Mini-Micro Systems

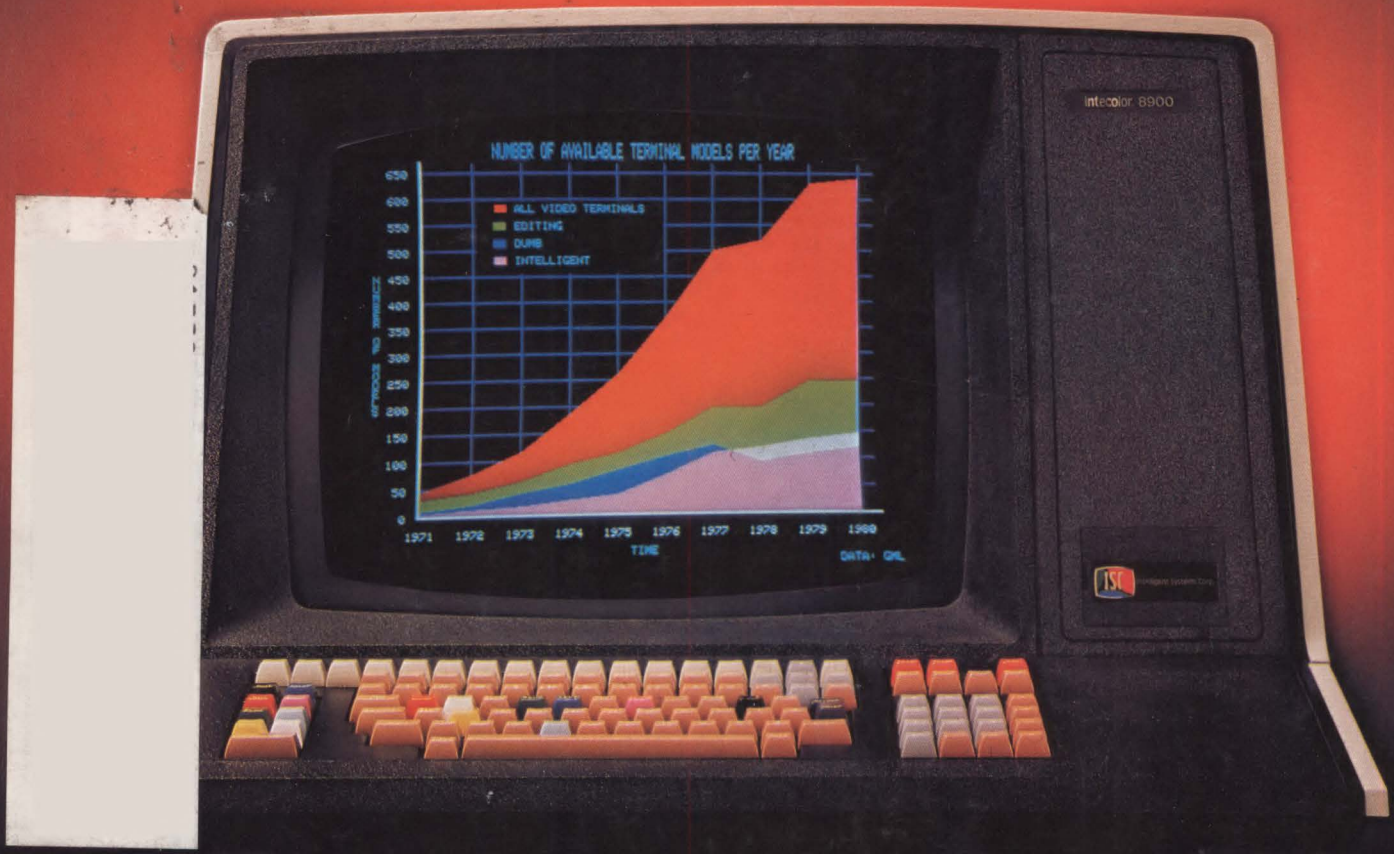
A CAHNERS PUBLICATION

AUGUST 1981

SPECIAL REPORT: CRT TERMINALS

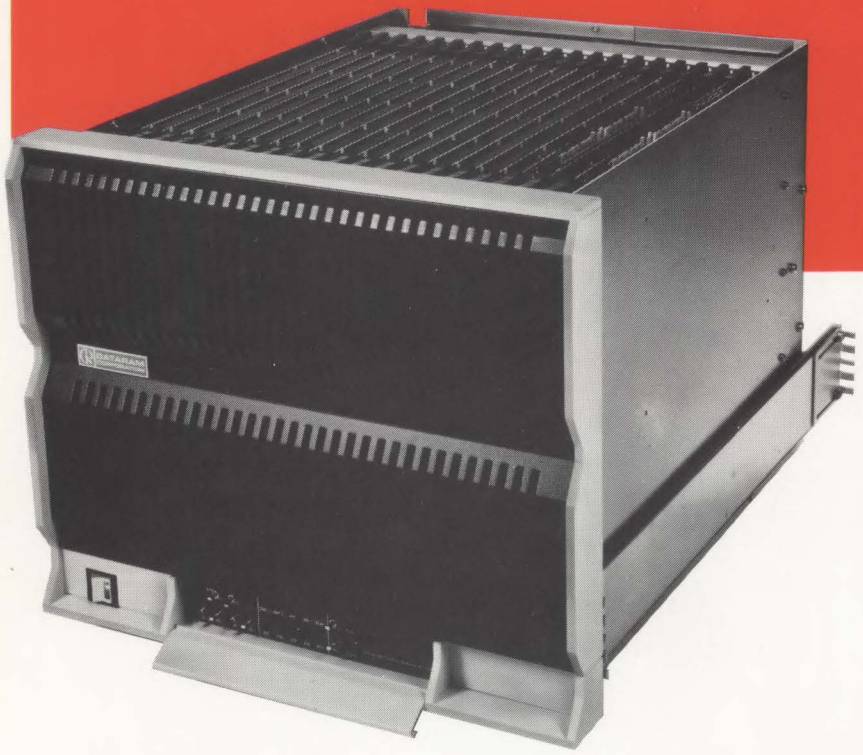
- Growing market for intelligence
- DEC's VT100: evolution by design
- Increasing comprehension with color

CP/M-compatible systems



THE INDUSTRY STANDARD

BULK CORE BULK SEMI



ALSO FROM DATARAM
JUST ANNOUNCED
PDP 11/44
MEMORY

Add a new dimension of speed and reliability to your minicomputer with economical, high-capacity BULK MEMORY from Dataram.

The world leader in minicomputer-compatible disk emulation systems. Dataram's wide range of disk emulations — twice as many minicomputer interfaces as anyone else! — brings the proven performance of BULK MEMORY to your application requirement.

Dataram's BULK CORE and BULK SEMI systems operate at speeds which are orders of magnitude faster than the mechanical disks which they replace, and do it with the reliability inherent in all-electronic devices. What's more, BULK MEMORY provides up to 8.0 MB in a 15¾" chassis, and offers dual-port capability to enable BULK MEMORY to be shared by two host minicomputers.

If you have a minicomputer and are looking for a way to get more for your storage dollar, Dataram has a BULK CORE or BULK SEMI system ready to work for you. If your minicomputer is not listed below, tell us about it. We'd like to add your name to our growing list of BULK MEMORY users.

MEMORY FROM THE LEADER

DATARAM CORPORATION

Princeton Road
Cranbury, New Jersey 08512
Tel: 609-799-0071 TWX: 510-685-2542

	DEC® PDP®-11	DEC LSI-11®	DEC PDP-15	DATA GENERAL NOVA®	DATA GENERAL ECLIPSE®	ROLM 1602	PERKIN ELMER	MODCOMP	HONEYWELL 316 and 516
BULK CORE	✓	✓	✓	✓	✓	✓	✓	✓	✓
BULK SEMI	✓	✓	✓	✓	✓		✓		
DUAL PORT	✓	✓		✓	✓				

Canada: Ahearn & Soper Ltd., Alberta, British Columbia, Ontario, Quebec • **Finland:** Systek OY, 737-233; **France:** YREL, 956 81 42 • **Hungary/Poland/Rumania:** Unitronex Corporation, WARSAW 39 6218 • **Italy:** ESE s.r.l., 02/6073626 • **Netherlands:** Technitron b.v., 020-45 87 55 • **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 • **Australia/New Zealand:** Anderson Digital Equipment, (03) 543 2077 • **India:** Industrial Electronic Instruments, 79281 • **Israel:** Minix Computers & Systems Ltd., 03-298783 • **Japan:** Matsushita Electric Trading Co., Ltd., 03 (435) 4501

CIRCLE NO. 1 ON INQUIRY CARD

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. 2 ON INQUIRY CARD

THE COMPETITION IS GREEN WITH ENVY

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 disk storage than you get from DEC.

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

DEC® designs great CPUs. But if you want 7.8 megabytes of disk 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 (or 1 megabyte double-sided) floppy 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 megabytes per buck than any DEC alternative. And you save in other ways.

Less rack space means lower cabinetry costs.

The DSD 880 interfaces require 70% less backplane space than similar DEC configurations.

The HyperDiagnostics™ panel and comprehensive 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. And it integrates with any DEC LSI-11 or PDP-11 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.

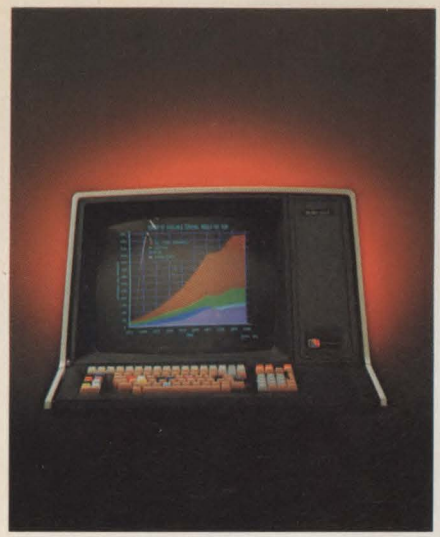
Want to know more? For full technical details, write Data Systems Design, 2241 Lundy Avenue, San Jose, CA 95131, or call the sales office nearest you.

Data Systems

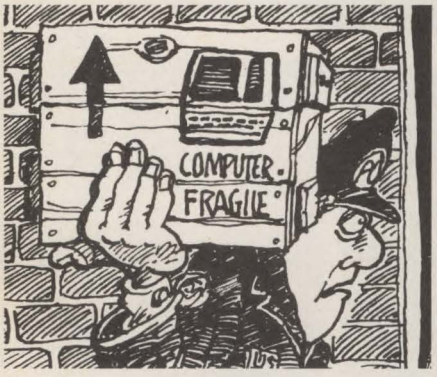
The Intelligent Alternative to DEC Disk Systems

United States: Western Region (408) 727-3163; Eastern Region (617) 769-7620. **International Sales:** Australia: Melbourne 03/543-2077, Sydney 02/848-8533; Canada 416/625-1907; Denmark 01/83 34 00; Finland 90/88 50 11; France 03/956 81 42; Israel 03/298783; Italy 02/4047648; Japan: Osaka 06/323-1707; Netherlands 020/45 87 55; New Zealand 4/693-008; Norway 02/78 94 60; Sweden 08/38 03 70; Switzerland 01/730 48 48; United Kingdom 01/207-1717; West Germany and Austria 089/1204-0.

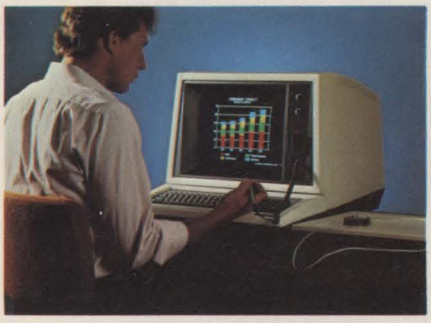
CIRCLE NO. 3 ON INQUIRY CARD



The market for CRT terminals, graphically depicted on a versatile color terminal, is the focal point for the lead article in a special report that begins on p. 105. Art direction by Susan Sheridan, photography by Ted Rogers, courtesy of Intelligent Systems Corp.



Page 18 . . . . . Reaching the first-time users



Page 147 . . . . . Making color affordable

MINI-MICRO SYSTEMS (USPS 059-470) is published monthly by Cahners Publishing Company, Division of Reed Holdings, Inc., 221 Columbus Avenue, Boston, MA 02116. Norman L. Cahners, Chairman; Saul Goldweitz, President; William M. Platt, President, Boston Division. Second class postage paid at Long Prairie, MN 56347. Postmaster: Send Form 3579 to MINI-MICRO SYSTEMS, 270 St. Paul St., Denver, CO 80206. MINI-MICRO SYSTEMS is circulated without charge by name and title to U.S. and Western Europe based corporate and technical management, systems engineers, and other personnel who meet qualification procedures. Available to others at the rate of $30.00 per year in the U.S.; $35.00 in Canada; $65.00 in all other countries (12 issues). Single issues $3.00 in the U.S.; $4.00 in Canada; $6.00 inall other countries.

Mini-Micro Systems

A Cahners Publication

Vol. XIV No. 8 August 1981

FEATURES

MINI-MICRO WORLD

DEPARTMENTS

We'll back up our disks— and anyone else's.

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

Kennedy is the only company that can offer an SMD compatible, 8″ 40 MByte disk drive (Model 7300) and an 80 MByte 14″ Winchester disk drive (Model 5380). To back them up, Kennedy has a ¼″ cartridge recorder (Model 6450), and Model 6809, ½″ Data Streamer Tape Transport.

Kennedy was the first to utilize the ¼″ 3M cartridge for disk backup; Kennedy was the pioneer in Winchester disk technology, and was a leader in developing a low cost streaming tape drive.

All of these products were conceived and designed to meet the need for reliable, low cost backup — for our systems or for any other system.

Kennedy has always backed its products. That's why we're No. 1. Call or write us about your problem.

We won't back off.

KENNEDY
Subsidiary, Magnetics & Electronics Inc.
1600 Shamrock Ave., Monrovia, CA. 91016
(213) 357-8831 TELEX 472-0116 KENNEDY
TWX 910-585-3249

KENNEDY INTERNATIONAL INC.
U.K. and Scandinavia
McGraw-Hill House
Shoppenhangers Road
Maidenhead
Berkshire SL6 2QL England
Tel: (0628) 73939
Telex: (851) 847871 KEN UKS G

KENNEDY INTERNATIONAL
Koningin Elisabethplein, 8
B-2700 Sint-Niklaas
Belgium
Tel: (031) 771962
Telex: 71870 KEN CO

KENNEDY • QUALITY • COUNT ON IT

CIRCLE NO. 4 ON INQUIRY CARD

CENTRONICS MOVING TO GET QUIETWRITER OUT THE DOOR

The formal debut of Centronics Data Computer Corp.'s Quietwriter printer is nearing. A company spokesperson says the product will be released in November or January, and that a series of new products probably will be introduced before the company's annual meeting in November. The Quietwriter is believed to operate faster than 30 cps under laboratory conditions, and will be priced higher than $2000, industry sources speculate. It is intended for the teleprinter and word-processing markets (MMS, January, 1980, p. 35). Observers consider the Quietwriter's debut and the new series to be necessary moves for Centronics, which has encountered stiff competition, especially from Japanese vendors, for its low-end Miniprinter line. Centronics reportedly made strides to keep Quietwriter development on track, despite the mid-July departure of three managers, including William Chalmers, who headed the Quietwriter effort. A source who knows the company says that Robert Kilcullen, who has assumed responsibility for the Quietwriter, also was ready to leave Centronics, but accepted a time contract or financial incentives or both to remain with Centronics. A company spokesman says he is not aware of any restrictive contractual discussions between Centronics and any key official, and that the departure of Chalmers will not have any negative impact on the Quietwriter program. "We have an experienced person in Bob Kilcullen, who knows the company and the program," the spokesman says, adding that there will be a very organized transition between Chalmers and Kilcullen.

DEC REORGANIZATION SPAWNS TECHNICAL VOLUME GROUP

A major reorganization is taking shape at Digital Equipment Corp., confirming rumors that have been circulating for the past year. While some of the details have yet to emerge, the key moves in a major realignment are these:

- The company spawned a fourth umbrella product group by pulling the technical OEM organization from the Technical Products Group and the μc products organization from the Computers Products Group. The new organization is named the Technical Volume Group and represents, by one unofficial estimate, about $400 million in revenues. Ward MacKenzie heads the new group.
- For the first time in nearly four years, DEC has named 15 men from throughout the company to vice presidential slots, increasing the number of vice presidents to 35.
- The company reorganized its Central Engineering Group, giving that 4500-person organization a system and technological focus rather than the traditional individual-component focus.

INTEL PLANS ETHERNET-COMPATIBLE SYSTEMS

Intel's agreement with Digital Equipment Corp. and Xerox Corp. to support the latter's Ethernet local area networking standard will not be limited to board-level hardware and semiconductor circuits. Sources close to the company say the Santa Clara, Calif., chip maker plans to unveil a line of desk-top and rack-mounted Ethernet-compatible systems early next year, some of which may incorporate the company's iSBC-550 two-board Ethernet/Multibus communications controller. One such system due for 1982 is the first in the company's 432-600 family, and will take the form of a box-level implementation of the iAPX-432 32-bit μp (MMS, May, p. 73). One source says the 432-based μc will incorporate the processor's three-chip set, a memory board and a two-board I/O subsystem based on an iSBC-8612 and designed to tie the 432's system bus to the company's Multibus. No pricing for the first 432-600 has been set.

DG'S MICRO ECLIPSE SLATED FOR FOLLOW-ON NOVA AND ENTERPRISE PRODUCTS

Despite reports that the introduction of Data General Corp.'s 16-bit Eclipse-on-a-chip is late, sources say that product should emerge this year or early next year in a variety of forms. A single-board computer, which incorporates the three-chip Eclipse and is code-named Alpha,

could be used in follow-on Nova products, MP-100 and MP-200 board products and the new Enterprise 1000 small-business system. Designers encountered problems earlier this year with the general I/O interface chip. Sources say the company decided to redesign the board to use 12 off-the-shelf discrete chips, but this costly and time-consuming process was abandoned recently as some I/O chip problems were solved. Alpha compares in speed with the Intel 8086 and Motorola 68000 16-bit μps, the source says. The operating system used is a superset of MP/OS. A DG spokesman says there is no delay in the announcement date, and that more issues than the I/O chip are involved in getting the product to market.

STRATUS SYSTEM USES 32-BIT μP

Stratus Computer, Inc., Natick, Mass., will bring its first product—a multiprocessing 32-bit commercial minicomputer that incorporates an 8-MHz Motorola 68000—to market late this fall. Called "Stratus" internally, the system will compete with Tandem Computer's Non-Stop computer, which is geared toward fail-safe operation. Stratus can include as many as 300 32-bit μps, company president William Foster explains. An entry-level system will include eight μps, 1M byte of main memory, 12M bytes of contiguous virtual address space available to users, about 70M bytes of 14-in. Winchester-disk storage, 10 CRT terminals and, optionally, line printers and hundreds of terminals. Prices begin at $100,000. The company developed its own operating system. The μp has 32-bit registers and data paths and a 16-bit address. Shipments are scheduled for December, and will coincide with the introduction date.

JAPANESE MOVE INTO SMALL-BUSINESS SYSTEM RETAILING

The first retail store stocking small-business systems built in Japan will be opened this summer by Toshiba America Inc., Tustin, Calif. The first store was operating last month in Los Angeles; the second is set for Orange County next month. The stores will feature a line of floppy-disk-based 8085-driven systems unveiled at May's National Computer Conference, and a floppy-disk-based word processor, the EX-100. Also in stock are Toshiba copiers, calculators, PBX equipment, system software, including CP/M and C BASIC, and canned Toshiba-supported application-level programming. Prices for the floppy-disk-based small-business system range from $5000 to $7000; prices for the EX-100 start at $8000.

LESS-THAN-$500 VIDEO DISPLAY TO DEBUT NEXT MONTH

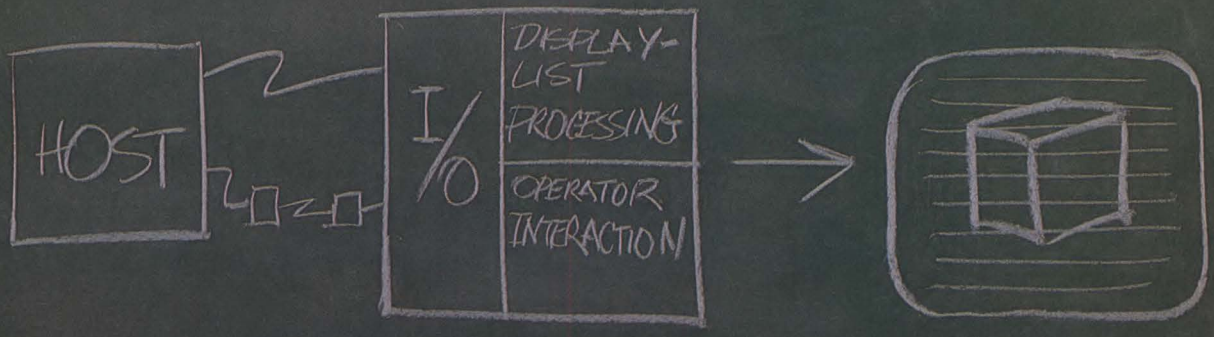
Price slashing in the general-purpose video-display terminal market is getting ruthless. This month, Lear-Siegler, Inc., will cut prices by about $300 on its ADM-3 and ADM-1 devices to $595 and $645, respectively. But that won't stop Emulog, Inc., Fremont, Calif., from introducing a general-purpose ASCII device priced at less than $500 in September. Code-named Alpha, the terminal uses a 6502 μp processor and includes two serial ports, a detachable, typewriter-style keyboard with sculptured keys, three programmable function keys, a 14-key numeric pad and a green phosphor screen that tilts and swivels. Alpha also includes independently settable and erasable tabs, protected fields and the standard range of transmission speeds, says company president Jim Kurinsky. An optional line-drawing feature will be available later, he says. At the same time, Emulog will begin shipping its second Data General-compatible display terminal, a D200 emulator.

DEC ELECTRONIC-MAIL SYSTEM MAY BOW NEXT MONTH

Digital Equipment Corp.'s version of electronic mail is expected to make its public appearance this fall, perhaps as early as September. DEC had been using Computer Corp. of America's Comet electronic-mail system until December, 1979, when DEC started working in earnest on its own system. The system is believed to run on the company's VAX 32-bit computer, and insiders claim the mail system will have several sophisticated functions, including reminder and routing capabilities.

THE MEGATEK DIFFERENCE:

REMOTE WORKSTATIONS



Whizzard 6200 raster-scan, line-drawing terminals are working remote workstations – fast, interactive, intelligent.

The Megatek difference starts with host-computer software. Wand 6200 is a computer-independent, Core-compatible Fortran package which organizes graphic information for maximum communication-line efficiency. Image segments can be dynamically extended, changed to a different color or line type, scaled, translated, or blinked with just a few simple commands.

Whizzard 6200 terminals can also be programmed with hundreds of graphic subroutines (e.g., the image of a bolt head). Instead of reconstructing such "instances" each time they are needed, the host computer simply transmits a subroutine ID number.

Swiftly interacting with the host computer at the "action" end of the communication line is an intelligent Whizzard 6200 memory-management I/O interface which maps subroutines, segments, and attribute information into a 64K-byte display-list memory (expandable to 128K bytes).

The final step, from memory to screen, is nearly instantaneous. Powered by a 32-bit proprietary processor, the Whizzard 6200 "graphics engine" processes display-list data into raster images at an average rate of 200 nanoseconds per pixel. Text can be displayed in eight hardware-generated character sizes. Twelve-bit vector coordinates (4096 x 4096 virtual display space) can be scaled up to 8X with full retention of fine-line detail. Images can be "Rasterized" into full-resolution hardcopy.

Monochrome or color, 512 x 512 or 1024 x 1024, every member of the Whizzard 6200 family is a complete graphics workstation, including desk, display monitor, keyboard, joystick, and optional data tablet. And all are upwardly mobile – up to the Whizzard 7200 series of 3D rotation-and-scaling raster/vector terminals.

The more you know about graphics, the more you lean toward Megatek.

There is a Megatek difference. See it, believe it. Call or write: Megatek Corporation, 3931 Sorrento Valley Blvd., San Diego, CA 92121. 714/455-5590. TWX 910-337-1270.

MEGATEK

MEGATEK CORPORATION

CIRCLE NO. 5 ON INQUIRY CARD

LSI-11® AND PDP-11®
DISK STORAGE SUBSYSTEMS

CONTROL DATA®

EMULEX®

COST EFFECTIVE/HIGH PERFORMANCE
First Computer Corporation offers a wide range of CMD/SMD/MMD/FMD disk storage subsystems for PDP-11 computer systems. These subsystems offer users a cost effective—high performance alternative for applications demanding large capacity disk storage.

HARDWARE/SOFTWARE COMPATIBILITY
All disk storage subsystems utilize Emulex microprogrammed emulating controllers which are fully software transparent to both the PDP-11 hardware and software.

INSTALLATION AND SERVICE
First Computer can provide installation and service for end-users desiring on-site warranty. Responsive service can be provided by over forty Control Data field service centers located in most major metropolitan areas.

REPUTATION AS A LEADER IN PDP-11 SYSTEMS
First Computer Corporation has built a reputation based on quality, reliability and service. During the last five years we have shipped over 1,000 PDP-11 systems to satisfied customers worldwide. We continue to protect this reputation by offering only the very best. Disk storage subsystems can be provided to meet most application requirements from the following selection guide:

HIGHEST QUALITY AND SUPER RELIABILITY
The disk drives utilized in these subsystems are manufactured by Control Data Corporation the world's largest independent supplier of peripheral equipment. Control Data builds quality and reliability into its disk drives because CDC designs and manufactures each of the critical components—heads, media and servo.

FULLY INTEGRATED AND TESTED
ALL disk storage subsystems are configured, integrated, and tested by First Computer Corporation to provide you with a totally plug-compatible disk storage subsystem. These subsystems can be installed on your system and be up and running the standard DEC diagnostics and operating systems within minutes.

MODEL	STORAGE CAPACITY		OPERATING SYSTEM EMULATION		MODIFIED HANDLER
	Removable	Fixed	RT-11	RSX11-M / RSTS/E	
9448-32	16	16	2 13.7MB RP02's	2 13.7MB RP02's	YES
			2 13.9MB RK06's	2 13.9MB RK06's	NO
9448-64	16	48	4 13.7MB RP02's	4 13.7MB RP02's	YES
			4 13.9MB RK06's	4 13.9MB RK06's	NO
9448-96	16	80	6 13.7MB RP02's	6 13.7MB RP02's	YES
			6 13.9MB RK06's	6 13.9MB RK06's	NO
9730-80	—	80	3 20.8MB RP02's	3 20.8MB RP02's	NO
				1 67.4MB RM02	NO

MODEL	STORAGE CAPACITY		OPERATING SYSTEM EMULATION		MODIFIED HANDLER
	Removable	Fixed	RT-11	RSX11-M / RSTS/E	
9730-160	—	160		2 67.4MB RM02's	NO
9762	80	—	3 20.8MB RP02's	3 20.8MB RP02's	NO
				1 67.4MB RM02	NO
9766	300	—		1 253.7MB RP06	YES
				1 256.1MB RM02	YES
9775		675		1 552.5MB RP06	YES
				1 552.5MB RM02	YES

CDC-1

® Registered trademark of Control Data Corporation

® Registered trademark of Emulex Corporation

® Registered trademark of Digital Equipment Corporation

™ Trademark First Computer Corporation

First™ computer corporation

TWX NUMBER 910-651-1916

645 BLACKHAWK DRIVE / WESTMONT, ILLINOIS 60559 (312) 920-1050

SOUTHERN REGION
Houston, TX (713) 960-1050

WESTERN REGION
California (To be announced)

NORTH CENTRAL REGION
Chicago, IL (312) 920-1050

CIRCLE NO. 6 ON INQUIRY CARD

RUBEN ENGINEERING, MITRE CORP. EYE EACH OTHER'S TECHNOLOGY

Mitre Corp., the Bedford, Mass., system consulting firm to the Defense Department, is evaluating The Assistant office system from Ruben Engineering Corp., Cambridge, Mass. (MMS, July, 1980, p. 77), for potential use on the CATV-based Mitrenet local area network. Along with an internal network at its Bedford facilities, Mitre has installed various government agency networks, including several within the Department of Defense.

Tom Reale, leader of the Bus Implementation Group at Mitre, says The Assistant's ability to replicate forms could be a valuable feature for Mitre and the DOD, both of which deal "with hundreds of thousands of forms." The Assistant's ability to automate various tasks performed by department administrators is also an attractive feature, Reale says. Ruben, on the other hand, is interested in tying its office systems into a local area network, but the company has made no commitment to follow the broadband Mitrenet approach, says a Ruben source, who adds that Ruben will soon announce the ability to link several of The Assistant systems together. He declines comment on what networking scheme the firm will use to provide this linkage.

STAR WORK STATION MAY GAIN VOICE STORE-AND-FORWARD FEATURE

Despite widespread opinion that Xerox's Ethernet local area network is poorly suited for voice traffic, one industry source expects the company to introduce a voice store-and-forward feature this fall for its Ethernet-compatible Star work station. George Colony, a senior analyst with The Yankee Group, Cambridge, Mass., says, "Ethernet is fantastic for voice store-and-forward operation," and he predicts the Star implementation of this feature will involve a microphone attached to the terminal that will accept spoken messages in a "voice-mailbox mode." This mode will enable a user to enter a voice message into the system, where it will be stored until it is accessed by the intended recipient. Xerox declines comment on this predicted Star feature, but John Shoch, a member of Xerox's research staff, confirms that Ethernet can easily support store-and-forward voice messages. Shoch also claims that a demonstration system at the company's Palo Alto, Calif., Research Center proves Ethernet can also support interactive voice conversations, such as those over telephone lines. Colony at the Yankee Group, however, disputes the potential for Ethernet networks to carry interactive voice. He says a project at the Massachusetts Institute of Technology's Lincoln Laboratory indicates that untenable delays occur when more than a few voice lines are linked over Ethernet.

ALSPA COMPUTERS DELIVERS $1995 Z80-BASED CP/M SYSTEM

Alspa Computers, Inc., a Scotts Valley, Calif., start-up has begun delivering an $1195 Z80-based desk-top machine aimed at the low end of the CP/M market. Founder Ron Alspaugh says the ACI-1, with 64K bytes of RAM, two 8-in., double-sided, double-density floppy-disk drives and three serial ports, is built into an 8½- × 5½- × 17-in. metal enclosure. Alspaugh, who was director of engineering at nearby Mountain Computers, Inc., says that by year-end, the system will be available with networking software that will link as many as 64 ACI-1s with any CP/M-based host computer.

DAISY PRINTER PRICES BREAK THROUGH $1000 FLOOR

The race for less-than-$1000 printers, begun about two years ago by manufacturers of dot-matrix printers, is filtering into the daisy-printer market, and manufacturers are readying products targeting that price floor. NEC Informations Systems, Inc., and Diablo Systems, Inc., both will introduce low-end models by year-end, sources at the companies confirm. NEC will introduce a 20-cps thimble-print-element printer that will be priced at less than $1000 in single-unit quantities. Diablo's forthcoming model 620 will sell for about $1000, and will operate at 20 to 25 cps. The 620 uses a single board and no cooling fans. Qume Corp. is expected to join the fray as well, but sources at Qume indicate the move is not likely soon. Daisy printers have been mechanical-parts-intensive, making it difficult to reduce prices,

sources say. The new price floor is the result of pressure from Japanese competition and demand by word-processing system manufacturers, sources say.

VOICE DEVELOPMENT SYSTEM SPEEDS SPEECH APPLICATIONS

Centigram Corp. will begin delivery of a voice-development system next month, says vice president of marketing Len Magnuson. The turnkey development system combines an intelligent terminal with the Sunnyvale, Calif., company's LISA speech-synthesis board (MMS, April, p. 5) and VOPAC speech-compression hardware. Magnuson says the system will enable users to develop sentences on the terminal's display screen through the Z80-based LISA board. The speech is then digitized by VOPAC and stored on a floppy or rigid disk before downloading to a host processor. He says the basic system, which includes the smart terminal, a speech-synthesis board, speech-compression hardware and dual floppy-disk drives, will sell for about $25,000.

'DYNABOOK:' A FUTURE STAR AT XEROX?

The latest Xerox rumor making the rounds is that a bookworm may become a star in the company's product line. One source who claims to have more than a nodding acquaintance with research projects at Xerox's Palo Alto, Calif., research center says Xerox researchers are working on a project labeled "Dynabook." Dynabook reportedly is intended to couple a flat-panel display screen with a computer as powerful as the Star, but in a box that measures 2×9×11 in. "It won't be out within the next five years," the source confidently asserts. But if they want to see where the Dynabook project is headed, Xerox watchers should look at the company's "Smalltalk" research language, which reportedly is getting a close look from Hewlett-Packard Co., Digital Equipment Corp. and other companies.

WANGWRITER TO BE ENHANCED WITH SECOND FLOPPY DISK, CP/M

Wang Laboratories, Inc., Lowell, Mass., appears to be taking a second step to place its Wangwriter word processor squarely in competition with Xerox Corp.'s new 820 word processor/small-business computer. In September, Wang will add a second floppy-disk drive and provisions for the CP/M operating system to the Wangwriter, a company source confirms. The features match those already available for the 820, which is priced at $6395 when configured as a word processor. In June, Wang's first step to become more competitive with the Xerox product occurred, when, almost immediately after the 820 was introduced, Wang cut Wangwriter prices 15 percent to $6400.

RANDOM DISK FILES

Anaheim-based **Siemens Corp.** is planning to expand its line of 5¼-in. hardware and to adopt a more aggressive stance in the OEM market for rotating memories. According to one report, the company has earmarked $8 million to develop and market a new line of hardware comprising two two-thirds high (48 and 96 tpi) floppy-disk drives; a 1M-byte, standard-height SA450-compatible, double-sided, double-density device; a high-capacity 6M-byte, 5¼-in. floppy; and a series of 5¼-in. Winchesters in the 6M- to 16M-byte range. Deliveries of Siemens' two-thirds-high drives, designated the 111-5T and the 221-5T could start in the first quarter of next year; evaluation quantities of the 1M-byte standard floppy, tagged the 221-5A, are now being delivered, with full-scale production also slated for early 1982. Evaluation quantities of the high-capacity floppy could appear by year-end.

Shugart Associates' recent decision to drop its four-platter, 58M-byte SA4100, 14-in. Winchester (MMS, October, 1979, p. 20) reflects the view that 14-in. drives in this capacity range will ultimately be replaced by newer 8-in. hardware, says one source close to the Sunnyvale, Calif., Xerox subsidiary. Meanwhile, Shugart will continue selling its lower capacity, 14M- and 29M-byte SA4000 14-in. Winchesters and will continue to support the SA4100 drives now in the field.

—John Trifari

NEW

IT'S MAGIC©

The System/48 is the outstanding office automation computing system for the 80's . . . it's so productive we call it MAGIC©. Look at these features:

- One to eight interactive users per node
- Data management system
- Report generator
- Query processor
- Screen format generator
- Automatic interface code generator
- Up to ½ Mbytes of user memory
- Winchester disk with 18-million bytes (formatted capacity)
- 15-minute mean-time-to-repair
- Built-in protection from line-voltage spikes, noise, and brownouts

And, it features MAGIC©, the Operating System that gets things done faster than you can say abracadabra because of its multi-keyed Indexed-Sequential Access Method and flexible file-organization. MAGIC© also offers high security, with password protection. MAGIC© supports global or local printers for as many users as desired.

MAGIC© also includes DataMagic II — TEI's red-hot database manager. DataMagic II has even more tricks up its sleeve — like automatic or manual record-lock protection and automatic transaction backout to protect the database. And it runs application software written for CP/M 2.X.

Take a MAGIC© leap into the future!

Arrange to attend one of our regularly scheduled System/48 workshops (RSVP).

CIRCLE NO. 7 ON INQUIRY CARD
OEM and Dealer Inquiries Invited

TEI INC. **System/48®**

5075 S. LOOP EAST, HOUSTON, TX. 77033
(713) 738-2300 TWX. 910-881-3639

If you can see it on a CRT, our new, multi-function matrix (MFM) can print it.

Fast.

Your play diagrams, graphs and block letters all look crisp, clear and solid— not like clusters of dots. And at a speed of 140 cps, the MFM-100 prints beautifully three times faster than most daisy wheels.

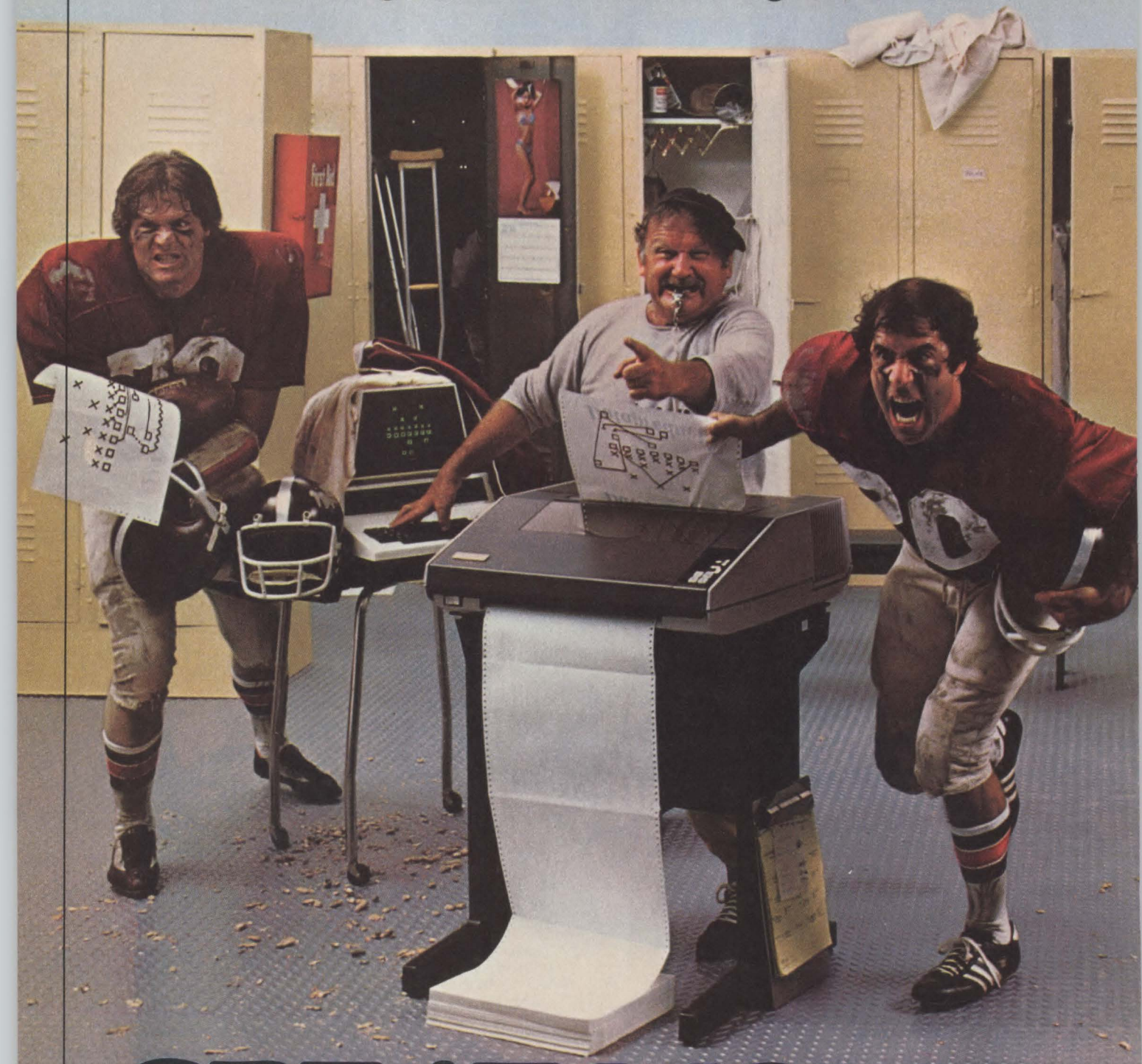
You get sharper alpha and numeric characters. You can print foreign languages. You can underline anything.

The secret of this business graphics professional is the specially designed Dataproducts printhead.

The column of 14 overlapping dots it prints gives you a continuous, solid vertical line.

(Nine dots form the basic character. There are two more dots for ascenders and three more for descenders and

Introducing our MFM-100 Matrix Printer. Business graphics never looked so good, so fast.



GREAT MOMEN

underlining.)

The MFM-100 needs no regularly scheduled maintenance.

The operator changes the ribbon and printhead.

The sophisticated self-diagnostics let you spot and correct problems. And that saves service calls.

The new MFM-100 is a very tough competitor that does beautiful work at a very competitive price.

Check it out.

Meeting Tough Standards.

We're the largest independent printer manufacturer in the world.

For 19 years we've been building printers for the biggest OEMs in the business. Their names go on our machines—which is a good testimony to the kind of work we do.

30 Day Delivery.

And often we can deliver a partial order even faster. If time is a problem, we'll help you solve it.

For more information about the MFM-100—or any Dataproducts printer—call (213) 887-8451.

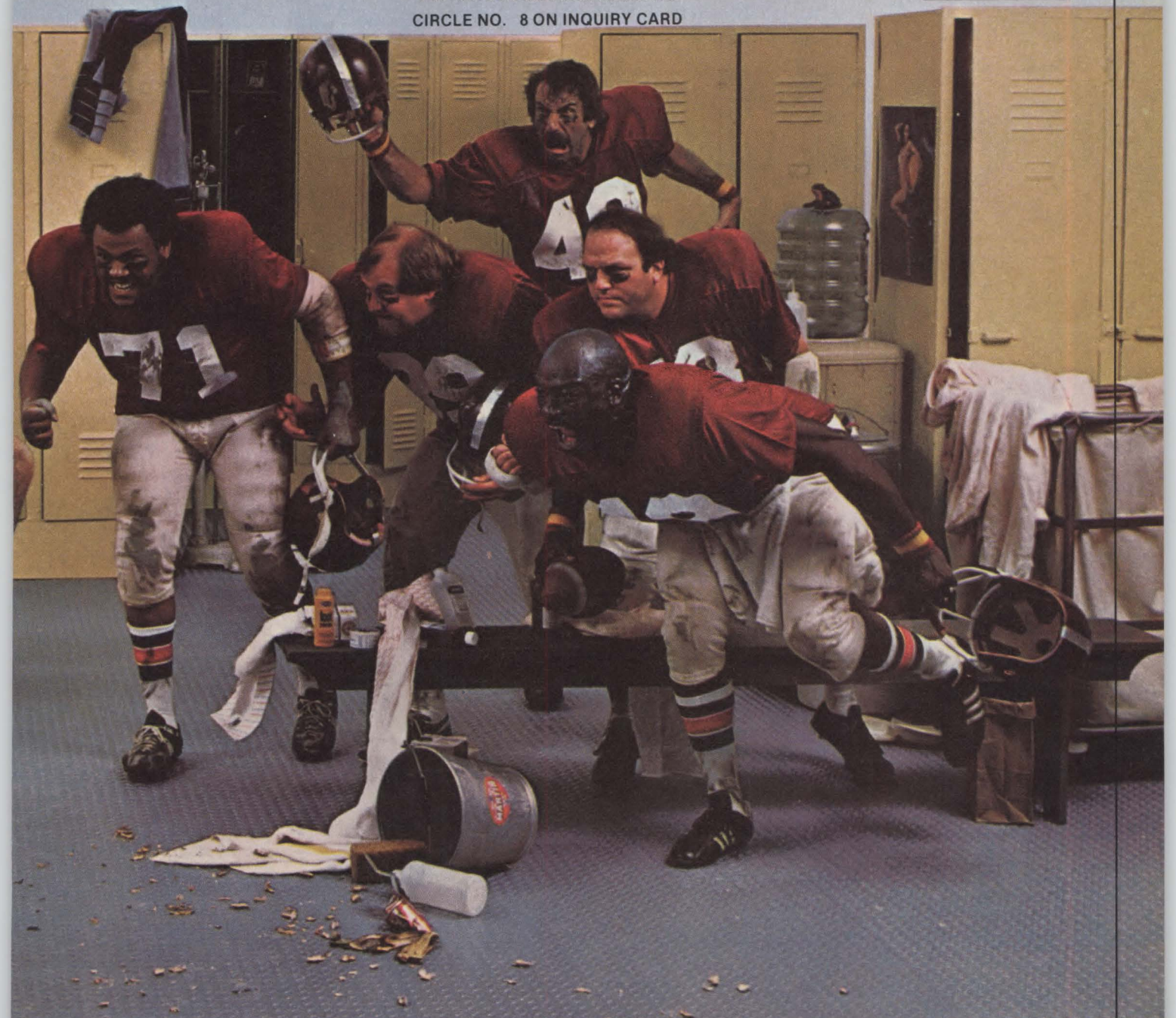
Or write:

Dataproducts, Marketing Department, 6200 Canoga Avenue, Woodland Hills, California 91365.

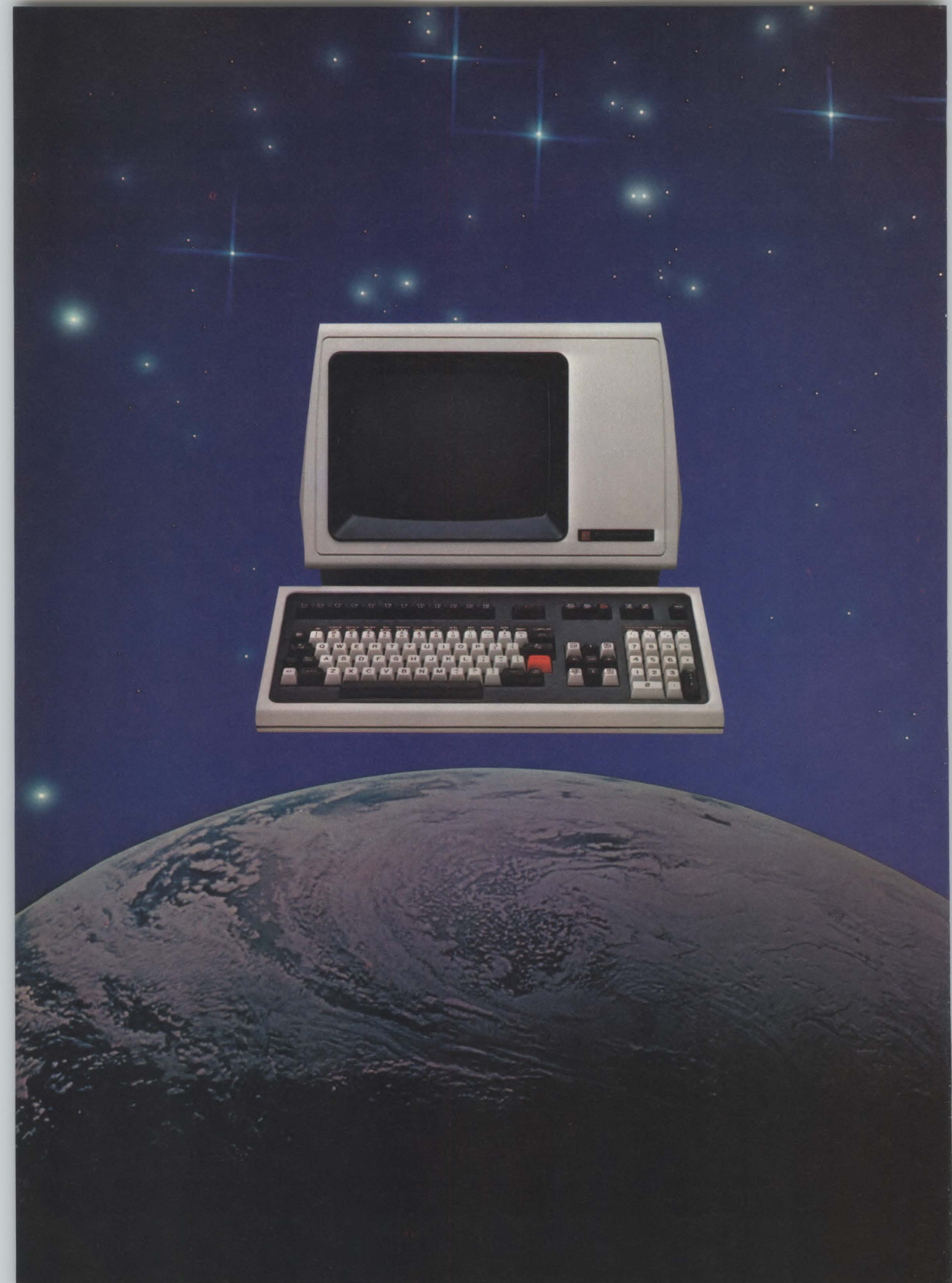
European Marketing Headquarters:
Ascot, England
Tel: 990-23377,
Telex: 849426

Dataproducts

CIRCLE NO. 8 ON INQUIRY CARD



TS IN PRINTING



A powerful display of innovative thinking.

Introducing TI's new OPTI 900 Model 940 Electronic Video Terminal.

The OPTI 900* Model 940 is the first in a family of electronic video terminals from Texas Instruments. Combining the power of an editing terminal with the convenience of video display, the Model 940 brings new perspectives to applications including data entry, electronic mail, commercial timesharing and data base management.

The 940 offers state-of-the-art human-factor design features to help reduce operator fatigue, and a variety of versatile characteristics to enhance any business application requiring high performance editing.

Standard display features on the Model 940 include a 12-inch diagonal screen with an operator-selectable format of either 80 or 132 columns by 24 lines. A 25th status line displays information in three selectable modes for functions like tabs, margins, errors or host computer messages.

The 940's display can be split both vertically and horizontally into separate data regions allowing a user the flexibility to operate within one region without disturbing another. And for applications like process control,the Model 940 features scrolling regions for quick, effective data comparison.

There is also a transparent print feature that permits a host computer to bypass the screen and transmit data to an optional local printer, allowing the operator continued use of the screen during the printing cycle. And the Model 940's memory can store up to 1,920 characters of data.

Featuring 128 displayable ASCII characters, the versatile Model 940 includes a unique combination of double high, double wide and double high/wide characters for display emphasis and reduced visual strain. Additional video features include 7×9 dot matrix characters with true underlining and true descenders.

The Model 940's detached keyboard, designed to increase operator comfort and productivity, is connected to the display monitor with a 6-foot coiled cord and features operator-oriented functionally clustered keys. For added user convenience the Model 940 also offers detachable nonglare screen filters and a tiltable display monitor as options. Other available application-oriented options include international or graphic character sets and additional memory of up to 5,760 characters to give the 940 added versatility for data entry applications.

TI is dedicated to producing quality, innovative products like the new OPTI 900 Model 940 Electronic Video Terminal. And TI's hundreds of thousands of data terminals shipped worldwide are backed by the technology and reliability that come from 50 years of experience.

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

For more information on the new OPTI 900 Model 940, 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.

TEXAS INSTRUMENTS
INCORPORATED

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.

CIRCLE NO. 9 ON INQUIRY CARD

The SLC-II is a microprocessor—that can speak. That's right. Its vocabulary runs well over 300 words. And what it can't say, it will spell for you. In English.

The SLC-II intercepts messages from your computer, and takes specific actions. Just hook up the SLC-II between your CPU and your terminal with its standard RS-232 or 20mA serial loop interface, and you're set. **With no software changes needed.**

It automatically dials a pre-set telephone number and delivers any given message in an electronically synthesized voice. So if trouble comes up, the SLC-II can make the necessary phone calls to have it fixed. That's why it's so much better than just a simple monitor, which can only helplessly record events. **The SLC-II can act on them.**

It can call and tell you when credit is overdrawn, when security needs tightening, when danger crops up—even when to get up in the morning.

Find out today how little it costs to add a voice to your computer. Call or write for more information about the SLC-II from Digital Pathways today, at 1260 L'Avenida,
Mountain View, CA 94043
Telephone (415) 969-7600
TWX: 910-379-5034.

DIGITAL PATHWAYS

MEET THE SLC-II. IT TALKS TO SIMPLY EVERYBODY.

Canada: (403) 286-2744 • England: 403 813 813 • Germany: (089) 60 60 71-72 Telex: 5216290 isio d
Switzerland: 022/310587 Telex: 289191

CIRCLE NO. 10 ON INQUIRY CARD

Zilog's 'supermicro' offers minicomputer-level performance

Hoping to establish a new level of performance for μp-based business systems, Zilog, Inc., will begin delivering in November what it calls a supermicro. The Cupertino, Calif., company's Z8000-based, multi-user, multitasking UNIX system is said to outperform Digital Equipment Corp.'s PDP-11/70 by as much as 30 percent, yet sells for one-third the minicomputer's price.

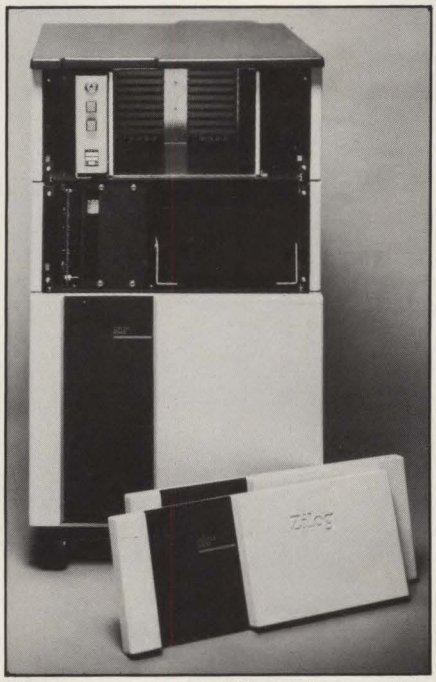
Rolando Esteverena, vice president of the company's Systems Division, says the System 8000 is the first application of the company's 6-MHz Z8001 μp and Z8010A memory-management units (MMUs) in a system-level product. In addition, the system represents the first full implementation of Zilog's Z-bus, a data-bus capable of 8-, 16- and 32-bit word transfers (MMS, June, 1980, p. 67).

Benchmark tests have shown that the System 8000 performs 10 to 30 percent faster than a comparably configured PDP-11/70, Esteverena says. That means, he explains, that the system 8000 takes 10 to 30 percent less time than the 11/70 to complete a system-level task.

Running under Zeus, Zilog's version of Bell Lab's UNIX, the system will handle as many as 32 users, Esteverena says, though the hardware can accommodate more.

Esteverena attributes the better-than-mini performance to the combination of processor, MMUs and operating system. "We've laid the groundwork in Zeus to take advantage of the Z8001's architecture," he claims. The MMUs have been optimized to allow the UNIX style of memory management, he points out, adding that the operating system has been enhanced to use the Z8001's memory- and code-segmentation features. Further, Zeus includes "the kind of system-level utilities and accounting functions you would expect on an 11/70-size machine," he says.

The new business system is essentially the same as Zilog's Z-Lab 8000, the company's Z8000 hardware- and software-development system introduced in March. Both machines use the same 6-MHz CPU and three MMUs. However, Zilog will deliver COBOL and Pascal with the System 8000, neither of which is available for the development system. Says Esteverena, "Customers will be getting a complete software-development system to which has been added a complete commercial system."



The System 8000 *is Zilog's first application of the 6-MHz Z8001 μp and Z8010A memory-management units in a system-level product.*

Reports late last year claimed the Systems Division was in serious trouble and that thought was being given to discontinuing its operations. Esteverena discounts these saying that his group is "a stable, functioning, producing organization."

"We have a commitment from Exxon," says Estevereva. "We have been performing, and will be moving across the board with competitive products like the System 8000."

An Exxon spokeswoman confirms that commitment. Exxon, she explains, is presented with total plans by affiliates, to which the parent company gives "tacit approval."

Two models of the 8000 are available. The model 20 incorporates the CPU and MMU board with a 24M-byte BASF 8-in. Winchester-disk drive, a 17M-byte DEI cartridge-tape drive, 256K bytes of error-correcting memory, and Z80A-based peripheral-controller boards into a modular chassis.

The model 30 has an additional 256K bytes of RAM and another disk drive. Memory in either model is expandable to 1M byte. Zilog uses 16K-byte RAMs, but Esteverena says that 64K-byte devices will be used as soon as practicable, resulting in 1M byte per memory board.

The CPU has eight communications ports, he says, and an optional serial I/O card adds eight more. There is also a parallel Centronics-compatible port and an optional line-printer port.

The modular design of the system

allows customers to add more disk drives, tape drives or memory. The disk and tape controllers are equipped to accommodate four devices each.

Zilog expects to ship about 1000 systems during 1982. Most will be four- to eight-user configurations.

Besides COBOL and Pascal, the System 8000 will include C, UNIX's native language; PLZ/SYS and PLZ/ASM, both Zilog-written development languages; and operating-system utilities. Esteverena says the systems will be sold with the development tools to third-party software houses, but he expects some OEMs to buy turnkey systems.

Prices for the model 20 and 30 without software are $27,000 and $34,000, respectively. A software-license fee for one user is $2000; for four users, $4250; and for eight users, $7250.

Plans call for incorporating the System 8000 into Z-Net by next year. *—Larry Lettieri*

First-time user pressures impact new low-end systems

At the risk of losing customers who demand easy-to-use and -service systems, companies selling computers to doubtful first-time users should heed one piece of advice—"seller beware." Data General Corp. and Xerox Corp., both trying to crack the low-end business-computer market for the first time, have taken the hint by trying to make a user's first exposure to a computer a comfortable one.

DG and Xerox each introduced personal business computers, their first such offerings, in June. The total market for small systems priced as high as $15,000 will exceed $6 billion in 1985, according to figures from Dataquest, Inc., Cupertino, Calif.

DG's Enterprise 1000 computer, priced at $7195 with a printer, includes video-disk training so that a user can work on the system while mimicking instructions. Xerox's 820 system, priced at $2995, not including printer or software, includes an easy-to-use training manual. Users are supposed to be able to learn each system in four hours.

"For a product to be successful in this market, a user must be able to open a box, put the system in place, plug in a program and have the computer up and running," says Herbert J. Richman, executive vice president at DG. He describes first-time users as having an appliance mentality; they want to press a button and have the system work. "This product can't tolerate service calls and the same failure rates as traditional machines," Richman says. The Enterprise 1000 is geared for $250,000 to $15-million companies that desire a general-accounting computer.

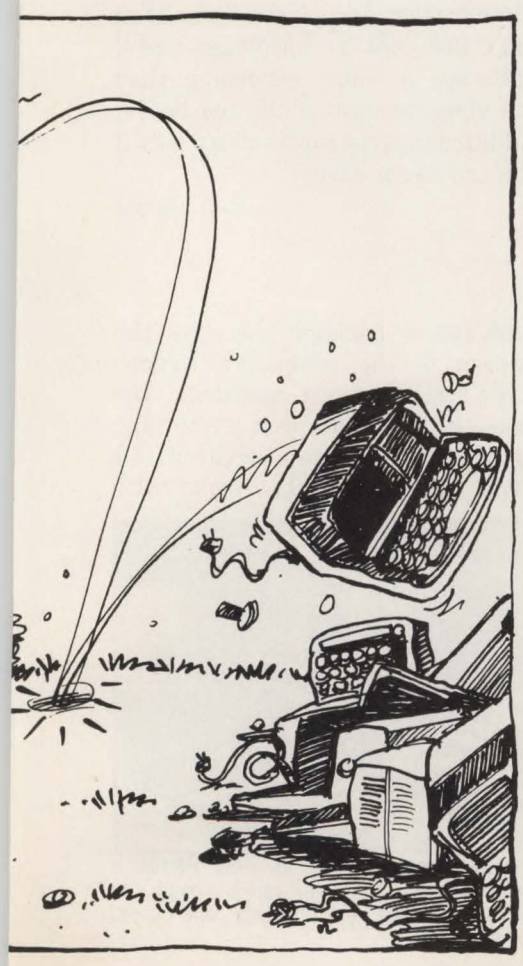
One beta-test site for the Enterprise 1000—Charleswater Products, Inc.—bears out Richman's theory. The small, West Newton, Mass.-based business has doubled its sales over the past several years. The company wanted a system that is easy for untrained operators to learn, is upgradeable, and that

Illustration by Jon McIntosh

works as reliably as other office equipment.

"I have no time in a small business to mess and fuss (with a computer)," says Charleswater's president George Berbeco. "I made it clear to DG at the start that if it did not work, I'd put it on the doorstep and they could pick it up. I just wanted to buy something that works. That's what DG provided."

The stand-alone Enterprise 1000 is DG's first turnkey system and the first member of a very-small-business-computer family. It is based on a 16-bit microNova μp, and includes a 24-line × 80-column CRT screen, two dual-density 5¼-in. floppy-disk drives housing 358K bytes each, 64K bytes of dynamic RAM, a 150-cps dot-matrix printer, a 90-day maintenance guarantee, documentation and video-disk training.



The Enterprise OS operating system is a subset of the MP/OS operating system. Programming in Business BASIC is available for $500. Business application packages include order entry and accounts receivable, priced at $1000 each, and more packages will be available.

Berbeco says the application packages are easy to use and feature credit-limiting checks, which will help his business. He is also pleased about upgrade possibilities. The product does not yet offer an easy vehicle for transporting software from the new 5¼-in. disks to media on other DG computers, some of which use 8-in. disks, and some of which have no slots at all.

"Language compatibility is an issue," says Lawrence Seligman, general manager of DG's small business systems division. "You want to write a program one time." That can be done with the Business BASIC available on the Enterprise 1000, which also can be run on microNovas, Novas, Eclipses and MV/8000 superminis. Seligman says DG will later offer a method to transport software more easily. The company will concentrate first on compatibility within the Enterprise family, and then extend that compatibility to other DG products.

Another item lacking in the initial offering is a hard-disk drive for increased mass storage and quicker response time. Berbeco says the floppy-disk drive does not have sufficient speed.

But DG is expected to add hard disks to the 1000 later, just as other vendors, including Xerox, Durango Systems, Inc., and NEC Information Systems, Inc. will add 5¼-in. Winchester-disk drives to their small business systems.

DG, which made its name by selling hardware in the fast-paced OEM market, is downplaying that image in its new market segment. The company is focusing on a total solution from one vendor, including hardware, software, service and training. DG believes that, as more competitors enter the fold, users will need a turnkey solution.

"We can't afford to destroy a user's first (system experience). We must satisfy him," says Gregory R. Fallon, manager of retail sales in the company's general-distribution division. DG will service the product, and service is a key buying criterion, Fallon says. DG will sell the 1000 through its six distributors and 130 retail outlets. Dealers will have a video-disk system in their stores to help train salespeople and customers.

Enterprise 1000 will be manufactured in Hong Kong and will be available by September.

Fallon believes DG's approach to supplying software is better than Xerox's, which allows users to go to independent suppliers to buy software.

The new Xerox 820 system, code-named "Worm," can be configured as a personal computer or a word processor. It includes a CP/M operating system, so that users can take advantage of the more than 2000 application programs on the market.

Based on a Zilog Z80 μp with 64K bytes of RAM and 4K bytes of ROM, the system also includes dual 5¼-in. floppy-disk drives, two serial and two parallel ports and a half-page CRT display. A 40-cps daisy-wheel printer is priced separately. Floppy-disk storage totals 92K bytes unformatted, and two optional 8-in. floppy-disk drives with 300K bytes of unformatted storage are available for $800 more. Optional software includes SuperCalc, an enhanced VisiCalc-like product developed for Xerox by Sorcim, Inc. SuperCalc is priced in the $200 to $300 range.

As a stand-alone small business computer, the 820 uses CP/M, priced separately at $200. As a word processor, the system uses Wordstar word-processing software and a

XEROX WORD PROCESSOR TRIGGERS PRICE CUTS

Xerox Corp.'s new 820 information system, which can be configured as a word processor or a small computer, has sparked price battles in the low-end word-processing-systems market. Reactions to the competitive pricing—$6395 with operating system and printer—came faster than margin pressures caused by IBM Corp.'s Displaywriter. Within a week of the 820's introduction, Wang lowered its Wangwriter price by 15 percent to $6400.

Although Xerox officials publicly claim the 820 will not compete with the Wangwriter or Displaywriter, which are more capable, higher priced systems, selling for less than $8000, one Xerox official noted privately that the reverse is true. "This is a low-end word processor—a Displaywriter counterattack," says John Titsworth, president of Xerox's information-products group, Stamford, Conn. "But it will also compete with Apple and Tandy," he adds.

Some industry observers suspect that Xerox wants to keep news of its ambition of competing with Apple and Tandy quiet so that sales of the word processor, which sells for $11,600, will not flounder. The 820 is not code-compatible with the 860. "I am disappointed," says Patricia Seybold, editor of The Seybold Report on Word Processing. "The text files are incompatible with those on the other system, "Xerox possibly did not want the 820 to eat away at 860 sales." Micropro International's Wordstar package was modified by Xerox for the 820.

Seybold explains that information on the 820's diskettes can be converted from CP/M format to 860 format by a utility program that runs on the 860, but 860 files cannot be converted for use on the 820.

subset of CP/M, both also priced separately. (See "Xerox word processor..." above.)

In either configuration, the 820 is a "market-share" product. "With this product, activity will heat up in personal computers," predicts Donald J. Massaro, president of Xerox's Dallas Office Products Division. The product will eventually be linked into the Ethernet local network as an entry-level device.

Xerox emphasizes that the product is easy to use and install, claiming that a customer can install the 820 in an hour and learn to use it in three hours using a training manual. Xerox plans to sell the product through its direct sales force, dealers, distributors, OEMs and 16 retail stores. The company will service and support the 820.

Although Xerox hopes to sell tens of thousands of units this year, at least one analyst believes the company still has to prove itself and terms it a start-up operation in its new market. "The key to success in that market is marketing, dealers and market understanding, as Apple demonstrated," says Peter Lieu, an analyst at Arnholdt & S. Bleischroder, Inc., New York. "You can't just look at hardware costs. Software is more governing than the absolute cost of the hardware. Additionally, the box is cheap only if you can use it easily."

—L. Valigra

H-P aims CP/M-based machine at personal systems market

In a major move to capture a share of the burgeoning personal-business computer market, Hewlett-Packard Co. has introduced a new desk-top, single-user computer system priced under $7500. Billed as a personal office computer, the HP125 is the Palo Alto, Calif., company's first product to use an independently developed operating system, Digital Research's CP/M.

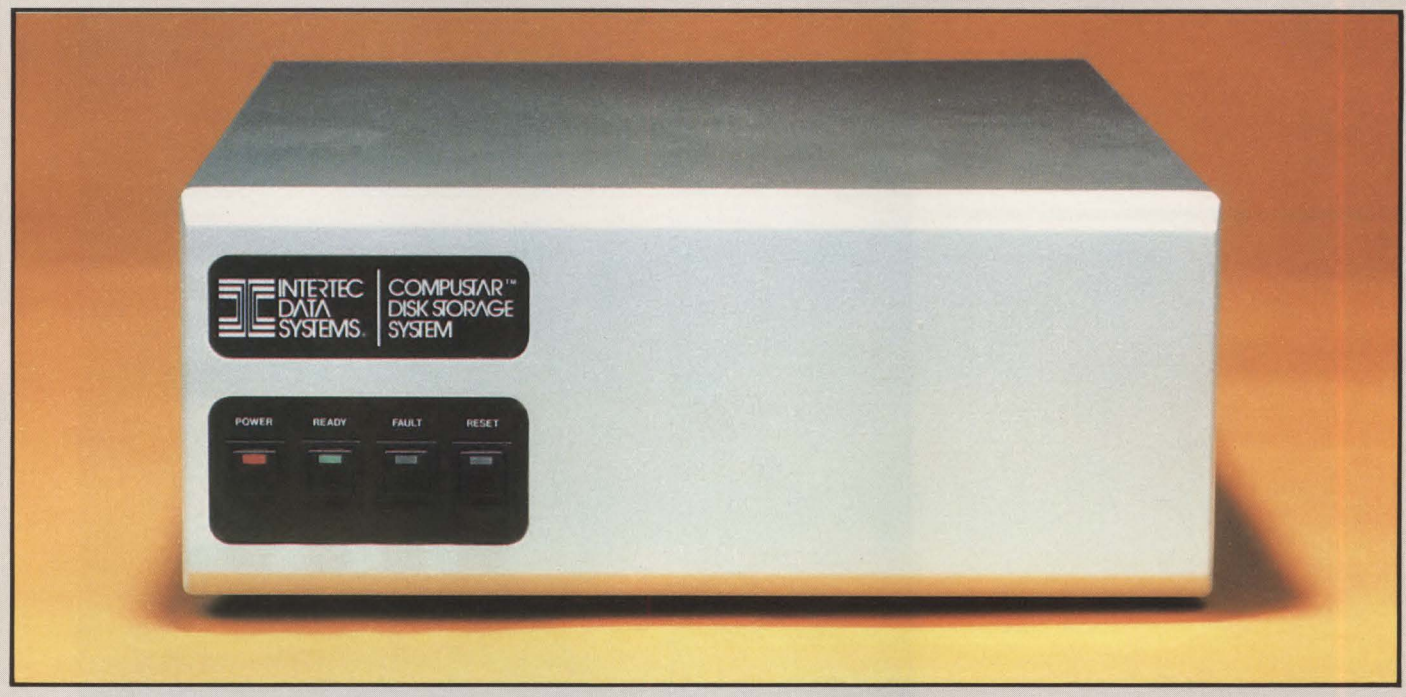
Executives at Hewlett-Packard say the HP125 combines the features of a word processor, financial calculator, smart terminal and graphics work station. H-P has included off-the-shelf software for these applications, including Personal Software, Inc.'s VisiCalc for financial problem-solving.

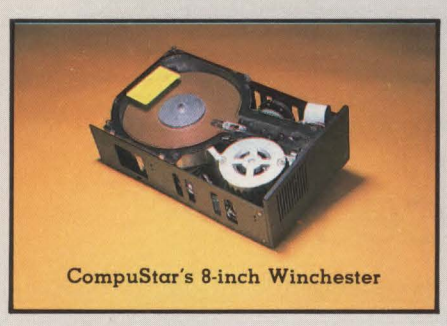
Besides VisiCalc, the HP125 is available with H-P-developed Graphics/125 for displaying business data in bar- or line-chart formats; a word-processing package, called Word/125, based on a product from Spellbinder, Inc., Davis, Calif.; BASIC 80 from Microsoft, Inc., Bellevue, Wash.; and H-P's own Link/125, a package that ties the system to the company's HP2000 large-scale business machines. Because the HP125 uses CP/M, any application software written for CP/M will run on the HP125 with

Hewlett-Packard calls its new HP125 *a personal office computer and is aiming it at large corporate departments and small businesses.*

SOLVE THE STORAGE SHORTAGE

with ten multi-user megabytes





CompuStar's 8-inch Winchester

Intertec's exclusive 255 User Controller

CompuStar Cable Assembly

If you could think of just one way to improve our phenomenally popular SuperBrain, what would it be? More disk storage? Well, we already thought about it. And for only a few thousand dollars for a whopping 10 megabytes of lightning-fast storage, it's nothing short of another major breakthrough! From the company that wrote the book on price/performance . . . Intertec.

Our New CompuStar™ 10 Megabyte Disk Storage System (called a DSS) features an 8 inch Winchester drive packaged in an attractive, compact desktop enclosure. Complete with disk, controller and power supply. Just plug it into the Z80 adaptor of your SuperBrain and turn it on.* It's so quiet, you'll hardly know it's there. But, you'll quickly be astounded with its awesome power and amazing speed.

*Some models require hardware/software modification.

The secret behind our CompuStar DSS is its unique controller/multiplexor. It allows many terminals to "share" the resources of a single disk. So, not only can you use the DSS with your SuperBrain, you can configure multiple user stations using our new series of CompuStar™ terminals, called Video Processing Units or VPU's™.

Four CompuStar VPU's are available. At prices starting at less than $2,500. Some models are designed to operate as stand-alone microcomputers, with internal disk storage. Just like your SuperBrain. Each model features its own 64K of RAM and can be "daisy-chained" into a powerful multi-user network. Just connect one VPU into the next. Using easy-to-install cable assemblies. Connect up to 255 users in a single system. One at a time. As you need them.

Whether you need an extra 10 megabytes for your SuperBrain or an enormous multi-user network, the CompuStar™ DSS solves your storage shortage problems. Sensibly. And economically. Plus, your investment is protected by a nationwide service network with outlets in most major U.S. cities. Providing efficient on-site or depot maintenance.

Get a demonstration of this extraordinary new system today. Call or write now for the name and address of your nearest CompuStar dealer.

INTERTEC DATA SYSTEMS®

2300 Broad River Rd. Columbia, S.C. 29210
(803) 798-9100 TWX: 810-666-2115

CIRCLE NO. 11 ON INQUIRY CARD

Now that the WICAT 68000 based system has quietly proven itself...

President of WICAT Systems Robert W. Mendenhall

We're ready to announce it.

While others were announcing their MC68000-based systems, we were proving ours. While other companies were scrambling to build and debug prototypes, WICAT's system was working successfully in Fortune 100 companies.

While others are promising 68000's, WICAT is delivering. Ask any of our Fortune 100 customers. Or ask us.

Call or write today for additional information.

WICAT Systems.

1875 South State P.O. Box 539 Orem, Utah 84057 **801 224-6400**

CIRCLE NO. 12 ON INQUIRY CARD

NEW PACKAGING, LOWER PRICE FOR HP250

Figuring that more than 2000 installations represent a milestone of sorts, Hewlett-Packard Co. has given its HP250 OEM first-time-user computer systems a new look, new peripherals, new software and a 24 percent reduction in price.

Two versions of the system are available, say company officials. One, the HP250/30, packs its processor and rotating memory into a filing-cabinet-sized box. H-P has moved to a 16M-byte, 8-in. Winchester-disk drive with the model 30, as well. A 67M-byte, 3M-built, ½-in. streaming tape-cartridge drive backs the disk drive manufactured by IMI, Inc., Cupertino, Calif.

The HP250/35, the second new model, retains the firm's original design of the 250 family—the desk-style work station—but incorporates the higher capacity Winchester drive and the streaming-tape backup. The model 35 also has an additional 32K bytes of system memory. It is possible to expand the model 35 as well, says H-P, by adding as many as five new personal work stations. The work stations are priced at $2250, half the price of their predecessors, says the company.

Both new HP250s run the company's OM250 business software that includes order-entry, accounts-receivable, inventory-control and sales-analysis packages. H-P has added text-processing and graphics options to the OM250.

A 250/30 sells for $22,500, while a model 35 is $25,600. The text-processing package sells for $750 for the first copy, and $200 for subsequent copies. The graphics software is provided to OEMs in a driver format.

Hewlett-Packard's HP250/30 computer system *supports as many as six personal work stations—and carries a price recently reduced 24 percent.*

slight modifications, the company says.

The HP125 is based on the company's HP262X intelligent-terminal family, says product marketing manager James Groff. The system uses two Z80As. One serves as the terminal processor and is the "original intelligence" in the 262X family. The second Z80, along with 64K bytes of RAM, handles program execution and CP/M.

Two models of the HP125 are available. The model 10 has dual 5¼-in. floppy-disk drives for 500K bytes of storage, while the model 20 uses two 8-in. floppies for 2.4M bytes of storage. Each model is available with either an integral thermal printer, a letter-quality printer for word processing or a 180-cps dot-matrix printer. One- or eight-pen plotters handle graphics output. Two RS232 data-communications ports are standard on each model. Prices start at $7460 for a model 10 with an 80-cps built-in thermal printer and dual 5¼-in. floppy-disk drives. CP/M is included in the price. Other software is priced separately: VisiCalc, $200; Word/125, $500; Graphics/125, $200; BASIC 80, $325; and Link/125, $150.

Although the HP125 is priced within the range of personal-computer users, H-P's Groff says the company is shooting for individual users in large corporations. "It's anticipated that close to 600,000 systems costing less than $15,000 will be purchased by industrial companies during 1981," Groff says. With that in mind, H-P has no plans to sell the HP125 in retail stores. Instead, the company will use its direct sales force, aiming the product initially at H-P's installed business-system base. *—Larry Lettieri*

Burroughs takes 'wait-and-see' approach to local networks

While competitors, including Wang Laboratories, Inc., Xerox Corp. and Datapoint Corp., preach their own approaches to local-area networking, Burroughs Corp. is assuming a "wait-and-see" attitude before committing to a strategy for its new OFIS 1 office-automation system.

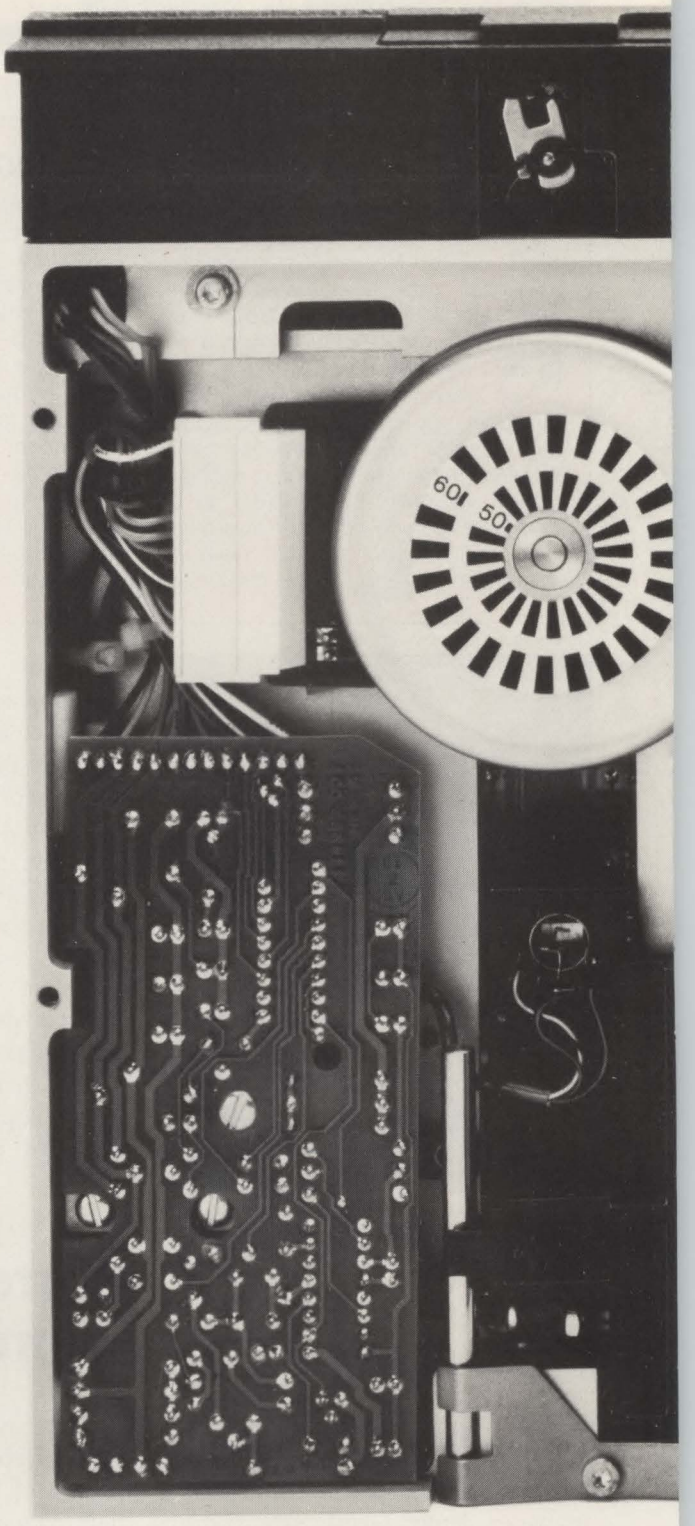
Burroughs intends to offer compatibility with the local networks that gain the largest market shares—such as Ethernet—says Roger W. Johnson, president of the company's Office Systems Group, Danbury, Conn.

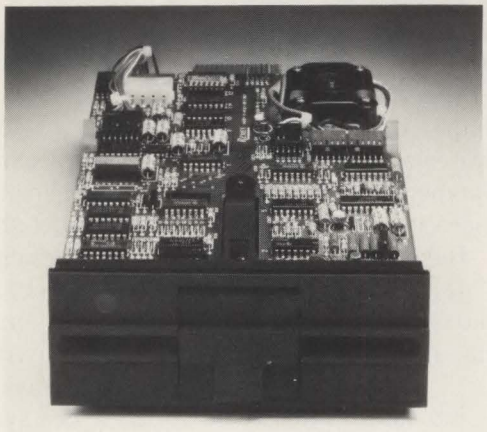
The company also will support IBM Corp.'s SNA and its own BNA communications protocols. "If there is no de facto standard by market share, it makes sense to be compatible (with any major network offered)," says Lou Galie, director of advanced systems engineering at the Office Systems Group. "You can't have a lock-out strategy," he adds.

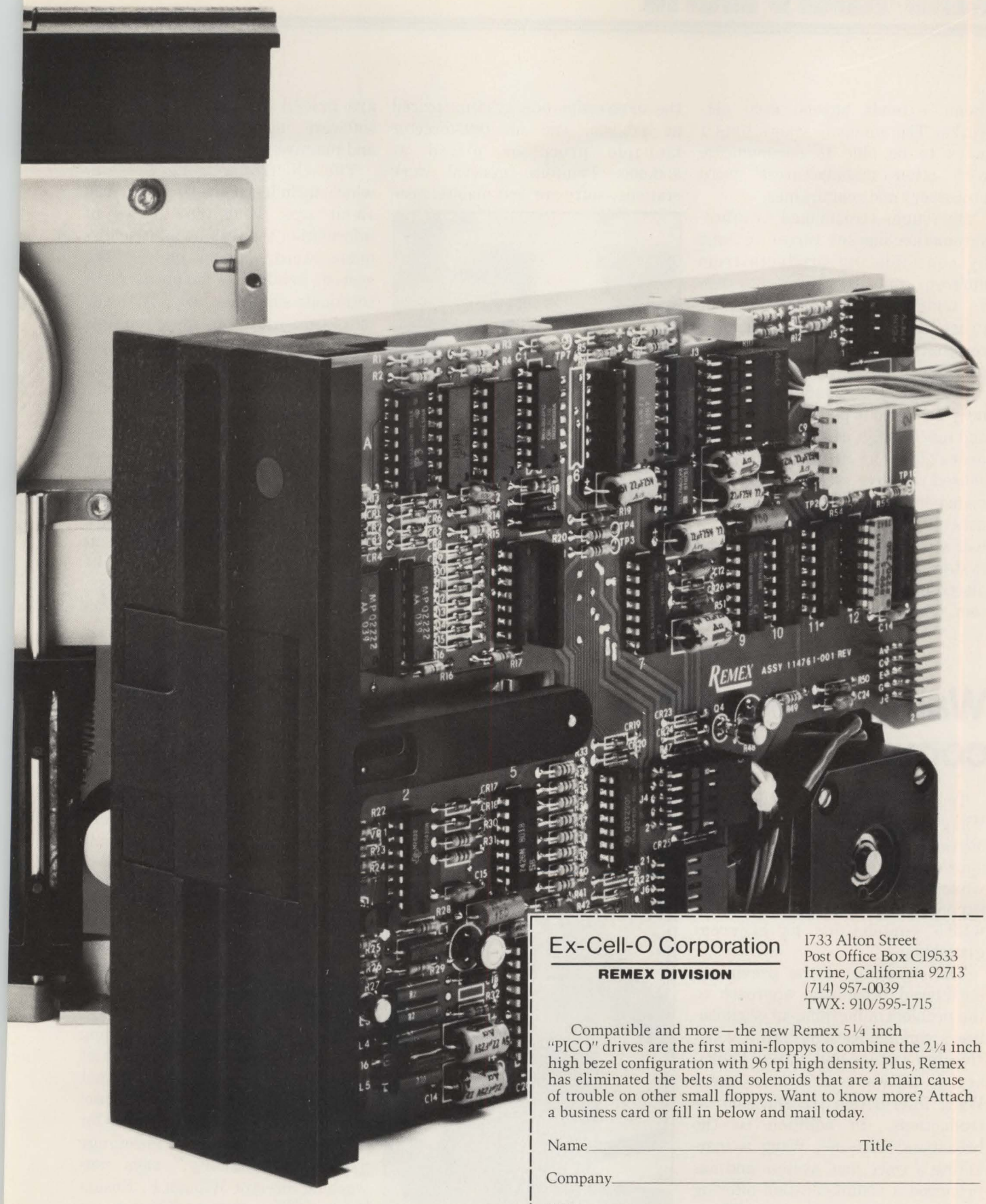
The company's compatibility

The New Remex 5¼ Inch Flexible Disk Drive.

Low Profile, 96 TPI. Direct Drive Performance.







Write or Call for Specifications and Delivery.

Ex-Cell-O Corporation
REMEX DIVISION

1733 Alton Street
Post Office Box C19533
Irvine, California 92713
(714) 957-0039
TWX: 910/595-1715

Compatible and more—the new Remex 5¼ inch "PICO" drives are the first mini-floppys to combine the 2¼ inch high bezel configuration with 96 tpi high density. Plus, Remex has eliminated the belts and solenoids that are a main cause of trouble on other small floppys. Want to know more? Attach a business card or fill in below and mail today.

Name_____ Title_____

Company_____

Address_____

City_____ State_____ Zip_____

Phone_____

CIRCLE NO. 13 ON INQUIRY CARD

theme extends beyond local networks. The company wants OFIS 1 users to be able to communicate with other manufacturers' word processors and mainframes.

Burroughs streamlined its office-automation market thrust in June by consolidating products from different company groups into OFIS 1, which includes a computer processor, an optical character recognition system and a word processor.

OFIS 1 can be configured modularly for various performance needs and functions. It can serve as a word processor, a filing system, a shared-resource system or an office-management system. System components include the OFISwriter, a half-screen display word-processing system priced at $5495; an OFISfile electronic filing-and-retrieval system, with prices starting at $59,400; the OFISreader OCR system, priced at $10,900; and an OFISdirector multiple processor priced at $33,500. Printers, general work stations, software and maintenance are priced separately. Optional software includes electronic mail and mainframe protocols.

Burroughs's OFIS 1 office-automation system *for professionals can be configured modularly to act as a word processor, an electronic file, a shared-resource system or an office-management system.*

The electronic-filing system, which includes multiple Intel 8086 16-bit μps, holds 80M bytes of information that can be accessed by name, word, date or phrase. The system handles as many as eight terminals simultaneously. With the processor, users can share multiple OFIS 1 CRT displays and multiple electronic-file systems. The filing system will be available in the fourth quarter.

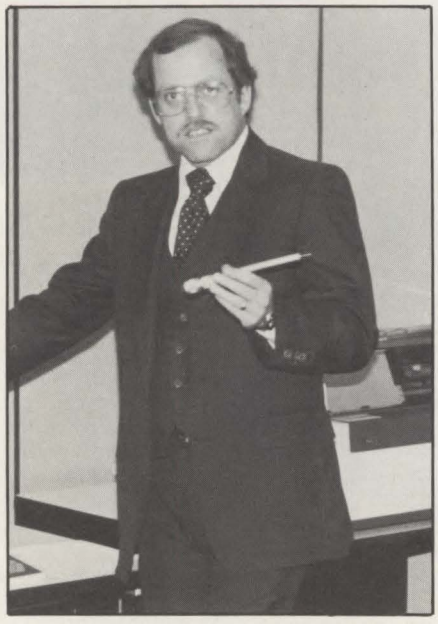
The OFISdirector processor houses four Burroughs B900-level μps and includes 360K bytes of main memory, 19M bytes of fixed-disk storage, 1M byte of floppy-disk storage and two communications lines. The OFISdirector will be available in the first quarter of 1982.

—L. Valigra

Wang Labs pushes communications offerings

True to its earlier indications, Wang Laboratories, Inc., Lowell, Mass., is taking a broadband approach to local-area networking while dismissing criticism over the supposed high cost of wide bandwidth connections as ethereal grumbling.

The detailing of the previously announced broadband approach to the problem of meshing an organization's communications into a cohesive interactive unit (MMS, February, p. 18) was one of three recent Wang information transmission introductions. In addition to the broadband network, Wang is marketing a voice mail system and has promised a communication offering for the firm's stand-alone Wangwriter word processor.



The Wangnet *is a coaxial cable-based system. Networking director William F. Rosenberger holds a portion of the cable.*

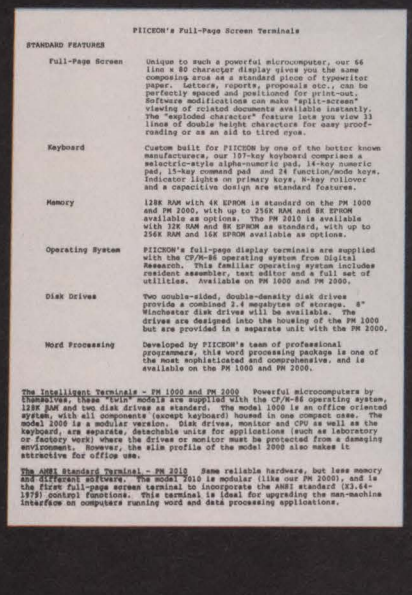
By adopting a broadband approach, the company is spurning Xerox Corp.'s efforts to have its baseband network, Ethernet, adopted as an industry standard. Bandwidth refers to the information capacity of a transmission line. Baseband networks allow only one device to use the transmission line at a given moment, whereas broadband networks allow multiple devices to use a line.

While Wang is going it alone with WangNet, the company is holding the door open to other companies that might be attracted to the approach.

"We have an interest in opening up WangNet broader than it is at the present time, and we would not turn down any approach from another vendor or manufacturer for information that would encourage greater compatibility," says networking director William F. Rosenberger. The company has not yet announced any such agreements.

With WangNet, the company is

PIICEON–The intelligent terminal for a full page world.



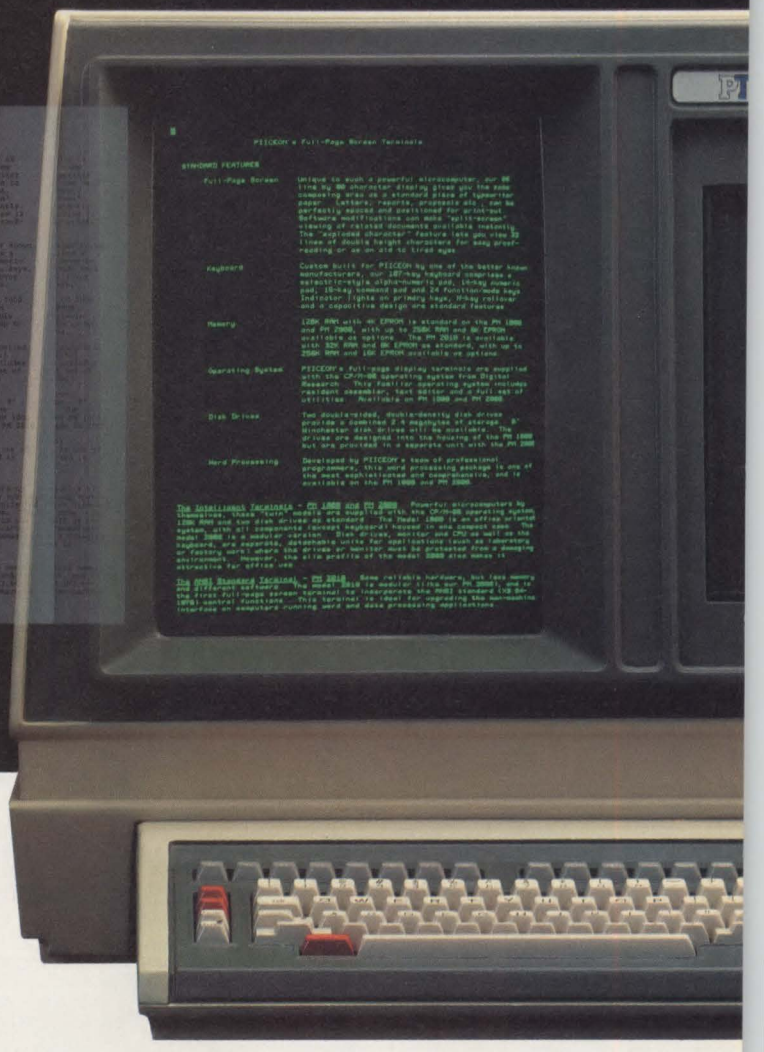
PIICEON's Full-Page Screen Terminals

STANDARD FEATURES

Full-Page Screen	Unique to such a powerful microcomputer, our 66 line x 80 character display gives you the same composing area as a standard piece of typewritor paper. Letters, reports, proposals etc., can be perfectly spaced and positioned for print-out. Software modifications can make "split-screen" viewing of related documents available instantly. The "exploded character" feature lets you view 33 lines of double height characters for easy proof-reading or as an aid to tired eyes.
Keyboard	Custom built for PIICEON by one of the better known manufacturers, our 107-key keyboard comprises a selectric-style alpha-numeric pad, 14-key numeric pad, 15-key command pad and 24 function/mode keys. Indicator lights on primary keys, N-key rollover and a capacitive design are standard features.
Memory	128K RAM with 4K EPROM is standard on the PM 1000 and PM 2000, with up to 256K RAM and 8K EPROM available as options. The PM 2010 is available with 32K RAM and 8K EPROM as standard, with up to 256K RAM and 16K EPROM available as options.
Operating System	PIICEON's full-page display terminals are supplied with the CP/M-86 operating system from Digital Research. This familiar operating system includes resident assembler, text editor and a full set of utilities. Available on PM 1000 and PM 2000.
Disk Drives	Two double-sided, double-density disk drives provide a combined 2.4 megabytes of storage. 8" Winchester disk drives will be available. The drives are designed into the housing of the PM 1000 but are provided in a separate unit with the PM 2000.
Word Processing	Developed by PIICEON's team of professional programmers, this word processing package is one of the most sophisticated and comprehensive, and is available on the PM 1000 and PM 2000.

The Intelligent Terminals – PM 1000 and PM 2000 Powerful microcomputers by themselves, these "twin" models are supplied with the CP/M-86 operating system, 128K RAM and two disk drives as standard. The model 1000 is an office oriented system, with all components (except keyboard) housed in one compact case. The model 2000 is a modular version. Disk drives, monitor and CPU as well as the keyboard, are separate, detachable units for applications (such as laboratory or factory work) where the drives or monitor must be protected from a damaging environment. However, the slim profile of the model 2000 also makes it attractive for office use.

