COBOL	
300 lpm; 30 to 180 cps	APL, BASIC, COBOL, FORTRAN, RPG, DIBOL	$18,285 to $39,530
50 to 600 lpm; 55 to 150 cps	BASIC, RPG	$29,950 to $35,900
125 to 300 lpm; 55 cps	BASIC	$35,800 to $44,100
300 to 1250 lpm; 10 to 165 cps	COBOL, FORTRAN	$6000 to $14,500
300 lpm; 150 cps	BASIC	$26,300 to $31,300
300 or 600 lpm	BASIC	$45,000
	APL, BASIC, COBOL, FORTRAN	$22,000
200 to 1100 lpm; 110 cps	COBOL	$19,000 to $36,900
300 or 600 lpm; 55 or 150 cps	BASIC	$25,300 to $48,500
	BASIC, Pascal	$2995 to $10,000
200 to 700 lpm; 200 cps	BASIC, COBOL, FORTRAN, RPG	$11,000 to $41,040
150 to 900 lpm	BASIC	$34,000
300 lpm; 30 cps	BASIC, COBOL, FORTRAN, Pascal	$31,480 to $49,080
150 to 400 cps	BASIC, COBOL, FORTRAN, RPG, Pascal	$14,675 to $28,000
60 to 900 lpm	BASIC	
	BASIC, COBOL, FORTRAN, PL/I, RPG	$9000 to $35,000
300 lpm	FORTRAN, RPG	$17,000
	BASIC, FORTRAN, Pascal	$27,000

Data General Corp.'s *CS/50 system is that company's latest addition to its fully compatible Commercial Systems family of small-business computers. It offers fast interactive response for as many as nine Dasher display terminals.*

In addition to DG and Qantel, vendors such as Prime Computer, Digital Equipment Corp., Hewlett-Packard Co., NCR Corp. and Wang Laboratories, Inc., offer families of processors for their small-business systems.

Reliability and maintainability

The first automobiles that sold in quantity were cranky beasts that broke down more often than they ran. Early radios, television sets and computers were equally temperamental. However, as more units were sold, better manufacturing and quality-assurance techniques evolved, along with better engineering, so the reliability of the products rose accordingly. A radio or TV is routinely expected to work all the time for years without a whimper.

Not so for computers. At least, not yet. But 500,000 computers are in the hands of users right now, and 500,000 systems will be in the hands of small businessmen in the next few years, according to industry forecasters. No doubt they will expect their computers to work as well as their radios, TVs and cars.

Tandem Computer Corp. focused attention on the reliability problem when it annouced its Non-Stop system—consisting of two to 16 computers tied together to provide redundancy and automatic switching. Should a processor fail (or should a memory unit, device controller or power supply fail), another automatically

For buyers, the decision-making process will get harder before it gets easier. Prices will fall and the number of features will rise.

takes over its function without missing a beat. No other vendor yet provides a system architecture that eliminates as many single points of possible failure.

Burroughs Corp. provides five processors in its B-920 system. One processor furnishes operating control, another manages data files, two task processors compile and execute application programs, and the fifth processor handles data communications. A redundancy feature in the B-920 allows the user more continuous processing. One or two task processors can be switched under operator control to act as the file management processor or the system control processor. This feature provides backup for critical user applications that require continuous system availability.

Hewlett-Packard takes an innovative approach to reliability with its so-called "guaranteed uptime service" for its model 3000 series 44 business system. Users within 100 miles of an H-P service center can sign an agreement that guarantees 99 percent uptime for the CPU and two system disks, 24 hours a day, seven days a week. If the protected devices fail to be up 99 percent of the time in a given month, then credit is given to the user against maintenance charges for the following month to compensate for the failure.

H-P also supports local and remote diagnostics in the 3000 series, as do DEC and DG for their products.

Software development

Given the spreading interest among data-processing managers in programmer productivity, it is natural to expect that vendors will supply software development tools to assist the user. Small-business systems lag behind mainframes somewhat in this respect, but vendors are clearly trying. No one, for example, talks about code generators or pre-compilers for application programs, although vendors do offer comprehensive and powerful utilities and debugging aids, along with high-level languages.

Not everyone offers a high-level language. Display Data Corp. offers none for its Insight 4001 system, preferring instead to custom-tailor its standard business programs for users. IBM offered a similar turnkey small-business system a few years ago, but most users seem content to program their own systems, or buy application packages from third parties, or both. Accordingly, more than half the vendors in our product table offer COBOL, and more than half offer BASIC. More than a quarter provide RPG. Many vendors also have FORTRAN for scientific work, and a few are beginning to furnish Pascal. But COBOL and BASIC remain most popular.

Unfortunately, several vendors stubbornly cling to homegrown languages. This is fine for the vendor because the user is locked in: A switch to a non-compatible system entails rewriting all application software. So if you want to marry a vendor for life, have a "bol:" SYBOL (Computer Automation), DIBOL (DEC), HIBOL (Infotecs), LOBOL (Logabax) or MOBOL (Mohawk Data Sciences).

Computer Automation, for one, argues that SYBOL can perform certain functions much more effectively than an extension to COBOL could do: handle a 24-line CRT screen, perform real-time coordination between simultaneous programs, activate concurrent utilities or provide communications. The company says forcing these features into standard COBOL would produce a clumsy, inconsistent language. It would be neither standard nor portable. So why bother?

The counter-argument is that a COBOL extension is at least partially standard, so it is at least partially portable. A home-brewed language is not all portable. There is strong evidence that most vendors agree with the counter-argument: Only five of the vendors in the product table offer homegrown languages.

To achieve wide use, a language needs an influential, well-heeled sponsor, such as IBM (FORTRAN, PL/1) or the Department of Defense (Ada). Rare is the language that proliferates without such support. And if it doesn't proliferate, the small-business user will have a hard time converting.

Integrated office systems

IO, in this case, is neither input/output nor the moon of Jupiter. It stands for the integrated office, which is one direction in which the small-business system of the future may evolve. Perhaps the small-business system will cease to exist as a separate entity in the high end of the market. In the interim, the system will integrate word and data processing; later, the integrated office system will emerge. Actually, the integrated office system of the future may differ little in architecture from current small-business systems. The difference will lie in the versatility of user terminals, which will certainly handle graphics as well as alphanumerics, may be able to display standard television signals and will have enough intelligence to support an electronic-mail system.

For now, several vendors provide word-processing software on their systems, and a few integrate word and data processing. Data processing creates a name and address file, and word processing uses the file as input to a letter-printing process. ■

Malcolm L. Stiefel, now a group leader at Mitre Corp., has worked as a systems analyst, systems engineer and programmer on military command-and-control, hospital administration, investment securities and municipal information systems.

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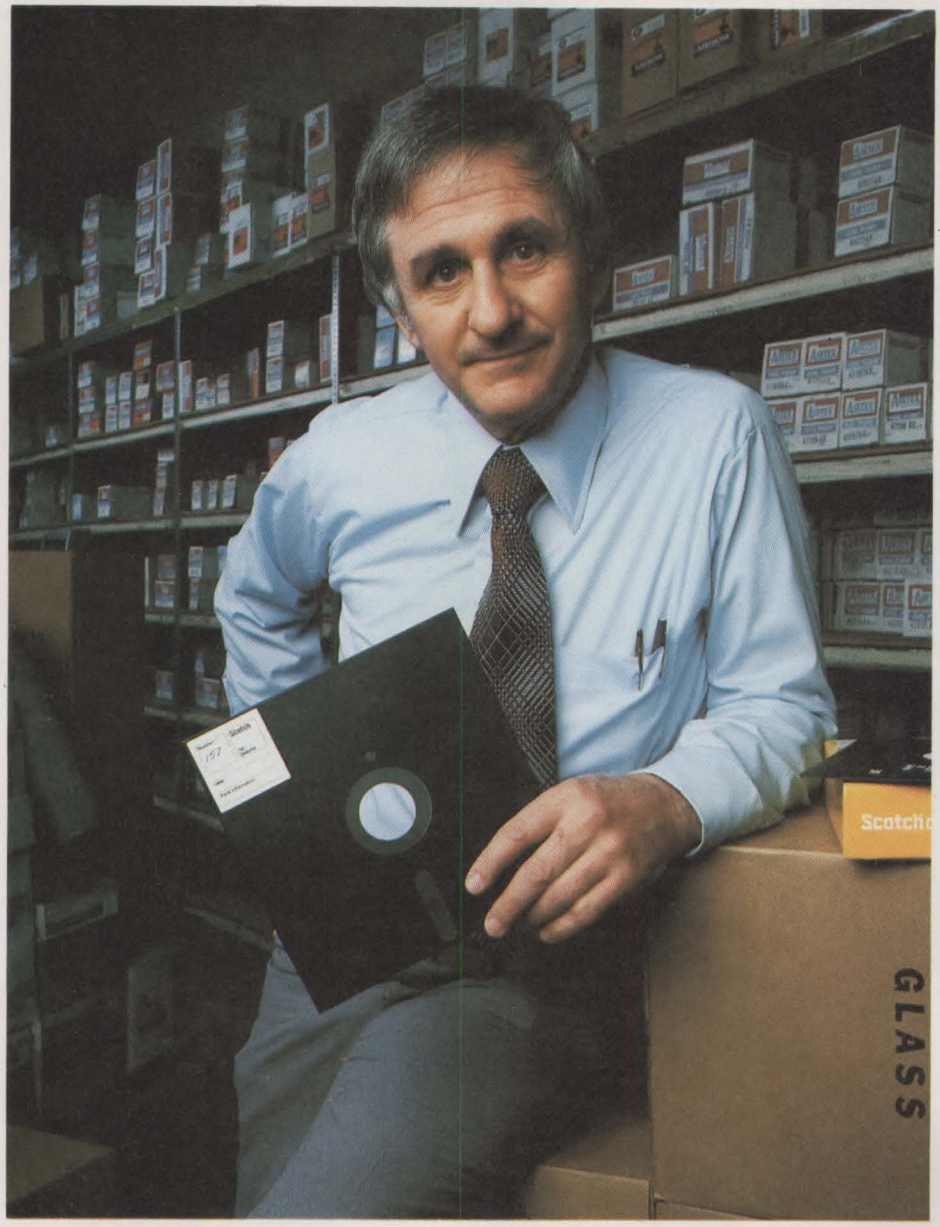

Don Stone, President, Mass. Auto Supply Company, Inc., Boston, Mass.

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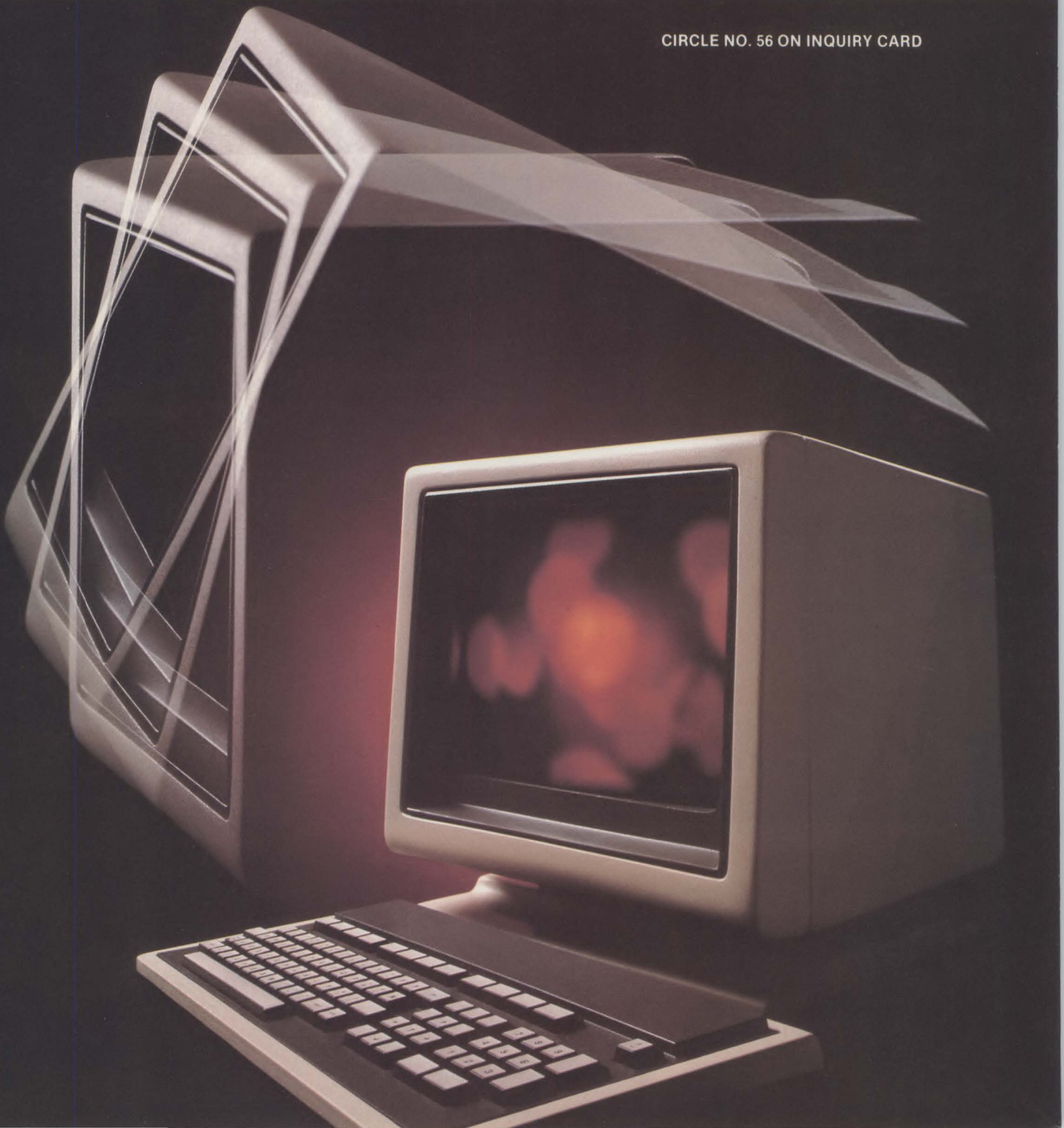


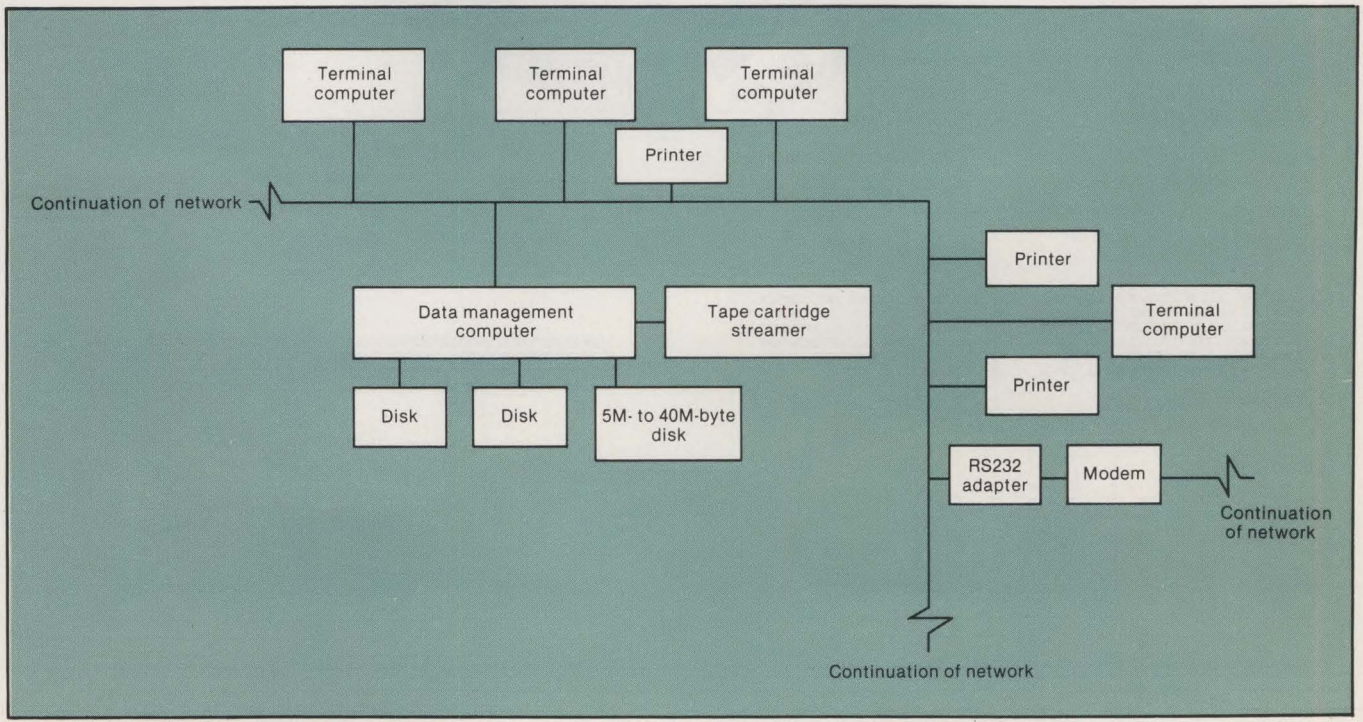
Novell's Nexus addresses work-station market

This expandable, low-priced system is equally adaptable to first-time users or large corporations

A new μc system that provides stand-alone processing at each user location in an expandable network has been introduced by start-up Novell Data Systems, Orem, Utah. The system—called the Nexus series—is described as both economical and easy to use, and is targeted at customers ranging from the first-time small-business user to large, multinational corporations. A second-generation system, it includes various combinations of 8- and 32-bit μcs and a variety of peripherals, including floppy- and Winchester-disk drives, printers and intelligent video display terminals.

Novell developed the Nexus II network because the company believes that available starter-priced computer systems have limited capabilities, particularly in the areas of processing capacity, memory and storage, and that computers that have adequate capacity are too expensive for most businesses shopping for their first data-processing systems. Novell's solution is an expandable local network that allows the customer to begin by buying a stand-alone computer, and to upgrade the system as needed without obsoleting his initial purchase.

Novell examined what Xerox had done with Ethernet and what Datapoint offered with ARC before developing



Novell's Nexus II *network expands to accommodate more than 100 Nexus II terminal computers, printers and other peripherals.*

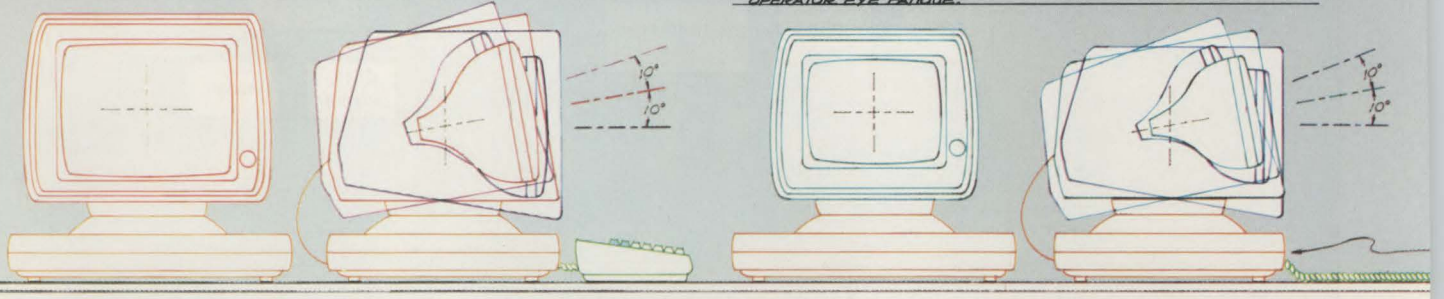
THE ZENTEC SERIES 8000 INTELLIGENT TERMINALS

The first Intelligent Terminal designed specifically for OEMs to configure and for people to use.

THE ZENTEC 8002 IS A COMPLETE INTELLIGENT TERMINAL COMPRISED OF THREE SEPARATE MODULES; THE 8201 LOGIC BOX, THE 8302 (15") VIDEO MODULE AND THE 8401 KEYBOARD.

WITH THE 8002, THE 15" CRT IS BALL-JOINT CONNECTED TO THE TOP OF THE LOGIC BOX AND PROVIDES A CONVENIENT 20° ANGLE OF TILT AND A 60° ANGLE OF SWIVEL.

THE ZENTEC 8001 IS SIMILAR TO THE 8002 WITH THE SUBSTITUTION OF A 12" VIDEO MODULE, THE NON-GLARE, HIGH RESOLUTION CRT SURFACE WITH A WHITE, GREEN OR AMBER PHOSPHOR IS OFFERED TO REDUCE OPERATOR EYE FATIGUE.



With the Series 8000, Zentec successfully re-defines the words Human Engineering. Never before has there been a more powerful, more flexible, more operator-oriented video display terminal designed expressly for OEMs and system integrators.

The first thing you see on the CRT is the almost completely glare-free surface for reduced operator eye fatigue. The single knob right up front is used to turn the system on or off and to control the level of brightness. While a P31 green phosphor is standard, white or amber phosphors may be optionally provided. Character resolution and contrast go easy on the eyes, too, and wait until you see the character size on our 15" screen!

Configurability AND Flexibility
With Zentec's unique multiple-module concept, the 8000 may be easily configured with either a 12- or 15-inch CRT with full swivel and tilt, up to three snap-in printed circuit boards in the logic box for fast MTTR, and a wide variety of detachable keyboard styles. A single PCB is standard with the 8000, and the OEM may add one or two of his own PCBs. The standard logic contains Zentec's unique mini-computer-like bus architecture under the control of a powerful microprocessor. Hardware for synchronous or asynchronous communications and printer I/O is standard. The Zentec 8000 may be configured with 16, 32, or 64KB of RAM and 4, 8, 12, or 16KB of ROM or PROM. That's flexibility!

The microprocessor-controlled detached keyboard of the 8000 is canted 11° for operator comfort and the keys may be stepped, or optionally, sculptured.

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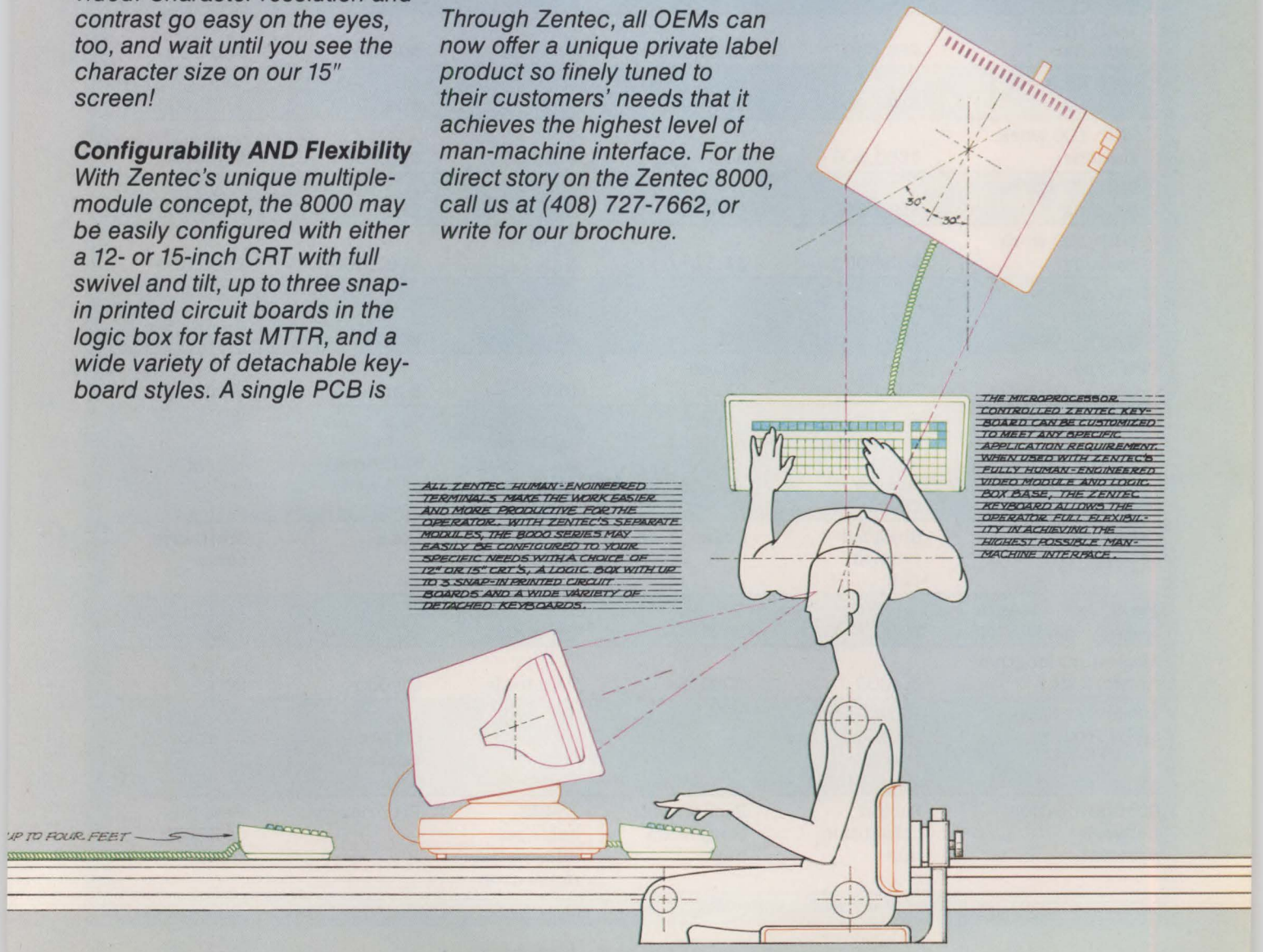


CIRCLE NO. 57 ON INQUIRY CARD

The Nexus series was designed as an integrated network, which transmits at 8M bits per sec. with as much as 3000 ft. of cable between work stations.

Novell's basic system *includes the Image 800 matrix printer (left), Nexus II terminal computer (center) and mini-Winchester subsystem.*

the Nexus Series. ARC's transfer rate was seen as too slow, and Ethernet as too expensive. Novell wanted speed, but at low cost.

Reliability was another big consideration. The company found that the majority of computer failures occurred in memory and resolved to remedy that potential weakness in the Nexus designs. The result was RAMGUARD, a feature that automatically detects and corrects single errors resulting from memory chip failure. RAMGUARD corrects any 1-bit error in any 0.5-byte of memory, and even if this kind of error were to appear in every 0.5 byte of memory, the company claims the computer would continue to function with an

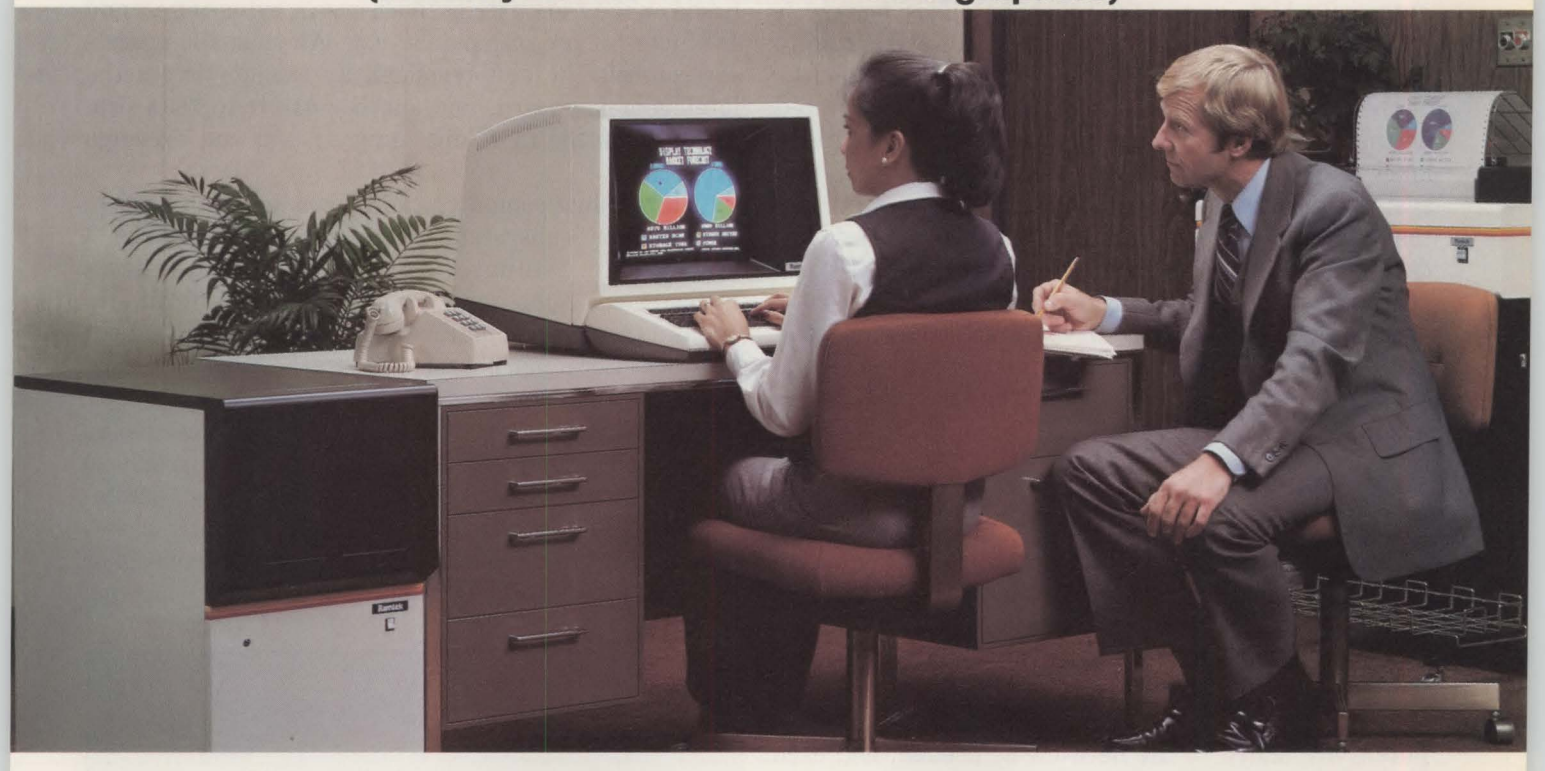
HOW NOVELL COMPARES ITSELF WITH THE COMPETITION

	Novell Nexus II	Ethernet	Convergent Technologies	Datapoint ARC	CP Net
Speed (M bits/sec.)	8	10	.6	2.5	.02
Price*					
With 1 work station	$12,700	$14,000	$18,000	$28,000	$9,000
With 10 work stations	$55,000	$113,000	$70,000	$98,000	$80,000
With 25 work stations	$139,000	$282,000	N/A	$245,000	$190,000
With 100 work stations	$553,000	$1,113,000	$70,000	$98,000	$80,000
With 25 works stations	$139,000	$282,000	N/A	$245,000	$190,000
With 100 work stations	$553,000	$1,113,000	N/A	$980,000	$700,000
Maximum number of work stations	100+	100+	16	6000+	16
CPU type	8 or 32 bit	Mixed CPUs	16 bit	8 bit	8 bit
Software available	All software developed to run under CP/M	Vendor software	Convergent or Convergent dealer developed	Data Point or Data Point dealer developed	Designed to run on MP/M
Cable type	Shielded twisted pair	Coax	Multiwire cable	Coax	Multiwire cable
Maximum distance between devices (ft.)	3000	3500	Hundreds	2000	1000
Maximum length of network (ft.)	30,000	7000	Hundreds	20,000	2000
Method of RAM error recovery	RAMGuard error correction 1 bit/nibble	N/A	?	Interrupt on parity error	Interrupt on error
Communication network protocol	Packet contention bus	Packet contention bus	RS422 balanced differential multi drop	Proprietary	Data bus or RS232 serial

*Projected price, which can vary with application

Ask Ramtek.

(Nobody knows more about Colorgraphics)



See the difference a sharper image and more colors make in our new colorgraphics terminal.

The 6212 displays the graphics output from your data base in clear bright images, letting you use color graphics in new, more powerful ways.

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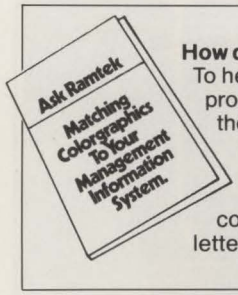

How do colorgraphics fit into your MIS picture? To help you evaluate the business graphics products on the market, Ramtek has prepared the booklet, "Matching colorgraphics to your Management Information System." It's Issue Number 5 of Ramtek's Use Our Experience Series. To get your free copy, write to Ramtek on your company's letterhead.

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The system's network provides true multiprocessing, in that all Nexus II terminal computers are independent processors and can operate simultaneously.

extremely high degree of reliability. This feature is integral in the design of the Nexus CPU, and is said to be unavailable in any comparably priced computer.

The Nexus series was designed as an integrated network, which transmits at 8M bits per sec. with as much as 3000 ft. of cable between work stations. The system includes a 32-bit data-management computer that acts as a file processor to control all access to the data files. This processor accommodates several types of storage, including 360K-byte floppy-disk drives, 20M- or 40M-byte Winchester drives and streaming tape drives. The system is initially offered with a single data-management computer, but it can be expanded to include several of these units.

Adding terminals

The system's network organization provides true multiprocessing in that all Nexus II terminal computers are independent processors and can operate simultaneously. Each terminal computer in the Nexus II network is an 8- or 32-bit μc that includes its own processor, video display (including both true X, Y graphics and alphanumeric functions) and keyboard. Terminal computers are added to the network as needed, and each such addition enhances the total processing and memory capability of the system.

Thus, the Novell Nexus series combines the best features of a multi-user/resource-sharing system with the full benefits of a personal, private computer dedicated to each individual work station. The advantages of timesharing are provided without CPU contention, memory swapping and other disadvantages imposed by conventional timesharing systems. This concept is extended even to remote work stations.

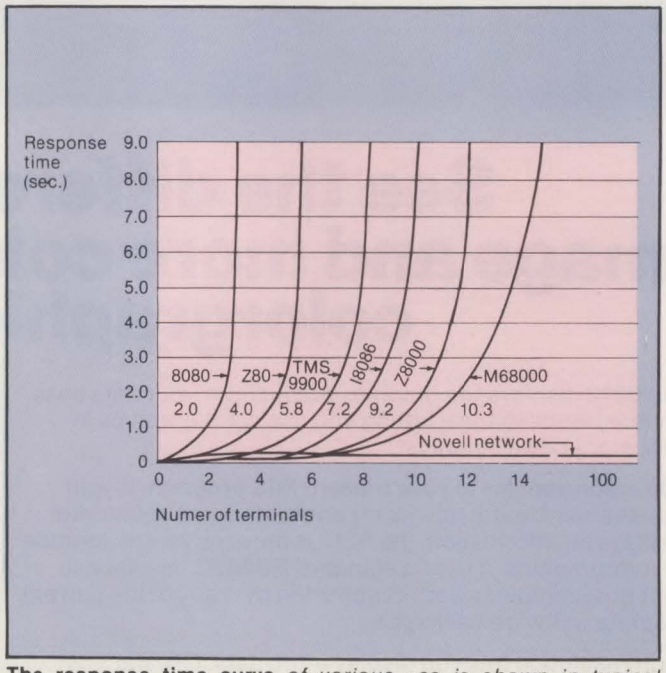
Novell Data Systems' *Nexus II terminal computer is an 8-bit μc with 64K bytes of RAM. It includes the processor, memory, video display terminal and keyboard.*

Nexus terminal computer

The Nexus II terminal computer, the heart of the Nexus II network, uses four μps. The terminal itself is based on the Z80A with as much as 64K bytes of RAM and 16K bytes of programmable ROM. An MC68A00 processor controls the CRT terminal, an MC6802 drives the intelligent keyboard, and another 64K-byte Z80A processor runs the CP/M operating system and executes programs.

The terminal computer can be connected to its own disk-storage subsystem to operate as a Nexus I stand-alone computer, or to a separate data-management computer through a network interface to act as a terminal computer work station in the Nexus II network. Local peripherals are attached via an RS232C communication port.

Each Nexus computer includes a Novell video display terminal. The 15-in.-diagonal CRT measures displays 80 or 132 characters per line. The display system accommodates a full ASCII character set plus an additional set, that can be down-line-loaded. The P31 (green) phosphor CRT has full graphics capability and includes internal editing features. The ergonometric keyboard contains 72 function keys with a numeric pad that can function as a calculator.



The response time curve *of various μcs is shown in typical business applications where each station in a system initiates a new message every 20 sec. and each message initiates six disk accesses.*

Software

Novell aimed at being compatible with a broad base of existing software to reduce dependence on proprie-

tary programs. As a result, the company adopted the CP/M operating system to enable the use of a large number of application programs in addition to Novell's accounting and word-processing software. More small businesses use CP/M operating systems than any other, and the software already written for these systems is extensive.

Novell's hardware pricing is attractive to customers who anticipate a growing need for information processing. Once the network is installed, additional terminal computers can be placed on line for approximately $3700 each. A work station with a stand-alone Nexus I computer, an 8-in. Winchester subsystem and a printer sells for less than $12,700.

A variety of printers are available, including the Novell Image 800 matrix printer, conventional word-processing character printers and 300/600-lpm units. The system automatically spools all printer output.

Novell's μp-based Image 800 *printer features 30 programmable functions and prints at 150 cps in a 9 × 9 dot-matrix format with no duty cycle restrictions.*

Expand as needed

The Nexus series allows hundreds of node connections to be made on the network, enabling a business to begin with a very small system and expand it as requirements demand without changing either hardware or software. Upgrading is via simple plug-in operation with no user modifications to the operating system.

Transmitting large amounts of data across even a high-speed communications line can slow response time and result in unsatisfactory performance. The Novell system eliminates this problem by separating the computing function from the terminal function at remote stations. This allows fast program loading, data calculation and manipulation at the local network, and only operator input and video display information is transmitted over the telephone line.

The company expects to be serving customers through a system of 100 dealers in the U.S. by year-end,

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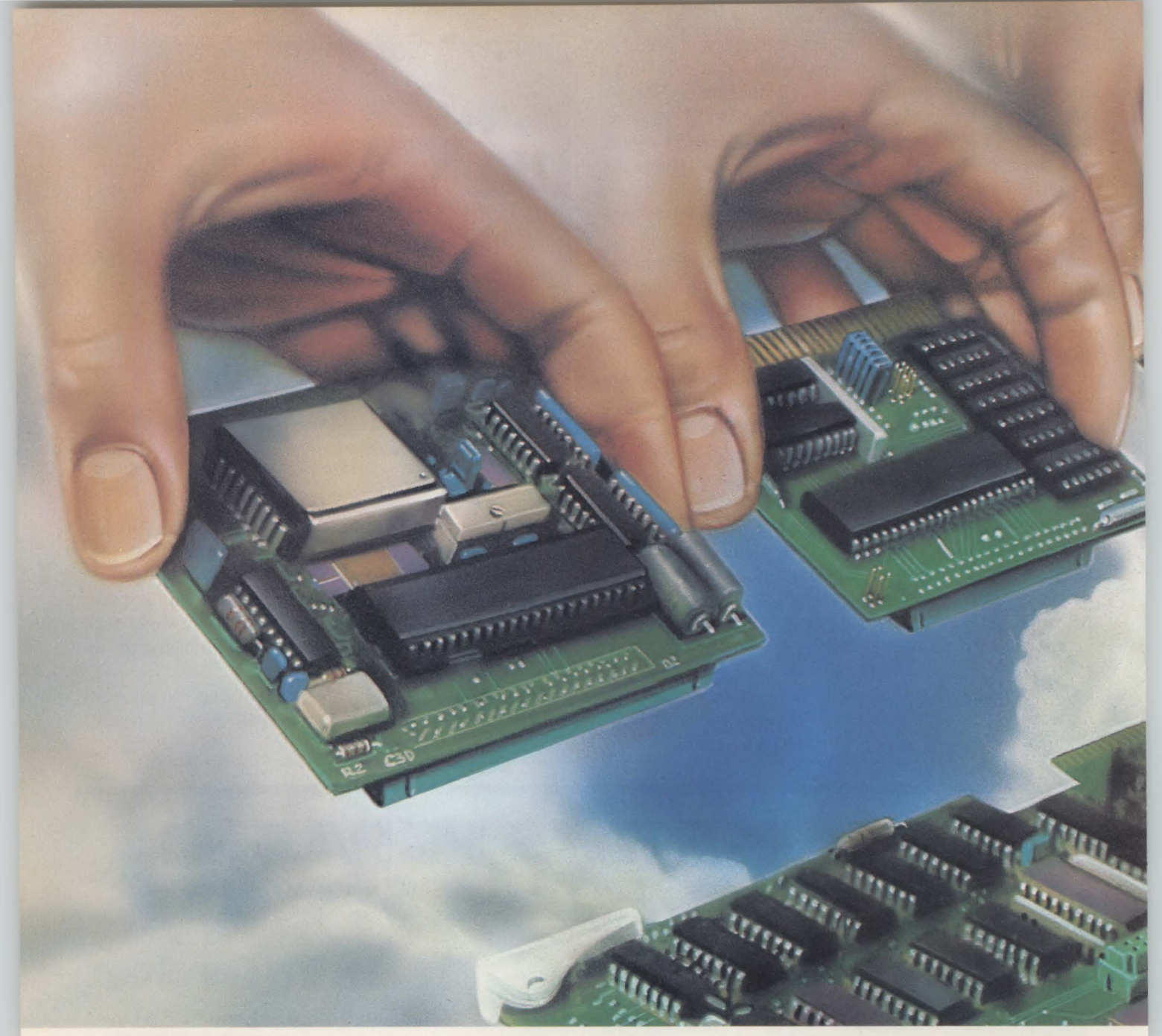

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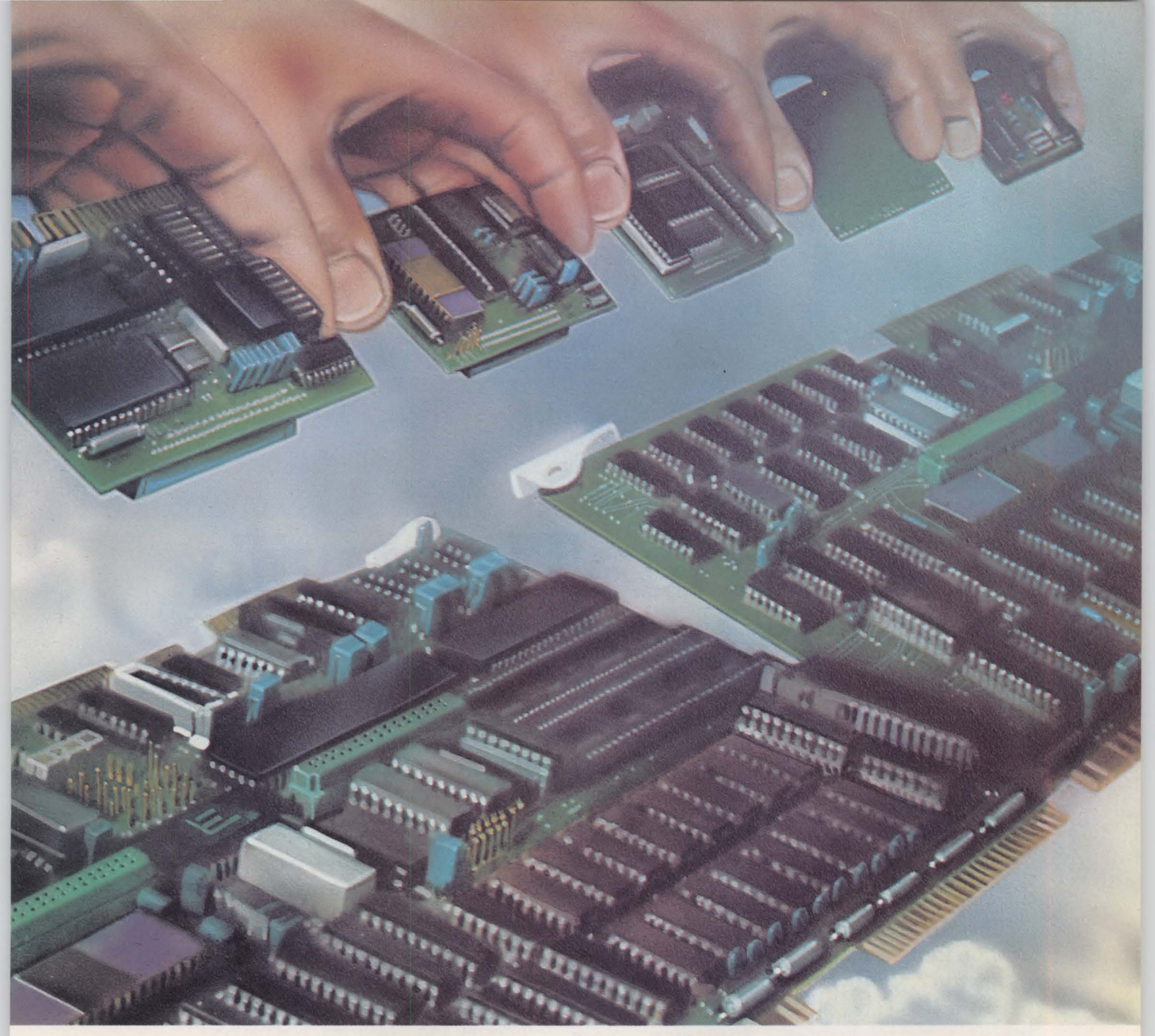

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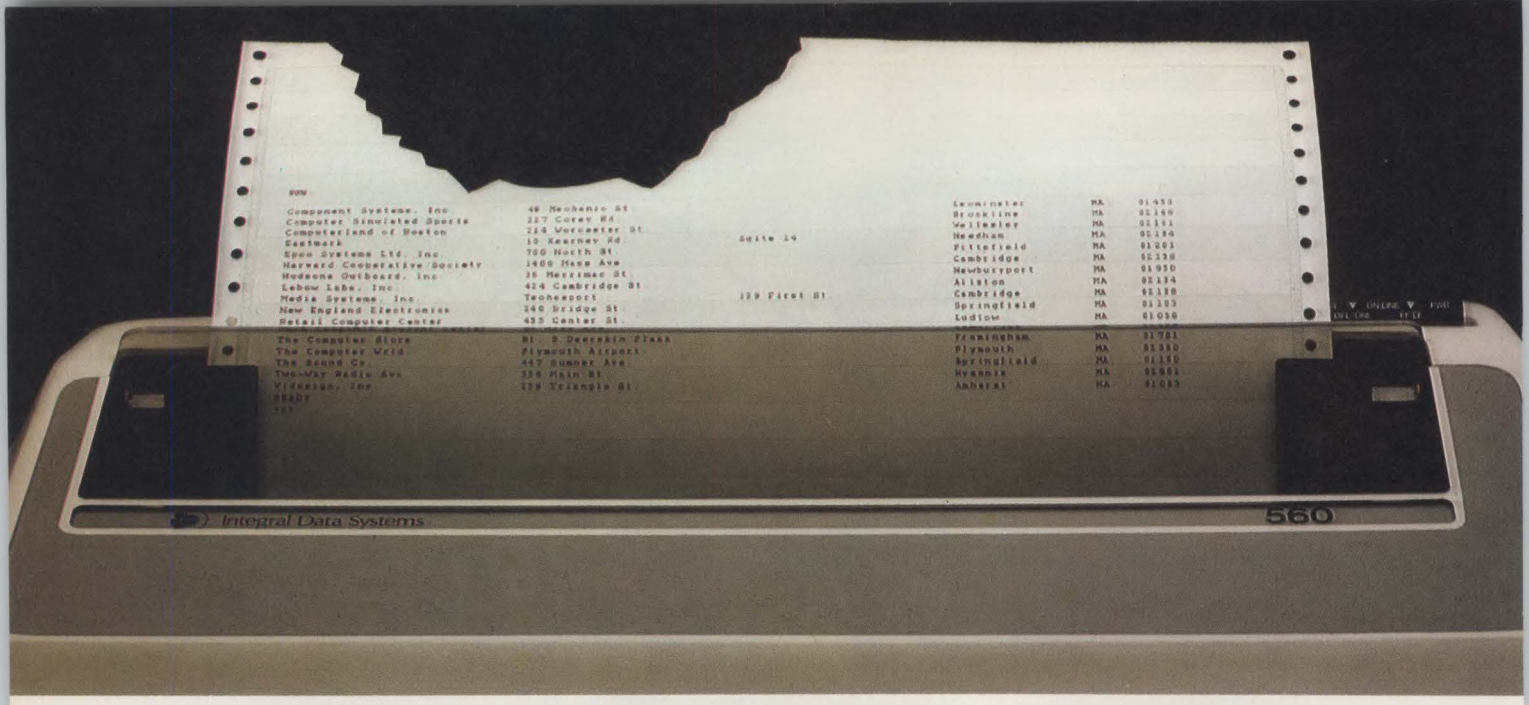

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MINICOMPUTERS

A mid-year market evaluation

STEPHEN J. SHAW, *Electronic Business* magazine

Growth of 26 percent in 1980 was well below the level of the 1970s, and thin backlogs are now triggering more innovation in marketing

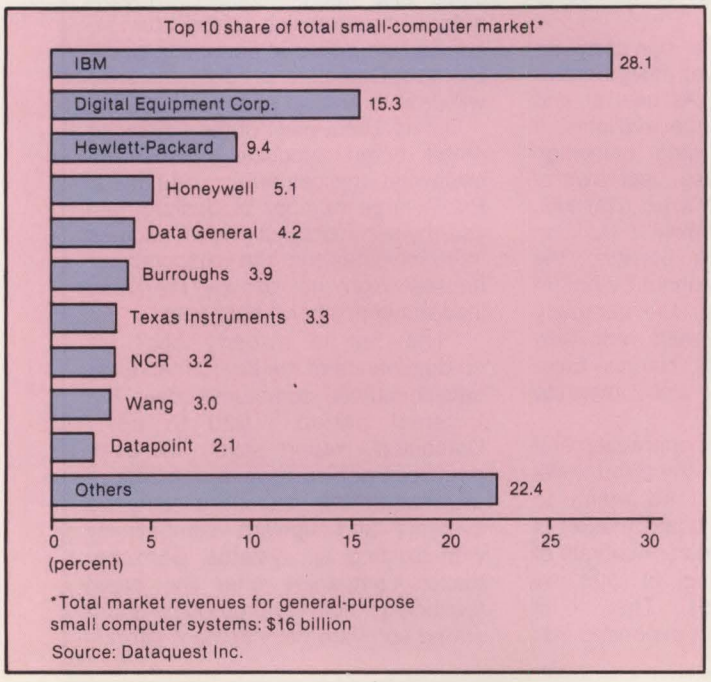
Most sectors of the small-computer industry came through 1980's economic downturn with delivery levels and balance sheets almost unscathed. But backlogs are now substantially lower than they were a year ago, making suppliers vulnerable to an extension of the recession past mid-year. A brighter trend is the slow decline in interest rates, which could encourage small businesses to revive computer orders that many had postponed when rates hovered around 20 percent.

