A CAHNERS PUBLICATION

Mini-Micro Systems

JANUARY 1981

New From Kennedy

Model 6450 High Density Cartridge Tape System

Low cost, flexible and reliable backup—that's Kennedy's Model 640 Cartridge Tape Drive and Model 650 Embedded Formatter—combined in one compact package—Model 6450. Model 6450 is loaded with features, such as:

- Low power consumption—the system requires only +5 and +24 volts for a total consumption of under 40 watts.
- Serpentine recording head—eliminates time consuming rewinds between tracks during backup process.
- 6400 BPI recording density—yields up to 17 Mbytes of unformatted data capacity on a 450 ft. cartridge.
- Infrared tape position detection—virtually impervious to ambient light, a major factor in tape position sensing errors.
- Online self test—The 6450 system performs online self test before your backup operation begins.

These are only a fraction of the features that make Model 6450 the most advanced ¼" tape cartridge available. All these features, combined with Kennedy experience and reliability guarantee it.

KENNEDY

Subsidiary, Magnetics & Electronics Inc.

1600 Shamrock Ave., Monrovia, CA 91016
(213) 357-8831 TWX 910-585-3249

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

KENNEDY • QUALITY • COUNT ON IT

CIRCLE NO. 1 ON INQUIRY CARD

IMMEDIATE DELIVERY

Lab Technologist.

Upjohn's Laboratory Procedures, Inc. delivers fast results with TI's 820 KSR.

Performing more than 80,000 clinical tests each day for physicians and hospitals, Laboratory Procedures, Inc., a wholly owned subsidiary of the Upjohn Company, needed a data terminal speedy and reliable enough to handle the workload. TI's OMNI 800* Model 820 Keyboard Send-Receive Data Terminal passed the test.

Specimens are picked up and rushed to the appropriate Upjohn laboratory where tests are performed. The lab results are entered into a host computer and transmitted to 820 KSR data terminals located in various hospital laboratories, doctors' offices and Laboratory Procedures distribution centers. The 820 KSR's clear, multiple copies are ideal for a hospital environment where patient records are maintained at the laboratory, nurse's station and physician's office.

The 820 KSR features an easy-to-use typewriter-like keyboard for simplified data access. Forms handling is quick and convenient with a 3 to 15-inch wide adjustable carriage that easily accommodates Upjohn's testing forms. And, the 820 KSR's 150 character-per-second printing provides speedy response to Upjohn's need for a cost-efficient remote data terminal.

Since installation, the 820 KSR's virtually nonstop performance has enabled Upjohn to cut communication costs by approximately 50 percent, while nearly doubling data throughput.

TI is dedicated to producing quality, innovative products like the Model 820 KSR. 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 worldwide organization of factory-trained sales and service representatives, and TI-CARE†, our nationwide automated service dispatching and field service management information system.

For more information on the Model 820 KSR, contact the TI sales office nearest you or write Texas Instruments Incorporated, P.O. Box 1444, M/S 7884, Houston, Texas 77001, or phone (713) 373-1050.

We put computing within everyone's reach.

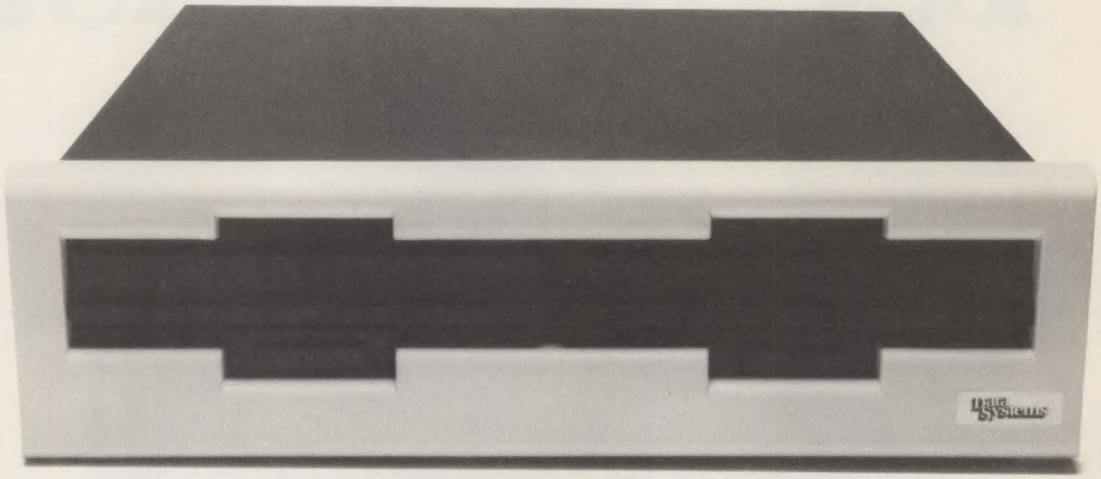
TEXAS INSTRUMENTS
INCORPORATED

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.

*Trademark of Texas Instruments †Service Mark of Texas Instruments Copyright © 1981, Texas Instruments Incorporated

CIRCLE NO. 2 ON INQUIRY CARD

THE DSD 440. TOTAL DEC® RX02 COMPATIBILITY,



AND MORE.

The DSD 440 is the only alternative to the DEC RX02 that's 100% software, hardware and media compatible with LSI-11, PDP®-11 and PDP-8 computers, including those with extended memory. It can be configured as an RX02 for DEC double density or IBM 3740 single density recording, or as an RX01 for backward operating system compatibility.

MORE

A 512-byte hardware bootstrap is built into all PDP-11 and LSI-11 interfaces. It loads system software automatically from either single or double density diskettes. Extensive self-testing is DIP-switch selectable with the "Hyperdiagnostics" that run without being connected to a computer. The low profile 5¼-inch DSD 440 features write protection and diskette formatting.

FASTER

The optimized DSD 440 microcode increases system throughput when using the RT-11 foreground/background monitor. In particular, the DSD 440 with an LSI-11 runs fill and empty buffer operations 20% faster than an RX02.

FOR LESS

The DSD 440 is the RX02 compatible flexible disk system that combines high performance and advanced features with fast delivery... at a lower price. For further information, call or write Data Systems Design today. A data sheet and price list will be forwarded to you immediately.

® Trademark of Digital Equipment Corporation

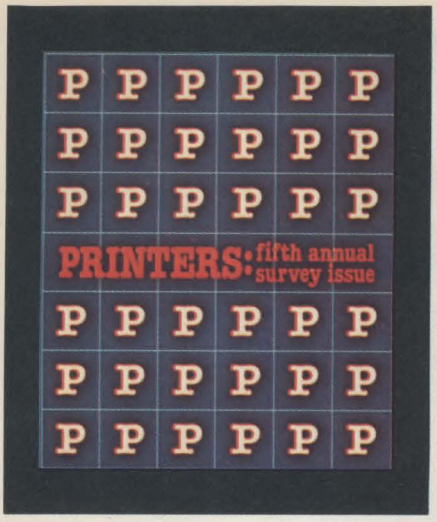
Data Systems

EASTERN REGION SALES
Data Systems Design, Inc.
51 Morgan Drive, Norwood, MA 02026
Tel: (617) 769-7620 TWX: 710-336-0120

WESTERN REGION SALES
Data Systems Design, Inc.
2560 Mission College Blvd., Suite 108
Santa Clara, CA 95051 Tel: (408) 727-3163

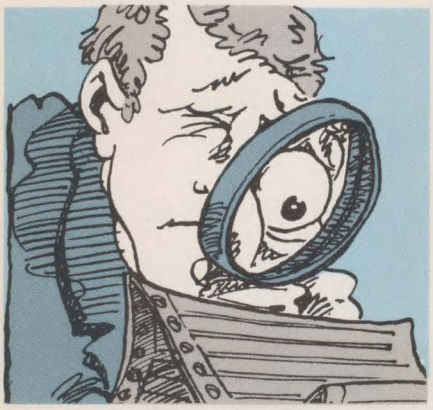
CORPORATE HEADQUARTERS: Data Systems Design, 3130 Coronado Drive, Santa Clara, CA 95051
Tel: (408) 727-9353 TWX: 910-338-0249

CIRCLE NO. 3 ON INQUIRY CARD



Both line and serial printers come under scrutiny in the report beginning on p. 60. Cover design by art director Ralph Stello from an idea suggested by Octek, Inc.

Page 20 . . . . . Shugart's 5¼-in Winchester



Page 128 . . . . . Choosing a line printer

VBPA ABP

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. Controlled Circulation 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 US 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 — U.S.; $35.00 — Canada; $65.00 — all other countries (12 issues). Single issues $3.00 — U.S.; $4.00 — Canada; $6.00 all other countries.

©1981 by Cahners Publishing Company, Division of Reed Holdings, Inc. All rights reserved.

Mini-Micro Systems

A Cahners Publication

Vol XIV No. 1 January 1981

FEATURES

60 LINE PRINTERS CONTINUE THEIR IMPACT . . . line-matrix technology gathers momentum, while drum printers fade.

84 CHOOSING A LINE PRINTER . . . *a question-and-answer guide to help even the uninitiated buyer make a logical choice.*

97 SURVEYING SERIAL PRINTERS . . . *prices continue to fall, while speed, reliability and print quality rise.*

113 DISTRIBUTION IN THE '80s . . . *COMDEX pinpoints distribution as the driving force behind small computer systems.*

125 A NEW APPROACH TO PROGRAM DEVELOPMENT . . . *building blocks for generating custom application systems.*

137 A PROGRAMMABLE LOGIC ANALYZER . . . *user-configurable resources simplify design of µp-based products.*

MINI-MICRO WORLD

13 H-P 'GRIZZLY' DOUBLES POWER AT A PRICE ONLY 5% HIGHER . . .
H-P 3000 Series 44 offers customers an upgrade path.

14 COMPETITION HEATS UP FOR LOCAL AREA NETWORKS . . . *Xerox Corp. and Apollo Computer jump into the fray.*

20 SHUGART EXPANDS PRODUCT LINE WITH 5¼-IN. WINCHESTER . . .
the SA600 follows Seagate, Irwin and Tandon into that market.

24 DEC SUES SYSTEM INDUSTRIES FOR INFRINGING VAX PATENTS . . .
but SI thinks it has a good defense.

26 OLIVETTI WILL SELL SYNTREX WORD PROCESSORS OVERSEAS . . .
Syntrex stands to gain $15 million to $30 million.

39 HIGH-END 8-IN. WINCHESTER BASED ON NEW ACTUATOR DESIGN . . .
Ontrax's offering could set new standards.

42 TINY EMULOGIC TAKES ON GIANTS IN DEVELOPMENT SYSTEMS . . .
with a value-added strategy—emulation.

DEPARTMENTS

5 BREAKPOINTS
24 MINIBITS
30 BOX SCORE OF EARNINGS
34 CALENDAR
53 EDITORIAL
54 LETTERS
149 NEW PRODUCTS
152 NEW SYSTEMS
156 NEW HARDWARE
176 NEW SOFTWARE
180 NEW LITERATURE
184 CLASSIFIED ADVERTISING
186 CAREER OPPORTUNITIES
191 INDEX TO ADVERTISERS

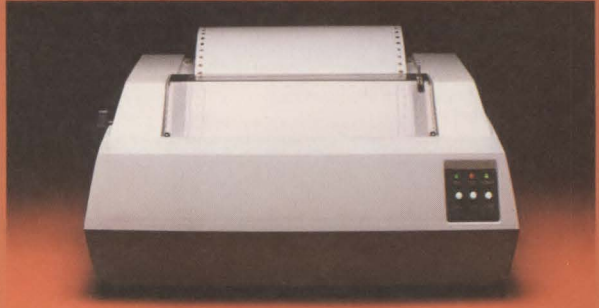
EXTRA. EXTRA.

Now you get more extras when you pick the new dot matrix printers by C. Itoh. Choose the Comet 80-column printer and get the extra benefits of four character sizes and paper-saving print compression. Choose the Comet II 136-column printer and receive the added extra of a full-width computer size printer that accommodates paper widths to 381 mm (15").

Both the Comet and Comet II also offer the rare combination of low cost and high performance. Both models operate at an efficient 125 cps bidirectional print speed and in a 9 x 7 dot matrix.

C. Itoh's Comet series has the extra advantage of a unique multilingual capability with a selection of four different alphabets: English, German, Japanese and Swedish. Other special characteristics include a programmable VFU (Vertical Format Unit) plus self-test diagnostics. For your operator's convenience, there's easy bottom or back paper loading, and both Comets use a standard low-cost nylon ribbon. Plus our printers already meet 1981 Class A FCC, UL, and fire safety requirements.

If all that wasn't enough, Comet and Comet II are plug-compatible with all major printers in the industry, meeting standard parallel serial interface specifications. Our printers are backed by C. Itoh's warranty and a nationwide field service organization.



And as a final, all important extra, when you choose either printer from C. Itoh you get immediate off-the-shelf delivery.

So if you want the highest quality at the best price, look into the extras the C. Itoh Comet and Comet II printers offer. You'll get a lot more than you bargained for. For more information, contact C. Itoh Electronics, Inc., 5301 Beethoven Street, Los Angeles, CA 90066; Tel. (213) 390-7778. Chicago Office: 240 E. Lake Street, Suite 301-A, Addison, IL 60101; Tel. (312) 941-1310. New York Office: 666 Third Ave., New York, NY 10017; Tel. (212) 682-0420. Dallas Office: 17060 Dallas Pkwy., No. 108, TX 75248; Tel. (214) 596-2974.

C. ITOH ELECTRONICS, INC.

One World of Quality

CIRCLE NO. 4 ON INQUIRY CARD

HEWLETT-PACKARD DEVELOPS 32-BIT μP

Hewlett-Packard Co. reportedly has developed a 32-bit μp chip set, on which details will be given at the International Solid-State Circuits Conference in New York City on February 18-20. The NMOS chip set is said to comprise a 32-bit processor, an I/O processor, a memory controller, a 128K RAM and a 512K ROM. Some of the chips reportedly contain as many as 600,000 transistors each.

WINCHESTER CONTROLLER CHIP SET IN NSC PLANS

National Semiconductor Corp.'s entry into the Winchester-disk drive business may come via a controller chip set reportedly under consideration by the Santa Clara, Calif., semiconductor maker. Said to be in the market survey stages only, the chip set is aimed primarily at 14-, 8- and 5¼-in. Winchester drives, but may also be able to control floppies. The company is said to be discussing the product with several drive makers, though no formal agreements have been reached. No decision to build the chip set has been made, reports say, nor has the firm determined the number of chips involved. One source indicates that a mid-1982 introduction is likely, however. National declines to comment.

APPLE TURNS TO SEAGATE TO SUPPLY DRIVES

Executives at Apple Computer, Cupertino, Calif., have revised plans to build 5¼-in. Winchester-disk drives in-house and reportedly have signed an agreement with Seagate Technology (formerly Shugart Technology) for more than 10,000 6M-byte ST-506 drives this year. "Apple won't be able to do their own drive this year," says one industry source. "Look for an in-house Winchester to make its appearance in 1982, however." Sources claim that the Seagate hardware will be used on the Apple III personal computer announced last year, as well as in a new system that could appear this year, tagged the Apple IV. A spokesman for the Scotts Valley, Calif., drive vendor has no comment on any dealings with Apple. Executives at Apple decline comment on the Seagate deal.

DEC MAY SET UP NEW DIVISION FOR NEW TERMINAL

Although Digital Equipment Corp., Maynard, Mass., has resisted the idea of reorganizing into divisions, the high-volume production of terminals and/or a potential new product may force such a move. The new terminal, called project K.O. internally (for Kenneth Olsen, the company's president), was implemented early last year under Olsen's watchful eye. The product is believed to be a low-end terminal that includes a protocol to link with non-Digital products on a network. It may include "Tiny-11" or T-11, which is a PDP-11 on a chip. Although sources close to the company say the product was refused acceptance into traditional product lines by Digital's product line managers in the past six months, a working prototype exists. And that product may be the focal point for a new division of Digital. One source says he finds it difficult to believe that a product endorsed by Olsen would be shunned by product line managers, but another says other pet projects of Olsen's never found their way to market. A company spokesman was unable to confirm the plans for reorganization or the new product.

'FINCH' WILL BE READY TO FLY THIS QUARTER

Look for Control Data Corp.'s second line of 8-in. Winchesters—a low-end family referred to as the "Finch" series—to make its formal appearance this quarter. CDC's new entry will sport a floppy-disk type interface and will offer capacities ranging from 10M to 30M bytes

using as many as three platters. Also featured will be voice-coil actuators and dedicated servo surfaces. According to one report, the Finch will be based on the "Lark" technology unveiled by CDC at last year's National Computer Conference. The Finch is a 16M-byte drive that combines fixed-Winchester media and a removable disk-cartridge for file backup (MMS, April, 1980, p. 69). The Lark's 8M-byte cartridge as well as its compatibility with older SMC devices will be absent from the Finch, however. The Finch will incorporate an integral data separator and could be available in production quantities as early as the second quarter of this year. Pricing reportedly has not been set, however.

3M 8-IN. WINCHESTERS DUE THIS QUARTER

3M's reentry into the 8-in. Winchester-disk drive market is expected before the end of the first quarter. (The firm had a share of Cupertino, Calif., drive maker, International Memories, Inc., before legal hassles made 3M give up that share in 1978.) Two models of the 8-in. disks are expected: the 8431, a 10M-byte single-platter drive, and the 8432, a 20M-byte dual-platter device. Both drives will use the proposed ANSI interface standard, X3T9.3, and have 280 addressable cylinders, a bit density of 8649 bpi and a track density of 219 tpi. Average seek time is 65 msec., and track-to-track seek time is 20 msec. The drives use a μp-controlled rotary stepper motor for head positioning. A brushless DC motor drives the spindle. A spokesman for 3M's Data Recording Products Division declines to comment on the other specifications, pricing and availability, and says only that the drives are undergoing field evaluation with selected potential customers.

TANDON TO SET UP R & D SPIN-OFFS

Look for many of the upcoming products marketed under the Tandon Corp. (formerly Tandon Magnetics) name to be developed at independent R & D companies funded by the Chatsworth, Calif., disk-drive vendor. Products under consideration at the two R & D operations set up so far are a 30M-byte 5¼-in. Winchester-disk drive with closed loop servo, a high-capacity 5¼-in. floppy-disk drive for backup applications and an 8-in. double-sided floppy-disk drive. Tandon may not be limiting itself to disk drives, however. "The company would be interested in setting up R & D houses to develop printers, terminals, whatever," says one source. "There could be a lot of these operations."

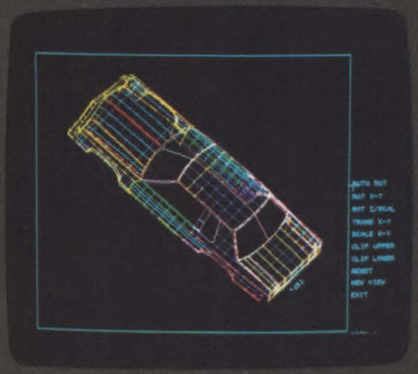
WINCHESTER CONTROLLER BOARDS MEET ANSI INTERFACE SPECS

Both Intel Corp. and Interphase Corp. are expected to introduce 8-in. Winchester-disk drive controller boards that conform to the proposed ANSI interface standard, X3T9.3. Michael Cope, president of Interphase, says his Dallas-based firm will begin delivering evaluation units of its WDC2880 next month and expects to have production quantities available by early in the second quarter. Cope says the WDC2880 can handle as many as eight ANSI-compatible drives, formatted for 10M to 40M bytes. At least three drive makers have expressed intentions to produce ANSI-compatible devices. The 2880 is also Multibus-compatible and can operate over 8- and 16-bit data buses. The board features DMA and dual addressing modes. A single WDC2880 sells for $1795; 100 units are $1350 each.

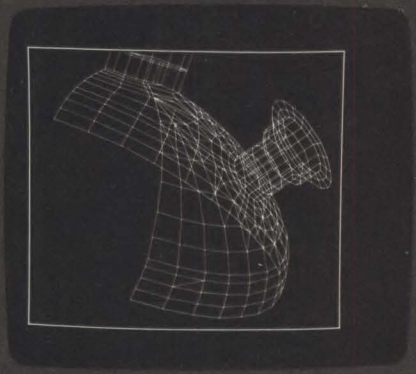
Intel's iSBC 215A will control as many as four 8-in. ANSI-compatible Winchesters, while the iSBC 215B will handle the same number of 14-in. drives, formatted from 4.5M to 26.7M bytes. Both boards are priced at $2000. Intel says the 215 has been designed to handle 5¼-in. drives as well.

Intel also began delivering an SMD disk controller board last month. Its iSBC 200 will interface as many as four SMD drives with storage capacity from 12M bytes to 2.4G bytes. Like the iSBC 215, the SMD controller board uses Intel's 8089 I/O processor. The 220 is priced at $2500.

Freedom of Expression.

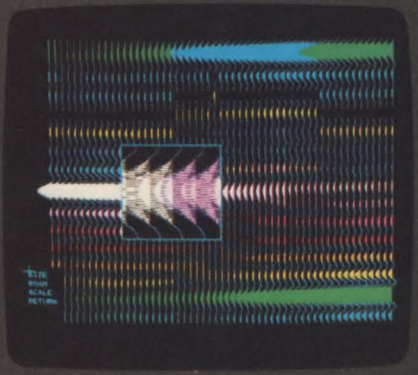


Only Megatek gives you all three, the excitement of dynamic raster color...

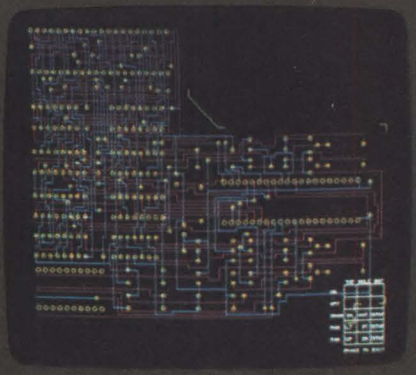


...the precision of 4096 x 4096 high resolution calligraphic Whizzard systems...

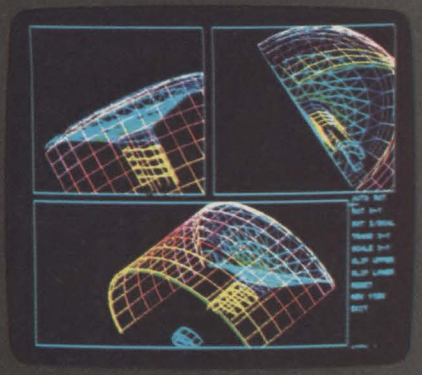
...and user-oriented software to make it easy to implement your application.



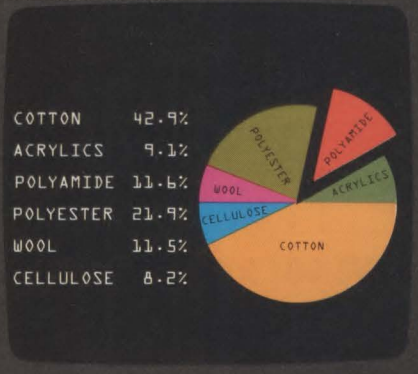
Powerful, real-time dynamics enable you to scan the display then zoom in for added detail.



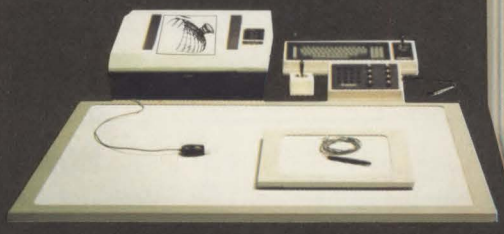
A large virtual display gives you the full picture, with the added information of up to 16 colors at a time.



Rotations mean you can view models from any angle and segment the display into multi-viewports.



It all adds up to the capabilities you need to put your ideas into pictures.



And you get freedom of choice, too, with intelligent interactive peripherals and modular design for easy expansion.

The Megatek Whizzard. It will set you free.

Express yourself with a Whizzard computer graphics system and take advantage of our technological innovations. You get system flexibility. Easy to use, ever-expanding software support. Installation, training and service world-wide. And an inside track on the future.

We're earning our reputation in computer graphics. Count on us. For advanced hardware compatible software. And added value.

Find out more about how Megatek can give you freedom of expression. Write for up-to-the-minute details on our complete line of computer graphics products.

Megatek Corporation, 3931 Sorrento Valley Blvd., San Diego, CA 92121. 714/455-5590. TWX 910-337-1270
Megatek International/Europe, 11 Woudstraat, 4031 JA Ingen, The Netherlands, Telephone: 31 3443-2800, Telex: -70619

MEGATEK

MEGATEK CORPORATION

CIRCLE NO. 5 ON INQUIRY CARD

Things are bigger in Texas.

But bigger doesn't necessarily mean better. Take printers, for instance. The 310 Ballistic™ Printer from Lear Siegler doesn't have a price tag nearly as big as the Texas Instruments 820. And though we're not the big guys in the printer field, we can offer you big enough reasons to buy our 310 Ballistic Printer. And that's a matter of no small importance.

A BIG DIFFERENCE.

You can see for yourself. Right down the line. When placed up against the big competition, the 310 Ballistic Printer comes out ahead.

First off, at 180 cps and with space/blank compression, you get higher throughput for higher volume data flow.

You also get a nine-wire head with a 9 high by 7 wide dot matrix. Which gives you true lower case descenders plus underlining.

The 310 Ballistic Printer also has a buffer expandable from 512 to 2048 that allows you to dump a full CRT screen in a split second.

THE 310 BALLISTIC PRINTER FITS RIGHT IN.

Our printer is totally compatible with all Lear Siegler terminals or with any RS-232C interface. It fits anyplace you have a CRT terminal or small business minicomputer system.

Feature	LSI 310	TI 820RO
Speed	180 cps	150 cps
Dot Matrix	9-wire head (9 hi x 7 wide)	7-wire head (7 hi x 9 wide)
Lower Case	Standard, with descenders and underlining	Standard, but no descenders or underlining
Buffer	512 expands to 2048	Fixed 1280
Space/Blank Compression	Yes	No
Interfaces	Serial and parallel	Serial only (parallel not available)
Current Loop	Standard	Optional
Forms Control	14 settings standard	Optional
Elongated character sets	Standard	Optional
Price	Base Price $2045 Expanded buffer 100 Price as shown $2145	Base Price $1995 Options 310 Price as shown $2305

The 310 Ballistic Printer is capable of satisfying low-speed day-to-day requirements and is economical enough to handle those high-speed tab runs, too. With the patented Ballistic printhead and 100% duty cycle, no job is too difficult.

NOW YOU'VE GOT A CHOICE.

With the 310 Ballistic Printer, Lear Siegler brings to computer printers the same high standards that made our Dumb Terminal® video display the standard for an entire product category.

That makes us a "full terminal" supplier now—that means CRTs and printers, too. Texas is no longer the lone star.

We're certain that we can offer you many things our competitors can't. We've listed them here in black and white. We feel the evidence speaks for itself.

So go ahead and choose. Because now you've got a choice.

LEAR SIEGLER 310 BALLISTIC™ PRINTER.

LEAR SIEGLER, INC.
DATA PRODUCTS DIVISION

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.

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

CIRCLE NO. 6 ON INQUIRY CARD

PDP11/03® PDP11/23®
MICROCOMPUTER SYSTEMS

FIRSTMICRO™ PDP11®

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

The Basic PDP-11/03 systems offer the designer a low cost compatible alternative to the larger members of the PDP-11 family. The larger faster PDP-11/23 systems offer the power, expandability and operating systems of the larger members of the PDP-11 family while retaining the proven cost effective Q-Bus architecture. These systems save you money, improve programming efficiency, and boost productivity.

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

Serving the world with cost effective computer systems.

TWX NUMBER 910-651-1916

First™ computer corporation

corporate square/825 north cass avenue/westmont, illinois 60559/(312) 920-1050

™Trademark First Computer Corporation ®Registered trademark of Digital Equipment Corporation

55-3

CIRCLE NO. 7 ON INQUIRY CARD

Technological leadership.

One board, one bus, one way environment for the '80s.

With Motorola MC68000 VERSAmodules, a single board offers all the functional versatility of competitive 16-bit systems at a fraction of the cost.

With VERSAmodules and the powerful VERSAbus™ interconnect, there's maximum utility, expandability, reliability and maintainability for a wide range of industrial, communication, lab automation and general business applications in one optimized system.

With the complete VERSAmodule family of circuit boards, system software, packaging and accessories the microcomputer system engineer can apply the power and versatility of the MC68000 MPU at a high level of system integration.

With VERSAmodules, you're into the '80s and beyond.

Most Powerful Microcomputer

The VERSAmodule Monoboard Microcomputer flagships the VERSAmodule family. Combining an MC68000 MPU, full VERSAbus interface, multiprocessor capability, substantial ROM/RAM, serial and parallel I/O and timer/counter functions, it's easily the most powerful single-board microcomputer yet offered. For designs requiring up to 128K bytes of ROM and RAM, plus two high-speed serial channels (up to 19.2K baud) and 40 lines of parallel I/O, this single board meets all system needs. Competitive approaches require two to four boards for the same capability, and, inevitably, more cost.

Total Software Environment

Many 16-bit applications, particularly in higher-performance, control-oriented areas, require a realtime, multitasking environment for efficient operation. By combining the ready-made RMS68K™ multitasking system software package with your VERSAmodule-based system, you can save the man-months of effort necessary to develop a system capable of managing resources efficiently in real time. Time and money saved can be used to apply your expertise to development of application programs.

to a total, 16-bit system VERSAmodules.™

New Generation Bus.

Supporting a mixture of 8- to 32-bit MPU architectures with high-speed transfer rates, VERSAbus offers a flexible, economical system bus ideal for industrial automation, communications or general business applications. VERSAbus is incorporated in the VERSAmodule chassis/card cage backplanes and willingly accomodates multiple processors. Designed-in ease-of-use for tomorrow's upgraded systems saves money by obviating major hardware and software redesign.

Inherent Reliability/ Maintainability.

VERSAmodule products support an unmatched level of system integrity. This includes reliability of the MC68000 with its advanced architectural features such as exception-processing and interrupt handling. These allow for graceful handling of common system problems such as bus error, illegal instruction, divide-by-zero, privilege violation, spurious interrupt, etc. This "soft-failure" capability alerts operating personnel and, in many cases, allows recovery before critical failure.

Reliability of VERSAbus-based systems is enhanced through power-fail detect and self-test features. AC-fail and power-down indication allow saving critical data in non-volatile memory through power outages. Self-test minimizes down-time by allowing manually-initiated self-test, when a problem is suspected, with failed boards indicated by on-board fault indication lights.

Versatile Development Support.

Unparalleled ease and efficiency in software development for VERSAmodules is yours through EXORmacs™ – a third generation 16/32-bit development system with state-of-the-art hardware architecture, advanced operating software and self-test capability. Pascal, FORTRAN and structured macro assembler allow choice of the language best suited to needs. A versatile, CRT-oriented text editor speeds up program preparation and modification. And a flexible linkage editor permits modular, top-down system development.

Again, less design time, lower cost and an earlier product operation date for a better bottom-line result.

Send for a new VERSAmodule brochure. Motorola Semiconductor Products, Inc., P.O. Box 20912, Phoenix, AZ 85036 or call (602) 244-5714.

Take a big step into the '80s with Motorola VERSAmodules.

Innovative systems through silicon.

MOTOROLA INC.

73MMS 1/81

TO: Motorola Semiconductor Products Inc., P.O. Box 20912, Phoenix, AZ 85036.

Please send me information on VERSAmodules.

Name _____

Title _____

Company _____

Address _____

City _____

State _____ ZIP _____

OUR STREAMERS VS. THEIRS.

Remember all the hoopla?

Quarter inch streamer tapes were heralded as the long-awaited answer to Winchester backup.

Trouble is, they turned out to be longer-awaited than anybody anticipated.

OEM's have yet to receive a single shipment of production streamer tape units from the early suppliers who made all the fuss.

Now that the commotion has died down, Archive quietly introduces its streamers and claims technological leadership in the field.

And if it seems you've heard that song before, consider that we've already made deliveries of Sidewinder basic & intelligent ¼" streaming cartridge tape drives.

Designed specifically for Winchester backup, the Sidewinder offers 30 or 90 IPS tape speed, 10 or 20 Mbytes of formatted storage in either basic or easily integrated intelligent units.

Call us today and learn how to get your Winchester project back on target.

Archive Corporation, 3540 Cadillac Avenue, Costa Mesa, California 92626, (714) 641-0279, Telex: 683466.

ARCHIVE

CIRCLE NO. 8 ON INQUIRY CARD

H-P 'Grizzly' doubles power at a price only 5% higher

Customers of Hewlett-Packard Co. who have been uneasy about what upgrade path would be set by the company's Cupertino, Calif., computer systems division can now be sure of two things: The high-end product—code named "Grizzly"—announced in early December is not a 32-bit-word machine. And it did not become the first H-P product that might adopt the Ethernet local area network the company intends to support. Instead, the H-P 3000 Series 44 has twice the power of the previous high-end commercial system, the Series III, and it is priced only 5 percent higher.

"The announcement of the Series 44 takes away the uncertainty about an upgrade path that H-P's customers have had over the past six months. They now know they can upgarde to a 16-bit machine with compatible operating system," says Rich Matlack, vice president, systems and applications, at Dataquest, a Cupertino market research firm. Matlack contends that H-P has lost some market share over the last six months because of customers' uncertainty. The past years' computer sales growth of about 45 percent (annual rate) had dropped to about 15 percent in the last half of 1980.

About 60 percent of H-P's customers upgrade their products after two years, says Bob Bond, marketing manager for the company's computer systems division. The Series III has been on the market that long. H-P intends to introduce one HP 3000 model per year, a company spokesman says. Bond says some of the larger, faster and more powerful computers to come may use 32-bit-word technology, but there are no definite plans.

The Series 44 will allow H-P to expand its market and take on larger customers and applications, says Bond.

The Series 44 includes a new operating system, a separate control maintenance processor for internal diagnostics and an interface to H-P's new laser printer (see "2680 laser printer thrusts H-P into office market," p. 23). A minimum configuration, priced at about $109,500 in single-unit quantities, includes a CPU with a 1M-byte main memory, a 50M-byte removable disk drive, a 1600-bpi magnetic tape drive, a CRT and four asynchronous terminal ports. All equipment is developed and manufactured by H-P. A 120M-byte disk drive is optional. A comparable Series III configuration is priced at $104,250. First shipments are scheduled for this month, with 16-week lead times.

The Series 44 is an upgrade vehicle for virtually all 5000 H-P 3000 installations worldwide. Upgrades can be made from the low-end Series 30 and 33, the II and the high-end III.

The Series III has as much as 2M-bytes of main memory and as many as eight disk drives for .960G bytes of storage. In comparison, the Series 44 has as much as 4M bytes of main memory in 512K-byte increments and as many as 16 disk drives for 1.92G bytes of storage. That's a two-fold increase in main memory and a 60 to 100 percent performance increase.

Although the Series 44 "stacks up" in performance against the Digital Equipment Corp. VAX 11/780, the Prime 650 and the DG MV/8000, Bond says he sees the IBM Systems 38 and 4331 group 2 business systems as its main competition. He identifies two primary markets: medium-sized

The H-P 3000 Series 44 business minicomputer *doubles the performance rate of its predecessor at a 5 percent higher price.*

manufacturing companies that use one computer and distributed data-processing applications, in which the Series 44 can function as part of a large network with other H-P minicomputers and/or large mainframe computers.

The Series 44 supports 3780, HASP, 3270, SNA and X.25 communications, as well as H-P's distributed systems network software.

The operating system, multiprogram executive 3 (MPE-3), has been enhanced to MPE-4, which includes file modifications that enable it to store 2G bytes. The memory manager has also been rewritten. MPE-4's object code is compatible with that of MPE-3. Most applications programs can be moved without modification to the 44 from a 30, 33, II or III. The 44 also supports H-P text, graphics, materials management and data base management software. MPE-3 systems can be upgraded in three to six months as part of the standard H-P maintenance agreement.

The benefit for users who upgrade is a 20 to 30 percent increase in the number of terminals the system supports on-line, or the same percentage decrease in response time, Bond claims.

The new minicomputer does not incorporate new technologies such as the gate arrays used on the new VAX 11/750 or the programmable array logic chips used in the MV/8000, although the company is examining those approaches. Bond says H-P engineers used "creative design" in the microcoding system to make the 44 more powerful. It uses Schottky TTL logic, which is faster than the standard TTL logic used in the System III, Bond says. Discrete arithmetic logic unit (ALU) chips implement the instruction set. More than 10M bytes of virtual memory is backed by 4M bytes of real memory. The virtual memory is stacked rather than partitioned, and it uses variable-length code segments. Program code is separate from the data used in instructions.

The 44 also includes a μp-based maintenance processor, which operates independently of the computer, enabling an operator to perform diagnostics at the board level during downtime. The 16-bit μp is a proprietary unit that uses silicon-on-sapphire (SOS) technology. The maintenance processor is housed on a PC board. A minimum configuration contains 12 boards.

H-P also will offer a "guaranteed uptime service," which guarantees 98 percent to 99 percent uptime on the CPU and on the two system disks over continuous three-month periods. The company will offer a service credit for downtime longer than 1 to 2 percent of that time period. The service will later be extended to more of the company's business systems, says Dick Warmington, marketing manager for the computer support division in Cupertino. The 44's control-maintenance processor board will help implement service in that equipment. A modem will be supplied with the service for remote diagnostics. No price has been set, but the service will be available in February in some U.S. locations.

Upgrades to the Series 44 will be made on a credit basis with prices starting at $43,000 for the CPU. Main memory is priced at $20,000 per megabyte. *—Lori Valigra*

Competition heats up for local area networks

Despite a flurry of publicity given to local area networks in the last year, commercially available systems have been scarce until now. Only Datapoint Corp., which pioneered the concept, and Zilog Corp. had marketed such systems, when two more companies jumped into the fray late last year.

Xerox Corp. and Apollo Computer Inc., a Billerica, Mass., start-up firm founded by former Prime Computer, Inc., executives (MMS, June, 1980, p. 63), have aimed their systems at different applications. Apollo's Domain system is intended for engineering and scientific applications, while Xerox's System 8000 is pointed at the office-automation market.

The Xerox System 8000 is based on the Ethernet local area network scheme developed by Xerox and being pushed by the company as an industry standard (MMS, July, 1980, p. 17). It is the first system introduced by Xerox based on Ethernet, and it is also the first commercially available Ethernet system.

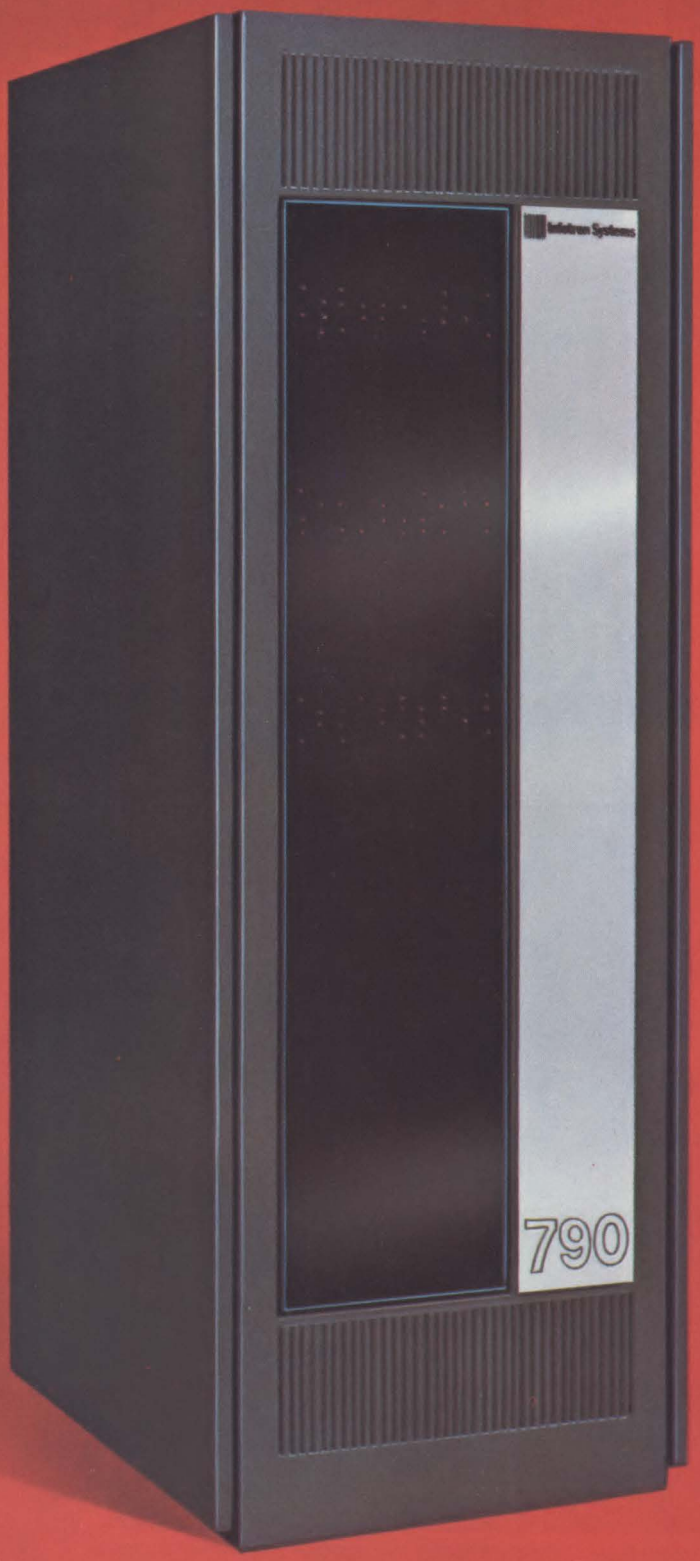
Xerox already has two large customers for the new system. Transamerica Corp., a San Francisco-based financial services firm, took delivery of the first System 8000 this month. In addition, the Atlantic Richfield Co. has placed a $10 million order for the system, a Xerox spokeswoman says.

The system incorporates Xerox's model 850 and 860 word-processing systems. Xerox has introduced an interface to enable the systems to be connected as stations to the network. In addition to the interface, Xerox has introduced disk and printer stations that attach to the network and can be shared with other stations.

The disk and printer stations are based on a 16-bit processor, and double as word-processing stations in addition to acting as shared resources for other network stations.

The disk station, called a file

Incredible Power!



The Supermux 790 Network Concentrator

The Supermux 790 is an intelligent network concentrator with incredible power . . . power that makes data transmission more economical, more reliable and more manageable than ever before.

The Supermux 790 gathers data from over four hundred inputs, concentrates it for economical transmission at speeds as high as 72,000 bps, and distributes it through as many as eight remote nodal locations to literally hundreds of destinations. The Supermux 790 also ensures that the data is error-free *and* keeps you up-to-the-second on everything that has happened every step of the way.

The Supermux 790 offers incredible control over the entire network. From your console you can reroute traffic, monitor and reconfigure any local or remote input or output and initiate powerful diagnostic routines to pinpoint problems—even problems in remote, unattended locations.

The Supermux 790 Network Concentrator talks to Infotron Supermux 480, 680 and 780 Statistical Multiplexers and, of course, other Supermux 790 units. This allows you to build multipoint networks using the most economical equipment in each location—without sacrificing data integrity.

For more information on how the Supermux 790 can cut your data communications costs, call or write today.

Infotron Systems Corporation
Cherry Hill Industrial Center, Cherry Hill, NJ 08003
800-257-8352 609-424-9400 TWX: 710-940-1247

Infotron Systems Limited
Poundbury Road, Dorchester,
Dorset DT1 2PG England
Telephone: (0305) 66016 Telex: 417276

Infotron Systems

First in Performance and Reliability

CIRCLE NO. 9 ON INQUIRY CARD

Discover what a smart terminal should really be. Meet SOROC's new IQ 135, a terminal ahead of its time. Priced like other not-so-smart terminals, our new IQ 135 offers more features than any other terminal in its price range. So check out the new SOROC IQ 135 and see why we call it the terminal with the incomparable IQ.

Our IQ 135 is an OEM's dream come true, with more functions and features than ever before offered at the price. Based on a Z-80 microprocessor, and fully software programmable, the IQ 135 offers a surprising number of designed-in standard features. Like fourteen user programmable function keys, full text editing, extensive video attributes, and adjustable right-hand margin. All of this, plus lots more, in a smart-looking terminal designed for operator comfort, convenience and efficiency.

When you want to discover what a smart terminal can really offer, look to SOROC—terminals with the incomparable IQ.

SOROC
TECHNOLOGY, INC.

165 Freedom Avenue
Anaheim, California 92801
(800) 854-0147
(714) 992-2860

CIRCLE NO. 10 ON INQUIRY CARD

Introducing the Incomparable IQ...

server, includes a display, memory and hard-disk drives that provide storage that can be shared among other stations in the network.

The file server also can be used as a "post office" for electronic mail messages transmitted via the networks.

The printer station includes a 3000-wpm laser-xerographic printer that is 12 times faster than a daisy-wheel printer, Xerox claims. The printer can change fonts in the middle of a page.

Also included in the Xerox introduction were two communications interfaces. One of them was developed by Xerox and is not as versatile as the other, which was developed by Ungerman/Bass Associates. The Xerox-developed model 872 communications server has four communications ports. The Ungerman/Bass-developed model 873 communications server has eight ports.

The communications interfaces enable other manufacturers' equipment to be interfaced to the System 8000. In addition, they enable the System 8000 to communicate with other networks or computer systems via telephone lines.

Prices for the System 8000 elements range from $14,000 for the model 872 communications server to $30,000 for a print-server package.

Like the system 8000, the Apollo system also employs a coaxial cable to link stations together into a local area network, but it uses a ring arrangement instead of a linear arrangement as in Ethernet. In the ring arrangement, network stations pass packets to each other like relay racers passing a baton in a race. In a linear network, stations pick packets off the network like items picked off a conveyor belt.

A linear network is said to be less vulnerable to component failures because stations are not an active part of the network. However, a ring network allows higher performance.

Apollo Computer *has jumped into the local area network market with its Domain system, which is intended for engineering and scientific applications.*

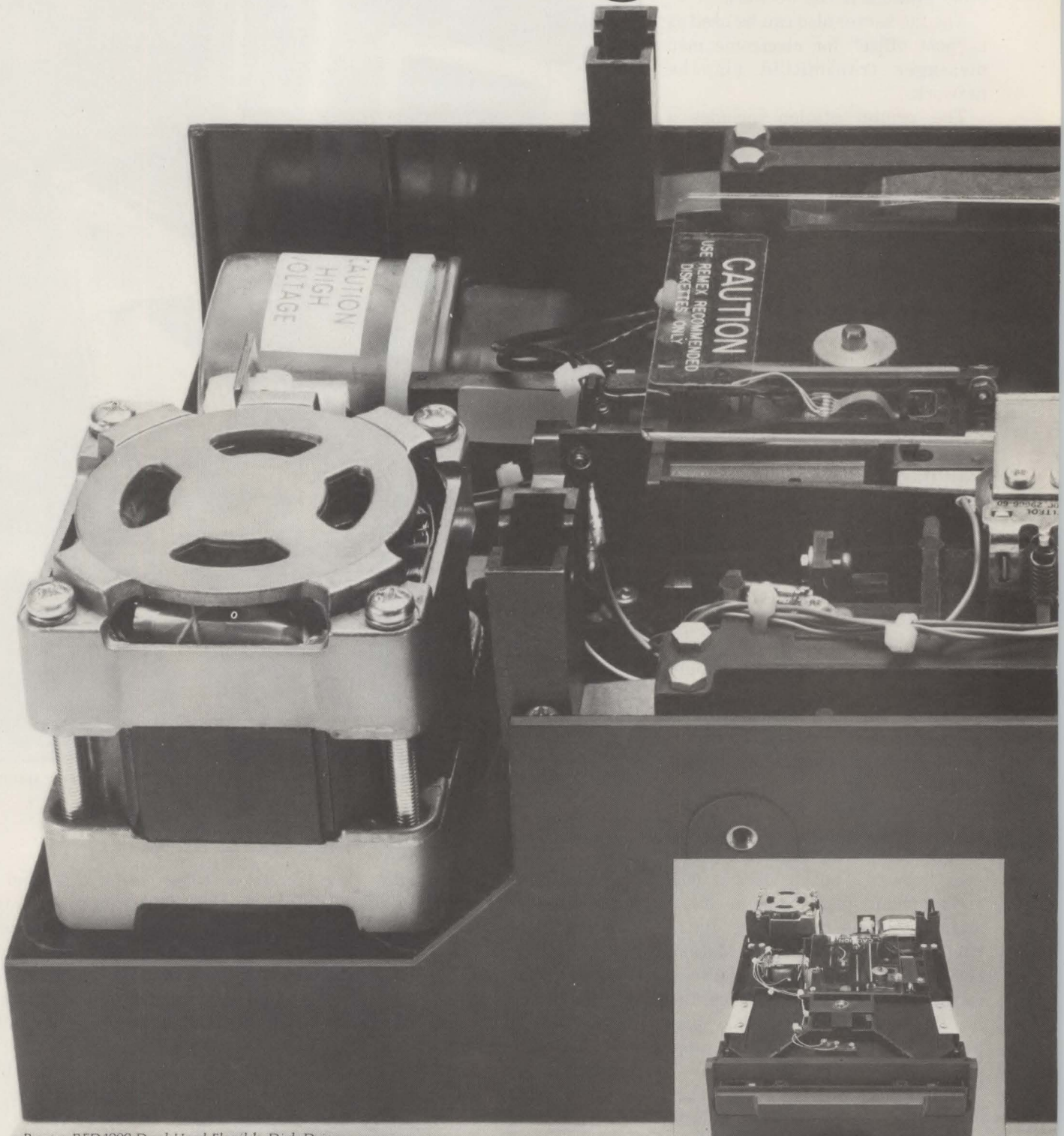
Apollo chose to use the ring arrangement because the company's founders were familiar with that type of network. Prime's Primenet network system also uses a ring network architecture.

However, like most companies that have announced or are contemplating announcing a local network system, Apollo says that it is not irrevocably committed to one architecture and would switch to Ethernet if it were in the company's interest to do so.

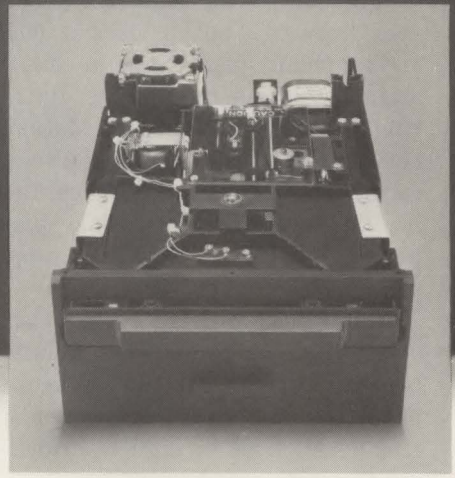
The Apollo station includes two Motorola 68000 16-bit μps and a floating-point processor for scientific computation. The stations support as much as 1M byte of main memory and as much as 16M bytes of virtual memory. The system includes a bit-mapped display with 1000 × 800 pixel resolution.

A basic network station that includes 256K bytes of memory, a display, three serial I/O ports, a 33M-byte Winchester disk and a 1M-byte floppy disk sells for $34,000. Deliveries are scheduled to begin in March. —*Paul Kinnucan*

Remex Dual Head
No Extravagant Claims.

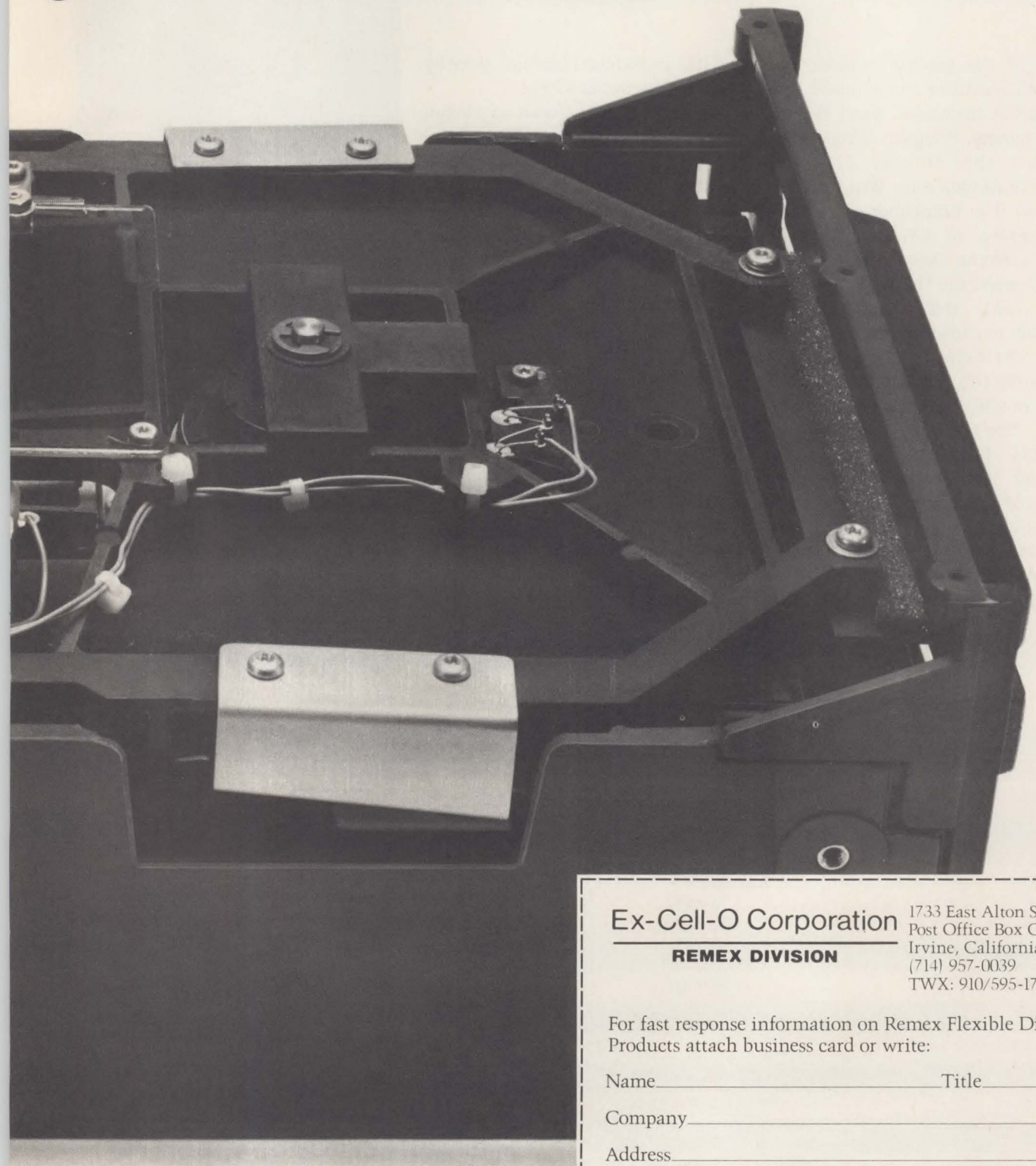


Remex RFD4000 Dual Head Flexible Disk Drive



Remex RFD2000 Single Head Flexible Disk Drive

Floppy Disk Drives.
Just Performance.



Write or Call for Specifications and Delivery.

Ex-Cell-O Corporation
REMEX DIVISION

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

For fast response information on Remex Flexible Disk Products attach business card or write:

Name_____ Title_____

Company_____

Address_____

City_____ State_____ Zip_____

Phone_____

CIRCLE NO. 11 ON INQUIRY CARD

Shugart expands product line with SA600 5¼-in. Winchester

One of the leading suppliers of 8-in. Winchesters has jumped into the market for 5¼-in. fixed drives. The company, Shugart Asssociates, supplies the popular 5M- and 10M-byte SA1000 8-in. Winchesters, and now it is branching out with a new series of 5¼-in. devices, designated the SA600.

Also called the "Midgid" (for mini rigid disk), the SA600 will be available in capacities ranging from 3M to 10M bytes in one-, two- and three-platter models. Shugart's entry is the fourth such drive to enter the 5¼-in. Winchester market, following the ST-506 unveiled last spring by Seagate Technology (formerly Shugart Technology), the high-end 510 announced last fall by Irwin International (MMS, November, 1980, p. 45) and the six-member TM 600 line introduced late last year by Tandon Magnetics Corp.

Shugart officials, however, do not feel that being fourth to announce the product will affect their market position, says Tom Makmann, marketing director at the Sunnyvale, Calif., Xerox subsidiary. "The prime consideration in low-end drives such as these is ease of integration and producibility." Evaluation versions of the SA600 are scheduled to be shipped this spring, with production drives slated for mid-year. "This year, we'll be ramping up our production facilities," Makmann says. "We plan to ship 50,000 units by the end of 1982.

Executives at Shugart Associates are not the only ones who foresee large quantities of 5¼-in. Winchesters rolling off the assembly lines.

Shugart's Makmann: *"The prime consideration in 5¼-in. Winchesters is ease of integration and producibility."*

Irwin International, Ann Arbor, Mich., expects to produce 7500 high-end, 12M-byte drives this year, and hit a production rate of 50,000 per year by the end of 1982. Finis

HOW SHUGART'S SA600 COMPARES WITH OTHER ANNOUNCED 5¼-IN. WINCHESTERS

	SHUGART ASSOCIATES			SEAGATE TECHNOLOGY	IRWIN INTERNATIONAL
	SA 602	SA604	SA606	ST-506	510
Unformatted capacity (megabytes)	3.33	6.66	10.0	6.38	12.3
Transfer rate	4.34M bits/sec.			5M bits/sec.	5.3M bits/sec.
Positioning times:					
Track/track	3 msec.			3 msec.	5 msec.
Average	75 msec.			170 msec.	25 msec.
Maximum	170 msec.			500 msec.	40 msec.
Rotational speed	3125 rpm			3600 rpm	4000 rpm
Recording density	7900 bits/in.			7690 bits/in.	8000 bits/in.
Track density	256 tracks/in.			255 tracks/in.	900 tracks/in.
Number of platters	1	2	3	2	1
Platter size	130 mm. × 40 mm.			130 mm. × 40 mm.	130 mm. × 40 mm.
Dimensions	5.75 × 3.25 × 8.0 in.			5.75 × 3.25 × 8.0 in.	5.75 × 3.25 × 8.0 in.
DC voltages	+12 VDC; +5 VDC			+12 VDC; +5 VDC	+12 VDC; +5 VDC; −12 VDC
Price (500 quantity)	$690	$870	$1000	$925	$1500 (includes integral tape-cartridge backup)

Conner, executive vice president and co-founder of Seagate Technology, Scotts Valley, Calif., says that his firm will move 50,000 units this year alone, while Sirjang Lal "Jugi" Tandon, president and founder of Tandon Magnetics Corp., Chatsworth, Calif., predicts his company will ship 12,000 units in 1981 and 100,000 next year.

Jim Porter, Mountain View, Calif., industry analyst and publisher of Disk/Trend Report, is a bit more conservative, however. "The industry's appetite for these drives is well known," he says, "but they present a speculative forecasting problem right now, because no one is manufacturing them in any quantity."

Porter says 23,000 5¼-in. Winchesters will move in 1981. "If a major OEM for this type of drive were to move suddenly with a new product line, these figures would have to be raised." Porter forecasts a shipment rate of 122,000 5¼-in. Winchesters per year by the end of 1983.

TANDON ANNOUNCES SIX 5¼-IN. WINCHESTERS

Tandon Magnetics Corp.'s anticipated entry into the 5¼-in. Winchester market, the TM-600 family (MMS, March, 1980, p. 28), comprises six drives ranging in storage capacities from 3M to 12M bytes. The new drives are available in three extended 230-cylinder (contiguous data tracks) versions—the single-disk, 4M-byte 601E, the dual-disk, 8M-byte 602E and the three-disk, 12M-byte 603E—and three unextended, 153-cylinder versions, starting with the single-disk, 3M-byte 601. Also available are the unextended dual-platter 6M-byte 602 and the three-disk 9.5M-byte 603. All six drives are available with two interfaces—one that enables attachment to higher-capacity 8-in. hardware, and one that ties the new Winchesters to Tandon's line of double-density, 96-track-per-in., 5¼-in. floppy-disk drives. Single-unit prices range from $1400 to $1600. Deliveries are under way.

How many of these drives ultimately will be shipped depends on how easily they can be incorporated into new and existing small-business computer systems and word processors. To speed the integration of the SA600 into this class of hardware, Shugart plans to offer two interface standards and, like Seagate Technology, has made arrangements with an outside firm to develop controllers for the new drives.