The ANSI Standard Terminal – PM 2010 Same reliable hardware, but less memory and different software. The model 2010 is modular (like our PM 2000), and is the first full-page screen terminal to incorporate the ANSI standard (X3.64-1979) control functions. This terminal is ideal for upgrading the man-machine interface on computers running word and data processing applications.



The first OEM terminal family that works the way people do.

Once, computers were only for numbers and a one-third page display was good enough. But now computers are for words, too, and sophisticated users are asking for a terminal with a Full Page Screen. Seeing a page at a time makes it easier to judge spacing, set margins and position text on letters, forms, memos and a thousand other things. And, having a Full Page Screen enhances any system you're building by improving the user's interface.

Three terminals to meet your configuration and interface needs.

PIICEON has three intelligent terminals with the Full Page Screen. Each is a fully integrated, stand-alone workstation with an on-board 16-bit microcomputer and a 15" CRT display. And, all three models let you take advantage of our unique proprietary word processing software and split-screen display for comparing related documents.

The Model 1000 has built-in floppy disk drives and expandable random-access memory. The Model 2000 has many of the same features but is modular, with floppy disk memory in a separate unit, for easy systems configuration. The newest terminal in the PIICEON line is the Model 2010. Modular, like the Model 2000, it is plug compatible with any computer that supports standard ASCII terminals, but goes beyond via the new ANSI standard. With our comprehensive implementation of the ANSI standard terminal control functions (X3.64-1979) you can upgrade both word and data processing systems.

PM2000 PM1000 PM2010

Designed with the OEM in mind.

From easy interfacing and rugged design, through our aggressive quantity discount schedule, PIICEON terminals make it easier than ever to build a system with an exciting price/performance story. Our modular design and rugged construction using proven components makes service easy, but infrequent. Best of all, you receive your PIICEON terminals when they are promised, no excuses.

Be intelligent! Mail this coupon for more detailed information.

I would like more information on:
☐ PM1000 and PM2000 Intelligent Terminals
☐ PM2010 ANSI Standard Terminal ☐ Please have a salesman call

Name_____ Title _____

Company_____

Address_____ City_____ State_____

Zip_____ Phone_____

PIICEON, Inc., Intelligent Systems Division
2350 Bering Drive, San Jose, CA 95131
(408) 946-8030

PIICEON

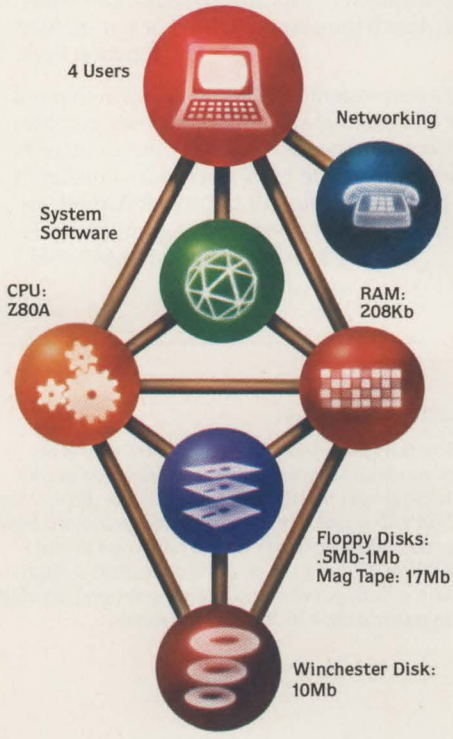

ALTOS
BRAND
PROVEN VALUE
COMPUTER · SYSTEMS
PRODUCED IN THE HEART OF SILICON VALLEY, CALIFORNIA U.S.A.
ALTOS
ALTOS

BUMPER CROP

8-inch Winchester Multi-User Systems. Now In Volume- $8,500.

Altos is delivering the cream of the crop with their new 8-inch multi-user Winchester disk systems. They're freshly packed with the quality features you expect from Altos, and at a price you expect from Altos, too—just $8,500.

Pick from two fully integrated systems, each packaged in our new compact, stylish cabinet suitable for either rack mount or table top applications. You get 10 MBytes of reliable on-line storage in our 8-inch Winchester drives. Then for system back-up storage, you can select from either 8-inch, single or double-sided floppy drives (ACS8000-10 and -10D) or a ¼-inch magnetic tape drive (ACS8000-10/MTU). And for powerful performance, all of these Z80A*based systems come complete with 208K of RAM and 6 programmable serial ports, ready to support four users.



SYSTEMS PICTURED:

ACS8000-10 (10Mb HD + 1 floppy)	$ 8,500
ACS8000-10/MTU (10Mb HD + DEI Mag Tape)	$10,990

Here's the most bountiful selection of systems and capacities in the field from the company that knows how to deliver quality systems in the volumes that OEMs need to stay competitive.

And Altos supports these systems with a broad software selection including the three industry standard operating systems—CP/M, multi-user MP/M** and OASIS†. These operating systems support seven high level programming languages: BASIC, FORTRAN, COBOL, PASCAL, APL, PL/1 and C. Also available are comprehensive communications packages: ASYNC—Altos-to-Altos, BISYNC—Altos-to-mainframe and full networking with CP/NET. All are designed to run on a high speed 800 Kilobaud networking channel—standard with every system.

The ACS8000-10 Winchester systems join our growing family of field-proven products. In just three years, more than 8,000 systems have been shipped to an OEM customer-base.

Get to market fast. Harvest your 8-inch Winchester system direct from the heart of Silicon Valley. Call or write today for specific product information and OEM pricing. Altos Computer Systems. 2360 Bering Drive, San Jose, CA 95131, (408) 946-6700, Telex 171562 ALTOS SNJ.

CIRCLE NO. 15 ON INQUIRY CARD

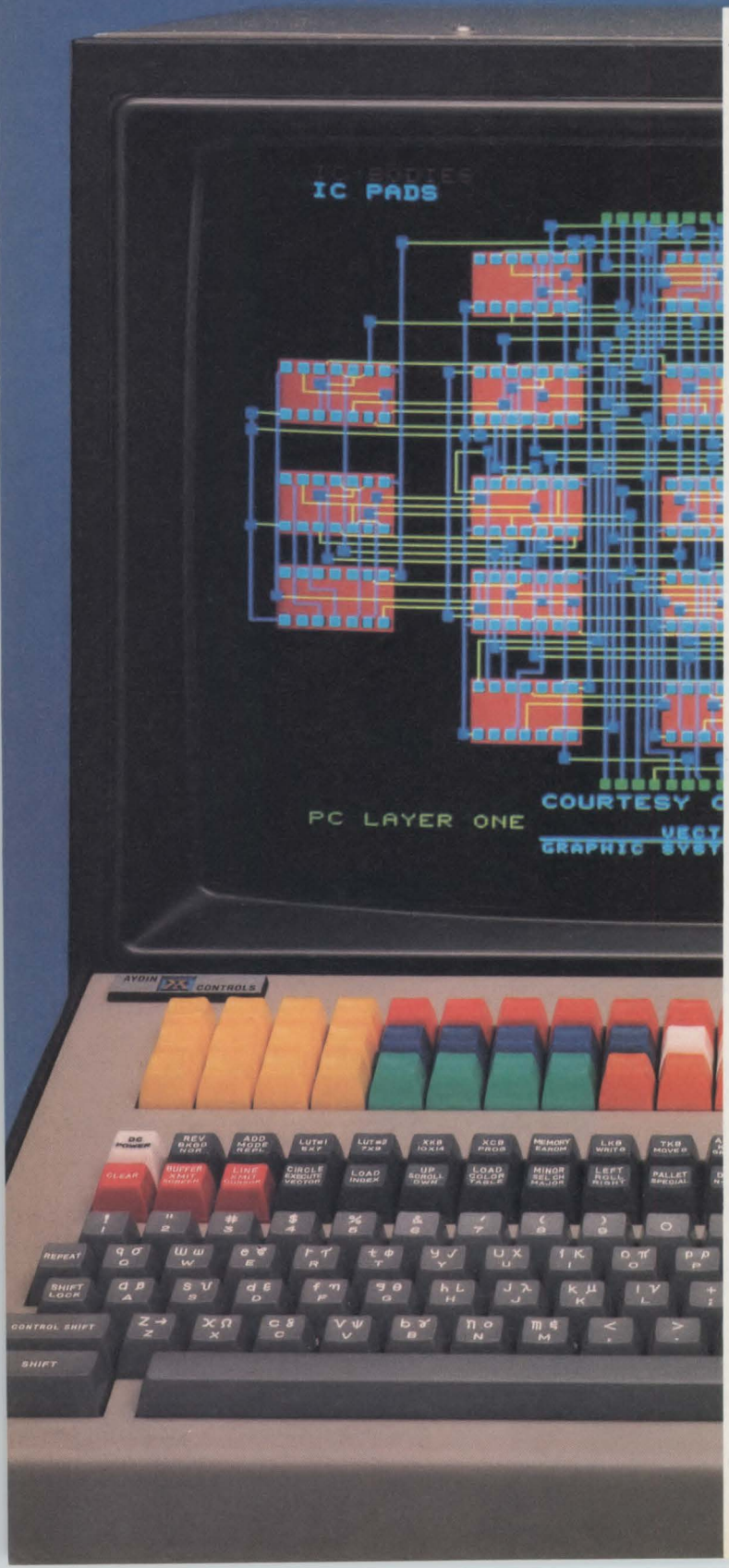
Packed with Fresh Ideas

ALTOS
COMPUTER SYSTEMS

*Z80A is a registered trademark of Zilog, Inc.
**CP/M and MP/M are registered trademarks of Digital Research, Inc.
†OASIS is a registered trademark of Phase One Systems, Inc.
‡datapro is a registered trademark of Datapro Research Corp.

Quickens Your Draw

Aydin user-oriented, full-color graphic systems let you tackle complex design and processing projects quickly and easily.



Aydin 5216 high-resolution multiprocessor-based color graphic systems lead the industry in fulfilling the needs of intricate process control CAD/CAM, simulation, C³I, image processing and many other sophisticated applications.

Versatility is the result of the Aydin growing family of hardware and 2D, 3D, imaging and CORE software modules. The 5216 gives you both the flexibility and programmability to design and implement your ideas efficiently and economically; a true man-machine interface. For example, AYGRAF instruction sets provide both standalone and distributed processing capabilities to support 2D graphics in a standardized manner. The 3D system, which supports standalone and host-driven applications, is designed to give the user the full benefit of sophisticated graphics, all with interactive control that doesn't burden the host computer.

Aydin modular design also means that you can customize the 5216 to your strictest requirements, easily expand memories, add storage and utilize various user-programmable lookup tables. In addition, a host of interactive devices are available, including joysticks, trackballs, graphic tablets, touch panels and lighted or non-lighted function keys.

It all adds up to a user-oriented 5216 color system that is a reliable, flexible and economical solution to your graphics and image processing needs. Quicken your draw with Aydin, the industry leader in high-resolution, intelligent color graphics. For more information, contact Aydin Controls, 414 Commerce Drive, Fort Washington, PA 19034. Tel.: 215-542-7800. (TWX: 510-661-0518.)

Leadership Features:

• High-performance multiprocessor bus architecture • Pixel or graphic DMA block mode data transfer (800 nanoseconds per 16-bit pixel) • Multiple pixels per word • Wide selection of display formats up to 1024 x 1024 x 16 • Video processing through lookup table RAM at bit rates to over 40mHz • High-speed hardware vector and character generation • Four sizes of alpha characters • High-speed hardware math • Both parallel and serial peripheral interfaces available • User programmable • 16-Bit microprocessor.

AYDIN CONTROLS

CIRCLE NO. 16 ON INQUIRY CARD

entering the networking fray with a coaxial cable-based system that can operate at speeds of 12M bits per sec., has a local networking range measured in miles and can handle data and video communications with the possibility of adding voice. Moreover, by using standard connectors developed by the cable television industry in conjunction with specially developed Wang components and processors, the cost-per-user installation will be about $400 in a typical 10-user system, exclusive of wiring costs, making it highly cost-competitive with other networking technologies, Wang officials contend.

Wang is offering three levels of connections within WangNet: an interconnect band, a utility band and WangBand. Rosenberger notes that the three products use only 35 percent of the broadband's capabilities. The broadband CATV technology used by Wang allows the system to offer multiple communication channels by digitally encoding information along specific frequencies. The WangNet system operates from 10 to 350 MHz.

Wang's broadband approach does not foreclose the possibility of compatibility with other networks. Under the interconnect portion of WangNet, any device that adheres to the RS232 standard can use the cable. The interconnect band acts solely as a pathway in a manner similiar to a telephone line, and communicating devices would require a common protocol to be able to "talk" to each other.

Within the interconnect band, Wang offers two channels—a switch channel and a dedicated channel.

Under the switch channel, two pieces of Wang hardware are required. A Wang frequency-agile modem (FAM) allows RS232 devices to enter the system, and a Wang Dataswitch instructs the modem as to which frequency to use. The FAM in conjunction with the Dataswitch essentially establishes a 9600-bps dedicated channel for the length of the call.

As many as 256 circuits can be established at any one time. The FAM is priced at about $1300, and the Dataswitch is priced at $12,000. Both will be available next June.

The dedicated channel allows the system to operate similiarly to a leased line. Wang offers two fixed-frequency modems (FFMs) that enable a user to gain access to the line. One FFM operates at 9600 bps ($850), and the other at 64,000 bps ($1200). Both will be available next February.

The utility band allocates seven channels for live or freeze-frame video. Wang allocates the space on the cable, but does not intend to offer video equipment.

Under the WangBand range of WangNet, the company's VS, OIS and 2200 systems can communicate over the cable. WangNet requires a new piece of hardware called the cable interface unit (CIU), which operates as a shared device and will be priced at $3800 when it is available in October, 1982.

Five operations can be performed under WangBand. Messages can be delivered as electronic mail under the company's Mailway system at a rate of 12M bps; a document can be requested from one system to another; a document can be sent from one system to another (some files may require conversion on the receiving system); documents can be logged on and edited on an OIS or VS, but not on a 2200 system; and OIS or 2200 work stations can log on to the VS systems and act as VS work stations.

Wang's digital voice exchange (DVX) is separate from WangNet and is a system that provides voice store-and-forward capabilities. The system can be expanded from a base-priced $125,000 DVX that can handle about 200 users to a $32,000 system capable of supporting 800 users. The DVX system will be available in January.

The DVX system's hardware includes CPU, storage disks and telephone-line interface units called input/output message processors (IOMP). Each IOMP can handle four telephone lines. The system can be expanded by adding IOMPs or by adding more storage in the form of 300M-byte Control Data disks.

The company's Wangwriter stand-alone work station, recently reduced in price, is getting communication capabilities that will allow it to be 3270- and TTY-compatible. The Wangwriter (which is now base-priced at $6400) was also given advanced text-editing functions.

—Eric Lundquist

Export license snafus plague high-technology trade

To hear participants at a recent seminar on the how-tos of exporting high-technology products, co-sponsored by the Department of Commerce and the Electronic Industries Foundation, one might wonder if the government is really on the side of U.S. business.

Those gathered to learn what the Commerce Department offers in the way of guidance for exporters felt that Commerce was speaking with a forked tongue. In his keynote address, newly appointed undersecretary of commerce for international trade Lionel Olmer stressed the need "for a change at the national level in trade policy" and the

importance of "business and government cooperating to have international trade flourish." Yet, he noted that the number of federal government-fostered "disincentives to trade" had grown from two to 15 over the past several years.

"The problem in a nutshell," says Southern California export consultant Richard Kontrimas, "is that there are too many regulations governing our exporting." Kontrimas adds that, compared with other countries, U.S. regulations are "inadequate and unfair." An understaffed department bureaucracy, Kontrimas says, adds to the cascading set of problems faced by a company trying to export its products.

Jack Klingert, vice president of Eastern Europe, Asia and Middle East operations for Control Data Corp., agrees with Kontrimas. Speaking at the seminar with Olmer, Klingert pointed out that "decisions regarding export licenses may be made without regard for the intent of the Export Act of 1979." Passed during the Carter Administration, the act covers products and technologies that are somehow related to U.S. national security. As a result, said Klingert, U.S. firms are put at a disadvantage when competing with foreign companies.

Kontrimas adds that customers unwilling to wait "four to eight weeks for the right piece of paper will go to another source for the product." The irony is that even those products considered to be sensitive by the U.S.—and for which licenses are rarely or never granted in the case of Eastern European countries or the Soviet Union—can be obtained from Japan or Western European nations.

Olmer summed up the feelings of many by saying, "The biggest disincentive to trade is export license-granting policy."

Nonetheless, licensing of high-technology exports will continue, said Lawrence Brady, assistant secretary for trade administration, addressing the Commerce seminar. The level of control may change, however, he pointed out. 'Whether a μp-controlled game should be controlled is a legitimate question," he said.

Taking some goods off the control list would help to reduce the time it takes to get a license, said Thomas Christiansen, manager of international trade relations at Hewlett-Packard Co. Sharing the platform with Brady, Christiansen said, "Unfortunately, electronics and computer-related products are affected too much by strategic and foreign-policy considerations." And, while Commerce continues to act as a front for the Departments of Defense and State, the delays will continue as well, he said.

But Brady claimed that changes would be made in the license-granting body within Commerce, the Office of Export Administration. He pointed out that close to 80,000 applications for export licenses are filed each year, but that OEA is not equipped to handle them on a timely basis. However, Brady claimed that deadlines will be set to handle the backlog in applications.

For computer and electronics firms, these changes are coming none too soon.

—Larry Lettieri

MINIBITS

RUBEN UNVEILS 'EASY' BUSINESS SYSTEMS

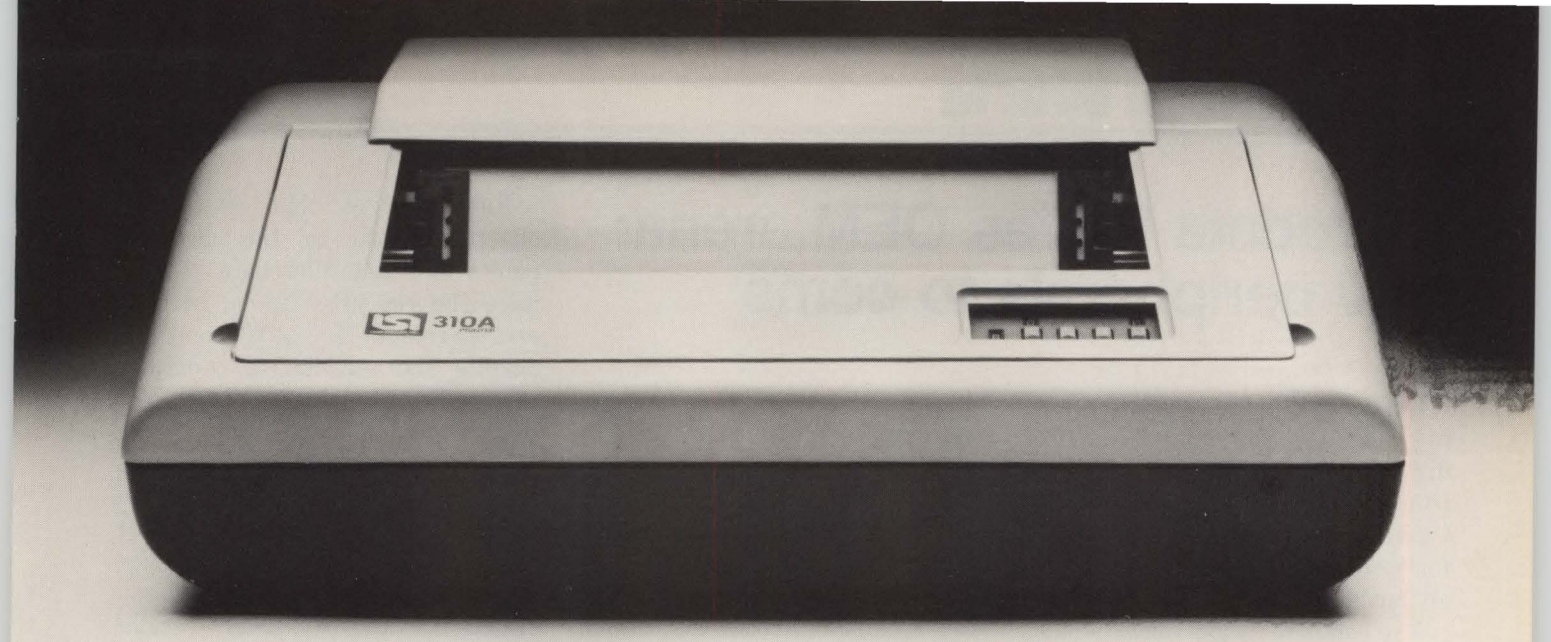
Attempting to make interaction with its new computer system as simple as following common office procedures, Ruben Engineering Corp. has implemented such familiar prompts as "desk," "drawers," "folders" and "forms" in its "Assistant" business system. Running under the firm's application-specific Business language, the Assistant incorporates an MC68000-based CPU plus several other μps that perform controlling functions. In a typical configuration, the system consists of the CPU, 33M bytes of 14-in. Winchester-disk storage (expandable to 652M bytes), 256K bytes of main memory (expandable to 2M bytes), an integral, 17M-byte tape cartridge for archiving and backup and a 15-in., 6000-plus-character CRT in a vertical or horizontal configuration. The basic system sells for $39,500 in single-unit quantities, with substantial volume discounts available. One system feature expected to be especially attractive to retailers is the Assistant's ability to communicate directly with point-of-sale cash registers. The system will be distributed through regional dealers, which will be encouraged to add value by modifying and expanding basic software capabilities.

SEMICONDUCTOR INDUSTRY SURGES FORWARD

The semiconductor industry is one of the fastest growing in the U.S., supported by a productivity rate that surpasses even the overall productivity rate of the U.S. economy between 1975 and 1979. However, 1981 is expected to be a low-growth year for the industry. By 1983, the previous growth patterns should resume.

A report by Cupertino, Calif.-based Semiconductor Industry Association (SIA), entitled: "Semiconductor Industry Economic Ratios: An SIA Report on Sales, Employment, Capacity and Productivity," reports that total worldwide semiconductor shipments steadily increased over the five-year period from 1975 to 1979 at an approximate 25 percent annual rate and reached a record level in 1979 of $6.6 billion. While productivity in that industry segment increased by an average of 22 percent annually in the late 1970s, the overall U.S. economy, by comparison, experienced virtually no measurable growth.

SIA predicts a low growth rate of 7 to 10 percent in the industry for 1981, as a result of soft international market competition, particularly in Europe. When worldwide demands strengthen as forecasted for 1982 and 1983, the report continues, growth will spurt to rates of 20 to 30 percent.



LSI quietly presents the Hummm Terminal.

From those wonderful folks who brought you the Dumb Terminal® video display, now there's the Hummm Terminal™ Printer.

Featuring quiet operation that's almost unheard of, outstanding reliability and print quality, impressive throughput and a long list of sensible features.

All at a hard-to-believe low price. So low, in fact, that you'll immediately know why we call it Hummm Economics.

A LOT OF IMPACT PRINTER WITHOUT A LOT OF NOISE.

Quite simply, the 310A Hummm Terminal is one of the quietest impact printers in its class. In fact, with its Acoustic Quieter it checks in at a soothing 56dBA. That's quieter than most typewriters. And than most copy machines.

Fine engineering is the quiet secret. The Hummm Terminal hums along bidirectionally at 180 cps.

BELLS AND WHISTLES STANDARD.

You won't find many options on the Hummm Terminal. Because we made most of them standard.

Its logic seeking capability finds the shortest path to the next character on a new line—thanks to space and blank character compression. And with an optionally expanded buffer of 2048 characters, a full terminal screen can be dumped instantly.

You get superior printing capability, including true lower case descenders and underlining—good for an original and five crisp copies on multipart forms. A 9x7 character field. Complete horizontal and vertical forms control. 14 switch selectable form lengths, and 14 perforation skip-over formats. And a 100% duty cycle.

HUMMMAN ENGINEERED.

The Hummm Terminal brings to computer printers the same high standards that made our Dumb Terminal video display the standard for an entire product category. It's rugged, durable, and stylish so it fits right into any office decor.

So call your nearest LSI Authorized Distributor and ask him for some Hummm Terminal information. And when you do, fill out the coupon completely and send it to us. We'll send you a free Hum^3 with over 3 billion combinations—and only one right one.

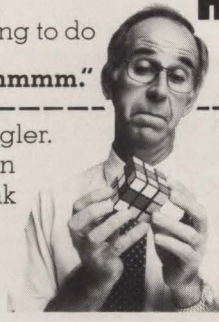
It'll give you something to do during those quiet moments when the Hummm Terminal is humming along.

Lear Siegler, Inc. Data Products Division, 714 North Brookhurst Street, Anaheim, CA 92803 714/774-1010. TWX: 910-591-1157. Telex: 65-5444. Regional Sales Offices: San Francisco 408/263-0506 • Los Angeles 213/454-9941 • Chicago 312/279-5250 • Houston 713/780-2585 • Philadelphia 215/245-1520 • New York 800/523-5253* • Boston 617/423-1510 • Washington, D.C. 800/523-5253* • Orlando 305/869-1826 • England (04867) 80666.
*800 numbers also includes states of: CT, DE, MA, MD, NY, RI, VA and W.V.

THE 310A HUMMM TERMINAL.

LSI LEAR SIEGLER, INC. DATA PRODUCTS DIVISION

"Hummmm."



Hummm, Lear Siegler. You've certainly given me something to think about. I asked my distributor about the Hummm Terminal.

Here's his name along with my business card. (I realize that I can't get a Hum^3 if I don't include my card.)

Name_____

Distributor _____

Distributor Sales Rep_____

Distributor Location_____

Distributor Telephone_____

Lear Siegler, Inc., Data Products Division, 714 North Brookhurst Street, Anaheim, CA 92803. Attn: Adv. C

CIRCLE NO. 17 ON INQUIRY CARD

Microdata leaves OEM arena; new peripherals to come

Concurrent with the first showing of its Sovereign line of distributed data-processing systems, Microdata Corp., Irvine, Calif., quietly announced that it was formally leaving the OEM peripherals business.

The company began operations as an OEM supplier of 16-bit minicomputers, and later moved into terminals, printers and disk drives, including a 3350-technology 14-in. Winchester-disk drive, the Reflex II. In recent years, however, sales of small-business computer systems carrying the name Reality have become the major source of company revenues. Now, says Microdata president Don Fuller, all manufacturing and developmental work on peripherals will be directed toward Reality and Sovereign end-user systems. "We will continue to support our existing OEM customer base," he says, "but we have no plan to expand our OEM peripheral operations."

In late 1978, the company had other plans for its peripheral operations, however. Microdata executives were then planning to revitalize what had become a secondary segment of the company's business, and were thinking in terms of a joint OEM peripheral venture involving another minicomputer maker. This venture was to be modeled on Magnetic Peripherals, Inc. (MPI), established jointly by Control Data and Honeywell.

Microdata saw its joint venture as a junior version of MPI with a customer base comprising what one company executive called second-tier minicomputer vendors—all vendors except for Digital Equipment Corp., Data General Corp. and Hewlett-Packard Co. By fall, 1978, Microdata had sent out joint-venture feelers to several other minicomputer houses.

The company was simultaneously proceeding with plans to establish a separate sales force to handle OEM hardware, and was considering establishing nationwide sales offices. Company executives estimated that within five years, half of Microdata's gross hardware revenues would be generated by OEM sales.

But Microdata's plans failed to materialize because other minicomputer vendors did not respond to the company's call for a joint venture to build peripherals. By the end of 1978, Microdata was resigned to the fact that to pursue the market according to its schedule, it would have to do so under its own steam.

Remembering that time, one observer close to the company points out that Microdata did not have the resources to be both an end-user and an OEM company, despite the infusion of capital it received as a result of its acquisition by McDonnell-Douglas. (A proposed acquisition by Addressograph-Multigraph—now A-M International—fell through as executives of both companies were preparing to sign the final papers.) "It was a classic situation," the observer recalls. "The OEM peripherals market represented a great opportunity, but there simply weren't enough resources to go around." As a result, the sales staff that was hired to tap the OEM market couldn't get the product they needed, and peripheral activities remained directed toward end-user systems sales.

Sounding the final note for Microdata's OEM peripheral plans was the departure this year of vice president Bud Bleininger. With

COAX-LINKED SYSTEM RUNS BATCH, ON-LINE JOBS

Microdata Corp.'s new Sovereign system is designed for data-entry, remote-batch and transaction-processing applications now using key-to-disk systems or stand-alone terminals. As such, company executives say, the system complements the firm's Reality small-business systems announced more than four years ago.

The Sovereign system was developed by a Microdata subsidiary in the U.K., where 278 systems have been installed since 1978, say company sources. Sovereign can be installed in various configurations using a series of "function processors" much like Xerox Corp.'s processors for systems based on its Ethernet data-communications link. Sovereign includes file processors for access and maintenance of on-line disk-storage devices; communications processors that emulate IBM's 3270 information-display systems and 2780/3780 remote-batch terminals; key-station processors, each able to handle as many as eight work stations and the work stations themselves.

A 70K-byte/second coaxial packet-switched line, the Dataway, interconnects the various system elements. Despite its use of coaxial cable and packet switching, however, Microdata plans to cast its lot firmly with IBM. "We live in a world defined by IBM's systems network architecture (SNA)," says group vice president Gerald Fleming. "Sovereign hardware is compatible with IBM at the systems level."

Sovereign systems must live in other worlds also, Fleming notes. To that end, the company is preparing a converter that will enable the communications processors that frequently handle IBM emulation to function in mixed SNA/.25 environments. This converter could appear in Microdata's higher speed Dataway 11 implementation next year.

The company is also watching Ethernet. "We're not sure that this is the way to go," Fleming says. "But we could change our mind if more office equipment is designed to interface by that standard."

IT™ is the difference between too smart and too dumb.

Just when you thought you were totally confused by all the "smart" computer terminals on the market, Lear Siegler eliminates the confusion by bringing you exactly what you need.

IT™—the Intermediate Terminal™ video display from Lear Siegler.

IT compresses the broad spectrum of "smart" terminals into ITself. Now, when you're looking for a terminal that isn't too smart but isn't too dumb either, IT is perfect for the job.

And IT is completely self-contained, with full editing, formatting and protected field capabilities.

With IT you get two pages of memory (a total of 48 display lines). A complete range of visual attributes. Blinking. Blanking. Reverse video. Reduced intensity with protected fields. And underlining.

Plus, you also get upper/lower case. A high resolution monitor. Built-in numeric keypad. Function keys. Full or half duplex. Conversation or block mode transmission. Modifiable personality. And optional business graphics.

And, best of all, you get the same high standards and solid workmanship that made the Lear Siegler Dumb Terminal® video display a legend in its own time.

LEAR SIEGLER, INC.
DATA PRODUCTS DIVISION

IT, the Intermediate Terminal from Lear Siegler.

Lear Siegler, Inc./Data Products Division, 714 North Brookhurst Street, Anaheim, CA 92803 800/854-3805. In California 714/774-1010.
TWX: 910-591-1157. Telex: 65-5444. Regional Sales Offices: • San Francisco 408/263-0506 • Los Angeles 213/454-9941 • Chicago 312/279-5250 • Houston 713/780-2585 • Philadelphia 215/245-1520 • New York 212/594-6762 • Boston 617/423-1510 • Washington, D.C. 301/459-1826 • England (04867) 80666.

IT™, Intermediate Terminal™ and Dumb Terminal® are trademarks of Lear Siegler, Inc.

CIRCLE NO. 18 ON INQUIRY CARD

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.

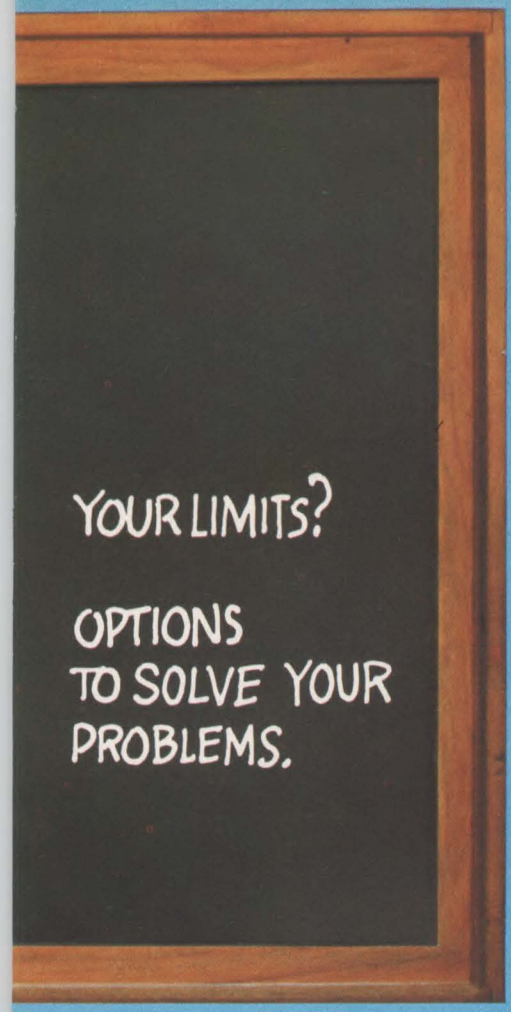
Choose from mainframe options ...

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.

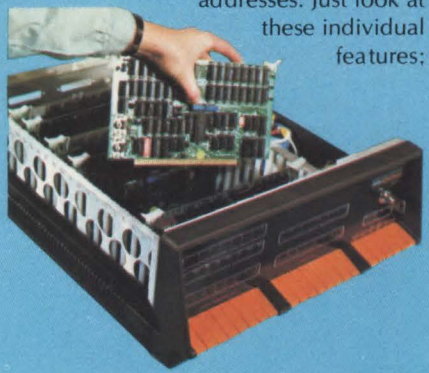
*In Calculus, a fundamental statement in the definition of limit; interpreted here to imply: "For your integration problem, Intersystems has a solution."

† Registered trademark of Zilog, Inc.



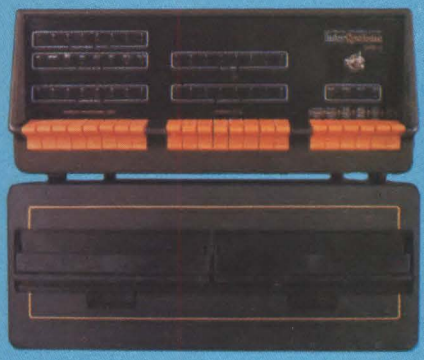
Board level options...

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...



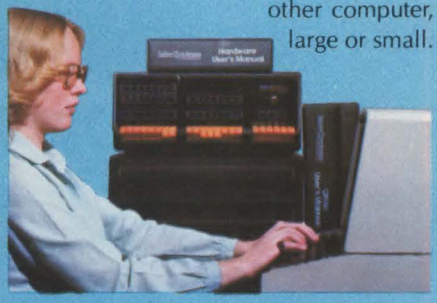
Interfacing disk drives is not a trivial matter, so when your objectives and resources dictate you spend your energy elsewhere, use our resources to perform the service for you. We can add our disk drive package to any Z-80 or Z-8000 configuration we provide ... again, fully assembled and tested and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

Or our complete Pascal Development System.

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.

One choice you won't have to make...

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.

Your solution should be clear.

Whether you're integrating for scientific, governmental or commercial applications, Intersystems can provide a Delta for your Epsilon.

Talk to us today.

Ithaca Intersystems Inc.,
Dept. M
1650 Hanshaw Road,
P.O. Box 91
Ithaca, NY 14850

Phone
(607) 257-0190

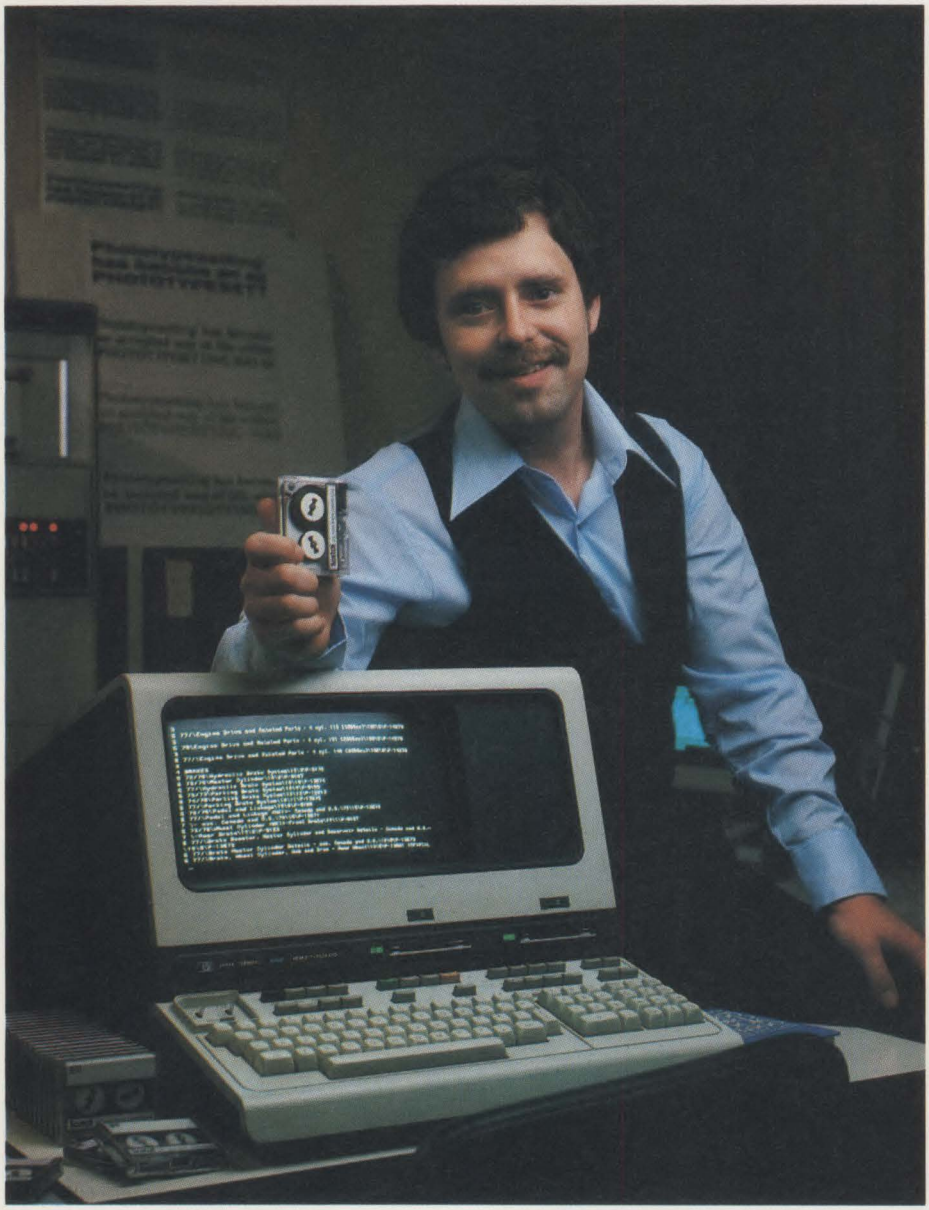
Inter-Systems™
Ithaca Intersystems Inc.
Micros for bigger ideas.

#Registered trademark of Digital Research

™Trademark of Ithaca Intersystems, Inc.

CIRCLE NO. 19 ON INQUIRY CARD

"Our reputation rests on digits, decimal points, and details. We wouldn't trust them to anything less than Scotch® Brand Data Cartridges."



Bill Birkett, Vice President, Trade Graphics, Inc., Livonia, Michigan

The unique design of a data cartridge provides great reliability, high storage capacity and long tape life. And where could you possibly get better data cartridges than Scotch Brand, made by 3M, the people who invented the data cartridge system itself?

3M controls every step in manufacturing. Top quality magnetic tape and precision components are part of every Scotch Data Cartridge. Over twenty-five years of service to the computer industry assure you of the utmost reliability.

Scotch Data Cartridges are available in miniature DC 100A, the standard-size DC 300A and now, an extra-length DC 300XL with 50% more storage capacity. They are compatible with most cartridge systems including Hewlett-Packard, IBM, NCR, Tektronix and TI.

To find out where you can find Scotch Data Cartridges or virtually any other data recording medium, call toll-free: 800-328-1300. (In Minnesota, call collect: 612-736-9625.) Ask for the Data Recording Products Division.

If it's worth remembering, it's worth Scotch Data Recording Products.

3M

CIRCLE NO. 20 ON INQUIRY CARD

three other executives, including Bill Zeissner, former director of peripherals at Microdata, Bleininger started up Tecstore, Inc., Huntington Beach, Calif. (MMS, May, p. 48). Tecstore's charter is to build high-capacity 14-in. Winchester-disk drives for the OEM market.

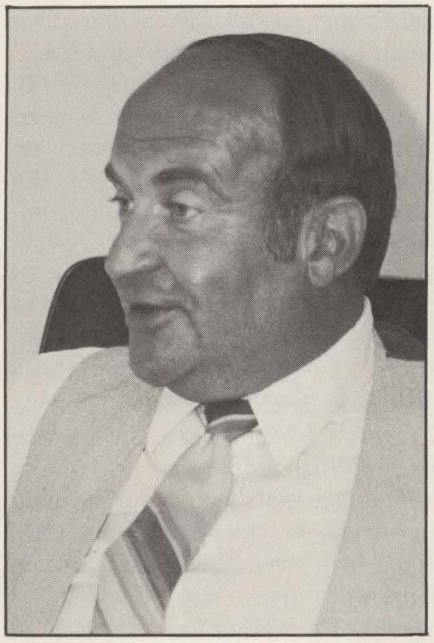
Microdata will also develop high-capacity Winchesters despite the company's decision to withdraw from the OEM market, says president Don Fuller. In addition, a 320M-byte 14-in. device may be in the works, says one report. Further details are lacking, but, says Fuller, "Microdata can be expected to leapfrog current drive technologies and offer systems equipped with high-capacity peripherals with thin-film read/write heads. —*John Trifari*

Franchising may help independent retailers

Minicomputer and μc manufacturers seeking independent retail outlets should team up with stable, professional business partners. But as partners, independent retailers do not have a good track record: many go out of business in the first year of operation. Joining established computer franchises, however, may increase their chances for success.

Expanding on that theme, Richard Brown, president of the Computer Store, Inc., Burlington, Mass., said that about 50 percent of independent retailers will not be in business in a year. His comments were made to an audience of retailers at the June Comdex show in New York. The Computer Store is a distributor that also runs 11 independent retail stores.

Brown was concerned that many independent retailers are their own worst enemies: their operations are not well-run, which creates a bad image in the industry. "The general industry (independent retailers) is perceived as a Mickey Mouse business," he said, adding that independent retailers are most vulnerable to the poor image. Exacerbating the image problem this year is the fact that the market has changed from a demand-driven one to a supply-driven one. Brown said that the selling heyday created over the past two years by large demand and limited computer supplies is disappearing. Manufacturers are catching up to demand, and companies are offering new products.



Independent minicomputer *retailers are "perceived as a Mickey Mouse business" and need to improve their image, says Richard Brown, president of the Computer Store, Inc.*

Ray Daly, president of the Program Store, Washington, D.C., says that 97 percent of general franchises, such as McDonalds, are still in business after the first year of operation, while only 16 percent of independent outlets survive the first year. Daly suspects the percentage of survival for independent computer stores is higher.

Advantages to franchising, Daly noted, include brand-name recognition, an established identity and the track record of the franchisor, group advertising, effective inventory controls and less need for experienced management, because franchisors offer management guidelines.

But franchising has its disadvantages, including lack of full autonomy for retailers, limited products or services, continuing fees, higher start-up fees and the carry-over if the franchisor gains a bad reputation. —*L. Valigra*

BELL FOLLOWS INTEL WITH 32-BIT μP

Following last February's introduction of Intel's iAPX 32-bit μp, the first such device on the market, Bell Laboratories has developed a prototype 32-bit chip, designed for in-house applications in Bell's telecommunication operations.

The chip processes 32 bits of information in a single instruction. Containing 100,000 transistors on a single piece of silicon, the chip was designed using CMOS technology and requires 0.5W of power to operate. Its architecture supports the UNIX operating system and COBOL.

The current version is being used as a tool to test design, logic and timing, and is larger and slower than what Bell expects the final product to be, company sources say. The Bell chip will be ready for production by year-end, says a company spokesman. Although it is being developed for in-house use and will not be available on the market, its arrival points to a possible trend in 32-bit design. Besides the Intel and Bell announcements, Hewlett-Packard is said to be readying a 32-bit chip for a 1982 introduction. —*Frank Catalano*

Graduates build a business tailoring μc software

Tim Tully tells of a μc vendor trying to make a sale to an Indiana hog farmer: "The farmer explained that hogs go through four breeding stages, and all he needed a computer for was to statistically keep track of his stock throughout these stages. 'Do you have a program that can to that for me?' the farmer asked the vendor. The vendor left without making a sale."

The story illustrates why Tully and two partners believe a solid market exists for customized μc application software, despite the expense of tailored programs compared to "canned" packages. Several private investors also agreed—to the tune of $90,000—that such a market exists. Thus, on May 18, 1981, the day after the three partners graduated from Purdue University, Nisus Corp. was born to provide such software.

The fact that people were willing to invest in the West Lafayette, Ind., firm even though the principals were fresh out of college is viewed as further confirmation of the company's potential by Tully, vice president of marketing and sales, who studied marketing at Purdue. Nisus president Jack Reynolds studied finance and has some background in computer sales. Larry Leemis, vice president of programming, has a B.A. in industrial engineering and a master's degree in math. Each of the partners is 23 years old.

Tully says that, thus far, "business has been fantastic." Nisus has a ready supply of programmers from Purdue, which, he says, has more than 6000 computer-science students. The company has hired five such programmers plus one office manager.

With its young staff, Nisus has succeeded in cutting the costs of custom programming in half, Tully claims. While a typical hourly rate for producing tailored programs may run from $40 to $50, Nisus charges its customers only $18.50 an hour. Or, if the job is large and could require a long development time, the company will provide a quoted price for the entire project.

Nisus has already written programs for a variety of customers. The products include a job-costing program for construction contractors, a package that manages a local broker's stock portfolio and tracks bond fluctuations, a farm-management program and software to help churches catalog membership and provide tax information relating to members' donations. The company produces its programs using Radio Shack equipment, but will write software for any μc.

Should a particular customized package appear to have mass market appeal, Nisus will sell it as an off-the-shelf product and pay the initial customer royalties for that right. Royalties will vary depending upon each package's retail value, but should probably range from 5 to 10 percent of the selling price, Tully estimates. He says Nisus will attempt to address the nationwide market with certain packages, possibly by selling software-licensing rights to μc manufacturers.

Although producing custom packages is the company's main focus, Nisus also offers consulting services to companies that might, for example, want advice in selecting the μc systems best suited to their needs. Nisus also runs a seven-week class for people who want to learn more about small computers and software.

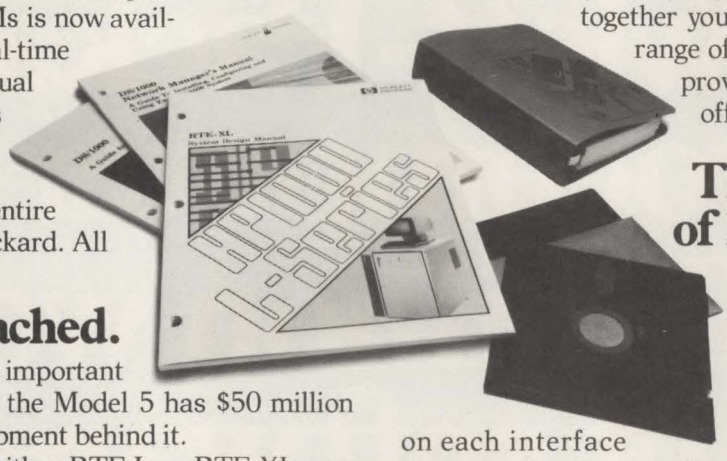
—Dwight B. Davis

There's more behind Hewlett-Packard's microcomputer than $50 million worth of software.

Full system support.

Announcing the new HP 1000 L-Series Model 5 microsystem.

The same two-board microcomputer that's becoming so popular with OEMs is now available as an integrated, real-time system—complete with dual minifloppies, 128K bytes of memory, your choice of interactive terminals *and* full support for the entire system from Hewlett-Packard. All for under $10,000.



All strings attached.

Software is the most important part of any system, and the Model 5 has $50 million worth of software development behind it.

You can start with either RTE-L or RTE-XL, our powerful multi-programming, multi-user operating systems. Their modular construction lets you build the real-time computing environment your applications programs demand—programs you can develop in Assembler, FORTRAN 4X and BASIC. And our HP DSN networking software makes it simple to put low-cost computing wherever you need it.

Data base management on a microcomputer? With our IMAGE DBMS, you've got a powerful tool for simple and efficient data management. And you can easily picture the possibilities offered by our GRAPHICS/1000 software. Like our other software packages, these are all upwardly compatible throughout the entire HP 1000 line, giving you an easy growth path to even higher performance.

Configure it out for yourself.

The Model 5 is completely modular, so you can virtually design a system yourself. Hard disks and other peripherals can be plugged in directly. And thanks to a 60% reduction in memory costs, you can go all the way to 1/2 megabyte of memory for an additional $2000.

Whether you buy a packaged system, or put one together yourself, you can get HP's full range of customer support services, provided from more than 170 offices worldwide.

The ins and outs of high-speed I/O.

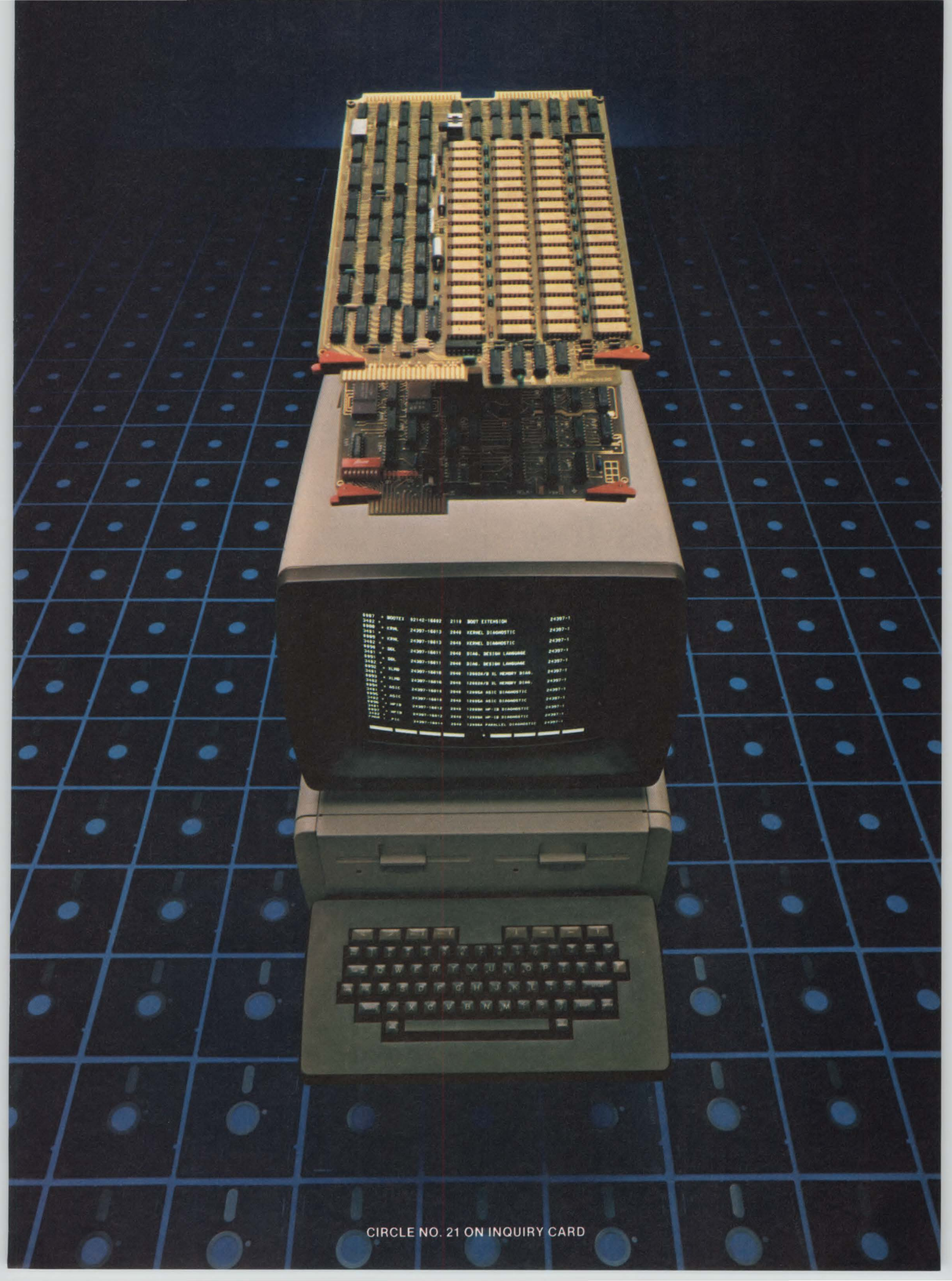
In designing the Model 5, we used an advanced distributed intelligence architecture that puts a separate LSI I/O processor board on each interface. This means each processor has its own direct channel to the entire 1/2-megabyte memory. (We used state-of-the-art 64K RAMs to put the 512K bytes of memory onto just one board.) With the CPU free to concentrate on computation, you get significantly increased throughput and exceptional performance.

If you'd like a hands-on demonstration, just contact your local HP sales office listed in the White Pages. Or for more information, and our new OEM catalog, write to Joe Schoendorf, Hewlett-Packard, Dept. 08107, 11000 Wolfe Road, Cupertino, CA 95014.

HEWLETT PACKARD

Prices U.S.A. OEM quantities of 100 units. Prices subject to change without notice.

22102
HPDS70



CIRCLE NO. 21 ON INQUIRY CARD

Calendar

SHOWS & CONFERENCES

AUGUST

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

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

AUGUST 31-SEPT. 1

Software Management Conference, Boston, sponsored by the Education Foundation of the Data Processing Management Association and the Washington, D.C., and Boston Chapters. Contact: EFDPMA Conferences, Department SMC, P.O. Box 91295 (5959 W. Century Blvd., Suite 1016), Los Angeles, Calif. 90009, (213) 670-2973.

SEPTEMBER

1-3 **Computerized Office Equipment Expo/Southeast,** Atlanta, organized by Cahners Exposition Group. Contact: Janet Schafer, Cahners Exposition Group, 222 W. Adams St., Chicago, Ill. 60606, (312) 263-4866.

1-3 **Computer Marketing Expo,** New York, sponsored by Computer Dealer Magazine. Contact: Computer Marketing Expo, c/o Conference Management Corp., 500 Summer St., Stamford, Conn. 06901, (203) 356-1900.

1-3 **FOC '81 West, International Fiber-Optics and Communications Exposition,** San Francisco, sponsored by Information Gatekeepers, Inc. Contact: Information Gatekeepers, Inc., 167 Corey Rd., Suite 111, Brookline, Mass. 02146, (617) 739-2022.

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

9-11 **Second Annual Office Automation Symposium,** Chicago. Contact: Symposium Manager, U.S. Professional Development Institute, 1261 Davan Dr., Silver Spring, Md. 20904, (301) 622-0066.

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

10-13 **Second Annual Mid-West Computer Show & Office Equipment Exposition,** Chicago. Contact: National Computer Shows, 824 Boylston St., Chestnut Hill, Mass. 02167, (617) 729-2000.

14 **Invitational Computer Conference,** Newton, Mass. Contact: B.J. Johnson & Associates, Inc., 2503 Eastbluff Dr., Suite 203, Newport Beach, Calif. 92660, (714) 644-6037. Other dates and locations available.

14-16 **Fifth Annual Data Entry Management Conference & Exhibit,** Las Vegas, Nev., sponsored by the Data Entry Management Association. Contact: Marilyn S. Bodek, DEMA, P.O. Box 3231, Stamford, Conn. 06905, (203) 322-1166.

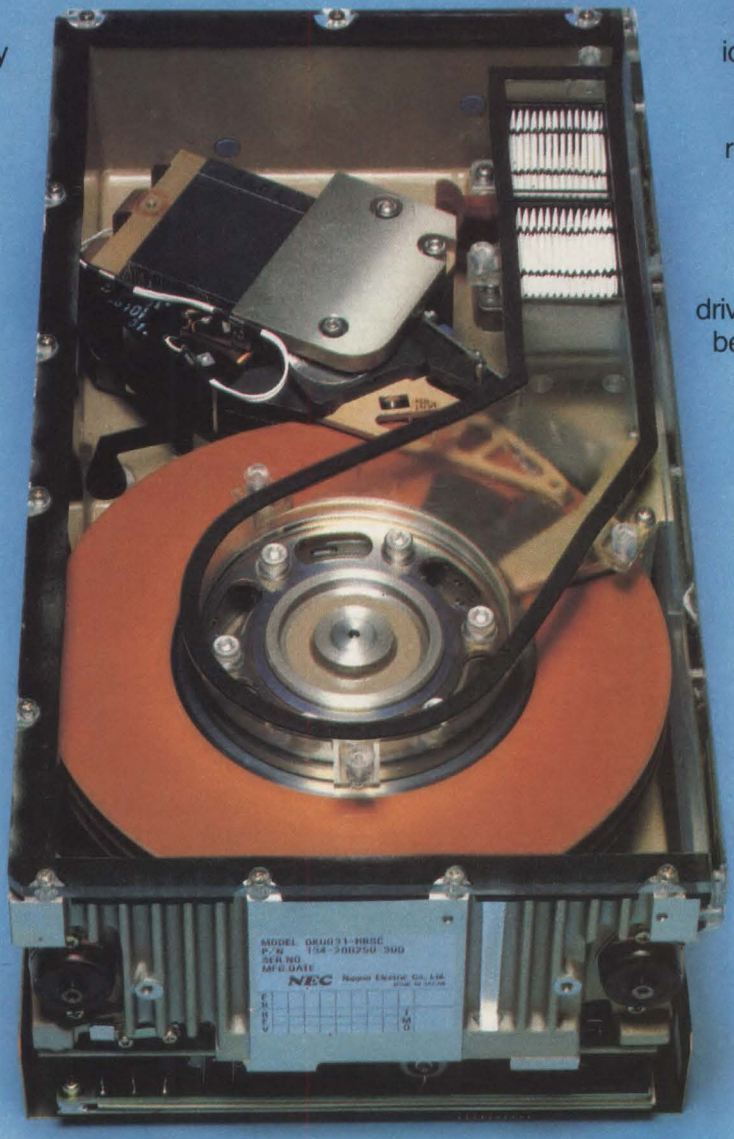
NEC introduces 8-Inch Winchesters.

With more capacity. Faster access. And the reliability you'd expect from NEC.

Once again, NEC leapfrogs conventional technology with its new D2200 family of eight-inch Winchester disk drives.

The first models in the series deliver 30-millisecond access time with capacities of 25.5 and 42.5 megabytes, respectively, and use conventional storage module device (SMD-type) controllers for convenient interfacing and formatting.

Sealed-disk Winchester technology is enhanced with voice-coil actuators, direct-coupled DC spindle motors and closed-loop air circulation which reduces parts count, eliminates periodic maintenance and gives the D2200 Series an MTBF in excess of 10,000 hours. When service is required, it's fast: the D2200s have a 30-minute MTTR.



The D2200 family is ideally suited to medium and heavy volume interactive business applications that require frequent disk access, as in virtual memory, database access and data communications operations.

Eight-inch Winchester drives are increasingly popular because they offer significant savings in installation, packaging, maintenance and cost-of-ownership.

And once again, NEC technology adds an extra dimension. Call your NEC Information Systems representative for more information.

NEC

NEC Information Systems, Inc.

Home Office: 5 Militia Drive, Lexington, MA 02173, (617) 862-3120
Eastern Office: 36 Washington Street, Wellesley, MA 02181, (617) 431-1140
Central Office: 551C Tollgate Road, Elgin, IL 60120, (312) 931-1850
West Coast Office: 8939 S. Sepulveda Blvd., Los Angeles, CA 90045, (213) 670-7346

CIRCLE NO. 23 ON INQUIRY CARD

Calendar

14-17 Second Annual National Software Package Conference, Chicago, sponsored by Infosystems. Contact: Software Info '81 Conference, 1730 N. Lynn St., Suite 400, Arlington, Va. 22209, (703) 521-6209.

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

15-17 Wescon '81 Show and Convention, San Francisco, sponsored by the Los Angeles and San Francisco Day 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 N. Sepulveda Blvd., El Segundo, Calif. 90245, (213) 772-2965 or (800) 421-6816.

15-17 Automated Technical Publications Symposium, Danvers, Mass., sponsored by the Aerospace Industries Association's Service Publications Committee. Contact: John W. Stahl, Aerospace Industries Association, 1725 DeSales St., N.W. Washington, D.C. 20036.

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.

19-21 Sunbelt Computer Exposition, Phoenix, Ariz. Contact: Taylor R. Coleman, General Manager, Judco Enterprises, P.O. Box 963, Scottsdale, Ariz. 85252, (602) 991-8622.

21-23 Federal Computer Conference, Washington, sponsored by Federal Educational 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, (541) 761-5831.

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

22-24 NEPCON/Central '81 (National Electronics Packaging & Production Conference), Rosemont, Ill. Contact: Cahners Exposition Group, 222 W. Adams St., Chicago, Ill. 60606, (312) 263-4866.

23-25 TREAT (Technology Revolution: Education and Training), Washington, sponsored by the Association of Media Producers and George Washington University's Department of Education and Human Resources. Contact: Mary Davis, Association of Media Producers, 1101 Connecticut Ave., Suite 700, Washington, D.C. 20036, (202) 857-1195.

24-27 Second Annual Mid-Atlantic Computer Show & Office Equipment Exposition, Washington. Contact: National Computer Shows, 824 Boylston St., Chestnut Hill, Mass. 02167, (617) 739-2000.

Build your own DEC system with CRDS...

MF-211

10½" Enclosure for LSI 11/23 System with built-in RX02 equivalent floppy disk system. Available with or without processor and memory.

HD-11/T

20.8 Megabyte Winchester disk software equivalent to 4 RL01 units. Optional cartridge tape backup.

FD-311

RX02 equivalent dual floppy system, single or double sided. Includes bootstrap loader, self-tester, formatter and diagnostic diskette.

MB-211

5¼" enclosure with 8 quad slot backplane. Front panel console with switches for Enable/Halt, Boot/Init and Line Time Clock.

Complete software compatibility at a savings!

With CRDS, you can configure your own DEC system and be assured of complete software compatibility. Each of the above systems is provided with slides for rack mounting or can be used in desk top applications. All DEC LSI 11 based modules and associated software packages are available through CRDS, if desired.

Attractive Packaging
Careful attention is given the CRDS repertoire of enclosures in assuring you an attractive yet comfortable blending of product in the DEC environment.

Significant Savings
Flexibility of procurement plus attractive OEM schedules allows you to optimize dollar savings in configuring your CRDS system. Use the time tested technique. Compare.

Warranty and Maintenance
A 90 day warranty is offered with your CRDS system. In the event of malfunction, by use of provided diagnostic routines, the defective submodule is normally found within minutes. After verification with the CRDS Maintenance Department, a replacement for your defective module will be promptly forwarded.

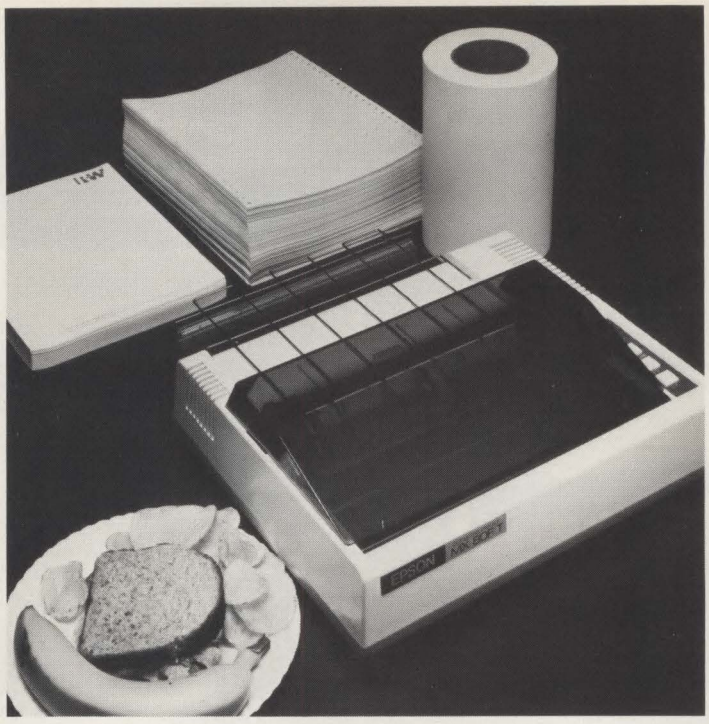
Call or write for a comprehensive literature package and prices.

CRDS

Charles River Data Systems, Inc. 4 Tech Circle, Natick, MA 01760 Tel. (617) 655-1800 TWX (710) 386-0523

CIRCLE NO. 25 ON INQUIRY CARD

The new MX-80 F/T. You can feed it anything. Almost.



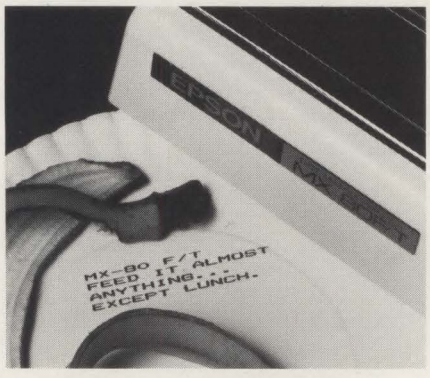
Epson.

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.

EPSON
EPSON AMERICA, INC.

Western: 23844 Hawthorne Boulevard, Torrance, California 90505/(213) 378-2220 TWX: 910-344-7390
Eastern: 98 Cutter Mill Road, Rm. 350, Great Neck, New York 11021/(516) 487-0660

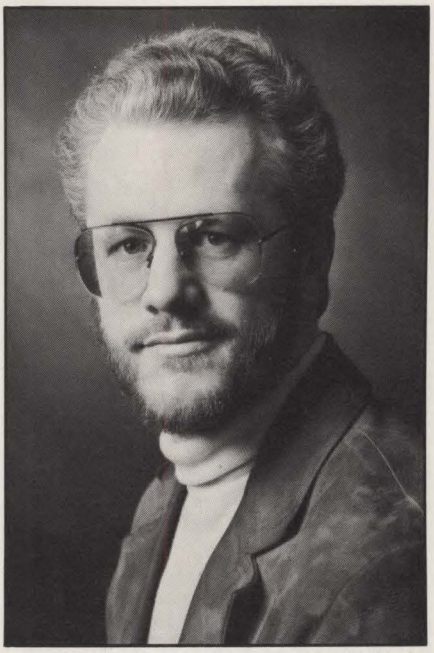
HUSAT conference examines CRT health problems

The static electricity charge on a CRT reduces the level of negative ions in the air breathed by the operator and can thereby aggravate the adverse effects of negative-ion depletion, including headaches, nausea and dizziness. That's one finding of research groups in Europe studying work-station ergonomics and the health hazards of CRTs.

Another finding revealed that dark characters on a light background are more comfortable for a CRT operator than the reverse because eyes adjust more quickly when moving from white paper documents to the screen. On-screen reflection is reduced, and glare from the surrounding environment is less bothersome.

These were among the topics discussed last month at a conference in England organized by the HUSAT Research Group. HUSAT, for human sciences and advanced technology, is an independent organization set up by members of the department of Human Sciences at Loughborough University of Technology, the conference venue and one of Europe's leading centers of ergonomic research.

The work on negative ions is being carried out in England at the department of human biology and health at the University of Surrey. Dr. Leslie H. Hawkins explained that the level of both positively and negatively charged ions is a lot lower in polluted city air than in a rural atmosphere and that the concentration of ions in air-conditioned offices was drastically lower, whether the office is in a rural district or a city. The destruction of natural ions in the air by air conditioning reduces their level from around 100 per cubic cm. to as low as 50 per cubic cm. As a result, workers complain of lethargy, nausea, dizziness and headaches. Why negative-ion depletion has these effects is not yet known. Positive-ion depletion, on the other hand, appears to have little adverse effect.



At the HUSAT Conference, *Tom Gilb, an independent consultant from Norway, discussed the dehumanized nature of the codes CRT terminal operators must learn.*

The problems caused by air conditioning can be solved by using a corona-discharge ionizer generating a constant stream of negative ions.

The problem for CRT operators is worse, said Hawkins, because the positive static charge on a CRT screen drastically reduces negative-ion levels in the "micro atmosphere" surrounding the CRT. Hawkins said a negative ionizer is an inexpensive addition to a CRT console that could improve job efficiency.

Experiments at Surrey University using a CRT in a specially constructed booth have shown that negative-ion levels affect the execution of relatively complex tasks more seriously than they do the performance of simple jobs. Females tend to suffer more from ion depletion and to respond more favorably to an ion-enriched environment that do males. Increasing the negative-ion concentration has less effect as ambient temperature and relative humidity rise. Further, two-thirds to three-quarters of all people are affected in some way by negative-ion concentrations.

Hawkins described an experiment with 54 individuals, many of whom work with CRTs in their jobs, at a computer site.

Two negative-ion generators were installed at the site, but, unknown to the operators, were not switched on for the first four weeks. The negative-ion level remained at around 550 per cubic cm. The ionizers were then switched on, boosting the negative-ion concentration to 3500 per cubic cm. for the eight remaining weeks of the experiment. Results showed a dramatic decrease in complaints of headaches, nausea and dizziness when the ionizers were on. The percentage of individuals with headaches dropped from more than 20 percent to around 5 percent, while dizziness and nausea on average affected less than 1 percent of people with the ionizers on compared with 2 percent to 5

percent in the ion-depleted environment. The ionizers appeared to be particularly beneficial to night-shift operators.

Dr. Gerald W. Radl of the Cologne-based technical-appraisal organization, Technische Uberwachungs Verein Reinland, TUV Reinland for short, discussed some of the work there on visual problems of CRT operation.

He asserted that the damage caused by an unsatisfactory visual environment was mainly psychological rather than physical. He pointed out that at least 50 percent of people in Germany have eye defects before using CRTs. When an operator starts using a CRT terminal, those defects are revealed by, rather than caused by, the display unit.

Experiments carried out by TUV Reinland found that operators make 8000 to 25,000 eye movements between manuscripts and the screen at word-processing stations during an 8-hour working period. Radl pointed out that the eye's adaptive mechanisms cannot work properly with such frequent eye movements.

Besides adapting to the different light levels of the screen and the document, the eye must also contend with reflections. At a typical distance of 50 to 70 cm. between an operator and a screen, the reflection of a lamp, for example, is seen on a different part of the screen by each eye or by only one eye. Thus, the system by which eyes control the angle of convergence of images is disturbed.

Reflection is one of several problems that can be substantially alleviated by using a CRT with dark characters on white background, and Radl discussed the results of experiments carried out at TUV with 24 operators.

For each subject, the presentation mode on a CRT was set at positive (dark characters on a light background) and later at negative. Of the 24 subjects, 19 expressed a preference for positive presentation and only three for negative. The average ratings out of six for positive was 4.7 compared with only 2.3 for negative. In addition, the average performance in text-transcribing tests was markedly better with positive text presentation than with negative. Radl also described TUV experiments investigating the relative acceptability of character colors on dark backgrounds. Tests were performed on seven colors achieved using different phosphors and filters. In each case, the subjects had to transcribe text for 10 min. Orange on white or yellow characters was found to be the worst for transcribing and the least acceptable to operators. Yellow characters, however, scored high in both transcribing and operator acceptability. Three types of yellow were used: yellow with no filter, yellow with an amber filter and white with a yellow filter. Green and white characters scored average marks for transcribability, but were almost as good as the yellows in terms of operator acceptability.

Independent consultant Tom Gilb, of Norway, discussed the problems created by the dehumanized nature of many of the codes that CRT operators must use. He described an experiment conducted about 10 years ago by Bell Labs, New Jersey, in which 350 operators were presented with 60 codes and asked to rate them according to difficulty, one being the easiest and nine the hardest. The results showed quite clearly that meaningful codes, such as PCU for program channel unit, were the easiest, and abstract numeric codes, such as 035 for Bahama Island, were the most difficult.

Gilb condemned "lazy" program designers for not designing user-friendly codes and suggested that meaning be built into codes, pointing out that hardware and programming costs are low. He also suggested system features, including a "panic button" providing instant help to an operator.

A trade-union view of CRT ergonomics was presented by Sheila McKechnie, health and safety officer of the British White Collar Union, the Association of Scientific, Technical and Managerial Staffs, ASTMS. She blamed many employers for purchasing badly designed CRTs and then bringing in work-station consultants to solve ergonomic problems.

—Keith Jones

Examining the 'human' aspects of technology

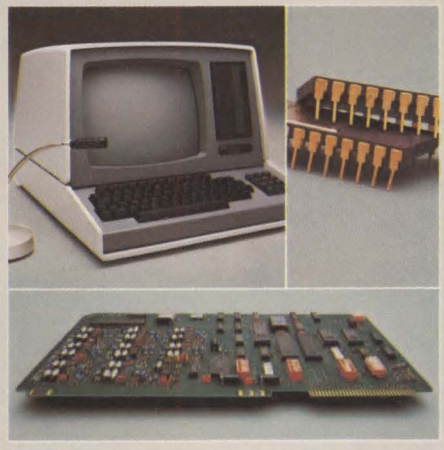
For those who put in hours at a work station, the office-automation "revolution" could be almost as grim as the industrial revolution. The "ideal" office work station, which frees users from the time-consuming chores of walking to a filing cabinet and mailing letters might be ergonomically unacceptable. Remaining seated in the same posture for hours can lead to permanent back injury, which, along with the eyestrain caused by staring at a CRT screen, is a long-term source of distress.

One man closely involved with the growing problem of work-station fatigue is consultant Tom Stewart, who spends most of his time examining and advising on the human aspects of office technology. Stewart is a leading European

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.
(714) 635-7210
or call toll free
(800) 854-6979.

INTERSTATE ELECTRONICS CORPORATION

Call to attend our nationwide voice seminars.

Q-Bus is a trademark of Digital Equipment Corporation. Multibus is a trademark of Intel Corporation. Dumb Terminal® is a trademark of Lear Siegler, Inc.

VOICE RECOGNITION BY INTERSTATE

CIRCLE NO. 27 ON INQUIRY CARD

QU

The daisywheel leader re-invents daisywheel printing.

Our new SPRINT 7™ and 9 lines of daisywheel printers and terminals allow you to abandon dot-matrix printing for reliable, letter-quality type at the best price-performance in the business.

How does Qume do it? Simplified mechanics, condensed electronics, and our exclusive MicroDrive™ – the most simple, durable and accurate print mechanism in the history of daisywheel printing. Available in several RO and KSR models, the SPRINT 7 and 9 feature Qume's traditional high performance, with 35, 45 and 55 CPS speeds. The SPRINT 7 printer line is backed by Qume's unparalleled OEM support programs, while the SPRINT 9 terminal line is fully serviced nationwide by G.E. Of course, we offer complete accessories

ME

and supplies, including the highest capacity ribbons and over 100 different printwheels.

You may be surprised— but Qume also builds the gentlest and most reliable 5¼″ and 8″ double-sided floppy disk drives. We're proud that we've installed more two-sided 8″ drives than any other manufacturer.

At Qume, we build and back our products knowing that our name and reputation depend on their quality. For more information, call or write Qume (408) 942-4000. 2350 Qume Drive, San Jose, Ca. 95131.

Qume®
A Subsidiary of ITT

CIRCLE NO. 28 ON INQUIRY CARD

A very inviting program for System Builders.

If you're a System Builder whose success hinges on providing complete end-user solutions, you're in luck. Because Prime offers both the systems and the support you need to help you succeed.

You can choose one system from Prime's product line, or you can choose to sell the full 50 Series line. Whatever's best for you and your customer.

And whatever that is, you'll be providing each end-user with a system that features 32-bit architecture, ease of use, and a convenient upgrade path.

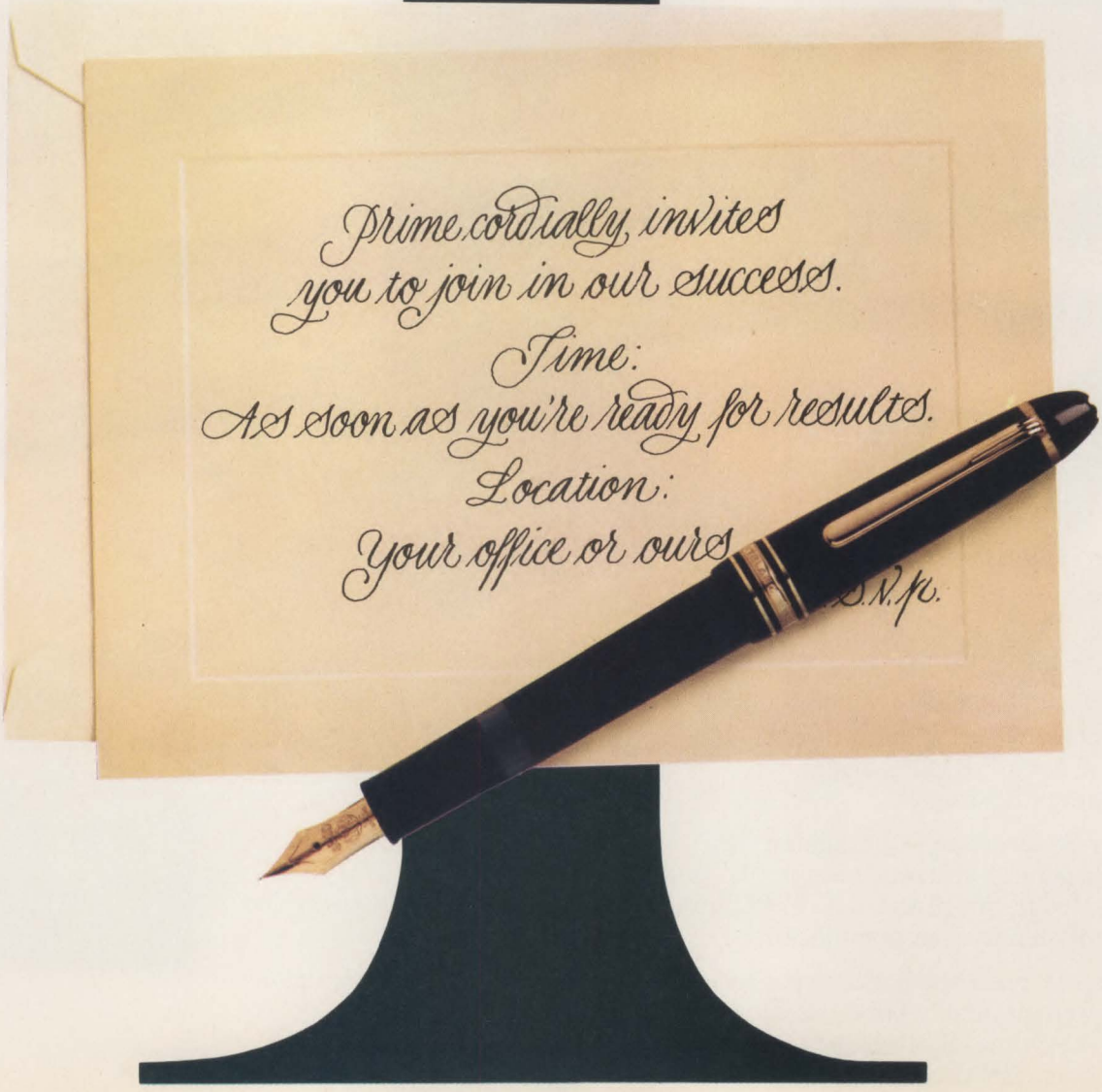
Also, Prime has plenty of software tools available for you to work with. And third-party application software is available, too.

All our products support industry-standard languages, and it's a simple matter to convert existing software.

To top it all off, we offer an aggressive volume discount schedule, plus a lot of marketing savvy.

To find out more, write Prime Park, MS 15-60, Natick, Massachusetts 01760. And we'll give you reason to celebrate.

PRIME
Computer



CIRCLE NO. 29 ON INQUIRY CARD

authority on the ergonomic aspects of CRT use and has led several research projects on office communications, information retrieval and CRT ergonomics. He works for Butler Cox and Partners, a U.K. information-technology consultancy and is co-author of *Visual Display Terminals*, a handbook on terminals and operator health.

Discussing the current work-station-ergonomics situation, Stewart says, "It is impossible to sell a fixed keyboard display in Sweden these days." Swedish workers are entitled to insist on ergonomically designed work places under a work-environment act of July, 1978, says Stewart. A national directive, "Reading of Display Screens," published in January, 1979, covers office light levels, screen reflection and related topics.

"In the Netherlands, the government has published an ergonomic checklist for display terminals, while in the U.K., a report has been produced by the government-sponsored health-and-safety executive, but there is no legislation yet in either country," Stewart says.

West Germany's regulations, he adds, are nearest to legislation. The national workers association, Hauptverband der Gewerblichen Berufsgenossenschaften, outlines those regulations, and an employer can be sued if they are not complied with. They specify character size, room lighting and seating requirements and demand detachable keyboards, palm rests and similar features, as well as eye tests for operators.

"Postural problems are more serious in the long-term than eyestrain because the back can be damaged permanently, while the eye muscles can recover," says Stewart. "But eyestrain is a more sensitive issue."

On the question of office lighting, Stewart believes that the luminance ratios of CRT terminals, desks and rooms should not exceed 1:3:10. In addition to glare from windows, unshielded luminaries and shiny desk tops, reflections from shiny key tops, especially of black keys, can also affect an operator's ability to adapt to the relatively low light levels emitted by the screen.

Flicker also causes eyestrain. Flicker is caused by a phosphorescent image decaying before it is refreshed by the electron scan. Some CRTs, designed for the 60-Hz refresh rate determined by the U.S. electric mains supply, create flicker problems when converted to a foreign mains supply that needs a lower refresh rate, such as U.K.-standard 50-Hz. Stewart warns that some phosphors that are acceptable in the U.S. should not be used in the U.K. unless a 60-Hz refresh rate is maintained.

The question of which CRT-screen colors are ergonomically best is up for debate in Europe, Stewart says. The Swedish manufacturer Datasaab favors green characters on a brown background, while the preference in West Germany is for dark characters on a light background. Stewart, however, believes that the stability and clarity of characters is far more important than color. "Different phosphors with the same color possess different characteristics and look different," he says.

Another culprit that is said to cause eye damage—rays that are emitted by CRTs—is dismissed by Stewart as almost nonexistent. He points out that modern solid-state CRT terminals operate with a less-than-20-KV anode voltage, while a voltage of about 30 KV is required even to achieve the background X-radiation level of 0.02 milliradians per hour.

Outbreaks of facial rashes among CRT operators in Norway were also originally attributed by some to harmful CRT emissions. Stewart provides a much more plausible explanation: "Sitting in front of a display screen builds up a charge of static electricity on an operator's face, which then attracts dust. For people with sensitive skin, such as very fair-skinned Norwegians, the result can be a mild rash."

A cause of much greater concern for Stewart is the permanent spinal damage that can be sustained by an operator who maintains an unnatural posture for long periods of time.

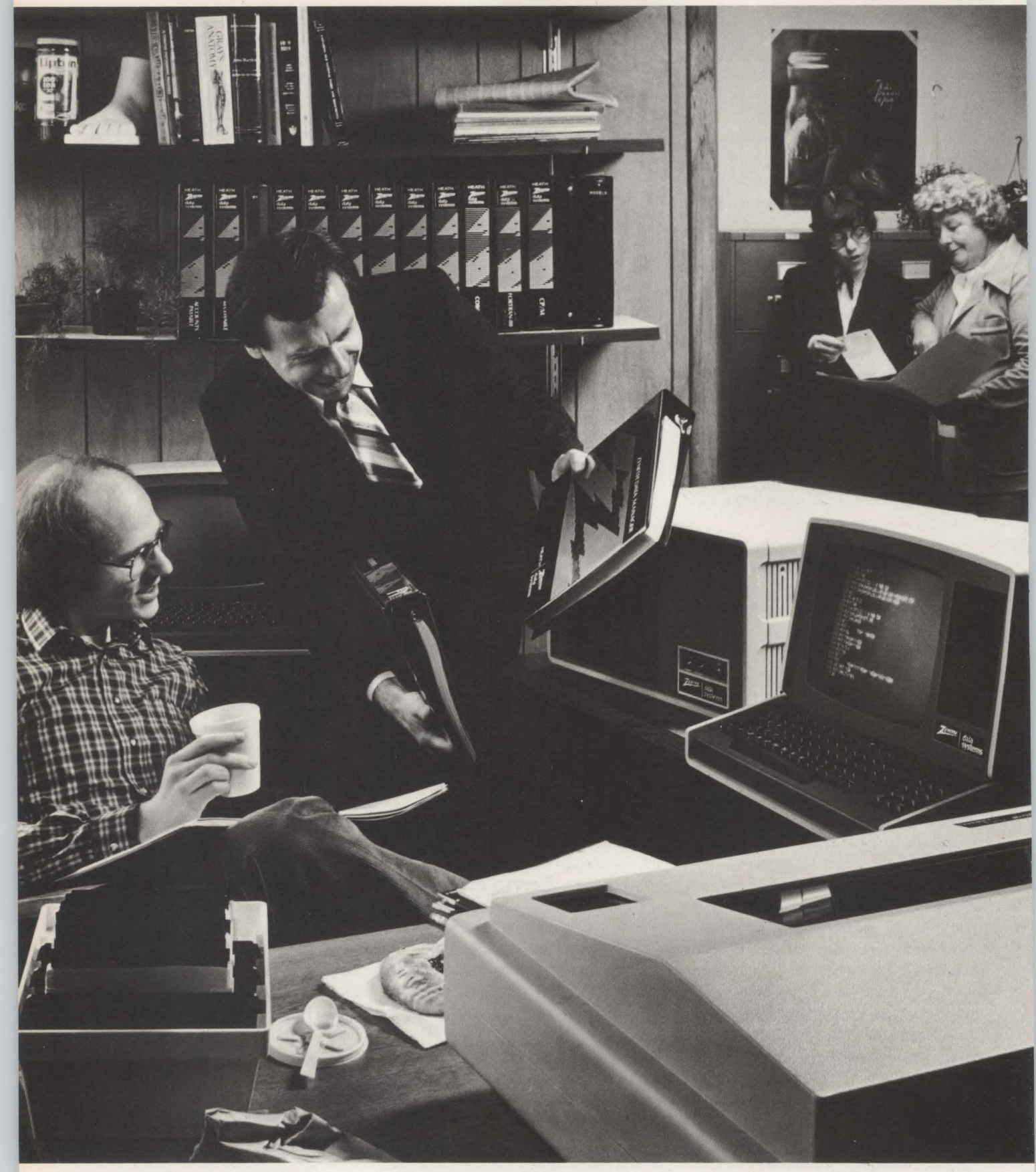
The natural curve of the human backbone is an inward one. Leaning over a CRT for lengthy periods forces the backbone to curve into an unnatural outward posture. Stewart says this can lead to the disks between the vertebrae being permanently damaged. This problem is not new; back trouble has been a hazard facing typists and other machine operators for years.

But the dangers to CRT operators could be worse, Stewart says, because unlike typists, CRT operators do not need to move around to perform their jobs. Even the minor changes in posture required by inserting fresh paper into a typewriter can be beneficial. Many typists also perform secretarial tasks that frequently take them away from their desk. In contrast, the electronic office work station includes only keyboard-based activities.

Operators can avoid some of these back and eye problems by taking frequent breaks. In addition, some work-station features can prevent fatigue during work periods. These include adjustable screens that help to avoid reflected light and a narrow keyboard that enables an operator to rest his arms on the desk. The desk should have ample space below it for an operator's knees.

The ideal keyboard thickness should measure 30 mm. from the middle row of keys to the top of the desk, according to CRT ergonomic standards laid down by the West German standards organization, DIN, which is roughly the equivalent

GOOD NEWS FOR SYSTEMS INTEGRATORS.



Zenith just added more software to its list of quality products.

You get everything you need from one, reliable source. Your customers get a name they know and trust.

What's the perfect match for Zenith's complete line of business microcomputers, video terminals and peripherals?

Zenith's quality software!

Business application programs. Operating systems. Languages. Utility software. Zenith has them all. So you can now offer your customers a *total package,* with the great name of Zenith behind it.

More ready-to-run business applications, with Peachtree's new Series 5 programs.

Zenith's software library now includes the new Peachtree Series 5 Business Programs.

So in addition to word processing systems for every application, you can now offer your customers General Ledger, Accounts Receivable, Accounts Payable, Inventory Management, and more.

These ready-to-run Peachtree programs are all menu-driven, and incorporate the new Series 5 enhancements for increased speed and storage capacity.

They also feature special Zenith enhancements for easier start-up. You get a CP/M operating system, Microsoft BASIC, a back-up utility and diskette formatting utility provided right in the program disk. Plus two-level password security and an easy to follow user manual.

More on-line storage, Operating Systems and Languages, for even more versatility.

Our Z89 microcomputer is now expandable from its standard 48K bytes of RAM storage to 64K. And our new Z47 Dual Disk Drive provides up to 2 megabytes of added on-line data storage!

When you couple that increased memory power with our new CP/M and HDOS Operating Systems, a whole new world of microcomputer capability is now open to you.

We've also added Microsoft's BASIC-80 Interpreter, BASIC-80 Compiler, FORTRAN-80 and COBOL-80 Languages. Plus UCSD Pascal.

Zenith offers a wide choice of inexpensively-priced software, too, called SOFTSTUFF™. These include General Ledger II, Small Business Inventory, Mail Pro — a mailing list and file manager, and more.

More service. More support.

Behind our rapidly expanding product line is our national network of authorized service centers. Each center offers complete parts and on-site service by factory-trained specialists.

If you need technical help, or want to discuss modifications, our marketing support engineers will be happy to discuss your specific needs.

And Zenith support doesn't stop there. Our national advertising and sales support materials will be working to make your job even easier.

Zenith's manufacturing expertise makes for excellent profit margins.

You'll find that Zenith Data Systems offers your customers an amazing degree of quality and versatility, at surprisingly affordable prices. While we offer you excellent profit margins. (That's where Zenith's 60 years of manufacturing experience comes in.)

To find out more reasons why you should be selling Zenith Data Systems products, send the coupon. Or call (312) 391-8860 and ask for our informative package for system integrators, "Interface To Profit."

ZENITH | data systems

The quality goes in before the name goes on.

Zenith Data Systems, 1000 Milwaukee Ave. Glenview, IL 60025

I'd like to know more about Zenith Data Systems' products, service and OEM program.

I currently represent_____

Name_____ Tel._____

Title_____

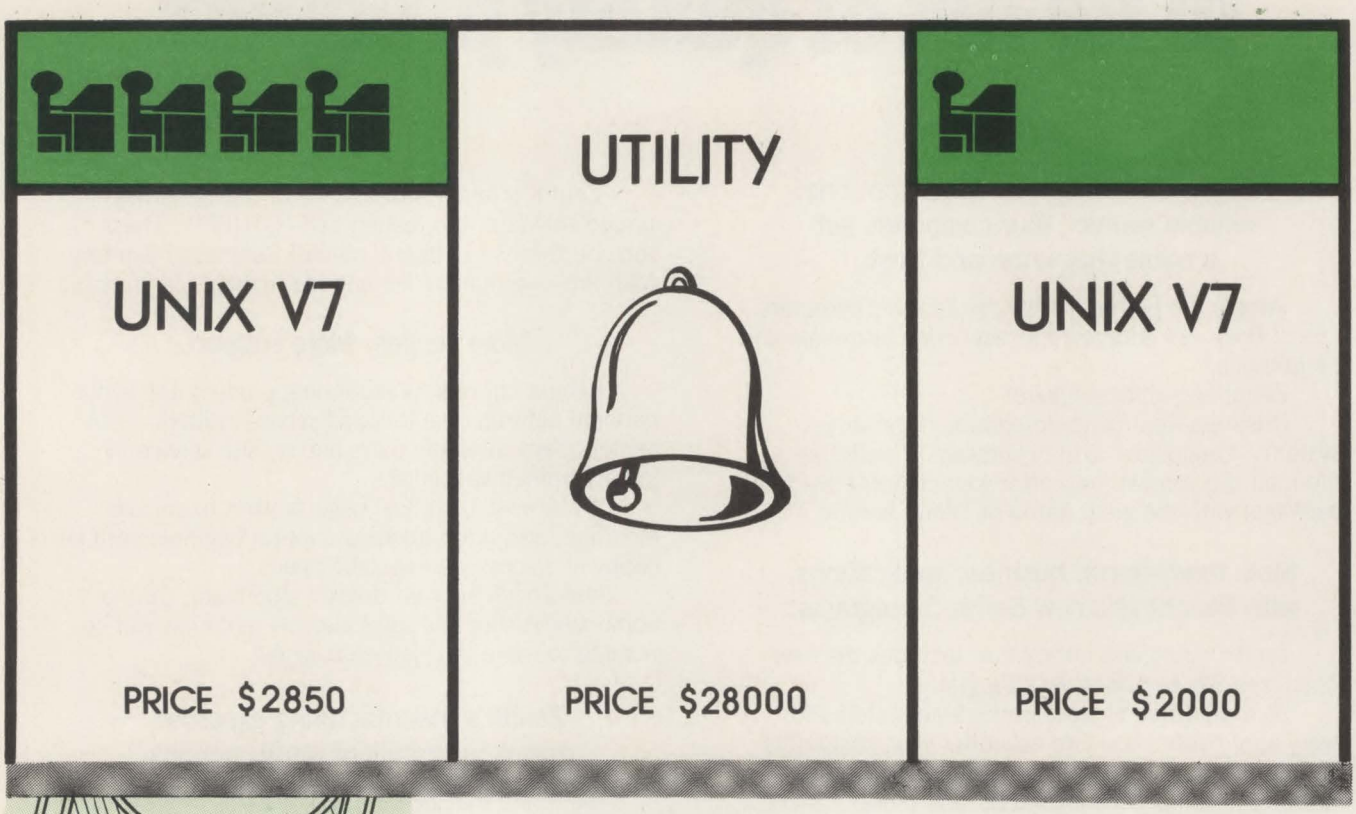
Company_____

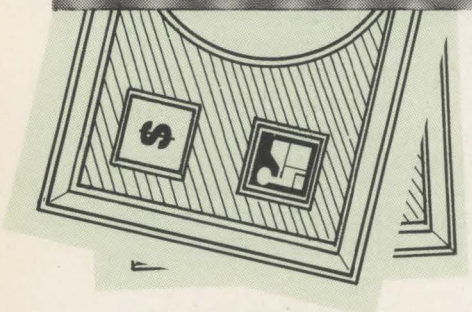
Street_____

City_____ State_____ Zip_____

MMS 08 (F)

FIRST ONLY THEY HAD IT
NOW WE'VE GOT IT
AND YOU CAN HAVE IT





*UNIX V7 *Enhanced*

Full UNIX, version 7, configured to operate efficiently on DEC PDP-11/23's 11/24's, and 11/34A's. With all of the original Bell Laboratory features **plus** many more. Full UNIX including C, FORTRAN 77, RATFOR, BAS, **plus** an optional ANSI BASIC Compiler. Full UNIX Shell **plus** device drivers for most standard devices not supported by Bell. Full UNIX **plus** an optional RT-11 emulator. Graphics utilities, document preparation, electronic mail, symbolic debugging, compiler compilers—it's all here. Fully sysgened, ready to run.