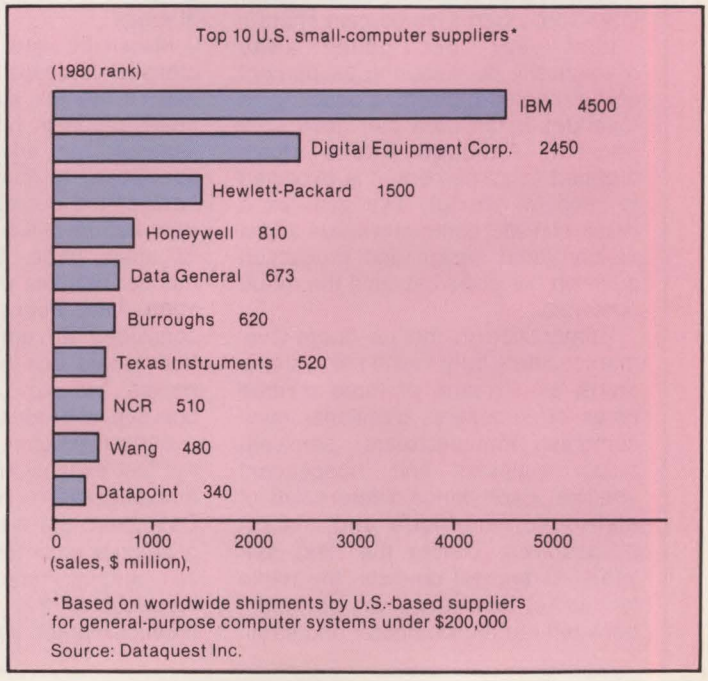
Sales of general-purpose computer systems priced at less than $200,000 grew 26 percent last year, the same rate achieved in 1979, says a Dataquest Inc. study. Last year's lull in the rate of increase was a far cry from the heady advances made through most of the 1970s. That lull pressured suppliers to examine internal organizations, to try new marketing and support methods and to exploit opportunities in new market niches and vertical applications areas.

"Overall, the computer companies fared rather well in a poor economy," says Grant Bushee, an analyst at Dataquest Corp., a Cupertino, Calif., market-research firm. "Continued softness, however, will have a greater impact because the backlog in orders won't carry companies as far as it has in the past," he says.

A need for greater responsiveness

Changing market conditions, which are testing computer vendors' responsiveness, pose the greatest challenge to the industry over the next few months. Companies that have flexible management and real





Large strides were made in software last year when suppliers began to respond to users' increasing demands for higher powered developmental languages and application packages designed for specific vertical markets.

commitments to selling business solutions, not just hardware, are weathering the economic hard times with revenues and profit margins intact. The management styles and product-line approaches of Digital Equipment Corp. and IBM Corp. are becoming more similar. Both vendors have successfully anticipated user needs. Companies that are known for rigid, centralized management, such as Data General Corp., are discovering that continued growth depends on an organization that revolves around the market rather than around the dictates of a chief executive.

Large strides were made in software last year when suppliers began to respond to users' increasing demands for higher powered developmental languages and application packages designed for specific vertical markets. As the customer base for small computers grows in size and sophistication, vendors are experimenting more than ever before with innovative marketing channels. More small-computer brands are appearing in retail outlets, while direct-sales operations are being beefed up. Additionally, most of the Top 10 suppliers are selling more aggressively than ever to OEMs and system houses.

Industry observers say that the buzz phrase "office of the future" has changed to "local distribution." DEC and other vendors continued development last year of a communications protocol compatible with Xerox's Ethernet approach. Others bet on alternative approaches, such as Datapoint's Arc network, stressing the trend toward integration of voice and data communications. Industry associations continue, in vain, to seek a network standard.

Computer hardware introduced in 1980 and in the first quarter of 1981 included six 32-bit superminicomputers, which offer the processing power of mainframes at minicomputer prices. These units promise to create new applications and to capture a healthy share of the heretofore small-computer market.

At the low end, suppliers continued to develop low-cost μcs, and a surge of new products is expected this summer. Competition at this level is intensifying as computer vendors respond to the marketing challenges posed by Tandy Corp. and Apple Computer Inc., which are expected to crack the Top 10 list next year. Pocket computers are also on the horizon. Radio Shack introduced a $250 hand-held computer last summer. In March, Hewlett-Packard Co. introduced the 41CV

DEC EMERGES AT THE BOARD LEVEL

Mirroring its success at the small-computer systems level, Digital Equipment Corp. established itself in 1980 as the undisputed leader in the market for 8- and 16-bit board-level μcs, according to a March, 1981, study by Dataquest Inc.'s small-computer industry service. In 1979, DEC, with 27 percent of the market, moved slightly ahead of former leader Intel Corp., with a 25 percent share.

Last year, DEC pulled away dramatically by capturing 38 percent of the market, more than doubling its revenues in an area that grew 48.9 percent. Although Intel's share dropped to 22 percent, it is expected to rebound strongly this year as a result of 1980 contract awards and a concentrated design and production push on the 8086 CPU and the 32-bit iAPX 432.

Competition in the μc board-level market differs from that in the systems arena as a result of three diverse types of suppliers—traditional minicomputer manufacturers, semiconductor suppliers and independent vendors. Each brings different sets of distribution methods and market philosophies. During the next four years, Dataquest predicts, the battle for market dominance will be fought between the minicomputer and semiconductor factions, with no clear victor emerging, as a result of complementary strengths and weaknesses.

But because DEC clearly won the 1980 round, the company can expect higher visibility in the μc field. "There's a growing awareness of DEC as a μc supplier," says Arthur Massicott, DEC's product line manager for the U.S. and general international areas.

Massicott says the company increased its board-level design activities 18 months ago. As new 8- and 16-bit products became available, it launched an advertising campaign specifically to increase user awareness of the company's μc activities. DEC also invested heavily in building its sales force, thus boosting the number of sales personnel by half in 1980. Last February, the company concluded an agreement with New York-based distributor Harvey Electronics Inc. to sell and integrate board-level products.

DEC's minicomputer orientation and the fast expansion of the board-level market haven't hurt. According to Dataquest, the 8-bit board market is growing at a compound annual rate of 38 percent, resulting in 830,000 installations by 1985. The 16-bit product market, which expanded last year at a 68.4-percent rate, is predicted to grow through 1985 at a 43-percent annual rate.

Continued reduction in semiconductor costs is driving down prices for existing board-level designs. As chip density increases, the same processor and memory capabilities can be assembled on a board with fewer chips and interconnects. The new extended-addressing chips, for instance, are priced at about $75 each. By 1985, Dataquest predicts, the price will drop to around $16.

During 1980, most of the advanced 16-bit board products came from traditional minicomputer companies. But a large number of designs last year by semiconductor firms, such as Intel, indicates that the minicomputer houses might not occupy the same leadership positions next year.

"The die is already cast for co-dominance of the board market by semiconductor companies over the forecast period (1980 to 85)," Dataquest's report says. "Minicomputer companies have a competitive advantage with executive software systems and upward compatibility with existing μc systems. Semiconductor companies offer the latest technology, chip-level products and a strong software development effort."

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While computers themselves are getting smaller, some of their prices are increasing, primarily because rising labor and capital costs have offset declining component prices.

programmable calculator, which features 500 program steps, printer interconnect display screen and other peripherals. Japanese suppliers, including Casio Computer Co. and Matsushita Electric Industrial Co., also have announced plans to introduce pocket computers.

While computers themselves are getting smaller, some of their prices are increasing, primarily because rising labor and capital costs have offset declining component prices. Hewlett-Packard, for instance, announced a 5 percent price increase in March, and other vendors are expected to follow suit. "Companies are now willing to pass along the effects of inflation with higher prices to their customers," says Bushee.

The shortage of components that plagued the computer industry in 1979 eased last year. Production of components, especially semiconductors, was stepped up as some vendors integrated backward and began to fabricate their own parts. For the most part, however, computer suppliers without internal component manufacturing negotiated arrangements with chip suppliers to avoid becoming locked into single sources.

Goliath endures; David challenges

IBM Corp. continued to dominate the small-computer field using its long-held strategy of offering a comprehensive product line backed by legions of sales and support personnel. Its offerings include the Series/1, the 4300 mainframe series that competes with many superminis, the 5120 line and the System/34 series. The once-postponed machine, the System/38, was introduced in the third quarter of 1978, only after the company delayed its delivery to meet its original performance specifications.

Digital Equipment Corp. *has strengthened its supermini hand with the VAX-11/750, a scaled-down version of the 780.*

IBM has been criticized for its difficulties in introducing and marketing new systems. The Series/1, introduced more than four years ago to compete with DEC's PDP-11 computers, never fulfilled the company's original objectives after early problems with its operating system.

"The Series/1 was received by the market more as a gateway from IBM networks to foreign terminals," says Donald Brown, an analyst with the Gartner Group, a research firm in Greenwich, Conn. "IBM has not been completely successful in tactically implementing any system."

But IBM is succeeding in improving the price/performance levels of its machines and in responding aggressively to competition—a contrast to the company's lethargy during the early 1970s. "IBM is much more competitive now than it was five years ago and will be much more competitive in the near future," Brown observes.

The company, a pioneer in innovative distribution channels, established business computer centers in late 1977 to sell its small-business line to groups of executives. Centers are now operating in 50 U.S. cities and 30 cities abroad. Last year, the company opened two retail outlets, which carry both small computers and office products. This was IBM's way of topping the small-business market, in which the cost of direct sales is prohibitively high.

Taking aim at IBM from the number-two spot is DEC. During the past year, DEC solved its problems with lengthy lead times, which had plagued the company in 1979 and part of 1980. "Some systems had 360-day lead times," says Brown.

To recapture the business it lost to competitors that delivered more quickly, DEC tripled production of some popular machines and began to manufacture semiconductors internally. The company boosted its capital spending for plant and production a whopping 159 percent to $321 million in 1980. Last October, the company unveiled the 32-bit VAX-11/750 supermini, which industry analysts report offers 60 percent of the performance at 40 percent of the price of the older VAX-11/750 (MMS, December, 1980, p. 13).

"DEC is doing extraordinarily well, and it's reflected in substantial gains in market share and position," Brown says. He believes that DEC and IBM are reversing some traditional roles. "IBM had a unified product line in the early '70s," he says. "Now there is some overlap in its small-computer systems." The situation at DEC is just the opposite: "They're making a push to unify product lines and eliminate systems overlap."

IBM is also emulating DEC's management structure to some extent. IBM traditionally has been perceived as directed from the top down with strong central control, while DEC has often been characterized as a "bottoms-

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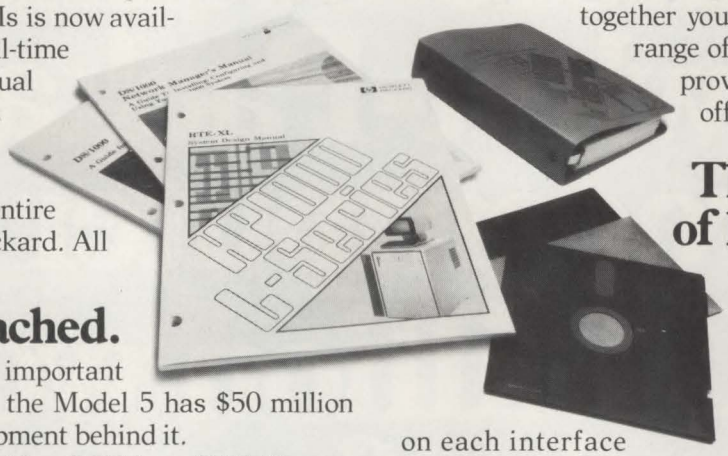

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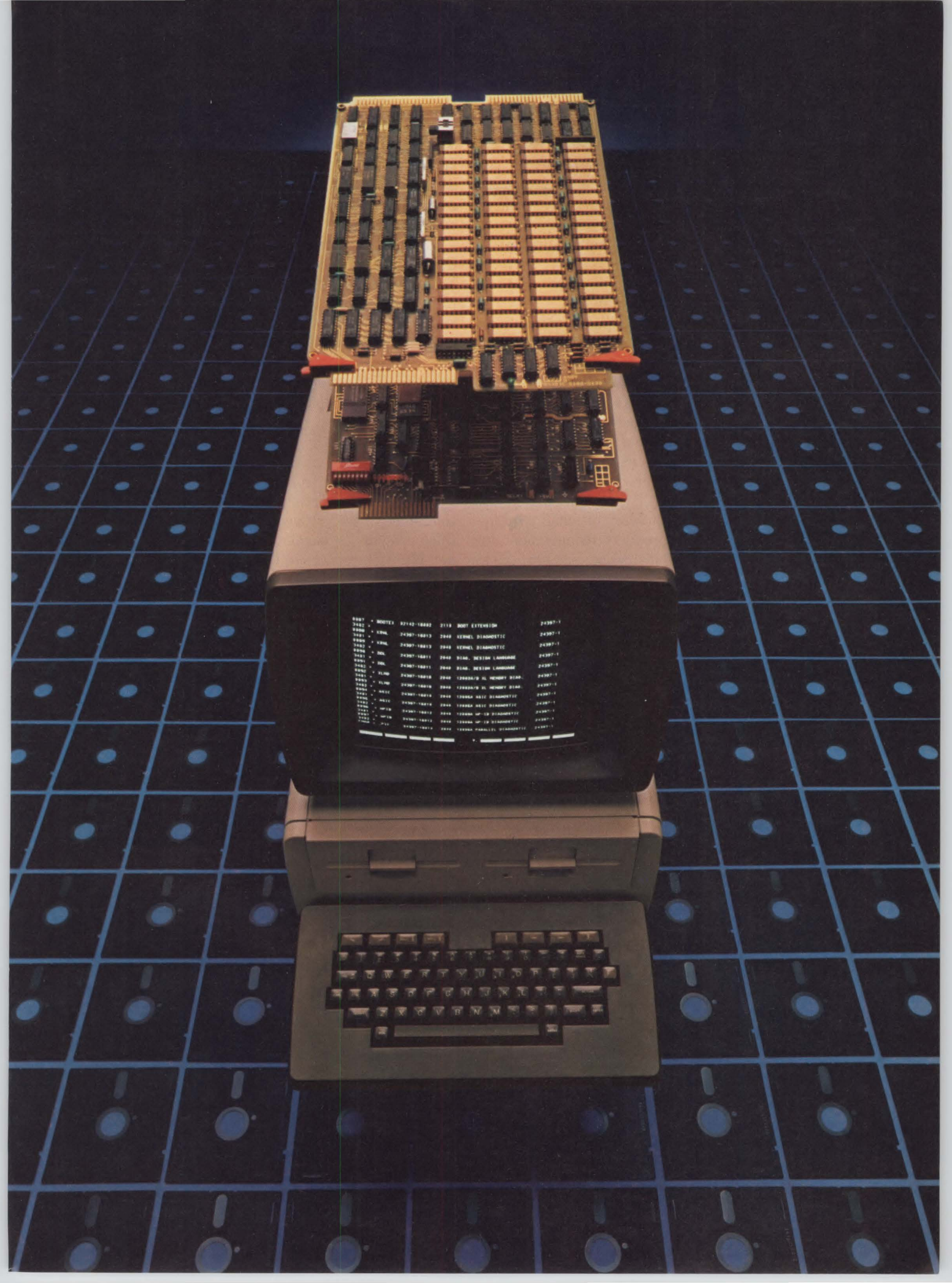

To recapture the business it lost to competitors that delivered more quickly, DEC tripled production of some popular machines and began to manufacture needed semiconductors internally.

up" company with a high degree of decentralized decision-making. Brown adds that "IBM is copying DEC and integrating some of DEC's lessons into its operations."

Flat growth in small-business systems

The segment of the small-computer market hit hardest by the 1980 recession was small-business systems. IBM's total market share dropped more than one percent in 1980. This was largely because this market segment became soft as small businesses postponed purchases of computer systems. While long-term prospects for small-business machines are good, analysts expect the downturn to continue through at least the first half of this year.

"Results were below what were anticipated for 1980," says James Randall, director of small general-purpose business systems, products management for NCR Corp. "Growth was flat in the small-business systems area."

Lagging sales in the U.S. were partially offset by a strong showing in Western Europe. But, given the counter-cyclical relationship of the U.S. and European economies, the market for small-business systems in Europe is expected to soften later this year as the U.S. market improves.

However, a soft economy doesn't deserve all the blame for the failure of the small-business segment to match the overall growth of the market, say some observers. Dataquest's Bushee also cites suppliers' failure to understand and meet the needs of their potential customers. "Too many of them were interested only in pushing hardware," he says. "As a result, the business segment is showing early signs of saturation."

Industry executives predictably disagree. Datapoint Corp.'s vice president and general manager for sales, Millard Allen, concurs that small-business system sales were flat, but he pins the blame solely on the economy. "Sales were slow because of the cost of money, not a lack of responsiveness to users' needs."

Data General hit hard

A high-flier that came down to earth last year was Data General Corp. Last year, its revenues increased 13.7 percent, slightly more than half the overall market growth of 26 percent (MMS, March, p. 50; April, p. 141) to $0.81 per share from $1.15 in 1979.

Executive vice president Herbert Richman concedes that some of the criticism of the company that came in the wake of its earnings performance was justified, notably with respect to the highly centralized management structure that carried over from the company's early years. But he says the criticism surfaced only when the effects of a poor economy became apparent. "As long as our profit margins were some 20 percent, [our critics] just said we were eccentric." he says.

The H-P Series 44 *business minicomputer doubles the performance rate of its predecessor at a 5 percent higher price.*

Plessey's SYST-23V Series

INTRODUCING Plessey's SYST-23VZ with DOUBLE-SIDED floppies

Designed for business, industrial, educational, scientific, and multi-terminal applications.

- 2 Mbyte double-sided floppy disc subsystem—1 Mbyte of storage per diskette
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- 128 to 256 Kbyte main memory
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Plessey's SYST-23V Series microcomputer systems provide you with an ideal balance of sophisticated computing and adaptable storage capabilities in a small system environment. Employ the SYST-23V as a stand-alone or as part of a large, multi-user network for scientific analyses, industrial monitoring, word processing, business accounting.

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Plessey's reputation for quality, service, delivery, reasonable prices, and worldwide support, has made us the largest independent producer of DEC*-compatible equipment. Our product line includes core and semiconductor memories; cartridge, disc pack, floppy, Winchester, magnetic tape controllers and subsystems; mini/microcomputer systems; video terminals; DEC-compatible software; and a variety of backplanes, expansion chassis and other accessories including communications devices. All Plessey products include applicable hardware and software documentation, plus warranty with maintenance/installation options.

*Trademark of Digital Equipment Corporation

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Play with a full deck.

Introducing the RM 65 line of microcomputer boards.

The RM 65 line gives you the options and flexibility to design precisely the microcomputer systems you need.

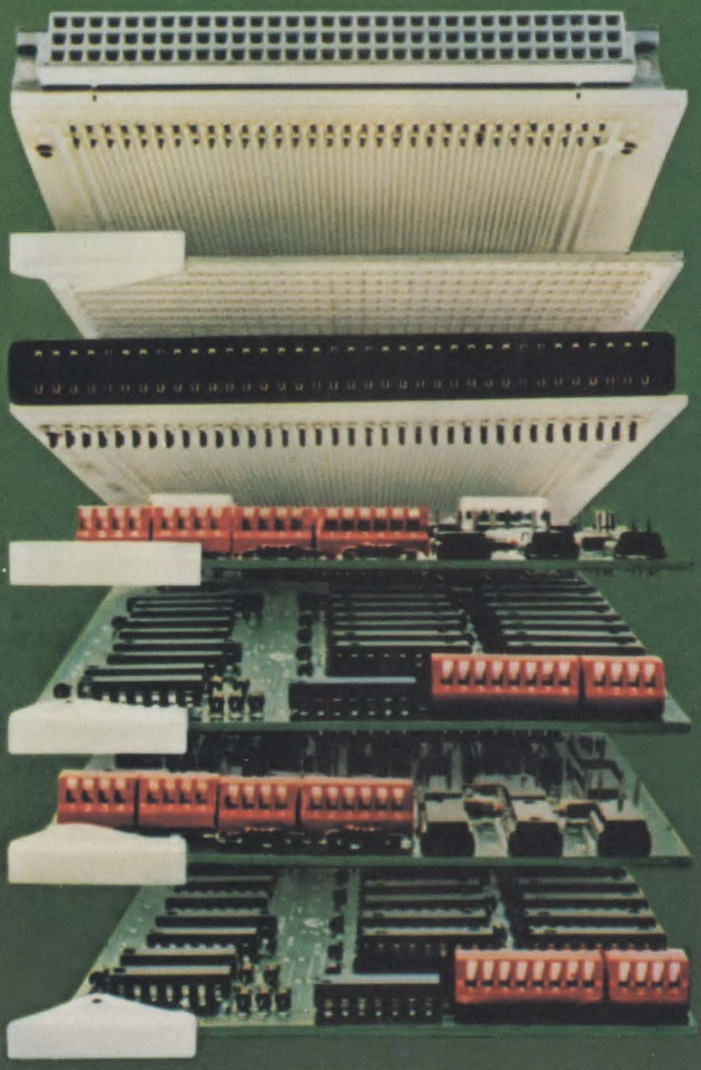
And you can do it quickly and economically. Because you're offered so many design alternatives.

Application software for the RM 65 line, for example, can be programmed in a number of languages: BASIC, PL/65, FORTH and Assembly Language.

RM 65 uses a motherboard interconnect concept so any card will fit any slot.

You can choose either edge connector or Eurocard versions.

And a set of card cages allows a broad variety of packaging options.



Single Board Computer Module
R6502 CPU, 2K bytes static RAM, 16K bytes PROM/ROM capacity, an R6522 VIA and support circuitry on a single RM 65 module.

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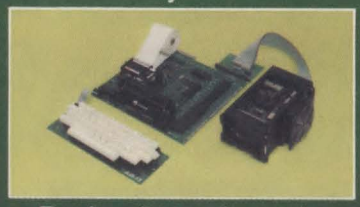
Your functional system can be economically developed on the AIM 65 Advanced Interactive Microcomputer. At less than $500, AIM 65—based on the high performance R6502 microprocessor—is the lowest cost development tool available for any board level system.



Rockwell stands ready with the system and application assistance your project requires. Call Rockwell for more literature. Or to schedule time at one of Rockwell's system development centers.

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RM 65 MODULES

CIRCLE NO. 65 ON INQUIRY CARD

Honeywell hopes to capture small-computer sales in the financial and airline markets with software packages that handle transactions.

Reorganization occurred at most small-computer suppliers during the past 18 months, reflecting the maturing of the small-computer market. "Manufacturers are starting to realize that the small-computer market consists of a number of different niches," says analyst Nancy Scull of International Data Corp., a Waltham, Mass., research firm. As a result, vendors are reorganizing internally to address vertical markets—medical, automotive, wholesale goods distribution, building trades and others—and are either developing in-house application software packages or are strongly encouraging value-added OEMs and systems houses to do the same. "Opening the vertical markets is a key to keeping the market growth high," Scull adds.

Honeywell, which jumped to fourth place on this year's Top 10 list with a revenue increase of a little less than 150 percent, established an applied business systems group last April that's oriented toward specific vertical markets. Separate business segments of the group with self-contained marketing and applications staffs are aimed at the health-care, office-automation, OEM, manufacturing and distribution markets. In addition, Honeywell hopes to capture small-computer sales in the financial and airline markets with software packages that handle transactions, communications and general-business applications.

"We've aligned our organization to meet customers' needs," says Henry Haugland, Honeywell's director of small-systems marketing. "We sell business solutions, not computers."

In 1980, Honeywell shipped as many of its Level 6 computers as the company had sold during the previous four years. Late last year it introduced a new family of machines, the DPS series, ranging in price from $20,000 for the stand-alone DPS 6/30 to $600,000 and more for the 6/96 mainframe (MMS, February, p. 13). Haugland says Honeywell placed emphasis on developing a compatible family of 11 machines to enable users to add more software and hardware as computing requirements and applications increased. "We've tried to position ourselves strategically to provide entry-level machines that are upgradeable and have built-in capability to handle future needs," he explains.

In a related development last March, Texas Instruments Inc. introduced the TIBIS 100 software package, designed for the building-materials industry. Unveiled at the National Home Improvement Congress, the program is aimed at helping users with accounting and inventory control. Joseph Watson, TI's marketing manager for the digital system group, says the company is actively looking for assistance from OEMs and systems houses with expertise in specific vertical markets.

Rather than develop application packages internally, Datapoint uses OEMs exclusively. "We rely on third-party channels to add value for application software," says vice president Allen. Through such channels, he adds, the company is going after sales in the energy and banking industries.

Distribution

Last year, the leading suppliers of small-computer systems were keenly concerned with how their products and services reached the market. They continued to experiment with retail stores and to establish arrangements with OEMs, dealers and distributors. Internal sales organizations were not overlooked, and several suppliers have tested the waters for mass-merchandising.

"Distribution has evolved over the past couple of years as more and more crucial to the small-computer market," says IDC's Scull. Prices of systems, especially at the low end, have decreased to such low levels that mass-media product advertising will become the rule. Only a small number of vendors, notably IBM and Wang Laboratories Inc., now practice this method of advertising, she says.

NCR, for instance, has traditionally relied on its internal sales organization to sell systems directly to end users. During the past 18 months, however, the company created a separate OEM sales organization and a distributorship program to sell both hardware and software.

The company did not follow the trend toward using retail outlets. A test marketing program with two such stores in Cincinnati failed, and the company ended the project last summer. A company spokesman says retail outlets were not cost-effective. NCR uses retail stores,

A MATTER OF DEFINITION

There are almost as many classes of small computers as there are industry analysts, executives and editors to supply definitions. Just as one develops a clear picture of the range of small-computer products and applications, advancing technology again blurs the scene. New product classes appear, old ones vanish, and traditional boundaries are altered at a dizzying pace.

Electronic Business magazine's annual survey of the Top 10 small-computer suppliers has reflected these changes of definition during the past three years. The article that appeared in 1979 looked at modular, general-purpose minicomputers for business, scientific and control applications, and small-scale data-processing units dedicated to business data processing. Last year's definition was altered slightly to include small-computer systems priced between $15,000 and $200,000. This year's definition changed again, expanding to encompass general-purpose minicomputers and μcs priced at less than $200,000 with no bottom limit.

Last year, the leading suppliers of small-computer systems were keenly concerned with how their products and services reached the market.

however, in marketing two business systems that sell for $5000 to $7000. These are sold through the company's Hauppauge, N.Y., subsidiary, Applied Digital Data Systems Corp., a 1980 acquisition of NCR.

Last year, DG, which has been selling its microNova line of small computers in retail stores since 1978, organized a dealer and distributor network for its larger systems. Executive vice president Richman says the network totals eight master distributors and 110 dealers. The company will also establish retail outlets in Europe this summer to coincide with the introduction of a new μc.

Also last year, DEC consolidated its retail chain, closing two of its 27 stores. It also attacked overseas markets by extending its authorized distributor program to Western Europe. The company has tightened qualifications for commercial OEMs and systems houses in anticipation of this summer's new electronic-mail and word-processing offerings. "We're actively exploring alternatives to current methods of distribution," says DEC vice president for corporate marketing Ted Johnson. "There'll be some new things by the end of this year."

A combination of factors is behind the industry's trend twoard new methods of distribution. Those factors include heightened competition among suppliers in the face of a more mature, slower growing market, the spiraling cost of direct sales relative to decreasing hardware prices and the success of retail stores as marketing outlets for μc and small-business systems. The next step is likely to be an expansion of the types and sophistication of mass-media campaigns. Now that the concept of retail computer stores is established, says Scull, "the key is to get customers into them."

IBM System/38 *computers get a final check before shipment.*

Coming trends

Uncertainty about the economy's performance will continue to affect the market for small computers and the business planning of manufacturers. "The industry is basically healthy," says the Gartner Group's Brown. "In the short term, however, I'm not confident of a return to its earlier robust state, and I'm wary of more jitters."

On the hardware level, the impact of the superminis has not been fully absorbed. Such systems represented a large portion of 1980 product announcements; DEC, DG, Honeywell Inc., Harris Corp. and Systems Engineering Laboratories were among those that unveiled machines occupying the evolving market between mainframes and traditional 16-bit minicomputers. It's likely that these products will carve a chunk out of both markets because they have powerful processing capabilities at attractive prices. "You can't underestimate the importance of those 32-bit systems," Bushee says.

Over the next 18 months, the Japanese will slowly make their presence felt on the systems level as they have in the components area. Fujitsu Ltd., in conjunction with its American partner TRW Inc., has announced its entry into the U.S. market with a supermini system. Nippon Electric Co., Sony Corp., Toshiba Corp. and OKI Electric Industry Co. are expected to follow suit through similar joint ventures with U.S. firms. Value-added software, however, should continue to be the exclusive domain of the U.S. for some time.

The marriage of telecommunications and distributed data processing awaits only the blessing of the computer industry in the form of choosing a protocol standard for local networking. There's a real possibility of a de facto standard emerging in the near future, but, until then, users are unlikely to risk investing large amounts of money in a large-scale office system that could prove to be a technological dinosaur a short time after delivery.

Continuing pressure to improve productivity will be the basic driving force behind the small-computer industry. Interest rates will probably fall and the overall economic picture brighten, but as one industry executive comments. "There will always be pressure to enhance delivery of services with the same work force. With computing power, the productivity improvement is real, tangible and measurable." ■

Stephen J. Shaw is a staff writer for *Electronic Business* magazine. This article appeared in its May, 1981, issue.

GOOD NEWS

Kode introduces a new concept in testing disk and tape drive quality and integrity.

MORE GOOD NEWS

The Kode Transition Density Analyzer™ is available now... when you need it!

WHAT DOES IT DO?

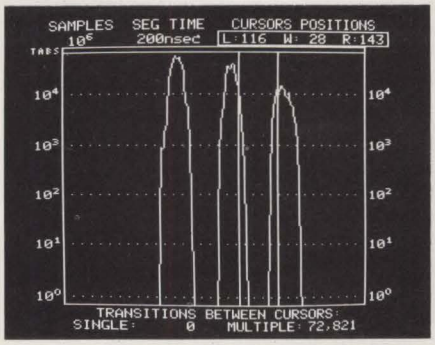
The TDA 101 helps you improve bit error rate and noise margin by more accurately and objectively evaluating PCM-encoded data integrity.

WHY DO YOU NEED IT?

You can easily view the effect on the output datastream as you make adjustments or changes to mechanical and electrical components of disk and tape drives. Media, too!!! You can actually test the quality of different media products. See the effect of head azimuth changes. View signal degradation on different disk tracks. Get a competitive edge.

IS IT EASY TO USE?

Compared to **any** existing method—it's a **joy!** The TDA 101 provides a graphic display of level transitions in a time histogram format. This unique display allows assessment of PCM data quality with unprecedented ease and accuracy.



Typical display of MFM encoded data.

HOW DOES IT WORK?

Any PCM format may be characterized as level transitions referenced to specific points in time. Transition displacements about the nominal are introduced by storage device variables such as poor equalization, magnetic media quality, speed variations, etc. The TDA will display deviations as small as 10ns.

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Kode is a subsidiary of Odetics, Inc.—a manufacturer of high-rel space satellite digital recorders. Pushing the state-of-the-art required a totally new instrument concept—so we built it.

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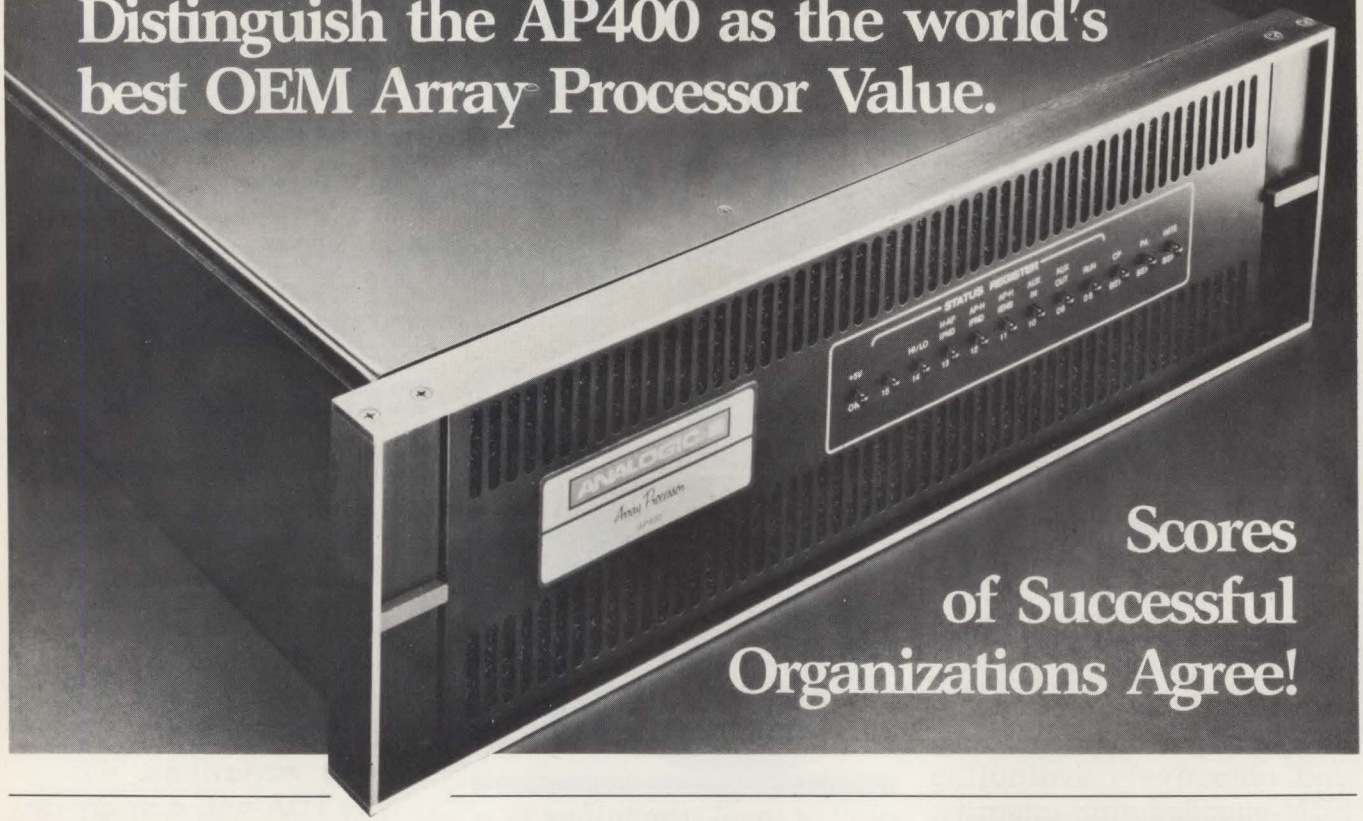
Computing Power, Programming Ease, System Reliability, Size and Price Distinguish the AP400 as the world's best OEM Array Processor Value.



Scores of Successful Organizations Agree!

Analogic began the design of the AP400 with the knowledge that OEM array processor users needed an order of magnitude more reliability, software maintainability and economy than anything available at that time. Now, less than two years since its introduction, system engineers, scientists and computer designers appreciate its performance and have designed-in over 500 AP400s in such diverse applications as ☐ X-Ray Tomography ☐ Ultrasonics ☐ Nuclear Magnetic Resonance ☐ Spectral Analysis ☐ Seismic Exploration ☐ Music Synthesis ☐ Digital Filtering ☐ Satellite Communications and more. Consider the advantages to the OEM.

You get just what you need

In its simplest form* the AP400 will tuck into your package, using your 5-volt power and your front panel. At the other extreme, the AP400 may incorporate 64K words of memory, and come as a complete, stand-alone, self-powered package. They can even be chained together to deliver total throughput equal to that of super computers — but at a fraction of the cost.

You pay far less for what you get!

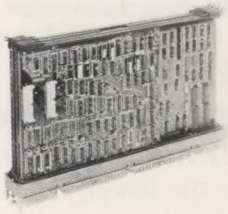
We know that OEMs are concerned with the total cost picture: initial price, costs of inventory, costs of software development and maintenance and costs of hardware maintenance.

In response to these concerns, the basic AP400 has been priced to reflect OEM quantity requirements. Software is inexpensive because we provide complete utility, application and system software and support in Host FORTRAN, Host Assembly and AP Assembly language...in standard or custom configurations. Further, the AP400 employs a familiar minicomputer-like hardware and software architecture and instruction set, similar to the host computer you're probably using now!

In addition, the AP400's straightforward system architecture and comprehensive diagnostics enhance reliability and simplify maintenance procedures. Analogic's sophisticated engineering design and reliability minimizes hardware maintenance cost.

The AP400 has a long product life expectancy

Continual development of a family of software-compatible machines ensures that all systems using the AP400 will keep their competitive edge for years to come.



**In its simplest configuration the AP400 is composed of 4-PC cards. It measures only 15½ x 10 x 2¼ inches.*

Technical information is available

Write for our comprehensive AP400 information package which includes a product selection guide, and a description of our technical services. Should you feel that a design conference would be helpful, tell us about your needs and we'll assemble a group of system architects, engineers and scientists to help you with your program. Analogic staff members are experienced professionals in meeting special customer needs such as inventory scheduling, special packaging and service arrangements.

Summary Specifications

- 10 million arithmetic computations per second
- 1024 point real FFT — 3.6msec, complex FFT — 7.4msec.
- Standard memory: 4K by 24-bit bipolar RAM
- Expandable 64K words in increments of 4K
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DISTRIBUTION

Mini manufacturers fight back

GENE R. TALSKY,
Professional Marketing Management, Inc.

Innovative distribution methods and support programs combat the μc threat

Minicomputer manufacturers are finding that sales of minis by resellers are not growing as rapidly as are those of μcs. That's evidenced in the *Mini-Micro Systems* 1980 Mini-Micro Computer Market Report, which predicted that planned acquisitions of minis by resellers (third-party participants) in 1980 would increase 43 percent over actual purchases in 1979. The report also predicted that planned acquisitions of μcs in 1980 would rise 74 percent—almost double the growth figure for minis. Further, the installed base of μcs would grow 99 percent in 1980, while that of minis would increase only 61 percent. This shift from minis to μcs is being driven by three factors:

- The "first wave" of minicomputer buyers has long since been sold.
- Manufacturers of μcs are now offering software with comparable capabilities at lower cost.
- Manufacturers of μcs are distributing more broadly than are their mini counterparts.

Minicomputer manufacturers, concerned about the trend toward μcs, are responding by revising products, lowering prices and offering more liberal discounts to their resellers, as well as with extraordinary measures to strengthen and enlarge their distribution networks.

Individual company responses

- **Data General Corp.** is undergoing major organizational changes. Much of its original marketing organization has been restructured, and some of its senior management, including William D. Jobe, vice president of the general distribution division, have departed. The company is establishing a wholesale distribution network to broaden its support capabilities and is intensively marketing to independent retailers.

The company is dropping some software lines, terminating support for others, such as Synergist, and announcing new ones. The company is also weeding out unprofitable channels of distribution and is investing heavily to develop new markets. DG's efforts, however, have been frustrated. For example, the company's attempt to enter high-level graphics and CAD/CAM markets by acquiring Megatek failed because of DG's poor financial position. This year will be a crucial test of the company's new policies.

- **Hewlett-Packard Co.** has established an OEM marketing organization to expand its reseller network for the system 250. It is also marketing its 1000L systems through ABC Computers, a value-added OEM. ABC, in turn, distributes through regional respresentatives and a dealer network. H-P is packaging independently developed software for licensing by resellers, and has recognized the need to expand its dealer services to include business and market-planning support.
- **Microdata** has formed an independent sales organization (ISO) division with two regional managers and a dealer advisory committee in its attempt to restore relations with resellers and to compete with its new

A simple algorithm

We work with the serious systems integrator ... on terms that make sense to you. That means giving you a set of products which expand your limits, not reduce them.

We manufacture the most complete family of high quality IEEE/696 S-100 mainframes on the market. Choices include three mainframes in rack-mount or table-top packages with complete board sets, to serve as the building blocks for your 8 or 16 bit system. We also provide other options ranging from complete floppy disk systems right up to our proven Pascal development system.

The $\int$ factor: one source.

No matter which option you choose, you get the benefit of working with completely integrated products ... fully assembled and tested ... under one warranty and one price structure ... leaving you free to concentrate on value-added application development and sales.

Choose from mainframe options ...

Select from three packaging options: Rack-mount, table-top or front panel models. All three feature our 20 slot S-100 motherboard with 25 amp power supply and are delivered fully assembled and tested with our Series II™ board sets. Any board configuration you choose works with any DPS-1 version, allowing you to vary your package offering, or develop on one version and market another.

- Front Panel model — a powerful development and diagnostic tool for Z-80† systems, which can be used for prototyping, servicing, debugging, and software or hardware development. Use its features to set breakpoints, trigger scopes, single step, slow step and more.
- Front Panelless desk top model—a lower cost option for OEM or other turnkey operations which do not require the extra capability of our Front Panel.
- Rack Mount version — features a heavy gauge frame designed to fit into standard 19" racks. CVT power supply for brown out immunity is standard.

*In Calculus, a fundamental statement in the definition of limit; interpreted here to imply: "For your integration problem, Intersystems has a solution."

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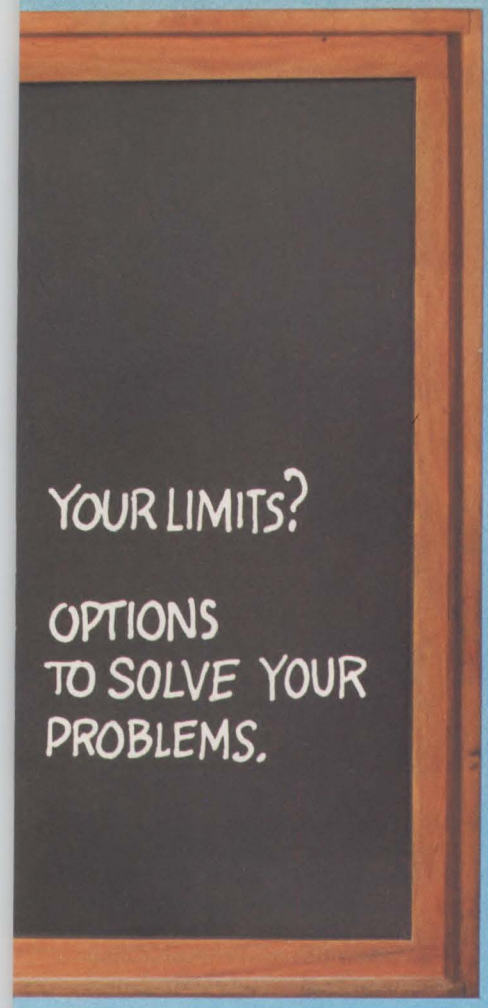
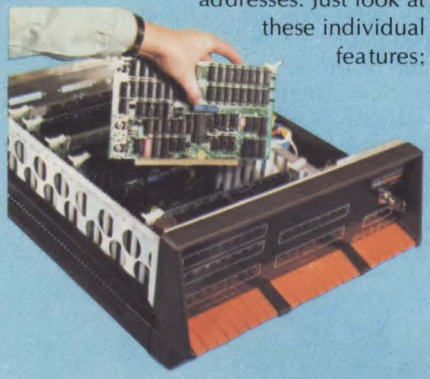


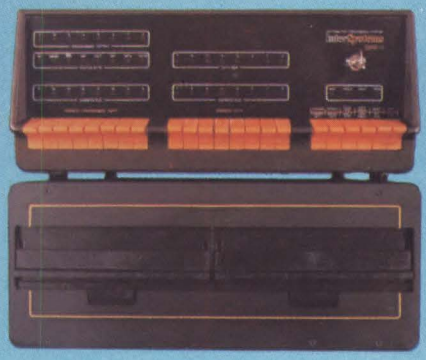
Board level options...

Intersystems mainframe packages, equipped with Series II boards, are operational in both 8 and 16 bit settings and support extended addressing in both I/O and memory space, recognizing 16 bit I/O addresses and 24 bit memory addresses. Just look at these individual features:



- MPU-80—uses a Z-80, 8 vectored interrupt lines and two 4K windows to address up to 1 Megabyte of RAM without bank select.
- 64KDR—sophisticated refresh circuitry allows unlimited DMA and absolutely reliable operation without wait states.
- 6 SI/O — six individually software-controllable serial I/O ports with optional interrupts. Each can run RS 232 at up to 19,200 BAUD, as can our VI/O board.
- VI/O—has two serial ports; two 8-bit parallel output and two 8-bit parallel input ports plus 8 individually controllable command lines and 16 levels of vectored interrupts.
- FDC II—can DMA up to a full track into 16 Megabytes of memory. Optionally generates interrupts and handles up to four 8" floppies.
- MPU-8000 — available with the non-segmented Z-8002†, which directly addresses 64K, or the segmented Z-8001†, which can directly address 8 Megabytes.

Extended systems options...



Interfacing disk drives is not a trivial matter, so when your objectives and resources dictate you spend your energy elsewhere, use our resources to perform the service for you. We can add our disk drive package to any Z-80 or Z-8000 configuration we provide ... again, fully assembled and tested and covered under one warranty.

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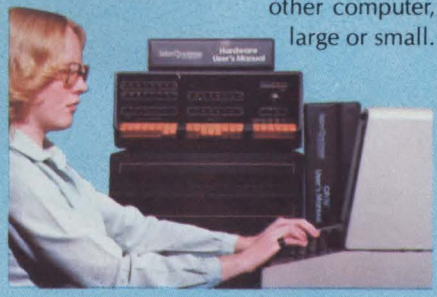
We use it for our own hardware and software development. It includes either table-top mainframe, two 8" floppy disks, 128K RAM, CP/M#, and Intersystems Pascal/Z™ compiler and Cache BIOS™.

THIS SYSTEM IS FAST! Why? Because our ultra-fast Cache BIOS automatically buffers whole tracks, eliminating most disk accesses. This delivers up to three times the throughput of any other floppy-based system we know and is equal to many small hard disk systems.

The system is versatile, too. SET program allows you to change many BIOS parameters and specify control characters to enable special features such as diagnostic output to trace program execution. It can also provide remote I/O to link your system to almost any other computer, large or small.



And it's reliable. The Cache BIOS System runs continuous memory tests when idle, and verifies with a Read after Write and Read after Read.

And the system also includes our Pascal/Z, a true native compiler producing ROMable and Re-entrant code. It features a minimum of extensions chosen for the development of your scientific and business applications. And it's compatible with our native code Pascal for Z-8000, providing a graceful upward path to 16 bit applications. So what you write now is right later.

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We don't believe you should ever have to sacrifice good technical support to find a good product. We'll back you to the hilt with services like free technical consultation, board-swapping, diagnostic packages, and documentation that gives you all you need to integrate, operate and maintain your system ... right down to schematics of the boards.

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The flexible 800 Series with MULTIBUS® module lets you use dual tablets, dual cursors, and multiple interfacing for greatly expanded system capabilities.

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The 600 Series, using electrostatic technology and incorporating the "active inch" principle, is also available in a wide range of sizes and surface options.

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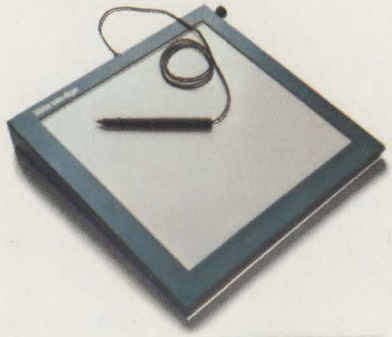

To further expand accuracy and high speed performance, we offer SMART software packages for the 600 and 800 Series. SMART provides local processing of digitized data to let you combine functions and calculations, and much more depending on your working requirements.

CalComp for all the alternatives in computer graphics.

CalComp offers full lines of drum, flatbed and beltbed plotters; controllers; computer output microfilm (COM) units, and electrostatic plotter/printers. And, new from CalComp, the Graphic 7 display system.

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H-P is packaging independently developed software for licensing by resellers and has recognized the need to expand its dealer services to include business and market-planning support.

generation of Reality-based systems. The company has reduced its prices, reorganized its product lines and increased dealer discounts to stop the migration of dealers to competitors. The company is developing a committed support organization to rebuild its distribution network, currently down to 18 dealers from almost three dozen.

- **Texas Instruments Inc.** has committed major resources to expanding its reseller support programs. The company is now attempting to expand its application software lines and to help its ISOs make better profits. TI also plans to supplement technical and sales training with business management and marketing training.
- **Point 4 Corp.** is expanding the low and high ends of its product line, and is investigating the possibility of expanding its distribution network to include office products suppliers.
- **Burroughs Corp.** is competing fiercely with NCR for dealers. Both NCR and Burroughs are committing major financial and management resources to broaden their distribution. Burroughs is establishing its APEX-ISO organization to deal with traditional OEMs, systems houses and ISOs. The company is establishing discount and support levels for each of these distribution outlets, and is attempting to regain credibility with its systems houses by establishing an advisory group to stimulate the development of its new program.
- **NCR** has already established its discount and support programs for both OEMs and distributors. The company is contracting authorized distributors for small networks, and OEMs for larger systems.
- **Perkin-Elmer** is selling some product lines through dealers, and others through distributors. It is also establishing a new division for specialized commercial markets by packaging its own and third-party software products for resale by OEMs and ISOs. The company is trying to establish itself in highly vertical commercial market niches with proven software.
- **Xerox Corp.** is expanding its third-party reseller base by adding distributors to recruit and train dealers. The company is also selling directly to retail chains and independents, and developing its own retail outlets.

The remainder of 1981 will provide some indication of the success of these measures. It should be an interesting year for mini manufacturers. ■

Gene R. Talksy is president of Professional Marketing Management, Inc., Gales Ferry, Conn.