The first interface will be identical to that used by Shugart's larger SA1000 8-in. drives, and will permit the SA600 to work with the SA1400 Winchester/floppy/tape-cartridge controller announced by Shugart last spring (MMS, May, 1980, p. 5). The second interface will be the same as that incorporated into the company's line of SA450/460 double-sided 48- and 96-track per in., 5¼-in. floppy-disk drives. Makmann says that a controller incorporating a data separator and able to link the SA600 to a backup floppy will be available from Shugart this quarter. Data Technology Corp., the Santa Clara firm that built the SA1400, will develop the controller, he says.

The SA600 5¼-in. Winchester and Shugart's line of minifloppy drives are also mechanically compatible, have identical mounting fixtures and operate at the same power levels. Like Shugart's other Winchester drives, the SA600 uses a stepper motor tied to a split-band actuator to move the read/write heads.

But unlike the 8-in. SA1000 and the firm's line of floppy-disk drives, the SA600 incorporates a direct-drive DC brushless motor to drive the spindle rather than an AC motor tied to the drive belt. Prices for the new hardware in 500-unit quantities are $760 for the 3.33M-byte SA602; $980 for the 6.66M-byte SA604, and $1190 for the 10M-byte SA606.

—John Trifari

	TANDON MAGNETICS			NEW WORLD COMPUTER CO.
	TM-601/601E	TM-602/602E	TM-603/603E	V-1TF
Capacity (unformatted/formatted, M bytes)	3.19/3.83	6.38/7.66	9.57/11.5	1.8
Data transfer rate	5M bits/sec. (E models: 4M bits/sec.)			6.8M bits/sec.
Access time	3 msec.			5 msec. (cylinder to cylinder positioning times)
Average latency	153/230 msec.			7 msec. (cylinder to cylinder positioning times)
Seek time	459/690 msec.			20 msec. (cylinder to cylinder positioning times)
Rotational speed	3600 rpm			3600 rpm
Recording density	7690 bits/in.			9000 bits/in.
Track density	254 tracks/in.			200 tracks/in.
Heads/disks	1/1	2/2	3/3	1
Head carriage	130 mm. × 40 mm.			130 mm. × 40 mm.
Dimensions	5.75 × 3.25 × 8.0 in.			2.8 × 5.75 × 8.0 in.
Power requirements	+12 VDC; +5 VDC			+12 VDC
Price	$1400-$1600 (evaluation quantities)			$750

When your VAX* computer memory can't handle your processing workload, you don't have to wait six months for add-in/on memory. Monolithic Systems Model 3610 VAX* expansion memory will be delivered in 10 days and costs only $9200 per MB...with guaranteed plug compatibility to your VAX 11/780.

Multiple sourcing of components assures fast, reliable delivery and selection of only the best parts available. All fully tested systems are 100% plug compatible and come with a standard one year warranty.

Monolithic Systems Corporation designed the first DEC compatible semiconductor memory available to the market 9 years ago. Our experience is unsurpassed in DEC compatibility.

Monolithic Systems means..... Technically advanced solutions

Monolithic Systems corp.

14 Inverness Drive East
Englewood, CO 80112

Telephone (303) 770-7400
Telex 45-4498

*VAX is a registered trademark of Digital Equipment Corporation

MSC Regional Sales Offices: Eastern Region
1101-B9 State Road, Princeton, NJ 08540, (609) 921-2240
Central Region 14 Inverness Drive East, Englewood, CO 80112, (303) 770-7400
Western Region 49 South Baldwin, Suite D, Sierra Madre, CA 91024, (213) 351-8717

CIRCLE NO. 12 ON INQUIRY CARD

2680 laser printer thrusts H-P into office market

Hewlett-Packard has thrust itself into the office systems market by introducing a laser page printer that can generate office forms.

The 2680 laser printing system is designed to fill the void between intelligent office copiers, such as the Xerox 5700 (MMS, November, 1980,, p. 26) and high-speed, high-priced data-processing output laser printers, such as the Xerox 9700 and IBM 3800. The latter systems sell for about $500,000 over five years, says Ed Hayes, marketing manager for H-P's information systems division, Cupertino, Calif. The company will also offer a Diablo character printer for the HP 3000.

The 2680 laser printer, which is designed for the System 3000 minicomputer line, is geared toward Fortune 500 companies that process 50,000 to 400,000 forms a month.

Print speed is 43 pages per min., or 3000 lpm, with 180-dpi resolution. Character sets can be positioned in different places on a page, so a letter can be printed with a signature on it. Copies are made on 8½ × 11-in. fanfold paper. Printing is normally done along the 11-in. edge, but H-P has incorporated the capability for 90-, 180- or 270-degree character-set rotation so printing can be done along the 8½-in. edge.

Two configurations are available. The 2680A laser printer is priced at $108,500. The system 2680, which incorporates the 2680A and two software packages, is priced at $121,000. The software packages are loaded into the HP 3000 Series 44 MPE-4 operating system via magnetic tape. The interactive design system package, IDS 3000, enables users to design forms and nonstandard print, such as logos and signatures, on-line. Interactive formatting system software (IFS 3000) positions the print on the page. An H-P 2648 or a 2647 graphics terminal, which must be used with the software, sells for $5000 to $8000. The model 9874A digitizer, which sells for about $8000, can digitize signatures. But the standard printer's software also can form signatures by using a grid of dots, says Robert McCaleb, product manager for the printer at H-P's Boise, Idaho, division, where the printer was developed.

The 2680 can be used with any Series 44, 30 and 33 minicomputers that incorporate the new MPE-4 operating system.

The Series III does not use the HPIB IEEE 488, but that interface is being incorporated as an upgrade. First shipments are scheduled for Feb. 1, with 16-week delivery times.

The printer incorporates five 8-bit μps. One μp directs the alphanumeric status display, one controls a closed loop to adjust page positioning, and three control I/O and memory mapping functions.

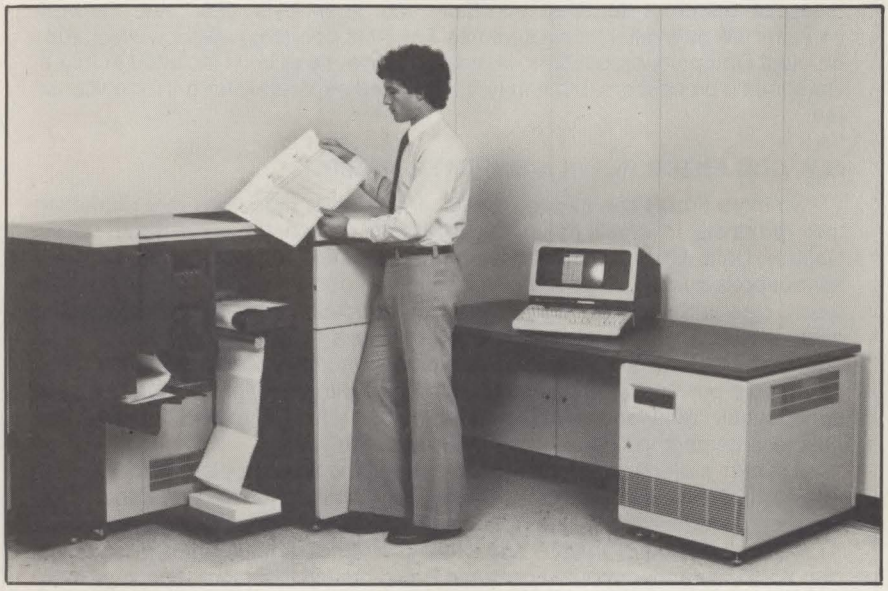
The laser printer, an outgrowth of a five-year effort that cost more than $10 million, uses a 5-mW. helium neon laser. Character images are inscribed by the laser onto a drum in the following manner:

Dot bit patterns created from CRT input are modulated and deflected onto the laser beam. Dots on the laser beam are impinged onto a photoconductive drum, where an electrostatic charge reversal "writes" the dots onto the drum. The drum rotates to a developer station, where electrically charged dry-ink toner is attracted to the dots.

The drum then rotates to a transfer assembly, where a reverse charge behind the paper attracts the toner to the paper. The paper passes through a fusing element where it is heated to 140° F. The paper then passes under a high-intensity infrared lamp, which melts the toner into the paper at 160° to 170°F.

McCaleb says H-P expects to sell 150 units by next year. He says the general market for laser printers in that price range will be more than $30 million in 1983.

—*Lori Valigra*



The Hewlett-Packard 2680 laser printing system, *which includes the 2680A page printer, functions under control of the new Series 44 business computer.*

System Industries sued for infringing DEC patent

Digital Equipment Corp. is suing a Sunnyvale, Calif., manufacturer of disk and tape subsystems for allegedly violating patents the Maynard, Mass., firm holds on its VAX and PDP-11 computer systems. The suit, filed in Boston, charges System Industries (SI) with violating DEC patents through the manufacture, sale and use of SI's 9400 disk systems and 9700 tape systems. The products are plug-compatible replacements for DEC-built hardware and connect to DEC's VAX and PDP-11 buses, a practice DEC claims infringes on the patents on these buses.

The suit represents the first defense of two VAX patents, says a DEC spokesman. The two patents, which protect the company's synchronous backplane interface (SBI), the high-speed VAX bus, were issued by the U.S. Patent Office on October 21 and November 4, 1980. The other patent covers DEC's PDP-11 Unibus, and was issued June 4, 1974.

DEC initially is seeking an injunction to prevent SI from further infringement on the patents, and has requested that it stop building and marketing the storage systems. DEC is also requesting damages, although an amount has not been specified.

System Industries president Edwin Zschau says his firm "had anticipated some action from DEC, so the suit was not a surprise." What did surprise SI, Zschau says, was that DEC did not notify SI that the VAX patents had been issued before filing the suit. A DEC spokesman, however, says that DEC knew the patents were going to be issued six months ago and had been in contact with SI during that time.

Zschau says he was also surprised by the Unibus complaint. "There are hundreds of companies hooking

MINIBITS

IBM OFFERS OEM DISCOUNT ON SERIES/1 MINICOMPUTER

Hoping to broaden the appeal of its Series/1 minicomputer, International Business Machines Corp. is offering a 10 percent discount to customers who enhance the machine and re-sell it to unaffiliated third parties. When combined with existing volume discounts, the new discount will enable such original equipment manufacturers to obtain as much as 20 percent off the Series/1 list price. However, there is a catch. Customers who take advantage of the OEM discount will receive a 30-day warranty instead of IBM's customary 90-day warranty. "It would have been prohibitive from a profits standpoint to offer both the discount and the full warranty," an IBM spokesman explains.

NEWSLETTER FOCUSES ON DISK-DRIVE DEVELOPMENTS

Managers who want to keep abreast of developments in the turbulent disk-drive market might consider subscribing to *Random Access International,* a monthly newsletter that began publication in October. Published by Andrew Roman, a management consultant and frequent contributor to *Mini-Micro Systems* on disk and printer topics, the 12-page newsletter covers all varieties of disk drives as well as the tape drives used to back them up. The newsletter also includes market forecasts and profiles on industry movers and shakers. A 15-issue charter subscription costs $195. Regular subscriptions will cost $240 per year. For a sample issue, write Random Access International, P.O. Box U, Fremont, Calif. 94537, or telephone (415) 794-0857.

DATAPOINT ENHANCES OFFICE SYSTEM WITH 16-BIT PROCESSOR

Continuing to build toward the electronic office of the future, Datapoint Corp. has introduced its most powerful office computer to date, the model 8800. The new 16-bit processor has four times the throughput and memory capacity (1M-byte) as Datapoint's previous high-end machine, the 8-bit model 6600. In addition, it comes with a new RMS operating system that enables stations operating in Datapoint's coaxial cable-based ARC network to share disk drives, printers and other peripherals regardless of their physical location. RMS also offers other features not available with Datapoint's earlier DOS operating system. These include multitasking and programming, unlimited file sizes and names and a hierarchical security system. A stand-alone version of the 8800 processor that can support 24 terminals will be available in the second quarter, and will carry an $88,000 price tag for a system with 256K bytes of memory, terminal interface and 202M-byte disk. ARC network versions will be available this summer. The RMS operating system, which runs on most Datapoint processors, is available now. Its price is included in that of Datapoint's processors, but it may be obtained separately for a $1500 license fee.

IBM, CDC ENTER RETAIL COMPUTER MARKET

Two more firms have swollen the list of computer manufacturers marketing their products to small businesses through company-owned retail stores. Control Data Corp.'s business centers, the first of which opened in a Minneapolis suburb in October, will sell such CDC products and services as disk drives and the Plato computer-aided education service. In addition, the centers will carry Ohio Scientific small-business systems, Centronics matrix printers and other products from independent suppliers. The company plans to base its business center network on an existing network of CDC-operated commercial credit and learning centers. CDC officials expect to have 102 business centers in operation by the end of the year.

IBM Corp.'s office products division opened the first of a planned network of retail outlets, called product centers, in Philadelphia in November. The product centers will carry the new Displaywriter word-processing system, the 5120 small-business system and other IBM office equipment and supplies. OPD added a second product center in Baltimore in December, and says more centers will be opened later this year.

BEEHIVE'S SMART TERMINALS do it all while lowering OEM/System costs and increasing total performance

APPLICATIONS

DATA ENTRY
INQUIRY
EDITING
TRANSACTION PROCESSING
COMMUNICATIONS

FEATURES

CRT-P4/P42, Split Screen, Attributes, Function Keys, Special Keys, Variable RAM/ROM, Printer/Aux. Port, Synch or Asynch, Self Diagnostics, Line Drawing, Editing, Multi-Page Buffering, Choice of Case Colors.

Call for applications assistance and delivery

TOLL FREE USA **(800) 453-9454**

CALIFORNIA Costa Mesa *(714) 540-8404* • Sunnyvale *(408) 738-1560*
FLORIDA Altamonte Springs *(305) 830-4666* **ILLINOIS** Arlington Heights *(312) 593-1565*
MASSACHUSETTS Woburn *(617) 933-0202* **NEW YORK** New York *(212) 682-2760* **UTAH** Salt Lake City *(801) 355-6000*
WASHINGTON, D.C. (VA) Falls Church *(703) 356-5133*
EUROPE The Netherlands *Phone 020-451522*

BEEHIVE INTERNATIONAL

"A proven competitive manufacturer of smart terminals"

CIRCLE NO. 13 ON INQUIRY CARD

into the Unibus," he says. This raises the question as to whether or not SI has been singled out by DEC. Zschau says he's not quite sure, but he claims that "based on its size and success, SI is more visible than other firms in the business." DEC will not comment.

Zschau thinks his firm has a good defense against DEC's charges. At press time, Zschau had not seen the newly issued VAX patents. However, he believes those patents, as well as the Unibus patents, will prove to be invalid.

"A good defense against patent infringement," he says, "is to show that there is 'prior art'—technology that anticipates an invention—that the patent office was not aware of at the time it issued the patent." He says SI will show the court that there is prior art, which invalidates the VAX and Unibus patents. DEC thinks both patents are completely defensible.

It's too soon to judge the effect of the suit on the DEC-compatible market, but Zschau thinks that DEC's action against SI will affect the rest of the industry. However, at least one DEC-compatible product maker doesn't agree.

"We all run the risk of exposure," says Bill Berkman, vice president of marketing at MiniComputer Technology, Inc. "But I don't think it will affect any of our products at all." The Palo Alto, Calif., company manufactures DEC-, Data General- and Perkin-Elmer-compatible disk-controller boards. Its latest product, the SMV-15, interfaces SMD disk drives to VAX systems.

Berkman recalls the IBM plug-compatible lawsuits of the 1960s and '70s, and says that from those cases the courts determined that such practices—restricting the attachment of foreign devices to an IBM processor, in those cases—were monopolistic in nature.

He points out that it may make sense, as a result of this suit, "for DEC plug-compatible product makers to fight a unified battle."

Berkman warns, however, that a prolonged court battle could seriously hurt System Industries financially.

DEC hasn't indicated how much it is seeking in financial damages. Zschau points out that a patent can only be infringed upon after it's been issued, and an amount determined by how long it has been in effect. He says that in the unlikely event DEC would be awarded damages on the VAX patent, they would be minimal. Damages on the Unibus patent may be substantially more than that, however.

—Larry Lettieri

Olivetti will sell Syntrex word processors overseas

A wide-ranging marketing agreement has been signed by Syntrex, Inc., Piscataway, N.J., and Olivetti SpA, Italy, under which Olivetti will market Syntrex's word processors under the Olivetti name outside the U.S. Olivetti may also gain limited marketing rights to some Syntrex products in the U.S.

Syntrex stands to gain $15 million to $30 million over the next two years. The Italian firm also invested $4 million to gain a 25-percent equity share in Syntrex. Each company will have access to the other's equipment.

Olivetti immediately gains an upgrade path for its current typewriter base. The first joint product effort is an electronic typewriter called Aries, which was introduced in October. Aries uses Olivetti components, and can be linked to Syntrex's Aquarius word processor through a $700 adapter. Olivetti will continue to supply high-end word processors through an earlier OEM agreement with Ontel Corp.

Olivetti Corp. of America may also handle the Syntrex products. It was involved in a deal with NBI, Inc., but that deal expired in December and was not renewed, an NBI spokesman says.

The deal was made to gain short-term capital for NBI for two years. Industry sources, however, speculate that Olivetti was dissatisfied in June when NBI introduced a higher-end system that was not initially available to Olivetti.

Although Syntrex claims Olivetti showed a version of its product privately at the recent SICOB electronics show in Paris, Olivetti publicly showed a word-processing system from Axxa Corp., which is the former Lexar system developed for Citibank. Axxa collapsed in October, and terms of that deal remain undefined. *—Lori Valigra*

TWO NEW COMPANIES CHANGE NAMES

Two start-ups recently announced in *Mini-Micro Systems* have undergone name changes when conflicts turned up during title searches. First to change was DATX Systems Corp. (MMS, November, 1980, p. 5), now called DMA Systems Corp. DMA, founded by four disk-drive executives, including three from neighboring INFOMAG Corp., has set up its headquarters in Santa Barbara, Calif., and intends to market low-end 5¼-in. Winchester drives. The second company, a Santa Clara, Calif., start-up put together by ex-Onyx executives Bob Marsh and Kip Myer and formerly called Cirrus Computers (MMS, December, 1980, p.38), now goes by the name Plexus Computers, Inc. Plexus plans to market a line of high-end μc systems based on the Zilog Z8000 16-bit μp and the UNIX operating system.

Right On The Dot.

THE INFOSCRIBE 500.

The Printer You Asked For

Calling all OEM's, system houses, professional end users. The 150 cps **INFOSCRIBE 500** is the newest and brightest entry in the serial matrix printer world. Here is unusual performance and surprising reliability, priced under $1,000 in modest quantities.

Easy to Look At, Easy to Use

INFOSCRIBE 500's sleek lines enhance the appearance of any system. A few straightforward operating controls, plus simple paper loading and a cartridge ribbon, make this printer easy to work with. It's incredibly quiet, too, making it easy to work around.

All Up Time

Unlike the competition, **INFOSCRIBE 500** runs and runs . . . and runs. Its amazing reliability results from sophisticated design implemented in top quality materials and workmanship. For occasional maintenance, all subassemblies are readily accessible. All in all, this leads to a very low cost of ownership.

Features and More Features

INFOSCRIBE 500 wallows in features every small business and minicomputer system designer has been looking for. Like unlimited duty cycle; bidirectional printing; 9 x 9 matrix; double-wide printing; 10, 13.6, and 16.5 cpi; vertical format control; subscripts; superscripts; true underlining; serial or parallel interfacing; software control by host processor; and more. Many more.

First in the Family

And here's the best news. **INFOSCRIBE 500** is the first in a series of four compatible models spanning the serial matrix printer market. No need to switch brands as the user's system grows. Included in the product line is a multifunction printer for both letter quality and DP quality characters.

Look Into It

If you're intrigued by a matrix printer that's right on the dot, send for our full color brochure on **INFOSCRIBE 500**. Write or call Carl Peterson at INFOSCRIBE, 2730 S. Harbor Boulevard, Santa Ana, California 92704, (714) 641-8595.

Distributor/Representative inquiries welcome, too.

INFOSCRIBE™

Character Perfect

CIRCLE NO. 14 ON INQUIRY CARD

NAKED MINI® 4 EVERYTHING YOU'LL

The NM 4/10
A half-card 16-bit mini with half-cost economy. Four on-board distributed I/O channels, hardware multiply/divide and DMA are standard. Cost? Even less than many micro-computers.

The NM 4/30
A midrange beauty. Twice as fast as the 4/10 and with a larger instruction set. Double register shifts, multiple-word memory reference instructions, and more.

The NM 4/90
Twice as fast as the 4/30 and with a beefed up instruction set. With a hefty 128K byte's worth of direct addressing, it's an ideal choice for high-performance applications like industrial control and data communications systems.

The NM 4/95
Top of the line. Memory management unit for expansion to 8 megabytes. ECC RAM memory for reliability. High speed cache memory for faster throughput. And Page Protection to prevent destruction of another user's space.

The NM 4/04
SCOUT,™ the little fella that's had OEM's buzzing for months. Through the wizardry of ISOLITE,™ SCOUT can test himself every time he's turned on. And a 16-bit CPU, I/O, 32K byte RAM, and card cage costs less than $1,000.

ComputerAutomation has just what you need to cut a path through to your computer solutions.

You need compatibility? We've got it, with software compatibility from SCOUT through our 4/90. And I/O compatibility across the family, from the 4/10 through the 4/95. All with up to 128K Bytes of directly addressable memory. And up to 8 megabytes of physical memory for the 4/95.

You want software and development tools? We've got all the operating software to get you up and running.

You demand reliability? We've got a track record of success in applications as diverse as automated bank tellers, aircraft control simulators, blood analyzers, laser welders and missile tracking systems.

Best of all, it's all part of CA's OEM philosophy that says to protect our profitability, we've got to protect yours. Which means com-

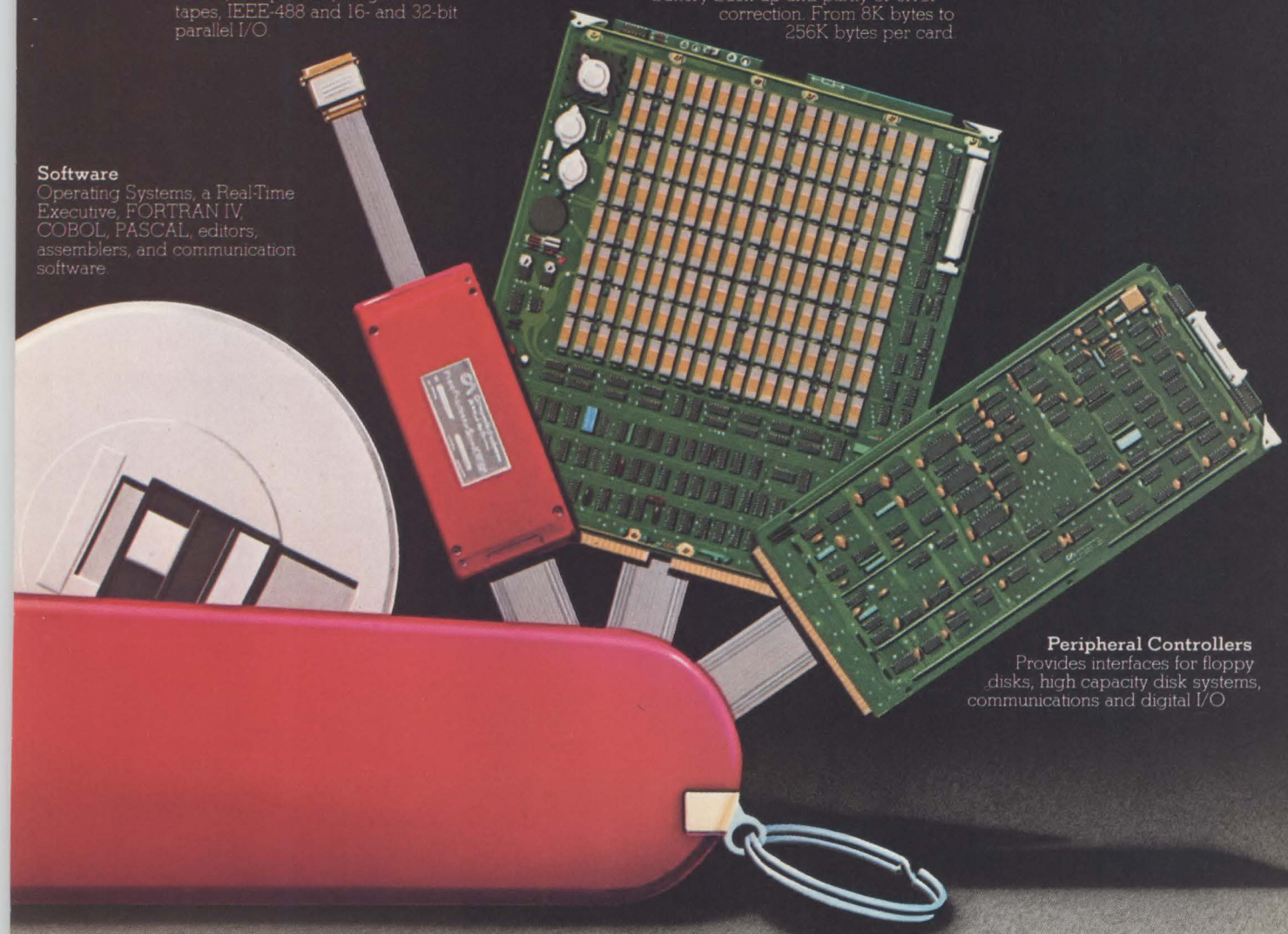
CA, NAKED MINI, SCOUT, ISOLITE and ComputerAutomation are trademarks of Computer Automation, Inc.

COMPUTERS. NEED IN THE OEM JUNGLE.

Interfaces
Our famous Intelligent Cables offer low-cost interfaces for async and bisync communications, CRT's, line printers, magnetic tapes, IEEE-488 and 16- and 32-bit parallel I/O.

Memories
The family never runs short of memories. Core, RAM, and E/PROM. Plus battery back-up and parity or error correction. From 8K bytes to 256K bytes per card.

Software
Operating Systems, a Real-Time Executive, FORTRAN IV, COBOL, PASCAL, editors, assemblers, and communication software.



Peripheral Controllers
Provides interfaces for floppy disks, high capacity disk systems, communications and digital I/O.

petitive prices, a hassle-free software policy, timely deliveries and the best warranty in the business.

We've got everything you'll need to battle your way out of the OEM jungle.

And the path out begins on the right.

ComputerAutomation
NAKED MINI® Division
Where OEM's come first.
18651 Von Karman, Irvine, California 92664

Send help fast.

☐ Please send the latest full-color brochure on the entire NAKED MINI family.

☐ Please send a sales representative.

☐ Please call me at (____)_____

If you're really in a hurry to fight your way out, give us a call at (714) 833-8830 X455.

Name_____

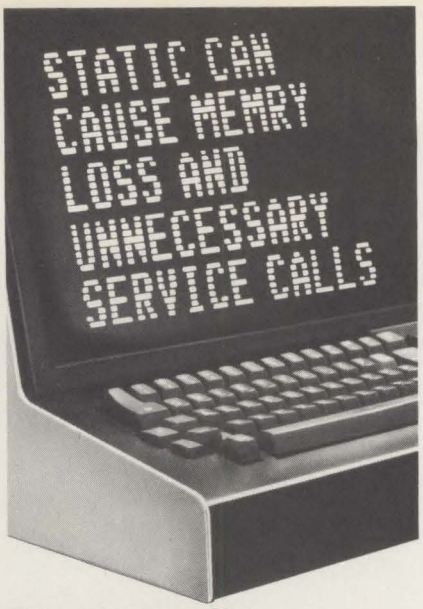
Company_____ Title_____

Address_____ City_____

State_____ Zip_____ Phone_____

CIRCLE NO. 15 ON INQUIRY CARD

© 1980, Computer Automation, Inc.



Protect yourself against the high cost of static

Electrostatic discharge, in addition to causing problems like the one above, can damage delicate electronic control and logic circuits. It takes so little voltage that you might not even feel the spark.

As little as 500 volts can send erroneous data, alter "memry", write incorrect data on a disk, or cause printers to run wild, throwing paper into the room. All of which means expensive service calls and even more expensive system down time.

Only 500 volts, yet you can easily generate over 12,000 volts of static charge just walking across a carpet. Even on a vinyl floor, 4000 volts is not uncommon.

The solution is simple

3M Brand Static Control Floor Mats can create an inexpensive "island of protection" around your delicate electronic equipment, harmlessly draining the static charge from operators and other personnel.

For as little as the cost of a single static-related service call, you can say goodbye to all these problems.

3M Brand Static Control Floor Mats come in hard mats for easy movement of castered chairs, and soft mats for comfortable standing.

For information about how you can purchase 3M Static Control Floor Mats, call toll free

1-800-328-1300

(In Minnesota, call collect 612-736-9625.)

Ask for the Data Recording Products Division.

3M Hears You...

3M

CIRCLE NO. 16 ON INQUIRY CARD

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
Advanced Micro Devices	6 mos.	9/28/80	147,621,000	13,865,000	.88
	6 mos.	9/23/79	106,265,000	10,360,000	.70
Analogic	Yr.	7/31/80	67,010,421	6,029,896	.88
	Yr.	7/31/79	48,615,079	4,528,005	.68
Aydin	9 mos.	9/27/80	75,593,000	5,290,000	1.53
	9 mos.	9/29/79	45,840,000	2,855,000	.84
Burroughs	9 mos.	9/30/80	2,108,135,220	150,712,911	3.65
	9 mos.	9/30/79	1,949,311,587	173,057,743	4.22
Centronics Data Computer	3 mos.	9/30/80	31,500,000	900,000	.15
	3 mos.	9/30/79	29,000,000	2,700,000	.46
Commodore International	3 mos.	9/30/80	35,212,000	4,517,000	1.31
	3 mos.	9/30/79	24,750,000	3,055,000	.91
Computer Automation	3 mos.	9/30/80	18,206,000	137,000	.07
	3 mos.	9/30/79	18,593,000	64,000	.03
Computer Sciences	26 wks.	9/26/80	278,503,000	13,060,000	.96
	26 wks.	9/28/79	205,012,000	10,422,000	.78
Comshare	3 mos.	9/30/80	20,933,600	803,200	.21
	3 mos.	9/30/79	16,259,700	968,300	.26
Data General	Yr.	9/27/80	653,900,000	54,700,000	5.20
	Yr.	9/29/79	507,500,000	49,800,000	4.82
Four-Phase Systems	9 mos.	9/30/80	143,838,000	3,854,000	.75
	9 mos.	9/30/79	126,376,000	11,908,000	2.36
General DataComm	Yr.	9/30/80	53,635,000	4,411,000	.77
	Yr.	9/30/79	41,414,000	3,236,000	.61
Gould	9 mos.	9/30/80	1,571,500,000	52,500,000	1.84
	9 mos.	9/30/79	1,490,800,000	76,500,000	2.73
Informatics	Yr.	9/30/80	123,606,000	5,989,000	2.71
	Yr.	9/30/79	109,224,000	4,492,000	2.02
Lear Siegler	3 mos.	9/30/80	347,198,000	14,040,000	.88
	3 mos.	9/30/79	321,129,000	12,506,000	.81
Logicon	6 mos.	9/30/80	26,973,000	1,069,000	1.11
	6 mos.	9/30/79	24,459,000	913,000	1.00
M/A-Com	Yr.	9/27/80	322,480,000	24,905,000	.77
	Yr.	9/27/79	227,083,000	13,173,000	.46
Modular Computer Systems	9 mos.	9/30/80	56,290,000	3,115,000	.69
	9 mos.	9/30/79	52,114,000	3,474,000	1.04
MSI Data	6 mos.	9/27/80	25,574,000	1,667,000	.73
	6 mos.	9/29/79	21,089,000	486,000	.21
Paradyne	9 mos.	9/30/80	52,186,000	5,613,000	1.02
	9 mos.	9/30/79	28,071,000	3,464,000	.76
Perkin-Elmer	3 mos.	10/31/80	252,054,000	16,472,000	.77
	3 mos.	10/31/79	204,152,000	14,716,000	.74
Printronix	6 mos.	9/26/80	23,356,000	2,005,000	.55
	6 mos.	9/28/79	16,633,000	1,452,000	.46
Ramtek	3 mos.	9/30/80	7,028,000	409,000	.15
	3 mos.	9/30/79	4,489,000	238,000	.12
Scan-Data	9 mos.	9/30/80	10,301,494	(1,706,281)	(.75)
	9 mos.	9/30/79	12,740,905	57,553	.03
System Development	3 mos.	9/28/80	47,992,000	3,547,000	2.56
	3 mos.	9/23/79	38,675,000	1,214,000	.73
Systems Engineering Labs	13 wks.	9/26/80	21,207,000	1,275,000	.40
	13 wks.	9/28/79	17,745,000	853,000	.29
Tandem Computers	Yr.	9/30/80	108,989,000	10,687,000	1.06
	Yr.	9/30/79	55,974,000	4,920,000	.59
Tymshare	9 mos.	9/30/80	177,101,000	14,989,000	2.93
	9 mos.	9/30/79	143,805,000	11,720,000	2.46
Wang Laboratories	Yr.	9/30/80	604,768,000	57,533,000	2.16
	Yr.	9/30/79	360,821,000	31,525,000	1.27

Up in the air over printer selection? Call Kierulff today for Dataproducts

Kierulff has off-the-shelf delivery of the complete Dataproducts printer line.

There's no need to get tense when searching for printers. Just ring up Kierulff and say, "Dataproducts."

All printers do something well. But the M-200 and M-120 matrix printers from Dataproducts do a lot of things exceptionally well.

Like speed, for instance. The M-200 will flash along all day at a happy 340 CPS. The less expensive M-120 moves at a more leisurely speed — 180 CPS.

Or features. The M-200 has a unique matrix head design that combines the flexibility of a single head with the speed and long life of multiple heads. Expected life is more than 300 million characters without any maintenance, or more than two years normal use.

You also get condensed/expanded print capability, ranging from 16.7 CPI to 5 CPI. And we include an optional status display, which lets you know if something's wrong and if it's something you can correct yourself.

But what if a matrix printer isn't the solution to your problem? Kierulff can still give you support with an in-stock selection of Dataproducts printers for various applications.

Like the T-80 Thermal Series, which knocks out copies with whisper-quiet efficiency, or the word processing quality Daisywheel D-50. We also have the B-300 Band printer (300 lpm) and the B-600 Band printer (600 lpm).

So don't get tripped up when buying a printer. Kierulff has a nationwide network of Regional Offices linked by a computerized inventory system. You want product... Kierulff gets you product.

We've got our act together.

KIERULFF ELECTRONICS
A SUBSIDIARY OF DUCOMMUN INCORPORATED

We're Determined.

Boston, MA (617) 935-5134 **Chicago, IL** (312) 640-0200 **Denver, CO** (303) 371-6500
Florida (813) 576-1966 **Los Angeles, CA** (213) 725-0325 **Milwaukee, WI** (414) 784-8160
Minnesota (612) 835-4388 **New Jersey** (201) 575-6750 **Orange County, CA** (714) 731-5711
Palo Alto, CA (415) 968-6292 **Phoenix, AZ** (602) 243-4101 **Portland, OR** (503) 641-9150
Salt Lake, UT (801) 973-6913 **San Diego, CA** (714) 278-2112 **Seattle, WA** (206) 575-4420

INTERNATIONAL
CALIFORNIA, Compton (213) 774-7364, 2301 E. Del Amo Blvd. 90220
TWX: 910-346-6319, Outside LA Area (800) 421-2250
NEW YORK, Hauppauge, LI (516) 273-8100, 330 Motor Parkway 11787
Telex 1432333

CIRCLE NO. 17 ON INQUIRY CARD

THERE'S ONE SU
A SPERRY UNIVAC M

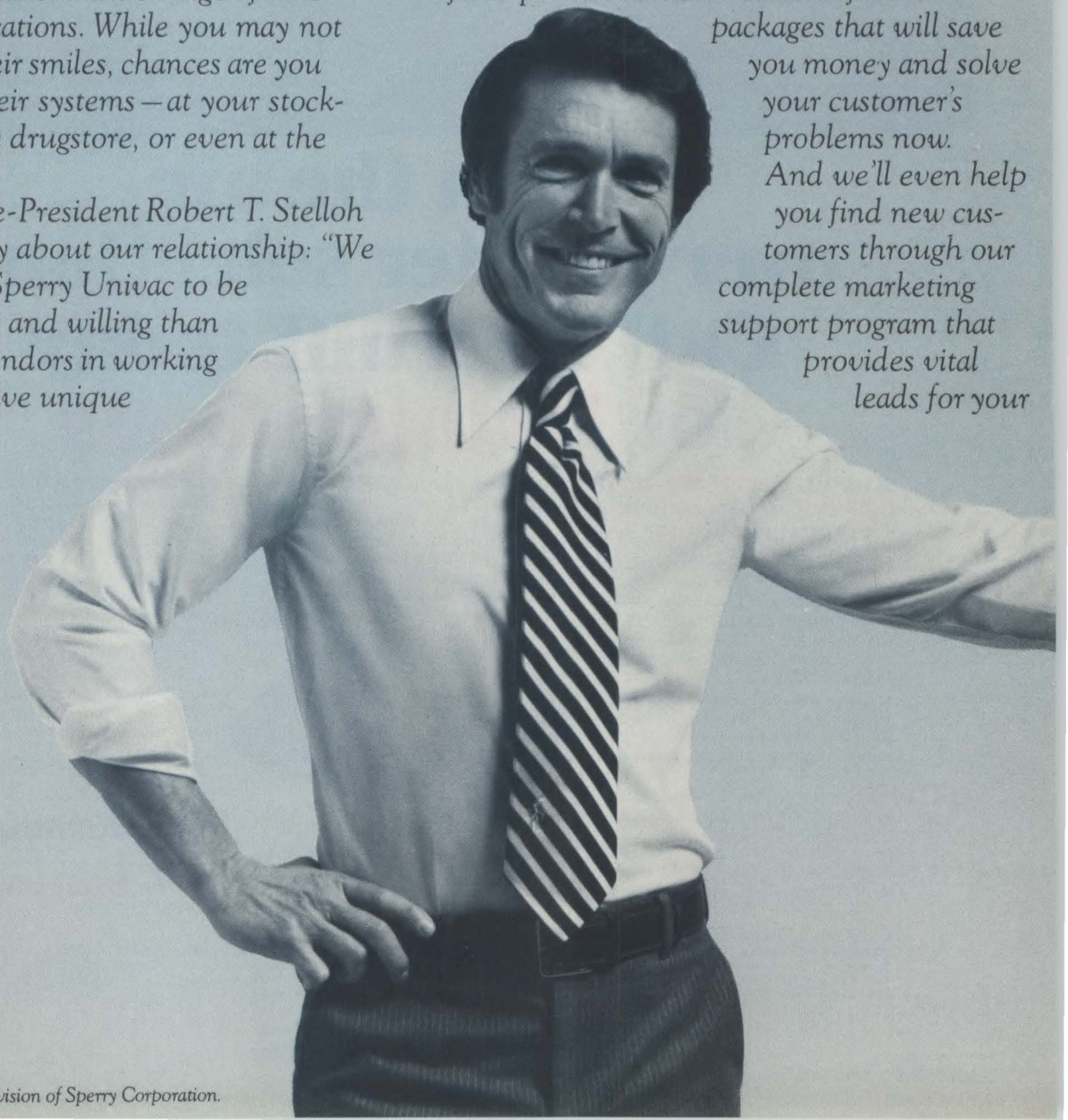
They smile a lot.

Because we've come up with the most practical plans and arrangements for minicomputer OEMs in the entire industry.

Consider International Computing Company (ICC) in Bethesda, Maryland, for example. They became a Sperry Univac Minicomputer OEM in February of 1979. ICC specializes in high reliability turnkey systems that cover a wide range of time-critical applications. While you may not have seen their smiles, chances are you have seen their systems—at your stock-broker, at the drugstore, or even at the racetrack.

ICC Vice-President Robert T. Stelloh has this to say about our relationship: "We have found Sperry Univac to be more flexible and willing than other mini vendors in working with us to solve unique customer problems in sales situations. ICC's ability to sell Sperry Univac hardware has been one of the major contributors to our 50% growth rate, and we expect it to be in the future. We feel the marketing support has been good, and we are impressed by Sperry Univac's aggressive and innovative pursuit of OEMs as a vehicle for growth."

At Sperry Univac, you have access to field-proven vertical market software packages that will save you money and solve your customer's problems now. And we'll even help you find new customers through our complete marketing support program that provides vital leads for your



Sperry Univac is a division of Sperry Corporation.

RE WAY TO SPOT INICOMPUTER OEM.

own geographic area. Furthermore, 10,000 field engineers will service Sperry Univac hardware worldwide. And hardware is available in 90-120 days.

Sperry Univac and our $10 billion in worldwide installed systems is a powerful testimonial to the popularity and dependability of our machines.

But the biggest thing that sets us apart from the competition is that we listen. If you've got a problem, we want to help solve it. In the most practical, economical, and effective manner possible.

Just ask International Computing Company. We did it for them.

And they're grinning all the way to the bank.

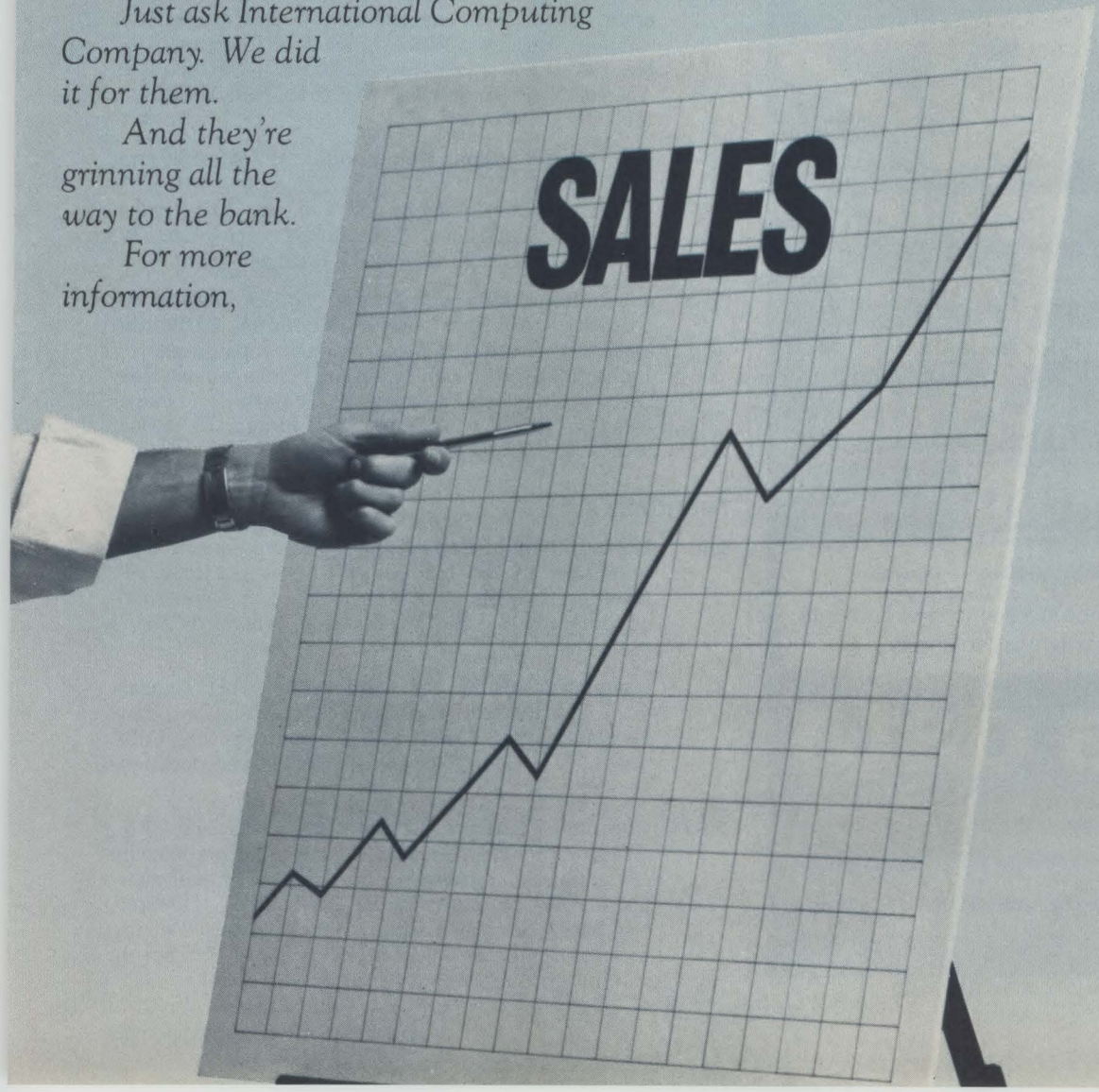
For more information, write to us at Sperry Univac Mini-Computer Operations, Marketing Communications, 17900 Von Karman Avenue, Irvine, CA 92714.

Or call toll-free **800/854-7517** *(8:00 a.m. to 4:30 p.m. PST). In California, call 714/557-9398 collect.*

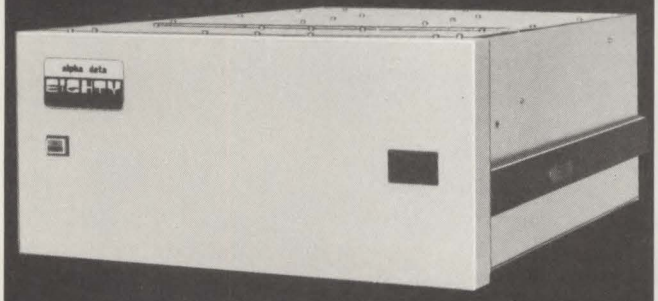
SPERRY UNIVAC

The Computer People Who Listen

CIRCLE NO. 18 ON INQUIRY CARD



FIRST CLASS ALL THE WAY!
NO MOVING HEADS!
with a
MODEL 80 DISC
8 MILLISECONDS
ACCESS TIME
8 MEGABYTES



IMPROVE YOUR SYSTEM'S PERFORMANCE with this most advanced, low cost
HEAD-PER-TRACK MEMORY

- Hard Plated Disc, 8 megabytes in 14" height. 4 megabytes in 8¾".
- Dependable performance in adverse environments.
- Call today for your mass memory solutions.

alpha data
The Mass Memory Technologists Since 1968
20750 Marilla St., Chatsworth, CA91311
(213)882-6500 * TWX(910) 494-4914

CIRCLE NO. 19 ON INQUIRY CARD

Calendar

SHOWS & CONFERENCES

JANUARY

22-23 **"Future Shock - Computers in the 1980s" Conference,** Los Angeles, sponsored by the American Institute of Aeronautics and Astronautics (AIAA) and the Education Foundation of the Data Processing Management Association (DPMA). Contact: AIAA Conferences Department Comp. 80, 5959 W. Century Blvd., P.O. Box 91295, Los Angeles, Calif. 90009, (213) 670-2973.

22-24 **Computer & Engineering Job Fair,** Dallas, sponsored by Computer & Engineering Job News. Contact: Paul Sullivan, Public Relations Director, Computer & Engineering Job Fair, 470 Boston Post Road, Weston, Mass. 02193, (617) 899-2702. Other dates and locations available.

27-29 **Advanced Semiconductor Equipment Exposition,** San Jose, Calif., sponsored by the Electronic Representatives Association - N. California Chapter. Contact: Cartlidge & Associates, Inc., 491 Macara Ave., Suite 1014, Sunnyvale, Calif. 94086, (408) 245-6870.

28-29 **"Leadership in the New Information Era" Conference,** New York, sponsored by *Business Week*. Contact: Business Week Executive Programs, c/o McGraw-Hill Conference & Exposition Center, 1221 Avenue of the Americas, Room 3677, New York, N.Y. 10020, (212) 997-4930.

28-31 **Internepcon Japan/Semiconductor International '81,** Tokyo, Japan, sponsored by Industrial & Scientific Conference Management, Inc. Contact: Industrial & Scientific Conference Management, Inc., 222 W. Adams St., Chicago, Ill. 60606, (312) 263-4866.

28-31 **International Microcomputers, Minicomputers, Microprocessors/Data Communications Exhibition** (IMMM/DATACOMM), Tokyo, Japan, sponsored by Industrial & Scientific Conference Management, Inc. Contact: Industrial & Scientific Conference Management, Inc., 222 W. Adams St., Chicago, Ill. 60606, (312) 263-4866.

FEBRUARY

2-4 **Microprocessor-Based Energy-Management Systems Conference,** Madison, Wis. Contact: Robert P. Madding, University of Wisconsin - Extension Engineering, 432 N. Lake St., Madison, Wis. 53706, (608) 263-7920.

3 **Invitational Computer Conference,** Fort Lauderdale, Fla. Contact: B.J. Johnson & Associates, 2503 Eastbluff Drive, Suite 203, Newport Beach, Calif. 92660, (714) 644-6037. Other dates and locations available.

23-26 **Computer Science Conference,** St. Louis, Mo., sponsored by the Association for Computing Machinery and the Computer Science Departments of many universities. Contact: Orrin E. Taulbee, Director, Computer Science Employment Register, Department of Computer Science, University of Pittsburgh, Pittsburgh, Pa. 15260, (412) 624-6475.

NEC Trimliners. A generation ahead.

300-600 LPM band printers that set new standards.

At NEC, we've been working on band printer technology for more than seven years. While others were contemplating the possibilities of this practical, low-cost method, NEC was constructing its first units, getting the bugs out, improving the designs. Bringing state-of-the-art electronics to band printer controls. Adding serviceability. Reliability. Durability.

Today, NEC offers two band printers with speeds of 300 and 600 lines per minute. Available now, they are also reliable—now. They incorporate a technology which is now. The band technology. Low-cost, very reliable, extremely flexible.

A new enhanced-print feature allows the user to change speeds under either software or hardware controls to produce higher quality printed output. The feature reduces the 300 LPM speed to 170 LPM, and the 600 LPM rate to 350 LPM.

NEC's Trimliner printers have *never* experienced any band breakage. They have uptimes 50% higher than the competition. Trimliners average less than 30 minutes to repair. They're quiet, modular, ultra-cool and available in desktop, pedestal-mounted or two models of quiet cabinetry.

The technology of the 80s in a printer for the 80s from NEC—a company that was preparing for this decade and its band printing needs while others were just thinking about it.

NEC's Trimliner band printers. A generation ahead.

NEC. Going after the perfect printer.

NEC

NEC Information Systems, Inc.

Head Office: 5 Militia Drive, Lexington, MA 02173, (617) 862-3120
Eastern Office: 36 Washington Street, Wellesley, MA 02181, (617) 431-1140
Central Office: 3400 South Dixie Drive, Dayton, OH 45439, (513) 294-6254
West Coast Office: 8939 S. Sepulveda Blvd., Los Angeles, CA 90045 (213) 670-7346
Southern Office: 2945 Flowers Road South, Atlanta, GA 30341, (404) 458-7014

CIRCLE NO. 20 ON INQUIRY CARD

The 'Red Box'. Our dynamite duo!

Bit Error Rate Test Set – EIA Interface Breakout Panel in pocket size package.

IDS'S MODEL 65/60 lets you both analyze and test at the EIA interface between a modem and terminal. Combines our popular "Blue Box" model 60 with a new bit error rate test set. All in one light, portable, hard plastic case. Works on rechargeable batteries. Available now.

INTERNATIONAL DATA SCIENCES, INC.
7 Wellington Rd., Lincoln, R.I. 02865
Tel. 401-333-6200 TWX 710-384-1911
Export: EMEC, Box 1285,
Hallandale, Fla. 33009 Telex 51-43-32

CIRCLE NO. 21 ON INQUIRY CARD

OEM Systems Designers...

GET IT UP AND RUNNING

Microbench™ Development Software

Complete development packages for:
- INTEL 8086/8088
  8080/8085
  8048/8748
- ZILOG Z8000 Z80
- MOTOROLA 6809 6800 to 6803

Includes:
- Cross Assembler • Linker
- Librarian • Downloader

Operates with DEC operating systems on:
- PDP-11 • LSI-11 • VAX

Also: FORTRAN—77 for the INTEL 8086/8088

Cost effective with prices starting at only $1,695.

VIRTUAL SYSTEMS
1500 Newell Avenue, Suite 406
Walnut Creek, CA 94596
(415) 935-4944

The state of the art in microprocessor software

CIRCLE NO. 22 ON INQUIRY CARD

Calendar

24-25 Ninth Annual Midwest Digital Equipment Exhibit, Minneapolis, Minn. Contact: Kim Shobe, Product Marketing, Loonam Associates, Inc., 7720 Bush Lake Road, Minneapolis, Minn. 55435, (612) 831-1616.

24-26 Nepcon West '81, Anaheim, Calif. Contact: Industrial & Scientific Conference Management, Inc., 222 W. Adams St., Chicago, Ill. 60606, (312) 263-4866.

26-27 Louisiana Computer Exposition, Lafayette, La., sponsored by the student chapter of the Association for Computing Machinery, the Computer Science Department and the Computer Center of the University of Southwestern Louisiana. Contact: William R. Edwards, Program Chairman, Computer Science Department, University of Southwestern Louisiana, P.O. Box 44330, Lafayette, La. 70504, (318) 264-6284.

27-28 International Conference on Aspects of Document Preparation Systems, Lausanne, Switzerland, sponsored by the Swiss Chapter ACM, IEEE, AFCET, INRIA and GESO. Contact: Prof. J.D. Nicoud, Program Chairman, Bellerive 16, CH 1007, Lausanne, Switzerland.

MARCH

8-11 TI-MIX 1981 Symposium, New Orleans, La., sponsored by Texas Instruments Minicomputer Information Exchange. Contact: TI-MIX, M/S 2200, P.O. Box 2909, Austin, Texas 78769, (512) 250-7151.

16-18 1981 Federal Office Systems Expo, Washington, sponsored by National Trade Productions, Inc. Contact: Michael Pomponio, Exhibits Chairman, National Trade Productions, Inc., 9301 Annapolis Rd., Suite 206, Lanham, Md. 20801, (301) 459-1815.

23-25 Office Automation Conference, Houston, sponsored by the American Federation of Information Processing Societies (AFIPS). Contact: Office Automation Conference, P.O. Box 9659, Arlington, Va. 22209, (703) 558-3617.

FINAL CALL FOR DATA

Mini-Micro Systems is planning a special report on data communications and network products for the March issue. The report will include several survey articles, and we want to be sure that as many vendors are represented as possible. Vendors of products in either of the two fields below are invited to contact our contributing editor on data communications, Walter A. Levy, President, Edgewood Computer Associates, Inc., 51 Strawberry Hill Road, Hillsdale, N.J. 07642, immediately to assure that you receive the appropriate vendor questionnaire.

Communication network processors: Packet-switching systems, front-end processors, network controllers, protocol converters and related products.

Limited-distance network products: Limited-distance modems, CATV network adapters, local network controllers and related products.

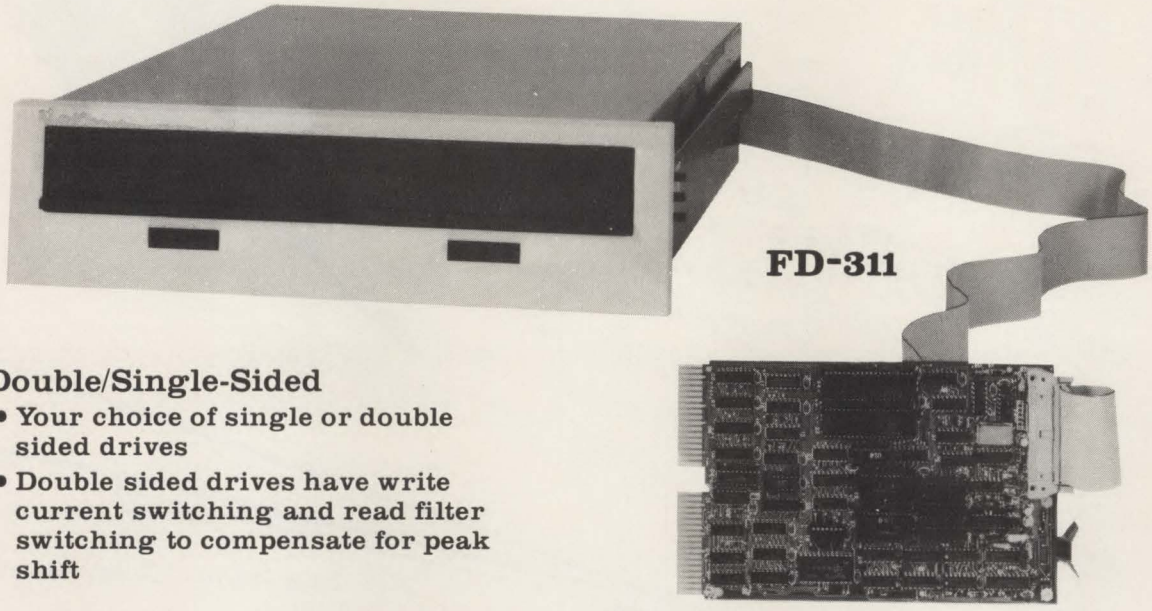
RX02 compatibility, price and delivery!

LSI-11 and PDP-11 Compatibility

- Single board controller/interface
- Unibus quad height card or Q-Bus dual card
- 2901-based controller with 2 years field experience

Software Compatibility

- Complete software and media compatibility
- No changes to device drivers required
- Many CRDS customers use RT-11, RSX and UNIX*



FD-311

Double/Single-Sided

- Your choice of single or double sided drives
- Double sided drives have write current switching and read filter switching to compensate for peak shift

User-Oriented Diagnostics

- Complete test of system and Q-Bus
- User-oriented menu-driven
- Written in higher level language
- Optional storage of error report

The FD-311 Dual Floppy System is the perfect plug replacement for your RX02, in half the space and at up to 30% savings.

It provides complete instruction set/media compatibility with DEC's RX02 for both the PDP-11 and LSI-11 series.

The attractive, furniture-quality 5¼" enclosure houses two floppy disk drives, each providing up to 512K bytes of formatted storage, plus necessary power. Over 1 megabyte per drive available with double-sided drives.

All control/interface electronics are contained on a single card using only a half quad slot of the Q-Bus backplane. A single quad slot is all that is required of the Unibus backplane.

You can get FD-311's in as little as 30 days ARO, for as little as $2,700 in quantities of ten.

RX02 compatibility, price and delivery . . . all wrapped up in a neat little package from CRDS. Call or write for details. Today.