*LSI/PDP-11/23 SYSTEMS

Compumart, the leader in LSI-11 based systems, has complete 11/23 systems with UNIX ready to go in almost any conceivable configuration. Disk storage available up to 300 Mb to meet any performance requirements. Winchesters, floppies, cartridge disks, line printers, tape drives—all available from stock.

PDP-11/24 SYSTEMS

PDP-11/24 configurations are available to support up to one megabyte of RAM and all available Unibus peripherals. These systems will be configured with the best DEC or compatible equipment to fit your exact requirements.

UNIX UNBUNDLED

No problem. Compumart offers our enhanced UNIX any way you want. Single user UNIX from $2000, configurable up to 36 users with a modest charge per user.

EDUCATIONAL PRICING

Compumart's UNIX pricing for colleges and universities is the best part of all—**it's free!** Single user UNIX is free for educational institutions when bundled with a $30,000 system. (Discounts for smaller systems available.)

Compumart has busted all the barriers to acquiring UNIX.
We've simplified UNIX.
We've simplified your job.

617-491-2700/800-343-5504
IN MASS.

COMPUMART

CAMBRIDGE DIGITAL DIVISION
65 BENT STREET, DEPT 7404
CAMBRIDGE, MASS. 02139

Systems Customized

UNIX is a registered trademark of Bell Telephone Laboratories. * Digital Equipment Corporation registered trademarks.

CIRCLE NO. 30 ON INQUIRY CARD

of the American National Standards Institute. Stewart points out that DIN standards are being debated within the International Standards Organization, and could be adopted as world standards.

Whatever happens in the standards area, work-station manufacturers must learn to live with ergonomic design requirements. Summing up the situation, Stewart says,"'Un-ergonomic' equipment can still be sold in Europe, but manufacturers have lost sales because their products have not met ergonomic standards." Users and trade unions are aware of the importance of ergonomics, he says, adding that ergonomics research is more advanced in Europe than in U.S. "There are not many companies in Europe that could get away with sacking workers for objecting to equipment." —*Keith Jones*

Europe pushes development of home videotex systems

An interactive color CRT in every home and office would have seemed nothing more than a faraway dream a few years ago, but it is quickly becoming realizable, thanks to the rapidly accelerating development of videotex.

Videotex is the generic name for the various technologies that enable a standard TV receiver to display pages of information transmitted from a remote computer. The two main techniques are teletext, a receive-only method in which pages are broadcast by a TV station, and viewdata, a more versatile interactive technology, which uses telephone lines to enable a terminal owner to interrogate a theoretically infinite data base of pages.

Initial experience with public viewdata systems shows that the most promising applications lie in areas involving data input, such as electronic-funds transfer, rather than electronic publishing or sophisticated data-base access. Gateway facilities on local and international levels using packet-switching networks to link viewdata services with the networks of banks and other high-volume transaction-handling organizations, such as mail order companies, will be a vital feature of the technology in the next four to five years.

Teletext and viewdata have been pioneered in Europe—viewdata development being led by the state-controlled public telecommunications authorities in the United Kingdom and France. Thanks to their monopolistic positions, they have had little trouble imposing their own page-display standards in their respective countries.

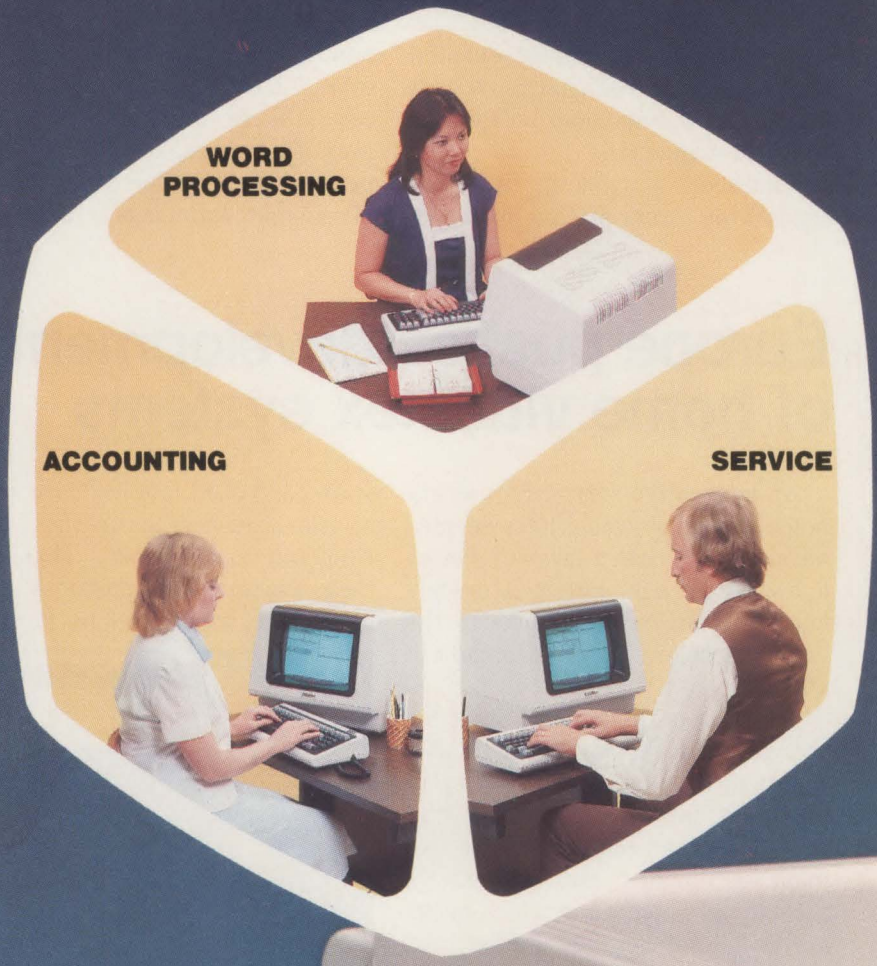
But the networking nature of viewdata makes international standards essential within Europe and vitally important on a worldwide basis. The whole appeal of viewdata is its low cost: no more than about $200 should be added to the cost of a standard TV by the viewdata

A viewdata adapter *(foreground) enables a standard color TV to be converted to a viewdata terminal in a few moments.*

The Multi-User Computer

MmmOST Throughput

Because each user has his own computer and memory (housed in the TeleVideo Smart CRT terminal), programs are executed in the user station. Throughput is maintained without degradation, even when there are 16 user stations!



MmmOST Software (CP/M®)

The entire TeleVideo computer product line uses the CP/M® operating system. More application software is available for CP/M® than any other operating system.

Nationwide Service

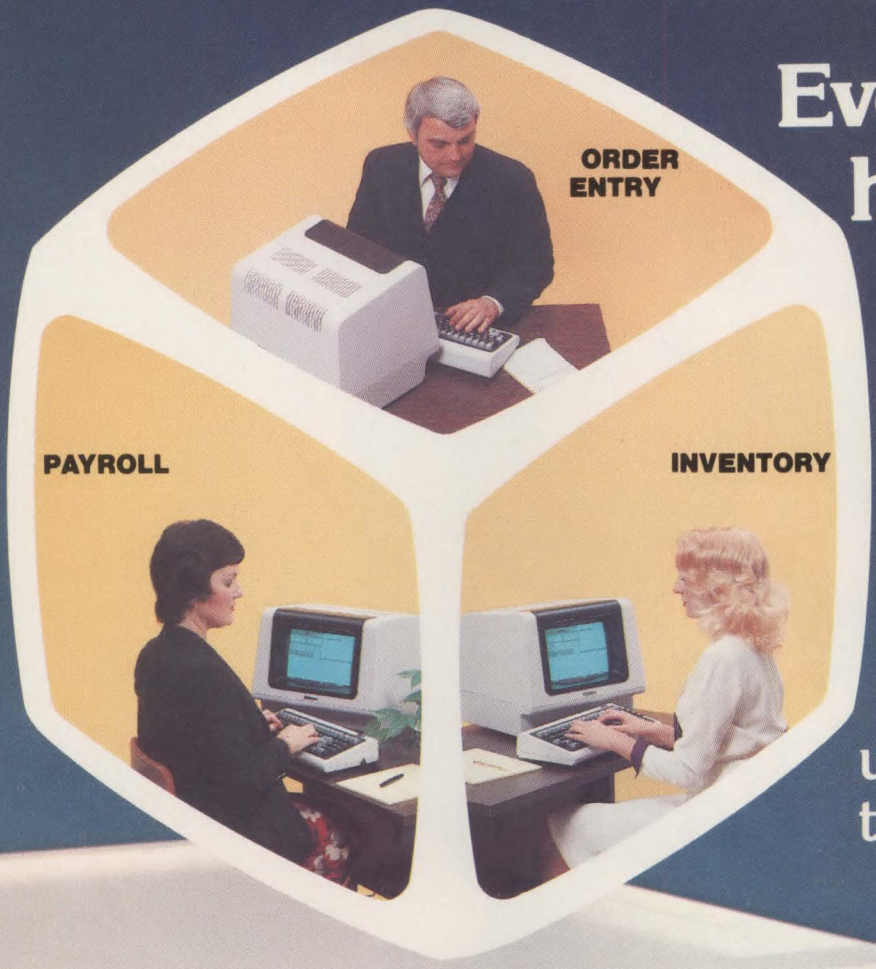
Nationwide service is available from General Electric Company's Instrumentation and Communication Equipment Service Centers.

Worldwide Availability

Atlanta, GA 404/255-9338
Bloomingdale, IL 312/351-9350
Boston, MA 617/668-6891
Dallas, TX 214/980-9978
Santa Ana, CA 714/557-6095
Sunnyvale, CA 408/745-7760
United Kingdom:
West End Surrey 44-9905-6464

With The MmmOST®*

*Multi-user, multi-task, multi-processor Operating System Technology



Every user has his own computer and 64K of memory.

TeleVideo's family of computers provides the MmmOST users . . . up to a total of 16 . . .

Featuring:

- Modular Growth
- Quality
- Value

System II Shown

TeleVideo® Systems

TeleVideo Systems, Inc., 1170 Morse Avenue, Sunnyvale, CA 94086
408/745-7760; 800/538-8725 (toll-free outside California)

CIRCLE NO. 34 ON INQUIRY CARD

We're giving 8-bit micros

a run for their money.

Digital introduces the $653* 16-bit micro. So why limit yourself to 8-bit thinking when you can get all the advantages of 16-bit performance at this low price?

Treat your system design to a more powerful and proven instruction set. More efficient processing. Precision arithmetic. The expandability which allows your system to grow as your needs grow, without changing system architecture. And to accommodate that growth without appreciably changing your software requirements.

Send us your application and we'll send you complete information on how to match your requirements with the performance of 16-bit micros from Digital. The company that has sold more high-performance micros than anyone.

The price is right. The time is now.

For full information, fill out the coupon or call toll free at (800) 225-9220. In MA, HI, AK and Canada call (617) 467-7000. Or simply contact the Hamilton/Avnet or Harvey Electronics office near you.

*In quantities of 50. Single unit price is $990. U.S. domestic prices only.

Please rush your 16-bit Micros Application Information Package to me at once. My application is:

☐ Laboratory/Scientific
☐ Data Communications
☐ Industrial/Process Controls
☐ Other (Please Specify) _____

Name _____

Title _____

Company _____

Street _____

City _____

State _____ Zip _____ Tel. ( )

Digital Equipment Corporation
Microcomputer Products Group, MR2-2/M70
One Iron Way, Marlboro, MA 01752

MM-8-1

digital

We change the way the world thinks.

CIRCLE NO. 125 ON INQUIRY CARD

interface circuitry, whether it is integral or contained in a separate adapter box. The cost of several different interfaces to handle several page-display methods could defeat the low-cost appeal. An array of data-entry methods could present even worse problems for information providers.

The announcement by U.S. telecommunications giant AT & T of its own viewdata-display standard, coupled with the accelerating proliferation of viewdata services, has transformed the subject of viewdata standards from a rather obscure academic issue into one of the hottest in information technology.

In Europe, progress has been made in reconciling the differences between the page-display techniques employed by British Telecom's public viewdata system, Prestel, and its French equivalent, Teletel, operated by the French PTT, Direction Generale de Telecommunications.

Both techniques employ the alpha-mosaic method. Characters are formed from a 10- × 14-dot matrix, and graphics are generated using cells of the same size as the character matrixes but containing six blocks. Each block can carry either the foreground or background color.

The main features of Prestel that differ from those of Teletel are the use of just 8 bits to identify each character in the page memory, and the serial insertion of an 8-bit control character in memory when one or more character features change, such as height, color or flashing on and off. Because a blank space appears on the screen each time a control character is received, this system is highly efficient if changes are infrequent, but is less so if they happen often.

Teletel employs a parallel-attributes method in which each character in memory is individually described by a total of 16 bits, 8 defining the character and 8 control bits describing most of the character's characteristics. Control information is processed in parallel with character codes, so no blank spaces appear on the screen. Teletel can thus offer character-by-character changes and, therefore, more detailed and attractive displays. But it is far less efficient than Prestel if changes are infrequent, and it is less flexible for editing and interactively altering parts of a frame being added to the data base because every character has to be reentered. Moreover, Teletel requires 2K bytes of page memory, about twice as much as Prestel.

Through a new facility called Gateway, *a private business computer system can be linked to a viewdata terminal using the pilot public viewdata service, Bildschirmtext, operated by Deutsche Bundepost, West Germany. British Telecom will add Gateway to its Prestel viewdata service next year.*

CEPT, an association of 26 European PTTs, have been meeting over the past three years to thrash out an agreement on a viewdata standard. That agreement, which came to fruition in May, was to merge the existing standards into one, incorporating the advantages of Prestel and Teletel while providing a high degree of compatibility so that existing viewdata terminals will not be rendered obsolete.

Terminals conforming to the new standard will incorporate 1K byte of memory for storing character codes and 960 bytes for stacking control codes. In this way, the control codes can be processed in parallel with character codes, thus eliminating Prestel's blank spaces. Only one control code will need to be stored for each attribute change, thereby eliminating the inefficiency of Teletel. The new system will need as much memory as Teletel, but with 40 bytes of control information available for each row of characters, many useful new frame features will be provided. They include as many as 16 different colors instead of the maximum of seven on the existing systems, full-screen background color, black foreground color, double-width characters, double height and underlining.

The existing Teletel system, like Prestel, transmits its 8-bit control codes serially, the only difference from Prestel being that the control codes follow every character code

"Quantum fully intends to be the leader in 8-inch Winchester drives by 1982."

—Jim Patterson, President Quantum Corporation

We have the very best people.
People whose impressive credentials inspired a level of financial backing seldom seen in a company so young. A management team with 110 years' experience and 20 patents in computer peripherals. The same people who developed the first generation of low-cost Winchester drives. And the second. People who have demonstrated the ability not only to design a superior drive, but to produce it. In high volume. At low-cost. So you can count on reliable delivery of high-quality drives . . . always at a competitive price!

The very best drives.
Our Q2000 series of 10, 20, 30 and 40-megabyte drives gives you up to four times the capacity of the current industry-standard Shugart SA1000, at a lower cost-per-megabyte. And all four are compatible with the SA1000 and with standard 8-inch floppy disk drives.

Major OEMs have already given the Q2000 series their highest vote of confidence: orders. To stay competitive in today's exploding market for low-cost computer systems, you need to know about Quantum 8-inch Winchester drives now.

For details, call Bob Teal, Quantum Corporation, 2150 Bering Drive, San Jose, CA 95131, phone (408) 262-1100.

QUANTUM ***Driving down the cost of quality.***

CIRCLE NO. 35 ON INQUIRY CARD

instead of being interspersed. The line protocols of the new standard will not differ radically from the existing Prestel and Teletel protocols, and its codes for existing characters and control functions will be the same.

Terminals conforming to the new standard will be able to handle both existing protocols and to generate exactly the same picture as does an existing terminal. Moreover, existing terminals in most cases will be able to generate an intelligible frame from the new protocol. Enhanced frame features will be ignored.

But the issue becomes more complicated when Canada's Telidon, the third public viewdata system down the development trail, comes into the picture. Backed by the Canadian government's Department of Communications, Telidon employs a technique called alpha-geometric for generating both characters and graphics. The terminal is programmed with a collection of geometric "primitive" functions, which can be used to generate precise fine-line drawings that are far superior in quality and accuracy to the rather crude "building-block" graphics provided by an alpha-mosaic display.

When only the Canadian system employed alpha-geometrics, the adoption by Europe of an alpha-mosaic standard seemed fairly safe. But when AT & T announced its own viewdata standard at the Videotex conference in Toronto, moves toward a world standard looked like they were being thrown into total confusion. As the fourth and latest heavyweight contender in the viewdata arena, AT & T issued a specification that included a combination of alpha-mosiacs and alpha-geometrics. Other features include re-definable character sets, continuous, rather than stepped, scaling of text size and variable line lengths. Examination of the AT & T standard shows that it is not compatible with all of the other three major systems, but Prestel and Teletel engineers believe compatibility can be achieved with the alpha-mosaic part of the AT & T system if the U.S. carrier accepts a few adjustments to its standard. The most important is a change in the standard number of lines of text per frame from 20 to 24.

British Telecom hastily issued assurances that universal adoption of the AT & T standard was unlikely to render existing Pretel terminals obsolete. This assurance was needed because there are now nearly 11,000 Prestel terminal users in the U.K.—more subscribers than on any other computer-based information system.

British Telecom believes that alpha-geometrics will raise the cost of viewdata circuitry in a terminal 400 percent compared with alpha-mosaics, and that fine-line graphics will be rendered obsolete in a few years by alpha-photographics. Alpha-photographics is the technique in which part of a viewdata screen is filled with a digitized photograph of the object described by the text. This will be far more acceptable than line drawings in one of the biggest potential viewdata applications areas—electronic retailing. British Telecom has already demonstrated an experimental alpha-photographic system called Picture Prestel.

The scope of the technique is now limited, partly due to memory costs but mainly because public viewdata services operate at relatively low line speeds—1200 bps standard on Prestel. As a result, the formation of a picture on a viewdata screen takes several minutes.

But British Telecom is looking forward to the introduction of 64K-bps transmission speeds on ordinary public-subscriber telephone lines in the U.K. and in other countries that are moving to digital switching. In September, BT will inaugurate a service for big companies and banks in central London, enabling them to communicate with each other over 64K-bps private lines. By 1983, London will have a substantial digitally switched public-telecommunications service overlaying the existing analog network. A Picture Prestel service will then be introduced, taking advantage of the 64K-bps line speeds. By 1992, a digitally switched public overlay network serving 30 U.K. cities will be in full operation, making Picture Prestel available to the majority of potential users.

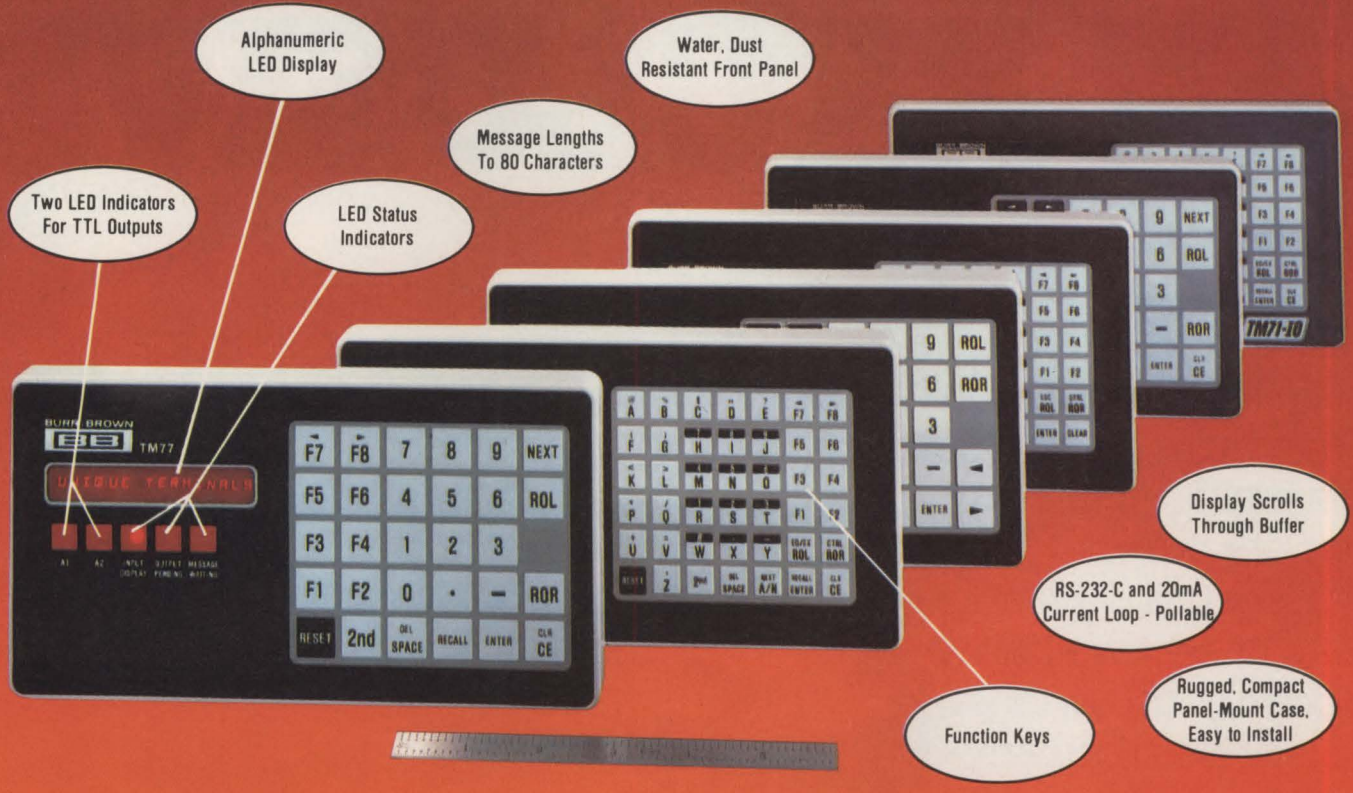
Prestel has been fully operational for more than a year and is available to more than 60 percent of all potential users in the U.K. The software, written in Babbage, is hosted by about 20 4000 series minicomputers manufactured by GEC Computers, Ltd., and installed at 10 regional centers. More than 500 organizations provide pages of information, and more than 183,000 pages are in use.

But information providers in general are not happy with the performance of Prestel so far. There were predictions when Prestel started that it would have more than 50,000 users after a year—a big contrast to the 11,000 figure achieved. Moreover, less than 14 percent of subscribers are residential, and British Telecom has decided to concentrate on developing the business market for now.

The prospects of Prestel (and viewdata in general) as an advertising medium are being questioned because of its relative crudeness and small screen size. Some information providers believe that data-base-access procedures are too complex for most residential users, and that electronic publishing will prove to be an unprofitable exercise, even in the long term. One counter to this argument is that viewdata can give the information provider an expanding "readership" without the additional printing costs incurred in paper publishing. *—Keith Jones*

SIX TOUGH TERMINALS

From $290*



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!

Putting Technology To Work For You

BURR-BROWN®

Contact Regional Sales Office Below Or Your Local Representative:

BOSTON - (617) 444-9020
CHICAGO - (312) 832-6520
COLUMBUS - (614) 764-9764
DALLAS - (214) 681-5781
DETROIT - (313) 474-6533
HOUSTON - (713) 988-6546
LOS ANGELES - (714) 835-0712
NEW YORK - (914) 253-9333
SAN JOSÉ - (408) 559-8600
SEATTLE - (206) 455-2611
TUCSON - (602) 746-1111 **CORPORATE HEADQUARTERS,**
P.O. Box 11400, Tucson, Arizona 85734, TWX: 910-952-1111

*In 100's

TO Burr-Brown, A&SP Dept., P.O. Box 11400, Tucson, AZ 85734

Please send me information on "Microterminals"!

Name_____
Title_____
Company_____
Address_____
City/State/ZIP_____
Telephone: ( )_____

C 2

CIRCLE NO. 36 ON INQUIRY CARD

SHUGART
AN EXCLUSIVE

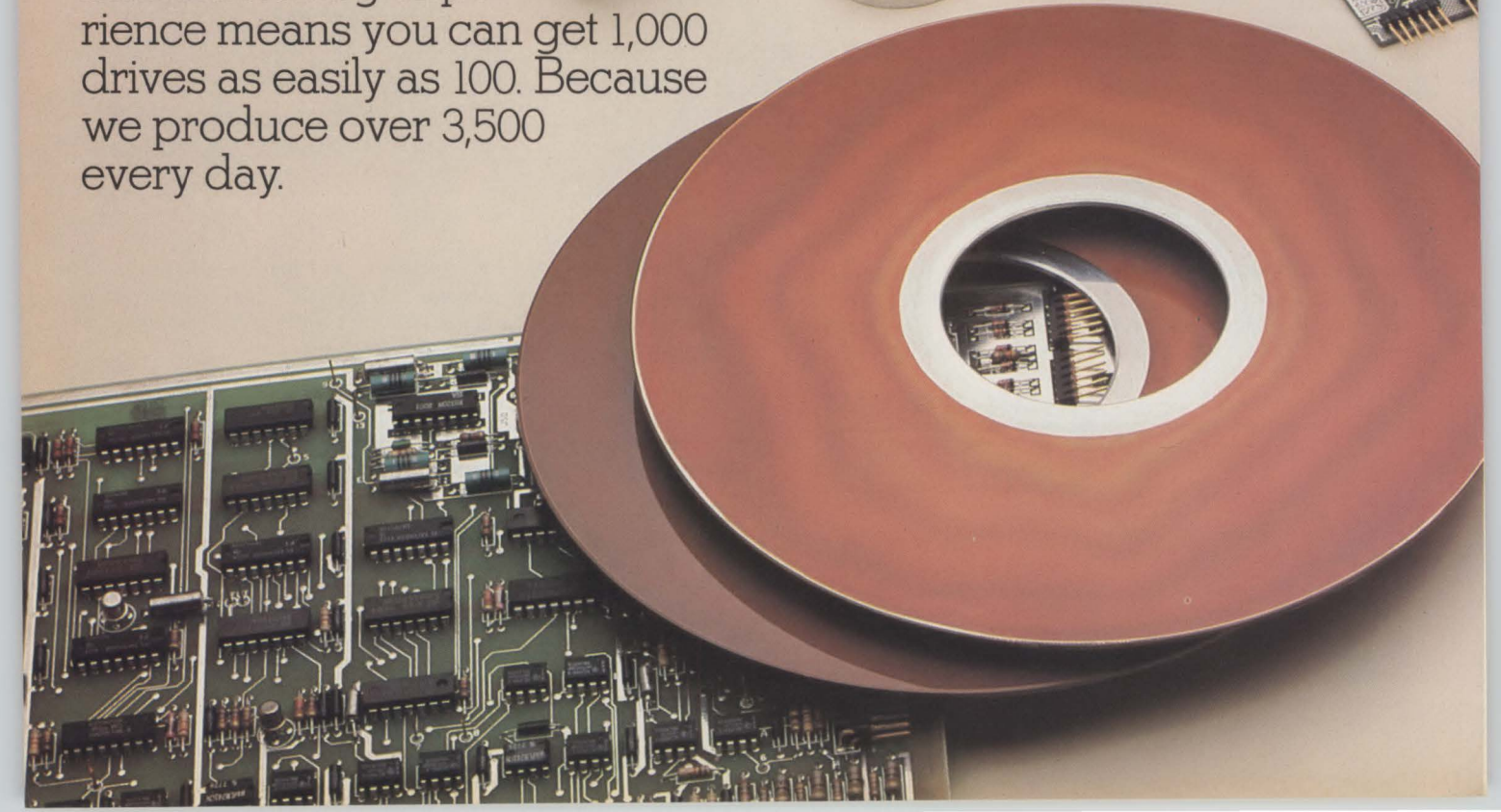
Experience.

When you specify a Shugart drive for your standalone system, you're getting something you can't get from any other manufacturer.

Because—1.8 million installations later—we know more about low-cost disk drives than anybody.

Our high-volume manufacturing experience means you can get 1,000 drives as easily as 100. Because we produce over 3,500 every day.

Our application engineering experience means we can help you get your product to market faster. Because we've helped customers design more



INTRODUCES INGREDIENT.

controllers than anyone else.

Our world-wide field engineering experience means longer running drives and faster repairs. Because we've got the largest field service force dedicated to our industry.

And our new product development experience means the biggest choice in low-cost disk drives.

From the industry-standard SA800 floppy—the recognized leader for low cost and high reliability.

To the SA850 double-sided floppy with up to 1.6 megabytes of storage. All reliable thanks to its Bi-Compliant™ head design.

To the SA1000 and SA4000/4100 8- and 14- inch Winchesters. With anywhere from 5 to 58 megabytes of high-performance storage.

All ready, right now, to be added to your system.

At Shugart, experience is more than a no-cost extra. It's something you can profit from.

For more information, contact Shugart Associates, 475 Oakmead Parkway, Sunnyvale, California 94086. Telephone (408) 733-0100. Hamilton/Avnet, authorized distributor.

Shugart

Right from the very start.

Sales and Service: Sunnyvale CA, Costa Mesa CA, Minneapolis MN, Richardson TX, Framingham MA, Landing NJ, Atlanta GA, Toronto Ontario, Paris France, Munich Germany.

CIRCLE NO. 37 ON INQUIRY CARD

The important plus in matrix printers:

grafixPLUS.™

Since their introduction in mid-1980, the Anadex high-resolution DP-9500 Series matrix printers have set new standards for printer quality and performance. All models feature the rugged Anadex 9-wire print head that combines long life with resolutions of 72 dots/inch vertical and up to 75 dots/inch horizontal. With this kind of resolution, fineline graphics (under data source control) and razor sharp characters are pluses built into every printer.

Performance Plus

The full standard ASCII 96 character set, with descenders and underlining of all upper and lower case letters, is printed bi-directionally, with up to 5 crisp copies, at speeds up to 200 CPS. Models DP-9500 and DP-9501 offer 132/158/176 and 132/165/198/220 columns respectively. Print densities are switch- or data-source selectable from 10 to 16.7 characters/inch. All characters can be printed double-width under communications command.

Interface Plus

Standard in all models are the three ASCII compatible interfaces (Parallel, RS-232-C, and Current Loop). Also standard is a sophisticated communications interface to control Vertical Spacing, Form Length and Width, Skip-Over Perforation, Auto Line Feed, X-On/Off, and full point-to-point communications.

Features Plus

As standard, each model features forms width adjustment from 1.75 to 15.6 inches, shortest-distance sensing, full self-test, 700 character FIFO buffer (with an additional 2048 characters, optional), and a quick-change, 6 million character life ribbon.

Quality Plus

Beyond the built-in performance of the grafixPLUS series printers, the engineered-in quality and support are equally important. The result? Approval of both UL and FCC, Class A; operating noise levels under 65dbA; and a nationwide service organization second to none.

To see for yourself why the grafixPLUS printers offer more pluses for your printing dollar, contact us today.

Anadex®

the plus in printers

Made in U.S.A. for the World

ANADEX, INC. • 9825 DeSoto Avenue • Chatsworth, California 91311, U.S.A. • Telephone: (213) 998-8010 • TWX 910-494-2761
U.S. SALES OFFICES, San Jose, CA (408) 247-3933 • Irvine, CA (714) 557-0457 • Wakefield, MA (617) 245-9160 • Austin, TX (512) 327-5250
ANADEX, LTD. • Weaver House, Station Road • Hook, Basingstoke, Hants RG27 9JY, England • Tel: Hook (025672) 3401 • Telex: 858762 ANADEX G

8086-based video terminal has ANSI control functions

A new video-display terminal that incorporates many of the terminal-control functions established by ANSI standard X3.64 has been introduced by Piiceon, Inc. Called the PM2010, the terminal combines an 8086 μp, 32K bytes of RAM and a full-page, 66- × 80-character display.

John Cosley, vice president of the San Jose, Calif., firm says, "The combination of hardware and ANSI specifications allows users to define their own terminal characteristics." The PM2010's download-and-go function, for example, permits users to download programs from the host CPU and change the definitions of the terminal's keyboard, Cosley says.

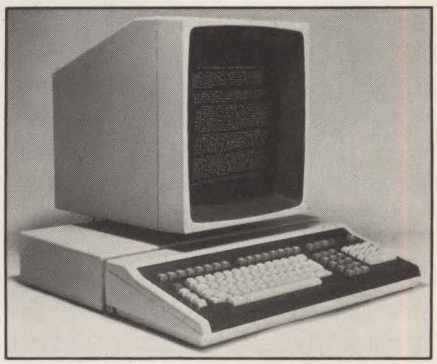
The standard enables pre-processing of data within the terminal, a function normally performed by the CPU. This data pre-processing offloads work from the CPU and helps minimize the number of data transfers between host and terminal, the two primary goals of the ANSI standard, Cosley says.

Besides pre-processing data, the 2010 implements other aspects of the ANSI standard, including form-filling and transfer, area qualifiers, block-mode transmission and multi-page and cursor controls with associated numeric parameters. The 2010 does not implement all ANSI specifications, Cosley says, simply because some just do not apply to the ASCII-compatible market.

A single board contains the 8086 and 32K bytes of RAM. Memory is expandable to 256K bytes on the same board, Cosley points out. The 2010 has two RS232C ports and a parallel printer port. Ten transmission rates—from 75 to 19.2K bps—are switch- or software-selectable.

All ANSI specifications are stored in the 2010's 8K bytes of EPROM, also on the single board. The terminal uses RAM during program execution, says Cosley, and the user can manipulate data in RAM to re-define the program to meet specific applications.

The full-page video display uses a 7 × 9 dot matrix in a 9 × 15 field to create large, readable characters, Cosley says. Any combination of 128 characters, including upper and lower case with descenders, can be displayed in high or low intensity. Other display functions include blinking, reverse video, blanks and underlining. The keyboard is detachable and features a full alphanumeric set with N-key rollover, eight function keys, a separate numeric pad and various dedicated keys.



Piiceon's PM2010 *video-display terminal incorporates many of the terminal-control functions established by ANSI standard X3.64.*

In quantities of 500, the 2010 sells for $2500. Cosley expects to have some beta sites running this month. Production and quantity shipments are set to begin in October.

—Larry Lettieri

DECmate seen enhancing strength of Digital's stores

While still withholding its KO personal-computer punch, Digital Equipment Corp. recently bolstered its small-business computer offerings by adding a beefed-up PDP-8 12-bit system using a new μp co-developed by DEC and Intersil Inc.

The DECmate, or WS 278 as it was called internally, is base-priced at $6795 with dual floppy disks and a dot-matrix printer. No software is included in the base price. In a word-processing configuration, the system, which includes a 55-cps Diablo daisy-wheel printer, is priced at $9195.

The DECmate is being touted as 2.3 times faster than the model 78 it updates, but does not replace, DEC officials say. Those officials also assert that the DECmate has overcome some of the performance problems associated with the venerable PDP-8 architecture that forms the basis for both DECmate and the 78.

The KO, or knockout project at DEC is a personal computer reportedly nearing introduction and expected to be announced in 1982 (MMS, July, p. 5).

The DECmate and the personal computer are especially important products for DEC's retail store outlets. Those stores find themselves in competition with a host of independent and company-owned

stores catering largely to small businessmen having their first encounters with computers. The DECmate, designed with that user in mind, represents a departure from the company's traditional focus, says Gary M. Cole, systems development manager for DEC's retail products group.

"With the DECmate, we were building a machine whose purpose was to be ready for use with the ultimate user. It's probably the first machine we've sat down and said that (about)," Cole says. "We're basically offering a ready-to-use business computer."

In operation, the software used on the DECmate will appear familiar to DEC's WS-78 users, and many of the company's WS-78 applications packages are available on the 278.

The major differences in the DECmate as compared to the 78 are in the DECmate's added memory capabilities, communications and added screen functions. The CPU, memory and control are contained on a single board, and a DEC VT-100 housing is used for the video display. The terminal with a communications option will be sold separately for $3900. The DECmate will be promoted by DEC as a "work processor."

The minimum configuration includes two 8-in. single-sided, double-density floppy disks offering 1M byte of memory, the DECmate terminal and an LA-34-W dot-matrix printer.

Software offerings that DEC will sell when the company begins delivery in August will include a new edition of the company's word-processing package and five financial programs, including accounts payable, accounts receivable, general ledger, inventory and payroll. The company will also offer a construction-management package, a legal-client accounting system, a financial-modeling system and a math/utility package.

The DECmate desk-top unit *features office applications and data-processing software, list processing, alphabetic and numeric sort, communications and a high-speed chart graphics video-display capability.*

The word-processing software includes the basic word-processing package and has a one-time price of $500. List processing is priced at $400, sort utility at $200 and a teletypwriter communications package at $150.

The DECmate is based on a CMOS LSI μp that operates on 5V at 5.1 MHz. The CPU's memory size is 32,768 words. The μp overcomes several of the limitations associated with PDP-8 architecture, Cole says.

He claims that by using "holes" in the address space, DEC was able to add vector interrupts and stack registers to the hardware. Vector interrupts give a system the ability to provide faster polling within the architecture. Stack registers are used to organize data more effectively within the system's hardware.

The addition of vectored interrupts and stack registers significantly improves the system's performance in applications using ROM, which was a traditional PDP-8 weakness, Cole says.

The boosted PDP-8 performance and VT-100 screen capabilities provide several advantages over the previous WS-78 system.

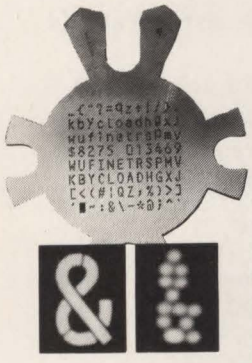
The 278 system's screen has an 80- and 132-column display, while the 78 had an 80-column screen. The 278 also has screen attributes, including bold, blink, underline and reverse-screen characteristics, which were beyond the 78's capabilities. In addition, the 278 has a 254-character set, compared to the 78's 96-character set, and has a high-speed display-edit mode that updates the screen at 80K bps. The high-speed mode will allow the 278

DATAGRAPHIX 132-COLUMN DISPLAYS GIVE YOU NOT ONLY BETTER QUALITY, BUT LETTER QUALITY.

It's the CHARACTRON

that makes the difference!

Reproduced from DatagraphiX, 132-column Charactron® CRT.



DatagraphiX' unique innovation acutally stencils sharp, clear characters on 132-column displays that are easier to read than most hard-copy computer printout pages.

A dot matrix display — any dot matrix display — just doesn't come close to the remarkable resolution of the CHARACTRON.® That's why the DatagraphiX displays are the only easy-to-read 132-column displays you can buy. Anywhere. In the entire world.

When you have 132 columns that you can really read, you will never need 80 columns again. You will never spend another cent reprogramming the 132-column computer output into 80 columns. You will never waste another minute of your time or the computer's time waiting for paper printouts just to see the full output line. In fact, all the time and money you will save make the DatagraphiX 132-column displays the most economical system enhancement you can add.

The DatagraphiX family of displays and controllers includes models that are compatible with a wide range of computer systems, including DEC, IBM and Univac.

There's no waiting either. Delivery is from stock for many models.

But don't just take our word on DatagraphiX display superiority.

Send us the coupon today and we'll arrange a live demonstration right in your facility. Because seeing is believing.

Yes, I want to see your letter-quality display terminals.

☐ Please call me to make arrangements for a demonstration.

Name _____
(Please print)

Title _____

Address _____

City _____ State _____ Zip _____

Phone (_____) _____

Mail To:
DatagraphiX
Display Products Department
P.O. Box 82449, San Diego, CA 92138
(714) 291-9960

MMS/8-81

DatagraphiX®

DatagraphiX, Inc., is a General Dynamics subsidiary.
DatagraphiX® and Charactron® are registered trademarks of DatagraphiX, Inc.

CIRCLE NO. 39 ON INQUIRY CARD

to do line graphics. Although DEC does not have a graphics package available, the company is expected to offer one shortly.

The 278's memory capacity goes considerably beyond the maximum 2M bytes of floppy-disk storage that limited the 78. The DECmate can be configured with as many as four RL02 10.4M-byte disk drives.

Communications hardware is priced at $900 whether purchased with the system or included as a later add-on.

Data processing can be performed within self-contained packages, such as general ledger, or can be performed on either of the two operating systems available to the programming user. COS/310 includes DEC's DIBOL-8 and DIBOL-11 business programming languages and a 2780/3780 synchronous communications capability within the COS/310 operating system. The other operating system is OS/78.

—Eric Lundquist

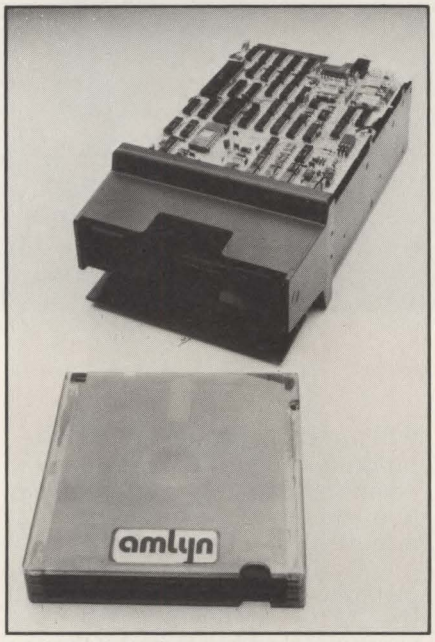
8M-byte floppy backs up 5¼-in. Winchesters

In their quest for even more storage capacity per spindle, makers of 5¼-in. floppy-disk drives have gone to double-sided recording and double-bit and track densities. They have also reduced drive height, enabling, in the case of Remex's "Pico," three drives to fit into the space of two—(MMS, April, p. 168). In another case, Alp Electric, Inc., fits two drives into the space usually required by one (MMS, June, p. 62).

Nine-month-old Amlyn Corp., San Jose, Calif., is trying yet another approach and has developed a device that crams an unprecedented 8M bytes of storage into a package with the same cut-out dimensions and depth as the de facto industry standard, Shugart Associates' double-sided, 500K-byte SA450.

Rather than record data on a single platter, however, Amlyn's new drive uses five single-sided, 1.6M-byte, 5¼-in. floppy disks packed into a proprietary cartridge. Data is recorded at a flux density of 9500 fcpi (compared to 5876 fcpi for the SA450) and 170 tracks per in. (compared to 48 tpi for the SA450 and 96 tpi for drives such as Shugart's SA460 and Tandon's TM-100-3).

To accommodate higher bit densities, Amlyn's drive uses a proprietary manganese-zinc ferrite head and high-quality Dysan media. Diskettes with mylar substrates tend to expand and contract, depending on heat and humidity. To accommodate higher track densities, therefore, Amlyn's drive incorporates a closed-loop servo system based on an Intel 8051 μp, and optical head-positioning techniques based on IBM's 2314-technology rigid-disk drives announced in the late 1960s.



Amlyn Corp.'s floppy-disk drive cartridge *holds five standard 5¼-in. floppy diskettes. Diskettes are interchangeable and can be used for simultaneous storage of both system software and transactional data.*

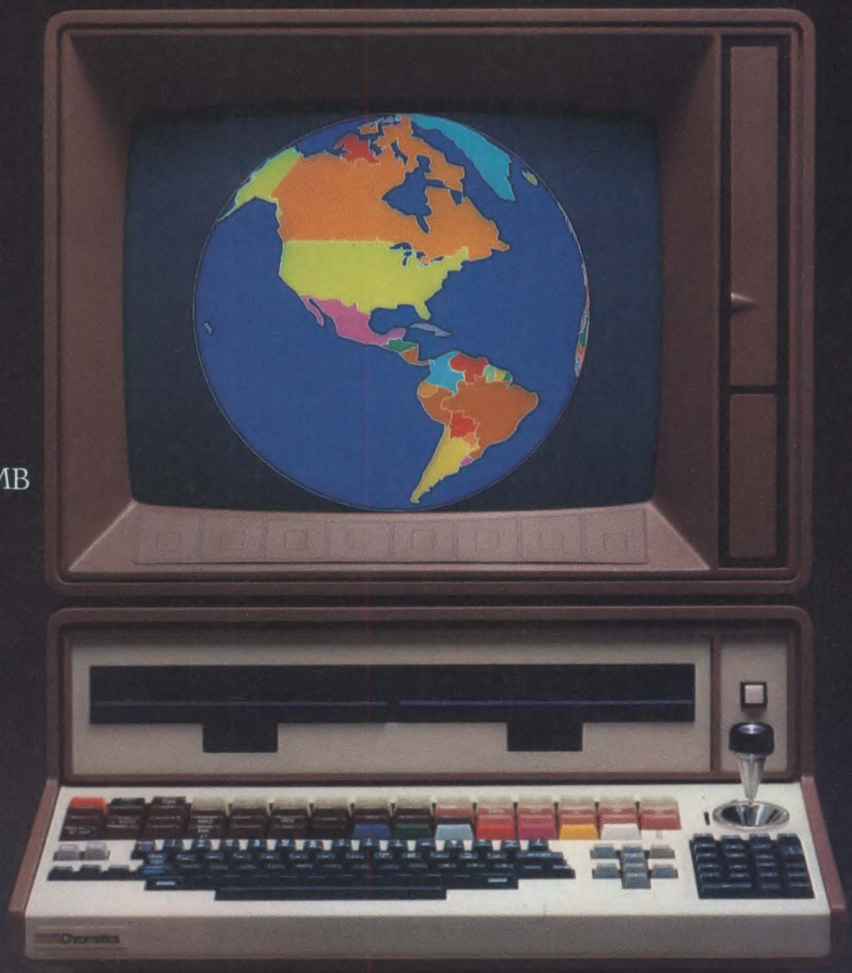
These circuits comprise a series of photo diodes and two mylar scales, each imprinted with fine vertical lines. One of these scales is mounted on the spindle assembly of the drive and serves as a reference point; the second is mounted on the head carriage. The result is a system, which, with light passing through the new scales, aligns the head over the center of a specified track, or to indicate to the head logic which way the carriage should be moved.

"Ground zero" for the system—the point from which track count begins—is a reference track prerecorded onto each diskette in the cartridge imstead of track #00 on standard diskettes. Also included in the Amlyn head-positioning circuit is a "carriage-home" indicator that functions much like the seek-error logic on Winchester-disk drives. The head-positioning circuit returns the head outside the reference track in case the head cannot find the specified track. Once in the carriage-home position, the head is stepped in until the trailing edge of the reference track is discovered. Track count then begins again, and the head is moved to the track indicated by the I/O instruction.

A split-band positioner tied to a microstepper controls the head carriage. The microstepper moves in increments of 59 μin. Spacing of the vertical reticules on the mylar

- Motorola MC68000 16-bit processor
- Multi-tasking operating system
- Languages supported include C, PASCAL and BASIC
- Mass storage devices up to 10MB

- 19" CRT
- 1024 x 768 high resolution color graphics
- 256 simultaneously displayable colors



- CAD/CAM
- Business Graphics
- Imaging
- Animation
- Process Control
- Scientific
- Graphic Arts
- Demography
- Cartography

- **CGC 7900** prices start at **$19,995.**

- Call toll-free 1-800-241-9467.

INTRODUCING THE WORLD'S MOST POWERFUL USE OF COLOR.

Chromatics
The World's Most Colorful Computer Company.

Chromatics, Inc./2558 Mountain Industrial Boulevard/Tucker, GA 30084/Telephone: 404/493-7000/TWX: 810/766-8099

CIRCLE NO. 40 ON INQUIRY CARD

AT SPERRY UNIVAC MINICOMPUTERS, WE BELIEVE THE ONLY GOOD OEM IS A HAPPY OEM.

That's why we work so hard to make our minicomputer OEMs and Systems Houses successful. Whether it be hardware, software, or even marketing support, Sperry Univac delivers it all.

That's why we're convinced that you, too, would be happy as a Sperry Univac OEM. Because, more than anyone else, we want you in our family—and are willing to offer a lot to prove it.

Consider applications software. We provide access to field-proven vertical packages for a wide variety of markets. You can drastically reduce your development costs, and immediately enter a vertical market through one of these packages.

HOTMAN, a hotel management system, is designed to meet all the requirements of the hotel industry. It's a true total concept for both the front and back office areas, designed by hotel people for hotel people.

MANMAN,® a manufacturing management system, is a complete integrated system with seven on-line application modules to cover every aspect of manufacturing operations.

DART (Distribution and Accounting for the Retail Trade) is a package that gives retailers a complete handle on their business.

OPIC (Order Purchasing and Inventory Control) is a comprehensive and completely automatic data processing system for distribution of merchandise as required for manufacturing, distributors and public warehousing.

Imagine. You can serve a vertical market now—without the initial cost and time to develop a marketable package. That makes our OEMs successful—which makes us happy.

And we don't stop with software packages. The SPERRY UNIVAC V77 minicomputer family has a member for just about any situation you can come up with. Not to mention the security of machines manufactured and maintained by one of the giants in the industry.

In short, we've made it very easy for OEMs and Systems Houses to work with us. And if you know of anything else we can do, give us a call. We'll listen. After all, at Sperry Univac we don't believe an OEM can be too happy.

For more information, simply mail us the coupon. Or call toll-free ***800/854-7517*** *(8:00 a.m. to 4:30 p.m. PST). In California, call 714/557-9398 collect.*

CIRCLE NO. 41 ON INQUIRY CARD

Yes, I want to become part of your OEM family for the following applications packages. Please send more information on:

☐ OPIC ☐ MANMAN ☐ DART ☐ HOTMAN

NAME_____

TITLE_____

COMPANY_____

ADDRESS_____

CITY_____ STATE_____ ZIP_____

PHONE_____ EXT_____

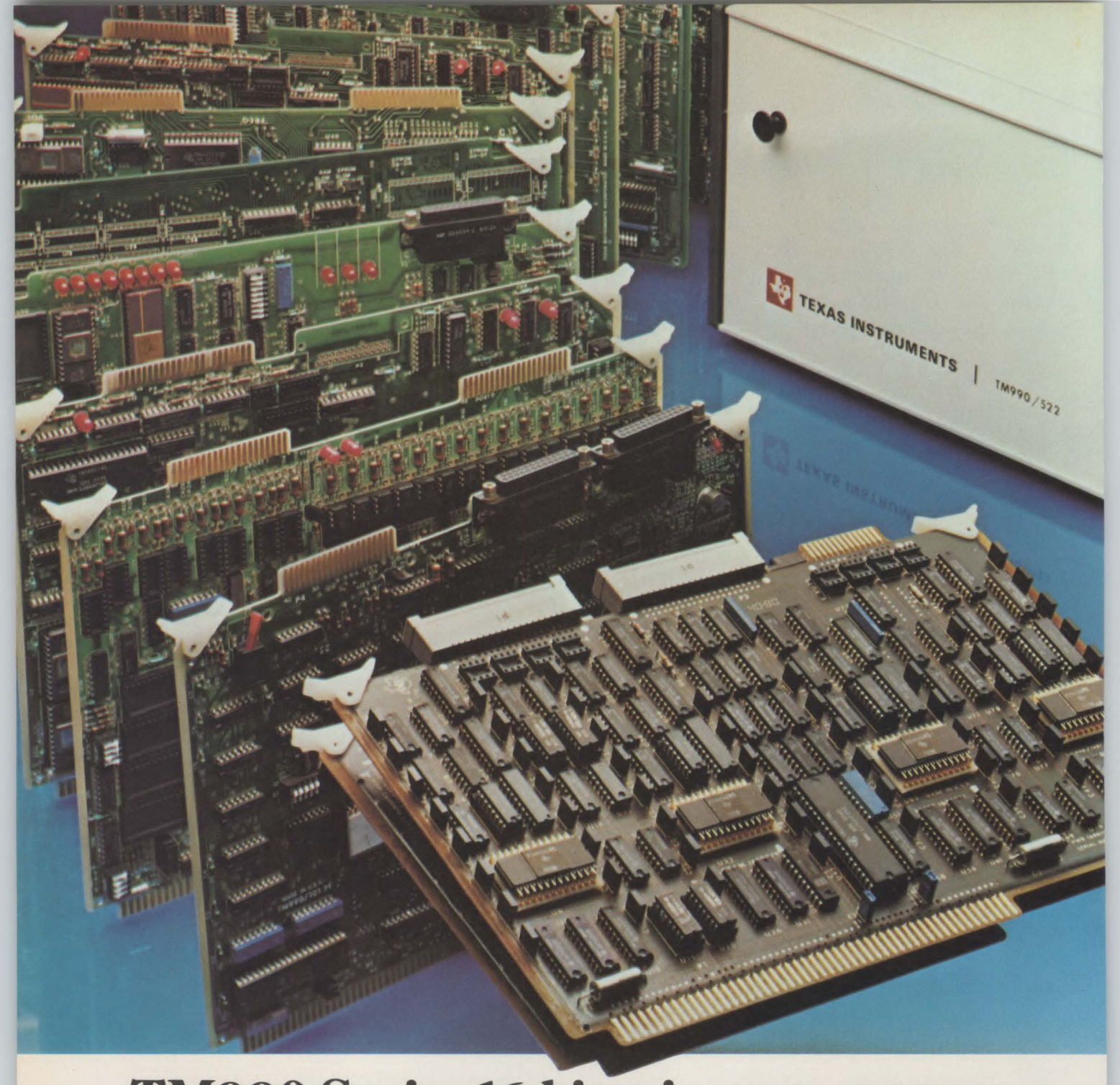
☐ *Literature only* ☐ *Please have a salesman call.*

Sperry Univac Mini-Computer Operations, Marketing Communications, 17900 Von Karman Avenue, Irvine, CA 92714. **MMS 8/81**

SPERRY UNIVAC

The Computer People Who Listen.

Sperry Univac is a division of Sperry Corporation.
MANMAN is a registered trademark of ASK Computer Services, Inc.



TM990 Series 16-bit microcomputers: Shortcut to industrial control solutions. The wide choice from Texas Instruments.

Solve a majority of your industrial control design problems rapidly. Economically. Efficiently. TI's broad TM990 Series of microcomputer modules can match your needs down the line. And off the shelf. Saving design time and money because they are pre-assembled, pretested. Giving you all the performance of TI's 16-bit 9900 microprocessors.

Super fast CPU

If you need a high-performance general purpose 16-bit CPU, then the new TM990/1481 two-board CPU is your answer. With 95 distinct instructions, it has the processing power of a minicomputer.

While the TM990/1481 is 3½ times faster than other TM990 CPUs when executing non-floating point instructions, it shines at floating point arithmetic. *It is 40 times*

faster. In fact, the TM990/1481 performs double precision floating point in the same time as it takes competitive products to perform single precision.

Memories: Broader range

Your choice in TM990 memories includes a variety of directly addressable semiconductor memory modules.

There's also provision to handle floppy disks drives. The TM990/303A controls up to four standard drives or three mini diskette drives.

Exceptional I/O capability

Interfacing with the outside world is relatively easy. The TM990 Series contains a comprehensive selection of I/O modules: Digital. Analog. Industrial AC and DC. And, *a readily available speech module*, the TM990/306. It can speak 179 words and is ideal for situations where the spoken word is the most effective means of communication.

Recently added to the TM990 line are two new communication modules. The TM990/308 Industrial Communication Module permits communication with as many as 31 other compatible TM990 systems. Over distances up to 10,000 feet, using twisted-pair lines. The optically isolated interfacing built into the 308 simplifies interconnects and lowers installation costs even in electrically noisy environments.

The TM990/307 allows communication with up to four RS232 devices such as terminals or modems.

Functional integration: Slashes your software costs

Functional integration. Hardware and software units developed together. To work together. TI is first with this system concept of the 80's that can substantially cut software development time and costs.

Key element is a set of software interconnect standards that ties the system together.

The Realtime Executive implementation allows you to interface TI's Component Software with the system easily and quickly. These Component Software packages provide a library of statements common to many programs. You choose what you need and combine it with the specific software required by your application. Savings can be more than two-thirds the cost of writing a typical program.

Available now: the File Manager. Coming soon: Software Data Communication packages.

The File Manager package performs such functions as library level management of diskette storage. Including install formatted volume, open/close/read/write files, random access to files.

TI's powerful AMPL hardware and software development system includes full speed emulation of 9900 microprocessors, and provides for program development in assembly language, TI Microprocessor Pascal (complete with concurrency), and Power Basic.

Broad and growing series: TI's TM990

Microcomputer Modules:
TM990/100MA
TM990/101M
TM990/180M
TM990/1481

Memory Module:
TM990/201 EPROM/RAM
TM990/203 Dynamic RAM
TM990/206 Static RAM

Mass Storage Module:
TM990/303A Floppy Disk Controller

Digital I/O Modules:
TM990/305
TM990/310

Analog I/O Modules:
TM990/1240
TM990/1241
TM990/1243

Communication Modules:
TM990/307
TM990/308

Speech Module:
TM990/306

Card Cages & Enclosures:
TM990/510
TM990/520
TM990/522
TM990/530

Industrial AC and DC I/O Modules:
TM990/5MT Series

Data Entry and Display Microterminal:
TM990/301

University Module:
TM990/189M

Software Development Module:
TM990/302

Complete accessories

The TM990 Series is supported by a broad selection of accessories — card cages, connectors, cables, and power supplies. Just added: the TM990/522 Enclosure containing a four-slot OEM chassis, power supply, and cooling fan in a neat, attractive, table-top unit.

For faster, simpler solutions to industrial control problems, take the shortcut. The TM990 Series of microcomputers. For more details about these time and money saving modules, see your local TI distributor, or fill out and return the coupon.

Texas Instruments Incorporated MM-1
P.O. Box 1443, M/S 6404
Houston, Texas 77001

☐ **Please send Brochure CL-377C.**
☐ **Please have a salesman call.**

NAME _____
TITLE _____
FIRM _____
ADDRESS _____
CITY _____
STATE _____ ZIP _____
TELEPHONE _____

Texas Instruments invented the integrated circuit, microprocessor and microcomputer. Being first is our tradition.

TEXAS INSTRUMENTS
INCORPORATED

85624B

CIRCLE NO. 42 ON INQUIRY CARD

scales is set at 590 μin. This leaves Amlyn with room to boost storage capacities by boosting track densities. Amlyn is reportedly considering increasing both bit and track densities, as well as introducing a double-sided drive.

The Amlyn drive works like a 1940s jukebox. First, the five-diskette cartridge is partially inserted into the drive, with about one-third of its length extending beyond the front bezel. Next, a stepper motor rotates the cartridge on its latitudinal axis so that the attitude of a specified diskette is correct for placement on the drive spindle. Once this attitude is established, a second motor turns on and drives a lever that retrieves the diskette from the cartridge and places it atop the drive spindle. This diskette is then clamped down, the spindle motor starts up, and the drive begins to read and write data. When a second file is needed, the procedure is reversed, and the lever system replaces the diskette in the cartridge and retrieves a second diskette. Maximum diskette-to-diskette transfer time is 1.5 sec.

Amlyn believes the major applications for its new drive to be file backup for 5¼-in. Winchesters and high-capacity storage in floppy-based systems. The A506, designed as backup for Seagate Technology's ST-506 6M-byte 5¼-in. Winchester, includes the appropriate Seagate connector hardware and uses the same software drivers and controllers required by the fixed-disk drive with one modification—a second phase-lock loop must be added to the data separator to accommodate the different transfer rates of the two drives.

When used as backup for the Seagate drive, four of the five data surfaces in the Amlyn cartridge are formatted to match each of the four 153-track data surfaces of the fixed-disk drive. This allows data to be mapped from one drive to another on a one-to-one basis. The fifth diskette can be used to store the systems software usually resident on the Seagate Winchester, say Amlyn executives, thus boosting total file-storage capacity on the fixed-disk drive.

The 5850 version can be used with controllers designed for single- and double-density versions of Shugart's double-sided, 32-sector SA850 8-in. floppy-disk drive.

Amlyn is now shipping evaluation quantities of the new drives, with production slated to begin during the third quarter of this year. Single-unit price is $1250; OEM pricing has not been set. Target price for the five-diskette cartridge is less than $35 in 100-unit quantities. —*John Trifari*

	A506	5850 Single-, Double-Density
Capacity	6.3M bytes	4M bytes, 8M bytes
Formatted Capacity/ Surface	1253.4K bytes	800K bytes, 1.6M bytes
Formatted Capacity/ Track	8192K bytes	5.2K bytes, 10.4K bytes
Transfer Rate	500K bps	250K bits, 500K bps
Bit Density/ Track Density	95000 bpi/(9500 fcpi)/ 170 tpi	95,000 bpi, (9500 fcpi)/ 170 tpi
Average Latency	83 msec.	83 msec.
Positioning Time		
Track to Track	3 msec.	3 msec.
Average	91 msec.	91 msec.
Diskette to Diskette (maximum)	1.5 sec.	1.5 sec.
Rotational Speed	360 rpm	360 rpm
Dimensions	3.23 × 5.75 × 7.88 in	3.23 × 5.75 × 7.88 in
Weight	4½ lbs.	4½ lbs.
Power Requirements	+12V at 1.2A, +5V at 0.9A	+12V at 1.2A, +5V at 0.9A
Price (single unit)	$1250, OEM pricing to come	$1250, OEM pricing to come

Product specifications *for Amlyn's A506/5850.*

ALTOS UNVEILS 10M-BYTE SYSTEM

Altos Computer Systems, San Jose, Calif., has introduced a multi-user small-business system with an integral 10M-byte Winchester-disk drive and either floppy-disk or magnetic-tape cartridge backup. Based on the Z80 μp, the ACS8000-10 system mounts in a standard 19-in. rack and provides 208K bytes of internal RAM.

Running under CP/M or MP/M, the ACS8000-10 incorporates Shugart Associates' SA1000 hard-disk drive. An Altos spokesman says the system's DMA controller will support a 40M-byte, four-platter Winchester-disk drive from Shugart within the next year.

Users can back the hard disk with single-sided, 1M-byte or double-sided, 2M-byte floppies or a 17.2M-byte magnetic-tape cartridge. Prices for the systems are $8500, $9500 and $10,990, respectively.

Additional on-line storage can be added via a stand-alone Winchester-disk drive or stand-alone floppy-disk and magnetic-tape units. The 8000-10 provides six programmable serial ports plus an RS432 communications port and can handle data rates as high as 800K bps.

DIALOGUE™ IMPROVES YOUR BUSINESS.

AMPEX

Screen image portion is unretouched.

DIAL

TERMINALS FOR ALL REASONS.

Dealing with one source for terminals makes sense. So when it comes to the different reasons you buy, it's good to know there's one source you can depend on. Ampex.

THE DIALOGUE 30. MORE OF WHAT YOU BUY A TERMINAL FOR.

Dollar for dollar, the Ampex Dialogue 30 Series gives you more in a basic terminal.

The Dialogue 30 puts all the basic features into a modern, efficient, well-designed terminal.

Compare our interactive, desk top terminal to any other terminal. You'll find more.

For example, most do not offer a detached keyboard. We do! Most do not offer automatic self test. We do!

And most do not offer a status line. We do with a continuous display of current operating modes, functions, and error/fault conditions. Even a standard printer port!

The Dialogue 30 has friendly user considerations, too. Like matte finish keytops, a non-glare CRT screen, an unobtrusive noise level, and a detached keyboard for improved productivity.

THE DIALOGUE 80. SOPHISTICATION THAT COSTS YOU LESS.

You'll find everything in our Dialogue 80 Series that is offered in the Dialogue 30 Series. And a great deal more!

Like editing features that insert and delete characters or lines. The list continues with write protect mode utilizing half intensity for protected fields. Combinable video attributes. Twenty truly programmable functions. And block mode with send line and send page capabilities.

The Dialogue 80 Series. More sophistication to improve productivity. For less!

FROM BASIC TERMINAL REQUIREMENTS TO THE TOUGHEST, THERE'S ONE SOURCE.

Ampex terminals. Whether you use, distribute, or integrate, count on Ampex terminals. You'll get your money's worth in price/performance as well as those features most in demand!

Call Harvey Hirsch today at Ampex Terminal Headquarters. His number is (213) 640-0150. In the Midwest, call Ampex at (312) 593-6000. In the East, call Ampex at (201) 489-7400.

Or write to Dialogue Terminals, Ampex Corporation, Memory Products Division, 200 North Nash Street, El Segundo, CA 90245.

O G U E

ALL DIALOGUE TERMINALS FEATURE:

CRT SCREEN
12-inch diagonal CRT
Non-glare screen
P4 (White) Phosphor
Green or Amber Phosphor CRT (optional)

DISPLAY MEMORY
24 lines by 80 characters
80 character status line

CHARACTER SET
96-Character ASCII Set
21 Control Characters
11 line graphic symbols (7 × 10 dot matrix)

CURSOR
Block or underline
Flashing or non-flashing
Readable and addressable

KEYBOARD
Typewriter style with numeric keypad and function control keys. Capacitive key switches.

PRINTING FUNCTIONS
Buffered print
Print transparent

INTERFACES
Primary Port:
RS232C asynchronous
20 MA current loop
Serial Printer Port:
RS232C asynchronous

TRANSMISSION RATES
Up to 19.2K bps

POWER REQUIREMENTS
Strappable, to handle 100, 115, 200, 220, 230, or 240 volts
50-60 Hz, Single phase, 75 Watts

DIALOGUE 30

OPERATING MODES
On-Line/Local
Full Duplex/Half Duplex
Monitor

TABBING
Columnar

DIALOGUE 80

OPERATING MODES
Block/Conversation
Full Duplex/Half Duplex
Protect
Write protect
Write Attribute
Auto-Flip
Monitor
Programmable Function Key

EDITING
Insert Character or Line
Delete Character or Line
Erase to End of Line
Erase to End of Page

TABBING
Columnar or field tabs, supported by four control keys

DISPLAY ATTRIBUTES
Can be assigned to characters or fields of characters in any combination:
Blanking
Flashing
Reverse Video
Underlining
Half-Intensity

OPTIONS
An additional two pages of display memory
An additional 2048 bytes of programmable function key memory

AMPEX SALES OFFICES

United States

CALIFORNIA, Sunnyvale (408) 725-2126
CALIFORNIA, Santa Ana (714) 973-2970
FLORIDA, Pompano Beach (305) 785-6400
GEORGIA, Atlanta (404) 451-7112
ILLINOIS, Arlington Heights (312) 593-6000
MARYLAND, Bethesda (301) 530-8800
MASSACHUSETTS, Waltham (617) 890-2040
NEW JERSEY, Hackensack (201) 489-7400
(212) 736-6116
TEXAS, Dallas (214) 637-5100
TEXAS, Houston (713) 774-8714

International

AUSTRALIA, Sydney 61+2+887-3333
BELGIUM, Nivelles, 32+67+224-921
BRAZIL, Rio de Janeiro, 55+21+274-8122
CANADA, Toronto, 416+791-3100
ENGLAND, Reading, 44+734+85200
FRANCE, Paris, 33+1+609-9155
WEST GERMANY, Frankfurt, 49+611+60581
HONG KONG, Hong Kong, 852+3+678-051
ITALY, Rome, 39+6+546-991
JAPAN, Tokyo, 81+3+264-7331
MEXICO, Mexico City, 905+539-6870
NETHERLANDS, Utrecht, 31+30+612-921
SWEDEN, Stockholm, 46+8+282-910
SWITZERLAND, Fribourg, 41+37+813-111

AMPEX

AMPEX MAKES THE DIFFERENCE

Ampex Corporation, Memory Products Division
200 North Nash Street, El Segundo, California 90245
(213) 640-0150 TWX: 910-343-6243 TELEX: 66-4490

Of Eagles and egos: book chronicles DG's supermini

The Soul of a New Machine, a book that chronicles the development of Data General Corp.'s MV/8000 "Eagle" supermini, offers an enlightening, if not startling, layman's look into the mysteries of developing a computer. Author Tracy Kidder explores not only the soul of a machine but also the souls of the engineers who worked on it. All the bits and pieces of a massive project are put into a cohesive story that probes the pressures of computer engineering.

"A lot of engineers are eager to be understood by layfolk," says Kidder. To give readers insight into the jobs of engineers, he includes passages such as the following, which describes the revelation of the proper answer to a development challenge: "Although they are generally shy about claiming to have had one, engineers often speak of 'the golden moment' in order to describe the feeling—it comes rarely enough—when the scales fall from a designer's eyes and a problem's right solution is suddenly there."

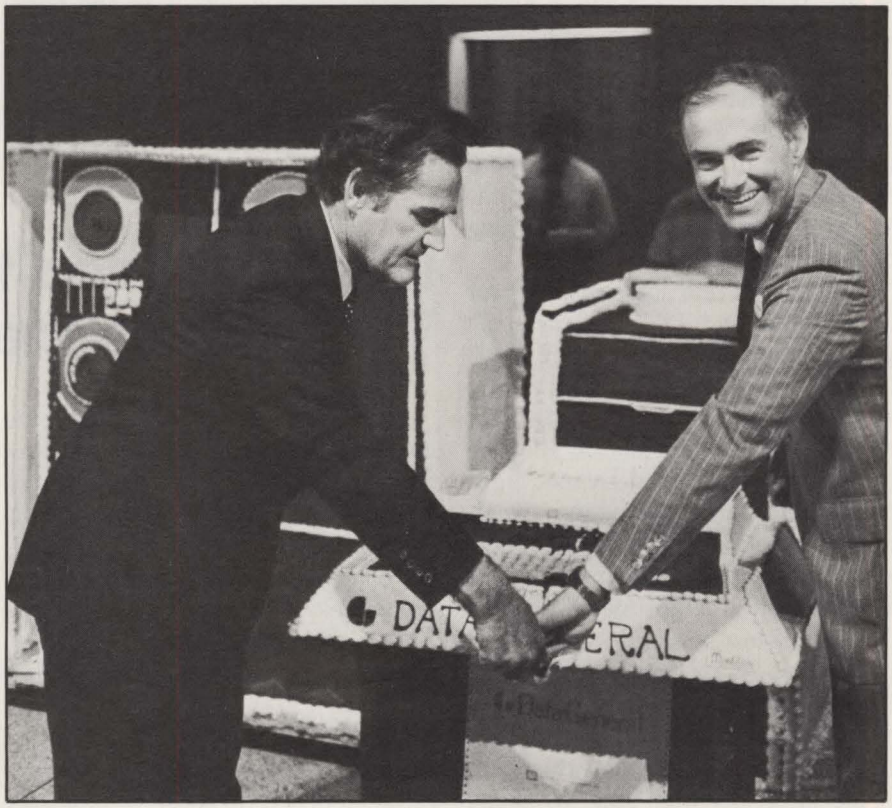
Kidder stumbled onto the story almost by accident. He set out to write a general book about the computer industry, but found that approach too broad. He was introduced to the Eagle project through a friend, and Kidder found it so fascinating that he narrowed the scope of his book. Kidder has observed first-hand the internal strife between two competing project groups, company politics, engineers' personalities, time pressures and the excitement of the project.

The MV/8000, code-named Eagle, was introduced last year (MMS, May, 1980, p. 11). The year before the Eagle project began, DG put its efforts behind a project called FHP, which was later moved from Westboro, Mass., to the company's North Carolina R & D facility. The development of FHP caused another project to be cancelled—Ego. The book relates that engineers from Ego and those left behind when FHP was moved to North Carolina were disillusioned until Eagle came along.

Recognizing that FHP was still far from completion, engineer Tom West convinced DG president Edson de Castro to fund Eagle, in case something went wrong with FHP. Although West, who became the MV/8000 project's head, kept Eagle low-key to company management, he drove project engineers hard, as if their lives and the life of the company depended on the product, Kidder relates.

West felt pressured because arch-rival Digital Equipment Corp. was gaining significant market share with its VAX-11/780 supermini. "We're gonna get schmeared if we don't react to VAX," West is quoted as saying.

Soul chronicles the eight months



Data General's Eagle *received notice other than that provided by Kidder's book. To celebrate the company's 100,000th computer shipment, Massachusetts Governor Edward King (left) and company president Edson de Castro open the ceremony by cutting into a 2100-lb cake.*

Kidder spent inside DG watching a team of engineers toil over Eagle, and watching their lives unfold as they worked under restrictive circumstances. Many of the engineers were fresh out of college, and they had to complete a five-year project in two-and-a-half years.

Adding to that pressure was a directive from de Castro: the machine could not have the mode-bit approach used by DEC and other competitors. A mode-bit approach means that a computer has a "split personality:" it runs 16- or 32-bit instructions. DG wanted to intermingle existing 16-bit instructions with 32-bit instructions on the same program, thus decreasing duplicated efforts.

Those restrictions caused dismay among some engineers, who initially felt the approach of mixing 16- and 32- bit instructions was mediocre. Kidder explains that Steve Wallach, the Eagle's architect, initially called the product a bag on the side of the Eclipse, a computer that would be built by adding onto an existing machine rather than being built from scratch. To emphasize his point, Wallach placed a brown paper bag on his office wall.

Wallach did find some rewards for his efforts and had at least one golden moment. After many frustrating days of developing a ring architecture that would protect some of the information in the computer, he decided to use eight rings and eight segments. Engineers at competing companies have since privately confirmed that Wallach had a bright idea.

Describing such development processes was a challenge for Kidder: "How do you watch people design or debug? You have to get into their minds." He does this well. Sometimes, he was able to make observations more easily. For example, he illustrates the frustration of writing Eagle microcode on the team's computer, which was called Trixie: "When especially frustrated, one Microkid (microcode writer) would walk into the lab where Trixie resided and yell at the machine."

The opportunity to work on such a large project attracted the neophyte engineers, despite the frustration and long hours involved. Working with the Eclipse group, however, was a rough way to begin a career. Kidder explains, "...before you've learned to find your way to work without a road map, you're sitting in a tiny cubicle or, even worse, in an office like the one dubbed Micropit, along with the three other recruits, your knees practically touching theirs...and you are told that you have almost no time at all in which to master a virtual encyclopedia of technical detail and to start producing crucial pieces of a crucial new machine."

Such graphic details in the book will make engineers shudder, claims a former DG engineer. Those on the project may find themselves overwhelmed as they read over the past three years of their lives.

Project head West has read Kidder's book and notes,"It is very painful, but extremely interesting. It's three years of therapy crammed into 12 hours (of reading)." West finds the book realistic, however. "That's what happened," he says. "Tracy is a good writer." The book will be released this month through Little Brown & Co. and the Atlantic Press.

In a way, *Soul*'s success is more assured than West's was. "The book assumes from the beginning that Eagle would work. It might not have," West says.

Kidder's book has already received considerable notice from outsiders, including Robert Pirsig, author of *Zen And The Art Of Motorocycle Maintenance*. Pirsig writes, "This is a really superb book, one that computer engineering has deserved for a long time...all the incredible complexity and chaos and exploitation and loneliness and strange, half-mad duty of this field are honestly and correctly drawn here." —*L. Valigra*

DEC attracted to cable-TV systems market

In a move that may presage an increased amount of specific application-oriented marketing, Digital Equipment Corp. recently set up a separate organization geared toward selling systems and services to the cable-TV industry.

DEC has long had a group-level market orientation aimed at broad application areas, such as laboratory, engineering-system and graphic-arts. But a further marketing refinement within those groups was delayed, some observers feel, while DEC built additional manufacturing capacity and reduced product-delivery lead times. During the past year, DEC has been in the midst of an aggressive expansion program that has helped cut lead times considerably on products including terminals and VAX 32-bit computers.

The cable-television marketing organization is part of the Graphic Arts Product Group, which itself is contained within the Computer Products Group, one of DEC's three main umbrella groups.

The first public acknowledgement of DEC's interest in marketing products to the cable-television

Small computer friendliness vs. big computer power.

HP's new computer syst

Whether it's laboratory testing, production automation or computation and analysis, Hewlett-Packard's newest computer systems put high-powered engineering performance into easy-to-configure, easy-to-use workstations. So you can solve your applications problems just the way *you* want to. And a lot sooner than you might have thought possible.

The HP 9826 for high-speed test.

Designed specifically for I/O-intensive instrument and control applications, the 9826 uses the powerful new MC 68000 chip for ultra-fast data transfer and number crunching. It also has a variety of I/O ports and built-in drivers, so you're free to concentrate on testing, not on system configuration. Which means you can get your solutions up and running in days, instead of weeks or months.

But the 9826 makes it easier still. Because you can run your programs in any of three languages: HP-enhanced BASIC, HPL, or PASCAL.

We also built a CRT display and advanced graphics right into the system, so you can see and interpret your data almost as soon as you get it. A special rotary control knob makes moving the cursor faster and easier than conventional keystrokes. And a built-in flexible disc, advanced datacomm and up to 512K bytes of read/write memory add the finishing touch.

The HP 9826. System prices start at $8950. Call us if you'd like to see a test run.

ems end the compromise.

The HP 9845 for high-performance design.

With a broad range of advanced capabilities (including new options offering three times the computational speed of the basic system), the HP 9845 can be configured to meet your precise needs—from finite element analysis to simulations and modeling. And almost anything in between.

The key is flexibility. You can choose from among 14 different configurations, including a color display and 448K bytes of read/write memory. Then, attach a hard disc, printer, plotter, or other peripherals. And with the 9845's advanced datacomm capabilities, you can even share technical information with other computers in distributed processing environments.

The HP 9845. System prices start at under $20,000. Call us if you've got similar designs.

All of our computers are backed by HP's worldwide service organization. For more information, call your local HP sales office listed in the White Pages. Or write to Hewlett-Packard, Attn: Pat Welch, Dept. 08108, 3404 E. Harmony Rd., Ft. Collins, CO 80525.

Prices U.S.A. list; subject to change without notice. 40106

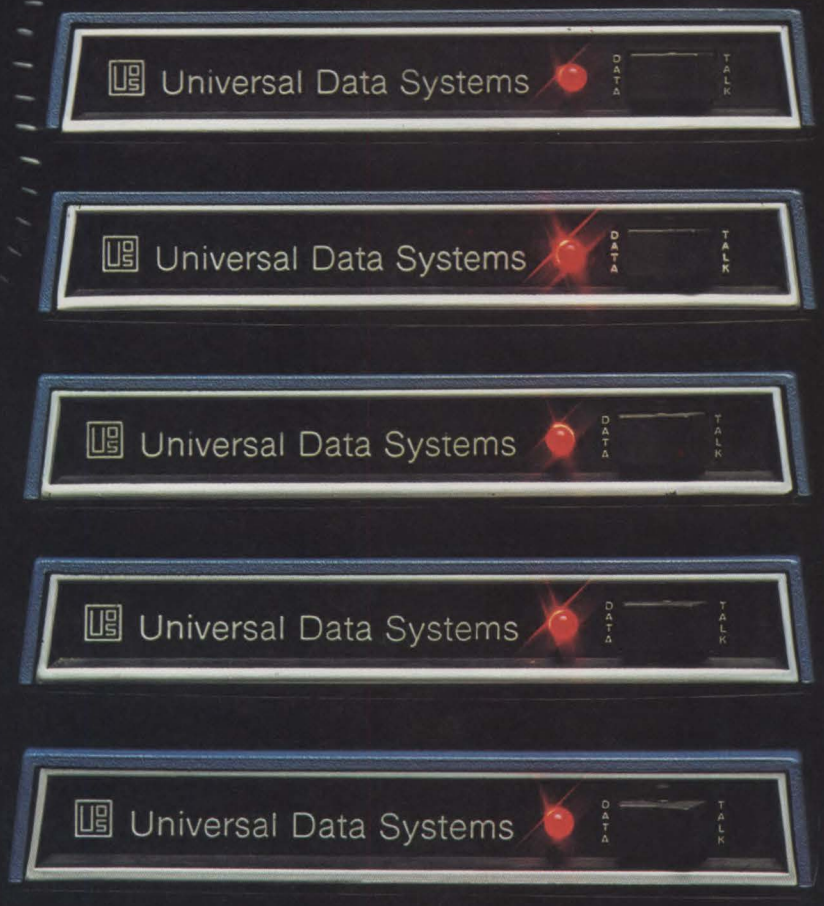
When performance must be measured by results.

HEWLETT PACKARD

CIRCLE NO. 43 ON INQUIRY CARD

FIVE OF A KIND

LOW POWER ★ LOW PRICED ★ LINE POWERED MODEMS



202S LP
auto-answer
1200 bps

$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

$195
(quantity one)

103 LP
originate only
300 bps

$185
(quantity one)

All UDS LP modems are FCC-certified for direct connection to the telephone network and require no AC power connection. For details, contact Universal Data Systems, 5000 Bradford Drive, Huntsville, AL 35805. Phone: 205/837-8100.

"Confidence in Communications"

Universal Data Systems

Member IDCMA

DISTRICT OFFICES: **Summit,** NJ, 201/522-0025 · **Blue Bell,** PA, 215/643-2336 · **Atlanta,** 404/998-2715 · **Chicago,** 312/441-7450 · **Columbus,** OH, 614/846-7478 **Dallas,** 214/385-0426 · **Santa Ana,** 714/972-4619 · **Sunnyvale,** 408/738-0433 · **Boston,** 617/875-8868.

CIRCLE NO. 44 ON INQUIRY CARD

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

industry took place in late May when DEC shared an exhibit with two of its OEMs at the National Cable Television Association's annual convention in Los Angeles.

For the first two years, DEC's cable-TV sales thrust will be directed at the top 50 multiple-system owners and the largest independent owners. The company intends to move in a top-down marketing approach. About 16 DEC salesmen are dedicated to cable-TV sales. The company eventually intends to offer products spanning the industry, said Richard J. Rose, cable marketing manager for DEC's cable TV group.

The larger cable-TV concerns were selected because they are most likely to be interested in moving away from time-shared systems and toward in-house computers, Rose said. Rose defined a large cable-TV concern as one with 100,000 to more than 1 million customers.

"About one year ago, cable emerged into the computer world," Rose said, explaining DEC's recent interest in the cable business. "Prior to that, service bureaus could handle the business."

As cable firms grow, they will continue to move toward in-house systems, Rose said. He estimated that in 1975, the cable industry stood at $800 million in annual revenues. By 1980, the figure had grown to $2 billion.

The $1.2-billion growth in five years brought an accompanying growth in invoicing, scheduling and marketing requirements, said Rose. DEC's interest in the cable-TV business is also sparked by its desire to gain a foothold as an equipment supplier to companies experimenting with applications such as teletext, in which information is provided to home viewers through video-display terminals.

"At this stage of the game, less than 10 percent (of the cable firms) use any computers," Rose said. DEC has made sales to Continental Cablevision in Boston, Mass., and Storer Broadcasting, Miami, Fla.

Rose said DEC will develop applications in-house and with third parties in the cable-marketing program.

At the national cable-TV show, DEC exhibited with Applied Data Research of Princeton, N.J., and Business Controls Corp., Englewood, N.J..

Applied Data Research has developed Cadre, a system that provides an on-line-information data base, which includes a subscriber's payment and installation histories, street files and work in process. It also has invoicing, payment-processing and work-order generation.

Applied Data Research's program is written in BASIC. Business Controls Corp., also has a subscriber-billing and information-management software system, and its programs are written in COBOL. The systems require VAX 32-bit computers, Rose said.

—Eric Lundquist

New owners, product give Computek new lease on life

A change in ownership, an expanded product line and a widened market emphasis are combining to pump new life into Computek, Inc., a 12-year-old Burlington, Mass., supplier of intelligent terminals.

Previously owned by General Automation, the Anaheim, Calif., manufacturer of industrial-automation products, Computek was acquired last March by four entrepreneurial computer executives—Rick Dill, the new company president, Mike Gold, marketing vice president, Phil Orso, strategic planning vice president, and Jim Black, manufacturing vice president. The four hope to give Computek a "mission in life," one that Gold says was lacking under General Automation's management.

"I think it was never really clear what Computek's focus was," Gold says. "The company was a manufacturing and R & D arm of GA rather than an independent company going after its own accounts."

Less than a month after taking charge, the partners introduced a new product—the Display 8/20

Computek's Display 8 terminal *features a detachable keyboard with a 96 ASCII character set, 16 user-definable function keys, a 19-key numeric pad and 14 screen-management keys.*

Z80-based terminal, the first in a series of μp-based products the company plans to offer. The Display 8 is the focus of Computek's new marketing strategy of attacking specific vertical markets. Hardware and software features of the new terminal, Gold says, make it suited for applications in the office-automation, financial/banking, telecommunications, distribution, factory data-management and service-bureau markets.

A third-generation terminal, the Display 8 follows the model 200 and

the Display 16, both of which established Computek as the number two intelligent terminal supplier to the printing and publishing industry, an industry Computek will continue to serve.

"Our original intention was to start a company from scratch," says Gold. "We wanted to build a powerful, high-performance intelligent terminal in which we could provide value added in vertical industries." Gold, who was a sales manager for Computek in 1972, says that when he learned the company was for sale and that its research staff was developing the Display 8, the advantages of taking over an established firm became evident.

"We had a going concern with a $70 million installed customer base, a sound engineering staff and a new product with functional characteristics matching those we wanted to develop in a start-up," says Gold.

Available in three models—the 8/10 and 8/15, with prices starting at $1500, and the 8/20 with prices starting at $1800—the Display 8 contains as many as 128K bytes of RAM and 16K bytes of ROM. It features a detachable keyboard with a 96 ASCII character set, 16 user-definable function keys, a 19-key numeric pad and 14 screen-management keys. A 12-in. etched video screen displays a maximum of 25 lines of 80 characters each, with the 25th line optionally displayed in reverse for highlighting terminal status. Video features include blink, dual intensity, underline, reverse video and blank. The terminal also displays block or line graphics.

Listing the Display 8's competition as terminals supplied by Zentec, Ontel and Convergent Technologies, Gold says that a customer can reduce his development time and costs using the new computer system. Backing up the claim, Computek is offering a software-completion guarantee, which states that the company will complete a customer's development plan if the customer can't do so himself.

"I think it's a significant concern of systems houses and sophisticated end users that they'll be able to complete applications software on time and within their allotted budgets," Gold says. "A customer of ours who knows he can call on us if he runs into difficulty looks at the guarantee as a sort of insurance policy."

The CP/M operating system, plus FORTRAN, BASIC, COBOL and Pascal, are available for the Display 8 in both interpretive and compiled versions. Standard programs offered include text editing, data entry, industry telecommunications protocols, multiple communications port interfacing and data manipulation.

Gold says Computek will continue to supply the model 200 and the Display 16 terminals "as long as there is a demand for them," but that the company will place most emphasis on the Display 8.

He adds that principal OEMs that use the older systems have agreed to make the conversion to the new terminal. One such customer, the Canadian branch of General Automation, has been building systems for banking and federal government applications using the Display 16 and is evaluating the Display 8.

"We originally started incorporating Computek products into our packages because of GA's past relationship with the company," says Robert Pritchard, general manager and vice president of GA, Canada. "But now we find it difficult not to use them because they're very saleable."

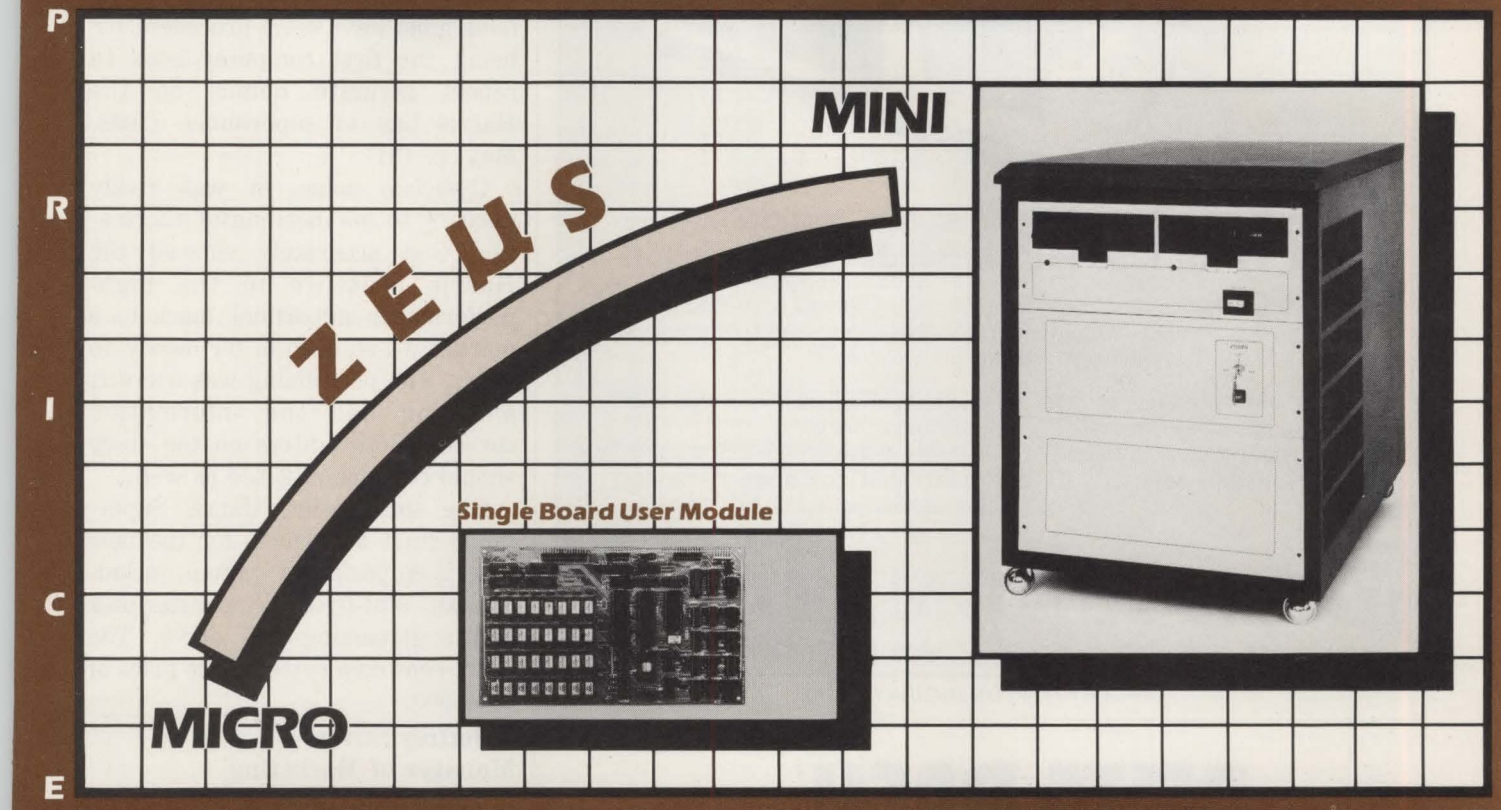
—Frank Catalano

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
Analog Devices	6 mos.	5/2/81	77,053,000	2,513,000	.28
	6 mos.	5/3/80	61,455,000	4,272,000	.52
Cullinane Database Systems	Year	4/30/81	29,351,000	4,554,000	1.47
	Year	4/30/80	17,727,000	2,404,000	.88
Data Access Systems	Year	8/31/80	37,241,676	5,148,355	1.82
	Year	8/31/79	28,153,475	3,414,573	1.25
Data General	36 wks.	6/6/81	492,300,000	37,000,000	3.48
	36 wks.	6/7/80	439,900,000	38,300,000	3.66
General Instrument	13 wks.	5/31/81	220,142,000	18,803,000	1.96
	13 wks.	6/1/80	205,010,000	15,025,000	1.69
ICOT	9 mos.	5/1/81	17,485,000	554,000	.06
	9 mos.	5/2/80	18,453,000	144,000	.02
Intertec Data Systems	Year	3/31/81	17,156,000	3,731,000	.95
	Year	3/31/80	5,104,000	192,000	.05
Magnetic Controls	6 mos.	4/30/81	28,246,000	1,533,000	.60
	6 mos.	4/30/80	24,727,000	1,529,000	.77
Monolithic Memories	36 wks.	6/7/81	61,460,000	5,984,000	.92
	36 wks.	6/8/80	48,332,000	5,866,000	1.27
National Semiconductor	Year	5/31/81	1,110,053,000	52,426,000	2.37
	Year	5/31/80	910,113,000	45,043,000	2.22
Sperry	Year	3/31/81	5,427,178,000	312,998,000	7.68
	Year	3/31/80	4,785,425,000	277,092,000	7.60
Unitrode	3 mos.	5/2/81	27,478,994	2,684,459	.93
	3 mos.	4/26/80	25,013,033	2,533,986	.79

ZEμS SPANS THE MICRO-MINI GAP.



Multiprocessor Technology

In multi-user applications, single processor computer systems have limited expandability and suffer severe performance degradation as users are added. ZEμS® modular multiprocessor architecture eliminates the CPU bottleneck and offers performance levels normally associated with more costly mini and mainframe computers.