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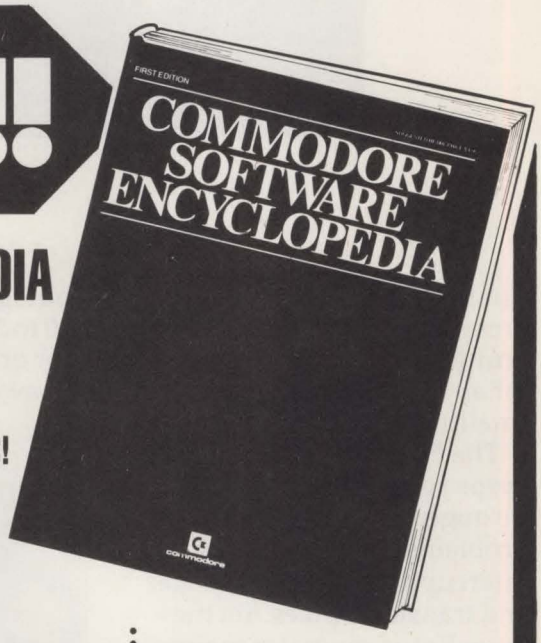

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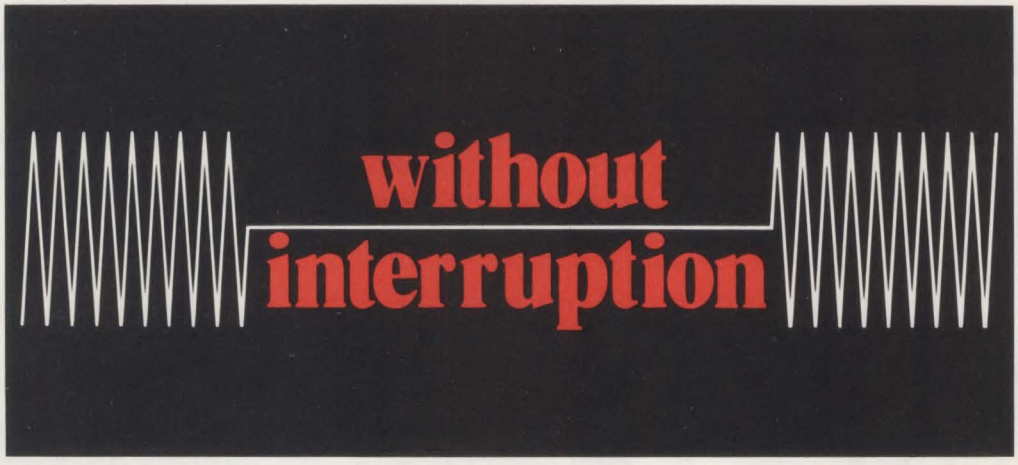

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CIRCLE NO. 70 ON INQUIRY CARD

Graphics comes to the microworld

JACK HEMENWAY and ROBERT GRAPPEL, Hemenway Associates, Inc.

New color graphics controller products ease software development and promise new applications

A picture might be worth a thousand words to some, but to a small-system user it can be worth much more. A graph can replace pages of tables and paragraphs of explanation. But system integrators considering providing this capability must first become familiar with the techniques involved in giving a μc system such color-graphics capability.

Text editing, process monitoring, mathematical modeling and other applications are all prime candidates for enhancement by graphical output. But until rather recently, graphics capability was the domain of minicomputers and mainframes because it requires a great deal of support from a host in terms of memory, computation and hardware. The introduction of graphics-controller chips, however, has made truly powerful graphic displays practical for μcs. By unburdening the host μp from housekeeping tasks, these chips free it to concentrate on data processing and display organization. Additionally, many graphics controllers can handle quite a bit more than housekeeping.

The use of TV screens and TV-like displays in μc systems is another important factor underlying the increased employment of graphics in μc applications. The mass markets for these display devices lower their cost to a level practical for μc systems. And, although the limitations of TV displays in terms of bandwidth and required support are a drawback, graphics-controller chips help solve these problems.

Two graphics-generation techniques

Graphic images are produced on a CRT terminal in either of two ways: raster scan or vector display. In the raster-scan approach, a repeating scan across all parts of the tube-face paints and renews the image by modulating the scanning beam, which is how a TV works. The vector-display scheme works like an oscilloscope, moving the beam only to those points on the screen that must be illuminated. Each technique has its advantages and limitations.

Mode	Array controlled (Horizontal × Vertical)	Color controlled
2-color graphics	256 × 192	Grn
	256 × 192	Buff
	128 × 192	Grn
	128 × 192	Buff
	128 × 96	Grn
	128 × 96	Buff
	128 × 64	Grn
	128 × 64	Buff
4-color graphics	128 × 192	A
	128 × 192	B
	128 × 96	A
	128 × 96	B
	128 × 64	A
	128 × 64	B
	64 × 64	A
	64 × 64	B
Alpha/semigraphics		
D_7 = A/S		
D_6 = INV		Grn
External		Org
		Grn
Internal		Org

A	B
Green	Buff
Yellow	Cyan
Blue	Magenta
Red	Orange

Fig. 1. Display modes *of the Motorola 6847 graphics controller chip.*

Hemenway Associates is a Boston-based system software house specializing in operating systems and languages for μps. This article is based on one that appeared in the May 27, 1981, issue of EDN *magazine.*

The synchronous address multiplexer generates all the clocking signals needed and provides the signals for refreshing dynamic memories transparently to the μp.

A raster-scan graphics display must continually redraw itself. It maintains a map of the desired image in memory, along with data on the state of each point (pixel) on the screen.

A pixel can consist of 1 bit (in a black-and-white display), or it can contain color or gray-scale information. Some displays call for 4 to 8 bits for each pixel. This requirement points up one of the major drawbacks of a raster-scan display: it often requires a very large memory to hold the image. For example, for a display with 256 points of resolution in both horizontal and vertical directions, requiring 4 bits for each pixel, 64K pixels or 32K bytes of memory would be needed—the maintenance of which can strain an 8-bit μp. On the other hand, a raster-scan display is versatile; manipulating points on the screen reduces to manipulating memory locations. A problem arises, though, in transferring the memory image to the screen: The timing constraints imposed by TV standards require sophisticated support circuitry because most μps are too slow to handle the display directly.

Vector displays, on the other hand, don't require large memory images; they store only the locations of the lines to be drawn on the screen. And because most of a graphics display is background, vector displays outperform raster-scan approaches in terms of storage requirements. However, a vector display calls for special display hardware: it won't work on a TV. And, because the vector display is based on lines rather than points, certain kinds of images are difficult to produce on a vector unit. Additionally, because a vector display draws lines on the screen one at a time, the time required to update the screen grows as the display becomes more complex, often leading to annoying flicker and dim displays.

The raster-scan technique seems to be the predominant method of graphics generation in μcs. The advantages of flexibility and inexpensive display hardware are hard to beat, and 16-bit μps have removed many of the memory restrictions that formerly hindered the raster-scan method. Additionally, graphics-controller chips help solve timing and control problems.

Color graphics in a chip

A powerful graphics-controller chip for raster-scan applications is the Motorola 6847. Although commonly used as a display controller for a video terminal, its graphics capabilities go far beyond that level.

Fig. 1 illustrates the chip's various display modes. Resolution ranges from 32 × 16 in alphanumeric mode with semi-graphics capability (the ability to define alternative dot-matrix patterns in addition to normal letters and numbers) to full-graphics mode, which provides 256 × 192 pixels. Each mode also has varying color resolution, ranging from as many as eight colors in the low-resolution modes to a choice of a foreground and a background color in the high-resolution ones. These trade-offs also call for differing amounts of memory. The alphanumeric mode requires only 512 bytes of storage, while the highest resolution graphics mode requires 6144.

Many other graphics-controller chips are available from other manufacturers, some with even more power than the 6847. The 6847 has limited alphanumeric resolution and color choice, and it lacks a light-pen feature. However, it is in widespread use, having been integrated into a color-graphics μc, the Radio Shack TRS-80 color computer.

Not to be confused with the original TRS-80 line, the color computer is an entirely new machine incorporating several advanced devices. Its CPU is a Motorola 6809, not a Z80 as in the original TRS-80. Standard 6800-family peripheral chips are also employed, along with the 6847.

SAM forms the heart

One new piece of hardware in the color computer is the 6883 synchronous address multiplexer (SAM). This chip provides the "glue" that binds the design together: it generates all the clocking signals needed by the 6809 and provides the signals for refreshing dynamic memories transparently to the μp. SAM also provides the memory data to the 6847 to free the 6809 totally from any responsibility for maintaining the screen display. The μp can, therefore, freely operate on a memory image without any timing constraints imposed by the screen scanning, which runs asynchronously.

Fig. 2 shows the color computer's memory map. Note that addresses FFC0 (61,440) through FFDF (65,503) are programmable registers within the SAM. Each pair of SAM addresses corresponds to one programmable bit: Accessing the even address clears the bit, while accessing the odd one sets it.

Start by plotting dots

The most basic primitive in a raster-scan-graphics system—the point-plotting routine—shows a user how to use the color computer's graphics capabilities. All other graphics capabilities are based on the ability to plot a point of the desired color at a desired screen location. Hence, the performance of this subroutine is crucial to the entire package's speed.

In a raster-scan display, each pixel maps to a memory location. The point-plotting subroutine, therefore, must be able to convert a pixel's X and Y coordinates to a memory address. The algorithm for this conversion depends on the display's design and the choice of display controller and mode. For the 6847 working on its maximum-resolution mode, address conversion occurs according to this formula:

Address:
=((X+XOFF)/8−(Y+YOFF)*32)+SCREEN+SCRNOFF.

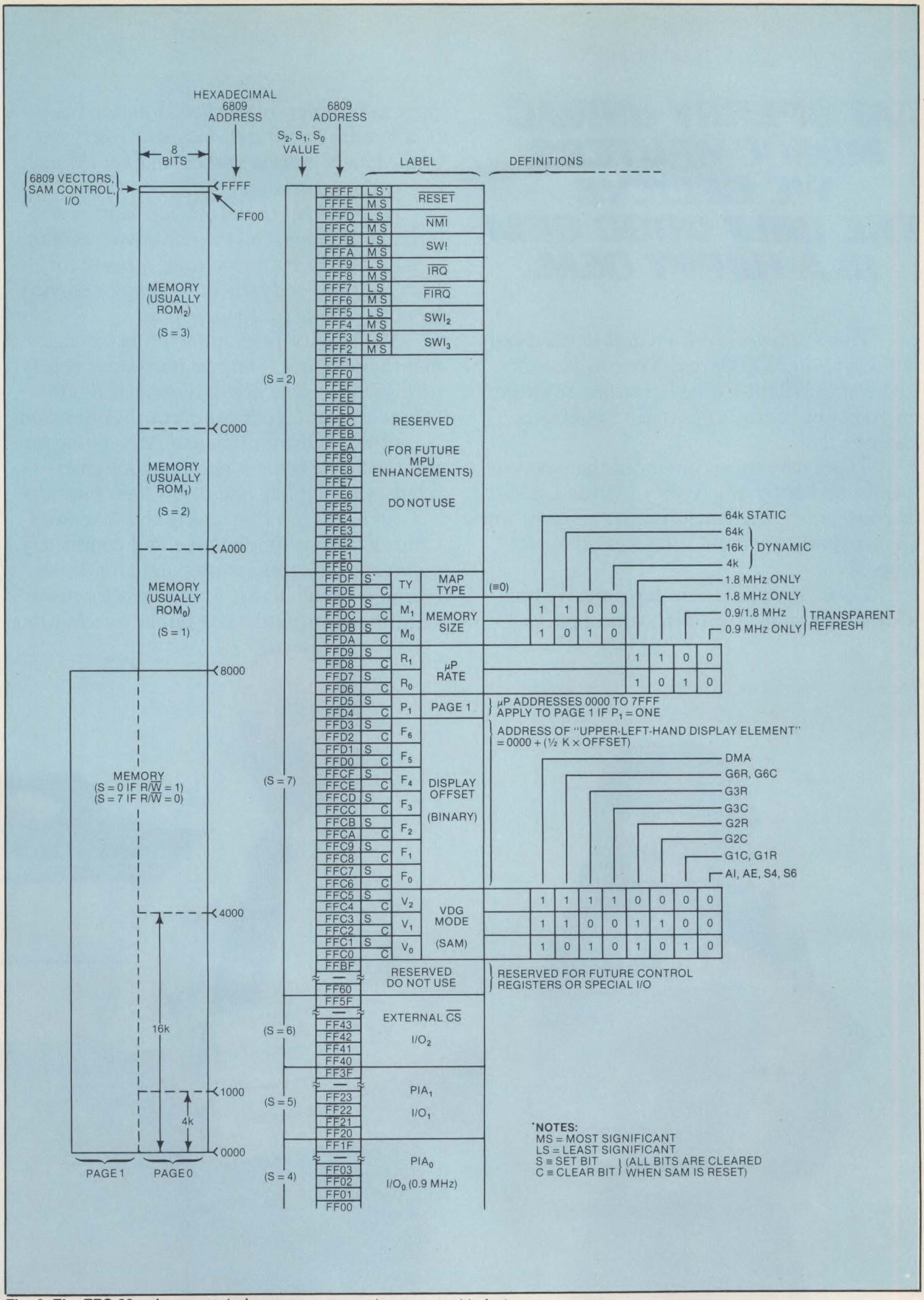

Fig. 2. The TRS-80 color computer's *memory map and programmable features.*

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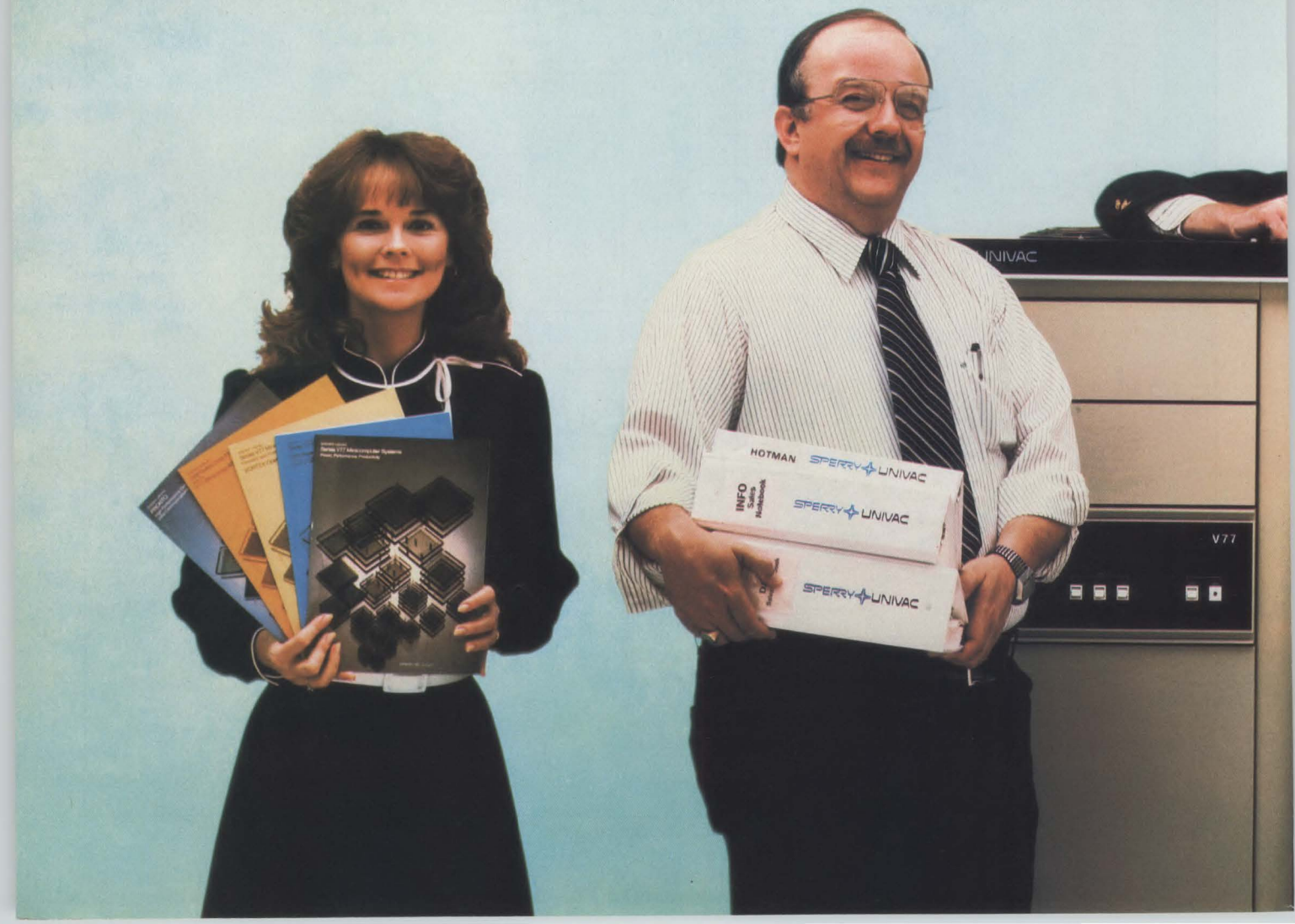

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CIRCLE NO. 71 ON INQUIRY CARD

Bresenham's algorithm requires no multiplications or divisions at all. With it, the changes in X and Y can be calculated as in the slope formula.

Here, SCREEN is the address of the start of the memory image, and XOFF and YOFF are the offsets needed to place the display's origin in the screen's center. (For the 6847 in full-graphics mode, XOFF=128 and YOFF=92.) The division by 8 in the X coordinate is required because each pixel gets stored as one bit in this mode. And the multiplication by 32 in the Y coordinate arises because each horizontal line on the screen consists of 256 pixels (32 bytes).

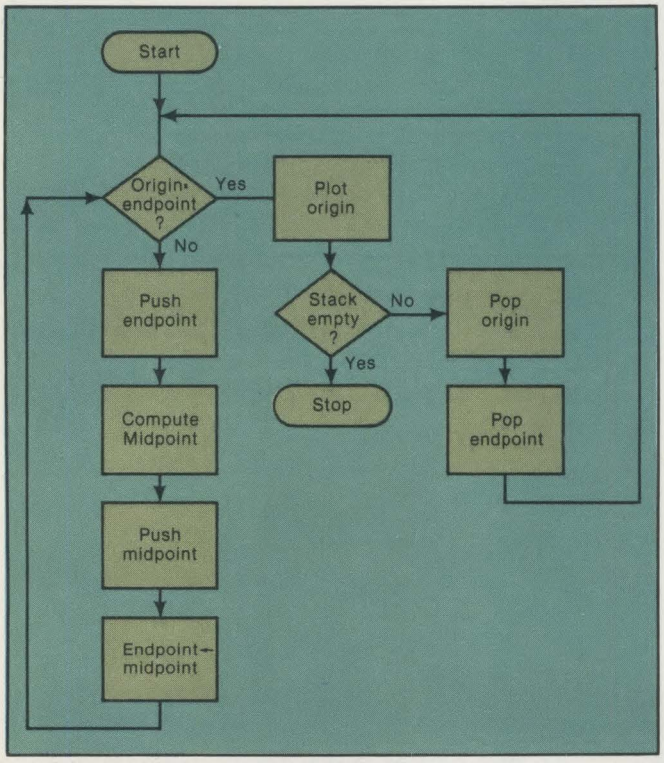

Fig. 3. "Divide and conquer" algorithm *for line drawing on a raster-scan graphics display. This algorithm reduces line segments to points by repeatedly dividing them in half.*

SCRNOFF is the length of the screen in bytes, minus 32. (This is the address of the first byte in the screen image's last line.) This offset is required to account for the fact that the screen's top is considered the positive direction, even though it consists of pixels stored at lower addresses.

Finding the byte isn't enough

The formula finds the relevant address in the memory image, but the point-plotting routine must address the desired pixel (a bit in this case). To do this, the algorithm must mask out the low-order three bits of a point's original X coordinate. (These bits specify the pixel position within the byte whose address has already been computed. They serve to select a bit mask that isolates the pixel from the rest of the byte.) Point plotting is one of the features of the color computer's BASIC. Thus, one BASIC statement (SET) serves to set any desired pixel on the screen to a desired color. The syntax of this SET statement is:

SET (X coordinate, Y coordinate, color),

and a companion RESET statement turns the pixel back to the background color. Color is specified by a code number: 0=black, 1=green, 2=yellow, 3=blue, 4=red, 5=buff, 6=cyan, 7=magenta, 8=orange.

After points come lines

Even in raster-scan displays, much of the image usually consists of lines. And, although a vector display generates its lines in hardware, a raster-scan unit makes its lines with software. Thus, a subroutine that can compute the pixels on a line, given the line's endpoints, is required. Several algorithms exist to perform this task, although some are mathematically too involved for practical use in μcs.

One algorithm uses the slope/Y-intercept specification for a line. That is, if a line's starting point, specified in BASIC, is (X1, Y1), and its ending point is (X2, Y2), the line's slope is

slope:=(Y2−Y1)/(X2−X1).

With this formula, you can find points along the line from

Y−Y1:=slope*)X−X1).

Unfortunately, the multiplications and divisions required by this approach are a problem for most μcs, and designers use much simpler and faster algorithms. One such scheme, Bresenham's algorithm, requires no multiplications or divisions at all. With it, the changes in X and Y can be calculated as in the slope formula, and an XINC (X increment) and YINC (Y increment) step can be set to unity. Beginning with the starting coordinates, the X coordinate can then be stepped toward its final value, at each step computing an error value that essentially determines whether the line would go above or below the current Y value with the current step. The Y coordinate changes to minimize the error smoothly. This algorithm requires a reasonable amount of computation per point and is practical for use in μcs.

Every line starts with a point

If every line were so short that it occupied only one pixel, line plotting would be the same as point plotting. However, most lines are longer. But these longer lines can be divided in half. A line can be divided into a sufficient number of pieces to make each piece a single pixel—a process that reduces line plotting to point plotting.

This scheme seems ridiculously complex. But the midpoint of any line can be found with

Midpoint X:=(X1+X2)/2
Midpoint Y:=(Y1+Y2)/2

where all operations are in integer arithmetic. Division by 2 is simple for any computer; it's just a right shift. Using the stack for storage of line segments, this recursive line-plotting algorithm might be termed the divide-and-conquer approach.

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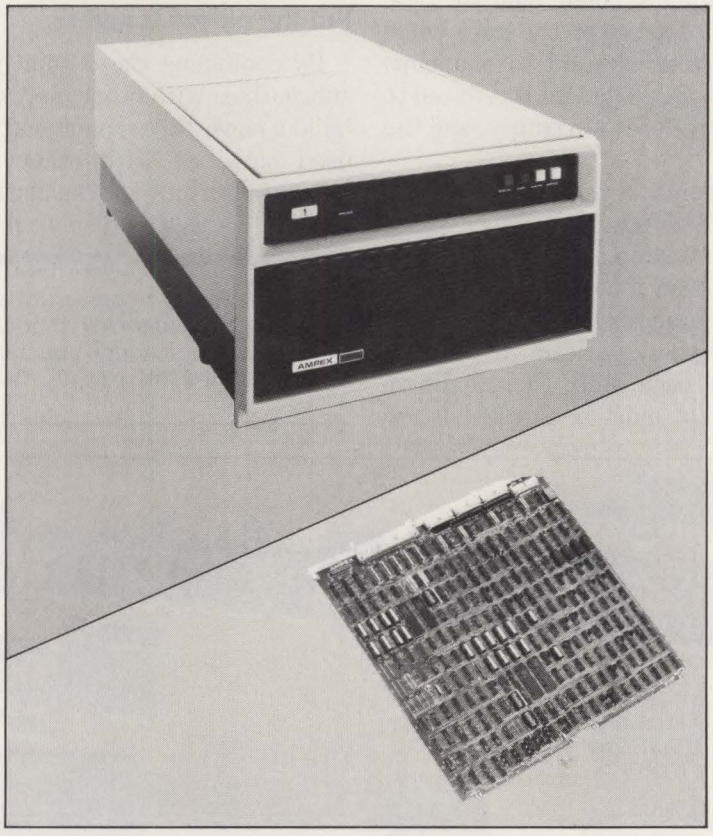

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Because the algorithm divides the length of the line by 2 at each step, the maximum number of line segments that must be stacked is the base-2 logarithm of 320, or about nine.

Fig. 2 flowcharts the algorithm, which has two basic loops. If the current endpoint is identical to the starting point, the line is reduced to one pixel. It should then be plotted and checked to see if the task is finished. If not, the last line segment worked on must be unstacked, and the task must be continued. If the starting and ending points are not identical, the line must be divided into two by computing its midpoint, then half the line (midpoint to endpoint) must be saved on the stack while work with the other half (starting point to midpoint) continues. Eventually, every line segment is reduced to a point and is plotted. The stack is then empty, and the routine returns.

Although this approach seems to require a great deal of stack space, it doesn't. The maximum stack space used can be computed by finding the length of the longest possible line. In the case of the 6847-based color computer operating at maximum resolution, the longest line is 320 pixels. Because the algorithm divides the length of the line by 2 at each step, the maximum number of line segments that must be stacked is the base-2 logarithm of 320, or about nine. Hence, all that is needed is a stack sufficient to store the four coordinates of nine line segments.

However, a subtle problem that can arise when computing midpoints can make this algorithm loop indefinitely. Specifically, the midpoint gets both pushed onto the stack and assigned to the endpoint; the problem arises because integer arithmetic loses information at each division step.

One solution is to compute two midpoints at each step, rounding one up and the other down. The higher midpoint is then paired with the greater of the endpoints. The truncated midpoint is the one found with a right shift; rounding up involves adding the carry (bit-shifted out the right-hand side of the coordinated sum) to the midpoint.

Put the pieces together

By combining these point-plotting and line-drawing subroutines with other pieces, a system-integrator can build a powerful graphics software resource that can be used alone or with other application packages. A program for interest calculation, for example, could be graphed as well as displayed in tabular form. ■

Jack Hemenway is president and **Robert Grappel** is vice president of Hemenway Associates, Inc., a Boston-based system software house specializing in operating systems and languages for μps.

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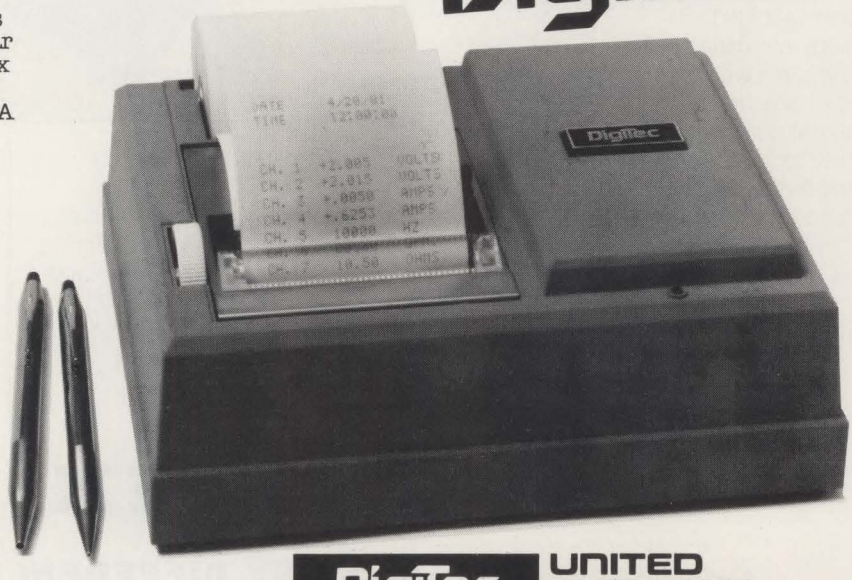

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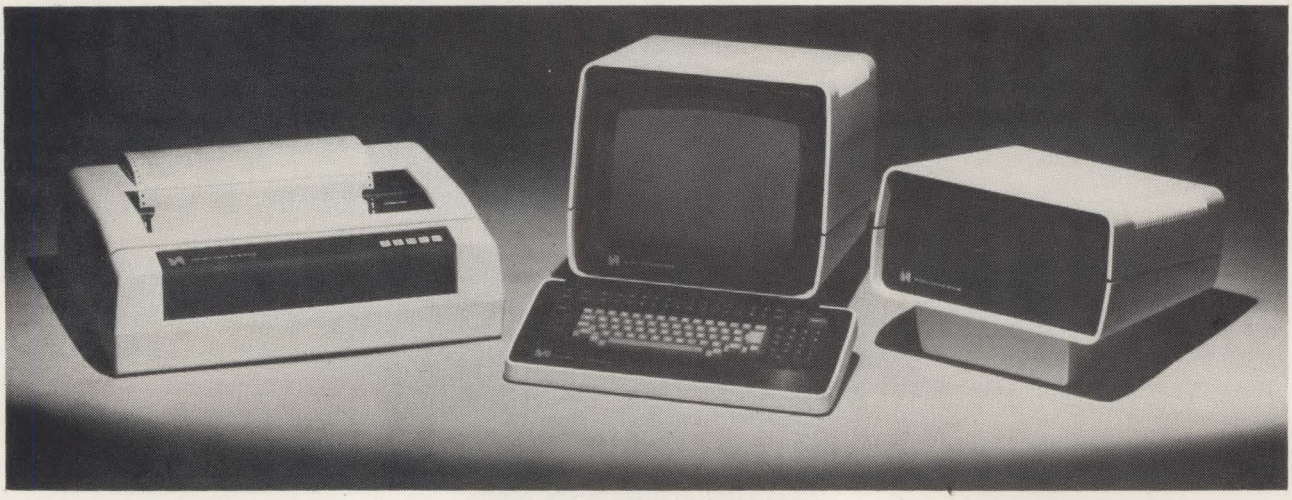

CIRCLE NO. 75 ON INQUIRY CARD

A primer on security

J. MICHAEL NYE,
Marketing Consultants International, Inc.

Scrambling and digital encryption are the two primary methods used to protect analog voice communications

Communications protection for voice and/or data messages requires the use of a variety of technologies, depending on specific application requirements. In voice communications there are two primary protection techniques: scrambling of the analog voice signal, or converting that signal to digital form and then implementing any of a variety of digital encryption techniques using standard cryptographic technology. Voice scrambling and digital voice-encryption techniques each has distinct advantages and disadvantages.

Voice scramblers usually offer a significant "human-factor" advantage in that they can provide excellent speech quality and speaker recognition. However, this is offset by the fact that the level of protection for voice scramblers is limited when compared with the strength of digital encryption techniques. Digital voice-encryption systems offer significantly greater protection at the expense of speech quality and speaker recognition. Digital voice systems use devices that create artificial speech at the receiving end, thereby creating an unnatural-sounding voice. Fig. 1 illustrates the relationship between the various voice-protection techniques available relative to protection levels among technology types compared with overall voice quality.

Voice scrambler systems usually offer short-term protection—the time that a message could be considered protected is measured in minutes and hours. However, with digital encrypted messages, length of protection is measured in terms of man-years of effort to decipher.

In data-communication applications (computer-to-

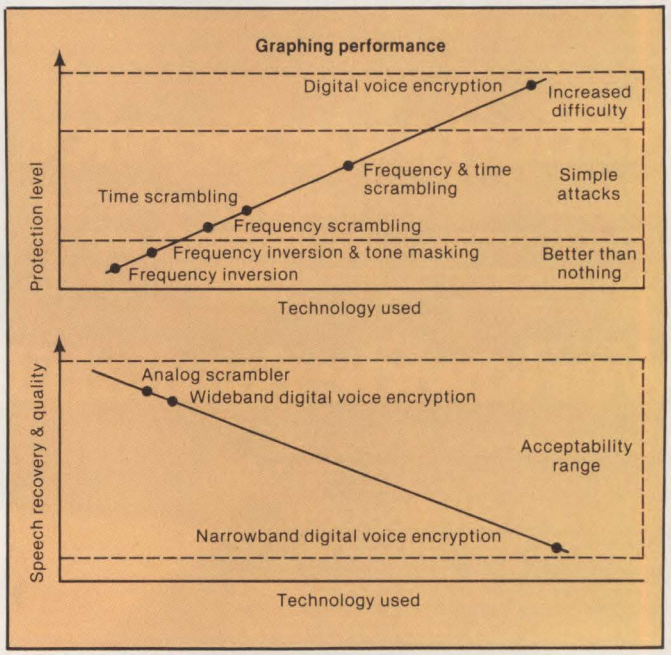

Fig. 1. Graphs of technology *versus level of protection and speech quality illustrate the nature of the trade-offs.*

This two-part article is adapted from a chapter in Who, What and Where in Communications Security: A Users' Guide to Voice and Data Communications Protection *by J. Michael Nye. Information on this publication is available by writing to the author at Marketing Consultants International, Inc., 100 w. Washington St., Suite 214, Hagerstown, Md. 21740.*

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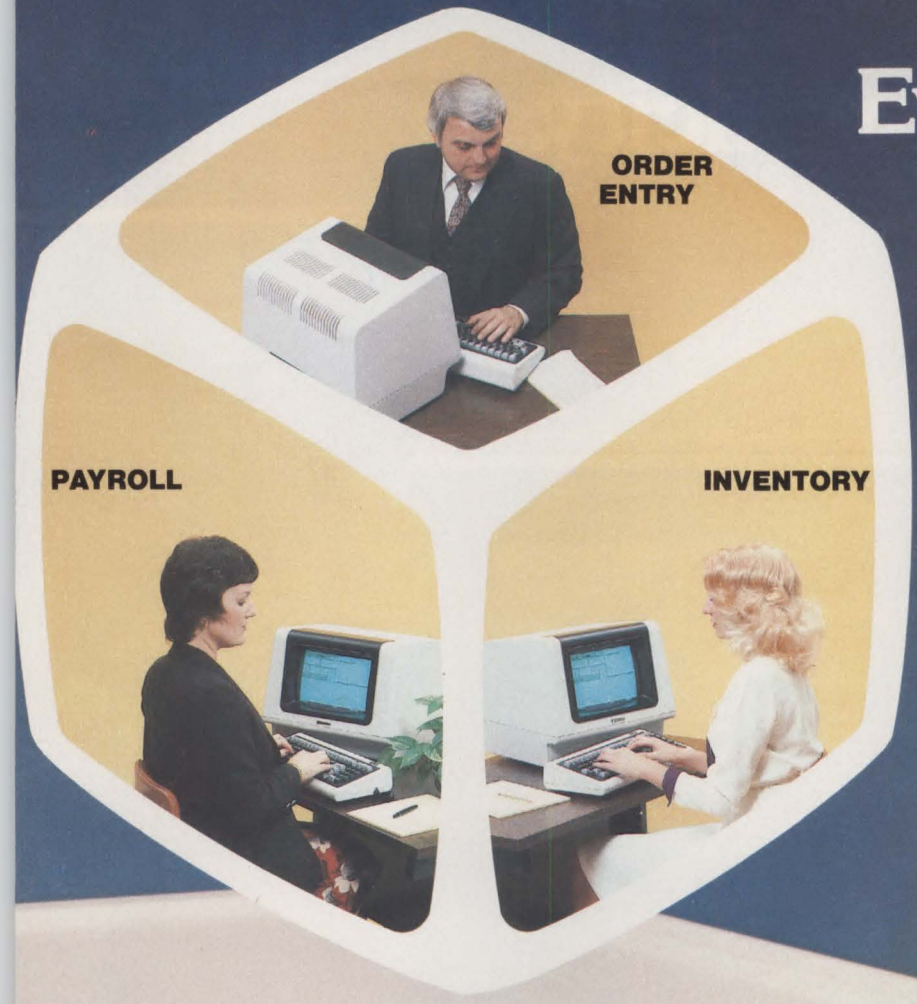

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TDM systems divide the voice signal into small segments (ranging from 30 to 100 msec.) that are then delayed for varying intervals before transmission. This delay allows mixing the order of the voice segments.

terminal, terminal-to-terminal and terminal-to-computer), protection principles are identical to those employed in digital voice systems, except that data systems are not burdened with the operation concerns of voice systems: intelligibility and speaker recognition. The vast majority of mesages likely to be intercepted routinely are digital communications because an eavesdropper can automate interception and message analysis. Nevertheless, high levels of protection for digital communications may be achieved relatively easily.

There are no standards for establishing levels of protection, at least for now. Consideration must be given to the sophistication of the protection device, along with the sophistication and resources available to the potential eavesdropper, on a case-by-case basis. It is possible, however, to distinguish between tactical and strategic levels of protection.

- **Tactical protection** restricts the information from an observer or listener for a period measured in minutes or days. A variety of simple techniques are available that provide this level of protection at a reasonable cost.
- **Strategic protection** requires the eavesdropper to expend long periods to decode useful information. Strategic protection protects information from interceptors who have sufficient resources (adequate funds and state-of-the-art computers) to decipher messages in periods measured in months and years.

An example of a situation requiring tactical protection of transmissions is a police vehicle responding to a burglary in progress when the burglar could have an inexpensive portable scanner. An application requiring strategic protection would be transmissions identifying sites offering the best potential for successful energy exploration.

Basic voice technologies

With existing technology, voice communications protection is accomplished by using two primary

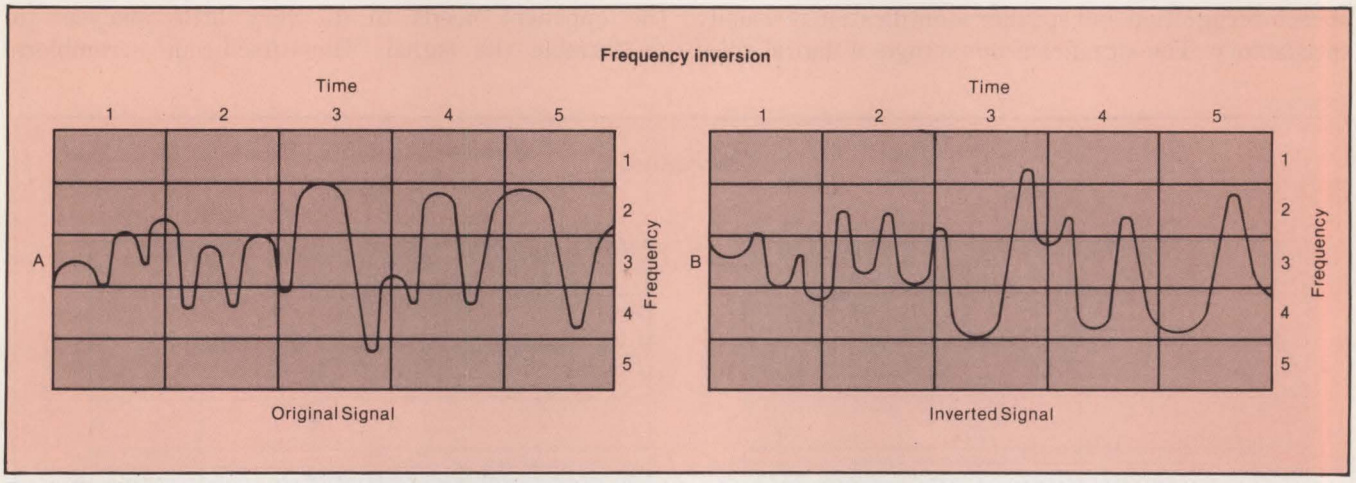

Fig. 2. The frequency-inversion process *involves only exchanging (transposing) the original waveform to its reciprocal. Plotted as frequency over time, the new waveform (B) is simply the original waveform (A) seen upside down.*

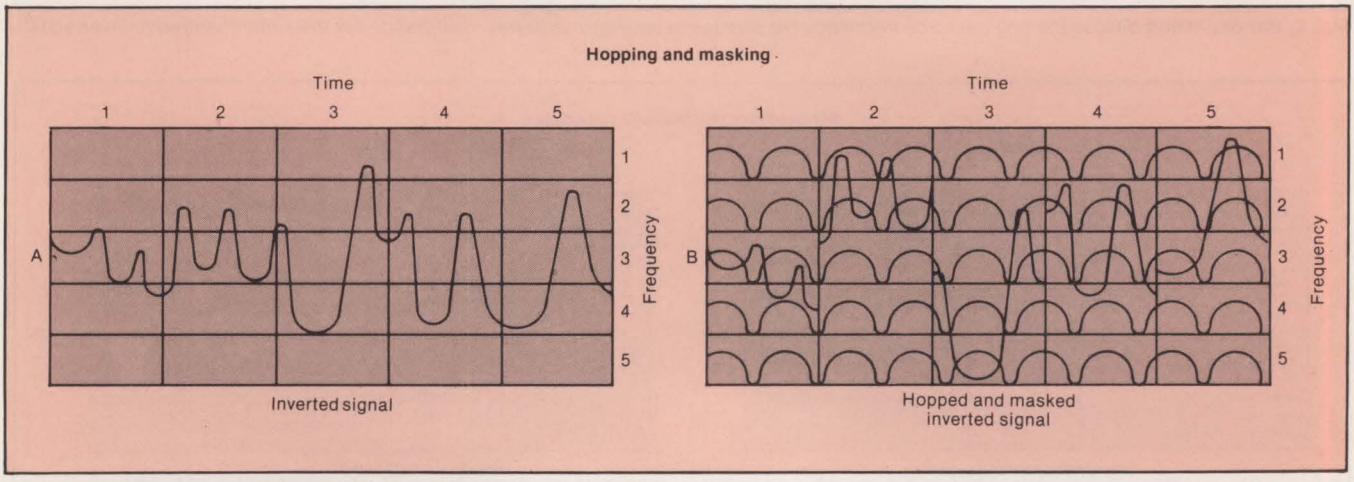

Fig. 3. Hopping and masking *analog voice-scrambling techniques are often used with frequency conversion. The hopping process involves adding or subtracting frequency components to time-sliced portions of the inverted waveform (A), causing these portions to appear discontinuous and shifted up and down (curve in B). Masking introduces a pattern of one or more spurious waveforms (black curves in B) overlaid on the inverted signal.*

Static systems allow the scrambling scheme (code) of the signal to remain constant during the course of the message transmission. Static systems employ a fixed code; dynamic systems rearrange the code.

techniques: analog scrambling and digital encryption. Analog scramblers modify the voice signal, changing the signal in the amplitude, time or frequency domains or any combination thereof. The scrambled signal can then be transmitted within the same bandwidth as the original clear signal.

Digital voice-protection systems convert the analog speech signal into an equivalent digital signal. Unfortunately, to obtain the voice quality inherent in an analog communication, transmission rates are needed that exceed the limits of a typical standard telephone (2400 bps). When the data rate is reduced to a level for operation over a normal voice-grade telephone line, there can be a significant loss in speaker intelligibility and speech quality. However, over communications channels allowing for a higher data rate, the quality of speech recognition and speaker identification is usually satisfactory. The significant advantage of digital voice systems is the high level of protection obtainable from a wide range of cryptographic techniques.

Analog voice systems

Voice scramblers avoid many of the transmission difficulties of digital voice systems because the scrambled speech signal is retained in analog form with the identical bandwidth and may be transmitted over normal voice-communications links without special equipment, such as modems. Therefore, speech scrambler devices are less expensive, considerably less complex and can be used against the limited-resource, passive eavesdropper typically encountered in situations requiring tactical protection.

There are two primary categories of voice-scrambling systems. Static systems allow the scrambling scheme (code) of the signal to remain constant during the course of the message transmission. Static systems employ a fixed code. Dynamic systems constantly rearrange the code permutations hundreds of times per each second of transmission time.

All three fundamental scrambling methods—frequency inversion, bandsplitting and time-division multiplexing (TDM)—use fixed-code scrambling. Therefore, when the scrambled voice signal is transmitted, the opponent needs to do very little analysis to unscramble the signal. Thus fixed-code scramblers

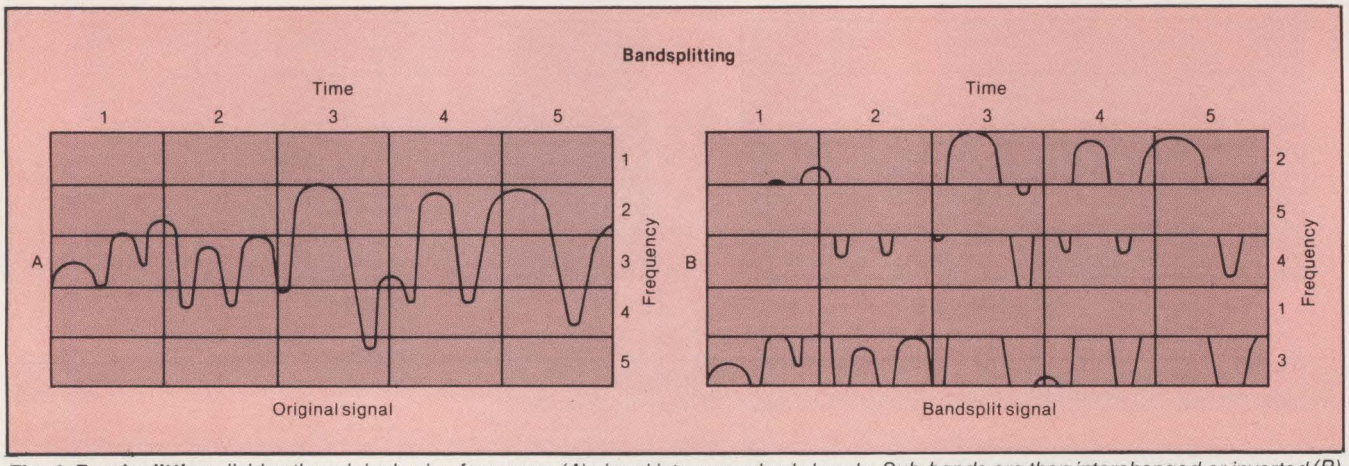

Fig. 4. Bandsplitting *divides the original voice frequency (A) signal into several sub-bands. Sub-bands are then interchanged or inverted (B).*

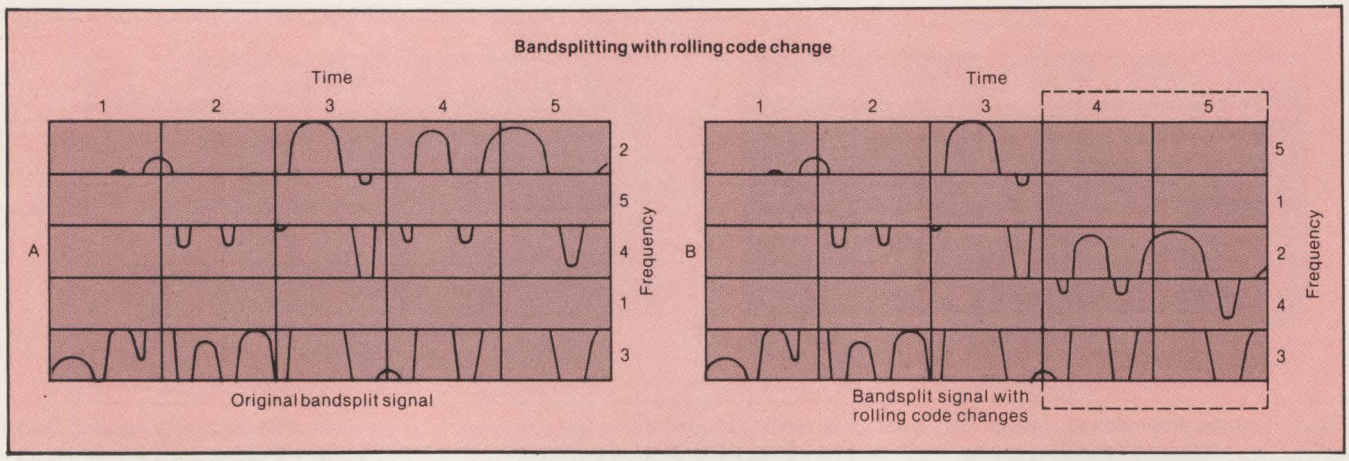

Fig. 5. Rolling code change, *often used with bandsplitting, involves periodically changing the frequency assignments of the band-split sub-bands. Compared with the original bandsplit signal (A), the rolled signal (B) shows different frequency assignments in time slots 4 and 5.*

provide less protection than dynamic scramblers. The trade-off is equipment cost.

Dynamic code devices continually change the coding method in a manner or sequence determined by a complex key. This forces the interceptor to use sophisticated analysis to determine the key and unscramble the message. The acquisition of a similar device is of little value unless the interceptor has knowledge of the key; even in the unlikely event the key is identified, it is useful only until the key is changed.

Frequency inversion. The inversion process simply converts the frequency components of a voice signal to new frequencies that represent the difference between the original frequencies and an inversion frequency. This amounts to inverting the speech-frequency spectrum—transposing the high frequencies with the low frequencies. For example, if the inversion frequency is 3000 Hz, a frequency component of 500 Hz would be converted to 2500 Hz (3000-500) (Fig. 2).

Unscrambling the scrambled signal is accomplished by a second inverter that has the same reference frequency as the scrambling device. For the simple frequency inverter, the unscrambling process consists of re-inverting the scrambled signal, which results in the original voice signal. Because of the simplicity of a fixed-code inverter, it is easy for an opponent to unscramble inverted speech.

It is even possible to decode fixed-code inverter transmissions aurally. To the unexperienced listener, inverted speech sounds unintelligible. However, with careful listening and experience, words or phrases become distinguishable. With concentrated attention, a determined interceptor can learn to understand inverted speech as if listening to normal voice communications. There are a variety of dynamic frequency inversion devices that use changing codes and virtually eliminate deciphering by ear.

Another scrambling technique often used in conjunction with frequency inversion is frequency hopping. This combination is similar to the basic frequency inversion method, except that after inversion occurs, the signal is changed in frequency—hopped up or down—as dictated by the code. When the hopping increments are irregular in time and frequency, the system can provide a much higher level of protection than frequency inversion alone.

Tone masking signals can also be added to these operations to disguise the message further (Fig. 3). Masking introduces additional artificial audio tones into the original speech signal. Unfortunately, using multiple-tone masks tends to reduce the quality of the recovered speech.