CRDS

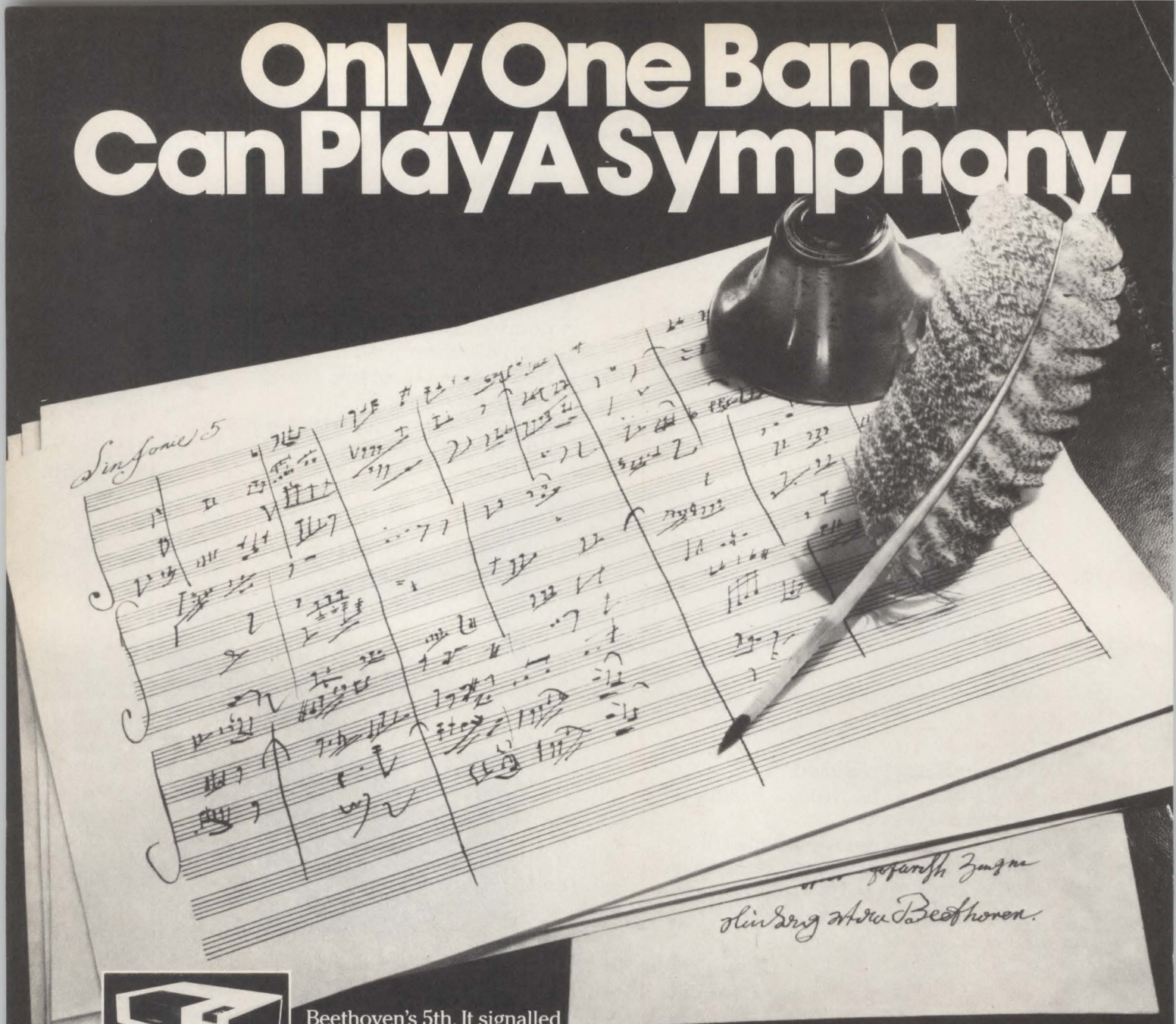
Charles River Data Systems, Inc.

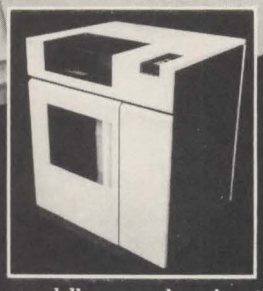
4 Tech Circle, Natick, MA 01760 Tel. (617) 655-1800 TWX (710) 386-0523

**UNIX is a registered trademark of Bell Laboratories.*

CIRCLE NO. 23 ON INQUIRY CARD

Only One Band Can Play A Symphony.





Beethoven's 5th. It signalled a new musical era. Because Ludwig van Beethoven broke with tradition. He extended limits. He ignored the artificial rules of form. He dared to do more. As a result, his originality of thought changed forever the world's symphonic standards and expectations.

With its new 3001 Band printer series, Data Printer is extending the commonly-accepted limits of band printing in much the same way. By taking the simple, low-cost band technology and combining it with the reliability, durability and power of heavy-duty cycle drum and chaintrain-type designs, Data Printer is setting a new printer standard.

This unique four-member family offers the industry's most complete repertoire of standard features. Like chaintrain-type hammer and actuator systems for the most demanding applications. Fine horizontal *and* vertical paper adjustments that keep the printout aligned. Standard quietized cabinetry that encloses *both* paper entry and exit to meet or exceed international office-environment demands. Operator-selectable self-test that detects faults before they become problems. And, microprocessor control for increased flexibility and versatility.

In addition, the 3001 offers speeds from 150 to 1100 LPM, operator-changeable fonts, clean-hands cassette ribbons, a touch-control operator's panel, 95% spares commonality, and a mean time to repair that has yet to be bested by any other band printer available today.

The 3001. Measure for measure, its the best band printer craftsmen can create.

Data Printer, 99 Middlesex Street, Malden, MA 02148, Telephone (617) 321-2400, TWX: 710-348-0794.

Data Printer
The Craftsmen.

CIRCLE NO. 24 ON INQUIRY CARD

High-end 8-in. Winchester based on new actuator design

The use of low-cost *powder metal and the lack of expensive permanent magnets help lower the cost of the new Ontrax actuator, explains Dick Matthews, vice president of engineering.*

Deliveries are scheduled to begin next month for the Series 8 model 136, the largest capacity 8-in. Winchester-disk drive to be announced so far. The new offering from Ontrax Corp., Sunnyvale, Calif., was unveiled last month (MMS, October, 1980, p. 7). It is a five-platter drive that holds 136M bytes and embodies an actuator and controller design that could set new standards for disk-drive engineers.

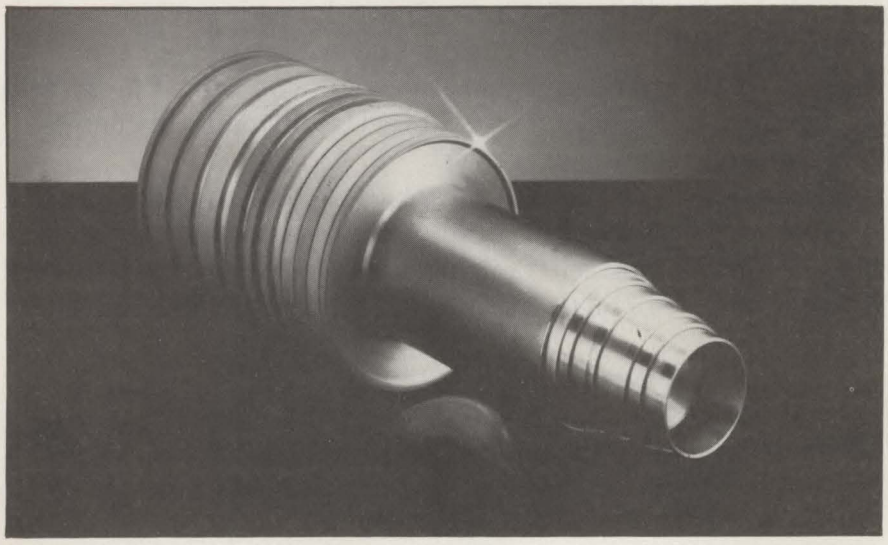
The double-density 3350-technology drive operates at 960 tracks per in., using a head actuator system that one Ontrax executive claims "performs at the level of a voice-coil motor but at the cost of a stepper." The actuating mechanism incorporated into the new Ontrax drive is the first digital positioner to appear in a disk drive, and is about the size and weight of an impact wrench used by an auto mechanic.

It comprises a series of 11 dovetailing, concentric sleeves each capable of a specified amount of linear movement. The sleeve closest to the read/write heads, for example, can move only 1 mil; the sleeve farthest from the heads can move 160 mils. A total of 2048 discrete movements (2^{11}) of 1 mil each are possible.

To make a specific move—to advance the read/write heads from one track to another—concentric rings surrounding the sleeves are magnetized as required. For example, by magnetizing all the rings, the actuator could move the read/write head from track 00 to track 2048. (That's a hypothetical example, however, because there are only 600 tracks per surface on the Ontrax drive.) To move from track 00 to 01 would require that only the first ring be magnetized.

A spring coil is used to continuously force the sleeves open, thus permitting the actuator to move the heads from the innermost tracks to the outermost ones. Fine tuning of the positioner over the center required track is carried out by controlling the amount of current flowing through a squeeze coil.

"The new actuator can be extruded from low-cost powder metal," explains Ontrax engineering vice president Dick Matthews. "There are no permanent magnets used in the device." These magnets are required in a voice-coil actuator, he adds, and can cost as much as $80 alone. Matthews figures that the Ontrax will cost about $120, compared to about $200 for a voice-coil device.

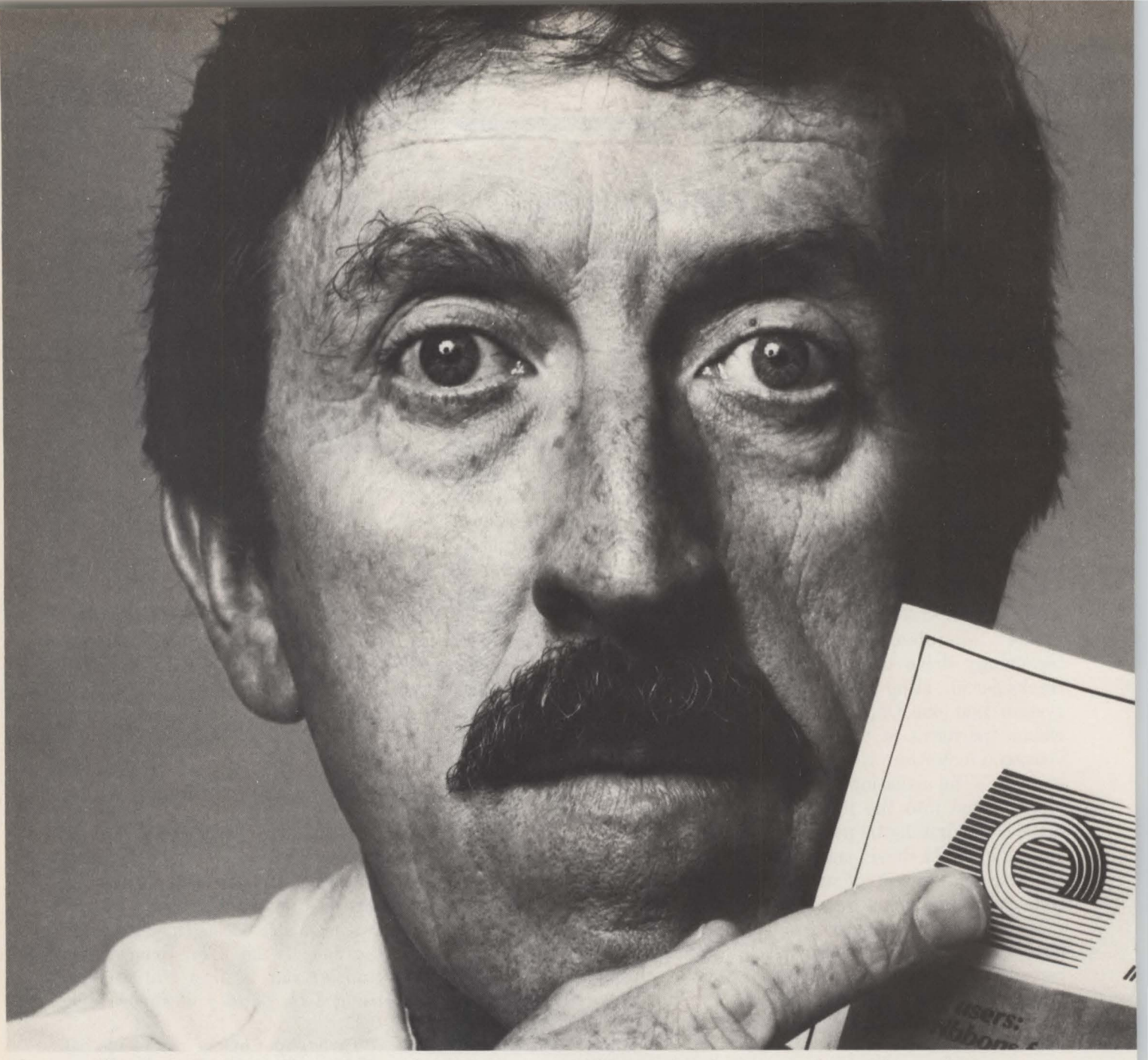


Actuator for the Ontrax *Series 8 model 136 comprises a series of concentric sleeves, each capable of a specified amount of linear movement.*

Each drive incorporates two of these actuators, cutting arm contention and permitting the use of separate device addresses. Use of two arms also boosts throughput on the model 136. The drive's raw transfer rate is 9.2M bits per sec. using a bit density of almost 7000 bpi.

Throughput on the model 136 has also been pushed by increasing the rotational speed of the disk to more than 4800 rpm—more than 1200 rpm faster that most other 3350-technology Winchesters. Matthews says this enables the drive's read/write heads to fly at the same speed as those used in 14-in. devices. But boosting rotational speed necessitated a larger spindle, he adds; thus 210-mm. media was incorporated.

The formatter that mounts on the drive's rear panel is also unique. Designed around a 16-bit M68000 μp and a 20-MHz backplane, the formatter comprises as many as 16 6- × 8-in. PC cards. On the drive side, the formatter sees an



"I'm Bob Sharkey. I'm in Manufacturing Operations at Inmac, and I am not crazy. We've built a big business on a very simple premise: Giving you what you need, when you need it.

"Need disks, tapes or floppies? We have them compatible with almost every mini and micro computer made. You need ribbons? We have ribbons compatible with 753 different printers. You need cables and connectors? We have 538 different kinds—in stock, ready to ship.

"We'll custom build cables to your specs. We'll give you any length you want. We can help you connect your CPU to virtually any peripheral you choose.

"And those are just a fraction of the more than 1000 computer-related products we stock and sell. I might get an ulcer trying to keep track of all that stuff, but I don't think I'll have to

San Francisco (408) 737-7777 • Dallas (214) 641-0024 • New York (201) 767-3601 • Chicago (312) 885-8383 • Denver (303) 825-6568

"If we don't have the computer supplies you need, I will eat this catalog."

Bob Sharkey
General Manager, Manufacturing Operations

eat a catalog sandwich.

"Call my bluff. Next time you have a problem getting what you need, call Inmac. We give you a sure-fire guarantee on anything you buy from us. You have 45 days to decide that you're fully satisfied. If you're not, we'll give you a replacement, refund or credit. And no hassle.

"We'll give you fast delivery. We have regional distribution centers, so we can deliver to over 90% of the computer sites in the U.S. within two days—by regular surface transportation. Or if you need it tomorrow, we'll get it to you tomorrow.

"Call us. Ask for our free catalog. Better yet, give us an order. All we need is your company P.O. number. Our hotline numbers are listed below."

Inmac

Computer supplies, accessories and cables. More. Better. Faster.

Detroit (313) 961-6865 • Los Angeles (213) 852-0973 • Wash. D.C. (202) 362-0214 • Boston (617) 536-9141 • Manchester, U.K. 92-35-67551

CIRCLE NO. 25 ON INQUIRY CARD

X3T9.3/143 revision 5 ANSI interface. On the other side, it sees a number of commonly used interface standards, including the storage module drive (SMD) lines found on older 3330-technology removable-pack devices and on some newer Winchester drives, and a GPIB instrumentation bus.

Direct connections to several tape backup devices, including ¼-in. cartridge drives and Cipher Data Products' ½-in. streaming tape are also available through the formatter. As a result, the formatter will function as a back-end processor—another first for an 8-in. device, Matthews notes.

The formatter requires a minimum of four cards—CPU, memory, communications port to link to the host adapter and a storage port to link to the drive. An additional card is required for the connection to a Cipher drive; two cards for an SMD interface. As many as four Ontrax drives—eight logical devices—can be handled per ANSI port.

With the actuator and the formatter, the company can dispense with the conventional analog servo data required to position the read/write heads over the center of the track in drives with track densities exceeding 300 tpi.

Instead, Ontrax uses embedded digital servo information written onto the disk in the form of illegal MFM codes. By counting timing pulses whenever a burst of this servo data appears, the formatter can calculate which servo pattern is being used, and hence which track is under the read/write head.

Use of digital servo information eliminates the need for a $100,000 servo writer, Matthews says. "The drive writes its own servo information. The actuator lays down track 00 and the eight servo bursts needed to identify it, thus initializing the media." The actuator then moves to track 01 and repeats the process, and so on, says Matthews.

Since the drive writes its own servo information, system reliability increases, Matthews adds. "In the past, if embedded servo information was accidentally written over, the only solution was to send the drive back to the factory." With the Ontrax drive, however, servo information can be reconstructed in the field. "The formatter contains the necessary software routines to do this as a standard feature," Matthews says. "In worst-case situations, the data could be downloaded to the drive via an RS232 port."

The model 136 is aimed at minicomputer manufacturers and large-scale systems houses, and is designed so that two drives can be mounted side-by-side in a 19-in. retma rack. The drive operates at an average access time of 25 msec.—making it one of the fastest 8-in. devices to hit the OEM market so far. Track-to-track time is 8 msec.

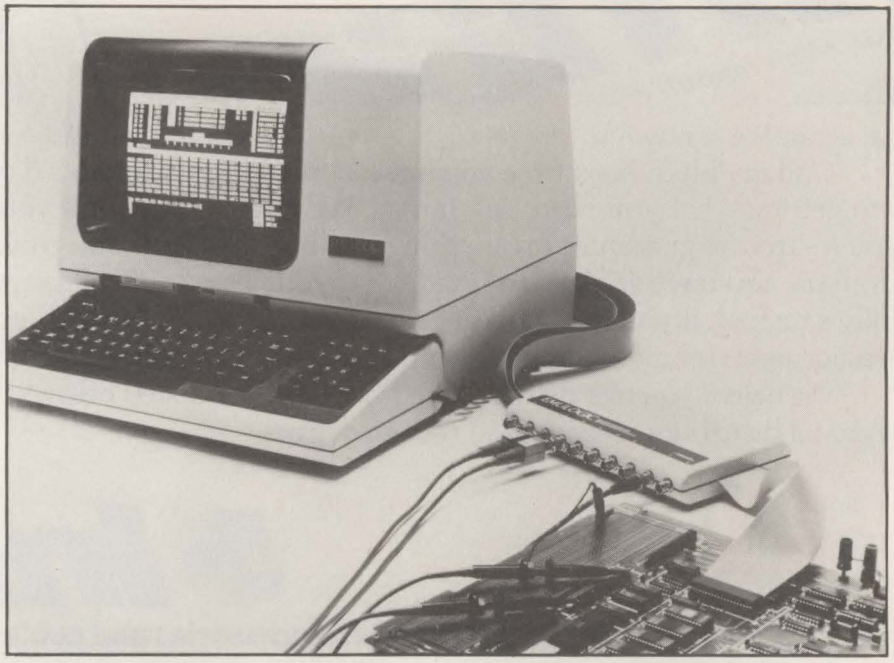
Ontrax's new offering will be available in two additional 8-in. versions, the two-disk, 34M-byte model 34 and the three-disk, 68M-byte model 68. Deliveries of evaluation units are set to start next month, with production slated for the third quarter of this year.

—John Trifari

Tiny Emulogic takes on giants in development systems

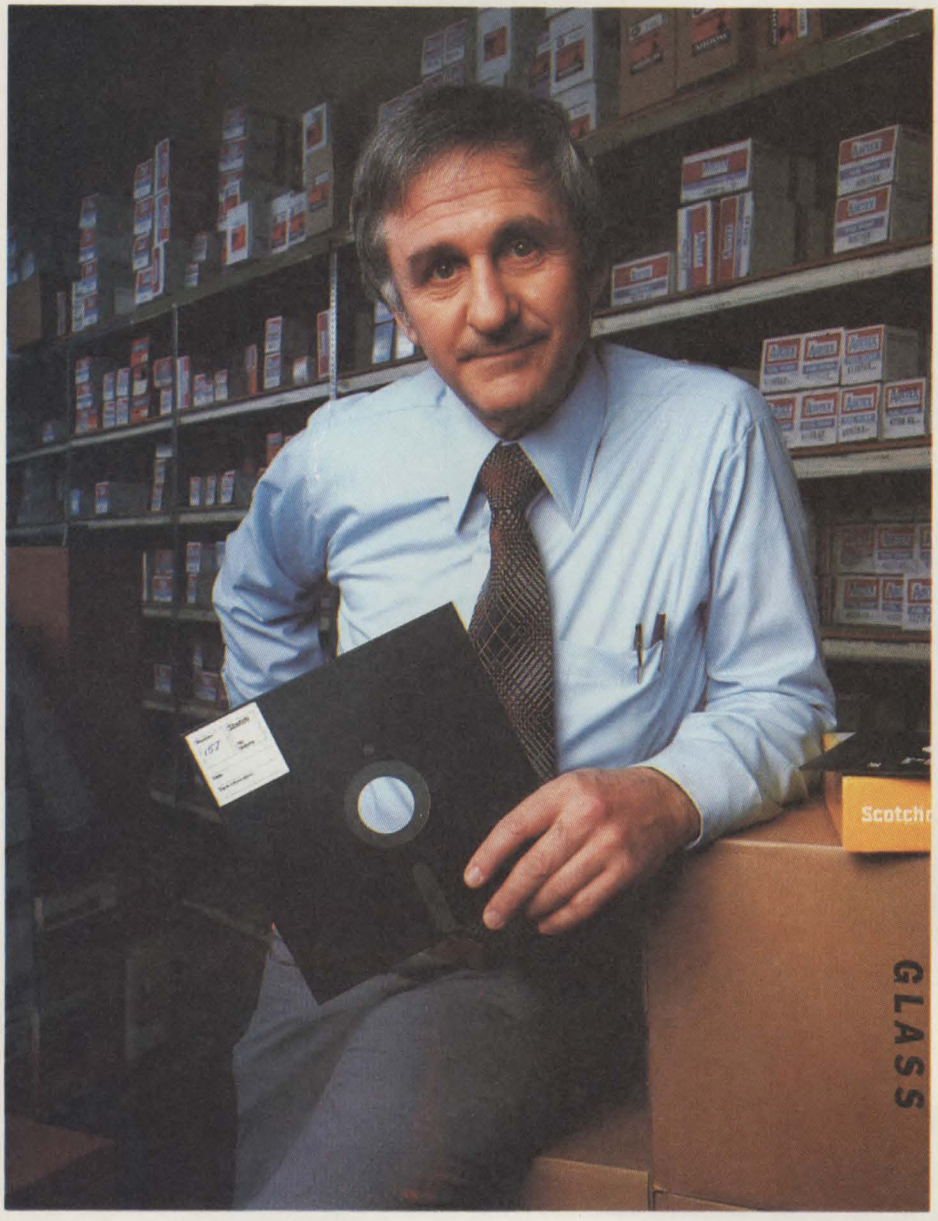
The burgeoning universal μc development system market has attracted such giants of the instrument business as Tektronix, Hewlett-Packard and GenRad. But such competition does not frighten "the newest kid on the block," Emulogic, Inc., even though its resources are puny in comparison. "We want to become recognized as a fourth among the leaders in the business," says Bob Smith, Emulogic president.

The Westwood, Mass., company,



The Emulogic ECL-3211 *is a 30-MHz universal emulation system that can operate as a stand-alone system or in a network with 64 stations controlled by a large host computer.*

"Our inventory is our existence. Think we'd trust it to anything less than Scotch® Brand Diskettes?"



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

Scotch Diskettes are the diskettes you can depend upon with the information *your* business depends upon.

Each one is tested and certified error-free before it leaves our factory. Because we know nothing less than perfection is acceptable for *your* vital business data.

Scotch Diskettes are available in regular or mini sizes, compatible with almost any system.

To find out where you can purchase Scotch Diskettes, call toll free: 800-328-1300. (In Minnesota, call collect: 612-736-9625.) Ask for the Data Recording Products Division. In Canada, write 3M Canada Inc., London, Ontario, N6A 4T1.

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

3M Hears You...

3M

CIRCLE NO. 26 ON INQUIRY CARD

For letters and reports that really matter, you can't beat our D-50. With its superfast hammer and a resolution twice as fine as other daisy wheel printers (over 11,000 points per square inch), the D-50 prints the sharpest characters and clearest graphics in the business.

It's available in KSR (Keyboard/Send/Receive) terminal and RO (Receive Only) printer and terminal models.

Minimum maintenance, maximum productivity.

Thanks to a simplified printing mechanism, the D-50 is extremely reliable. It's designed to operate without adjustments, lubrication or preventive maintenance (other than routine cleaning).

The D-50 features long lasting reel to reel ribbon. You can complete lengthy jobs without an operator having to change it.

You'll save on ribbon replacement costs, too.

We have your type.

The D-50 uses standard 96 character plastic daisy wheels. They're available in a wide range of type styles, including international sets.

The print wheel motor tilts so you can change the wheel quickly, without removing the ribbon.

Dataproducts' Daisy Wheel Printer. When you have to make the best impression.

GREAT MOMEN

A name you can trust.

Dataproducts is the world's largest independent printer manufacturer. For over 18 years, we've built printers for the biggest OEMs in the business, putting their names on our machines. These customers make sure our printers live up to some pretty tough standards.

30 day delivery.

Often we can deliver a partial order even faster. If time is a problem, give us a call.

We're ready to help.

We'd love to show you how D-50 Daisy Wheel Printers and Terminals can help you look sharp with your customers. Call for more information. Or write our Marketing Department at 6200 Canoga Avenue, Woodland Hills, CA 91365. Telephone: (213) 887-8451

Toll Free—Calif. (800) 272-3900 ext. 201
Rest of U.S. (800) 423-2915 ext. 201
European Marketing Headquarters:
Neu Isenburg (Frankfurt), West Germany
Tel: 06102 3201

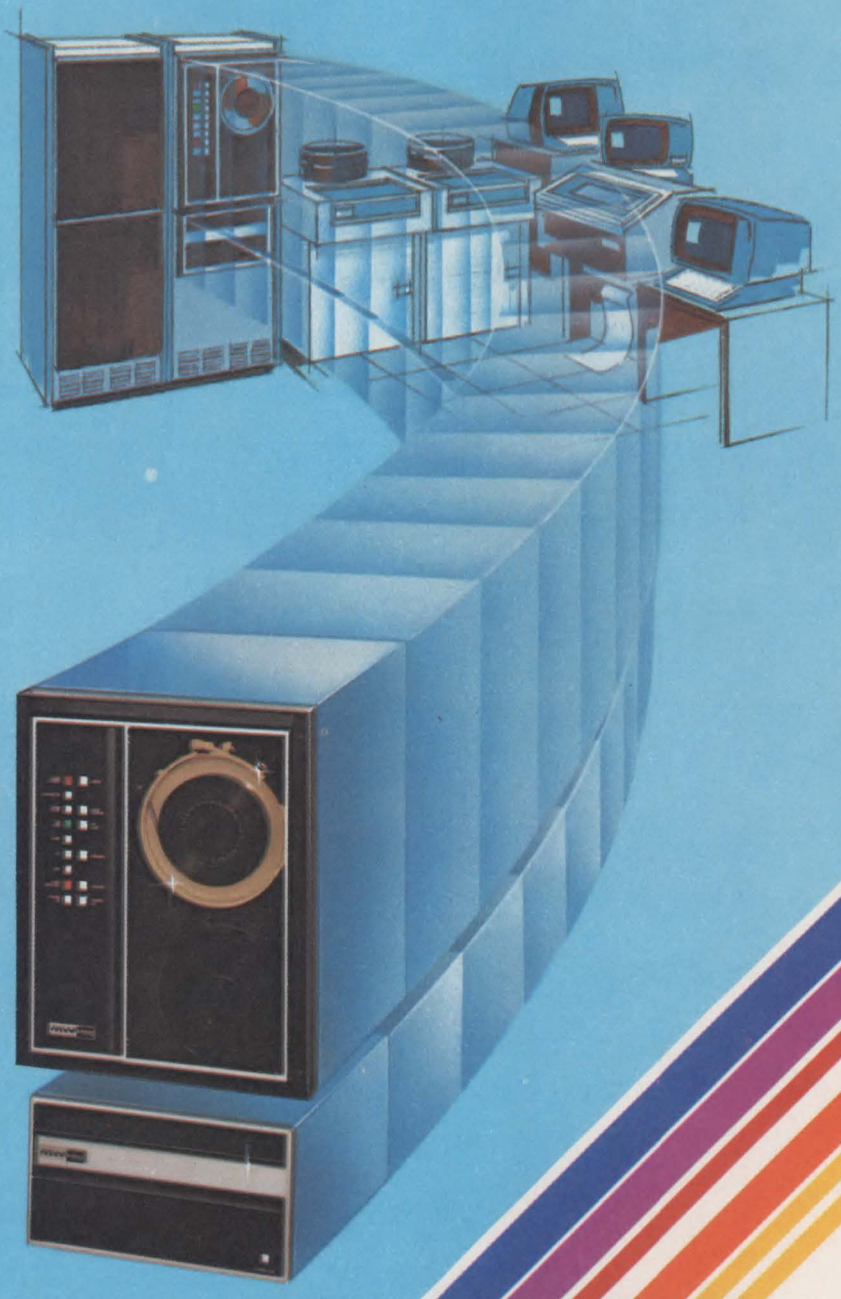
Dataproducts

TS IN PRINTING

CIRCLE NO. 27 ON INQUIRY CARD

TELEX GCR: STANDS OUT...AND FITS IN.

Outstanding field-proven subsystems to fit your high-performance needs.



TELEX GCR Tape Subsystems *stand out* as the most proven, high performance rack-mountable GCR units available today. Field proven in demanding seismic operation. Compatibility proven in IBM plug-compatible applications. Versatility proven in super-minicomputer environments.

Enhance your high performance computing system with high performance peripherals. Select the TELEX 6200 family. Available in 6253 (6250/1600/800 bpi), 6250 (6250/1600 bpi) and 6240 (1600/800 bpi) tape drives and tri-density 6850 formatters. Tape speeds of 50, 75 and 125-IPS available.

TELEX GCR subsystems *fit in* with your high performance computer system. Already interfaced to sixteen different CPU's. TELEX Engineering assisted with these interface developments to provide reliable operation and customized features. And we stand ready to assist you in making TELEX subsystems fit into your computer system.

With more than 2,000 units shipped — a majority for high-speed 125-IPS operation and a large number with tri-density capability — TELEX GCR offers field maturity, versatility, and integratability.

For more information, contact the nearest TELEX OEM Sales Office listed below or phone our OEM Marketing Department in Tulsa at (918) 627-1111.

The innovation continues... **TELEX®**

Telex Computer Products, Inc.
Terminals/Peripherals/Systems/OEM Products

6422 East 41st Street/Tulsa, OK 74135/(918) 627-1111
Nashua, NH (603) 880-6252 • Needham, MA (617) 449-1703
Southfield, MI (313) 352-2720 • Garden Grove, CA (213) 594-4513
Dallas, TX (214) 233-5744 • Houston, TX (713) 771-3504

however, has only 10 employees, no manufacturing facilities, and uses the home of one of it co-founders as a development laboratory.

So, the company has decided to adopt a value-added strategy, concentrating on the function that it considers most important in a development system—emulation—and adding that function to an existing minicomputer system.

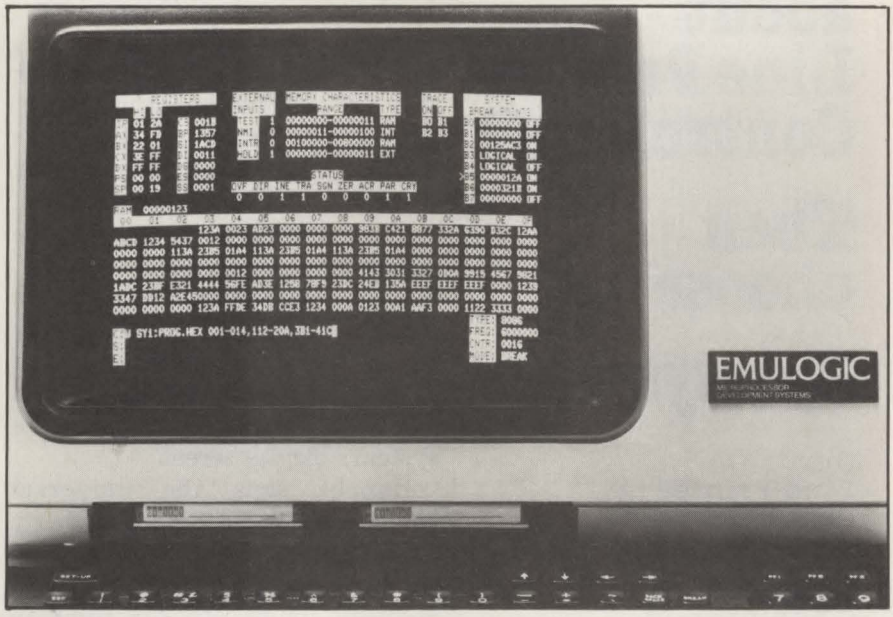
That strategy is reflected in the company's initial product—the EC1-3211 universal development system introduced last July. The system essentially is a DEC LSI-11 floppy-disk system to which Emulogic has added a high-performance universal μp emulator.

The principal advantage of the Emulogic system is that it won't become obsolete with the introduction of new μps, says Smith. Its bus width (32 bits) and emulation speed (30 MHz) enable it to handle any μp on the market as well as the 32-bit μps on the drawing boards at major semiconductor manufacturers.

The system's emulation speed is about twice as fast as that of any universal development system on the market, Smith claims, and is almost three times the speed of the fastest general-purpose μp on the market—the Intel 8086.

The Emulogic system has sparked considerable interest—and skepticism—among the company's competitors. "I think they're naive in believing they can do all the things they say they can," says Sam E. Lee, product line manager for Hewlett-Packard Co.'s model 64000 universal development system.

Lee's doubts are based on his experience with the H-P 64000 (MMS, September, 1979, p. 90). For one thing, he says the company has encountered unforeseen technical problems with each new processor it has emulated. Moreover, he says the company orginally intended to base the 64000 on a universal emulator, but discarded the approach as too risky. "We knew we could emulate any processor's instruction set, but we weren't sure that we could handle any bus arbitration or I/O scheme," Lee explains.



The Emulogic ECL-3211 *includes a smooth-scrolling, full-screen display that enables a user to examine register status, external input status, memory map and other information.*

However, Emulogic remains confident. "We haven't seen or heard of any chips that we can't handle," says Victor Bennet, another Emulogic co-founder, whose home in the New England fishing port of Gloucester, Mass., serves as Emulogic's development lab.

Bennet says the company was able to achieve the very high emulation speed by using high-speed (35-nsec.) RAM emulation memory and by looking up critical parameters in tables instead of calculating them on the fly, as other development systems do. The table lookup approach increases the amount of memory required by the emulator—and so adds to its price—but it substantially reduces the time spent obtaining critical operating parameters, Bennet points out.

Another advantage of the Emulogic system, Smith says, is the speed and economy with which the system can be expanded to support new μps as they become available. Smith claims that Emulogic can develop support for an additional μp in 30 days at a price of about $1500 per chip family. In contrast, he says it takes other universal development system vendors as long as a year to create new emulators, and those emulators typically sell for $2500 to $5000.

The system supports the Intel 8048 and 8086 μp families, and the company plans to add other chip families at a rate of two a month, with the order of introduction being determined by customer requests.

Bennet attributes Emulogic's ability to add support for chips quickly and economically to the emulator's design. Unlike other manufacturers, who design emulators from scratch for each new chip family, Emulogic has designed a universal emulator, which the company can tailor to any specific processor simply by changing its microcode and adding simple interface circuitry. The interface circuitry is contained in a pod that plugs into the system to be tested.

In addition to the universal emulator, Emulogic has also

Choosy about Line Printer Controllers?

Then choose us.

Datasystems.

Our Line Printer Controllers are fully compatible with **DEC Data General or IBM Series/1 computers**

And our unique SELF TEST feature allows you to verify controller, cable and printer operations.

With 12 months warranty, next day delivery and engineering consultation on call, Datasystems is your best choice.

Call (714) 566-5500 or write for more information

DATASYSTEMS
We make the difference

8716 Production Ave., San Diego, CA 92121

CIRCLE NO. 29 ON INQUIRY CARD

developed a universal assembler, based on DEC's RT-11 assembler, and a universal screen formatter that also help the company support a new processor quickly. For example, to create an assembler for a specific processor, Bennet says, the company has to change only the assembler's three lookup tables. Similarly, developing a display for a particular processor involves only telling the screen formatter what parameters should be displayed and where they should be located on the system's display screen.

Bennet says the universal emulator took two years and nearly $1 million to develop. "We went through every μp on the market and reduced them to a common denominator," Bennet says. The company then built an emulator to emulate that idealized μp, implementing much of the emulator in microcode to allow it to be quickly and inexpensively tailored to a particular μp.

Emulogic's strategy of basing its system on a high-performance universal emulator carries a price. "The emulator is very expensive," concedes Bennet. The emulator's price is reflected in the price of the Emulogic system—$24,000 for a basic development station that includes a display, a dual floppy-disk drive, an emulator and an adapter for one chip family.

Still, the Emulogic system is competitive with other high-end universal systems. For example, a comparable H-P 64000 development system sells for $30,000 with a hard-disk drive and cartridge tape.

Critics of the Emulogic approach point out that a user is paying for an emulation capability that he may never need. "It's a valid point," admits Smith. But, "Our policy is that a customer should make his major investment in the initial system, and then be able to add support at a low incremental price. We believe that adding additional chip support to a universal system should be as easy and inexpensive as adding software."

Another potential disadvantage of the Emulogic system is its lack of high-level language translators. Other universal system vendors all offer such translators. Smith concedes that the lack of high-level translators is a "soft spot" in the system, but he points out that translators are available from independent software houses, and he is compiling a list of such firms for customers who require high-level language support. In addition, he is exploring the possibility of offering the UNIX operating system with the Emulogic system because there are numerous compilers available for translating UNIX's high-level language, C, into the machine languages of μps.

Because of its advanced features, Emulogic's universal system is aimed at sophisticated users. "We see our typical customer as a designer who already has owned at least one development system, and so knows what he wants," Smith says. Those advanced features include as many as eight breakpoints that can be concatenated to create complex debugging sequences, a 512 × 72 bit trace memory able to take snapshots of a system both before and after an event, the ability to emulate multiple μps simultaneously, the ability to vary a μp's speed from the system keyboard and a display that shows all the information required to monitor a system under test.

Although Emulogic announced the system in July, it did not begin accepting orders until December, Smith says, adding that the company has received more than 2000 inquiries concerning the system since its announcement. Emulogic plans to market the system through manufacturers representatives. The company has signed nine representatives and plans to add more, Smith says.

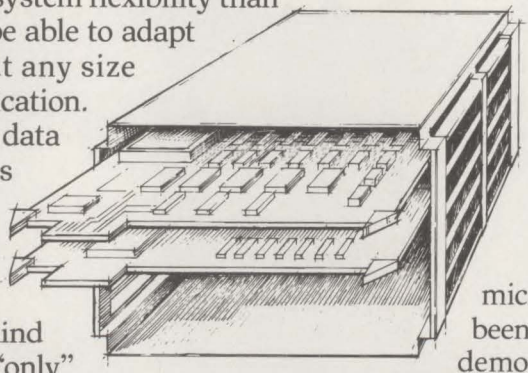
—Paul Kinnucan

Hewlett-Packard announces another small breakthrough.

The two-board, 1/2 megabyte microcomputer.

Our HP 1000 L-Series now offers state-of-the-art 64K RAMs. They're the reason we've been able to put 512 kilobytes of memory on just one 6¾" x 11" board.

With the CPU on the other board, the L-Series opens a whole new dimension in microcomputers. Because with so much memory in so little space, you have more system flexibility than ever before. In fact, you'll be able to adapt the L-Series for just about any size job—and any kind of application. Including communications, data management and process control.



Big software for small hardware.

You may have to remind yourself that the L-Series is "only" a microcomputer. With powerful software features like our multi-programming, multi-user RTE operating system and language support that includes Assembler, FORTRAN 4X, BASIC and PASCAL, there's almost no limit to the high performance products you can build. Especially if you take advantage of our proven data base management system and networking software—also upwardly compatible throughout the entire HP 1000 line.

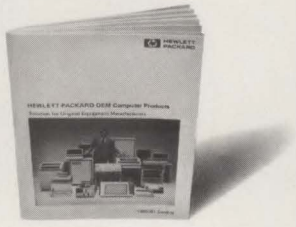
Multiple I/O processors, too.

The L-Series is designed with an innovative distributed intelligence architecture that assigns I/O traffic to separate processors located on each interface board. This means each I/O processor has its own direct memory channel—and direct access to the entire main memory. So you get exceptional I/O performance and greatly increased throughput.

Choose your configuration.

The HP 1000 L-Series comes in a wide range of board, box and system packages. Which means you'll be able to choose the configuration that's best for your application. Development units are available at $13,250* for the CPU and a full 1/2 megabyte of memory.

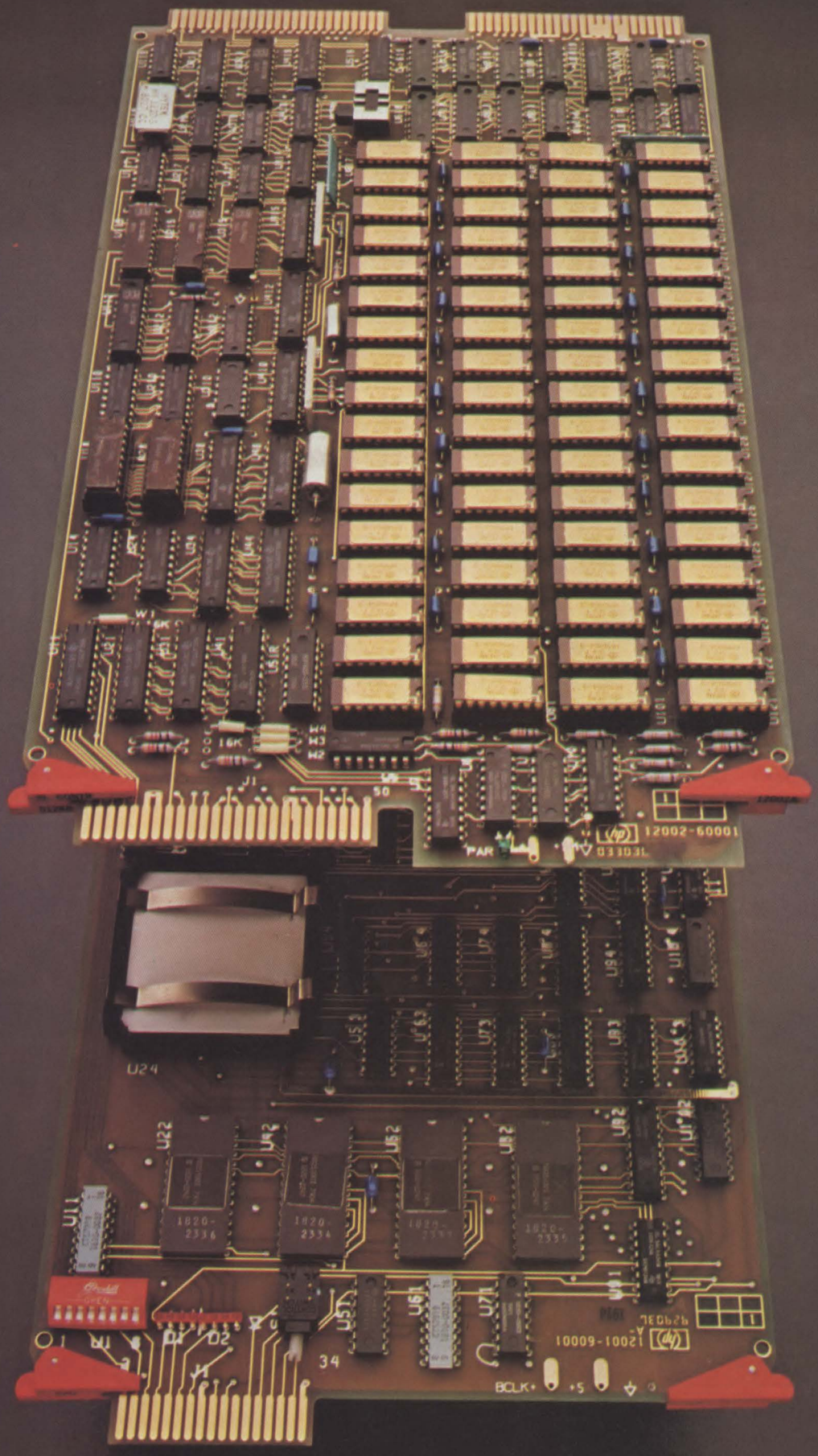
If a two-board, 1/2 megabyte microcomputer sounds like what you've been looking for, come in for a hands-on demonstration. Just call the nearest HP sales office listed in the White Pages. Or write for more information, and a copy of our new OEM catalog, to Hewlett-Packard, Attn: Joe Schoendorf, Dept. 886, 11000 Wolfe Rd., Cupertino, CA 95014.



HEWLETT PACKARD

*Price is U.S. list.

22007 HPDS41



CIRCLE NO. 30 ON INQUIRY CARD

We burned the midnight oil designing the Impact 912 printer.

From the beginning the name Documation has meant reliability in OEM products. Products that mean your nameplate goes on the most innovative peripherals available today.

Now the same state-of-the-art engineering technology and manufacturing excellence that revolutionized the card handling equipment industry are available to you in the new Documation IMPACT 912.

A 900/1200 line per minute OEM printer, designed & built for the original equipment market with the features and rugged dependability that have made Documation the leader in impact printer technology.

The IMPACT 912 means your engineering, manufacturing and delivery problems are taken care of. We've done that for you, by doing what we do best — making you look good.

So you can leave by 5.

IMPACT 912

DOCUMATION

P.O. Box 1240, Melbourne, Florida 32901
(305) 725-5500 TWX:510 959 6286

CIRCLE NO. 31 ON INQUIRY CARD

STAFF

Vice President/Publisher
S. Henry Sacks

Editor-in-chief
Lawrence J. Curran

West Coast Editor
John Trifari

Senior Editor
Paul Kinnucan, News

Executive Editor
Alan R. Kaplan

Managing Editor
Peter P. Hayhow

Associate Editors
Michael Riggs
Lori Valigra

Associate West Coast Editor
Larry Lettieri

Copy Editor
Frances T. Granville

Editorial Assistant
Nancy Love

Editorial Secretaries
Rose Ann Secondino
Kathie J. Doonan

Art Director
Ralph Stello, Jr.

Staff Artist
Ann Bartolotti

CONTRIBUTING EDITORS

Product Profile
Malcolm L. Stiefel

Data Communications
Walter A. Levy

Executive Vice President
and Group Publisher
H. Victor Drumm

Group Editorial Director
Roy Forsberg

Director of Graphics
Lee Addington

Vice President
of Production
Wayne Hulitzky

Production Supervisor
William Tomaselli

Production Manager
Susie Pratt

Assistant to the Publisher
Linda L. Lovett

Circulation Director
Michael Tucker

Director of Marketing
Richard B. Dalrymple

Promotion Manager
Susan Rapaport

Editorial Offices

Boston: 221 Columbus Ave.
Boston, MA 02116
(617) 536-7780
Paul Kinnucan

Los Angeles: 5670 Wilshire Blvd.
Los Angeles, CA 90036
(213) 933-9525
John Trifari

San Jose: Sherman Bldg., 1 Suite 1000
3031 Tisch Way
San Jose, CA 95128
(408) 296-0868
Larry Lettieri

Back issues of Mini-Micro Systems are available on microfilm. Contact University Micro-films, 300 North Zeeb Rd., Ann Arbor, MI 48106 for ordering information.

Reprints of Mini-Micro Systems articles are available on a custom printing basis at reasonable prices in quantities of 500 or more. For an exact quote contact Art Lehmann, Cahners Reprint Service, 5 So. Wabash, Chicago, IL 60603 (312) 372-6880.

Stamping out computerphobia

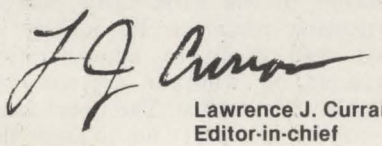
Despite the widespread acceptance of computers as essential tools of business, resistance to their use is not evaporating. There are still those who may sabotage the hardware because they feel alienated or threatened by its presence. Computerphobia may even be getting stronger as the age of technology progresses, and people's feelings heighten that they are less important than machines. But computerphobia can be softened by more humanistic marketing on the part of computer vendors, and by more concern about a system's impact on the part of management at the potential user organization.

Computerphobia can take a variety of forms. An article in a recent issue of *Discover*, Time Inc.,'s news magazine of science, mentions reactions ranging from phobic executives at potential user organizations "who will always conclude that, alas, there is some impediment" to installing a computer to the repeated outright sabotage of a CRT terminal by a hospital technician. Upon discovery, the technician pined that she wanted to work with people, not with computers. In the article, Jeffrey Meldman, associate professor at MIT's Sloan School of Management, points out that such reactions to a computer's presence show that employers must convince workers that computers make their work easier.

That's a message worth remembering for computer manufacturers and users alike. But vendors should make special efforts toward creating a climate of acceptance for the systems their sales forces hope to install long before the systems go in. Manufacturers of word-processing systems have done a good job of considering the user by making their systems more "friendly" toward operators—with anti-glare CRT screens, human-engineered keyboards and spelling dictionaries.

Computerphobia can be neutralized by vendors inviting potential users to thoroughly sample the hardware well before it's installed. The president of an electronic banking system supplier in Atlanta encourages his client banks to set up dummy systems for trials by customers so that the customers can overcome their fear of making mistakes with an automated teller.

There's still a lot of hard work to be done in that direction before computerphobes become extinct, as John Leo, the writer of the *Discover* article envisions. He concludes that eventually, "Everyone will accept computers, because there is no alternative." A marketing plan that neutralizes the perceived threat of computers will surely hasten that day.



Lawrence J. Curran
Editor-in-chief

Letters

MORE ON TAXATION

To the editor:

Bob Sherin's comments, as reprinted in the October editorial ("On software taxation" MMS, October, 1980, p. 75), have much to commend them as a concept. Unfortunately, his interpretation of Massachusetts law does not fully support his position.

The tax law under which the cases about which he wrote exempts corporations that are "engaged in manufacturing" from certain local property taxes. First Data Corp., a timesharing company, argued that it was a manufacturer (of information), and its hardware (not software) was exempt from taxation. The Appellate Tax Board did rely on a 1905 case involving a news bulletin, a 1947 case involving telephone equipment and Kentucky and Arizona cases involving television and broadcasting equipment, all denying such a tax exemption; the board said, "Whether the information is printed on computer printouts or contained on magnetic tapes, it is still information or knowledge. The Board does not believe that this information or knowledge is the character and kind of manufactured product envisioned by the statutes in question."

On appeal, the Massachusetts Supreme Judicial Court affirmed the decision, but did not, as Mr. Sherin indicated, hold "that data processing is a service that falls within the intangible classification." Rather, it noted that the statute had been passed in depression times to encourage the mills and factories that were falling into decline, and cited again the decisions relied on by the Appellate Tax Board. It specifically disagreed with Minnesota decisions holding that computer hardware, including an optical scanner, did produce a "marketable product" and was therefore exempt in that state from personal property taxes.

Exemption from taxation is a matter of legislative grace. The burden is upon the taxpayer to prove it is within the exemption. There are good arguments to be made that software is intangible, but court decisions holding that a timesharing service is not manufacturing, and therefore its hardware is taxable, do not give much support to Mr. Sherin's argument.

The Supreme Judicial Court's closing comment in the First Data case is particularly pertinent. By analogy, it could well apply to administrative decisions on whether software is tangible or intangible. The Court said, "It may be poor policy not to assist the computer industry equally with industry, which happens to qualify as engaged in manufacturing; indeed, the statute may be anachronistic; but these are matters beyond our province." At the August hearing, I suggested to the Revenue Department that because their authority is only to tax tangibles, and whether software is tangible or intangible is much disputed (court decisions have said intangible; tax collectors say tangible), the question should be settled by legislation.

Robert Bigelow
Attorney
Bigelow & Salzburg
Woburn, Mass.

ERGONOMIC CONCERNS

To the editor:

My attention was drawn to "CRT terminals ergonomics: a growing concern in CRT design" (MMS, November, 1980, p. 119). While the article touched on several important aspects of operator comfort, it did not mention the discomfort an operator wearing bifocal or trifocal eyeglasses feels when trying to read most CRT terminals.

The advertisement on p. 32 and p. 33, the ergonomic terminal from LSI, was encouraging, however. Some adjustment of the CRT is possible, and even more is possible when the monitor is detached. I want to see more of this.

David J. Gunn
SWS Data Manager
Interstate Electronics Corp.
Anaheim, Calif.

DATACOMM FEEDBACK

To the editor:

I enjoyed reading Carol Ogdin's fine article on front-end processors ("Microcomputers are supplanting front-end processors," MMS, October, 1980, p. 147). It provides an excellent explanation of a subject with which many engineers have problems.

I was, however, somewhat surprised that in the various mentions of LSI manufacturers that supply integrated circuits for data communications, Standard Microsystems Corp. never appeared.

Standard Microsystems is a leading supplier of MOS/LSI to the data-communications market. It was the first company to supply a receiver/transmitter for bisync and, more recently, the first supplier of an SDLC/HDLC/DDCMP multiprotocol receiver/transmitter, the COM 5025. The Signetics 2652 that was mentioned in your article is pin-compatible with the COM 5025, but was released many months later.

Brian Cayton
Marketing Manager
SMC Microsystems Corp.
Hauppauge, N.Y.

To the editor:

Carol Anne Ogdin's article is a timely and interesting discussion on the merits and problems of the EIA-RS449 Standard, but I found some errors that need to be corrected.

- Fig. 2 (p. 148) gives the impression that the bit elements of an ASCII communications character are not all of same length, which is misleading.
- In Fig. 2, and on p. 150, the statement should be: The subsequent X3.16 standard specifies that the seventh ASCII character bit is to be followed by an even-parity bit for asynchronous transmission, or an odd-parity bit for synchronous transmission.
- In Table 1 (p. 149), recommended maximum distance for RS423A should be 120, not 1200.
- On p. 149, a sentence reads, "The RS232C contains 10 new logical functions and related signal lines." It should read, "The RS449 set contains...

C.P. van Lidth de Jeude
Director of Engineering
North American Philips Corp.
Piscataway, N.J.

TIP OF THE ICEBERG

To the editor:

Conspicuous by their abscence, in an otherwise fine article on μc operating systems (MMS, October, 1980, p. 97), are the operating systems for the Radio Shack TRS-80 model I. Those operating systems are Radio Shack's TRSDOS, Apparat's NEWDOS80 and Virtual Technologies' VTOS 4.0. Given the number of TRS-80s sold, this "oversight" seems to be another example of industry professionals looking at only the tip of the iceberg. The small business and professional users of the TRS-80 are an ever-increasing market—one that the traditional data-processing industry ignores at its own risk.

When the world goes to μcs, a large percentage of those μcs will be TRS-80s. Let's not be enamored by technology. A successful product is more than the fastest chip or the fanciest software. Successful marketing, user-oriented education and support and "friendly" software are as important as, if not

Introducing

The OP-1/15

A Unique Low-Cost Display Computer

Announcing the latest addition to the highly successful OP-1 family of display computers ... the OP-1/15.

Designed as an intelligent user-programmable work station or low-cost standalone system, the OP-1/15 is housed in an attractive desk-top enclosure. Its advanced styling includes a modern, low profile keyboard and tiltable CRT display.

A large 15 inch display monitor provides 25 lines of crisp and clear character presentation. Sophisticated video enhancements such as reverse, blink, bold, underline and suppress are standard and under program control.

The OP-1/15 is compatible with Ontel's wide selection of software. It may be configured with up to 64K of RAM and 16K of PROM storage. Integral serial and parallel adapters provide communications capabilities for cluster operation with local printing.

Optional features include a matching dual mini-diskette console with DMA-based controller for more than a half-megabyte of local storage. Most standard Ontel peripheral controllers may be used as the high speed I/O port on the OP-1/15.

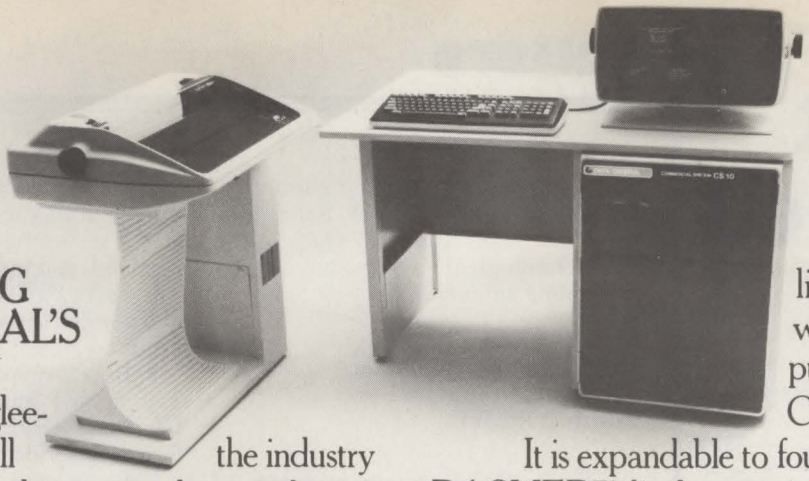
Contact me today for additional information including our very attractive pricing and delivery.

Douglas Wagner
National Sales Manager
Ontel Corporation
250 Crossways Park Drive
Woodbury, NY 11797
(516) 364-2121

CIRCLE NO. 32 ON INQUIRY CARD

THE FIRST COMPUTER DESIGNED SOLELY FOR THE PURPOSE OF BEING A FIRST COMPUTER.

CIRCLE NO. 33 ON INQUIRY CARD



INTRODUCING DATA GENERAL'S NEW CS/10.

It has been gleefully estimated by all the industry pundits that during the next twelve months somewhere in the neighborhood of 500,000 small businessmen will purchase their very first computer.

Isn't it ironic that, until now, there was no computer perfectly suited to this emerging market? In fact, the choice narrowed down to computers that were either too much, or too little, or weren't capable of expanding to accommodate any but the most stagnant of businesses.

Which is precisely why we at Data General engineered the new CS/10. While the CS/10 is eminently affordable (actually it's the lowest priced—$10,950 list—serious multi-terminal computer in America and features one of the most aggressive discount policies for industry suppliers and volume purchasers), it is designed to provide a surprisingly wide range of sophisticated functions with enormous possibilities for expansion.

Its technical specifications? A master-control console with a powerful 16-bit microcomputer, a large easy-to-read display screen, an alphanumeric keyboard (with a wide range of keyboards and printers available as options), two integral diskette systems with up to 2.4 million bytes of on-line data storage (the CS/10 has the ability to be upgraded to Winchester-type technology and 50 million bytes of on-line data storage) and interactive COBOL (ANSI 1974, level I specifications with some level II features implemented) which, aside from being the most widely used programming language, is also among the easiest to use—even for a comparative neophyte.

But beyond these features—which, we'd like to remind you, is where few small computers ever go—the CS/10 truly excels.

It is expandable to four interactive DASHER™ display terminals. Such innovative software tools as the Proxi™ program generator can be added to help you customize programming for practically peanuts and there's even an optional remote unit that enables you to diagnose problems from your desk or wherever you happen to be.

And perhaps the most significant competitive aspect of the CS/10 is that it isn't just one lonely machine. It is part of an entire family (CS/10 through 70) of program and data-compatible systems, which of course means that one modest CS/10 installation can easily burgeon into a 17-terminal CS/70 system (with an impressive number of peripherals).

And the software you develop for the CS/10 can be used in any further CS system you may grow into, up to the CS/70, so businesses needn't suffer undue financial hardships if they should become successful and grow.

If you'd care to know more about the new Data General CS/10—and, believe it or not, there's more to tell—simply fill out the coupon below and we'll be happy to inundate you with information.

Data General

Mail to: Data General Corporation
4400 Computer Drive, MS C228, Westboro, MA 01580

Attention: Marketing Communications Department

☐ Please send me free information on Data General computers.

☐ I'm in a rush. Please have a sales representative call on me.

Name _____

Title _____

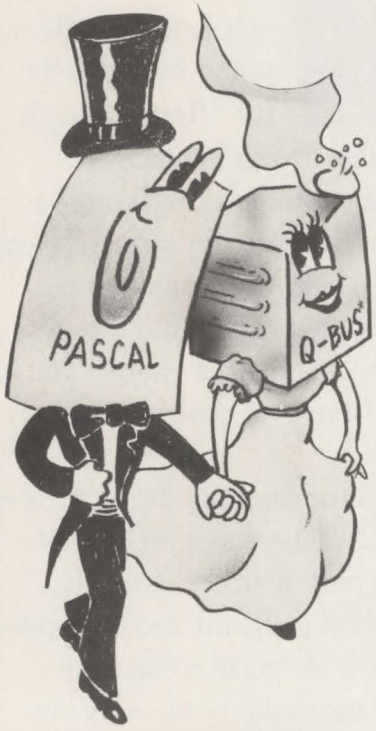
Company _____ Tel. _____

Address _____

City _____ State _____ Zip _____

MMS-1-81

Just Married



PASCAL + Q-BUS* WITH PDQ-3

That's right — Pascal and the Q-Bus* are finally together! The PDQ-3™ is here!

The PDQ-3 is a fully interrupt driven, 16 Bit stack computer with up to 256 KB of memory. The system features direct UCSD Pascal P-code execution with the UCSD certified operating system. Two floppy disks come as standard. The Q-Bus* allows a wide range of peripherals to be connected to the computer.