Single Board User Module

ZEμS is expandable from 1 to 64 users simply by adding the OSM-1080 single board user module for each user. Each module consists of a Z80A, 64K RAM, two serial and parallel I/O. A master processor module supervises all user requests for common storage and/or shared peripherals. Each user module communicates with the master module via a high speed, parallel, synchronous, interprocessor data channel. Response time remains fast even as more users are added. And each user remains autonomous from each other. A unique reset feature through the console break key eliminates the need for operator attendance at the main computer. Should a user "crash," he simply resets himself and loads in a fresh copy of the operating system. Consider the advantages for remote and timeshare applications.

CP/M® Compatible Operating System

OSM's proprietary MUSE® (Multi-User System Executive) operating system was specially designed for ZEμS. Many times faster than other leading operating systems, MUSE provides a true multi-user environment. And MUSE is totally CP/M compatible allowing execution of readily available languages and application programs. MUSE also allows for almost unlimited expandability. Each user can choose from up to 3 system printers with full print spooling as well as a dedicated local printer. Plus, over 600MB of hard disk storage can be accessed through MUSE's proprietary directory management system. Other multi-user operating features provided by MUSE include both user and common file areas, password protection, and record locking for shared file update.

OSM

Computer Corporation

2364 Walsh Avenue
Santa Clara, CA 95051
(408) 496-6910 TWX 910 338 2099

Broad Application Spectrum

ZEμS systems satisfy a broad spectrum of applications—from a wholesale environment where many users access and update a large shared data base to a true multitasking environment, such as professional offices, where various tasks are performed simultaneously.

Best Price/Performance Ratio

ZEμS single user systems are competitively priced with single processor microcomputer systems, and ZEμS' multi-user systems are priced thousands of dollars less than comparably performing larger systems. For example, the ZEμS 5+ system is a five user configuration including 6-Z80A processors, 384K RAM, 12 serial and 11 parallel I/O, 34MB of hard disk storage, .6MB of floppy storage, and 20MB of tape backup. Also included with every system is the MUSE operating system—all for just $19,900.

We're shipping ZEμS multiprocessor computer systems now! For more information call our marketing department today!

ZEμS Delivers
MAINFRAME POWER
—AT A MICRO PRICE

Letters

PLAUDITS FROM HARRIS

To the editor:

Congratulations. *Mini-Micro Systems* must have set a precedent for being the first computer book to report accurate details on the Harris line of superminis (MMS, May, p. 131).

Cynicism aside, it was really pleasing to see meaningful information that accurately showed the Harris presence in the high-performance supermini market...a market we've been in for nearly 10 years. The positioning was correct, and you had the information correct. Both editors on the story should be congratulated as well.

One small point: Harris Superminis start at $69,950 for the new Harris 80 packaged system, including an 80M-byte Winchester-disk and a streaming-tape drive. The chart showed a system base price of $100,000.

J. Jeffrey Stives
Manager of Marketing Communications
Harris Corp.
Fort Lauderdale, Fla.

FIRST UNIX LICENSER

To the editor:

Your recent article, "The UNIX operating system: portability a plus" (MMS, April, p. 153) provided very useful information on the UNIX operating system. The virtues of UNIX and its growing popularity deserve such attention.

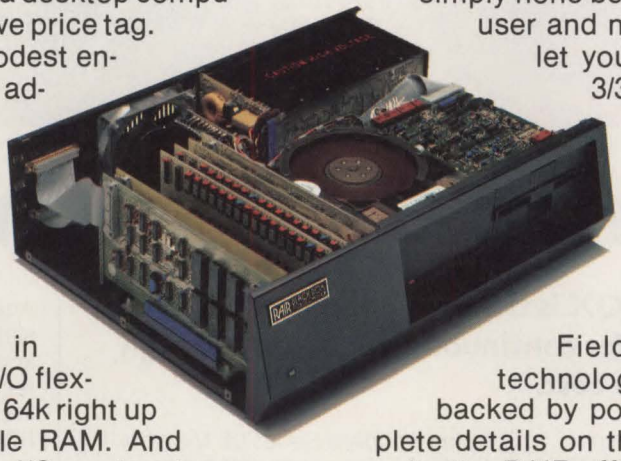
However, the article is seriously deficient in one respect. Your accompanying list of companies authorized to sell UNIX sub-licenses fails to name Interactive Systems Corp., the first commercial licenser of UNIX systems, which has to date shipped the greatest dollar volume of UNIX sub-licenses in the world.

Interactive's IS/1 system is a significant extension of UNIX, but retains UNIX compatibility. It operates not only on DEC PDP-11

The Consummate Compact Computer.

You'll love the Black Box 3/30. It's everything you've ever wanted in a desktop computer. Including a very attractive price tag.

Take a look inside its modest enclosure. And you'll find an advanced 5-Mbyte micro-Winchester for fast-access, high-capacity storage. Plus a dual-sided, double-density floppy for backup.



The Black Box 3/30 gives you the ultimate in memory management and I/O flexibility. You can expand from 64k right up to ½-Mbyte of addressable RAM. And there're 16 programmable I/O ports along with an IEEE 488 bus that support VDUs, printers, other peripherals—and datacomm.

When it comes to software support, there's simply none better. Our single-user, multi-user and network operating systems let you configure the Black Box 3/30 to meet the widest range of tasks. For applications and development, you have a choice of BASIC, PL/1, PASCAL, FORTRAN, and COBOL languages.

The Black Box 3/30. Field-proven microcomputer technology perfectly packaged. And backed by powerful software. For complete details on the Black Box 3/30, call or write the RAIR office nearest you. Be sure to ask about our discount pricing for OEMs and distributors.

United States: RAIR Microcomputer Corporation
4101 Burton Drive, Santa Clara, CA 95050, Telephone: (408) 988-1790 Telex: 677038
West Germany: RAIR Computer GmbH
Clemensstrasse 5-7, 5000 Köln 1, Telephone: (0221) 219811 Telex: 8881915
United Kingdom: RAIR Ltd., Wellington House,
6-9 Upper St Martins Lane, London WC2H 9EQ Telephone: (01) 836 6921 Telex: 298452

RAIR

CIRCLE NO. 48 ON INQUIRY CARD

Intel's Series 90/iQX. The memory

Intel's new Series 90/iQX is the first standard Intelligent Memory System to offer continuous operation and high maintainability at low cost.

Now, for the first time, OEMs can design systems with built-in protection against errors, downtime, and excessive maintenance costs. How? With Intel's new Series 90/iQX.

Series 90/iQX Intelligent Memory System

The iQX controller adds the intelligence of an iAPX 86 microcomputer to the standard Series 90 Memory System. Intelligence that monitors memory operation directly, detects and corrects errors, runs local or remote diagnostics, and reallocates memory space as required. All without burdening the host system.

Fault-tolerant operation

Hard errors or soft, Series 90's iQX controller uncovers them. Soft errors are simply "scrubbed" and corrected. In case of hard errors or device failure, the controller routes data around the problem, allocating spare memory as needed. It then logs the error for future reference.

With protection like this, the Series 90 system will continue operating uninterrupted until all spare memory is filled.

And thanks to the iQX's memory status reporting, your customer will know well in advance of memory resource problems. Which not only improves data integrity, but increases reliability and reduces maintenance dramatically.

Instant diagnostics

To keep users continually apprised of conditions within their memory system, the iQX controller provides easy access to its complete diagnostic file. Information can be accessed by the host system either automatically via a simple message-driven software interface, or manually, using the iQX's Service Communicator. This detachable terminal allows technicians to instantly retrieve diagnostic data in plain English through a compact, alphanumeric keyboard/display. With no interruption of the host computer's operation.

For fast, simple maintenance, system diagnostics inform the user of any

machine with non-stop intelligence.

errors it has tracked—soft or hard, correctable or avoidable—and their precise location by row and column.

Many problems can also be solved using the iQX's memory tasking capability to move data blocks as required. Then too, the iQX monitors the system's power supply and signals a warning if voltages drop critically. As a final, double protection, the iQX controller even diagnoses its own operation continuously.

Diagnosing from a distance

To reduce maintenance costs for remote systems and networks, iQX diagnostics can be accessed over phone lines through a single diagnostic station. By being able to analyze problems from afar, you'll eliminate unnecessary service visits and shorten those that are required. And since one diagnostic station can easily serve up to 150 installations, the set-up and ongoing diagnostic costs are contained as well.

Consider the economics

The iQX's protection features offer important economic advantages for systems OEMs. Because of the increased demand for fault tolerance in today's marketplace, systems equipped with iQX capability add significant value to your products. In fact, many applications simply could not be justified economically *without* such self-healing and remote maintenance. Now, through Intel's leadership in 16-bit microprocessing, the Series 90/iQX brings you this capability at an incremental price only nominally above that of ECC alone.

In sum, iQX gives your systems state-of-the art fault protection, reduced maintenance costs, and therefore increased value. Best of all, Intel is delivering Series 90 systems with iQX right now. For detailed information, return the coupon to Intel Corporation, 3065 Bowers Avenue, Santa Clara, CA 95051. Telephone (408) 987-8080. For hot line service, call (800) 538-1876.

☐ My needs are immediate; have a Sales Engineer call.

☐ Please rush me—by first-class mail—Series 90/iQX technical literature.

Name _____

Title _____

Organization _____

Address _____

City/State/Zip _____

Telephone ( ) _____

Mail to: MMS 8
Intel Corporation
3065 Bowers Avenue
Santa Clara, CA 95051
(408) 987-8080

Europe: Intel International, Brussels, Belgium.
Japan: Intel Japan, Tokyo. United States and Canadian

intel® delivers solutions

CIRCLE NO. 49 ON INQUIRY CARD

Letters

computers, but also on the VAX VMS operating system as a subsystem. Interactive recently concluded an agreement with ONYX to provide IS/1 as the standard UNIX system for the ONYX C8002 system; our IS/1 for the ONYX is operational today. We greatly appreciate your interest in UNIX. We believe, however, that you should correct any misimpressions created by the article regarding the primary suppliers of UNIX sub-licenses.

Dwayne C. Lowry
Vice President, Sales & Marketing
Interactive Systems Corp.
Santa Monica, Calif.

ZEDA IS PORTABLE

To the editor:

In reference to the new Osborne I μc (MMS, May, p. 23), you state that "with the exception of a bubble-memory-based system introduced more than a year ago by Findex, the new hardware from Osborne is the first portable personal computer to reach the market."

The first portable personal computer to reach the market was the ZEDA 525, part of the growing, mutually compatible family of ZEDA computers marketed during the past two years by ZEDA Computers International Ltd. The 525 was announced in October, 1981, and OEM deliveries have been in progress for the past several months. The ZEDA 520 features a 4-MHz Z80A μp, 48K bytes of RAM and a double-density floppy-disk drive.

Robert J. Bosen
Vice President
ZEDA Computers International Ltd.
Provo, Utah

TRANSPARENT MODES

To the editor:

I wish to comment on "Exploring new designs in video display technologies" (MMS, February, p. 173).

BEFORE YOU BUY A FINE PRINTER, READ THE FINE PRINT.

That's where you'll find the prices—in the tiny type under the brief descriptions.

Which is only appropriate. Because with C. Itoh's full line—from the workhorse business printers to the racehorse word-processing printers—the descriptions could be much bigger.

But the prices couldn't be much smaller.

Moreover, as part of the Leading Edge Inventory Bank,™ our printers (along with dozens of other popular computer products) are available for 24-hour "withdrawal." Within a day of when we receive your order, your order will be on its way from our nearest warehouse (Boston, New York, Los Angeles, etc.), thus saving you both time and freight. So you can use our space, and our money, to inventory your product, and still be sure of having exactly what you need, exactly when you need it.

All the printers on this page are warranteed by Leading Edge™ for 3 months on parts and labor.

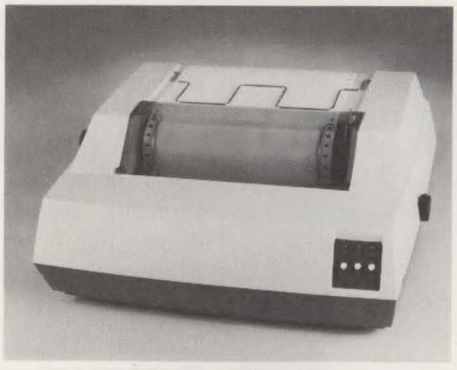
For the name of your nearest dealer—just pick up the nearest telephone.

TOLL-FREE 1-800-343-6833.

In Massachusetts, call collect (617) 828-8150.

Strictly business (Comet I)

The industry workhorse of dot-matrix printers. No frills; but almost nothing to go out of whack. 10" carriage; 80 columns (132 in compressed print mode). Industry-standard (teletype) ribbons. Retail: about $495.

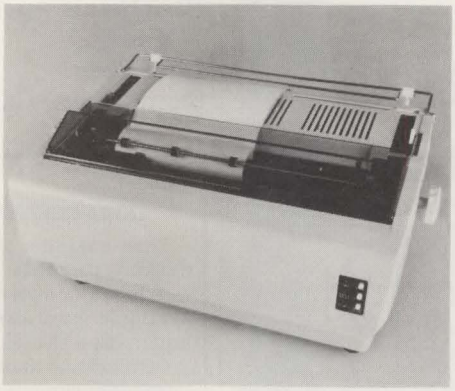


Big business (Comet II)

The first 15" printer to retail for under a grand. Full 132 columns for standard-width accounting reports, giving you easy-to-read 10 cpi printout up to 66 lines deep. And, like with the Comet I, ribbons are available everywhere. Retail: about $995.

Beyond business (Starwriter I)

Lowest-priced letter-quality printer on the market. Comes complete and ready to use, requiring no changes in hardware or software. Industry-standard daisy wheels and ribbon cartridges. Plug-in compatible with a wide variety of systems. 25 cps; 163 columns; precise character placement; full graphics capability. Retail: about $1,895.



Busy business (Starwriter II)

The racehorse of letter-quality daisy wheel printers. Typical 45 cps throughput is about equal to (or, in bi-directional mode, actually *faster* than) "thimble" printers rated at 55 cps. Like the Starwriter I, it uses easily available daisy wheels and ribbon cartridges, and it's compatible with software packages, like Wordstar and Magic Wand, programmed for systems like the Qume Sprint 5. Retail: about $2,395.

LEADING EDGE.™

Leading Edge Products, Inc., 225 Turnpike Street, Canton, Massachusetts 02021.

DEALERS: For immediate delivery from the Leading Edge Inventory Bank,™ call toll-free, **1-800-343-6833.**
In Massachusetts, call collect (617) 828-8150, Telex 951-624.

CIRCLE NO. 51 ON INQUIRY CARD

Letters

The Intel 8275 CRT controller uses two row buffers to control the display memory. The article incorrectly states that two 80-byte buffers are used to hold one character row; in fact, each of the two row buffers can hold a separate 80-character row. The CPU can load one row buffer while the 8275 presents the other row buffer to the video logic. The row buffers allow the use of slower memories than those used by private video displays. In addition, the CPU can share memory between its variable storage and the display, without any dual-port control.

The article states that attributes occupy character positions on the line, which will cause blank spots to appear on the screen. While this is true for one of the 8275 modes (nontransparent attribute), it ignores another mode that has invisible attributes (transparent-attribute mode). I believe the author has committed an error of omission. Most users select the transparent-attribute mode. The nontransparent attribute mode is typically used only during system debugging, or when the user wishes to test for attributes in the data stream.

Thomas M. Rossi
Peripherals Applications Manager
Intel Corp.
Santa Clara, Calif.

LOOKING AHEAD 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 three categories:

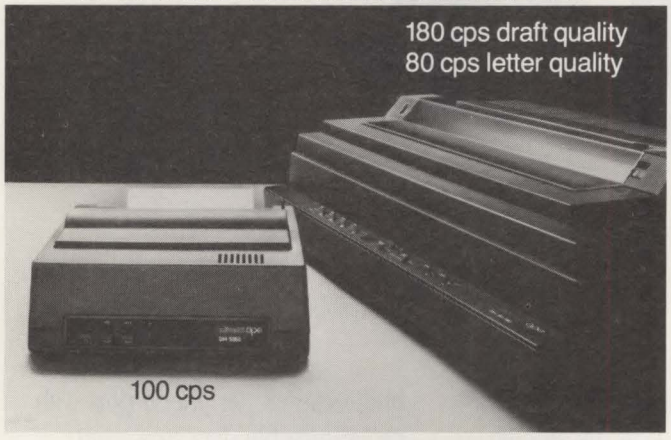
OCTOBER's main topic will be data base management software.

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

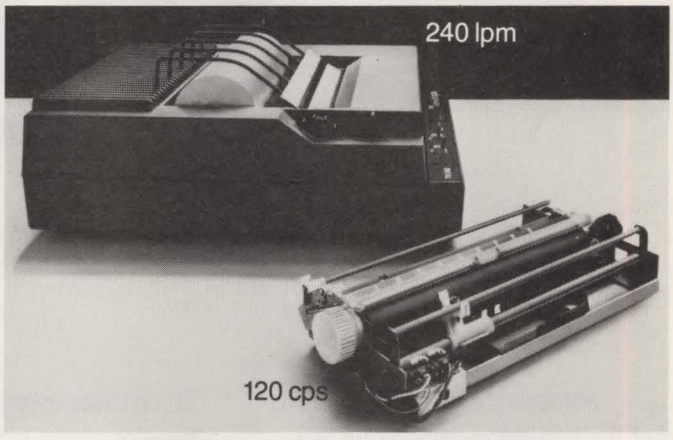
DECEMBER will offer Mini-Micro Systems' third annual special report on computer graphics.

ope means:

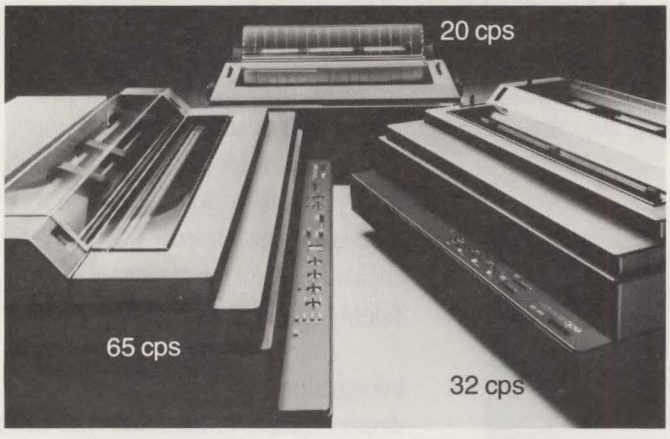
DOT MATRIX PRINTERS



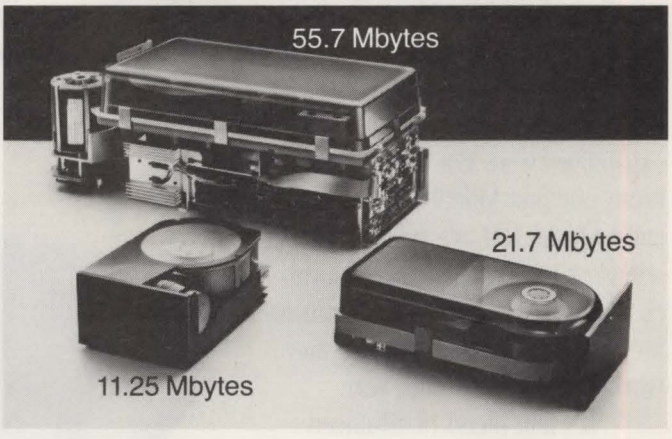
THERMAL PRINTERS



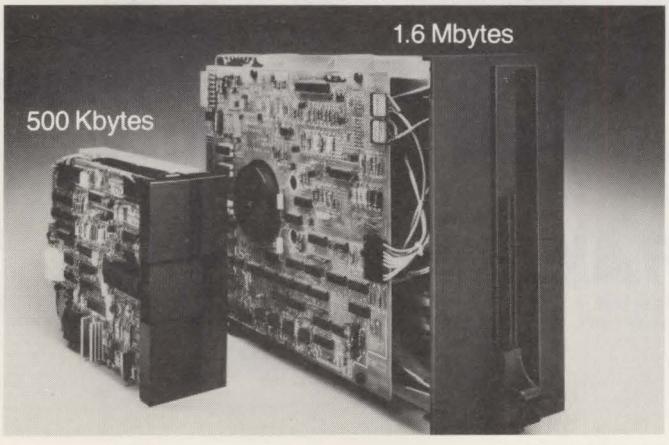
DAISY WHEEL PRINTERS



FIXED DISK DRIVES



FLOPPY DISK DRIVES



Olivetti Peripheral Equipment was created specifically to serve the OEM market.

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.

olivetti ope

505 White Plains Road, Tarrytown,
New York 10591. Telephone: (914) 631-3000

CIRCLE NO. 32 ON INQUIRY CARD

Good-bye ugly.

Somewhere along the line we got the reputation for making very high quality, but less than beautiful terminals. In a secret sort of way that pleased us. It reassured us that our engineering innovations, 100% unit testing, and fast-response service capabilities were not taken lightly. From our first Model 3311 to our latest Model 100, we sold four generations of Teleray terminals to loyal customers. Not necessarily because they looked nice, but because they worked right—year after year.

It's that blend of advanced engineering design and quality control that makes our Model 100 the most innovative terminal in the 132-column class.

Its non-volatile, programmable memory provides 880 characters for 20 separate user programmable functions on dedicated keys. Its smooth scroll can be programmed for 5, 10, 15, or 20 lines per second. Its four character widths let you program 40, 66, 80 or 132 columns. And special graphics, screen saver, auto repeat, bi-directional peripheral port with programmable data rates, and modular serviceability are just a few of its standard features. In addition, it's 100% compatible with the VT100.

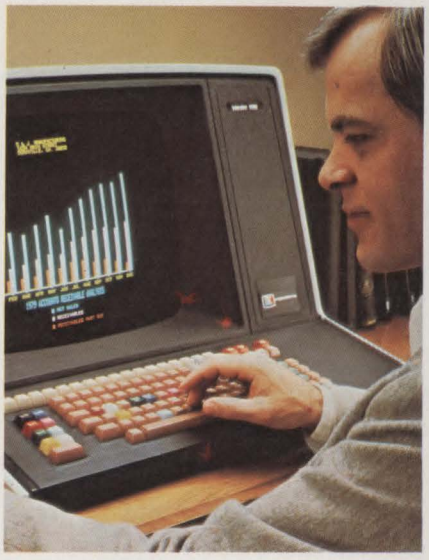
We believe that most of you will see the beauty of a Teleray, no matter what it looks like. But if you want everyone to know that you have good taste, specify our new "N" enclosure. Now the beauty of a Teleray shows even on the outside.

Call or write for more information or a no-obligation demonstration. Phone: 800-328-6179 or 612-941-3300.

Say hello to an obvious beauty.

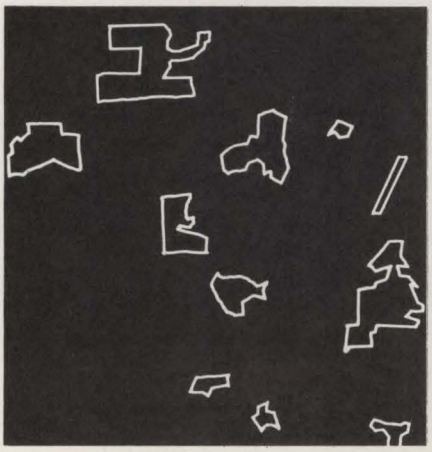
TELERAY
DIVISION OF RESEARCH INC
BOX 24064 MINNEAPOLIS, MINN. 55424

CIRCLE NO. 53 ON INQUIRY CARD



105 A special report on CRT terminals begins with an in-depth look at the market, where competition among manufacturers is benefiting users. The article, written by two researchers at GML Corp., defines the terminal industry's three sub-markets (dumb, editing and intelligent), examines the cyclical developments of each and forecasts where each may be headed. The article includes extensive tables that compare representative terminals in each category. . . . Manufacturers and developers of computer equipment, especially CRT terminals, have only recently begun to appreciate the importance of ergonomics. Users again are the winners as manufacturers realize that their products are to be used by a variety of operators, they must be adjustable to a variety of operators (p. 119). . . . The use of color, which infused new vitality into photography many years ago, is beginning to exert much the same effect on the minicomputer/ μc world. In two articles (p. 139 and 147), our special report examines ColorCalc and ColorGraph—software packages that improve the manipulation and presentation of financial information for easier analysis— and the new RM-6211 Colorgraphic terminal—a low-cost, desk-top color-graphics system from Ramtek Corp.

131 Two other articles in the special report focus on Digital Equipment Corp.; specifically, on DEC's industry-standard VT-100 terminal, and on the terminals that duplicate—or "emulate"—key features of the VT-100. While the basic VT-100 is nearly two years old, the modular design philosophy of the terminal has resulted not only in widespread emulation, but also in a series of recent terminal announcements from DEC. The new VT-125, described here for the first time (p. 131), both results from and is representative of the subject of this article: DEC's approach to the VT-100's evolutionary design. . . . Meanwhile, not all of the so-called VT-100 emulators match the DEC terminal's performance in every respect. The degree of emulation can be an important factor in terminal selection, and the second article (p. 155) compares representative emulators to the DEC original.



161 Following the special report, there are articles on software for minicomputer and μc systems. On p. 161, consultant Harvey Weiss continues his series of articles evaluating data base management systems for minicomputers. This month, Weiss examines DRS, which has impressed users and independent evaluators with its power, versatility and "friendliness." . . . Desk-top computer users once suffered from a dearth of good graphics applications software packages. Now, the abundance of such packages has created another problem: how to combine packages without the time and expense of reformatting and re-entering common data. That's a problem Tektronix has tried to overcome with this PLOT 50 Software Library, a collection of graphics packages for the Tektronix 4050-Series desk-top computers (p. 168).

Monolithic Systems has solved the case of DEC* compatible memory

No, the Butler didn't do it. Monolithic Systems did. We designed the first semiconductor DEC compatible memory seven years ago. Since that time we've built a strong case for our memory products.

Review the evidence and judge for yourself.

EXHIBIT A:

LSI-11/23 256 KB dual-high memory with 22 bit addressability.

The MSC 4804 utilizes single voltage 64K rams and wire wrap posts instead of switches to provide the most reliable LSI-11 memory available. On-board parity generation, checking, storage and battery back-up operation are standard. A 128KB version is also available or our 64KB, MSC 4604. (Exhibit A1)

EXHIBIT B:

VAX 11/780 256 KB add-in memory

Monolithic Systems MSC 3610 is a direct replacement for the DEC M8210 VAX memory. The 256KB system is designed to provide maximum heat dissipation and thus extend memory life.

EXHIBIT C:

PDP 11/70 256KB add-in memory

The MSC 3611 is designed for DEC's MK11 semiconductor system and maintains full diagnostic and ECC compatibility.

EXHIBIT D:

PDP 11/70 256KB to 2MB, add-on ECC memory

The MSC 3602 is extremely fast, has an MTBF in excess of 40,000 hours and contains the most powerful set of on-board diagnostics in the industry. The rugged, modular design allows easy maintenance, low cost spares and extremely low MTTR. On-site repair contracts are available after the standard one year warranty.

EXHIBIT E:

VAX 11/750 256KB add-in memory

The MSC 3612 is a compatible replacement for the M8728 DEC memory with a 32Kx72 bit configuration.

IN CONCLUSION:

Monolithic Systems provides the features and services OEM's value. All memory elements are socketed, all products carry a full one year warranty and delivery is less than 30 days for quantities under 25. Refer to the chart below for the Monolithic Systems product that suits your particular computer's need.

*DEC, VAX, LSI-11, PDP-11/70 are registered trademarks of Digital Equipment Corporation.

MSC MODEL NUMBER	LSI-11	LSI-11/2	LSI-11/23	VAX 11/780	VAX 11/750	PDP-11/70	PDP-11/04	PDP-11/05	PDP-11/10	PDP-11/30	PDP-11/34	PDP-11/35	PDP-11/40	PDP-11/44	PDP-11/45	PDP-11/50	PDP-11/55	PDP-11/60	DATA SYSTEM 330	DATA SYSTEM 350	DATA SYSTEM 570	NEAREST * DEC MEMORY EQUIVALENT
3602						X															X	MK11-
3605							X	X	X	X	X	X	X		X	X	X	X		X		NONE
3606							X				X							X				MS11-L
3607						X	X	X	X	X	X	X	X		X	X	X	X		X	X	NONE
3608						X	X	X	X	X	X	X	X		X	X	X	X		X	X	NONE
3610				X																		MS780
3611						X															X	MK11-
3612					X																	MS750
3901						X															X	NONE
4604	X	X	X															X				MSVII
4804		X	X															X				MSVII
To Be Announced													X									MSII-M

Monolithic Systems corp. ...means technically advanced solutions.

84 INVERNESS CIRCLE EAST
ENGLEWOOD, COLORADO 80112
FOR FURTHER PRODUCT INFORMATION AND PRICING . . . CALL TOLL FREE 1-800-525-7661
TELEX: 45-4498

CIRCLE NO. 54 ON INQUIRY CARD

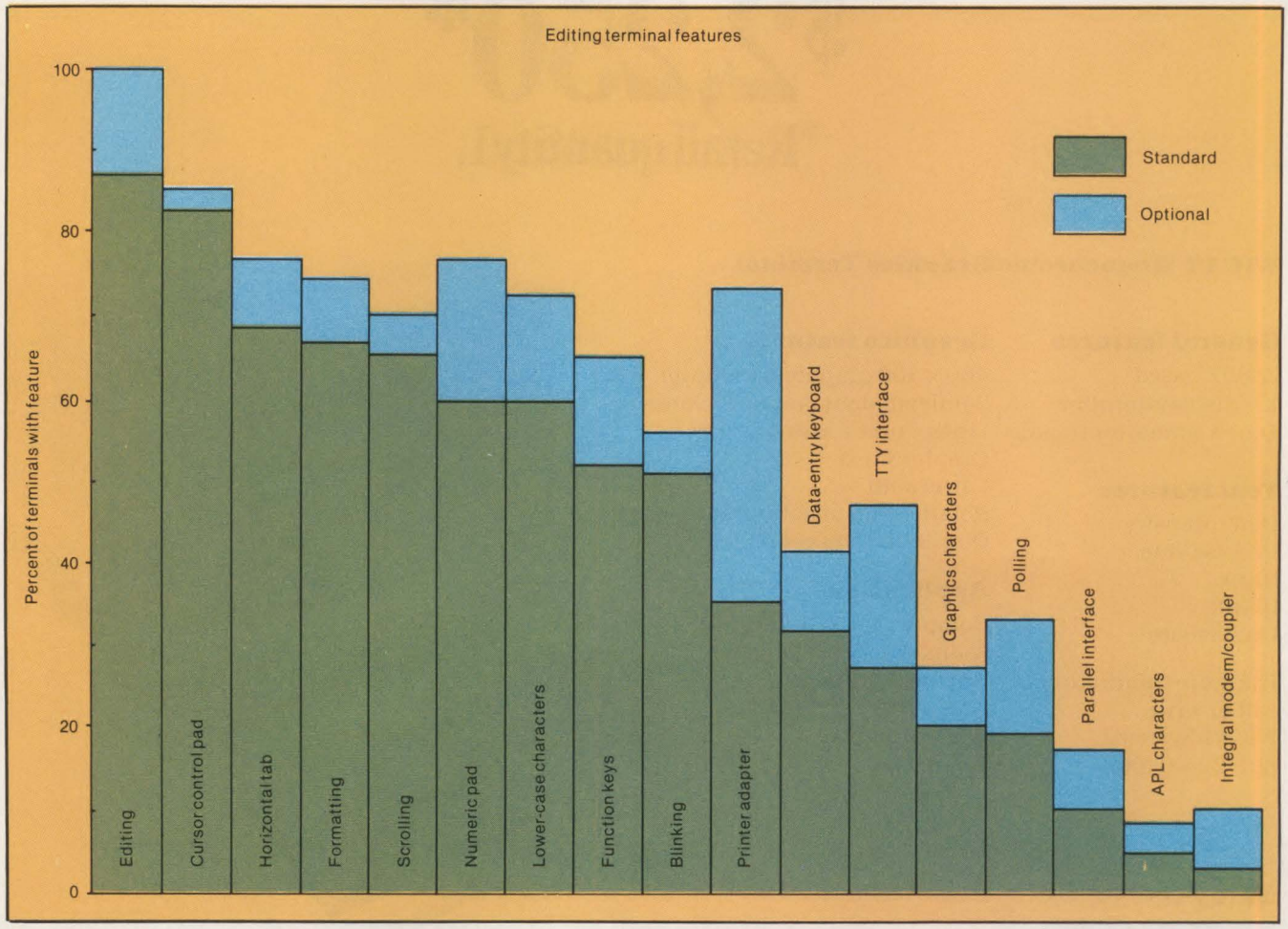
CRT terminal makers fight for market

PATRICK KENEALY and DAVID H. FREEDMAN, GML Corp.

Prices fall and features multiply as manufacturers strive to escape the fate of dumb CRT terminal vendors

If video terminals looked good to you five years ago, they probably look great now. Seven hundred dollars will get you things you didn't even know you needed back then. But behind all the blinking, tilting and scrolling are some very worried product managers. The terminals war will be causing some new casualties soon, and for now, only the user is smiling.

User needs have defined three principal display-terminal sub-markets: dumb; editing (or smart), which have line and character insert and delete capabilities; and intelligent, which are user-programmable. Buyers look for different prices and features in each sub-



Editing-terminal features *have become more popular as many vendors attempt to make devices competitive without lowering prices. Most editing terminals now provide a wide spectrum of standard features, some of which can now be found on terminals priced at less than $800. A number of dumb terminals are available in optional editing versions.*

Announcing affordable graphics: MG8000 Graphics Terminal: $2,250*

*Retail quantity 1.

WICAT Monochrome Graphics Terminal

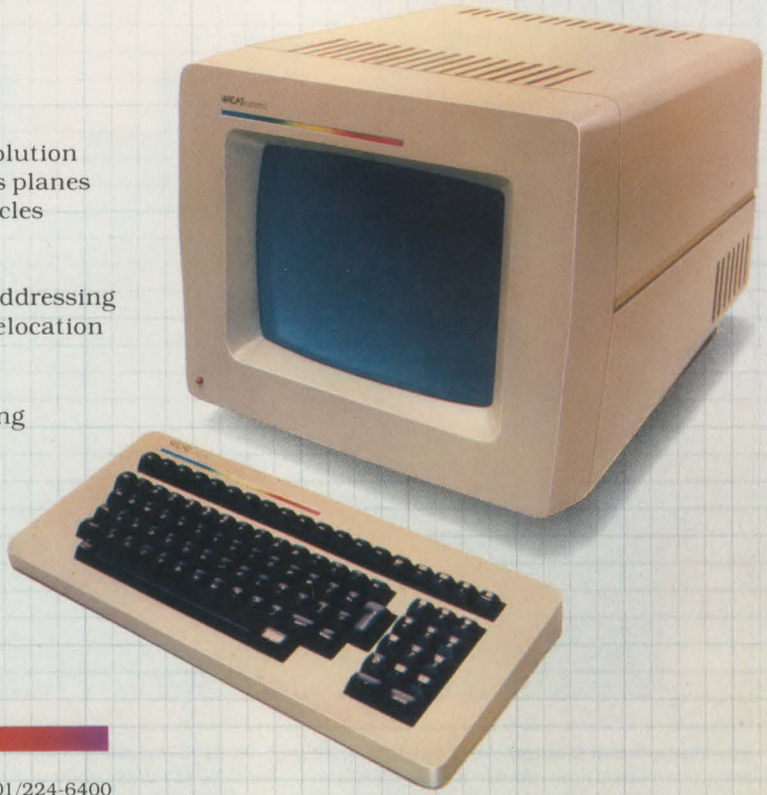
General features
Z8002 based
12" display monitor
Touch screen (optional)

Text features
Half intensity
Reverse video
Blink
Blank
Underscore

For more information call or write WICAT Systems 801/224-6400.

Graphics features
400 x 300 graphics resolution
2 independent graphics planes
Lines, curves, arcs & circles
Graphics text
Pattern fill
Relative and absolute addressing
Object definition and relocation

Applications
Computer-based training
Animation
Business graphics
CAD/CAM
Process control
Scientific



WICATsystems

P.O. Box 539 1875 South State Orem, Utah 84057 801/224-6400

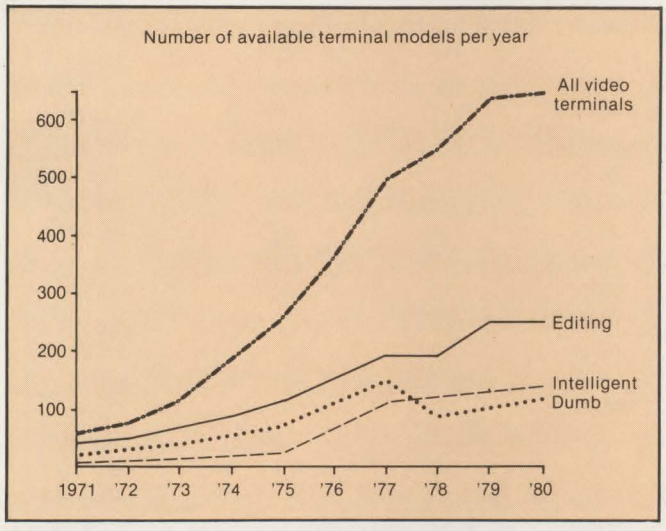
CIRCLE NO. 55 ON INQUIRY CARD

The need for manufacturers to satisfy selective shoppers is the driving force behind the product-definition and pricing cycles of the display-terminals industry.

market, and for good price/performance ratios in all three. The need for manufacturers to satisfy selective shoppers is the driving force behind the product-definition and pricing cycles of the display-terminal industry. Innovations and new prices spread fast in an industry in which information is freely exchanged in dozens of national conferences and trade journals. An examination of the cyclical development of each display-terminal sub-market will show why different product managers have different worries and where each sub-market may be headed.

The dumb terminal sub-market, the most mature of the three, is characterized by intense but predictable price competition heading toward the less-than-$500 level.

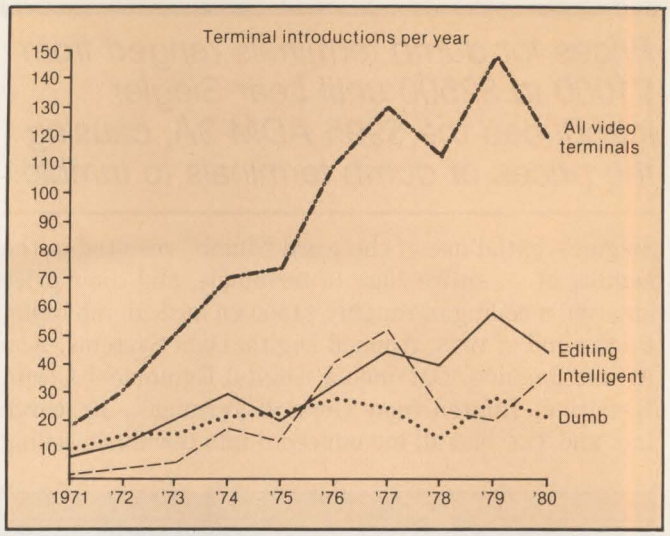
The editing-terminal segment is the most precarious



The number of available video terminals *has grown steadily despite vendor attrition. The 1977 drop in dumb terminals was brought on by price competition; the editing terminal industry is on the verge of a similar shakeout. Overall industry figures include graphics and numeric-only terminals.*

of the three. Editing-terminal makers are searching for identity, fighting simultaneously on many fronts for brand recognition, price leadership, emulation capabilities and application niches.

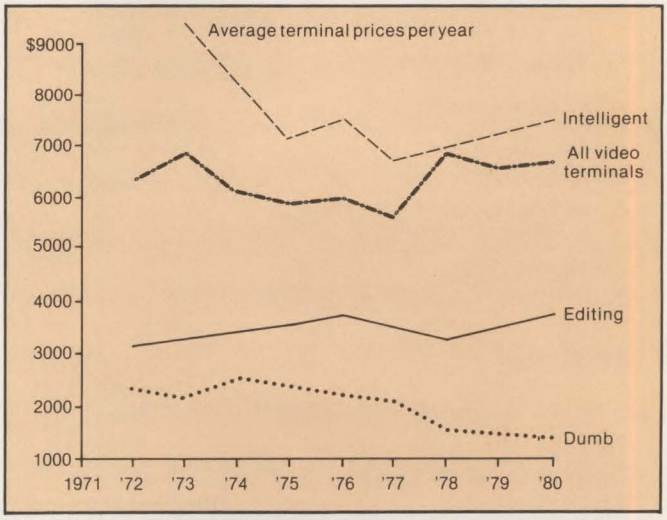
Intelligent-terminal manufacturers, the least mature of all, are playing for the highest stakes. With some intelligent terminals virtually indistinguishable from stand-alone systems, manufacturers are still looking for that unique combination of mass storage, μps and communications that will give them a defined claim in an as-yet-undefined market. That market now spans desk-top and dedicated systems, including word-processing, graphics and distributed systems.



Introduction rates have been unsteady *since 1977, reflecting changing user needs, lower prices and new technology. The 1975 to 1976 boom in intelligent-terminal introductions followed the availability of inexpensive μps.*

The dumb-terminal industry developed in the early 1970s to fill the need for simple interaction between users and computers without the noise, paper cost or maintenance problems of teleprinters. "Glass Teletypes," as the video units were often called, had no local intelligence or editing capability. By the end of 1974, builders and buyers had defined the first-generation dumb terminal as a teletypewriter-compatible device displaying 960 or 1920 upper-case characters on a 12-in. video screen. That year, 50 manufacturers offered dumb terminals, and new models were being introduced at the rate of one a month.

Prices for dumb terminals ranged from $1000 to $2500 until Lear Siegler introduced the $995 ADM-3A, causing the prices of dumb terminals to tumble. The ADM-3A's intensive advertising campaign centered around the slogan "dumb terminal, smart buy." Lear



Average-price trends *show ongoing price competition in the dumb-terminal industry. Availability of $700 editing terminals will bring prices down in both editing- and dumb-terminal industries. Intelligent-terminal average prices reflect diverse capabilities and applications. The steep increase in overall terminal prices is a result of the introduction of several expensive graphics systems.*

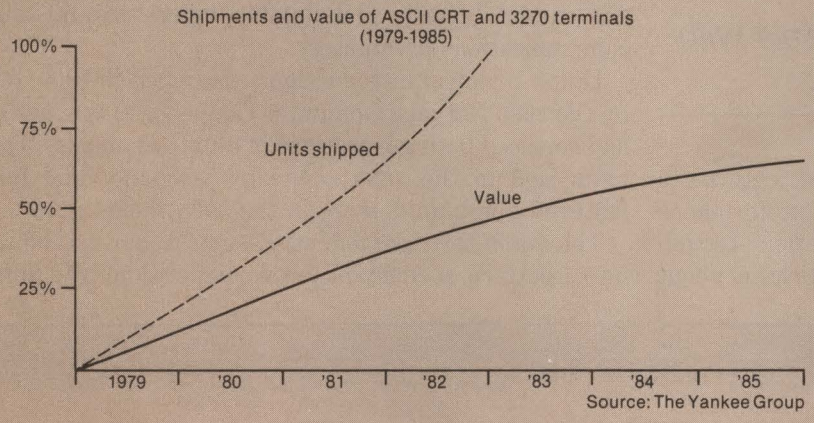
Prices for dumb terminals ranged from $1000 to $2500 until Lear Siegler introduced the $995 ADM-3A, causing the prices of dumb terminals to tumble.

Siegler's initial use of the word "dumb" resulted in the naming of an entire class of terminals, and their price imposed a ceiling of roughly $1500 on basic dumb units. By the end of 1975, Applied Digital Data Systems, Ann Arbor, Beehive, Datamedia, Digital Equipment Corp., Hazeltine, Infoton (now General Terminal), Research Inc. and TEC had all introduced dumb terminals selling for less than $1500. The market took years to define the features of first-generation dumb terminals; it took eight months to define their prices.

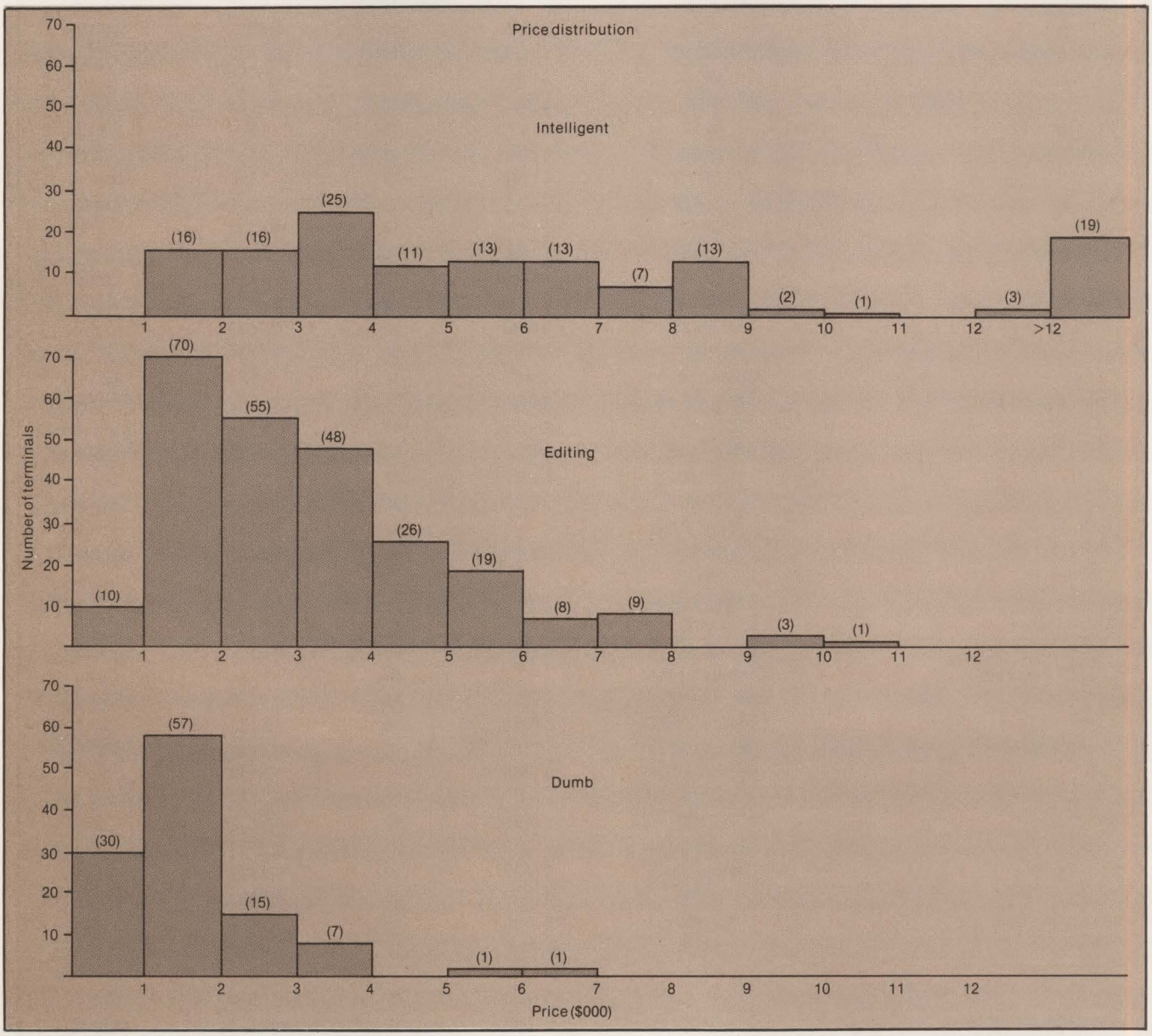
Price cutting came easier to large-volume vendors, such as ADDS and DEC, than it did to small- and medium-sized vendors relying on larger profit margins to assure profitability and growth. During the shake-out years of 1976 and 1977, many small producers were driven out of business, while medium-sized companies, such as Beehive and Infoton, spent perilous years cutting margins and retooling. Many vendors left the dumb-terminal market to build higher margin editing units. Others dropped mainstream dumb units in favor of portable, executive-style, ruggedized or other spe-

UNDER-$1000 VIDEO TERMINAL

Manufacturer	Model	Price	Diagonal Screen Size	Characters Per Screen	Type
ADDS	Regent 20	$695	12	1920	Dumb
	Regent 25/120	$950	12	1920	Dumb
	Viewpoint	$650	12	1920	
AM International	402	$995	12	1920	Dumb
Beehive	DM5	$880	12	1920	Editing
Data Terminals	81	$895		1920	Dumb
Dataview	Marquis	$845	12	1920	Dumb
DTI Data Terminals	Entry 81	$945	12	1920	Intelligent
Emulog	Alpha	$550	12	2000	Dumb
Facit	4410	$995	12	1920	Dumb
General Terminal	GT-100E	$995	12	2000	Editing
	SW-1	$550			Dumb
Hazeltine	1410	$850	12	1920	Dumb
	1421	$895	12	1920	Dumb
	Esprit	$695	12	1920	Dumb
Heath	WH19	$995	12	2000	Editing
Informer	D311	$850	6/9	512/1024	Dumb
Intertec Data	Emulator	$895	12	2000	Editing
	Intertube III	$895		1920	Editing
Lear Siegler	ADM-3A	$850	12	1920	Dumb
	ADM-3A +	$945	12	1920	Dumb
	ADM-5	$995	12	1920	Dumb
Micro-Term	ACT-IVA	$675		1920	Editing
	ACT-5A	$995	12	1920	Editing
	Mime-314	$895	12	1920	Editing
Otto Electronics	OE 1000	$375		1020	Dumb
Perkin-Elmer	Bantam 550	$966	12	1920	Dumb
Soroc Technology	IQ 120	$995	12	960/1920	Dumb
	IQ 130	$650	12	1920	Dumb
Southwest Tech	CT-82	$895	9	1312/2024	Editing
TEC	511, 611	$925	12	2000	Dumb
	530, 630	$995	12	2000	Editing
Televideo	TVI-912B, C	$845	12	1920	Editing
	TVI-920B, C	$995	12	1920	Editing
	910	$699	12	1920	Dumb
Terminal Data	675	$695	9	1024	Dumb
Texas Instruments	Insight 10	$995	5	960	Dumb
Vector Graphics	Mindless Terminal	$926	12	1024	Dumb
Video Data Systems	100 Series	$995		1920	Editing
Volker Craig	Chat	$645	12	1920	Dumb
	VC404	$995	12	1920	Dumb
Zenith	Z19	$995	12	1920	



Shipment value will increase only slightly, although unit shipments of ASCII CRT terminals and IBM 3270-compatibles will boom, according to The Yankee Group. The Cambridge, Mass., researchers predict that unit sales for these two fastest growing sectors of the terminal market will expand at an average annual rate of 25 percent during the next few years, but their total value will rise only 10 percent a year because of declining prices per unit. Because manufacturers' costs (sales, marketing, production, R & D) are not likely to fall as rapidly as prices, even those companies having "good" years in terms of increased revenues may report lower earnings because of squeezed profit margins.



Price distribution *shows intelligent terminals are not as well-defined as are editing and dumb terminals. Editing-terminal prices are clustered less tightly than dumb-terminal prices because editing vendors can add features to make higher priced units competitive. The more expensive units are often ruggedized or cluster devices.*

More than 120 manufacturers compete in the editing market, offering consumers more than 300 models with assortments of similar features.

cial-purpose models.

Vendors that could not cut prices added features to their dumb terminals to improve price/performance ratios. By the end of 1977, a second generation of dumb terminals had been defined with a median price of about $1300 and a much longer list of standard features than the $1000 bare-bones units. Second-generation dumb units featured 15- and 12-in. screens, separate numeric and cursor keypads and flexible, operator-adjustable communications parameters.

Dumb-terminal introductions rose again in 1979, but, by the 1980 National Computer Conference, the market had repriced both generations of dumb terminals. Basic units sold in the $850 range by year-end, and fully featured dumb units were in the $995 range.

The dumb-terminal industry seems to have stabilized into a pattern of constant price competition. The dumb

132-COLUMN TERMINALS

Manufacturer	Model	Price	Screen size	Columns	Type
Braegen	BT-100	$1995	12	80/132	Editing
C. Itoh	VIT 100	$1995	12	80/132	Dumb
Cobar	3100		12	132	Dumb
	3132	$1995	12	80/132	Editing
Dacoll Engineering	DL180 VDT	$8028	12	80/132	Intelligent
	242-2	$1465	12	80/132	Editing
	242-3	$1260	12	80/132	Editing
Data General	5210	$4500	15	132	Editing
Datagraphix	132-1	$2150	11	132	Dumb
	132-1D	$1695	11	132	Dumb
	132-2	$1795	11	132	Editing
	132-70	$4950	14	40/132	Editing
	132A	$3950	15	132	Editing
	132B	$4450	13	132	Editing
Datamedia	DT80/2	$1495	12	80/132	Dumb
	DT80/5	$1840	12	80/132	Dumb
	DT80/5L	$2240	15	80/132	Editing
	Colorscan 10	$3795	12	132	Editing
Digital Equipment	PDT-11/110	$4800	12	66/132	Intelligent
	PDT-11/130	$6000	12	66/132	Intelligent
	PDT-11/151	$8600	12	80/132	Intelligent
	VT100	$2050	12	132	Dumb
	VT100-T	$7100	12	80/132	Editing
Direct	VP800/A			80/132	Editing
	VP800/B	$2350	12	80/132	Editing
	900		12	80/132	Intelligent
ECD	Smart ASCII	$8000	15	16/132	Intelligent
Garyco Data	132/C	$1995	15	80/132	Editing
	132/M	$3195	15	80/132	Editing
GDS Data Systems	Displaymaster		14	132	Dumb
Hazeltine	Executive 80-20	$1455	15	80/132	Editing
	Executive 80-30	$1815	15	80/132	Editing
Human Designed	Concept APL8	$1365		80/132	Editing
	Concept 108	$1365		80/132	Editing
ID Systems	ID-100		13	80/132	Editing
Lanpar	XT100	$1959	12	80/132	Editing
Lee Data	Series 300			80/132	Editing
Micro-Term	Mimi-100	$1795	12	80/132	Editing
Ontel	OP-1R	$1595	15	80/132	Intelligent
Plessey Peripherals	PT-100	$1500	12	80/132	Editing
Tab Products	132/15	$2450	15	80/132	Editing
Tektronix	4054	$16,500		132	Intelligent
Teleray	100	$1790	12	132	Editing
Texas Instruments	940	$1895	12	80/132	Editing
Visual Technology	Visual 400	$1650	12	80/132	Editing

REFERENCE LITERATURE

For more information on the terminals surveyed in this article, use the reader circle numbers below.

Company	Circle No.
Adage, Inc., Boston	263
ADDS Inc., Hauppage, N.Y.	264
ADI, Ann Arbor, Mich.	265
AM International, Los Angeles	266
Ampex Corp., Redwood, Calif.	267
Anderson Jacobson Inc., San Jose, Calif.	268
Applied Systems Corp., St. Clair Shores, Mich.	269
Artel, Palo Alto, Calif.	270
Basic-Four Corp., Tustin, Calif.	271
Beehive International, Salt Lake City	272
Braegen Corp., Cupertino, Calif.	273
Bunker Ramo Corp., Oak Brook, Ill.	274
Burroughs Corp., Rochester, N.Y.	275
Callan Data Systems, Westlake Village, Calif.	276
Cobar, Anaheim, Calif.	277
Codex Corp., Mansfield, Mass.	278
Comark Corp., Waltham, Mass.	279
Compression Labs, Cupertino, Calif.	280
Computek Inc., Burlington, Mass.	281
Computer Optics, Inc., Bethel, Conn.	282
Computerwise, Inc., Grandview, Mo.	283
Consolidated Computer, Tempe, Ariz.	284
Control Concepts, Binghampton, N.Y.	285
Control Data Corp., Bloomington, Minn.	286
Courier Terminal Systems, Phoenix	287
CSC, Chelmsford, Mass.	288
Dacoll Engineering, Bathgatz, W. Lothian, Scotland	289
Data General Corp., Westboro, Mass.	290
Data Terminals, Campbell, Calif.	291
DatagraphiX, San Diego, Calif.	292
Datamedia Corp., Pennsauken, N.J.	293
Datapoint Corp., San Antonio, Texas	294
Decision Data, Horsham, Pa.	295
Delta Data Systems Corp., Philadelphia	296
Digi-Log Systems, Inc., Horsham, Pa.	297
Digital Equipment Corp., Maynard, Mass.	298
Direct, Inc., Sunnyvale, Calif.	299
DMC Corp., Santa Clara, Calif.	300
DTI Data Terminals, Grants Pass, Ore.	301
ECD Corp., Cambridge, Mass.	302
ECS Microsystems, San Jose, Calif.	303
Elbit Computer, Haifa, Israel	304
Emulog, Westwood, Mass.	305
Facit, Inc., Greenwich, Conn.	306
Ferranti Computer, Manchester, England	307
Formation Inc., Mt. Laurel, N.J.	308
Fujitsu America, Inc., Santa Clara, Calif.	309
Garyco Data Systems, Seattle	310
GDS Data Systems, Seattle	311
General Terminal Corp., Tustin, Calif.	312
Genisco Computers, Costa Mesa, Calif.	313
Harris Corp., Ft. Lauderdale, Fla.	314
Heath Corp., Benton Harbor, Mich.	315
Hewlett-Packard Co., Cupertino, Calif.	316
Honeywell Information Systems, Billerica, Mass.	317
Human Designed Systems, Philadelphia	318
IBM Corp., White Plains, N.Y.	319
ID Systems, Dublin, Ohio	320
IESI, Seattle	321
Informer, Los Angeles	322
Intelligent Systems Corp., Norcross, Ga.	323
International Entry Systems Corp., Seattle	324
Intertec Data Systems Corp., Columbia, S.C.	325
Lanpar, Montreal	326
Lear Siegler, Inc., Anaheim, Calif.	327
Lee Data, Minnetonka, Minn.	328
Logicon-Intercomp, Inc., Torrance, Calif.	329
Matrox Electronic Systems, Montreal	330
Megadata Corp., Bohemia, N.Y.	331
Micro-Data, Los Angeles	332
Micro-Term, St. Louis	333
Mohawk Data Sciences, Herkimer, N.Y.	334
Motorola, Inc., Phoenix	335
NCR Corp., Miamisburg, Ohio	336
Olivetti Corp. Of America, Tarrytown, N.Y.	337
Ontel Corp., Woodbury, N.Y.	338
Otto Electronics, Princeton, N.J.	339
Paradyne Corp., Largo, Fla.	340
Pencept, Waltham, Mass.	341
Perkin-Elmer Corp., Garden Grove, Calif.	342
Perry Data Systems, Raleigh, N.C.	343
Pertec Computer Corp., Los Angeles	344
Phone 1, Rockford, Ill.	345
Piiceon, Inc., San Jose, Calif.	346
Plessey Peripheral Systems, Irvine, Calif.	347
Racal-Milgo, Inc., Miami	348
Ramtek Corp., Santa Clara, Calif.	349
Raytheon Data Systems, Norwood, Mass.	350
RCA Service Co., Camden, N.J.	351
R2E Of America, Minneapolis	352
SCI Systems, Huntsville, Ala.	353
Shasta General Systems, Burlingame, Calif.	354
Solid State Technology, Inc., Woburn, Mass.	355
Soroc Technology, Inc., Anaheim, Calif.	356
Southwest Technical Products, San Antonio, Texas	357
Sperry Univac, Irvine, Calif.	358
SSTI, Woburn, Mass.	359
Systematics General Corp., Falls Church, Ga.	360
Tab Products Co., Palo Alto, Calif.	361
Tandberg, San Diego, Calif.	362
Tano Corp., New Orleans	363
Tektronix, Inc., Beaverton, Ore.	364
Telcon Industries, Inc., Ft. Lauderdale, Fla.	365
AEG-Telefunken Corp., Konstanz, W. Germany	366
Teleray, Minneapolis	367
Teletype Corp., Skokie, Ill.	368
Terminal Data, Rockville, Md.	369
Texas Instruments Inc., Houston	370
Thomson-CSF, Robinson, France	371
Transac, Orlando, Fla.	372
Trivex, Inc., Costa Mesa, Calif.	373
TRW Data Systems, E. Norwalk, Conn.	374
Vector Graphic, Inc., Westlake Village, Calif.	375
Video Data Systems, Inc., Hauppauge, N.Y.	376
Visual Technology, Inc., Andover, Mass.	377
Volger-Craig, Waterloo, Ontario	378
Vydek, Inc., Florham Park, N.J.	379
Wang Laboratories, Inc., Lowell, Mass.	380
Wordplex, Inc., Westlake Village, Calif.	381
Zenith Corp., Glenview, Ill.	382
Zentec Corp., Santa Clara, Calif.	383

terminal has been defined, priced, redefined and re-priced within a decade. Vendor attrition has been heavy: of the 91 companies that ever built dumb terminals, one-third have left the market. Dumb-terminal introductions in 1980, although down from 1979 levels, still numbered 24. The industry remains profitable for efficient large-volume and innovative small-volume producers, and more than 60 vendors competed in the dumb-terminal market last year. Users can now choose from some 150 dumb units, many of them priced at less than $1000 (Table 1).

Editing terminals—a maturing industry

Attendees at NCC 1981 last May in Chicago saw the first definitive pricing of the second generation of editing terminals. The editing terminal's history parallels that of the dumb terminal; given the vendor shakeout that followed the pricing of second-generation dumb terminals, editing-terminal product managers have cause to worry.

The editing terminal also dates back to the early 1970s when it was developed to provide programmers and data-entry operators with local buffer storage for character- and line-insert/delete editing. The first generation of editing terminals displayed 1920 upper- and lower-case characters, and featured cursor control as well as special-editing keypads. The same intelligence and buffering needed to provide editing also

A first-generation intelligent terminal is a full-function terminal featuring 64K bytes of RAM, an 8-bit μp and one or more floppy-disk storage drives.

provided screen formatting, protected fields, video highlighting, tab keys and data compression. Most of the buffered units were still teletypewriter-compatible, but a significant number were IBM 3270-compatible. Most first-generation editing units—such as the ADDS Consul 880, the Beehive Superbee and the Hazeltine 2000—sold for $3000 or more.

Average editing-terminal prices rose slowly from $3200 in 1972 to $3700 in 1976, and the number of models offered went from 40 to 145 as sales boomed. In 1976, Hazeltine introduced the MOD One dumb or editing terminal that sold for $2050 in its editing version. The market endorsed the price point, and by the end of the year, ADDS, Beehive, Datamedia, Lear Siegler, Omron, Scientific Measurements and TEC all offered editing units for less than $2500.

Editing-terminal introductions were off during 1977 and again in 1978 but rose during 1979 as vendors brought prices down and began manufacturing today's second-generation editing terminals. These units feature larger display screens; more scrollable memory; detachable keyboards with numeric, cursor and function keys; and flexible communications parameters. Many current editing terminals generate partial graphics and provide foreign- or special-character sets. Several vendors have fought for market share by offering low-cost emulators for popular editing terminals such as the IBM 3270, DEC VT-100 and Burroughs TD830. There are more than 100 3270 emulators, and many editing terminals emulate more than one competitive unit.

Ampex Dialogue Touchterm 80 editing terminal *represents the latest effort of VDT manufacturers to boost capability beyond simple keyboard interaction. The Touchterm 80 uses scanning-infrared-beam technology for touch sensing. This allows not only soft-key (expanded keyboard) operation, but also stream-mode (digitizer) input of continuous-path and rate data.*

These features are possible because of inexpensive μps and memory. Few of today's editing terminals offer all the features mentioned, but the list of features on a mainstream editing terminal is long. More than 120 manufacturers compete in the editing market, offering consumers more than 300 models with assortments of similar features. Functionally similar second-generation editing terminals have been differentiated by ergonomic, portable and executive packaging, and by massive brand-name advertising campaigns. Editing terminals were defined, priced and redefined during the 1970s, and NCC '81's $700 editing units indicate that editing terminals will be largely repriced in the next 12 months. As advertisements stress hard prices again instead of brand loyalty, the market should heat up.

Intelligent terminals—which direction?

While the dumb-terminal industry is a mature one and the editing-terminal industry rapidly approaches maturity, the intelligent-terminal industry is still in its

INTELLIGENT TERMINALS

Manufacturer	Model no. Configuration
Applied Digital Data Systems, Inc.	System 70
Applied Systems Corp.	ASC terminal
Artel	series 1000
Burroughs Corp.	MT600, MT7000, MT900
Callan Data Systems	CD100
Codex Corp.	CDX-68
Comark Corp.	QB-11-12
Computek, Inc.	116, 200, 216/30, stand-alone or two and four-terminal cluster Display 8
Data General	MPT-80, -83, -87
Data Terminals & Communication	model 382
Datamedia Corp.	Elite 4000A
Delta Data Systems Corp.	7000 Series, stand-alone
Digi-Log Systems, Inc.	Microterm II, stand-alone
Digital Equipment Corp.	PDT-11 Series, as many as four terminals per cluster
	VT-103
Direct	900
ECD Corp.	smart ASCII, stand-alone
ECS Microsystems	4000,4500
Genisco Computers Corp.	G1000
Hewlett-Packard Co.	model 2647A: stand-alone
Honeywell Information Systems, Inc.	SPD 20 series, SPD300 series, SPD 820/2, stand-alone or clusters of eight, 16 or 32 terminals
IBM	5280
Intelligent Systems Corp.	3600 series, 8000 series, stand-alone
International Entry Systems, Inc.	Datacorder II: stand-alone
Intertec Data Systems Corp.	Compustar, Superbrain, stand-alone or as many as 15 terminals per cluster

first generation. Intelligent terminals are used in distributed-processing, office-automation, word-processing, graphics and stand-alone applications. This diversity of applications denies vendors a coherent market to define product features and prices. Never at a loss, terminal vendors have defined the first-generation intelligent terminal themselves.

A first-generation intelligent terminal is a full-function terminal featuring 64K bytes of RAM, an 8-bit μp and one or more floppy-disk storage drives. The terminal supports at least one programming language and offers a standard or optional serial printer. Many intelligent units display suprisingly sophisticated graphics, and more than a dozen feature multicolored displays. Prices range from $4000 to $8000 for basic units and from $6000 to $10,000 for units with bundled software and printers. The wide price distribution is again the result of diverse applications; very similar hardware configurations command very different prices in applications with different price tolerances.

Software allows similar hardware to support diverse applications. Virtually all intelligent terminals are programmable in assembly language, and more than half of them support BASIC programming. COBOL, FORTRAN and Pascal are popularly supported, and many intelligent terminals feature CP/M or similar operating systems with multilingual capability.

As distributed-processing, office-automation, word-processing and other intelligent-terminal applications become more standarized and comprehensive, intelligent-terminal vendors will be forced to dedicate their machines to fewer and fewer applications. Datapoint Corp. and Texas Instruments Inc. specialize in distributed-data processing. Others, notably Wang Laboratories Inc., have stressed office automation, and still others, such as Chromatics, have branched into the business color-graphics market. Companies such as Intelligent Systems, Zentec and Televideo continue to offer nonspecialized intelligent terminals that provide users with the equivalent of a stand-alone μc. While these terminals generally cannot support extensive word-processing or shared data-base capabilities, they allow the user to develop and run programs off-line, reducing demands on their host computers.

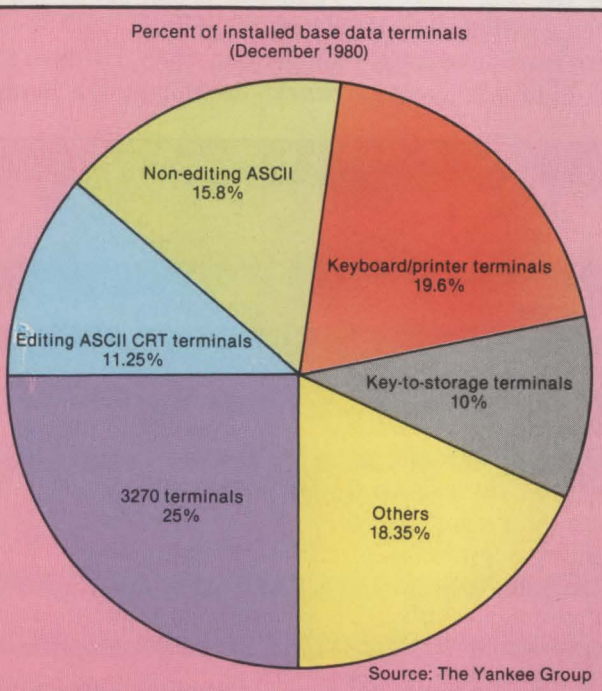
Two basic directions of competition, then, are open to vendors of intelligent terminals: developing the hard-

Processor, Memory (bytes)	Display, Keyboard	Price
16K	80 × 24, 12-in. screen, numeric pad, function keys	$4895
8085, 2K to 32K	80 × 24, 12-in. screen, numeric pad	$1690 and more
8086, 64K to 832 K	96 × 39, 15-in. screen, numeric pad	$15,600
20K to 96K	80 × 25 or 80 × 48, 5-, 9- or 12-in. screen, numeric pad	$2625 and more
various, 64K	80 × 25, 12-in. screen, numeric pad, function keys	$3195 (without processor)
8K to 42K	80 × 24, 12-in. screen, numeric pad, function keys	$8000
LSI-11, 32K to 128K	64 × 16 or 80 × 24, 9-in. screen, numeric pad, function keys	$9535 and more
GA 16/110, 8K to 128K	80 × 24 or 80 × 25, 12- or 15-in. screen, numeric pad, function keys	$4995 to more than $27,000
64K	80 × 25, 12-in. screen	$3900
Micro Nova, 60K	80 × 25, 12-in. screen, numeric pad, function keys	$4800 to $7100
8K to 56K	80 × 24, 12-in. screen, function keys	$3875 to $9395
8080A, 4K to 32K	80 × 24, 12-in. screen, numeric pad, function keys	$2895
TI9900, 32K to 128K	80 × 28, 15-in. screen, numeric pad, function keys	
dual Z80As, 48K to 64K	80 × 24, 12-in. screen, numeric pad	$8400 and more
LSI-11, 32K to 60K	66 × 7, 80 × 14, 132 × 24, 12-in. screen, numeric pad, function keys	$4800 and more
LSI-11/2 or 2/23, 64K	132 × 24, 12-in. screen, numeric pad, function keys	$3200 without processor
	132 × 28, 12-in. screen, numeric pad, function keys	
6512A, 32K to 1M	16 × 10 to 132 × 40, 15-in. screen, numeric pad	$8000 to $10,950
Z80, 64K to 80K	80 × 25	$2500 to $6100
Z8001; 32K to 512K	36 × 78, 39 × 85, 60 × 128, 66 × 146, 19-in. screen, numeric pad, function keys, joystick	$11,150
32K	80 × 24, 12-in. screen, numeric pad, function keys	$8950 to $12,550
4K to 128K	80 × 24 or 40 × 12, 12-in. screen, numeric pad, function keys	$6122 to more than $30,670
64K	80 × 24	$5630
8080A:6K to 64K	64 × 32 or 80 × 48, 13- or 19-in. screen, numeric pad, function keys	$1895 to $15,000
Z80: 64K to 80K	40 × 1	$3895 and more
dual Z80As, 32K to 64K	80 × 24 or 80 × 25, 12-in. screen, numeric pad, function keys	$2995 and more

Dumb terminals have been defined, priced, redefined and re-priced within a decade, and vendor attrition has been very heavy.

ware and software features necessary to support specialized functions, and improving the price/performance characteristics of the nonspecialized, μc-like intelligent terminals.

Second-generation hardware, in the form of 128K-byte, 16-bit systems based around Winchester-disk drives and backed by streaming cartridge-tape drives, is ready for vendors wishing to pursue distributed-processing/office-automation applications. Prices for 8-bit μps and memory continue to fall for those offering basic stand-alone units.



Source: The Yankee Group

Installed data terminals in the U.S. exceed 4 million and are valued at almost $12 billion.

As of December 1980, editing ASCII CRT terminals had a total installed base of 450,000 units, 11.25 percent of all installed CRT terminals. The Yankee Group, a Cambridge, Mass., market-research firm estimates that of the 295,000 ASCII terminals shipped in 1980 (valued at $300 million), 139,000, 47.1 percent, were editing terminals. By the end of 1981, 68.2 percent, will be editing terminals.

IBM, 3270 terminals account for the largest piece of the currently installed "pie." The Yankee Group estimates that in 1980, 300,000 3270 terminals were shipped. About 175,000, 58 percent, were IBM terminals. The remainder were dominated by Raytheon, ITT Courier, Telex, Harris, Memorex and Teletype. The total installed base of 3270 terminals was about 1 million in December, 1980, with IBM controlling about 55 percent. The Yankee Group expects shipments to increase at a steady 25- to 30-percent rate over the next two years.

Both basic stand-alone and distributed-processing intelligent terminals are well-defined. Prices for both are emerging. Basic intelligent units should sell for less than $3000, including a low-cost matrix printer. Distributed-processing units should sell for $5000 to $10,000.

The future

The futures of the dumb-, editing- and intelligent-terminal industries should follow divergent paths and provide user groups with different features and prices.

Vendors of dumb terminals, barred by definition from adding functions to their units, will continue to cut prices slowly. Display-tube, power-supply and keyboard costs have stabilized, and parts counts in dumb units are lower today than ever. The most likely sources of future cost-cutting will include even more vertical integration, overseas manufacturing and building less expensive cabinets and enclosures.

The dumb terminal is already emerging as the layman's terminal and has been replaced in most sophisticated data-processing shops by editing terminals. Voice recognition, handprint and touch-screen

INTELLIGENT TERMINALS

Manufacturer	Model no. Configuration
Logicon-Intercomp, Inc.	EE/80, as many as four terminals per cluster
Matrox Electronic Systems	CTM-300
Megadata	700/RTE
Mohawk Data Sciences Corp.	Series 21, as many as four terminals per cluster
NCR Corp.	model 2950
Northern Telecom Systems Corp.	NTSC 405, 435, 440, 445, as many as two or eight terminals per cluster
Olivetti Corp. of America	TC800, as many as 16 terminals per cluster
Ontel Corp.	OP-1 Series, as many as 16 terminals per cluster
Perkin-Elmer Data Systems Corp.	model 3500, stand-alone
Piiceon	PM-2010
Ramtek Corp.	model 8410, model 8450
Raytheon	PTS-2000; as many as 32 terminals
RCA	ZMS-50, stand-alone
R2E of America	Micral C, stand-alone
Shasta General	model 3360, as many as eight terminals per cluster
Solid State Technology, Inc.	series 8100, as many as four terminals per cluster
Sperry Univac	UTS 20, UTS 40, UTS 400, stand-alone or clusters of 12 or 16 terminals
Systematics General	T5145
Tano Corp.	outpost 11, stand-alone
Tektronix, Inc.	model 4051, stand-alone
Telcon Industries, Inc.	VCS-300
Texas Instruments Inc.	model 770, 771, stand-alone
Wang Laboratories, Inc.	PCS II, WCS-15, stand-alone
Wordplex	Wordplex/1, stand-alone
Zentec Corp.	ZMS-70, ZMS-90, stand-alone

technologies are already offered on a few dumb units, and these technologies should flourish as the dumb terminal solidifies its position as the preferred terminal for unsophisticated users. While any one of the new data-entry methods might revolutionize the dumb-terminal industry, a new, cheaper display technology would have an immediate and profound effect. The dumb-terminal industry has defined and priced two generations of terminals. It will be engaged in price competition and miscellaneous specialization until new technology allows it to produce a third-generation product.

The editing-terminal industry is just now pricing its second-generation terminal, and the low prices set at NCC '81 will undoubtedly drive some manufacturers out of the business. Vendors will still justify higher priced editing terminals by adding functional improvements, such as portability, multicolored displays, 132-column displays and more complex editing/word-processing functions. Vendors of low-end editing units will enlarge display screens, increase character resolution and redesign detachable keyboards as ergonomic design becomes a requirement rather than the novelty it was

Matrox Electronic Systems' CTM-300 *intelligent color terminal can be down-loaded from a host computer. The detachable keyboard has illuminated caps and shift-lock keys.*

Processor, Memory (bytes)	Display, Keyboard	Price
16K to 32K	80 × 24, 15-in. screen, numeric pad, function keys	$4800 and more
Z80A, 2K	80 × 25, 12-in., 8-color screen, numeric pad, function keys	$2940
64K	80 × 24, 15-in. screen, numeric pad	$7000
48K to 256K	40 × 12 or 80 × 24, 15-in. screen, numeric pad, function keys	$7035 and more
8085, 48K to 60K	80 × 24, 12-in. screen, numeric pad, function keys	$3630 and more
48K to 256K	64 × 8 or 80 × 25, 12- or 15-in. screen, numeric pad, function keys	$2160 to more than $20,500
16K to 48K	26 × 10, 40 × 12 or 80 × 24, 6- or 15-in. screen, numeric pad, function keys	$12,000 and more
8085, 16K to 64K	80 × 24, 14-in. screen, numeric pad, function keys	$1650 to $4195 in quantities of 100
6800, 16K to 48K	80 × 25, 12-in. screen, numeric pad, function keys	$5833 and more
8086, 32K to 256K	80 × 66, 15-in. screen, numeric pad, function keys	$4200
8080A, 6K to 256K	80 × 24, 15-in. screen, numeric pad, function keys	$2400 to $8200
8085, 16K	80 × 32, 15-in. screen, numeric pad	$3245 to more than $22,000
RCA 8085	80 × 25, 12-in. screen, numeric pad, function keys	$2425
Z80, 24K to 64K	80 × 24, 12-in. screen, numeric pad	$8995
8085, 32K to 64K	80 × 25, 12-in. screen, numeric pad	$3995 and more
2K to 64K	80 × 25, 12-in. screen, numeric pad	$3500 and more
8080, Z80A, AMD 2900, 32K to 64K	80 × 24 or 80 × 25, 12- or 15-in. screen, numeric pad, function keys	$4160 to more than $11,160 per terminal
64K to 128K	80 × 24, 11-in. screen, numeric pad	$12,000
MC6800, 32K to 64K	80 × 24, 12-in. screen, numeric pad, function keys	$4995 and more
6800, 8K to 32K	74 × 35, 9-in. screen, numeric pad, function keys	$5995 and more
16K	80 × 24 or 40 × 24, 12-in. screen, numeric pad	$2895 to $3395
TMS 9900 (16-bit), 32K to 64K	80 × 24, 12-in. screen, numeric pad, function keys	$5995 to $9695
8K to 32K	64 × 16 or 80 × 24, 9- or 12-in. screen, numeric pad	$4800 to $11,400
Z80, 48K to 56K	80 × 24, 12-in. screen, numeric pad	$12,500 and more
4K to 64K	80 × 24 or 80 × 25, 15-in. screen, numeric pad, function keys	$3900 and more

Vendors of dumb terminals—barred by definition from adding functions to their units—will continue to cut prices slowly.

two years ago. The editing terminal will be the choice of programmers, data-entry operators and other users concerned with cost-effective productivity. The editing terminal is appropriate for more applications than other terminals, and, in its various forms, should be the workhorse terminal of the early 1980s. Price competition among low-end editing units will heat up fast, while

IBM-COMPATIBLE TERMINALS

Manufacturer	Model	Compatible Model	Manufacturer	Model	Compatible Model
Adage	GS/300	Available		4500	3271, 5
	4115	4250	Elbit USA	DS377	3277-2
	4250	3250	Ferranti	PT7-40	3270
	4370	3250	Formation	F4277	3277-2
	4380	3250	Fujitsu	M3520	3270
ADI	D60	OPT	Harris	804	360/370
	D60S	OPT		8160	2260
Anderson Jacobson	AJ 510	2741, OPT		8180	3270
Basic Four	G77	3277		9200	3270
Beehive	DM3270	3275, 6	Honeywell	FDC3102	X780
Bunker Ramo	System 90	3270		SPD 20/20 TPU	3270
	System 90/12	3270		SPD 20/30 TPU	3270
	System 90/22	2260		SPD 20/40 TPU	3270
	System 90/32	3270		SPD 320 LFC	3270
	2204	2260		SPD 325	3275
	2206	2260		SPD 330/2	3270
Burroughs	TD701	2260	ICL	1500	3270
Codex	CDX-68	3780		7500	3270
Compression Labs	CLI-441	2780	IESI	Datacorder II	3741
Computer Optics	CO:77	3270	Informer	314D,I	3270
	CO:78	3278		D4012	3270
	8277-1	3277	Intelligent Systems	8001	3270
	8277-2	3277		8001G	3270
	8277-3	3277		8051	3270
	8278-1	3278	Lee Data	Series 300	3270, 8
	8278-2	3278	Lexitron	1201	3275
	8278-3	3278	Megadata	2001	3270
Computerwise	Transactor III	3275		700	3270
Consolidated Comp.	Key-Edit 22	3780		700/RTE	3270
	Key-Edit 24	3780		850	3270
Control Concepts	EM-3275	3275/76	Memorex	1377-4	3277
Control Data	Certainty 610-10	4979		2051-11	5251-11
Courier Terminal	TC278	3278		2078	3278
	270	3270	Microdata	Sovereign	3270
	275	3275		1560	2780
	277	32XX		5750	
	700	3270	Mohawk Data Sci.	21/40	STD
CSC	CML-32	3247		21/50	STD
	ML-32	3270	Motorola	RDX-1000	3270
Dacoll Engineering	DL180 VDT	2700	Northern Telecom	Data 100/74	3780
	246	3270		Data 100/77	3780
	246	3271		Data 100/78	3780
Data Term. & Comm.	382 V	2741		Data 100/82	3271
Datagraphix	132-70	3270		NTSC 435	
Datapoint	3670	3277/2		NTSC 440	3770
Decision Data	3751-11	5251-11		Sycor 255	3275
Digi-Log Systems	Microterm II	2780		Sycor 257-2	3270/75
DMC	DMC 270	7441		Sycor 290	3270
ECD	Smart ASCII	OPT	Olivetti	TC800	3270
ECS Microsystems	4000	3270, 1	Paradyne	PDS270	3277,8

portable, color and word-processing high-end units will stay as expensive as their individual applications allow.

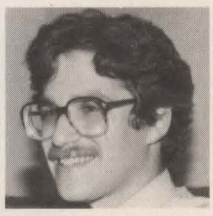
The intelligent-terminal industry promises the highest profits and risks. Prices and margins are high and flexible, but so are off-line-storage, printer and software-development costs. Manufacturers of stand-alone, general-purpose, intelligent terminals will compete with each other and with μc vendors. Commercial μc systems commonly communicate with larger computer systems and sell for less than intelligent terminals with similar software, memory and off-line storage. Memory-, μp- and diskette-system prices are stabilizing, just as those of display tubes, keyboards and power supplies have, and prices for basic intelligent units should be defined and competitive in the next eight months.

Manufacturer	Model	Compatible Model
	PIX-II VDU-77	3277
Pencept	Handprint	
Perkin-Elmer	3500	3275
Perry Data Systems	PDS 9800	3101
Pertec	CMC 1800	2780
Phone 1	P1-11	3277
	P1-14	3277
Racal-Milgo	4276	3275,6
	4278	3278-2
Ramtek	8410	3740
	8450	3275-BSC
	8460	3275-BSC
Raytheon	PTS 100	3270, 4
	PTS-2000	3278
	1001A	2946
SCI Systems	2404	3275
Sperry Univac	Uniscope 200	270X
SSTI	Series 8100	3270
Tab Products	701	
	700	27XX, 37X
Tandberg (Norway)	TDS 8030	3270
	TDV 2114	3270
Tektronix	4027	3271
	4051	2780
	4052	RJE 2780
	4054	RJE 2780
Telefunken	SGT 3205.000	Yes
	SGT 3205.100	Yes
Teletype	40/4	3277
	4540	3270 OPT
Telex	TC275B	3275
	TC276	3276
	TC277D	3270
	TC278	3278
Texas Instruments	770/1,2	3780
	771/1	3780/278
Thomson-CSF	TSC	3270 OPT
Transac	VMP 70	3270
Trivex	+ 70 (0712)	3271
	+ 70 (0712M)	3271
	+ 70 (0722)	3272
	+ 70 (0752)	3275
	+ 70 (0722)	3277-2
	+ 80 (8078)	3278
	+ 80 (8079)	3278
TRW Data Systems	2001	370
Vydec	1200	2741
	1800	2741
	2000	2741
Wang	2200 PCS-111	

Manufacturers of intelligent terminals for distributed-processing applications will find themselves competing as system vendors rather than terminal vendors. Datapoint, Four-Phase, Northern Telecom and others will compete against minicomputer vendors, such as DEC, Honeywell, and Hewlett-Packard, rather than against mainstream terminal vendors. As 16-bit μcs become common among intelligent terminals, they will become even less distinguishable from minis and small business systems.

Proprietary operating, communications and other software will keep prices for these units high, but terminal vendors will have to offer field service, large peripheral-software support and flexible leasing arrangements to be competitive with minicomputer vendors. A firm vendor commitment to distributed processing will amount to that vendor leaving the terminal industry and entering the minicomputer industry.

The differing futures of the display-terminal subindustries reflect the evolving needs of the various sub-markets they serve. Each sub-industry is in a different stage of development, as the introduction and price-distribution graphs illustrate, but each serves its buyers well. As an industry matures, efficient and innovative producers prosper, while inefficient or redundant producers are forced to reorganize or leave the market. Attrition that is caused by consumer forces rather than by predatory or monopolistic competitors is natural in a free-market economy and serves the consumer. Many companies have folded in this dynamic industry, but an equal number enter the market every year, providing users with more attractive and numerous choices than ever. The display industry is not dominated by IBM and the other giants in the same way as the mainframe or minicomputer industries, and monopolistic competition among a few giants is unlikely in the near or distant future. ■



Patrick Kenealy and **David H. Freedman** are editors of Terminals Review and Display Pricing Strategy Service, published by GML Corp., Lexington, Mass.

THE LAST THING WE'LL SELL YOU IS A TERMINAL.

There are hundreds of CRT terminals on the market. Some good. Some not so good. And you can buy most of them, right off the shelf. So why do more large-volume users specify Zentec? It's simple really. We provide intelligent solutions to your information processing needs. It's our business. And our solutions don't begin with a terminal. They end with one.

The Total Solution—a Custom Approach
The solution begins with you, with your system and business objectives. We work with you to help analyze and set your objectives from the viewpoints of marketing, engineering, manufacturing and your customer. Then our hardware and software team applies your solution requirements against our modular systems. We implement a unique terminal workstation around a flexible minicomputer-like bus architecture and threshold LSI technologies. In short, Zentec provides a custom solution... custom keyboards, custom printed circuit boards, custom software, firmware and even packaging... whatever it takes to solve your problem. All at a very competitive price.

Lower Cost of Ownership—the Intelligent Investment
Quality is a fundamental part of every Zentec terminal system. Since the last decade, we've met and surpassed the quality requirements of the nation's leading large-volume users. Our manufacturing processes assure the highest product quality and reliability standards. Each component, subsystem and system is 100% tested. Burned in. Then tested again. As a result, our DOA (Dead-On-Arrival) rate is less than 1%. This means you can eliminate testing our terminals prior to shipment to your customer. And our MTBF (mean time between failure) is over 10,000 hours. That translates to fewer service calls. But even if a call is necessary, our MTTR (mean time to repair) is now under 20 minutes. Work the entire equation: *competitive price + low DOA + long MTBF and short MTTR = low cost of ownership.*

Custom Solutions—Added Value
The fundamental values of a custom terminal can add up to your most intelligent alternative, specifically:

- Code executed at the terminal workstation level reduces host overhead, extending the life of the host system.
- More terminal workstations can be supported by the host with faster response time.
- Faster response time, keyboards customized to meet application requirements and other ergonomic features add up to high operator productivity.
- Value-added terminal workstations assure greater control of the aftermarket for your products.

Get Off the Shelf, and Back into Business
Custom configuration. Quality. And lower cost of ownership. They're three important reasons why more and more companies are coming to Zentec for intelligent solutions to information processing problems. Companies like R.C.A., G.T.E., Tandem Computers Incorporated, McDonnell Douglas, and United Press International. For more good reasons, send in the coupon below. Or call us at (408) 727-7662. It may be one of the most intelligent moves you've ever made.

ZENTEC™

2400 Walsh Avenue, Santa Clara, CA 95050
(408) 727-7662

Sales Offices: Long Grove, IL (312) 634-9550; Playa Del Rey, CA (213) 822-0278; Richardson, TX (214) 690-9265; Rockville, MD (301) 762-7990; Santa Clara, CA (408) 727-7662; Walpole, MA (617) 668-6713; White Plains, NY (914) 428-2801; West Palm Beach, FL (305) 684-8898.

OK Zentec, tell me more about your intelligent alternatives. Please—

☐ Send me product literature.
☐ Have a Zentec representative contact me.
☐ Call me at ( ) _____

Name: _____

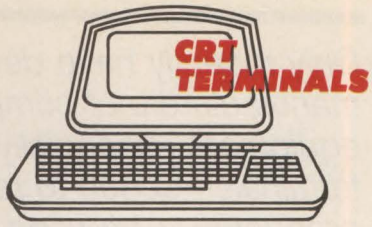
Title: _____

Company: _____

Address: _____

City: _____ State: _____ Zip: _____

CIRCLE NO. 56 ON INQUIRY CARD



Providing terminal comfort

CATHERINE RAFTERY & JOHN KEENER, Lear Siegler, Inc.

The modern terminal can't offer eternal peace, but it can be most accommodating

It has been said that when it comes to finding tools and appliances that are easy to use, nobody has to search longer than a left-hander. There is another larger group, however, that may have an even more valid claim on the title of "Forgotten Consumer." Anyone whose physical proportions and capacities are not quite average has occasionally experienced the discomfort of working with implements that are not quite right. Why? They were engineered for the "average" user—that special breed who is not nearly as numerous as designers have believed. Only recently have developers and manufacturers of computer equipment—especially CRT terminals—begun to realize that if their product is to be used by a variety of operators, it must be adjustable to each individual.

The National Institute for Occupational Safety and Health (NIOSH) reports that 5 to 10 million video-display terminals are being used by more than 7 million operators. This tremendous proliferation of CRT units has resulted in concern for the health of those who work with the equipment over prolonged periods. Designing "user-friendly" terminals has become an important consideration for manufacturers and OEMs that integrate the units into their systems. As a result, buyers of these products can now select from an ever-increasing array of terminals engineered specifically for long-term comfort. CRT terminals now have components that detach, tilt, swivel, rotate and respond in various other ways to the needs of the operator.

Lear Siegler's ADM 42 Ergonomic Terminal *console has a 15-in. tiltable screen with an anti-reflective surface, high-resolution monitor controls for contrast and brightness, a tiltable monitor, a detachable keyboard and 32 touch-sensitive screen pads that activate pre-programmed functions.*

Ergonomics—minimizing discomfort

The study of the physiological interaction between

Only recently have developers and manufacturers of computer equipment—especially CRT terminals—begun to realize that if their product is to be used by a variety of operators, it must be adjustable to each individual.

man and machine is called ergonomics. In response to the many ergonomic studies conducted during the past couple of years and the growing demand for products that are comfortable, designers have begun to incorporate features into their CRT terminals that improve operator productivity by minimizing discomfort, error and fatigue. These ergonomic features involve all terminal components, including case, screen, keyboard and electronics. A buyer may not need a terminal loaded with ergonomic features, and should weigh each feature against its price. An occasional user should consider that ergonomically featured products may not be justified. However, in situations in which a terminal is an operator's main tool, comfort is a key concern. The buyer must decide which ergonomic features he must have and which he can do without. If he makes his selections with his own operation in mind, he will probably choose wisely.

Research indicates health problems

NIOSH—the main organization studying ergonomics—found that employees using terminals regularly had far more health complaints than non-users. Visual problems ranked as the most widespread complaint, specifically, blurring, itching and burning eyes. NIOSH discovered that workers trying to compensate for their discomfort often assumed awkward body positions at the screen, resulting in backaches, neck aches and

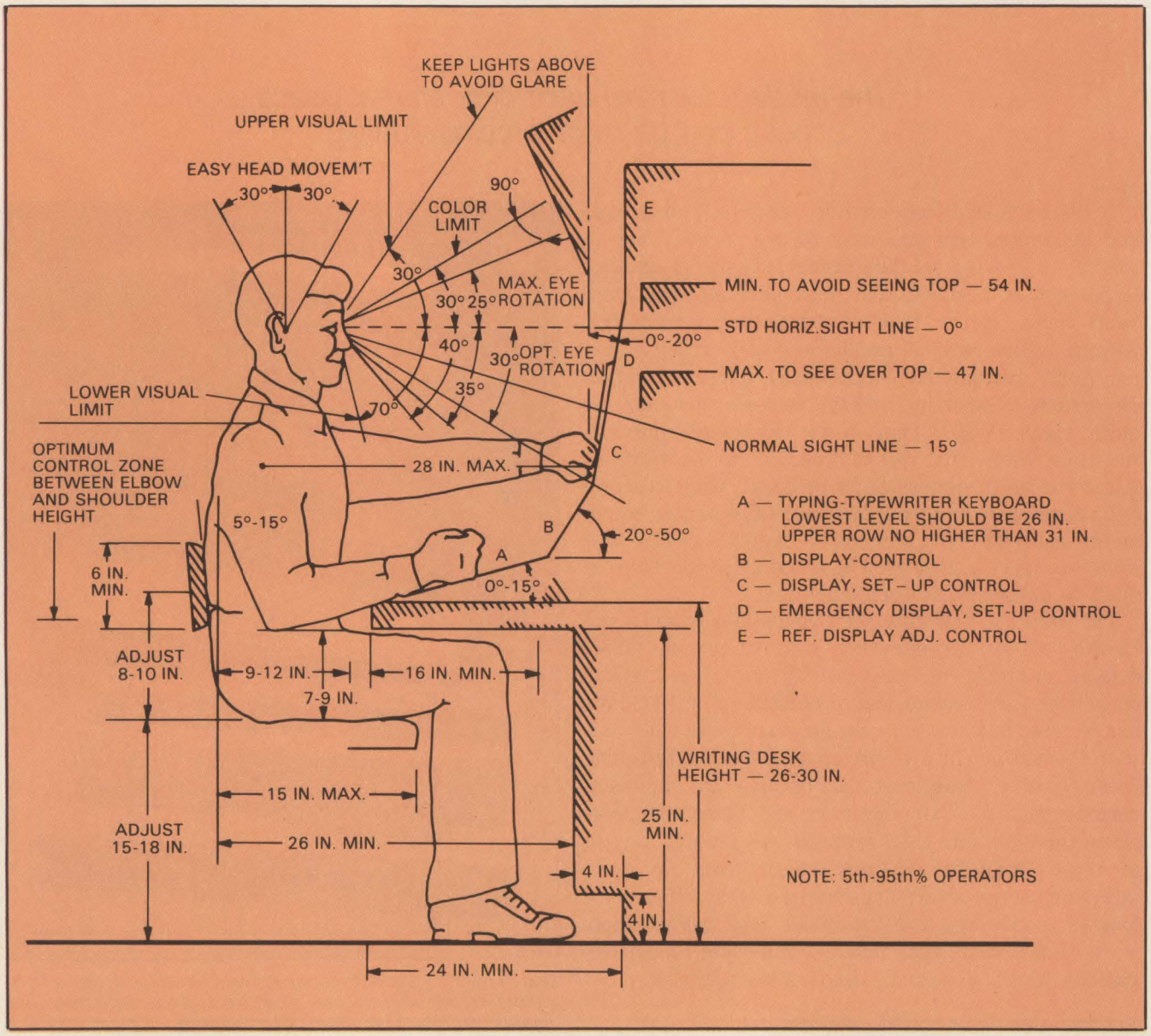


Fig. 1. The ideal ergonomic work station *is one in which everything can be adjusted for maximum efficiency and comfort. Chart is courtesy of Design West, Irvine, Calif., and statistics are from* Measure of Man: Human Factors in Design *(published by Henry Dreyfuss & Associates).*

FOR $650, ANYONE CAN SEE OUR VIEWPOINT.