Bandsplitting. The information-bearing frequencies

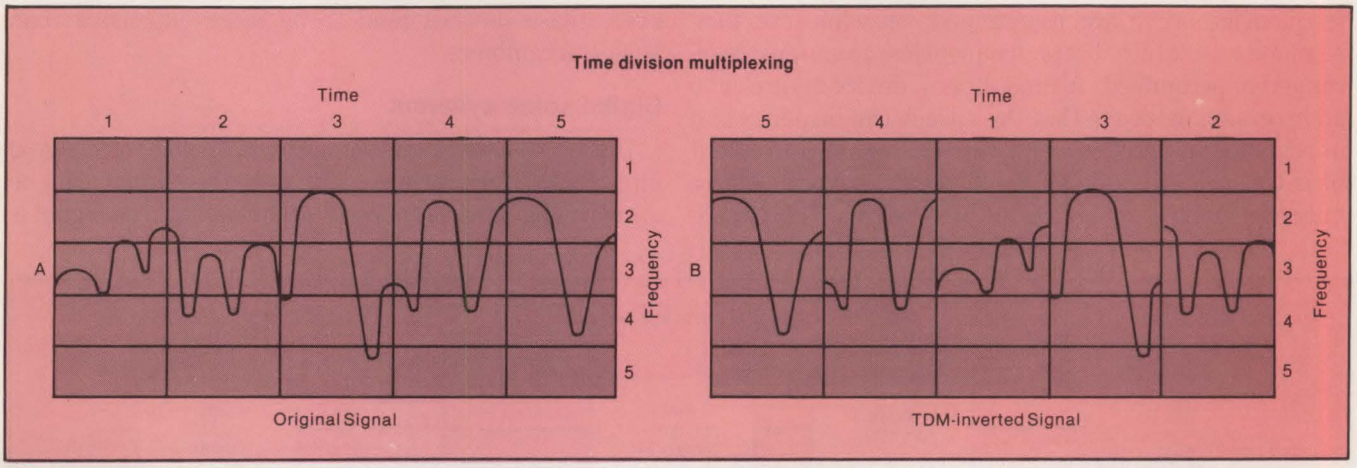

Fig. 6. Time-division multiplexing *is used to scramble a voice signal (A) by rearranging the sequence of time divisions (B).*

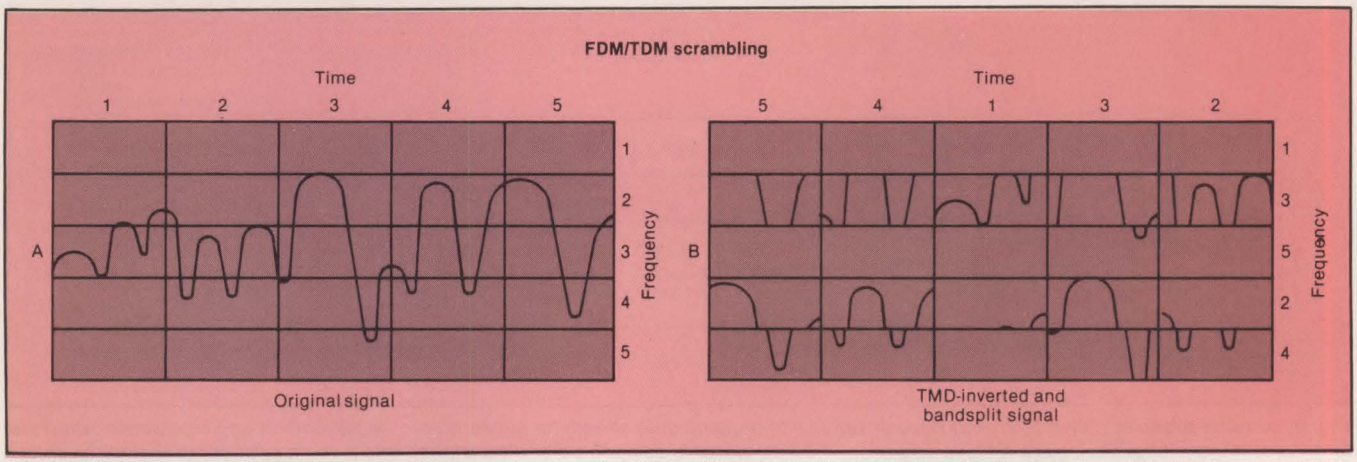

Fig. 7. A hybrid approach *to voice scrambling combines bandsplitting with time-division techniques to displace the original voice signal (A) in both frequency and time. Therefore, both the horizontal (time) and vertical (frequency) assignments in (B) are permuted.*

The inversion process simply converts the frequency components of a voice signal to new frequencies that represent the difference between the original frequencies and an inversion frequency. This amounts to inverting the speech-frequency spectrum.

of the human voice lie mainly in the range of 300 to 3400 Hz. Unlike the simple inversion process, bandsplitting voice scramblers divide the voice-frequency signal into several sub-bands and then interchange these sub-bands or invert them (Fig. 4). A bandsplitter provides stronger protection than frequency-inversion systems, but, as in the case of frequency-inversion techniques, it is relatively vulnerable to simple attacks. More complex bandsplitting techniques include the use of rolling code devices (Fig. 5). A rolling code periodically changes the code used to rearrange the frequency displacement of sub-bands.

Time division multiplexing. Frequency inversion and bandsplitting operate in the frequency domain. That is, voice-input frequencies are changed to new frequencies based on a code selection. In time division multiplexing (TDM), the voice frequencies are unchanged while the time segments in which these frequencies occur are rearranged, or while the time segments in which these frequencies occur are rearranged or scrambled. A time-divison device is similar to an inversion device in that the speech can be generated in reverse. In practice, however, this is not convenient because such a scrambler would need to save the entire message before replaying it in reverse. This would introduce unreasonably long delays in the communications channel.

Therefore, TDM systems divide the voice signal into small segments (ranging from 30 to 100 msec.) that are then delayed for varying brief intervals before transmission. This delay allows mixing the order of the voice segments, thus significantly increasing the unintelligibility of the signal. TDM systems are susceptible to the principal problem of other voice-scrambler devices—while there are many ways to rearrange the normal voice sequence, usually the rearrangement is fixed and repeatable and, therefore, vulnerable to simple attack (Fig. 6).

A fairly new technique that offers a higher degree of protection could be considered a "hybrid" of the time- and frequency-scrambling techniques described. In this type of system, the analog signal is immediately converted to digital form. The digital signal is then encrypted independently in each frequency band. Therefore, any redundancy in the original voice signal is destroyed, and the permutations are performed in both the time and frequency domains (Fig. 7). The digitally encrypted message is then converted back to analog form and transmitted over the normal voice-grade channel. This technique offers a much wider selection of key codes and can work in the typical environments in which analog devices are easily integrated into existing communication systems. However, these devices tend to be more expensive than analog scramblers.

Digital voice systems

Digital voice systems convert the analog voice signal into digital form. Once digitized, the signal can be encrypted in a variety of ways. On receipt, the signal is

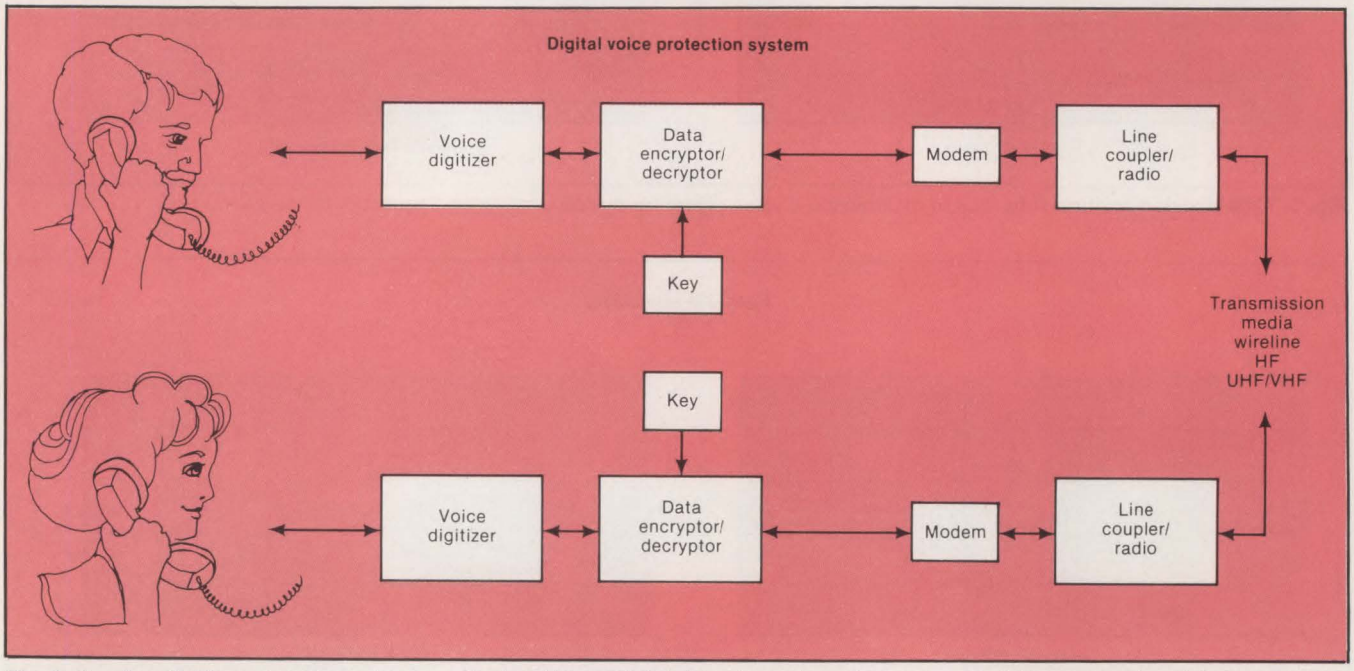

Fig. 8. A voice digitizer *converts analog speech signal into a digital data stream for subsequent encipherment and modulation when the terminal is transmitting. During the receive operation, a digital signal is deciphered and transferred into a voice synthesizer that reconstructs the analog signal for voice output. The method of analog-to-digital conversion employed depends on the data rate of the digitizer and the transmission medium.*

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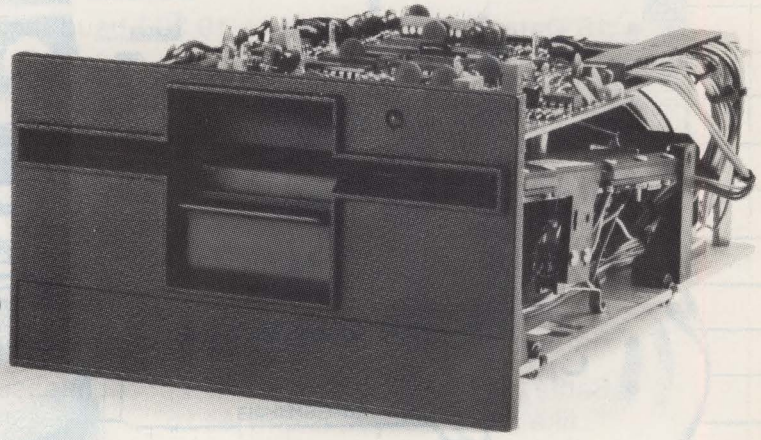

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Unscrambling a scrambled signal is done with a second inverter that has the same frequency as the scrambling device.Because of a fixed-code inverter's simplicity, it is easy to unscramble inverted speech.

decrypted and then converted back to its original analog form by use of a voice synthesizer that reconstructs the phonetic structure of human speech. The level of protection depends entirely on the strength of the encryption technique.

When voice signals are digitized, a data rate as high as 56K bps is necessary for high-quality output. Such a high rate restricts digital systems from use in conventional HF, UHF and VHF radios, and dial-up telephone channels. To use digital voice systems over a voice-grade telephone network, a data rate of about 2400 bps is required. For special applications it is possible to design a conditioned network or communications channel that will allow 9600 bps, but this will eliminate the advantage of access to the Direct Distance Dial (DDD) network.

For a digital voice system to be used in dial-up operations, it is necessary to reduce the data rate to be transmitted. Some devices that reduce digital voice-to-data rates that are acceptable to dial-up operations are typically known as vocoders and delta-modulation systems. They provide a wide range of voice quality from reasonably good to poor, depending on the speaker, communication channel, line noise, etc., but, because of the lower data rate, the synthesized voice sounds artificial and machine-like, having reduced intelligibility and speaker recognition.

Within the last few years, several new techniques have been developed to improve the voice quality at the 2400-bps data rate. Specifically, linear predictive coding (LPC) allows operation at this rate. Another technique, adaptive predictive coding (APC), allows a bit rate of 9600 bps. Higher bit rates mean improved speech quality. Regardless of the voice digitizing function employed, the digital signal must then be encrypted prior to transmission to provide protection (Fig 8). ■

The second part of this article will cover the encryption of data communications.

J. Michael Nye is president of Marketing Consultants Inc., Hagerstown, Md.

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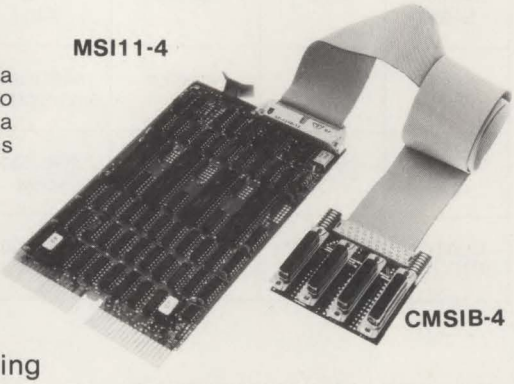

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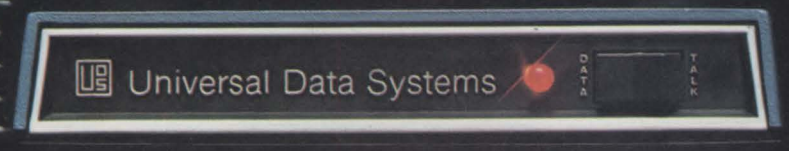
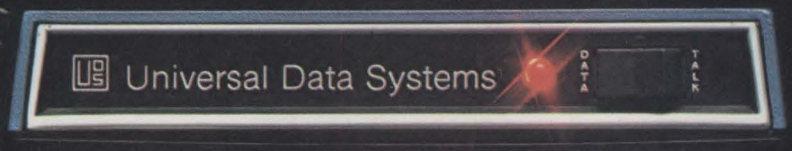


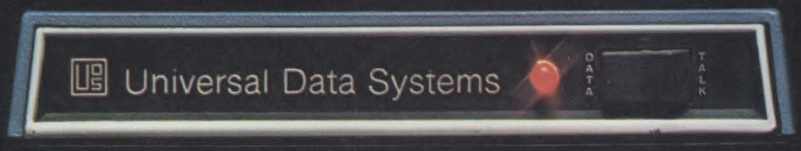
$295
(quantity one)

202 LP
1200 bps



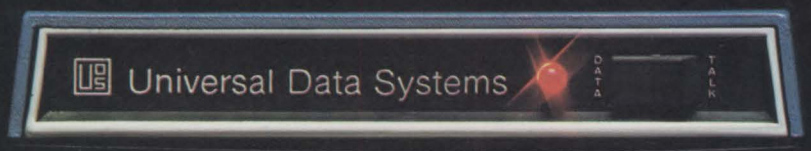
$245
(quantity one)

103J LP
originate/answer
auto-answer
300 bps



$245
(quantity one)

103 LP
originate/answer
300 bps



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SOFTWARE SECURITY

A new look at patentability

FRED M. GREGURAS, Kutak Rock & Huie

Recent court decisions shed new light on which path software developers can take to protect their innovations

Developers of innovative software are becoming increasingly concerned with securing legal protection for their programs. Software is especially vulnerable to theft, so as the packages become more available and valuable, coverage becomes vital. While trade secret and copyright protection remain the better means of safeguarding innovations in the software used in data-processing installations, two recent U.S. Supreme Court cases concerning patentability—the Diehr and Bradley decisions—may be pivotal for some software developers.

Total copyright protection is obtained by putting a copyright notice on the "work" and registering it with the Federal Registrar of Copyrights. The recently enacted Federal Computer Software Copyright Act of 1980 explicitly provides such protection for software. This type of coverage protects only images (what can be put on any medium); it does not prevent someone from stealing the logic and writing his own program.

Trade secret protection is best established by having an attorney draw up a software license agreement with a provision that specifies what the secret is, who may and may not have access to it and for how long, and what is to happen at the end of the agreement. Trade secret protection safeguards ideas, designs and concepts as well as the software images, and the holder of this type of coverage is bound not to divulge his own secret. Trade secret protection has the advantage over patents in that its eligibility requirements are simpler, and that it covers all types of software.

Nevertheless, the Diehr and Bradley decisions may encourage some software developers to carefully explore patent protection. In those cases, the court decided, essentially, that the more a program is embodied in the hardware, or the more significant the post-algorithm activity, the more likely it is that a program will be found patentable.

But to understand the ramifications of these decisions, it is helpful to examine what a patent is, and the conditions for obtaining one. A patent is issued by the federal government to the first creator of certain kinds of new and useful inventions when certain conditions are met. It provides the inventor with the right to take legal action to prevent others from making, using and selling the invention in the U.S for 17 years.

Three basic conditions must be met for a patent to be issued. First, the subject matter of the invention must fall within one of the statutory classes for patents designated by Congress in 35 U.S. Code (U.S.C. 101). Those classes include a new and useful process, machine, manufacturing method, composition of matter and other inventions. Patents may not be granted, however, for methods of doing business, newly discovered laws of nature or purely mental processes.

Second, the invention must be novel, involving a process, machine, product or design that is different from what has previously been discovered or is already known (35 U.S.C. 102).

The third condition is that the differences between the invention and what is already known must be of

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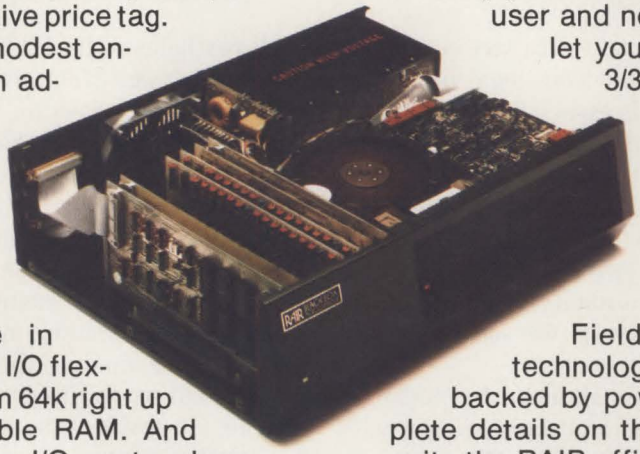

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CIRCLE NO. 85 ON INQUIRY CARD

The rationale for excluding laws of nature, which mathematical algorithms are held to be, is that they cannot be discovered because they have always existed, and that such fundamental laws should not be preempted as a patent would do.

such character that the new discovery would not be obvious to a person having ordinary skill in the technical field related to the discovery (35 U.S.C. 103).

It is the "newly discovered laws of nature" exclusion in the threshold condition of 101 on which the Supreme Court had previously declared certain computer software not eligible for patent protection. The Diehr and Bradley decisions established that the particular inventions satisfied the first condition for a patent. Whether the inventions satisfy the other basic conditions remains to be determined.

The rationale for excluding laws of nature, which mathematical algorithms are held to be, is that they cannot be discovered because they have always existed, and that such fundamental laws should not be preempted as a patent would do. Because computer programming is based on sequential and branching instructions expressed in general mathematical terms (mathematical algorithms), patent protection has been difficult to obtain. The sequential, methodical operation of a computer system has often been part of an evaluation of what a computer program is doing in a particular matter.

The Diehr case

In a 1975 patent application, James Diehr and Theodore Lutton made a claim on an industrial process that involves a computer program to regulate the curing, or heating, time of rubber products in a mold press. The synthetic rubber seals are designed to prevent oil leakage in automobile and railroad engines and wheel bearings.

The synthetic rubber must be cured from its initial soft form to a hardness that will act as a seal. The process includes a continual measurement of the temperature in a mold and a computer program that repeatedly uses a well-known equation (the Arrhenius equation) to calculate the time required for curing based on the temperature in the mold. The mold press opens automatically when the continual recomputations indicate that the rubber is to be removed.

The claimants did not argue that the computer program itself is patentable. They asserted that the algorithm used in their invention is peripheral to the patent application and that they had created a totally new process.

The Patent and Trademark Office (PTO) rejected the patent claim as being non-statutory subject matter under 101. The PTO Board of Appeals evaluated each of the non-computational steps in the process, and found none of them novel. It determined that the only new feature was the isolated computational step. But, according to the PTO, that step is a "law of nature"—an algorithm—so the process is not novel and, therefore, does not meet the statutory class requirement of 101.

The court's reasoning

The Court of Customs and Patent Appeals (CCPA) reversed the PTO determination and held that the claim, as a whole, recites a method for molding rubber articles and merely employs a formula for a new and useful end without attempting to preempt the use of the formula. It found one of the steps to be novel—"constantly determining the temperature" and "constantly providing (it to) the computer"—but pointed out that novelty is not relevant to meeting the 101 condition.

In both Bradley and Diehr, the CCPA held that only if both the answers to the following questions are affirmative is a claimed invention non-statutory under previous Supreme Court decisions.

- Do the claims directly or indirectly recite a mathmetical formula or a specific method of calculation?
- Would enforcement of those claims prevent everyone from solving the equation or carrying out the calculation?

Thus, essentially, the CCPA would find a claim non-statutory only if it would wholly preempt the mathematical formula, not merely because the invention involves a computer program.

The Supreme Court, by a 5 to 4 vote, agreed with the CCPA's holding. It essentially adopted the CCPA test of viewing the process as a whole and that a novelty determination is not part of the 101 requirement. "A new combination of steps in a process may be patentable even though all the constituents of the combination were well-known and in common use before the combination was made."

Writing for the majority, Justice William Rehnquist stated that industrial processes such as this are the type that have historically been eligible for patent protection. The court held that the two inventors did not seek to patent a mathematical formula. "Instead," wrote Rehnquist, "they seek patent protection for a process of curing synthetic rubber. Their process admittedly employs a well-known mathematical equation, but they do not seek to preempt the use of that equation. Rather, they seek only to foreclose from others the use of that equation in conjunction with all of the other steps in their claimed process."

Importantly, the court held that the post-algorithm steps in the process must be "significant" to satisfy the 101 condition.

Justice Rehnquist added, "Our earlier opinions lend support to our present conclusion that a claim drawn to subject matter otherwise (patentable) does not become (non-patentable) simply because it uses a mathematical formula, computer program or digital computer."

The four dissenting justices adopted the PTO's position and charged that the rubber-curing process

The more physically fixed or embodied a computer program is in hardware, the more likely it will be found patentable.

was not unusual or novel, and was based on a method of calculation—conditions that make it unpatentable.

Justice Paul Stevens, who wrote the dissenting opinion, stated: "As the court (majority) reads the claims...the inventors' discovery is a method of constantly measuring the actual temperature inside a rubber molding press. As I read the claims, their discovery is an improved method of calculating the time that the mold should remain closed during the curing process."

The Bradley decision

The other recent Supreme Court decision that has a bearing on software patentability stems from a 1975 patent application made by John J. Bradley and Benjamin S. Franklin for a firmware invention. This invention combines computer hardware (a control unit) permanently programmed with microcode (a sequence of computer instructions) to improve the speed and efficiency of the computer to operate in a multiprogramming mode.

The inventors compare their invention to the recently advertised Cadillac that switches its power source from four to eight cylinders according to the changing needs of the car.

The PTO refused to issue a patent, stating that the only novel aspect of the invention was an algorithm, a step-by-step procedure.

The CCPA reversed the PTO Board of Appeals, holding that what the computer does in a specific situation must be distinguished from how it does it. On March 9, 1981, the Supreme Court, without clarification, affirmed the CCPA's holding that this particular invention meets the 101 requirement.

Physical conditions are vital

Firmware inventions are more likely to be patentable when a general-purpose computer is not involved. Most μps with firmware have only one intended end use, which would limit the scope of what a patent claim could preempt.

The more physically fixed or embodied a computer program is in the hardware, the more likely it will be found patentable by analogy to traditional hardware. As the line between software and hardware blurs, the possibility of patent protection increases because traditional hardware in computer systems is within the scope of 101. Firmware patentability could also depend on whether the claims are phrased as hardware architecture or as process, or "means for," claims.

But the more readily programmable—alterable—a program is by the user, and the more it can be isolated from the hardware or an industrial process, the more likely the software will be considered an algorithm. "Stand-alone" system and application software packages, such as general ledger, payroll systems or data base management systems, would typically fall into this category. The Diehr case does indicate that an industrial process that includes a computer program as a component part meets the 101 condition for patentability if the post-algorithm activity is significant.

Practicality favors copyright

Patent protection covers the whole process of the invention, but it is important to remember that even if the 101 statutory class condition of the patent law is met, the requirements of 102 and 103 must be satisfied. Copyright, on the other hand, provides only image protection, but still may be preferable when applicable. (It is still unclear to what extent copyright applies to chip technology, even under the 1980 amendment to the Federal Copyright Law.)

Obtaining a patent can be costly and may take years. An average of 23 months is required for an application to be processed, and this delay is lengthening. A discovery might not have any commercial value by the time the patent is issued, assuming the application is approved. In contrast, it takes relatively little time to establish copyright or trade-secret protection. Further, the term of patent protection is only 17 years as compared to at least 50 years under copyright law and the unlimited duration of trade-secret law, if the trade secret is protected.

Therefore, trade secret protection in a controllable distribution and copyright protection in the home-computer industry and other off-the-shelf public distributions will continue to be primary methods of protecting software assets. ■

Fred M. Greguras is a partner in the law firm of Kutak Rock & Huie, Omaha, Neb.

THE REST OF THE YEAR IN MMS

The remainder of 1981 in Mini-Micro Systems promises a wealth of information in major survey articles that detail available hardware, plus technology and market trends in five categories: CRT terminals, μcs, μc operating systems, memories and computer graphics.

AUGUST is CRT terminal month, featuring a roundup of what's happening in the world of dumb, editing and intelligent terminals.

SEPTEMBER will bring an ambitious survey covering single-board μc products and the various operating systems that make them work.

OCTOBER's main topic will be data base management system software.

NOVEMBER will focus on both add-on and add-in memory systems, and also explore the system implications of semiconductor random-access memory technology.

DECEMBER will offer Mini-Micro Systems' third annual special report on compute graphics.

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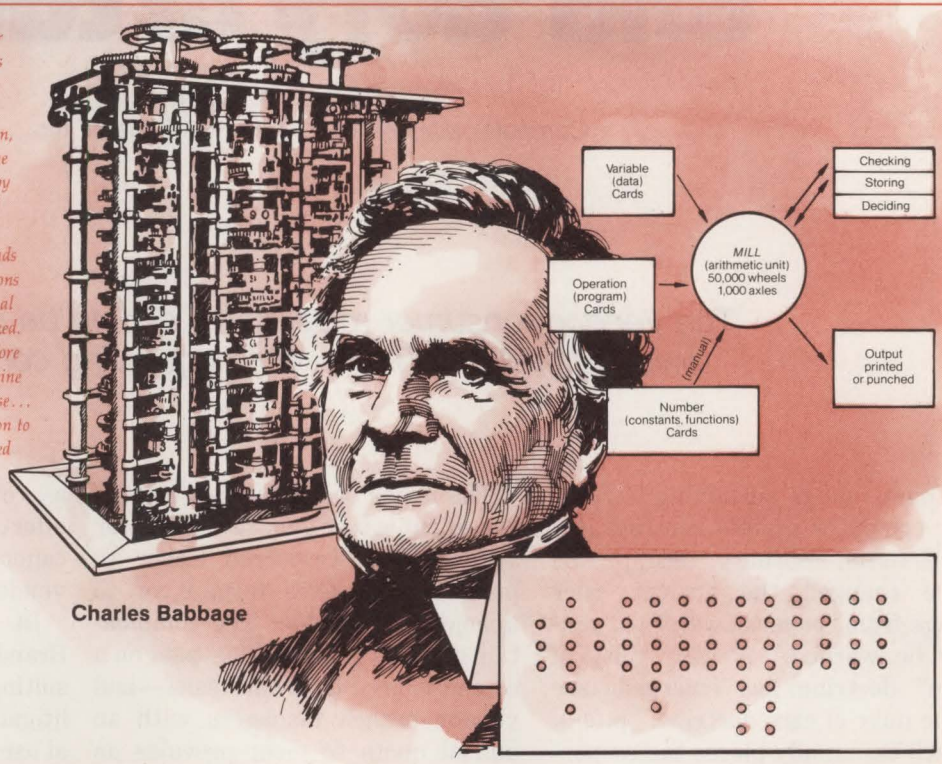

Charles Babbage

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CIRCLE NO. 86 ON INQUIRY CARD

READER FEEDBACK

System vendors and 'duty of care'

JEFFREY H. MERIAN,
Computer Management Systems of Miami, Inc.

The vendor-consumer relationship should be directed toward solving problems, not negotiating contracts

Court rulings pertaining to turnkey computer system contract disputes (MMS, February, 1980, p. 127) have changed the ancient sales adage from "buyer beware" to "vendor be warned." A new "duty of care" doctrine has emerged (see "The duty of care doctrine," p.168), which essentially places the responsibility of consumer education in the hands of the vendor.

The rationale for this is that the vendor is dealing in a sophisticated, high-technology product about which the consumer is not competent to make technical judegments. Whether the vendor agrees with this doctrine or not is of little consequence because the precedent has clearly been established.

The major problem posed by this precedent is that very few computer vendors are structured either to protect themselves from it or to uphold the doctrine. The combination of entire sales staffs—paid on a commission of hardware sales—and vendor branch managers with an annual quota to meet provides an irrefutable motivation simply to put hardware on the street. Individual salesmen and sales managers must make their quotas, or they will be replaced by people who will. This is not a good environment for the industry, because reputation and successful installations become secondary to quotas. It is also bad for the uninitiated consumer because he is caught in the middle of a very competitive marketing effort. It results in promises that cannot be met profitably by the vendor.

In the earlier article, Dick Brandon of the Brandon Consulting Group, a computer litigation firm, offers several useful suggestions about what vendors should include in contracts to avoid liability and to promote understanding between vendors and consumers as to what is acceptable. These are worthy

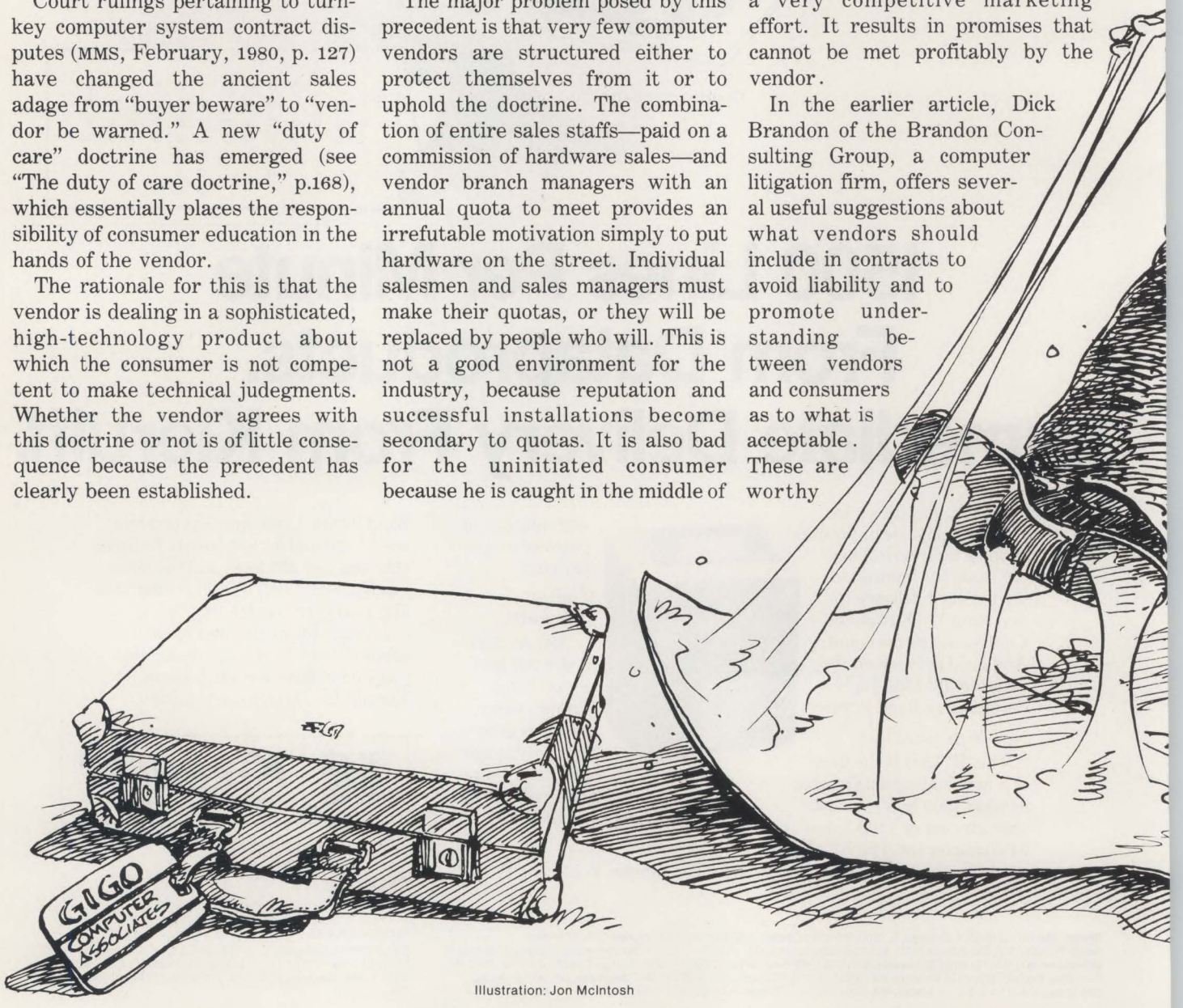


Illustration: Jon McIntosh


ntrait

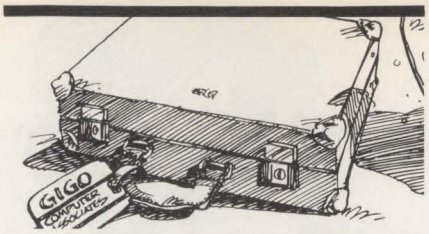
goals, whether for a computer system or any other commodity. However, because the computer vendor's business is to sell systems to and install systems for consumers with various problems, there are several facets of the industry that make Mr. Brandon's proposed solution untenable for both vendors and consumers. The difficulties lie in the contract, vendor resources and the consumer.

The contract

A contract between a vendor and a consumer should be an agreement on the use of EDP equipment to solve a problem. It should not be a document whose primary purpose is to protect the vendor from litigation. Because computer installations are complex, their exact definitions require volumes of detailed documentation and specification. Neither the consumer nor the vendor has the system so clearly defined before signing a contract that such a document would be feasible. Therefore, the consumer is reluctant to commit without extensive hands-on experience. He wants to use the vendor's expertise in arriving at a solution.

The computer contract problem can be summarized as follows: A complete computer system—hardware and software—cannot be treated as a production commodity. Each installation is different, and each computer installation is a new product for the vendor. Each client insists that his computer system reflect his style of doing business, but he cannot define his requirements before contract signing.

Most minicomputer vendors target companies with annual revenues between $0.5 million and $50 million, which, depending on the amount of data storage required, translates into hardware sales from $12,000 to $150,000, with the average being about $40,000. Yet for every 10 proposals submitted, the vendor will sign only one contract; and the personnel qualified to specify systems are his most expensive resource.



A contract should be an agreement on the use of EDP equipment to solve a problem —not a document that protects against litigation.

Thus, the vendor's problem is simple: His most expensive resources must remain dedicated to income-generating endeavors. Consequently, detailed system specification is performed only after the contract is signed. To reverse the process by defining the system in detail first would result in only 10 percent of an analyst's time being paid for by the client. Sales and marketing expenses are predicated on anticipated hardware sales. If there are no hardware sales, there are effectively no sales and marketing expenses. But systems staff salaries are incurred regardless of hardware or software sales. Consequently, the vendor can cover his system staff expenses in only two ways: from the gross margin generated by hardware sales, in which case the vendor may consider dedicating some of his systems resources to pure marketing endeavors; or by forcing his systems group to become a software profit center, in which case he can't afford non-income-generating endeavors.

Because systems staffs are expensive and marketing income highly unpredictable, most vendors maintain as lean a systems staff as possible, supporting this expense with software sales generated as a function of hardware sales. This results in a systems group that is overworked when sales are up, but lean enough to live off the backlog when sales are down—and, on the average, cover its own expenses.

The consumer

A vendor's insistence on a precise system specification at the time of contract signing may well scare the consumer away from purchasing altogether. The fact that marketing people have spoken to him about such things as mass-storage capacities, internal cycle times and I/O channel capacities heightens the anxiety he already feels about automating his business. Consumers want confidence and security as much as hardware and software solutions. If the vendor insists that the fearful and uninformed consumer commit to every detail of a system, the consumer would become more cautious. He would take each step in the buying cycle even more deliberately and demand even more detail from the vendor, who, in turn, would continue to accumulate expenses. This cycle would continue until the vendor

THE 'DUTY OF CARE' DOCTRINE

Contract law generally holds that two business persons executing a commercial contract are deemed to be equally sophisticated in the subject matter of the contract—that is, they both are presumed to know what they are doing. This is not always true in a turnkey computer contract. The user may be a novice, almost totally dependent on the vendor for all information and knowledge.

In several recent cases, a "duty of care" doctrine has been successfully pursued that must stand as a warning to vendors of turnkey systems. The courts assume that the vendor is a professional, similar to an architect, lawyer, engineer or doctor. An an expert in the field, the vendor understands both computer technology and, to the extent his software addresses it, the user's business. The vendor thus owes the user a duty of care—a responsibility not to sell a system that cannot meet the requirements. Failure to honor this duty of care is essentially malpractice, and the vendor can be held liable. In this event, the user must prove that the vendor did act as an expert, that the user was a relative novice and that the vendor knew that the system was inadequate.

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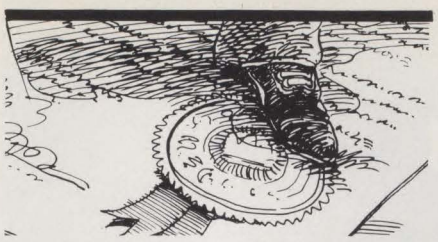

Each client insists that his computer system reflect his style of doing business, but he cannot define his requirements before contract signing.

could no longer support the exorbitant marketing expenses, and the consumer would be buried in so much detail that his decisions would become impossible.

The logical extension of this situation is that the systems and software components of the computer industry must become more than a necessary evil to sell a piece of hardware. Since the vendor must apparently accept certain obligations arising from lack of client sophistication, as do professionals in medicine and law, he must price and sell his products as doctors and lawyers do. Clients pay lawyers by the hour for consulting time, in addition to their standard retainer fees; so must the client be willing to pay for the vendor's expertise and efforts to protect the client's best interests. If a vendor can be sued for breaching an unwritten obligation, he can be paid for keeping one. Vendors have no one but themselves to blame for having sold their system resources as if they were products rather than professional services. The industry could avoid many of its problems by pricing its systems work on a cost-plus or time-and-materials basis. Fixed-fee pricing works well with packaged software, but only when the package remains a package, which is rare.

The market is competitive, and competitors who undercut software prices will take business away in the short run. But in the long run, the price-cutting competitor cannot survive. Hardware gets more sophisticated and less expensive every year—with a proportionate decrease in gross margins—while the programming costs remain relatively constant. The price-cutting fixed-fee vendors' software margins are getting smaller.

The only viable alternative is for the industry to accept its legal obligations under the duty of care doctrine and adjust its marketing practice accordingly. It must sell packages on a fixed-fee basis—that's the motivation behind offering packaged software to the consumer. But it should get paid for professional services as rendered.

Detailed contracts, which would guarantee satisfactory performance, are worth pursuing, and performance guarantees indicate an admirable degree of professionalism and level of performance. But the nature of the business does not lend itself to such documents. When was the last time a lawyer guaranteed in writing that a client would win a court case, or a doctor that a patient would be cured?

The only static definable product the vendor sells is hardware, for which the manufacturer writes the performance specifications, and the manufacturer is not always the vendor. The other product that system houses sell—systems and programming expertise—depends as much upon the creativity of the vendor's people, the client's ability to assimilate the total system into his operation and the vendor's and client's ability to communicate clearly and concisely with each other as it does upon the quality of the programs the vendor writes. The vendor is remiss if he does not give customers a performance guarantee. But to write performance guarantees on the former would be like guaranteeing to write one classical symphony a month for the rest of your life. ■

Jeffrey H. Merian is technical services manager for Computer Management Systems of Miami, Inc.

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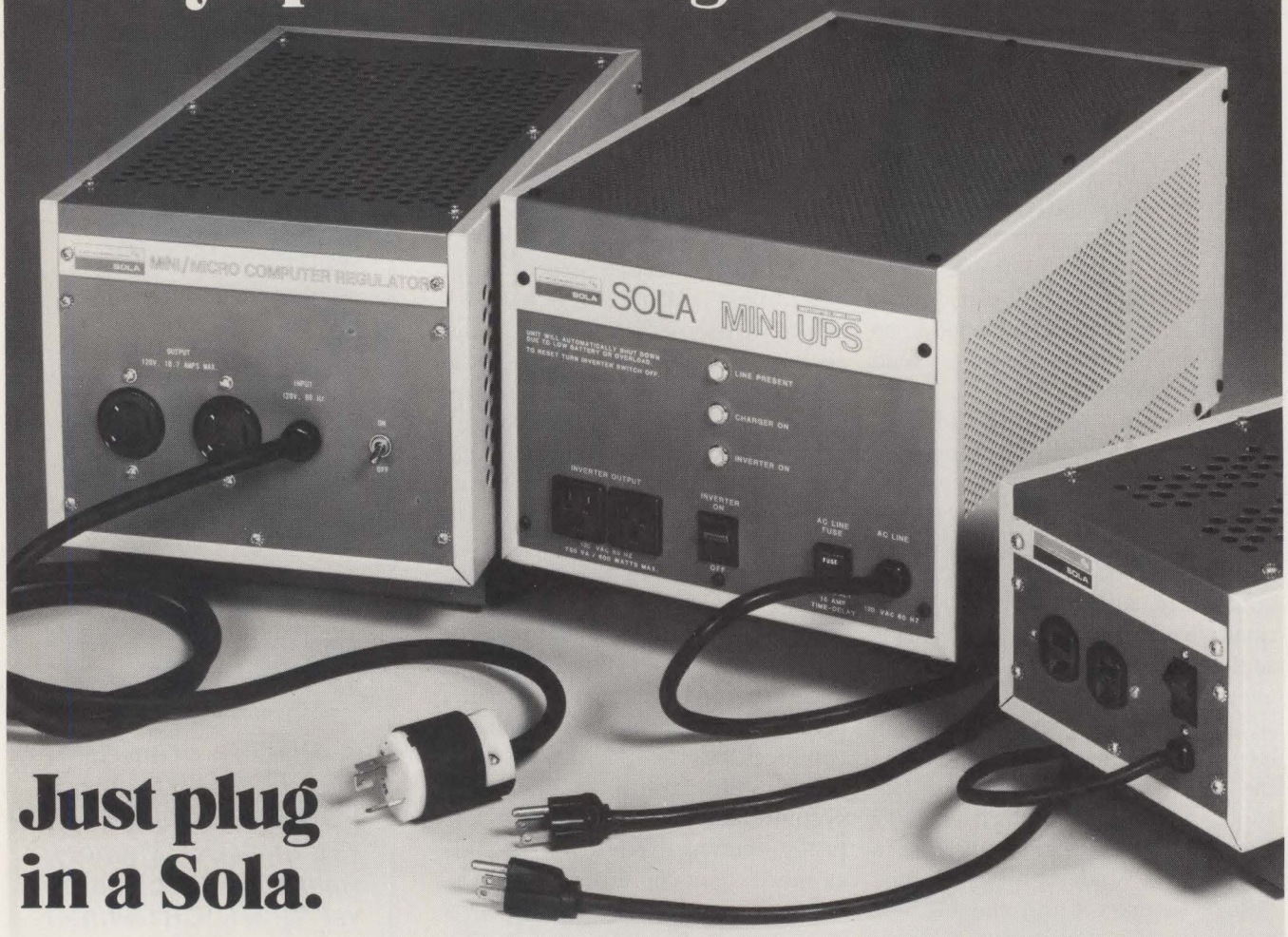

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			common-mode	transverse mode		
	momentary sharp voltage peaks or split-second power outages	short-term high or low voltages due to load start-up or shut-down	Unwanted voltages or frequencies due to bad grounding, switching, or radio-type interference		Planned voltage reductions in response to high demand	Total loss of line power
			line-to-ground interference	line-to-line interference		
Dedicated Line (with dedicated 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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APPLICATIONS

System automates Las Vegas casinos

A look at gambling from the other side of the table

Have you ever wondered how gaming casinos keep track of the thousands of dollars in chips and cash that pass over their tables each day?

Until recently, the answer was manually—using time-proven practices that, while accurate, were labor-intensive and slow and that left the casino vulnerable to theft when shifts changed or when chips were transported. Casino management didn't have a full understanding of gaming activity until several days after accounts were tabulated.

That situation has changed at the Las Vegas Hilton and Flamingo Hilton casinos, thanks to a combined minicomputer and μc system that permits on-line analysis of gaming revenue.

A printed report, detailing the entire casino's daily operation, is ready for review two hours after the swing shift's final accounting. Casino managers can check individual table transactions on a video terminal or print the activity for the shift at any time.

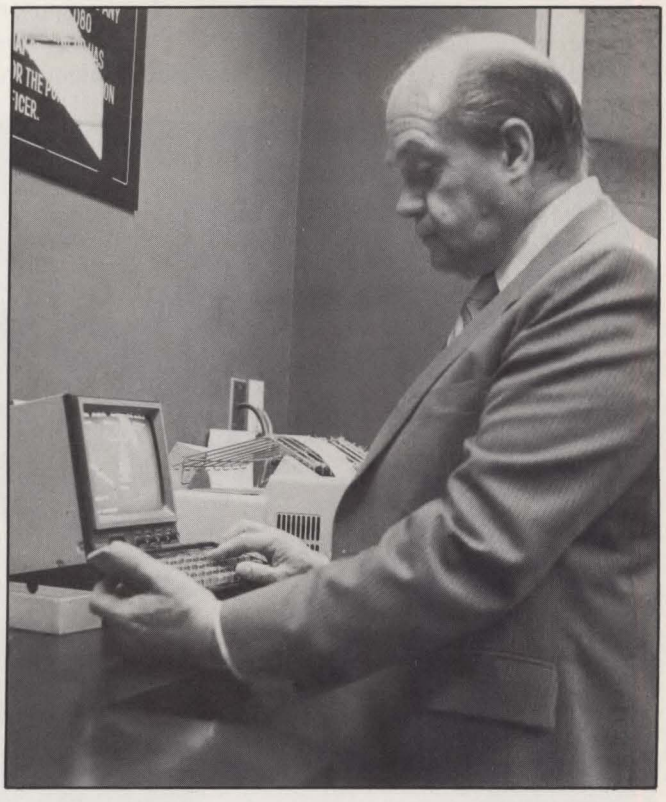
From the other side of the table, the gaming business is a cross between banking and distribution. "Because of the amount of money we handle, we are like a bank," says Ira M. Kirschner, casino controller at the Las Vegas Hilton, "except that we cannot record each transaction.

"The chips represent the casino's products that are sold and redeemed. They are liquid assets that must be inventoried at each table before and after each shift. They also are renewed when they run short and retrieved when there is a surplus."

Counting the cash and chips is a manual operation. The accounting and reporting practices, which Kirschner describes as relatively simple, required several days. Each table's activity had to be individually tabulated and then the totals for each shift had to be cumulated, by game. Finally, daily activity reports were prepared, usually three to five days later.

The new concept originated in 1978 when the Las Vegas Hilton's casino management brought the problem to Systems Integration Management Co., Las Vegas, an authorized DEC distributor. Working closely with the casino staff, SIMCO designed a turnkey system that eliminated many cumbersome procedures that were previously manual. The first system was installed in the Las Vegas Hilton in July, 1979, with the Flamingo Hilton's system following in March, 1981.

Heart of the system is a Digital Equipment Corp. PDP-11/04 minicomputer in the count room, linked to two Imsai μcs in the cashier's cage. The PDP-11/04 has two RO1 disk drives, each with 5M bytes of storage. VT-100 video terminals associated with the mini are located in the count room and accounting department, and a thermal printer is located in the surveillance



Casino cage manager *Douglas A. Coleman enters fill-and-credit requests from pit boss into μc-controlled terminal. System automatically prints credit or fill slips and notifies surveillance personnel that chips will be moved through the casino.*

Equipped with SIMCO-designed keyboard and video displays, the μcs allow convenient data entry in a manner that is familiar to cage personnel.

room. The PDP-11/04 performs computations and prints the daily reports on an LA180.

Equipped with a SIMCO-designed keyboard and video displays, the μcs allow convenient data entry in a manner that is familiar to cage personnel. Each μc has a 32K-byte main memory and a 512K-byte floppy-disk drive, which can store 3000 records, or about three days' gaming activity. The redundant CPUs permit continued operation during service periods or computer malfunctions.

Reducing manual calculation

"The new systems perform the same functions that were once performed manually," says Kirschner, "but it does them quicker and more accurately." At each shift's beginning, chip inventories are taken at each table; the number of chips and dollar amounts are entered into the PDP-11/04.

When additional chips are required during play, the pit boss calls the cashier, who enters the amount, table number and game type into a pre-formatted screen display on a video terminal connected to a μc. Cashiers need no special computer training because the display has the same format as the previously used paper form. When the procedure is completed, the computer automatically prints the "fill slip," recording the transaction along with time and date. Simultaneously, it alerts the surveillance department about the operation.

The fill slip is routed to the cashier's cage, where the requested number of chips are counted. In the surveillance room, an observer directs a remotely controlled closed-circuit television camera on the chip tray in the cashier's cage and zooms in closely to verify the amount. Then, as the chips are moved through the casino, the activity is viewed from appropriate cameras located behind acrylic shields in the celing.

A similar action takes place, in reverse, when there is a chip surplus at any table. The pit boss phones the cashier, who keys a "credit slip" into the μc, prints it and dispatches a security guard to make the pickup. Surveillance also is notified. Four counts and signatures are required for both fills and credits—one each for dealer, pit boss, security guard and cashier.

"Chip transportation is one area in which an operator is potentially vulnerable to theft," says Kirschner. "The new system adds significantly to our surveillance precautions, because we check the route prior to the transfer."

Throughout the shift, the process continues with fills and credits routinely taking place and being tabulated by the minicomputer in real time. Counter checks ("markers") also are keyed into the computer as credits. Management can determine the play at any table in real-time, using a terminal.

Currency, exchanged for chips at the tables, is placed in a double-keyed lock box, in which it is held until end of shift.