For more information call or write:

ADVANCED DIGITAL PRODUCTS

7584 Trade St.
San Diego, CA 92121
[714] 578-9595

*Trademark of Digital Equipment Corporation

CIRCLE NO. 34 ON INQUIRY CARD

Letters

more important than, technology. Marketing is how Radio Shack got where it is today. The other nontechnological factors have been adequately addressed by very few.

Rich Hanson
Small Business Computer Systems Group
Washington, D.C.

AN OPPOSING VIEWPOINT

To the editor:

I strongly disagree with the advice you gave in the November issue of *Mini-Micro Systems* ("Seconding the Ethernet motion," MMS, November, 1980, p. 73).

In promoting Ethernet, you overlook two severe cost penalties associated with its bus network. First, every terminal must be equipped with a buffered interface. Although this cost is not insignificant, it is trivial compared to the second penalty; the user has to install broadband transmission cables to interconnect equipment.

In supporting Ethernet, you point to the success of the general-purpose interface bus (GPIB) used in the instrument market. The big difference between the two is the size of the communication network required. GPIB uses a few short cables. Ethernet applications call for extensive coaxial cabling throughout a whole facility. Any user of IBM 3270 equipment will tell you how expensive that is to install, and, when moves occur, to administrate.

In nearly all cases, there is no need to install any cable for data communications within a facility or campus served by a common PABX. The existing telephone wires can carry data and telephone traffic simultaneously. Teltone's data carrier system (DCS-2) exploits the bandwidth of the telephone pair to carry both services.

Low-pass, passive L-C filters are used to isolate the telephone and PABX from the high frequencies used for data. These filters allow the telephone link to function normally, and prevent spurious, high-frequency transients from interfering with data transmission.

Frequency shift keying is used for data transmission. Frequencies of 36 and 40 KHz transmit data from the station unit to the termination circuit, and frequencies of 72 and 80 KHz are used in the reverse direction.

The system carries full-duplex data at any speed as high as 9600 bits per sec. and has an operating range of 17 dB maximum loss at 80 KHz; i.e., as long as 5000 ft. on a 26-gauge wire pair.

The cost savings of this approach are usually dramatic, because:

- Material costs are low (about $400 per line), and installation is simple.
- Users buy equipment as they need it. They don't have to pay now for future needs.
- Data terminal moves are simplified. The jumper move needed to transfer telephone service automatically transfers data service.

The network architecture of this approach and of the next generation of voice/data PABXs implies a Star configuration at the terminal level. The bus interface (the electronics associated with buffering, speed changing and protocols) is moved from the terminal to a central point. From the point of view of the CPU or network controller, the communication channel is an integral part of the data terminal.

A bus architecture is appropriate for small local systems, such as computer rooms or instrumentation centers, or for large, one-way broadcasts, such as cable television. It is not effective for distributed processing/intelligence.

Charles L. Anderson
President
Teltone Corp.
Kirkland, Wash.

MORE ON ORACLE

To the editor:

I found the article on the ORACLE data base management system (MMS, August, 1980, p. 111) well-researched and informative. However, I suspect that the LRU algorithm mentioned in the article refers to the "least recently used" replacement scheme popular in virtual memory managed operating systems, and not to "last record update."

Dan Razzell
Programmer
British Columbia Telephone Co.
British Columbia, Canada

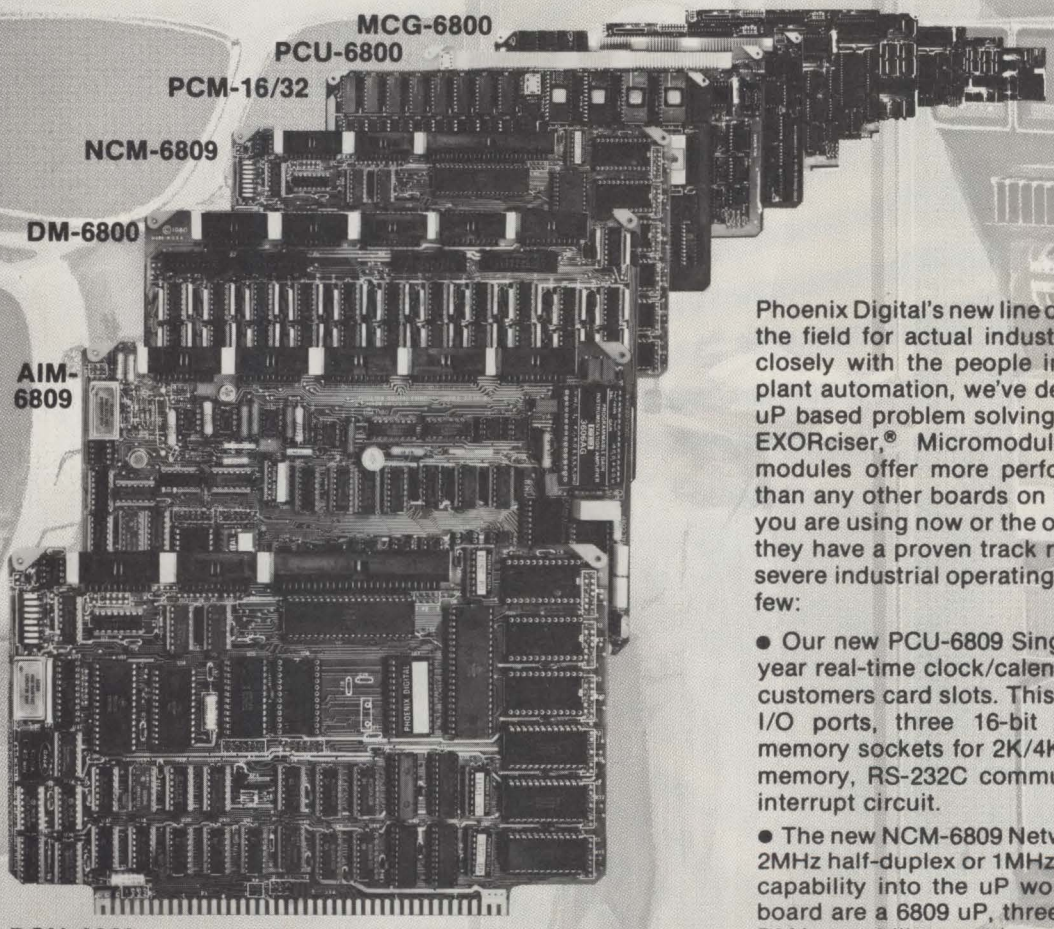
DISK SUPPLIER UPDATE

To the editor:

As an update on the new μc system unveiled by ADDS at Comdex ("Breakpoints," MMS, October, 1980, p. 8), Priam, rather than Shugart and Memorex, will supply the 14-in. Winchester disks.

Jan Fettin
Priam
San Jose, Calif.

New Microcomputer Solutions For Industrial Control



Phoenix Digital's new line of uP boards were developed in the field for actual industrial applications. By working closely with the people in the problem-filled world of plant automation, we've developed a broad spectrum of uP based problem solving solutions. We feel that these EXORciser,® Micromodule,™ or R65 bus compatible modules offer more performance and more economy than any other boards on the market--either the boards you are using now or the ones your thinking about. And, they have a proven track record of high performance in severe industrial operating environments. Here are just a few:

- Our new PCU-6809 Single Card Computer with its 4-year real-time clock/calendar is finding its way into our customers card slots. This card offers two 10-bit parallel I/O ports, three 16-bit programmable timers, eight memory sockets for 2K/4K/8K ROM and/or 1K/2K RAM memory, RS-232C communications port and a priority interrupt circuit.
- The new NCM-6809 Network Controller Module brings 2MHz half-duplex or 1MHz full duplex serial data transfer capability into the uP world. Also incorporated in this board are a 6809 uP, three 16-bit programmable timers, DMA capability, multiprotocol communications control handling HDLC, SDLC, DDCMP, and bi-sync protocol, and RS-232C communications port.
- The DM-6800/6809 Digital Modules through their four 6821 PIAs, provide nine 8-bit parallel ports. Working with the DTP-08 Digital Termination Panels, this module provides high level & low level interfacing.
- The AIM-6809 Analog Interface Module is an intelligent 6809 uP based high level/low level analog-to-digital converter module. This module provides 64 single-ended or 32 fully guarded differential input channels. It can be used as a stand-alone single card computer.

AND WE HAVE MORE! Try us and find out what high performance, fast delivery, service and economy really mean. If you are looking for more than boards, ask about our complete DPAC Series Plant Automation Computer Systems.

Call collect or write for complete information.

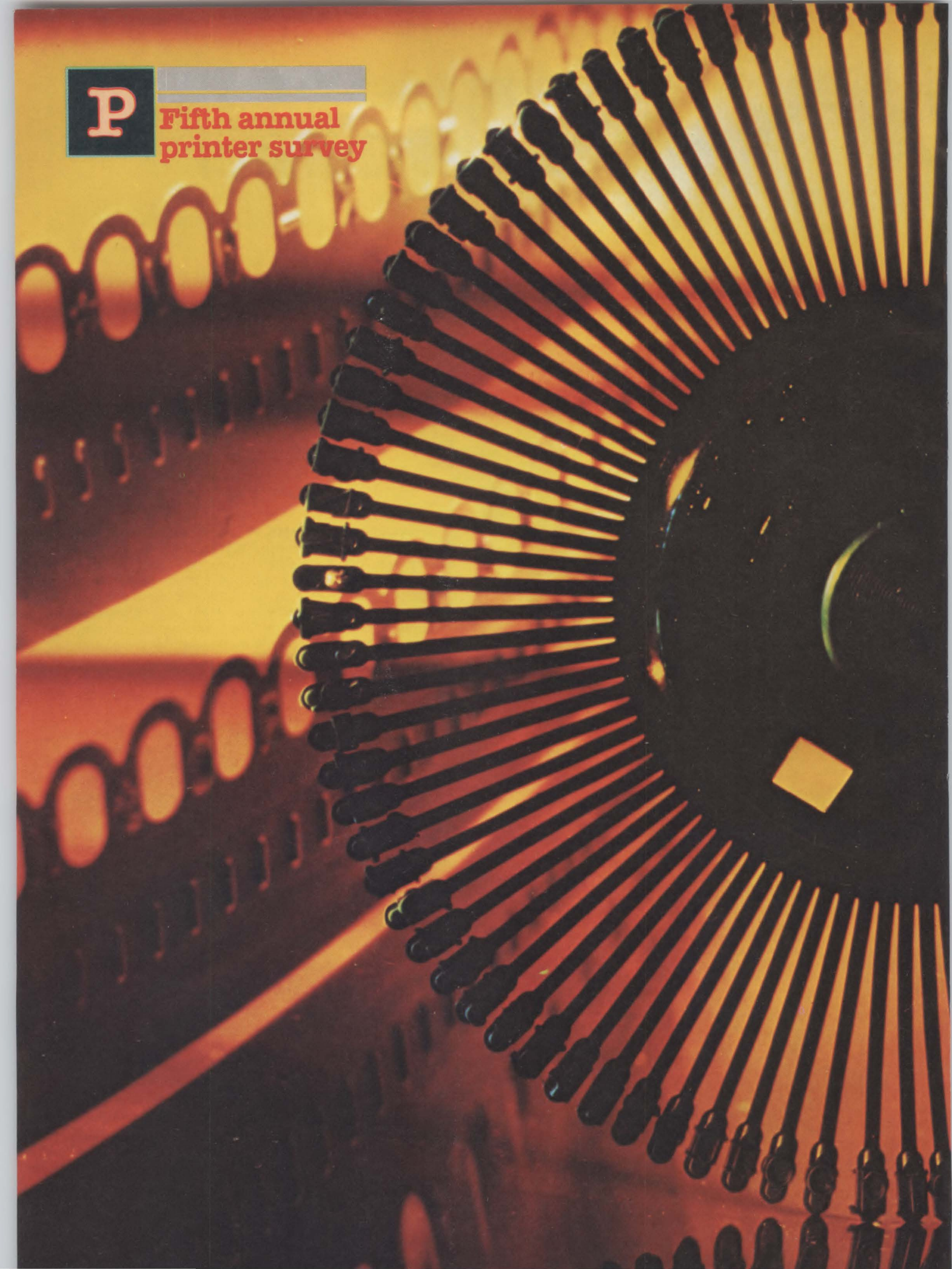
TM Motorola

phoenix digital corporation

3027 north 33rd drive / phoenix, arizona 85017
(602) 278-3591

"Industrial Solutions Thru Automation"

CIRCLE NO. 35 ON INQUIRY CARD


P
Fifth annual
printer survey

Line printers continue their impact

ANDREW ROMAN, Roman Associates International

Line-matrix technology gathers momentum, drum printers fade in a market that will top $2 billion in 1984 shipments

Serial printers have commanded the printer industry's center stage in the past year or more because of a boom in the μc-based systems in which they're used, and because their prices continue to move inexorably lower than $1000 toward $500. But all the hoopla in the serial world shouldn't obscure the fact that the market for line printers is thriving, fueled by a growing demand for high-speed minicomputers, high-end μc systems and larger mainframes. Indeed, shipments of line printers should exceed 341,000 units by 1984, more than double the number shipped last year. The dollar value of those 1984 shipments will top $2 billion, an increase of $780 million over 1980's total of $1.22 billion.

These other trends are emerging in the line printer market in the next few years:

- Of the three main market segments for line printers—OEM, plug-compatible and captive—the OEM segment is the fastest growing, at a compounded annual rate of 28 percent (Figs. 1, 2).
- Among the chief impact line-printer technologies, matrix-line printers will experience the greatest gain, showing a four-fold increase (Fig. 3).
- By 1984, considerably more printers on the market will be at a speed of 600 lines per min. than there are now. Shipments of 300-lpm printers will remain constant at a market share of about 50 percent, with 600-lpm units showing major gains over today's share of about 18 percent.
- Shipments of impact line printers with speeds faster than 2000 lpm will decline as non-impact devices using laser, electrostatic, xerographic and magnetic technologies make inroads into the market.

The impact line-printer industry is both technology- and market-driven. Today's band impact line printers are an integration of several disciplines, including semiconductor electronics, electromechanical components, communications, electrical and mechanical engineering and computer science.

A thrust toward lower-cost line printers is developing as a result of the decreasing costs of semiconductors, electromechanical and plastic components and technology and because of refinements in friction-free hammer design and fabrication. But the decreasing price of these components is offset by the steadily increasing cost of castings, mold design and tooling and other labor-intensive parts and subassemblies.

Impact line printers provide high-quality print copies at speeds from 100 lpm to more than 3000 lpm, good graphics resolution and flexibility, ease of interfacing to a host CPU via a standard interface, use of standard and readily available ribbons, paper forms and other consumables and a low total of cost of ownership.

The other half of the thrust leading to development of a separate low-cost line-printer segment results from market demand for low-cost alternatives to high-speed hard-copy output devices.

Impact line printers can be classified as a separate product category—a subset of a larger market that comprises impact serial and line printers, non-impact serial and line printers and teleprinters (keyboard printers, both impact and non-impact). Non-impact printers have been excluded from this review because they embody totally different technologies, and will be treated in a later issue.

The who's who

There are more than 25 manufacturers of impact line printers, approximately 12 of whom have recently announced or soon will announce new products. Some 20 of these also manufacture other types of serial and

Photo courtesy of Dataproducts Corp.

A thrust toward lower-cost line printers is developing as a result of decreasing costs of semiconductors, electromechanical and plastic components and technology.

line printers (Table 1). The oldest name in the impact line printer business is IBM; the newest, and one of the most successful entrants, is Printronix, Inc. Printronix was founded and established in 1975, shipped its first production units in 1976, and in less than five years has captured second place in the market, behind independent market leader Dataproducts Corp.

But before Printronix could make its move, the company had to overcome the barriers to entering this market: the need for substantial capital investment, the pressure for a new low-cost printing technique and, most of all, the requirement for a field sales organization. There are still market opportunities for those who can foot the bill, are well capitalized and have staying power, but new entrants into this highly competitive market will probably come from multinational companies, such as Fujitsu, Hitachi and Siemens.

The number of line printer manufacturers is not expected to grow or shrink more than 10 percent in the next few years. There will be consolidations, acquisitions and mergers. Existing manufacturers are expected to announce product line expansions, along with a move toward offshore plant expansion in Ireland, Puerto Rico, Scotland and Mexico.

The industry structure

The market is characterized by several levels of competition, which differ at the OEM and end-user levels. At the top of the OEM impact line-printer industry are the independent manufacturers, with the bottom of the chart occupied by end users (Fig. 5). The vast area between is classified as the OEM market, but in reality, it is a series of distribution channels. These OEMs range from true systems houses to stocking distributors, dealers, retailers and mail-order systems houses.

The term OEM is relative, depending on where one is positioned in this chart, but it still stands for original equipment manufacturer. Some line printer manufacturers sell mechanical subassemblies, without any electronics, to other printer manufacturers, who then mate the necessary control and interface electronics, power supply and cabinetry for sale to an end user. Examples of this practice include Dataproducts to Decision Data Corp., CDC to Telex, and Dataprinter to Memorex.

The greatest growth in the line printer industry will come through distribution channels and independent sales organization channels. There are an estimated 30 of these value-added integrators who buy the printer in larger quantities from a printer manufacturer, add value by way of interfacing, sales, service and marketing, and re-sell to an end user at a profit.

And while the OEM "agglomorate," including distributors and ISOs, will account for the greatest growth among market segments, the emerging technology of the early 1980s appears to be line-matrix. Band and belt printers will still dominate the market in 1984, with a 76 percent share, but the line-matrix segment will surge ahead from 13 percent to 23 percent—at the expense of drum technology, which will plummet from a 20 percent share to less than 1 percent (Fig. 3).

The chief differences between serial printers and line

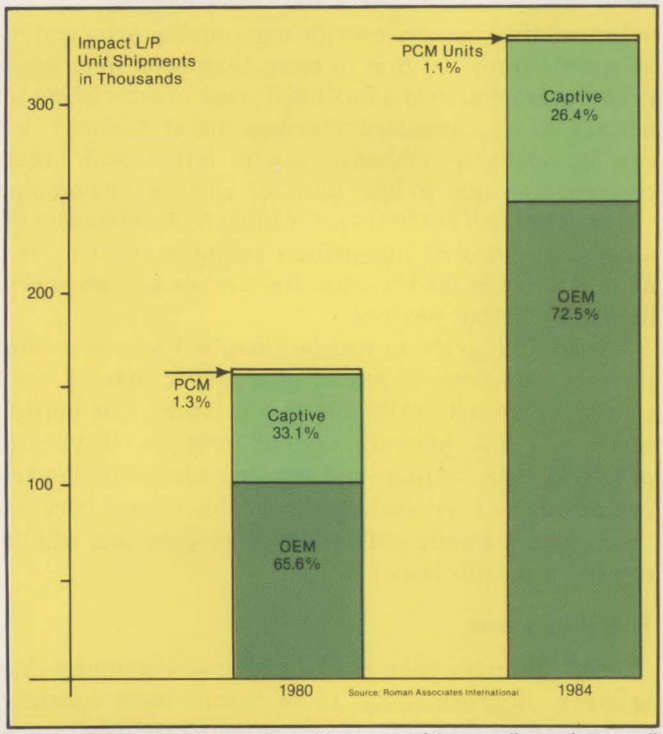


Fig. 1. Forecast shows *that shipments of impact line printers will exceed 341,000 units by 1984, more than double 1980 shipments.*

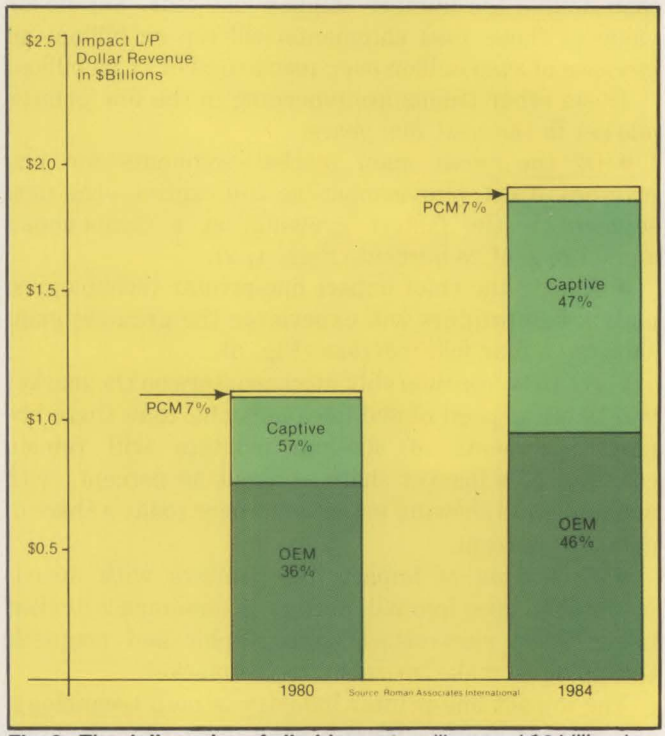
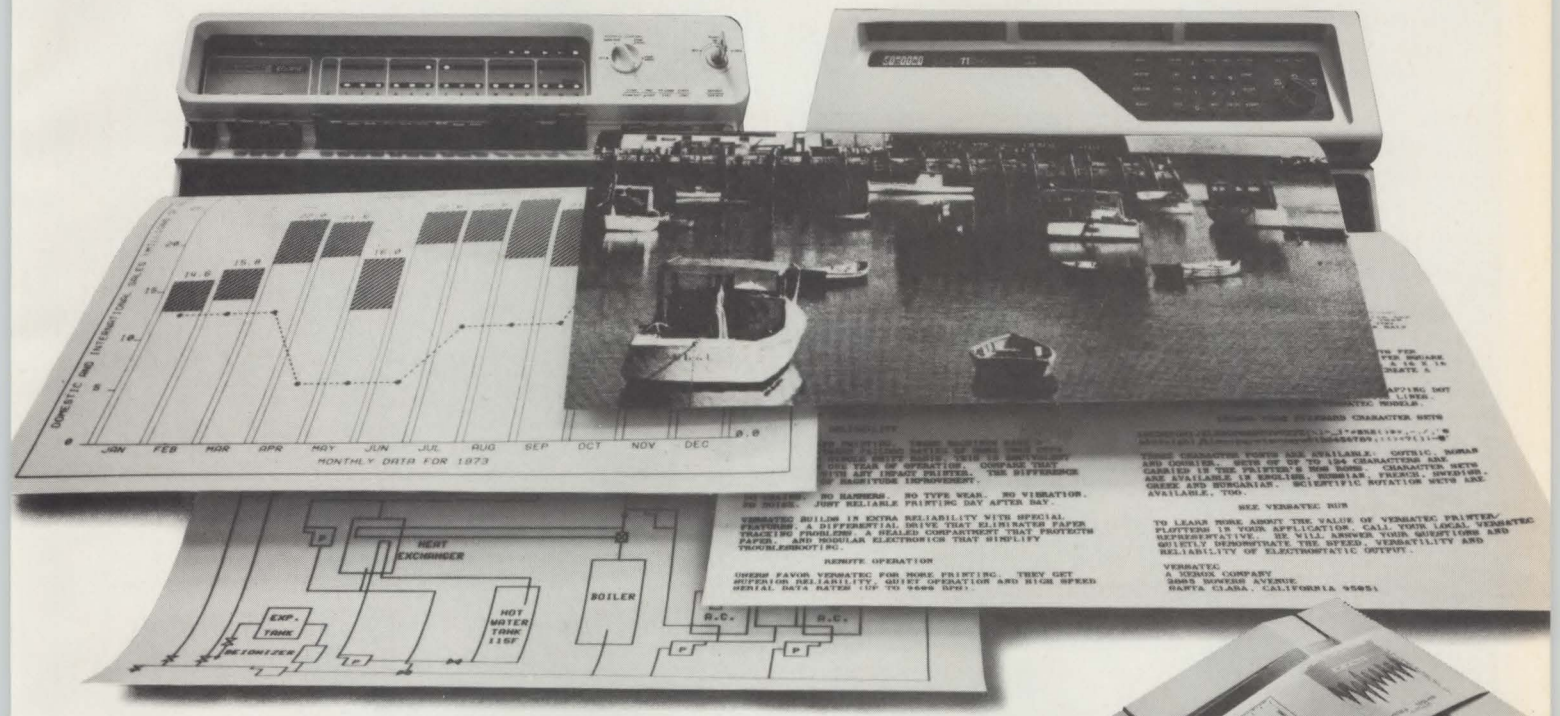


Fig. 2. The dollar value of all shipments *will exceed $2 billion by 1984, while the value of OEM shipments will more than double.*

Magnify your mini. With Versatec.



Get more from your mini. Print up to 1200 LPM. Plot up to 34 square feet per minute. Produce hard copy from display in under twelve seconds. Plot gray scale images that rival lithographic halftones. All with your mini and one Versatec printer/plotter.

Do more. Log data from mini-based instrumentation. Get hard copy plots from multiple stations in an interactive mode. Gain better cost-efficiency by using a single printer/plotter for output from multiple computers and parallel data sources. Or send data to multiple printer/plotters for output where you want it.

A bigger picture. Need wider plots for CAD, mapping or business graphics? You can have them in widths up to six-foot. And yes, your mini can drive these wide plotters. Our Vector-to-Raster Converter™ makes it easy.

Better value. Faster speed and more versatile output capability add up to more performance per dollar. And Versatec printers and plotters continue to be an excellent investment. Ask any user. They just keep going and going. Another plus. Quiet, no-clatter operation makes them nice to be around.

Any mini. Whether you use a PDP-11, a NOVA/Eclipse, an HP 21MX or an Interdata, just plug in Versatec controllers and software driver optimized for your operating system. Then link Versaplot graphics software with your existing pen plotter application package. That's it. You're up and running.

Get "Total Output". Circle our number for a 28-page brochure filled with application information, samples and detailed specifications for 47 Versatec models. You'll discover why Versatec is the minicomputer user's favorite printer/plotter.

VERSATEC
A XEROX COMPANY

2805 Bowers Avenue, Santa Clara, California 95051 (408) 988-2800

XEROX® is a trademark of XEROX CORPORATION. ™Versaplot and Vector-to-Raster Converter are Versatec trademarks. PDP-11 is a trademark of Digital Equipment Corporation. NOVA/ECLIPSE is a trademark of Data General.

CIRCLE NO. 36 ON INQUIRY CARD

TABLE OF IMPACT LINE PRINTER MANUFACTURERS

The following table, compiled by Roman Associates International, is provided as a guide to manufacturers of impact line printers.

Manufacturer	Model Number	Printing Method	Speed (lpm, with 64-character set)	Character Sets	Number of Columns
Burroughs Corp.	B9246-3, B9246-6	band	300, 600	48, 64, 96	132
	B9246-20	train	2000 (with 48-char. set)	16, 48, 64, 96	132
	B9247-14, B9247-15	train	1100, 1500	18, 48, 72, 96	132
	9247-16	train	750 (48-char. set)	16, 48, 64, 96	132
	B9249-2, B9249-3, B9249-4	belt	160, 250, 350	48, 64	132
Centronics Data Computer Corp.	6000 series	band	150, 300, 600	48, 64, 96 or 128 ASCII or EBCDIC	132 (136 optional)
	6080/6081	band	300, 600, 900	48, 64, 96, 128	132 (136 optional)
Control Data Corp.	9383, 9386, 9389	band	300, 600, 900	48, 64, 96 or 128 ASCII	132 (136 optional)
	9380-12	band	1200	48, 64, 96, 128	132, 136
	9372-1, 9372-2, 9372-3	train	1200, 1600, 2000 (48-char. set)	48	132, 136
Data General Corp.	4323, 4324	band	240, 300	64, 96	132
	4218	drum	300	64, 96	132
	4215	drum	600	64, 96	132, 136
	4244	drum	900	64, 96	132
Dataprinter Corp.	3001 series	band	300, 600, 900	48, 64, 96 or 128 ASCII	132, 136
	3000 series	band	300, 600	48, 64, 96 or 128 ASCII	132, 136
	1200 series	chain/train	600, 900, 1000, 1200	48, 64, 96 or 128 ASCII	132, 136
Dataproducts Corp.	B-300, B-600	band	300, 600	48, 64, 96	132
	B-900	band	900	48, 64, 96	132, 136
	B-1500	band	1500	48, 64, 96	80, 132, 136
	2200	drum	300, 600, 900	64 or 96 ASCII, EBCDIC, OCR	136
	2470	drum	1250	64 or 96 ASCII, OCR, foreign-language	132, 136
	2550	charaband	1500 (with 48-char. set)	48, 64, 96	132, 136

Horizontal Spacing (cpi)	Vertical Spacing (lpi)	Number of Copies	Interfaces	Price	Comments
10	6 or 8	6	all Burroughs B systems	$11,500, $14,000	out-of-paper and paper-movement detectors
10	6 or 8	6	all Burroughs B systems	$66,000	operator-changeable train modules
10	6 or 8	6	all Burroughs B systems	$33,000, $44,000	powered forms stacker (B9247-15 only)
10	6 or 8	6	all Burroughs B systems	$20,000	12-channel VFU
10	6 or 8	6	all Burroughs B systems	$5990, $7990, $10,990	self-reversing ribbon, diagonal print technique
10	6 or 8	6	8-bit parallel, RS232C	OEM, single-unit quantities: $4710 (300 lpm), $6545 (600 lpm)	85 percent parts commonality among four models, 12-channel VFU
10 (15 optional)	6 or 8	6	8-bit parallel, RS232C	$6500/$5505	6080 has quietized cabinet
10 (15 optional)	6 or 8	6	CDC, Centronics, Dataproducts, Dataprinter, RS232	OEM, single-unit quantities: $5150, $7150, $10,580	acoustic cabinet, electronic VFU, LED fault indicators
10	6 or 8	6	CDC, 7-bit ASCII, others		same
10	6 or 8	6	CDC, others	OEM single-unit quanitities: $32,850, $36,165, $39,985	operator-changeable train, paper-out or jam switches, power forms stacker, quietized cabinet
10, 15	6 or 8	6	DG	$9500	for DG Nova and Eclipse systems
10	6 or 8	6	DG	$13,750	includes controller
10	6 or 8	6	DG	$18,000	includes controller
10	6 or 8	6	DG	$25,500	includes controller
10, 15	6 or 8	6	CDC shortline or longline, Dataproducts, Centronics, Univac Cade, Uniscope	$5508, $7350, $10,215	cassette ribbon, acoustic cabinet, paper-out/paper-jam indicators, modular construction, 95 percent parts commonality
10, 15	6 or 8	6	CDC, Dataproducts, Centronics, Univac	$4740, $6470	universal power supply
10	6	6	CDC, Dataproducts, Centronics, Univac	$12,330, $15,050, $17,545, $21,140	sound-deadening cabinet, vacuum cleaner system, paper-motion detector
10, 15	6 or 8	6	all Dataproducts and various OEM I/Os	OEM, single-unit quantities: $4960, $6646	self-test, diagnostic display, operator-changeable bands
10	6 or 8	6	all Dataproducts and various OEM I/Os	OEM, single-unit quantities: $9800	same
10	6 or 8	6	all Dataproducts and various OEM I/Os	OEM, single-unit quantities: $16,700	operator-changeable bands, Mark V hammer
10	6 or 8	6	all Dataproducts and various OEM I/Os	OEM, single-unit quantities: $7723, $9614, $12,655	being replaced by B-family band printers
10	6 or 8	6	all Dataproducts and various OEM I/Os	$21,515	off-line self-test, static eliminator, Mark IV hammer
10	6 or 8	6	all Dataproducts I/Os	$24,330	12-channel VFU, full-line buffer, self-test, operator-changeable charaband

Manufacturer	Model Number	Printing Method	Speed (lpm, with 64-character set)	Character Sets	Number of Columns
Decision Data Computer Corp.	6603, 6605, 6606	drum	300, 450, 600	48, 64	132
	6665, 6680	drum	650, 800	48, 64	132
	6609, 6610	drum	900, 1000	48, 64	132
	6615	charaband	1500 (with 48-char. set)	48, 64	132
Digital Equipment Corp.	LP11-V/W (LP05)	drum	240, 300	64, 96	132
	LP11-Y/Z (LP06)	drum	436, 600	64, 96	132, 136
	LP11-C/D (LP-14)	drum	650, 900	64, 96	132, 136
Documation, Inc.	Impact 912	band	900-1200	48, 64 or 96 ASCII or EBCDIC	132
	Impact 1600	band	1200, 1400, 1600 (with 48-char. band)	48, 64 or 96 ASCII or EBCDIC	132
	Impact 2250	band	1550, 1800, 2250 to 3000	48 or 63 ASCII, 60 PL/1	132, 150
Fujitsu America, Inc.	3020, 3021, 3022	band	230, 670, 900	48, 64 or 96 ASCII	136
General Electric Co.	TermiNet 120	belt	120, 180	64 or 96 ASCII	80 or 120
	TermiNet 340	belt	90, 340	64 or 96 ASCII	132
	TermiNet 510	belt	240, 340, 425	48, 64 or 96 ASCII	132
Hewlett-Packard Co.	2613A, 2617A	drum	300, 600	64, 96	136
	2619A	chain/train	1000, 1200	64, 96	132
	2608A	line matrix	250, 320, 400	128	132
Honeywell Information Systems, Inc.	PRU 1200, PRU 1600	belt	1200, 1600 (with 48-char. set)	48, 63, 64 or 96 IBM, ASCII or OCR	136, 160
	PRU 640/840	belt	600, 800	63, 64, 96	120, 136
	PRU 0457/0657/ 0857/1107	drum	450, 650, 850, 1100	39, 45, 48, 53, 63	132
	PRU 9103/9104/ 9105/9106	drum	240, 300, 436, 600	64, 96	136
	PRU 9108/9109	drum	660, 900	64, 96	136
	PRU 9117/9118	band	300, 600	64, 96	132
IBM Corp.	3203 (five models)	train	600, 1000, 1200 (with 48-char. set)	48	132
	3211	train	2000 (with 48-char. set)	48	132, 150
	5203	chain	100, 200, 300	48 to 120	96, 120, 132

Horizontal Spacing (cpi)	Vertical Spacing (lpi)	Number of Copies	Interfaces	Price	Comments
10	6 or 8	6	DEC, DG, HP, Perkin-Elmer, Univac BC/7 and UTS-700, and IBM S/1, S/3, S/34 and 360/370	$16,000 to $19,000	illuminated print area, forms extractor, stacker, accommodates nonstandard forms
10	6 or 8	6	same	$18,500 to $21,500	same
10	6 or 8	6	same	$20,300 to $23,300	same
10	6 or 8	6	same	$38,300 to $43,200	same
10	6 or 8	6	Unibus	$15,400 to $17,800	programmable VFU, EDP or scientific font drums
10	6 or 8	6	Unibus	$23,400 to $24,100	programmable VFU, fault indicators, self-test, EDP or scientific font drums
10	6 or 8	6	Unibus	$25,700 to $30,200	self-test, paper shelf, quietized cabinet, static eliminator
10	6 or 8	6	Dataproducts 2200, various OEM	$17,000	off-line diagnostics, optional power stacker, changeable bands
10	6 or 8	6	IBM 1403 and 3211, Burroughs	$28,800	acoustical lining holds noise to 74 dBA, power stacker, 12-channel VFU
10	6 or 8	6	IBM 360/370, 303X and 4300, Burroughs, Univac and Dataproducts	$46,800	powered hood, acoustic lining, operator switch panel
10	6 or 8	6	OEM and custom-designed I/O available		off-line self-test diagnostics and fault indicators, spare parts commonality among all three models
10	6	6	Centronics, Dataproducts, RS232	$4130	being phased out and replaced by models 310 and 340
10	6	6	various parallel and serial; buffered	$3860, $4603	paper shelf and basket for front or rear paper feed
10	4, 6, 8	6	various parallel and serial; buffered	$5795	special character belt for word-processing quality
10	6 or 8	6	HP 1000, 3000, 21MX	$12,750, $17,250	off-line self-test
10	6	6		$23,000	
5, 10	6, 8	6	HP 1000, 3000, 21MX	$9900	full graphics capability
10	6 or 8	6	Honeywell Level 62, 64, 66	$44,420, $64,940	acoustical cabinet, changeable cartridge belt
10	6 or 8	6	Honeywell Level 62, 64	$33,663, $39,606	acoustical cabinet
10	6 or 8	6	Honeywell Level 64	$19,810, $26,455, $30,444	operator control panel, lit status indicators
10	6 or 8	6	Honeywell Level 6	$10,500, $13,650, $21,525, $23,100	off-line test mode, fault indicators, full-line buffer
10	6 or 8	6	Honeywell Level 6	$24,150, $25,935	off-line test mode, fault indicators, full-line buffers
10, 15	6 or 8	6	Honeywell Level 6	$10,500, $15,700	self-test diagnostic display
10	6 or 8	6	IBM 370, 303X, 4331, 4341	$27,360 to $38,320	power-assisted stacker
10	6 or 8	6	IBM 360, 370, 4300	$50,900	OCR code optional
10	6 or 8	4 to 6	IBM S/3, 370	$7005, $7805, $10,880	dual feed carriage, operator-changeable chain

Manufacturer	Model Number	Printing Method	Speed (lpm, with 64-character set)	Character Sets	Number of Columns
IBM Corp.	5211	belt	160, 300	48, 64, 96	132
	5225 (four models)	line matrix	280, 400, 490, 560	95 or 184 EBCDIC or ASCII	132 to 198
Memorex Corp.	2089-2, 2089-3, 2089-4	belt	75, 120, 265	48, 64, 96	132
	3476	chain/train	600, 760	48, 64	132
Mohawk Data Sciences Corp.	2142-1, 2142-2	belt	90, 150, 240, 230, 300, 340	64, 96	132
	2145	drum	435, 600	64, 96	132
	2442	drum	660, 900	64, 96	132
	2446	drum	1000, 1250	48, 64, 96, 112	132, 160
NCR Corp.	6420-2101	band	300	48, 64, 96	132, 136
	6420-3201	band	600	48, 64, 96	132, 136
	6420-2301	band	900	48, 64, 96	132, 136
	C646-201	train	1200 (with 52-char. set)	52	132
	C647-201	train	2000 (with 48-char. set)	48	132
NEC Information Systems, Inc.	L300, L600	band	190, 240, 310, 370; 370, 460, 600, 700	48, 64, 96, 128	136
Northern Telecom Systems Corp.	1422, 2423, 2424	belt	125, 250, 300	48, 64 or 96 ASCII	80, 132
Okidata Corp.	SL125, SL160, SL250, SL300	line matrix	125, 160, 250, 300	96 ASCII	132
	SLG	line matrix	120 and 400	96 ASCII	132
Potter Instrument Company, Inc.	LP 6303/6304/ 6305/6306	line matrix	300, 400, 500, 600	64, 96, 192	132
Sperry Univac	0789 (three models)	band	180, 300, 640 (with 48-char. sets)	48, 64, 96, 128, 192	132
	0776-00/02 (two models)	band	760, 940	48, 64, 96, 128	136
	0776-04/06	band	1200	48, 64, 96, 128	136
	0770-00/01, 0770-02/03, 0770-04/05	band	800, 1400, 2000		132
Tally Corp.	T-2000	line matrix	125, 200	64, 96	132
	T-3300	line matrix	240, 300	64, 96	132
	T-5000	line matrix	400, 500	64, 96	132
Teletype Corp.	M/40	belt	220, 300, 400	48, 64, 96	80, 132
Telex Computer Products, Inc.	7211	train	2000 (with 48-char. set)	48	132, 136

Horizontal Spacing (cpi)	Vertical Spacing (lpi)	Number of Copies	Interfaces	Price	Comments
10	6 or 8	4 to 6	IBM S/34, S/38	$9405, $11,460	multinational character set
10, 15	6 or 8	4 to 6	IBM S/34, 5280 DDS	$11,650, $13,450, $14,950, $16,350	character matrix is 8 dots high by 7 dots wide
10	6	6	IBM 3271, 3272	$11,680	acoustic cabinet
10	6	6	IBM S/34, S/38	$14,500	12-channel VFU, adjustable paper receptacle
10	6	6	MDS S/21 DDP systems	$8120 to $11,320	front or rear paper loading, self-test with LED indicator
10	6 or 8	6	MDS S/21 DDR systems	$20,600	quietized cabinet optional
10	6 or 8	6	MDS 1200/2400/2300 systems	$30,000	off-line self-test
10	6 or 8	6	MDS 2400 systems	$37,250	operator's panel (model 5321 OEM version also available)
10	6 or 8	6	NCR I/8400, V-8400	$9220	includes controller
10	6 or 8	6	NCR I/8400, V-8400	$10,820	electronic VFU
10	6 or 8	6	NCR I/8400, V-8400	$30,000	quietized cabinet
10	6 or 8	6	NCR I/8400, V-85XX	$44,250	enclosed forms feed and power stacker, operator-changeable type array
10	6 or 8	6	NCR I/8400, V-85XX	$69,650	enclosed forms feed and power stacker, operator-changeable type array
10	6 or 8	6	Dataproducts, Data-printer, Centronics, RS232C	$4800, $6920	90 percent parts commonality, L600 has acoustic cabinet that reduces noise to 96 dBA
10	6 or 8	6	Centronics, Dataproducts, Data-printer, Datapoint, DEC, DG, RS232C		fully buffered, hammer fuse alarm, self-test, 90 percent spares compatibility
10	6 or 8	1 to 5	Centronics, Dataproducts, Printronix, RS232 to 9600 baud	$2895, $2895, $4355, $4355	compact desk-top mounting, stored program diagnostics, elapsed time meter, seven-wire actuators provide full graphics and plotting for SL 125 and SL 250
10	6 or 8	1 to 5	Centronics, Dataproducts, Printronix, RS232 to 9600 baud	$5335	compact desk-top mounting, stored program diagnostics, elapsed time meter, seven-wire actuators enable full graphics and plotting
5, 10, 13.3	6 or 8	6	plug-compatible, various parallel and serial interfaces available	$4950, $5400, $6200, $7000	parts commonality within family, field-upgradeable, adjustable dual tractors, graphics and plotting capability
10	6 or 8	1 to 6	S/80, V/77, BC-7, 1100, UTS, UDES	$10,584, $12,500, $15,650	cassette ribbon, bands are operator-changeable
10	6 or 8	6	S/80, S/90	$36,570, $41,380	diagnostic indicators, speed is upgradeable, multinational print bands
10	6 or 8	6	S/80, S/90	$52,150	diagnostic indicators, speed is upgradeable, multinational print bands
10	6 or 8	6	S/90, 1100, 1110	$56,304, $64,896, $86,686	acoustical cabinet, mechanized power forms stacker
10	6 or 8	6	HP, DG, DEC, Datapoint, Univac, IBM, RS232	$4395	multinational character sets, optional communications I/O
10	6 or 8	6	Centronics, Dataproducts, Data-printer, RS232	$5495	self-test diagnostics, graphics plotting capability
10, 13.3	6 or 8	6	Centronics, Dataproducts, Data-printer, RS232		being replaced by a new model
10	6 or 8	3 or 6	TTY, parallel	$4197	self-test diagnostics, table top or cabinet models
10	6 or 8	6	IBM 360, 370, S/3, 4300	$40,000	IBM 1403 and 3211 plug-compatible

The number of line-printer manufacturers is not expected to grow or shrink more than 10 percent in the next few years.

printers lie in the number of characters printed at the same time and in printing speed. Serial print heads usually move from left to right across a page, printing one character at a time. Some new models print bidirectionally, yielding increased speed and throughput. Serial printer speeds are in a 10- to 600-character-per-sec. range.

Impact line printers imprint a full line of characters at the same time and on the same line. Line-printer speeds range from 100 to more than 3000 lpm. The major advantage of impact line-printer technologies over non-impact is their instantaneous multiple-copy capability. All impact printers can be divided into two generic categories: they have either front-striking or rear-striking mechanisms. In a front-striking printer, a typeface character or the matrix print head's pins strike a ribbon against the paper to form a character, as does an office typewriter.

In rear-striking printers, a hammer mechanism forces the paper and ribbon against a character to form

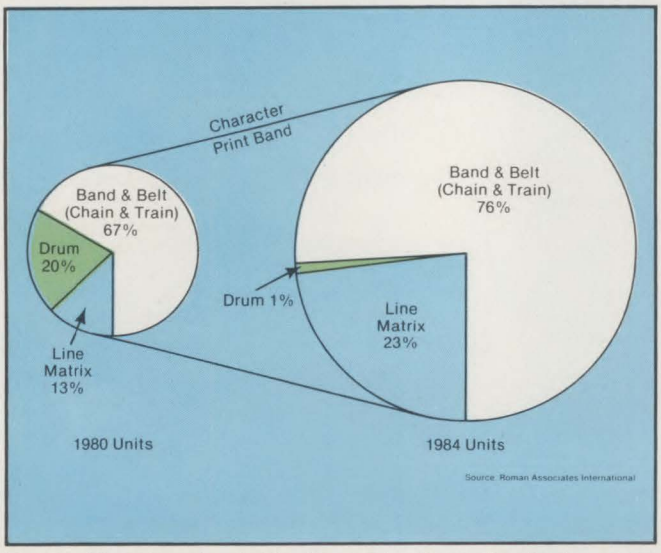


Fig. 3. The changing technology mix *shows the demise of the drum, while line-matrix technology will achieve more than a four-fold gain. But band-printing technology will continue to dominate.*

the image. The embossed character elements are contained on drums, trains, chains, bands or belts. Typical speeds of these types of printers are 100 lpm to more than 3000 lpm. The IBM 3211 2000-lpm train printer, the new IBM 5225 matrix line printer and similar matrix line printers by Printronix, Hewlett Packard, Tally and Okidata use front-striking techniques.

Matrix line printers

Matrix line printers, such as the Printronix and Tally machines, imprint a line of dots at a time rather than a line of formed characters. The paper is then moved up by a stepper motor in ⅙-in. steps, as in the Printronix P-300, to print the next desired dot. Printed characters are then defined by a 9 × 7 dot matrix array, (9 horizontal and 7 vertical). Excellent-quality print is achieved by printing overlapping dots of uniform density.

An upper-case character is formed by a 9 × 7 dot matrix, with five overlapping dots in the horizontal plane on nine centers for accurate character rendition. The nature of the printing mechanism ensures accurate dot placement throughout the life of the machine, without any adjustment. A dot is impacted by electromagnetically releasing a leaf spring that is normally held under tension by a permanent magnet.

	1980
up to 250 lpm	13.0%
251 to 500 lpm	56.0%
501 to 850 lpm	18.0%
851 to 1200 lpm	8.0%
1201 to 2000 lpm	4.2%
above 2000 lpm	0.8%

Source: Roman Associates International

Fig. 4. The speed distribution of line printers *is centered at 300 lpm, followed by 600 lpm, of all 1980 shipments.*

Because there are very few moving parts, the printer is inherently very reliable.

In the Printronix P-300, printing is done by a bank of 44 leaf-spring hammers positioned horizontally across 18 dot-positions, or at every third character-position. The hammers are mounted on a shuttle, which sweeps the hammers across three character-positions over a 0.3-in. movement. As the shuttle sweeps across, the hammers are activated at each position in the dot-row at which a dot is required. The paper-feed stepper-motor-driven mechanism moves the paper upward one vertical dot-row, while the hammer-bank shuttle is slowed at the end of each movement, and then accelerated in the reverse direction.

This process continues through a total of nine sweeps, as in printing a lower-case character with tails, until a line of characters has been completed. Seven sweeps form an upper-case character. The paper is then advanced a distance equal to one line-separation, and the process is repeated for the next line of print. The Tally printer has 132 hammers moving in a single-comb structure across five dot-positions.

Principal elements of the Printronix P-300 printing mechanism are:

- A motor-driven cam coupled to a flywheel on which is mounted a magnetically sensed timing disk.
- The hammer bank, mounting electromagnetically actuated leaf-spring print hammers. The cam moves the hammer bank in an oscillatory shuttling motion.
- Ink-ribbon and paper-advance mechanisms.

The major mechanical difference between matrix-line printers and conventional line printers is the absence of a drum, chain or band carrying the type characters.

WHY CIS COBOL LETS YOUR MICROCOMPUTER PERFORM LIKE A MAINFRAME.

Now, you can use a microcomputer for sophisticated business applications ...because now there's CIS COBOL. Micro Focus developed this COBOL so your microcomputer can run the same programs as a minicomputer or a mainframe.

CIS COBOL is Micro Focus' Compact, Interactive, Standard COBOL which offers the advantages of COBOL... powerful data structure features, English-like language, existing programmer expertise... to provide you with a full commercial language. You won't be restricted by size either: a 64K byte microcomputer will compile up to 8000 lines of COBOL, more if the program's split into dynamically loaded modules.

Choose a Compact Compiler.

The Compact compiler runs on 32K byte microcomputer systems. Its powerful subset includes full support for random, indexed and sequential files.

Or choose the Standard Compiler.

The Standard CIS COBOL compiler requires a minimum 48K of user RAM. A super-set of the Compact compiler, implementing ANSI '74 COBOL to Federal Low-intermediate Level.

The same CIS COBOL extensions for conversational working, screen control, interactive debugging, and special peripheral support are in both compilers. And there are more reasons to consider CIS COBOL:

- It conforms fully to the ANSI '74 standard, so programs are portable upwards and downwards to minis or mainframes.
- Its interactive features enable mainframe programmers to get results fast... working on inexpensive microcomputers.

Forms

The FORMS utility lets you build a screen layout online at the CRT. Then it automatically generates COBOL record descriptions for inclusion in your program.

Forms-2

A superset of FORMS, it eliminates the need to write simple data entry and inquiry programs, because the programs can be automatically generated from screen definitions.

Environment

CIS COBOL products run on the 8080 or Z80 microprocessors under the CP/M* operating system, and on the LSI-11 or PDP-11 processors under RT-11. They are distributed in a variety of disk formats and come with a utility that enables you to use any make of CRT.

OEMs

Intel has adopted CIS COBOL and offers it (as iCIS-COBOL) for their Intellec and Intellec II systems. Ideal for OEM's or private label, CIS COBOL was developed entirely by Micro Focus. Send inquiries for CIS COBOL object packs and application vendor terms to MICRO FOCUS or its licensed distributors. Distributor terms also available from MICRO FOCUS.

Send me more information for:
☐ Single Copy Users
☐ Reseller and Distributor Licensing

Name_____
Title_____
Company_____
Address_____
City/State_____
Zip/Phone_____
Computer Model_____
Version of DOS_____

MICRO FOCUS™

Micro Focus Inc. • 1601 Civic Center Drive • Santa Clara • CA 95050 • Tel: (408) 984-6961 • Telex: 171-135 MISSION SNTA

U.K. Office • 58 Acacia Road • St. Johns Wood • London NW8 6AG • Tel: 01 722 8843 • Telex: 228536 MICROF G

MMS 1

CIS COBOL distributors include: Vector Graphic, Onyx Systems, Altos Computer Systems, Lifeboat Associates, Research Machines, Telecomputing, Modular Business Systems, Rair, Midlectron, Rostronics and Johnson-Laird Inc. †Intellec is a trademark of Intel Corp. *CP/M is a trademark of Digital Research Inc.

Add in Reliability. Then Relax.

Our LSI-11* compatible memory systems come with built-in ECC (Error Checking and Correction) circuitry. So you don't have to worry about expensive service calls, or strained relations with customers. Our 2,500 ECC systems in the field have a proven MTBF *in excess of 15 years.*

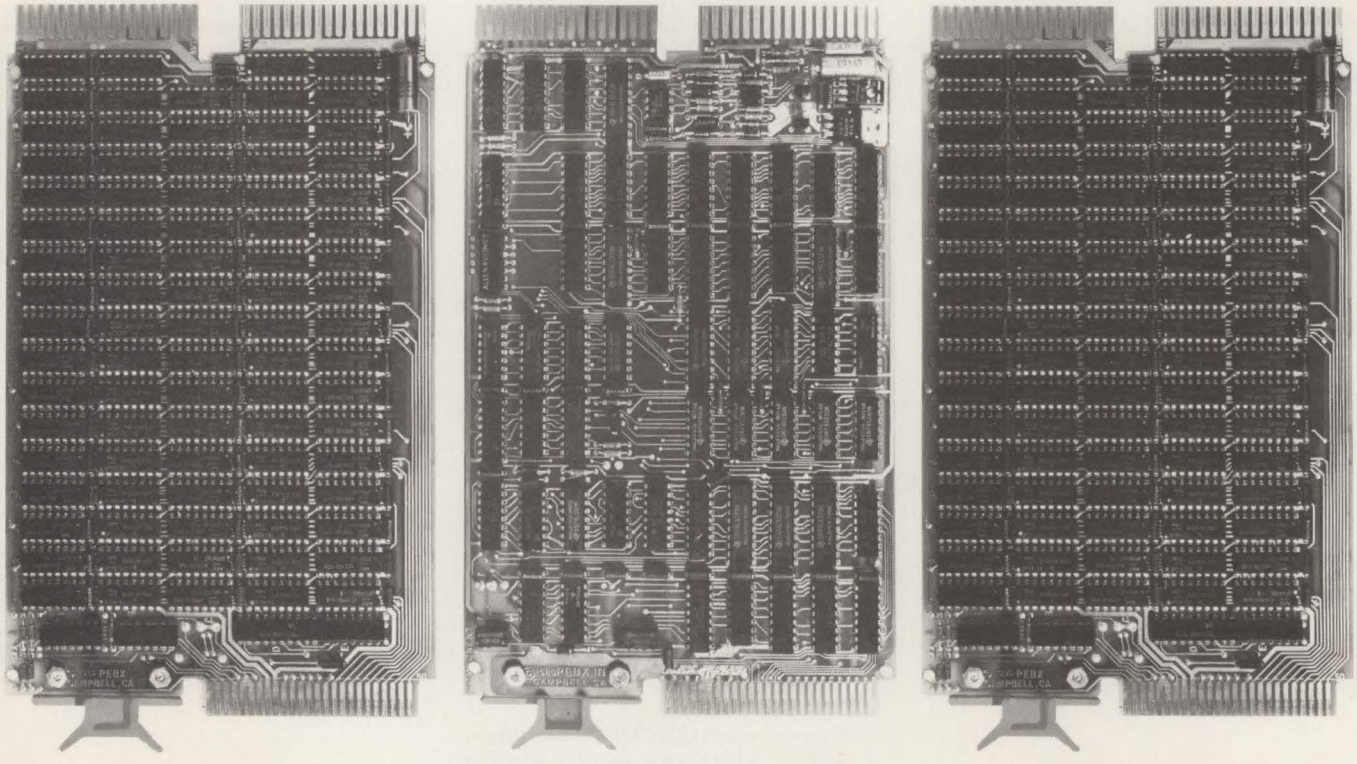
PEBX is the first to protect your LSI-11 system from failing RAMs and those random alpha particle crashes. We've also made protection from power outages as easy as hooking up a battery.

We'll give you from 32 to 256K bytes of error-correcting memory that takes care of all single-bit errors. Plus a display that points to any erring RAM, allowing *preventive* maintenance rather than finger-pointing after a system crash.

So if you're an OEM and you don't want to worry about costly service calls, find out about our add-in reliability and relax. *Contact PEBX toll-free today at (800) 538-3112, (in California (408) 866-7838), for full information on how you can get the best LSI-11 compatible memories available today.*

PEBX
501 Vandell Way
Campbell, CA 95008
(408) 866-7838

Finally: LSI-11 Compatible memories with ECC.



*LSI-11 is a registered trademark of Digital Equipment Corporation.

CIRCLE NO. 38 ON INQUIRY CARD

A TIMEPLEX CUSTOMER REPORT ON STATISTICAL MULTIPLEXING.

Eight California-based companies of the Alco Standard Corporation use the Timeplex SERIES II MICROPLEXER™* to concentrate the input/output of up to 30 terminals linked to a computer in Valley Forge, Pa.

This network is managed by Alco Data Services, which offers computer services to the 130 companies that comprise Alco Standard Corporation.

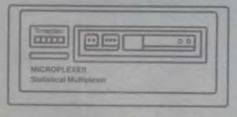
"Effective network management and control are indispensable," according to Norm Pfizenmayer, Corporate Director, Alco Data Services, "since our West Coast companies use the system for a variety of crucial on-line applications, including inventory control, accounts receivable, accounts payable and general ledger, to name a few."

The SERIES II is equipped with a unique Supervisory Port option–a window into the network–which provides key operating statistics and diagnostic information to the user, without interfering with the function of the system.

States George Kovolenko, Senior Communications Consultant, Alco Data Services: "One person, sitting at a CRT here in Valley Forge, easily monitors the system. At the same time, the operator can automatically downline program any multiplexer channel in the system, even those in California–all from the front panel of the master unit."

Concludes Mr. Kovolenko: "As far as multiplexers are concerned, we needed advanced features, flexibility and reliability. And we found it with the Timeplex MICROPLEXER."

Use the handy coupon to check Timeplex out for your company. Or call us toll-free at 800-431-2918, Extension 230. For New York: 800-942-1216, Extension 230.

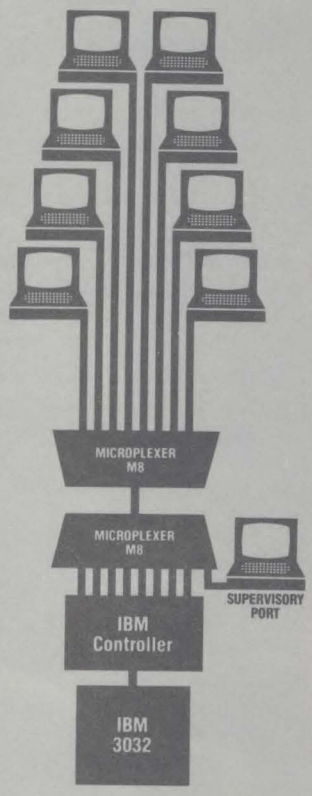


Timeplex®

Timeplex, Inc./One Communications Plaza
Rochelle Park, NJ 07662
(201) 368-1113 TWX: 710-990-5483

"At Alco, we rely on the unique Timeplex multiplexer to monitor a network linking eight California companies. All from a single CRT 3,000 miles away."

George Kovolenko
Senior Communications Consultant
Alco Data Services



This West Coast data communications network, which is managed by Alco Data Services, is based on SERIES II MICROPLEXER statistical multiplexers located in Los Angeles, California and at the Corporate Data Center in Valley Forge, Pennsylvania.

*Patents pending

CHECK US OUT. ONLY TIMEPLEX CAN DO IT.

I have____ terminals,____ ports.

My application(s):
☐ Time-sharing ☐ Interactive
☐ Other_____

Please send the following:
☐ Alco Data Services Case Study
☐ Handbook on Statistical Multiplexing
☐ Please call me.
I have an immediate need.

Name
Title
Company
Address
City/State/Zip
Telephone

MSY/010081

Send coupon to: Timeplex, Inc.
P.O. Box 5006; Clifton, N.J. 07015

CIRCLE NO. 39 ON INQUIRY CARD

Announcing the New Line of Voltage Regulating Transformers from Jefferson.

Jefferson's Voltgard™ gives tight voltage regulation and isolation along with low harmonic content. This makes the Voltgard™ ideal for use on all kinds of process control equipment, NC machines and any electronic equipment where a low harmonic content is needed for suitable operation. Various sizes up to 11 KVA.

Jefferson's Electrogard™ provides a wide input range along with tight regulation and the ability of output voltage adjustment. The Electrogard™ has the capability of withstanding high inrush currents without total voltage collapse which is needed to start your equipment. The Electrogard™ comes in sizes up to 10 KVA.

Jefferson's Minigard™ protects your sophisticated computer systems, POS terminals, word processors and other electronic equipment from brownout, over-voltage, transients, common mode noise, transverse mode noise and the Minigard™ is also current limiting. Minigard™ can eliminate the need for a dedicated line. Various sizes up to 11 KVA.

JEFFERSON® ELECTRIC
a division of Litton Industries
840 25th Avenue, Bellwood, Illinois 60104
(312) 626-7700 • Toll Free: (800) 323-3293

Litton

CIRCLE NO. 40 ON INQUIRY CARD

Band and belt printers will still dominate the market in 1984, but the matrix line segment will surge ahead to 23 percent of the market.