Now any business person can afford a computer display terminal. And businesses which have only one or two can easily add more.

It's all made possible by a remarkable new display unit called ADDS Viewpoint.

Through advanced microtechnology, ADDS Viewpoint offers the capacity and high performance features of display terminals costing hundreds of dollars more.

In fact, you could own **three** Viewpoint terminals for about the price of two ordinary terminals.

And no terminal has been more carefully designed for the end user.

Viewpoint features a full-size screen in a smaller, space-saving cabinet.

The typewriter-like keyboard connects to the CRT unit with a stretch cord. You can move it to one side or put it on your lap for ease of use.

Two-position screen tilt gives you added viewing convenience.

And, if you work with foreign languages, you'll be delighted to discover that Viewpoint comes with six switch-selectable international character sets.

Viewpoint is available in two models (A, B). Model B, in addition to all the other features, includes a glare filter.

These are just a few of the reasons why, at $650, you're bound to see our Viewpoint. For a demonstration on your own system, send the coupon.

SOMETHING EXTRA IN EVERYTHING WE DO

ADDS
Applied Digital Data Systems Inc.
VIEWPOINT

Applied Digital Data Systems Inc. MM-8
Department MC, 100 Marcus Blvd.
Hauppauge, NY 11787 (516) 231-5400

Gentlemen: I wish a demonstration of your new ADDS Viewpoint display terminal on my system.

I am: ☐ End user ☐ OEM ☐ Distributor

My anticipated yearly quantity is ( ) display units.

Name_____

Title_____

Address_____

City_____ State_____ Zip_____

Telephone_____

CRT terminals have received more attention than other equipment because they are an operator's direct link with a computer.

other muscular problems. Fortunately, in all cases, these disorders were only temporary.

Researchers have not determined, however, the exact causes of these health problems. NIOSH concluded that the issue is far too complex to be the fault of the CRT terminal alone. A worker's entire environment—his physical traits, stress threshold, computer experience and the tasks he performs—can contribute to his discomfort. Lighting, angles of the equipment and desk and chair heights are also possible factors (Fig. 1).

Ergonomic improvements

CRT terminals have received more attention than other equipment because they are an operator's direct link with the computer. This focus on terminals has spurred modifications of three components in particular: the keyboard, the screen and the case.

Keyboards today are detachable to enable users to position them independently of the display to conform to individual spatial requirements. They are also being made heavy enough to prevent sliding during operation, yet light enough to be easily moved.

According to the book *Measure of Man: Human Factors in Design* (Henry Dreyfuss & Associates), keyboard dimensions and organization are almost as important as detachability. There should be 28 cm. from the top of the operator's seat to the tops of the keys. The keyboard should be sloped at a 5- to 15-degree angle, like that of a typewriter. The distance from the base of the keyboard to its home keys should be less than 50 mm.; 30mm. is ideal.

The keys should operate at 0.25- to 1.5-in.-per-lb. pressure. Spacing between adjacent keys is optimal at 18 to 20 mm. to prevent mishits. Catastrophic damage to work can occur, for example, if the break key is accidentally struck. Concave or dished home-row keys with a matte finish to minimize reflections also improve operator accuracy. To avert other errors, certain functions, such as terminal reset, should require a two- or three-key command. Some ergonomic keyboards emit an audible feedback when a key is depressed.

Finally, keyboard organization can help eliminate stress. Most operators are more familiar with the arrangement of a typewriter keyboard than that of a Teletypewriter. Providing a familiar tool eliminates a training step and makes the terminal less intimidating. The same is true for a numeric keypad configured in a calculator layout (7, 8 and 9 in top row) or telephone format (1, 2 and 3 in the top row). When the numeric pad is used for accounting, for example, calculator format is preferable. Function keys should be a different color or shape from the alphanumeric section of the keyboard.

The CRT screen of most video-display terminals is usually fixed at an angle of 10 to 15 degrees from the vertical—ideal for a person of average height. Ergonomically designed terminals, such as Lear Siegler's ADM 32 and ADM 42, offer adjustable screen tilt, usually from 5 degrees forward to 15 degrees backward. Research indicates that operators should be able to position their line of sight within 15 degrees of a terminal's central axis. A rotatable screen is also helpful when an operator must move about while entering data.

The properties of a screen are critical if visual problems are to be averted. Ergonomic terminals incorporate features to offset glare and flicker as well as to improve character quality.

Anti-reflective properties can be built into a CRT screen. Coatings, plastic panels and etching reduce glare from the polished glass of standard CRT faceplates. If the phosphor of the display screen has a long persistence, a user may see trails after the characters; too short a persistence causes flickering.

Some terminals offer variable-brightness control. If the screen offers only dual intensity, however, a user should make sure that both levels can be read without difficulty.

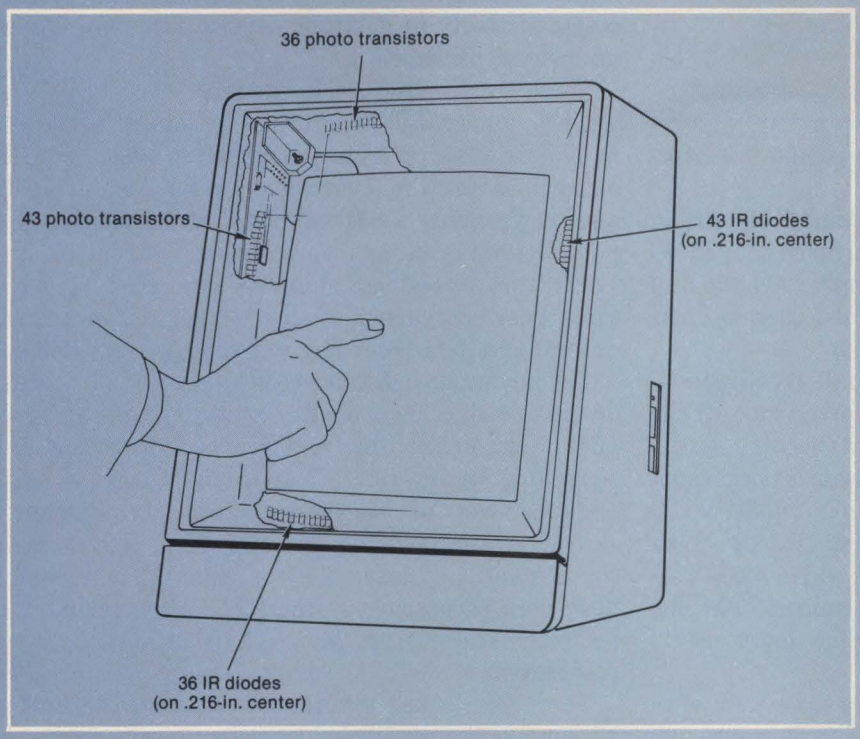
High-quality character display should be a priority in terminal selection. Characters generated by dot matrix, for example, should merge individual dots closely enough to produce a well-defined image. The width of the characters should be approximately 70 to 80 percent of upper-case-character height, and the space between characters should be between 20 to 50 percent of character height. Row space is optimal at 100 to 150 percent of character height. There should be a marked distinction between similar characters, such as X and K, O and Q, T and Y, S and 5, I and L and U and V; O and 0 are often hard to differentiate. In addition, the cursor should be a conspicuous part of the display.

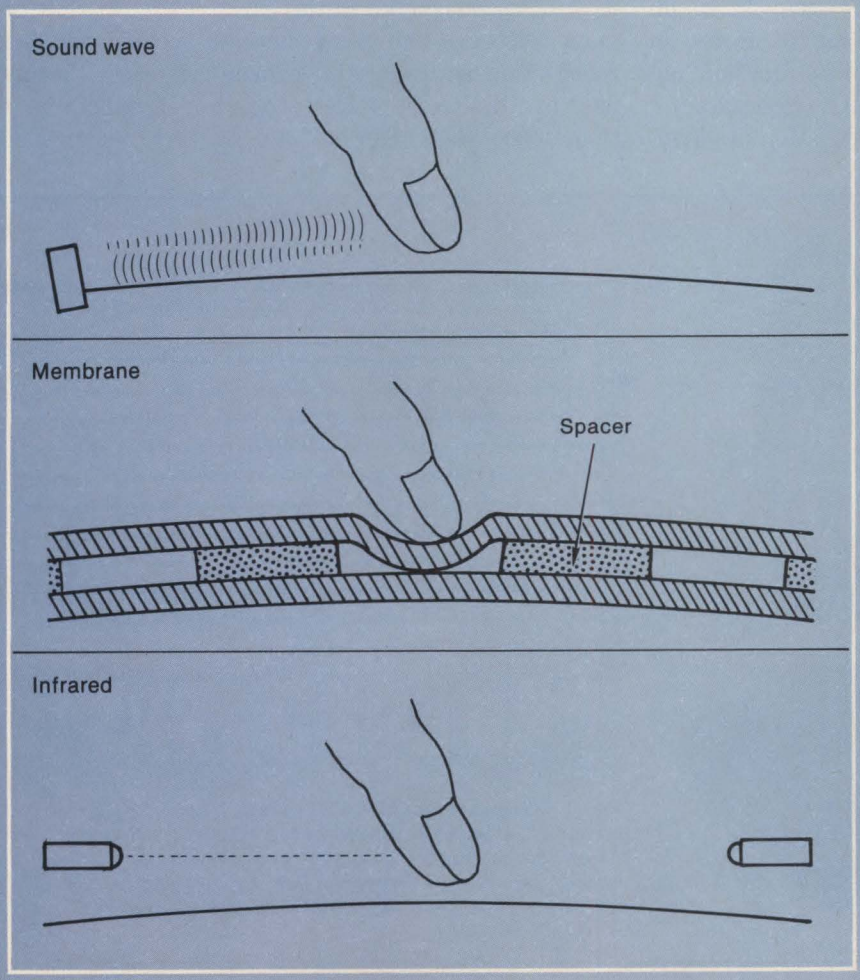
The cabinets of ergonomic terminals are also undergoing changes to include an overhang above the display, which prevents screen glare, and a front-edge keyboard-housing extension on which an operator can rest his hands.

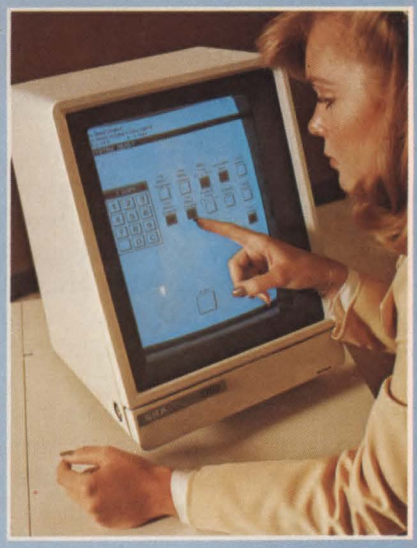
As video-display terminals become increasingly commonplace in the office, it becomes more important for the units to be both unobtrusive and attractive—much like a telephone or typewriter. The terminal should be small enough to require minimum desk space and should be a neutral color to blend with a variety of environments. The case should have a matte finish to minimize glare, its material should be textured to hide wear and scratches, and its keycaps should be a dark color to conceal fingerprints. Finally, openings in the terminal should be kept as small as possible to reduce the likelihood of tiny objects falling into the unit's electronics.

Certain terminal functions, intended for ease of use, can be considered ergonomic features. These include

APPROACHES TO TOUCH







The three major approaches used in touch-control CRT terminals employ acoustic, resistive-membrane or infrared principles.

The first method uses acoustic surface waves on a transparent surface. The presence of a finger or some other object causes the waves to be reflected. Echoes are then detected, and the times between the wave creation and the echoes determine the X-Y position of the finger for system operation.

The membrane approach makes use of a two-sheet overlay on the CRT screen. One overlay is glass-coated with a transparent resistive substrate; the other is a plastic membrane with a transparent conductive layer. The voltage of the signal varies with the point of finger contact, and measuring sensors compute the X-Y coordinates of the touch.

In the third approach, infrared light is used as the signal, and photodetectors form the signal receiver. The visual display screen has touch-sensing elements mounted around it to form an emitter-detector matrix. This matrix forms a series of crossing light beams that cover the screen and are interrupted when someone touches the screen. The coordinates of the interrupted beam are relayed to the controller, which relates the coordinates of the screen button touched by the user.

The Xerox 5700 electronic printing system (MMS, November, 1980, p. 26), shown in the photo and diagram, uses the infrared touch-input system supplied by IR pioneer Carroll Manufacturing Co. (MMS, March, 1980, p. 76).

As video-display terminals become increasingly commonplace in the office, it becomes more important for the units to be both unobtrusive and attractive—much like a telephone or typewriter.

editing, visual attributes, function keys and operator-feedback features such as a status line.

Today's terminals offer a broad range of editing capabilities. Some conversational terminals, such as Lear Siegler's ADM 5, allow erasure only to the end of the line or page, while smart terminals, such as Lear Siegler's ADM 32, offer complete editing.

Some applications require visual attributes—blinking, blanking, underlining or reverse video. If the primary purpose of a system is forms-data entry, visual attributes make an operator's job much easier. Constant data can be displayed in one video mode, while variable data is entered in a highlight mode. Like editing capabilities, various levels of video-mode features are available. Some low-cost terminals offer one or two of the visual attributes, while more costly terminals provide all of them.

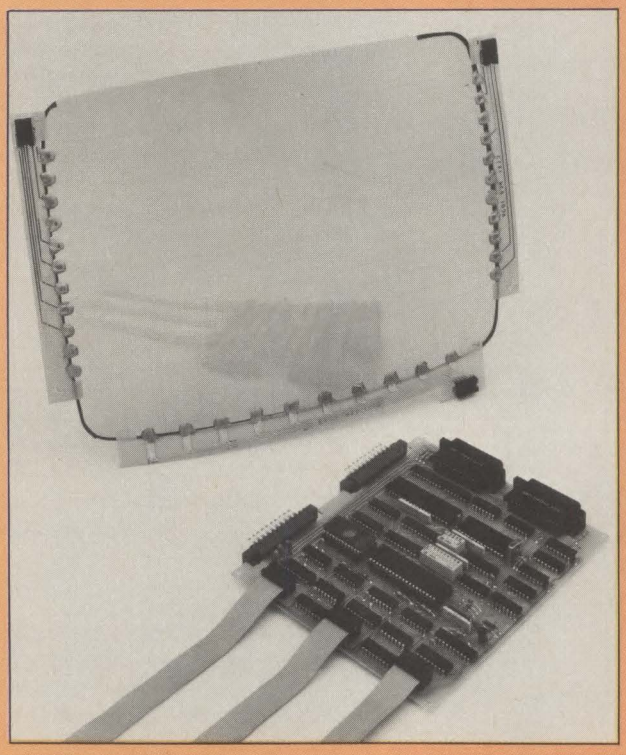
Whenever an operator can enter the same data with one key instead of several, productivity is improved. Programmable function keys permit this. If a job involves a phrase or data string, it can be stored in function-key memory so that every time a function key is actuated, a string of characters will be generated.

Two new technologies that make operation of video-display terminals easier by limiting or eliminating the use of a keyboard are voice-recognition and touch-sensitive screen terminals. Both are useful for non-typists and novice computer-users because they don't require typing to access important data. These technologies, formerly prohibitive in price, are now available in low-cost packages.

Voice technology. Forecasters expect the U.S. market for speech-recognition products to be $100 million by 1984, up from $10 million in 1980. Voice data entry is useful whenever the operator is entering data and performing a second task concurrently. Some potential applications include inventory control, quality-control inspections, shipping and receiving inspection, order entry (such as airline reservations and sales orders) and data recording in scientific laboratories.

The advantages of voice technology are significant: a dramatic reduction in operator training time and error, faster data-entry time and reduced operating costs. According to Interstate Electronics Corp., a leading manufacturer of speech-recognition equipment, a skilled word-processing operator takes approximately three months to learn the command structures for a new word-processing system. The same operator can learn the material in two days using automatic voice recognition.

There are some limitations to voice technology, although there have been dramatic improvements since it was first marketed in the early 1970s. At that time, most systems had very limited vocabularies, poor recognition accuracy and exorbitant prices. Today, a user can buy some voice-recognition products for less than $5000—less than half the price of their predeces-



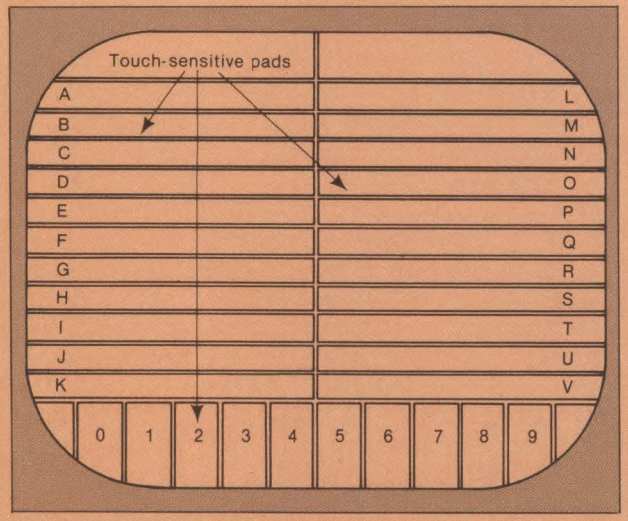


Fig. 2. The touch-sensitive CRT screen *has 32 nearly invisible pads (A-V, 0-9) that respond to the touch of a finger so that users can conduct an interactive dialog with the terminal to obtain information from on-line files without any prior training. This unit is from Interaction Systems, Inc., Newtonville, Mass.*

STR® technology for high data integrity. Three major tape formats for design flexibility.

We don't forget the OEM's needs.

The STR-810 digital recorder is designed for data logging, data acquisition and as a system loader. Using either the 3M DC-300A or DC-300XL cartridges, packing density is 1600 bpi, for respective data capacities of 2.3M bytes and 3.4M bytes per cartridge, using four tracks. Features include microprocessor-controlled tape movement and read/write electronics. For maximum versatility, interfaces include RS-232 and IEEE-488. Or, using control and status lines available, you can interface to specific microcomputers such as LSI-11 and 8080. EPI's optional ANSI X3.56 formatter, with NRZI or phase-encoded personality cards, turns the 810 into a plug-in component for industrial instrumentation and mini/microcomputer-interfaced peripheral markets. Price: $756 in quantities of 100. **STR-STREAM** is a high-speed, high-capacity version of the 810 designed for Winchester disc backup. Density is 6400 bpi for 17M bytes capacity per cartridge. Features include advanced head design, MFM formatting and compatibility with 8" or 14" discs.

CIRCLE NO. 115 ON INQUIRY CARD

EPI's STR-610 is a compact, low cost digital recorder that's ideal for use with POS terminals, smart CRT terminals and as a general peripheral for mini/microcomputer-based systems. The 610's recording density is 800 bpi for a capacity of 168K bytes/track, using a two-track 3M DC-100 mini-cartridge. Formatting is ANSI Standard and interfacing is parallel, with a variety of options. Price: $280 in quantities of 1,000. **The STR-LINK III** is a high-speed (9600 baud), portable program loader that uses the STR-610's drive system and shares the same specifications. It is used as a field service tool for diagnostic work or as a peripheral in a mini/microcomputer system. STR-LINK III uses a serial RS-232 interface for data communications or data terminal applications, and it can be controlled through RS-232, ASCII control codes, or manually. Price: $1,615 in single quantity.

CIRCLE NO. 116 ON INQUIRY CARD

STR-LINK II is EPI's proven medium-speed (1200 baud) universal portable program loader for programmable controllers and process control systems. Using a standard cassette, it features switch-selectable transmission modes for maximum flexibility. Price: $1,889 in single quantity.

For maximum design freedom, proven reliability and high data integrity through Speed Tolerant Recording technology, remember EPI—the company that doesn't forget the OEM's needs. For more information, contact Electronic Processors Inc., P.O. Box 569, Englewood, Colorado 80110. Phone (303) 761-8540.

EO/4

CIRCLE NO. 117 ON INQUIRY CARD

Let EPI remember for you.

ELECTRONIC PROCESSORS INCORPORATED

Two new technologies that make operation of video-display terminals easier by limiting or eliminating the use of a keyboard are voice recognition and touch-sensitive screen terminals.

sors. Although many still have a vocabulary of only 100 words or so, recognition capability is now better than 99 percent. Most systems are still speaker-dependent, which means that an operator's vocal patterns must be programmed into the computer by repeating the command words or phrases several times. These sounds are then converted into digital codes and stored in computer memory. When a user intones a command, a digital code for the new sound is compared with the stored data until the two signals match (Fig. 2) or verification is achieved.

Touch-sensitive screens. Touch-sensitive screens, like voice recognition, simplify communications with the computer. Touch screens operate with sensitive pads that respond to the touch of a finger (Fig. 2). The screen is activated by a human body's capacitance, which is detected by sensors. In this way, users who are unfamiliar with data-processing equipment can conduct an interactive dialog with a CRT terminal to obtain information from on-line files.

Touch-sensitive capability has applications in perhaps the broadest market of all—the general public. Using a menu-selection mode, these terminals take the video-display terminal into airport-terminal flight directories, hospital-patient data, executive-suite financial analysis, department-store merchandise information, library card catalogs and museum and national-park directories. ■

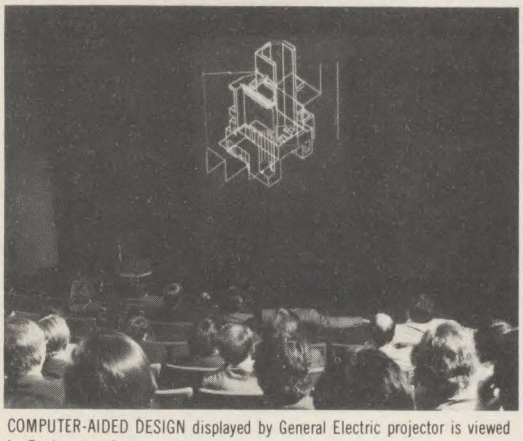
Catherine Raftery is director of product marketing, and **John Keener** is director of terminal development at Lear Siegler, Inc., Anaheim, Calif.

NEXT MONTH IN MMS

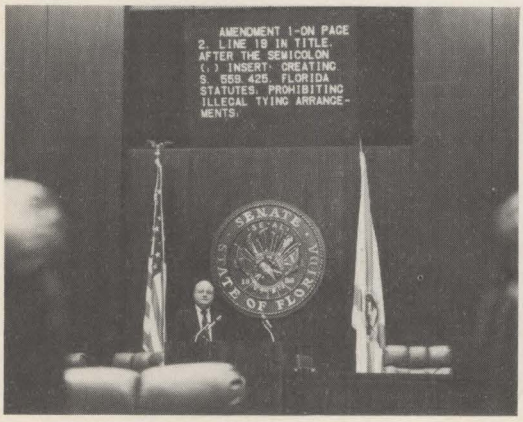
Two major product profiles—surveys of products and trends in two categories—will highlight the feature article section of Mini-Micro Systems in September. They are single-board μcs and analog input/output boards for computer systems

In the first of these, Contributing Editor Mal Stiefel will survey a broad range of single-board μcs that are offered as standard, off-the-shelf products for integration into stand-alone systems, smart terminals, communications processors and other equipment. Extensive tables for product evaluation will accompany the article.

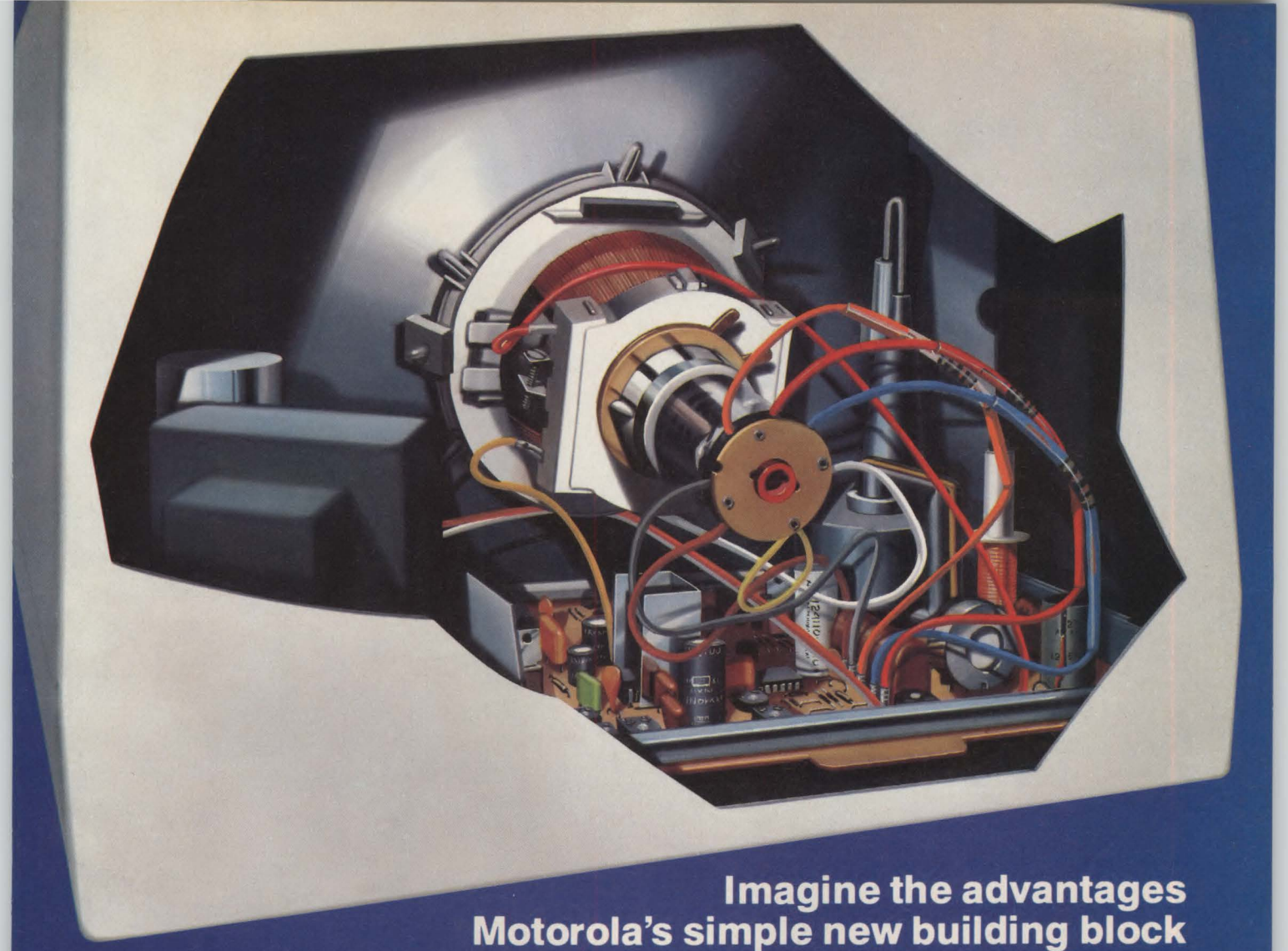
The other product profile will explore the latest developments from builders of board-level units that link digital mini- and microsystems to the analog world. These analog I/O subsystems acquire and convert data such as temperature and pressure for use by a computer.



COMPUTER-AIDED DESIGN displayed by General Electric projector is viewed by Engineering Society of Detroit.



WORDS "PUNCHED UP" by clerk of Florida State Senate are inspected carefully before a vote.



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.

MOTOROLA

Display Systems

1299 E. Algonquin Road Schaumburg, IL 60196
312/397-8000

CIRCLE NO. 59 ON INQUIRY CARD

If you're still looking for the best 5¼"

rigid disk drive, you haven't found us yet.

Hard to believe, perhaps, but our 5¼" rigid drives rank among the highest in storage capacity. No one ships as many 5¼" floppy drives. 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

The most successful disk drive company you never heard of.

CIRCLE NO. 60 ON INQUIRY CARD

CalComp's new 36" EPP plots from vector data. Thanks to our new 95X controllers.

CalComp adds an all new 36" Electrostatic Plotter/Printer to our family of EPPs. The new CalComp Electrostatic Model 5500 gives you high quality, full size plots of your CAD/CAM, seismic, mapping, or other engineering drawings.

New controllers drive EPPs and pen plotters.
CalComp's new vector to raster controllers are the first in the industry to drive both electrostatics and pen plotters. These unique and versatile models—for online and online/offline applications—free your host computer from timely and costly conversion tasks. Plus, one controller can simultaneously be attached to eight CalComp electrostatic plotters and a CalComp pen plotter. You add to the configuration as your operation continues to grow. All with one supplier...CalComp.

The best warranty and service available.
The CalComp exclusive one-year warranty on parts and labor is the only one of its kind. Plus, we offer the largest team of systems analysts and field service engineers to help guarantee prompt, quality product support.

There's a lot more to know about CalComp's newest EPP and vector to raster controllers. Contact your nearest CalComp sales office or write for more information.

CALCOMP
A Sanders Graphics Company
SANDERS

2411 West La Palma Avenue, Anaheim, CA 92801 (714) 821-2011 TWX 910-591-1154

CIRCLE NO. 61 ON INQUIRY CARD

Digital's VT-100: modularity by design

ANDREW H. NILSSEN,
Digital Equipment Corp.

The architectural objective of this popular terminal is to provide for continued enhancements

The VT-100 terminal has evolved from simpler designs by separating different technologies into distinct modules that optimize each technology's strong points. The result is an overall design that easily accommodates new features.

Beginnings

Video terminals were something of a novelty in the late 1960s. They had been developed primarily as a substitute for electromechanical teleprinters for use in applications in which hard copy was not as important as rapid data transfer. Video terminals are also quieter, more reliable and less expensive than teleprinters.

The first video terminal developed by Digital Equipment Corp., the VT05, was a very limited device. Like other "glass teleprinters" of its time, it could display only 20 lines of 72 upper-case characters per line, had a parts density high enough to require a fan, weighed more than 50 lbs. and used standard video-display technology.

The VT05's design was fairly rigid. It had a few relatively minor options. For example, parity for error checking was available only as a factory-installed option.

But DEC designers learned many things from the VT05 terminal. Besides verifying that there was a significant market for video terminals, feedback from VT05 users led to the company's second-generation VT50 terminal series.

The most typical of the VT50 series, the VT52, had both upper- and lower-case letters, a 24-line × 80-column display capacity, audible feedback keys and an auxiliary pad of numeric keys that could also double as program-function keys.

The addition *of a graphics-board module converts DEC's VT-100 to the new VT-125, which allows images to be formed of individual dots rather than pre-defined* 5 × 7 matrixes.

From a mechanical standpoint, the VT52 terminal is built around a series of electronic circuit cards or modules arranged to promote natural convection. This, together with the lower parts density of the circuit components, made it possible to eliminate using fans.

From a servicing standpoint, the VT52 needed only to have its baseplate removed to expose nearly every electronic test point, and sufficient space was provided to allow field-service personnel to install a small electrolytic printer for hard-copy output. Unfortunately, the printer proved to be unpopular because of the relatively undeveloped state of electrolytic-printer technology at that time.

A more successful adaptation of the VT50 series was the addition of a large module with a CPU chip and

Editor's note: While the basic VT-100 is nearly two years old, the modular design philosophy of this industry-standard terminal has resulted in widespread industry emulation, plus a series of more recent terminal announcements from Digital Equipment Corp. The new VT-125, described here for the first time, both results from—and is representative of—the subject of this article: DEC's approach to the VT-100's evolutionary design.

The most typical of the VT50 series, the VT52, had both upper- and lower-case letters, a 24-line × 80-column display capacity, audible feedback keys and an auxiliary pad of numeric keys that could also double as program-function keys.

associated circuitry to make a computer-in-a-terminal unit. The module is functionally a PDP-8 minicomputer, and the resulting video-data processor terminal was designated the VT78. While more limited than a general-purpose minicomputer, the VT78 has been used successfully as a stand-alone word-processing system, the WS78, and as an entry-level business computer system, the DEC Datasystem 308.

VT-100 modular design

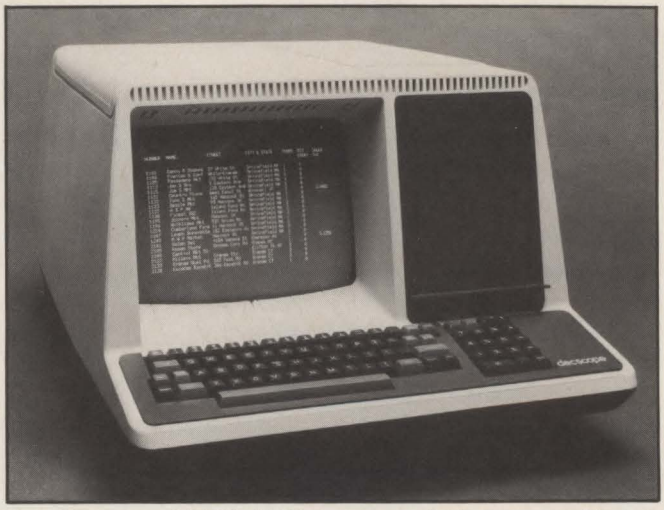
Just as experience with the VT05 went into the design of the VT50, so experience with the VT50 series led to the VT-100. It is far more modular than its predecessors, consisting of only four basic functionally distinct elements: a keyboard, a monitor assembly, a power supply and a terminal controller board.

Keyboard. Unlike previous DEC terminals, the VT-100 keyboard is detached, connected to the remainder of the terminal assembly via a three-conductor, coiled cord that plugs into a receptacle in the rear of the monitor assembly. Thus, a user can position the keyboard for optimal confort and efficiency, and a malfunctioning keyboard can be replaced in a few seconds. The keyboard is patterned after an office typewriter to minimize the need for special training. Above the standard keys, a seven-LED status panel displays whether the terminal is on-line or local or if the keyboard is free or locked. A status word from the terminal controls the "bell" (a small speaker) and the LEDs in the keyboard.

The keyboard connection is serial, asynchronous and full-duplex. A clock signal sent from the terminal along the three-conductor (power, ground and signal) cord controls the key-scanning process. Referenced to the clock signal, the keyboard scans the keys and sends back the row and column location of any key that is pressed.

The terminal controller board (TCB) controls the operating characteristics of the terminal. It uses an Intel 8080 μp chip that accesses 8K bytes of program ROM and 3K bytes of screen/scratch RAM. An additional 8K bytes of ROM firmware and 3K bytes of screen RAM can be added by plugging in the advanced video option (AVO) module, and another 2K bytes of ROM can be installed for custom character fonts.

The VT05, DEC's first video terminal, *is sculptured for aesthetics. The terminal used a conventional electronic design with closely packed circuit boards that required fans for cooling. Its character set included upper case only, and it did not provide for printers or equivalent satellite peripherals.*



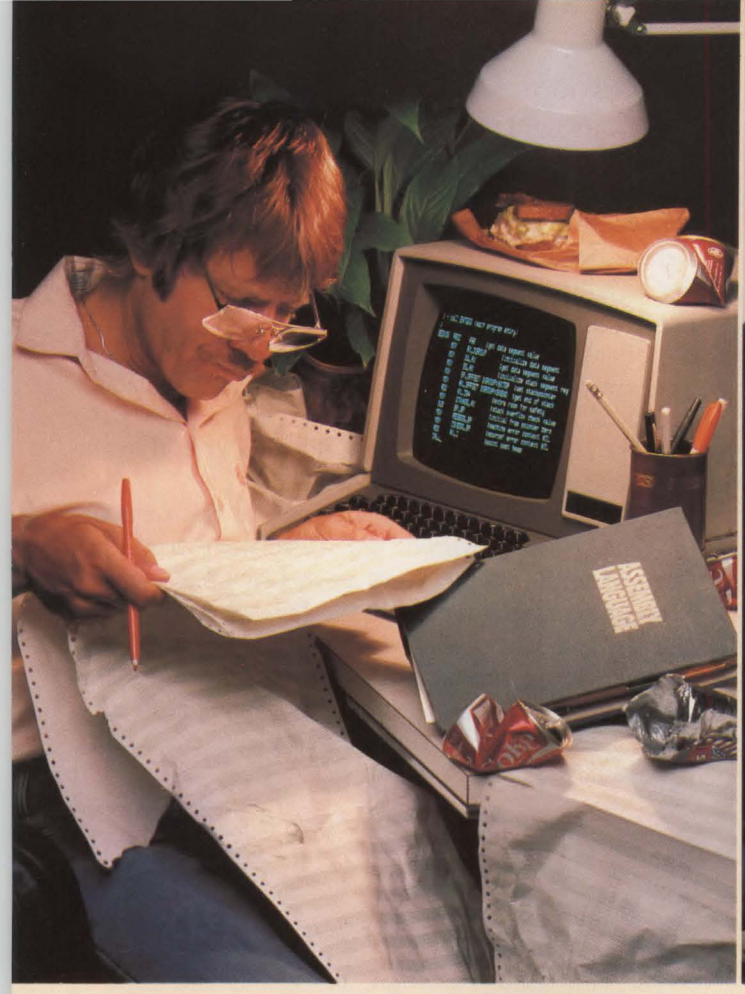
The VT52, one of DEC's VT50 series terminals, *was considerably more versatile than the VT05. A boxlike cabinet and low-density circuit boards enabled cooling by natural convection. The VT52 featured both upper- and lower-case alphabets and an auxiliary keypad for numeric entry and cursor control. Adjustments for baud rate and line/local were made by using a screwdriver on recessed controls on the bottom of the terminal.*

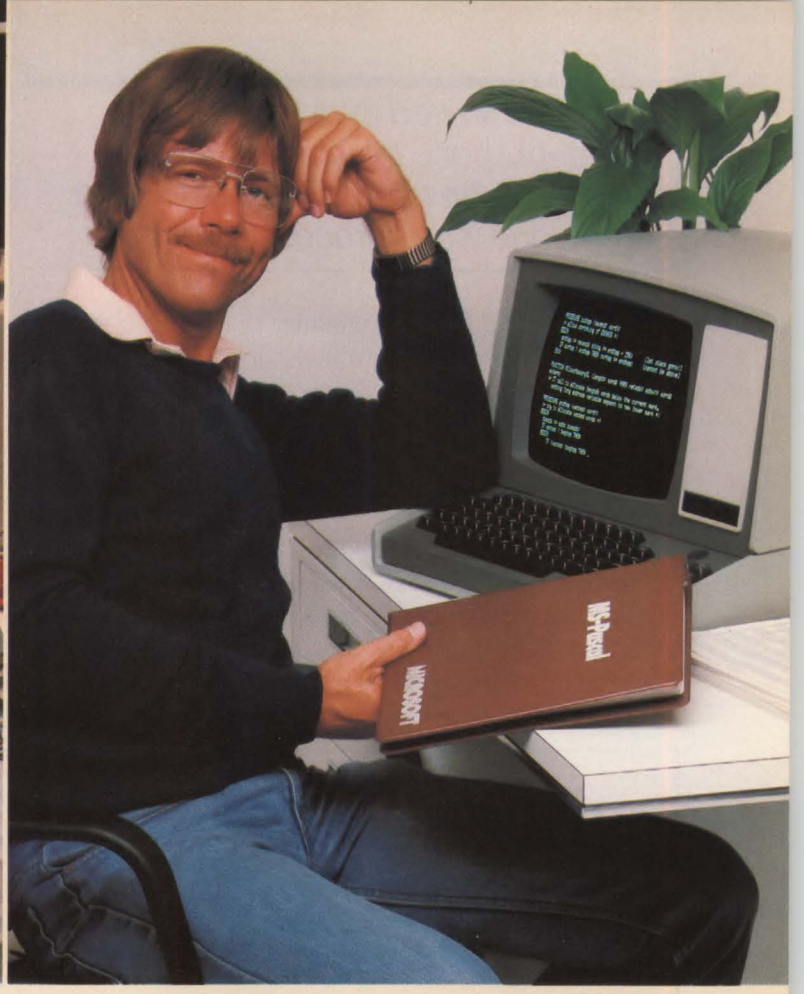
SPLIT TV/VT SCREEN FOR SECURITY APPLICATIONS

The VT-100 can accept video signals as an input as well as outputting its screen contents to drive slave monitors. Video input signals can be "ORed" with the signals from the VT-100's controller board and displayed on the terminal's screen.

A typical application for this capability is in security, in which television cameras used to monitor areas in a secure facility can be interfaced through a video switch to a VT-100. The cameras are synchronized using the terminal's video output signal, and camera images can be displayed on the terminal's screen in conjunction with video-terminal text by using the VT-100's split-screen feature. A typical setup would reserve the top two-thirds of the screen for the video picture and the bottom third for the text.

This arrangement allows a security guard to get a close-up of the identity badges of employees desiring entry, and forward the badge data via the terminal to the computer system to determine authorization status. Unlike conventional badge readers, the visual verification made possible by this technique precludes such practices as having more than one person gain entry by using a single badge.





Now, write better system software. With MS-Pascal.™

Before and after. Until now, if you wanted to do machine oriented programming, there was assembly language. Now, MS-Pascal™ gives you a high level language that allows you to program at the byte, word, address and interrupt level. All in clean, structured, high-level language.

Beyond Pascal. For starters, MS-Pascal is an ISO-standard Pascal native code compiler. But, we took it a few steps further. We added Pascal language extensions that are specifically for system software programming—the programming jobs you thought could only be written in assembly language.

Portability. Your MS-Pascal programs will run, without modification, on any of our target machines. With its machine-independent front-end and code generators for 8-bit and 16-bit microprocessors, MS-Pascal is completely portable. The 8080 and 8086 code generators are available now, including versions compatible with CP/M® and CP/M-86® operating systems.

More system-level extras. Everything about MS-Pascal has been designed for efficiency in system implementation. A global optimizer phase produces tight, fast code. Plus, MS-Pascal comes with its own linker and assembler. And, unlike some versions of Pascal, you can freely call assembly language routines from MS-Pascal programs.

Natural extensions. All MS-Pascal enhancements are natural extensions of the Pascal language. For example, there's a variable-size LSTRING type, special machine-oriented BYTE and WORD types, a unique machine address type, and attributes like PUBLIC for variables and procedures. These and other features make MS-Pascal a structured language with enough fine detail to satisfy even a system-level programmer.

For systems OEMS. Whether you're selling development systems, OEMing microcomputer hardware/software systems, or writing your own system software, MS-Pascal is a time and machine efficient native-code Pascal compiler that means greater productivity for you, your customers, and your customers' clients. And remember, Microsoft also offers BASIC, FORTRAN, COBOL and the XENIX™ operating system.

You don't bet on our software. We do. Microsoft's royalty program offers you low entry-level prices, with payments scheduled on a when-and-as sold basis. Call our OEM Accounts Manager at 206-455-8080 for more details. If you need a programming language that works harder, MS-Pascal is your language. We used it to write the MS-Pascal compilers.

CP/M and CP/M-86 are trademarks of Digital Research, Inc.
XENIX is a trademark of Microsoft.

MICROSOFT

WE SET THE STANDARD

10800 N.E. 8th St., Suite 819
Bellevue, Washington 98004
(206) 455-8080 • TLX: 328945

CIRCLE NO. 62 ON INQUIRY CARD

While more limited than a general-purpose minicomputer, the VT78 has been used successfully as a stand-alone word-processing system.

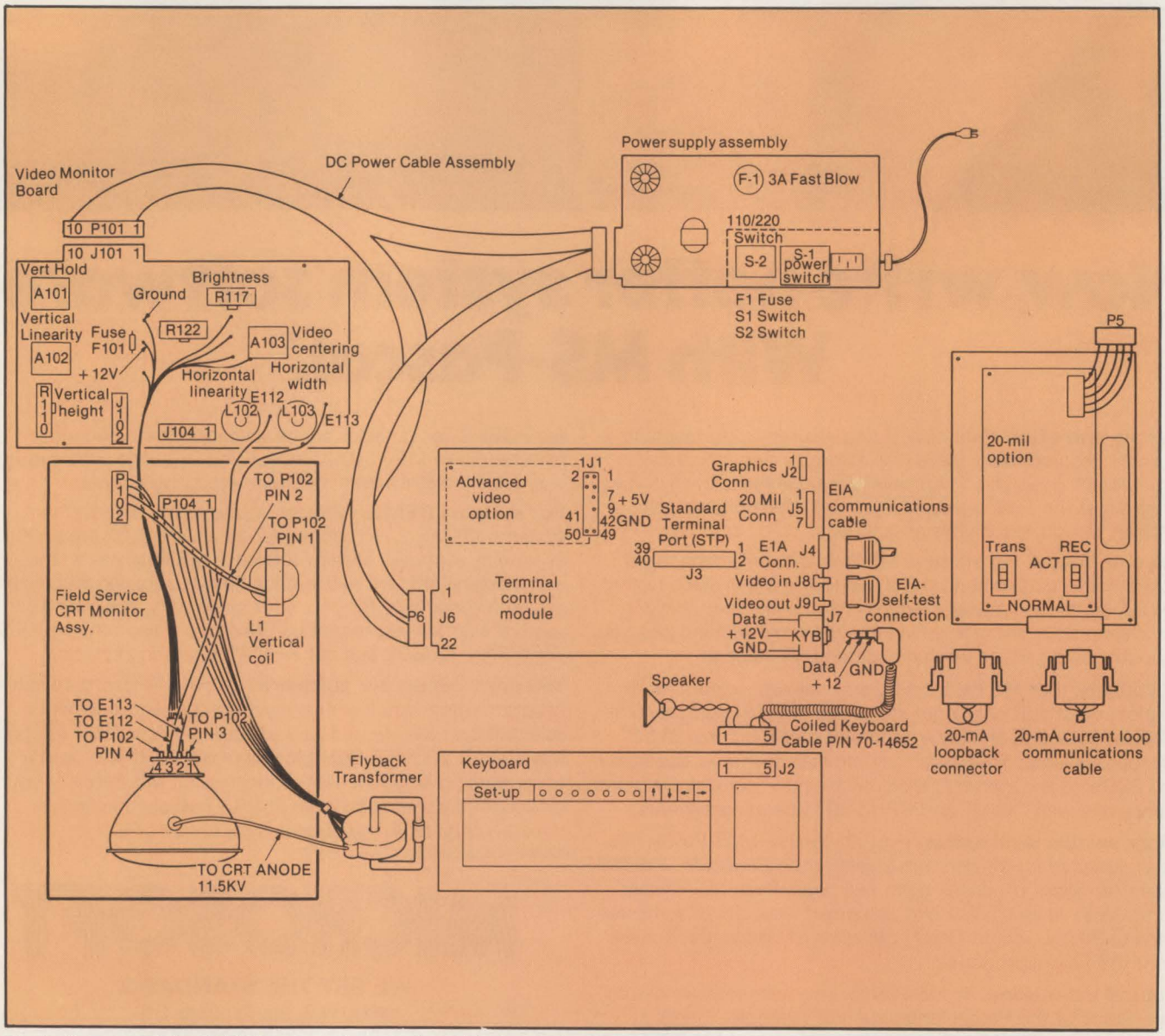
In addition to the AVO module, the terminal-control board has a "standard terminal port," connector, into which an expansion board can be inserted. A typical application of the standard terminal port is to interface the VT-100 terminal with a serial line printer. Other TCB interfacing sockets provide for 20-mA loop and graphics options.

Many of the timing and control functions of the VT-100 terminal are performed in two custom-designed bipolar ICs. Custom LSI enabled designers to offer extended video functions without increasing the number of chip packages on-board.

The VT-100 terminal uses nonvolatile read-write memory (NVR) to save and recall set-up parameters, such as characters per line, transmit and receive baud rates, screen brightness and standard or reverse video, by depressing appropriate keys in the top row. This arrangement removes the need for mechanical DIP switches, resulting in a more reliable unit that is also easier to adjust.

The NVR memory used in the VT-100 can retain its data for about 10 years and 1 billion reads. The component used is an ER1400 EAROM that stores about 1400 bits of data in 14-bit serial form. When the VT-100 is powered up, the μp transfers the data stored in the EAROM to RAM.

The Intel 8080 performs a self-test of the terminal each time it is powered up. Checksum tests are performed on all memory, all keyboard LEDs and the bell are activated, and a check for the end-of-scan character from the keyboard is performed. Any errors are displayed on the screen as a numeric code. This feature, taking advantage of the modular design,

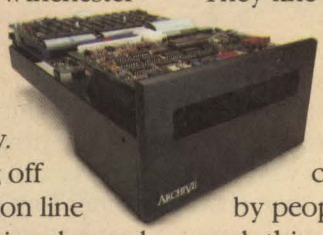


Block diagram of the VT-100 *reflects its overall modularity. Each of these basic sub-assemblies can be easily replaced, expanded or enhanced. Space is provided for the advanced video option at the upper right of the terminal controller module (center).*

MAKING THINGS HAPPEN IN TAPE TECHNOLOGY

ARCHIVE: Leader in advanced tape technology products. Creator of the Sidewinder,™ the first full-production ¼-inch streamer.

Archive makes things happen. Like the Sidewinder. The Sidewinder is the industry's first proven ¼-inch streaming cartridge tape drive backup for your Winchester disk-based computer.



It has become *the* accepted backup solution in the industry. Sidewinders are rolling off an automated production line to meet an ever-increasing demand.

Archive has come a long way, fast. And there's a reason. Archive was formed by an experienced, management group of OEM professionals whose backgrounds encompass the entire spectrum of engineering, manufacturing, and marketing of reliable, high volume, state-of-the-art peripherals. They knew what they wanted to do. They knew what had to be done. They have the money to do it.

Interestingly, Archive is financed primarily by computer people—by people who fully understand such things as R&D costs, start-up time, and meticulous quality control.

It's no accident that Archive is already the leader in the field. They're working on the future now: ***making things happen in tape technology.***

If you'd like to know more about this unusual company, write (on your corporate letterhead, please) for the brand new Archive capabilities brochure.

ARCHIVE
CORPORATION

3540 Cadillac Avenue
Costa Mesa, CA 92626
(714) 641-0279
Telex 683466, TWX 910-595-2458

CIRCLE NO. 63 ON INQUIRY CARD

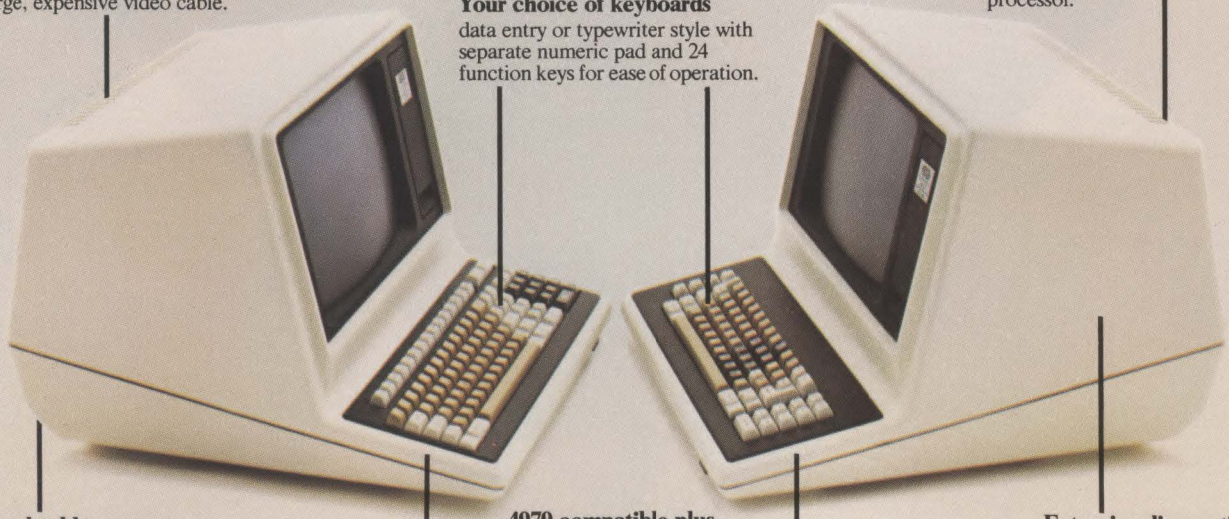
Get more features for your money

Attach your Series/1 to Control Data Display Stations

Easy low cost connection
Digital coupling permits operation up to 4,000 feet from CPU—without large, expensive video cable.

No "attachment controller cards" to buy
Because they're already included—ready for easy direct connection to the I/O bus of your Series/1 processor.

Your choice of keyboards
data entry or typewriter style with separate numeric pad and 24 function keys for ease of operation.



External cable connectors
for ease of installation and deinstallation.

4979 compatible plus many value-adding features and options
All this with no software modifications required.

Extensive diagnostics
and even "self-test on power up" for ease of servicing.

Should you choose a minicomputer on the basis of peripherals available for it? We think so, because it's the peripherals that people actually work with every day. And because the whole peripheral package usually costs more than the processor itself.

That's why we've engineered so much performance and value into our Certainty Series—an entire family of products designed around the Series/1.

Our compact Certainty 610 Series Display Station is more than a 4979 "look-alike."
The Display Station is a full-page terminal, just like the 4979, but with extra features and options. One of its biggest attractions is its ease and economy in connecting it to your Series/1. Ordinary digital cable works fine (installing thick video cable gets very expensive). And you can locate it almost a mile away from the processor. You get a wide variety of other features and options, too. Reverse video, protected fields, anti-glare screen, and a choice of keyboards—both of which include typamatic keys, n-key rollover, home position identification, sculptured keys, and color coding for ease of use.

Yes, we've engineered a lot of customer convenience and versatility into our Certainty 610 design, to give you a lot more than a basic display for your money.

You won't have to worry about service, either. More than 4800 Customer Engineers in our worldwide maintenance organization support our products.

Available Now

Our Certainty 610 Series is ready to help you get optimum performance and ease of operation from your Series/1. For data sheets and more information, call today, toll-free. 800/328-3390.

CONTROL DATA CORPORATION

Addressing society's major unmet needs as profitable business opportunities

CIRCLE NO. 64 ON INQUIRY CARD

The AVO increases screen memory to 24 lines of 132 columns and provides extra memory for custom character sets and as many as four visual attributes per character.

makes the average time to service the VT-100 terminal less than 30 min.

The power supply for the basic VT-100 terminal is a 110/220V switching supply with 95W output capacity at four voltages. The terminal requires about 35W, leaving 60W available for options or additional boards with the terminal's card cage, which has five empty slots.

VT-100 options

Many standard modular options are available for the terminal. The AVO increases screen memory to 24 lines × 132 columns (from a base of 14 lines × 132 columns) and provides extra memory for custom character sets and as many as four visual attributes per character (bold, blink, underline and reverse video).

A firmware change implemented in 8K bytes of additional program ROM on the AVO converts the VT-100 terminal into a smart block-mode local editing unit, the VT-132. In this configuration, the terminal's μp can relieve the host CPU of data-entry tasks.

The optical printer-port board contains an Intel 8085 processor with 8K bytes of ROM and as many as 2K bytes of RAM that is interfaced serially with the communications line.

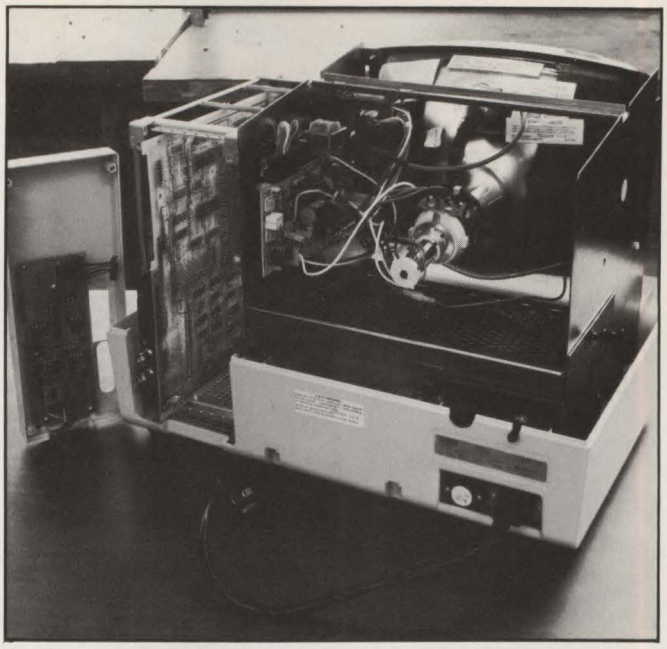
VT-100 + graphics = VT-125

An exceptionally powerful option is a graphics board that uses bit-mapped architecture. Bit mapping gives a programmer access to any pixel on the 768 × 240 pixel screen.

The addition of the graphics-board module significantly extends the terminal's graphics characteristics. The VT-100 terminal, like a typewriter, allows only one pre-defined 5 × 7 pixel character per position on the screen. Drawing a picture under these circumstances is extremely primitive, limited as it is to available character fonts. However, adding the graphics board converts the VT-100 to the VT-125 graphics terminal, which allows images to be formed of individual dots rather than pre-defined 5 × 7 matrixes.

The VT-125 board uses an Intel 8085 μp with 48K bytes of RAM for the bit-mapped screen, 16K bytes of RAM for local user storage of command macros and 24K to 32K bytes of program ROM to drive the graphics instruction set.

The bit map of the VT-125 terminal has two planes, resulting in 2 bits of memory per pixel. This memory can be used to store four levels of pixel intensity, enabling the VT-125 terminal to highlight points on the screen and to perform gray shading. When the VT-125 is used with a color monitor, the shading information is transposed to four user-defined colors.



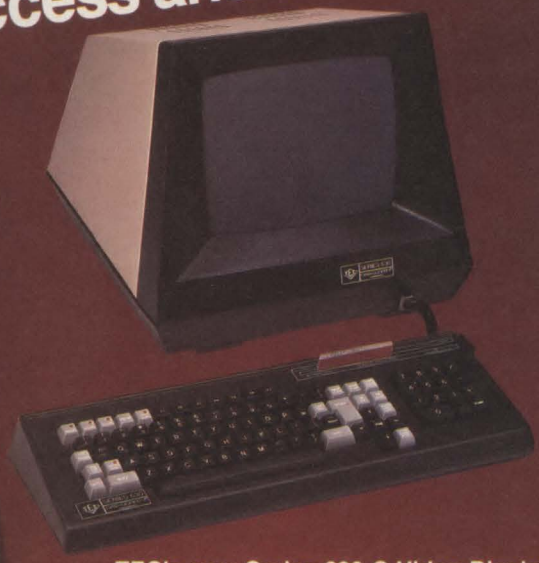
Partly disassembled VT-100 *shows the physical modularity of the terminal. All sub-assemblies are connected by plugs and fasteners for rapid disassembly with a minimum of tools. There is sufficient space within the chassis to permit addition of enhancements and extensions, such as processors, as in the case of the DECmate or the VT-103, or graphics extensions, as in the case of the VT-125.*

The VT-100's case is sufficiently large to enable designers to add hardware if desired. For example, the recently announced DECmate computer system is built around a VT-100 series terminal with processor and memory installed. The resulting terminal has full minicomputer power and functionality, employing a new semiconductor implementation of the PDP-8 processor, and is the basis for a low-cost system for office and commercial applications.

Another variation of the VT-100 terminal is the VT-103, for users who want to configure their own computer-in-a-terminal systems. The VT-103 terminal contains a heavy-demand power supply and a backplane that can accept an LSI-11/2 or LSI-11/23 μc board, plus associated memory and I/O. A user need only establish communication connections between the LSI-11 μc and the terminal circuitry, which can be done internally. The VT-103 terminal's case can also accept a TU58 dual tape-cartridge drive, enabling a user to configure a fairly powerful computer system within a VT-100 case. Reflecting on DEC's earlier designs, there was effectively no room in the VT05 for modification or expansion. When the VT50 terminal series was developed, some modifications could be made, but it was not a very flexible terminal because all its parts were interlocked. By isolating video-terminal functions into modules, DEC has developed in the VT-100 terminal series a highly flexible terminal that has already been adapted to several different configurations. ■

Andrew H. Nilssen is Digital Equipment Corp.'s product manager for video terminals.

NEW! Sophisticated Computer Access and Security



SERIES 630
DATA-SCREEN® TERMINAL

TEC's new Series 630-C Video Display Terminal offers its magnetic stripe card reader keyboard to protect your confidential computer files thru error-free computer authorization.

- Cards encoded to IATA, ABA, and Thrift standards.
- ASCII data is read from the card and sent to the CPU, and is stored in the terminals memory but not necessarily displayed, to provide security.
- Offers ability to control access to computer and data files by requiring each operator to have a card, possibly containing a user identification number and security level code.
- Applications include credit card sales transactions, airline ticketing, security, identification, and audit trailing.
- Cost effective, state-of-the-art.
- The 630C can be custom tailored to meet your exact requirements.

AVAILABLE NOW

Distributor Inquiries Welcome

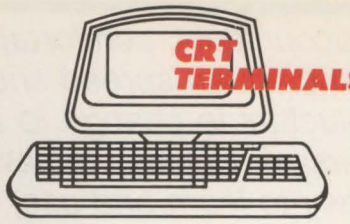
TEC, Incorporated Corporate Headquarters, 2727 N. Fairview Ave., P.O. Box 5646, Tucson, AZ, USA 85703
(602) 792-2230 • TWX 910-952-1377 Telex 16-5540

SALES OFFICES IN THE FOLLOWING LOCATIONS

- BOSTON (617) 879-6886
- CHICAGO (312) 655-1060
- DALLAS (817) 274-9827
- LOS ANGELES (714) 848-3111
- MINNEAPOLIS (612) 941-1120
- PHILADELPHIA (201) 780-6700
- SAN FRANCISCO (415) 572-1566
- WASHINGTON D.C. (703) 354-1222

DISTRIBUTORS IN MOST INDUSTRIALIZED COUNTRIES

CIRCLE NO. 65 ON INQUIRY CARD



Enhancing comprehension with color

FRED CALEV, Compuworld

Twin software packages—ColorCalc and ColorGraph—transform dry statistics into concise, meaningful information

The use of color, which infused new vitality into photography many years ago, is beginning to exert much the same effect on the minicomputer-μc world. Business executives are finding that financial data presented in color, in addition to being inherently more pleasing to the eye, become more readily understandable than the dreary black-and-white printouts to which they have grown accustomed. Psychological studies have found that color-coded graphs can be perceived 80 percent more efficiently than black-and-white graphs.

During the past decade, technological advancements have dramatically reduced the time needed to perform calculations and the space required to store the results. But the output is just a stack of numbers—a collection of row and column totals that, by themselves, tell little. Someone still must interpret the data, visualize the statistical relationships and then use them to make a decision that could involve a considerable chunk of corporate resources. It is vital, then, that the data be as precise and as unambiguous as possible.

Out of the need to improve the manipulation and presentation of financial information for easier analysis grew ColorCalc and ColorGraph. ColorCalc organizes raw data into rows and columns, using color to highlight and isolate key information. ColorGraph develops graphs and charts in color. The accuracy, simplicity of use and safeguards against error make these programs attractive in information analyses.

Hard-copy devices *available for permanently recording ColorCalc/ColorGraph displays include black-and-white and color ink-jet printers (shown), color-slide cameras and cameras and images for off-the-screen or direct-from-memory Polaroids.*

Approaches to data presentation

The accountant's spread sheet, a flexible, widely employed business tool for organizing and comparing data, is what managers have traditionally used to analyze financial information. The sheet consists of data in rows and columns. Sales information, for example, can be recorded by date of sale or listed by the salesman's name. Inventories can be described in terms of cost per piece or replacement cost. The spread sheet in Fig. 1 illustrates a portion of the second-quarter budget of a manufacturing company. The figures can be re-examined and amended as the budget changes. ColorCalc eliminates tedious rewriting and recalculating by automatically totaling columns whenever a change is made. The totals are transformed into a color-graphic display by ColorGraph.

ColorCalc and ColorGraph are written in macro-

Accountants, comfortable with handwritten spread sheets, are often reluctant to change to a computerized version. Unless the new program is easy to learn and use, they will not adopt it.

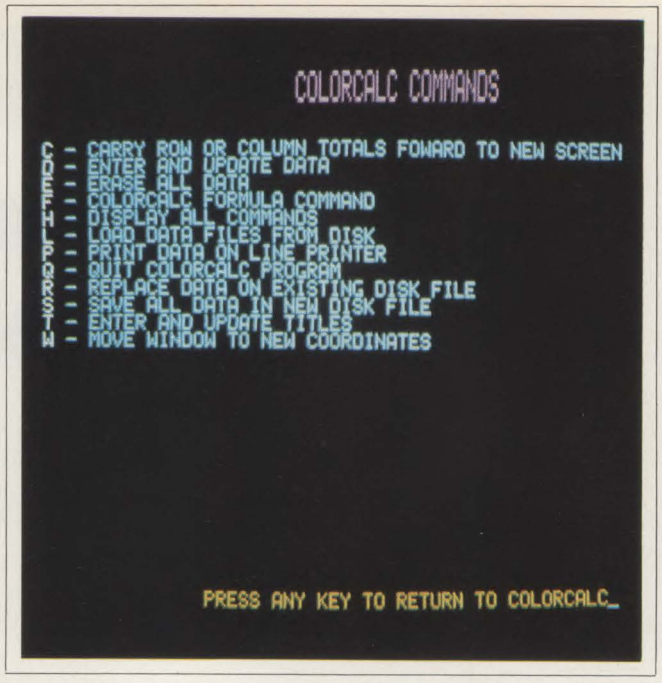
assembly language and run on the Intelligent Systems model 3650 μc. The CRT has suitable graphic resolution, vivid color and serious business capabilities, including RS232 ports and expandable storage.

Ease of use is essential

Accountants, comfortable with handwritten spread sheets, are often reluctant to change to a computerized version. Unless the new program is easy to learn and use, they will not adopt it. ColorCalc was designed for simplicity: it is no more difficult to enter data into ColorCalc than to write it on paper. The program makes correcting easier and requires no computing experience on the user's part. Its manual includes a glossary of all computer terms used and instructions on handling diskettes and "talking" to the computer.

Pushing three buttons loads the ColorCalc program. The operator then chooses among 12 single-key commands that direct the system. Command "L", for example, loads data files. A sample file is included on the ColorCalc disk and is printed in the manual. Setting up the spread sheet is easy. Once a file is loaded, the user strikes "D" to cue the machine for data entry, and types numbers. Using cursor-control keys, an operator manipulates the data into the appropriate columns. ColorCalc allows as many as 51 columns and 53 rows to be entered—more than twice as many entries as the average paper spread sheet.

ColorCalc prevents keyboard errors by locking out all unpermitted keys. In data-entry mode, for example, only numbers, plus signs and minus signs are accepted. Control keys and escape sequences are also invalid, so it is virtually impossible for a user to "fall through" the program and end up facing statements like "OD ERROR in 160" on the screen. Error prevention is imperative in software created for inexperienced computer users who cannot cope with surprises. An unexpected message



Command menu: *These 12 simple commands cover all possible user interactions with ColorCalc. The menu can be requested by the user at any time.*

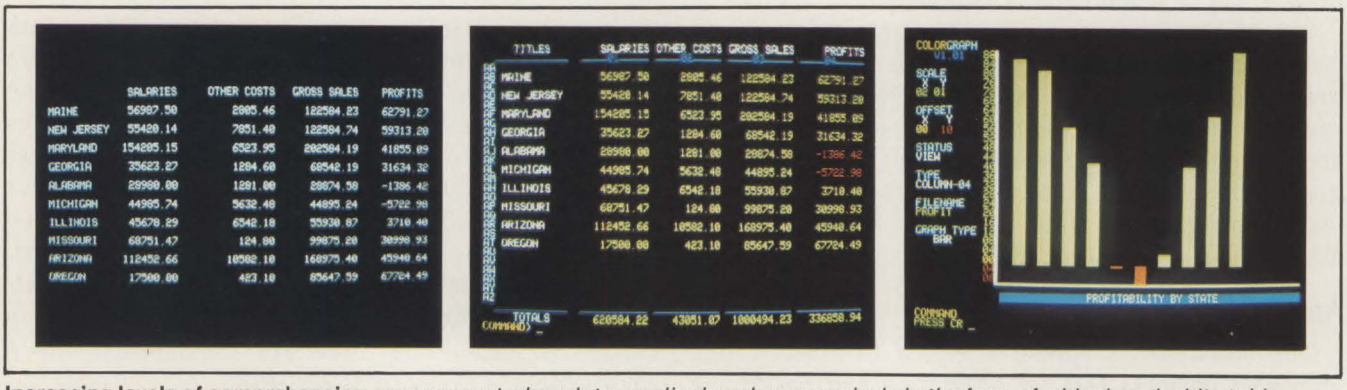
can send them right back to their pencils and paper. ColorCalc contains another feature no user-oriented program should be without—a "help" index that lists program commands and describes what they do.

Each category of data is distinguished by its own color, making data entry quicker and more accurate. Titles are in a different color from numbers, which are in a different color from system prompts. Decimals are automatically aligned, with positive numbers always appearing in green and negative numbers in red.

Forecasts and 'what-ifs'

The completed ColorCalc spread sheet displays accounting data in its most current status. But business managers frequently want projections based on possible sales increases, changes in staff or other contingencies. ColorCalc's "formula" command allows users to visualize trends and possibilities.

A formula can operate on or bypass any column or row, and can be executed any number of times. Formulas use standard calculator functions—addition,



Increasing levels of comprehension *are apparent when data are displayed progressively in the form of a black-and-white table, color table and, finally, in color graphics.*

Digital's Field Service. It's one reason why our OEMs sleep more soundly than most.

If you're an OEM, you know that field service can either make you or break you. So in the interest of your continued success, as well as your peace of mind, Digital is improving the way your computers are serviced, developing innovative options, specifically addressed to your needs.

Service in any 30-day increment, for example, lets you add considerable value to your products, while we stand behind ours.

Maximum 4-day installation time makes you look good in your customers' eyes and, at the same time, helps you avoid cash flow problems.

Maximum 4-hour trade show response assures you a minimum of embarrassing downtime during those all-important conventions.

Fixed price de- and re-installation allows you unprecedented freedom of movement with your hardware.

Finally, a single *Digital master service agreement* covers all your systems, reducing a potential morass of paperwork down to one central billing point.

At Digital, we realize that a good part of our success is based on the success of our OEMs. That's why we're committed to creating new service concepts, worldwide, that help you build worry-free relationships with your clients.

So if you're concerned about service problems, talk to us. We have some great ideas for you to sleep on.

Write: **Digital Equipment Corporation,** Field Service Marketing Communications, PK3-2/S25, 129 Parker St., Maynard, MA 01754.

At Digital, we think a computer service people who is only as good as the 14,000 stand behind it.

Hardware isn't everything, even when it's as good as ours. Today, you demand a lot more from a computer company. You demand follow-through.

Distributed computing systems require their own unique kind of follow-through. Service capabilities must be as flexible, as localized, and as geographically dispersed as the systems they support.

That's why Digital fields a worldwide team of over 14,000 customer service people, people thoroughly versed in the workings of distributed computing. They'll provide help where and when you need it, instruction where and when you want it, and the security of knowing that a major international company is backing up your system.

Hardware service. A plan to fit any need.

Different Digital customers require different levels of field service. For example, if downtime on your computer means downtime on your entire business, there's a lot we can do to minimize it. We can guarantee service calls within a few hours, seven days a week. We can perform preventive maintenance on a regular basis. And we even have Remote Diagnosis, a state-of-the-art troubleshooting procedure in which our computers diagnose yours over the phone, saving time and money.

User training. Learning to work with our computers.

Digital has 23 training centers worldwide, including over 500 systems solely devoted to hands-on instruction. According to your needs, we can train your people in three different ways: by lecture and lab training at our centers, by self-paced training courses, or by on-site instruction right in your own offices.

Software support. Expertise across the board.

Digital has more than 1,800 software experts in 150 locations worldwide. They can install, debug, maintain and update 13 different operating systems, using 27 major computer languages. And they can design and test software in a dozen different application areas.

Service. Training. Support. With Digital, you get a lot more than superior hardware. You get a long-term commitment. To your computers. To your business.

And to your peace of mind.

Digital Equipment Corporation, 129 Parker St., Maynard, MA 01754. In Europe: 12, av. des Morgines, 1213 Petit-Lancy, Geneva. In Canada: Digital Equipment of Canada Ltd.

digital

We change the way the world thinks.

digital

We change the way the world thinks.

The data contained in a ColorCalc file can be instantly graphed with ColorGraph programs. ColorGraph uses the same data disk as ColorCalc, and no changes are required.

subtraction, multiplication and division as well as computations for percentages and multiples.

ColorCalc's formulas are created by stringing together appropriate one-letter mnemonic sub-commands. For example, suppose column 1 contains six months of sales figures, and we want to know what the figures would be if each month had shown a 5 percent increase over the month before. ColorCalc's "multiple" command makes this easier than using a calculator. The formula would be set up as shown in Fig. 2.

As many as 10 frequently used formulas can be stored for reference with the Save subcommand. The example in Fig. 2 can be saved by adding "S3" to the end of the formula, and can be recalled with the command "F3". As with other ColorCalc modes, if the user enters an incorrect formula, the machine rejects the entry, highlighting the unacceptable portion of it in a contrasting color to tell the user exactly where the mistake occurred. The user has the option of "undoing" a formula and returning to original data with a single keystroke—a very useful option for managers who like to examine every possible contingency.

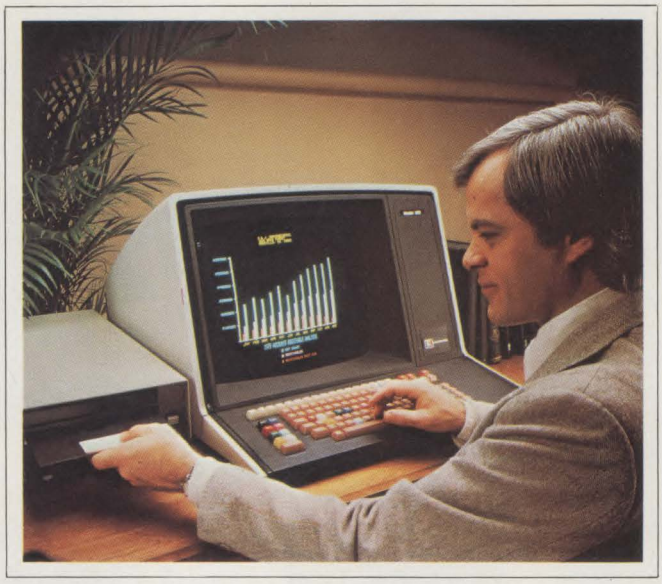
Accountants can be certain that ColorCalc is producing accurate data, regardless of the intricacy of calculations, because there are no rounding errors. ColorCalc does not rely on BASIC's ability to do arithmetic. The program uses its own math routines, with a 40-bit normalized integer, to be certain that all calculations are accurate to the penny for as much as $5 billion. This precision is essential for most business applications.

Creating the graphs

The data contained in a ColorCalc file can be instantly graphed with the ColorGraph program. ColorGraph uses the same data disk as ColorCalc, and no changes are required. The program is loaded, offers some simple instructions and draws a grid on the screen. When a user enters the name of a ColorCalc file, a graph appears, is automatically scaled and illustrates the column totals from the ColorCalc spread sheet. The default graph style appears in bar form, but a user can opt for line or scatter graphs instead.

One of the major drawbacks to graphics, despite its climbing popularity, has been its complexity. Graphics software too often requires a user to have technical expertise. All of ColorGraph's routines, however, are controlled by simple CRT commands that follow a format consistent with those of ColorCalc for easy switching from one to the other. ColorGraph can graph any section of the spread sheet and can zoom in on any portion of the graph for closer scrutiny. It can zoom in on the X axis, Y axis or both, and the graph can be rescaled to any multiple.

The user has complete freedom in designing and tinting the graphs. They first appear in red and green, but any of six other foreground and background colors can be selected. Both X and Y axes can be labeled with the operator's choice of titles and colors. The completed graph can be saved on disk. ColorGraph has a directory command that shows an index of the ColorCalc files and



Typical business configuration *of Intelligent System's Intecolor 8300 desk-top computer.*

	July	August	September	Total	Year to date
Salaries	$112,852	$112,852	$113,754	$339,458	$676,769
Advertising	20,000	20,000	18,000	58,000	116,000
Maintenance	1750	1750	1750	5250	10,500
Rent	2365	2365	2365	7095	14,190
Taxes	4722	4722	4722	14,166	28,232
Legal	10,000	5500	2500	18,000	55,000
Postage	1100	1350	1570	4020	7850
Total	$152,789	$148,539	$144,661	$445,989	$891,978

Fig. 1. *A typical spread sheet.*

The endless wave.

How many micro-Winchesters™ will Seagate build? As many as you want.

Seagate Technology is producing 5¼-inch micro-Winchester drives in ever increasing volume. And we are delivering on schedule.

In our first year, we shipped more than 12,000 drives. We are now shipping more than that every quarter. And we can easily double that. Adding capacity is simply a matter of cloning additional production lines.

So when you hear that other OEMs are placing big orders with us, don't worry. We have the capacity to satisfy big volume demand.

How many drives do you need? We'll give you a shipping schedule to fit your requirements. And we'll commit to that schedule, in writing. And don't forget. It's an easy upgrade to our ST512 with thin film heads.

For complete specifications, circle our readers' service number. To order an evaluation unit, write, telex or phone.

Seagate Technology

360 El Pueblo Road Scotts Valley, California 95066 (408) 438-6550 TELEX 172114 SCVL
Regional Sales Offices: Allamuchy, New Jersey (201) 852-6184;
Newport Beach, California (714) 851-9964

"Turning the tide in fixed disc technology"

™micro-Winchester is a trademark of Seagate Technology.

CIRCLE NO. 67 ON INQUIRY CARD

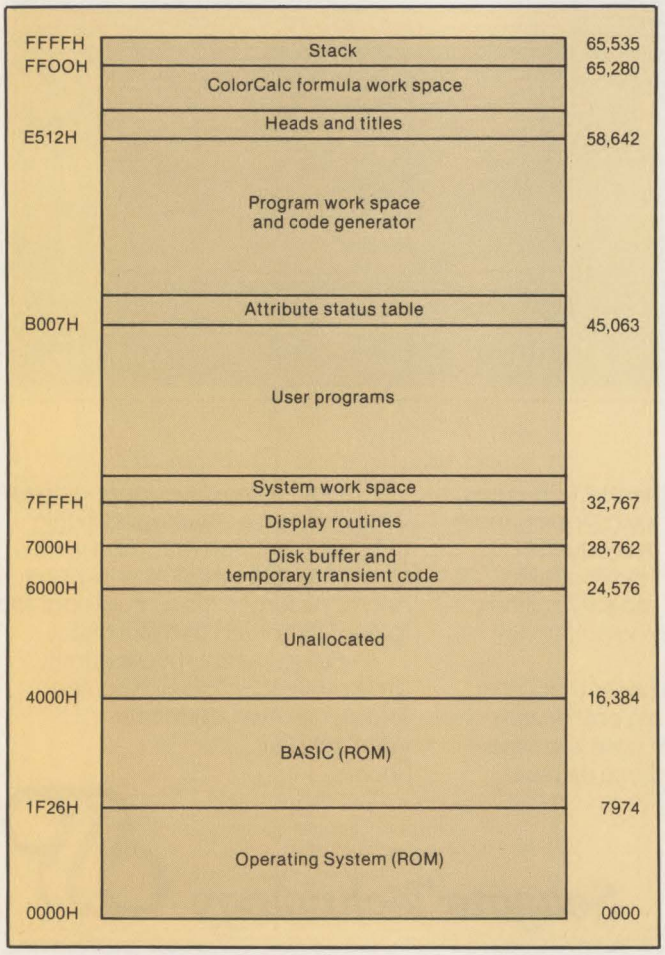
ColorGraph's displays simplify the interpretation of data. The graphs show relationships that are otherwise difficult to visualize, so comparisons can be made immediately.

FORMULA - CO2 = CO1*104%M
(Column 2 = Column 1 x 105% Multiple)
The screen will show . . .

	Current sales	Projected sales
January	1000.00	1050.00
February	1874.00	2061.40
March	1860.00	2139.00
April	2021.00	2425.20
May	2298.00	2895.48
June	2512.00	3315.84
Totals	11,565.00	13,886.92

. . . where the highlighted column is calculated

Fig. 2. *ColorCalc's formulas.*



Memory map shows *the locations of code and work space for Intecolor 3650, on which ColorCalc and ColorGraph are implemented. Note that the 4K bytes allocated to the disk are also available, on a transient basis, for program code.*

ColorCalc was designed *for simplicity and is meant to help users who are comfortable with handwritten data and who are reluctant to change to a computerized version.*

picture displays saved. It also tells how many more pictures can be stored.

ColorCalc's displays simplify the interpretation of data. The graphs show relationships that are otherwise difficult to visualize, so comparisons can be made immediately.

Beyond the figures

ColorCalc spread-sheet data satisfies accounting requirements for organizing, checking and recording information. The finished spread sheet can be printed with a menu that has user-selectable defaults for various printers. Once the user specifies a given configuration, the program remembers it for future use. ColorCalc accepts paper widths from 64 to 132 characters, automatically calculating the number of columns that will fit on each page, and centering the output as well.

But ColorCalc and ColorGraph have uses that go beyond displaying printed lists of numbers. ColorGraph can be a valuable tool at meetings for displaying financial data directly from the CRT. The program has an "All" command that cycles through every screen picture stored on the disk. An automatic delay of 1 to 99 sec. can be inserted between each display to leave time for discussion.

Hard copy is available in several forms. ColorGraph uses a low-cost Epson printer to generate black-and-white graphs. And the new PrintaColor ink-jet printer can produce full-color charts and illustrations. Available soon will be an interface to the Image Resources photographic system, which outputs directly from computer memory rather than from the display. ■

Fred Calev is owner of Compuworld, a computer store in Rochester, N.Y. He has an electrical engineering degree from Rochester Institute of Technology, has been employed by Digital Equipment Corp. and specializes in software.

Layered software for applications programming... helps the pieces fit.

Meeting each minicomputer user's software requirements is a difficult and time-consuming task for the systems integrator. Now, with a unique layered approach to software, SYSTEMS makes applications programming more efficient and less costly. Each layer addresses a related set of user programming problems. Within each layer, there is a choice of software aids that focus on specific user requirements.

In addition to most modern high-order languages and the advanced MPX-32 interactive, real-time operating system, SYSTEMS offers extensive software libraries. They contain prefabricated code to eliminate repetitive programming. SYSTEMS software tools and libraries allow the programmer to more efficiently generate, test, optimize and document applications programs and reduce development and maintenance costs. These tools also provide management with greater visibility and control.

SYSTEMS has the most comprehensive selection of software development tools and methodologies available today. We also offer the SOFTOOL 80™ package as a licensed part of our standard product line. Memory requirements and CPU overhead are never a problem as all the tools and libraries are removed after program development is completed.

SYSTEMS layered approach provides all the pieces for your applications programming needs ...and they fit. Call or write the company with a lifetime of real-time experience and watch the pieces fall in place for you.

Systems Engineering Laboratories, Inc.,
6901 W. Sunrise Blvd., Ft. Lauderdale, FL 33313.
(305) 587-2900, 1-800-327-9716.

CIRCLE NO. 68 ON INQUIRY CARD

™Trademarked product of SOFTOOL Corporation.

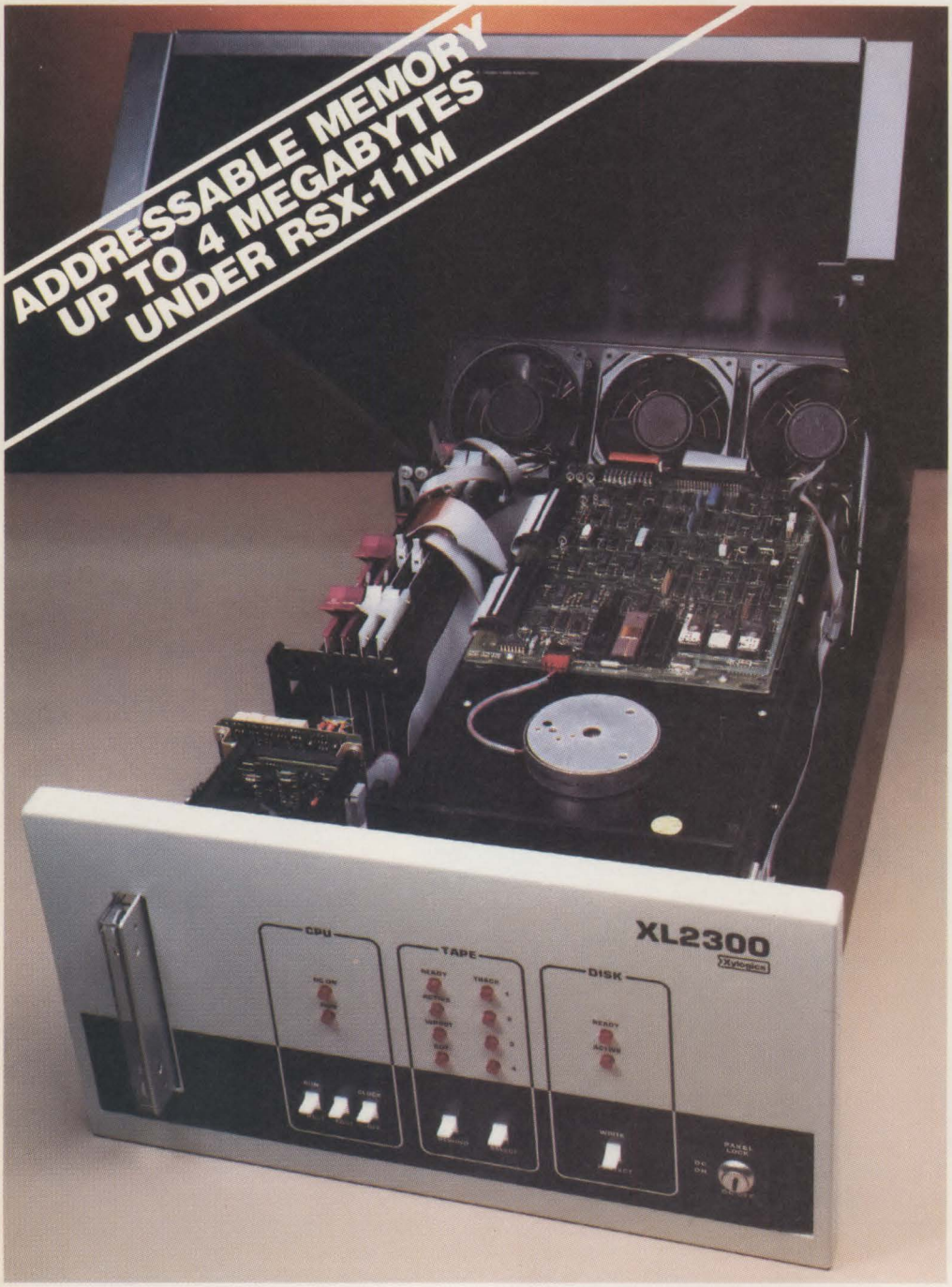
Proven COMPUTER Performance

SYSTEMS

A Subsidiary of GOULD INC.

Argentina•Australia•Belgium•Canada•Colombia•England
France•Italy•Japan•Mexico•Sweden•Thailand•West Germany

LSI-11/23 Winchester Disk Cartridge Tape



Xylogics Brings Them Together

10½

Xylogics new XL2300 measures only 10½ inches high, yet it gives you more system power than a conventional PDP 11/23 in a 60-inch cabinet. Everything you need for a completely integrated, DEC* compatible system is here:

- DEC LSI 11/23 processor (22 bit addressing optional) 96KB - 4MB random access memory
- 24 MB Winchester disk with Xylogics **PERIPHERAL PROCESSOR** emulating RL02
- 17 MB cartridge tape with Xylogics **PERIPHERAL PROCESSOR** emulating TU10
- Up to eight DLV11, RS232 communications ports
- Q-bus compatible, 16 slot backplane
- Power supply, whisper-quiet cooling, comprehensive on-board diagnostics.

100

The XL2300 is 100% compatible with all DEC PDP*-11 operating systems and I/O protocols. Application software written for RT-11, RSX*-11M, and RSTS*/E will run without modification on the XL2300. Third party software not previously available on an LSI-11 system, such as TAPS**, WORD***-11 and UNIX, will also run unmodified on the XL2300.

Xylogics' unique **PERIPHERAL PROCESSORS** give XL2300 users the benefits of state-of-the-art disk and tape performance by emulating the control functions of standard DEC RLV21 and TM11 controllers.

800

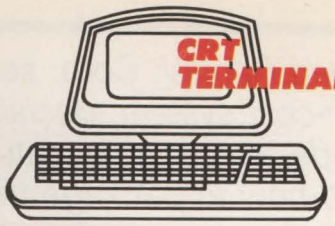
The XL2300 is ideal for OEMs and systems builders who want to combine DEC software compatibility, compact modular system packaging, unbeatable peripheral performance, and outstanding reliability. A toll-free call will get you more information on this powerful new system from Xylogics.

- Dealer Inquiries Invited.

*REGISTERED TRADEMARKS OF DIGITAL EQUIP. CORP. **REGISTERED TRADEMARK OF INFOMATICS, INC. ***REGISTERED TRADEMARK OF DATA PROCESSING DESIGN, INC.

U.S. Headquarters: 42 Third Avenue, Burlington, MA 01803 Tel: (617) 272-8140 (TWX 710-332-0262) European Headquarters: 46-48 High Street, Slough, Berks SL1 1ES U.K. Tel: (0753) 78921, Telex 847978

CIRCLE NO. 69 ON INQUIRY CARD



Making color affordable

KEITH SORENSON, Ramtek Corp.

A low-cost Ramtek terminal is shaped by advances in semiconductor technology and adaptations of more sophisticated imaging systems

A color-graphics system providing the most desirable combination of features—full pixel addressability, resolution of 640 pixels × 512 or 480 lines, 16 displayable colors, a variety of interactive devices and hard-copy options—has been a costly proposition. Many systems have offered one or several of these capabilities, but, until now, none has put all of them into an affordable package.

When Ramtek Corp., Santa Clara, Calif., set out to design such a low-cost system, decisions had to be made as to which features to include and how to package them. The result—the new RM-6211 Colorgraphic Terminal—is based on long-term analysis of customer feedback and on adaptations of technology from highly sophisticated graphics/imaging devices and custom alphanumeric systems also built by the company. The introductory price tag for this terminal is less than $6000.

Ramtek's 6211 is a compact device that sits on a user's desk and is light enough to be portable; its 50-lb. weight compares to approximately 135 lbs. for the firm's original desk-top model, the 6200A. The terminal can be linked via serial asynchronous communications with any host computer using a standard RS232C interface.

The 6211 offers resolution and color choice equal to that of Ramtek's more expensive graphics terminals. Standard resolution is 640 × 480 pixels, with an option for 640 × 512. This compares to 512 × 256 pixels for the older 6200A.

The 6211's 13-in. monitor employs a technique called precision in-line (PIL), in which an in-line gun is coupled with an ultra-fine shadow mask. The combination eliminates the need for dynamic convergence control, providing a cost-effective tool with enough resolution for most graphics applications.