At closing, each table is again inventoried, and slips indicating closing dollar amounts are forwarded to the cashier's cage. There, the information is entered into the computer by table and game. Closing entries are

At closing, count-room personnel *open each lock box separately and count the currency. Upon verification, amounts by table are entered into the VT-100 terminal at right.*

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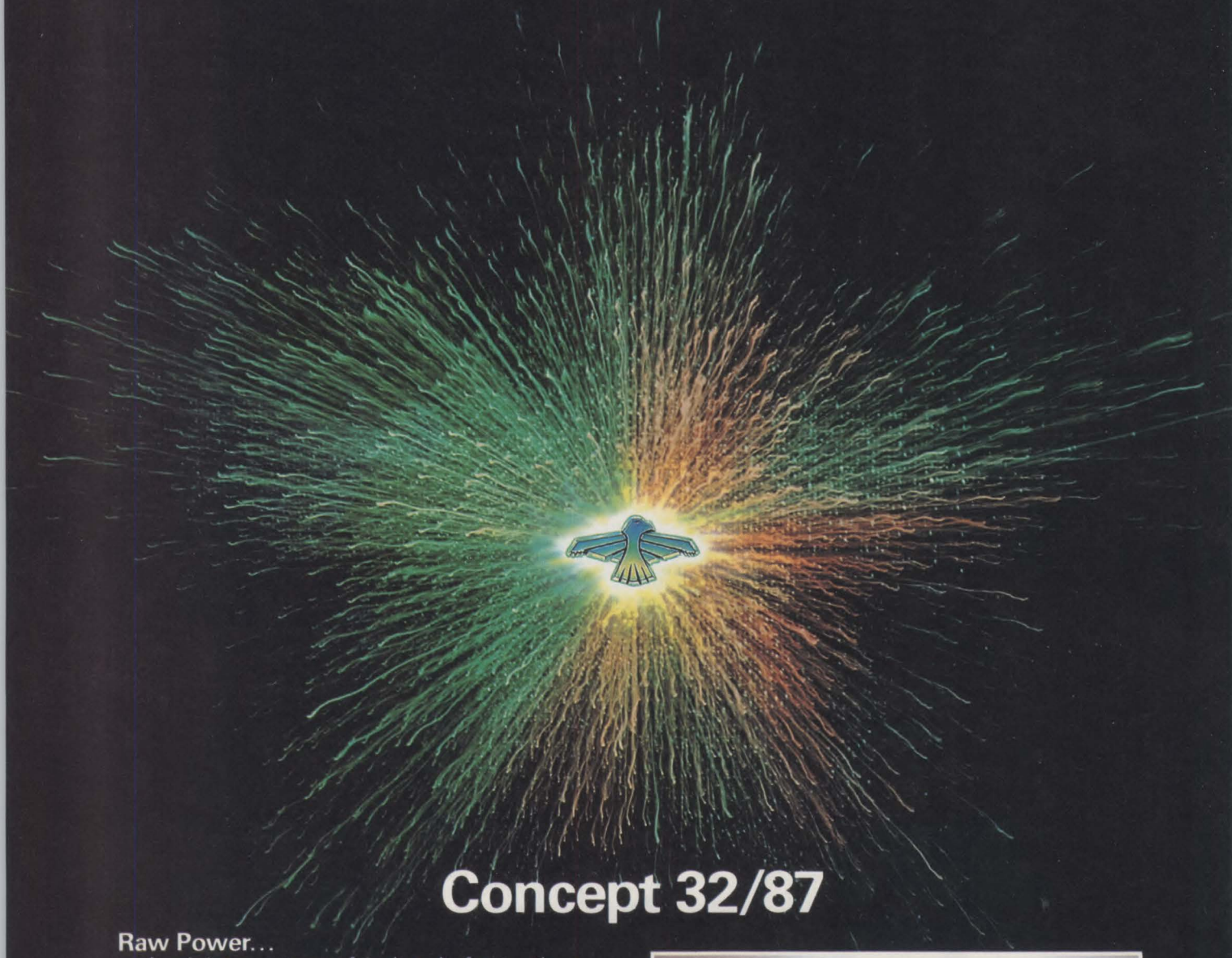

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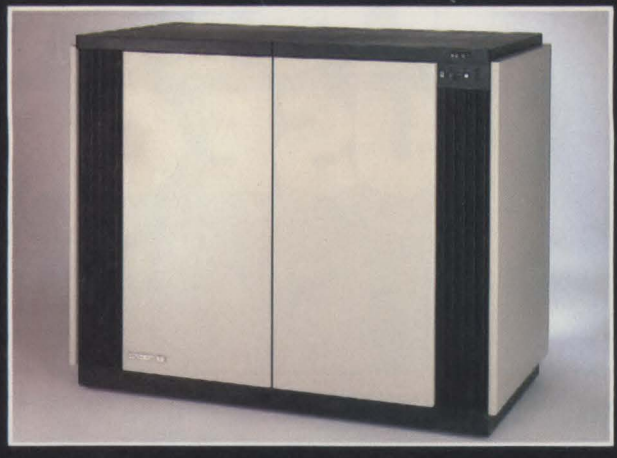

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Chip transportation is one area in which an operator is potentially vulnerable to theft. The new system adds significantly to surveillance protection.

appended to the transaction files, giving a complete record of all activity during the shift.

The lock boxes for the tables are transferred to the count room where they are opened, one at a time. Three people count the currency and ascertain the total. A fourth person independently separates the bills by denomination and verifies box totals. Upon consensus, the amounts are keyed into a VT-11 terminal by table number. A complete count for the Las Vegas Hilton's 49-table casino requires as much as two hours.

Virtually as soon as the counting is concluded, the PDP-11/04 prepares a printed master gaming report, organized by game and table. Opening chip inventory, net fills, total fills, closing figures, currency taken in and markers are tabulated. Win or loss amounts for each table are given along with subtotals by game and pit. Simultaneously, the computer updates data files with the information and begins preparing daily reports.

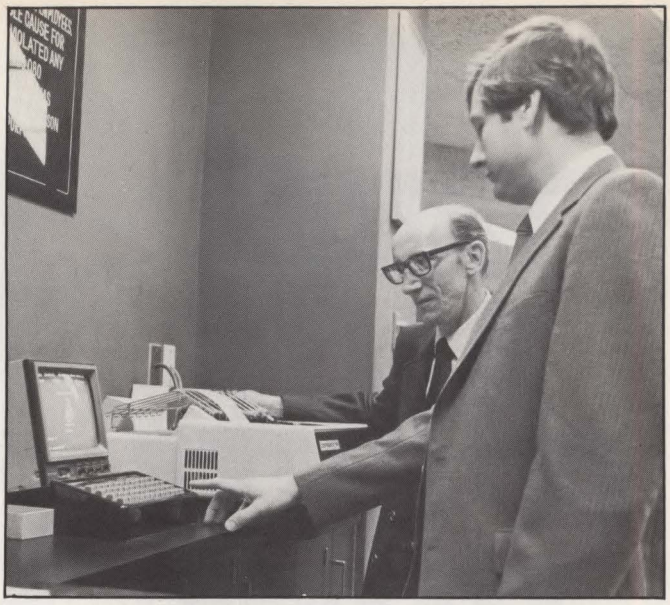
"We close our accounting day at 3 a.m., says Kirschner, "and the count is normally finished by 5 a.m. We have full daily and cumulative reports ready by 7 a.m. the same day. When we were keying similar manually prepared forms into an accounting machine, the reports took three to five days to prepare.

"By eliminating many manual accounting efforts, we were able to shift some personnel into more productive activities," he continues, "although we had no overall staff reductions. There also are fewer errors, because totals now are entered into the computer only once rather than having to be rekeyed into the accounting machines."

Game results give a prove-out figure that serves as one journal entry into the master accounting system. Uncashed chips that are retained by customers are carried as liabilities for a period of time, and reconsolidated later as income. "The chips sell for $1 to $500 and cost us only a few cents to manufacture," says Kirschner. "We are happy to have people keep them as souvenirs."

The system prepares a gaming-analysis or "drop-and-win" report daily. This report details casino operations by table and shift. Data are given for the previous day, along with month-to-date and year-to-date cumulative figures. A comparison with similar figures for the prior year lets managers observe long-term trends.

A daily summary report lists totals for each game—Baccarat, Twenty-One, Craps, Roulette and Big Six—with cumulative totals and prior-year comparisons. From these documents, management determines cash-flow activity and may observe trends to perceive unusual activity. "When there is money around, there is always a possibility for cheating," explains Kirschner. "When we see aberrations, surveillance is alerted to observe the table in question more closely."



Ira M. Kirschner, *Las Vegas Hilton's casino controller (foreground), and William L. Dempsey of SIMCO examine "fill-and-credit" entry terminal in cashier's cage. Keyboard permits single-keystroke entry for all normal functions so that personnel require no special training.*

After lock-box personnel *determine the currency from each table, personnel separate the bills by denominations and verify the count while Kirschner oversees.*

The Digital Equipment Corp. minicomputer prepares a semimonthly, 35-page "cash-and-credit-drop" report, which separates daily activity by cash and markers, both in dollar amounts and percentages. These are tabulated by game, table and shift, with cumulative summaries letting casino managers analyze cash-credit ratios.

"Overall, the new systems give much better control over casino perspective," concludes Kirschner. With more timely information, management has its fingers on the operation's pulse at all times. ■

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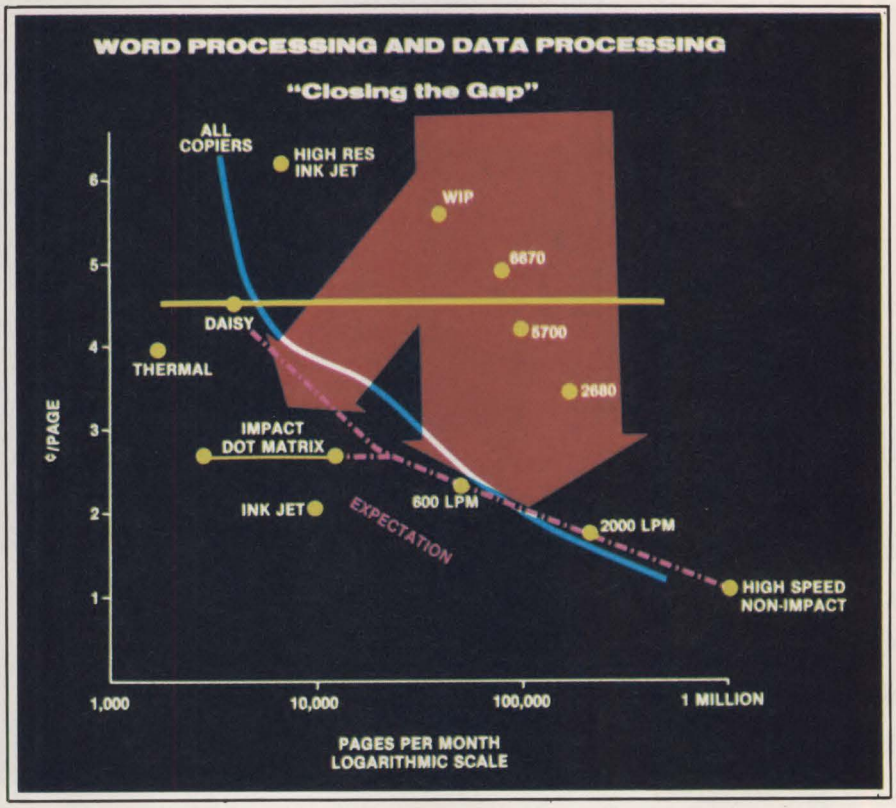
Delphax offers low-cost, non-impact printer for minis

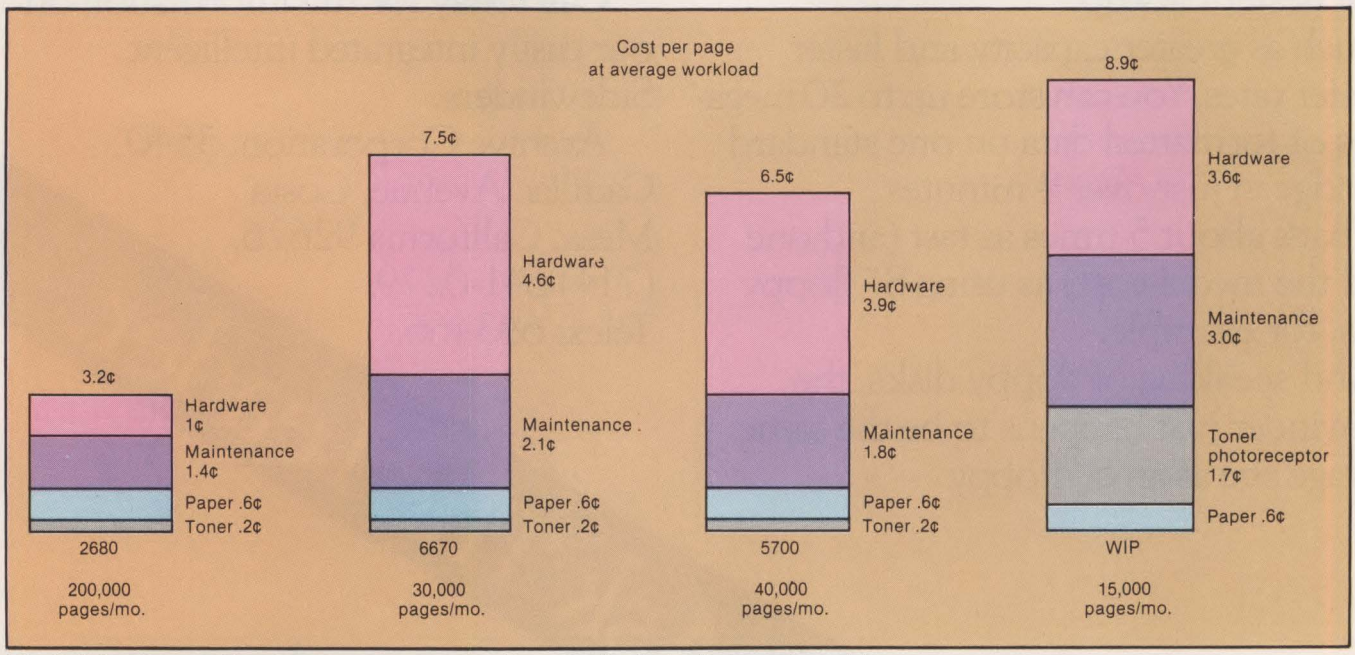
Spurred by almost universal customer demand for reliable, low-cost, high-quality, non-impact printers for minicomputers, many manufacturers are trying to address this promising market with a variety of technologies, including laser-xerography, ink-jet, magnetic and electrostatic printing.

The latest bid comes from newcomer Delphax Systems, Mississauga, Canada. Delphax will market a non-impact page printer mechanism based on an ion-deposition principle (see "New printer also brings new technologies," p.182). Incorporating fewer mechanical and more electronic parts to improve reliability, a printer using the Delphax mechanism could carry a price less than half—or about $35,000—that of its competitors, the company claims.

A glut of high-speed matrix and line printers typically serve as minicomputer output devices. But Hewlett-Packard Co. opened the

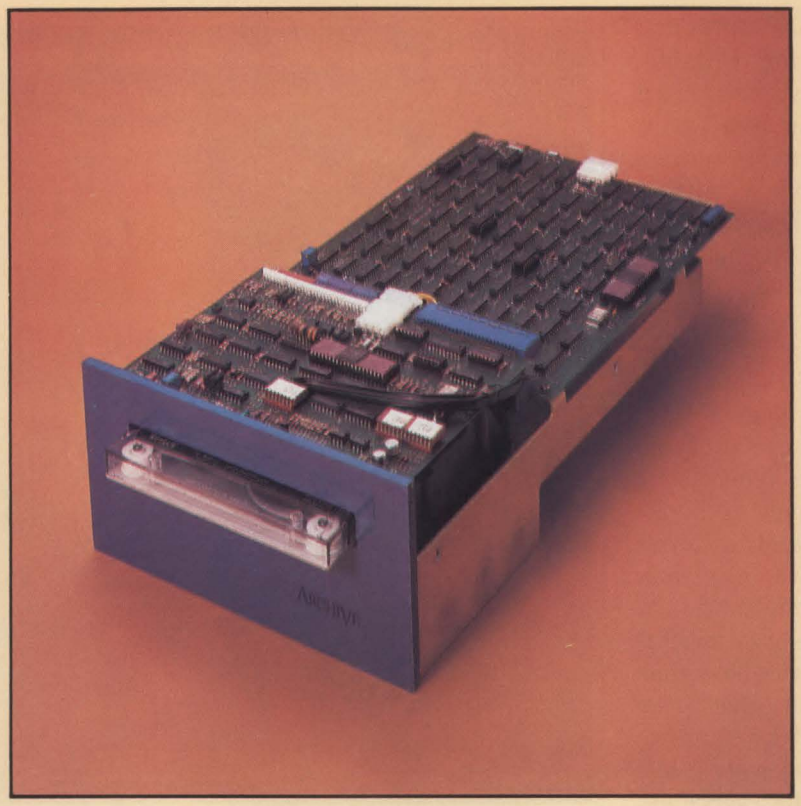


As the printer industry matures, *the cost to print a page by a non-impact printer will decrease, approaching the costs of more conventional technologies. Source: Dataquest, Inc.*



The Delphax Otter will undercut *most current non-impact technologies in the cost to print a page for an average monthly work load. Source: Dataquest, Inc.*

What Makes Archive Streamers The Intelligent Backup Choice?



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door for non-impact page printers recently when it introduced the 2680 laser printer for use with its HP 3000 minicomputers (MMS, January, p. 23). That 43-page-per-min., 180-dot-per-in. resolution printer sells for about $108,500. Competitive laser xerographic printers include the IBM 6670, a 12- to 36-ppm device priced at about $75,000, and Xerox Corp.'s 5700 and 9700. The lower priced 5700 copier/printer prints at 43 ppm and sells for about $66,300 (MMS, November, 1980, p. 26).

The market for such printers is growing rapidly, according to figures from Dataquest, Inc., a Cupertino, Calif., market-research firm. Last year, North American revenues for non-impact printers were $51.3 million, including units sold and leased, plus maintenance. This year, those revenues will jump to $76.3 million, and reach $914.7 million by 1985.

"The market is clearly waiting for high-resolution page printers with the features of the 9700 and 5700," says O. Ralph Finley, vice president of Dataquest. The printers should have a resolution of more than 240 dpi, software-controlled printing and a variety of fonts and forms. Finley says these capabilities cannot be achieved on impact printers, which are limited to 64 characters.

Although laser xerography has opened this market, printers with that technology are expensive to design and require more maintenance than traditional impact line printers, Finley says. Recognizing those problems, Delphax is offering an alternative to laser xerography, which, because of a higher electronics content, is billed as being more reliable and less costly. Rather than convert a copier into a printer, Delphax built a completely new printer.

Delphax's Otter image-output module, based on ion-deposition imaging, prints on plain paper. A family of mechanisms to be introduced will include printers operating at 15, 30 and 60 ppm and offering 240-dpi resolution. The Otter uses an ion cartridge rather than the laser modules used in other systems. The company holds three patents on the technology and has applied for more.

The ions are fired through a print cartridge onto a very hard dielectric drum. Single-component toner is attracted to the drum and transferred onto the paper by pressure rollers. Fixing the image onto the paper requires no heat. As a result, the printer does not need fans and

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has lower power consumption than competing printers.

The technology was developed by Dennison Manufacturing Co. and refined over the past two years in a joint venture between Dennison and Canada Development Corp., a venture-capital firm. This partnership grew into Delphax, which was formed to use the technology in a commercial product.

Delphax will sell the printer as a

NEW PRINTER ALSO BRINGS NEW TECHNOLOGIES

Delphax Systems' new Otter ion-deposition non-impact printer mechanism—the result of more than six years of effort at Dennison Manufacturing Co. and Delphax—includes many novel technological approaches. The printer uses mostly electronic parts instead of the failure-prone mechanical parts used in laser-xerographic printers.

"We have a technology with complexity in the electronics, not complexity in the mechanical parts," says Steve Dunik, Delphax's vice president of engineering.

Delphax holds two patents on the ion print cartridge, which was developed in-house, and several others are pending. The cartridge consists of an 8½-in.-long thin metal strip mounted on a 12- × 3-in. stiff-backed cartridge. The strip has 2048 tiny holes.

The disposable ion print cartridge can be easily replaced by slipping it out of the printer mechanism. The company claims that more than 100,000 pages can be printed before an operator must check the cartridge. Replacement price has not been set, but overall cost over the cartridge's life will be competitive with that of daisy wheels.

The ion print cartridge is built in layers of aluminum that are pin-aligned using PC techniques, explains Dick Fotland, manager of advanced development and one of the printer's inventors. The cartridge is assembled in a semi-clean environment and is tested at each critical step. The electronics in the cartridge ionize surrounding air, and the negatively charged ions exit through holes in the cartridge to form an electrostatic image on the dielectric drum surface. The holes in the cartridge are multiplexed to save on the number of drivers and connections needed to control their activity.

Another key component in the print mechanism is an abrasion-resistant drum. Unlike photosensitive drums in laser-xerographic printers, which can be scratched when a paper-jam mechanism is removed, Delphax's drum is as hard as case-hardened steel, Fotland says. The 8-lb. drum is made of a steel shaft with aluminum shrink-fitted over it.

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mechanism or engine to be configured by customers, who will add an interface, software and fonts. Price for an evaluation engine, which will be available in the third quarter, is $12,000. Full production is scheduled to begin in the fourth quarter. OEM prices have not been set.

Delphax president Gary Ampulski claims that the Otter, when configured similarly to an IBM 6670, will reduce by half the cost of producing a page. "With the Delphax engine, OEMs have the ability to integrate the functionality of a 6670 at half the price," he says.

The company says it is possible to get a cost lower than 2¢ per page, including maintenance and consumables such as paper. That cost would apply to a volume of 250,000 sheets per month, an average data- or word-processing system load, says Tom Stoiber, vice president of marketing. That compares favorably with the HP 2680, according to Dataquest.

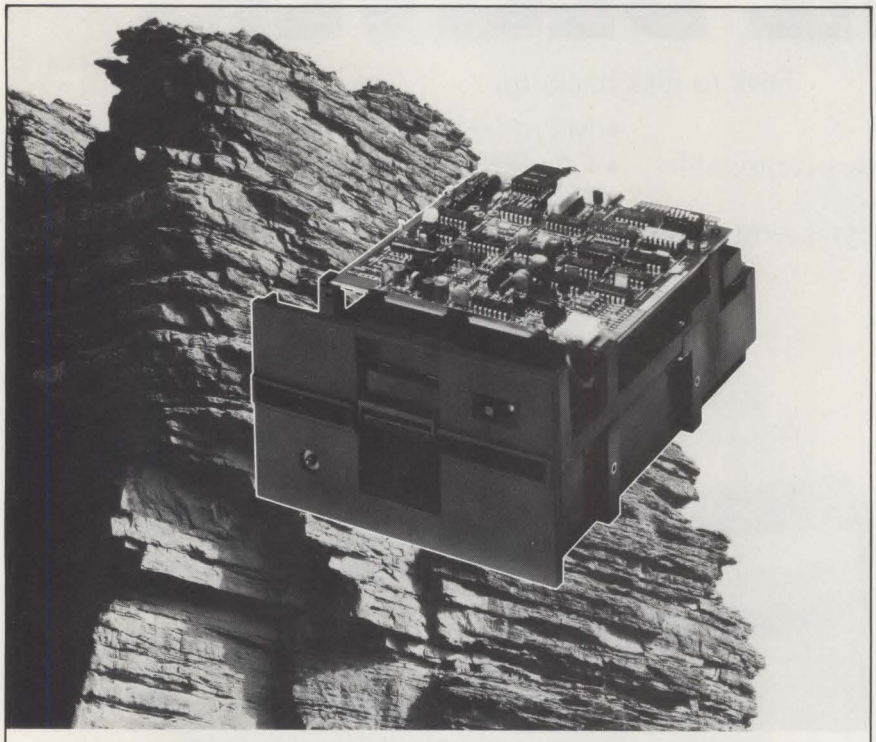
Delphax is targeting customers that have tried to develop their own laser-xerographic printers. Ampulski says the buyers are application-oriented, and the printer will be used in decentralized environments on both word- and data-processing systems. He expects a large number of minicomputer users to purchase the printer initially.

Because the Dennison technology is a well-known and needed technology, the Otter has drawn considerable interest from prospective customers. Customers cite several concerns in selecting a printer, including cost, reliability, maintenance and service. Two potential customers agree that a systems approach is important.

"People who design printers must work closely with software writers," says William H. Burling, principal engineer of non-impact printing at Digital Equipment Corp., Maynard, Mass. DEC has evaluated several printer technologies, including Delphax's. Burling explains that the software must tell the printer what to do, so that text and charts can be intermixed, for example.

"If you use the versatility of a non-impact printer," Burling says, "that means you must embed escape sequences into the text and control characters and the code to turn certain features on and off." He adds that is it not difficult to write font software.

Burling says H-P takes a systems approach with its 2680, and H-P agrees. "A lot of our contribution is in software, so the 2680 is



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extremely flexible," says Steve Richardson, product marketing manager at H-P's Boise, Idaho, division. He says the software in the H-P 3000 minicomputer adds to that flexibility, and that H-P is interested in Delphax's technology.

Features of the Otter that DEC's Burling finds attractive include its ability to fix characters to paper in one step, which could yield higher resolutions; its simple, direct paper path; its instant turnaround when printing, so that users don't have to wait for heaters or fusers to warm up; and the hard aluminum finish on the drum, which is inexpensive.

However, Burling is not satisfied with the Otter's print quality. One test to determine resolution and print clarity is to have the printer produce a solid black page. Burling says the Otter leaves voids, and characters vary in density. He admits, however, that the print quality may be acceptable in light of the unit's high throughput and potential reliability. Delphax's Stoiber explains that the printer is still being refined, and that it now can print black areas well. He adds that Delphax is working with several toner vendors to optimize character fixing.

Burling also says the printer's power supply is too large. Because there are no laser scanners, one trade-off is that Delphax had to use extensive print-cartridge drivers. Those drivers are being refined to reduce costs, Stoiber says.

Burling is impressed with the printer's electronics content. "(It) is attractive to minicomputer manufacturers, which are familiar with electronics costs and are experienced with electronics." He adds that service will be in everyone's mind when considering total cost.

Serviceability is also important to H-P's Richardson. He says a decision to use such a print engine depends not only on lower cost, but also on reliability, serviceability and how long the supplier will be in business. "If we purchased a print engine, we would have to marry all our electronics and software with it." This would cost a considerable amount, so the time, benefit and engineering resources involved would all have to be carefully evaluated.

Many industry executives, however, are skeptical about the manufacturability of a printer incorporating so many new technologies. Many company representatives say they will get an evaluation unit, but will adopt a wait- and see attitude before making commitments.

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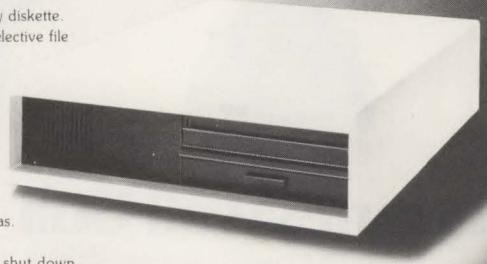

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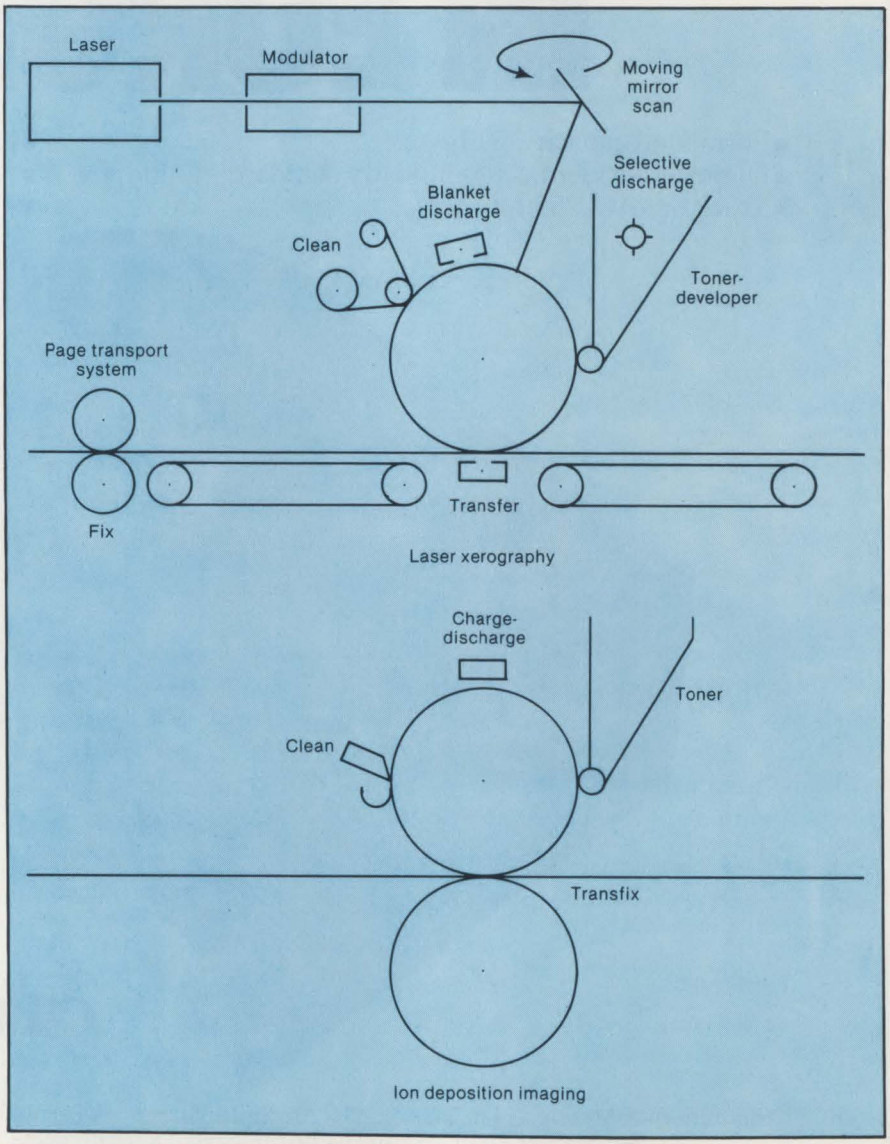
New Products

H-P's Boise division R & D manager Jim Hall and DEC's Burling are two who are concerned about the manufacturability of the print engine. "If it is commercially producible, we are interested. It's hard to know if they can pull off all they say they can," says Hall.

But Delphax is taking its product very seriously. It claims to have manufacturing under control, although officials will not elaborate on many specifics because of patents in progress. "It is Delphax's job to take Dennison's technology and make it manufacturable. It is a big step to go from a research machine to manufacturing, especially to get manufacturing reliability in quantity," acknowledges Steve Dunik, Delphax's vice president of engineering.

"This company has the potential to be a significant force in the electronic-printing business as an OEM supplier," adds Ampulski. He says Delphax is building a worldwide procurement operation, and that if any printer part must be single-sourced, it will be backed up in-house. The company is also setting up an OEM field-service organization that will include North American depots. —*L. Valigra*



Delphax is trying to increase reliability *and cut costs in its Otter printer by using fewer mechanical parts. The Otter includes about 33 percent mechanical parts, compared with 80 percent in laser-xerographic printers.*

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New Systems

Medical/dental system uses Pertec equipment

This medical/dental office system package, using Pertec equipment, includes accounts-receivable management, insurance-form processing, production reports, recall processing, appointment scheduling and word-processing capabilities. The system includes 64K bytes of RAM, a 12-in. CRT screen with detachable keyboard and two double-density floppy-disk drives providing 1.2M bytes of mass storage. Prices start at $9995. **Mitex, Inc.,** Englewood Cliffs, N.J.

Circle No 200

Sigma introduces Chinese-language system

The Sigma-10 Chinese-language computer system displays 1520 Chinese characters or 4800 alphanumeric characters. Other features include variable font matrix sizes, a 64K-byte user memory and 1024K bytes of on-line storage. Prices start at $21,000. **Sigma Information Systems, Inc.,** Belmont, Mass.

Circle No 201

Plessey announces processor for PDP-11

Miproc-16 AP, off-loads preprocessing, post-processing and I/O handling from any PDP-11. The system can also operate separately using DMA with any Unibus or Q-bus PDP-11. A software handler links the PDP-11 and Miproc-16 AP. Software is developed on the PDP-11 using a Pascal compiler. An optional floating-point processor operates in parallel with normal instructions. **Plessey Microsystems,** Melville, N.Y.

Circle No 202

CCS introduces Z80A-based μc system

This S-100-based system includes a Z80A-based CPU that provides real-time hardware-vectored interrupt and interrupt nesting. The system's DMA structure permits multiprocessing with interleaved data transfer rates as high as 2M bytes per sec. The CPU also includes two programmable real-time clocks, two 8-bit parallel interface channels and two independently baud-rate programmable RS232 I/O channels that can operate asyncrhonously as fast as 19.2K baud. The system's OASIS real-time, multitasking software operating system features re-entrant and relocatable program capabilities and uses an ISAM file structure. Prices range from $2350 to $9100. **California Computer Systems,** Sunnyvale, Calif.

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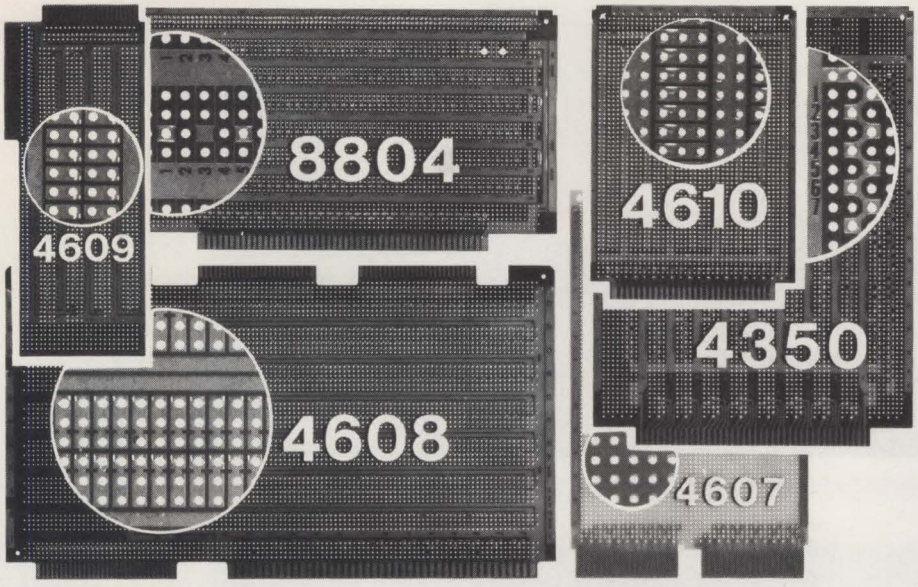

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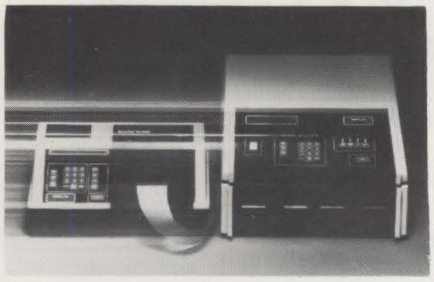

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TMS unveils telephone-information system

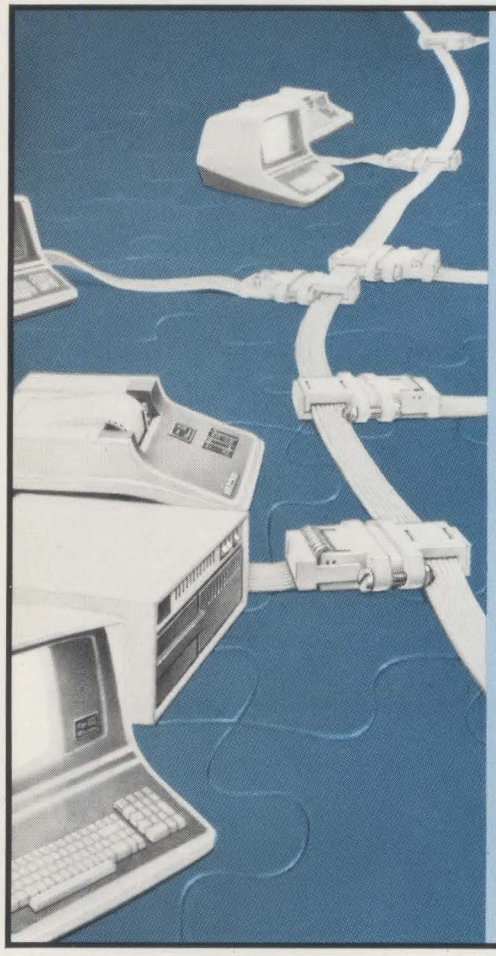
The μp-based ZAP-CALL/System 10 telephone-information system, aimed at control and allocation of phone costs, charge back of costs to clients/account numbers and projects, and network analysis applications, is compatible with all major computerized PABXs. The system reports telephone usage in summary and detail on individual extensions, cost centers, divisions, client/account numbers and total organizations. It also includes local, Day DDD and private-line costing; file-maintenance programs; and system-test programs for local and remote diagnostics. Price is $9900. **Telephone Management Systems, Inc.,** Waltham, Mass.

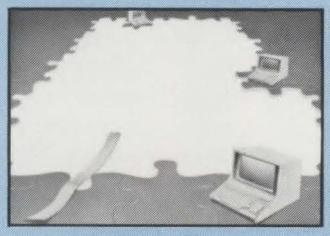
Circle No 205

Datapoint announces Z80A-based system

The Z80Z-based model 1550 small-business computer supports as many as three single- or double-sided diskettes providing as much as 8M bytes of storage. The system with 64K bytes of memory can support a 10M-byte cartridge drive. The unit supports the vendor's Databus business-programming language, and FORTRAN and BASIC-PLUS languages. Prices range from $7075 to $9075. **Datapoint Corp.,** San Antonio, Texas.

Circle No 206





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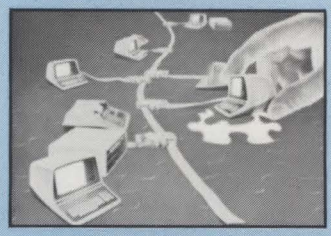

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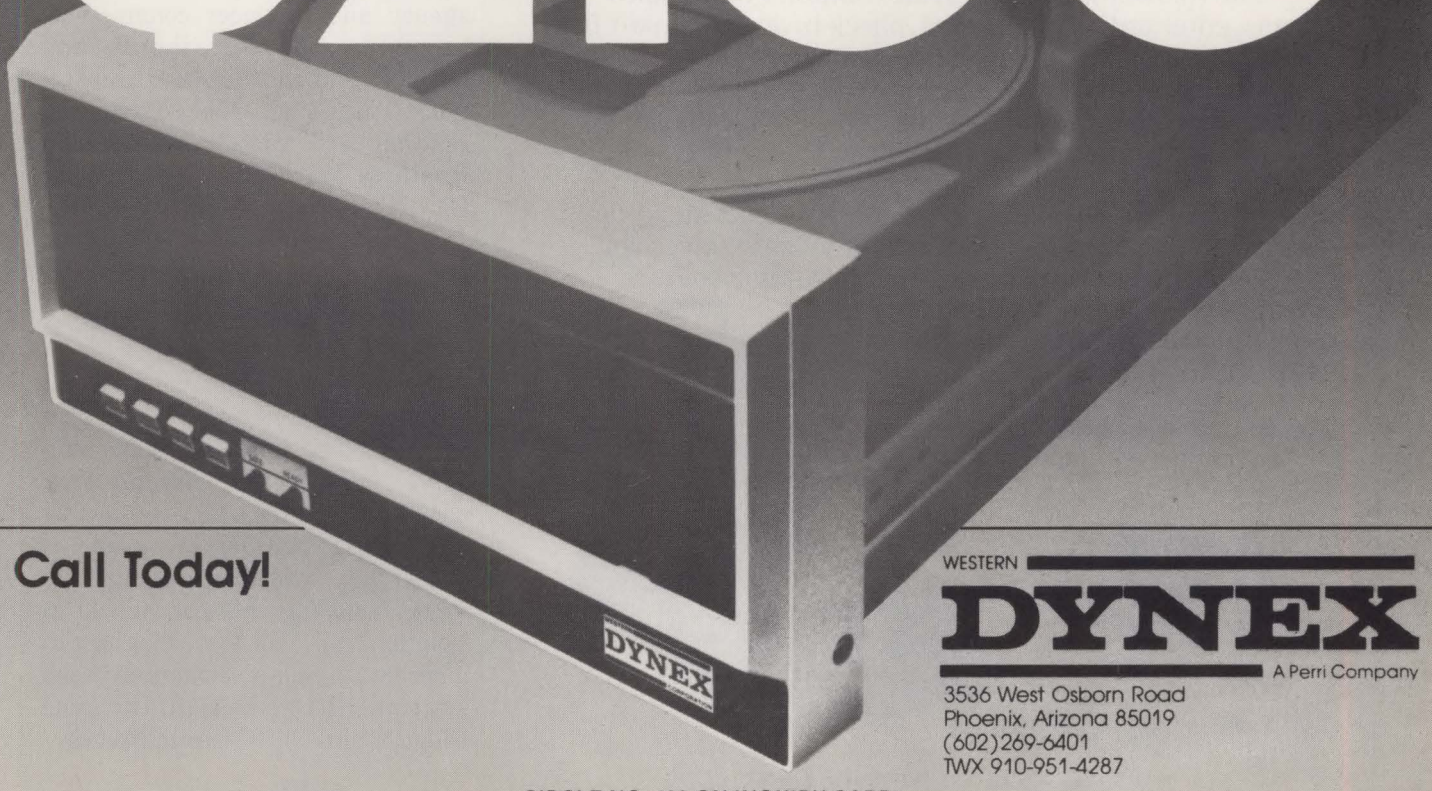

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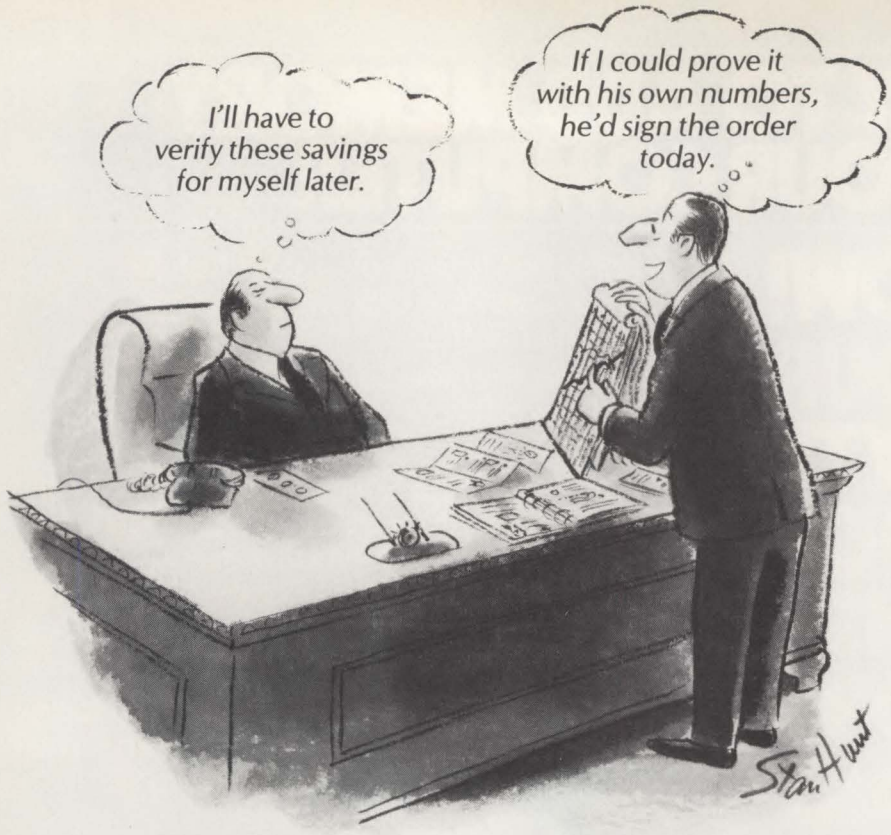

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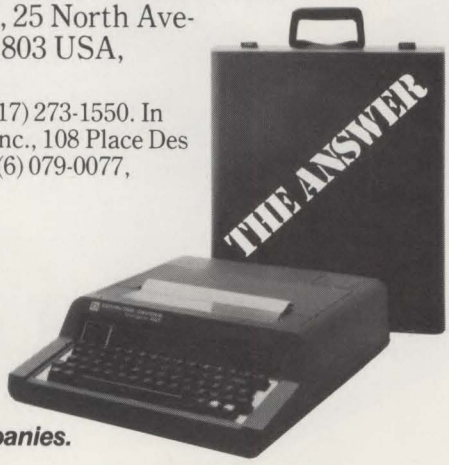

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Circle No 207

Rexon introduces insurance system

The Medalist insurance agency management system is designed for insurance agencies processing approximately $1 million or more in premiums annually, serving 1000 or more customers or handling 1500 or more policies. The system performs automatic invoicing for accounts-current and direct-bill customers, calculates expiration dates and agency and producer commissions based on operator inputs and handles standard policy transactions, including policy issuance, renewal and cancellation. **Rexon Business Machines Corp.,** Culver City, Calif. **Circle No 208**

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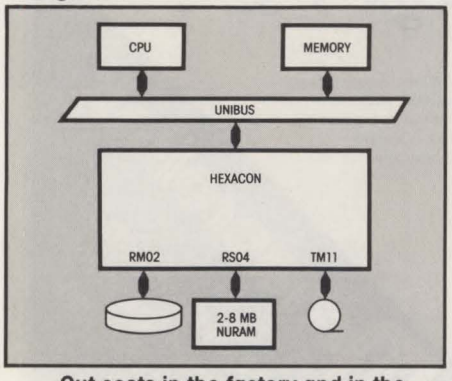
Now there's no reason to put up with this inefficiency. Now there's the HEXACON™ controller.

HEXACON is our new hex-wide peripheral controller that simultaneously handles up to four RM02/RM03 80 MB disk drives, four TU10 ½" tape drives and 8 MB of our NURAM™ semiconductor disk. All from just a single slot.



Cut costs in the factory and in the field. By using one board to do the work of three or more—with no degradation—you save a bundle in a number of ways.

Your most immediate savings is the elimination of two comparably priced controller boards. But farther down the line, HEXACON's upgrade flexibility lets you expand a configuration less expensively because you don't necessarily need to buy additional boards or a larger chassis.

This also means your spares inventory costs are cut way back. Not only in the factory, but in the field as well.

And at the same time, HEXACON increases your system's reliability because it uses far fewer ICs to do the whole job (198 in all).

What these and other cost-benefits all boil down to is a rebalancing of your system operational costs. HEXACON brings the price of I/O processing back in line with the costs of instruction processing and memory. Which makes the old one-to-one approach a thing of the past.

It all stems from our XPU™ architecture. HEXACON is based on our advanced Transfer Processing Unit (XPU) design concept.

The XPU's generalized intelligence emulates the transfer processing logic of DEC's RM02/RM03 disk, TU10 tape and RS04 fixed head disk controllers. So it's fully hardware and software compatible with any UNIBUS system.

By consolidating this logic into a single powerful microengine—and with the aid of on-board multi-sector buffers—HEXACON can simultaneously transfer data at the rates of 1.2 MB/sec (80 MB disk), 320 KB/sec (1600 BPI tape) and 500 KB/sec (8 MB NURAM fixed head disk emulator).

And only one UNIBUS load services all three device types.

Practicality prevails. HEXACON's XPU architecture further enhances its overall reliability because it utilizes only proven technologies. There are no risky new and exotic parts to complicate the matter. Just good, solid and efficient design. From the same company that brought solid reliability to DEC add-in memory.

Leave it to the Practical Wizards to add a whole new dimension to inner space.

For complete details on our HEXACON controller, simply send in the coupon below or call Bill LeDuc toll-free at **(800) 538-8510** or **(800) 538-8514.** In California call **(408) 736-6994.**

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MMS 6/81

CIRCLE NO. 111 ON INQUIRY CARD

Add two MACROLINK 256KB Memory Modules to your 7/32 and get a megamini!

'Break the 7/32 half-megabyte barrier!'

Until now, the only way to get more than 512KB into your 7/32 was to spend over $60,000 for a big stack of 64KB boards, LMBI's, power supply and add-on chassis — or break down and buy a new 3200. Now with MACROLINK's new 256KB Memory Modules, you can extend the life of your 7/32's and accommodate the new operating systems with full megabyte memory performance.

Fully compatible with Perkin-Elmer hardware and software, the new power-saving MACROLINK 256KB MOS Memory Module plugs into any memory slot and can be "mixed and matched" with host-supplied core boards. MACROLINK's 750 ns cycle time is realized throughout the full megabyte of memory — no time-stealing LMBI's required. Plus — MACROLINK's ECC with onboard error logging makes your memory up to 60 times more reliable.

Selling for $7700* (U.S.A.) in OEM discounted quantities of seven to nine, MACROLINK's 256KB Memory Module will upgrade your 7/32 to 3200 Megamini capacity for the cost of memory alone. They're available off-the-shelf fast — so move up to Mega-7/32 now!

'Move up to the Mega-7/32™!'

Mega-7/32 is a trademark of MACROLINK, INC.; Megamini® is a registered trademark of Perkin-Elmer Corporation

macrolink

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CIRCLE NO. 112 ON INQUIRY CARD

THE KEY TO A RECIPE'S PREPARATION IS CAREFUL SELECTION OF THE INGREDIENTS

And the ingredients for the Roloff System are the 16-bit Z8000* processor, full Multibus* compatibility, support for 1-32 users, and an advanced operating system.

The Roloff System By exploiting the performance potential of the 16-bit microprocessor, the Roloff System has the extra power to handle communication with several terminals at once. And Roloff Systems puts that power to work with an advanced operating system never before used in microcomputers.

Roloff Systems support from one to 32 users, each running a different program. Your system can have 96K to 16M bytes of internal RAM.

Roloff Systems grow with you through the flexibility of the Intel Multibus, allowing you to start with a small system and easily enlarge it as the business grows, without making any changes in the original programming. It will accommodate any standard Multibus board from any manufacturer.

Roloff Systems are designed for the user, with the needs of the average office/production worker in mind. Almost any business program written in BASIC or COBOL is easily transferred to the system, and no "computer language" is required of normal users. Though the system is easy to use, the powerful operating system gives programmers great flexibility.

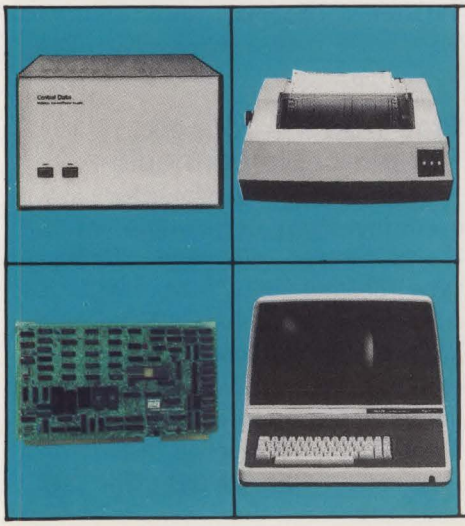
The Roloff System has advanced features not normally found in microprocessor operating systems. A special notes file and paging function enables users to "talk" to each other through the terminals. Roloff Systems indexed file access method and effective security system save time and frustration for the user while protecting data bases from unauthorized entry.