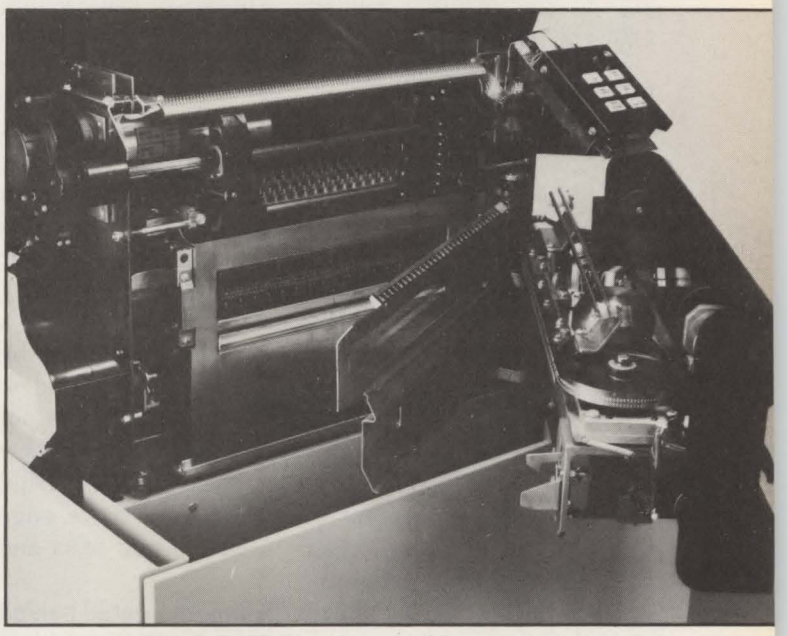
Instead, the matrix printer requires only a hammer mechanism that makes a dot. Thus in the matrix-line printer, the design of the hammer and its electronic driver to strike only a dot, not a full character, can be considerably simplified. These are the primary reasons for the fundamentally lower cost and reliability of matrix-line printers.

There is a substantial difference between the hammers used to strike a full-font character, such as an "M" or a "W", and those needed to simply strike a dot. Only a small fraction of the hammer energy is needed to strike a dot, the mechanical construction is simpler, and the electronic drive circuitry is much less complex. Because a matrix printer forms each character from an array of dots, the hammer energy can be optimized for printing only dots and thereby give uniform printing density. This enhanced print quality is particularly noticeable in carbon copies of multiple-part forms.

Advantages of matrix line printing

Any number of character type styles can be stored in a matrix printer without slowing the printer because they are electronically accessed. This is not so in a band or belt printer, which, if rated at 300 lpm with a 64-character band set, would slow to 150 lpm with a 128-character band set. Quieter operation also results because a matrix line printer hammer uses about 1/10 the energy of a band or belt mechanism. Matrix line printers also offer full plotting capability, because the mechanism has the inherent accuracy to place dots anywhere on the paper; it's practical to use a matrix line printer as a plotter because the horizontal dot-density is sufficient at 100 dots per linear in.

Graphs, pictures, bar codes and large labels can be printed under computer control. Band, drum or chain printers are very limited in this application, and some may not have any graphics capability. No hammer adjustments are required in matrix line printers. Solid-appearing characters can be achieved by overlapping dots both horizontally and vertically.



Control Data Corp.'s 9380-12, *with towel ribbon on band gate and swing-away ribbon shield, provides easy access for forms loading.*

IBM has recognized the flexibility of impact line-matrix technology recently by announcing the 5225 impact matrix line printer for the 5280 DDP system and the system 34, with speeds ranging from 280 to 560 lpm.

Okidata also uses the line-matrix principle in its Slimline series, which produces dots with actuators mounted on a horizontally oscillating shuttle bar. Twenty-two plunger-type actuators are spaced six character-positions apart on the shuttle bar, covering the full width of a 132-column page. For speeds as high as 400 lpm, 33 actuators spaced four character-positions apart are contained on the shuttle bar.

During each half-cycle oscillation of the bar, one dot-row of all 132 characters is produced. The next row of dots is printed as the shuttle bar returns. This simple and unique shuttle-bar approach reduces the duty cycle to approximately one-third that of conventional seven-wire serial print heads. As the motor-driven shuttle bar moves smoothly in a continuous oscillatory motion, it enables precise dot control and placement of a printed

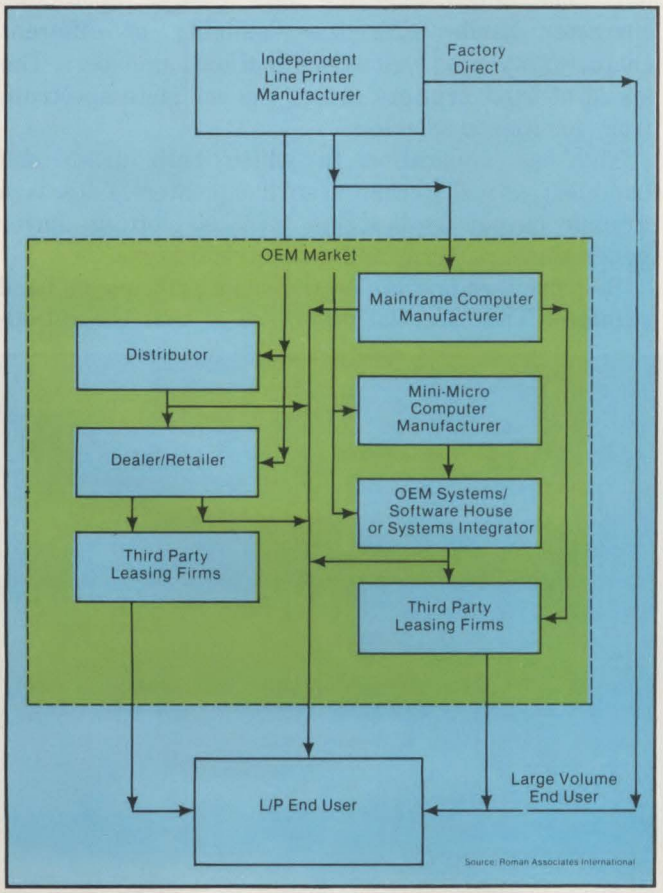


Fig. 5. Distribution channels *for non-captive (OEM) line printers.*

The major mechanical difference between matrix and conventional line printers is the absence of a drum, chain or band to carry the type characters.

0.0158-in.-diameter dot anywhere on a page. Horizontal dot-density with the Okidata shuttle-bar method ranges from 60 to 100 dots per linear in.

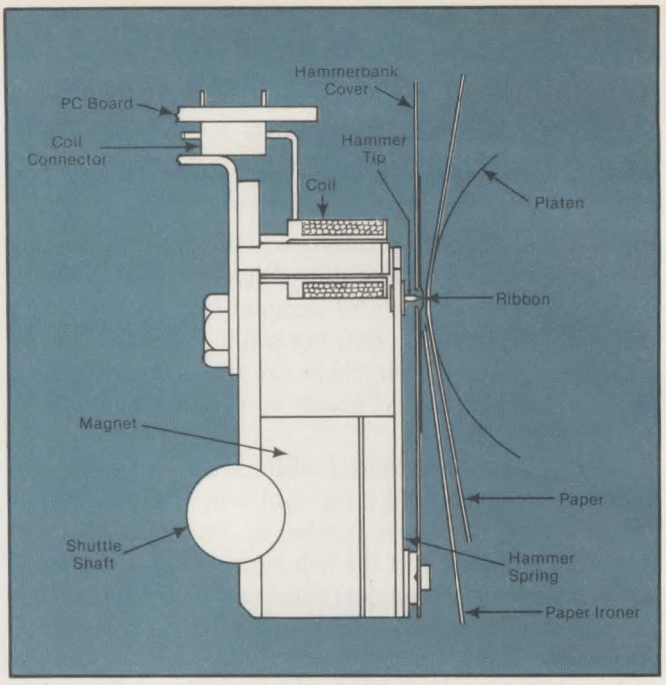
Hewlett-Packard's model 2608A also uses line dot-matrix technology embodied in a comb-type hammer bank assembly with 132 tines. Each covers one print position and is shifted horizontally to make as many as five dots in normal 5 × 7 dot-matrix printing.

Fig. 3 shows that by 1984, approximately one of four impact line printers shipped will be a matrix line printer—a four-fold increase over 1980 unit shipments.

Band and belt printing

Belt and band printers use rear-striking mechanisms in which the character set moves horizontally across the print line. The raised characters are etched on a continuous metal band, which is tensioned between two tapered pulleys mounted at opposite ends of the belt drive bed. A drive motor coupled to the drive pulley causes the band to rotate counterclockwise at a constant velocity. The band is biased downward by tapered pulleys until contact is made by edge guides. On edge guide-equipped systems, the operator is not required to vertically align the band each time a new character band is positioned in place; vertical band registration is accurately controlled with these edge guides used on Dataproducts B Series, CDC 9383 and 9386 and IBM band printers.

Upon impact, a bank of print hammers located behind the paper pushes the paper and the print ribbon against the embossed character belt, which is backed by a platen, thus forming a character. On lower-speed band printers, such as those of Dataproducts and IBM, hammers are shared across two column-positions to keep the cost down.



Detail of Printronix's *matrix line printer.*

The useful service life of a character on the metal band varies between 30 million and 40 million impacts; they seldom wear out. But if the print band breaks (a rare occurrence), the entire belt must be replaced. Character belts sell for $200 to $300 in OEM quantities and as high as $1000 in small, end-user quantities.

The advantages of band-printer technology lie in its low cost, high-quality print and relatively fast throughput. The interchangeable and easily replaceable character bands offer the flexibility of different character styles as well as multinational alphabets. The speed of band printers covers the complete spectrum from 100 lpm to 3800 lpm.

The one application in which both drum and band/belt, as well as chain/train line printers, falter is in graphic output applications such as plotting, forms generations, patterns and geometric designs.

Belt printers operate on the same principle as band printers. The essential difference is that the raised-

REFERENCE LITERATURE

For more information on the impact line printers surveyed in this article, use the reader circle number below.

Company	Circle No.
Burroughs Corp., Detroit Mich.	368
Centronics Data Computer Corp., Hudson, N.H.	369
Control Data Corp., Rochester, Mich.	370
Data General Corp., Westboro, Mass.	371
Data Printer Corp., Malden, Mass.	372
Dataproducts Corp., Woodland Hills, Calif.	373
Decision Data Computer Corp., Horsham, Pa.	374
Digital Equipment Corp., Maynard, Mass.	375
Documation, Inc., Melbourne, Fla.	376
Fujitsu America, Inc., Santa Clara, Calif.	377
General Electric Co., Waynesboro, Va.	378
Hewlett-Packard Co., Palo Alto, Calif.	379
Honeywell Information Systems, Inc., Waltham, Mass.	380
IBM Corp., Armonk, N.Y.	381
Memorex Corp., Santa Ana, Calif.	382
Mohawk Data Sciences Corp., Parsippany, N.J.	383
NCR Corp., Dayton, Ohio	383
NEC Information Systems, Inc., Lexington, Mass.	384
Northern Telecom Systems Corp., Minneapolis, Minn.	385
Okidata Corp., Mount Laurel, N.J.	386
Potter Instrument Co., Inc., Gonoc, N.H.	387
Sperry Univac, Blue Bell, Pa.	388
Tally Corp., Kent, Wash.	389
Teletype Corp., Skokie, Ill.	390
Telex Computer Products, Inc., Tulsa, Okla.	391

Sensational Value

300 lines per minute
Only $2695

The Slimline Series

Three hundred lines per minute for only $2695.* That's about $800 less than Dataproducts and $700 less than Printronix, a savings of over $100,000 for most OEM customers. What's the catch? What do you give up? The answer is—nothing! In fact, you win all around. There are four other Slimlines from 125 to 400 LPM. Compare them all.

Compare versatility. Okidata Slimlines are microprocessor-smart. They print text in a wide range of program-selectable fonts. They print oversize characters and bar codes for tags and labels. They bring dull reports to life with graphics for charts, diagrams and illustrations.

Compare print quality. Our fifth copy is almost as good as our first. The unique Slimline head uses short, straight wires that travel in a straight path to the paper to print through thick forms.

Compare reliability. The Slimline is ruggedly built to run all day with no duty cycle limitations. The head is warranted for 500,000,000 characters. And, stored program diagnostics and a stored program machine history make service a snap.

Compare size. The tabletop Slimline SL300 is smaller than all the others, half the size of Printronix. Three hundred lines per minute for only $2695. Call today for all the details.

*Quantity 100 OEM prices

OKIDATA

Okidata Corporation, 111 Gaither Drive, Mount Laurel, New Jersey 08054 609-235-2600

CIRCLE NO. 41 ON INQUIRY CARD

Horizontal-moving font line printers accounted for two of every three impact line printers shipped last year.

surface character elements are attached like vertical fingers to a flexible nonmetallic (usually plastic) belt. Examples of belt printers are the GE Terminet 120 or 300 series, and the Teletype 40 series. If a character on the belt breaks or wears out, only that character needs to be replaced, saving the expense of a new belt. Belt printers are also capable of 100-lpm to more than 2000-lpm speeds, but usually fall in the 300- to 1500-lpm range.

Horizontal moving-font line printers, such as band and belt devices, accounted for two of every three impact line printers shipped in 1980 (Fig. 3). Horizontally moving-font band and belt printers will continue to dominate projected 1984 unit shipments, with three out of every four units shipped.

Chain or train printers

In chain/train printers, character slugs move horizontally past print hammers located at each column-print position. The characters pass by each hammer in sequence so that a complete character set revolves by several hundred times per min. Sometimes the character slugs in train printers are not connected to each other and consequently push themselves around the track; in chain printers, they are connected to each other. With both methods, however, several complete character sets revolve past the hammer positions at a constant speed. The hammer is fired at the precise instant that the character to be printed moves into position. The term for the character being in-phase or out-of-phase refers to the measure of how precisely the character is aligned with the print-column hammer at the moment of hammer firing.

Dataproducts' 1500-lpm band printer, the BP-1500, *is the first in a series of high-speed printers designed to provide high-quality print and reliability at heavy duty cycles.*

Reliability is a potential problem in these printers because wear occurs in the tracks, and hammer and electronic adjustments are critical, requiring periodic adjustment.

The problem of vertical character alignment registration was eliminated early, but has been replaced by horizontal alignment character registration in all horizontal-moving-font line-printer techniques. But horizontal alignment character registration is much less discernible; it's virtually unnoticeable to the eye. Examples of chain/train printers are the Dataprinter CT-1200 family; the IBM 3211; IBM 1403 and 5203; and the Burroughs 9247. For speeds as high as 2000 lpm, chain/train printers will accomplish the desired performance.

Drums on the wane

Drum printers have a complete set of characters embossed around the circumference of a cylindrical drum. The drum rotates at a constant speed, moving a complete character set in a direction vertical to the paper. Drum printers have 132 hammers in a horizontal row, one for each column-print position. The selected hammer strikes the desired character at each print-column position each time the drum presents the appropriate character at that column position. Hammer flight timing is critical to achieve and maintain good-quality print, so there is a need for continuous flight-time adjustments by a trained field-service technician. Improperly adjusted hammers will result in vertical misregistration of characters and unattractive, wavy lines. Another negative feature of drum printing is a limited choice of character fonts; the whole drum has to be changed if a different font is desired, and drums sell for $3000. Examples of older drum-printer products are the very successful Dataproducts 2230, 2260, 2290 and 2470 series and the Hewlett-Packard 2613A, 2617A and 2618A, etc.

Reliability is a problem because wear in the character tracks on the drum is common, and hammer and electronic adjustments are critical, requiring periodic maintenance. These are the chief reasons that Fig. 3 forecasts the demise of drum-printer technology, which will be replaced by horizontal-moving-font techniques such as band, belt, chain and train. ■

Andrew Roman is president of Roman Associates International, an independent consulting firm in Newark, Calif., that specializes in computer peripherals.

Micro-computer data base management at its best!

Get the most out of your micro-computer. Use our advanced and productive data management system.

HDBS is an extended hierarchical data base system offering

- fixed length records
- file-level read/write protection
- one-to-many set relationships

MDBS is a full network data base system offered as an upgrade from HDBS...or it may be ideal as your initial system. **Unique and versatile,** it adds these features:

- full network CODASYL-oriented data structures
- variable length records
- multiple levels of read/write protection
- one-to-one, many-to-one, and many-to-many sets
- non-redundancy of data, easy updating
- occurrences of a record type may own other occurrences of the same type
- a single set may have multiple owner and member record types

MDBS-DRS. As an add-on to MDBS, the DRS system offers extraordinary flexibility in data base restructuring to meet new needs.

- Item, record, and set types can be added, deleted, or renamed in an existing data base as well as other data base characteristics. You can redesign the data base after it is already on-line!

MDBS-RTL. As an add-on to MDBS, the RTL (Recovery Transaction Logging) logs all data base transactions, so that in the event of a system failure, the data base can be recovered with minimal loss of information.

- The recovery processor permits selective reloading of the data base from the transaction file. Users can log messages, indicate complex transaction sequences, and effect selective control over the recovery process.

MDBS-QRS. An interactive Report-Writer/Query-System for HDBS/MDBS data bases. Features...

- may be customized for non-technical users
- complex retrieval conditions may be specified
- detailed reports can be quickly generated
- wildcard and "match-one" string specifications included

HDBS and MDBS Packages Include:

- DDL data definition language analyzer/editor
- 260-page users manual
- DMS data management routines callable from host language
- Sample application program and DDL files
- Relocator to re-org all routines
- System specific manual for bringing up our software

Both HDBS and MDBS Systems...

- Run under...
  CP/M® with CBASIC; Microsoft BASICs, FORTRAN or COBOL; InterSystem PASCAL/Z; Sorcim PASCAL/M; Micro Focus CIS COBOL; Digital Research PL/I
  OASIS
  TRSDOS and NEWDOS (Models I and II) with Disk BASIC
  North Star DOS with North Star BASIC
  Apple DOS and Applesoft BASIC
  Machine Language Interface available on all above systems.
- Up to 254 record-types definable in the data base; each record-type may contain up to 255 item-types; each item-type may be up to 9,999 bytes in length.
- Names of data items, records, sets, and files are wholly user definable.
- Commands to add, delete, update, search, and traverse the data base.
- Straightforward use of ISAM-like structures.
- Records can be maintained in several sorted orders.
- Written in machine language for maximum execution efficiency and minimal memory usage.
- Independent of types and sizes of disk drives. Support data base spread over several disk drives (max.8); disks may be mini- or full-sized floppies or hard disks.
- Available versions: Z80 (requires approx. 18K), 6502 (approx. 30K), 8080 (approx. 22K)
  Total memory requirement must allow for buffer areas. For Apple users, a language card is recommended.
- 8086 version available. (Call or write for details and prices.)

Ordering information (applicable to Z80, 8080 and 6502 versions):

HDBS (Version 1.04)	$ 300.00
MDBS (Version 1.04)	900.00
DRS	300.00
RTL	300.00
QRS	300.00
HDBS upgrade to MDBS	650.00
MDBS with DRS, RTL, and QRS	1500.00
HDBS/MDBS Manual	35.00
DRS Manual	5.00
RTL Manual	5.00
QRS Manual	5.00
System Specific Manuals (each)	5.00

Within a given operating system, add $125.00 for each additional language selected.

For prices outside the U.S. and Canada, please ask for price lists.

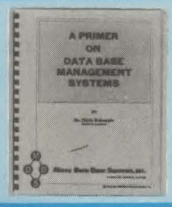
Add $2.50 handling fee for non-cash order ($5.00 outside U.S.).

When ordering, specify intended use with...

1. North Star DOS and BASIC
2. CP/M® - CBASIC
3. CP/M® - Microsoft BASIC 4.XX
4. CP/M® - Microsoft BASIC 5.XX
5. CP/M® - Microsoft BASIC or FORTRAN Compiler
6. CP/M® - Microsoft COBOL-80
7. CP/M® - InterSystem PASCAL/Z
8. CP/M® - Sorcim PASCAL/M
9. CP/M® - Digital Research PL/I
10. CP/M® - Micro Focus CIS COBOL
11. TRSDOS/NEWDOS and TRS Disk BASIC (Models I and II)
12. Apple DOS and Applesoft BASIC
13. OASIS
14. Machine Language Programs (Specify operating system.)

Indiana residents add 4%.

We accept Visa and Master Charge.



54-page "primer" on data base systems for micro-computers — only $10.00 per copy.

Dealer Demo-Package ($60.00) includes Primer, HDBS/MDBS Manuals, Demo-Disk, etc.

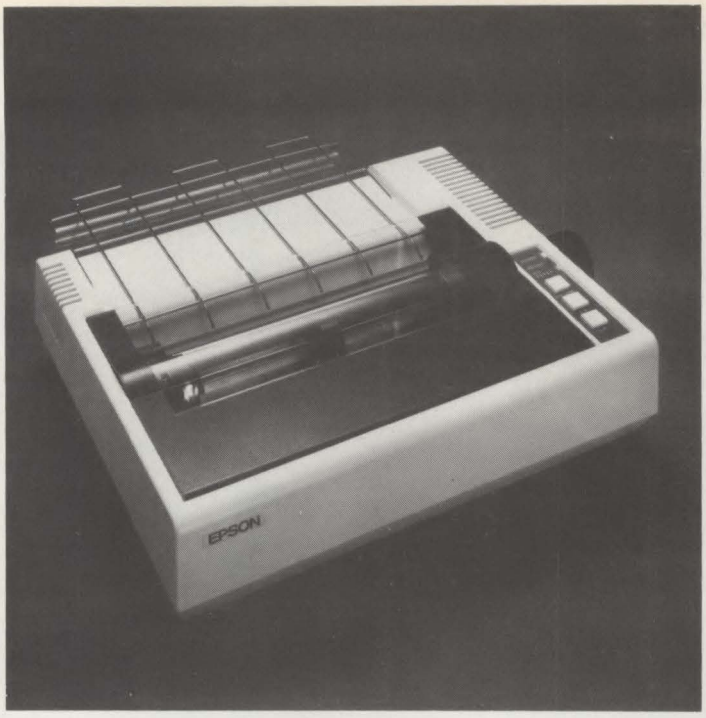
Setting standards of excellence for data base software...worldwide.

Micro Data Base Systems, inc.

Dept. M, Box 248, Lafayette, IN 47902
317-448-1616

CIRCLE NO. 42 ON INQUIRY CARD

The MX-80. It not only does everything, it does everything well.



Epson.

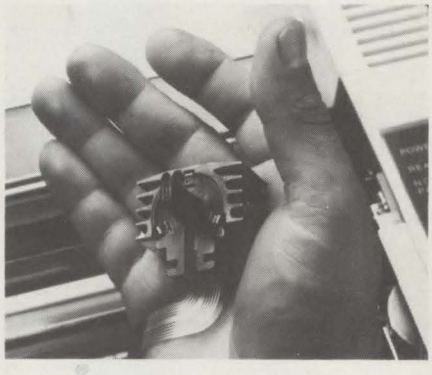
This is the new Epson MX-80 dot matrix printer. It does just about everything you could ask a printer to do. Quickly. Quietly. Reliably. In fact, for OEM installations, the MX-80 may be the single best, all-round printer you can buy. But that's not the best reason to buy it.

The MX-80 prints bidirectionally at 80 CPS in a user-defined choice of 40, 80, 66 or 132 columns. And if that's not fast enough, its logical seeking function minimizes print head travel time. The MX-80 prints 96 ASCII, 64 graphic and eight international characters with a tack-sharp 9x9 matrix. For a long time. Epson printers are known for reliability and the MX-80 is no exception. But that's not the best reason to buy it either.

The print head has a life expectancy of up to 100×10^6 characters, and when it wears out, just throw it away. A new one costs less than $30 and the only tool you need to change it is attached to the end of your arm. The MX-80 is compact, weighs only 12 lbs., and the whole unit, including the two stepper motors controlling carriage and paper feeding functions, is precisely controlled by an internal microprocessor. But even that isn't why you should specify the MX-80.

The best reason is this: because Epson makes more printers than anyone else in the world, we can afford to sell each one for a little less. So you can get one Epson MX-80 Printer for less than $650. And more than one for even less than that.

That's what we call a small price to pay for a printer that does everything well.



The world's first disposable print head. When it wears out, just throw it away. A new one costs less than $30, yet it's so simple, you can change it with one hand.

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

CIRCLE NO. 43 ON INQUIRY CARD

THERE IS ONLY ONE 32-BIT COMPUTER WHOSE LOGIC DOESN'T DEFY LOGIC.

PRESENTING THE DATA GENERAL ECLIPSE MV/8000.

Apparently, our competitors are operating under the premise that there is no need to make their new computers compatible with their older ones. And have no qualms about rendering obsolete the years of man-hours and the hundreds of thousands of dollars you've invested in software.

At Data General, we believe this kind of logic defies logic. Which is why we designed our 32-bit MV/8000 to protect your software investment.

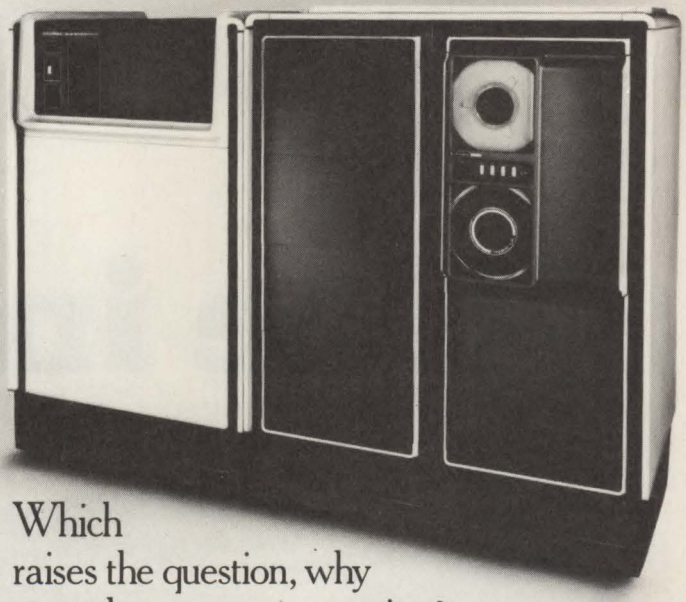
Not destroy it.

However, the MV/8000's software compatibility is only part of what places it in a class by itself. Another factor is speed. It's the fastest computer of its size on the market.

In fact, its 36.4 MB/sec memory bandwidth is at least two to four times faster than its nearest competitor.

It's also more reliable, much easier to maintain, quicker to get operational (it not only offers the widest range of software, but the widest range of languages*) and offers sophisticated security features, word processing, communications capabilities and data base management. All superior to its nearest competitor.

And while these features alone make the MV/8000 a most attractive investment, there's something else. It also costs less than its nearest competitor.



Which raises the question, why go to the nearest competitor?

If the logic of purchasing any other 32-bit computer escapes you as much as it escapes us, just fill out the coupon and we'll be happy to fill you in on the one computer that eclipses them all.

The remarkable new Data General Eclipse MV/8000.

Data General

Mail to: Data General Corporation
4400 Computer Drive, MS C228
Westboro, Massachusetts 01580

Attention: Marketing Communications Department

☐ Please send me more information on the Data General Eclipse MV/8000.

☐ Please have a sales representative call on me immediately.

Name_____

MMS-1-81

Title_____

Company_____ Tel._____

Address_____

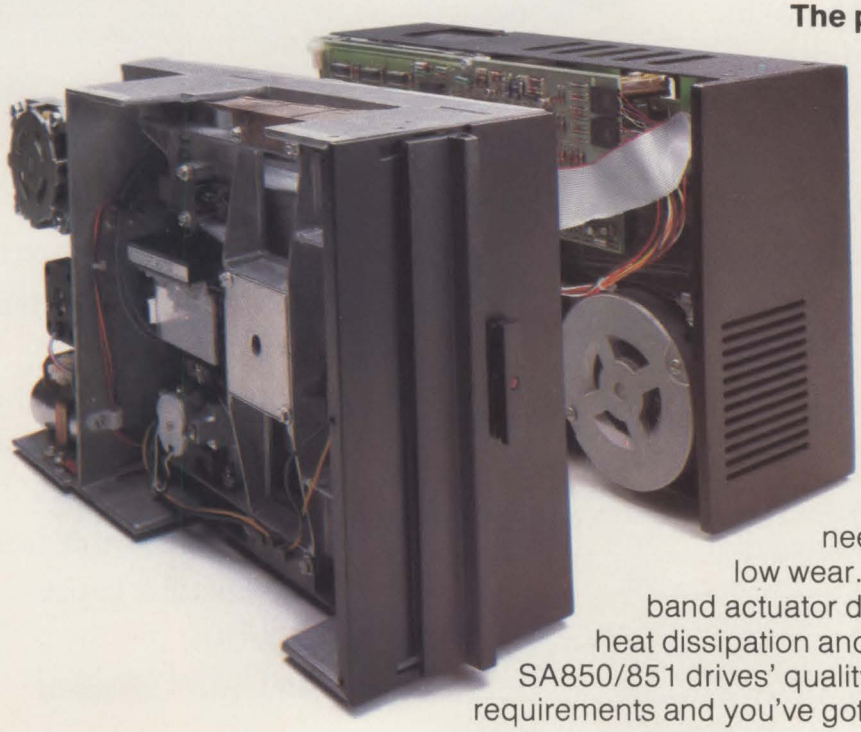
City_____ State_____ Zip_____

*Fortran 77, Cobol, Basic, PL/1 and RPG II

CIRCLE NO. 44 ON INQUIRY CARD

Now rolling on the fast track. The race is on for high volume production of double-sided eight-inch floppys. And Shugart's SA850/851 drives are widening their lead. The first OEM double-sided drives introduced in 1977 were from Shugart and since then we've continued to invest our resources in perfecting the technology. After hundreds of man/years of R & D and production engineering, we've succeeded in bringing our OEM customers the most reliable, cost-effective and manufacturable double-sided drive in the industry. With more than 70,000 SA850/851's already installed and production rolling into high gear, now's the time to get your double-sided product plans on the inside track with the Shugart Express.

SA850
The inside track



The perfect match. With 1.6 MBytes of unformatted storage, the SA850/851 drives are the perfect back-up solution for Winchester fixed disk systems. And since they're identical in size and I/O compatible with our SA800 drives, the SA850/851's are the perfect match for upgrading existing single-sided floppy systems as well. Head and media problems are a thing of the past because our Bi-Compliant™ head assembly delivers the superior media compliance needed for solid data integrity and low wear. And our famous Fasflex™ metal band actuator delivers 3 ms access times with low heat dissipation and superb reliability. Match up the SA850/851 drives' quality and performance with your system requirements and you've got a winner—on any track.

™ Trademark of Shugart Associates

/851. for OEM success.

Experience Curve Benefits. With more technological firsts and shipments of 1½ million floppy disk drives, Shugart brings unsurpassed experience to its production of double-sided floppys. And we are continuing to reinvest in R & D, manufacturing technologies and customer support programs to bring you the most thoroughly engineered, most reliable double-sided floppys in the industry. Give us a call today for your reservation on the Shugart Express at one of our sales offices, or Hamilton/Avnet outlets. □ **Shugart Associates: 475 Oakmead Parkway, Sunnyvale, CA (408) 733-0100.** *Sales & Service: Sunnyvale, CA; Costa Mesa, CA; Minneapolis, MN; Richardson, TX; Framingham, MA; Mt. Freedom, NJ; Atlanta, GA; Toronto, Ontario; Paris, France; Munich, Germany.* □

Shugart®

CIRCLE NO. 45 ON INQUIRY CARD

Choosing a line printer

VINCENT HEWITT, DENNIS KING
and JOAN NAIDISH, Dataproducts Corp.

Here's a question-and-answer guide to help even the uninitiated buyer make a logical choice

In at least one respect, life gets easier every day for those in the market for new printers. Manufacturers are designing machines with higher performance, greater flexibility, more operator conveniences, better environmental characteristics and lower prices than ever before. But when the range of alternatives increases, so too does the difficulty of choosing between them.

The overriding issue in selecting a printer is its intended applications. What will the machine be expected to do? It makes no sense to spend top dollar for a heavy-duty printer that will stand idle most of the time, or vice versa. Pushing a light-duty unit beyond its design limits will give rise to unnecessary breakdowns and expensive service calls.

Here, the focus will be on the selection criteria a customer should apply when shopping for a line printer. In practice, however, the same rules of thumb apply when choosing any printer. Our question-and-answer format should guide even the uninitiated toward a logical printer choice for his application.

What is the maximum price a user should pay for a line printer, and what performance restrictions does that price ceiling dictate?

As with anything else, the adage "you get what you pay for" applies. Line printers come in all shapes and sizes with speeds ranging from 150-lpm dot-matrix units to 45,000-lpm non-impact ink-jet printers. The corresponding prices range from $5000 to $320,000. Price cannot be considered in a vacuum.

Illustrations by Jon McIntosh

Speed, output volume and duty cycle are important qualifiers.

Print speed should be determined by your output volume. For example, very-high-speed printers (4000 to 18,000 lpm) are intended for high-volume printing with large mainframe systems. A user should consider such printers if his output is more than a million sheets per month. High-speed printers (900 to 2000 lpm) are usually associated with medium- or large-scale computers. This speed range will produce 100,000 to 500,000 sheets per month. Printers in the 300- to 900-lpm speed class are most often used with small-business systems and will generate 50,000 to 100,000 sheets per month.

There's more to speed and output volume than meets the eye, however. Both also depend on a printer's duty cycle, or the ratio of printing time to the number of hours the printer is actually under power. Printers are not designed to print 100 percent of the time. An average medium- or high-speed printer's duty cycle is about 25 to 40 percent.

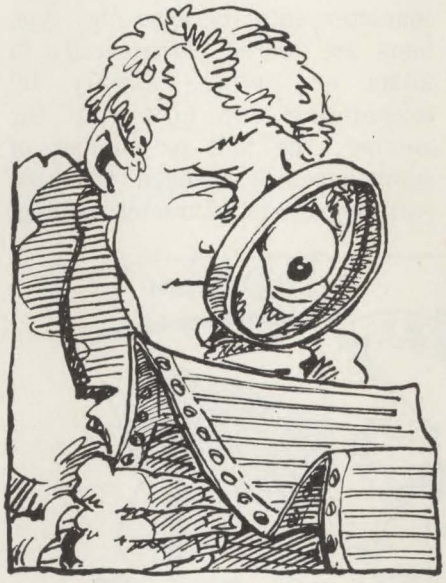
The relationship between print speed, output volume and duty cycle becomes clearer by example. Suppose an application requires a daily output of 10,000 single-sheet forms, each containing 50 lines of printed information. The printer, then, must produce 10,000 × 50, or 500,000 lines of copy daily. If a customer is considering using a 1200-lpm printer, it would take about seven hours—almost a full workday—to complete the job.

But when we introduce duty cycle into this equation, we find that the same job will take four days to complete when the printer runs on a 25-percent duty cycle and two-and-a-half days on a 40-percent duty cycle. Obviously, a user must either buy more than one printer or buy a considerably higher-speed unit. And that affects his budget.

But he should not yield to the temptation to buy an inexpensive printer designed for light duty cycles to handle a high-volume application. Such a printer, if overworked, might produce the required output, but the cost of replacing prematurely worn-out parts would soon offset any initial saving.

What print quality does a customer need, and how does that requirement affect his choice of print methods (i.e., band, belt, drum, matrix)?

The application dictates not only print speed and price, but print quality as well. Clean, legible copy is a must on invoices, statements and letters going outside a company. Lower print quality may be acceptable if the printout is strictly for internal use. Print



quality ranges from high (letter quality) to barely legible. Appearance and legibility depend on several factors: printing technology, type of ribbon or ink, quality and type of paper, number of copies and printer maintenance.

Line printers offer two distinct types of characters: fully formed or dot-matrix. Fully formed characters are generated by band, belt, drum and chain or train printers. These technologies provide high-quality printing. If not adjusted properly, however, these units can cause line smear or character misregistration. Vertical-moving fonts, such as drums, may produce vertical misregistration or wavy lines, while horizontal-moving fonts, such as bands and belts, may cause horizontal misregistration, or uneven spacing between characters on the same line. Dot-matrix characters are on the other side of the coin. This printing technique is available in impact-matrix and all non-impact line printers. Print quality ranges from poor at a low dot density to good at a high dot density. Although matrix printers are used for many applications, some consider their print quality less desirable than that of fully formed characters when correspondence or formal text preparation is required. Nonetheless, some non-impact matrix printers provide such fine resolution that the characters appear fully formed. Print quality for non-impact printers requiring special paper varies with the type of paper and technology.

Whether a user chooses a unit that prints fully formed or matrix characters, he must make sure that the resulting print quality is suitable for his application. He can request print samples so that he can check for clear, sharp characters that have no extraneous ink, smudging or background clutter. If he expects to use a particular paper type, he should ask that print samples be run on that paper using new and used ribbons. The print technology, ribbon-inking density and paper finish will all markedly affect final print quality. If the user is planning to use multipart forms, he should request additional samples to ensure an acceptable bottom copy.

How does the selected print technology affect the number of characters and fonts available in a set?

The printer technology a user selects determines the number of characters and fonts available in a set. Impact line printers using fully formed characters fall into two categories: vertical font carriers, or drum printers, and horizontal font carriers, such as band, belt, chain or train printers.

A drum has a complete set of characters embossed around its circumference for each print position. Each character appears on the drum with a frequency corresponding to the number of

printable columns. A 132-column printer will, for example, have 132 Es on its drum. Drum printers come with either 48-, 64- or 96-character sets, or two sets of 48. Though the font carriers are available in different character sets, as well as other languages (such as Farsi and Katakana), most drum printers do not have interchangeable drums. The particular font the user chooses will be the one used for all his printing needs. Although the font flexibility of this type of printer is limited, drum life is usually measured in years.

Horizontal font carriers have greater character-set and font flexibility than drum printers. Band, train or chain printers enable all print positions to use each character set. An operator can easily change fonts, so that more than one character set can be used on the same printer.

Availability of fonts and character sets for impact matrix and all non-impact line printers is a different ball game. The advantage here is that the same print mechanism can generate numerous character sets, because the type fonts are stored electronically in ROMs or PROMs. Simply by exchanging one ROM chip for another, the font or number of symbols can be changed. On some matrix printers, character spacing, height and width can also be varied under switch or program control, and on others, graphics capability is available.

If your application requires high output volume, don't be tempted to buy a less expensive printer designed for light duty cycles. It might do the job, but the cost of replacing prematurely worn-out parts would soon offset any initial savings.

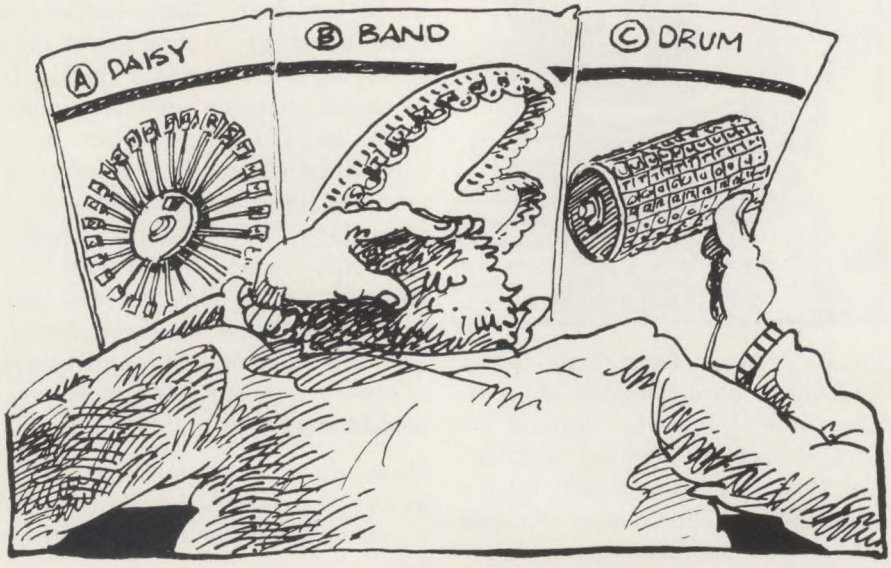
With non-impact printing technologies, such as ink-jet or laser-xerographic, a printer can be programmed not only to print any character of any size, but also to generate any graphic image and any logo, and to do it in color, if desired.

The character set a user chooses will determine the specific symbols or letters he will use in his printing application, and also will affect the print speed of the unit. A 900-lpm band printer, for example, may print at 1100 lpm using a 48-character set, 900 lpm at 64 characters and 700 lpm at 96 characters. The smaller the character set, the higher the number of character sets on the font carrier and the higher the print speed.

How do forms-handling requirements affect the choice of a printer?

An important indication of a printer's flexibility is its forms-handling ability. Depending on the application, a user may need a unit that can accommodate different paper widths, or preprinted multipart forms, or one that can control the vertical printing format of the user's output.

If printing tasks involve the use of different paper widths, the user should make sure the printer can accommodate these sizes. A 132-column line printer, for instance, can handle paper widths ranging from a few to 19 in. If a user is considering an 80-column printer,



Technology	Speed	Advantages	Limitations	Price and Typical Manufacturer(s)
Impact matrix	150 to 600 lpm	High resolution with dense matrix, ROM = changeable fonts, graphics capability, medium speed	Lower reliability with higher duty cycles, low resolution with sparse dot matrix	$5000 to $16,400 Tally Corp.
Drum	300 to 2000 lpm	High reliability, good medium to high duty cycle	Limited character fonts, slight vertical mis-registration	$10,000 to $60,000 Dataproducts Corp.
Chain or train	300 to 2000 lpm	Good print quality, interchangeable character sets, as many as 128 characters	Chain or train track wear	$15,000 to $95,000 IBM Corp.
Band or belt	150 to 3800 lpm	Interchangeable fonts, good print quality, high reliability	Belt and drive wear, entire band replacement for individual worn character	$7000 to $120,000 Dataproducts Corp. Documation, Inc., IBM Corp.

Summary of impact *line printer technologies.*

The new smart terminal for savvy OEM's/systems houses.

Introducing a new block mode, editing terminal from Perkin-Elmer — the 1245. A terminal smart enough to keep people from blowing your system.

Your host computer downloads all the needed option and configuration details to the 1245. There are no switches! All this greatly reduces system upsets caused by operator-originated errors.

Your host computer can enable just those groups of keys on the 1245 that are required and lock out the rest, preventing operator errors.

Besides its three self-test programs, the 1245 can execute special OEM test programs downloaded into screen memory.

One 1245 communication mode minimizes system response time and transmission costs by sending only "modified fields."

Your customers will love the 1245's exceptionally clear display with 9 x 12 resolution. Its tiltable, hooded, and etched tube gives unsurpassed glare rejection. It offers a full set of video attributes, 32 line-drawing characters for business forms and a 25th status line. You can choose a detachable keyboard with either 12/24 or 16/32 function keys and a light pen.

We're a Fortune 500 company and a leading supplier of data communications terminals. Sales offices are located in Atlanta, Boston, Chicago, Los Angeles, New York, San Francisco, and throughout Europe.

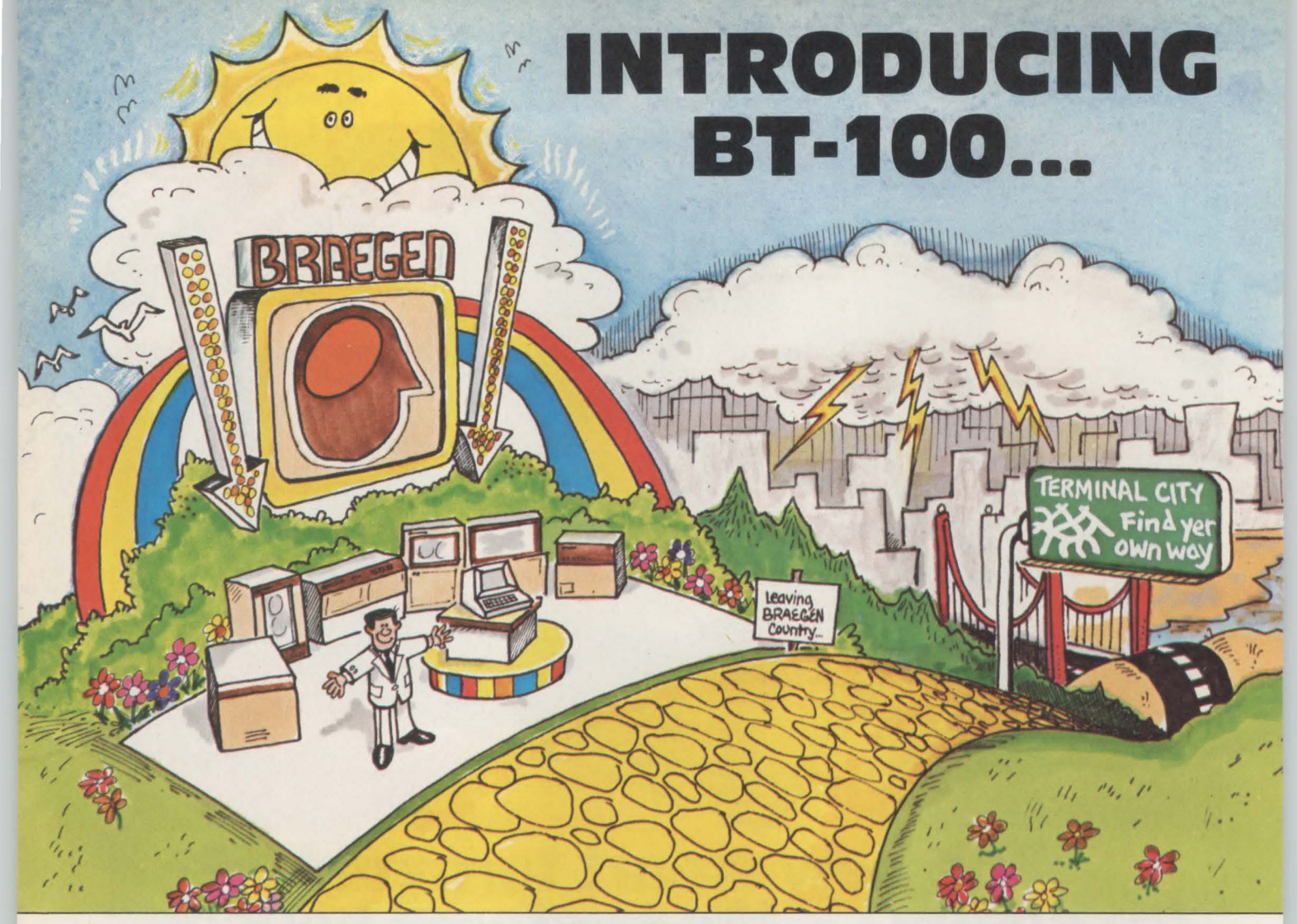
For more information on the 1245 write: Perkin-Elmer, Terminals Division, Flanders, NJ 07836. **Or call toll free (800) 631-2154. In NJ (201) 870-4712.**

On site and/or depot maintenance services for all Perkin-Elmer terminals are available through our own service force of 400 people located in 52 cities coast-to-coast.

PERKIN-ELMER

CIRCLE NO. 46 ON INQUIRY CARD

INTRODUCING BT-100...



The latest addition to our line of DEC®-compatible peripherals.

Locating the right VT-100® -type Video Display terminal can be a stormy proposition. BRAEGEN's new BT-100 is the ray of sunshine you've been looking for.

The first in a family of VT-100® - compatible terminals, the BRAEGEN BT-100 comes loaded with outstanding features that are only available as costly extras on other terminals in its class. For example: the BT-100 provides an advanced video package with four alternate character attributes: Bold, Underline, Reverse, and Blink, all of which can be selected in any combination on a character- by-character basis. Then there's an active or passive 20MA current loop and an RS-232 interface...all standard.

The BT-100's unique character spacing is designed to reduce eye fatigue and the standard typewriter style keyboard simplifies operator training. The list of features goes on and on. And, like all BRAEGEN peripherals, the BT-100 is backed by a one year warranty and a nationwide network of service centers.

Before you get lost in terminal city, contact your nearest BRAEGEN office and get the complete BT-100 Story. For applications not requiring the sophistication of the BT-100, ask about our Models BT-2A, BT-5A, and the BT-314.

OEM quantity discounts available

BRAEGEN

CENTRAL REGIONAL OFFICE: (312) 692-2250 *Overland Park, KS (913) 262-5053 / Southfield, MI (313) 569-3269 / Bloomington, MN (612) 831-5007 / Cleveland, OH (216) 362-1555* **EASTERN REGIONAL OFFICE: (617) 890-4890** *Norcross, GA (404) 449-0846 / Union, NJ (201) 687-5094 / New York, NY (212) 682-7451 / Bala Cynwyd, PA (215) 667-1740 / Houston, TX (713) 771-0400 / McLean, VA (703) 442-8508* **WESTERN REGIONAL OFFICE: (408) 496-6578** *Anaheim, CA (714) 520-9211 / Los Angeles, CA (213) 644-2292 / San Francisco, CA (415) 495-8973 / Denver, CO (303) 340-1062 / Bellevue, WA (206) 747-9321*

CIRCLE NO. 48 ON INQUIRY CARD

he's limited to a maximum printing width of 8 in. (at 10 characters per in.). Some band and matrix printers have the added flexibility of being able to print either condensed or expanded characters. This means that the same information could be printed on a 14-in.-wide sheet of paper or condensed to fit on a standard 8½- × 11-in. sheet.

To print special multipart forms, such as payroll checks or invoices, a user will need an impact printer, which can provide multiple copies (usually two to six including the original) in a single pass. Although non-impact printers cannot produce more than one copy in a single printing pass, they can, by means of a page buffer, duplicate a printed page as many times as needed. As a bonus, the last copy, as well as all copies in between, will have the same print quality as the first. Although this compensates for a non-impact printer's inability to print multipart forms, a page buffer may be practical and economical only for light workloads. With a heavy workload, a user may not be able to afford tying up the CPU any longer than necessary.

Print quality depends on several factors: printing technology, type of ribbon or ink, type and quality of paper, number of copies and printer maintenance.

Despite their lack of multicopy capability, high-speed, non-impact printing systems offer other forms-handling features. Some ink-jet units can print on envelopes as well as standard 8½- × 11-in. plain paper in either a vertical or horizontal format. Xerographic printers eliminate the need for preprinted forms, because the forms can be generated from a photographic image or an electronic forms generator. Still other electrostatic units will print on continuous rolls of specially coated paper and perforate, punch, cut, trim, collate and stack several jobs at a time.

For applications requiring highly formatted or preprinted forms, a user may want a printer equipped with a vertical format unit (VFU). A VFU enables information to be printed on specific portions of a form by automatically omitting spaces where desired. This can significantly increase throughput by enabling the printer to slew between printed lines. VFUs can read programmed punched paper tape or can be loaded directly from a computer.

Other printer features that facilitate forms and paper handling include adjustable form-thickness controls, paper pullers, power stackers and form-length select switches.

What are the user's concerns regarding supplies and consumables, such as ribbons and paper?

Though the amount of paper used is a function of the application, the per-unit cost is not. Volume printing does not economically lend itself to the use of printers requiring special paper, unless there is some other overriding consideration. Similarly, applications requiring multiple copies become very expensive if secondary reproduction techniques are needed.

Ribbon expense, which may on the surface seem insignificant, can be substantial over the useful life of a printer. Although price is a factor, a user shouldn't assume all ribbons are the same and opt for the cheapest, thinking he'll save money. He may fare better by buying a more expensive ribbon that will last longer and cost less in the long run.

The procedure for loading supplies into the printer is also important. Because paper must be frequently loaded into any printer, the procedure should be simple and require a minimum amount of time, without awkward physical contortions. If pin-feed paper is used, tractor faceplates should be exposed and tractor teeth clearly visible when loading paper. All types of printers should have provisions for initially aligning the top-of-form and left-hand margins if preprinted forms are used.

Ribbon changing, no matter how infrequent, is bothersome, and installation should be easy and clean.

What options or accessories are necessary or desirable?

The selection of options or

accessories should be based on a user's application and the skill of the printer operator. Will the operator be a highly skilled technician or someone who will simply turn the machine on, load paper and change ribbons?

With μps, manufacturers have been able to design features that minimize downtime and service calls and provide for unattended operation. Built-in diagnostic displays can now monitor machine status, automatically displaying any changes. This enables an operator to identify or correct off-line conditions—many times without a service call. And with a built-in self-test feature, the operator can run the printer independently of the system to verify correct operation.

Some manufacturers equip their printers with audio alarms or built-in status sensors to indicate conditions such as paper-out and paper and ribbon motion. These features are user conveniences that provide for unattended operation and reduce the possibility of data loss.

Other options, such as special interfaces, universal power supplies and forms-handling features, enhance printer operation and flexibility. Again, the combination of options and accessories a user selects should be based on his needs. And when considering several printers, a user should make sure he's not comparing apples with oranges. While one manufacturer may offer several accessories as standard equipment, another may offer the same features as options. Buyers should understand exactly what is included in the "sticker price" and what's extra.

The printer technology you select determines the number of characters and fonts available in a set.

Where will the printer be used, and what considerations does that environment impose?

It's a good idea for a user to follow the manufacturer's installation specifications for the printer's environment. However, as systems move out of the computer room and into the office, so will printers. As a result, users may need to consider several additional factors.

One of these is noise, which can affect the concentration, comfort and productivity of people working near an impact printer. Because this has become a sensitive issue in the last few years, several manufacturers have designed printers with fully enclosed cabinets that reduce their operating noise levels from 70 to 75 dBA to approximately 60 dBA, which is quieter than an office typewriter. Where noise is a critical factor, a user might consider non-impact printers, which are very quiet.

Another environmental consideration is appearance. If a unit is going to become part of an office, it should fit in with the other office furniture and machines.

Extremes of temperature and humidity can affect a printer's operation, so the user should make sure it is placed in an area that

meets the manufacturer's specs for those conditions. And although it sounds almost trivial, the printer should be properly grounded, and antistatic carpets should be installed to minimize static electricity discharge, which can scramble PC board functions and cause errors. Some manufacturers offer static eliminators, either as options or as standard equipment, to reduce the possibility of static discharge.

Once the user has decided on the printer's location, he should plan for any special power requirements. Some printers need only a 115V line; others call for a 220V power source. For safety, the printer should conform to local and state codes. In most states, UL approval is required for any electrical device, and in Canada, the printer must adhere to the CSA (Canadian Safety Act).

What kind of processor will drive the printer, and what kind of interface does the printer require? Is a special controller required?

A printer with great performance on paper can turn out to be useless if it's not compatible with a user's system: the printer must be able to communicate with the computer. Line printers are connected to the computer through a parallel, or occasionally a serial, controller. The controller may be embedded in the computer chassis or external. When the computer sends instructions to print, the controller must transfer data to the printer in a form it can understand, then verify that the printer has received the data.

NEW ADD-IN MEMORIES FOR NOVA+ & ECLIPSE+ COMPUTERS.

Add-in confidence with optional on-board ECC and diagnostics.

MOSTEK®

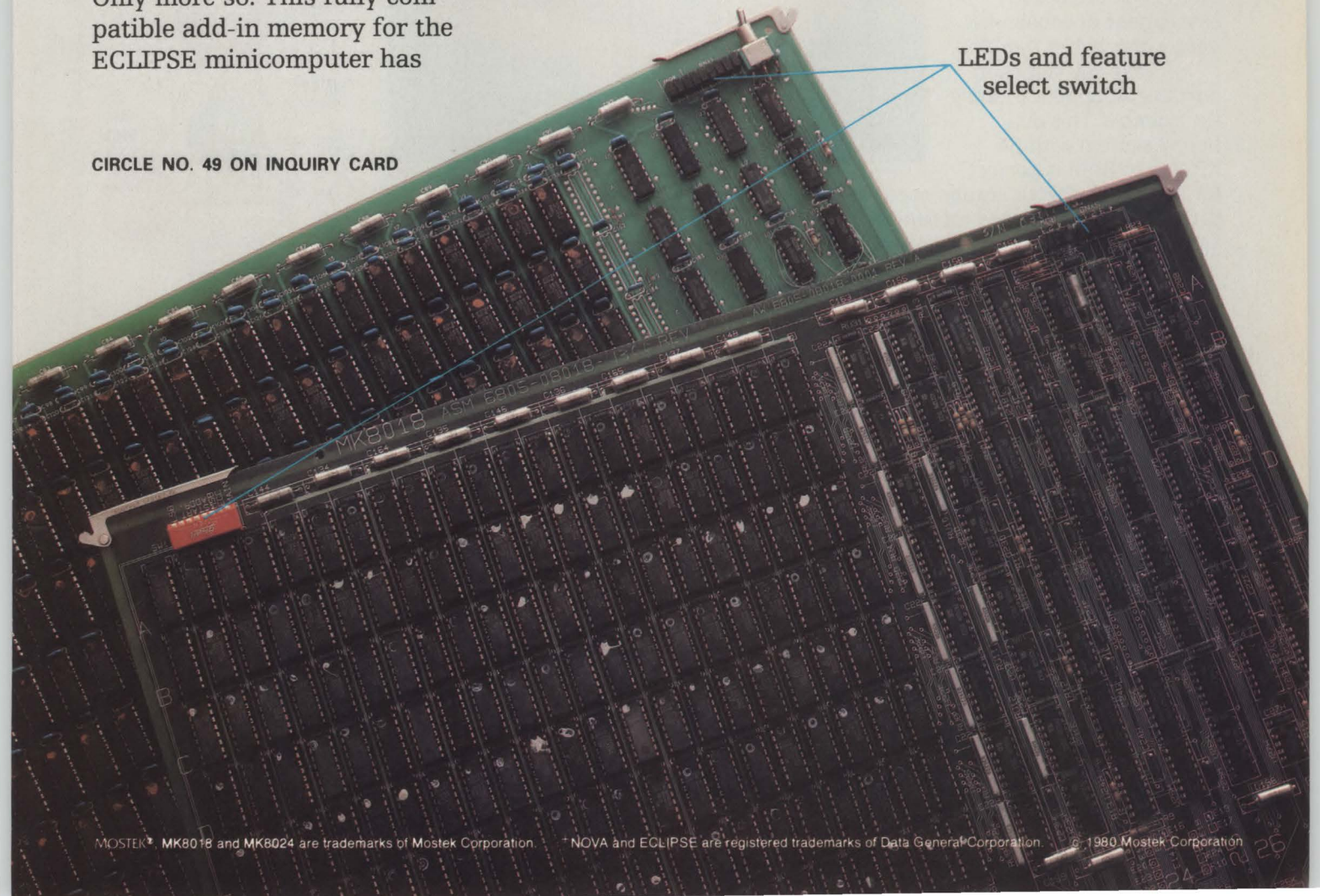
Think of the added confidence that on-board ECC and diagnostics can give you. For NOVA 4/X & 4/S minicomputers, our fully compatible MK8018 memory system features an on-board single-bit error correction option complemented by an 8 LED error log display. With it, you can troubleshoot to the individual RAM level.

The same is true with our MK8024 memory system. Only more so. This fully compatible add-in memory for the ECLIPSE minicomputer has three ECC options. One of which includes single-bit error correction that is independent of and transparent to the processor.

Using industry-standard Mostek dynamic RAMs, memory configurations for the MK8018 range from 32K ×16/21 up to 128K×16/21. For the MK8024, choose from 16K×16/21/22 up to 128K× 16/21/22.

Call your Mostek regional sales office for more details.
Northeast: 617/256-1500
East and South: 201/842-5100
North Central: 612/935-4020
South Central: 214/386-9141
Western: 714/549-0397
Northwestern: 408/287-5081

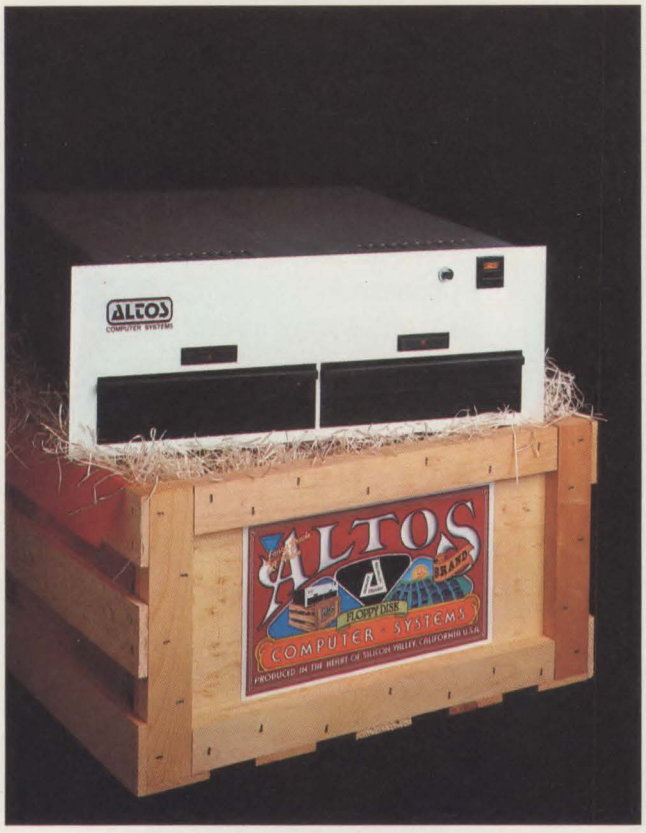
Or contact Mostek Corporation, 1215 West Crosby Road, Carrollton, Texas 75006, (214) 323-1802. In Europe, contact Mostek Brussels 660.69.24.