Four refresh-memory planes controlled by a user-programmable video lookup table display 16 colors from as many 64. These can take the form of eight colors plus an alphanumeric overlay or a blink function. The video

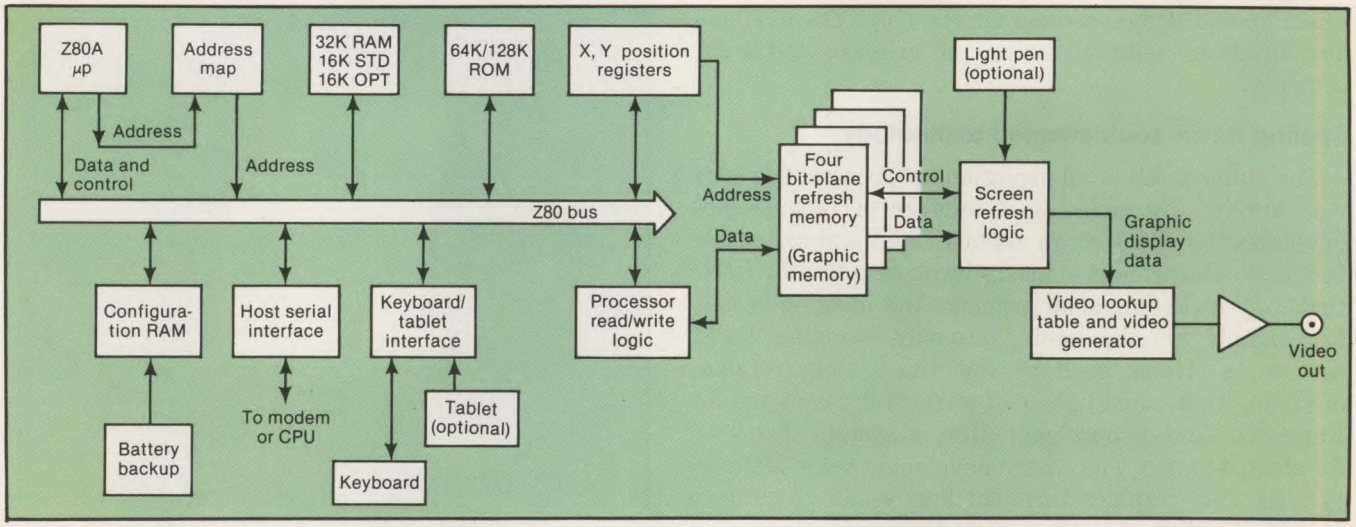


Fig. 1. Video lookup table *at far right in block diagram is borrowed from more sophisticated Ramtek system. It controls the four refresh memory planes in the graphic memory to allow displaying as many as 16 colors from a palette of 64.*

When Ramtek Corp. set out to design a low-cost system, decisions had to be made as to which features to include and how to package them.

lookup table, first developed by Ramtek for more sophisticated systems that perform both graphics and imaging, permits a user to change the intensities of the colors at will. It also allows film-loop animation and raster-smoothing operations via user programming.

Users interface with the 6211 via the Colorgraphic Programming Language (CGL), a set of English-oriented commands that can be learned quickly by a non-programmer.

An emulation package developed specifically for the 6211 allows user libraries of existing Tektronix Plot 10

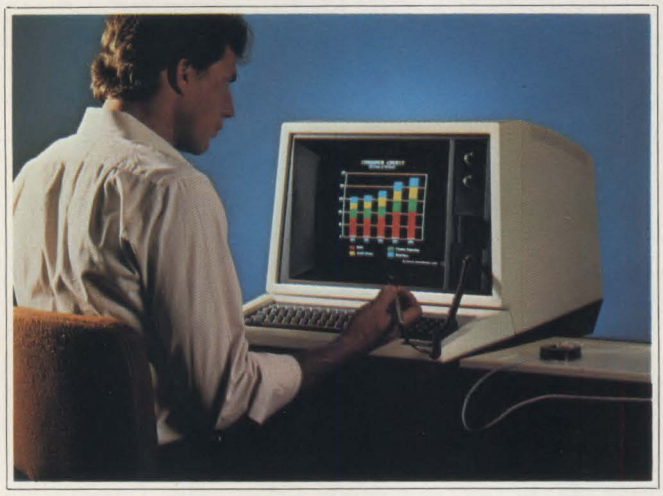


Fig. 2. The 6211 Colorgraphics Terminal *is suitable for a variety of data-analysis applications. Here it is being used to display credit data in a business applications.*

software to be transported to the 6211 and upgraded easily to incorporate color.

Interactive devices available with the 6211 include an 11-sq.-in. digitizing tablet, a light pen for menu selection and high-speed cursor steering. The 6211 can also interface with a variety of printers and color cameras.

Scaling down sophisticated technology

The culmination of an evolutionary process, the 6211 was derived by adapting a number of technologies developed for much more sophisticated and expensive products. Features previously incorporated into Ramtek's top-of-the-line 9000 graphics and imaging series, for example, are now coming into play in smaller, lower cost units. Items such as the video lookup table, digitizing tablet and light pen were first developed for Ramtek's 9400 display generator, a system that sells for about $60,000. The cost of developing these features just for the graphics terminal line would have been prohibitive. But once they were developed, they could easily be implemented on the less-costly models.

The 6211 reduces the number of characters necessary to draw basic graphics by 25 to 40 percent, depending on the specific graphics application. This saves valuable programming-transmission time and money. Furthermore, the original 6200A had a "fill" command that would fill simple objects with solid color. Complex objects, however, presented a problem. For a polygon with a hole in the center, for example, the command would fill only a portion of the shape and would leave a shadow over the hole. The ability to fill highly complex

Fig. 3. Interfaces to various hard-copy devices, *including those producing instant prints and 35-mm. slides, are standard features on the 6211.*

Fig. 4. A Centronics-compatible parallel printer interface *supports the Ramtek 4100 Colorgraphic Printer.*

Introducing a two terminal system. Under twenty.

The customer who's too big to start small, but too small to start big, needs the Texas Instruments DS990 Model 3. At less than $20,000 (quantity one, U.S. domestic price) it includes two terminals, 2.3M-byte dual diskettes, 96K bytes of memory and a 150 CPS printer.

The Model 3 features COBOL software, upward compatibility with the DS990 line, and expandability to 4 terminals so it can grow with your customers. Add to that IBM 3780 communications capability and TI's comprehensive service support, and you've got a best-seller. The DS990 Model 3. It's the right size, at the right price. For more information, contact Texas Instruments Incorporated, Box 202146, Dallas, TX 75220. Phone 800-527-3500 (Texas collect 214-995-6616). Refer to code A47-204.

The New DS990 Model 3. For the medium-size businessman.

TEXAS INSTRUMENTS
INCORPORATED

CIRCLE NO. 70 ON INQUIRY CARD

The 6211 was derived by adapting a number of technologies developed for much more sophisticated and expensive products.

and irregular shapes, which was later developed for the 9900 series, has been adapted for the 6211.

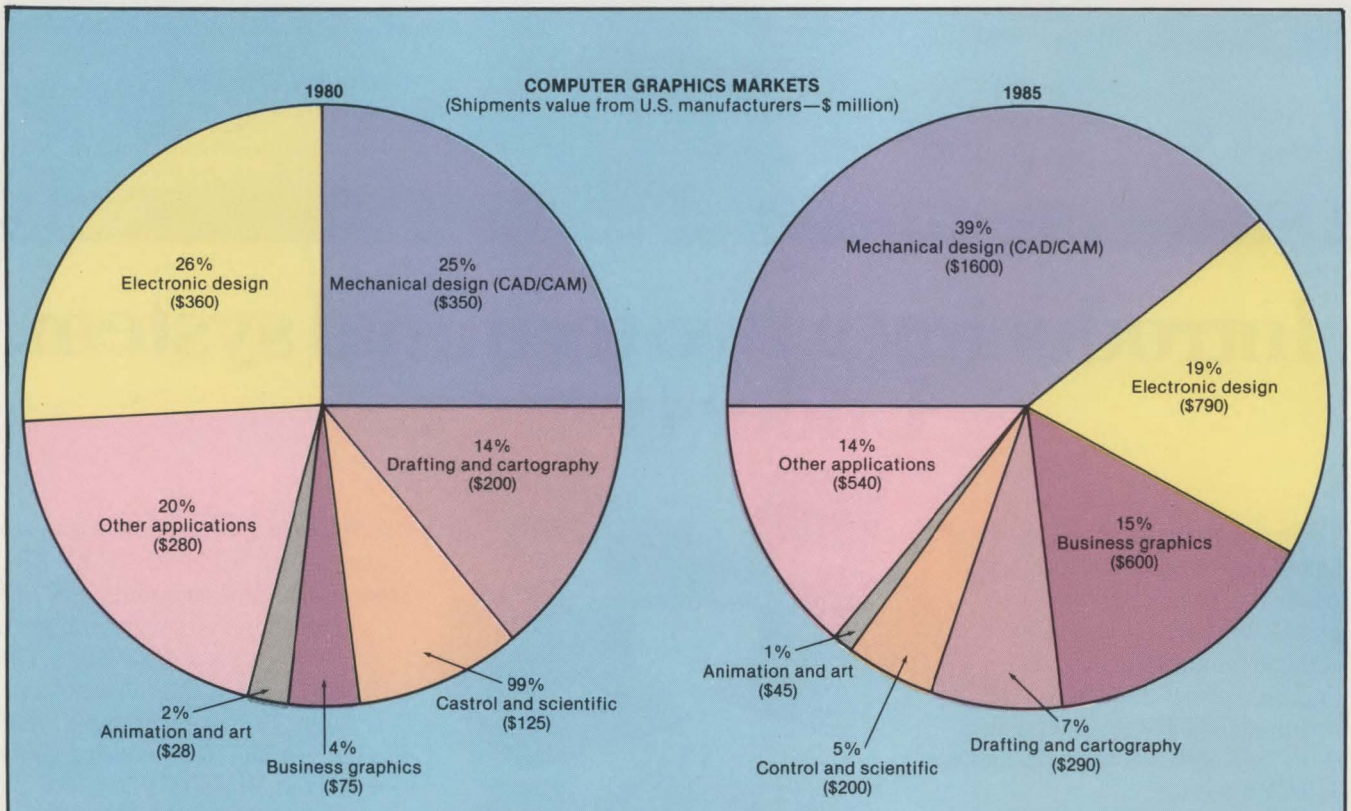
The ability to put more function into a smaller space—made possible by advances in semiconductor technology, especially the incorporation of higher density RAMs—has been responsible for much of this. The system uses 16K-byte RAMs, versus 4K devices for earlier Ramtek terminals, permitting the 6211 to incorporate four refresh memory planes—doubling the number of displayable colors over the 6200A. In addition, much of the terminal's bulk has been eliminated, with no sacrifice in viewing area. Because monitor technology has advanced to the point where the monitor itself is smaller, its case can now accommodate the terminal's electronics, which previously required a separate chassis.

But the cost of developing the small package for the 6211 posed a problem. Designing and manufacturing a new package would have involved an extremely large investment. However, experience with another product line, an unrelated custom project for Ramtek's line of alphanumeric terminals, provided the solution. Ramtek signed a contract to design, develop and manufacture customized CRT terminals in 1979. The desk-top terminals had to be compact and portable. Ramtek made a sizable investment in special tooling to come up with a versatile cabinet design. Once designed for a custom application, this terminal could be produced in volume at a relatively low cost.

Giving users what they want

Not all possible features of a color-graphics terminal can be included in a small, relatively inexpensive package. The combination of features chosen was based on market research conducted with customers over an extended period. Smaller size and lighter weight, as well as compatibility with existing software, such as the Plot 10 graphics package, were commonly required features.

Users also requested more interactive functions. In some cases (e.g., digitizing tablet versus light pen), personal preference played a major role, and multiple options have been provided. While a digitizing tablet makes it easy to trace a picture into the system, it forces a user to watch two locations at once: the tablet and the screen. The light pen is an easy-to-use tool that lets a user look at a single picture and "drag" an object across the screen. Tracing an object, however, requires that an overlay be physically attached to the screen.



Seven segments of the computer-graphics market *are identified by Strategic Business Services, Inc., in this analysis and projection to 1985. The electronic-design sector, which grew at a 59 percent clip from 1976 to 1980, will grow at a much-reduced 17 percent rate from 1980 to 1985. The CAD/CAM sector, however, will accelerate its already fast 31 percent growth of the last five years to a 36 percent rate by mid-decade. Strategic includes education, transportation and military applications under "other applications," noting that use of graphics for defense has contributed to the state of the art.*

Temperature measurement and control?

No sweat.

ADAC expands the use of DEC LSI-11 and Intel SBC-80/10 and 80/20 into the most demanding industrial applications.

- Direct Multiplexing of Thermocouple Signals.
- Cold Junction Compensation.
- Software Selection of Thermocouple Types.
- Linearized RTD Measurements.
- Choice of Relay or Solid State Multiplexing.
- 250 Volt Common Mode Isolation.
- Input Full Scale Ranges from 10mV to 500mV.
- Programmable Gain Amplifier with 6 Gain Settings.
- 16 Differential Inputs per Card.
- 12 Bit Resolution.
- Program Control/Program Interrupt Interface.
- High Level Software with Thermocouple Linearization.
- Complete Integrated Systems.

To learn more about measuring thermocouples by data acquisition systems, contact:

adac CORPORATION

70 Tower Office Park
Woburn, MA 01801, 617-935-6668

CIRCLE NO. 71 ON INQUIRY CARD

The largest untapped market of the future is business graphics.

Users also wanted to interface to a wide variety of hard-copy devices. The 6211 provides a Centronics-compatible parallel printer interface that supports Ramtek's 4100 Colorgraphic Printer for low-cost, plain-paper hard copy; color camera systems for photographic hard copy are also supported. Complete presentational-graphics systems are now available at a lower price than ever before because the cost of electronics in color printers and cameras plummeted.

Previously, color printers sold for about $30,000, plus the cost of the interface, and large, color camera systems were even more. Now, for less than $16,000, a user has soft copy on the screen and a choice of a color line printer or a camera system that produces slides or

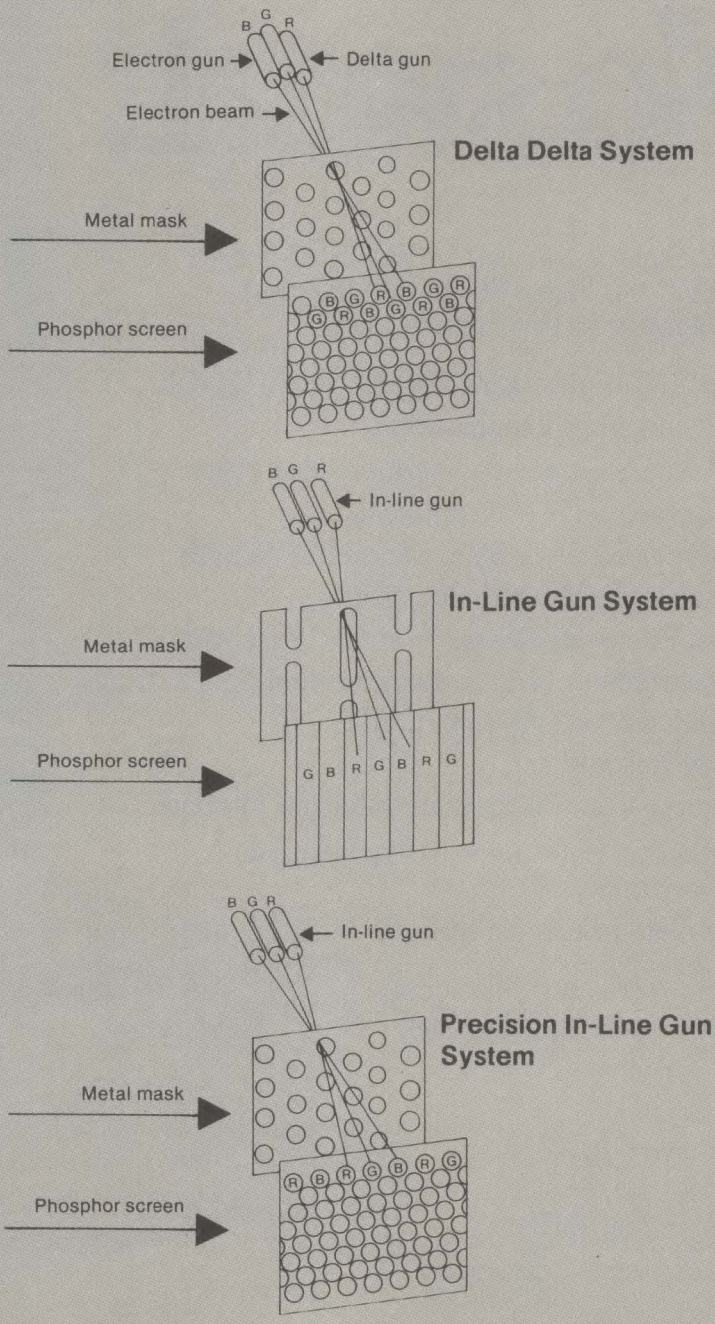
THREE MONITOR APPROACHES

A raster-scan color monitor has three basic components: the "guns" that shoot electron beams, a phosphor screen, made up of tri-dots of red, green and blue phosphors and a thin, steel shadow-mask that aligns each gun with the correct color phosphor. Three configurations of these components have evolved: the delta-delta system, the in-line system and the precision in-line (PIL) system.

Delta-delta system. This configuration provides the highest color resolution available in raster CRTs. The red, green and blue guns are arranged in a triangle, and a shadow-mask with round holes aligns each gun to the proper phosphor dot. The critical factor in determining performance is the "pitch," or space between the holes in the shadow-mask. Home TV uses a nominal shadow mask pitch of .92 mm. The higher resolution requirements of broadcast studio monitors was met with a .64-mm.-pitch shadow-mask. The application demands on graphic monitors stimulated further development leading to an ultra-high-resolution shadow-mask with a pitch of only .31 mm.

In-line gun system. The search for lower priced consumer television tubes led to the in-line gun system. All three elements differ from the delta-delta system. The color guns are now in a line rather than a triangle, the phosphors are laid down in stripes of red, green and blue rather than in tri-dots, and the electron beam is directed through slots in the shadow mask instead of round holes. This technology lowers monitor costs by eliminating expensive dynamic-convergence controls needed in delta-delta tubes. Attempts have been made to use slot-mask CRTs for computer graphics.

Precision in-line. This system is used in the 6211 terminal monitor and borrows advantages from both the delta-delta and in-line technologies. A PIL monitor couples an in-line gun configuration with the type of fine-pitch shadow mask and tri-dot phosphor screen used in delta-delta CRTs. Like the in-line CRT, PIL monitors also eliminate the need for dynamic-convergence controls. The result is a cost-effective color monitor that also incorporates the fine resolution of the tri-dot shadow mask. PIL tubes are adequate for computer graphics when used for 640 × 512 (or lower) pixel resolution.



48 Bit Virtual Memory Mainframe Power Plus DISSPLA® Publication Quality Graphics

An Economical Solution To Massive Software Execution. The PGM was initially designed to implement DISSPLA, a large computer graphics package having over 50,000 Fortran statements grouped into approximately 350 subroutines. This package, currently implemented on almost 400 large mainframes, has proved to be beyond 16 bit minis. Not only is the PGM able to handle this massive package with ease, it has proved capable of implementing almost any large scale Fortran system in existence. **It currently compiles, links and executes programs over 2 megabytes** — these are well beyond many mainframes.

48 Bits — Almost Double The Precision Of 32 Bit Machines. The full 48-bit PGM word provides **11+ floating point precision** (39 bit mantissa) compared to 5-6 digits for 32 bit machines. This is a single precision of roughly one millimeter on the earth's circumference.

24 Megabyte Address Space. The virtual memory totally dispenses with program overlay and segmentation. Virtual memory is implemented without cache memory or other expensive hardware crutches: The PGM utilizes the properties of higher level languages to implement a unique virtual memory scheme that is competitive in speed with machines costing orders of magnitude more.

Interactive Textbook Quality Graphics — The Primary Output Medium. Not only is the full DISSPLA package available, but also INTERACT, a **non-programmer** system for generating simple or sophisticated report quality charts and graphs in minutes. INTERACT operates through question/answer menus and any inexpensive digitizer pad. DISSPLA, the leading graphics package, enables the integration of custom sophisticated graphics into user developed programs. INTERACT source code is provided for customization. Also available are DIGIFONT for custom shaded font digitization, POSTGRAPH for storing and plotting identical output on different devices plus other powerful graphics utilities.

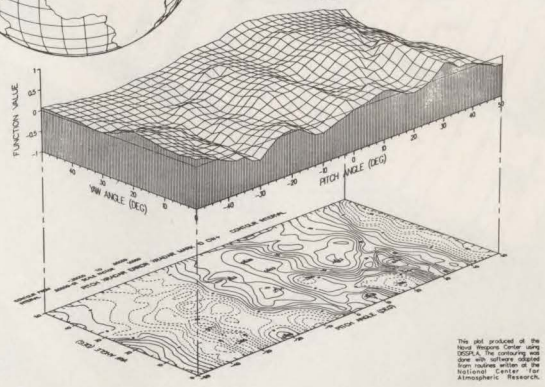
Standalone Computer, Distributed Processor or Dedicated Controller. The PGM operates both as a dedicated machine or as a node to a central mainframe. Optional sum checking is provided for data integrity in host communication. RS232, IBM 2780, DCT 2000, and other protocols are supported. **The PGM can provide DISSPLA facility to users of a mainframe without incurring mainframe memory or execution overhead.**

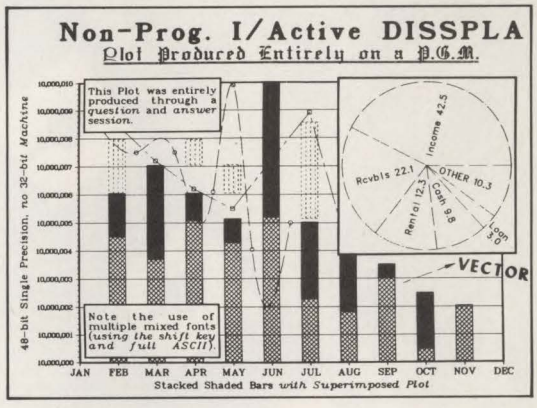
Major Graphics Devices Interfaced. The PGM is **non-partisan to any graphics device manufacturer.** Drivers are available for Tektronix 4010 Series, Chromatics, AED 512, IDT 2000 terminals; H.I. DP 14/15, Zeta 1453, Calcomp 1051, Soltec and Tektronix plotters; Dicomed, COMp80 and FR80 microfilm; Xerox 6500 color hardcopy; H.I. 8400, Versatec and Benson Varian Electrostatics. Color separation is furnished, enabling the use of high resolution monochromatic devices for color printing. Output may be generated on several devices simultaneously. A special parallel interface is available for the Xerox 6500 supporting full 600 X 1000 device resolution. **Vector to raster conversion is conducted in the PGM for raster devices at 500-1000 vectors/second.**

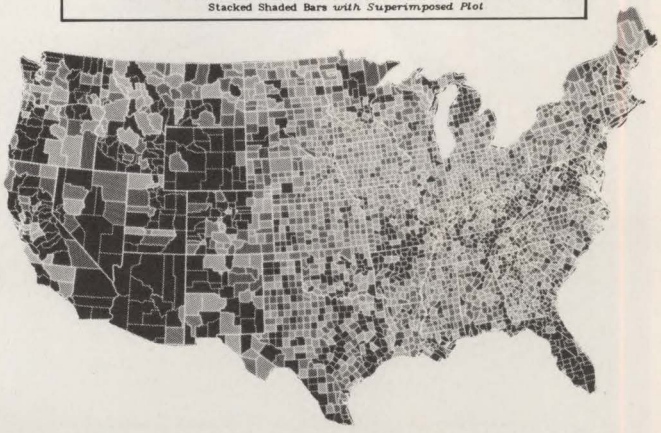
Powerful Virtual Memory Operating System Available. An extensive VMOS, extended Fortran compiler, Multipass Link Editor, Library Management and Trace/Peek/Poke Symbolic debugger provide a complete software development system.

An Elegant Low Entropy Software Engine. The PGM 48-bit TTL bit slice processor is a hardware extension of the compiler. There are **no registers, and no assembly language.** Statements such as A = B + C; A(I)=B(J+K)*C(M,N); IF(A(I)<B(J,K)) GO TO 5 are **single PGM instructions. Polynomial evaluate, block move and search are also provided as single instructions. The PGM achieves its remarkable performance simply by circumventing the superfluous instructions executed by general purpose computers running high level language software. The PGM is the first machine designed totally top down.** An 8-bit microprocessor takes care of all I/O for the 48-bit number cruncher.

Enter The PGM. So if your needs are too big for an Apple™ and your budget is too small for a VAX,™ the PGM is the solution. The PGM provides a graphics based engine with performance rivalling machines costing 100 times more.







Shaded County Boundaries — The Ultimate Benchmark

The above map was produced with a few simple commands to a custom modified INTERACT version. It represents over 200,000 vectors each of which was projected through Alber Equal Area projection requiring execution of 400 statements per vector for a total of roughly 80 million Fortran statements. The counties comprise over 3,100 polygons, each bounded by about 100 points: **they were accessed in random order.** The map is produced on a 3 x 4 foot plotter for full detail. The program is over 1.5 megabytes. Shaded maps are a standard PGM DISSPLA enhancement. The raw execution speed (no disk swapping) is approximately 100,000 Fortran statements per second. Compilation speed is approximately 1,000 Fortran statements per minute. The map was reproduced courtesy of Zytron Graphic Systems, Cupertino, California.

Prices Start At $27,000

Standard PGM includes full 48-bit processor, Intel 8080 I/O frontend, 29 megabyte disk, 300 kilobytes error correcting memory (expandable) and 5 RS232 ports. Options include 9 track tape interface, high speed parallel channel, Xerox 6500 interface and interface for synchronous protocols. Software supplied as extra cost items.

SUPERSET inc

10633 Roselle Street, San Diego, California 92121
Telephone (714) 452-8665

DISSPLA is a registered trademark of Integrated Software Systems Corporation.

CIRCLE NO. 73 ON INQUIRY CARD

More potential users will realize that they can cost-justify implementing graphics by having several departments share a terminal for various applications, or that, as prices drop, they can afford multiple units instead of sharing.

4- × 5-in. instant color prints.

The trade-offs

But the desire for compactness and lighter weight necessitated some sacrifices, primarily in the system's expandability. The 6211, whose internal electronics are contained on a two-board set, cannot accommodate a number of the options of its more expensive counterpart, the 6212, a $13,500 system that includes a "desk-side console" chassis with space for expansion.

The 6212, for example, has an optional high-speed vector generator that enables vectors to be written at the rate of 0.8 μsec. per pixel (compared to the standard speed of 6 μsec. or more, depending on the vector angle).

Furthermore, although the compact 6211 incorporates three extra BNC connectors for daisy-chaining additional monitors, all monitors must show the same picture. The 6212 can expand via additional memory boards to show different pictures simultaneously on different monitors.

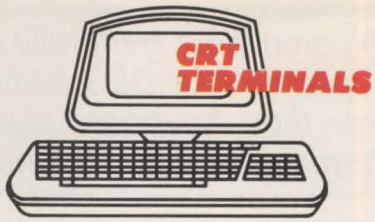
Another 6212 option not available on the 6211 is a VCO/encoder card that modifies the standard computer-graphics output signal to operate with broadcast television, video recorders and other RS170/189-compatible equipment.

Implications for the future

The trend toward providing more for less in graphics is expected to continue—even to accelerate—during the next several years. More and more potential users will realize that they can cost-justify implementing graphics by using a terminal in several departments within an organization for several applications within a department, or that, as prices drop, they can afford multiple units instead of sharing.

Several factors will be involved. Software vendors will continue to expand their list of applications packages. A number of manufacturers are working on specialized graphics circuits, and powerful 16- and 32-bit μps, as well as 64K-byte RAMs, will be used in graphics devices. As economies of scale take over, and these chips become available from multiple sources, total system costs should drop further, making graphics truly accessible to a mass market. ■

Keith Sorenson is manager of graphics terminal software at Ramtek Corp., Santa Clara, Calif.



Just who are the DEC emulators?

JOHN CHAPMAN, Cobar, Inc.

Many call themselves VT-100 emulators, but only a few are; knowing the difference may be important

About 20 manufacturers make CRT terminals that duplicate—or "emulate"—key features of Digital Equipment Corp.'s VT-100 series terminals. However, not all of these so-called emulators match the DEC terminal's performance in every respect. The degree of emulation can be an important factor in terminal selection. Most users want an emulator to perform, look, feel and even sound like a DEC terminal to minimize operator re-training. Only a terminal that meets these criteria deserves the name "DEC emulator."

Screen
- Size
- Phosphor
- Format
- Non-glare

Keyboard
- Layout
- Indicators

Emulation
- VT100
- VT132
- AVO (advanced video options)
- Printer port

Enhancements
- Set-up legends
- Screen save
- Monitor mode
- Click volume control
- True 19,200 baud operation

All emulators generally attempt *to replicate four DEC features: computer interface, keyboard layout, display format and internal functions.*

How then does one recognize a true emulator? There are two types of emulators—"primary" and "secondary." Primary emulators are designed specifically for the DEC market and duplicate most of the VT-100's features. Secondary emulators are general-purpose ASCII terminals modified to resemble a DEC terminal. The result is usually an imperfect copy.

All emulators (see table) generally attempt to replicate four DEC features: computer interface, keyboard layout, display format and internal functions. Fortunately, the interface presents no problem. The old familiar RS232 is standard here.

Many emulators have keyboards identical or very close to DEC's. Exact duplication of the VT-100's keys, indicators and tables, including their locations, is important because re-training operators who are accustomed to DEC terminals can be expensive. Even slight keyboard differences can cause problems. Many users, for example, have complained that error rates have risen alarmingly when operators accustomed to a DEC terminal are moved without training to an emulating terminal with a different keyboard. Keyboard enhancements should be made only after determining their effects on the operator.

Most emulators have a 24-row display with either 80 or 132 characters per row, just as DEC's does. They use ROM or PROM for character generation, and RAM for character storage. With one exception, they use a dot matrix for characters. The exception is DatagraphiX, which uses the Charactron for character generation. With the Charactron, the character is formed by a stencil instead of a dot matrix. This gives a crisper, better looking character. However, it is more expensive and is relatively inflexible. The dot matrix is

All emulators generally attempt to replicate four DEC features: computer interface, keyboard layout, display format and internal functions.

limited only by the terminal's ROM or PROM capacity.

Although Table 1 shows the DEC VT-100 as having a display format of 24 rows × 80 or 132 columns, this is true only if the advanced video option (AVO) is installed. Without AVO, the VT-100 can display only 14 rows when in 132-column mode, and is limited to a single video attribute. AVO provides four attributes: blink, bold (bright), underline and reverse. The same comments apply to those emulators that do not provide the AVO as standard.

Internal functions are the heart of an emulator because they determine its "personality." The functions include processing characters received from the keyboard or the computer, maintaining the display and controlling the transmission to the computer.

Internal functions separate the "pure" from the "impure" emulators. Differences in keyboard layout or display format are easy to spot immediately, and differences in the computer interface will be detected as soon as on-line operation is attempted. However, inexact emulation of the internal functions is not as easily detected.

Emulators that fall short of exact emulation may do so in the duplication of video attributes (e.g., an unusual combination of attributes, perhaps modified by character size or reverse screen). But problems more often arise in the interpretation of command sequences.

Cobar, Inc.'s model 3132 *editing video terminal emulates DEC's VT-132, VT-100 and VT52.*

REPRESENTATIVE EMULATORS

Manufacturer	Cobar	Data Media	Data Graphix	DEC	Direct	C. Itoh	Micro Term
MODEL	3100	80/1	132/ID	VT-100	VP 800/A	CIT-100	MIME-100
SCREEN							
Size (inches)	12	12 (150 pt)	12	12	12	12	12
phosphor	P4	P4	P3	P4	P4	P4	P4
format	24 × 80/132	24 × 80/132	24 × 80/132	24 × 80/132	24 × 80/132	24 × 80/132	24 × 80/132
non-glare	yes	yes	no	no	yes	yes	yes
KEYBOARD							
layout	yes	yes	no	STD	no	yes	no
indicators	yes	yes	no	STD	no	yes	yes
numeric pad	yes	yes	yes	STD	yes	yes	yes
ENHANCEMENTS							
true 19,200 baud	yes	no	no	no	no	yes	yes
set-up legends	yes	no	no	no	no	yes	no
screen save	yes	yes	no	no	no	yes	no
true VT52 scroll key	no	no	no	no	no	yes	yes
monitor mode	yes	no	no	no	no	yes	no
key click volume control	yes	no	no	no	no	no	no
paging	no	no	no	no	yes	no	no
printer port	STD	STD	OPT	OPT	STD	OPT	STD
EMULATION							
VT 100	yes	yes	partial	STD	partial	yes	yes
Advanced video opt. (AVO)	STD	STD	STD	OPT	OPT	STD	STD
VT 132	OPT	no	no	OPT	no	no	no
printer port	yes	no	no	STD	no	yes	no

This emulation failure is particularly unpleasant because it usually appears only under special conditions. For example, a series of commands occurring while a scroll is in process might not be processed properly. This explains why emulators frequently operate successfully on one system but fail on another.

Enhancements are important in the emulation market. Sometimes it seems that there is no limit to the number of features added to the terminal. Provided that enhancements don't put the price out of line and interfere with a terminal's performance, there really is no limit. However, enhancements should not change any standard capabilities. There are risks in using unassigned codes or commands; DEC may add features using those codes or commands, or an application program may inadvertently use an undefined code. In both cases, the enhancement suddenly becomes a liability.

However, some emulator makers have added truly useful enhancements to their terminals. One firm heard complaints about the disturbing noise of the VT-100's keys. As a result, its terminal has two levels of audio feedback: one duplicates the click of the DEC terminal, and the other is quieter. This is an example of a simple enhancement that has proven to be popular with users.

Another type of enhancement is to improve on the performance of the target terminal. For example, the VT-100 requires that a pad character, which is ignored by the terminal, be inserted before each data character to operate at a sustained 19,200 bps. Most emulators have eliminated this requirement.

Other useful enhancements include: English-language prompt legends to describe the selected setup mode bit, eliminating the constant need for reference material; a screen-save feature that reduces display intensity after a period of inactivity to eliminate phospher burn; a monitor mode that causes all received data to be displayed, including control codes, to assist in program debugging. A true VT52 Scroll-key capability, offered by a few emulators, causes the No-Scroll key to function identically to the VT52 Scroll key when operating in VT52 mode. This makes the terminals more familiar to operators accustomed to using VT52s.

Many emulator makers got into the DEC market by acting quickly to capitalize on DEC's problems in delivering the VT-100 about two years ago. (DEC was 18 months behind on deliveries at one time.) They jumped in with promises of better delivery, lower price, some enhancements and improved service. The promises were usually kept, although some question the claim of better service. Most emulator makers copy DEC's practice of selling through distributors, which have frequently provided poor field support.

Primary emulators have a distinct sales advantage: they require less support. A partial emulator is a prime target for complaints from customers who believed they bought an exact DEC replacement. There may be no problem for months. Then the customer decides to bring in new software and complains when it won't work on the emulator.

	Plessey	Teleray	Volker-Craig	Visual Tech.
	PT-100	Model 100	VC-2100	Visual 100
	12	12	12	12
	P4	P4	P4	P4
	24 × 80/132	24 × 80/132	24 × 80/132	24 × 80/132
	yes	yes	yes	yes
	no	no	no	yes
	no	yes	no	yes
	yes	yes	yes	yes
	yes	yes	yes	yes
	no	yes	no	no
	no	no	no	no
	no	no	no	no
	no	yes	no	no
	no	no	no	no
	no	no	yes	no
	OPT	OPT	OPT	OPT
	yes	yes	yes	yes
	STD	OPT	OPT	STD
	no	no	no	no
	no	no	no	no

Source: Cobar, Inc.

DEC's VT-100: *The terminal that triggered all the emulation.*

Many users have complained that error rates have risen alarmingly when operators accustomed to a DEC terminal are moved without training to an emulating terminal with a different keyboard.

Some significant changes are occurring in the giant DEC market that will affect emulator users. One is the growing importance of the VT-132—DEC's smart-terminal version of the VT-100. As a smart editing terminal, the VT-132 fits in with DEC's shift in emphasis to commercial business-forms management, word-processing, distributed-processing and off-line-terminal applications. As a block-mode terminal, the VT-132 also tallies with DEC's renewed attack on the mainframe business-systems market, in which terminals are generally clustered by function. This contrasts with the current use of the VT-100 as an independent conversational terminal. The VT-132 is also likely to play a major role in DEC's Ethernet local area network plans. Initially, DEC is likely to integrate existing products into Ethernet, and the VT-132 makes a good fit because it can be configured as a terminal-cluster controller.

Because of the growing importance of the VT-132, a user with a roomful of VT-100s would be shortsighted to yield to the temptation to buy VT-100 emulators. A user should insist on an emulator that at least equals the VT-132 in performance to ensure room for future growth.

Another market development that will affect users is DEC's renewed agressiveness as a terminal maker. DEC is no longer foundering in deliveries. Today, four DEC factories are running full tilt, and the company has closed the shipping gap; there was a glut of VT-100s early this year. It's doubtful that a company as strong as DEC would repeat the mistakes of the VT-100 with the VT-132.

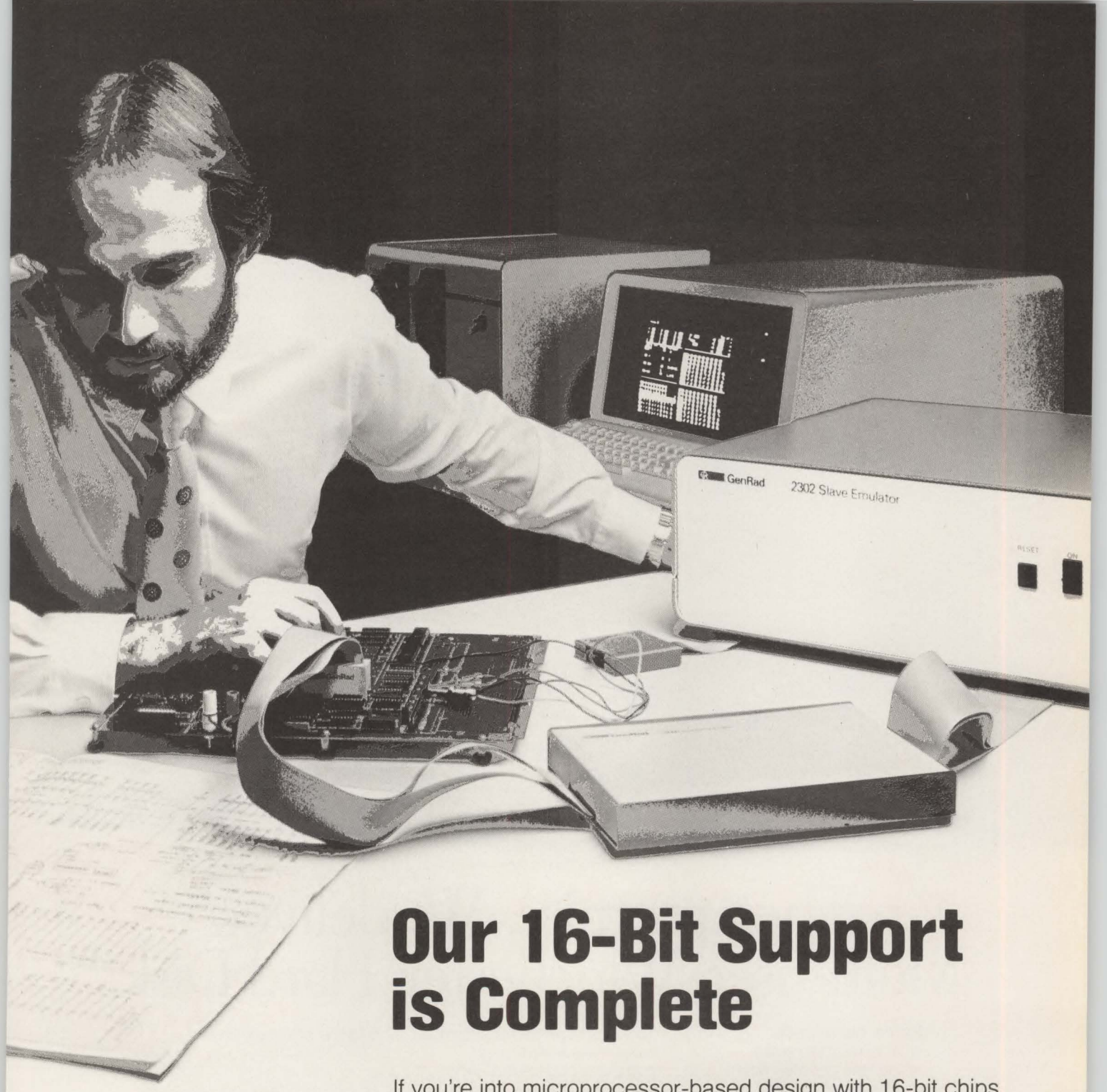
The resurgence of DEC will serve to weed out many emulator manufacturers. Others will fall by the wayside, unable to meet the demands of an increasingly sophisticated market. More OEMs and end users alike are likely to insist on exact emulation. Should that be the case, only manufacturers totally committed to the DEC market will be able to meet that demand. ■

John Chapman is president of Cobar, Inc., Fullerton, Calif.

NEXT MONTH IN MMS

In addition to two major survey articles on single-board μcs and analog I/O boards, the September issue of Mini-Micro Systems will include:

- A detailed look at an application of distributed μcs in an aluminum rolling-mill control system.
- A tutorial on X.25 that examines hardware and software considerations for implementing this powerful data communications standard.



Our 16-Bit Support is Complete

If you're into microprocessor-based design with 16-bit chips, call us. We've got the hardware and software support you need. We've got it NOW! We can support you with full-speed, real-time, transparent emulation; simultaneous emulation of multiple processors; and full logic analysis capability. We're also shipping PASCAL Compilers for 8086, 68000 and the Z8000 series. Give us a call and we'll prove we've got the only way to emulate . . . the only way to write programs for 16-bit chips. Call today. We won't ask you to wait for 16-bit support.

16-BIT PROCESSOR	SLAVE EMULATORS	PASCAL COMPILERS
8086	•	•
68000	•	•
Z8001/ 8002	•	•

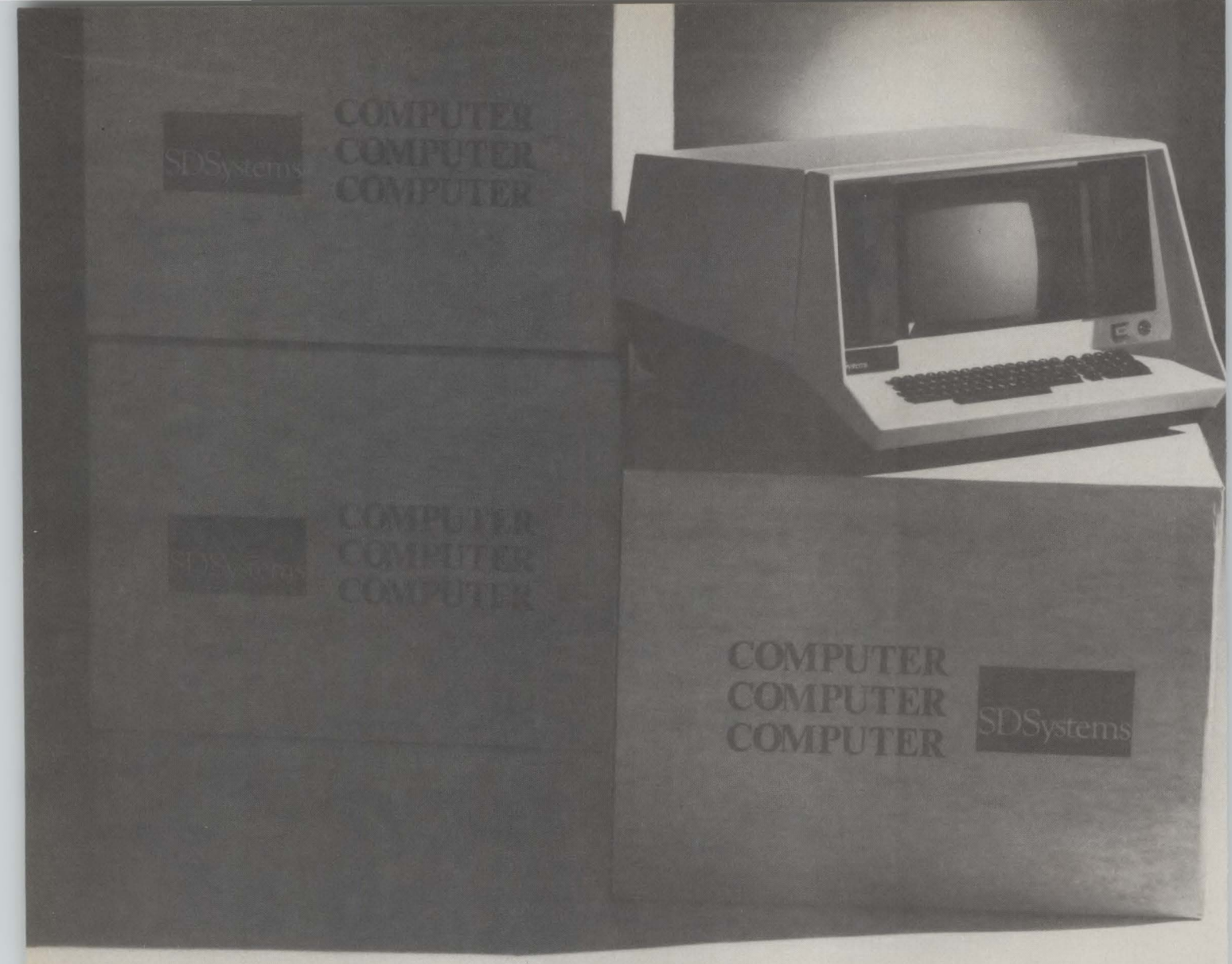
Complete support also available for the 6809 and other 8-bit chips

SEE US AT WESCON, BOOTH NO.'S 1635, 1637, 1736 AND 1738.

5730 Buckingham Parkway
Culver City, CA 90230
(213) 641-7200 TWX: 910-328-7202

GenRad
Development Systems Division

CIRCLE NO. 77 ON INQUIRY CARD



They promise. We deliver. Multi-user. Winchester. Hard Disk.

We're complete.
Small to medium-sized businesses get their data processing needs met by SDSystems computers. Flexibility is the watchword with this product range:

- ☐ The MS-20. A single-user system with 2 Mb floppy disk storage.
- ☐ The SD-200. A single/multi-user system (1-5) with 2 Mb floppy disk storage.
- ☐ The SD-605/610. A single/multi-user system (1-5) with 5/10 Mb Winchester storage.
- ☐ The SD-700. A single/multi-user system (1-5) with 32-96 Mb hard disk storage.

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.

We've been tested.
With years of experience, over 25,000 computer boards and hundreds of computers installed worldwide, SDSystems has answers that streamline data processing needs.

We deliver. Fast.
Delivery time for any of our products is 30 days or less from date of purchase. They're all available. Today.

We're always there.
SDSystems trains and supports a network of local dealers. Proven businessmen who offer a wide variety of SDSystems-approved, CPM-compatible applications packages, end-user training, and responsive customer service.

Flexible. Fast. Reliable.
For more facts, call (214) 340-0303, or write SDSystems, Box 28810, Dallas, TX 75228.

SDSYSTEMS
A SYNTECH COMPANY.

CIRCLE NO. 78 ON INQUIRY CARD

DRS: a data-management system for minis

HARVEY M. WEISS, Weiss & Associates

Users and independent evaluators are impressed with the power, versatility and 'friendliness' of this program

Sixth of a Series

In the DBMS environment, systems with only one basic form of data structure are common, although systems having a secondary structure overlaying the primary one are gaining in popularity. But a three-file structure in the same system is rarely conceived, much less implemented. Nevertheless, a DBMS program called DRS, originally designed by Aeronautical Research Associates of Princeton, N.J., for its own large data bases, possesses that three-structure capability. This feature combined with several others to earn the DRS system 383 points of a possible 500 on Weiss & Associates' revised evaluation checklist.

Readers of this series will recall that previous systems were rated against a possible 400 points. The evaluation has been made more comprehensive because DBMSs now have increased capability, and more criteria must be considered to maintain validity.

This is the sixth in a series of evaluative reports on data base management systems for minicomputers. The first, on the ORACLE system, appeared in the August, 1980, issue, and the second, which ran in October, reviewed SEED. Other articles reviewed QDMS in February, 1981, TAGS in March and MDBS in April. These reports are intended to provide sufficient information about DBMS to enable potential users to determine if they should consider installing the system. Each article surveys the features of a single DBMS and evaluates it against a standard set of criteria. If there is a particular system you would like to see reviewed, please send its name and supplier to: Editor, Mini-Micro Systems, *221 Columbus Ave., Boston, Mass. 02116.*

DRS was intended for minicomputers but has subsequently been used on other systems, including mainframes. Its capabilities have been expanded for a wide range of business and scientific applications. Among its more attractive attributes is a fully integrated data dictionary through which all access to the data base must pass. DRS owes much of its versatility to this powerful feature. The dictionary provides a user-friendly screen builder and powerful report writer. Also, because the system has its own language, experienced application programming staffs are not needed.

DRS is unique in that it offers the data-base designer three options when the file logic is constructed:

- It permits data to be stored serially in a flat file, with multiple indexes created as required to retrieve and update data.
- It can be implemented if a network or hierarchical data structure is required, without affecting the performance of an inverted structure that could also be in place.
- It permits a relational-like structure in which record types can be linked into logically related fields via common values stored in indexes.

The system runs in the batch and on-line modes simultaneously and uses the resident system for data-communications support. Security and privacy mechanisms operate at the user, data-base, field-name, command, and individual-record (not record-type) levels. In addition, passwords may be linked to each other to provide more than one level of control. DRS offers the restart/recovery option of roll-forward capability, initiated when the operating system senses a failure.

DRS is transportable between different hardware

DRS was originally intended for minicomputers, but subsequently has been used on other systems.

systems. It can be used on DEC'S PDP-11 models 23 to 70 (under the IAS/RSX-11M/RSX-11D operating systems, with RSTS available in the near future); DEC'S VAX (VMS); Univac's 90/XX (VS9); IBM'S 370 (CMS/OS/DOS/TSO) and any 370 plug-compatible machine; CDC 6000/7000 and CYBER series (XRNOS/NOS/SEOPE); IBM'S 1130; General Automation's 18/30 (under TSO/CYTOS, with 440/480 under development); Digital Scientific's Meta 4000/5000 (under TSO/CYTOS); and Computer Hardware's 2130 (under TOS/CYTOS). DRS is installed complete as a user program and does not require a SYSGEN on any system. It can also be used on IBM and CDC hardware systems from three national time-sharing houses: University Computing Corp., On-Line Systems and Multiple Access, Ltd., Canada.

A DRS data-base system is defined, constructed and

```
SIP01 - MASTER MENU


SCREEN
*
ENVIRONMENT_SECTION
*
                    SCREEN SPECIFICATION FOR MASTER MENU FOR DEMO UIC
*
*****************************************************************************************
*                                                                                       *
*                    THE FOLLOWING SET COMMAND ESTABLISHES THE SIZE OF THE              *
*                    SCREEN AS 80 COLUMNS WIDE AND 24 LINES LONG. THE FIRST             *
*                    23 LINES ARE AVAILABLE FOR FORMS, THE LAST LINE, LINE              *
*                    24, IS USED AS THE MESSAGE AREA.                                   *
*                                                                                       *
*****************************************************************************************
*
*
                    SET COLUMNS-80, LINES-24
*
*****************************************************************************************
*                                                                                       *
*                    THE NEXT SET STATEMENT OVERRIDES THE DEFAULT PROMPT                *
*                    WIDTH, SETTING IT TO 35. THIS CAUSES THE PROMPT                    *
*                    PARAMETER ON ACCEPT STATMENTS TO BE DISPLAYED 35                   *
*                    COLUMNS TO THE LEFT OF THE ACCEPT FIELD                            *
*                                                                                       *
*****************************************************************************************
*
*
                    SET PROMPT_WIDTH - 35
*
*
*****               DEFINE A TEMPORARY FIELD TO STORE INTO                  *****
*
                    FIELD_DEFINITION WHAT_NEXT, MODE-INTEGER
*
FORM_DEFINITION_SECTION
*
************                DEFINE THE FORM FOR THE MASTER MENU                ************
*
MENU:               START_FORM
                    DISPLAY 'MASTER MENU FOR SCREEN DEMONSTRATION',
                            COLUMN-1, 80, LINE-3, JUSTIFY-CENTER
                    DISPLAY ('1. ADD EMPLOYEE TO HDBSAMPLE DATA BASE*',
                             '2. SALARY INCREASE — HDBSAMBLE DATA BASE*',
                             '3. ADD TO REPORT WRITER DATA BASE*',
                             '4. MODIFY REPORT WRITER DATA BASE*',
                             '5. EXIT')
                            COLUMN-15, 50, LINE-6, 10
                    ACCEPT WHAT_NEXT, COL-36, LENGTH-1, PICTURE-NUMBER, MIN_VALUE-1,
                            MAX_VALUE-5
                            PROMPT-'WHAT DO YOU WANT TO DO? (1, 2, 3, 4, 5)',
                            LINE-*NEXT_LINE + 2
                    END_FORM
*
************                END OF MASTER MENU FOR DEFINITION                  ************
```

The screen input processor *allows the user to manipulate data quickly and effectively. This example shows how the user has established the size of the screen and the placement of data.*

Line Printer Controllers that test themselves-

MDB makes the difference!

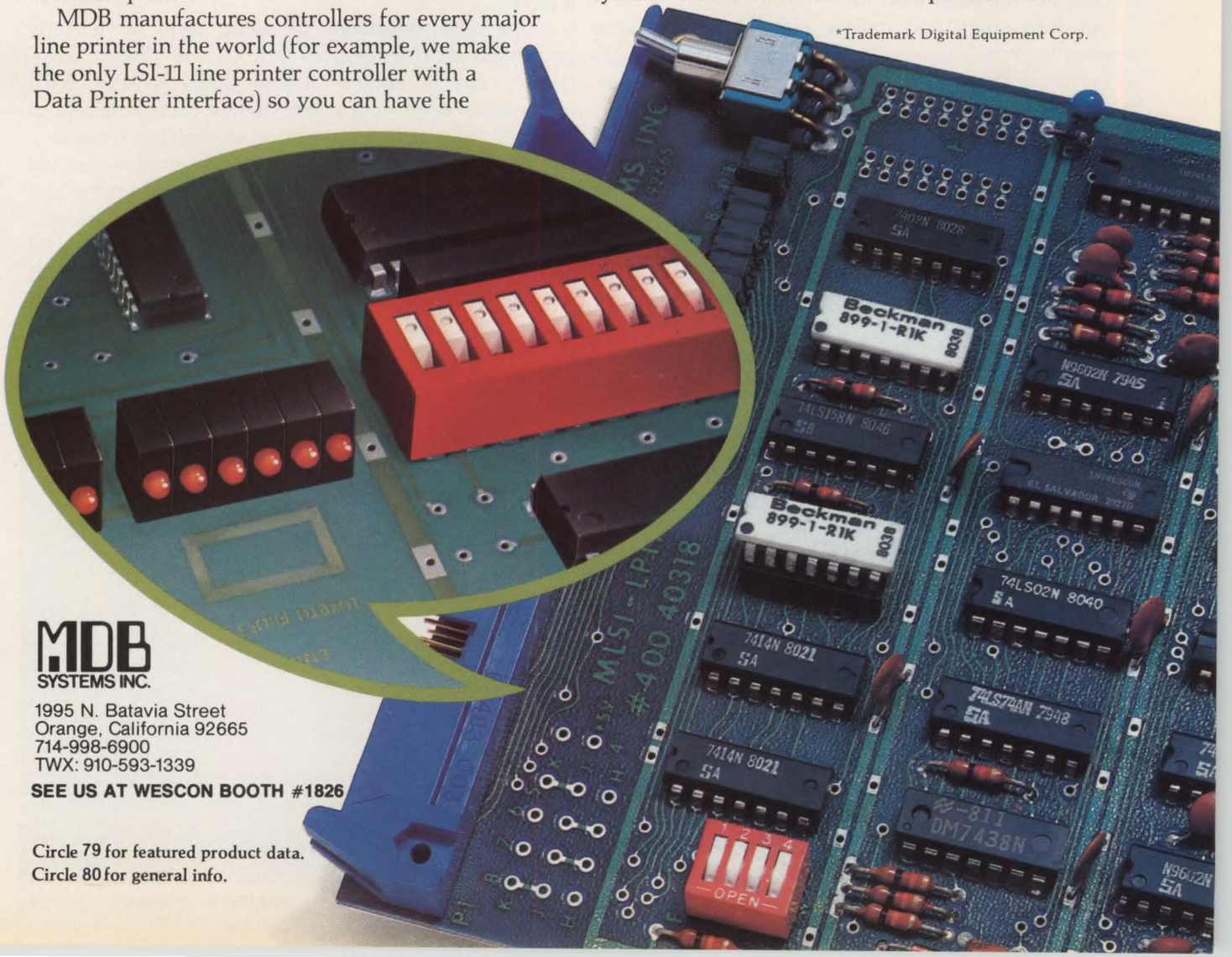
Only MDB has Line Printer Controllers that are completely self testing with PrinTest,™ Loop Back and LED's for visual indication of the data being transmitted. You save maintenance costs and down time. MDB's exclusive PrinTest feature, when activated by an edge mounted toggle switch allows you to exercise the controller's printer interface, interconnection cable and all parameters of the printer (except VFU). Then flip a second switch for Loop Back which causes the controller to function as if in full operation with a printer while, in fact, the printer is disconnected. You verify controller operation or troubleshoot the module without noise, paper waste or confusion. And MDB controllers with the PrinTest feature can be remotely activated from the printer.

MDB manufactures controllers for every major line printer in the world (for example, we make the only LSI-11 line printer controller with a Data Printer interface) so you can have the exact printer system at the exact speed you need—whether you use a PDP* 11, VAX,* LSI-11/2 or 11/23, PDP-8, DG, H-P, PE or IBM Series/1 computer.

And that's not the only difference MDB interface products can make to you. MDB makes the only DZ11 compatible multiplexors for DEC's LSI-11 series. They offer RS-422, RS-232 and current loop capability. We offer PROM modules with window mapping, communications interfaces that support X.25 and a unique LSI-11/23 system with 22 bit addressing and up to 4 Mbytes of memory. Our boards are warranteed for a full year, many are available off the shelf and they can be purchased under GSA contract #GS-OOC-02423.

Want to see the difference we can make in your system? Call or write for all our specifications.

*Trademark Digital Equipment Corp.



MDB SYSTEMS INC.
1995 N. Batavia Street
Orange, California 92665
714-998-6900
TWX: 910-593-1339

SEE US AT WESCON BOOTH #1826

Circle 79 for featured product data.
Circle 80 for general info.

The processes of designing and generating a DRS data base consist of making entries into the dictionary and describing the data to be stored.

controlled by a set of functions that constitute the data dictionary. These are themselves DRS data bases and fall into several categories:

The **command control** defines the syntax and variations of each command during execution.

The **data base control** provides the catalogue, which defines the global characteristics of all data bases available. These characteristics include the names and locations of components such as utility data bases and physical files related to each user's data base.

The **data-base definition** provides the field specifications; it defines the names and characteristics of all records and data items in a data base. Included are such attributes as size, mode, content and security constraints, and other documentation for each entry. The field specifications also include page and segment-expansion limits.

The **input/output control** defines the I/O and report formats for a given data base. An output format may be inherently complete or may interact dynamically with the DRS LIST function. Several standard or default formats are supplied with DRS.

The **data entry and update control** (screen-input processor) provides screen and hard-copy forms-oriented terminal input, update and output control definitions. These include data verification, validation and security constraints.

The **index control** defines index structures and associative record relationships.

The **security control** provides the password specifications that permit individual access-lit control for commands and data processing.

The **input/output filter** provides the translate, thesaurus and noise-word specifications needed to define tables for data translation.

Because the data-base definitions are kept separate from the other controls or filters, the controls and filters can be created, changed or eliminated without affecting a definition. As in other products that center on a data dictionary, control of all aspects of data-base definition, creation and processing is not just a tool but an integral part of the data-base environment.

Using the system

The processes of designing and generating a DRS data base consist of making entries into the dictionary and describing the data to be stored. Also included in the procedure is the desired format of input: the validity checks, the storage form of the data, the grouping of the data into records, the relationship between data items, the items to be indexed, the output forms, the global characteristics and any security or passwords. These definitions are entered in a utility data base that describes and controls all aspects of the user's data base. The utility data base can be accessed and used just like any DRS data base. In addition, a data base may have multiple specifications of any type, including catalog entries.

The three major components of DRS include the host language, the screen input processor and the report writer.

DRS's **host language** is called XBS. It is fully implemented with features such as sub-schema facilities to aid in control access down to the field-addressable level; concurrent update control; access to data through an index, scan or associative structure; on-line update; automatic data-base updating; and audit-trail development for data-base integrity and DRS-recovery facilities. DRS provides its own file-access techniques and therefore requires only the lowest level direct-access method. This allows DRS to optimize its I/O to fit its own needs and avoids the additional overhead

EXPLAINING THE EVALUATION MATRIX

The evaluation matrix is the chief tool used in evaluating DRS. In a competitive evaluation, the matrix would list the criteria used, the vendors being considered and the ratings each vendor received. (Not all criteria are used each time.) The first step is to establish an importance weight factor for each criteria. This factor establishes the relative importance, on a scale of 1 to 10, of a feature or capability of the DBMS in meeting system requirements. The vendor's software is then rated, again on a scale of 1 to 10, according to its ability to meet that specific criterion, establishing the vendor's requirement score. Multiplying the importance weight factor by the vendor's requirement score produces an effective score for the vendor for that criterion.

For example, if one of the selection criteria, a data-base loader (software), is extremely important, it could be assigned a weight of 10. If vendor 1 does not provide such an offering, its ability to meet this criterion might be rated as 1. The resulting effective score for this criterion for this vendor would be 10 ($1 \times 10 = 10$). However, vendor 2 might provide such a product, receiving a rating of 10. That vendor's effective score would then be 100 ($10 \times 10 = 100$).

Once all the criteria used in the selection process have been weighted, and all vendors' responses have been given a rating, their effective scores can be calculated and totaled.

The criteria listed in the matrix comprise a standard list that could be used to define system requirements for a data-base management system. Details of their meaning can be found in any document describing DBMS functions, or are available from Weiss & Associates.

The evaluation matrix is used here only to establish a rating for DRS and its ability to meet all the criteria as if all had an importance weight of 10. If a criterion receives a score greater than 7, it indicates that DRS could effectively meet that system requirement. A score of 4 to 6 indicates it is marginally satisfied, and a score lower than 3 is unsatisfactory.

EVALUATION MATRIX VENDOR RATING: DRS

SELECTION CRITERIA		VENDOR SCORE
1.	DBMS Manipulation Process:	
1.1	Data/Record Generation	10
1.2	Data Base Update Process	10
1.3	Data Base Deletion Process	10
1.4	Security Techniques	8
1.5	Privacy Control Techniques	8
1.6	Data Integrity Controls	8
1.7	Data Format Translation	8
1.8	Error Processing Techniques	7
1.9	Data Redundancy Controls	9
1.10	Data Compaction Process	5
1.11	Data/File Convertibility	8
1.12	Program/Data Independence	10
1.13	Data Manipulation Language	10
	Possible: 130	111
2.	DBMS Physical Structure:	
2.1	Record Structure (Logical/Physical) Supported	10
2.2	Record Creation Process	8
2.3	Record Modification Process	8
2.4	Physical Storage Processes	7
2.5	Record Indexing Mechanisms	10
2.6	Data Space Management	8
2.7	DBMS Structure	8
2.8	File Growth	8
	Possible: 80	67
3.	DBMS Tools:	
3.1	Data Query Facility	
	3.11 Availability of Tool	10
	3.12 Ease of Use	10
	3.13 Capabilities	10
3.2	Report Writer Facility	
	3.21 Availability of Tool	10
	3.22 Ease of Use	10
	3.23 Capabilities	10
3.3	Data Dictionary Facility	
	3.31 Type	10
	3.32 Ease of Use	10
	3.33 Program/Operation Interface	10
	3.34 Reports Capability	1
3.4	Data Communications Facility	
	3.41 Protocols Supported	1
	3.42 Ease of Use	1
3.5	System Development Tools	
	3.51 System Design Tools	1
	3.52 Program Development Tools	1
	3.53 Data Base Design Tools	1
	3.54 Screen Design Tools	10
	Possible: 160	106
4.	System Implementation:	
4.1	Hardware Requirements	10
4.2	Data Base Loading Facility	8
4.3	Data Definition Language	8
4.4	Vendor Support	8
	Possible: 40	34
5.	Secóndary Features	
5.1	DBMS Utilities	
	5.11 Performance Statistics	5
	5.12 Simulation Facility	5
5.2	Vendor Response to Hardware/Software Changes	8
5.3	Ease of Installation	8
5.4	DBMS Maintenance Policies	8
5.5	Customer Experience	9
5.6	Documentation	6
5.7	Training Availability	8
5.8	System Performance	8
	Possible: 90	65
	Total Possible: 500	DRS: 383

DRS provides its own file-access techniques and therefore requires only the lowest-level direct-access method.

that could result in using a more generalized access method.

The **screen input processor** (SIP) is a software package that permits conversational screen or terminal sessions by a non-DP person. SIP consists of two modules: a compiler that runs under DRS and a screen/terminal processor that executes the compiled screen description. Although not as user-friendly as other products reviewed in this series, SIP does provide a quick and effective way to develop processes that allow users to manipulate their data (see figure).

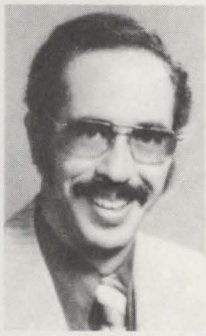
The **report writer** (RPW) is a general-purpose data-management tool for manipulating and printing information from DRS data bases. It has many options for controlling the placement and styling of the output, and also permits computations of virtually unlimited complexity at any point during report processing.

Although the report writer was intended for simple reporting, it also allows a programmer to code complex processing sequences with the flexibility of high-level languages such as FORTRAN and COBOL. For example, it is possible to branch, establish loops and invoke separately defined subroutine-like procedures.

In summary, DRS provides more than 70 commands to select, sort, compute and report numeric and textual data and to perform routines. The DRS data bases may contain information stored in variable or fixed-length fields or records. They can also have complex inter-record relationships and can be fully or partially indexed on any fields or combination of fields. ■

ADVANCED DATA MANAGEMENT: A COMPANY OVERVIEW

Advanced Data Management was originally an integral part of the Aeronautical Research Associates of Princeton. Several years ago it was established as a separate division of the company, responsible for the sales of DRS. Advanced Data Management has 20 employees and is located at 15-17 Main St., Kingston, N.J. The company reports more than 170 users of DRS, with 70 percent being acquired in the last three years.



Harvey M. Weiss, president and principal consultant of Weiss & Associates, Denver, Colo., has had more than 20 years of experience in data processing. His firm's activities include development of data base plans and designs and evaluation and selection of data base management systems for clients in industry, education and government.

A transferable software library

PLOT 50 is a collection of graphics packages that employs exchange formats to allow data transfer among packages

Desk-top computer users once suffered from a dearth of good graphics application software packages. Now, the abundance of such packages has created another problem: how to combine packages, without the time and expense of reformatting and re-entering common data. For example, a design engineer may require packages for drafting design analysis, report generation and project management. Many of these applications use at least some common data. If a significant amount of time must be spent to re-enter the data or to develop conversion programs, much of the benefit of a desk-top computer is lost. A solution to this problem is to use data-exchange formats that allow easy transfer of information among packages.

This is the technique employed by Tektronix, Inc.'s PLOT 50 Software Library—a collection of graphics packages for Tektronix 4050 series desk-top computers that supports picture composition, document preparation, graphics-presentation aids, statistics and project management. PLOT 50 uses standard file formats that allow data (either graphic or numeric) entered into or generated by one library program to be accessed by another. To transfer or exchange data, it's necessary only to select the proper utility routine after entering or manipulating the data. There is no need to re-enter or reformat data, or to name, mark or size the disk.

Shared data can be either numeric or graphic. The numeric-transfer format is referred to as a "standard file." The graphic (pictorial) transfer format is called

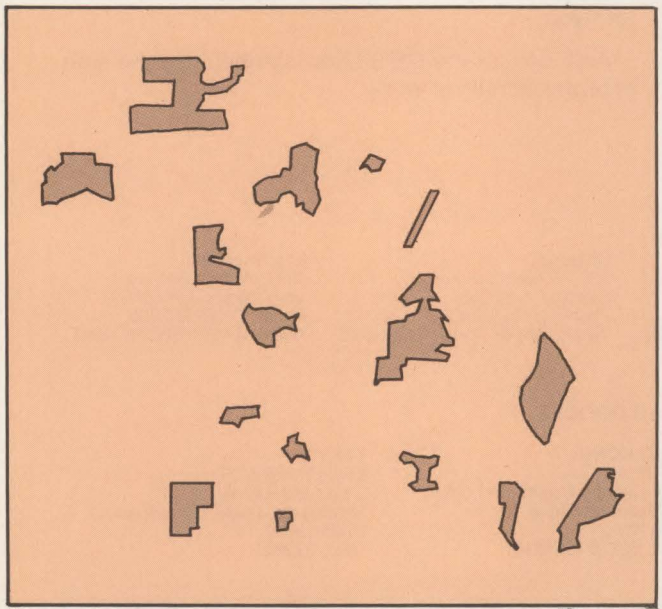


Fig. 1. Using a Tektronix 4054 desk-top computer, *a 4907 file manager, 4956 grapics tablet and the PLOT 50 interactive-digitizing package, a city park map can be digitized, with parks appearing as polygons on the display screen.*

```
DATA FILE INFORMATION

Data file                       : PARKS
Number of objects in file       : 76.
Extent (min X, max Y)           : 500.696652852 , 51900
       (min Y, max Y)           : 3300, 61343.6941023
Control point coordinates       : 1) 0, 0
                                  2) 49658, 0
                                  3) 49658, 49658
Aspect ratio (width/height)     : 0.747765515416
Attributes Defined
1 RECREATIONAL FACILITIES
    (string: max length 36 char)
Object Information
1  [id# 10] Polygon             Name: Greenbelt Park
   Number of points             : 5
   Extent (min X, max X)        : 15000, 15700
          (min Y, max Y)        : 3800, 4300
   Perimeter                    : 2219.80390272
   Area                         : 300000
   Centroid X, Y                : 15350, 4063.88888889
   RECREATIONAL FACILITES:
          "none"
```

Fig. 2. The digitizing package *allows simultaneous entry of various attributes and names, and automatically computes area and perimeter values.*

graphic model exchange (GMX). Both files reside on the Tektronix model 4907 file-manager program disk or 4050 system cartridge tape to permit extensive interchange possibilities between PLOT 50 software packages. User application programs work with the PLOT 50 standard files, or data generated by a user's own data-analysis packages can be transferred to packages compatible with PLOT 50 GMX or standard files.

A standard file overview

A standard file comprises a header file and a data file. The data file consists of observations of one to 100

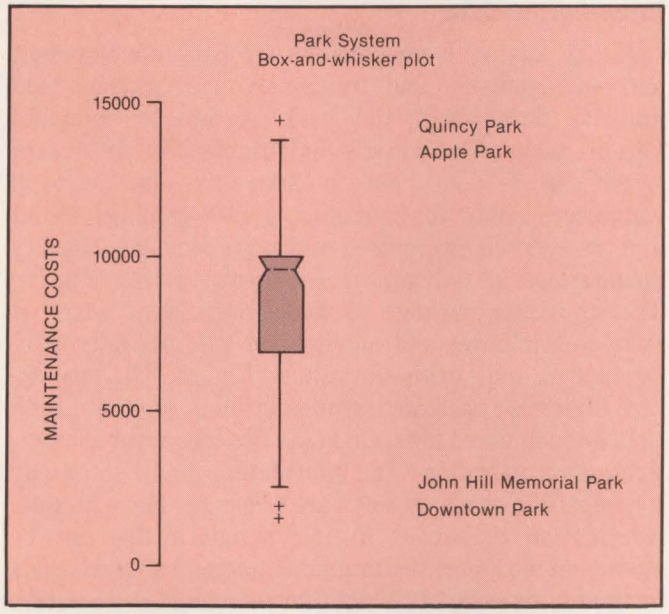


Fig. 3. Information contained in the standard file *can be combined with maintenance costs, without the need to re-enter data from the digitizing package. The PLOT 50 provides graphic representation of the data.*

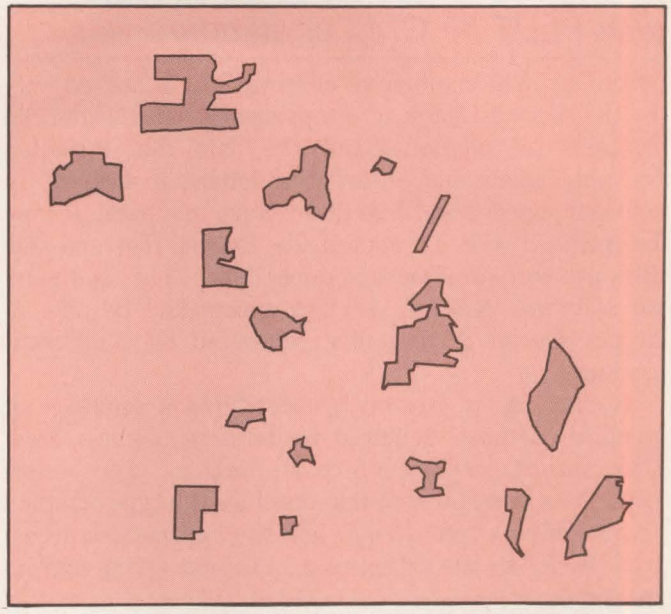


Fig. 4. The city map created by interactive digitizing *can be enhanced using the PLOT 50 picture-composition package. Polygons need not be re-entered, and text and drawings can be added to make the image appropriate for other uses.*

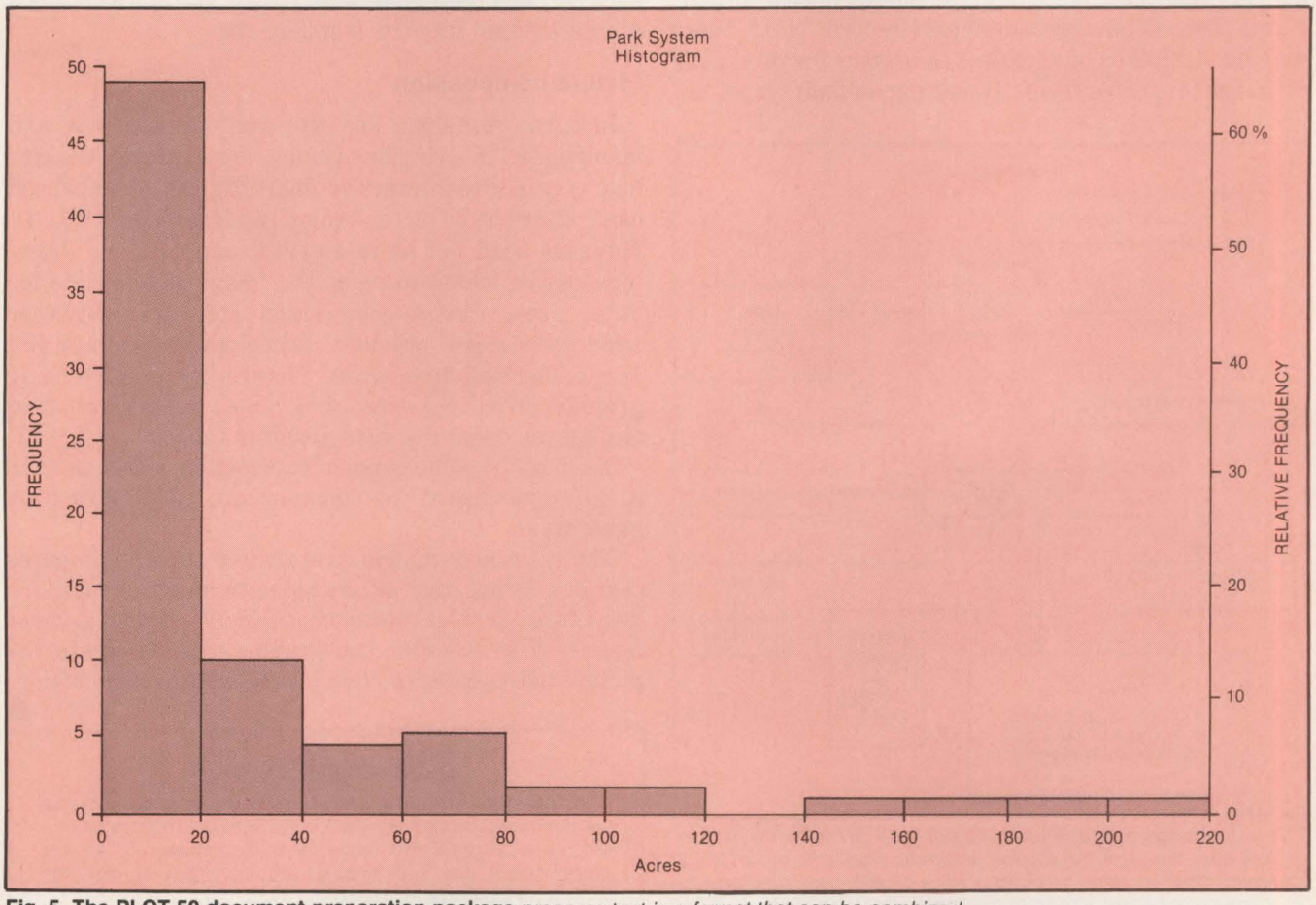


Fig. 5. The PLOT 50 document-preparation package *prepares text in a format that can be combined with pictures for reports or technical documents.*

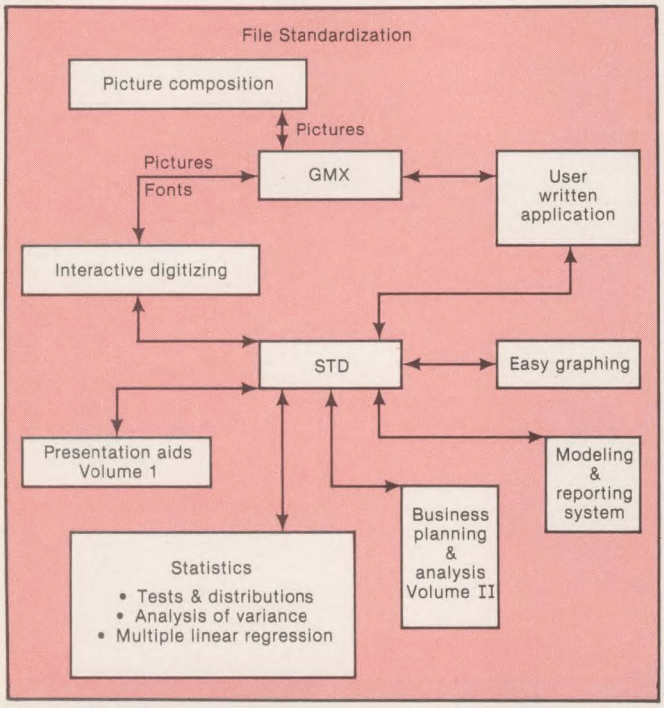
User application programs work with the PLOT 50 standard files, or data generated by a user's own data-analysis packages can be transferred to packages compatible with PLOT 50 GMX or standard files.

variables. The number of observations is limited only by the space available on a tape or disk. The header file contains information about the data file, including variable labels and observation labels, if desired. In addition, special and free files unique to a package may be included with a standard file. Special files and free files are software-package-dependent. Thus, one PLOT 50 software package will not necessarily be able to access special or free files generated by a different package.

A GMX file is created by specifying a sequence of graphic "actions" required to define a picture. Each GMX record corresponds to an "action." The record contains a function code that specifies the type of action (e.g., define a text string) and the parameters necessary to define the action (e.g., the text string and its location).

A GMX picture is comprised of one or more sub-pictures. Each sub-picture consists of combinations of five types of objects: point, sub-picture reference, path, polygon and text. All follow the same general format. First, there is an object-definition record. Next, there may be attributes of an object necessary for producing its image (e.g., line style). If missing, default values are used. After the attributes, there may be a section defining object labels. Finally, graphical objects have a section that specifies their screen coordinates.

To illustrate the advantages of a common file format, and to describe how PLOT 50 packages work together, let's examine a hypothetical application.



The interchange possibilities *between PLOT 50 software packages, showing that user-application programs work with the PLOT 50 standard files, or data generated by a user's own data-analysis packages can be transferred to packages compatible with PLOT 50 GMX or standard files.*

Entering the data

A city agency is responsible for park development and management, and frequently uses graphic and numeric data about the park system to complete various tasks. This entails digitizing a city park map, which can be done using a Tektronix 4054 desk-top computer, a 4907 file manager, a 4956 graphics tablet and the PLOT 50 interactive-digitizing package. The city parks appear as polygons on the display screen (Fig. 1). The digitizing package allows simultaneous entry of various attributes and names, and automatically computes area and perimeter values (Fig. 2). The interactive digitizing package includes utilities to create both GMX and standard files. Once the files are established—a five-step operation—the information can be shared by a compatible PLOT 50 software package. For example, information contained in the standard file can be combined with park-maintenance costs to analyze costs or to provide valuable insight for planning future parks. PLOT 50 statistics software provides easy-to-understand graphic representations of the data (Fig. 3). There is no need to re-enter data from the digitizing package, and data generated by the statistics routines can be entered into the standard file.

Picture composition

Pictures contained in GMX can be accessed and manipulated in a similar manner. For example, the city map created by interactive digitizing can be enhanced using the PLOT 50 picture-composition package (Fig. 4). Polygons need not be re-entered, and text and drawings can be added to make the image appropriate for other uses. Picture-composition software moves or windows images, provides identifiers or symbols and creates multiple text styles. Pictures are created using graphic primitives—including lines, arcs, boxes and circles—or using the 4956 graphics tablet.

Much of the same graphic information will be used in a different format to communicate the information generated.

The PLOT 50 document-preparation package prepares text in a format that allows space to insert pictures for reports or technical documents (Fig. 5). Again, it is not necessary to re-enter the graphic data to create the picture in the space provided using picture composition. ■

NEXT MONTH IN MMS

Two major product profiles—surveys of products and trends in two categories—will highlight the feature article section of Mini-Micro Systems in September. They are single-board μcs and analog input/output boards for computer systems.

You should hear what PASCAL PDQ-3™ users are telling us!

"FAST, EXPANDABLE, AFFORDABLE!"

- One happy user rated the PDQ-3 up to 6 times faster than a LSI-11* based system in the development of the LISP Compiler.
- Another user rated the PDQ-3, up to 20 times faster than the APPLE, while running a Financial Planning Software Package he is marketing.
- A third user reported that the PDQ-3 required only one and one-half hours to reformat the text of a 200 page manual. He estimated a savings of three and one-half hours over another popular microcomputer.
- In a Recursive Quicksort comparison, for example, the PDQ-3 was matched against the TERAK version of the LSI-11 and the INTEL 8080. This benchmark generates a list of 10,000 random numbers, which it sorts using a process of array indexing, integer arithmetic, comparisons and procedure calls.
  The INTEL 8080 took 316 seconds; the TERAK required 198 seconds; but the PDQ-3 took only 44 seconds to sort the entire list.
- The PDQ-3 benchmark comparisons are available in print on request. They include tests for Transitive Relations, Floating Point Add/Subtract and Multiply/Divide, Transcendental Functions, Task Switching and many more.

EXPANDABLE
Options available:

- Backplane expandable to 8 Slot Quad size
- Expandable to 128KB Memory
- Double sided, double density floppy disc drives
- Hard disc drives up to 300MB
- Mag Tape Drives up to 75 IPS
- Printers up to 300LPM
- Abundant communication capability
- Unlimited LSI-11 "Q-Bus" Options

AFFORDABLE
The PDQ-3 Computer Systems consist of:

- A Processor card containing a 16 Bit Stack Oriented Processor
- Real Time Clock
- Fully Interrupt Driven Interval Timer
- DMA Floppy Disc Controller that can be ordered with Single or Double Density
- Multiplexed CRT and Printer Interface
- Two 8" Floppy Disc Drives
- 4 Slot Quad size LSI-11 "Q-Bus" Backplane
- Complete UCSD Pascal Software Operating System

Complete System for under $7900 (includes Z-19 terminal).
Call or write now to:

Advanced Computer Design
A Subsidiary of Computer Services Group, Inc.
7584 Trade St. / San Diego, CA 92121 / (714) 578-9620

*LSI-11 and "Q-Bus" are trademarks of Digital Equipment Corporation and UCSD Pascal trademark of the Regents of the University of California.
Educational Discounts and EOM pricing available

CIRCLE NO. 83 ON INQUIRY CARD

Secret Weapon for System Builders

The key to successful computer systems is successful software — tailored to the customers' needs, bug-free, structured, well documented, easy to maintain and to extend.

FORCE, POINT 4's Automated Programming technique is a powerful new tool for creating just such software.

- ★ *You interactively define menus, screens, data elements, synonyms, files and reports.*
- ★ *FORCE enters them into a data dictionary.*
- ★ *You write a sequence of high level macros that define the logic of your program.*
- ★ *FORCE generates structured, debugged, fully commented programs in Business BASIC. It validates all data, handles all error conditions, presents a uniform interface to the user.*
- ★ Documentation? FORCE provides it.
- ★ Changes? Modify any of the formats or the logic, and FORCE changes the programs.
- ★ Run-time efficiency? Faster code than you can write by hand.
- ★ Programmer productivity? Up by 500% to 1000%.
- ★ Want to convert your programs to run on the 400 nanosecond POINT 4 computer? FORCE is the answer.

Should you be without FORCE?

POINT 4
DATA CORPORATION

2569 McCabe Way
Irvine, Calif. 92714
(714) 754-4114

May the Secret Weapon Be With You.

CIRCLE NO. 84 ON INQUIRY CARD

SOFTWARE

Getting compatible with CP/M

WILLIAM R. VAUGHN, Mostek Corp.

Manufacturers reshape a generally accepted operating system to broaden its application

In an attempt to broaden the applications for CP/M, several hardware manufacturers, including Cromemco, Inc., SD Systems and Mostek Corp., have molded a generally accepted μc operating system to their own use. Such support should improve the attitude of users toward μc systems and, more importantly, result in higher productivity. These newer systems improve both the efficiency of the hardware and the productivity of the application programmer, who does not have to write a special routine to perform a simple multiplication or to get at the system clock.

CP/M is a disk operating system designed to run on 8080- or Z80-μp-based μcs. Originally developed by Digital Research, Pacific Grove, Calif., in the mid-1970s, CP/M was one of the first hardware-independent disk operating systems for μcs, providing a plug for a previous market void. Before CP/M, a μc user had to rely on software supplied by the μc's manufacturer, which was often limited in quality and quantity and usually could not be transported to other manufacturers' systems. As a result, users were virtually tied to a particular manufacturer's products. CP/M freed users from dependence on vendor software and gave them access to a growing base of pre-written and tested application-software packages.

No operating system is without its faults, however, and CP/M is no exception. The original CP/M, for example, was intended for use with single-density diskettes, thus restricting the use of double-sided and quad-density floppy- and hard-disk systems. Similarly, CP/M was designed for use with a printing terminal and did not easily accommodate CRT terminals. These deficiencies, many of which have been corrected in subsequent CP/M releases from Digital Research, spurred several μc hardware and software vendors to create their own CP/M-compatible systems. These include I/OS (or TSA/OS) and Multi-OS sold by InfoSoft Systems; CDOS sold by Cromemco; SDOS and COSMOS sold by SD Systems, Garland, Texas; and the newest system, M/OS-80 sold by Mostek. All these systems can run CP/M application programs without change. Their operational syntax is easier to use and more forgiving than the original CP/M's, and they offer better user file protection and system performance. CP/M-compatible systems differ from their progenitor, however, in that

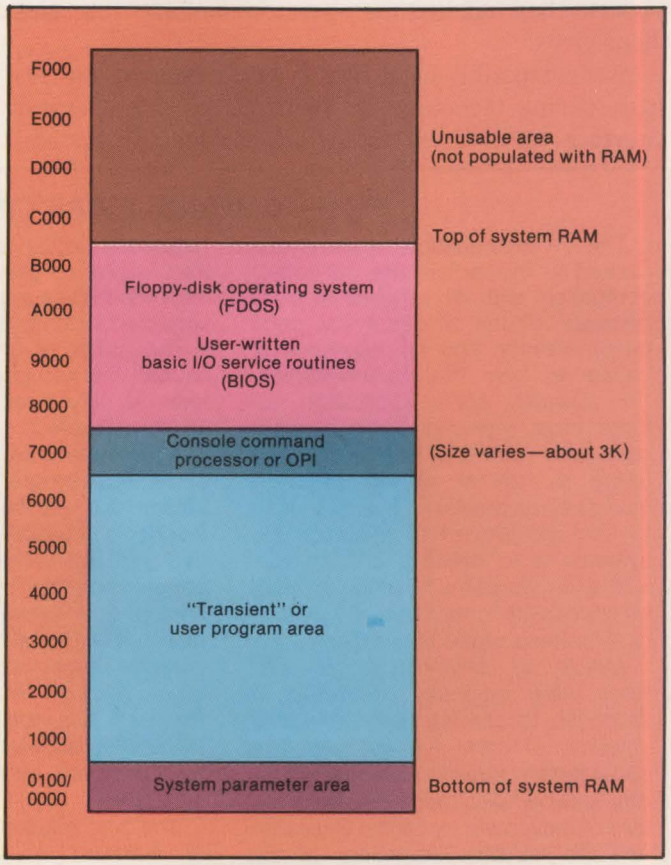


Fig. 1. Typical memory map *for a 48K-byte CP/M system.*

(Editor's note: As this article suggests, Digital Research hasn't been standing by idly as hardware vendors developed CP/M-compatible operating systems. The originators of the popular system have been improving on the product themselves, and will detail some of those developments in an article in a later issue.)

CP/M-compatible systems differ from their progenitor in that they are tailored to operate on a pre-defined set of hardware, yielding systems that perform better than the original CP/M but have less flexibility.

they are tailored to operate on a pre-defined set of hardware, yielding systems that perform better than the original CP/M but have less flexibility. This article compares CP/M-compatible systems to CP/M to show how differences in memory and disk structure affect system performance.

In CP/M-compatible systems, the basic memory structure is usually very similar to that of CP/M systems. The transient program area (TPA) must start at location 100 Hex (Fig. 1). The system implied-run directive assumes this and loads all transient programs at that address. Those programs can subsequently move themselves to other RAM locations to make room for other transient programs.

Many transient programs, especially the newer compilers, require the maximum amount of TPA RAM space (56K bytes) to function. As a result, they cannot work properly on smaller systems. To circumvent this problem, some older programs, such as Digital Research's DDT and some BASIC interpreters, overlaid the console command processor (CCP). They could do this because they handled the operator-computer interface themselves.

CP/M-compatible operating systems improve on this space-saving technique by allowing the CCP operator interface (OPI) to be made disk-resident at system-generation time or at operator request. This increases the amount of available memory space by about 3K bytes.

Improvements in the system parameter area

CP/M-compatible systems have also made improvements in the system parameter area (Fig. 2), which is used to store vectors and data required by user programs and the system itself. For example, starting at location 0, the system that branches to the "warm boot" or restart vector (location 0) causes some CP/M systems to reread portions of the DOS from disk. M/OS-80 and several other CP/M-compatible systems do not need to perform this disk access unless the OPI (console processor) is overlaid.

CP/M-compatible systems define a few areas (Fig. 2), such as locations 28H through 2FH, that were designated as unused or undefined in the CP/M documentation. Also, M/OS-80 and several other emulators provide the user with another level of security by trapping jumps to locations that contain Hex FF bytes. This feature protects the user from programs that branch into non-allocated areas of RAM. CP/M does not support this feature and would permit the user to call location 38, for example, using whatever random value has been placed there as an executable instruction.

CP/M also does not support user interrupts. Most CP/M implementations disable interrupts upon entry, thus defeating the entire interrupt protocol set up by a user application. Virtually all CP/M-compatible systems can and often do use interrupts for a number of user and system functions.

Disk structure and sector size

CP/M's disk structure is not very efficient or flexible. For example, the CP/M home-disk operation requires a

HOW COMPATIBLE ARE CP/M-COMPATIBLE SYSTEMS?

The CP/M-compatible systems discussed in this article are not totally compatible with all versions of CP/M because of the ambiguity of CP/M documentation and the existence of variations from the documentation. For example, some application authors have replaced areas of CP/M code with code that is more to their liking or better suited to their individual application. The response by the creators of CP/M-compatible systems is to disclaim compatibility with such programs because it would be impossible to maintain compatibility with these rogue applications.

Almost all CP/M-compatible systems were originally conceived in response to shortcomings in earlier versions of CP/M (up to 1.4). The compatibility question was considerably less complex then because of the lack of movement by Digital Research and the resulting stagnancy of the "standard." CP/M-compatible authors had several years to eliminate incompatibilities and had at one point corrected virtually all known bugs.

The arrival of CP/M 2.2, however, caused the compatibility question to rear its ugly head again. Because Digital Research chose to use a different means to achieve larger file sizes, those programs written for CP/M version 2.0 and later versions lost a level of compatibility with the emulative systems. The authors of the CP/M-compatible systems have enhanced their systems to emulate the new CP/M functions. M/OS-80, for example, supports all CP/M version 2 calls except those that Digital Research has labeled as not required for use by application programmers, or those that conflict with M/OS-80 standards.

The best solution to the compatibility question is to address each problem as it arises. Mostek has done so by buying and testing as many application programs and systems support languages as possible. Mostek has found that all programs that work on CP/M version 1.4 now work on M/OS-80. Programs that are specifically designed to run on CP/M version 2.2 are few and generally include new versions of existing compilers. These are currently being tested with results yet to be determined. Customers who are worried about compatibility are encouraged to let Mostek test their CP/M application under M/OS-80.

As for programs written expressly for CP/M-compatible systems, many use system calls not contained in the standard CP/M. This prohibits their use on a normal CP/M system. For example, many programs written by Cromemco for use with CDOS will not run on a non-CDOS system.

Location:	Contents:
0000-0002	Warm boot entry point; reinitializes operating system and passes control from user to DOS.
0003	IOBYTE; 8-bit switch to indicate various levels of I/O device hierarchy.
0004	(Reserved)
0005-0007	Jump vector to BDOS; used by transient programs to request supervisor services.
(0006-0007)	Address portion of above vector; used to determine lowest address in memory used by DOS.
0008-0027H	Interrupt locations 1-5 (not supported in normal CP/M implementations); used by interrupt-driven routines as required in CP/M-compatible systems.
(0028H-002FH)	(Not mentioned in CP/M documentation.) Reserved for interrupt vectors in CP/M-compatible systems.
0030H-0037H	Interrupt location 6 (not supported in normal CP/M implementations); used by interrupt-driven routines as required in CP/M-compataible systems.
0030H-0037H	CP/M-compatible debugger breakpoint.
0038H-003AH	Illegal address trap (M/OS-80) or CP/M DDT debugger breakpoint.
003BH-003FH	(Not used—reserved.)
0040H-004FH	Scratch area reserved for DOS.
0050H-005BH	(Not used—reserved.)
005CH-007CH	File control block (FCB) formatting area. For use by transient (user) programs).
007DH-007FH	(Not used—reserved.)
0080H-00FFH	128-byte buffer; default area used by disk I/O and console command line upon entry to a transient program.