Roloff System's are inexpensive in comparison to other systems. And because the system is easily expanded, your initial investment can be minimal.

Roloff System's are Central Data. Since 1975, Central Data Corporation has been designing and manufacturing an innovative line of CPU boards.

For detailed information on how easily the Roloff System can go to work for you, write or call us: (217) 359-8010 TWX 910-245-0787.

An example system might include 128K bytes of internal RAM, a 10 megabyte cartridge disk, and an interface for up to four terminals or printers. Such a system would cost $11,345.



The Roloff System

Central Data Corporation

P.O. Box 2530, Station A
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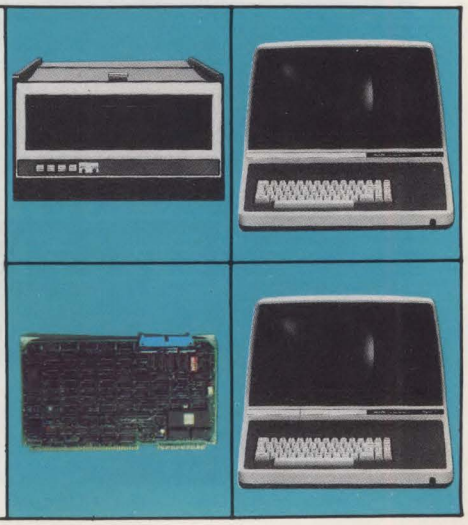
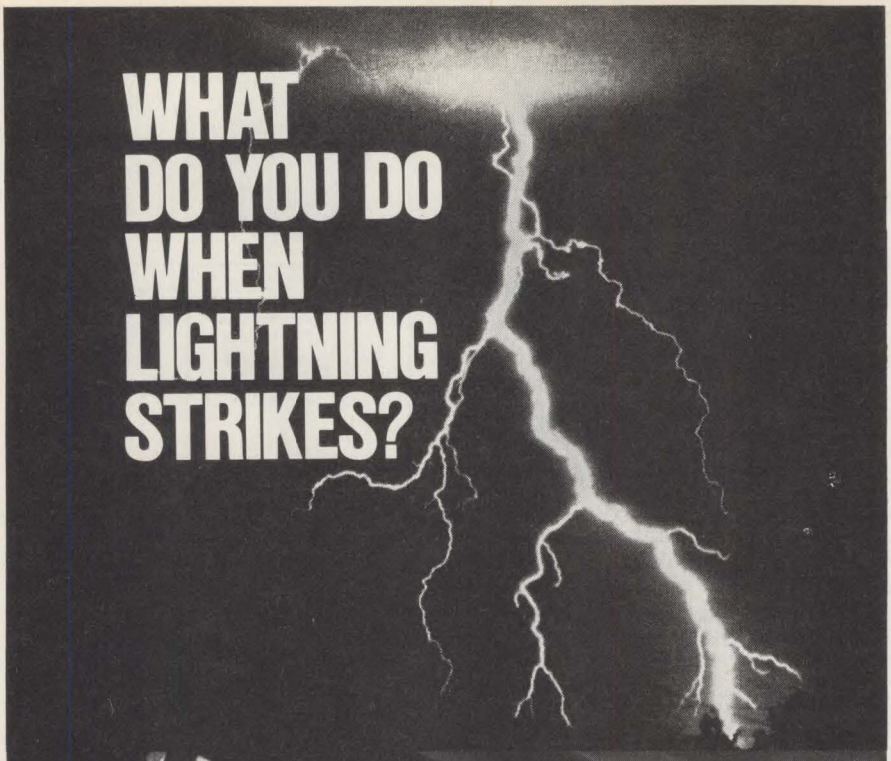
Champaign, IL 61820
(217) 359-8010 TWX 910-245-0787

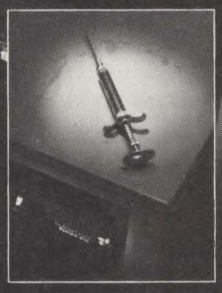
*Multibus is a trademark of Intel Corporation
Z8000 is a trademark of Zilog Corporation



CIRCLE NO. 113 ON INQUIRY CARD



Immunize Your Computer with Deltec AC Power Equipment



When your computer misses a beat, chances are the cause was introduced into the power transmission line by noise, glitches, brownouts, or blackouts.

Deltec is aware of these persistent AC power problems and has developed a variety of products that filter noise, regulate voltage, and generate backup power to keep your computer up and running. The cost is a mere fraction of expensive down time. Ask a Deltec engineer what a Super Isolation Transformer, AC Line Conditioner, or Uninterruptible Power System can do for you. He will analyze your problem and recommend only what you need for the solution.

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GOULD, INC. POWER CONVERSION DIVISION

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Sales Department (714) 291-4204
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CIRCLE NO. 114 ON INQUIRY CARD

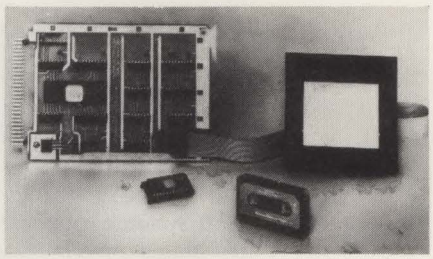
New Products

design aids

Diagnostic tool has security mode

The model 510 diagnostic tool provides compensation for baud rate differences between consoles and dial-up modems, a message mode for direct console operator/remote diagnostician communication, a security mode and flexibility for word format, X on / X off and master/slave functions. Operating speed is 110 to 19,200 bps on any RS232 or 20-mA system. Price is $895. **Custom Systems, Inc.,** Eden Prairie, Minn.

Circle No 210



Peripheral board for Z80 STD-bus

The CCB-1 μp peripheral board mates the Mostek, Pro-Log Z80 STD bus to a digital cassette. The board directly interfaces with a Braemar CM-600 mini-cassette transport. Using a 2716 EPROM, the board is compatible with Mostek's ROM-based operating system. The EPROM redirects the normal paper tape I/O to the mini-cassette. Price is $280. **Tetronics,** Phoenix, Ariz.

Circle No 211

Star-Tron introduces 100-pin cable connector

This 100-pin cable connector has a one-piece housing made of a thermoplastic compound. Crimp-type contacts are used with a contact insert molding of Valox, and stainless steel clamps are ribbed for extra strength. Price is $35, with quantity discounts available. **Star-Tron Corp.,** Providence, R.I.

Circle No 212

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Small to medium-sized businesses get their data processing needs met by SDSystems computers. Flexibility is the watchword with this product range:

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You won't spend much time or money expanding your computer capabilities. From single to multi-user, from floppy to hard disk storage — modular additions eliminate costly system replacements. Now. And in the future.

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CIRCLE NO. 115 ON INQUIRY CARD

design aids

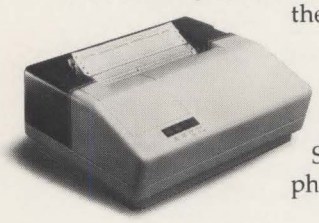
Am2900 family adds variable clock generator

The Am2925 clock generator and microcycle length controller produces four clock output waveforms with one of eight microcycle lengths under microprogram control. Microcycle length control allows designers to select the appropriate clock length, enabling microcycle to be tailored to the actual instruction time required. A crystal-controlled on-chip oscillator can be driven at frequencies as high as 31 MHz, providing a 32-nsec. oscillator period. A buffered oscillator output is also provided. The Am2925 comes in a 24-pin DIP. Prices start at $12.20 in 100-unit quantities. **Advanced Micro Devices Inc.,** Sunnyvale, Calif. **Circle No 213**

A printer for all reasons.

Packed with features, yet low in price. Burroughs new SP110 receive-only printer is ideal for telecommunications or general purpose use. It prints at 90 CPS. Durable mechanism and 9-pin printhead are field proven in hundreds of applications. It also features bidirectional printing, three-way handling, alternate character sets and Centronics parallel, RS232C, or current loop interfaces.

It all adds up to one outstanding printer. Get the full story. Call or write for the name of your nearest representative.



Burroughs OEM Marketing, Burroughs Place, Detroit, MI 48232. (313) 972-8031. East Coast: (201) 757-5000. Central U.S.: (612) 932-3800. West Coast: (714) 835-7335. In Europe, Langwood House, High Street, Rickmansworth, Hertfordshire, England. Telephone Rickmansworth (09237) 70545.

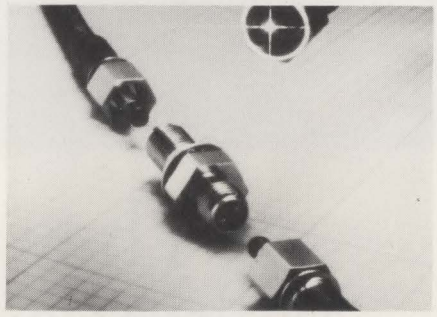
Burroughs

CIRCLE NO. 116 ON INQUIRY CARD

Chassis accommodates two four-slot backplanes

The WP909 5¼-in. rack-mount chassis accommodates one or two DEC four-slot backplanes or one nine-slot unit. The unit comes with 5V at 15A and ±15V at 2A. Optional 25A supplies are available. A snap-off front cover provides access to all PC boards for removal, insertion or testing. Prices start at $750 in single-unit quantities, with OEM discounts available. **Wesperline,** Tustin, Calif.

Circle No 214



AMP announces fiber-optic connectors

These fiber-optic connectors, which can be mated with SMA connectors, accept single fibers as small as 125 μm. and fiber bundles as large as 1140 μm., with cable diameters from 2.3 to 4.9 mm. An internal ferrule ensures axial alignment of fibers within 0.01°, and the proprietary resilient tip provides accurate fiber-to-fiber centering without accessories. A corrosion-resistant metal body and coupling nut help provide EMI/RFI shielding for electro-optic receiver circuitry and can be used with an optional "O" ring. **Amp Inc.,** Harrisburg, Pa.

Circle No 215

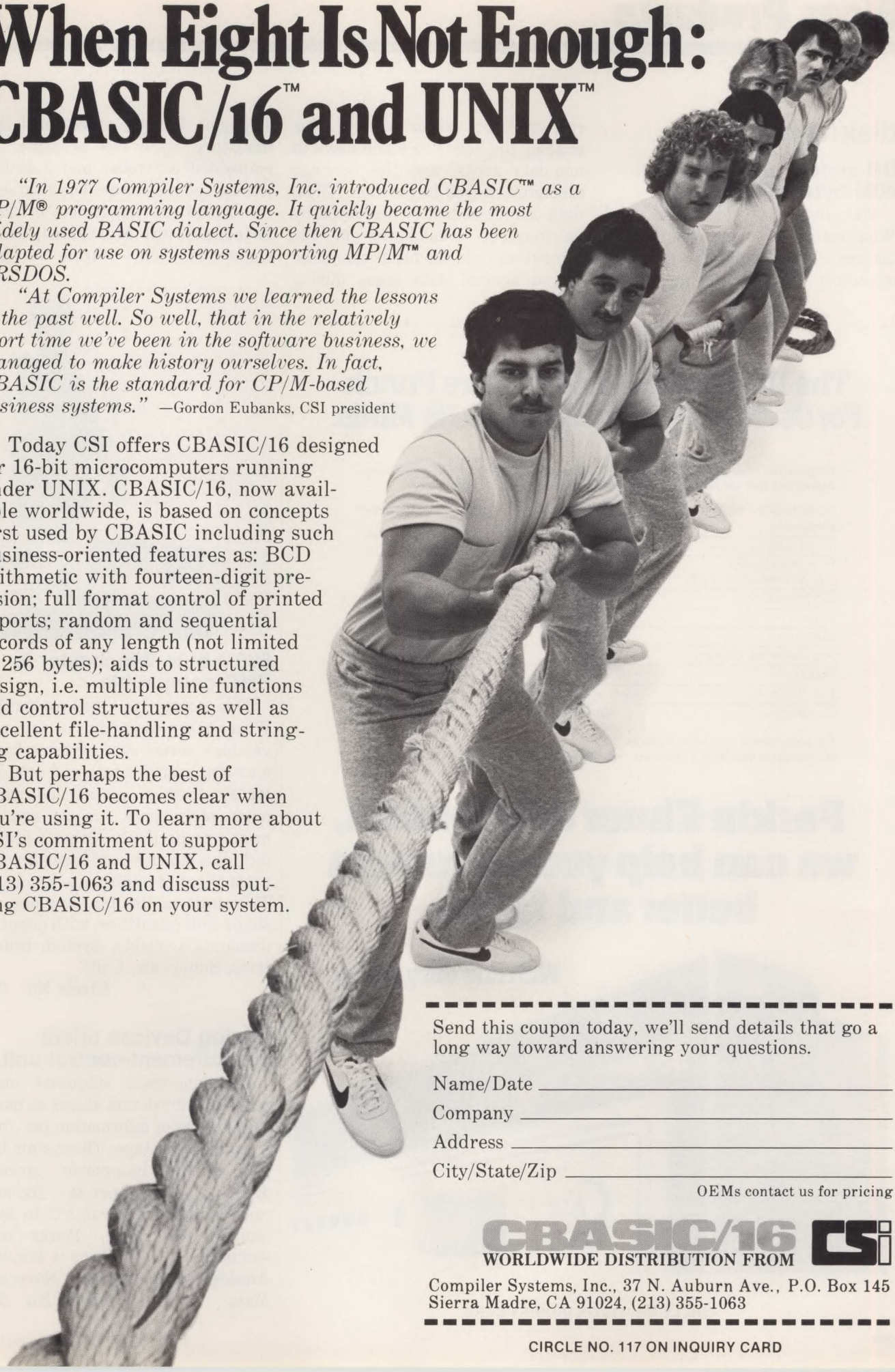
When Eight Is Not Enough: CBASIC/16™ and UNIX™

"In 1977 Compiler Systems, Inc. introduced CBASIC™ as a CP/M® programming language. It quickly became the most widely used BASIC dialect. Since then CBASIC has been adapted for use on systems supporting MP/M™ and TRSDOS.

"At Compiler Systems we learned the lessons of the past well. So well, that in the relatively short time we've been in the software business, we managed to make history ourselves. In fact, CBASIC is the standard for CP/M-based business systems." —Gordon Eubanks, CSI president

Today CSI offers CBASIC/16 designed for 16-bit microcomputers running under UNIX. CBASIC/16, now available worldwide, is based on concepts first used by CBASIC including such business-oriented features as: BCD arithmetic with fourteen-digit precision; full format control of printed reports; random and sequential records of any length (not limited to 256 bytes); aids to structured design, i.e. multiple line functions and control structures as well as excellent file-handling and stringing capabilities.

But perhaps the best of CBASIC/16 becomes clear when you're using it. To learn more about CSI's commitment to support CBASIC/16 and UNIX, call (213) 355-1063 and discuss putting CBASIC/16 on your system.



Send this coupon today, we'll send details that go a long way toward answering your questions.

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CIRCLE NO. 117 ON INQUIRY CARD

disk/tape

IMI announces 40M-byte Winchesters

The 40M-byte 7740 8-in. fixed Winchester-disk drive has a safety feature that provides for the head assembly to be automatically retracted at power down. This enables the heads to touch down in non-data areas, and the carriage assembly to lock in position. Thus, data cannot be lost or destroyed by too-frequent touchdowns in the same place, and the heads cannot be jarred against data areas during shipment. Other features include a miniature voice coil actuator, an embedded controller and a brushless DC spindle motor. The 7740 sells for $2950 in quantities of 250. **International Memories, Inc.,** Cupertino, Calif. **Circle No 216**

600M-byte Winchester is SMD-compatible

This 600M-byte, SMD-compatible Winchester-disk drive for the vendor's series 9400 systems has a 9.67-MHz transfer rate and 6000-hr. MTBF. Average access and maximum seek times are 25 and 50 msec., respectively. Other features include a moving-head assembly and 675M bytes of unformatted storage. The unit sells for $37,000 in single-unit quantities, with quantity discounts available. **System Industries,** Sunnyvale, Calif.

Circle No 217

Analog Devices offers measurement-control unit

The nine-track MAC02-28 magnetic-tape drive unit stores as much as 4M bytes of information per 1000 ft. of magnetic tape. The system has 800- or 1600-bits-per-in. storage density at 18¾ in. per sec. The unit can operate over a 15.5°C to 32°C temperature range. Power consumption is 985W. Price is $29,328. **Analog Devices, Inc.,** Norwood, Mass. **Circle No 218**

The Disk Controller With More Punch For Users of Perkin-Elmer 32-Bit Minis.

Includes the Perkin-Elmer 7/32, 8/32, 3220 or 3240's. DIVA can give you storage capabilities that will satisfy you on two big counts: price and performance.

COMPARISON:	DIVA Computroller V	Perkin-Elmer Controller
Intelligence:	Yes	No
7 Byte Error Correction:	Both header and data	None
Formatting Speed: (e.g. 300 Mbyte Disc Pack)	8 Minutes	8 Hours
675 Mbyte Disc	Yes	No
Drives:	8/Per	4/Per
Buffering:	Full FIFO	No
Mix/Match Disc Drives:	Yes	No
Data-Lates:	No	Must Start Over
CPU Space:	One B or E Selch	Two I/O's
Construction:	Multiwire	PC

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Perkin-Elmer or Interdata, we can help you store data better and faster.

With one easy piece.

CIRCLE NO. 118 ON INQUIRY CARD

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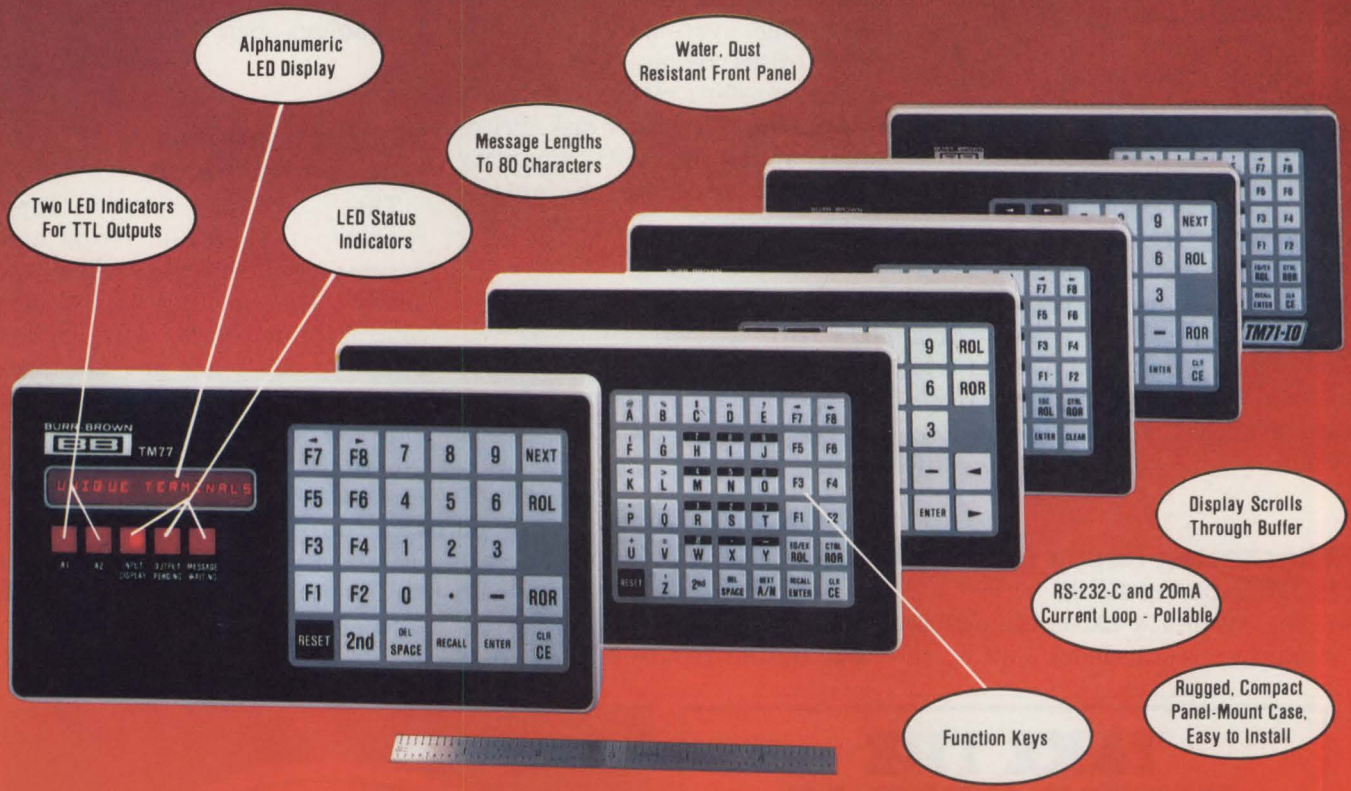

Model	Alpha Display Characters	Baud Rate	Data Buffers	Keyboard	Function Keys(2)	Features	Supply Voltage
TM71	16	110-19200	320 Characters(1)	Alpha	14	Full feature	+5VDC
TM77	16	110-19200	320 Characters(1)	Numeric	14	Larger keys	+5VDC
TM71-I/O	16	110-19200	320 Characters(1)	Alpha	14	TTL I/O	+5VDC
TM77-I/O	16	110-19200	320 Characters(1)	Numeric	14	TTL I/O, larger keys	+5VDC
TM70	12	300 & 1200	36 Characters	Alpha	8	Low cost	+5VDC
TM76	12	300 & 1200	36 Characters	Numeric	8	Larger keys	+5VDC

1) Two 80-character input buffers - two 80-character output buffers.
2) User programmed.

MICROTERMINALS: The practical, easy to install, simple to operate answer for real world data entry/display: priced for OEM designs; tough, waterproof for factory floor work; pretty enough to enhance control consoles; so versatile they can often replace fragile CRT's and printers. If your man/machine communications are complex - or simple - and limited in volume, one of these compact (8.5" x 4.5" x 0.6") terminals may be ready to talk to you...but talk to us first!

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C 1

CIRCLE NO. 119 ON INQUIRY CARD

disk/tape

Dylon announces magnetic tape for MINC

The model 9001 ½-in. magnetic-tape system is compatible with the DEC LSI-11-based MINC instrumentation system. The system offers nine-track 800/1600 bpi density at speeds as high as 75 ips and transfer rates as high as 100,000 bytes per sec. A Z80A-based μp provides error detection and correction. The system also includes a self-testing subsystem. Configuration from 7- to 10½-in. reels and from 12½ to 75 ips are available. **Dylon,** San Diego, Calif. **Circle No 219**

Winchester, floppy system is DEC-compatible

The FWT01172 LSI-11-compatible storage system includes 8.9M bytes of fixed 8-in. Winchester storage and 1M bytes of double-sided floppy-disk storage. The system is compatible with RT-11 and RXS-11M operating systems. The unit's floppy disks require less than 60 sec. to transfer 1.2M bytes of data to or from the Winchester disk. Prices start at $6700, with quantity discounts available. **Scientific Micro Systems,** Mountain View, Calif. **Circle No 220**

IDT introduces tape peripheral for H-P 85

The model GPIB-3000 magnetic tape peripheral, which is compatible with the HP 85, reads and writes ANSI, ECMA and ISO-compatible ¼-in. digital cartridge. The unit provides mass storage for more than 3M bytes of data per cartridge and supports three slave drives via a dual buffer front-end. Average transfer rate is approximately 6K bytes per sec. Prices start at $4080 for a single drive and $5580 for a dual drive. **Innovative Data Technology,** San Diego, Calif. **Circle No 221**

System combines tape reader/punch

The model 4601 tape reader/punch station reads and punches simultaneously or independently. The unit features a μp-controlled interface with buffer memory, skip-delete and full tape-editing features and an RS232C interface with 110 to 1200 baud rates. The punch has an MTBF of more than 100 million characters and can punch 75 cps. The reader features a carriage-return delay and can read as many as 120 cps. **GNT Automatic Inc.,** Waltham, Mass. **Circle No 222**

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We challenge you to take the Rhino Test at this year's Comdex Show. Stop by booth #1213 to see how the DISPLAY-MASTER comes out at least a half a rhino ahead of any 132 column CRT.

With DISPLAYMASTER, you're looking at the clearest, widest view of any CRT on the market—a full 12¼" across the horizontal. And that size plus our green phosphor screen gives you more clarity, better readability and a near full-sized presentation of what appears on your print out.

Don't take our word for it. Pick up a Rhino ruler at booth 1213 during Comdex and see if your current CRT or one you're considering measures up.

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DATAVUE

CIRCLE NO. 120 ON INQUIRY CARD

AOS On
A NOVA® 4/X?
Wild Hare's
MTSS Provides NOVA® Users
With Multi-User Capabilities

DG users now have a choice when upgrading to a multi-user environment. Previously, the only way to support a true multi-user environment was to upgrade to AOS, but not anymore.

MTSS provides all of the standard RDOS features for up to 16 users simultaneously and each user is totally independent. Users may edit, compile and execute programs written in FORTRAN IV, FORTRAN V, ALGOL, BASIC, MACS, etc.

This means no software rewriting is necessary. No new operating system need be installed.

More importantly, MTSS supports **all** NOVA®'s as well as ECLIPSE®'s so no expensive hardware upgrade is required.

Now Data General Users
Have A Choice!

WILD HARE COMPUTER SYSTEMS INC

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CIRCLE NO. 121 ON INQUIRY CARD

LEADER OF THE PACK

You'll see a lot of confusing claims for disk packs and storage modules, but here are a few tips that can help you make the right choice when you're specifying your next pack:

BASF products represent BASF technology and quality, because, unlike many suppliers, we make them ourselves.

We polish our uncoated metal disks to a mirror finish for optimum headflight characteristics and virtually no possibility of media-induced headcrash.

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We magnetically orient all oxide particles in the disk coating for greater packing density.

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For the name of your nearest supplier, write BASF Systems Corporation, Crosby Drive, Bedford, MA 01730, or call 800-343-4600.

*For Burroughs: Front-load single disk cartridges, 80 MB Tridents.
For CDC: 80 and 300 MB storage modules. Phoenix single disk cartridges.
For Data General: 50, 100, 200, and 300 MB disk packs, top-load single disk cartridges.
For DEC: 100 and 200 MB 12-high packs, front-load single disk cartridges, 80 and 300 MB storage modules.
For Honeywell: Phoenix single disk cartridges, 80 and 300 MB storage modules, 100 MB packs.
For IBM: 100 and 200 MB 12-high packs, top and front-load single disk cartridges.
For Wang: Phoenix single disk cartridges, 80 and 300 MB storage modules, top-load single disk cartridges.

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Company _____

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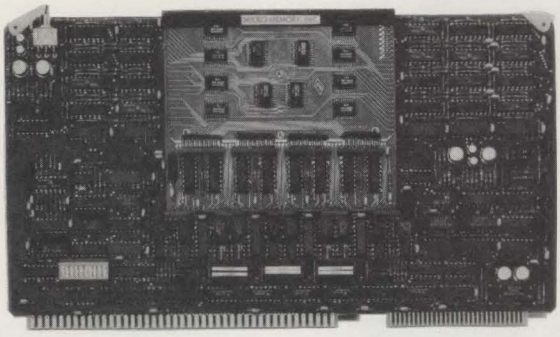
MMS-6

CIRCLE NO. 122 ON INQUIRY CARD

MULTIBUS* CORE MEMORIES

*NON-VOLATILE *WRITE-PROTECT *POWER-FAIL INTERRUPT

MM-8086/16

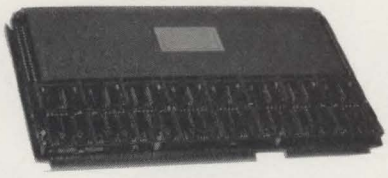


NEW $875

16K BYTES

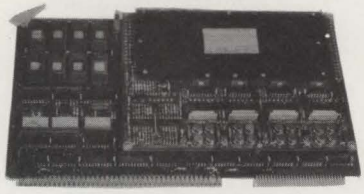
* Single Card Slot 16K Bytes of Read/Write Memory
* Compatible with 8 and 16 Bit Processors
* Non-Volatile — Requires no Back-up Battery
* AC/DC Power Monitoring for Data Protection
* Write-Protect Control in 4K Bytes Increments

MM-8086



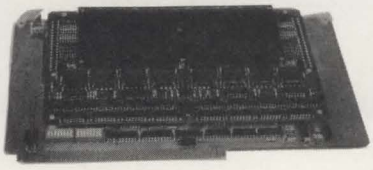
32K BYTES

MM-8080B



16K EROM & 8K CORE

MM-8080/16



16K BYTES

MODEL	PRICE
MM-8086/16	$875.00
MM-8086	$1275.00
MM-8080B	$790.00
MM-8080/16	$849.00

Temperature Cycled and Burned-in During Memory Diagnostic

ONE YEAR WARRANTY ON PARTS AND LABOR

Micro Memory Inc
9436 Irondale Ave.
Chatsworth, California 91311
Telephone: (213) 998-0070

*Multibus is a trademark of the Intel Corp.

CIRCLE NO. 123 ON INQUIRY CARD

New Products

memories

512K-byte RAM board detects, corrects errors

The model MBC-512/16C 512K-byte Multibus RAM board corrects single-bit and detects double-bit errors. The board accommodates 8- and 16-bit word transfers, and stores error-correction information in an on-board register. The board also includes a memory-protection line that prevents spurious memory-write cycles caused by random transient signals during power failures, address decode and board enable, a memory array, error detection and correction, clock, error status registers and indicators. The MCB-512/16C board is priced at $4500 in large quantities. **Advanced Digital Technology,** San Jose, Calif. **Circle No 223**

Piiceon memory board offers 128K bytes of RAM

This 128K-byte RAM board can be used with 8- or 16-bit processors. Access time is 330 nsec., and cycle time is 550 nsec. Power requirements are +8V at 0.60A, -16V at 0.036A and +16V at 0.54A. Price is $2000 in single-unit quantities, with quantity discounts available. **Piiceon Inc.,** San Jose, Calif. **Circle No 224**

Andromeda provides LSI-11 add-ins

The MEM11-128 and the MEM11-64 add-in memories for LSI-11S provide 256K (128K × 16) and 128K bytes (64K × 16), respectively. The dual-width cards (5 × 8½ in.) plug directly into Q-Bus backplanes. The first and last addresses are switch-selectable in 1K-word increments. Options include byte-parity generation, error detection and 22-bit address recognition. Prices range from $700 to $3240. **Andromeda Systems, Inc.,** Canoga Park, Calif. **Circle No 225**

Capacity without Compromise

12.72 megabytes in a four-platter 5¼-inch drive.

Get big capacity without risk. The RMS-512 gives you more bytes per drive and per dollar than any other 5¼-inch drive, using field proven conventional Winchester technology. All in a minifloppy-sized package.

Better reliability. Our electrical-mechanical brake secures spindle in power-down mode to prevent media and head damage when the system is moved or shipped. No screws or locks to remember.

Worried about data separation hangups? Our **Data Express**™ data separator handles high data transfer rates, even when used with a standard SA1000 floppy-type interface.

Concerned about head landings? We give you a landing shipping zone outside the data area.

Looking for ways to reduce heat and power? We beat the heat with less than 20 watts. In standby "power save" mode, power consumption drops to 14 watts.

Do you want extra quality assurance? RMS burns in every complete disk drive system to specification limits.

Better performance. Our electronically dampened actuator provides for servo-like positioning and more stable settling. Buffered mode improves seeking speed. Integral microprocessor simplifies diagnostics and control.

And all at a better price. RMS gives you proven Winchester technology at the lowest entry cost per drive or per byte. Three models offer a range of capacities (3.18, 6.38 and 12.72 megabytes). For specifications and price information, circle our readers' service number. For an evaluation unit, call Mike Kirby at **408-730-1346.**

Rotating Memory Systems, Inc.
1031-A E. Duane Avenue
Sunnyvale, California 94086
(408) 730-1346

RMS

SMALL BUSINESS Computers by Lazor Systems, Sunnyvale, CA

CIRCLE NO. 124 ON INQUIRY CARD

memories

CompuPro announces 16K × 8 static RAM board

The STD RAM-16, a 16K × 8 static RAM board for the STD bus, is configured as two 8K × 8 blocks addressable on any 8K boundary, and will run with 4-MHz processors. The board uses 2114 static RAM chips and can be populated with memory chips that allow the system to have 1K byte to 16K bytes of nonvolatile memory. Price is $325 in quantities of one to nine. **CompuPro Division of Godbout Electronics,** Oakland, Calif.

Circle No 226

Intel announces intelligent memory

The series 90 i/qx intelligent memory system includes circuitry that corrects single-bit errors and detects double-bit errors, built-in diagnostics for controller memory modules and three methods of accessing the diagnostics—computerized access by the host, service communicator access or remote access. Two chassis configurations are available. A vertically mounted model houses as many as 16 memory modules, and a horizontally mounted version houses as many as four modules. Price for a typical system is $142,770. The remote diagnostic system is $16,590. **Intel Corp.,** Sunnyvale, Calif.

Circle No 227

Matrox introduces 512K-byte memory

The Mega-4 Multibus-compatible memory card for 8- and 16-bit μc systems contains as much as 512K bytes of read/write memory, a memory-management unit, distributed refresh and full parity generating/checking circuitry. Worst-case access time is 625 nsec., and cycle time is 725 nsec. The Mega-4 is available in 32K-, 64K-, 128K-, 256K- and 512K-byte configurations and can be populated with 16K- or 64K-byte RAMs. Prices range from $680 to $5775, in single-unit quantities, with OEM discounts available. **Matrox Electronic Systems Ltd.,** Quebec, Canada.

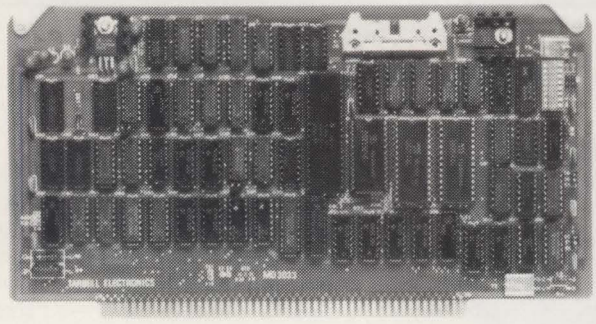
Circle No 228

Dual-width board packs 256K bytes

The CI-1123 dynamic memory system for use with the DEC 11/23 places 256K bytes of memory on a single dual-width board. The unit has 4M-byte address field checking for each byte of memory, 240-nsec. access time and 400-nsec. cycle time. Price is $2550 in single-unit quantities. **Chrislin Industries, Inc.,** Westlake Village, Calif.

Circle No 229

NEW TARBELL
S-100 CPU/IO BOARD



- Z-80™ will run at 2 or 4 Mhz
- 2 RS-232 Serial I/O ports
- Powerful Memory Management
- Programmable Timer
- Full masked priority interrupts
- Has everything needed for MP/M™
- 6 month full warranty

Z-80 is a trademark of Zilog Inc.
MP/M is a trademark of Digital Research

Tarbell Electronics

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Carson, CA 90746
Phone (213) 538-4251

CIRCLE NO. 125 ON INQUIRY CARD

DEC LSI-11
COMPONENTS
at a
savings

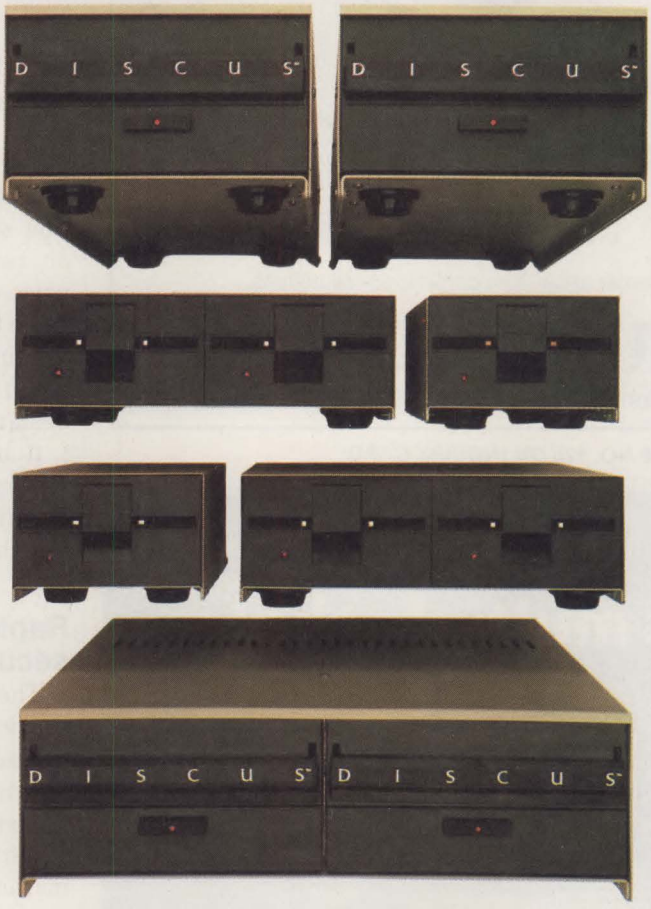
MCS SIMPLY EXISTS TO PROVIDE THE MARKETPLACE WITH DEC LSI-11 COMPONENTS ● FAST ● LOW PRICED ● WORLDWIDE

Mini Computer Suppliers, Inc.
25 Chatham Rd., Summit, NJ 07901 /201-277-6150 /Telex 13-6476

CIRCLE NO. 126 ON INQUIRY CARD

MORROW DESIGNS

Cost effective answers to floppy disk problems.



DMA answers. Standard, accumulator transfer floppy disk controllers can stall your microcomputer system's CPU for as long as 160 milliseconds. Just to access and transfer a sector of data to main memory. If CPU processing speed and system performance are critical, you need something better. That's where Morrow Designs' new intelligent Disk Jockey DMA™ controller comes in. This new breed of perpherial handles both 5¼" and 8" drives and can read almost any format in existence. Speed? Your CPU runs at full tilt while the DMA controller seeks and gathers a sector of data. How? Information transfers to and from main memory occur as "cycle steals" from the system bus. And the missing memory cycles are transparent to the CPU totalling only two milliseconds instead of the usual 80.

Build a buffer. Give the Disk Jockey DMA a little extra memory and your system's performance gets even better. The extra storage is used as a track buffer. So, whenever a sector on a new track is read, the track buffer is automatically filled with the other sectors on the track. The result? Additional data on the track is immediately available. Without the 80 millisecond rotational latency normally encountered. And similar efficiencies occur with disk writes. Sectors in the track buffer are conditionally written on the disk only if a new track is accessed. And only one revolution of the disk is required.

Now, prices.* All systems listed are supplied with a floppy disk drive, Disk Jockey Direct Memory Access Controller, CP/M** 2.2 operating system, power supply, fan, cables, cabinet and Microsoft 5.2 BASIC.

Even lower prices. Morrow Designs' floppy disk systems with Disk Jockey™ 2D controllers offer the same high quality at even lower prices. Now without memory mapping!

Fast answers. See Morrow Designs' family of cost effective floppy disk systems at your computer dealer. For a somewhat more leisurely answer, circle the reader service number below. For immediate answers, phone us at (415) 524-2101.

LOOK TO MORROW FOR ANSWERS.

5¼ Inch Systems (formatted data)	
400,000 Bytes (1) Dual Sided 48 TPI Drive	$1110
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800,000 Bytes (1) Dual Sided 96 TPI Drive	$1499
1,600,000 Bytes (2) Dual Sided 96 TPI Drive	$2599

OEM pricing available

8 Inch Systems (formatted data)	
500,000 Bytes (2) Single Sided Drive	$1199
1,000,000 Bytes (2) Single Sided Drive	$1975
1,000,000 Bytes (2) Dual Sided Drive	$1595
2,200,000 Bytes (2) Dual Sided Drive	$2675

OEM pricing available

*Prices subject to change without notice.
Disk Jockey DMA and Disk Jockey 2D are trademarks of Morrow Designs
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MORROW DESIGNS

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CIRCLE NO. 127 ON INQUIRY CARD

Choice

GNT Makes a Tape Punch Station and a Tape Reader/Punch Combination.

Both are small, quiet, and economical. One of them will fit your needs exactly.

The 4601 Combo

- Punching speed: 75 Cps Reading speed: up to 150 Cps
- RS-232-C serial interface
- Utilizes all types of Mylar® and paper tape
- Reliability: MTBF 100 million characters

The 3601 Punch

- Punching speed: 50 or 75 Cps
- RS-232-C serial interface
- Utilizes all types of Mylar® and paper tape
- Reliability: MTBF 100 million characters

Contact your local dealer or call for complete specifications.

GNT AUTOMATIC INC.

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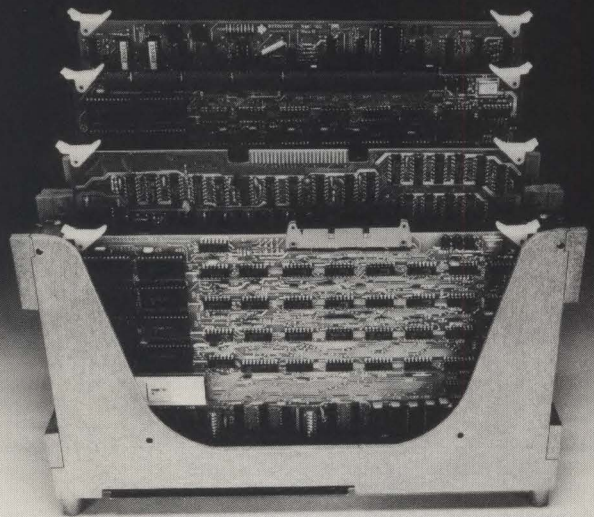
CIRCLE NO. 128 ON INQUIRY CARD

Multibus™ multiple choice.



RIGID DISK SOLUTIONS FROM THE EXPERTS.

Intelligent Rigid Disk Controllers for ANSI Winchester, Storage Module, Cartridge Disk and more. Bipolar Micro-Computer Controlled, ECC, Full Sector Buffering, Bad Track Mapping, High Speed DMA, Macro Level Instructions, and Family Software Compatibility for starters. Call (214) 238-0971, or write 13667 Floyd Circle, Dallas, Texas 75243.

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New Products

services

Radio Shack announces Dow Jones service

The Dow Jones Information Services data base contains current and past news stories from the Dow Jones News Service, *The Wall Street Journal* and *Barron's National Business* and *Financial Weekly*, all published by Dow Jones Co., Inc. It includes price quotations on more than 6000 stocks and other securities listed on the four major U.S. stock exchanges and the national over-the-counter market. The service also offers information on revenues, earnings, dividends, price-earnings ratios and stock price performance relative to market indicators on 3200 companies and 180 industries. The package is designed for use with TRS-80 models I, II and III computers, TRS-80 color computers and the TRS-80 Videotex terminals. **Radio Shack,** Fort Worth, Texas. **Circle No 261**

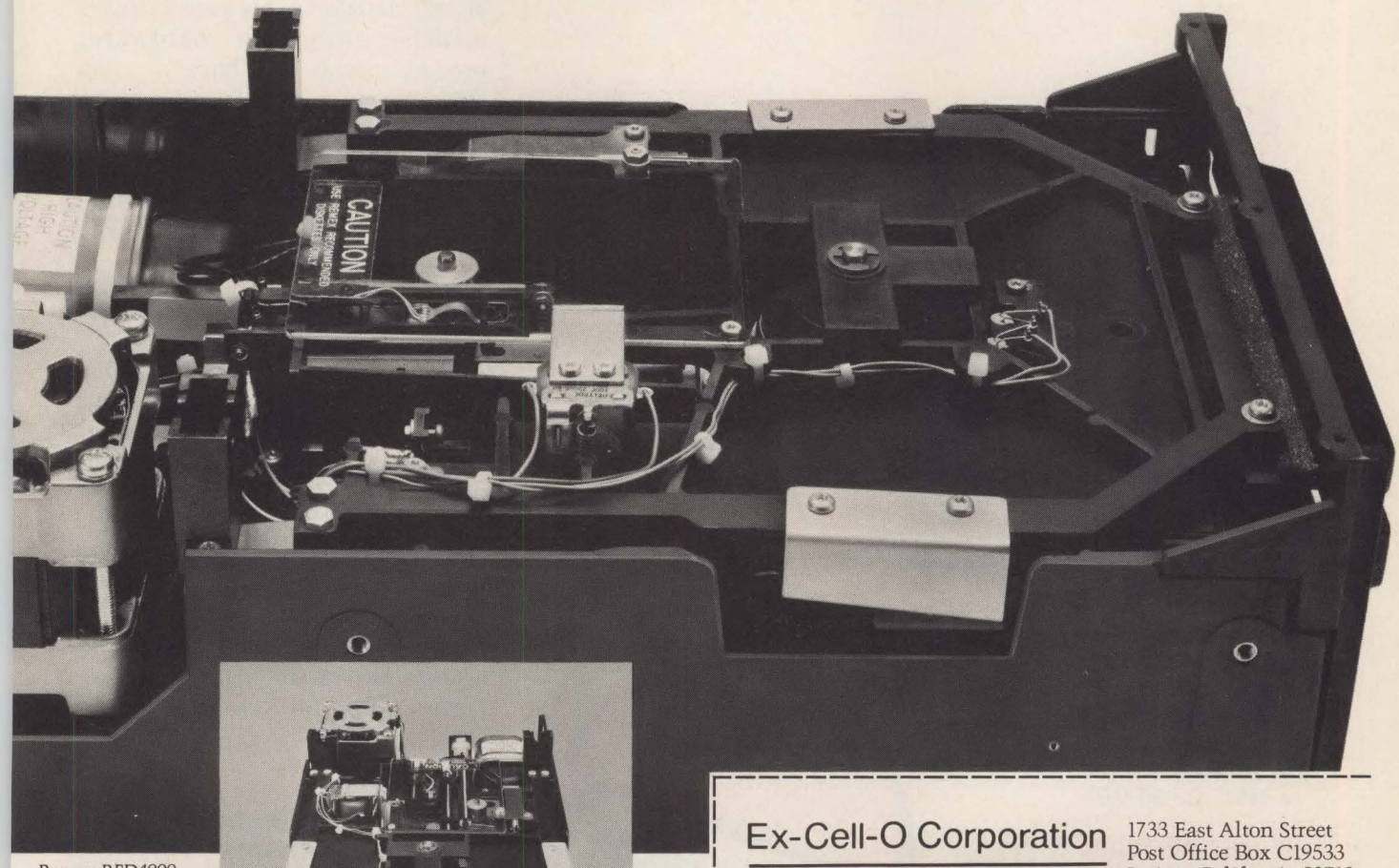
Rapidata announces securities service

The Rapidquote II data base service provides current and historic trading, financial and descriptive information on more than 32,000 securities traded on major North American exchanges. Historic information includes more than 12½ years of daily price/volume information on common and preferred stocks, bonds, options and mutual funds; dividend and stock distribution statistics for equity issues, bond interest payment data for debt issues; and rankings and beta coefficients for use in analyzing risks associated with various securities. The data base was developed by Capital Market Systems, Inc., and is updated daily from information provided by Telstat Systems Inc. Data accuracy is maintained through daily validity and quality-assurance checks. **Rapidata, Inc.,** Fairfield, N.J. **Circle No 262**

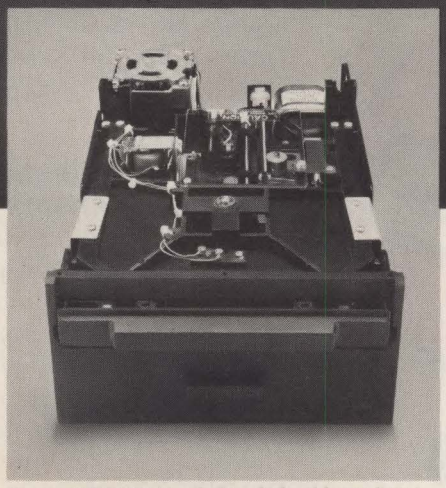
CIRCLE NO. 129 ON INQUIRY CARD

Remex Dual Head Floppy Disk Drives.

No Extravagant Claims. Just Performance.



Remex RFD4000 Dual Head Flexible Disk Drive



Remex RFD2000 Single Head Flexible Disk Drive

Write or Call for Specifications and Delivery.

Ex-Cell-O Corporation
REMEX DIVISION

1733 East Alton Street
Post Office Box C19533
Irvine, California 92713
(714) 957-0039
TWX: 910/595-1715

For fast response information on Remex Flexible Disk Products attach business card or write:

Name_____ Title_____

Company_____

Address_____

City_____ State_____ Zip_____

Phone_____

CIRCLE NO. 130 ON INQUIRY CARD

services

Yankee Group announces IBM monitor service

The Inquiry:IBM subscription-consulting service provides information about IBM and its market strategies. The service provides quarterly assessments of IBM's residual values and individualized client liaison and consulting, hardware/operating system strategies, network DDP strategy and products/systems. Price is $7500, with discounts for existing clients. **The Yankee Group,** Cambridge, Mass. **Circle No 263**

Multiperipherals For Your Multibus

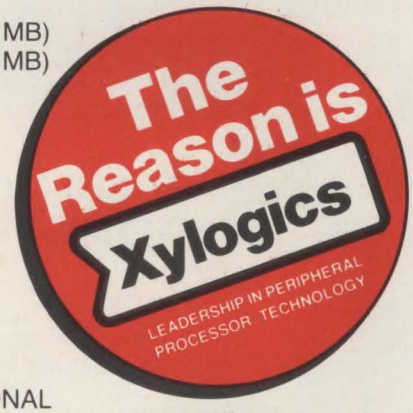
MULTIWAYS

Need large disk capacity for your Multibus system? Xylogics has what you need.

Multi Disks
- CDC Hawk (10 MB)
- CDC cartridge modules (32-96 MB)
- CDC storage modules (80-300 MB)
- CDC Lark (8 MB/8 MB)
- BASF (24 MB)
- NEC (20-80 MB)

Multi Interfaces
Choice of Xylogics **Peripheral Processors** for either storage module or Diablo 44B interface.