CIRCLE NO. 49 ON INQUIRY CARD

MOSTEK®, MK8018 and MK8024 are trademarks of Mostek Corporation. +NOVA and ECLIPSE are registered trademarks of Data General Corporation. © 1980 Mostek Corporation

WHY GROWING CONCERNS PICK OUR FLOPPY BASED SYSTEMS



Growing concerns require fresh ideas. Ideas that stimulate growth. Ideas that manage growth. Ideas that are designed to grow with the business.

Altos Computer Systems, a world leader in single board microcomputer technology, cultivates these ideas and delivers them in an attractive assortment of economical floppy disk based systems.

Take the compact, portable ACS8000-2 family, for example. This dual floppy system with 64 KBytes of RAM is perfect for inexpensive work station applications such as business accounting and word processing.

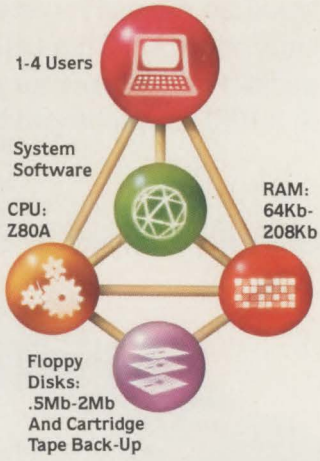
Altos' versatile and upgradable ACS8000-5 system is the solution for growing storage capacities. Simply add chips to Altos' reliable, fully socketed single board computer to upgrade to any of Altos' ACS8000-6 hard disk or multi-user systems. Choose up to 208 KBytes of on-board RAM storage which can be accessed in 48 KByte banks—one bank for each of four users. Like all Altos family members, the ACS8000-5 has full asynchronous, bisynchronous, and networking communications capabilities.

All Altos systems are packaged with the most select features, such as the single board Z80A* CPU, quality Shugart drives, and optional DMA and floating point processors. And every Altos system must endure extensive reliability testing including 48 hours of in-process burn-ins.

Altos supports three industry standard operating systems: single/multi-user CP/M,** OASIS,† and Altos' proprietary AMEX.™ Seven high level programming languages are offered which are CP/M or AMEX compatible.

Weed through the micro-computer system alternatives. No matter what your application, you'll pick Altos.

For specific details about pricing or performance, call or write: Altos Computer Systems, 2360 Bering Drive, San Jose, CA, 95131, (408) 946-6700, Telex 171562 ALTOS SNJ.



Packed with Fresh Ideas

ALTOS
COMPUTER SYSTEMS

*Z80A is a registered trademark of Zilog, Inc. **CP/M is a registered trademark of Digital Research, Inc. †OASIS is a registered trademark of Phase One Systems, Inc. © 1980 Altos Computer Systems

CIRCLE NO. 50 ON INQUIRY CARD

The variables that must be considered when matching a printer and computer include baud rates, protocols, word length and parity. The user must consider these factors when the printer is selected. Many printers and computers match easily, but many don't. Although compatability problems can be resolved, it's easier to discuss the requirements before buying.

Where can a user buy a printer, and who will be responsbile for maintaining and repairing it?

The three main sources for printers are manufacturers, computer or communications suppliers and system houses. The key factor in selecting one of these is the level of support the user needs. Computer and communications suppliers are in a position to lease or sell an entire system and to take full responsibility for its installation and maintenance. Minicomputer manufacturers and terminal suppliers often have extensive service organizations dedicated to maintaining user equipment. Their service facilities are well staffed and have adequate parts supplies to provide all levels of support with a reasonable turnaround time.

System supply houses usually specialize in developing unique hardware-software combinations to suit their customers' needs. Once they've developed the system, it is turned over to the buyer for operation and upkeep. Some system houses can refer customers to third-party maintenance services for their equipment.

A printer with great performance on paper can turn out to be useless if it's not compatible with the system: the printer must be able to communicate with the computer.

If the buyer can assume responsibility for providing the necessary hardware interface, software, maintenance and service, a printer manufacturer may be the lowest-cost hardware source. However, the initial saving may eventually be eaten away by maintenance and spare parts expenses.

Some manufacturers maintain field-service organizations. Such groups are often established to provide advisory support to OEM customers. Other manufacturers actively solicit end-user business and are prepared to provide full field service. Still others have distributor networks through which users can buy equipment and receive service.

The price for full service may seem high compared to the basic printer cost, but a user might quickly spend a lot of money trying to do it himself if he lacks adequate experience. Many users have become disenchanted with a system when it functions improperly and when the computer manufacturer, communication supplier, printer manufacturer and software designer all disclaim responsibility.

When selecting a supplier, the user should realistically assess his resources, determine the amount of risk he is willing to assume during system integration and carefully select a supplier who will provide the required level of support.

What determines the total cost of ownership?

Perhaps the single most important consideration in the selection of a printer, after basic performance specifications, is the total cost of ownership. This includes the initial purchase price, plus the cost of supplies, maintenance and spare parts over the expected life of the unit. When analyzing competing products, it's common to find that an inherently superior product with a higher initial cost will, over its life, incur a lower cost of ownership, in which case the higher purchase price is easily justified. A comprehensive analysis should, therefore, include a thorough life-cycle cost study.

Three fundamental factors contributing to a printer's cost are reliability, periodic maintenance requirements and the cost of supplies.

Reliability, or MTBF (mean time between failure), means how long a printer will run before something goes wrong. If the failure rate is too high, repair and parts costs will be prohibitive. How reliable a printer will be depends on its design and on the way it's manufactured.

The requirement for periodic maintenance is a function of the soundness of a printer's design. All

Technology	Type	Speed	Advantages	Limitations	Price and Typical Manufacturer(s)
Electrostatic	Line	300 to 18,000 lpm	Graphics capability, versatile fonts, high speed, quiet	Special paper, wet toner	$5000 to $165,000 Versatec, Inc. (low-speed) Honeywell, Inc. (high-speed)
Xerographic	Line	1200 to 14,000 lpm	High speed, high resolution, quiet, multiple character sets, 132-column lines, eliminates preprinted forms	High cost, high maintenance, high-volume applications	$32,000 to $326,000 Xerox Corp. (high-speed) IBM Corp. (higher-speed)
Ink-jet	Serial or line	30 cps to 45,000 lpm	Plain paper, forms flexibility (including envelopes), quiet, high resolution at low speeds	Reduced print quality at high speeds, reduced reliability	$2500 to $25,000 IBM Corp. (low-speed), $5800/mo. Mead Digital Systems, Inc. (high-speed)

Summary of non-impact *line printer technologies. All non-impact printers have matrix-generated type fonts, limited to single-copy output.*

Perhaps the single most important consideration in the selection of a printer, after basic performance specifications, is the total cost of ownership, including the initial purchase price, plus the cost of supplies, maintenance and spare parts over the life of the unit.

devices are designed to operate at some duty level. The simpler the design, the more reliable the product. An inherently simple electromechanical system properly used will require little maintenance. A more complex or improperly used system will require more frequent and more costly maintenance.

The cost of paper and ribbons will certainly influence the total cost of ownership. The price the user pays for supplies will depend on what he's printing and the print quality he needs. Just as a higher priced printer may, in the long run, justify its initial expense, more expensive paper and ribbons may eventually pay for themselves.

Regardless of whether a line printer is selected for its stand-alone merits or for integration into a complete system, all of the foregoing selection criteria should be applied. The relative weights of each criterion may vary from one application to the next, but if the selection process begins by sorting matrix from fully formed character printers and then balancing the parameters of speed, output volume and duty cycle, the rest will fall easily into place. ■

Hewitt

King

Naidish

Vincent J. Hewitt is vice president of Dataproduct Corp.'s high-speed line printer division. **Dennis D. King** is Dataproducts' director of business management, and **Joan R. Naidish** is Dataproducts' public relations manager.

NEXT MONTH IN MMS

Disk drives get the feature spotlight in the February issue of Mini-Micro Systems. There will be major product surveys covering:

- The latest in Winchester hard-disk drives, including market forecasts for the next three years, plus a look at technology trends during that same period;
- Floppy-disk drives, including a concentrated table of hardware and performance data;
- An extensive first look at an important new disk drive.

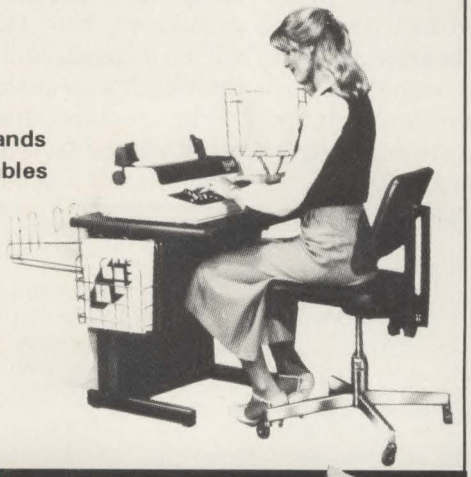
Supporting . . .

NEC, TI, DEC, QUME, DIABLO & CENTRONICS PRINTERS

IN STOCK FOR IMMEDIATE DELIVERY

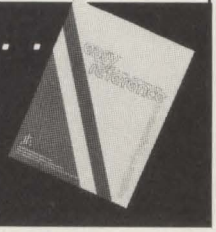
- Terminal Stands
- Interface Cables
- Ribbons
- Forms
- Media

and other essential Printer Products



ANSCO
P.O. BOX 2259
GARDENA, CA 90247

FREE . . .
catalog available



CALL TOLL FREE (800) 421-1270
IN CALIFORNIA (213) 532-7780

CIRCLE NO. 56 ON INQUIRY CARD

DEC®
Customized

Lots of companies can deliver DEC hardware. We deliver fully integrated LSI-11 based systems tailored to your specific needs. When you need them. We configure only the best hardware and software components from DEC with a wide range of compatibles from other solid manufacturers.

Systems Problems? We configure them out.

CONFIGURATION HOTLINE:
617-491-2700/800-343-5504

COMPUMART
Cambridge Digital Division
270 Third Street Box 568
Dept. 7405 Cambridge, MA 02139

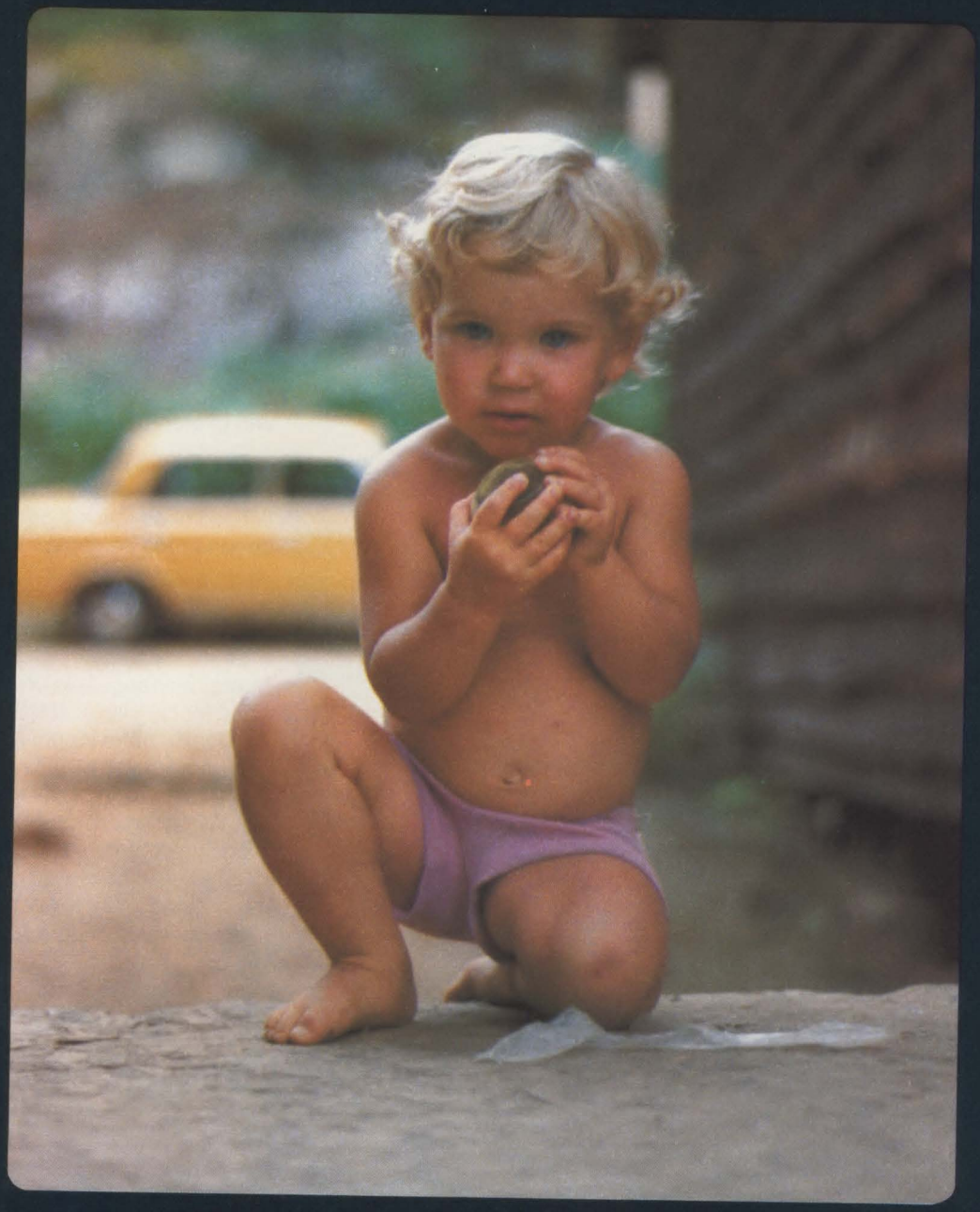
Providing Complete System Solutions since 1971.

TELEX 921401

Call or write for our DEC LS1-11 Systems Catalog

CIRCLE NO. 57 ON INQUIRY CARD

if the DEC Computer System you want hasn't been built yet... build it!



TRANSDUCTION: The Superblue Company
1645 Sismet Road, Unit 11
Mississauga, Ontario, Canada L4W 1Z3
Phone (416) 625-1907 – Telex 06-961374

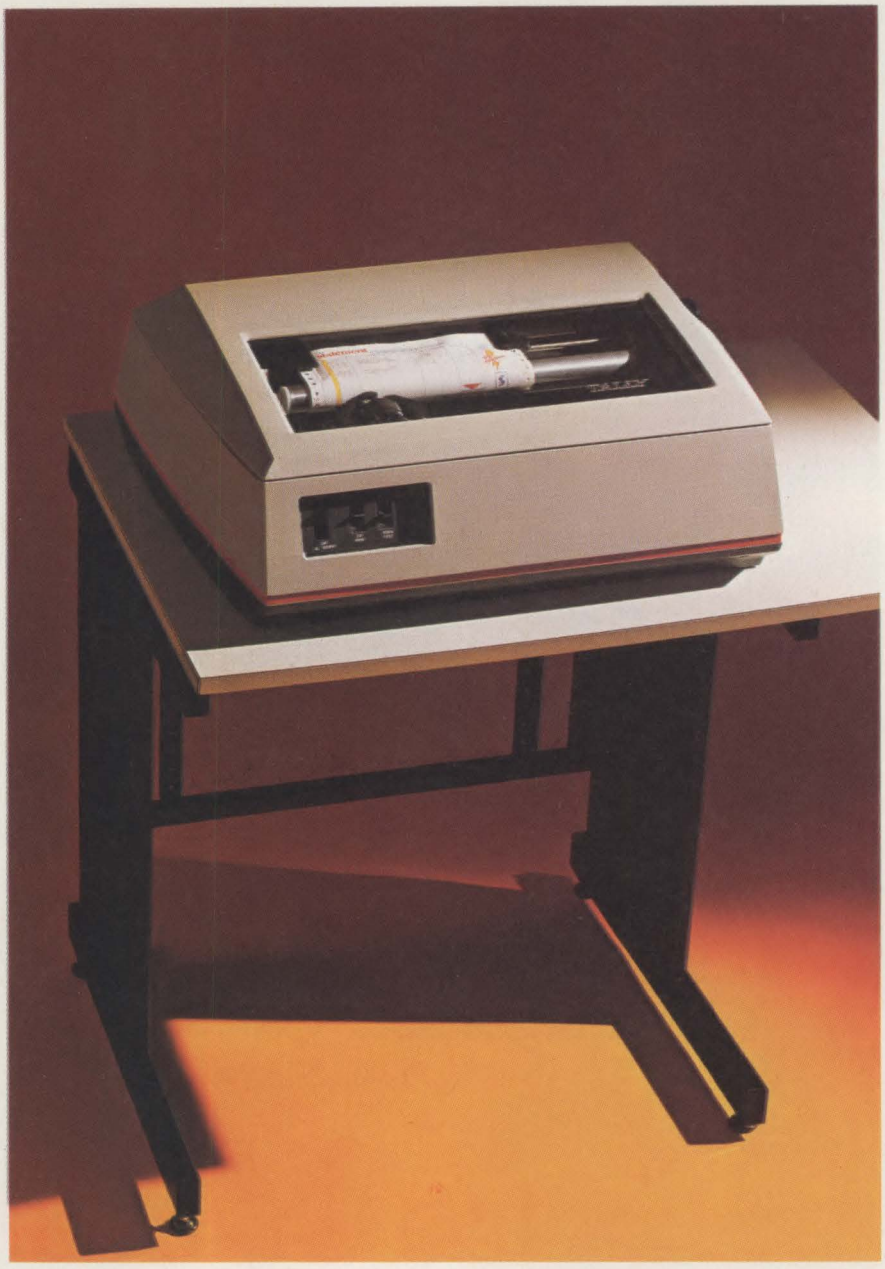
FOR LSI-11

CIRCLE NO. 140 ON INQUIRY CARD

FOR PDP-11

CIRCLE NO. 141 ON INQUIRY CARD

A NEW SERIAL PRINTER FROM THE LEADER IN MATRIX TECHNOLOGY



Mannesmann Tally sets the pace in price with the T1705.

From the Tally tradition of quality and reliability comes another dramatic advancement in lowered cost of ownership. A combination of low purchase price, low maintenance costs and low parts usage. A "no options" fully loaded printer that combines the latest in LSI electronics with precision mechanics. You get standard features that are extra cost options on other printers.

OEM's will select it because users will prefer it!

The T1705 is the quietest impact printer on the market. It has 160 cps optimized bi-directional printing with high speed 48 ips head slew for throughput speeds up to 200 lines per minute. Rugged reliability. No preventive maintenance requirements.

Standard features include a new operator changeable precision print head for long life and superb print quality. Dual tractors for positive paper positioning and control. Operator selectable 6 or 8 lpi spacing. Self test. Forms control. A convenient snap-in ribbon cartridge for clean, fast and easy ribbon changing. Double wide character printing. And a buffered serial interface.

A new serial printer. Competitively priced. 30 day delivery. Call your nearest Mannesmann Tally Sales outlet.

Mannesmann Tally, 8301 South 180th Street, Kent, WA 98031. Phone (206) 251-5524.

Printers for the long run.

MANNESMANN TALLY

CIRCLE NO. 52 ON INQUIRY CARD

Surveying serial printers

MALCOLM L. STIEFEL, Contributing Editor

No breakthroughs, but prices continue to fall, while speed, reliability and print quality rise

"The trend," says Bob Wilczewski, is toward "better quality print, higher speed and lower price." Wilczewski, president of Two-Day Corp., a Riverton, Wyo., manufacturer of print mechanisms, was responding to the question, "Where is the serial printer headed?" These trends have been in evidence for some time, of course: there are printers that sell for less than $300 in single-unit quantities; one printer runs at a mind-boggling 900 characters per sec., and the print quality of dot-matrix units has improved so dramatically that they are finding their way into word-processing applications, formerly the private domain of daisy-wheel printers.

This energetic progress can be traced to the appearance four years ago of the μp as a printer controller. Since then, there have been continual improvements in serial printers—in reliability and maintainability, as well as in price and performance. Much has happened since we last profiled these devices (MMS, January, 1980, p. 71).

Technologies

The technologies that have dominated the serial printer market in the past few years—impact dot-matrix and daisy-wheel—continue to outsell all others. Thermal, electrostatic and electrosensitive devices retain a small share of the market, and ink-jet printers, which have seemed ready to emerge for several years, remain almost nonexistent.

The preeminence of dot-matrix printers (Fig. 1) is apparent in our product table. A whopping 72 percent of the manufacturers represented in the table produce impact dot-matrix printers. Their popularity is easy to understand: printing at speeds as high as 900 cps, they are the fastest, and they are among the least expensive and most reliable serial printers on the market. Vendors quote print-head lives in excess of 100 million operations and ribbon lives of more than 10 million impressions. At these rates, a unit that runs at 200 cps for three hours a day will wear out a ribbon in a week (i.e., five days) and a head in 10 weeks. Many vendors claim still better performance, and if the use rate is lower, the lives of the ribbon and head are correspondingly longer.

Impact formed-character printers are produced by 26 percent of the manufactuers listed in the product table.

Fig. 1. The Qantex Series 6000 *impact dot-matrix printer.*

The popularity of impact dot-matrix printers is easy to understand: they are the fastest and among the least expensive and most reliable of the printers now on the market.

Most of these units are daisy-wheel printers (Fig. 2), and a few use NEC's thimble element. Printers with typewriter-like arrangements of print keys, like the Teletype systems of many years ago, have largely disappeared from the market. The daisy wheel's popularity stems from its high-quality print, which is very much a factor in word-processing applications. Daisy-wheel units also make multiple copies, and the print wheels are readily interchangeable, enabling the use of many different symbol fonts. The drawback to all formed-character printers is their low speed: 60 cps seems to be the upper limit.

Seventeen percent of the vendors listed in the table make thermal dot-matrix printers. These devices, which are very quiet, use a set of wires that are heated to slightly scorch specially coated paper, thereby producing dot-matrix characters. Their major applications are in areas such as hospitals and professional offices, where low-noise operation is vital. However, they are slower than impact dot-matrix printers and can produce only one copy at a time. These limitations severely restrict their usefulness for data processing.

Another 14 percent of the vendors make electrosensitive, electrostatic, ink-jet and electrographic units. One vendor—Triformation Systems, Inc., of Stuart, Fla.—makes a series of printers that print in braille.

The electrosensitive devices lead these also-rans with 7 percent of the total. Electrosensitive units print one copy at a time on aluminum-coated paper. The output is said not to fade, but the paper is expensive.

Ink-jet printers continue to hold great promise, but the technology has failed to attract vendors. Although ink-jet units are silent and flexible—able to print almost any font—they can make only one copy at a time, and their heads tend to clog with ink, making them troublesome to maintain. These difficulties also turn off prospective customers, so the technology lies dormant. Among the manufacturers listed in the table, only Siemens, a longtime advocate of ink-jet techniques, and Silonics offer ink-jet printers.

The field as a whole is marked by a surprising lack of recent innovation. Progress has been made in speed, reliability and print quality, but no fundamentally new technologies have surfaced. The most dramatic development in the last two years has been the "magnetic stored-energy" print head, which has given Florida Data Corp.'s printers their speed. And in June, Centronics will introduce its Quietwriter—a serial printer that drives a stylus, more like a pen plotter than a printer. The unit has been slow to come to market because of design problems, and it will probably run at less than 50 cps when it finally does appear. Promising new techniques, such as laser printing, which is already a reality in super-high-speed line printers, have yet to filter down to the low-cost serial-printer market.

In 1978, Sanders Technology introduced an

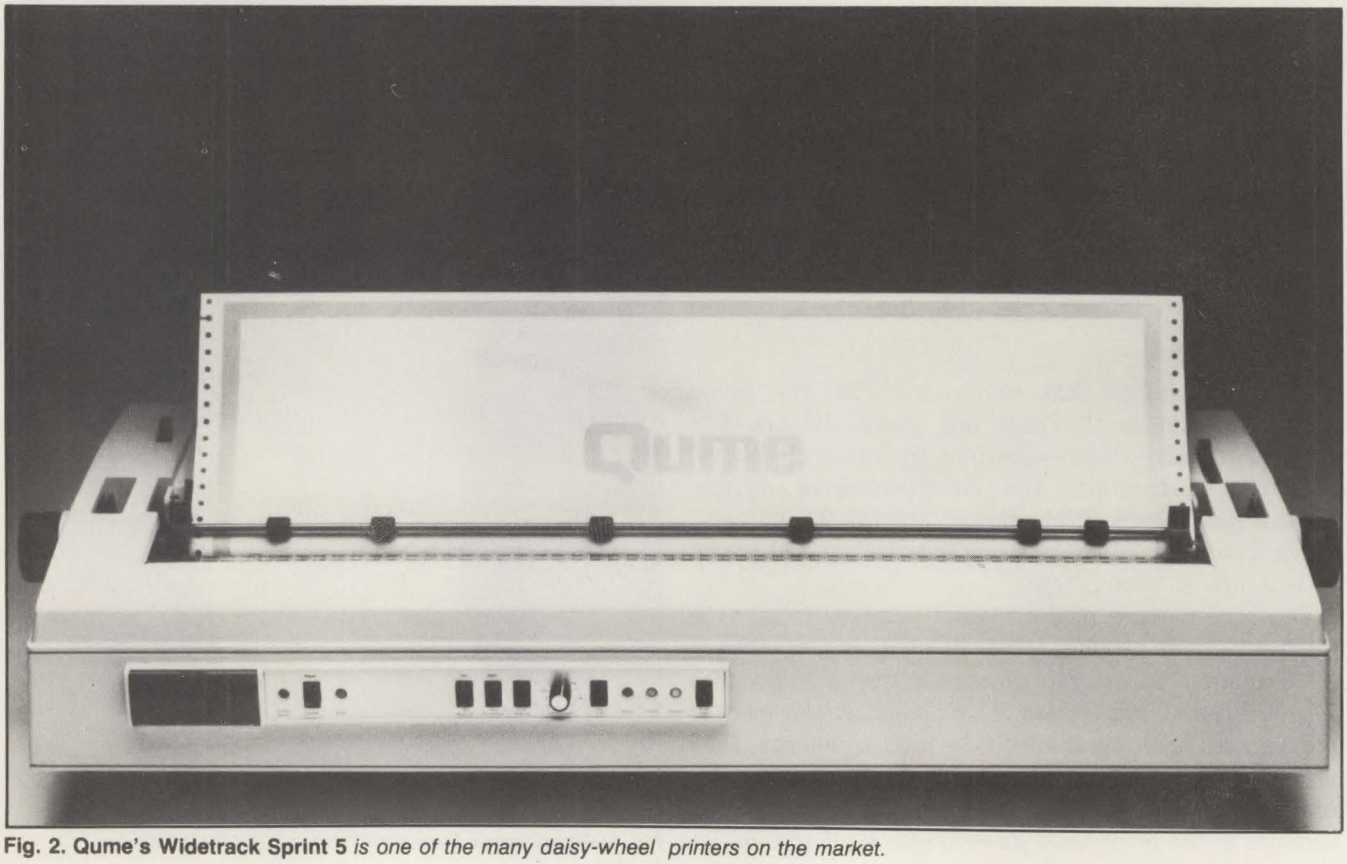


Fig. 2. Qume's Widetrack Sprint 5 *is one of the many daisy-wheel printers on the market.*

exciting new serial printer, called the Media 12/7, which works like a dot-matrix printer, but generates output that actually looks good—not as good as daisy-wheel print, but a step in the right direction. The Media 12/7 is still on the market, and others have joined the fray: Malibu Electronics with its Dual-Mode 200, Integral Data Systems with the IDS-460 and Florida Data with its model BNY.

Most intriguing of this group, and the one that may in the long run prove most popular in word-processing applications is the Integral Data Systems unit. It prints sharply defined characters in a 24 × 9 matrix (Fig. 3a) in a single pass, using overlapping dots (Fig. 3b) to make high-density letters at 160 cps.

The Florida Data printer slows from its full speed of 600 cps to an effective rate of 150 cps, making two passes per line to fill a 19 × 18 dot matrix (Fig. 4). Normal printing, for data-processing, is done in one pass on a 9 × 9 dot matrix.

Similarly, the Malibu Electronics unit prints 165 to 250 cps at full speed and 42 to 60 cps in letter-quality mode, with two passes on each line (Fig. 5).

The Integral Data Systems printer is regarded as more desirable than the others because it does its work in a single pass, making the print quality less sensitive to registration errors. In its competitors, the ability to place dots on the second pass across each line in precise relation to the dots put down on the first pass is critical. This repeatability is likely to degrade over time, and print quality will suffer accordingly. Not so with the IDS 460.

All four vendors point out that their units save users money by eliminating the need for separate printers for data and word processing. Frank Price, manager of OEM applications for Florida Data Corp., cites a customer who successfully printed a technical manual, including text and schematics, on a BNY printer in graphics mode. In this mode, the print head moves at only 19 in. per sec. as opposed to 60 ips in full data-processing mode or 30 ips in letter-quality mode.

The vendors are also quick to admit, however, that not all users are happy with these units. Lawyers and accountants, they say, are among the holdouts. Over

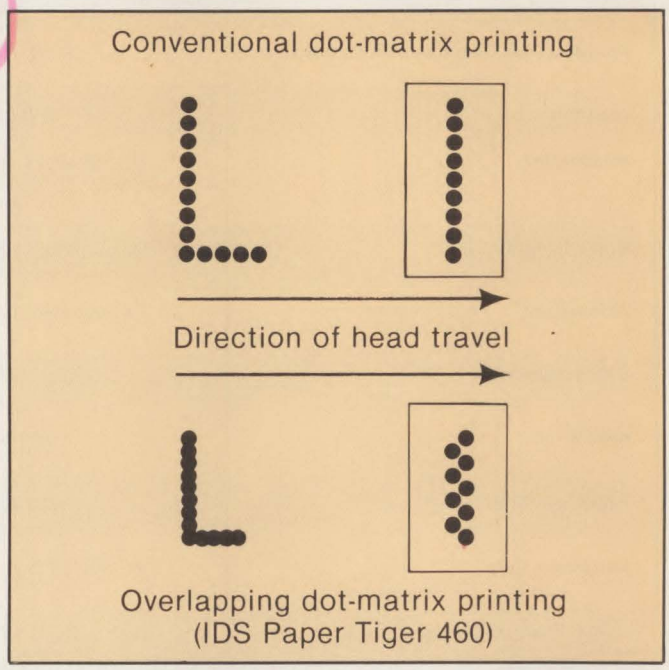


Fig. 3b. The IDS-460's print head *uses offset wires to increase dot density and improve print quality.*

```
MNOPQRSTUVWXYZ[\]^_'abcdefghijklmnopqrstuvwxyz{|}~ !"#$
>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_'abcdefghijklmnopqrst
/0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_'abcde
 '"#$%&'()*+,- /0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUV
pqrstuvwxyz{|}~ !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFG
abcdefghijklmnopqrstuvwxyz{|}~ !"#$%&'()*+,-./012345678
RSTUVWXYZ[\]^_'abcdefghijklmnopqrstuvwxyz{|}~ !"#$%&'()
CDEFGHIJKLMNOPQRSTUVWXYZ[\]^_'abcdefghijklmnopqrstuvwxy
456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_'abcdefghij
%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[
uvwxyz{|}~ !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKL
fghijklmnopqrstuvwxyz{|}~ !"#$%&'()*+,-./0123456789:;<=
WXYZ[\]^_'abcdefghijklmnopqrstuvwxyz{|}~ !"#$%&'()*+,-
HIJKLMNOPQRSTUVWXYZ[\]^_'abcdefghijklmnopqrstuvwxyz{|}~
9:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_'abcdefghijklmno
*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_'
z{|}~ !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQ
klmnopqrstuvwxyz{|}~ !"#$%&'()*+,-./0123456789:;<=>?@AB
\]^_'abcdefghijklmnopqrstuvwxyz{|}~ !"#$%&'()*+,-./0123
MNOPQRSTUVWXYZ[\]^_'abcdefghijklmnopqrstuvwxyz{|}~ !"#$
```

Fig. 3a. A print sample *from the Integral Data Systems IDS-460 dot-matrix printer.*

TABLE OF SERIAL PRINTER SUPPLIERS

The following table is provided as a guide to evaluating vendors of serial printers. *Mini-Micro Systems*' staff prepared the table from its own sources and from information supplied by GML Corp., Lexington, Mass.

Manufacturer	Model Number; Type	Speed; Number of Columns	
Agile Corp.	4200 series; impact formed-character	55 cps; 132 or 158 col.	
Alanthus Data Communications Corp.	T-300, T-320; impact dot-matrix	30 cps; 132 col.	
Algorithmics	PR-DW1; impact formed-character	45 cps; 132 or 158 col.	
Anadex, Inc.	DP-500 series, DP-750 series, DP-1000 series, DP-8000, DP-9500, FP-600; impact dot-matrix and formed-character	25 to 200 cps; 9 to 176 col.	
Apple Computer, Inc.	Silentype; impact dot-matrix and formed-character, thermal matrix	40 cps; 80 col.	
Axiom Corp.	EX-800 series, IMP series; electrostatic, impact dot-matrix	132 to 160 cps; 20 to 132 col.	
B-G Instruments	PP-101, PP-201; thermal dot-matrix	22 to 28 cps; 11 to 14 col.	
Base 2, Inc.	model 800, impact dot-matrix	100 cps; 80 col.	
Basic Four Corp.	model 3200; impact dot-matrix	160 cps; 80 col.	
Burroughs Corp.	AP-100, AP-300, TP-313, TP-353; impact dot-matrix	90 cps; 45 to 150 col.	
C. Itoh Electronics, Inc.	Comet, Comet II, Starwriter, Starwriter II, model 820; impact dot-matrix	25 to 150 cps; 80 to 136 col.	
Capitol Circuits Corp.	model 100, model 400; impact dot-matrix	65 to 120 cps; 27 or 40 col.	
Centronics Data Computer Corp.	Microprinter series, 100 series, 300 series, 500 series, 700 series; impact dot-matrix, electrostatic matrix	60 to 180 cps; 20 to 132 col.	
Computer Devices, Inc.	Miniterm 1202KSR, Q3 series, model 1201; thermal dot-matrix	38 to 50 cps; 80 or 132 col.	
Computer Optics, Inc.	CO: 7787-1; impact dot-matrix	88 cps; 132 col.	
Control Data Corp.	Certainty 420-10, 753-10, model 9317; impact dot-matrix, thermal dot-matrix	30 or 180 cps; 80 or 132 col.	
Coosol	101A-40, 101B-80; impact dot-matrix	55 or 60 cps; 40 or 80 col.	
CPT	Rotary V; impact formed-character	40 cps; 132 or 158 col.	
Data General Corp.	6000 series, impact dot-matrix	30 to 180 cps; 132 col.	
Data Terminals & Communications	DTC-200/RO, DTC-302/RO, DTC-382; impact formed-character, impact dot-matrix	45 or 200 cps; 132 or 158 col.	
Datacq Corp.	MDC 300 series, Print Swiss; impact formed-character	59 or 63 cps; 16 or 21 col.	
Datapoint Corp.	9200 series, 9600 series; impact formed-character and dot-matrix	30 to 240 cps; 120 or 132 col.	
Dataproducts Corp.	D-50, M-120, T-80; impact dot-matrix, impact formed-character, thermal dot-matrix	47 to 180 cps; 80 or 132 col.	
Dataroyal, Inc.	IPS-5000, IPS-7000 series; impact dot-matrix	120 to 200 cps; 132 col.	
Datasouth Computer Corp.	DS-180, impact dot-matrix	180 cps; 132 col.	

	Horizontal Spacing; Vertical Spacing	Number of Copies; Character Sets	Interfaces	Price
		6 copies; 96 international and ASCII characters	Hewlett-Packard, Burroughs	$3995 to $5995
		4 to 6 copies		$1300 to $1500
	10 or 12 cpi; 6 or 8 lpi	96 ASCII, OCR, ATL character sets		$2978
	7 to 10 cpi; 4.7 to 8 lpi	1 to 6 copies; 42, 64 and 96 ASCII, graphics, numerics and symbols	RS232, current loop, parallel, Centronics-compatible	$570 to $1650
		1 copy; 96 ASCII		$595
	5 to 20 cpi; 8 lpi	1 to 3 copies; 48 to 256 ASCII, APL	RS232, current loop, parallel	$495 to $1495
		1 copy; numeric, 64 ASCII	parallel, Centronics-compatible	$595
		3 copies; 96 ASCII	RS232, current loop, Centronics-compatible	$699
	10 cpi; 6 lpi	6 copies; 96 ASCII	parallel	$7095
	12 cpi; 6 lpi	2 copies; 64 and 96 ASCII	Burroughs	$2240 to $5150
	10 and 16.5 cpi, 6 lpi	3 or 4 copies; 96 ASCII	RS232, parallel	$300 to $2795
		96 ASCII		$545 to $775
	5 to 20 cpi; 5 to 12 lpi	1 to 12 copies; 48 to 128 ASCII, international, and special characters	RS232, parallel	$349 to $5305
	10 cpi; 6 lpi	1 copy; 96 or 188 char., APL, ASCII, Katakana, Selectric	RS232	$825 to $1585
	10 cpi; 6 lpi	5 copies; 48 or 64 EBCDIC		$5290
	10 to 16.5 cpi; 6 or 8 lpi	1 or 5 copies; 64 or 96 characters, special character set	IBM, RS232, Centronics-compatible	$2035 to $4855
			RS232, parallel	$325 to $485
	10 or 12 cpi	6 copies; 88 characters		$4000
	5 or 10 cpi; 6 or 8 lpi	6 copies; 96 or 128 ASCII or international	Data General, RS232, current loop	$2200 to $4800
	10 or 12 cpi; 6 or 8 lpi	2 or 5 copies; 64 ASCII, OCR A and B, foreign	RS232	$2700 to $3850
	8 cpi; 6 lpi	numeric characters and symbols	RS232 serial, parallel	$675 to $895
	10 cpi; 6 or 8 lpi	5 or 6 copies; 48 to 128 ASCII	RS232, parallel	$2500 to $5540
	10 cpi; 6 lpi	1 or 6 copies; 64 to 128 ASCII	RS232	$1471 to $2150
	10 or 15 cpi; 6 to 9 lpi	6 copies; 64 to 224 ASCII	RS232, current loop	$1295 to $2410
	10 cpi; 6 lpi	6 copies; 96 ASCII	RS232, current loop, Centronics-compatible	$1395

Manufacturer	Model Number; Type	Speed; Number of Columns
Decision Data Computer Corp.	3240-01, 6540 series; impact dot-matrix	120 or 150 cps; 132 col.
Di/An Controls, Inc.	model 60; impact dot-matrix	180 cps; 132 col.
Diablo Systems, Inc.	Hyterm, Hytype II, Matrix, series 2300, 1300 series, 1600 series, model 630; impact formed-character, impact dot-matrix	40 to 200 cps, 132 to 264 col.
Digi-Data Corp.	model 2510; impact dot-matrix	200 cps
Digital Equipment Corp.	LA120; impact dot-matrix	180 cps; 132 col.
DIP, Inc.	DIP-81, DIP-84, DIP-85; impact dot-matrix	100 cps; 40 to 132 col.
Epson America, Inc.	TX-80; impact dot-matrix	150 to 200 cps; 80 col.
Extel Corp.	AH; impact dot-matrix	30 cps; 80 col.
Facit Data Products	model 4520, model 4542; impact dot-matrix	100 to 250 cps; 80 or 150 col.
Florida Data Corp.	model BNY, 600 series, PB-600; impact dot-matrix	150 to 900 cps; 132 to 198 col.
General Electric Co.	1200 series, 200RO, 2030, 2120, 30, 300; impact dot-matrix, formed-character	30 to 200 cps
Gulton Industries, Inc.	ANP-9, AP-20, Microplot-44, NP-7; thermal dot-matrix	24 to 88 cps; 7 to 44 col.
Harris Corp.	1676, 2100 series, 2200 series, 2300 series, 3165, 8600 series, 8700 series; impact dot-matrix and formed-character, thermal dot-matrix, electrographic	10 to 120 cps; 72 or 80 col.
Heath Co.	WH-14; impact dot-matrix	50 cps; 80 or 132 col.
Hewlett-Packard Co.	HP2630 series; impact dot-matrix	180 cps; 68 to 227 col.
Honeywell Information Systems, Inc.	PRU1000 series, PRU1901, PRU9114; impact dot-matrix	30 to 160 cps; 132 col.
Houston Instrument	TISPP 6000; thermal dot-matrix	25 cps; 80 col.
Howard Industries, Inc.	Typrinter 221; impact formed-character	20 cps; 132 to 198 col.
Impact Data	model 801, model 961; impact dot-matrix	132 cps; 80 or 96 col.
Infoscribe, Inc.	model 500, model 1000; impact dot-matrix	150 or 180 cps; 136 col.
Integral Data Systems, Inc.	IDS-400 series, IP-125, IP-225; impact dot-matrix	50 to 160 cps; 80 or 132 col.
Interface Systems, Inc.	2240, 2360, 4100SC, model 736; impact dot-matrix and formed-character	50 to 180 cps; 80 or 132 col.
IBM Corp.	2222, 3200 series, 3700 series, 5100 series, 5200 series, 3616; impact dot-matrix	40 to 120 cps; 126 to 220 col.
International Microtronics Corp.	NP-7; thermal dot-matrix	28 cps; 7 col.
Kontron Electronic, Inc.	DDP 5080; electrosensitive	32 cps; 16 col.
Lear Siegler, Inc.	model 301, model 310; impact dot-matrix	180 cps; 136 col.
Litton Industries, Inc.	M-1824, MS-4000; impact dot-matrix	60 or 80 cps; 40 or 42 col.
LRC	7000T; impact dot-matrix	80 cps; 64 col.
Malibu Electronics Corp.	model 165, Dual-Mode 200; impact dot-matrix	42 to 250 cps
Matchless Systems	MS-204; impact dot-matrix	125 cps; 80 col.
Memorex Corp.	Nidek 1300, model 2056; impact dot-matrix	100 or 200 cps; 10 or 80 col.
Micro Computer Machines, Inc.	MCP-132; impact formed-character	45 cps; 132 col.
Micro Peripherals, Inc.	MP-40, series 40, TP-40, model 80; impact dot-matrix	50 to 80 cps; 40 or 80 col.
Microdata Corp.	Matrix 8702; impact dot-matrix	165 cps; 132 col.
Microtek, Inc.	MT-80; impact dot-matrix	125 cps; 80 col.
Mohawk Data Sciences Corp.	model 1310; impact dot-matrix	100 cps; 132 col.
Motorola Semiconductor Products, Inc.	700 series, 779, 781; impact dot-matrix	60 to 180 cps; 80 or 132 col.
National Data Products	T1602, impact dot-matrix	160 cps; 132 col.
NEC Information Systems, Inc.	Spinwriter 5510, 5500Q; impact formed-character	55 cps; 136 or 163 col.

	Horizontal Spacing; Vertical Spacing	Number of Copies; Character Sets	Interfaces	Price
	10 cpi; 6 or 8 lpi	5 copies; 96 ASCII or EBCDIC characters	IBM, RS232	$2395 to $3975
		12 copies; 96 ASCII	RS232, current loop	$1400
	10 or 12 cpi; 6 lpi	5 to 15 copies; 96 to 128 ASCII	RS232, parallel	$1380 to $2235
			RS232	
	10 cpi; 6 lpi	6 copies; 128 ASCII and foreign characters	DEC	$2700
		3 copies; 96 ASCII	Centronics-compatible	$499 to $795
	10 cpi; 6 lpi	2 copies; 96 ASCII		$745
	10 cpi; 4.4 or 6 lpi	3 copies; 64 to 128 ASCII	RS232, current loop	$1760
	10 or 12 cpi, 6 or 8 lpi	2 or 6 copies; 96 or 128 ASCII, Katakana, Libris	parallel	$990 to $4200
	10 to 16.5 cpi; 6 or 8 lpi	6 copies; 96 or 128 char. ASCII, OCR	Centronics-compatible, Dataproducts-compatible, RS232, current loop	$4550 to $5500
	10 cpi; 6 or 8 lpi	3 to 9 copies; 64 to 128 ASCII, APL	RS232	$1400 to $5375
	5 or 6 lpi	1 copy; 48 or 64 ASCII, numeric character set		$495 to $990
	6 lpi	1 copy; 64 or 96 ASCII	Harris	$1900 to $9000
		3 copies	RS232	$895
	5 to 17 cpi; 1 to 12 lpi	5 or 6 copies; 128 ASCII and foreign characters	RS232, current loop, parallel	$3350 to $4550
	10 cpi; 6 lpi	5 copies; 96 and 128 ASCII	Honeywell	$2260 to $4000
		1 copy; 64 and 96 ASCII		$1640
	10 to 15 cpi; 6 or 12 lpi	ASCII, foreign, reverse printing	RS232, IEEE-488, Centronics-compatible	$2750
	10 cpi; 6 lpi	6 copies; 96 ASCII	RS232, Centronics-compatible	$849
	10 to 16.5 cpi; 6 or 8 lpi	6 copies; 96 ASCII	RS232, Centronics-compatible	
	10 or 16.5 cpi; 6 or 8 lpi	4 or 6 copies; 96 ASCII, graphics	RS232, Centronics-compatible	$799 to $1295
	10 cpi; 6 to 10 lpi	5 or 6 copies; 48 or 64 ASCII, EBCDIC	IBM	$3950 to $5950
	10 cpi; 6 or 8 lpi	6 copies; 48 to 100 EBCDIC	IBM	$2570 to $10930
	5 lpi	1 copy; numeric characters		$520
		128 ASCII		$645
	10 or 16.5 cpi; 6 or 8 lpi	6 copies; 96 or 128 ASCII, foreign	RS232, parallel	$1845 to $1995
	12 cpi; 5 lpi	64 ASCII		$180 to $210
	12 cpi	1 copy; 96 ASCII		$389
	10, 12, 15 cpi; 6, 8 lpi	1 to 6 copies; 96 ASCII	RS232, parallel	$2395 (model 165)
	10 cpi	3 copies; 96 ASCII	Centronics-compatible	$749
		3 copies; 96 ASCII	RS232	$1400 to $5975
		5 copies; 96 ASCII		$3950
	10 cpi; 6 lpi	2 or 6 copies; 64 or 96 ASCII	RS232, parallel, Centronics-compatible	$435 to $849
	10 cpi; 6 lpi	6 copies; 96 ASCII, APL, foreign	RS232, parallel	$2750
	10 cpi	96 ASCII	RS232, parallel	$750
	10 cpi; 6 lpi	64 ASCII		
	10 or 16.5 cpi; 6 lpi	5 or 6 copies; 64 ASCII	parallel, Centronics-compatible	$1495 to $3125
	10 cpi; 6 or 8 lpi	6 copies; 64 ASCII	RS232	$4000
	10 or 12 cpi; 6 or 8 lpi	6 copies; 96 or 128 ASCII	parallel, current loop, Centronics-compatible	$2535 to $3055

Manufacturer	Model Number; Type	Speed; Number of Columns
Nixdorf Computer, Inc.	model 510; impact dot-matrix	165 cps; 132 col.
Okidata Corp.	CP110, CP210, Microline series; impact dot-matrix	80 to 120 cps; 80 to 132 col.
Olivetti Corp. of America	DY series, PR series; impact formed-character and dot-matrix, thermal dot-matrix	20 to 200 cps; 80 to 222 col.
Omni Computer Corp.	Omniprinter ; impact dot-matrix	120 cps; 80 col.
Panasonic Co.	EUY series; thermal dot-matrix, electrostatic, electrosensitive	23 to 160 cps; 15 to 80 col.
Perkin-Elmer Data Systems Corp.	CP series, 310 RO, 650 series; impact or thermal dot-matrix	45 to 180 cps; 80 to 165 col.
Pertec Computer Corp.	P-80; impact dot-matrix	80 cps; 80 or 120 col.
Plessey Peripheral Systems	PM-LC11; impact dot-matrix	200 cps; 132, 158 or 176 col.
Practical Automation, Inc.	DMTP series, PK 970; impact dot-matrix	74 to 120 cps; 20 to 132 col.
Printer Terminal Communications Corp.	model 877, model 879; impact dot-matrix	120 cps; 80 or 132 col.
Qantex	model 6000; impact dot-matrix	150 cps; 136 col.
Qume Corp.	Micro 3 Twintrack, Q30, Q45, Sprint series Widetrack; impact formed-character	30 to 75 cps; 132 to 315 col.
Radio Shack	Line Printer series, Quickprinter series; impact dot-matrix, electrosensitive	50 to 200 cps; 16 to 132 col.
R. C. Sanders Technology Systems, Inc.	Media 12 7; impact dot-matrix	216 cps
SCI Systems, Inc.	1100, 1110; electrosensitive	2200 cps; 40 to 136 col.
SCM-Kleinschmidt	7300 series; impact formed-character	30 or 40 cps; 76 to 132 col.
Series 1 Plus	S-340	340 cps
Siemens Corp.	PT 80; ink-jet matrix	90 cps; 72 or 136 col.
Silonics	Quietype; ink-jet matrix	180 cps; 80 or 132 col.
Southwest Technical Products Corp.	6450; impact dot-matrix	120 cps; 40 to 132 col.
Super Brain, Inc.	LP-80; impact dot-matrix	125 cps; 80 col.
Sweda International, Inc.	MR-1824; impact dot-matrix	80 cps; 18 or 24 col.
Syntest Corp.	SP-300 series; impact dot-matrix	50 cps; 40 col.
Tally Corp.	M78, M79, M80, T-1602, T-1612, T-1705; impact dot-matrix	160 or 200 cps; 66 to 132 col.
Tec, Inc.	Mini-Print; thermal dot-matrix	30 cps; 80 col.
Tektronix, Inc.	4600 series; electrosensitive, impact dot-matrix	60 to 180 cps; 80 or 132 col.
Teletype Corp.	43 RO, 4300 series; impact dot-matrix	30 cps; 80 or 132 col.
Telex Terminal Communications, Inc.	TC230 series, TC280 series, TC87, model 311; impact formed-character and dot-matrix	30 to 180 cps; 80 to 158 col.
Telpar, Inc.	PS-48C; thermal dot-matrix	24 cps; 20 or 48 col.
Texas Instruments Inc.	Silent 700 series, 800 series; impact and thermal dot-matrix	30 to 150 cps; 80 or 132 col.
Triformation Systems, Inc.	BD-3, LED-120, LED-30, TRI-80, 1SE-1, braille	10 to 160 cps; 40 or 80 col.
Trivex, Inc.	model 0862; impact dot matrix	165 cps; 132 col.
Tymshare, Inc.	model 736; impact dot-matrix	150 cps; 132 col.
United Systems Corp.	6100 series, 6300 series, 6400 series; thermal dot-matrix, electrosensitive, electrostatic	42 to 64 cps; 18 to 32 col.
Victor Business Products	model 80, model 30, 5000 series; impact dot-matrix	100 or 110 cps; 34 to 96 col.
Vista Computer Co.	V300; impact formed-character	25 or 45 cps; 136 or 163 col.
Wang Laboratories, Inc.	2200 series; impact dot-matrix and formed-character	15 to 200 cps; 40 to 158 col.
Xerox Corp.	model 1730, model 1750; impact formed-character	40 or 45 cps; 132 or 158 col.
Xymec	HY-Q1000; impact formed-character	20 cps
Zentec Corp.	Print Subsystem	30 cps; 132 or 158 col.

	Horizontal Spacing; Vertical Spacing	Number of Copies; Character Sets	Interfaces	Price
	10 cpi; 6 lpi	5 copies; 64 ASCII		
	10 or 12 cpi; 5 to 8 lpi	3 or 4 copies; 64 or 96 ASCII, custom, graphics	RS232, current loop, parallel, H-P, Centronics-compatible	$800 to $4060
		5 copies; 96 or 128 ASCII, national		$1900 to $2690
	10 cpi; 6 lpi	4 copies; 96 ASCII	RS232	$1345
		1 copy; 128 ASCII		
	10 or 12.5 cpi; 4 or 6 lpi	1 or 6 copies	RS232	$1327 to $5500
		4 copies; 96 ASCII, international	parallel, RS232	$930 to $1200
	10, 12 or 13.3 cpi; 6 or 8 lpi	ASCII, graphics	parallel	$2307
	8 to 16.5 cpi; 6 or 9 lpi	2 or 4 copies; 64 ASCII, programmable set, boldface		$211 to $520
	10 cpi; 6 lpi	3 or 6 copies; 48 to 96 ASCII, foreign		$999 to $1299
	10 cpi; 6 or 8 lpi	6 copies; 96 ASCII		$1395
	10 to 15 cpi; 6 lpi	1 or 10 copies; 88 to 192 ASCII	RS232, current loop, parallel	$1435 to $3995
	10 cpi; 6 lpi	1 to 5 copies; 96 ASCII		$219 to $1960
		3 copies; user-programmable character set	RS232, Centronics-compatible	$3900
	10 cpi; 7 lpi	1 copy; 96 ASCII	RS232, parallel	$304 to $735
	10 cpi; 3 or 6 lpi	3 or 4 copies; 64 ASCII	RS232, parallel	
	6 or 8 lpi			$5750
	10 cpi; 3 to 6 lpi	1 copy; 96 ASCII	Centronics-compatible	$3919
	6 or 8 lpi	1 copy; 96 ASCII	RS232	$2995
	10 cpi; 6 lpi	5 copies; 96 ASCII	parallel	$2395
	10 cpi; 6 lpi	96 ASCII	Centronics-compatible	$985
	12 cpi; 5.4 lpi	3 copies	RS232, parallel	
	12 cpi	3 copies; 64 ASCII	RS232, current loop, parallel	$520 to $660
	10 to 16.5 cpi; 6 or 8 lpi	6 copies; 48 to 96, ASCII, OCR-A, OCR-B, national	RS232, Centronics-compatible	$1995 to $4925
	10 cpi; 6 lpi	1 copy; 64 ASCII		$1695
	10 or 16.5 cpi; 6 lpi	1 to 6 copies; 96 ASCII	RS232	$2250 to $4575
	10 or 13 cpi; 3 or 6 lpi	2 or 3 copies; 64 to 96	RS232, current loop	$1167 to $1275
	10 to 13 cpi; 6 or 8 lpi	3 or 6 copies; 64 to 128 ASCII, EBCDIC, graphics	IBM	$4100 to $8750
	10 cpi; 6 lpi	1 copy; 96 ASCII	RS232, current loop	$799
	10 or 16.5 cpi; 6 or 8 lpi	1 to 6 copies; 64 to 128 ASCII	RS232, current loop	$995 to $1995
	10 cpi	1 copy; 64 to 128 characters		$1275 to $13,500
	6 or 8 lpi	5 copies; 64 to 128 ASCII		$6450
	6 or 8 lpi	6 copies; 128 ASCII	RS232	$2120
	10 lpi	1 copy; 64 characters	parallel, RS232, current loop	$395 to $725
	10 or 11 cpi; 6 lpi	5 copies; 48 to 96 ASCII	current loop, parallel	$298 to $1075
		3 copies; 96 characters	RS232, Centronics-compatible	$1895 to $2195
	10 or 12 cpi; 6 lpi	4 or 5 copies; 96 ASCII		$1200 to $5000
		6 copies	RS232	$2710
	10 to 15 cpi	2 copies; 100 characters	RS232, IEEE-488, Centronics-compatible	
		96 ASCII		

When you need a printout fast and there's no time for mistakes or failure, you can depend on the Dataproducts M-200. It's twice as fast as most other serial matrix printers. With reliability second to none.

Yet it's still competitively priced.

A printhead you can count on.

We build the M-200's 14-wire head to last through at least 300 million characters—over two years of typical use. In most applications, it will last more than 500 million characters. No one else has anything like it.

It can print as many as six copies at once. With crisp, easy-to-read type. In condensed, standard or expanded characters.

When it's time to replace the head, the operator simply snaps the new one into place. No service call is necessary.

At 340 CPS, the M-200 Matrix moves even faster than the boss.

GREAT MOMEN

So easy to own, it practically takes care of itself.

The M-200 requires no scheduled maintenance at all.

It even has an optional status display that diagnoses operator faults and helps the operator identify other troublespots for an engineer.

A name you can trust.

Dataproducts is the world's largest independent printer manufacturer. For 18 years, we've built printers for the biggest OEMs in the business, putting their names on our machines. These customers make sure our printers live up to some pretty tough standards.

Now our M-200—and our M-120, a 180 cps matrix—are available with *our* name on the cabinet. Or with your name.

30 day delivery.

Often we can deliver a partial order even faster than that. If time is a problem, give us a call.

We're here to help.

We have distributors and sales representatives throughout the world. We'd love to show you how our printers can improve your system.

Call for more information. Or write our Marketing Department at 6200 Canoga Avenue, Woodland Hills, CA 91365. Telephone: (213) 887-8451

Toll Free—Calif. (800) 272-3900 ext. 201
Rest of U.S. (800) 423-2915 ext. 201
European Marketing Headquarters:
Neu Isenburg (Frankfurt), West Germany
Tel: 06102 3201

Dataproducts

TS IN PRINTING

CIRCLE NO. 53 ON INQUIRY CARD

Ink-jet printers continue to hold great promise, but the technology has so far failed to attract vendors.

time, these pockets of resistance will probably erode. Users will become educated to the benefits of the units, and still further improvements in print quality, from these and other vendors, will be forthcoming. Even today, these printers are well-suited to users with data-processing burdens, but who also make mass mailings to current and prospective customers. They may never fully supplant the slower daisy-wheel printers, but as user acceptance increases, these sophisticated matrix printers will find their way into all types of word-processing applications.

Much ado has been made in the last year about very low-priced printers, such as those made by DIP, Inc., selling for less than $1000 in single-unit quantities. Their appearance was inevitable: the explosion of the personal-computer market guaranteed it. After all, hobbyists and small businessmen did not want to spend more on a printer than on a CPU, memory and communications. The new under-$1000 printers were designed to meet their needs.

It is important to realize, however, that compromises had to be made. More expensive units, which still predominate, are far superior to the low-priced printers in many respects: they are faster and more rugged (and therefore more reliable in heavy-duty operation). They are also more flexible.

For example, the DIP-81 80-column printer from DIP, Inc., which sells for $499 retail, runs at 100 cps. However, it does not support horizontal or vertical tabs; if multiple lines are to be skipped in printing a form, a line-feed character must be transmitted for each line skipped, and the paper moves at a constant speed. Similarly, if several character positions are to be skipped on a line, a space character must be transmitted for each one. The unit recognizes a top-of-form control command that moves the paper to the top of the next form.

```
 !"#$%&'()*+,-./0123456789:; =¢?
@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^¢
\abcdefghijklmnopqrstuvwxyz |
```

Fig. 4. A print sample *from Florida Data Corp.'s BNY printer running at 150 cps.*

Thus, a user cannot take advantage of high-speed horizontal or vertical slewing to improve throughput. This contrasts sharply with the performance of the Dataroyal IPS-7000 series, which covers 132 columns at 200 cps for $2410. The user can insert control characters in the data stream to set and clear horizontal and vertical tabs, enabling him to print forms with maximum throughput, using the printer to the best possible advantage.

Datasouth Computer Corp. takes a different approach to setting tab stops in its 132-column DS-180, which sells for $1395 and runs at 180 cps. The operator actuates function keys on the printer to set and clear tabs. This reduces the burden on the programmer, but slows the operator and requires the user to specify the steps the operator must take before each new form is mounted on the printer. It appears, from these examples, that functional capability is related to price. The old maxim "you get what you pay for" applies to serial printers as much as to anything else.