Fig. 2. Contents *of page zero.*

long trip back to track two for a directory search or update. CP/M operations are substantially hobbled by this structure.

In most CP/M implementations, disk sectors are 128 bytes long (thus the 128-byte buffer area at location 080H). In other versions, especially the higher density systems, the sector size can extend to 1024 bytes. In these higher density systems, the DOS performs special handling and deblocking of these sectors. Some new disk-controller boards handle this deblocking with built-in CPUs and buffers in a manner totally transparent to the DOS. Although CP/M can be adapted to either soft or hard sectoring, most systems using 8-in. diskettes employ the soft-sectoring technique. There is no real standard for 5¼-in. diskettes.

The system allocates blocks (virtually synonymous with sectors) in groups of eight or more, called clusters, which usually have a length of 1024 (1K) bytes (128*8). A bit map of the used and unused clusters is kept in memory for each disk drive and is re-initialized every time the system is warm booted (whenever the operator types control-C) or the system is restarted upon power-up. The 1K cluster-allocation scheme significantly reduces the size of the bit map but requires that a file's size be MOD 1K, that is, no file can be smaller than 1K byte with additional increments of 1K for larger files.

Allocation of clusters is made as the user program demands them. When using CP/M, a serious problem can occur if a user fails to type control-C after changing a diskette. Because the bit map in memory would not necessarily match the newly inserted diskette, the system can allocate sectors that the bit map erroneously shows to be vacant. The result is a directory that has

Block*	Purpose
0	Bootstrap program
1 . . . 51	DOS system
52 . . . 67	System directory
68 . . .	User file area

*Blocks in most CP/M systems are one sector long (128 bytes)

Fig. 3. Disk structure *allocation.*

clusters assigned to more than one file, or files whose clusters are overlaid by incoming data from another file. Ordinarily there is little recourse if this happens.

Newer CP/M-compatible systems, however, like M/OS-80, provide more protection against such problems. Unlike CP/M, M/OS-80 makes a new bit map whenever a file is opened. This takes the system an additional moment to perform but provides the security needed to protect valuable files. In addition, a user is not locked out when a write-protect error occurs in an application. A user often can recover from disk errors by correcting the problem and instructing the operating system to continue despite the error, or to retry the procedure. A user can defeat this process by changing diskettes after files have been opened, or in the middle of an application that does not expect the operator to change disks. But the chances of a self-inflicted file wound are considerably lessened in M/OS-80 and some other emulators.

CP/M allocates the outer sectors of the system diskette (0-1) to the bootstrap program and operating-system-resident image—or at least a program that will give the system enough intelligence to load the DOS image. The full operating system is then loaded from

CP/M-compatible operating systems improve on the space-saving technique by allowing the CCP operator interface to be made disk-resident at system-generation time or at operator request.

the file named SYSTEM.COM. Then the operator interface is loaded from a file called OPI.COM. Because this file thrashing takes about 10 sec., CP/M-compatible operating systems do not reload the resident image into memory when a warm boot (control-C) is performed, saving a user several seconds of waiting. In addition, because the DOS is not reloaded, a system disk need not be kept on the master drive at all times as in some CP/M implementations.

The system file directory, which starts at track two or block 52, contains the names and locations of files on the disks and, in the case of CP/M-compatible systems, or CP/M version 2.n, it contains file-security attribute bits. These attribute bits enable a user to mark a file as write-protected, read-protected, erase-protected or system (to make the file invisible to an operator). Some multi-user systems also permit a user password or user number to be assigned to a file, adding another level of protection.

Increasing file sizes

CP/M version 1.4 systems limit a file to 256K bytes, minus the system boot and directory blocks, thus 240K bytes. CP/M-compatible systems increase the blocks-per-cluster to 16 or more to accommodate larger disks. This increases the cluster size to 2K and increases the minimum file size to 2K with 2K increments. Expanded clusters provide the user with files that can extend beyond 512K bytes.

CP/M version 2.n provides for larger files by allowing as many as 512 logical file extents, where each logical

Relative byte	Purpose
0	Entry type (not used by CP/M 1.4); disk specifier in CP/M 2.2 and CP/M-C.
1-8	File name (left-justified, blank-filled).
9-11	File extension.
12-13	Current file extent; beginning at 1, extent is incremented by 1 for every 16 clusters added to file. Essentially, this is the FCB number. Byte 13 used for larger files in CP/M-compatible systems.
14	CP/M-defined as for internal use.
15	Record count; number of blocks written to file in current extent (0-80 Hex).
16-31	Cluster allocation map; bytes contain the cluster numbers for each cluster assigned to this file.
32	Next sequential record to be read; relative to top of file with first record = 0.
33-35	Random record pointer (24-bit value) to permit fetching or writing records nonsequentially anywhere in a file.

Fig. 4. File control *block (FCB) structure.*

THE FUTURE OF CP/M

CP/M is one of the most widely used operating systems for the 8080/Z80 in existence. Although M/OS-80, CDOS and the other CP/M-compatible operating system vendors have not sold as many copies as Digital Research has of the original CP/M, they have provided healthy competition. Because of that competition, Digital Research has improved its systems support and has made several important improvements to the CP/M package. In short, CP/M-compatible systems have helped to bolster the performance, features and stability of the entire "CP/M standard" concept.

The future of CP/M or CP/M-compatible systems is tied to the future of the processors on which they are designed to run—the 8080 and Z80. As 16-bit processors evolve, operating systems will evolve around them, and users will again choose one system that best meets their needs. Some of these new processors may be able to emulate the 8080 or Z80 chips, and thus support CP/M. But, as was seen in the transition from the IBM 360 DOS to the IBM 370 OS/MFT, "antiquated" operating systems can quickly lose favor with customers who, for reasons ranging from vanity to performance demands, want to migrate to faster operating systems.

However, 8080/Z80 systems are likely to be around for decades. As the technology gets cheaper, the tendency to produce one large, powerful machine will be offset by the concept of having a dozen or a hundred small ones to share the work. In these multiprocessor systems, single or multiple sets of CP/M (or a derivative of it) could be preeminent.

The future will also see the maturing of multitasking versions of CP/M that are already emerging. These include MP/M (Digital Research, Pacific Grove, Calif.), COSMOS (SD Systems, Garland, Texas) and Multi-OS (InfoSoft Inc., Westport, Conn.). These systems enable a processor to be shared among several competing tasks. These systems, however, do not take full advantage of the declining costs of 8-bit µps by using dedicated processors to handle the various tasks. Some systems do use slave processors to perform smart console overhead and disk front-end processing. But this dispersal of system intelligence to sub-processors is about as far as most mass-produced multiprocessor systems have gone on the 8-bit level. These multiprocessor systems are expected to gain favor as time passes because they are cheaper to produce.

THE RELIABLE ALTERNATIVE TO DISK...

If you've been looking for the storage capacity of head-per-track disk with the speed and reliability of main memory — you've just found it... MINIMEG™, the *reliable* alternative to disk.

Independent studies have shown that most CPUs sit idle, waiting for the disk. MINIMEG stores the disk data (software compatible with most head-per-track controllers) and transfers it immediately, eliminating disk delays. No disk delays means no idle CPU, which results in increased system speed.

Compare the cost/performance of MINIMEG to most head-per-track drives...
— PERFORMANCE — RELIABILITY — SPEED CAPACITY... MINIMEG is the winner every time. Look at these features:

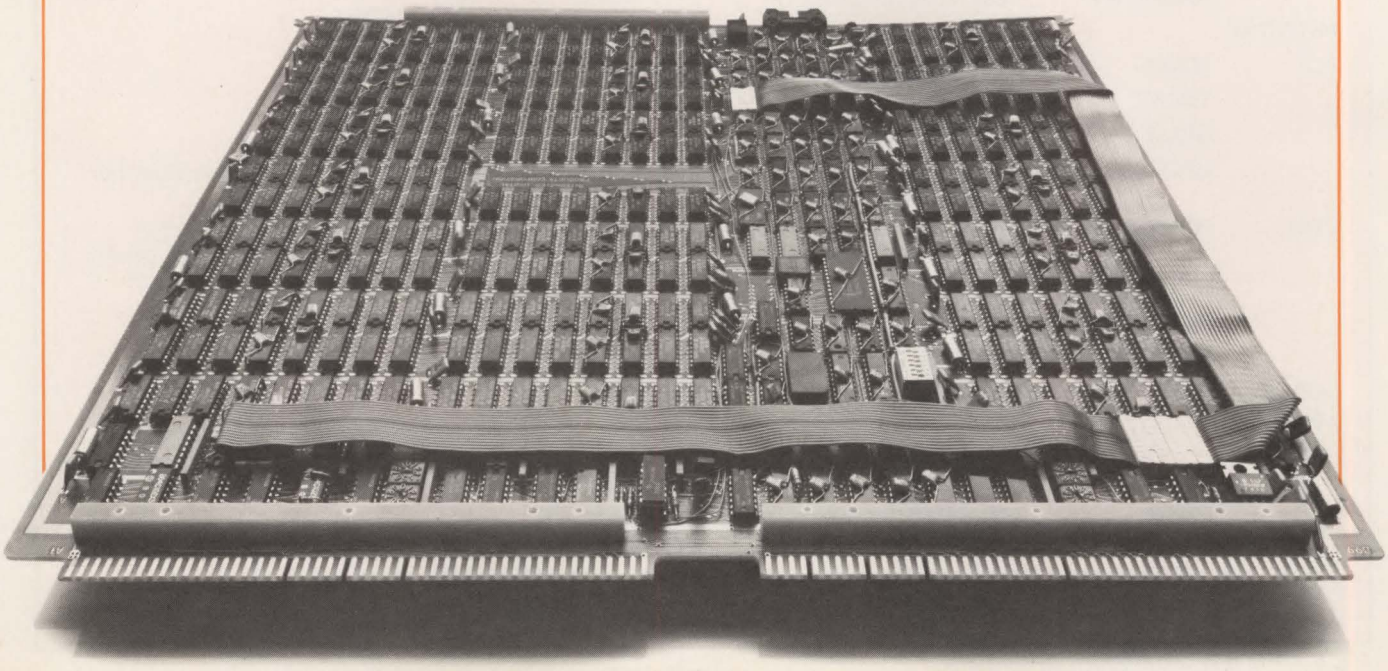
- Up to 2 Megabytes per Nova* size board
- Up to 32 Megabytes capacity per system
- Controller and Memory on one board
- Hardware/Software compatible with most Nova*-type computers
- Error correction for full data integrity
- Battery backup option
- Compatible with AOS*, RDOS*, BLIS*, VMOS*
- Cache drives for IRIS* and BITS*

There is a *reliable* alternative to disk... MINIMEG... the ideal choice for applications requiring fast access to frequently-used data.

Get all the facts... Call or write:

INTEGRATED DIGITAL PRODUCTS

3150 East La Palma Ave., Unit D
Anaheim, CA 92806
(714) 632-6972
TWX 910 591 1198



*Registered trademarks of Data General, Point 4 Data Corp., IPI, Dynamic Concepts, and RMD Associates.

CIRCLE NO. 85 ON INQUIRY CARD

Virtually all CP/M-compatible systems can and often do use interrupts for a number of user and system functions.

extent contains 16K bytes of data. CP/M 2.0 is structured, however, so that as much as 128K bytes of data are addressed by a single physical extent (corresponding to a single directory entry), maintaining compatibility with previous versions.

Additional schemes involving entirely new directory structures are now in place in the newer M/OS-80 and CDOS versions as well as in the newest CP/M version 2.2. In the case of M/OS-80 (hard-disk version) and CP/M 2.2, these extended-directory allocation formulas expand the user file size to more than 64M bytes. These file sizes are intended for use on hard-disk versions where a considerably larger bit map is kept on the disk itself to conserve system RAM space.

The primary way to delineate files is the file-control block (FCB). Although the FCB varies somewhat from system to system because of eccentricities of the implementation, the basic format is unchanged (Fig. 4). Newer hard-disk systems have altered the format to accommodate larger files, but virtually all CP/M systems will recognize the file structure of another. In addition, CP/M-compatible systems employ several unused bytes to define attribute bytes, user IDs and expanded file sizes.

There are several areas of inconsistency between CP/M and its emulative cousins (Fig. 4). For example, byte 14 is reserved by CP/M for internal use. In many implementations of CP/M, it is set by the DOS to some random value; in others it is set to zero. M/OS-80 and several other CP/M-compatible systems expect this number to be the secondary record count. This counter is used only when the record count in byte 15 exceeds

Program name		
CP/M	M/OS-80	Function
ASM		8080 absolute assembler.
	COPY	Image copy entire disk.
	DISKRD	Disk diagnostic. Read all sectors of disk requested.
DDT	(DDT)	CP/M debugger. This program is PROM-based in M/OS-80 with many of the same functions.
	DSKDUMP	Dump a disk or file by block for inspection or alteration. Permits alteration of any sector in any file including the diskette directory.
DUMP	DUMP	Print files in Hex and ASCII format.
ED	EDIT	Text editor.
	ERASE	Conditionally erase files with operator prompting.
	FORMAT	Initialize diskettes.
	GTOD	Initialize or read system clock.
	LABEL	Examine or alter disk labels. Alter directory or cluster size.
LOAD		Intel Hex file loader. Translates Intel Hex format into memory image.
	MEMTEST	Test RAM memory.
MOVCPM		Generate a new CP/M system for a particular memory size.
PIP	XFER	Transfer datasets to other datasets or devices.
	PRINT	Print disk files.
	SPLIT	Segment large files.
	SPOOL	Initiate print spooler. Permits printing of files as a separate task while system is functioning elsewhere.
STAT	XSTAT	Determine directory status. In CP/M, list files by size, show or alter IOBYTE assignments. List-size function performed by DIR (built-in function) in M/OS-80.
	STARTUP	User-written auto-start program for custom systems.
	STARTUP.CMD	User-written auto-start batch (submit) file.
	SXFER	Similar to XFER but requires only one disk.
SUBMIT	@	Submit a command stream from disk.
SYSGEN	WRTSYS	Write system image to tracks 0 and 1. M/OS-80 reads from either a file or the system area of any mounted disk and writes to a file or the system area of any disk, even in single-disk systems.
	XDIR	Extended directory. Provides a sorted listing in multiple columns for CRTs. Entire directory is shown on the screen at once.
XSUB		Extended submit utility provided in CP/M 2.2 versions. Permits programs run under SUBMIT to accept input data from files.

Fig. 5. CP/M and M/OS-80 *utilities compared.*

Call:	Function or feature description
30	Set file attributes. Permits marking a file as read-protect, erase-protect, etc.
33-36	Supports random I/O to files of more than 65M bytes.
130	Set user control-C handling. This permits setting up a one-use system that cannot be user-interrupted.
132-133, 152-154	Logical block I/O without regard to files.
133	Control printer spooling (not supported by CP/M in any version).
136	Chain to user program. Future versions will permit this call to support an overlay technique.
137-138	Built-in multiply and divide routines.
140	Eject disk. Useful on systems that have hardware facilities to control disk ejection. Can be set up to prohibit removal of disks from a system until the software permits it.
142	Set terminal functions. On some systems, permits a certain CRT protocol to be built into the system so that user programs can converse with an application-transparent terminal.
143-146	Set/read date and time.
149	Read disk label. Disks under M/OS-80 may be user-labeled.
150	Turn disk-drive motors off. Some implementations turn the motors off if the disks are not used after more than 15 sec.
151	Set system bottom. When loading user RAM- (or ROM-) resident subroutines, the system RAM top may be altered to reflect the presence of these programs.
159	Gets the disk assigned as master. In M/OS-80, one of the disks may be designated the master library disk. The disk is searched when searched-for files are unsatisfied on the current or requested disk.

Fig. 6. Enhanced CP/M *functions available with M/OS-80.*

$255_{10}(FF_{16})$. The result is that when listing the directory for some CP/M disks on M/OS-80 systems, the size shown is extremely large. However, once copied under M/OS-80, the fields are corrected.

Basically, the new CP/M-compatible systems can read old CP/M format directories. Not all new-format directory structures are inter-compatible, but this has not been a significant problem so far. The widest divergence in incompatibility lies in the structure of the various hard-disk implementations. Because virtually all of these are of the fixed-media type, and lack the ability to be removed and moved to another dissimilar system, the problem will not be significant until removable-media disks are more commonplace.

A more serious problem that has hampered transporting disks between systems concerns double-sided diskettes. Because IBM set the standard for 8-in. diskette formats (3740 format), a problem arose when IBM changed the optionally 00 or FF filler bytes to mandatory FF when using dual-density or dual-sided disks. This meant that single-sided, single-density diskettes created on new machines could not be read on older machines. Fortunately, new controller chips from Western Digital Corp. allow software to select the filler bytes to permit downward compatibility. M/OS-80 in the dual-density, dual-sided mode allows compatibility.

Almost all CP/M implementations include utility programs to manipulate system files, create new systems and system disks, examine file directories or perform other housekeeping functions. Some CP/M-compatible systems, such as M/OS-80 have considerably more support programs than CP/M (Fig. 5). Many of these programs take full advantage of the additional system calls provided by M/OS-80. Others are similar to programs provided by CP/M, but, in most cases, provide more features and flexibility than their CP/M equivalents. It would be impossible to determine what features CP/M 2.2 would have at this time if it were not for constant competition by CP/M-compatible systems.

M/OS-80, CDOS and other CP/M-compatible operating systems are intended to run on hardware of the manufacturer's choosing, enabling vendors to increase system efficiency and reduce system memory requirements.

But pre-packaged systems do not address the problem faced by system configurators who want to create systems around a custom card or a special front-end software handler. To alleviate this problem, Mostek is building a system that allows a user to write his own drivers and link them into the system as required. This method is considerably cleaner than the method used by Digital Research in the earlier versions of CP/M, which did not allow a user to boot up a hardware configuration different from the system on the boot disk.

In addition to supporting standard CP/M functions, CP/M-compatible systems provide additional features that enable systems and applications programmers to use system resources more efficiently (Fig. 6). For example, a system spool operation enables a system to use the abundant wait time during periods of I/O to spool print files onto disks for later printing. ■

William R. Vaughn is an applications engineer with Mostek Corp., Carrollton, Texas.

The One Printer Solution for the Two Printer Problem.

HIGH SPEED DATA PROCESSING

The new Dual-Mode 200 brings speed and uncompromising print quality to business and professional applications.

Financial statements, inventory reports, labels and more are printed at data processing speeds from 165 cps to 250 cps.

Fully adjustable tractors and a friction feed platen provide precise forms handling for pinfeed and single sheet paper.

Complete "Dot Control" graphics is standard with resolution to 120 x 144 dots per inch.

Interfacing is easy with both E.I.A. RS-232C serial and an ASCII parallel port.

LETTER QUALITY WORD PROCESSING

The Dual-Mode 200 also features letter perfect print you will be proud to use for business letters and reports. Letter Mode speeds range from 42 cps to 60 cps.

The standard Titan 10 pitch font is complemented by an array of optional fonts including Elite 12 pitch, italics, proportionally spaced, OCR-A, scientific and foreign character sets.

Up to 12 font selections may be stored in the printer and interchanged while printing.

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

It's the perfect solution for the two printer problem.

The Dual-Mode 200 Printer for the one printer office.

Call or write today for complete specifications and O.E.M. pricing.

malibu
Electronics Corporation

2301 Townsgate Road, Westlake Village, CA 91361, (805) 496-1990

a subsidiary of Datametrics Corporation

CIRCLE NO. 66 ON INQUIRY CARD

DOTS DO IT BETTER™

H-P adds factory-automation hardware, software systems

Hewlett-Packard Co. is strengthening its position in the factory and industrial markets with new hardware and software aimed at data acquisition and process control and production planning and control.

The HP2250 measurement-and-control system consists of a μc-based real-time processor, 11 analog and digital function cards for sensors and actuators, control-and-measurement software and a variety of packaging options to suit different environments.

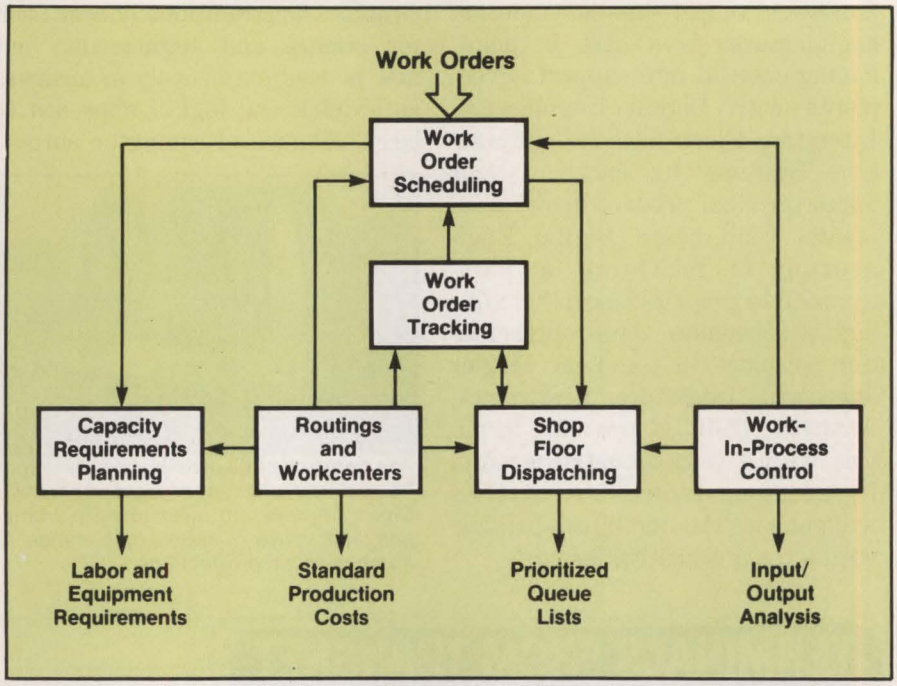
Software for the HP2250 includes H-P's measurement-and-control language, MCL/50, plus what H-P calls an automation library consisting of ready-to-use application programs. Among other things, MCL/50 allows local HP2250-based compilation of control algorithms.

Based on H-P's L-series silicon-on-sapphire processor, the HP2250 has been optimized for I/O-intensive applications, the company claims. The system can be linked to H-P's 1000 series computers or 9800 series desk-top systems.

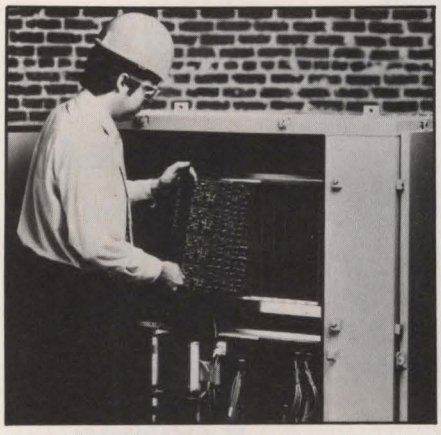
Available in NEMA-12 cabinets, standard RETMA racks or a roll-around chassis, prices for the HP2250 with MCL/50 start at $14,000. Deliveries will begin this summer.

For the firm's large 3000 series computers, H-P has introduced Production-Management/3000, six software modules for managing the production - planning - and - control functions of manufacturing operations. The modules include routing and work-center control, work-in-progress control, work-order scheduling, shop-floor dispatching, work-order tracking and capacity-requirements planning.

Production Management/3000 is priced at $31,500, with quantity discounts available. —*Larry Lettieri*



An overview *of H-P's new Production Management/3000 application software shows the modular concept upon which the system is built. It can be installed, modified and maintained by manufacturers without computer programming.*



The HP2250 measurement-and-control processor *can be packaged in a sealed NEMA-12 cabinet for harsh industrial environments. The system can be linked to H-P's 1000 series computers or to the firm's 9800 series desk-top systems.*

Low price, features enhance Lear Siegler terminals

Price wars are not in danger of disappearing, but increasing competition within the OEM video-display terminal market has forced some manufacturers to develop new marketing strategies other than the traditional price/performance aspect, says an executive at Lear Siegler, Inc. In markets in which prices are not the only option, he

continues, the competition seems to be shifting to features in the form of peripheral "specials," such as graphics, voice recognition and touch-sensitive screens.

The data-products division of the Anaheim, Calif.-based terminal manufacturer is a case in point, having entered into support agreements with Digital Engineering, Interstate Electronics and Interactive Systems to enhance their dumb-terminal product line. Sacramento, Calif.-based Digital Engineering is providing a plug-compatible graphics board that adds high-performance data-representation graphics to the Lear Siegler line, and Interstate Electronics, Anaheim, Calif., is providing terminals with a voice-actuated feature. In addition, Interactive Systems will enhance the dumb terminal line with a touch-sensitive feature.

Lear Siegler sees computer graphics as the most popular of the three features, citing that the market for graphics is expected to grow approximately 30 percent this year as a result of price decreases. Graphics has traditionally been used for science and engineering, but now is used extensively in business as a quick and logical approach to large volumes of computer output.

The data-products division *of Lear Siegler has entered into support agreements with Digital Engineering, Interstate Electronics and Interactive Systems to enhance its dumb terminal product line.*

The Lear Siegler graphics board fits into the terminal housing and converts the device into a Tektronix 4010 software-compatible data-representation graphics terminal with vector-drawing and point-plotting capabilities.

Also, voice-recognition products have decreased in price from $25,000 to the $3000 to $5000 range, making voice input a more affordable feature.

Lear Siegler's voice-recognition unit combines speech with the advantages of video display and is a boon for non-typing users, according to a Lear Siegler source.

Pricing for the graphics board (available for the ADM 3A and ADM 5) is $1150. The voice-recognition option for the ADM 3A and ADM 5 is priced at $2100, and the touch-sensitive screen for the ADM 42 is $995.

—Nancy Love

when smart is not enough ....

other manufacturers cheapen terminals by taking away features!

SOROC reduces price by being the best at what we know best - low cost high performance visual displays.

we have all the features you need - at the price you need!

- screen editing
- multiple video attributes
- 14 programmable functions
- 25 th status line/user message
- block/conversational mode
- buffered auxiliary port
- printer port
- rates from 110 to 19,200 baud
- protected fields
- programmable repeat/blink rate
- adjustable right hand margin
- cursor control
- tabbing
- z-80 based
- graphics option

SOROC IQ 130

FLEXIBILITY

.... compare price!

SOROC TECHNOLOGY, INC.

165 FREEDOM AVE • ANAHEIM • CALIFORNIA • 92801 • (714) 992 2860 •
111 CENTRAL AVE • HARTSDALE • NEW YORK • 10530 • (914) 328 0008 •

CIRCLE NO. 86 ON INQUIRY CARD

New Systems

Versatec offers remote plotting system

The model 444 remote plotting work station supports remote job entry, electrostatic plotting/printing and graphics manipulation capability—scaling, rotation, mirroring and windowing. The system accepts unsorted vectors, a random format as well as sorted vector, compressed raster, raster and print-data formats. The work station includes a μp with 64K bytes of memory, a CRT display, a 24M-byte disk and bipolar algorithmic processor. The system supports any two of the vendor's printer/plotters in any mix of paper widths. Versaplot software, a system of FORTRAN-callable subroutines, runs on the host computer. Price is $35,000. **Versatec,** Santa Clara, Calif.

Circle No 161

Zilog announces Z-NET computer systems

The distributed commercial systems (DCS), a series of computer systems that integrates word and data processing and software development, includes as many as four distributed work stations, a shared data station and a matrix printer. Each DWS includes an MCZ 2/20 computer system with a Z80A-based CPU and 64K bytes of memory, a CRT terminal, Z-NET transceiver, Z-NET network protocol software, multi-user COBOL, and all cables and connectors. The shared data station file-management system includes a dedicated CPU, a 10M-byte hard disk and software. A two-work-station system is priced at $27,400. **Zilog,** Cupertino, Calif. **Circle No 162**

Computer system includes 96K-byte MOS memory

The RDS-VT23 system features 10M bytes of disk storage (5M bytes fixed and 5M bytes removable), a DEC VT103-LSI-11 terminal and an LSI-11/23 central processor with 96K bytes of MOS memory. The system has a user-definable EIA RS232 data port and optional RT-11 and RSX/-11M operating systems, floating-point capabilities, printers and instrument bus and parallel interfaces. The unit is priced at $16,500 in single-unit quantities, with quantity discounts available. **Remtech Inc.,** Huntsville, Ala.

Circle No 163

PMC announces distribution system

The Downloader local network distribution system is comprised of a master disk-based PMC-80 computer with a 48K-byte memory and several slave PMC-80s with 16K-byte memory units. The slaves accept data serially from the master at 10,000 bps. The master PMC-80 has an interface on an S-100 bus card. Slaves are connected in daisy chains by a two-wire cable. A master PMC-80 with 48K-byte memory and two disk drives sells for less than $3000, and each slave sells for less than $1000. **Personal Micro Computers, Inc.,** 475 Ellis St., Mountain View, Calif. 94043.

Circle No 164

Vector Graphic system supports five terminals

The Z80-based 5005 system uses a 5M-byte, 5¼-in. Winchester-disk drive, a 630K-byte floppy-disk drive and an error-correcting disk controller. The 5005 enables as many as five users to combine almost any mix of applications programs and any number of terminals. The unit supports two printers, one with serial interface, the other with parallel interface. Error correction is implemented through a proprietary board. As many as five erroneous bits in every 256 bytes transferred from disk to processor are corrected. Price is $8995 for a system with a single terminal; additional terminals are $1895 each. **Vector Graphic, Inc.,** Westlake Village, Calif. **Circle No 165**

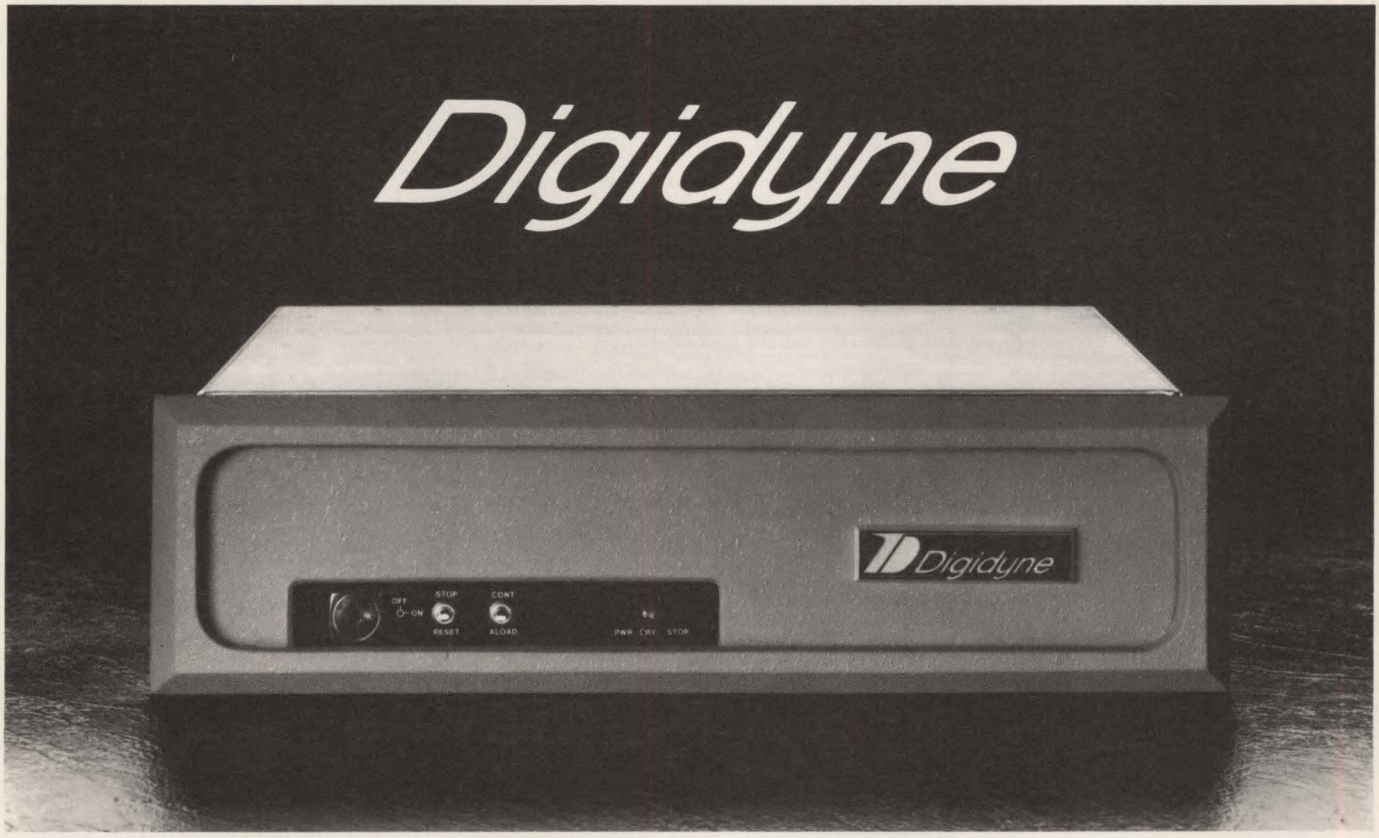
Desk-top system uses 5¼-in. Winchester drive

The System 3005 desk-top computer uses Seagate Technology's 6M-byte, 5¼-in. Winchester-disk drive, backed by a 630K-byte floppy-disk drive. The Z80A-based system includes a serial port, three parallel ports, three PROM slots and a Flashwriter II video board. Software includes the vendor's CP/M 2, with drivers for Qume, Diablo or Centronics printers, as well as the vendor's matrix and letter-quality printers. Other features include a ZSM Z80 assembler, a screen-oriented program editor and a full-screen debugger. Price is $7950. **Vector Graphic, Inc.,** Westlake Village, Calif. **Circle No 166**

Micromation unveils small-business system

The Mariner 9000 series of 8-bit small-business systems can be configured with single- or double-sided floppy-disk drives (500K bytes or 1M byte, respectively) and an 8-in., 21M-byte Winchester-disk drive. A ¼-in. tape cartridge provides disk backup. The system supports RS232 terminals and printers with serial and Centronics interfaces. The Mariner accommodates either 110V, 60-Hz or 220V, 50-Hz power sources. Prices start at $4500. **Micromation Inc.,** 1620 Mongomery St., San Francisco, Calif. 94111. **Circle No 167**

A word to the wise Data General user:



Our complete line of Data General compatible computers and controllers can save DG users up to 50% without sacrificing quality.

Digidyne has delivered over 2,000 single board Nova* compatible CPU's. Our complete line of computers and peripheral control units include controllers for storage modules, magnetic tapes, cartridge disks, line printers and communications devices.

Digidyne's D-832 computer features a front loading 5-slot chassis, power supply and virtual control panel. Also standard are parity check and detection, power fail/restart, multiply/divide, self contained diagnostics, auto-load programs and a "set and forget" switch register. In addition, the D-832 can be expanded to 128K bytes of directly addressable memory on one board. But, best of all, the D-832 is priced at $1,888 at quantity 50.

Compare price and performance. Digidyne is the field-proven alternative to Data General. So DG users, why pay more and get less?

For more information please call or write:

Digidyne

2625 Ariane Drive
San Diego, California 92117
(714) 483-0364

CIRCLE NO. 87 ON INQUIRY CARD

*Trademark of Data General

New Products

disk/tape

Floppy drive offers ceramic ferrite head

The FDD 296-5 double-headed, high-speed 5¼-in. floppy-disk drive uses a ceramic ferrite recording head design. The unit provides 1000K bytes of on-line data storage (unformatted) in double-density applications and 500 bytes in single-density applications. Daisy-chain capability permits as many as four drives to be combined on a bus for a total of 4M bytes of on-line data storage (unformatted) in the double-density version. Track-to-track access time is 20M sec., average access time is 542 msec., and head-loading time is 50 msec. Data-transfer rate is 125K bps with single-density or 250K bps with double-density recording. Price is $550. **Siemens Corp.**, Anaheim, Calif.

Circle No 168

Siemens announces 5¼-in. floppy

The FDD 196-5 5¼-in. floppy-disk drive operates in single- or double-density applications. Double-density, unformatted storage capability is 500K bytes on each side of the diskette; single-density unformatted capacity is 250K bytes. An optional dual-index and file protect sensors permit recording on both sides of the media by flipping the diskette, for a total capacity of 1M byte. As many as four drives can be daisy-chained on a bus, for a total of 2M bytes of on-line data storage. Track-to-track access time is 20 msec., average access time is 542 msec., and head-loading time is 50 msec. Data-transfer rate is 125 bps with single density and 250K bps with double density. Price is $450 for the single-sided version and $470 for the double-sided versions. **Siemens Corp.**, Anaheim, Calif.

Circle No 169

Dysan disk cartridge offers 6038-bpi density

The CMD 9448 16M-byte, front-loading disk cartridge for use with Ampex DFR900 and CDC 9448 disk drives, permits nominal recording densities of 6038 bpi with 384 tpi. Rotational speed is 3600 rpm and data-transfer rate is 9.677M bps. A plastic canister prevents foreign material from entering the cartridge assembly. **Dysan Corp.**, Santa Clara, Calif. **Circle No 170**

Winchester backup uses serpentine method

The model 401 cartridge transport for Winchester-disk backup uses read-after-write recording heads that accommodate the bidirectional tape operation used in nonstop serpentine recording applications. The unit stores as much as 17M bytes on a DC-300XL tape cartridge, using a 6400-bpi recording density and 30-ips tape speed. Data transfer rate is 24K bytes per sec. Single-unit price is $1835, with OEM discounts available. **Qantex Division, North Atlantic Industries, Inc.**, Hauppauge, N.Y.

Circle No 171

Floppy-disk drive packs 2M bytes

The model 1117 family of 5¼-in. floppy-disk drives includes two single- and two double-sided models using 96- or 100-tpi double-track recording and 12,000 bpi using MFM recording techniques. The unit provides 12,000-bpi data recording density, 6-msec. track-to-track positioning speed and 600K-bpi data-transfer rates. Double-sided models provide 2.175M and 2.025M bytes of formatted storage at 100 and 96 tpi, respectively; single-sided versions offer 1.2M and 1.1125M bytes at 100 and 96 tpi, respectively. **Micropolis Corp.**, 21329 Nordhoff St., Chatsworth, Calif. 91311.

Circle No 172

NOW PICK JUST THE 132-COLUMN PERFORMANCE YOU NEED.

Choose from our popularly priced Excel 32 to our big screen Excel 14.

All eight Excel models feature superior ergonomics like tiltable displays, non-glare screens, and detachable keyboards with familiar typewriter response.

Standard performance features include bi-directional smooth or jump scrolling, split screen/regional scroll, double-high/wide and double-high characters, keyboard selected set-up parameters and CRT Saver. Plus you get a 128 character set that includes special graphic symbols displayed across either 80 or 132 columns. Various Excel models also emulate many popular terminals and all are designed for high-speed interactive communications.

The new Excel terminals from Datamedia are proven products in advanced ergonomic packages. And they've got what the 132-column market has needed for a long time — Selection. Find out how the smarter terminal maker will make you a smarter terminal buyer. Call (609) 665-5400. Use the handy coupon or write: Datamedia Corporation, 7401 Central Highway, Pennsauken, NJ 08109.

DATAMEDIA

Eight Excel terminals to choose from.

☐ **EXCEL 12**
- VT100™, VT52™ Compatible
- Advanced Video Option
- Enhanced Printer Port
- 12" Screen

☐ **EXCEL 22**
- VT100, VT52 Compatible
- 12" Screen

☐ **EXCEL 14**
- VT100, VT52 Compatible
- Advanced Video Option
- Enhanced Printer Port
- 14" Screen

☐ **EXCEL 24**
- VT100, VT52 Compatible
- 14" Screen

☐ **EXCEL 32**
- "Software Saver" — emulates Datamedia 1521, ADM™3A, Regent™25, and Hazeltine™1420.
- 12" Screen

☐ **EXCEL 52**
- VT100 Compatible/APL Second Language
- 12" Screen

☐ **EXCEL 34**
- "Software Saver" — emulates Datamedia 1521, ADM 3A, Regent 25, and Hazeltine 1420.
- 14" Screen

☐ **EXCEL 54**
- VT100 Compatible/APL Second Language
- 14" Screen

☐ Please call to arrange a demo.

☐ Please send product information.

Return to: Datamedia Corporation, 7401 Central Highway, Pennsauken, NJ 08109 (609) 665-5400.

Name _____

Company _____ Title _____

Address _____

City _____ State ____ Zip _____

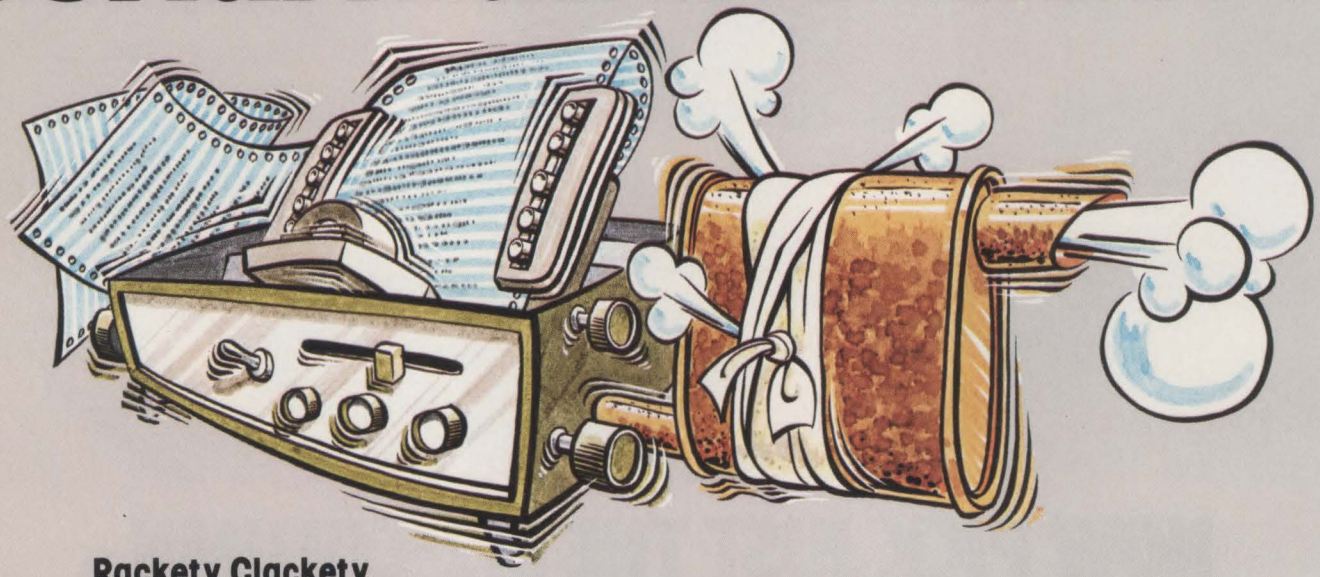
Phone _____

From the smarter terminal maker.

*VT100, VT52 are registered trademarks of Digital Equipment Corporation; ADM3A is a registered trademark of Lear Siegler, Inc. Regent 25 is a registered trademark of Applied Digital Data Systems. Hazeltine 1420 is a registered trademark of Hazeltine Corporation.

CIRCLE NO. 89 ON INQUIRY CARD

Do You Need to Midasize™ Your Serial Matrix Printer?



Rackety Clackety

If you want the work a matrix printer outputs, you have to live with the noise it puts out. That's the nature of the beast.

Until now.

INFOSCRIBE 1000 is a serial matrix impact printer, but its sound level is **only 53.9 dBA.** By independent sound laboratory test.* No other matrix printer we know of can make this claim.

If you ran **INFOSCRIBE 1000** in the public library, Marian the Librarian wouldn't even look up. It's that quiet.

Our Family Tree

INFOSCRIBE 1000 is not only no nuisance, it's no nonsense. The whole Infoscribe printer family shares technology and parts, cutting down on operator training, maintenance time, parts stocking, and specialized software. And this reflects where it counts: in lower bottom-line cost of ownership.

Cornucopia of Features

We poured features into the **INFOSCRIBE 1000**; it will pour them out for you. Sophisticated features like versatile graphics, under full software control; data processing quality characters at 10, 12, or 16.5 cpi, with correspondence quality characters at 10 cpi; subscripts and superscripts in any selected pitch; double-wide printing, true underlining; three 96-character sets in any alphabets, selectable on a character-by-character basis; rugged tractor feed; and an input buffer expandable to 3532 characters, to name a few.

As for throughput, you'll be delighted. A basic print speed of 180 cpi coupled with vertical and horizontal tabbing, plus bidirectional printing with logic seeking in both directions, pushes work out of the machine at an impressive rate. 100% duty cycle operation, naturally.

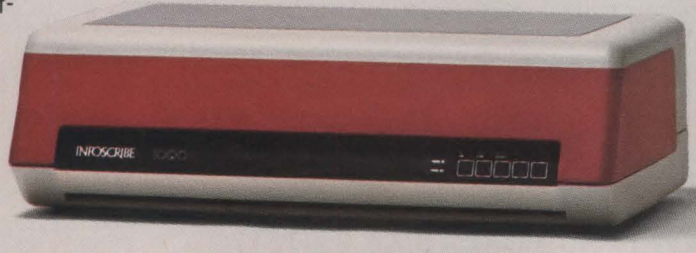
Beauty and the Beasts

INFOSCRIBE 1000 sits on a pedestal in your office, but it could as easily sit on a pedestal in the Louvre. It's a wonder of sleek, gracious design that makes competitive instruments, with their protruding ganglia and tumorous knobs, look like props for a horror movie.

And **INFOSCRIBE 1000's** esthetics are pure practicality. They reduce noise, exclude dirt, simplify operation, and put maintenance where it belongs: inside the case. Why not upgrade your computer with a printer that's a work of art: **INFOSCRIBE 1000.**

And Why Not Now

This is the time to place your order for one or a thousand **INFOSCRIBE 1000's.** At $1,825 for single units (considerably less in OEM quantities), Infoscribe's prices are outright philanthropy. Get full details immediately from your local Infoscribe distributor/representative or computer dealer.



Contact Infoscribe for an abstract of the independent testing laboratory report.

™ A trademark of Midas International

INFOSCRIBE™

QUIETLY AUTHORITATIVE

CIRCLE NO. 90 ON INQUIRY CARD

interactive terminals

MSI introduces hand-held sales terminal

The model 84 hand-held data-entry terminal feeds sales orders to a central computer via telephone lines. The unit measures 3½ × 6 × 1½ in.; is powered by four penlight batteries and weighs less than 1 lb. The unit includes an LCD that allows full alphanumeric character generation and a custom application module that allows a user to change the personality of the terminal. The unit is priced at $650 in quantities of one to 500 and $575 for quantities of 501 and more, including one custom application module. Additional modules are $65 each for EPROM units; ROM modules are $50 each for less than 500 and $45 each for more than 500. **MSI Data Corp.,** Costa Mesa, Calif. **Circle No 173**

Cobar offers video terminal

The model 3100 DEC-compatible video terminal emulates the DEC VT-100 with advanced video option. The unit features a printer port, a non-glare screen, four video attributes, set-up prompt legends, 19,200-bps operation and screen save. Price is $1595. **Cobar, Inc.,** 1181 N. Fountain Way, Anaheim, Calif. 92806. **Circle No 174**

Codex announces intelligent terminal

The CDX-68/24 AND CDX-68/44 intelligent terminals feature a multitasking operating system, multiple terminal support, a wide variety of peripherals, communications and applications development tools. The diskette-based model 24 and disk-based model 44 use an OS-9 operating system patterned after the UNIX operating system, which runs on Motorola 6809 μps. A data-entry-and-inquiry package, called ASK provides a data dictionary, a keyed random access data base and a report writer. Prices for typical configurations are $16,500 for a two-terminal 68/24 and $24,500 for a four-terminal 68/44, with quantity discounts available. **Codex Corp.,** Mansfield, Mass. **Circle No 175**

Terminals feature Z80 controller

The models EDC-202 and EDC-223 Digital Equipment Corp. LSI-11-based video computer terminals feature Z80-controlled display units. The unit displays 24 lines × 80 upper- and lower-case characters and a 25th user-status line. A 59W power supply drives an LSI-11 backplane. The 202 and 223 include 64K and 96K bytes of memory, respectively. Both feature asynchronous serial interfaces that operate at data rates from 150 to 38,400 bps. The 202 and 223 sell for $2995 and $4995, respectively. **Ellert Digital Communications,** 75 W. Green St., Pasadena, Calif. 91105. **Circle No 176**

Honeywell offers video subsystems

The models VTS7710 small-cluster and VTS7740 large-cluster video terminal subsystems include μp-driven terminal controllers that support as many as four and eight keyboard/display terminals, respectively. The 12-in. display screens feature 24 lines × 80 characters. Other features include a 76-key ANSI II keyboard and 9600-bps transmission rates. The VTS7710 and VTS7740, including controller, four display terminals and a 160-cps printer sell for $15,575 and $27,250, respectively. **Honeywell Inc.,** 200 Smith St., Waltham, Mass. 02154. **Circle No 177**

memories

Memory board supports Q-bus

The model MK8023 256K × 18 add-in memory board supports Digital Equipment Corp.'s Q-bus computers. The board features 512K-byte memory capacity, on-board parity generation and checking, an access LED, an on-line/off-line switch and an I/O page-selection switch. Single-unit prices range from $2075 to $3125, with OEM, educational and government discounts available. **Mostek Corp.,** 1215 W. Crosby Rd., Carrollton, Texas 75006. **Circle No 178**

New card is DEC-compatible

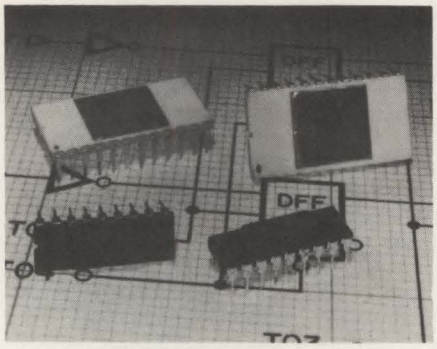
The model NS70/75 256K-byte memory card plugs into Digital Equipment Corp.'s VAX-11/750 and PDP-11/70 MK-11 MOS memory backplanes. The card can be electrically removed from the backplane via an on-line/off-line switch. In off-line mode, the card is transparent to system diagnostics. With battery backup, it retains stored data in on- or off-line mode. The NS70/75 is priced at $2250 and $1340 for the 256K- and 64K-byte versions, respectively. **National Semiconductor Corp.,** 2900 Semiconductor Dr., Santa Clara, Calif. 95051. **Circle No 179**

Card features 16-bit register

The Multibus - compatible BLC-0218 128K-byte memory card features an on-board CSR 16-bit register. The card operates in 8- or 16-bit data buses, 20- or 24-bit memory addressing and 8- or 16-bit I/O addressing. The unit also offers internal or external refresh and various operating voltages. The BLC-0218 is priced at $1500. **National Semiconductor Corp.,** 2900 Semiconductor Dr., Santa Clara, Calif. 95051. **Circle No 180**

Memory module is S-100-compatible

This S-100-compatible magnetic-bubble-memory system uses Intel's model 7110 1M-bit bubble device. Each board stores 128K to 256K bytes. As many as four boards can be daisy-chained to provide 1M byte of storage. Available software interfaces the system to any 8080/Z80 CP/M system. Average access time is 40 msec., and data rate is 100K bps for a one-bubble system and 800K bps for an eight-bubble system. Single-unit prices start at $2295; 100-unit prices start at $1670. **Teleram Communications Corp.** 2 Corporate Park Dr., White Plains, N.Y. 10604. **Circle No 181**



Fujitsu introduces Schottky TTL PROMs

These Schottky TTL PROMs are organized as 1K × 4, 2K × 4, 1K × 8 and 2K × 8. The 4K version has a 35-nsec. access time. Other features include low power dissipation, +5V power supply requirements, programmability with data I/O, low-current PNP inputs, three-state outputs and chip-enable leads for simple memory expansion and diffused eutectic aluminum process technology. **Fujitsu Microelectronics,** Santa Clara, Calif. **Circle No 182**

Plug-in card increases Apple II storage

The plug-in Apple Language Card enables users of Apple II and Apple II Plus computers to run turnkey programs written in any Apple-supported language, including Pascal, FORTRAN and Pilot. The card provides an additional 16K bytes of general-purpose RAM, increasing the size of the Apple II internal memory to 64K bytes. The card includes auto-start ROM, which provides an automatic-loading feature that transfers a language from diskette into RAM space. Price is $195. **Apple Computer, Inc.,** 10260 Bandley Dr., Cupertino, Calif. 95014. **Circle No 183**

Pro-Log introduces STD bus card

The model 7705 32K-byte EPROM card for the STD bus has 8 on-board sockets. All 32K bytes are continuous and can be mapped to either the upper or lower half of the 64K-byte memory map. The unit responds to the STD bus MEMEX line, which enables two banks of memory to occupy the same memory space. A memory-bank-select technique can be implemented via an external segment-select input on the unit's card-ejector edge. The 7705 sells for $99 in small quantities. **Pro-Log Corp.,** 2411 Garden Rd., Monterey, Calif. 93940. **Circle No 184**

National announces 16K EPROM

This 16K, UV EPROM is available in two 16K (2048 × 8) versions: the asynchronous NMC27C16 and the synchronous NMC6716. Features include TTL-compatible I/O during read and program modes, a tri-state output, access times as fast as 350 nsec. and operation from a 5V power supply. The device is packaged in a 24-pin, dual-in-line, ceramic package with a transparent lid. Prices for the NMC27C16 and NMC6716 range from $67 to $125. **National Semiconductor Corp.,** 2900 Semiconductor Dr., Santa Clara, Calif. 95051. **Circle No 185**

Want reliable power for office electronics without costly special wiring?

Just plug in a Sola.

With minicomputers, terminals, word processors, disk memories and high-speed printers, you often get instructions to put in a "dedicated" power line. But, instead of breaking through walls, cutting trenches in floors, laying special conduit, pulling lots of wire and adding more breakers and switchgear to get reliable power, why not simply plug a portable Sola Power Protector into the outlet that's already there?

Dedicated lines can add anywhere from $1200 to $8000 or more per machine, even in new construction. For a fraction of that cost, a Sola Micro-Minicomputer Regulator not only replaces the dedicated line but does what dedicated lines can't do. It raises and lowers voltage to compensate for line fluctuations and brownouts. It blocks out electrical noise, and destructive power dips or surges. Our new Mini-UPS goes one step further. Its built-in battery maintains power when your electric utility fails. This keeps your electronics running smoothly until your generator comes on line. Both units are available in 60 Hz or 50 Hz.

Dedicated lines, at best, minimize power disturbances that are caused by other equipment in your building. Sola Power Protectors guard you against all kinds of power line disturbances regardless of where they originate. Check this chart to compare effectiveness.

	spikes and faults	dips and surges	line noise		brownout	blackout
			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

Don't go through another day risking electronic malfunction due to unreliable power. Talk to your local Sola Electric representative or distributor. Or contact Sola Electric, 1717 Busse Road, Elk Grove Village, IL 60007. (312) 439-2800. We're the people who invented power protection 50 years ago.

The Power Protectors

A UNIT OF GENERAL SIGNAL GS

SOLA

VT100 GRAPHICS IN 4.4 MINUTES!

From Selanar Of Course!

SIMPLY ADD A CARD
Adding the Graphics 100 PC card to your existing VT100 or VT103 gives you the most versatile CRT terminal on the market today. No other component or CRT changes are required.

OR BUY OUR GRAPHICS TERMINAL
The Selanar GT100 combines the DEC VT100 and the Graphics 100 into a very competitively priced terminal, designed to fit your application.

NEED TEKTRONIX 4010 OUTPUT?
Our GT100 has all the capabilities of the VT100 plus our new Tektronix 4010 emulation mode. Create excellent graphics displays with packages like **PLOT 10**, **DISSPLA & TELAGRAF**, or any other package with 4010 output mode.

HOW ABOUT SOFTWARE?
Selanar supplies • Calcomp type Fortran subroutines for: RT-11, RSX, VMS. • Light pen support software • Hardcopy support software.

CALL US!
Let us show you how to get the most from your computer terminals.

(408) 727-2811

ISI SELANAR INTERNATIONAL 2403 De La Cruz Blvd. Santa Clara, CA., 95050

EUROPEAN HEADQUARTERS: ISI COMPUTER Alte Landstrasse 5 D 8012 Ottobrunn Telefon (089) 60 60 71-72 Telex 5216290

GRAPHICS SOFTWARE COURTESY OF INFORMATION SYSTEMS DESIGN AND DYNAMIC GRAPHICS, INC.

CIRCLE NO. 119 ON INQUIRY CARD

New Products

printers

Star Micronics offers 80-column printer

The model DP-8480 80-column dot-matrix printer includes bidirectional printing with a logic-seeking carriage control for faster throughput; 96 ASCII alphanumeric, block graphics, Japanese Kata-Kana and international scripts; a parallel interface; optional EIA RS232C, IEEE-488 and 20-mA current loop interfaces; 10, 12 or 16.7 characters per in.; a replaceable printing head; and a built-in self-test mode. Price is $495. **Star Micronics, Inc.,** New York, N.Y. **Circle No 186**

Dot-matrix unit features 200-cps printing

The 2170 dot-matrix printer features five paper-drive combinations, top- or bottom-feed paper and independently programmable dual-tractor drive. Other features include 200-cps, bidirectional printing, near letter-quality print at 100 cps and true descenders; variable type fonts; solid-state circuitry; 9 × 9-pin ballistic print head; the ability to handle a variety of ticket sizes and shapes; and a five-input interface. **Cardinal Industries,** Webb City, Mo. **Circle No 187**

DEI introduces impact printer

The model DE-80SG 80-column tractor drive printer can be programmed to store in internal EPROM as many as seven character sets simultaneously, generate bar codes and produce an answer-back message. The unit provides 7 × 9 serial impact printing, a 150-cps print rate, 960-dpi graphics capability with a 2048- or 4096-byte buffer, a 50- to 9600-baud crystal controlled baud rate and RS232C and 20-mA loop interface. Single-unit price is $995, with OEM discounts available. **Data Electronics Devices, Inc.,** Salem, N.H. **Circle No 188**

Unit combines printer and controller

The Microprint 121 combines an intelligent controller with a μc-based printer. It prints at 10 lps, 210 cps on aluminized paper, using upper- and lower-case ASCII with expanded characters and underlining. The unit provides any character subset, sample numbering, units labeling and minor calculations. Other features include parallel and serial RS232C inputs with baud rates as high as 9600, and a double-buffered full-line of data that allows continuous printing at the maximum rate. **Scientific Software & Instrument, Inc.,** Sunnyvale, Calif. **Circle No 189**

Infoscribe unveils serial matrix printer

The Infoscribe 1000 serial matrix impact printer offers data-processing-quality characters at 10, 12 or 16.5 cpi, and correspondence-quality characters at 10 cpi. The printer can also be operated in a graphics mode, with 70-dpi resolution. A μp controls character recognition, printing, print-head positioning and paper movement. The printer stores a standard ASCII 96-character set and an alternate character set in ROM. The printer is priced at $1795 in single-unit quantities, and less than $1000 in OEM quantities. **Infoscribe, Inc.,** Santa Ana, Calif. **Circle No 190**

New Products

graphics

Noritake announces 256 × 64 display

The DM256×64A display panel consists of 16,384 fluorescent 0.4-mm.-sq. arranged in a 256 × 64 configuration. The display fills 166.15 × 41.35-mm. area. and emits bright, high-resolution dot-matrix images. The randomly addressable unit can display cursive and block alphanumeric messages, graphic-line and filled-in area pictures, symbols and geometric patterns. A double-matrix interconnections configuration enables the display of bright blue-green images. **Noritake Electronics, Inc.,** Torrance, Calif. **Circle No 191**

Intergraph announces color graphics display

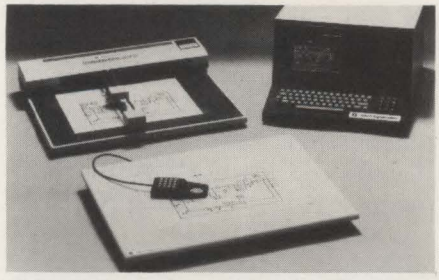
This high-resolution, flicker-free color graphics systems includes a 16-bit μc and dual 19-in. 1280 × 1024 raster screens, one color and one monochromatic. Each screen can display two- and three-dimensional graphics, operator prompts and messages, with independent hardware pan, zoom and drag. Users can select eight colors from a palette of 4096 for simultaneous display. Additional memory planes allow the number of active colors to be increased as desired. A keyboard and digitizing tables, menus and cursors are included to make up a work station. Work station prices start at $60,000. **Integraph Corp.,** Huntsville, Ala. **Circle No 192**

Form and Substance offers graphics terminal

The IM-1 graphics terminal has a basic interface using a full RS232C I/O port. The terminal interfaces to most S-100 computers. A software package includes interactive X-Y plotting, 3D contour plotting and pie charts. An Anadex printer, offering high-resolution dot-matrix reproductions, is optional. **Form and Substance, Inc.,** Los Angeles, Calif. **Circle No 193**

Flat-panel display has 72.5-lpi resolution

This flat-panel EL display assembly provides 80 characters per line and as many as 12 lines of alphanumeric or graphic data on a 128 × 512 field array. The panel measures 1.77 × 7.1 in. The 72.5-lpi resolution is a precise flicker-free presentation of about 37-ft. Lamberts for light-on-dark or dark-on-light material. **Hycom, Inc.,** Irvine, Calif. **Circle No 194**



GTCO announces turnkey CAD system

The Interactive Grafics Digitizer (IGD) turnkey CAD system features an 8080-based 11- × 17- in. tablet with .001- in. resolution, a 16-button cursor and two Z80 μps. Also included are a table top console with 96K bytes of RAM, two minifloppy disk drives totaling 320K bytes, a 9-in. CRT terminal with 512 × 256 resolution and four 110- to 9600-bps RS232C ports. Price is $11,065, with OEM discounts available. **GTCO Corp.,** 1055 First St., Rockville, Md. 20850. **Circle No 195**

A blueprint for office automation.

There's a lot of questions these days about office automation—what it is, what it will do, how to build the right system.

Artelonics has analyzed these questions and more, and thinks it has an answer. We call it our "blueprint for office automation." And the cornerstone is a powerful 8086 microprocessor-based desktop office computer—the Series 1000.

Word processing . . . fully-featured and document-oriented.

Designed for systems architects.

From its inception, the Series 1000 has been specifically designed as a tool for use in an integrated office computing system.

Combining word processing, data processing and communications with high resolution graphics, the Series 1000 offers extraordinary versatility at a surprisingly low cost.

A building block for office automation.

The Series 1000 is readily expandable. You can begin with a fully-featured stand-alone terminal, add to it in small increments, or build it into a large and complex system using your own customized hardware and applications software.

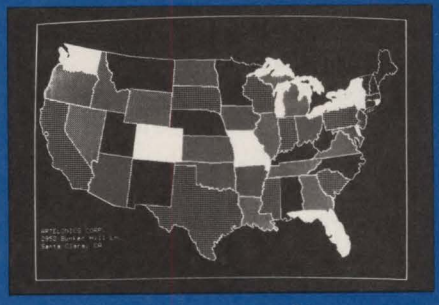
A cornerstone for future expansion.

Multibus™—compatible, the Series 1000 lets you plug-in a variety of custom interfaces, and currently supports RS232 and asynchronous communications.

Bisynchronous communications protocols including 3270, 2780 and 3780 will be available soon.

A blueprint—plus the right tool—equals office automation.

A blueprint is only as useful as what it enables you to build. With the Series 1000's exceptional combination of features plus remarkable flexibility, you can begin creating the future of office automation . . . today.



High resolution graphics . . . maps, bar charts, pie charts, combination words and charts, etc.

CP/M-86™ is available now.
MP/M-86™ is coming soon.

For more information, contact: Artelonics Corp., 2952 Bunker Hill Lane, Santa Clara, CA 95050, or call (408) 727-3071.

CP/M-86 and MP/M-86 are trademarks of Digital Research.

Multibus is a trademark of Intel Corporation.

Tell me more. My immediate need is:

☐ Word processing ☐ Communications
☐ Data processing ☐ High resolution graphics

Name_____
Title_____
Company_____
Address_____
City_____
State_____ Zip_____
Phone (_____) _____

Mail to: Artelonics Corporation,
Attn: Marketing Services Department,
2952 Bunker Hill Lane,
Santa Clara, CA 95050. MMS 8/81

artelonics
Affiliate of Shell Canada Limited

CIRCLE NO. 94 ON INQUIRY CARD

test equipment

Breakout/monitor has 13 LEDs

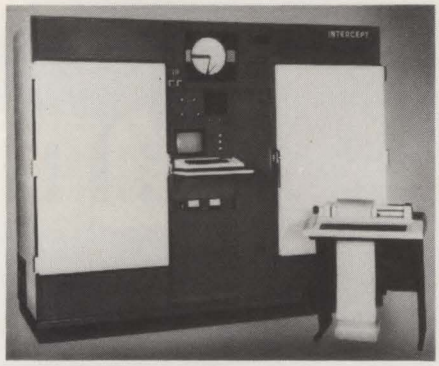
The MT25 EIA/CCITT breakout/monitor, a portable diagnostic device, permits the individual accessing of the leads of the EIA RS232 interface, and the patching and/or monitoring of those leads. A total of 11 LEDs indicate the status of the primary RS232 signals, and two additional LEDs provide other signals. Twenty-four miniature rocker switches allow each signal to be interrupted, and test access points provided at the DTE and DEC side of the interface allow for patching or monitoring of each signal. Price is $149, including carrying case and jumper wires. **Multi-Tech Systems, Inc.** New Brighton, Minn. **Circle No 196**

Thalamus introduces IC tester

This dynamic in-circuit digital IC tester performs tests on the device under test at incoming synchronous clock rates as high as 5 MHz in a real-time environment. Its operating system provides a turnkey tester without programming. Default operating characteristics can be overridden. The unit can test most logic families; varying densities; common chip sizes and programmable and nonprogrammable μps; memories and peripheral devices. The unit sells for approximately $35,000. **Thalamus Electronics Inc.,** Mississauga, Ontario, Canada. **Circle No 197**

System provides device testing

The model T357 discrete semiconductor test system performs wafer probe, final test, quality assurance, incoming inspection and device evaluation on bipolar transistors, diodes, SCRs, triacs, FETs and optocouplers. It features a 64K-byte memory, dual tape drives and software, including on-line device libraries, help lists and data reduction. The unit is priced at $80,000. **Teradyne, Inc.,** 183 Essex St., Boston, Mass. 02111. **Circle No 198**



System performs burn-in tests

The Intercept burn-in and test system continuously administers functional tests to as many as 18,000 ICs during burn-in conditioning. The system includes a user-programmable controller and test routines that can be stored on floppy disk and accessed. Minimum cycle time is 100 nsec., and timing can be controlled from the keyboard in 2-nsec. increments. Overshoot is rated at 5V, and rise time is 25 nsec. Prices range from $200,000 to $540,000. **Reliability Inc.,** P.O. Box 218370, Houston, Texas 77218. **Circle No 199**

National's board evaluates μp family

The NSC888 μp board enables users to evaluate the performance of the vendor's 8-bit NSC800 family. Features include 1K × 8 of user-accessible RAM and two 2716-compatible memory sockets, one of which is used by the monitor EPROM, and the other of which is used for user applications. The device requires a ±5V power supply and an RS232 interface cable. Price is $995 in single-unit quantities. **National Semiconductor,** 2900 Semiconductor Drive, Santa Clara, Calif. 95051. **Circle No 200**

MORROW DESIGNS

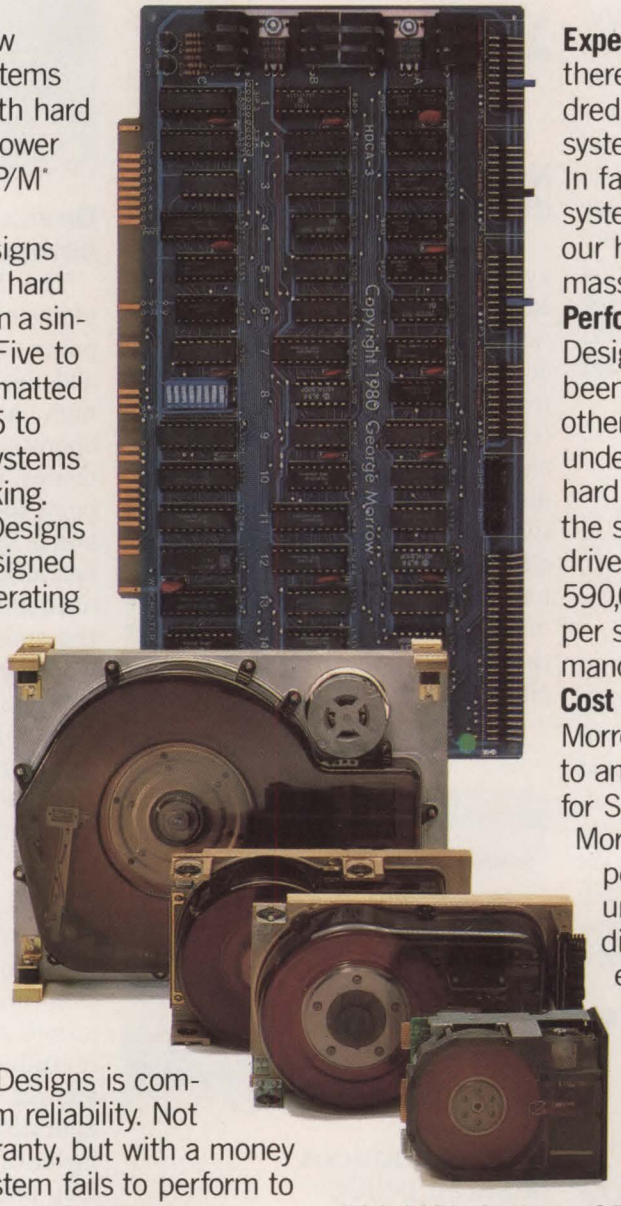
NOW, 26 Mbytes $4,495

Leading edge technology in hard disk systems.

Complete systems. Morrow Designs hard disk subsystems are delivered complete with hard disk, controller, cabinet, power supply, fan, cables and CP/M* 2.2 operating system.

Widest range. Morrow Designs offers the widest range of hard disk systems available from a single supplier. 5¼," 8," 14." Five to over 100 megabytes of formatted hard disk storage. $2,995 to $17,980. Cost effective systems that work. And keep working.

S-100 and more. Morrow Designs hard disk systems are designed for use with the CP/M operating system. Available software packages allow our systems to run on any IEEE696/S-100 Standard system with no hardware modification. Plus, Cromemco,*** North Star,** Vector Graphics, Godbout, Dynabyte, Exidy,**** IMSAI, Micromation, Processor Technology and California Computer Systems.



Reliable systems. Morrow Designs is committed to hard disk system reliability. Not simply with a 90-day warranty, but with a money back guarantee. If our system fails to perform to specification, send it back. We'll send back your money.

Experience. As of April, 1981, there were over fifteen hundred Morrow Designs hard disk systems successfully installed. In fact, over 200 independent systems integrators now use our hard disks to solve their mass storage problems.

Performance answers. Morrow Designs hard disk systems have been benchmarked against all other systems. None is faster under CP/M. Morrow Designs hard disks operate at 10 times the speed of a floppy disk drive. Transfer rates range from 590,000 bytes to 900,000 bytes per second. That kind of performance can become addictive.

Cost effective answers. Compare Morrow prices and performance to anything presently available for S-100 systems. You'll find Morrow's price/megabyte/performance ratio to be unmatched. Leadership in disk systems technology earned us leadership in price/performance. And that may have earned us a call from you. Circle the Reader Service Number for our full line data sheets. Can't wait? Call us at (415) 524-2101. And yes, OEM quantity prices are available. **LOOK TO MORROW FOR ANSWERS.**

*CP/M is a trademark of Digital Research.
**Northstar is a trademark of North Star Computers, Inc.
***Cromemco is a trademark of Cromemco, Inc.
****Exidy is a trademark of Exidy Corporation.

MORROW DESIGNS

5221 Central Avenue, Richmond, CA 94804
(415) 524-2101

CIRCLE NO. 122 ON INQUIRY CARD

datacomm

Wideband translator increases network capacity

The model 1009W DAX wideband translator, which functions as the "head-end" of a two-way broadband coaxial cable network, features an increased bandwidth to 54 MHz, providing 252 full-duplex point-to-point data circuits (nine channels). The Data Exchange broadband coaxial cable network provides local communications, allowing simultaneous data, video and voice over a CATV coaxial cable. Each terminal device in the network interfaces to the coaxial cable via an interface unit called a DAX. A backup system can be configured using a second DAX translator with switchover unit. **Amdax Corp.,** Bohemia, N.Y.

Circle No 201

IDS introduces telephone line switch

The model 8547 telephone line A, B, C, D, E switch can be used with TTY data links and for two-wire switching. It contains a five-position rotary switch on the front panel, which allows an operator to switch all signal conductors from the rear panel terminal block, labeled common (COM) to one of five terminal blocks labeled A, B, C, D or E. Connections for the unit are made at the rear panel by means of six four-screw terminal blocks. No power is required. The unit is priced at $355. **International Data Sciences, Inc.,** Lincoln, R.I.

Circle No 202

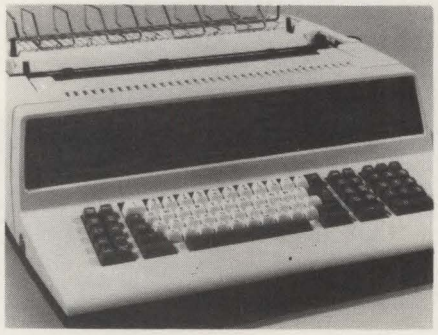
IDS announces limited distance modem

The model 6210 limited-distance modem provides asynchronous operation over telephone company or private two- and four-wire nonloaded, metallic (twisted-pair) conductors at speeds as high as 9600 baud. It can be used in point-to-point and multidrop network configurations and is in local data distribution (as far as seven miles) using 26-gauge wire. The unit provides internal strap selections for constant or controlled RTS, high or low transmit level and normal or high receiver impedance. The modem uses a pulse-modulation scheme and transmit and receive lines are transformer coupled. Price is $300. **International Data Sciences, Inc.,** Lincoln, R.I.

Circle No 203

Northern Telecom offers digital switching system

The DMS-250 digital switching system for specialized common carrier application functions as a tandem switch, an end-office switch or a combination of both. The unit features high-level control language (PROTEL) to allow data-table changes without reloading; built-in self-diagnostics for troubleshooting and testing; and a maintenance and administration position for maintenance, trunk testing, network management and service order changes. **Northern Telecom Inc.,** Nashville, Tenn. **Circle No 204**



Telex introduces tabletop printer

The model 767 tabletop keyboard printer for interactive and batch processing processes data from IBM 370, 4300 or 8100 hosts using SDLC line protocol at speeds as great as 4800 bps. The bidirectional unit uses a plastic or metal daisy wheel for draft- or letter-quality print. It prints at speeds as high as 60 or 80 cps. Features include a three-digit LED panel, an optional auxiliary port and an EBCDIC keyboard. **Telex Computer Products,** 6422 E. 41st St., Tulsa, Okla. 74135.

Circle No 205

Device limits computer access

The Datacryptor II device prevents unauthorized access to computer information by enciphering and deciphering data at speeds as high as 9600 bps. The device operates in half- and full-duplex modes, on dial-up lines or on leased point-to-point or multidrop lines, and in synchronous or asynchronous networks. Datacryptor II uses a master key to encrypt and decrypt transmissions of a working key. The working key encrypts and decrypts a user's data and is not stored or transmitted in plaintext form. Prices start at $2100. **Racal-Milgo, Inc.,** 8600 N.W. 41st St., Miami, Fla. 33166. **Circle No 206**

Modem is Bell-compatible

The model TC4007 asynchronous, Bell-compatible modem operates at speeds as great as 300 bps. Features include originate-answer, auto-answer and half- and full-duplex operating modes. The modem also includes RS232C and 20-mA current-loop interfaces, LED-indicated diagnostics and field-programmable auto-dial. The 10½- × 7½- × 3-in. unit weighs less than 4 lbs. and sells for $295. **Tek-Com Inc.,** 2142 Paragon Dr., San Jose, Calif. 95131.

Circle No 207

Price/Performance Breakthrough! Versatec V-80.

Get more output for less money. Print 1000 lines per minute, more than three times faster than competitively priced 300 LPM impact printers. Plot a full page of high quality graphics with 200 point-per-inch resolution in less than eight seconds. Produce big image hard copies from storage tube or raster scan displays. And do it all, quietly. With Versatec V-80.

Your best choice for hard copy. You can justify V-80 for printing alone. Use it for fast, quiet program listings. Print 132 columns on an 11" by 8½" page. Choose from a wide range of character sets—ASCII in three fonts (Gothic, Roman or Courier), nine international languages or a scientific/engineering character set. When you are ready for graphics, V-80 gives you high resolution plotting for data analysis, CAD, business presentations, seismic sections, mapping, etc.

V-80 keeps delivering more performance for less money. V-80 non-impact electrostatic writing uses only seven moving parts. That means better reliability and easier maintenance. Modular design enables faster repairs.

And V-80 is nice to be around. Quiet electrostatic writing eliminates the irritating clatter of impact printers. Output is presented on a sloped platen for easy viewing. And changing toner is easier and cleaner than changing a printer ribbon.

Get more output from your system. Versatec offers interfaces and intelligent controllers for all popular computers and display terminals, on-line and off-line systems, and support for local and remote operations. And V-80 is backed by the world's largest electrostatic printer/plotter sales and service network.

Break through to better price/performance. Circle our readers' service number for a free V-80 brochure.

VERSATEC
A XEROX COMPANY

2805 Bowers Avenue Santa Clara, California 95051 Telephone: (408) 988-2800 TWX: 910-338-0243
27/35 London Road Newbury, Berkshire, England Telephone: (0635) 42421 Telex: 847259

XEROX® is a trademark of XEROX CORPORATION. ™V-80 is a trademark of Versatec.

CIRCLE NO. 97 ON INQUIRY CARD

SEE V-80 AT SIGGRAPH

New Products

components

Baud-rate generator has 16 standard bit rates

The model K1135C baud-rate generator provides 16 standard bit rates from 50 to 19.2K baud. The device has 0 percent frequency error and an oscillator frequency (F_0) output available for TTL or LS gates, and an $F_0 \div 4$ output that can be used for other systems clock. Clock frequency is 16 times the baud rate, which allows the UART/ each data and recheck for validity. **Motorola Inc.**, Franklin Park, Ill.

Circle No 208

Card-edge connector is press-fit

This preassembled card-edge connector can be readily press-fit to eliminate solder, screws and clean-up. Installation requires an arbor or air-operated shop press, a backup board and a special vendor-supplied tool. The device provides a gas-tight joint to seal out corrosion and assure dry-circuit resistance that does not exceed .5 milliohms. Connectors are available with a .350- or .410-in card-slot depth. **Elco Corp.** Huntingdon, Pa.

Circle No 209

Voltage tracking protector limits differential

The model TII-340TA, low-voltage surge protector provides surge protection to ground and across-the-line limiting. The unit contains a three-electrode gas-tube lightning and surge arrester, two resistors and two zener diodes. In operation, back-to-back zeners are across the line and clip or limit voltage differentials from one line to another. When surged, line-to-ground voltage is prevented from rising and eventually arcing over. The devices are available for 8V, 20V and /30v across-the-line voltage limiting and between 150 and 300 VDC breakdown voltage surges. **TII Industries, Inc.**, Copiague, N.Y.

Circle No 210

CRT filter has anti-glare surface

The Parascreen RI filter, molded of RSA-strengthened acrylic, offers heat and scratch resistance, clarity and data display contrast. An anti-glare surface texture reduces operator eyestrain. Parascreen is available in a 12-in. size, with a 25-in. spherical radius. It has a satin surface texture of 40 percent reflection and is available in light smoke and amber colors. RSA-strengthened acrylic meets or exceeds performance characteristics of a wide range of clear engineering thermoplastics, including impact acrylic, cellulosics and polycarbonate. **The Richardson Co.**, Madison, Conn.

Circle No 211

THE ANN ARBOR AMBASSADOR™

SETTING THE NEW STANDARD IN PRICE AND PERFORMANCE

- Large 15-inch non-glare screen
- 60-line (4800 character) display
- Both Zoom and Scroll control, local and remote
- Selectable scrolling region
- 5 Graphic Renditions: bold, blink, blank, reverse-video and underline
- 5 Area Qualifications: protect, guard, numerics, justify and security
- 22 Cursor controls, including set, read, save, restore and move 1 to N
- 12 Tab controls, including column and field tab stops, and tab with justify
- 13 Erase controls
- 12 Edit controls, including the ability to locally rearrange data on the screen
- 12 Send controls and modes
- 10 Print controls and modes, including local and remote copy, and print format control
- 11 Receiving modes, including slow scroll and pause
- 11 Operator convenience modes, including selectable cursor
- 6 Setup lines permit review and control of terminal modes, send and print parameters and diagnostics
- 48 Function keys hold up to 64 down-loaded strings for transmission or internal execution
- Supports ANSI X3.64, ECMA-48, and ISO DP 6429 coding
- Ann Arbor quality throughout
- And much, much more!

We think you'll find the Ann Arbor Ambassador not only powerful and flexible, but easy to use. Call us for more information at Ann Arbor Terminals, Inc., telephone (313) 663-8000.

*OEM 100 pc. price, U.S. domestic sales.

ANN ARBOR TERMINALS, INC

6175 JACKSON ROAD • ANN ARBOR, MICHIGAN 48103 • TEL: 313-663-8000 • TWX: 810-223-6033

CIRCLE NO. 98 ON INQUIRY CARD

components

Programmable counter measures frequency

The PC-6 dual-input programmable counter measures frequency to 10 MHz, frequency ratio, sub-second time period from 40 nsec. to .999999 sec., sub-second time interval from 250 nsec. to .999999 sec. and unit count to 999,999 counts. Frequency and time measurements are displayed on six .3-in.-high LED digits. All functions, input ranges and the slope of either input can be selected manually or electrically. The PC-6 sells for $149 in single-unit quantities, with OEM discounts available. **Datel Intersil,** Mansfield, Mass. **Circle No 212**

Motorola announces synchronous multiplexer

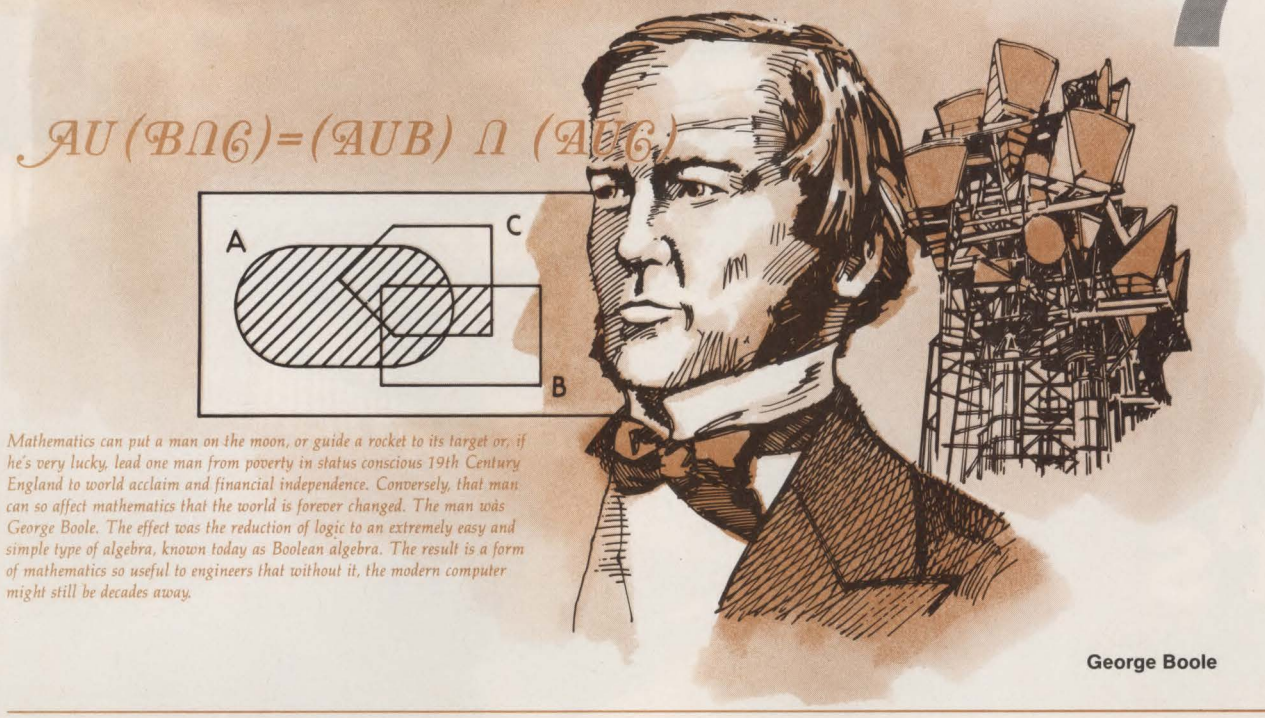
The SN74LS783 synchronous address multiplexer combines a μp, a color video-display generator and 4K- to 64K-byte dynamic or static RAMs with a 96K-byte addressing range. It includes an external 14.31818-MHz crystal and can also operate in a DMA mode. The IC can decode device-select commands from the host CPU. It is enclosed in a 40-pin ceramic or plastic package. Price in quantitites of 100 to 999 is $15. **Motorola Semiconductor Products Inc.,** Phoenix, Ariz. **Circle No 213**

Clock oscillators replace discrete components

The models K1161A, K1162A and K1163A clock oscillators replace discrete components, and can be plugged into a DIP socket or soldered directly to a PC board. Model K1162A, at 2.5 to 25 MHz, has a tight symmetry (45/55 percent) TTL output. Model K1161A provides a dual-complementary output, driving one to 10 TTL gates per output, over a 2.25- to 10-MHz range. Model K1163A provides its primary clock output at 10 to 14.999 MHz, and a ÷2 output. **Motorola Inc.,** Franklin Park, Ill. **Circle No 214**

Kierulff Salutes Innovators In Electronics

7



Mathematics can put a man on the moon, or guide a rocket to its target or, if he's very lucky, lead one man from poverty in status conscious 19th Century England to world acclaim and financial independence. Conversely, that man can so affect mathematics that the world is forever changed. The man was George Boole. The effect was the reduction of logic to an extremely easy and simple type of algebra, known today as Boolean algebra. The result is a form of mathematics so useful to engineers that without it, the modern computer might still be decades away.

George Boole

Kierulff Delivers The New ADDS Viewpoint, For Just $650*

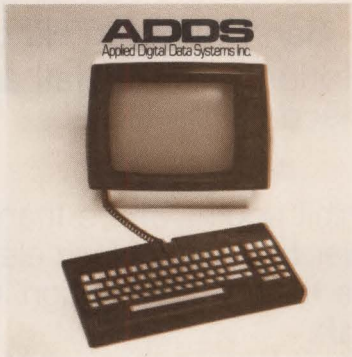
Now you can call Kierulff for immediate off-the-shelf delivery of ADDS' new Viewpoint computer display terminal. And at a low, low price. In fact, you can buy three Viewpoints for about the price of two ordinary terminals. And the price is even lower if you buy in OEM quantities.

Check these new features

Full-size screen in a space-saving cabinet. Portable typewriter-like keyboard. Two-position tilt screen. Six foreign language character sets. Filter screen (optional). Put them together and you'll see our Viewpoint.

Or move up to the exclusive *Regent*® line

Kierulff also carries the entire *Regent* family of ADDS terminals,



from the simple *Regent* 25 to the buffered *Regent* 60. Terminals to satisfy your requirements and Kierulff to fill all your needs. You can count on Kierulff for...

- Off-the-shelf delivery
- The finest distributor terms
- Factory warranty and service
- Multi-million dollar inventory
- Immediate delivery

Kierulff and ADDS...a great way to do business in 24 cities throughout America.

***$650 single quantity. Even less in OEM quantities.**

Regent® is a registered trademark of Applied Digital Data Systems Inc.

ELECTRONICS KIERULFF
A DIVISION OF DUCOMMUN INCORPORATED

The Distribution Solution For The '80s

Austin, TX (512) 250-7038 **Baltimore/Philadelphia/Washington, D.C.** (201) 575-6750 **Boston, MA** (617) 935-5134 **Chicago, IL** (312) 640-0200 **Cleveland, OH** (216) 464-6100 **Connecticut** (203) 265-1115 **Dallas, TX** (214) 238-6861 **Denver, CO** (303) 371-6500 **Florida** (813) 576-1966 **South Florida** (305) 652-6950 or (305) 463-4940 **Houston, TX** (713) 778-6530 **Los Angeles, CA** (213) 725-0325 or **San Fernando Valley** (213) 994-0316 **Milwaukee, WI** (414) 784-8160 **Minnesota** (612) 835-4388 **New Jersey** (201) 575-6750 **New York** (516) 365-3418 **Orange County, CA** (714) 731-5711 **Palo Alto, CA** (415) 968-6292 **Phoenix, AZ** (602) 243-4101 **Portland, OR** (503) 641-9150 **Sacramento, CA** (916) 924-8522 **Salt Lake, UT** (801) 973-6913 **San Diego, CA** (714) 278-2112 **Seattle, WA** (206) 575-4420 **St. Louis, MO** (314) 569-7630 **Tucson, AZ** (602) 624-9986 **Tulsa, OK** (918) 749-9543

INTERNATIONAL

CALIFORNIA, Compton (213) 774-7364, 2301 E. Del Amo Blvd. 90220. TWX: 910-346-6319, Outside LA Area (800) 645-5252
NEW YORK, Hauppauge, LI (516) 273-8100, 330 Motor Parkway 11787. Telex 1432333

CIRCLE NO. 99 ON INQUIRY CARD

It's *Wescon* time.

. . . in San Francisco. September 15 - 17, 1981.

- Professional Program — San Francisco Hilton Hotel
- Exhibition — Civic Auditorium/Brooks Hall and San Francisco Hilton Hotel

Wescon/81 — nearly 1,000 exhibit booths, more than 150 Professional Program presentations. America's premier high-technology electronics exhibition and convention brings together more than 50,000 design, manufacturing, and test engineers and other professionals.

Join us in San Francisco and help celebrate *Wescon's* 30th Anniversary!