Multi Benefits
- Bit-slice control technology
- Compatible with INTEL, NATIONAL 80/20, 86/12
- SMD configurations of up to four drives in any mix of storage capacities
- Fast delivery
- Low prices



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CIRCLE NO. 131 ON INQUIRY CARD

Electronic magazine features DEC equipment

The Digital Digest electronic magazine can be accessed through a Digital Equipment Corp. or a DEC-compatible terminal. Subscribers dial into the magazine via a modem and read its monthly contents on their own CRTs. All articles in the magazine are indexed for a key-word search, and a subscriber can print out a hard copy of any article on his own printer. Articles cover DEC hardware, product reviews, a buyer's co-op offering DEC-compatible hardware and a software exchange that allows users to swap programs. **Digital Publications, Inc.** Norcross, Ga. **Circle No 264**

Digital Research announces software support plan

The independent software vendor support plan for the CP/M operating system includes seminars, technical support, software licensing and protection information, newsletters, manuals and magazine articles, and a referral catalog. The three-day seminar covers PL/I-80 applications and system programming, and legal and marketing aspects of developing a software business. **Digital Research,** Pacific Grove, Calif. **Circle No 265**

Service troubleshoots network problems

This nationwide service will use a 24-hour hot line to help customers minimize network outages. The service will supply hardware/software experts on call with hands-on experience, including network topology, hardware components, multiplexing, leased lines, carrier interfaces, protocols and diagnostic troubleshooting. The service's third party opinion will help resolve vendor conflicts and prescribe solutions. **Worldwide Computer Services Inc.,** Gaithersburg, Md. **Circle No 266**

You don't have to take our word about Maxell Floppy Disk quality.

Ask the people who made your system.

Maxell Floppy Disks are either expressly specified or recommended by many major disk drive manufacturers. We're also relied upon by a growing number of 8" and 5¼" Floppy System owners. They find our Floppy Disks do everything possible to bring out the maximum performance of their systems. And they find our disks do this consistently.

Are we better than others? Will a box of ten Maxell Disks always contain ten disks that produce high performance results every time? We think so. We certify each one. We maintain extraordinary quality control. So they all meet or exceed the most critical industry standards.

But please ask the manufacturer of your system to double check our recommendation. See your computer products supplier. Or write to us for more information. We recommend dealers write to us about the opportunities Maxell Business Products offer.

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BUSINESS PRODUCTS DIVISION

Maxell Corporation of America, Business Products Division, 60 Oxford Drive, Moonachie, N.J. 07074 Tel: (201) 440-8020

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DIGITAL CASSETTES.

FIRST WE MAKE THEM BETTER. THEN WE MAKE SURE THEY'RE BETTER.

We certify every *Ectype*™ digital cassette we make. Not every other one. Call 1-800-843-9862 (In Canada call 605-996-8200) for the name of your nearest distributor.

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Your flexible alternative
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HEY!
YOU DEC PEOPLE.
Here's A Deal That Will Blow Your Socks

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WRJM02-AA
80 MBYTE
Disk & Controller

Buy one from us at the 100 unit price, with no commitment.

$10,000.

WEX West Coast Computer Exchange, Inc.
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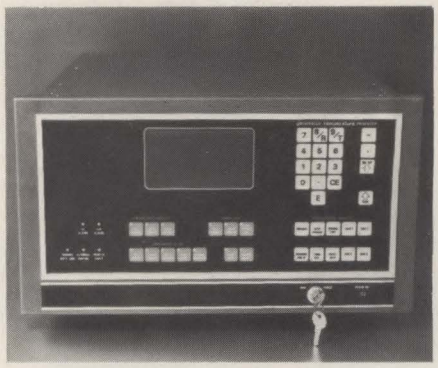
Manufacturers: (DEC) equivalents.
Dealer: DEC equipment
248 Sobrante Way, Sunnyvale, CA 94086

CIRCLE NO. 134 ON INQUIRY CARD

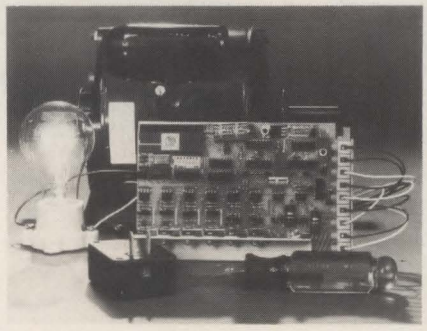
New Products

micros



Turnkey μc has 60 circuit modules

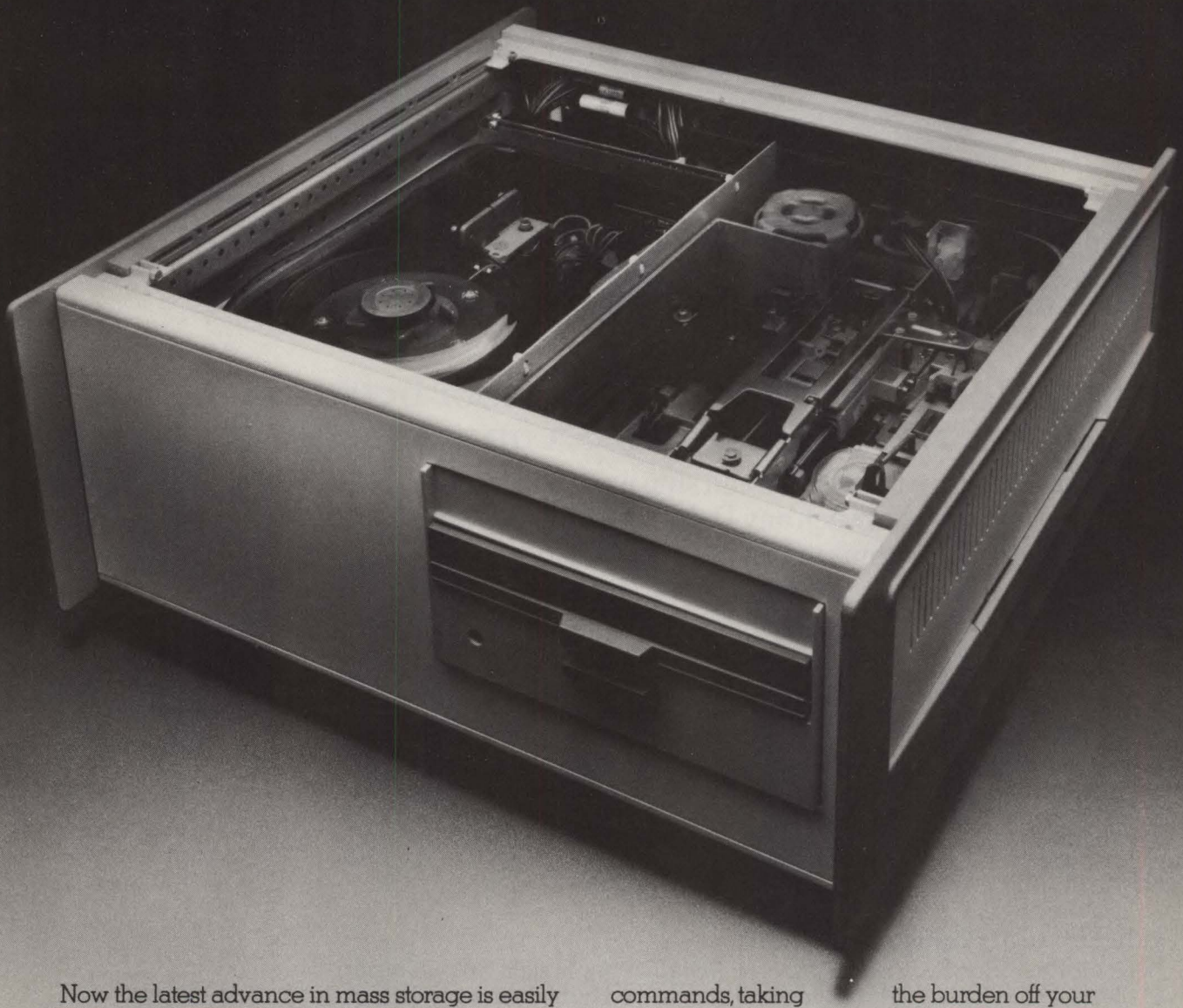
The RTC4000 industrial μc control system includes more than 60 circuit modules, including CPU, digital and analog I/O, memory, communications and power supply. Custom software is available. Prices range from $3000 to $8000 in 25-unit quantities. **Electronic Management Systems Inc.,** Omaha, Neb. **Circle No 267**



Single-board computer features power I/O

This single-board computer with analog, serial and power control I/O can be configured with eight analog inputs, one analog output, serial I/O and any mix of eight AC or DC inputs or outputs. Other features include a 6801 or 68701 μp with 128 bytes of RAM, 2K bytes of ROM and a watchdog timer. Prices range from $88 to $295, depending on quantity and options. **Wintek Corp.,** Lafayette, Ind. **Circle No 268**

FINALLY, WINCHESTER TECHNOLOGY FOR 6800/6809 EXORbus* SYSTEMS.



Now the latest advance in mass storage is easily added to your EXORbus system. New Series 9670 magnetic disc storage modules from Creative Micro Systems come in a choice of six configurations. Each combines the large memory of a Winchester disc with back-up on floppys or tape.

You can specify up to four disc drives per system for as much as 80 MB on-line storage. Your configuration comes as a complete system with one or more drives, an intelligent controller and power subsystem packaged in a compact, attractive enclosure. Interface is plug-in easy because the 9670's host adapter is pin and outline compatible with the EXORciser* and Micromodules* and other industry-standard cards.

Advanced features include choice of formatting, support of EPDT (Enhanced Programmed Data Transfer), plus compatibility with all present and planned systems using the EXORbus. Also, our intelligent controller executes high level commands, taking the burden off your main processor. In addition, you can get a super development system by combining the 9670 with our 9609 single board microcomputer and Microware, Inc.'s remarkable OS-9 operating system with Basic 09, Pascal, and "C" compilers.

Once again, the Creative approach delivers an extremely powerful, yet low-cost system. Call us at (714) 898-9669 for details, including price and delivery facts. Generous OEM volume discounts are available.

And be sure to request our free catalog—twenty pages packed with compatible products for the EXORbus. All offer attractive price/performance and fast delivery. Write: Creative Micro Systems, 11642-B Knott Street, Garden Grove, CA 92641.

CMS **CREATIVE MICRO SYSTEMS**

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CIRCLE NO. 135 ON INQUIRY CARD

Who's ready for 10,000 U.S. communities?

Delta Air Freight ships door-to-door between 80 cities covering 10,000 U.S. communities.

See that Delta map below? You can ship just about anything, big or small, between any Delta cities shown. That covers over 10,000 communities in the U.S. You can ship door to door. Or airport to airport. And because Delta has 1500 take-offs daily, Delta can frequently give your shipment same-day delivery.

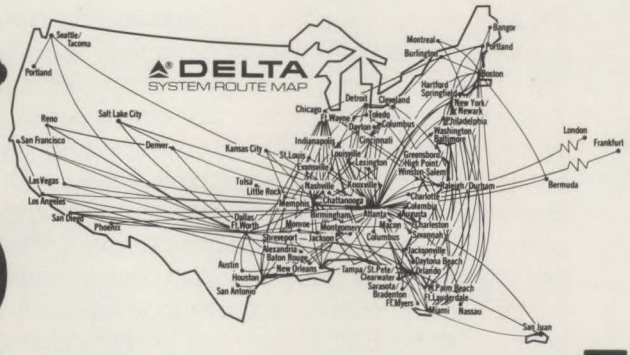
Delta can ship anywhere in the U.S. or the world, via interline connections. In many instances, Delta Air Freight rates are lower than other freight services. And Delta will quote you special low rates tailor-made for your shipments. For full details, call the Delta air cargo representative nearest you.

Other Delta Air Cargo services:

Delta Air Parcel Service. Up to 25 lbs. $15 door-to-door. 10 packages minimum.

Delta 3-D™ Air Freight. 40% off regular freight rates on high density shipments.

Delta Air Cargo Ready all-around.



CIRCLE NO. 136 ON INQUIRY CARD

New Products

data entry

TI announces data-entry terminals

The models 767 and 769 bubble-memory data terminals, designed for error-checking capabilities and intelligent data-entry functions, are compatible with most synchronous, 3780 protocol emulations and communications networks. The units feature thermal printing at 30 cps, 5 × 7 dot-matrix print head and TTY interactive and 3780 batch transmission. The 767 is priced at $3995, and the 769 is priced at $4295. **Texas Instruments Inc.,** Dallas, Texas. **Circle No 269**

MIS introduces sales-accounting system

The "Route Manager" sales-accounting data-entry system with printer is designed to ride on delivery trucks of distributors of beverages, bakery, snack food and similar products. It permits salespeople to record sales and order information for central computer processing, to access customer and product information stored in the system's memory and to print invoices and sales reports. The user-programmable system includes an alphanumeric hand-held terminal with as much as 32K bytes of 8-bit memory. **MSI Data Corp.,** Costa Mesa, Calif. **Circle No 270**

OCR document reader has four scan lines

The model 3000 OCR document reader includes automatic feed, as many as four scan lines, as many as 16 sort pockets, optical mark reading, punch card reading, a μp for user-programmable document control and a CRT keyboard. Prices range from $5000 to $25,000. **Input Business Machines, Inc.,** Rockville, Md. **Circle No 271**

System reads bar codes

The Wand 1-system uses bar code readers to record shipment of products. Each product is labeled with machine- and human-readable codes. The bar codes contain product identification and manufacturing lot information that allows users to trace the destination of each manufactured item. The system runs on the IBM Series/1 computer under the EDX and PXS operating systems. Other features include a formatted menu, a prompting capability, the IBM 4952 CPU, video display stations and a 9.3M-byte disk. System software sells for $9000, and prices for hardware configurations start at $26,000. **Wakefield Software Systems, Inc.,** Wakefield, Mass. **Circle No 272**

H-P offers digital bar-code wand

The HEDS-3050 bar-code wand features internal metal shielding to reduce susceptibility to electromagnetic interference. The wand reads all common bar-code formats printed with a minimum 0.3-mm. bar code. Applications include data entry capture in manufacturing environments and program entry for personal computers, appliances and intelligent instruments. Price is $110 in quantities of one to 99. **Hewlett-Packard Co.,** Palo Alto, Calif. **Circle No 273**

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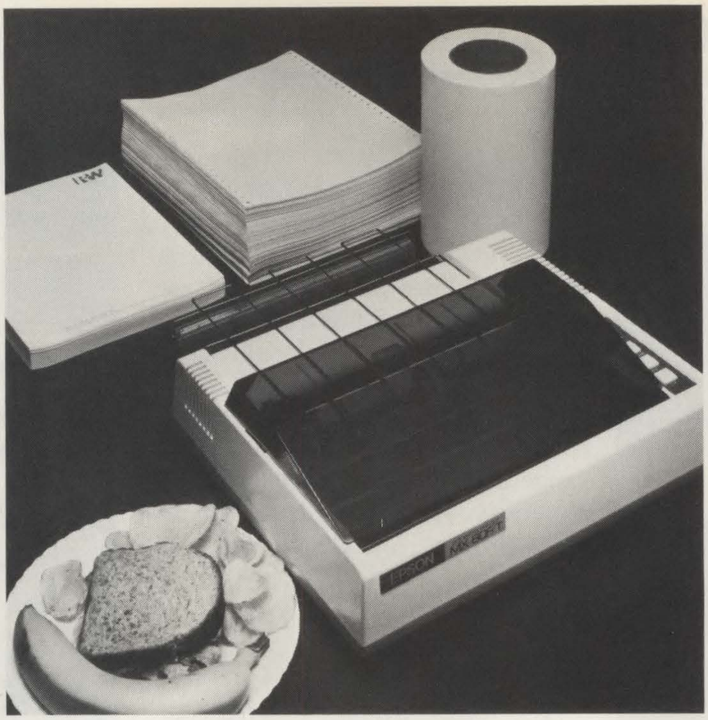
CIRCLE NO. 137 ON INQUIRY CARD



The new MX-80 F/T. You can feed it anything. Almost.

Epson.

This is Epson's newest and most versatile printer — the MX-80 F/T. It does everything the famous MX-80 does, and since it accepts both friction and tractor-feed paper, it prints on almost anything. So for many OEM uses, this printer may be the best printer you can buy.

It prints bidirectionally in your choice of 40, 80, 66, or 132 columns. And to make the throughput even faster than its 80 CPS, a logical-seeking function minimizes print head travel time.

It prints 96 ASCII, 64 graphic and eight international characters with a tack-sharp 9x9 matrix. And since all Epson printers are known for reliability — and the MX-80 F/T is no exception — it prints and prints and prints. You can expect 100,000,000 characters from the print head. And when the head finally wears out, it's so inexpensive you can just throw it away. To put in the new one takes only one hand and a few seconds of time. The MX-80 F/T is compact, weighs only 15 lbs., and the whole unit, including the two stepper motors controlling carriage and paper feeding functions, is precisely controlled by an internal microprocessor.

But here's the best part. The MX-80 F/T prints on just about anything you feed it. It has both a friction and a tractor-type pin-feed mechanism. So it prints on forms, labels, letterheads, roll or continuous fan-fold computer paper. Or even paper plates.

You can have the MX-80 F/T for under $750, and for even less in quantity. And for a printer that isn't finicky about what's for lunch, we call that chicken feed.

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EPSON AMERICA, INC.

Western: 23844 Hawthorne Boulevard, Torrance, California 90505/(213) 378-2220 TWX: 910-344-7390
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CIRCLE NO. 138 ON INQUIRY CARD

THE SMALL COMPUTER LARGE ENOUGH FOR 8 FULL-SIZE ADULTS.

Small computers aren't kid's stuff anymore.

Micromation's M/NET™system delivers big computer power to small computer users. So do a lot of other products in single user systems.

But M/NET has a feature just right for growing companies. And for large companies with special applications. It's called upgradeability.

Because when a company grows, so does its need for computer power. And that's where M/NET moves out ahead. For each user terminal you add, M/NET adds a processor and 64K of memory. Not just out to 3 or 4 users. But all the way up to 8 processors for 8 on-line terminals.

So M/NET users don't suffer from the response-time delays common in other multi-user, micro-based systems.

The M/NET system gives you the flexibility of a modular architecture, plus CP/M* software compatibility. And your choice of data storage: floppy disks and Winchester-type drives.

Here at Micromation, we've spent four years building a professional company.

We provide the technical backup, the service, and the support that business users—and business computer dealers and OEM's—demand.

If you're serious about using computers to help your business, call us for the name of your nearest Micromation distributor. And if you're a computer dealer that's serious about expanding your market coverage and customer base, call us for full details on our complete M/NET dealer support program.

We'll show you why M/NET is the small computer large enough for you.

Micromation, Inc. 1620 Montgomery Street, San Francisco, CA 94111. (415) 398-0289
TWX: 910/372-6101, TELEX 172 457.

MICROMATION M/NET™

IT'S ONLY SMALL ON THE OUTSIDE.

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CIRCLE NO. 139 ON INQUIRY CARD

datacomm

Modem features 12 channels

The RAM-22 random access modem operates at strap-selectable speeds of 2400, 4800 or 9600 bps. As many as 12 independent full-duplex channels can exist using a building's AC wiring as the transmission line. Each channel is separated in the frequency domain and can be used in a point-to-point or multidropped mode. Stand-alone and rack-mounted versions are available. **Data-Control Systems,** Danbury, Conn. **Circle No 274**

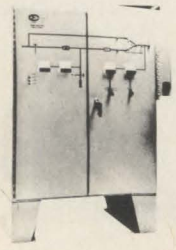
THE UPS TEAM

Uninterruptible Power Backup for Your Ace Computer

The computer game is one of speed and critical decisions. In microseconds your computer could be knocked out by a surge or loss of power. If your computer is down it could mean the showers for your communications, security, medical laboratory, process control or computer systems.

The CLARY Uninterruptible Power System (UPS) stands as the flawless defense against sudden power attacks on your system. Backed up by the CLARY UPS, all of your power problems are over. We will keep you in the ballgame while the others are on the bench.

We have a limited supply of the U.S. Dept. of Commerce Report entitled, "The Effects of Electrical Power Variations Upon Computers: An Overview." For a free copy and more information on UPS, please call or write to:



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CIRCLE NO. 191 ON INQUIRY CARD

System provides network analysis

The RTA-1327 multichannel response time analyzer system, designed to operate with 3270-type protocols, provides network analysis and monitoring, data reduction and presentation and long-term performance records. The system consists of eight μp-based, plug-in channel modules, an eight-channel data multiplexer module, a common-control front panel, power supply and a μp-based color-graphics intelligent CRT terminal. Price is approximately $38,000. **Datacomm Management Sciences Inc.,** Norwalk, Conn. **Circle No 275**

Multiplexers replace DG boards

The models 4111 and 4113 multiplexers for the Data General Nova and Eclipse computers are software-transparent to DG's ULM and ALM series, respectively. Both single-board multiplexers require one CPU slot and contain eight asynchronous ports, one synchronous port, two EIA teletype ports and a real-time clock. The units accommodate 50 to 38.4K baud data speeds, and all multiplexer ports support full modem control. **Quentin Research, Inc.,** Northridge, Calif. **Circle No 276**

BOEING BOUGHT OUR FIRST 32-BIT COMPUTER. SIGHT UNSEEN.

Nobody buys the first of anything.

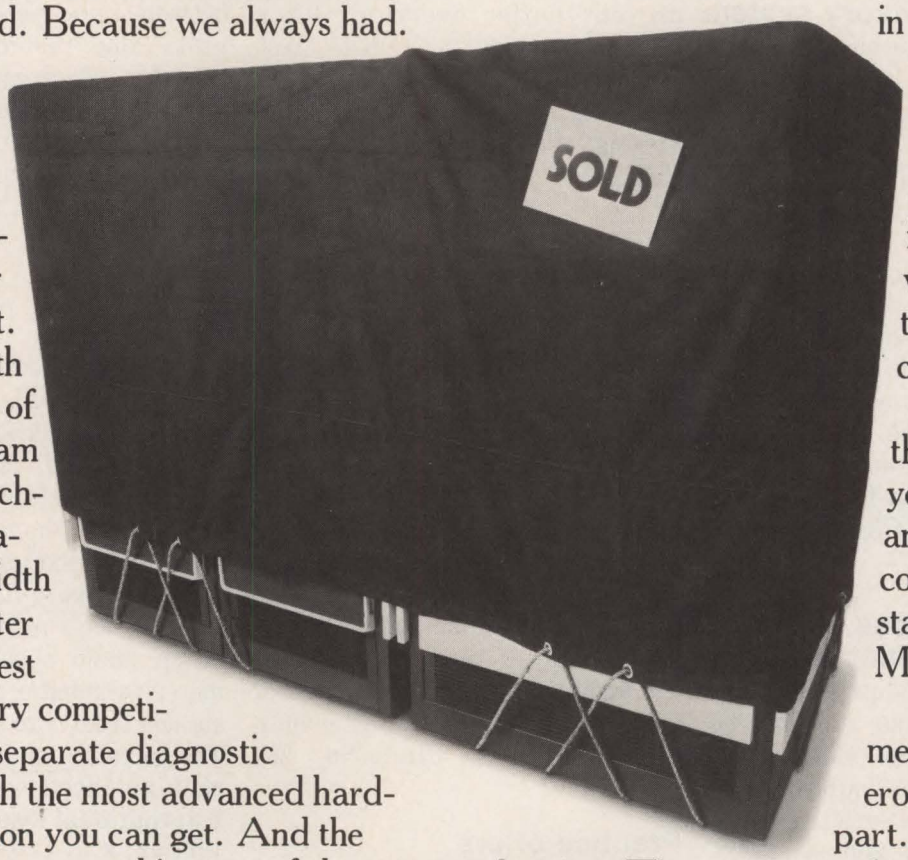
So whatever possessed Boeing to take the first ECLIPSE MV/8000™ computer off our production line?

They believed we'd deliver what we said we would. Because we always had.

In this case we told them we'd deliver a 32-bit system unlike any other on the market.

One with the reliability of VLSI program array logic technology. A machine bandwidth 2-4 times faster than the nearest virtual memory competition. And a separate diagnostic processor with the most advanced hardware protection you can get. And the hardware features on this state-of-the-art-system supported by software. On the day of delivery. (Something some computer companies never get done.)

Which was precisely what they needed to work with the ECLIPSE® systems supporting development of the flight control/avionic systems for their new 757 and 767 airplanes. The first integrated avionic systems built around digital technology for commercial applications.



As it turned out, their MV/8000 system arrived ahead of schedule. Got up and running ahead of schedule. And from day one, has lived up to their expectations.

We tell you this story to point out that in an industry noted for abandoning its customers with every advance in technology, we have continued to take care of our own.

So much so that you can run your NOVA® and ECLIPSE code on our latest, state-of-the-art MV/8000 system.

This is not meaningless generosity on our part. It is a business decision. The one upon which this company was founded.

If you would like detailed information about our new MV/8000 system, call your local Data General sales office. Or write us at MS C 228, 4400 Computer Drive, Westboro, MA 01580.

And should that information tempt you to buy an MV/8000 system, there is one more thing we would like to point out.

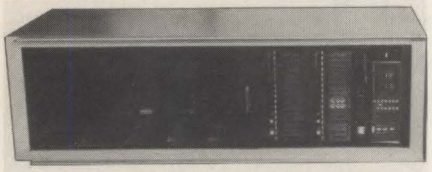
You will not be the first.

Data General

We take care of our own.

CIRCLE NO. 140 ON INQUIRY CARD

datacomm



Digi-Log introduces network supervisory system

This network supervisory system includes automatic monitoring and alarming, testing and reconfiguration capabilities for eight communication lines and a data line monitor for diagnostic testing of all components in a network. The system addresses communications line supervision, EIA interface surveillance, automatic visual and audible alarm conditions, network reconfiguration through patching, communications line testing and protocol monitoring and simulation. Price is $10,378. **Digi-Log Systems, Inc.,** Horsham, Pa. **Circle No 277**

Intertel introduces direct-connect modem

The CM2020 1200-bps single-card modem measures 30 sq. in. The modem, which is Bell 202S-compatible, includes on-board test circuitry, frequency-sensitive carrier detect circuitry and selectable call origination. The modem sells for $199 in two-unit quantities. **Intertel,** Andover, Mass. **Circle No 278**

General Datacomm announces multiplexer

The Megamux multiplexer transports data at 2M bits per sec. The unit allows a user to mix as many as 54 synchronous, asynchronous and isochronous channels. It provides automatic system reconfiguration, on-site, without traffic interruption. **General Datacomm Industries, Inc.,** Danbury, Conn. **Circle No 279**

Data distributor provides error correction

The TP-212 data distributor allows connection of two asynchronous terminals to a synchronous modem or to one or more ports of a multiport synchronous modem. The system provides for error detection, automatic retransmission and the use of X-ON, X-OFF signals to prevent buffer overrun. Other features include a remote test capability and remote reading of operating parameters. **TeleProcessing Products,** Simi Valley, Calif. **Circle No 280**

Data link analyzer detects bit errors

The model 301 data link analyzer detects and displays bit errors, block errors, block count, RTS/CTS delay, loop delay, percent peak distortion, transmit clock rate, receive clock rate and DC voltage. The unit includes single-function slide switch selections, multiple single-function displays, decimal format selections, set-up error indicators, self test, DC voltmeter and audible and dB measurement of input. **Epicom, Inc.,** Altamonte Springs, Fla. **Circle No 281**

Prentice offers 2400-bps modem

The full-duplex P-201C private line/dial modem can operate at 2400 bps on unconditioned type 3002 leased lines or can be directly connected to the direct-distance dial network. On-board ring detect and answer-back circuitry enable automatic data transfers from remote sites. Other features include front-panel indicators that continuously display modem and EIA lead status, built-in modem test circuitry and a stand-alone enclosure with separate power supply. The P-201C is priced at $950 in quantities of one to 10. **Prentice Corp.,** Sunnyvale, Calif. **Circle No 282**

Datatel unveils limited-distance modems

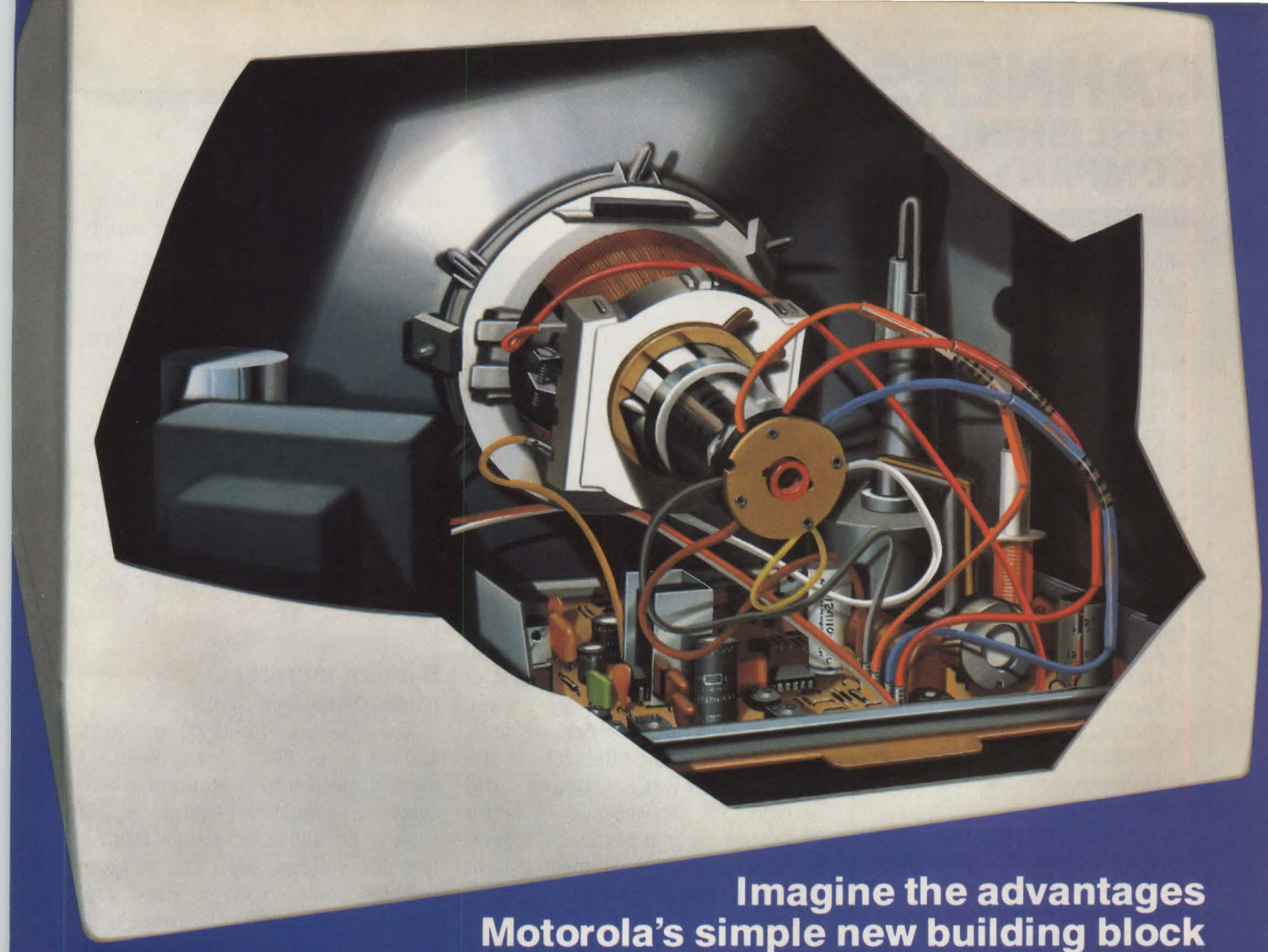
The DCP3000 and DCP3020 asynchronous limited-distance modems provide for operation at speeds as high as 9600 bps on telephone lines, and as much as 19,200 bps on private facilities. The units have a carrier-detector circuit that provides a means for signaling between remote and local units. The units also include analog- and digital-loopback capabilities. Prices for the DCP3000 range from $160 to $200; the DCP3020 is $200 to $250, depending on quantity. **Datatel, Inc.,** Cherry Hill, N.J. **Circle No 283**

IDS offers audio generator

The model 8508 audio generator and monitor allows an operator to listen to and measure received analog signals appearing at a modem-telephone line interface. The unit generates a 1-KHz tone variable from 0 dBm to −16 dBm. The module's monitor is composed of an audio speaker and a dBm meter to monitor and measure line signals from −20 dBm to +3 dBm. The portable unit is priced at $985; a rack-mounted version is $730. **International Data Sciences, Inc.,** Lincoln, R.I. **Circle No 284**

IDS introduces tech control center

The Tech Control Center includes the vendor's Hawk 4000 series Datatrap, which performs interactive diagnostics and passive monitoring of serial data appearing at an EIA RS232 interface. The system also includes the series 8900 MiniTech control modules, which provide patching, switching and monitoring for testing data networks, and optional DCD alarms and power-supply redundancy features. **International Data Sciences, Inc.,** Lincoln, R.I. **Circle No 285**



Imagine the advantages Motorola's simple new building block system will give your design engineers

Motorola's new Alpha Series is more than a new generation of 12" and 15" display modules. Its design, though remarkably simple, redefines the standards by which you will measure the performance of your terminals.

Greater reliability

On-going tests project a dramatic 75% increase in MTBF over even our own most reliable MD series.

Greater reliability is a result of synergistic elements at work at Motorola. Paramount is product design. The Alpha Series makes extremely efficient use of fewer components and incorporates integrated circuits throughout the system.

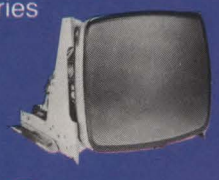
Advanced manufacturing processes and revolutionary testing equipment at Motorola's unique multi-million dollar facility in Joplin, MO, are designed to improve the quality and reliability of the Alpha Series.

Enhanced video performance

Motorola has extended resolution and bandwidth in the Alpha Series for sharper alphanumeric presentation. Center resolution has been increased from 1000 to 1200 lines; corners from 750 to 950 (P4 phosphor). Bandwidth has been stepped up from 22 MHz to 30 MHz (−3Db). Compare geometry and linearity specifications and you'll find that Motorola's Alpha Series ranks among the highest in the industry.

Design flexibility

Whether your requirements call for composite video, true TTL compatibility or direct drive, the versatile Alpha Series can handle a wide signal input variation. Horizontal scan rate is available at 15.7 or 18.7 kHz. The streamlined chassis of the new display allows you more flexibility in your mechanical design. Ease of access to the controls and unique options such as 24 vdc operation and 20 pin ribbon cable add to making the Alpha Series extremely adaptable display modules.



Motorola displays the character of your business.

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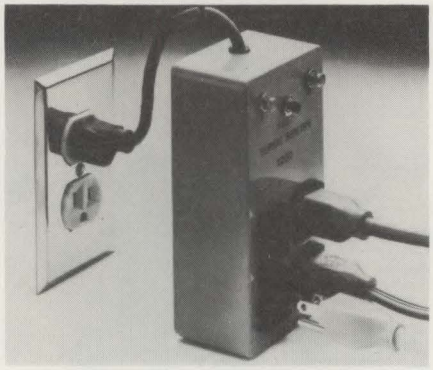
New Products

power supplies



Surge-control device protects against transients

The model SS-120-D surge-control device protects equipment that is susceptible to damage when power-line voltage drops or fails. The system also detects short-duration voltage surges and responds in picoseconds to shunt unwanted or dangerous voltages. Features include an indicator light that shows if a dropout has occured, a reset button that allows power to be restored and four 120V receptacles for multiple equipment protection. Price is $132.50. **RKS Enterprises, Inc.,** San Jose, Calif.
Circle No 286

Elpac offers DC-DC supply

The 6W, single-output DC-DC power supply is available in 12V, 0.5A; 15V, 0.4A; or 28V, 0.2A outputs driven from any DC source of 4.5 to 5.5V. Features include isolated primary to secondary power, filtered to a maximum of 120 mV peak-to-peak, (50 mV typical), with regulation of ±.15 percent. The system sells for $41. **Elpac Power Systems,** Santa Ana, Calif.
Circle No 287

AMD announces 20-pin subsystem

The Am6300 power control subsystem, a 20-pin IC, incorporates all the necessary functions to monitor, control and regulate a power supply system. Features include 2.5V, ±1 percent temperature-compensated reference, 100-mA output for driving external power transistors, logic-controlled power-up enable for supply sequencing, independent overvoltage and undervoltage shutdown circuitry and independent current-limit shutdown circuitry. Prices begin at $5 each in 100-unit quantities. **Advanced Micro Devices, Inc.,** Sunnyvale, Calif.
Circle No 288

System monitors minicomputer lines

The "Glitch Sentry" monitors 120-VAC power lines feeding minicomputers, test equipment and sensitive electronic equipment. It sounds an alarm at power failure, low line voltage, high line voltage, voltage spike, voltage drop and high-frequency noise. It comes with a card describing possible causes and solutions for power disturbances. The unit sells for $300 in single-unit quantities. **Billings McEachern Inc.,** Sunnyvale, Calif.
Circle No 289

Sola introduces 50-Hz mini UPS

This 50-Hz mini UPS unit protects small electronic equipment from AC power line problems, including blackouts, brownouts, transients and noise. The unit is available in 300 and 600 VA ratings, and is contained in an enclosure with a sealed, maintenance-free, lead-acid type battery. The unit provides 24 min. of regulated power at full load from its battery backup. The unit also responds to AC line fluctuations, actively regulating output voltage and isolating the load from transients and brownout conditions. **Sola Electric,** Elk Grove Village, Ill.
Circle No 290

A Brilliant New Graphics Terminal from Genisco

Raster brilliance, contrast and erasability. Z-8001 intelligence plus programmability. All in a desk top, high resolution (1024 x 792), monochrome, graphics terminal ticketed at a low $10,000.*

Genisco's G-1000 is the low cost graphics terminal you've been holding your purchase order for. It is the first direct raster replacement for the Tektronix 4014-1** terminal—plug to plug and software compatible. But, at the same time, the on-board Z-8001 microprocessor plus 16K words each of RAM and PROM let you develop your own programs at your pace while your system is up and running on existing software (like PLOT-10).

Because the G-1000 is a bit map raster scan device it can do things a storage tube can't approach—like provide easy viewing in normal room light, and allow erasure of any portion of the screen without altering or redrawing the rest of the display. Genisco has equipped the G-1000 with all the quality features—60Hz noninterlaced refresh for flicker free viewing, a large 19 inch display, a detachable keyboard with cursor joystick. And, an optional alphanumeric overlay eliminates the need to use a second terminal. The unit supports a selection of I/O equipment including graph tablet and hard copy devices. With all that and the Z-8001 intelligence, the list of future capabilities is virtually open-ended.

Take a look at Genisco's new G-1000—the 4014-1 replacement and a whole lot more.

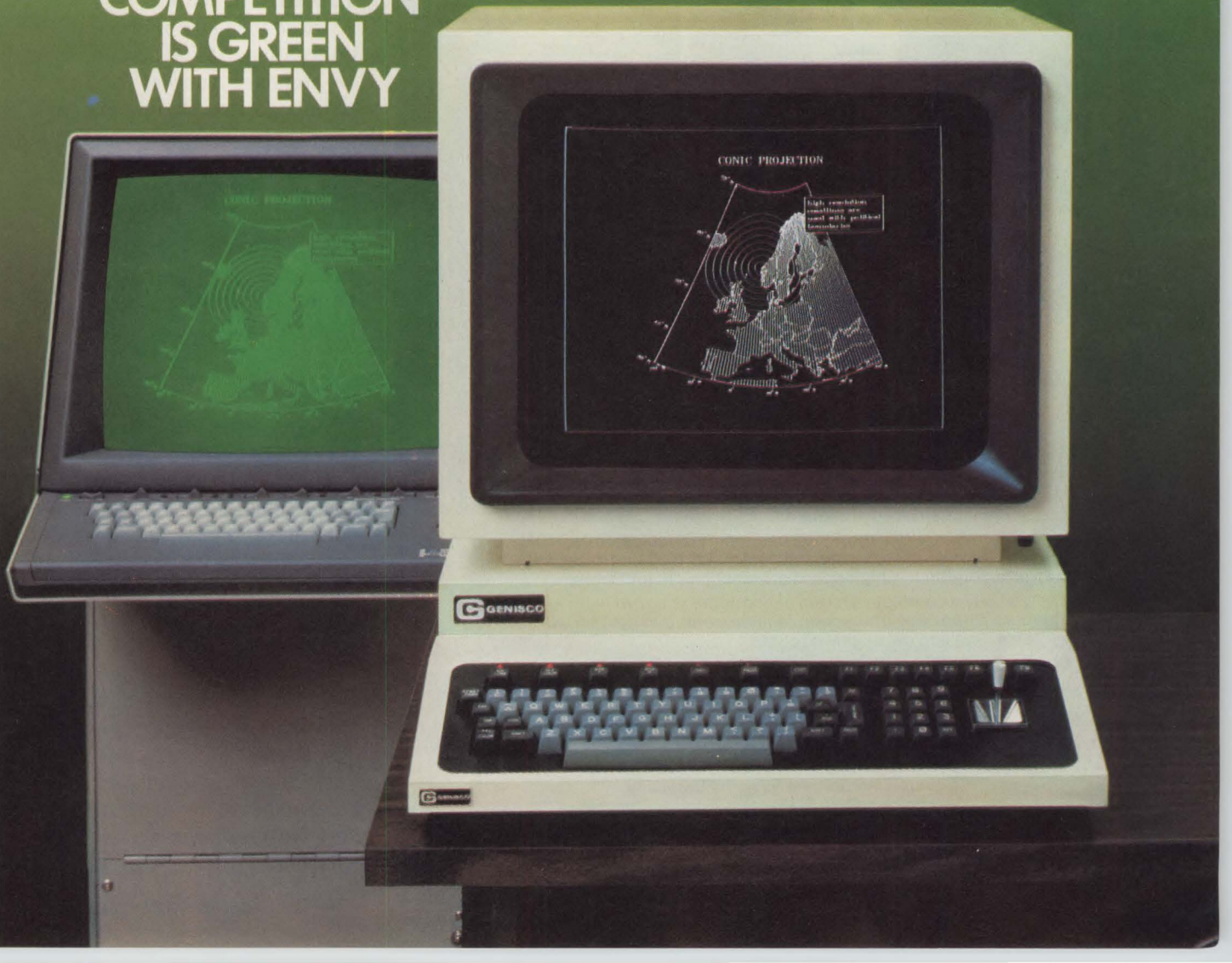
Call or write for more information to Genisco Computers Corporation, 3545 Cadillac Avenue, Costa Mesa, California 92626. (714) 556-4916.

*Price varies according to quantity.
**Trademark of Tektronix
Graphics software from ISSCO Graphics.

Genisco

CIRCLE NO. 144 ON INQUIRY CARD

THE COMPETITION IS GREEN WITH ENVY



power supplies

Data Devices introduces portable power conditioners

The "Datapower" portable power conditioner eliminates the need for a dedicated power line for computers. Input voltages as low as 25 percent below normal are regulated to within ±7 percent of nominal. The unit can be used for computers, minicomputers, security systems, peripherals, word-processing equipment and μcs. The unit sells for $995 to $2195. **Data Devices International,** Chatsworth, Calif.

Circle No 291

Ruggedized Microcomputer

It's Easy to Design Your Severe Environment System Using our Ruggedized Version of Intel's 86/05 Microcomputer and Versatile Support Modules.

SECS 80 is a ruggedized version of Intel's iSBC* single-board computer. Even uses the same development system software.

Meets MIL-E-5400, 4158, 16400, making it perfect for military, avionics, and tough industrial environments.

SECS 80 comes with a multitude of support modules: RAM, ROM, EPROM, digital tape recorder and controller, 1553 interface, A-D converter, digital I/O, high-speed arithmetic unit, and more.

You can buy a complete system or configure your own with individual modules. Either way, this versatile microcomputer system will save you valuable time and development costs.

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CIRCLE NO. 145 ON INQUIRY CARD

Sola introduces 70-VA power regulator

This 70-VA voltage regulator, intended to protect small electronic equipment against all power-line problems except blackouts, features noise-rejection values of 120 dB in common mode and 60 dB in transverse mode, nearly total line isolation of less than 3 pfd and continuous, stepless voltage regulation. Input line voltage fluctuations as great as ±15 percent are regulated at the output to ±3 percent. The unit is available in 50 Hz and 60 Hz types. Price is $150 in single-unit quantities. **Sola Electric,** Elk Grove Village, Ill.

Circle No 292

Fuse kits offer 100 mA to 10A

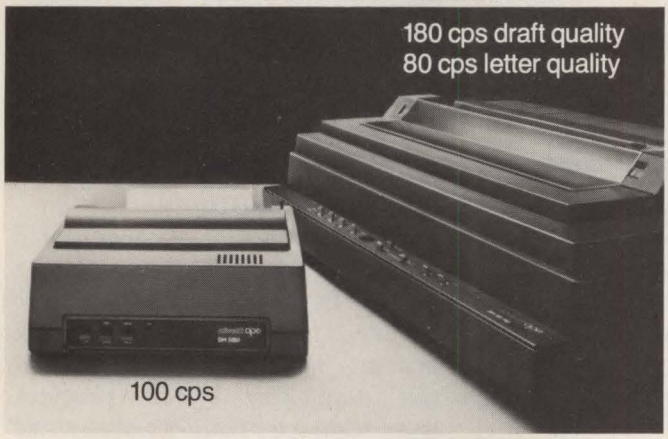
These fuse kits offer a total of 360 international 5- × 20-mm. fuses in 18 standard current ratings from 100 mA to 10A. One kit is composed of quick-acting fuses, and the other is composed of time-lag types. The kits are designed for R & D labs and maintenance and repair applications. Prices in small quantities are $67 or $78, depending on type. **Panel Components Corp.,** Santa Rosa, Calif. **Circle No 293**

Open-frame switchers have soft-start circuitry

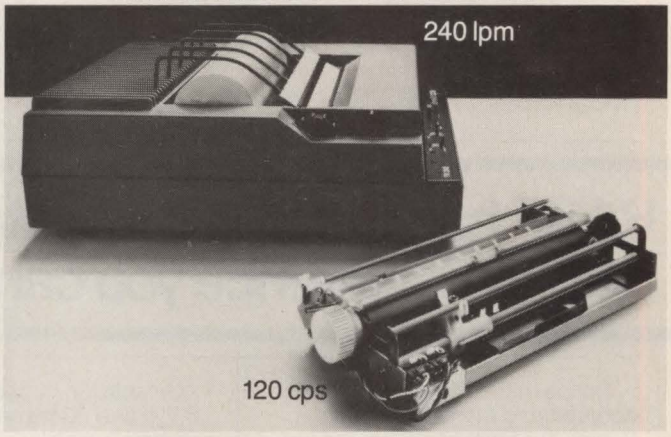
The NT150 and NQ150 150W open-frame switching power supplies have triple- and quad-output capability with post-regulated auxiliary outputs. Features include built-in line filtering and soft-start circuitry, 115/230 VAC input capability, full regulated auxiliary outputs, LSI control circuitry and built-in remote sense and overvoltage protection on the main output. Price is $282 in quantities of one to nine, and $196 in quantities of 100 to 249. **National Power Technology,** Anaheim, Calif. **Circle No 294**

ope means:

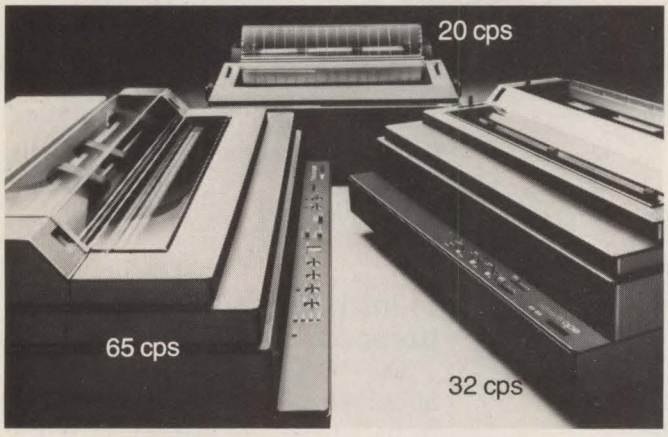
DOT MATRIX PRINTERS



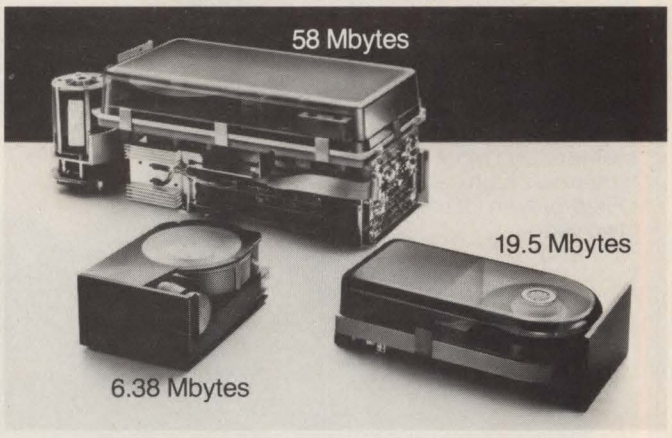
THERMAL PRINTERS



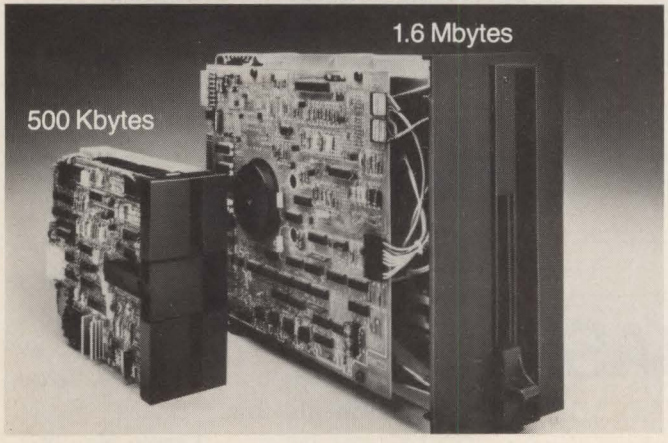
DAISY WHEEL PRINTERS



FIXED DISK DRIVES



FLOPPY DISK DRIVES



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OPE means: 200 highly skilled engineers in R&D
1,500 people involved in production
432,000 square feet of plant space

OPE means: Technology, know-how and quality: the benefits of over 70 years' experience.

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CIRCLE NO. 146 ON INQUIRY CARD

interactive terminals

Piiceon introduces intelligent terminal

The model 1000 terminal includes a 66 × 80 character video display, 64K bytes of RAM, 8K bytes of PROM, two dual-sided, double-density floppy-disk drives with 1.2M bytes of local storage each, a 7 × 9 dot-matrix display, 128 ANSII characters and three RS232C ports. Price is $8654 in 25-unit quantities, with OEM discounts available. **Piiceon, Inc.,** San Jose, Calif.