Even so, competition is forcing printer prices down, and vendors—particularly of low-priced units—will soon face additional stiff competition from Japanese vendors. This will cause further price erosion. The entry of such well-heeled organizations as Fujitsu, Seiko and Hitachi into the American market is just around the corner, says Lloyd Lokka, marketing vice president of Malibu Electronics Corp. He notes that

```
                                                    Output speeds
range from 165 cps to 250 cps in the data processing mode and 42 to 60 cps in
the letter quality mode, depending on the font selected.  Two character sets are
standard on the Dual-Mode 200 - one each for data processing and word processing,
both 10 pitch Titan fonts.  Numerous alternate character fonts are available, in-
cluding sans serif 10 pitch, 12 and 15 character per inch, proportionally spaced,
italics, OCR-A, graphics, scientific and foreign character sets.  The printer is
capable of storing up to six different character fonts in ROM with a data process-
ing and a word processing version of each for a total of 12 speed/font options.
The user may also design custom character sets and download them to the printer.
```

Fig. 5. A print sample *from Malibu Electronics Corp.'s Dual-Mode 200 dot-matrix printer.*

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 pin-feed 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 daisy-wheel 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. 54 ON INQUIRY CARD

DOTS DO IT BETTER™

Vendors—especially of low-priced units—will soon face stiff competition from the Japanese.

such companies as NEC, C. Itoh, Epson America and Okidata have already established a foothold here, and the others are about to follow. Their presence will be felt mainly in the low-end, high-volume market, where the Japanese have always been strongest.

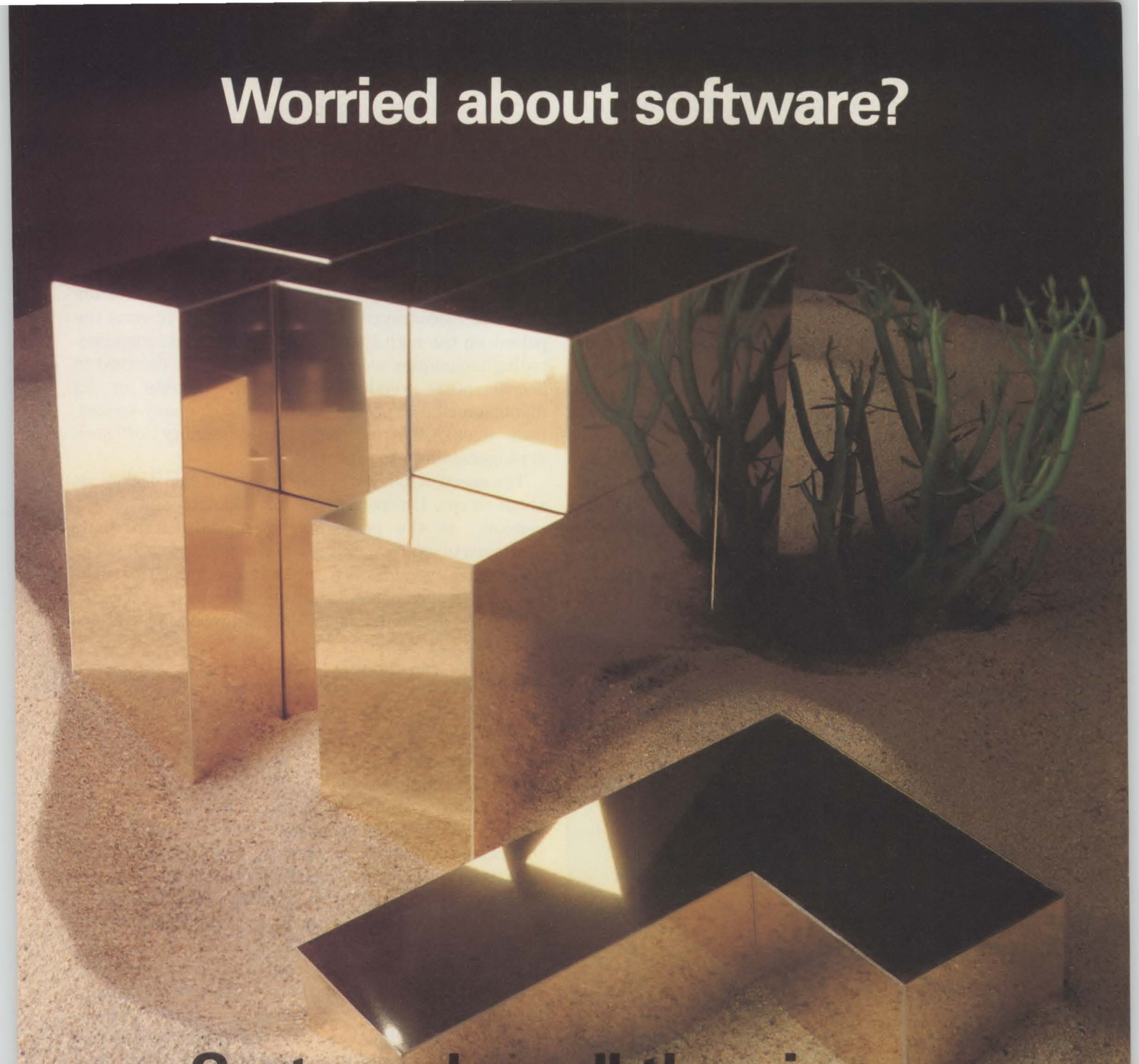
Until the early 1970s, serial printers loafed along at 10 to 15 cps, 110-baud transmission (corresponding to full-time printing at 10 cps) was common, and 300-baud transmission (corresponding to full-time printing at 25 to 30 cps) was breathtakingly fast. But as faster serial communications interfaces became available, print speeds rose accordingly. A breakthrough occurred in 1976 with the advent of the μp-based controller,

REFERENCE LITERATURE

For more information on the serial printers surveyed in this article, use the reader circle numbers below.

Company	Circle No.
Agile Corp., Sunnyvale, Calif.	263
Alanthus Data Communications Corp., Rockville, Md.	264
Algorithmics, Wellesley, Mass.	265
Anadex, Inc., Chatsworth, Calif.	266
Apple Computer, Inc., Cupertino, Calif.	267
Axiom Corp., Glendale, Calif.	268
B-G Instruments, Alta Loma, Calif.	269
Base 2, Inc., Fullerton, Calif.	270
Basic Four Corp., Tustin, Calif.	271
Burroughs Corp., Detroit, Mich.	272
C. Itoh Electronics, Inc., Los Angeles, Calif.	273
Capitol Circuits Corp., Allston, Mass.	274
Centronics Data Computer Corp., Hudson, N.H.	275
Computer Devices, Inc., Burlington, Mass.	276
Computer Optics, Inc., Bethel, Conn.	277
Control Data Corp., Minneapolis, Minn.	278
Coosol, Inc., Anaheim, Calif.	279
CPT Corp., Hopkins, Minn.	280
Data General Corp., Westboro, Mass.	281
Data Terminals & Communications, Campbell, Calif.	282
Datacq Corp., Monterey, Calif.	283
Datapoint Corp., San Antonio, Texas	284
Dataproducts Corp., Woodland Hills, Calif.	285
Dataroyal, Inc., Nashua, N.H.	286
Datasouth Computer Corp., Charlotte, N.C.	287
Decision Data Computer Corp., Horsham, Pa.	288
Di/An Controls, Inc., Boston, Mass.	289
Diablo Systems, Inc., Hayward, Calif.	290
Digi-Data Corp., Jessup, Md.	291
Digital Equipment Corp., Maynard, Mass.	292
DIP, Inc., Boston, Mass.	293
Epson America, Inc., Torrance, Calif.	294
Extel Corp., Northbrook, Ill.	295
Facit Data Products, Greenwich, Conn.	296
Florida Data Corp., West Melbourne, Fla.	297
General Electric Co., Waynesboro, Va.	298
Gulton Industries, Inc., East Greenwich, R.I.	299
Harris Corp., Dallas, Texas	300
Heath Co., Benton Harbor, Mich.	301
Hewlett-Packard Co., Boise, Idaho	302
Honeywell Information Systems, Inc., Waltham, Mass.	303
Houston Instrument, Austin, Texas	304
Howard Industries, Inc., Anaheim, Calif.	305
Impact Data, Anaheim, Calif.	306
Infoscribe, Inc., Santa Ana, Calif.	307
Integral Data Systems, Inc., Natick, Mass.	308
Interface Systems, Inc., Ann Arbor, Mich.	309
IBM Corp., Armonk, N.Y.	310
International Microtronics Corp., Tucson, Ariz.	311
Kontron Electronic, Inc., San Mateo, Calif.	312
Lear Siegler, Inc., Anaheim, Calif.	313
Litton Industries, Inc., Pine Brook, N.J.	314
LRD, Riverton, Wyo.	315
Malibu Electronics Corp., Westlake Village, Calif.	316
Matchless Systems, Gardena, Calif.	317
Memorex Corp., Santa Ana, Calif.	318
Micro Computer Machines, Inc.,	319
Micro Peripherals, Inc., Salt Lake City, Utah	320
Microdata Corp., Irvine, Calif.	321
Microtek, Inc., San Diego, Calif.	322
Mohawk Data Sciences Corp., Parsippany, N.Y.	323
Motorola Semiconductor Products, Inc., Phoenix, Ariz.	324
National Data Products, Middletown, N.J.	325
NEC Information Systems, Inc., Lexington, Mass.	326
Nixdorf Computer, Inc., Burlington, Mass.	327
Okidata Corp., Mt. Laurel, N.J.	328
Olivetti Corp. of America, Tarrytown, N.Y.	329
Omni Computer Corp., San Juan Capistrano, Calif.	330
Panasonic Co., Secaucus, N.J.	331
Perkin-Elmer Data Systems Corp., Flanders, N.J.	332
Pertec Computer Corp., Los Angeles, Calif.	333
Plessey Peripheral Systems, Irvine, Calif.	334
Practical Automation, Inc., Shelton, Conn.	335
Printer Terminal Communications Corp., Ramona, Calif.	336
Qantex, Hauppauge, N.Y.	337
Qume Corp., San Jose, Calif.	338
Radio Shack, Fort Worth, Texas	339
R.C. Sanders Technology Systems, Inc., Amherst, N.H.	340
SCI Systems, Inc., Huntsville, Ala.	341
SCM-Kleinschmidt, Deerfield, Ill.	342
Series 1 Plus, Wharton, N.J.	343
Siemens Corp., Iselin, N.J.	344
Silonics, Inc., Sunnyvale, Calif.	345
Southwest Technical Products Corp., San Antonio, Texas	346
Super Brain, Inc., Los Angeles, Calif.	347
Sweda International, Inc., Pine Brook, N.J.	348
Syntest Corp., Marlboro, Mass.	349
Tally Corp., Kent, Wash.	350
Tec, Inc., Tucson, Ariz.	351
Tektronix, Inc., Beaverton, Ore.	352
Teletype Corp., Skokie, Ill.	353
Telex Terminal Communications, Inc., Tulsa, Okla.	354
Telpar, Inc., Addison, Texas	355
Texas Instruments Inc., Houston, Texas	356
Triformation Systems, Inc., Stuart, Fla.	357
Trivex, Inc., Costa Mesa, Calif.	358
Tymshare, Inc., Cupertino, Calif.	359
United Systems Corp., Dayton, Ohio	360
Victor Business Products, Chicago, Ill.	361
Vista Computer Co., Torrance, Calif.	362
Wang Laboratories, Inc., Lowell, Mass.	363
Xerox Corp., El Segundo, Calif.	364
Xymec, Irvine, Calif.	365
Zentec Corp., Santa Clara, Calif.	366

Worried about software?



Systems has all the pieces.

Software is the keystone of every computer system. All other elements of the total system are dependent on software, for it's software that makes those pieces fall in place. Software tools from SYSTEMS interlock these elements to provide the most economical and manageable high-performance 32-bit minicomputer system available.

Whether you are designing, developing, or maintaining a minicomputer-based operation, SYSTEMS can equip you with easy to use, functional software for maximum return on your computer-invested dollar and at low risk.

SYSTEMS software packages have been designed to meet computer management's needs by applying state-of-the-art methodologies and rigorously enforced standards to simplify programming in all set-up tasks... from configuring and coding to debugging and documentation. If testing, integrating, or enhancing of existing computer programs is required, SYSTEMS can handle that too. Software management tools from SYSTEMS are the key to meeting project schedules and staying on budget, by providing standardized program appearance and simplified documentation, giving you increased programmer productivity across the board.

SYSTEMS has the software keystone that's right for your computer puzzle. Call or write SYSTEMS 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.

Argentina•Australia•Belgium•Canada•Colombia•England
France•Italy•Japan•Mexico•Sweden•Thailand•West Germany

SYSTEMS
Proven COMPUTER Performance

CIRCLE NO. 55 ON INQUIRY CARD

1980

Steadily declining prices for printers using established methods will make it increasingly difficult for new technologies to compete effectively.

enabling the use of bidirectional printing to improve throughput. That is, the printing is done while the print head moves from left to right or from right to left. Before the μp, printing could be in one direction only, so time was wasted while the carriage returned to begin each new line.

With this new technique, the speed of impact dot-matrix printers with solenoid-driven heads could reach 200 cps, where it seems to have peaked. There are exceptions. Dataproducts, for example, offers the M-200, which flies along at 340 cps, but it uses a dual-column print head that prints two characters at a time. And Pertec Computer Corp. markets the P250, (manufactured by its parent company, Triumph Werke Nurnberg AG, of West Germany), which operates at 250 cps—just slightly higher than the usual limit.

This 200-cps speed limit is imposed by the nature of the print head itself: typically it takes 700 μsec. or more for a print wire to be fired, strike the ribbon, bounce back and reposition to be fired again. For seven such moves (of each of nine wires, forming a 7 × 9 matrix), close to 5 msec. elapse. At faster speeds, the wires become stuck in the ribbon. Hence, the peak rate is 200 cps; the print head moves horizontally at 20 ips to print 10 characters per in.

Competition is forcing *printer prices down, and imports from Japanese manufacturers such as NEC will intensify that competition, especially in the low-end, high-volume market.*

Florida Data Corp. escaped these boundaries in designing a print head for its serial printers. The head roars along at 60 ips, and the print rate is 600 cps. The company's model 600-C can also print in a condensed, 15-cpi format; the head still moves at 60 ips, boosting the print rate to a phenomenal 900 cps. No one else has a technique that approaches this speed, and Florida Data has discouraged others from trying. It owns the patent on the high-speed head and keeps its manufacturing techniques secret. The company has declined to license other vendors to use its patents or its manufacturing expertise, although a company spokesman does not rule out the possibility of such arrangements in the future.

The speed of daisy-wheel printers has also peaked, at about 60 cps. Ultimately, this may spell trouble for the vendors, as the print quality of dot-matrix units continues to improve, but not in the next few years. The daisy-wheel vendors are serenely contemplating market growth of 35 percent per year over the next three to five years, as the demand for word-processing systems continues to escalate.

The future

For users of serial printers, this is the best of all possible worlds: the available technologies are well-proven, unit reliability is improving, prices are coming down, and high speed is now being combined with high-quality print. As prices for printers using established technolgies continue to fall, it will become increasingly difficult for new technologies to compete effectively, so none are seen on the horizon. But this shouldn't disturb users, because gains already seen in the existing techniques are likely to be supplanted by still more improvements in the future.

For vendors, the future appears sunny, although a few clouds appear here and there. The word-processing market is growing exponentially, and the printer market with it. But these boundless opportunities will attract well-financed entrepreneurs—the Japanese as well as others—to the market, making it difficult for undercapitalized companies to compete, no matter how attractive their products. Look for some mergers in response to the resulting squeeze. ■

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

AT COMDEX SHOW

Distribution in the '80s

Conference for independent sales organizations pinpoints distribution as the driving force behind small computer systems

Distribution, rather than technology or marketing, will be the driving force for small computer systems in the '80s. That was the message of COMDEX '80, the second annual Conference and Exposition for Independent Sales Organizations (ISOs) held at the Las Vegas Convention Center in November. And it was a message delivered, heard and acted upon by the 350 exhibitors and 9500 attendees who made COMDEX '80—in terms of timeliness, size and satisfaction—the most successful commercial small-systems conference ever.

The confluence of this show with the emerging importance of distribution in the small systems business was best captured by Richard Brown, president of the Computer Store, headquartered in Burlington, Mass., believed to be this country's largest independent computer retailing organization. He described COMDEX '80 as "a show that in years to come will be seen as pivotal in the evolution of a true mass market for small commercial systems." Brown believes that the under-$50,000 computer market must eventually be almost completely a re-seller market. "Two years ago it was about 30 percent re-seller; two years from now that proportion will be 90 percent. This show seems to be the only one that recognizes this," he said.

Attendance at the 35 COMDEX '80 *conference sessions averaged 75 entrepreneurs.*

Series 630

NEW

Quite frankly, when it comes to OEM terminals, TEC far exceeds competition.

designed with the OEM in mind

A must for your consideration because the Series 630 starts where other terminals stop.

The 630 is a smart state-of-the-art ergonomically designed terminal which incorporates quality, reliability, and the flexibility to adapt to your system at a price which helps keep your overall system cost down.

The 630 has many standard features to complement your system. A few of these are detached keyboard with the reliable reed switch technology, non glare screen, full editing capabilities, user programmable auxiliary I/O port and horizontal split screen, six user defined function keys, and upper and lower case characters.

TEC also offers an array of options to make the 630 even more attractive to you, some of which are tilt/swivel terminal base, 96 character limited graphics set, composite video output, 2, 4, or 8 pages of memory with paging or scrolling.

TEC has been in business for over 23 years. We know how to make OEMs happy, we have built CRT terminals for them for over 15 years. That's a long time and we're proud of it. We believe in providing individual support to all of our customers, especially after the sale has taken place. TEC will also modify or completely redesign its terminals to meet your exact requirement.

Made in U.S.A.

For a detailed brochure on the 630 or other TEC terminals, or for applications assistance, contact TEC today.

TEC, Incorporated

DECADES OF SUPPORT

Corporate Headquarters
2727 N. Fairview Ave.
Tucson, Arizona USA 85705 (602) 792-2230
TWX 910-952-1377 Telex 16-5540

- Boston (617) 879-6886
- Chicago (312) 655-1060
- Cincinnati (513) 984-6620
- Los Angeles (714) 848-3111
- Minneapolis (612) 941-1120
- Philadelphia (201) 780-6700
- San Francisco (408) 374-2660
- Washington D.C. (703) 354-1222
- West Palm Beach (305) 684-1604

TEC International, Inc.
European Sales Office
Avenue Louise 148–Box 6
1050 Brussels, Belgium
(02) 649-81 54 Telex 846-63553

TEC®

CIRCLE NO. 58 ON INQUIRY CARD

DISCOVER The FPS-100 Solution

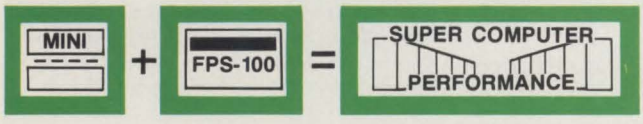
Eight Million Floating-Point Operations Per Second

THE SYSTEM BUILDERS' CHALLENGE

Your users demand more detail in computer-generated images, displays that move or change faster, or data reduction and analysis that's ready sooner. Call it super-computer computation speed and precision. It used to be available only from large, expensive mainframe computers. Now there's a fully-programmable mini-sized, mini-priced alternative.

THE FPS SOLUTION

If your product uses a general purpose minicomputer for numerically intensive computations, you should investigate the FPS-100. When connected to a mini, the FPS-100 makes a low-cost system with supercomputer capabilities.



Performance improvements of more than 200 times are possible, depending upon your application.

EASY TO INCORPORATE

An extremely high performance real-time arithmetic processor designed to crunch reams of data and handle complex computational tasks with relative ease ... and at minimal cost*. The FPS-100 is completely programmable and it's adaptable to a variety of host computers, using either integer or floating-point formats. It executes up to 8-million floating-point operations per second with 8-decimal digits of precision ... satisfying most applications.

EASY TO USE

We make the FPS-100 easy to use with two FPS-100 Resident Real-Time Operating Systems, and comprehensive development software such as a special FORTRAN Cross Compiler, Assembler, Simulator, Debugger, General Math Library of 250 routines, an Image Processing Library and a Signal Processing Library. With these effective tools, your investment in development time is minimized.

THE TREND IS CLEAR

Discover the FPS-100 solution, as have those OEMs and System builders who are leaping ahead of their competitors in applications such as CAD/CAM, Image Analysis, Real-Time Signal Processing, Seismic Analysis, and Non-destructive Testing.

Contact your nearest FPS Sales Engineer for more information or call, toll free, Jim Strelchun, FPS-100 Product Manager.

*as low as $17,899 in OEM quantities.

FPS Sales and Service Worldwide: Boston, Calgary, Chicago, Denver, Houston, Los Angeles, New Orleans, New York, Orlando, Ottawa, Philadelphia, Portland, San Francisco, Seattle, Stratford, Toronto, and Washington, D.C. International Offices: Australia and New Zealand (Sydney • Techway P/L), France (Paris), Germany (Frankfurt and Munich), India (Bombay • Hinditron Computers P/L), Israel (Tel Aviv • Eastronix), Japan (Osaka, Nagoya, and Tokyo • Hakuto Co., Ltd.), Mexico (Mexico City • Equipos y Sistemas de Mexico, S.A.), Switzerland (Geneva), and United Kingdom (Bracknell Berks).

FPS FLOATING POINT SYSTEMS, INC.

...the world leader in array processors.

Circle #85 for more information

Circle #86 for contact by FPS

CALL TOLL FREE (800) 547-1445
Ex. 4999. P.O. Box 23489 (S 500),
Portland, OR 97223 (503) 641-3151,
TLX: 360470 FLOATPOINT PTL

Exhibiting manufacturers were concerned about the quality and staying power of prospective dealers. 'We're choosing our dealers carefully,' said one.

What makes COMDEX a phenomenon is its unique position among the dozens of other industry trade shows. Only COMDEX addresses the ISO market. "There just aren't any other shows that reach this market directly," said attendee William Saichek, vice president for operations of Amcor Systems, Santa Ana, Calif. Amcor is a value-added retailer of Onyx and Altos business systems, particularly for the pharmaceutical vertical market, and Saichek attended "to see what was available." A lot was. "I accomplished much more than expected," he said, adding that he was so busy checking out opportunities in the exhibit hall that he could not attend conference sessions.

If attendees were enthusiastic, exhibitors were ecstatic. "A terrific show. We'll definitely be here next year, and with more space," said Brian Wiltshire, vice president and general manager, system division, Applied Digital Data Systems, Inc., Hauppauge, N.Y. Wiltshire said he contacted a dozen regional distributors, his primary goal at COMDEX, and actually signed 20 dealers for the ADDS Multivision system before the end of the third day of the four-day show. "By the end of day three, it was time to go home. We'd already sold our first year's production of Mentor systems (a 16-bit Microdata Reality-compatible system), and we were ready to go back to our rooms and put our feet up."

Kenn G. Morris, manager, systems marketing division of Pertec Computer Corp., Los Angeles, came to COMDEX to look for independent dealers and distributors for the company's XL 40 and XL 20 mini systems. Said Morris: "We had more quality leads by noon of the first day than we received all of last year."

Systems manufacturers weren't the only exhibitors pleased with COMDEX. Anchor Pad International, Culver City, Calif., manufactures a device that locks terminals to desk tops. "I was asked to fly in and help man our booth because there was too much traffic for the two people there," said president Chris McManus. "This has been a far better show for us than any we've been to, including office equipment and security shows."

Paul O'Grady, president of Micro Focus, a London-based software firm with U.S. headquarters in Santa Clara, Calif., found COMDEX to be "the best show we've ever attended—far better than COMPEC in London or any NCC." Micro Focus licenses CIS COBOL, a GSA-certified ANSI COBOL compiler and run-time system for use on μcs, including 8086-based systems and Apple IIs running CP/M. "No one who stepped into our booth wasted a second of our time," said O'Grady. "This is a high-quality show, and we'll be back next year with double the space."

Of major concern to exhibiting manufacturers were the quality and staying power of prospective dealers. Systems manufacturers were as careful about selecting successful dealers as they were about choosing dealers with attractively packaged software for the vertical markets they hoped to penetrate.

"We are being very careful about qualifying our

SUCCESSFUL RETAILING MEANS BETTER BUSINESS PRACTICES

Although many vendors argue about the best channel for broader distribution, most agree that if they chose retailing, they would have to use solid business and marketing methods to run a successful store. "The general trend in sales is toward computer stores. It is necessary for companies (such as Xerox Corp., Computer Data Corp. and Burroughs Corp.) to take a position in the retail market," says Robert F. Wickham, president of Vantage Research, Inc., Mountain View, Calif.

Indeed, when Xerox opens a store in a city where there is a Computerland store, Computerland sales increase, says Michael A. McConnell, vice presdient, operations, Computerland Corp., San Leandro, Calif. "Now the retail store must gain more credibility to sell computers," McConnell says. The most important factor in a retail store is that it must be run as a business, he contends, with a focus on receivables, profits, inventory control and advertising. Retail stores also must look for a manufacturer that advertises and supports dealers.

More sophisticated buyers are asking more sophisticated questions, says James A. Alexander, vice president of sales at Vector Graphic, Inc., Westlake Village, Calif. He says Vector sends out packages of information to help dealers sell computers and has a dealer-education program.

Help in selling products would come as welcome relief to computer stores, most of which stock broad product lines. Vantage's Wickham says the stores must be able to sell hand-held calculators, personal computers, small-business systems and minicomputer-based systems. One problem with retailing, he says, is that a store is not static; it requires a combination of retail and direct sales, of selling to store traffic and going to customer sites to seek buyers actively. The number of small businesses that a store contacts may be a factor of how many people are within driving distance of the store.

Product mix is another important factor in drawing customers into a store. In determining which products to carry, store owners must consider four factors, suggests Gerald A. Wright, vice president, Digital Deli Computer Store, Mountain View, Calif. Store owners must know what the customer wants, how much he can afford, how much money must be tied up in inventory so sales are not lost in long delivery times and the type of sales staff in the store. Wright selects products that his sales staff is comfortable selling. "Salesmen are the most important assets (in a store), not what is on the balance sheet."

In selecting hardware and software products, Wright examines software documentation, product packaging that is not intimidating to potential buyers, location of the nearest place to obtain service, product interfacing requirements, and how manufacturers react in crises.

About one-quarter of the 750 booths *used by COMDEX '80 at the Las Vegas Convention Center are shown here. By the third day of the four-day conference, more than 1000 units were committed for next year.*

dealers," said ADDS' Wiltshire. "Even financially stable people don't always know how to sell. Companies that have sold commodities must demonstrate that they can sell to end users, and companies that have sold very small systems must prove they can also sell systems priced about $10,000." Wiltshire added that ADDS also looked for dealers capable of putting together imaginative financial or lease packages. "We look for a lot," he said, "but here we seem to be meeting all the right people at one place at one time."

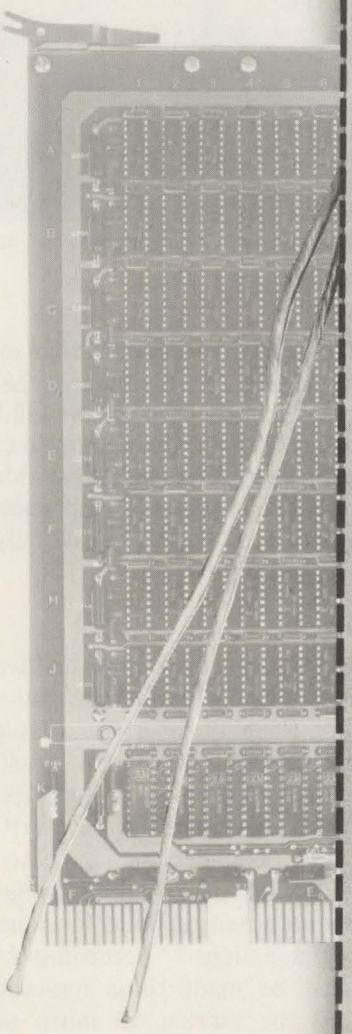
Honeywell's Edward J. Harof, director of marketing, distribution sales operation, characterized the quality vendor quest as a search for "heads-up" re-seller organizations, and stated that COMDEX is definitely the place to find them. "This is our major vehicle for reaching ISOs," he said, "I've been meeting, discussing and signing from early morning to midnight every day. There just aren't enough hours. I've been busier at this show than at any other I've attended." At one point, said Harof, he was so inundated with "the quantity of quality ISOs" that he placed a call to Fred Snow, Honeywell's vice president for Applied Business Systems Operations, and asked for Snow and two more people "to handle all the proposals we want and have met."

Pertec's Morris culled quality by concentrating on distributors rather than dealers "to distinguish between those who *want* to sell and those who *can* sell." Said Morris: "Dealers often don't have the expertise to generate volume. They're too small to feed their kids and ours at the same time. That's why we emphasize distributors. And to reach them, COMDEX is the only place to go."

Margins trouble ISOs

While manufacturers expressed concern for qualified distributor/dealers, the latter focused on adequate sales margins as the key problem. Speaking at a round-table discussion on ISO-vendor issues, Dennis Cagan, president of the David Jamison Carlyle Corp., Los Angeles, a national distributor of terminals, read the handwriting on the wall: "Now that COMDEX has vindicated distribution, distributors like us are thinking about pulling out for lack of adequate margins and (because of) competition with our suppliers." According to Cagan, manufacturers must be made to understand that "price is not driving the market as much as training and support," and that unless vendors recognize the ISO's need for "bottom-line profits," the required support levels simply cannot exist.

WRITE YOUR OWN TICKET for VAX, PDP-11 and Q-Bus Memory



We have VAX, PDP11 and Q-Bus Memory boards available for immediate delivery from shelf stock. To see if we can deal on your terms, fill out the ticket and fire it off to us. Or, better yet, pick up the phone and ask to talk to one of our memory sales crew. Either way, we'll respond immediately.

And, our involvement won't stop at competitive pricing and on-time deliveries. We'll back up our boards with the best warrantee program in the industry.

Tell us how you want to deal. We'll do the rest. Call us at **408-734-4300**

NAME _____

TITLE _____

COMPANY _____

ADDRESS _____

PHONE _____

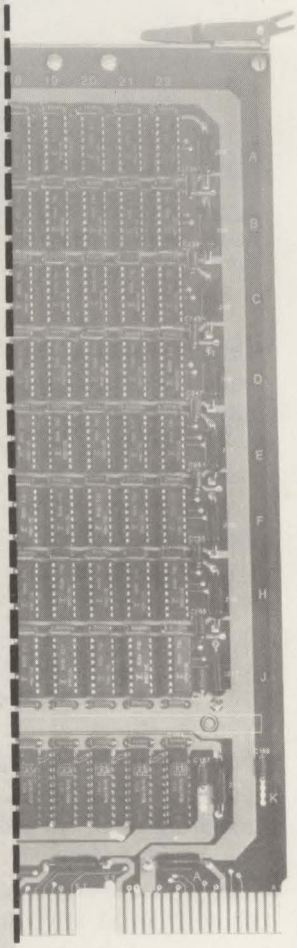
MEMORY REQUIRED _____

EVALUATION UNIT REQUIRED BY _____

APPLICATION _____

12-MONTH QTY REQUIRED _____ BEGINNING _____

PRICE _____ PRESENT SOURCE _____



INTERSIL
SYSTEMS DIVISION
Marketing Department
1275 Hammerwood Avenue
Sunnyvale, CA 94086

CIRCLE NO. 59 ON INQUIRY CARD

It is important for computer retailers to reduce selling costs by better merchandising and a realistically priced continuing support program, says one computer sales executive.

At the same round table, John Keough, president of Southern California Data, Inc., a Microdata dealership based in Santa Ana, Calif., said that "reasonable" profit margins were in the 35 to 40 percent range. Keough, who organized Basic Four's dealership network in 1973, recalled that after discovering that Basic Four's cost of marketing/sales was 41 percent, he suggested the company de-emphasize direct sales in favor of entrepreneurs. The discount offered was "35 percent plus," he said.

Chuck Peddle, vice president, advanced systems development for Commodore Business Machines, also offered the 35 percent figure as "the minimum for successful ISOs," but that percentage did not please Portia Isaacson, president of Future Computing, Inc., an ISO in Richardson, Texas. Isaacson cited the new retail distribution channels emerging from such vendors as Xerox and IBM, which make it imperative that ISOs get a profitable act together. But while encouraging computer retailers to continue their fight for better margins, Isaacson said it was equally important for them to seek ways to reduce selling costs. Better merchandising is one such way, she said, and a realistically priced continuing support program is another. On the subject of merchandising, Isaacson said, "There is a lot to be learned from such retailers as Radio Shack." As for support, she said experience had shown her the wisdom of using a "consultant who the customer does not perceive as store personnel." Otherwise, a customer simply considers all assistance as part of a sales effort.

Irwin Jacobs, Digital Equipment Corp.'s vice president, commercial OEM group, agreed with Isaacson about the need for sellers to learn how to charge for services, as did William Jobe, Data General's vice president and general manager, general distribution division. Jobe's comments, however, were more germane to the ISOs attending the sessions because as he pointedly exclaimed, "Data General is the only Fortune 500-sized company with plans to sell through dealers like office equipment suppliers and independent, profit-loving entrepreneurs like the Computer Store." The point was not lost on DEC's Jacobs.

New vendor objectives

Systems makers noted the appearance of a new kind of distributor—a distributor with a different background, perhaps different reasons (from parts distributors) for being in the distribution business.

Dynabyte, Inc., a manufacturer of Z80-based, multi-user, multiprocessing μc systems that use CP/M and MP/M, was attending its second COMDEX. Mike Scashols, vice president for marketing at the Menlo Park, Calif., company said that his firm was looking for "third-party re-sellers, those distributors who used to buy DEC or DG hardware, but who are now looking for a lower-price offering." Dynabyte's hardware and software sells in the $5000 to $10,000 range.

Scashols said Dynabyte's goals differed from last year's because the firm's product offerings have changed. "Last year we were looking for retailers," he said, explaining that Dynabyte's product line then consisted of floppy-disk-based, single-user systems with prices that appealed to small retailers whose customers were unsophisticated.

With the addition during the past year of the Series 5000 Z80-based, hard-disk product line, Scashols needs "committed dealers who have identified vertical markets and have the application software for these markets."

This is a new breed of distributors, said Scashols. "They are no longer technologists, but business people who have identified markets with a need and are targeting products for these areas."

Zilog, Inc.'s Bill Hesley agreed with Scashols, adding that the new distributors are well financed and understand the vertical markets they're attacking. Most important, said the marketing manager for Zilog's general system group, "They can add substantial value to our product line."

The Cupertino, Calif., semiconductor maker was also

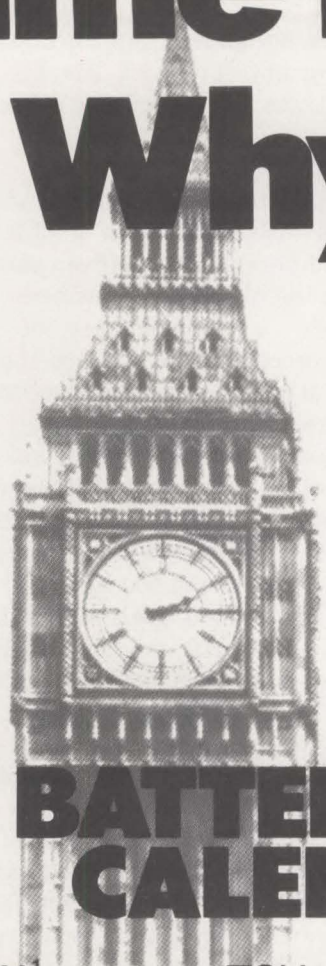
TRAGEDY AT THE GRAND

A pall was cast over an otherwise high-spirited COMDEX when, in the early morning of the last day of the conference (Friday), a fire raged through the nearby MGM Grand Hotel, site of last year's show, killing at least 84 persons.

Fortunately, most COMDEX attendees and exhibit personnel were housed at the Las Vegas Hilton, adjacent to the Convention Center. But effects of the tragedy were shared by show participants and management, who reacted quickly with offers of assistance. After learning that the entire East Wing of the Center, the site of a concurrent Billy Graham evangelical meeting, was being converted into a hospital and evacuation center, several computer vendors offered to make available systems for collecting and updating lists of survivors and missing persons. The system eventually used was supplied by Honeywell, which forklifted a multiterminal Level Six computer from the exhibit floor and staffed it with Honeywell booth personnel. The system was operating by 2 p.m. Friday, and by Saturday afternoon more than 3600 names had been entered.

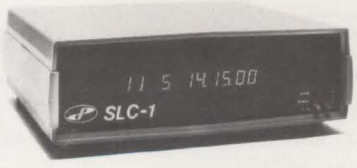
The Interface Group, sponsors of the COMDEX show, extended cash advances to COMDEX participants and their families who fled the Grand, and assisted with logistical problems. Additionally, many exhibitors were seen in the lines of blood donors. Said one, who doubtless spoke for many, "It was a terrible tragedy, but I'm glad I was here and could help."

Time is precious Why lose it?



BATTERY SUPPORTED CALENDAR CLOCKS

PDP-11[1]	TCU-100 • $495
	TCU-150 • $460
LSI-11/2[1]	TCU-50D • $325
Multi-Bus[2]	TCU-410 • $325
EXORcisor[3]	TCU-68 • $325
HP 2100	TCU-2100 • $395
Lockheed SUE	TCU-200 • $550
Naked Mini[4]	TCU-310 • $385



Serial Line Clock . .SLC-1 • $640
(RS 232 or 20mA) Microprocessor controlled. Auto message intercept and response. 10 Digit display option $190.

If automatic and accurate date and time entry is important to your system on power-up — you need a Digital Pathways battery supported calendar clock. All Digital Pathways' TCUs have on board NICAD batteries to maintain date and time during power down (typically up to three months). Timing is provided by a crystal controlled oscillator. Prices are U.S. domestic single piece. Quantity discounts available.

For more information on these timely products, contact:

Digital Pathways Inc.
1260 L'Avenida
Mountain View, CA 94043
Phone: (415) 969-7600

[1] *Trademark of Digital Equipment Corp.*
[2] *Trademark of Intel Corp.*
[3] *Trademark of Motorola Inc.*
[4] *Trademark of Computer Automation Inc.*

DIGITAL PATHWAYS

CIRCLE NO. 60 ON INQUIRY CARD

"Our new VISUAL 400 tops the industry's finest line of video terminals."

"Compare Visual's line of terminals with any other in the industry. Character or block mode. 80 or 132 columns. Black and white or green and black screens. Double high and double wide characters. Super editing. Limited graphics. Paging. International character sets. Programmable function keys. We emulate and outperform terminals from DEC®, Hazeltine, Lear Siegler and ADDS. Chances are we've got the right terminal at the right price for you. Call our marketing department and see for yourself."

Tom Foley, President

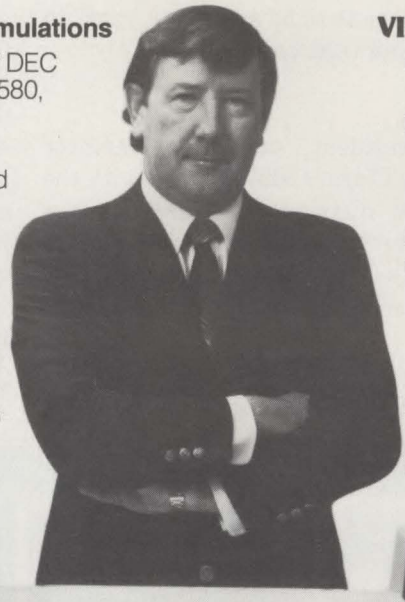
VISUAL 100 –

DEC VT100® Compatible Plus

- Advanced video package is standard
- Non-glare, tiltable screen
- Detached solid state keyboard, n-key rollover
- CRT saver feature
- Serial buffered printer interface option
- Hewlett-Packard protocol compatibility option

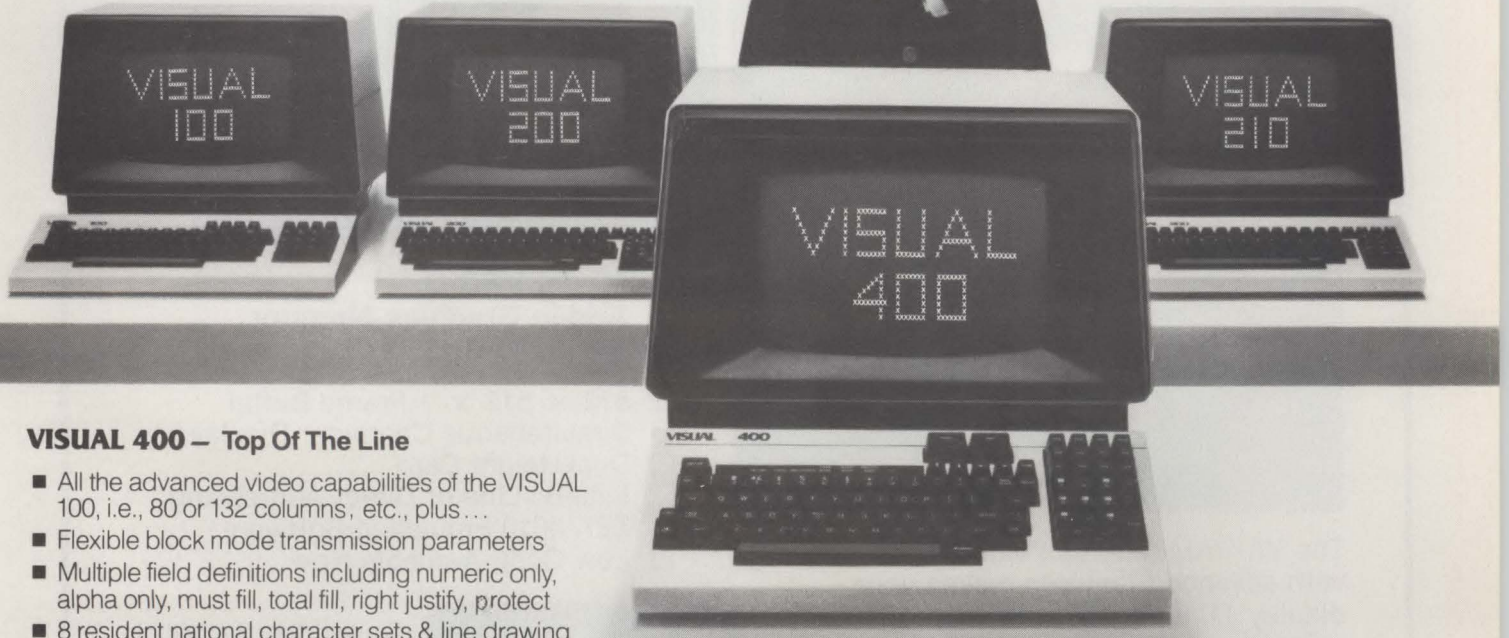
VISUAL 200 – Switchable Emulations

- Switch selectable emulation of DEC VT52®, Hazeltine 1500, ADDS 580, LSI ADM-3A
- Non-glare tiltable screen
- Detached solid state keyboard
- Large 7 x 9 dot matrix characters with descenders for lower case
- Background/foreground, blink, security fields, editing
- EIA-RS232-C and 20 ma interfaces, serial printer port, smooth scroll, 14 function keys
- Numeric keypad and cursor positioning keys



VISUAL 210 – Block Mode

- All the features of VISUAL 200 plus...
- 14 user programmable function keys, up to 48 codes each may be down line loaded
- Transmit line, field, page
- User programmable message framing including start of message, end of line, field separator and end of message codes
- Remote transmit
- Suspend/resume transmit
- Transmit unprotect/all



VISUAL 400 – Top Of The Line

- All the advanced video capabilities of the VISUAL 100, i.e., 80 or 132 columns, etc., plus...
- Flexible block mode transmission parameters
- Multiple field definitions including numeric only, alpha only, must fill, total fill, right justify, protect
- 8 resident national character sets & line drawing
- Programmable non-volatile function keys
- Control code display
- Printer port independent of communication interface
- 2 or 4 optional pages of memory; flip page or scroll
- Set-up modes for selection of terminal parameters, eliminating cumbersome switches

VISUAL See for yourself

Visual Technology Incorporated

Railroad Avenue, Dundee Park, Andover, MA 01810
Telephone (617) 475-8056 Telex 951-539

CIRCLE NO. 61 ON INQUIRY CARD

While manufacturers expressed concern for qualified distributor/dealers, the latter focused on adequate sales margins as the key problem.

attending its second COMDEX. And it was there for a different reason from last year's. "Our primary activities in 1981," said Hesley, "will be in the small-business computer area. We're looking for North American channels of distribution for our product." Zilog markets several Z80-based small-business systems, called the MCZ family.

Zilog's primary distribution has been via OEMs of all sizes, said Hesley. The firm wants to attract the mid-sized OEM "selling from 20 to 50 systems a year" to supplement Zilog's existing OEM base.

Business first

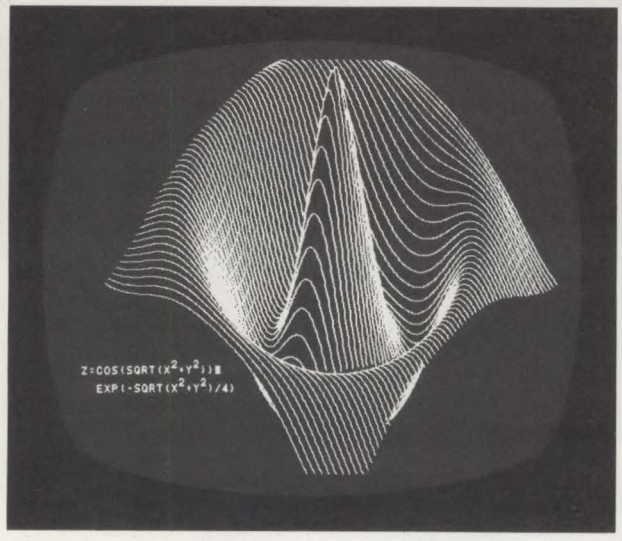
Tom DeLoia, vice president, sales, for Mercator Business Systems, Santa Clara, Calif., agreed with the description of the new distributor. Mercator was attending its first COMDEX, said DeLoia, who is responsible for Mercator's dealer programs, specifically to find "dealers who are businessmen first, technologists second."

Mercator's 8086-based System 4000, introduced last September, will be sold through the company's "dealer-partnership program," which, said DeLoia, "creates a demand at the user level to help pull sales through the dealer."

Mercator president Hub Martin thinks that the major problem in distribution is that most distributors/dealers have a tendency to focus on products rather than on the company manufacturing the product. "They ignore personal chemistry and the manufacturer's philosophy," he said, adding, "A good company will have a good product. With good management, a company cannot lag in product development for long."

Martin also saw problems with a trend in distribution toward exclusivity, though some firms at COMDEX used the show as an opportunity to announce exclusive dealer arrangements. One of those was Mini Computer Systems, Inc., Elmsford, N.Y. Martin called exclusivity a double-edged sword. He fears that a distributor/dealer's market penetration is limited by his ability to finance his own growth. Consequently, many distributor/dealers will be unable to meet sales quotas expected by manufacturers. "Often, such arrangements fail from the start, largely because neither company has been honest with the other," he said. As far as Mercator is concerned, Martin intends to deal with distributors in vertical markets, even if they are in the same territory. ■

A *Mini-Micro Systems* staff report by **Alan Kaplan, John Trifari, Lori Valigra** and **Larry Lettieri.**



The VIURAM family of video interfaces with advanced features makes your display I/0 a natural extension of your computer software, not a choke point. Our direct-access alpha-graphic display hardware, by avoiding cumbersome serial methods, provides maximum efficiency, fast character and pixel thruput, and extreme ease of software implementation.

LSI-11 GRAPHICS

Model VRG-Q
Add-In Graphics Memory
for the Q-BUS

- ☐ 512 × 512 × 1 Frame Buffer
- ☐ Simultaneous Character Display
- ☐ Dual-Height Card
- ☐ Line-By-Line or Direct Addressing
- ☐ TEK 4010 Emulation Software
- ☐ Low Cost, Available Now

Peritek corporation

Contact Tom Birchell at:
3014 Lakeshore Avenue
Oakland, California 94610
(415) 465-9000
TWX: 910-366-2029

Computer Technology Division

CIRCLE NO. 62 ON INQUIRY CARD

Introducing high performance storage for any micro. Ready to roll.

Digital's new TU58-EA will change the way you use tape storage.

Because it combines the convenience and cost advantages of a ready-to-roll tape cartridge, with the performance advantages of random accessing.

The TU58-EA is a compact table-top package, complete with power supply and EIA interface, ready to hook up to any computer.

And it has a built-in MPU that makes it think like a disk. Instead of handling data serially like other tape systems, the TU58-EA reads, writes and searches for data in blocks. So you can use it in more time-critical applications.

We also offer two unpackaged versions for greater design flexibility: the single-drive TU58-AB, and dual-drive TU58-BB. Both offer universal EIA interfacing.

High performance storage is just one of the ways Digital makes microcomputers easier to work with. We offer hundreds of hardware products to choose from. Boards, boxes, and development systems. Memory and interface boards. Terminals and printers. With the widest selection of powerful, proven software in the industry.

All backed by Digital's support group of over 14,000 people worldwide.

It's the total approach to micros, only from Digital.

For more information call our toll-free LSI-11 Hotline at **800-225-9220.** (In MA, HI, AK and Canada, call 617-467-7000.) Or send the coupon.

Digital Equipment Corporation, MR2-2/M65, One Iron Way, Marlboro, MA 01752. In Europe: Digital Equipment Co. Limited, Acre Rd., Reading, RG2 OSU, England. In Canada: Digital Equipment of Canada, Ltd. Or contact your local Hamilton/Avnet distributor.

☐ Please send more information on the TU58 family.
☐ Please have a Sales Representative call.

Name_____

Title_____

Company_____

Address_____

City_____ State_____ Zip_____

Telephone_____

My application is_____

Send to: **Digital Equipment Corporation,** MR2-2/M65, One Iron Way, Marlboro, MA 01752.
DEC-C-156 MM-1-1

digital

We change the way the world thinks.

CIRCLE NO. 63 ON INQUIRY CARD

JUST CONNECT AXIOM'S EX-850 PRINTER TO THE VIDEO INPUT OF VIRTUALLY ANY CRT DISPLAY AND INSTANTLY PRINT WHAT YOU SEE.

The Video Un-Interface

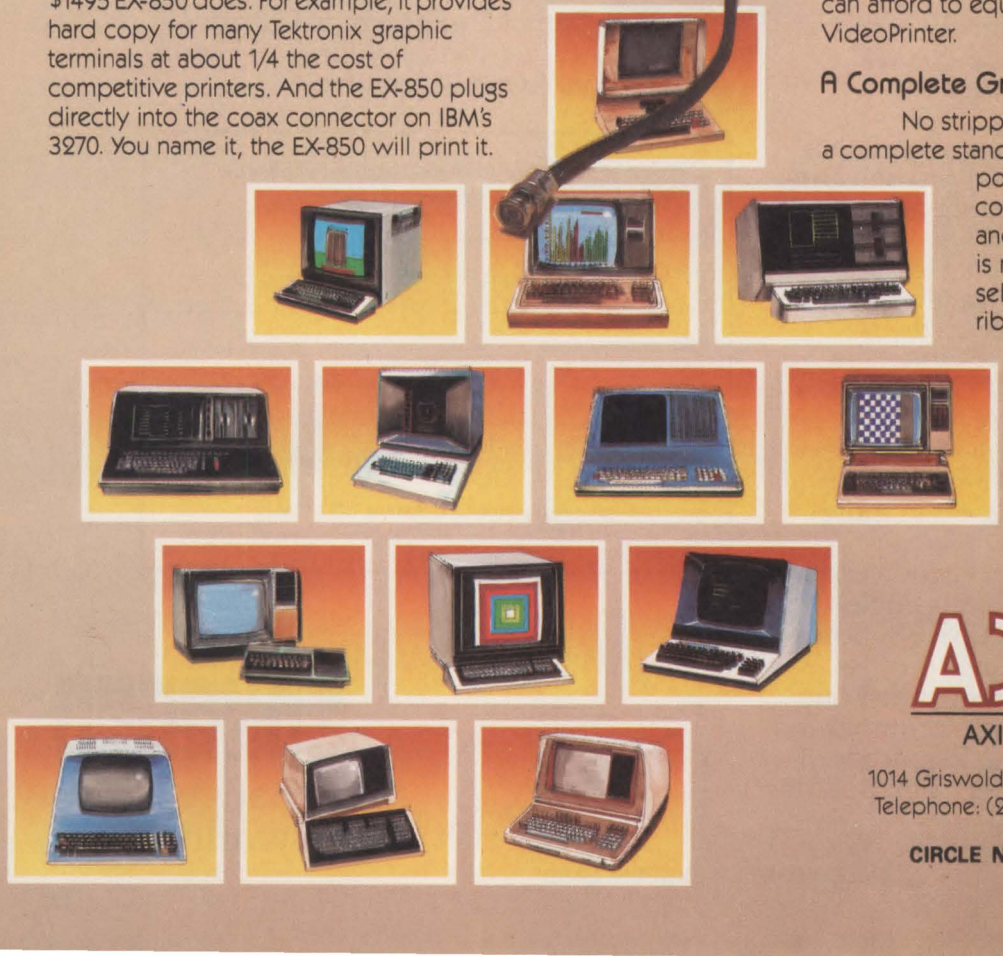
Imagine, instant hard copy of anything displayed on the CRT of your graphics terminal, video monitor or TV set... with absolutely no hardware or software interface.

And we mean anything — complex graphics, alphanumerics in any size or font, foreign symbols and hieroglyphics — whatever is on the screen.

That's because this amazingly simple printer operates from the composite video input of the CRT display. Just connect two wires and start printing.

IBM, Tektronix... You Name It

Nowhere will you find a printer that does what the $1495 EX-850 does. For example, it provides hard copy for many Tektronix graphic terminals at about 1/4 the cost of competitive printers. And the EX-850 plugs directly into the coax connector on IBM's 3270. You name it, the EX-850 will print it.



For Banks, Insurance Companies, and Others — The Electronic Notebook

The compact EX-850 is the ideal companion for CRT terminals in banks, insurance companies and a multitude of other businesses. It provides low cost hard copy at a teller's window, an executive's desk, or on the production line floor. At $1495 (less in quantity) you can afford to equip every terminal with an EX-850 VideoPrinter.

A Complete Graphics Printer

No stripped-down model, the EX-850 is a complete stand-alone printer including case, power supply, video printer controller, low paper detector, bell and paper roll holder. Maintenance is minimal, too. The printhead is self-adjusting and there are no inky ribbons to change. And every Axiom printer is backed by our nationwide distribution and service centers in the USA and 18 foreign countries.

AXIOM

AXIOM CORPORATION

1014 Griswold Avenue • San Fernando, CA 91340
Telephone: (213) 245-9244 • TWX: 910-496-1746

CIRCLE NO. 64 ON INQUIRY CARD

A new approach to program development

WILLIAM J. SPITZ, The Software Store, Ltd.

A series of 'application utility' programs contains the basic building blocks for generating custom application systems

The Small Business Administration estimates that there are 10.4 million small businesses in the U.S. Eventually, all but the smallest will have a computer, and it will probably be a microcomputer-based system. But there's a wide software gap between the power of the microcomputer and the many applications in which it can be used effectively. While reliable computer equipment is available, and the prices are within the reach of small businesses, application programs are generally lacking.

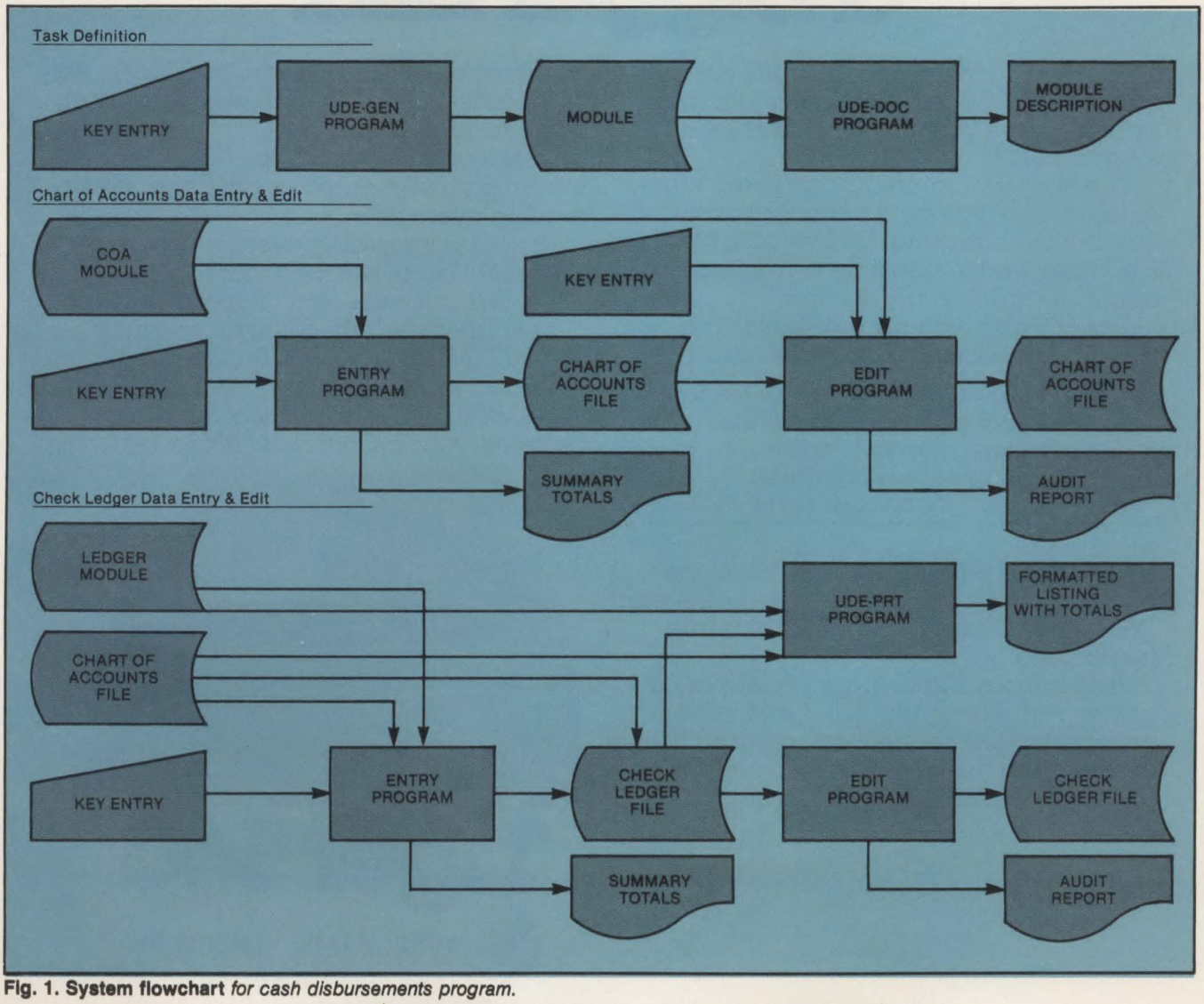
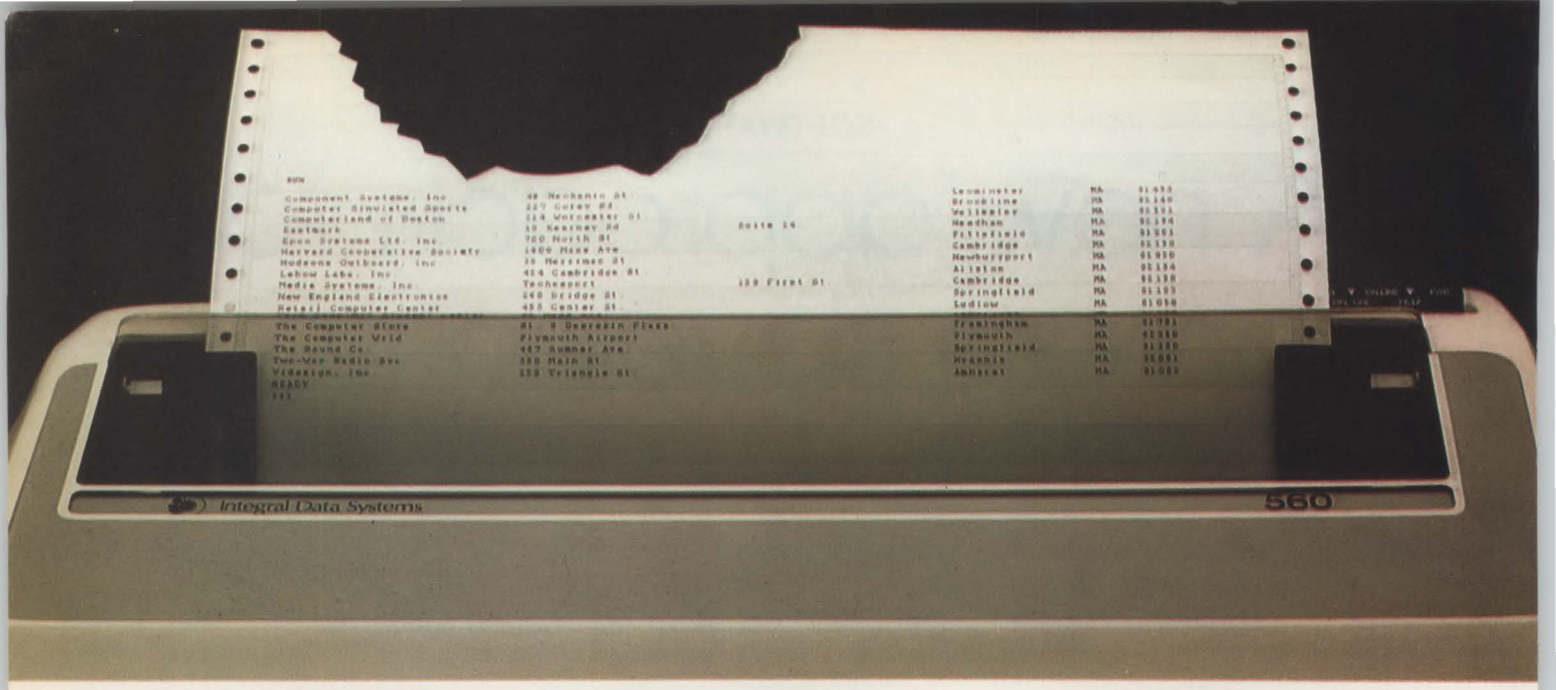


Fig. 1. System flowchart *for cash disbursements program.*



Meet the Tiger with a bigger bite.