For complete show details, including registration and transportation information, call and ask for the *"Wescon/81 Preview."*

In California — 800/262-4808
213/772-2965

Outside California — 800/421-6816

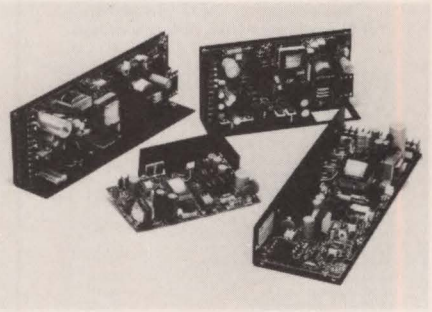
Wescon/81

Wescon is sponsored by the San Francisco Bay Area and Los Angeles Councils of IEEE, and the Northern and Southern California Chapters of ERA

Produced by Electronic Conventions, Inc., a non-profit corporation / 999 N. Sepulveda Blvd., El Segundo, CA 90245

New Products

power supplies



Power supplies have five output ratings

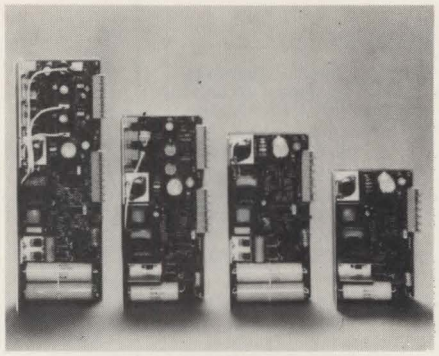
The NT/NQ series of open-frame switching power supplies is available in 65W, 75W, 130W, 150W and 200W output power ratings. The switchers are packaged in industry-standard outline configurations. All models feature triple- and quad-output capability with post-regulated auxiliary outputs in a 20-KHz fixed-frequency pulse-width modulated design. Other features include built-in line filtering and soft-start circuitry, 115/230 VAC input capability and 10 percent minimum loading on main output. Prices range from $115 to $315. **National Power Technology,** Anaheim, Calif. **Circle No 215**

UPS assures continuous operation

The ConstAC 1-, 3-, 5-, 7.5- and 10-KVA uninterruptible power systems assures continuous operations of essential equipment during blackouts, brownouts, interrupts and line transients. When AC power is available, the unit functions as a battery charger and AC line filter. Automatic transfer occurs in the event of AC line disruption providing no-break, 120 VAC power through the ConstAC UPS from standby batteries. Optional accessories include remote alarm/status panel, batteries, battery enclosure and meters for monitoring AC and DC load functions. **Lorain Products,** Lorain, Ohio. **Circle No 216**

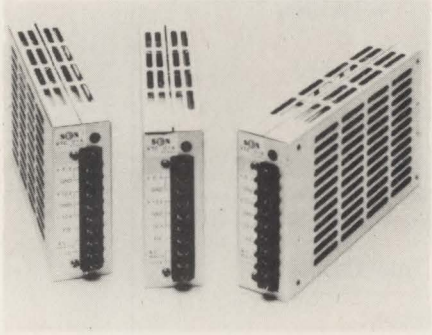
New Products

power supplies



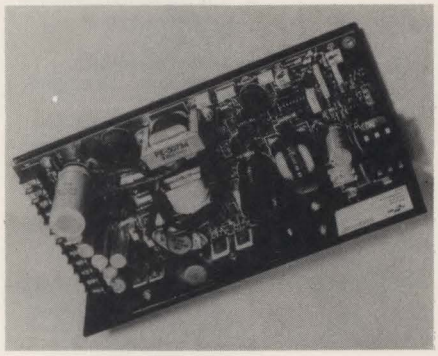
Switching power supplies offer independent outputs

This line of open frame switching power supplies includes nine models with 115 VAC and 11 models with 115/230 VAC inputs. Six models have one output, 10 models have three outputs, and four models have four outputs. Outputs are 5, 12, 15 and 24V. Other features include output regulation of 1 percent, ±20 percent line tolerance, in-rush limiting on turn-on, thermal protection, output ripple and noise ≤ 50 mV peak to peak. Prices range from $145 for single-output models to $300 for four-output models. **Condor, Inc.,** Camarillo, Calif. **Circle No 217**



Pacific Electronics offers 50W switching supply

The VTC 50W multi-output switching power supply has typical 75 percent efficiency and independently regulated outputs. The units measure 1.5 × 7.19 × 3.86 in. The DC output control is a single-screwdriver adjustment. Input range is 90 to 132V. Switching is high frequency at 50 KHz. The units minimize EMI/RFI with input filters and modular constructions. All units have soft-start circuitry and are burned in at full power for 48 hours before shipment. **Pacific Electronics, Inc.,** San Jose, Calif. **Circle No 218**



NPT announces 130W switchers

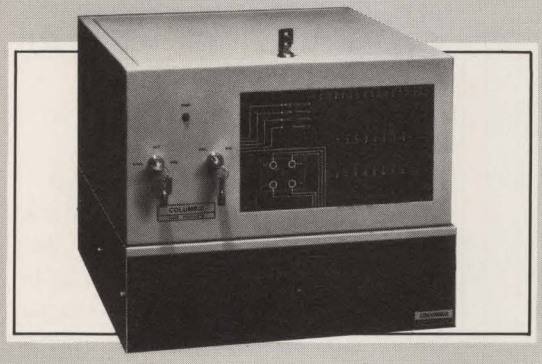
The models NT130 and NQ130 130W switchers feature triple- and quad-output capability with post-regulated auxiliary outputs in an outline configuration. Features include built-in line filtering and soft-start circuitry, 115/230 VAC input capability, fully regulated auxiliary outputs and LSI-controlled circuitry. Price is $259 in quantities of one to nine and $187 in quantities of 100 to 249. **National Power Technology,** 2111 Howell Ave., Anaheim, Calif. 92806. **Circle No 219**

MPI unveils open-frame PS

The model CP120 open-frame power supply provides four regulated DC outputs to μc-based industrial controller systems. The system features DC outputs of 5V at a current of 6A, 12V at 1A, −5V at 0.5A and −12V at 0.5A. The CP120 features current-limiting foldback for overload protection and built-in overvoltage protection. **Microcomputer Power, Inc.,** 2272 Calle de Luna, Santa Barbara, Calif. 95050. **Circle No 220**

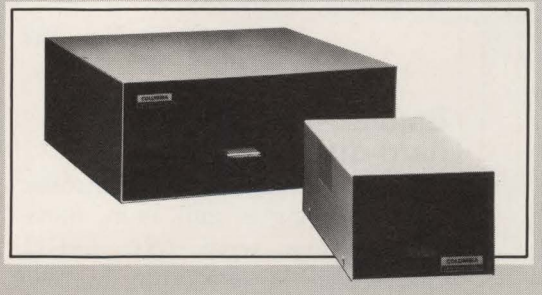
When the Market Demands Performance

Why compromise your requirements to the limitations of a personal computer? Columbia Data delivers a full range of high performance microcomputer systems featuring unmatched capability, reliability, support and **real** economy.

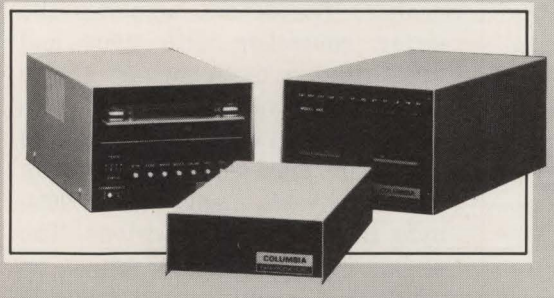


Multi-User Multi-Tasking Multi-Processor System
Affordable, upgradeable and expandable distributed processing is a reality with our new DC-1000 system. By simply adding satellite processor boards, our modular architecture allows for servicing up to 16 users, while creating a complete CP/M environment for each user; allowing full and fast execution of standard, unmodified CP/M programs. A master processor manages interaction of resources such as printers, floppy and Winchester disks, and data communication lines, at such speeds that a user is unaware others are sharing these peripherals.

Standalone Computer System With Graphics
With a Model 900 Commander Microcomputer, you don't need a separate graphics terminal . . . it's built in. You can display bar charts, histograms and complex point-to-point plots. And, because this Commander has an independent processor controlling the display, graphics can be handled without interrupting primary computing tasks. So . . . don't buy a graphics terminal . . . select a Columbia Data Products' Model 900 with the fullest I/O complement today, including RS-232, parallel, DMA and IEEE Bus controllers.



Floppy and Winchester Disk Based Computer Systems
Commander Series FX and MX computer systems let you connect your dumb terminal into a powerful distributed processing system. With these floppy disk based Z80A computers, you can perform a vast array of computer tasks using high-level language programs (such as BASIC, PASCAL, COBOL, and FORTRAN). Expandable versions are also available offering high performance Winchester disk storage and multi-user capability with up to 5 users sharing a 256K Z80A processor system running under CP/M and MP/M.



Intelligent RS-232 Storage Systems
These microprocessor-controlled data storage products offer cost effective storage with trade offs between capacity and access speed. In addition to the standard storage capabilities, these high-speed tape units, mini-floppy disks and data buffer units provide intelligent data handling, improved file management and editing as well as ease of operation . . . locally or remotely. Each data storage product is fully compatible with RS-232C/CCITT V.24 bus standards for data rates up to 19,200 baud.

COLUMBIA
DATA PRODUCTS, INC.

Home Office:
Columbia Data Products, Inc.
8990 Route 108
Columbia, MD 21045
Telephone: 301-992-3400
TWX: 710-862-1891

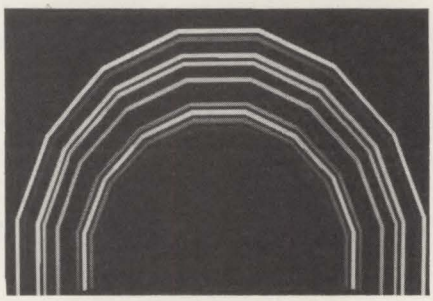
West Coast:
Columbia Data Products, Inc.
101 Scholz Plaza (Versailles)
P.H. 21
Newport Beach, CA 92663
TELEX: 692310

Europe:
Columbia Data Products (Europe)
P.O. Box 1118
4050 Moenchengladbach 1
West Germany
Telephone: 021-61-33159
Telex: 852 452

CIRCLE NO. 100 ON INQUIRY CARD

interfaces and controllers

Package offers Tektronix emulation



The GGEN graphics-interface and software package enables S-100 μcs to emulate a Tektronix 4010 terminal. The unit provides resolution graphics in black and white, gray or color. Hardware is S-100-bus-compatible, and software is CP/M-compatible. Hardware options include compatible monitors, light pen and graphical BASIC. Price, including a manual, is $300. **Cambridge Development Laboratory,** 36 Pleasant St., Watertown, Mass. 02172. **Circle No 221**

Interface enables transfers among Intel μps

The model 11-0080 Megalink Multibus-compatible interface enables DMA block transfers among as many as 255 Intel iSBC/System 80 and 86 μps at a 1M-bps rate over a single coaxial cable. The unit is packaged on a 6¾- × 12-in. board that plugs directly into iSBC/80 and 86 card cages. The HDLC communications protocol is implemented in hardware and on-board EPROM. An on-board μp performs link operations. The unit sells for $1700 in 10-unit quantities. **Computrol Corp.,** 15 Ethan Allen Highway. Ridgefield, Conn. 06877.

Circle No 222

Emulex introduces hard-disk controller

The SC02 single-board controller for interfacing 8- and 14-in. hard-disk drives with DEC LSI-11 computers is available in two models. The SC02/A emulates the RP11E controller with RP02 and RP03 disk drives to support 8M- to 160M-byte drives. The SC02/C emulates the RK611 controller with RK06 and RK07 drives to support with fixed/removable media 16M- to 96M-byte cartridge-module drives. The SC02/A is priced at $2500 in single-unit quantities and $1600 in quantities of 100 or more. The SC02/C controller is priced at $2800 and $1790 in OEM quantities. **Emulex Corp.,** Santa Ana, Calif.

Circle No 223

SERPENTINE VERSION AVAILABLE

17+ MEGABYTE DISK BACKUP

CARTRIDGE TAPE DRIVE

The Model 400 and 401 MAXIDRIVE™ packs 17.2 megabytes on a 450 ft. data cartridge. The model 400 offers a standard, and the 401 incorporates a serpentine recording head. Read-after-write dual gap and selective erase are standard for both models. Unique, hard mounted motor. Rugged transport mechanism. Excellent power dissipation. High, 6400 bpi density. Fast, 192,000 bps transfer rate. Solid state BOT/EOT detection. Plug-in electronics. Plus more.

Contact us today for complete details.

Qantex*

Division of
North Atlantic Industries
60 Plant Avenue, Hauppauge, NY 11788
(516) 582-6060 TWX 510-227-9660
(800) 645-5292

*Registered Trademark of North Atlantic Industries, Inc.

CIRCLE NO. 102 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.

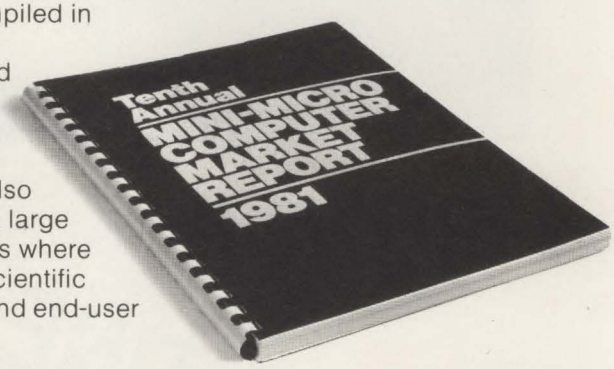
State-of-the-industry

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.

*Projections based on statistics compiled for the *1981 Mini-Micro Computer Market Report*

Mini-Micro Systems

A Cahners Publication
221 Columbus Avenue, Boston, MA 02116
(617) 536-7780

Regional Sales Offices:

Boston	(617) 536-7780	Orange County	(714) 851-9422
New Jersey	(201) 625-9225	Los Angeles	(213) 933-9525
Chicago	(312) 654-2390	San Francisco	(408) 243-8838
Denver	(303) 388-4511		

I want the facts about the $24 billion minicomputer and microcomputer markets.

☐ Send me a copy of the *1981 Mini-Micro Computer Market Report*
_____ Check for $495.00 is enclosed
_____ Purchase order for $495.00 is enclosed

☐ Have your regional sales manager call me about
_____ *1981 Mini-Micro Computer Market Report*
_____ *Market Segment Data Base* (prices upon request)

Name _____

Title _____

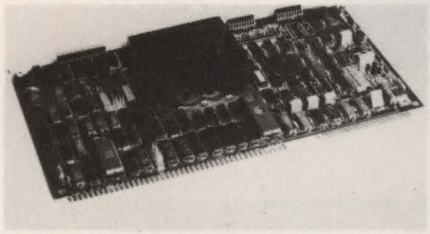
Company _____

Address _____

City _____ State _____ Zip _____

Telephone _____

interfaces and controllers



Disk-drive controller is Multibus-compatible

The Multibus-compatible MSC-9205 single-board Winchester disk-drive controller supports 20-bit addressing and provides 8- or 16-bit DMA data transfer, DMA command transfer and 8080 and 8086 compatibility. Other features include alternate sectoring on each track, variable interleaving, 22-bit error detection, 11-bit error correction, data separation, automatic position verification and automatic retry. Single-unit price is $795. **Microcomputer Systems Corp.,** Sunnyvale, Calif. **Circle No 224**

Disk/tape controllers emulate DEC, DG

The model ADC-21 controller emulates DEC RM02/3, RM04/5 or RK06/7 disk subsystems and RU 10/TM 11 and operates under RSX-11, RSTS/3, IAS and UNIX operating systems. The model ADC-20 controller emulates DG's 6067/6061 disk subsystem and 6021 tape subsystems using SMD disk drives and formatted tape drives. The unit, for DG Nova and Eclipse computers, operates under standard RDOS, AOS, IRIS and BLIS/COBOL operating systems. The ADC-20 is priced at $4400, and the ADC-21 is priced at $5100 in OEM quantities. **Ampex Corp.,** El Segundo, Calif. **Circle No 225**

Apple offers separate language card

This language card, enables users of Apple II and Apple II Plus personal computers to run turnkey programs written in any Apple-supported language, including Pascal, FORTRAN and PILOT. The card provides an additional 16K bytes of general-purpose RAM, increasing the size of the Apple II internal memory from 48K to 64K bytes. The card allows users of the Apple II and Apple II Plus to load and run programs written under the CP/M operating system that were designed for a 64K-byte computer. The card sells for $195; the language system sells for $495. **Apple Computer Inc.,** Cupertino, Calif. **Circle No 226**

BE A WINNER!

Participate in:

nepcon'81 Central

September 22-24, 1981
O'Hare Exposition Center
Rosemont, IL
(Suburban Chicago)

Here's the winning combination!

The Exhibition

Your chance to see Mid-America's winning line-up of equipment and technology leading to lower costs and greater productivity in:

- **PCB Prototype Design and Packaging**
  Artwork design and generation, laminates, flex circuits, multi-layers, hybrid packages, chassis, wire and cable, sockets, connectors, hardware and other components
- **Testing**
  Bare board and in-circuit testing, component test, functional testing for performance, digital testing, automatic test generation, inspection, etc.
- **PCB Fabrication/Production/Assembly**
  Component insertion machinery, soldering, aqueous and solvent cleaning, drilling, component preparation and processing, etching, screen printing, chemicals, lead cutters, connector assemblies and other equipment, materials and techniques

The Conference

Provides working answers to everyday production problems. Speakers include professionals of outstanding rank and achievement sharing their insights and discoveries in a dynamic program featuring the state-of-the-art in:

- Electronic Packaging — connectors and chip carriers
- PCB Fabrication — resists and imaging
- Inspection Techniques
- Full Scale Testing Systems
- Professional Advancement Courses
- Testing Workshops

The Electronics Testing Center

Get the competitive edge at the **Electronics Testing Center** located on the exhibit floor, featuring demonstrations of the latest equipment for electronic testing from incoming inspection to final test. Update your skills in this increasingly important manufacturing function.

Make sure you're in the running

Team up with more than 10,000 electronics engineers, designers, specialists and support personnel who gather to buy and specify production essentials. Get all revved up for NEPCON/Central '81. Clip and mail this coupon today for more details!

SHOW HOURS:
Exhibits Open: 11 a.m. Daily
Conference Starts: 9 a.m. Daily
Registration Opens: 8 a.m. Daily

Organized By:

CEG Cahners Exposition Group
Leading organizer of trade shows and conferences worldwide

YES! ☐ I am interested in EXHIBITING. Please send floor plans and full details.

YES! ☐ I am interested in ATTENDING. Please send registration and program data.

Name _____ Title _____
Company _____
Address _____
City, State & Zip _____
Telephone _____
Our Products _____

MAIL TO: NEPCON/Central '81
c/o Cahners Exposition Group
222 West Adams Street, Chicago, IL 60606 (312) 263-4866 Telex 256148

F

PDP-11 SYSTEMS SOFTWARE

by s&h computer systems, inc.

Over a thousand PDP-11 sites world-wide have already expanded their world with S&H software. This exciting-new world awaits you. For a detailed itinerary, contact us now.

TSX-PLUS

- RT-11 compatible.
- Real-time job support.
- Provides efficient, general purpose time-sharing for up to 20 users on 11/23 and 11/34 based systems.
- Up to 56Kb virtual address space per user.
- Supports COBOL-Plus, FORTRAN, BASIC, MACRO, PASCAL, DBL, TECO, KED, PIP, DUP, DIR, etc.
- Transparent line printer spooling system with queueing by form name.
- Detached jobs and "virtual" lines.
- Optional logon facility that requires project number and password for system access; maintains system usage charge information and device/file access control.
- Command files with parameters and user created system commands.

COBOL-Plus

- Highest performance of any COBOL system available for the PDP-11.
- Operates with RT-11, TSX and TSX-Plus.
- Automatic program segmentation feature eliminates the need for overlays.
- Fully symbolic interactive debugger.
- Multi-key ISAM files with dynamic B-tree structure — no overflow areas.
- Cursor positioning clauses with ACCEPT and DISPLAY statements.
- ANSI SORT statement when used with TSX-Plus.
- STRING, UNTRING, INSPECT, CALL, COMPUTE and COPY statements.
- Shared file record locking when running under TSX-Plus.

s&h computer systems, inc.
department aid-2r
1027 17th avenue south
nashville, tennessee 37212
(615) 327-3670
twx 810-371-1468

NASA photograph

CIRCLE NO. 75 ON INQUIRY CARD

CP/M Users Group provides data base

The CP/M Users Group CP/MUG has collected more than 1000/ programs on more than 40 diskettes, available for a modest charge from computer clubs and computer stores. The CPM/UG.DB data base contains references to all CP/MUG programs. Each program or program collection is referenced by a number of descriptive key words, which are used to select information about a particular class of programs. Each program or program-collection entry in the data base contains the disk number, program name, size, language and comments from the disk catalog and abstract. Price is $20, plus $1.50 for shipping and handling. **Elliam Associates,** Woodland Hills, Calif.

Circle No 227

Automation Consultants unveils report writer

With SKY WRITER, users can print reports of the entire contents or selected portions of a data file, including the key section or data section, sorted in any order, along with associated information stored in secondary files. Before printing, the program can perform arithmetic computations and character manipulations on the original data, and can calculate intermediate and final totals of numeric fields. Reports can be generated with 132 or 217 characters per line, and can be displayed on the CRT before printing. The user controls page width, number of lines per in. and per page, inter-line spacing and heading and column order and format. **Automation Consultants,** Menlo Park, Calif. **Circle No 228**

MAG announces list-management system

PRISM/LMS is intended to provide list management without programming. A user defines data to be stored in the files, and multiple keys can be defined for each file. Users can create mailing labels, envelopes, pre-printed forms, Rolodex cards, personalized form letters and contracts. Selected fields from selected records can be printed in specific locations on a form or merged into surrounding text. Column totals can be printed on numeric or monetary fields. PRISM/LMS runs on μcs using the CP/M, MP/M, CP/M-86, ONIX (UNIX for Onyx C8002) or model II TRSDOS operating system, with CBASIC as the host language. Price is $225. **Micro Applications Group,** 7300 Caldus Ave., Van Nuys, Calif. 91406.

Circle No 229

Package provides graphics for PDP-11

This version of the DI-3000 graphics-software system is tailored for DEC PDP-11 computers with 128K words of main memory, running under the RSX-11M, RSX-11M-PLUS and IAS operating systems. DI-3000, a package of FORTRAN-callable subroutines, is said to conform to the Core system graphics standard of ACM/SIGGRAPH. Features for developing graphics applications include color, 3D, area fill and patterning, graphic-arts-quality text, snapshot debugging and a picture-library facility. Interactive development tools are supported for digitizing, menu functions and image transformations. Drivers are available for Calcomp, Tektronix, Ramtek, H-P, AED, Chromatics, Genisco, Megatek, Imlac and other graphics devices. **Precision Visuals, Inc.,** 250 Arapahoe, Suite 303, Boulder, Colo. 80302. **Circle No 230**

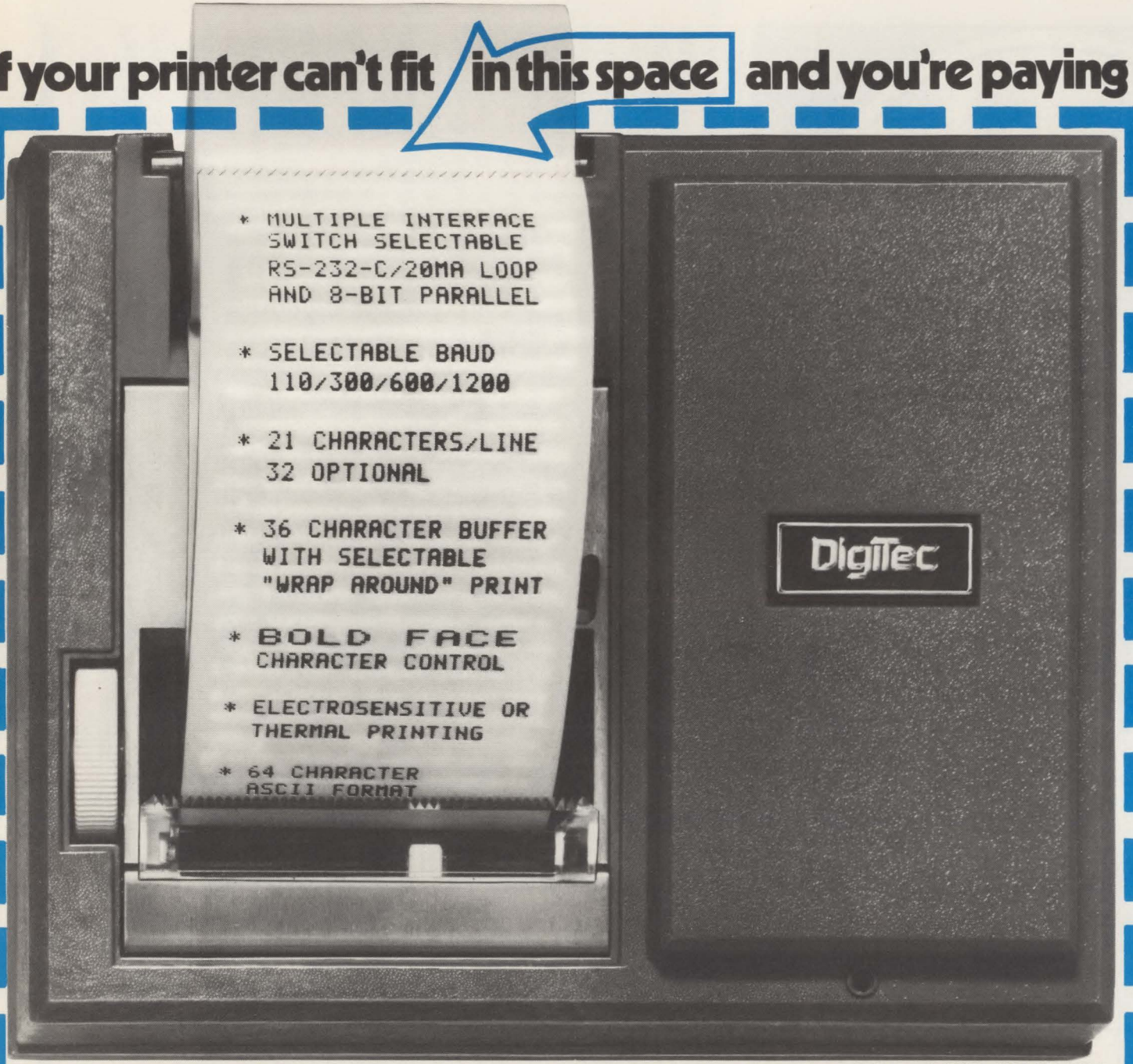
Graphics system provides daisy-wheel plotting

The Daisy-wheel Plotting System, written in FORTRAN, operates with computers using the CP/M operating system to produce line, bar and circle graphs. The package contains 60 user-callable FORTRAN routines that provide basic plotting functions. Utility routines merge graphics with text. Features include automatic data scaling, tic marks and grid lines, legends, use of two-color ribbons and a set of error messages. A set of upper- and lower-case characters can be provided at any size. Suggested retail price, including source code, is $600. **Escape, Ltd.,** Atlanta, Ga. **Circle No 231**

Query language available for PDP-11

The generalized reporting system (GRS), an on-line data-base query and report-writing language, runs on Digital Equipment Corp.'s PDP-11 computer under the RSTS/E operating system. The GRS query language is designed so that one statement, in many cases, can produce a formatted report, including page numbers and column headings. This is accomplished through the use of a wide range of defaults, which can be overridden by more sophisticated users. Summarization statements and built-in calculations allow users to aggregate data and perform complex analyses. A perpetual license is available for $12,000. **Enterprise Technology Corp.,** 305 Madison Ave., New York, N.Y. 10165. **Circle No 232**

If your printer can't fit in this space and you're paying more than $299,* you're using the wrong printer.



This Is The Actual Size of DigiTec's New Low Cost Model 6430/6470 Printers 7.38"W x 3.08"H x 6.12"D, WT 3½ LBS.

DigiTec.
NON-IMPACT PRINTERS

We've opened a whole new world of printer applications to both the OEM and end user.

A built-in one chip microprocessor provides the simplest possible multiple interfacing. Just plug into the standard EIA connector.

You read first line-up . . . just like a book, its electric writing is quiet enough to use in a library . . . it's designer-styled to look good in any environment, . . . and

Who Else But DigiTec Warrants Their Printers For 1 Full Year.

$299.*

in 100 quantities
$399. List

DigiTec.

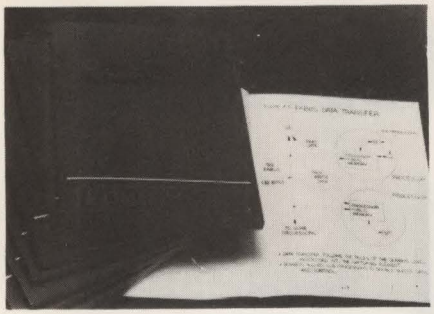
UNITED SYSTEMS CORPORATION

918 Woodley Road, Dayton, Ohio 45403
(513) 254-6251, TWX (810) 459-1728

Demonstration only Circle No. 107 on Inquiry Card

Information only Circle No. 96 on Inquiry Card

New Literature



Distributed architecture examined in booklet

Distributed-intelligence computer architecture is examined in the *Functional F64 Series Technical Description*. The volume provides an overview of the company's distributed-intelligence concept, Cyblok, comparing it with conventional sequential and parallel architectures. The book also discusses mass storage, I/O processing building block modules, switching elements, bus structure (FABUS) and operating system (DUMBOS). The $14.95 publication includes flowcharts, graphics, tables and a summary of more than 16 modules and accessories. **Gould Inc.,** 3 Graham Drive, Nashua, N.H. 03060.

Circle No 233

Handbook features hybrid components

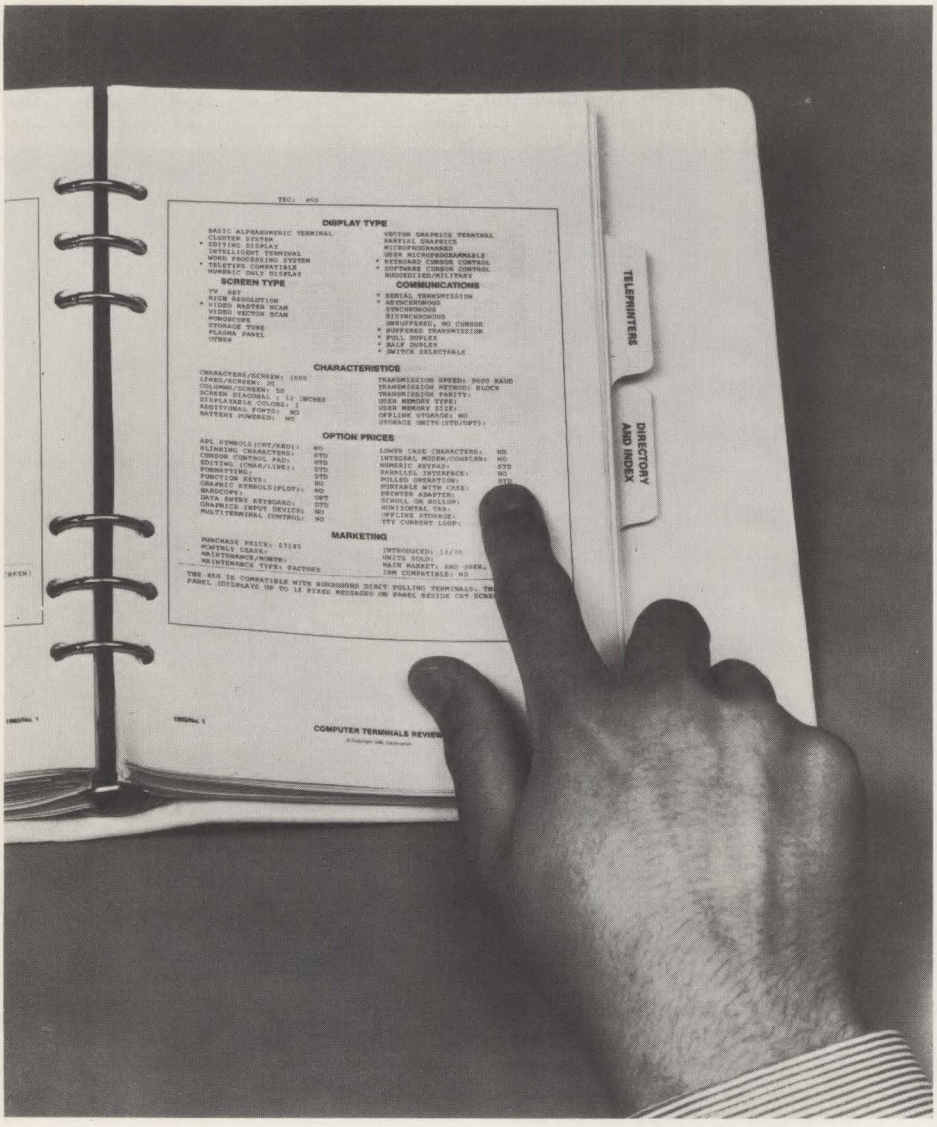
A line of monolithic, hybrid and modular products is detailed in a handbook. The 566-page book describes A/D and D/A converters, data-acquisition systems, sample-holds, operational amplifiers, instrumentation amplifiers, multiplexers, special-function devices and power supplies. The catalog provides selection tables, data sheets for key products and ordering information. **Datel Intersil,** 11 Cabot Blvd., Mansfield, Mass. 02048. **Circle No 234**

Telecomm products examined in brochure

A line of video-, voice- and data-transmission systems is described in a catalog. The 36-page booklet details microwave radio transmitter-receivers and radio subsystems, fiber-optic transmission systems, multiplexing systems, FDM and PCM cable carrier systems, PCM and N-type repeated-line equipment and PCM digital multiplexing equipment. The catalog also includes subscriber carrier systems, data-transmission systems, auxiliary data equipment, supervisory and control systems and VF and signaling equipment. **GTE Lenkurt, Inc.,** 1105 County Rd., San Carlos, Calif. 94070.

Circle No 235

"The useable terminal reference."



INFORMATION ON NEARLY 900 TERMINALS MADE BY MORE THAN 200 COMPANIES WORLDWIDE

- **FEATURES**
- **APPLICATIONS**
- **PRICES**
- **SPECIFICATIONS**

GML INFORMATION SERVICES

Our subscribers tell us that our GML COMPUTER TERMINALS REVIEW is more *useable* than any other reference they have. Ours is the one they *use* daily while the others collect dust on the shelf. The GML difference is that our REVIEW is more *current, complete,* and above all *concise* ....Its design makes it easier to find facts quickly and handier to carry around.

Maybe, that's why all our REVIEWS have been so popular for nearly 10 years with thousands of subscribers, such as IBM, Honeywell and Digital. Make use of the GML REVIEW yourself by ordering your subscription now.

Please enter my one-year subscription to COMPUTER TERMINALS REVIEW, including two updating revisions a year, plus free, unlimited telephone consultations for $175 in North America and $200 overseas.

☐ Bill me ☐ Bill my company ☐ Check enclosed

Purchase Order # _____ (must be included if billed later)

Name _____ Title _____

Company _____

Address _____

City _____ State _____ Zip _____

Tel. (_____) _____ Date _____

Signature _____

GML Corporation
594 Marrett Rd., Lexington, MA 02173 (617) 861-0515

Pamphlet examines signal-conditioning systems

The Series 1800 analog signal-conditioning systems is detailed in a brochure. The eight-page pamphlet describes the system's interchangeable, plug-in modules; 4-, 8- or 16-channel card cages; field-adjustable plug-in linearizer options for thermocouple modules, sequenced connector design, LED status indicator and flexible mounting configuration. **Acromag,** Wixom, Mich.

Circle No 236

Publication examines dynamic RAMs

Decoupling 16K and 64K dynamic RAMs is detailed in a technical paper. The 12-page bulletin, which includes figures and tables, describes multilayer ceramic capacitors, a high-frequency test circuit and capacitors. The paper provides applications, characteristics and design information. **AVX Corp.,** 60 Cutter Mill Rd., Myrtle Beach, S.C. 29577. **Circle No 237**

Publication details analog cartridge recorder

The ECR-20 militarized bidirectional analog cartridge tape recorder is described in a data sheet. The pamphlet, which includes schematic diagrams, details system performance, environmental ranges, controls and indicators. The data sheet also provides application, environmental, electrical and mechanical specifications. **Genisco Technology Corp.,** Rancho Dominguez, Calif.

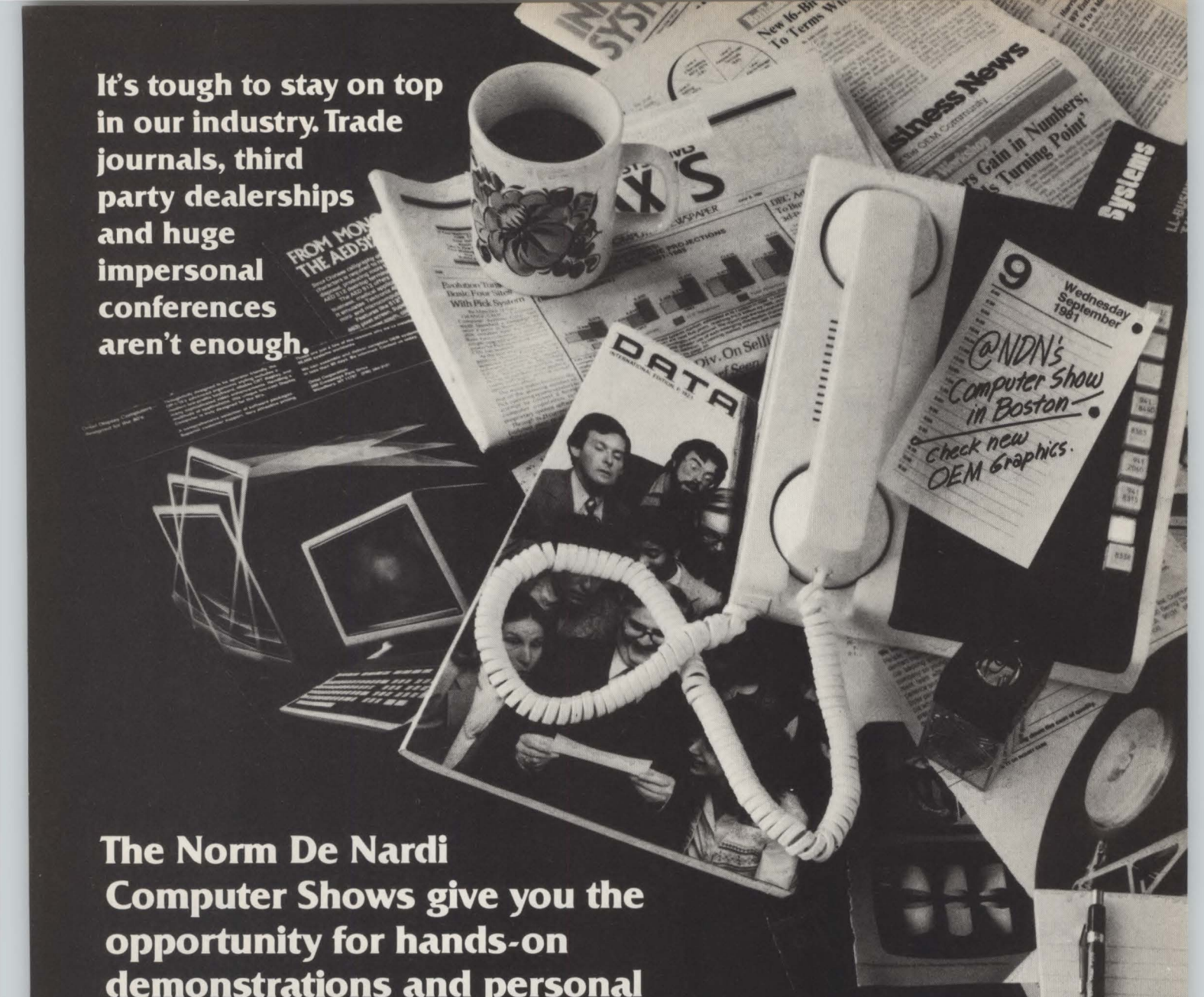
Circle No 238

Publication outlines pressure transducers

A line of standard-sized precision pressure transducers is detailed in a bulletin. The eight-page booklet outlines flush diaphragm, general-purpose, high-performance 5-VDC-output and marine pressure transducers. The bulletin also provides a pressure-conversion chart, physical and environmental specifications, applications and diagrams. **Kulite Semiconductor Products, Inc.,** Ridgefield, N.J. **Circle No 239**

Data sheets detail static RAMs

The 8112 8K RAM and the 2141 static RAM are described in four-page data sheets. The bulletins cover AC and DC operating characteristics, specifications, pin configurations and absolute maximum ratings. The sheets also provide packaging and ordering information and diagrams for read and write cycles. **GTE Microcircuits,** Tempe, Ariz. **Circle No 240**



The Norm De Nardi Computer Shows give you the opportunity for hands-on demonstrations and personal dialogue direct with the manufacturer. All in one day, within minutes of your office.

NDN
Enterprises

In one afternoon you can see the latest in OEM and sophisticated end-user computer graphics, disc drives, minicomputers, terminals, printers and other peripheral products our industry has to offer. You'll have an opportunity to exchange ideas with such manufacturers as Tektronix, Ampex, CDC, Shugart, Centronics, IBM, Data General, DEC, Dataproducts, Perkin-Elmer, Xerox, Versatec, Intersil, Hewlett-Packard.

SHOW SCHEDULE: 1 PM to 7 PM

Sept. 9, 1981	**Marriott Hotel, Newton, MA**
Dec. 3, 1981	**Hyatt Hotel, Palo Alto, CA**
Mar. 11, 1982	**Inn-at-the-Park, Anaheim, CA**
Apr. 22, 1982	**Hyatt Hotel, Palo Alto, CA**

Call or write for your invitation or exhibitor information to:
Norm De Nardi Enterprises,
289 S. San Antonio Rd., Suite 204,
Los Altos, CA 94022 415/941-8440.

"By expanding our potential, we help you expand yours."

"As a Vector computer, I'd like to introduce our dealers and OEMs to the newest member of the Vector computer family: me.

"I'm a Vector 5005 Multi-Share™ system, with all the intelligent, convenient characteristics of our 3005, and then some. I come with a 5¼ inch, 630K floppy, and a 5¼ Winchester disk drive that provides 5 megabytes of storage, and I can support from 1 to 5 terminals and 2 printers. Also, my Dual Mode controller board incorporates sophisticated error correction techniques normally found only in much bigger systems.

"Your customers will like me for yet another reason. I am a truly integrated word and data processing system. Different jobs can be done on the same terminal and different terminals can be doing different jobs simultaneously. I fit in equally well in small businesses (where the need is for perhaps 2 terminals) or in corporate environments (where I can be used as a multi-station word processor or comprehensive departmental machine). And I can grow as your customer's computing needs grow—with add-on terminals that are easy for you to install.

"For more information, call us at 800-423-5857. In California, call 800-382-3367. Or write to us at 31364 Via Colinas, Westlake Village, CA 91362.

"We Vector 5005s are here. Each time we get closer to our full potential, you get closer to yours."

VECTOR
Vector Graphic Inc.

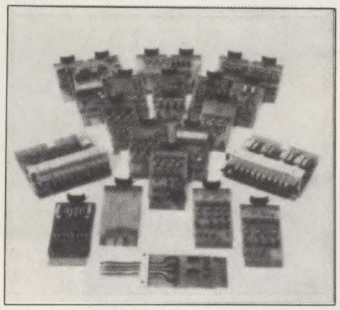
COMPUTERS FOR THE ADVANCEMENT OF SOCIETY.

CIRCLE NO. 152 ON INQUIRY CARD

Classified Ads

HARDWARE

DEC® SPARES DISCOUNTED



When you consider module replacement and its required downtime, it makes sense to have adequate spares on hand. Sure, you can call your local service rep. and begin the waiting game, or call us for overnight delivery.

We have in stock PDP-8®, RTM®, LAB-8®, and hundreds of other DEC® modules at up to 50% discount. In addition, due to our large inventory, we offer our MODULE EXCHANGE Program. Phone us, and we will ship the requested module by air. Then, if you need your module repaired, mail us your repairable module. We will send the module out for repair charging you only the exchange rate. Call your nearest office to place an order for spares or module exchange.

CALIFORNIA	TEXAS	FLORIDA
"Chuck"	"Brier"	"Jenny"
415-796-7368	214-428-5300	305-272-8753

FEDERATED CONSULTANTS INC.

1218 SOUTH ERVAY
DALLAS TEXAS 75215

® *trademark of Digital Equipment Corporation*

CIRCLE NO. 130 ON INQUIRY CARD

CRISIS COMPUTER CORP

HEWLETT • PACKARD
DEC
SURPLUS

LARGE SUPPLY OF

TAPE DRIVES	DISC DRIVES
SYSTEMS	CPU'S
MEMORY	I/O CARDS
PARTS	COMPONENTS

BUYING ★ ★ ★ ★ SELLING

2356 Walsh Ave., Santa Clara, CA 95051 **(408) 727-0431**
For domestic and international sales TWX **910-338-7330**

CIRCLE NO. 131 ON INQUIRY CARD

SERVICES

IBM SERIES/1
SOFTWARE — CONSULTING
SYSTEMS & APPLICATIONS DESIGN

Business, scientific and realtime applications. EDX, EDL, FORTRAN, PL/1, ASSEMBLER and MTM. SERIES/1 - 370 link (MVS, JES2, RJE), analogue-digital applications, graphics and custom character sets.

S/1 COMP ASSOCIATES
444 Lincoln Blvd. Suite 242
Venice, CA 90291
(213) 392-8733

Call Today...

to advertise on these pages

(617) 536-7780

DEC

SYSTEMS
&
COMPONENTS

C.D. SMITH &
ASSOCIATES, INC.
12605 E. Freeway,
Suite 318
Houston, TX 77015
713-468-2384
TELEX 26-2547

CIRCLE NO. 132 ON INQUIRY CARD

NEW LITERATURE

Microprocessor Catalog

40 page catalog of 6800 single board computers, interface modules, SPRINT 68 control computer/development system, WIZRD multitasking DOS, assemblers, compilers, BASIC, cross assemblers, cross compilers, custom engineering, OEM applications software.

WINTEK

Wintek Corp.
1801 South Street
Lafayette, IN 47904
317-742-8428

CIRCLE NO. 133 ON INQUIRY CARD

Copy Deadline:

Space reservations and advertising copy must be received by the 10th of the month preceding the issue date. Camera-ready mechanicals for display ads must be received by the 15th of the month preceding the issue date. For example, to appear in the February issue, copy must be received by January 10; mechanicals by January 15.

RSX-11M SYSTEMS
From 1 to 80 Megabytes

TT-1
Table-Top System
100% DEC

VT103-BA Terminal
LSI-11/2
64KB RAM
RX02 Disk (1 MB)
4 Serial Lines

$ 8,950

RM-10
Rack Mounted
100% DEC

VT100-AA Terminal
LSI-11/23
256KB RAM
RL01 Drives (10 MB)
4 Serial Lines

$ 22,950

RM-20
Rack Mounted
100% DEC

VT100-AA Terminal
LSI-11/23
256KB RAM
RL02 Drives (20 MB)
8 Serial Lines

$ 25,950

TT-20
Table-Top System

VT103-BA Terminal
LSI-11/23
256KB RAM
CRDS Disk Drive
(20 MB)
4 Serial Lines

$ 19,950

CM-40
Cabinet Mounted

VT100-AA Terminal
LSI-11/23
256KB RAM
CDC Drive (40 MB)

8 Serial Lines

$ 25,950

CM-80
Cabinet Mounted

VT100-AA Terminal
LSI-11/23
256KB RAM
CDC Drive (80 MB)

8 Serial Lines

$ 26,950

Quantity discounts available
No system more than 60 days away.
Most systems in stock for immediate delivery.
All systems include RSX-11M documentation and media.
Other DEC hardware and software available. Call for a quote.

ADVANCED COMPUTER SYSTEMS, INC.
250 Prospect Street
Waltham, Massachusetts 02154
617-894-3278

CIRCLE NO. 134 ON INQUIRY CARD

PROJECT MANAGERS AND ENGINEERS

If you need a fast, flexible, efficient, low-cost tool for managing projects; if you need results in minutes instead of hours or days, you need MicroPERT (tm)

MicroPERT (tm) Project Management System offers features unparallel in its price range. including:

Over 200 graphic output options including Network Diagrams, Gantt, Manpower, Resource & Cost charts on a variety of graphic output devices.

Over 45 report output options including Event, Activity, Manpower & Resource schedules. Cost detail & summary reports & exception reports for most categories on a variety of output devices.

MicroPERT (tm) is available for purchase or rental, on disk & tape-based versions for Tektronix 4050 series (desktop) Graphics Computers from:

SHEPPARD SOFTWARE COMPANY
4750 Clough Creek Rd.
Redding, CA 96002
(916) 222-1553

MICROPROCESSOR SOFTWARE

8048, TI9900, 8080/8085, 6800, 6502, Z80, etc.

Fortran IV Microprocessor Cross Assemblers and Simulators for all computers. Over 250 installations on 16-bit minis to 60-bit maxis (over 25 different manufacturers). Features include macros, conditional assembly, cross reference tables, etc. Most assemblers are relocatable and include linking loaders. For more information contact **Microtec, P.O. Box 60337, Sunnyvale, CA 94088. (408) 733-2919.**

CP/M COMMUNICATIONS

Comprehensive menu driven program supports links with timeshare & other CP/M systems. Disk buffer allocates to available RAM. Terminal mode feature: Session log to disk. File transfer modes perform auto disk page w/o data loss: XON/XOFF or CRC 16 protocol. Supports acoustic and auto dialing modems. Local mode disk dir, rename, delete, login, console echo, control display, session log.

$250 Source $75 Object

Free brochure on other 8080/Z80 products (Utilities, Subroutines, Language Systems)

Hawkeye Grafix Phone: 213/348-7909
23914 Mobile • Canoga Park • CA 91307

SOFTWARE

CP/M® ↔ IBM
CP/M ↔ DEC
Compatibility with

REFORMATTER™

Exchange data files with most IBM and DEC equipment through ***REFORMATTER*** disk utilities. With ***REFORMATTER***, you can read and write IBM 3740 and DEC RT-11 formatted diskettes on your CP/M system. Programs feature bi-directional data transfer and full directory manipulation. ASCII/EBCDIC conversion provided with CP/M↔IBM.

Each program $195.00 from stock. Specify CP/M↔IBM or CP/M↔DEC when ordering.

Program Data Sheets and Application Guide available from MicroTech Exports, Inc., 467 Hamilton Ave., Suite 2, Palo Alto, CA 94301 ☐ Tel: 415/324-9114 ☐ TWX: 910-370-7457 MUH-ALTOS ☐ Dealer & OEM discounts available.

CP/M® is a registered trademark of Digital Research.

CIRCLE NO. 135 ON INQUIRY CARD

EEC SYSTEMS

INTRODUCING LEX-11
WORD PROCESSING FOR THE VAX, LSI-11 and PDP-11

Immediate availability on all DECs operating systems including VMS, RSTS/E, RSX-11M, RT-11 also under UNIX and TSX-PLUS. LEX-11 is a proven system with installations world wide. This easy to use system is flexible and includes many features such as single keystroke functions, menu driven, user definable menus, calculator, forms, list processing, data base management facilities, electronic mail and spelling dictionary. Complete turnkey systems available.

Local distributors wanted: OEM discounts.

EEC Systems
286 Boston Post Road
Wayland, MA 01778
(617) 358-7781
(617) 443-6376

CIRCLE NO. 136 ON INQUIRY CARD

ISIS↔CP/M®

CP/M users may transfer data bi-directionally to ISIS diskettes. The "ISIS-CP/M UTILITIES" provide complete high speed data transfer to/from ISIS diskettes to/from CP/M diskettes and also include a utility to display the ISIS directory. Will work in any version CP/M environment with any density drive.

$250 on single density 8" diskette. Free brochure on other software development tools.

Southern Computer Systems
PO Box 3373A
Birmingham, AL 35255
Phone: **205-933-1659**

CP/M® is a registered trade mark of Digital Research. ISIS is a trade name of Intel Corp.

CIRCLE NO. 137 ON INQUIRY CARD

Classified Ads

CLASSIFIED ADVERTISING ORDER FORM

Mini-Micro Systems' classifieds reach more mini-micro people.

Rates; $60.00 per column inch:
Our rates apply to both display classified and regular classified listings. There is no charge for typesetting regular classified listings. Plan approximately 50 average words to a column inch, approximately 38 characters per line. Please send clean, typewritten (double-spaced) copy.

Category: The following categories are available; be sure to specify the category you wish to be listed under: Business Opportunities, New Literature, Selling, Buying, Trading, Seminars, Services, Software, Supplies & Accessories. (Other categories may be employed at our discretion.)

Run this ad in_____(number issues)
Ad size:_____col. wide by_____inches deep. Under_____(category)
Check enclosed for $_____(Pre-paid orders only)

Signature_____

Name _____ Title _____

Company _____ Telephone No. _____

Address _____

City _____ State _____ Zip _____

MAIL TO: Linda L. Lovett, Classified Advertising, Mini-Micro Systems, 221 Columbus Ave., Boston, MA 02116

Mini-Micro Systems
Career Opportunities/Recruitment Advertising

7-Day Closing
(Prior to Issue Mailing Date)

Rates
$60 per column inch.
Column width 1¾″ × 10″ (4-column/page).
Full page: $2,400 (1 × B & W)

Circulation
Over 92,000 technically sophisticated professionals in computer operations/systems management, data communications, engineering management, systems engineering/integrators, educators and systems programming specialists.

Recruitment
Hot Line
(203) 327-6772

Call your ad in—
we'll set the type
at no charge.

Mail Film to:
Peggy Gordon
Recruitment Manager
CAHNERS PUBLISHING CO.
999 Summer St.
P.O. Box 3809
Stamford, CT 06905

COMPUTER PROFESSIONALS

The Good Opportunities
The Good Life.....New England

Match a lifetime opportunity with our diverse recreational climate, affordable housing and nationally competitive salaries. The most exciting technical challenges today for software and hardware professionals are on the drawing boards of New England's computer, electronic and end-user companies.

Work here! Live here! Grow here!

Management and individual contributor positions are available with salaries from $25 - 60K in the following disciplines:

- Operating Systems
- Utilities and Tools
- Compilers/Interpreters
- Data Base Design
- Office Automation
- Word Processing
- Networking, SNA/SDLC/NCP
- Local Networks
- Bisynch Emulations 3780/3270
- Packet Switching X.25, CCITI
- Commercial EDP
- MRP/Inv. Ctrl./Shop Fl. Ctrl.
- A/P, A/R, G/L, Pay/Psn'l.
- Microprocessor Design
- Micro Firmware/Software
- CPU Logic Design
- Peripherals Design
- LSI/VLSI Development
- ATE/Test Engineering
- Power Supply Design
- Telecommuncations
- Signal Processing
- Modem Design
- Reliability/Quality
- EMI/RFI Engineering
- CAD/CAM Software

Please forward a resume in confidence or call:

Boston Area
(617) 721-1021

Nashua, NH
(603) 880-6720

TECHNICAL DIRECTIONS, INC.
440 Amherst Street N-2, Nashua, NH 03063
Client companies assume fees and relocation expenses

ELECTRONIC DESIGN ENGINEERS
$18,000-$40,000 +

Immediate, desirable upstate NY & nationwide. Junior to senior project management. Engineering placement specialists since 1946. In confidence send resume or call James F. Corby, Pres.

NORMIL E PERSONNEL ASSOCIATES
5 Leroy St., Box 110 Westview Station
Binghamton, NY 13905
607-723-5377

WISC.-ILL.
to $40,000

3 - RSX11M Engineers
2 - Applications Programmers
4 - Software Test Dev. Engrs.
2 - Telecom Engineers
1 - Switch Systems Engrs.
1 - Medical Instrumentation Engr.
2 - Graphic Systems Eng.
9 - Micro Processor Des. Appl.

Inquire: **(312) 430-4222**

ELECTRONIC ENGINEERING GROUP
Div. of Polytech Research Corp.
7667 W. 95th Street
Hickory Hills, IL 60457
Attn: Mr. R. W. Keogh,
V.P. of Recruitment
An Equal Opportunity Employer

ELECTRONIC SPECIALISTS

R.J. Evans & Associates, Inc., a leading edge Corporate Recruiting Firm for the high technology industry. Our clients' needs are extensive. Chances are we have the right position, salary, responsibilities and location you desire. Forward your resume for confidential consideration or telephone us directly.

R.J. EVANS & ASSOCIATES, INC.
26949 Chagrin Boulevard #300
Beachwood, Ohio 44122
1/216/464-5100

THE ACCESS GROUP, INC.

Career opportunities available nationwide for engineering professionals skilled in design, development and manufacturing. Confidential search conducted by degreed engineers. Positions fee paid. Free resume service.

Call or write for a free career/salary guide.

Northeast 179 Allyn Street
Hartford, CT 06103
(203) 527-9107

NY/Mid-Atl/SE Box 3267
Stamford, CT 06905
(203) 356-1166

SW/West/Mid-west P.O. Box 18302
Las Vegas, NV 89114
(702) 731-2097

Affiliate offices in 120 cities nationwide

Telephone Peggy Gordon, 203-327-6772 to place your recruitment/classified ads.

MINI-MICRO ENGINEERS
23-42,000
We serve Cincinnati & National clients in a variety of industries including computer manufacturing/sophisticated machine controls/toys. For a more challenging career, contact W. Keith Baldwin. All positions are fee paid.

Baldwin & Associates
One Lytle Place, 621 Mehring Way, Suite 307, Cincinnati, Ohio 45202 513/241-6557

Hardware / MSEE
BSEE / Software

If you have 1 or more years experience in any of the following areas: Electrical-Electronic, Analog-Digital Ciruits, Systems Design or Development, Mini-Micro Processors, Project, Process, Test Controls or Instrumentations and possess a BSEE and or a MSEE and would like your career handled by a service that specializes exclusively in Electrical Engineers on a nationwide basis then send your resume in confidence to:

SOUTHERN ENGINEERING SERVICES
P.O. BOX 2045
SARASOTA, FLORIDA 33578.

"A PERSONAL SERVICE FOR ELECTRICAL ENGINEERS"

NEW ENGLAND NATIONWIDE

Dynamic Personnel System, specialists in technical placement in the heart of New England, currently has hundreds of Electronic and Data Processing openings at every level including:

HARDWARE / SOFTWARE	**TO 42K**
DIGITAL / ANALOG	**TO 40K**
SYSTEMS / ATE	**TO 39K**
SYSTEMS ANALYSTS	**TO 36K**
PROG / ANALYSTS	**TO 30K**

And if New England's not your cup of tea, we offer openings across the country through our affiliation with National Personel Consultants.

Naturally, companies pay all fees, interview and relocation expenses.

Send resume or call:
Toll Free 800-628-3374.
In Mass. (collect) 413-781-0982.

dps

DYNAMIC PERSONNEL SYSTEM
181 Park Avenue
West Springfield, MA 01089

PROCESS COMPUTER SYSTEMS ENGINEERS

Join Aramco Services Company in Houston for top salaries, unique experience

When Aramco Services Company, a wholly owned subsidiary of Aramco, the largest oil-producing company in the world, hires you as a process computer specialist, you'll get a top salary. Plus a great benefits package. You'll also be starting out on what could be a very rewarding career position.

Work in Houston on the world's biggest overseas projects

Aramco is the key company involved in the development of the energy resources of Saudi Arabia.

Many Aramco projects are very large in scope, complexity, and in the application of advanced technology. There are challenging smaller projects, as well.

Many of the projects are supported in Houston by process computer specialists who serve as the key liaison between Saudi Arabia and U.S. vendors or turnkey contractors. Often, the smooth start-up and trouble-free operation of a project costing millions, or even billions, are aided by an individual or a team in Houston.

Can you think of any other place in the country quite like this where you could start to carve out such an interesting career?

This could be the job you've waited for

In this key job supporting major Aramco projects, we require *process computer software engineers* with BS degrees in engineering, math or computer sciences, and 3 or more years' experience in various real-time processes or SCADA projects.

We also need *process engineers* with BS degrees in chemical engineering, and 3 or more years' experience in designing and maintaining process computer and instrumentation systems.

Process computer hardware systems engineers are needed with BS degrees in electrical engineering, computer science or engineering technology, plus 3 or more years' experience in designing and maintaining process computer and instrumentation systems.

You'll be based in Houston, but from time to time you will be required to travel to vendors in the U.S. and to Saudi Arabia.

Interested? Send us your résumé and we'll get back to you very soon. Write: Aramco Services Company, Section DOM, Dept. MNS0801TF04A, 1100 Milam Building, Houston, Texas 77002.

ARAMCO/HOUSTON
SERVICES COMPANY, DOMESTIC

Computer Industry Professionals

You're In Demand!

IMMEDIATE OPENINGS THROUGHOUT THE COMPUTER INDUSTRY, INCLUDING POSITIONS PARTIALLY LISTED BELOW:

Computer Specialists:
-Programming Analyst
-Hardware/Software
-Micro/Mini/Super Mini
-System/Application
-Operations/Testing
-Graphics/Diagnostic
-Word Processing
-Data Base Management

Engineering and Science:
-Electrical/Electronic
-Solid State/Physicist
-Material/Metallurgy
-Mechanical/Chemical
-QA/QA/Reliability
-Design/System
-Mathematician
-Technical Writer

Segments of Industry:
-Manufacture of Computer
-Hardwares/Peripherals
-DP Services/Software/Planning
-Public Utility/Communication
-Finance/Insurance/Real Estate
-Consulting Firms
-Education/Medicine/Law

Management and Business:
-Executive/Management
-Project/Staff Management
-Administrative Support
-Field Support
-Planning/Scheduling/Cost
-Marketing/Sales
-Programming Supervisors

WE ARE THE COMPUTER INDUSTRY SPECIALISTS. ACT TODAY AND SEND FOR OUR FREE COST—OF—LIVING INDEX OF ALL MAJOR CITIES. YOU CAN ALSO TAKE ADVANTAGE OF OUR FREE RESUME SERVICE.

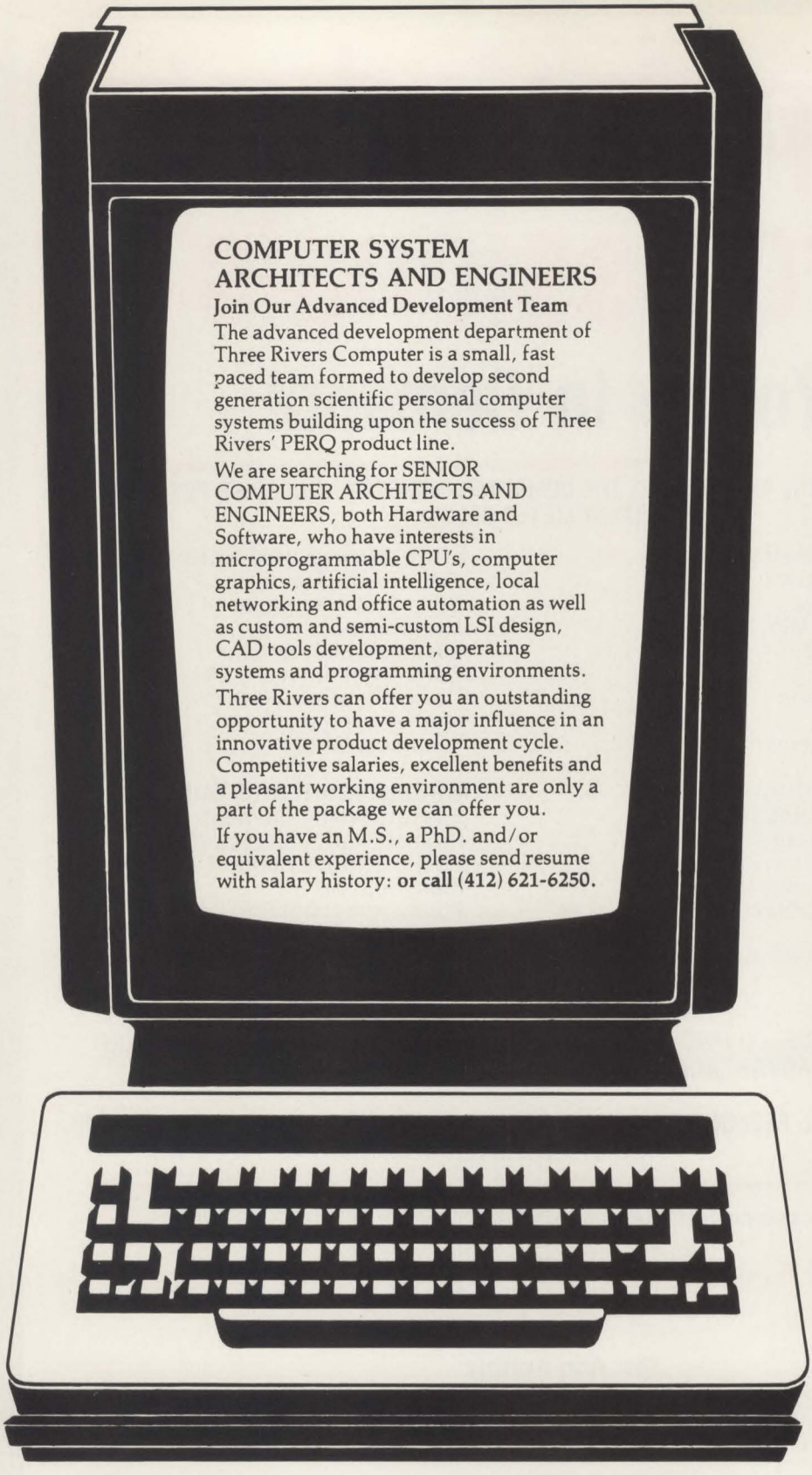
—ALL FEE/INTERVIEW/RELOCATION EXPENSES ARE—
—PAID BY EMPLOYER—

Please submit resume with current salary to:

COMPUTER PROFESSIONAL PLACEMENT SERVICES, Inc.

Ms. Ann Keithly
P.O. Box 487—MM
Marlton, New Jersey 08053

Or call for a free time-saver application:
(609) 983-8203
Ask Ann about our exclusive computer career advancement program



COMPUTER SYSTEM ARCHITECTS AND ENGINEERS

Join Our Advanced Development Team

The advanced development department of Three Rivers Computer is a small, fast paced team formed to develop second generation scientific personal computer systems building upon the success of Three Rivers' PERQ product line.

We are searching for SENIOR COMPUTER ARCHITECTS AND ENGINEERS, both Hardware and Software, who have interests in microprogrammable CPU's, computer graphics, artificial intelligence, local networking and office automation as well as custom and semi-custom LSI design, CAD tools development, operating systems and programming environments.

Three Rivers can offer you an outstanding opportunity to have a major influence in an innovative product development cycle. Competitive salaries, excellent benefits and a pleasant working environment are only a part of the package we can offer you.

If you have an M.S., a PhD. and/or equivalent experience, please send resume with salary history: **or call (412) 621-6250.**

Three Rivers Computer

Personnel Department
720 Gross Street
Pittsburgh, PA 15224

Three Rivers Computer is an Equal Opportunity Employer

My career really got moving when I answered an ad in

Mini-Micro Systems

ATTENTION SOFTWARE ENGINEERS:

YOU'VE EARNED YOUR SPURS.

You've put in at least 3 years of practical, on-the-job experience. And now, you've earned your spurs. You've earned the Texas sunshine and you've earned the chance to join the team at E-Systems Garland Division. You'll need your spurs, too, because some of the toughest high-technology electronics problems you can face are solved every day at E-Systems.

OPPORTUNITIES FOR SOFTWARE ENGINEERS:

- wide range of jobs:
  - -a real-time distributed/embedded software systems involving command and control, switching, communications, signal processing/analysis, DBMS, graphics, and man-machine interfaces
  - -also: research, systems engineering, requirements definition, design, implementation, testing
- state-of-the-art technology:
  - -mainframes: IBM 370/155/158, IBM 3033, CDC Cyber 175
  - -minis: VAX 11/780, PE 3220, SEL 32/7780, DG S/330, PDP 11/34, PDP 11/23, HP 21 MX, TANDEM
  - -micros: Motorola 68000, 6809
  - -special-purpose hardware: bit-slice processors using AMD and 2900 Logic, parallel processors using Fairchild F 100K ECL, communications networks using NSC Hyper-channel hardware, Multi-Megabyte Multiport Memories, and much more!
- broad range of languages:
  - -high order languages like Pascal and Structured FORTRAN
  - -assembly languages and Microcode
  - -PDL and Programmer's Workbench

PUT ON YOUR SPURS

Don't miss out on this Texas size opportunity. We are planning to be in the following cities with some of our top technical people to talk with you. Send your resume today for professional review and priority attention:

Atlanta
Bethesda
Boston
Chicago
Dayton
Los Angeles
Melbourne/ Orlando
Minneapolis
Newark
Philadelphia
Phoenix
Pittsburgh
San Diego
San Jose
Seattle
St. Louis

If you have a degree and 3 or more years of experience, grab hold of this opportunity — don't delay — send your resume to: Professional Placement, E-Systems, Inc., Garland Division, P.O. Box 226118, Dept. ES43, Dallas, Texas 75266.

E-SYSTEMS
Garland Division

The problem solvers.

ENGINEERS

Major Florida electronics firm has immediate needs for the following:

LSI	**Design**	**1-10 years exp.**
CADS	**Software**	**1-10 years exp.**
MASK	**Engineers**	**3- 5 years exp.**

Our client company offers unparalleled growth and visibility, top salaries, progressive benefits and a near-perfect Florida lifestyle. For immediate and confidential consideration, please forward your resume, or call:

Phil Lehman (813) 872-1853

FRANK LEONARD PERSONNEL
1211 N. Westshore Blvd., Dept. MM
Tampa, Florida 33607

Member *Equal Opportunity Employer M/F*
Client Company Pays All Fees

EMPLOYMENT SERVICE FOR PROGRAMMERS AND ANALYSTS

National Openings With Client Companies and Through Affiliated Agencies

Scientific and commercial applications • Software development and systems programming • Telecommunications • Control systems • Computer engineering • Computer marketing and support

Call or send resume or rough notes of objectives, salary, location restrictions, education and experience (including computers, models, operating systems and languages) to either one of our locations. Our client companies pay all of our fees. We guide, you decide.

RSVP SERVICES, Dept. MM
Suite 700 One Cherry Hill Mall
Cherry Hill, New Jersey 08002
(609) 667-4488

RSVP SERVICES, Dept. MM
Suite 230, Dublin Hall
1777 Walton Road
Blue Bell, Penna. 19422
(215) 629-0595

RSVP SERVICES
Employment Agents for Computer Professionals

HOW TO START A COMPUTER BUSINESS

"Computer Business Opportunities 1981" annual report covers the best moneymaking ventures - consulting, software packages, dealerships, systems houses, services, repping, maintenance, vertical markets and much more - plus 20 steps on how to start, where to be in the 80's, the small business market, common entrepreneur's mistakes, financing, marketing, competing with biggies, directory of services and self-help sources, going part-time to full-time. Nowhere under one cover is a better industry perspective for self-employment planning. Contents from key back-articles of "Computer Opportunies," the entrepreneur's newsletter since 1978, "Low Capital Computer Business Guide" (10,000 copies sold), and continuous research from our field seminars. Over 200 pages ring-bound, $65.00, check, Visa, Mastercharge, or written company P.O. 30 day refund guarantee.

DATASEARCH INCORPORATED
4954 William Arnold Road / Dept. K
Memphis, Tennessee 38117
For faster service on credit card orders, phone 901/761-9090

A small ad here can attract a lot of attention call today **(203) 327-6772** for details.

Minis have arrived

IF YOU THINK IMS OR CICS PAYS A LOT, WAIT TILL YOU HEAR WHAT WE OFFER FOR MINI COMPUTER EXPERIENCE

We mean business at Computer Horizons Corp. If you can handle a mini computer development project, designing and developing important software and applications, then we will pay you an above average salary and give you.....BAL; COBOL; JCL; and other mini skills....

Computer Horizons Corp is one of the nation's leading data processing services companies. Through a network of 6 Regional Headquarters, we are providing fast and efficient technical services to a large, national and local clientele.

If you have experience in one of the following areas:

PDP11/RSTS/E BASIC +
Wang VS,COBOL
PRIME, PRIMOS
UNIX, 'C'
8100 DMS
DATAPOINT DATABUS Or COBOL
IBM SYS/3, 34, 38, RPG II

We Want To Meet You Now!!

Positions currently exist in our New York and New Jersey regions. Additional opportunities can be discussed for Miami, Houston, San Francisco, and Chicago.

When selected you will receive an above average salary and a complete benefits package including dental insurance. Additionally, we offer relocation assistance and a full array of in-house training opportunities.

To apply, just call collect or send your resume to:

David M. Reingold
Director National Recruiting
(212) 371-9600

CH® COMPUTER HORIZONS CORP.
Dept MMS 747 Third Avenue
New York, New York 10017

An Equal Opportunity Employer M/F

Telephone Peggy Gordon, 203-327-6772 to place your recruitment/classified ads

YESTERDAY'S FRONTIERS WERE CROSSED BY COVERED WAGON; TOMORROW'S WILL BE CROSSED BY YOUR IMAGINATION.

INCO is looking for *imaginative* PDP-11 scientists, engineers, and designers with the following experience:

- Back-end processing
- Relational data base R&D
- Distributive microprocessing
- Memory mapping
- Associative computing
- Packet switching

Principals only/U.S. Citizenship required

Call or send your resume to Bob Sullivan:

INCO, Inc.
8260 Greensboro Dr.
McLean, Virginia 22102
703-442-7960

EOE **M/F/H**

QUANTITATIVE TECHNIQUES/ REMOTE SENSING

Ph.D. or M.S. with experience, or B.S. with several years of qualifying experience. Four positions in Applications Branch of EROS Data Center. All are senior level positions in Data Analysis Section. Applicant should be expert in spatial analysis methods and/ or image processing techniques. Responsibilities include research and software techniques development. Knowledge of remote sensing applications is important. Send detailed resume with references to:

Gordon A. Strom
Personnel Supervisor

Technicolor Graphic Services, Inc.
EROS Data Center
Sioux Falls, South Dakota 57198

(605) 594-6511

THINKING OF A MOVE?

If you're considering making a move, **Career Opportunities** can bring your qualifications to the attention of the top companies, nationwide, with engineering needs.

As a service to our readers, a new section, **Situations Wanted** is now available. Simply fill out the following form (all information strictly confidential) and return with your pre-payment of $20.00 **(made payable to Cahners Publishing Co.)** to:

Name _____

Address _____

City _____ State _____ Zip _____

Home Phone _____

PLEASE PRINT YOUR COPY CLEARLY _____

_____

_____

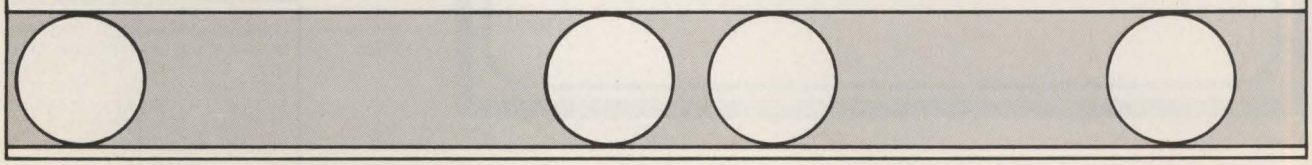
_____

_____

_____

Peggy Gordon
Mini-Micro Systems
999 Summer St.
P.O. Box 3809
Stamford, CT 06905

You will be assigned a Box No. and all responses will be mailed to you immdiately. Please keep your copy to 1 inch (approximately 30 words).



Telephone Peggy Gordon, 203-327-6772 to place your recruitment/classified ads

FIELD APPLICATION ENGINEERS

Intersil is offering outstanding career positions within its Microcomputer Systems Field Application Engineering Staff. Career-oriented, technically sound, self-motivated professionals are what we are looking for.

Three to five years of solid design experience in digital process control and data acquisition is a must. You should be thoroughly familiar with microprocessors and digital, analog and industrial I/O interfaces. A working knowledge of microcomputer software components such as operating systems, high-level languages and applications handlers is also required.

Three major territories are available—the West, Midwest or Eastern.

In your territory, you will be responsible for applications or systems engineering utilizing Intersil's Microcomputer products in the following areas:

—Identifying potential customers.

—Working with Intersil Field Sales and customers on defining requirements.

—Generating final technical proposals for each application.

—Interfacing the required task between engineering and customer.

—Supporting customers technically during the design and system integration phase of each program.

—Establishing new standard products from common industry requirements in industrial control systems.

Applicants should have a BS/MS in engineering or electronics. Industrial instrumentation experience is a big plus.

We offer an excellent benefits package and working conditions. If you are technical, enjoy interfacing with customers and like to travel, give Intersil a call or send us your resume: INTERSIL, Inc., 1275 Hammerwood Ave., Sunnyvale, CA 94086. (408) 743-4394. We are an equal opportunity employer M/F/H

INTERSIL

SOUTHEAST
Our 12 Offices in NC, SC, GA and FL specialize in Control Systems, Instrumentation, Electronic Design, and Engineering positions from 18 to 40K. Aggressive, confidential. Fee-Paid service. Send resume to Ted F. McCulloch, **BEALL PERSONNEL** P.O. Box 5042, Spartanburg, SC 29304.

ELECTRONIC ENGINEERS

We have over 40 years experience in placing professionals in all engineering disciplines with a special emphasis on electronic professionals. Your career move should be an A-1 priority. Working with professionals can insure that. Your skills are our trade at Nationwide.

NATIONWIDE BUSINESS SERVICE
145 State St., Suite 310
Springfield, MA 01103
"in Our 43rd Year"

ENGINEERS/ MANAGERS

As one of the nation's most respected recruitment firms for high technology industries, we can offer you a wide variety of opportunities, all fees, interviews, and relocation paid by our many national client companies.

Some of our most pressing client company needs follow:

Software Engineers, all levels to $47,000
Hardware Engineers, all levels to $45,000
Quality Engineers, Electronics to $37,000
Manufacturing Engineers to $35,000

Our clients include many of the "big name" and smaller, fast growing companies in the commercial, scientific, and defense industries, with a specialization in the mini and micro computer fields.

Dick Ray Career Consultants
540 Meadow St. Ext.
Agawam, MA 01001
413-789-0907

SITUATIONS WANTED

OUTSTANDING PROGRAMMER SEEKS CONTRACT WORK IN WASH. D.C. AREA. 3 YEARS EXPERIENCE: DP, CAD/CAM; IBM 370, HP3000, NOVA'S; ASSEMBLER, FORTRAN, PASCAL, TPL.
Box S-1

CONSULTING SERVICES—OEM PERIPHERAL PRODUCTS-DISK DRIVE SPECIALTY. MARKETING, SALES, MARKET AND PRODUCT STUDIES, STRATEGIC AND TACTICAL BUSINESS PLANNING. 25 YEARS EXPERIENCE, 7 AS A CONSULTANT. BSES/PH.D.
Box M-1

Engineers
Exclusive
$20 - $60K

Walden and Associates is selected to assist this well-known company in staffing their new R & D center with qualified technical personnel; backgrounds in radio or TV frequency, cable and digital design technicians and engineers. The following is a partial listing:

- Software Section Manager
  Manages a segment of the development program. Directs the work of project leaders, software professionals and/or support personnel. Organizational responsibility will consist of 1-10 software engineers. **to $50K**
- Software Department Manager
  Manages a major component of the software development program. Directs section managers, project leaders or software engineers. Organizational responsibility will consist of 10 or more professionals **to $60K**
- Software Engineering Specialist **to $42K**
- Principal Software Engineer **to $36K**
- (2) Digital Design
  CRT background/graphic design/micro processor **to $33K**
- (4) Cable designers
  CATU - inter-connections cable **to $28K**
- (2) Radio frequency high tech
  AS degree, military exp. or computers **to $20K**

Please forward your resume
in confidence to:
A.B. WALDEN

WALDEN and ASSOCIATES

98 Hoyt St. **Suite A**
Stamford, CT 06905 **Fee Paid**

harmonizing career goals
with employment opportunities

Software Development

MICRO COMPUTERS

VIENNA, AUSTRIA

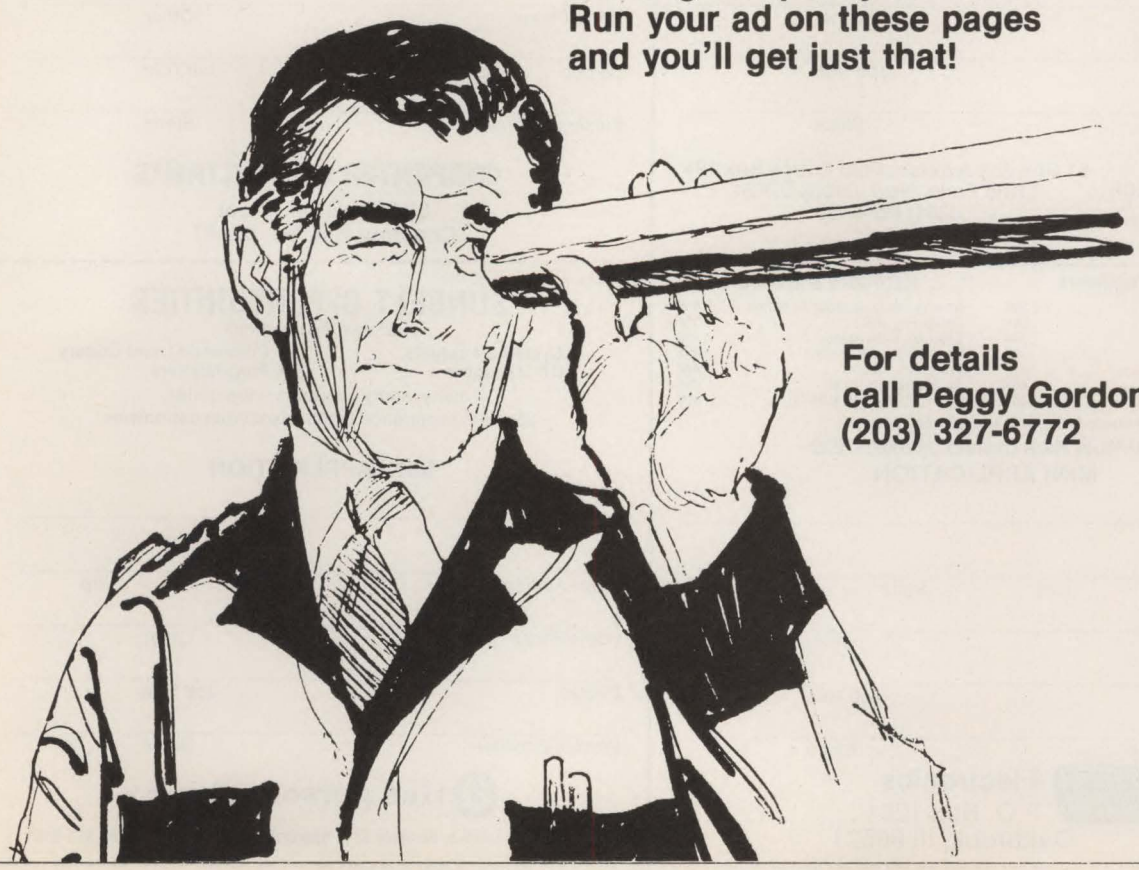
A multi billion dollar international company has a major commitment in the micro-computer field and requires a software development professional to be a key member of their team.

Responsibilities will be for design of systems software architecture, implementation and adaptation of operating systems, creation of tools and utilities, and technical negotiations with software houses.

Depending on experience, the successful candidate will act as a specialist within a software team or lead a group of up to 4 software developers. A minimum of 2 years experience in micro-computer operating systems of 8 Bit and 16 Bit machines is required. Knowledge of operating systems such as UCSD/PASCAL, CP/M, MP/M, CROMIX, etc., required.

This unique opportunity can be either on a permanent or contractual basis. German language not required. Please send resume and current salary to Box 3296, 420 Madison Ave., New York, N.Y. 10017.

Looking for quality resumes?
Run your ad on these pages
and you'll get just that!



For details
call Peggy Gordon
(203) 327-6772

Telephone Peggy Gordon, 203-327-6772 to place your recruitment/classified ads

Career Opportunities/ Mini Applications

DP PROFESSIONALS

Programmer/Analysts through Systems/MTS Managers. Salaries from 18K to 55K. Hundreds of openings in upstate New York and nationally through 118 affiliated offices.

Mini-Micro Specialists . . . to 42K
Sr. Project Managers . . . . to 39K
Sr. Software Engineers . . . to 35K
Systems Programmers . . . to 35K
Systems Managers . . . . . to 55K
Programmer Analyst . . . . to 30K

MINI APPLICATION

Name

Home Address City State Zip

Home Phone Other

Degree Job Title

Present Employer Since

All fees employer paid. Send resume or call: **Rod Brehaut**

NIGHTINGALE PERSONNEL CONSULTANT AGENCY
306 S. Salina St., Suite 201
Syracuse, NY 23202
(315) 472-4776

THE PROFESSIONALS

SINCE 1957 FRONTIER HAS BEEN SUCCESSFULLY WORKING WITH PROFESSIONALS IN THEIR JOB SEARCH. WE WOULD LIKE TO WORK WITH YOU. TOGETHER-YOU AND FRONTIER-THE PROFESSIONALS.
ENGINEERS • PROGRAMMERS • ANALYSTS • OPERATORS

MINI APPLICATION

Name

Home Address City State Zip

Home Phone Other

Degree Job Title

Present Employer Since

frontier placement agency
National Personnel Associates

1333 RAND BUILDING
BUFFALO, NEW YORK 14203
DIAL 856-4490 · AREA CODE 716

SW ENGINEERS/SW MANAGEMENT To $45K

SW Design/Systems/Analysis: Real-Time (microsecond level), Signal Processing, Electro Optical Scanning/Tracking, Multi-Computer Architecture, Micro's, Systems Integration. U.S. Citizen Required.

MINI APPLICATION

Name

Home Address City State Zip

Home Phone Other

Degree Job Title

Present Employer Since

Hi-TECH Search Inc.

61 Stevens Avenue, Post Office Box 194
Little Falls, New Jersey 07424
(201) 785-9480

PROFESSIONAL SEARCH FOR ELECTRONICS EXPERTS

As a professional, your time is valuable. So is ours. We will work with you to select only those opportunities within the parameters (position, location, size of company, etc.) you set. It is this selective use of your time and ours that makes us effective.

MINI APPLICATION

Name

Home Address City State Zip

Home Phone Other

Degree Job Title

Present Employer Since

CARPENTER CONSULTANTS
824 Boylston Street
Chestnut Hill, Ma. 02167

Systems Engineers

Dir. Software CAD/CAM	55K
Dir. Prod. Dev. CAM	55K
Tech. Support CAD	38K
Supv. Syst. Design CAD	44K
Sr. Eng. "Plotters"	42K
Sr. Engineer CPU ARCH	45K
EE 2 yrs Exp Digital	28K

Hardware & Software

Sr. Eng. Instrumentation & Controls	40K
Design Eng. I&C	35K
Syst Eng. Micro Based	40K
Sr. Eng. Micro Based Syst	40K
Prod. Mgr. Telecom	44K
Sr. EE Analog to Digital	43K
Logic CPU Interface MOS TTL	40K

many positions in Micro-based systems

Call Noel Rice Collect 312-887-1220

MINI APPLICATION

Name

Home Address City State Zip

Home Phone Other

Degree Job Title

Present Employer Since

FC Electronics
P.O. Box 1281
Oakbrook, Ill 60521

SUNBELT OPPORTUNITIES

Nation-wide openings

- **Systems Analysts**
- **DP Managers**
- **Command Level Coders**
- **Programmers**

many, many positions—top dollar
25 years experience & 150 associates nationwide

MINI APPLICATION

Name

Home Address City State Zip

Home Phone Other

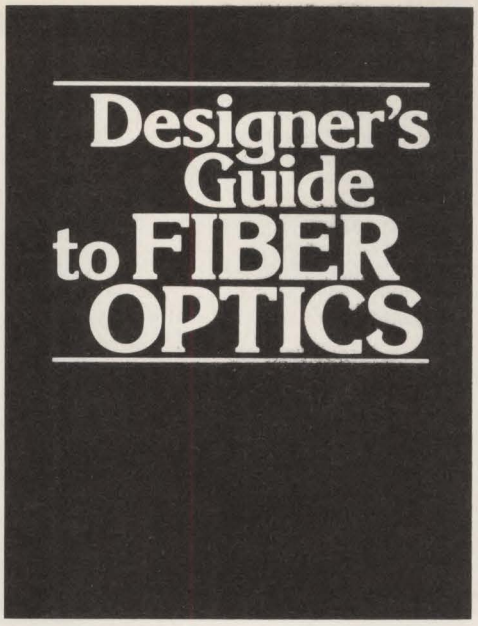
Degree Job Title

Present Employer Since

atlas personnel inc.

P.O. Box 3261 • 465 E. Kennedy St. • Spartanburg, SC 29304 • 803-585-8161

Telephone Peggy Gordon, 203-327-6772 to place your recruitment/classified ads.



A Designer's Guide to FIBER OPTICS

This comprehensive, authoritative guide covers all aspects of fiber-optic systems. Totalling 60 pages, it provides full understanding of the components, their key parameters and how they relate to fiber-optic system design.

- **Part 1 — Understanding glass fibers and their parameters**
- **Part 2 — Matching sources and detectors to the fibers**
- **Part 3 — System-design considerations**
- **Part 4 — Building a fiber-optic system**
- **Part 5 — What's available today: Fibers, connectors, sources and detectors**

Send to:
Fiber Optic Reprints
EDN Magazine
221 Columbus Ave
Boston, MA 02116

Please send _____ copies of
Designer's Guide to Fiber Optics
— $5.00 ($7.00 Non-USA surface mail
$9.00 Air mail)

Check or money order must accompany each order. No COD. MA residents add 5% sales tax.

Send to:

Name _____

Title _____

Company _____

Address _____

City _____

State _____ Zip _____

MMS 5/81

Advertisers Index

See pages 222-235 for Career Opportunity Advertisers

REGIONAL SALES OFFICES

BOSTON
John J. Fahey,
Eastern Regional Manager
221 Columbus Avenue
Boston, MA 02116
(617) 536-7780

NEW JERSEY
Joseph F. Fitzhugh,
Regional Manager
262 East Main Street, Room 202
Rockaway, NJ 07866(201) 625-9225

CHICAGO
Clayton Ryder,
Regional Manager
Charles Durham, Jr.,
Regional Manager
15 Spinning Wheel Rd.-Suite 224
Hinsdale, IL 60521
(312) 654-2390

DENVER
John Huff,
Regional Manager
270 St. Paul Street
Denver, CO 80206
(303) 388-4511

DALLAS
Don Ward
Regional Manager
4100 McEwen Rd., Suite 225
Dallas, TX 75234
(214) 980-0318

JAPAN
Tomoyuki Inatsuki,
General Manager
Trade Media Japan Inc.
R. 212 Azabu Heights
1-5-10 Roppongi
Minato-ku,
Tokyo 106 Japan
Tel: (03) 585-0581

ENGLAND
Ian Hardman
Systems International
Quadrant House,
The Quadrant
Sutton Surrey, SM2 5AS
England

LOS ANGELES
Robert Billhimer,
Regional Manager
5670 Wilshire Boulevard
Los Angeles, CA 90036
(213) 933-9525

ORANGE COUNTY
David E. Pearson,
Regional Manager
2021 Business Center Drive
Suite 208
Irvine, CA 92715
(714) 851-9422

SAN FRANCISCO
Frank Barbagallo,
Regional Manager
Sherman Building, Suite 1000
3031 Tisch Way
San Jose, CA 95128
(408) 243-8838

Career Opportunities
Lynn George
Recruitment Advertising Director
Peggy Gordon
Recruitment Advertising Manager
1200 Summer St., Suite 307
Stamford, CT 06905
(203) 327-6772

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.

C. ITOH ELECTRONICS, INC.
One world of quality

COMMAND PERFORMANCE.

® Registered trademark of the Digital Equipment Corporation.

CIRCLE NO. 114 ON INQUIRY CARD

DEC, Data General, H-P communications costs are down

If you're supporting multiple remote terminals on your minicomputer system, whether from DEC, Data General, HP or anyone else, chances are you are paying a fortune in communications costs and probably not even running the terminals as fast as you'd really like to. And, to add insult to injury, you have to put up with the occasional phone line 'glitch' which drives your CRT's crazy.

What you really need is a smart little box that will provide error control for your 'dumb' terminals and allow several of them to share one telephone line, contending for the line when they need it, not each paying for a dedicated transmission facility all day.

Well, look no further. MICOM's Micro800 Data Concentrator allows up to 16 terminals to share a single phone line — and our new Micro900 Multidrop Concentrator even lets you *multidrop* those terminals at up to eight different locations, *without requiring any changes to existing hardware or software*.

More than 20,000 Micro800's are already in service, installed by the user as painlessly as plugging in a terminal. And with some of our customers supporting four 2400 bps CRT's on a single 2400 bps line, no wonder they're delighted! What's more, with the Micro800, transmission errors are gone forever. We even have a single channel configuration for lone terminal installations. And for added convenience, our new Micro8000 Concentrator Modem packages both concentrator and high-speed modem in a low-cost compact package.

Send for complete details of the MICOM concentrator family today . . . better still, why not call and order a pair on a 30-day sale-or-return basis. No strings attached! We *know* you'll love it.

MICOM™ MicroComputers for DataCommunications™

MICOM SYSTEMS, INC. • 20151 Nordhoff Street • Chatsworth, CA 91311 • Telephone (213) 882-6890 • TWX 910/494-4910
Eastern Regional Sales and Service • Plaza Nine, Suite 514 • 900 Route 9 • Woodbridge, NJ 07095 • (201) 750-1120
Regional Sales Offices • Atlanta, GA (404) 435-2999 • Dallas, TX (214) 258-0774 • St. Louis, MO (314) 576-7626
MICOM-BORER LTD. • Bel Court • 15 Cradock Road • Reading, Berkshire RG20JT, England • (0734) 866801 • Telex 847135

Available *now* from these stocking reps...

Alabama: (800) 327-6600 ● **Alaska:** Anchorage (907) 276-5616/Juneau (907) 789-3310 ● **Arizona:** (602) 994-5400 ● **Arkansas:** (214) 620-1551 ● **California:** Anaheim (714) 635-7600/Lodi (209) 334-1961/San Diego (714) 565-1557/Santa Clara (408) 727-6491 ● **Colorado:** (303) 777-8070 ● **Connecticut:** (203) 226-4281 ● **Delaware:** (609) 779-0200 ● **Florida:** Coral Springs (800) 432-4480/Orlando (800) 432-4480 ● **Georgia:** (800) 327-6600 ● **Hawaii:** (808) 261-3751 ● **Idaho:** (801) 466-6522 ● **Illinois:** (312) 255-4820 ● **Indiana:** (317) 846-2591 ● **Iowa:** (402) 895-5850 ● **Kansas:** (816) 252-3700 ● **Kentucky:** (317) 846-2591 ● **Louisiana:** (800) 327-6600 ● **Maine:** (617) 235-5520 ● **Maryland:** (703) 241-7803 ● **Massachusetts:** (617) 235-5520 ● **Michigan:** (313) 588-2300 ● **Minnesota:** (612) 425-4455 ● **Mississippi:** (800) 327-6600 **Missouri:** Independence (816) 252-3700/St. Louis (314) 721-0401 ● **Montana:** (801) 466-6522 ● **Nebraska:** (402) 895-5850 ● **Nevada:** (714) 635-7600 ● **New Hampshire:** (617) 235-5520 ● **New Jersey:** North (212) 687-2455/South (609) 779-0200 ● **New Mexico:** Albuquerque (505) 292-1212/Las Cruces (505) 524-9693 ● **New York:** East Aurora (716) 655-4322/Loudenville (518) 459-5891/New York City (212) 687-2455/Rochester (716) 442-5631 ● **North Carolina:** (800) 327-6600 ● **North Dakota:** (612) 425-4455 ● **Ohio:** Cleveland (216) 267-0445/Dayton (513) 434-7500 ● **Oklahoma:** (214) 620-1551 ● **Oregon:** (503) 224-3145 ● **Pennsylvania:** East (609) 779-0200/West (412) 892-2953 ● **Rhode Island:** (203) 226-4281 ● **South Carolina:** (800) 327-6600 ● **South Dakota:** (612) 425-4455 ● **Tennessee:** (800) 327-6600 ● **Texas:** Dallas (214) 620-1551/Houston (713) 862-6685 ● **Utah:** (801) 466-6522 ● **Vermont:** (617) 235-5520 ● **Virginia:** (703) 241-7803 ● **Washington:** (206) 364-8830 ● **West Virginia:** East (703) 241-7803/West (412) 892-2953 ● **Wisconsin:** (414) 784-9379 ● **Wyoming:** (303) 371-2422 ● **Washington, D.C.:** (703) 241-7803 ● **Guam:** (671) 646-7280 ● **Puerto Rico:** (809) 723-9689

CIRCLE NO. 115 ON INQUIRY CARD