Circle No 295

Metrologic announces laser data terminal

The MS123 laser data terminal includes a laser bar-code scanner, a 16-pad keyboard, a 24-character display and a 21-column matrix printer. The stand-alone, interactive data-entry system provides laser scanning of objects of any size or shape at distances as far as 20 ft. The printer provides printout for tickets, receipts, date due slips and production tickets. The MS123 is priced at less than $3000 in 100-unit quantities, including printer. **Metrologic Instruments, Inc.,** Bellmawr, N.J. **Circle No 296**

TI introduces personal terminal

The Insight Series 10 personal information terminal enables a user to dial a telephone number, type in a log-on sequence and instantly retrieve information from the news, law, commodities, banking, insurance and stock market areas. The Series 10 also provides a method for sending and receiving inter/intraoffice communications through a host computer. The screen can display 24-row × 40-character columns, with a total screen capacity of 960 characters. Other features include a 53-key keyboard and an EIA RS232C interface. The terminal sells for $995 in single-unit quantities. **Texas Instruments Inc.,** Dallas, Texas.

Circle No 297

BASF has the 8″ Winchester drive with the difference you can see.

Notice that our linear voice coil actuator and many of our electronics are positioned *outside* the basic package. It makes a big difference in reducing circuit-damaging heat, and cuts your risk of magnetic field-induced data loss. Our linear actuator is a far more accurate and higher performance design than the competition's rotary or stepper motor systems, and more appropriate to tomorrow's high track densities.

- Field-proven for more than two years.
- Available for immediate delivery.
- 8, 24, and 40 megabyte unformatted capacity.
- SMD, Disk Bus, and ANSI interface options.
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CIRCLE NO. 147 ON INQUIRY CARD

The Zenith Smart Terminal.

Compare the features.

Reverse video by character can be used to emphasize words, lines, phrases or paragraphs.

High Resolution CRT reduces eye strain and operator fatigue.

Z80 Microprocessor-control brings easy editing, cursor flexibility and reverse video highlighting to your on-line system.

Professional touch keyboard follows standard typewriter layout with 72 keys, including 12 special function keys, (8 user programmable) plus 12 key numeric pad.

Underline or reverse video blinking cursor is addressable to allow you to edit or correct on the entire screen.

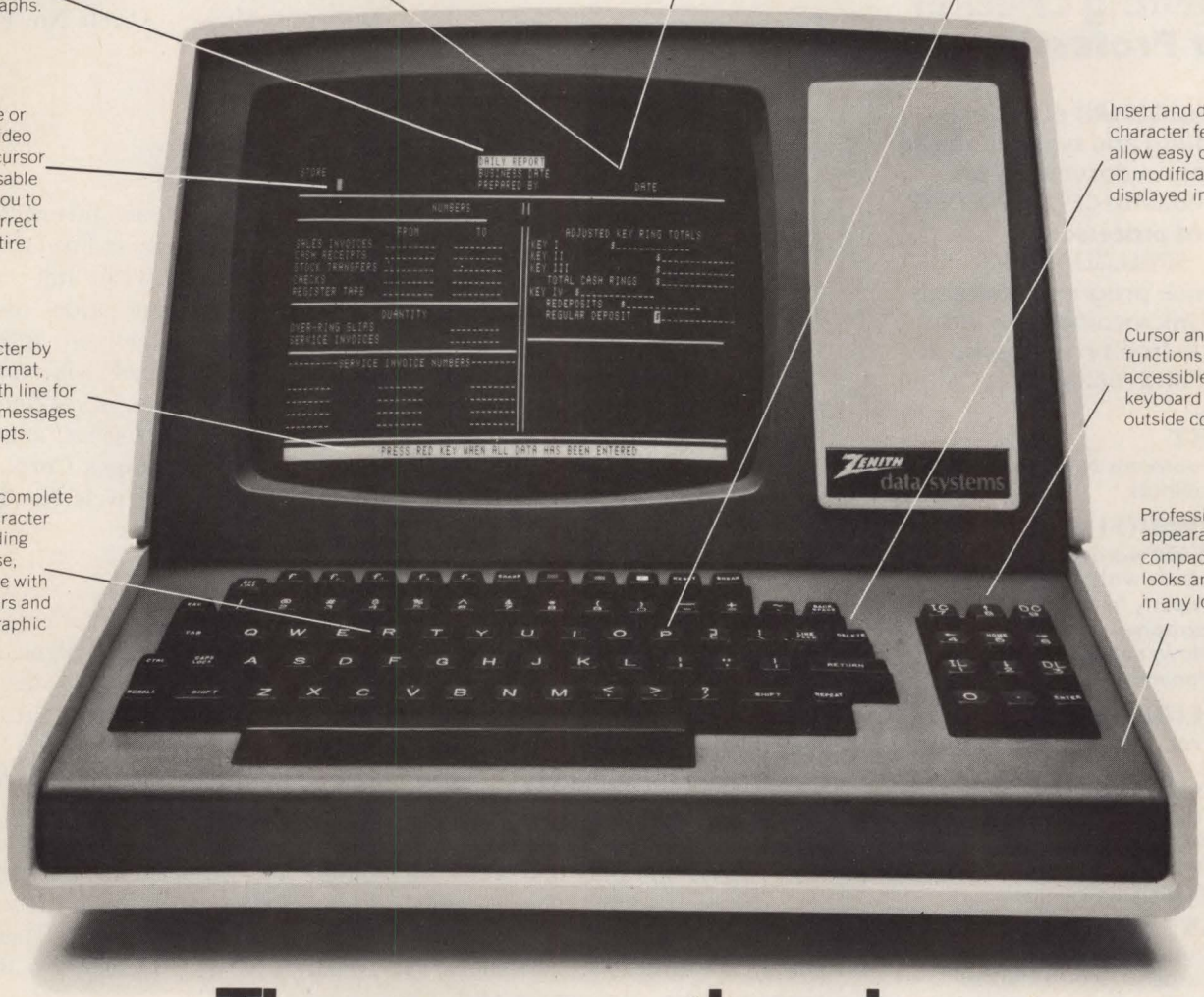
Insert and delete character features allow easy correction or modification of displayed information.

80 character by 24 line format, plus a 25th line for operator messages and prompts.

Cursor and special functions are accessible by keyboard or outside computer.

Displays complete ASCII character set including upper case, lower case with descenders and special graphic symbols.

Professional appearance and compact size looks and fits well in any location.



Then compare the price.

For under $1000,* the Zenith Z19 smart terminal is a very smart buy. It can be utilized with almost all commonly available computer systems and provides the most advantageous features for data entry, editing, inquiry, and transaction processing—wherever you need a top-of-the-line, general-purpose terminal.

The Z19 is ideal for high speed data entry. The 12" diagonal CRT gives you a crisp, clear video image. And the Z19's keyboard follows the standard typewriter keyboard layout for operator ease. Along with this you get ANSI and DEC®-VT52 compatibility. And one other important plus: Quality you can depend on, because it's Zenith.

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CIRCLE NO. 149 ON INQUIRY CARD

New Products

interactive terminals

Computerwise offers alphanumeric terminal

The TransTerm 1 alphanumeric terminal uses a 64-character, 5 × 7 dot-matrix LCD organized in two 32-character lines with an underscore cursor. The unit displays a 96-character ASCII character set and communicates in full-duplex RS232 asynchronous, ASCII with 20-mA current loop or RS422 optional. Switch-selectable 300, 1200, 2400 and 9600 baud rates are available. The unit sells for $449 in single-unit quantities. **Computerwise, Inc.,** Grandview, Mo. **Circle No 298**

Protocol terminal accesses two mainframes

The ECS 4000 dual protocol series terminals directly access two mainframes and can be configured into concatenated local networks. Capabilities include Burroughs TD 830, NCR 796-501, Honeywell VIP 7700 and 7801 emulations and VT 52-compatible TTY. The terminal includes dual-legend keys for protocol-unique functions, protocol cards that contain firmware and I/O facilities and an executive PROM. Price is $4300 in single-unit quantities, with volume discounts available. **ECS Microsystems,** San Jose, Calif. **Circle No 299**

Raytheon introduces 9-in. display terminals

The models 4205, 4206 and 4207 9-in. terminals display as many as 1920 characters. Models 4205 and 4207 support a model 4206 slave display connected by coaxial cable at as far as 200 ft. Characters are displayed in a 9 × 7 dot matrix, 0.17 in. × 0.07 in. (80 characters per line) or as a 7 × 7 dot matrix, 0.13 in. × 0.09 in. (64 characters per line). A half-dot shift provides character recognition comparable to a 13-dot matrix. **Raytheon Data Systems,** Norwood, Mass., **Circle No 300**

Ampex offers interactive VDT

The Dialogue 30 interactive terminal operates in on-line/local or monitor modes, with full- and half-duplex communication protocol. The unit offers an RS232C asynchronous interface, which operates at 19.2K baud, a 24-line × 80-character data format and 96 ASCII characters. **Ampex Corp.,** El Segundo, Calif. **Circle No 301**

Terminal has I/O capability

The model TM71 terminal includes an alphanumeric data-entry/display and parallel TTL I/O. Features include a 42-key keyboard, a 16-character LED display with scroll-left/scroll-right controls, an 80-character output buffer, transmit buffer and programmable function keys. Price is $450 in 100-unit quantities. **Burr-Brown,** Tucson, Ariz. **Circle No 302**

Interface announces alphanumeric terminal

The Alpha-Tone portable, battery-operated terminal with a 40-key alphanumeric keypad can be acoustically coupled to any telephone handset. The terminal uses the vendor's touch-talk order entry system, TOES. Applications include order entry and order confirmation for automotive parts, appliances, appliance parts, business supplies, apparel and electrical and electronic equipment. Price is less than $250. **Interface Technology, Inc.** St. Louis, Mo. **Circle No 326**

Our CIT-101 video terminals are upstaging all other competitive models. For one, you can count on immediate shipment. And secondly, you can expect truly outstanding performance.

Here are just some of the features that make this CRT the star of today's video scene: Plug compatibility with the DEC® VT 100, and DEC® VT 52, and other 132-column models. A 16-megahertz Monitor and non-glare screen, coupled with matted non-glare key-caps, make for a design that is optically engineered to reduce eye fatigue. Variable speed smooth scrolling for more convenient data display. Easy change from 80 to 132 columns without memory loss, made possible by our standard 3200 character buffer (132 columns x 24 lines). Better reading double-height characters, available in single and double width formats. A monitor mode that displays the control codes you need in program debugging instead of an expensive line analyzer. A set-up mode "C" that offers you full VT 52 mode, "form-feed" to clear the screen, half and full duplex selection, as well as window erase and screen dimmer capability.

You also get special operator-oriented features, such as a "no-scroll" key status indicator, a set-up mode dictionary display, repeat key, home/clear key and "time of day" in set-up mode. Besides unrestricted 9600 BAUD transmission, the CIT-101 offers an optional independent bi-directional serial port that provides you with a link to a variety of other peripherals. All this is accomplished without the use of custom LSI.

As you can see, the CIT-101 by C. Itoh steals the show from all other CRTs. And it's miles ahead when you want your show to go on, as quickly as possible. Contact our exclusive representative for an exclusive preview. ACRO Corporation, 18003-L Skypark South, Irvine, CA 92714, (714) 557-5118; Houston, TX, (713) 777-1640; Cherry Hill, NJ, (609) 667-4114; Chicago, IL. (312) 992-2346.

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CIRCLE NO. 150 ON INQUIRY CARD

GET THE FACTS

About the $24 billion* minicomputer and microcomputer markets

The tenth annual *1981 Mini-Micro Computer Market Report* gives you the facts. It is the industry's most comprehensive survey covering purchases for the past year plus projected purchases during the next 12 months in 22 separate categories including minicomputers, microcomputers, tape and disk drives, CRT terminals, printers, modems, software and related equipment. For OEMs and end-users.

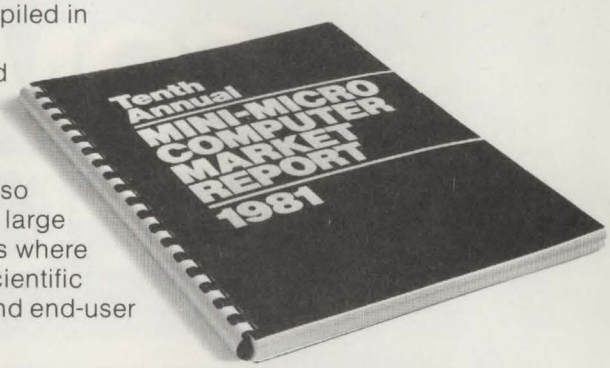
State-of-the-industry

If you are marketing to the minicomputer and microcomputer markets, the *1981 Mini-Micro Computer Market Report* is *must* reading. It gives you the key market trends in each and every product category. With it, you can:

- determine competitive positions
- evaluate current market shares
- determine projected changes in market shares
- identify emerging industry growth areas
- identify the major criteria used by purchasers to evaluate suppliers
- identify application trends
- analyze industry or product growth trends to better plan marketing directions

Most comprehensive industry survey

The *1981 Mini-Micro Computer Market Report*, compiled in conjunction with the computer industry's leading independent research firm, Dataquest, Inc., is based on responses received from more than 12,000 *Mini-Micro Systems* readers. Covered by the report are Third-Party OEMs such as systems integrators, specialized system OEMs, and, software houses. Also covered are the sophisticated end-users located at large corporations with volume requirements, at EDP sites where minicomputers interface with mainframes, and in scientific and engineering areas. The report gives you OEM and end-user buying plans separately.



Market Segment Data Base

In addition, you can get the specific buying plans of individual respondents for any of the 22 product categories covered by the *1981 Mini-Micro Computer Market Report* through our *Market Segment Data Base* (price upon request). For the facts about the $24 billion mini-micro computer markets, call your *Mini-Micro Systems* sales representative. Today.

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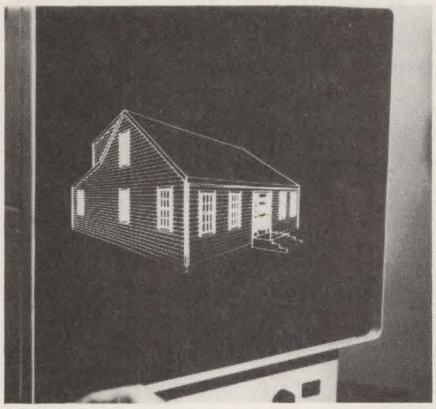


Sigma announces CAD system

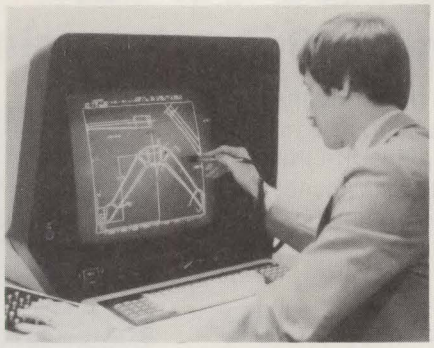
The Sigmagraphics II general-purpose μp-based CAD system includes a Z80A μp with a 176K-byte RAM, a drum plotter, a "Rastergraf" CRT, a custom plasma display, an operator's desk and software. The "Rastergraf" I/O display device provides an image resolution greater than 1000 × 1000 pixels and screen sizes as large as 25 in. The system accepts local generation of drawing details. Sigmagraphics II sells for less than $100,000. **Sigma Design West, Ltd.,** Englewood, Colo. **Circle No 303**

TAC introduces formatter for Okidata printers

The PF/2A print formatter accepts asynchronous RS232C ASCII input and provides parallel output to the Okidata SL125 or SL250 printers, enabling them to print bar codes, variable size and aspect ratio characters, product and corporate logos, variable forms layout and labels. Features include the ability to expand characters independently in both horizontal and vertical dimensions and italicized, half-tones or white-on-black characters. Price is $2295. **Technical Analysis Corp.,** Atlanta, Ga. **Circle No 304**

Vector system emulates IBM 3250 equipment

The VG 8250 graphics display system, which supports computer graphics-augmented design and manufacturing, emulates IBM 3250 equipment and uses the IBM graphics access method driver. The system includes a hand-held tablet/digitizer, a maintenance/data management supervisor, continuous rotation and scaling of characters and an optional electrostatic plotter. **Vector General,** Woodland Hills, Calif. **Circle No 305**



Vector General unveils graphics display system

The VG 8250 graphics display system, which emulates the IBM 3250, supports the computer graphics-augmented design and manufacturing programming system. The system has a channel speed as high as 1.2M bytes per sec. and can operate in selector, block-multiplexer or byte-multiplexer modes. Other features include a hand-held tablet/digitizer, a maintenance/data-management supervisor, continuous rotation and scaling of characters and an optional electrostatic plotter. **Vector General,** Woodland Hills, Calif. **Circle No 306**

Graphics tablet is compatible with PET

This graphics tablet, which is compatible with PET computers, offers 100/200 point-per-in. resolution, and 100 coordinate pair-per-sec. conversion rate. The tablet measures 13 × 15.3 × 0.75 in. The unit facilitates hard-copy verification because an 8½- × 11-in. pad of paper fits onto the tablet's surface. **Kurta Corp.,** Tempe, Ariz. **Circle No 307**

Office Systems offers graphic arts system

This computer-assisted slide-generation system for graphic artists consists of a μc-based slide system mounted in a work table. A touch-sensitive computer screen enables a user to select stored slide formats and, using a graphic tablet, sketch original art or add text for slide titles, with a keyboard. Pressing a foot switch provides an exposed slide in 6 sec. on the system's output camera. Options include a back-lit light table (built into a graphics tablet) and a 10M-byte Winchester disk for storing as many as 4000 images. Price is $1900 per month, with no per-slide charges. **Office Systems,** Los Angeles, Calif. **Circle No 308**

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CIRCLE NO. 153 ON INQUIRY CARD

New Software

Package provides WP for System/34

ZWORD/34, a word-processing system for the IBM System/34, permits on-screen format changes so the image on the screen is identical to the image printed. Data can be inserted from existing files without converting the files to a special format. A single instruction is used to print the first page of a document on a letterhead and the remainder on continuation sheets (or to otherwise split output between two types of forms). Documents are created and maintained on a full-screen text editor (79 characters × 20 lines). ZWORD/34 sells for $3000. **Accusoft, Inc.,** San Francisco, Calif.

Circle No 309

Elliam introduces Master Catalog for CP/M

A Master Catalog system that tracks all files on all floppy disks in use runs on μcs under the CP/M operating system. The package produces selected or complete listing of file names, in alphabetical order, with the name of the disk containing each file. The package also sorts the directory on a diskette in alphabetical order. Another routine lists the directory in alphabetical order, three or four columns wide, giving the size of each file. Source and object programs on floppy disk sell for $10, plus $1.50 for shipping and handling. **Elliam Associates,** Woodland Hills, Calif.

Circle No 310

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Get the only tape subsystem in the world that works with ANY Data General CPU or DG emulator, at a price you would expect to pay for only a tape drive. It's the most cost-effective tape backup available for Winchester disc drives, giving you maximum storage in the shortest possible time.

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CIRCLE NO. 154 ON INQUIRY CARD

THE NEW BELDEN BIT-DRIVER™ HAS ARRIVED

For simplex and full duplex asynchronous data transmission at up to 56K bps. Belden's new Bit-Driver system is ideal for in-house and in-plant interconnection of a wide range of EDP and process control equipment. Users can now get all hardware including either metallic or optical Bit-Drivers, plus cables to match specific environmental needs and RS-232 interface cables from one supplier. Our integrated system approach gives you "matched performance" reliability for the entire data link. Our optical unit is ideal for solving your lightning, EMI and ground loop problems, too.

When you consider the savings in telephone company rates and equipment rental charges plus the advantage of owning your own system, the Bit-Driver is an idea whose time has arrived. For more information, contact Belden Corporation Fiber Optics Group, 2000 S. Batavia Ave., Geneva, IL 60134, (312) 232-8900.

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New Software

ESP introduces system for Apple IIs

ESP dataKEYper, an interactive, menu-driven data-management system for an Apple II computer with 48K bytes of memory, includes a query capability that allows basic statistical reporting on the data. A report generator feature allows a user to custom-tailor reports. Other features are mailing-list processing, sort, list, create and edit. The product comes on 5¼- and 8-in. floppy- and 10M-byte Winchester disk drives. Price is $99 for the floppy version and $449 for the hard-disk version. **ESP Computer Resources Inc.,** Hollis, N.H.

Circle No 311

ADABAS-M DBMS available for VAX/VMS

The ADABAS-M DBMS runs on DEC VAX-11/750 and VAX-11/780 computers under the VMS operating system. ADABAS-M, written in macro assembler uses inverted/relational data structures with data and index compression. The reentrant, multithreaded nucleus supports a data base of multiple files. A single-CPU license sells for $40,000. **Software AG of North America, Inc.,** Reston, Va.

Circle No 312

Disk operating system for TI TM990 µps

PDOS/EXPRES, a multi-user, multitasking operating system for the TI TM990 µp module family, includes an 8K-byte PDOS module, BASIC language interpreter, character and screen editor, assembler, floating-point package and user utilities. PDOS supports 5¼- or 8-in. floppy disks, bubble memory, hard disks and as many as 256K bytes of memory in sequential, random, shared and read-only access modes. PDOS-EXPRES sells for approximately $1500. **Eyring Research Institute, Inc.,** Provo, Utah.

Circle No 313

FORTH announces Exorset 30 polyFORTH

PolyFORTH, an operating system and programming language for the Motorola Exorset 30 µc, is intended for instrumentation, process control, data acquisition and graphics. It also runs on the 6800 and 6809 processors on the Motorola EXORcisor development system and Intel, DEC and other systems. The system includes a screen editor, assembler, interpreters and FORTH language compiler. Options include 2D graphics, a math package based on fixed-point fraction arithmetic and file management. List price is $4750. **FORTH, Inc.,** Hermosa Beach, Calif. **Circle No 314**

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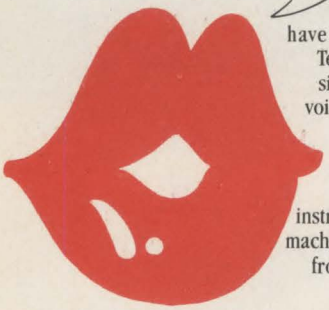

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	LA34 DECwriter IV Forms Ctrl.	1,095	105	58	40
	LA120 DECwriter III KSR	2,295	220	122	83
	LA120 DECwriter III RO	2,095	200	112	75
	VT100 CRT DECscope	1,595	153	85	58
	VT132 CRT DECscope	1,995	190	106	72
TEXAS INSTRUMENTS	TI745 Portable Terminal	1,595	153	85	58
	TI765 Bubble Memory Terminal	2,595	249	138	93
	TI Insight 10 Terminal	945	90	53	34
	TI785 Portable KSR, 120 CPS	2,395	230	128	86
	TI787 Portable KSR, 120 CPS	2,845	273	152	102
	TI810 RO Printer	1,895	182	102	69
	TI820 KSR Printer	2,195	211	117	80
DATAMEDIA	DT80/1 CRT Terminal	1,695	162	90	61
	DT80/5 APL CRT	2,095	200	112	75
	DT80/5L APL 15" CRT	2,295	220	122	83
LEAR SIEGLER	ADM3A CRT Terminal	875	84	47	32
	ADM31CRT Terminal	1,450	139	78	53
	ADM42 CRT Terminal	2,195	211	117	79
HAZELTINE	1420 CRT Terminal	945	91	51	34
	1500 CRT Terminal	1,095	105	58	40
	1552 CRT Terminal	1,295	125	70	48
TELEVIDEO	920 CRT Terminal	895	86	48	32
	950 CRT Terminal	1,075	103	57	39
NEC SPINWRITER	Letter Quality, 55/15 RO	2,895	278	154	104
	Letter Quality, 55/25 KSR	3,295	316	175	119
QUME	Letter Quality KSR, 55 CPS	3,395	326	181	123
	Letter Quality RO, 55 CPS	2,895	278	154	104
HEWLETT PACKARD	2621A CRT Terminal	1,595	153	85	58
	2621P CRT Terminal	2,750	263	154	99
CENTRONICS	730 Desk Top Printer	715	69	39	26
	737 W/P Desk Top Printer	895	86	48	32

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CIRCLE NO. 156 ON INQUIRY CARD

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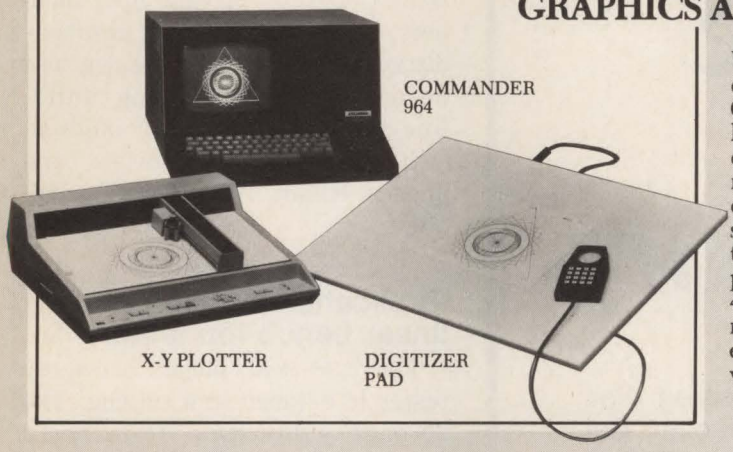
GRAPHICS AND DIGITIZING



With all the self contained vector and point plotting capabilities of a sophisticated graphics terminal, our COMMANDER 964 lets you create bar charts, pie charts histograms and complex point-to-point plots. You can even output displays intended for a Tektronix® 4010 with our terminal emulator. And, the Model 964 provides you with a double processor Z-80A architecture so that display buffers, software, firmware and associated real-time constraints of the 512 x 256 graphics capability are all independent of the primary 64K memory processor system. As a result, the full 4.0 MHz processor speed is dedicated to the end user which means that you can run larger programs and enjoy faster execution times when using CP/M™ and PASCAL based software.

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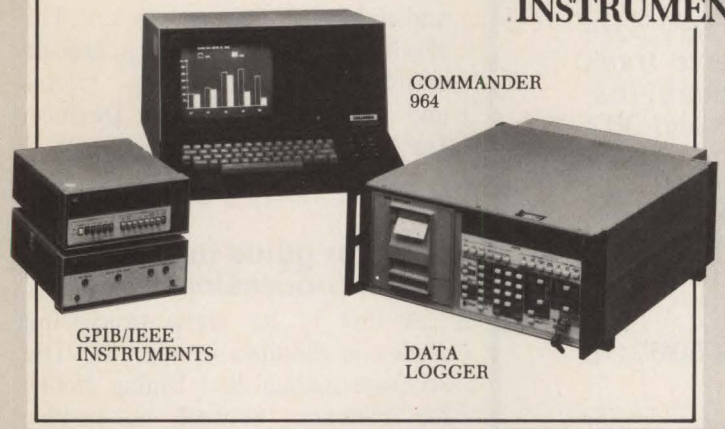

Columbia's COMMANDER has the operating performance and interface flexibility to handle your instrumentation and control applications. It has four RS232 ports that can handle serial data up to 19,200 baud, four parallel ports and four independent, programmable-interval timer/counters. In addition, the dual Z-80A architecture with maximum RAM expansion to 128K, full 512 x 256 graphics capability together with optional DMA, GPIB/IEEE controller and 9511 Arithmetic Unit, make the COMMANDER a powerful, intelligent controller. All of this, and the availability of higher level languages such as BASIC, FORTRAN, PASCAL and ASSEMBLERS, makes our COMMANDER the best.

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CIRCLE NO. 157 ON INQUIRY CARD

The success of the Cheyenne is really an inside story.

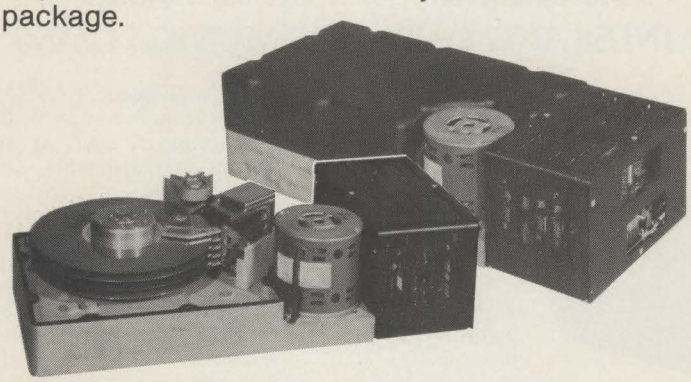
From the outside, the Cheyenne sealed disc memory tells the story of its rugged reliability. But *inside,* you can see the result of more than 15 years experience building rotating memories.

The Cheyenne features SLI's unique rotary positioner and closed-loop dedicated servo track system. Capacity is up to *51.4 megabytes,* unformatted, on 4 discs, with 7.3, 22 and 36.7 MBytes available.

Other Cheyenne features include microprocessor-based drive electronics, with built-in diagnostics; SMD interface (others available); 478 TPI and 6500 BPI.

The A/C spindle motor is standard, as is 50/60 HZ with no hardware change required.

There's more... inside the Cheyenne. Write or call Ray Kristiansen for the full story and our literature package.



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Woodland Hills, Calif. 91367
(213) 884-7300
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CIRCLE NO. 158 ON INQUIRY CARD

New Literature

Bulletin lists communications equipment

A line of data-communications products is detailed in a catalog. The 28-page booklet describes the Bell-compatible private line, modems, multiplexers and limited-distance modems. The catalog also describes rack-mounting units, line-saving devices, modem-switching devices, cabinets and phones. **Rixon, Inc.,** Silver Spring, Md. **Circle No 315**

Publication describes linear bench-top tester

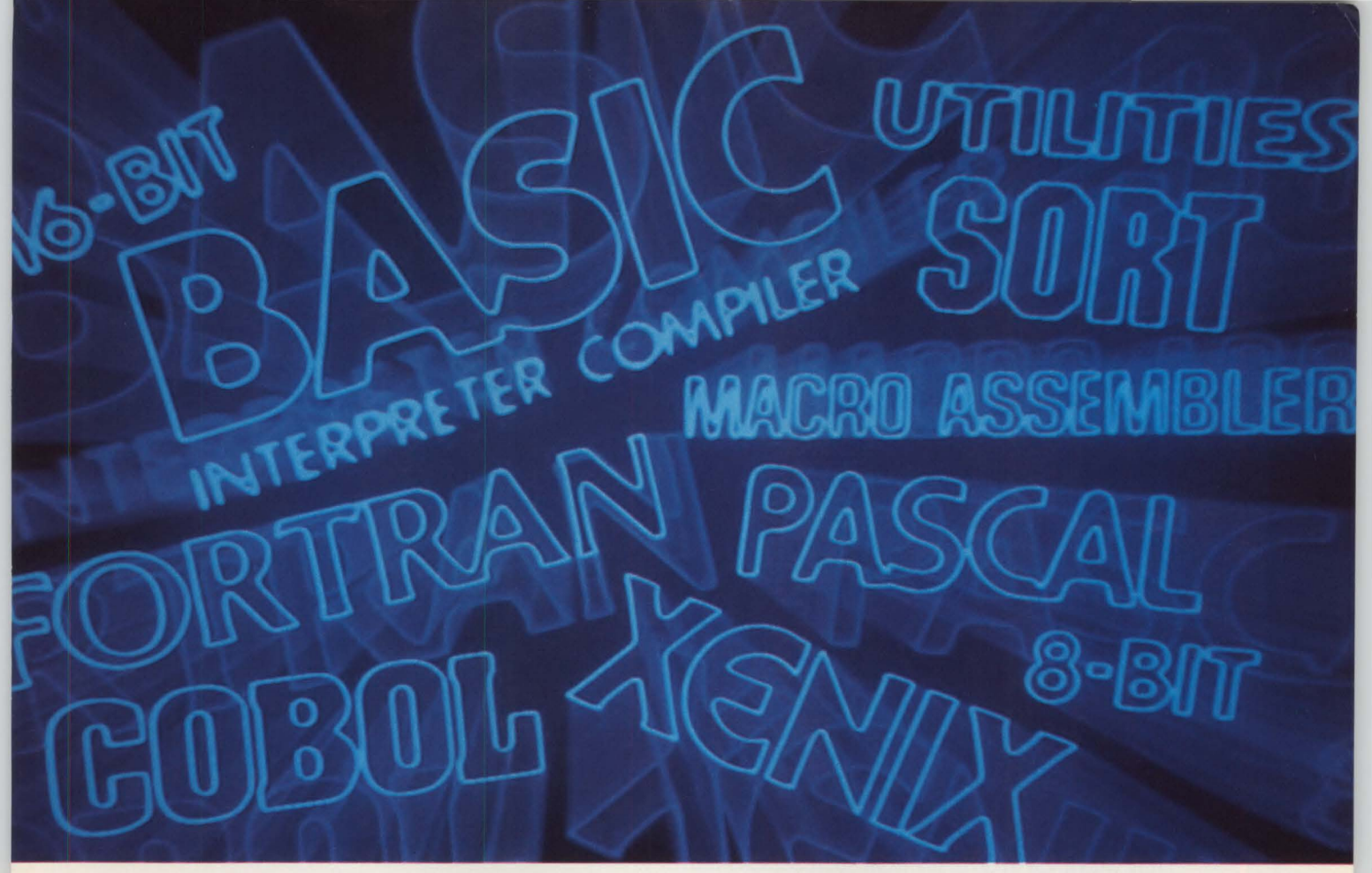
The LTS-2000 linear bench-top tester is detailed in a catalog. The 20-page publication describes a 12-bit 40-nsec. D/A converter, a 12-bit serial D/A converter and 8- and 10-bit video D/A converters. The catalog also provides application articles, sample programs, photos and diagrams. **Analog Devices, Inc.,** Norwood, Mass. **Circle No 316**

Selector guide details signal-processing diodes

A line of RF signal-processing diodes is detailed in a guide. The six-page manual lists tuning diodes for frequency control, hot-carrier diodes for mixing and detecting, and PIN diodes for switching. The guide also provides design curves and packaging and reliability data. **Motorola Semiconductor Products, Inc.,** Phoenix, Ariz. **Circle No 317**

Bulletin describes wafer stepper

The model 800SLR wafer stepper is detailed in a brochure. The two-page publication describes the system's automatic wafer-to-reticle alignment. The brochure also includes a photo, diagrams, top- and front-view dimensional drawings, specifications and benefits. **TRE Semiconductor Equipment Corp.,** Woodland Hills, Calif. **Circle No 318**



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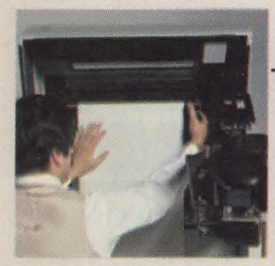

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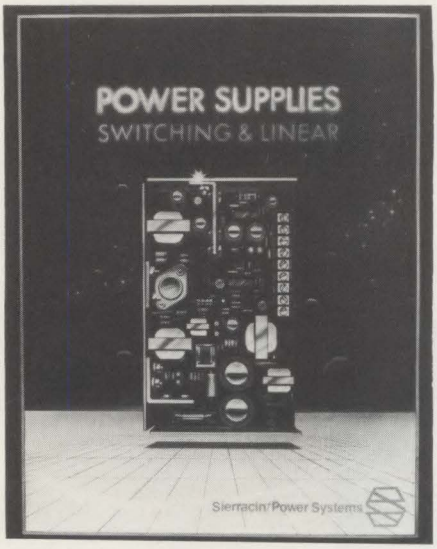
New Literature



Bulletin describes power supplies

A line of open-frame switching and linear power supplies is detailed in a catalog. The eight-page bulletin lists supplies for OEM linears, floppy-disks, μps, low-power applications, S100 buses and custom power applications. The catalog also provides prices, specifications and outline dimensions. **Sierracin/ Power Systems,** Chatsworth, Calif. **Circle No 319**

Bulletin examines travel keyboard

The Inductric keyboard, available in sloped or stepped styles, is detailed in a brochure. The publication describes the system's electronically adjustable touch-control capability, noise immunity from electrical interference, key-tops and price. The bulletin also includes illustrations and diagrams. **Mechanical Enterprises, Inc.,** Sterling, Va. **Circle No 320**

Brochure examines data converters

A line of high-resolution data converters is detailed in a catalog. The 20-page brochure describes high-resolution A/D and D/A converters, sample-hold amplifiers and voltage-to-frequency converters. The pamphlet includes selection criteria, a product summary, specifications and applications. **Analog Devices,** Norwood, Mass. **Circle No 321**

Data sheet examines Group 3000 tape system

The Group 3000 triple-density 125-ips tape system is described in a data sheet. The pamphlet, which includes photos and specifications, details the switch-selectable single-, dual- or triple-density tape's automatic thread/load capability, 781K-byte transfer rate, read/write reliability and time and space savings. **Qualex Technology Inc.,** Reseda, Calif. **Circle No 322**

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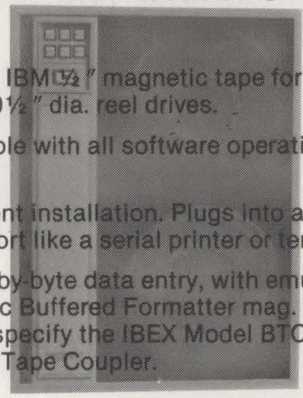

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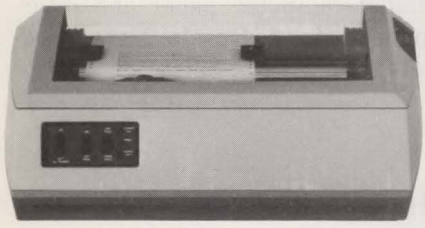
Four new printer ideas from the matrix printer leader

ONE

New 40 x 18 matrix Dual purpose printer: The new T-1805 serial printer uses a unique 40 x 18 matrix dot pattern for high quality correspondence printing; or, flip a switch, it uses a 7 x 9 matrix for high speed data processing printing. In the high speed mode it turns out reports at time-saving throughput rates up to 200 lines per minute. In the reduced speed correspondence mode, its pivoting print head lays down an overlapping dot array to create high quality characters that look like they came from an office typewriter.



TWO

Line printer offers business graphics and more: The T-3000 line printer is more application extensive than ever. This 300 line per minute multi-font machine now prints business graphics, subscripts, superscripts and customer defined special characters. This in addition to double high character or condensed printing. And to further its flexibility, characters can be loaded downstream from a host computer on command. Any number of character sets can be changed or interchanged on the fly. No printer stoppage. No wasted time.

For remote applications, the T-3000 even offers a communications adapter for long distance link-up with the host computer.

THREE

New enhancement! DEC LA-120 compatible: The versatile T-1612 teleprinter can now conform to the same function codes as the DEC LA-120. That means it's a simple swap to upgrade to the feature packed, lower priced T-1612. Remember, the T-1612 teleprinter offers the same functional features as the LA-120, plus extras like nine-needle print capability for true descenders and underlining, two-color red and black printing and forms handling bonuses like the Auto Front Feed for pre-cut forms and the Quick Tear for fast and easy forms removal.

FOUR

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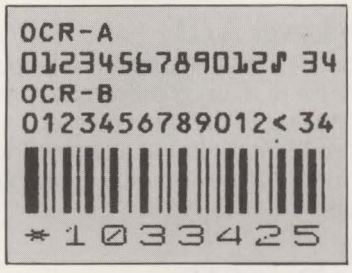

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ITEM #3 CIRCLE NO. 36 ON INQUIRY CARD
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CIRCLE NO. 164 ON INQUIRY CARD

New Literature

Publication features data products

A line of data-processing and microfilm supplies, furniture and accessories is listed in a catalog. The 48-page, illustrated publication includes magnetic media; media storage, filing and retrieval systems; printout storage and handling systems; microfilm storage and retrieval; and work stations. The catalog also provides information on print wheels, printer ribbons, fanfold computer paper and interconnect cables. **Devoke Data Products,** Palo Alto, Calif.

Circle No 323

Bulletin features pneumatic auxiliaries

The Series 5400 single- and quad-channel, pressure-to-current transmitters are detailed in a guide. The 12-page bulletin also includes the Series 2300/77 current-to-pressure transmitters. The guide provides applications, specifications, input/output and wiring data and dimensions of available enclosures. The publication also contains diagrams, options and ordering information. **Rochester Instrument Systems,** Rochester, N.Y.

Circle No 324

Guide details digital ICs

COS/MOS digital integrated circuits are detailed in a product guide. The 32-page catalog covers standard circuit types for commercial and industrial applications and high-reliability types for aerospace, military and critical industrial applications. The bulletin lists maximum ratings, recommended operating conditions, static electrical characteristics and classifications, and provides selection charts, functional diagrams and ordering information. **RCA,** Somerville, N.J.

Circle No 325

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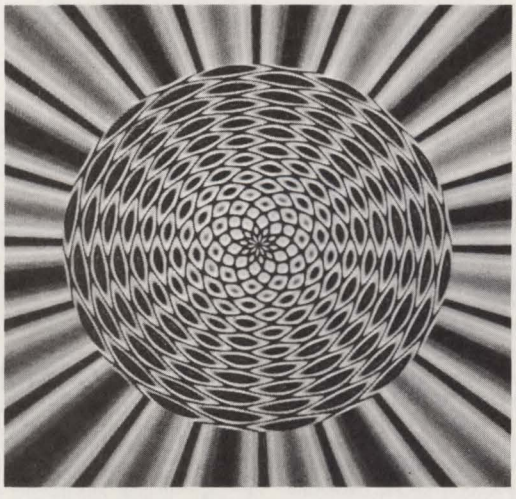

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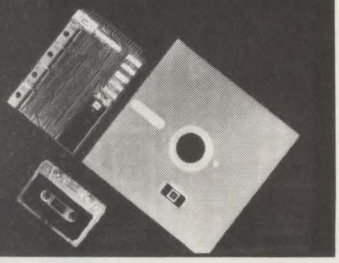

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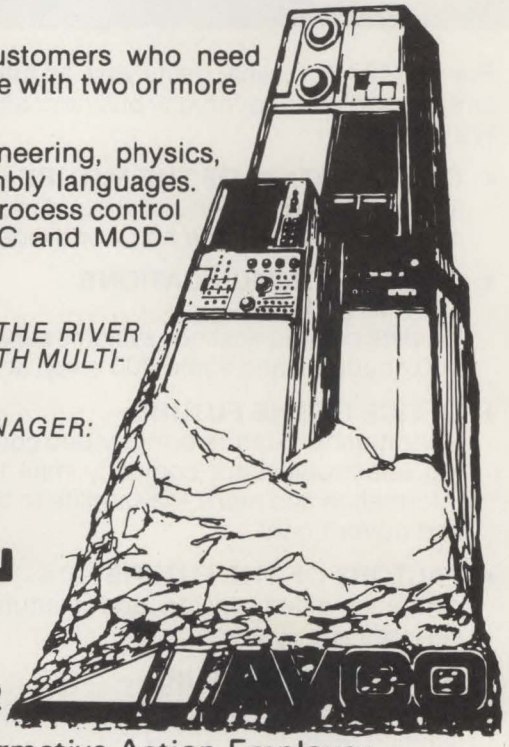

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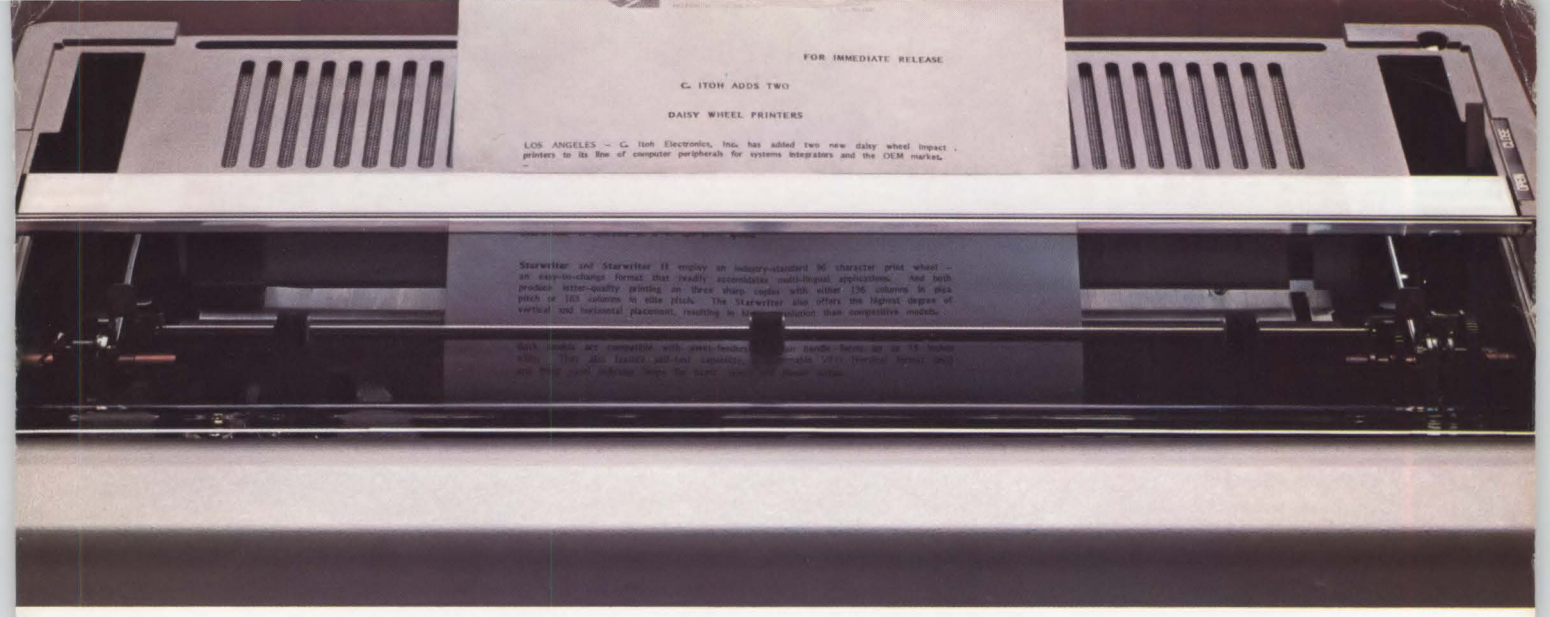

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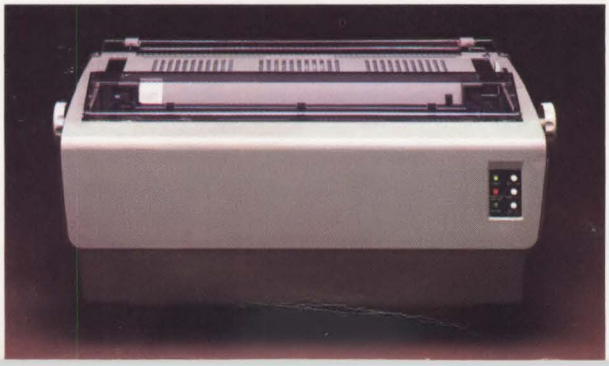

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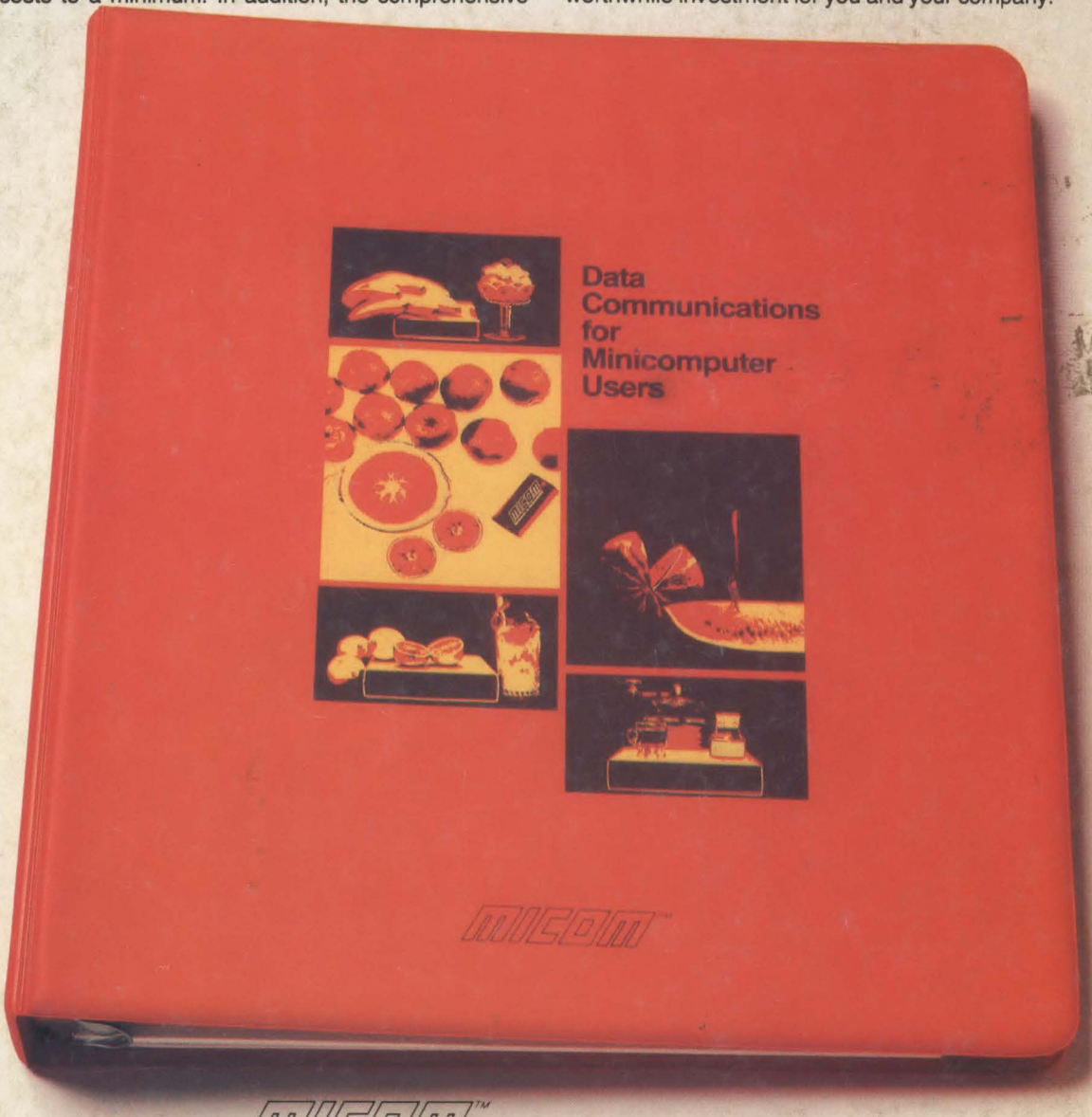

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