Introducing the remarkable 132-column Paper Tiger™ 560. The first full-width matrix printer to give you fully formed characters for a low $1695.*

The new 560 features a staggered nine-wire ballistic type print head that overlaps dots in both horizontal and vertical planes. It bi-directionally prints up to 150 dense, text quality characters per second.

The 560 also features a reliable cartridge ribbon that lasts up to four times as long

presents a breakthrough in matrix printin
ering the user excellent print quality wit
ce of a matrix printer. Employing a uniq
red column" head manufactured by Integr
creates high quality printouts by overla

Paper Tiger 560 Print Sample

as spool and cassette ribbons, separate heavy-duty stepper motors to drive the print head and advance the paper, plus true tractor feed.

And famous Paper Tiger performance comes with every new 560. Like fixed or proportionately spaced text, programmable tabbing and business forms control, automatic text justification, print formats to 220 columns, parallel and serial interfaces, self-diagnostics, and more. All inside the most compact printer of its kind.

Need more stripes? Dotplot,™ our high-resolution raster graphics package, is standard on every 560.

For data processing, word processing and small business applications, this is your Tiger. The business-sized Paper Tiger™ 560.

It's a Tiger you can count on.

Call TOLL FREE 800-258-1386 (In New Hampshire, Alaska and Hawaii, call 603-673-9100.) Or write: Integral Data Systems, Inc., Milford, NH 03055.

Paper Tiger 560

Integral Data Systems, Inc.

*Suggested single-unit U.S. price. Very generous OEM discounts available.

CIRCLE NO. 65 ON INQUIRY CARD

Many packaged programs are too general, and adapting them becomes a one-sided compromise for the buyer.

Application programs are detailed sets of instructions that put a computer to work to solve a broad spectrum of business problems, from accounting to inventory control. Potential users have three choices to consider when they need application programs. They can develop the programs themselves, hire a consultant to develop them or purchase "packaged programs." These approaches might be combined in various ways. For example, a manager of a small business can hire a consultant to tailor packaged programs to meet his specific needs, or he can buy packaged programs and alter them to meet his special requirements.

When evaluating different strategies, he should consider the implications of the methods, such as development time, ease of operation, ease of program modification to meet changing needs, quality of the documentation and cost.

Developing a program from scratch is not usually suited for most first-time computer users because of the expertise, high cost and time required. The second approach, hiring a consultant, solves the programming skill requirement, but because cost is an important factor for most small businesses, the ease of use of the programs and the quality of the documentation usually suffer under tight budgets. The ease of future program modifications depends on the quality of the users' manual, the structure (design of the system) used by the consultant and the consultant's future availability. Development time may also be a deterrent if much of the application has to be developed from scratch.

CHECK LEDGER FILES

Data Item	Description
Account #	A six-digit number made up of two parts as specified by the State of Michigan for township accounting. The Account Number is used as a key to the Chart of Accounts description. Account Number to be validity checked against keys in the Chart of Accounts file.
Reference #	Either the associated check number, Journal entry number or other source document reference #. Reference number to be automatically incremented by the system.
Date	Month, day, year of the transaction. Each two-digit number is right justified with zero fill left by the system (January is coded as 01). Month and year are automatically duplicated into each record.
Amount	System checks entry for numeric validity. Transactions are batch totaled by account code and credit/debit designation.
Description	Payee and invoice number or other transaction description.

CHART OF ACCOUNTS FILE

Data Item	Description
Account #	A six-digit number.
Account Description	Account description to be used as a label for keyed category totals.
Credit/Debit	A Credit/Debit indicator. 1 = Credit 2 = Debit 0 = Other.

Fig. 2. Data characteristics *and definitions.*

Purchasing packaged programs from software vendors also involves risks. Theoretically, these applications programs can be purchased off-the-shelf, but in practice there have been delivery problems because the time to get the application running smoothly took much longer than the vendor anticipated. These programs are designed to satisfy a wide range of users and are priced at a fraction of their development cost. To protect the developer's investment, many packaged programs are sold only in machine code, which is the most elementary and difficult of computer languages. This makes modification practically impossible. While some programs are supplied in source code (usually BASIC) to allow for some modification, the buyer may find himself back at square one, asking if he should revise it himself, hire a consultant or buy a new package.

Many packaged programs are simply too general. Seldom are the accounting procedures identical across the same type of business, so that adapting to packaged programs becomes a one-sided compromise for the buyer. Aware of these limitations in canned applications, officials at The Software Store have developed a series of "application utility" programs intended to overcome the limitations. The Software Store, Marquette, Mich., is 4-yr.-old software-development company that provides programming power for business applications.

The Store has identified what its officials regard as the essential segments of any computer operation, and have devised the application-utility programs to accomplish them. They believe the five key segments are data entry, data edit, sort or merge, information selection and report generation. The application utility programs include the ENTRY, EDIT, SORT, SELECT, UDE-PRT (universal data entry print) and REPORT systems that become the basic building blocks for generating custom application systems. These utilities can be combined in numerous ways to create solutions to complex business problems quickly and at a lower cost than using most other methods. The approach allows a user or consultant to interactively define a set of instructions for the computer that reflect a user's specific needs, and that can be easily changed or revised when needs change.

The application utilities are usually made up of three programs: an interactive task-definition program to generate a disk file (module) containing the task definition, a documentation program to generate a printed description of the task definition and a

Application utilities are made up of three programs: documentation, task execution, interactive task definitions.

task-execution program to carry out the task. For example, in the universal data ENTRY system (Fig. 5), the task-definition program is UDE-GEN, the task-documentation program is UDE-DOC, and the task-execution program is ENTRY.

A cash disbursements journal application will be

THE SOFTWARE STORE
UDE MODULE DOCUMENTATION

UDE MODEL: LEDGER. MDL DATE: 8/24/80 OPERATOR: WJS

OUTPUT FILE
  NAME: LEDGER DRIVE: A FIELDS PER RECORD: 7 FILE FORMAT: FIELD

CODE FILE
  NAME: COA DRIVE: A FIELDS PER RECORD: 3 KEY FIELD: 1
  TYPE OF KEY:STRING DESCRIPTION FIELD:2 CR/DB FIELD: 3

CRT INPUT
  # VARIABLES: 7 # VARIABLES ON CRT: 7 # RECORDS DISPLAYED: 2
  KEY VARIABLE: 2: ACCOUNT # KEYED TOTALS ON VARIABLE: 6: AMOUNT

----VARIABLE----		BATCH	-TESTS-		VALIDITY/ AUTO ENTRY	DISK OUT	---CRT---			
#	NAME	TOTAL	NUM	LEN	PROCESSING*	SEQ	SEQ	LN	COL	OTHER*
1	REFERENCE #	NO	NO		INCR/RUN	5	1	7	2	
2	ACCOUNT #	NO	NO		KEY TEST	1	2	7	11	
3	MONTH	NO	FILL	2	NONE	3	3	7	23	
4	DAY	NO	FILL	2	NONE	4	4	7	27	
5	YEAR	NO	FILL	2	AUTO DUP	2	5	7	31	
6	AMOUNT	YES	YES		NONE	7	6	7	35	
7	DESCRIPTION	NO	NO		NONE	6	7	7	45	

THE SOFTWARE STORE
UDE MODULE DOCUMENTATION

CRT FORMAT

UDE MODULE: LEDGER.MDL DATE: 8/24/80 OPERATOR: WJS

```
+0000000001111111111222222222233333333334444444444555555555566666666667777777777
LN+1234567890123456789012345678901234567890123456789012345678901234567890123456789
 +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 1+                          TOWNSHIP CASH DISBURSEMENTS ENTRY
 2+
 3+                               (3) (4) (5)
 4+     (1)          (2)          ----DATE----        (6)          (7)
 5+  CHECK #    ACCOUNT     MM  DD  YY     AMOUNT    DESCRIPTION
 6+   +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 7+
 8+
 9+
10+
11+
12+
13+
14+
15+
16+
17+
18+
19+
20+
21+
22+
23+
24+
END OF DOCUMENTATION
```

Figs. 3a, 3b. *Printed documentation.*

presented to demonstrate the ease of developing applications programs with these utilities. This project was done for a local town, which wanted to enter transactions from a check ledger and get a formatted printout of this data, with totals by account code and credit/debit designation. The township also wanted to be able to edit this data before further processing in case errors were present. A system flowchart for this application is provided in Fig. 1.

The chart of accounts and check ledger data definition is shown in Fig. 2. The account codes and descriptions in this example are from the accounting procedures manual for the State of Michigan. The data characteristics are used to define validity checks and other data-entry aids in the UDE-GEN program.

The data-entry tasks associated with the chart of accounts and the check ledger were defined using the UDE-GEN program. The chart of accounts task-definition module was named COA.MDL, and the check ledger task-definition module was named LEDGER.MDL. Fig. 3 contains the printed documentation for these modules, which are stored on diskette for later use or revision. The chart of accounts file acts as a "code file" when entering the check ledger information. This file is used by the ENTRY program is validate account codes, to define keyed total categories and to provide a label

THE SOFTWARE STORE
UDE MODULE DOCUMENTATION

UDE MODULE: COA. MDL DATE: 8/24/80 OPERATOR: WJS

OUTPUT FILE
  NAME: COA DRIVE: A FIELDS PER RECORD: 3 FILE FORMAT: FIELD

CRT INPUT
  # VARIABLE: 3 # VARIABLES ON CRT: 3 # RECORDS DISPLAYED: 2

----VARIABLE----		BATCH	-TESTS-		VALIDITY/ AUTO ENTRY	DISK OUT	---CRT---			
#	NAME	TOTAL	NUM	LEN	PROCESSING*	SEQ	SEQ	LN	COL	OTHER*
1	ACCOUNT #	NO	NO	7	NONE	1	1	7	2	
2	ACCOUNT DESCRIP	NO	NO		NONE	2	2	7	14	
3	CREDIT/DEBIT	NO	NO		TABLE TEST	3	3	7	51	0,1,2

THE SOFTWARE STORE
UDE MODULE DOCUMENTATION

CRT FORMAT

UDE MODULE: COA.MDL DATE: 8/24/80 OPERATOR: WJS

```
+0000000001111111111222222222233333333334444444444555555555566666666667777777777
LN+1234567890123456789012345678901234567890123456789012345678901234567890123456789
 +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 1+                          TOWNSHIP CHART OF ACCOUNTS
 2+
 3+                                                        CREDIT = 1
 4+     (1)                 (2)                            DEBIT = 2
 5+ ACCOUNT #  ACCOUNT DESCRIPTION                         OTHER = 0
 6+  +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 7+
 8+
 9+
10+
11+
12+
13+
14+
15+
16+
17+
18+
19+
20+
21+
22+
23+
24+
END OF DOCUMENTATION
```

Figs. 3c, 3d. *Printed documentation.*

Application utilities can be combined in many ways to create solutions to business problems quickly and at lower cost than other methods.

and credit/debit designation for each account code.

The last step of the initialization process was to create the chart of accounts file. This was done using the ENTRY program and the previously defined COA.MDL module. Fig. 4 contains a sample of the chart of accounts data. The EDIT program, together with the COA.MDL module, can be used to edit or update the chart of accounts data.

The check ledger transaction file was entered with the ENTRY program using the previously defined LEDGER.MDL module and the chart of accounts file. After data entry was completed, the ENTRY program produced the totals by account code and the credit/debit designation shown in Fig. 5. The UDE-PRT program was then used to produce a formatted listing with the batch and account code totals defined in the LEDGER.MDL module. The UDE-PRT output is shown in Fig. 6.

The EDIT program and the LEDGER.MDL module can be used to edit or revise the check ledger transaction file. The EDIT program uses the same task-definition module as the ENTRY program and provides a printed audit listing of changes along with file search commands for specific records.

The development time required for this example was about 2 hr., including the time spent reading the various manuals. It would have taken at least several man-months of effort to accomplish this task without The Software Store's application utilities. This example does not use all available application utilities, but it provides a basis for visualizing how the application utilities might be used.

The SORT, MENU and SELECT utilities, not discussed here, are additional building blocks that allow the user to expand his range of computer applications. The SORT utility allows a user to sort and/or merge data files. Sorting or merging of files may be very simple or complex, depending on how modules are linked together in a "sort-stream." SORT provides the ability to control and execute batch processing as an unattended operation.

The MENU job stream control system can be used to link the various application utility and other programs together. The programs and associated task modules are automatically run by the MENU system. When a job stream is completed, control passes to the MENU program, where the operator can select the next job stream.

The SELECT utility provides a means to copy selected records from a UDE file to a new file. The selection criteria are interactively defined by the operator and

Chart of Accounts - August 1980

TOWNSHIP CHART OF ACCOUNTS

(1) **ACCOUNT #**	(2) **ACCOUNT DESCRIPTION**	**CREDIT** = 1 **DEBIT** = 2 **OTHER** = 0
215-702	Salaries	2
215-727	Office Supplies	2
215-728	Printing	2
215-729	Postage	2
215-732	Xerox	2
215-752	Fuel Oil	2
215-755	Other Supplies	2
215-769	Electricity	2
215-770	Building Maintenance	2
215-776	Janitorial Supplies	2
215-778	Equipment Maintenance	2
215-802	Membership-Publication	2
215-811	Computer	2
215-853	Telephone	2
215-860	Travel	2
215-920	Utility	2
215-956	Miscellaneous	2
215-957	Capital Outlay	2

THE SOFTWARE STORE

UNIVERSAL DATA ENTRY SYSTEM

FILE NAME: LEDGER ENTRY: 08/24/80 BY: WJS

BATCH TOTALS:

AMOUNT: 4319.61

KEYED CATEGORY TOTALS:

Salaries [DEBIT]:	433.73
Office Supplies [DEBIT]:	60.19
Printing [DEBIT]:	321.19
Postage [DEBIT]:	250.60
Xerox [DEBIT]:	141.12
Fuel Oil [DEBIT]:	234.23
Other Supplies [DEBIT]:	12.65
Electricity [DEBIT]:	653.05
Building Maint [DEBIT]:	524.71
Janitorial Supp [DEBIT]:	106.54
Equipment Maint [DEBIT]:	629.92
Membership - Pu [DEBIT]:	110.63
Computer [DEBIT]:	125.00
Telephone [DEBIT]:	98.21
Travel [DEBIT]:	513.15
Utility [DEBIT]:	28.74
Miscellaneous [DEBIT]:	75.95
TOTAL DEBITS	4,319.61

RECORD TOTALS:

28 NEW RECORDS ENTERED

0 RECORDS DELETED DURING INPUT

896 CHARACTERS OUTPUT TO DISK (APPROX)

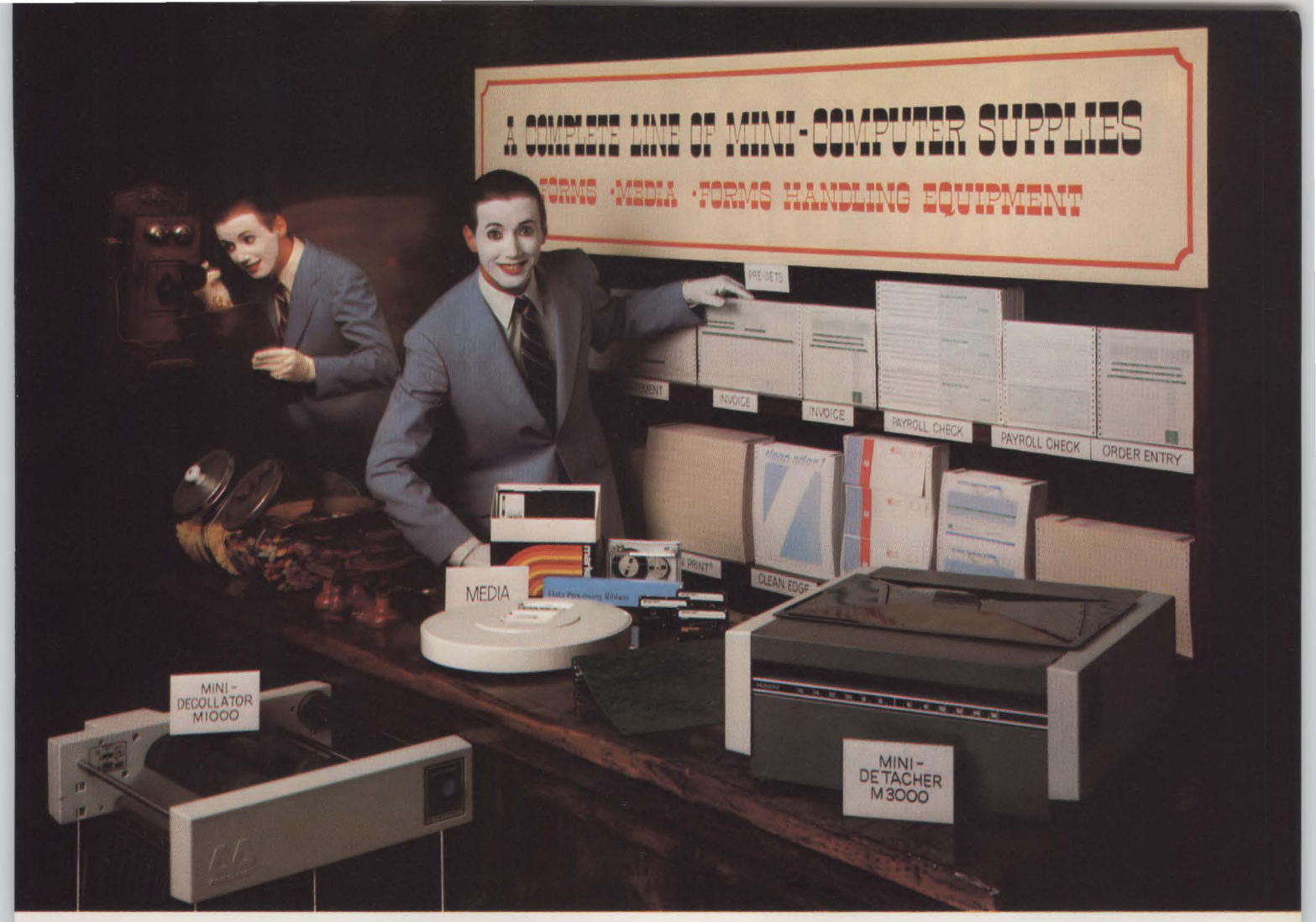
Fig. 5. Totals by account code, *with credit/debit designations.*

Chart of Accounts - August 1980

REPORT SOURCE: [FILE NAME: COA ENTRY: 08/24/80 BY: WJS EDIT: 8/24/79 BY WJS]

18 RECORDS PROCESSED

Fig. 4. Sample chart *of accounts data.*



The spirit of the general store lives on at Moore!

One phone call brings everything for your mini-computer plus personal service

Save time and money with Moore's one source for all your mini-computer supplies. Need forms? Your Moore representative will show you our Pre-Sets, a group of forms pre-designed to match over 40 standard mini-computer programs. Pre-sets save you time and reduce your forms cost. Your Moore representative also will design custom forms for your mini-computer that increases efficiency and reduces data handling costs. Ask about our Speedimailer®, a self-mailer system that eliminates the cost of separate component printing, assembly, inserting and sealing. Ask too about Speediweb demand printing forms that maintain numerical control without waste. Choose from Moore's complete line of off-the-shelf computer output forms. Moore Clean Print®, saves removal of carbon paper, and Speedireed®, with its unique Eye Track color bars, saves reading time, saves paper. In addition, we can help you choose time-saving decollators, detachers and other forms handling equipment. When you need floppy disks, cartridges or other magnetic media, call your Moore representative for top brands at competitive prices. When you need binders or racks for your computer output or ribbons for your printers, call. Think of your Moore Representative as your personal "storekeeper" for all your mini-computer supplies. Everything you need is just a phone call away.

Call toll free for our new Mini-Computer Supply Reference Guide. 800-323-8325/In Illinois 800-942-8330

MMS-1-81

☐ Send me your Mini-Computer Supply Reference Guide

☐ Have a Representative Call

Name _____

Title _____

Company _____

Phone _____

Street _____

City _____

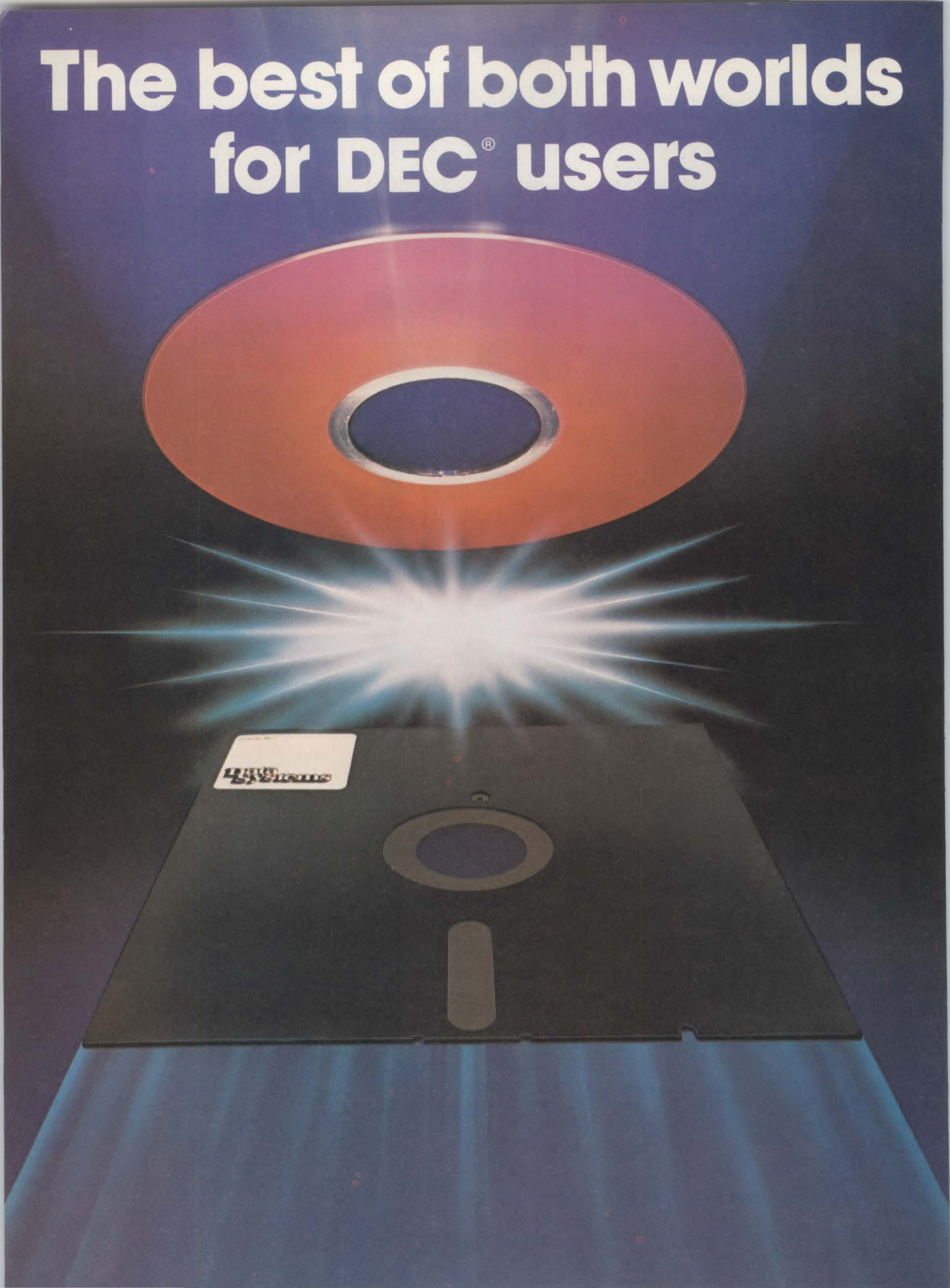
State _____ Zip _____

MOORE BUSINESS FORMS, INC.

1205 Milwaukee Ave., Glenview, IL 60025
800-323-8325/In Illinois 800-942-8330

CIRCLE NO. 66 ON INQUIRY CARD

The best of both worlds for DEC® users



Data Systems Design's DSD 880

Introducing the DSD 880 — A DEC-compatible disk system combining eight-inch winchester and floppy disks

For DEC users who need more capacity and performance than an RX02, the DSD 880 now offers a more cost effective alternative than a dual RL01. Consider these benefits offered by the DSD 880:

- significantly lower initial and total life-cycle costs
- the reliability of a winchester, with 7.8 Mbytes, emulating RL01
- the removability of a floppy disk, with 1 Mbyte, emulating RX02
- valuable saving in rack space (5¼" vs. 21" for dual RL01)
- unique "hyperdiagnostics" enabling fast and easy trouble-shooting to the modular level
- built-in bootstrap eliminating the need for an expensive DEC bootstrap board and saving a backplane slot
- one half-quad backplane slot vs. two quad boards for the RLV11
- versatile interface card for easy integration with any LSI-11 backplane, unlike DEC's RLV11 interface that needs a special backplane and cannot be used with the VT 103 terminal

Compare for yourself and see why nothing compares to the DSD 880.

Data Systems

The Intelligent Alternative to DEC Disk Systems

To get more information on the DSD 880 call or write:

CORPORATE HEADQUARTERS:
2241 Lundy Avenue
San Jose, CA 95131
TEL: (408) 727-9353
TWX: 910 338-0249

WESTERN REGION SALES:
2560 Mission College Blvd., Suite 108
Santa Clara, CA 95051
TEL: (408) 727-3163
TWX: 910 338-0249

EASTERN REGION SALES:
51 Morgan Drive
Norwood, MA 02062
TEL: (617) 769-7620
TWX: 710 336-0120

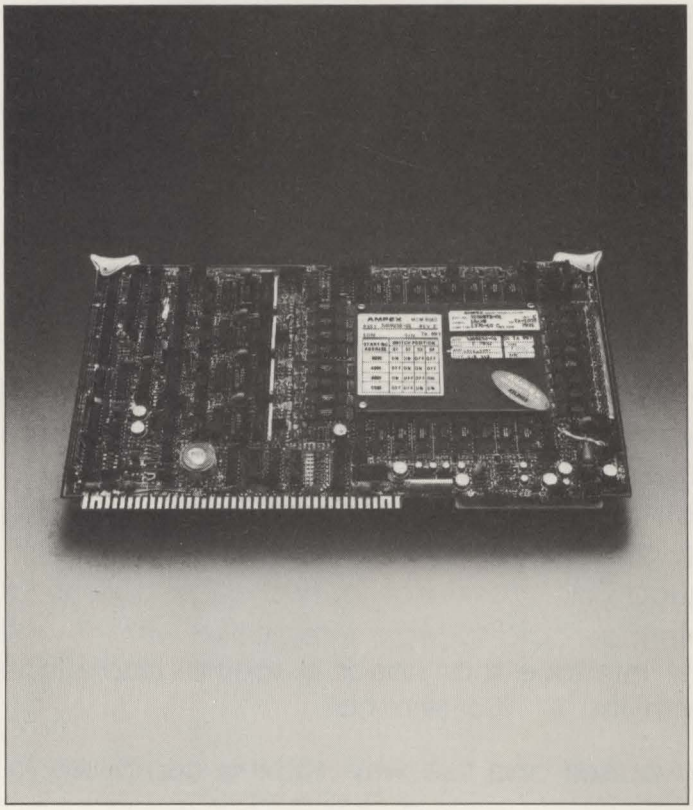
INTERNATIONAL SALES: Australia, Melbourne (03) 543-2077, Sydney (02) 848-8533; Canada (416) 625-1907; Denmark 01/83 34 00; Finland 90/88 50 11; France 03/956 81 42; Israel 03/ 298783; Italy 02/ 4047648; Japan, Osaka (06) 323-1707, Tokyo (03) 345-1411; Netherlands 020/45 87 55; New Zealand 4-693-008; 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. 67 ON INQUIRY CARD

®Registered trademark of Digital Equipment Corporation

AMPEX NON-VOLATILE RAM FOR 8080.

16K BYTES $885.



For many applications, a microprocessor is unexcelled in price/performance. But volatile memory can erase the advantage in a hurry.

With the Ampex MCM-8080, your microcomputer will never forget the data. Even in the event of a power failure. It uses reliable, non-volatile cores. All in the same card size, with the same performance, and the same plug-compatible connections as Intel RAM for SBC 80/05, 80/10 and 80/20, the MDS-800 and the 888 System Development Center.

Ampex MCM-8080 RAM provides 16K bytes of non-volatile memory, is Multibus* compatible, and occupies only one card slot. And all at a price that will make you smile: $885.

8080 RAM. It's just one of a complete line of Ampex computer memories.

Remember, you will not lose data when power is interrupted. And you don't need batteries.

Andy Nizynski will provide more details on our infallible memory and the full Ampex product line. Call him now at 213/640-0150. Or write him at Ampex Memory Products, 200 North Nash Street, El Segundo, California 90245.

*Trademark, Intel Corporation

AMPEX

MAKES THE DIFFERENCE.

CIRCLE NO. 68 ON INQUIRY CARD

When a job is completed, control passes to MENU, where the operator can select the next job stream.

allow complex selection tasks based on one or more of the variable values in each record.

REPORTS, the UDE report-writing program that will round out this series of flexible programming tools, is being developed. REPORTS will generate financial statements, balance sheets, sales reports and other documents from the UDE data file.

The Software Store's programming tools are designed for use with a disk-based computer with at least 52K bytes of memory and 500K bytes of disk storage. The programs are written in Microsoft BASIC. ■

Township Check Register - August 1980

TOWNSHIP CASH DISBURSEMENTS ENTRY

[1] CHECK #	[2] ACCOUNT	[1] [2] [3] ---DATE--- MM	DD	YY	[6] AMOUNT	[7] DESCRIPTION
1234	215-702	08	03	80	196.47	JOHN SMITH
1235	215-752	08	03	80	234.23	HARVEY OIL (A3214-3)
1236	215-802	08	03	80	34.23	ASSESSORS JOURNAL (8/78 - 8/80)
1237	215-776	08	03	80	12.23	CARL'S MARKET
1238	215-811	08	03	80	125	THE SOFTWARE STORE (90712-5)
1239	215-729	08	03	80	56.48	POSTMASTER
1240	215-728	08	03	80	321.19	LAKE SUPERIOR PRESS (4523)
1240	215-729	08	03	80	194.12	LAKE SUPERIOR PRESS (4523)
1241	215-860	08	03	80	234.7	JOHN SMITH
1242	215-853	08	16	80	98.21	MICHIGAN BELL
1243	215-776	08	16	80	34.91	CARL'S MARKET
1243	215-755	08	16	80	12.65	CARL'S MARKET
1244	215-770	08	16	80	346.21	LAMB ROOFING CO. (12345)
1245	215-732	08	16	80	141.12	E.H. ANDERSON (45671)
1246	215-769	08	16	80	653.05	MQT BOARD OF LIGHT & POWER
1247	215-956	08	16	80	54.13	WAHLSTROMS
1248	215-920	08	16	80	28.74	MICHIGAN GAS CO. (45701)
1249	215-778	08	16	80	98.12	SUPERIOR TRUCK SERVICE (56192)
1250	215-802	08	16	80	76.40	SUNDAY SUN
1251	215-778	08	16	80	531.8	CLIFF'S WELDING (54109)
1252	215-727	08	16	80	60.19	MARQUETTE OFFICE SUPPLY (12398)
1252	215-956	08	16	80	12.59	MARQUETTE OFFICE SUPPLY (12398)
1253	215-770	08	16	80	178.50	KING'S NORTHERN (76012)
1253	215-776	08	16	80	59.4	KING'S NORTHERN (76012)
1253	215-956	08	16	80	9.23	KING'S NORTHERN (76012)
1254	215-860	08	16	80	278.45	NORTH CENTRAL (MQT-NY-MQT 8/28/80)
1255	215-702	08	16	80	218.12	JOHN SMITH
1256	215-702	08	16	80	19.14	PENSION FUND TRUST ACCOUNT

Township Check Register - August 1980
REPORT SOURCE: [FILE NAME: LEDGER
ENTRY: 08/24/80 BY: WJS]

BATCH TOTALS:
AMOUNT: 4319.61

KEYED CATEGORY TOTALS:

Salaries [DEBIT]:	433.73
Office Supplies [DEBIT]:	60.19
Printing [DEBIT]:	321.19
Postage [DEBIT]:	250.60
Xerox [DEBIT]:	141.12
Fuel Oil [DEBIT]:	234.23
Other Supplies [DEBIT]:	12.65
Electricity [DEBIT]:	653.05
Building Maint [DEBIT]:	524.71
Janitorial Supp [DEBIT]:	106.54
Equipment Maint [DEBIT]:	629.92
Membership - Pu [DEBIT]:	110.63
Computer [DEBIT]:	125.00
Telephone [DEBIT]:	98.21
Travel [DEBIT]:	513.15
Utility [DEBIT]:	28.74
Miscellaneous [DEBIT]:	75.95
TOTAL DEBITS	4,319.61

28 NEW RECORDS ENTERED

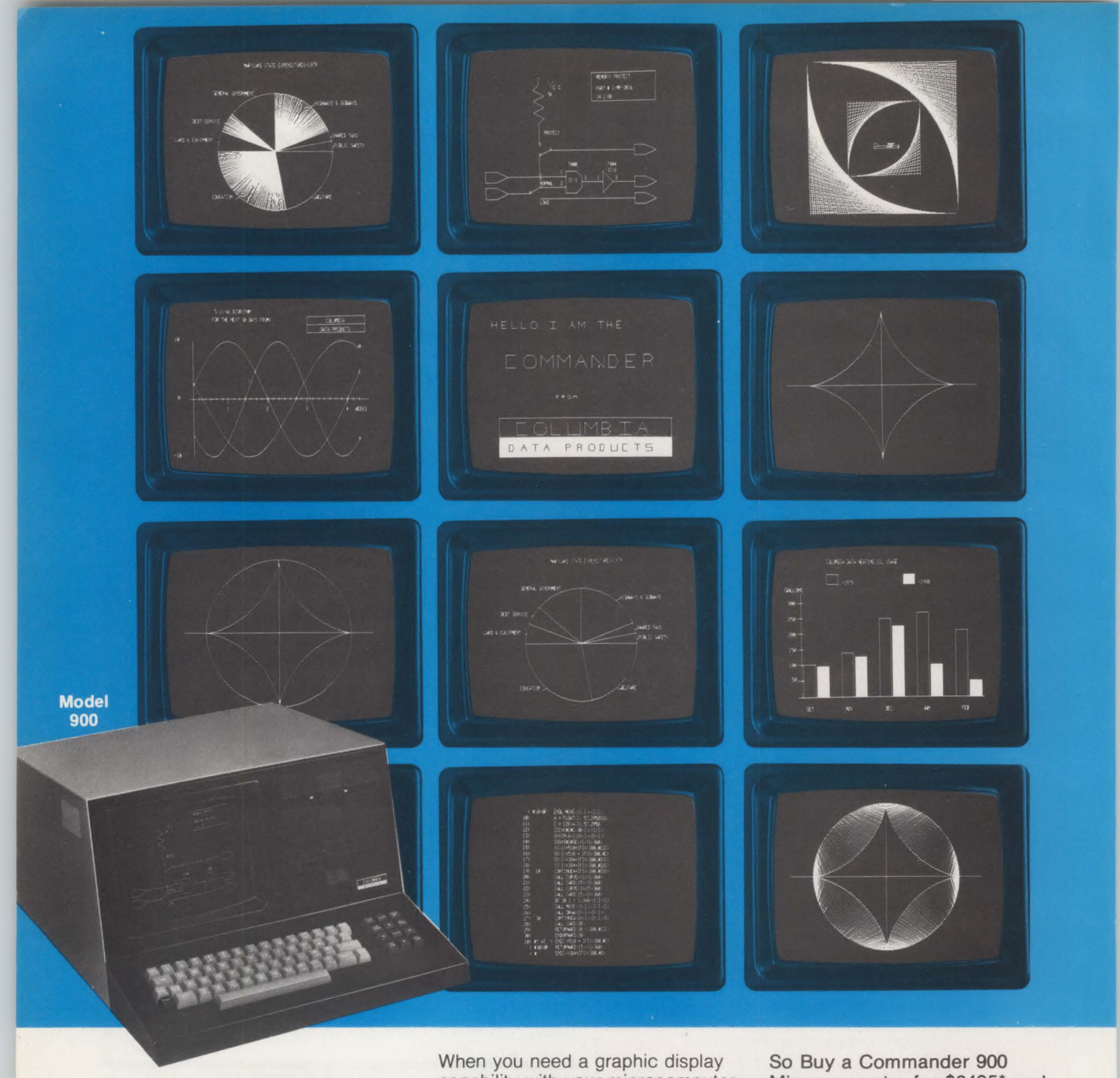
Fig. 6. Output *of the UDE-PRT program.*

William J. Spitz is a systems analyst with the Software Store, Ltd., a Marquette, Mich., firm that specializes in business application software for minicomputers.

NEXT MONTH IN MMS

Disk drives get the feature spotlight in the February issue of Mini-Micro Systems. There will be major product surveys covering:

- The latest in Winchester hard-disk-drives, including market forecasts for the next three years, plus a look at technology trends during that same period;
- Floppy-disk drives, including a concentrated table of hardware and performance data;



Model 900

Our Microcomputer Doesn't Need a Separate Graphics Terminal...

It's Built In

When you need a graphic display capability with your microcomputer ... don't buy a separate terminal ... select our Model 900 Commander with the self-contained vector and point plotting features of a sophisticated graphics terminal.

You can display bar charts, pie charts, histograms and complex point to point plots. You can even output displays originally intended for a Tektronix 4010 with our Tektronix® terminal emulator. And because Commander has an independent processor controlling the display, graphics can be handled without interrupting primary computing tasks.

CIRCLE NO. 69 ON INQUIRY CARD

So Buy a Commander 900 Microcomputer for $3495* and Get a Graphics Display Terminal FREE. Contact Columbia Data Products.

COLUMBIA
DATA PRODUCTS, INC.

Computer Systems Division
9050 Red Branch Road,
Columbia, Maryland 21045
TEL: 301-992-3400
TWX: 710-862-1891

® Trademark of Tektronix, Inc.

*Dual, independent Z80A Processors, 96K RAM, dual floppy drives, and 512x256 resolution vector graphics on a 9 inch CRT in quantity 100 to qualified OEMs. I/O includes 4 RS-232 ports, 4 parallel ports and RS-170 composite video.

A programmable logic analyzer

STEVEN DEN BESTE, Tektronix, Inc.

User-configurable resources simplify design and maintenance of microprocessor-based products

Logic analyzers—the primary debugging tools of digital electronics—are of two basic types (Fig. 1). Analyzers designed for debugging random logic have generalized probes (usually with individual leads, but sometimes with a mass termination) and only a few channels. These units de-emphasize triggering ability in favor of deep memory and high sampling rate. Microprocessor-oriented logic analyzers have specific probes for each chip they support and many channels, but are relatively slow. The most important features of this type of analyzer are triggering capability and specialized data formatting.

Most logic analyzers of either type have hard-wired hardware resources (word recognizers and counters), configured by the designer to deal with the problems a user is thought to be most likely to encounter. The user can enter the values of the resources, but their relationships to each other are fixed. As microprocessor applications become more numerous and sophisticated, the problems logic analyzers are called upon to solve become ever more difficult to predict. The traditional approach of hard-wiring a logic analyzer into only a few configurations is fast reaching its limits. Tektronix's 7D02 (Fig. 2) is the vanguard of a new generation of logic analyzers with user-programmable resources, which will help expand the boundaries of microprocessor-based design.

	Microprocessor Systems	Large Systems
Software Development	Microprocessor Development Aids (Cross-Assemblers and Cross-Compilers)	On-Line Assemblers and Compilers
Hardware/ Software Integrations	Microprocessor-Oriented Logic Analyzers	On-Line Debuggers
Hardware Development	Microprocessor-Oriented Logic Analyzers	High-Speed Logic Analyzers

Fig. 1. This chart shows *the best tool for each task involved in developing a computer-based product.*

Architecture and operation

The heart of the 7D02 is a RAM-based state machine, which accepts inputs (events) and generates outputs (commands) on cycles of a clock. The input and the current state determine the output for that cycle and the state for the next.

Fig. 2. A Tektronix 7D02 *programmable logic analyzer with attached personality module and microprocessor probe.*

The traditional approach of hard-wiring a logic analyzer into only a few configurations is fast reaching its limits.

There are four possible states, each of which can be programmed by a user to represent a certain ouput in response to a specified input. For each state, the input consists of six lines originating from four word recognizers and two counters. The seven-line output includes individual lines to the main trigger, timing-option trigger and data qualifier, plus four bits to control the counters (Fig. 3). When programming a state, the user can link any event or combination of events to any command or combination of commands. This control of the analyzer's resources yields unprecedented triggering ability.

The sophistication of a logic analyzer's triggering lies not in its ability to capture required information, but in its ability to exclude irrelevant data. If it can capture the desired data only once out of 1000 runs, it is useless. For example, suppose there is a location TEMP that contains an important value. This location is set from many different places within the subroutine TEMPSETTER, but no other routine in the firmware is supposed to write to that location. Unfortunately, something else is changing TEMP at random (but not very often).

With a traditional logic analyzer, the approach to this problem would be to trigger on the location being written to. The user would run the analyzer over and over, examining each data result and manually filtering out the legitimate accesses by the routine TEMPSETTER. This is a tedious and, if the event being searched for is rare, perhaps prohibitively difficult method. But the 7D02's generalized architecture makes solving such problems easy, in this case by means of the program in Fig. 4.

The 7D02's programming language, which is similar to a block-structured language, uses four TESTS, each containing one or more IF/THEN DO clauses. The IF portion of the clause specifies an event; the THEN DO portion specifies what command to execute when that event occurs. Any event can be linked to any command. When there are several IF/THEN DO clauses in a TEST, all operate simultaneously. Only one TEST is active at a time, and only the IF/THEN DO clauses within the currently active TEST are operative. A GO TO command enables transition between tests. For example, in Fig. 4, TEST 1 is the first step in the trigger sequence. The 7D02 searches constantly for two events (in this case, word recognizers). If it finds one, it executes the associated command. Thus, if TEMP is written to, the 7D02 will trigger; if the beginning of TEMPSETTER is found, the 7D02 will go to TEST 2.

In TEST 2, there is no trigger command, so nothing will happen if TEMP is written to. The 7D02 has not been programmed to pay attention to that event in this test. TEST 2 will end only when it finds the end of the subroutine TEMPSETTER, at which point it returns to

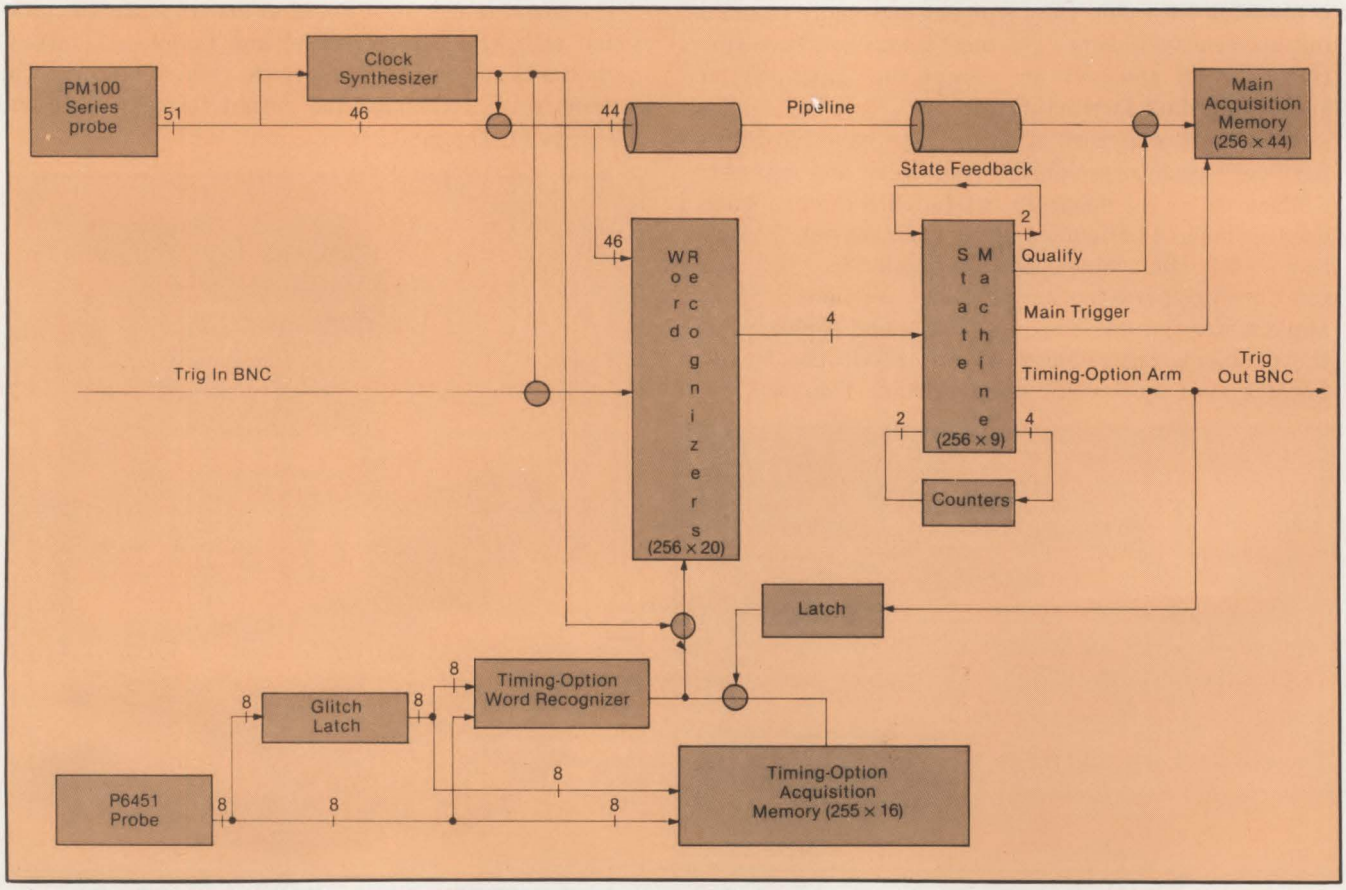


Fig. 3. Block diagram *of the 7D02's data-acquisition section. Both the state machine and the word recognizers are RAM-based, requiring two stages of pipeline so that the data reaches the main acquisition memory at the same time as the qualify line and the main trigger.*

Good BASIC systems are rarely found without CBASIC.™

"... BASIC is the most widely used microcomputer language, and CBASIC is the most widely used BASIC dialect." ... *Adam Osborne — "From the Fountainhead"*

"CBASIC is easy to use and has excellent file-handling and string capabilities." ... *Dr. Allen Louderback — "Infoviews"*

"CBASIC has everything we need to write our Selector™ programs ... dynamic allocation of arrays ... superb string handling capabilities ... elegant disk I/O ... allows large file buffers to reduce disk access/ increase disk I/O speed ... outstanding for comprehensive business applications." ... *Bob Goodman — Micro-Ap Inc.*

Proven Dependability

CBASIC has been available and in use for over three years, proven as a CP/M® business language. CBASIC business oriented features include: random and sequential records may be any length (not limited to 256 bytes); fourteen-digit precision binary coded decimal arithmetic; full format control of printed reports. It also provides aids to structured design such as multiple line functions and control structures.

Full MP/M™ Support

MP/M and CP/M2 were supported first by CBASIC and have extensive field testing. CBASIC uses MP/M's queues to prevent interleaved printing — providing effective support to multiple users. It supports full eight megabyte files and operates effectively in 48K memory.

Development and OEM Customer Support

Compiler Systems is committed to support CBASIC as your cutomer's needs grow. Ongoing efforts insure support for 16 bit micro and minicomputers. Call our hotline (213) 355-1063 to discuss technical questions.

CBASIC is a trademark of Compiler Systems, Inc.
MP/M is a trademark of Digital Research
CP/M is a registered trademark of Digital Research
Selector is a trademark of Micro-Ap Inc.

OEMs contact us for pricing

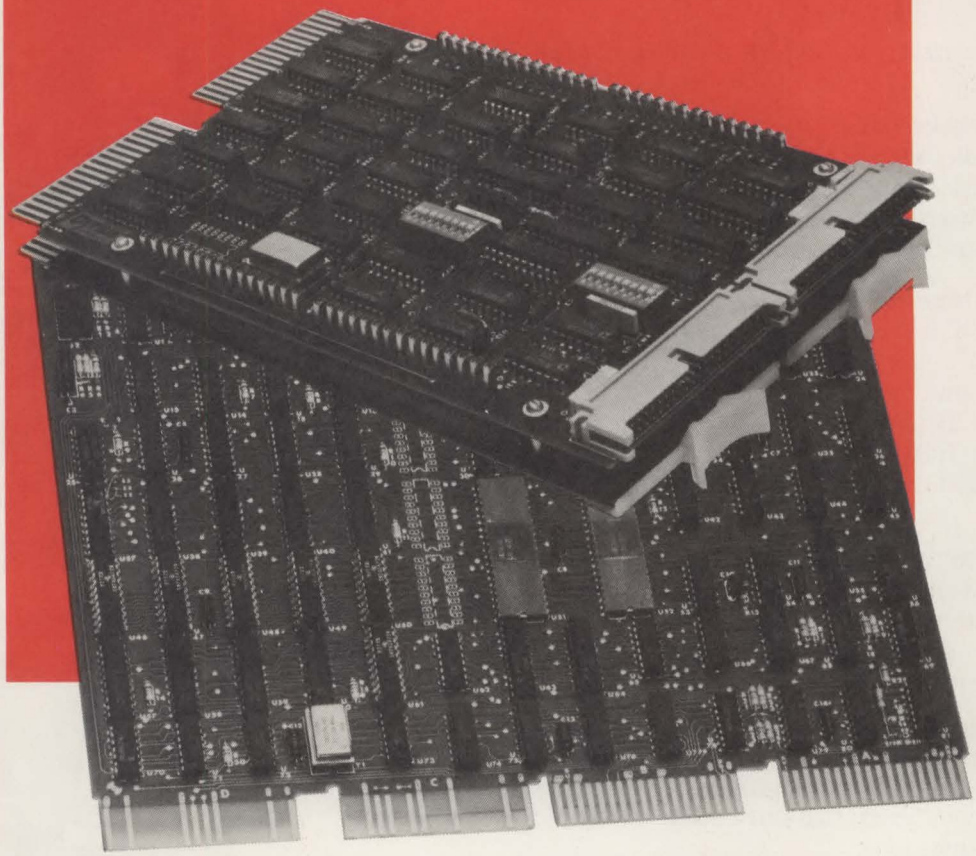
CBASIC

WORLDWIDE DISTRIBUTION

Compiler Systems, Inc. P.O. Box 145, Sierra Madre, CA 91024, (213) 355-4211

CIRCLE NO. 70 ON INQUIRY CARD

DEC®-COMPATIBLE PERIPHERAL CONTROLLERS



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

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

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

Look at the chart of our current family of peripheral controllers, growing every day. If you don't see the controller you need, we're probably working on it right now. Call us and discuss your requirements.

DEC, LSI-11 and PDP are registered trademarks of Digital Equipment Corporation.

DATARAM CORPORATION

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

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

CIRCLE NO. 71 ON INQUIRY CARD

The Prime system builder's kit. Just add your software and sell.

Our small, 32 bit, 50 Series computers come packed with everything you need, including the same in-depth support and system installation that we provide with our most powerful systems. All you have to do is add your own application software.

We offer the Prime 150 and 450 in minimum quantities of five, with an unusually aggressive discount schedule. Our delivery time is one of the fastest in the industry.

And as part of the package, you get our large-system performance: up to 32 million bytes of virtual memory for each of up to 32 simultaneous users; our PRIMOS operating system that supports extensive communications and networking; and a wide range of industry-standard languages like COBOL, Pascal, PL/1 and FORTRAN.

So when you need a powerful 32 bit system, get in touch with the company that gives you a lot more than just hardware. Write Prime Computer, Prime Park MS 15-60, Natick, MA 01760. In Europe: Prime Europe, 6 Lampton Road, Hounslow, Middlesex TW3 1JL, England. Tel. 01-570-8555.

PRIME Computer

CIRCLE NO. 72 ON INQUIRY CARD

The program to reduce software costs. Microprocessor Pascal System. New. From Texas Instruments.

Learnability. Transportability. Maintainability.

The features of Pascal, plus the benefits of TI's learning curve experience, are offered in the new Microprocessor Pascal system.

A system designed for microprocessor applications.

A system developed for the 16-bit 9900 Family, including the TM990 microcomputer modules, and 990 minicomputers.

A system to effectively lower your software costs today. And keep them low tomorrow.

At TI, Pascal is the first and only corporate-wide approved high-level programming language. For a lot of good reasons.

Pascal lets you solve your application without getting involved in the intricacies of machine architecture. And, Pascal's block structure results in fewer programming errors, because the code is easier to write, read and modify.

TI's Microprocessor Pascal system consists of six parts and provides the most Pascal capability ever offered:

- Source Editor — specifically designed to create/edit Pascal programs and check program syntax.
- Compiler—compiles conventional Pascal programs as well as TI's Pascal concurrent extensions into interpretive code, which can then be executed directly, or converted into 9900 native machine code.
- Host Debugger — over fifteen options for tracing variables and modifying data.
- Configurator—enables the target system to retain only the parts of the runtime support necessary for program execution.
- Native-Code Generator — converts Pascal interpretive code into 9900 native machine code.
- Run-Time Support—both interpretive and native-code execution provide a speed/memory trade-off.

TI's continuing commitment to innovative, cost-effective 16-bit microprocessor software means an increased applications capability and decreased development time for you.

Find out how you can reduce your present and future software costs. Put the new TI Microprocessor Pascal system to work for you, today.

For more information, call your nearest Texas Instruments field sales office or authorized distributor, or write to Texas Instruments, P.O. Box 1443, M/S 6404, Houston, Texas 77001.

85582CI

TEXAS INSTRUMENTS
INCORPORATED

© 1981 Texas Instruments Incorporated

CIRCLE NO. 73 ON INQUIRY CARD

Users can set up programs that trigger if processing takes too long.

TEST 1. With this program, the 7D02 will trigger only when TEMP is written to and TEMPSETTER is not running.

Though this problem is beyond the abilities of most logic analyzers, it requires less than half of the resources of the 7D02. It uses three of the four word recognizers and two of the four TESTs, and it does not require the storage-qualification capability, the timing option or the counters.

Using the counters

The two counters in the 7D02 are general-purpose and can be used either to count discrete occurrences or as timers. This enables the inclusion of fixed time periods as part of a trigger, which is very useful under some circumstances.

For example, suppose a user is designing a device that receives from an RS232 port characters that it processes and sends somewhere else (such as a terminal). The user's manager has asked how fast the device will go. The user thinks it might be able to run at 19.2K baud, which means that it would accept asynchronous transmission of ASCII characters with one start and one stop bit at a rate of one every 520 μsec.

The user can set up a program that triggers if processing takes longer than 520 μsec. (Fig. 5). A long stream of test data (several hours) can be sent to the device, and if any character takes too much time, the 7D02 will trigger. In this example, Word Recognizer 1 is used to detect receipt of the character, and Word Recognizer 2 is used to detect the end of processing for that character. TEST 1 waits for the character to be received. When the character is detected, the 7D02 starts the timer and goes to TEST 2 (the bracket around the two commands indicates that they are to execute simultaneously when the event is found). In TEST 2, there is a race. If the end of processing (Word Recognizer 2) occurs first, the 7D02 returns to TEST 1 to

```
   TEST 1
1  IF
1    WORD RECOGNIZER #1
1    DATA = XX
1    ADDRESS = 051B
1    IO/M = X  INRQ = X  FETCH = X  R/W = 0
1    INACK = X  HOLD = X  EXT TRIG  IN = X
1    TIMING WR = X
1  THEN DO
1    TRIGGER 0-MAIN
1       0-BEFORE DATA
1       0-SYSTEM UNDER TEST CONT.
1       0-STANDARD CLOCK QUAL.
1  OR IF
1    WORD RECOGNIZER #2
1    DATA = XX
1    ADDRESS = 9721
1    IO/M = X  INRQ = X  FETCH = 1  R/W = X
1    INACK = X  HOLD = X  EXT TRIG  IN = X
1    TIMING WR = X
1  THEN DO
1    GOTO 2
   END TEST 1

   TEST 2
2  IF
2    WORD RECOGNIZER #3
2    DATA = C9
2    ADDRESS = XXXX
2    IO/M = X  INRQ = X  FETCH = 1  R/W = X
2    INACK = X  HOLD = X  EXT TRIG  IN = X
2    TIMING WR = X
2  THEN DO
2    GOTO 1
   END TEST 2
```

Fig. 4. This program *will cause the 7D02 to trigger only if the location TEMP (address 051B) is written to when the subroutine TEMPSETTER is not running. Word Recognizer 1 is true when TEMP is written to. Word Recognizer 2 is true on TEMPSETTER's first instruction (address 9721). Word Recognizer 3 is true when a RET instruction is executed, indicating the end of TEMPSETTER.*

```
   TEST 1
1  IF
1    WORD RECOGNIZER #1
1    DATA = XX
1    ADDRESS = XXXX
1    IO/M = X  INRQ = 1  FETCH = X  R/W = X
1    INACK = X  HOLD = X  EXT TRIG  IN = X
1    TIMING WR = X
1  THEN DO
1
1    COUNTER # 1 1-μS
        2-RESET AND RUN
1    GOTO 2
1
   END TEST 1
   TEST 2
2  IF
2    WORD RECOGNIZER #2
2    DATA = XX
2    ADDRESS = C15B
2    IO/M = X  INRQ = X  FETCH = 1  R/W = X
2    INACK = X  HOLD = X  EXT TRIG  IN = X
2    TIMING WR = X
2  THEN DO
2    GOTO 1


2  OR IF
2    COUNTER # 1 = 00520 1-μS
2  THEN DO
2    TRIGGER 0-MAIN
2       2-AFTER DATA
2       0-SYSTEM UNDER TEST CONT.
2       0-STANDARD CLOCK QUAL.
   END TEST 2
```

Fig. 5. This 7D02 program *will trigger when the processing of a received character takes longer than 520 μsec. Word Recognizer 1 is true when the character is received (indicated by an interrupt). Word Recognizer 2 is true when the interrupt routine's last instruction (address C15B) is executed. That indicates that the processing has been completed.*

Only when processing of a character takes too long will the 7D02 trigger.

wait for the next character; if the timer runs out, the 7D02 triggers and the 7D02's acquisition memory will show what the device was doing. The 7D02 can loop from TEST 1 to TEST 2 and back millions of times without triggering. Only when processing of a character takes too long will triggering occur.

The timing option

The 7D02's triggering ability makes it especially suitable for integrating hardware and software, but the 7D02 can also be used for hardware development. When bringing up hardware that uses a microprocessor, it is often necessary to examine the behavior of random logic. The 7D02's timing option adds this capability. It is 8 bits wide, can capture data at 50 MHz and has first- and second-order glitch latching down to 5 nsec. and a separate glitch memory.

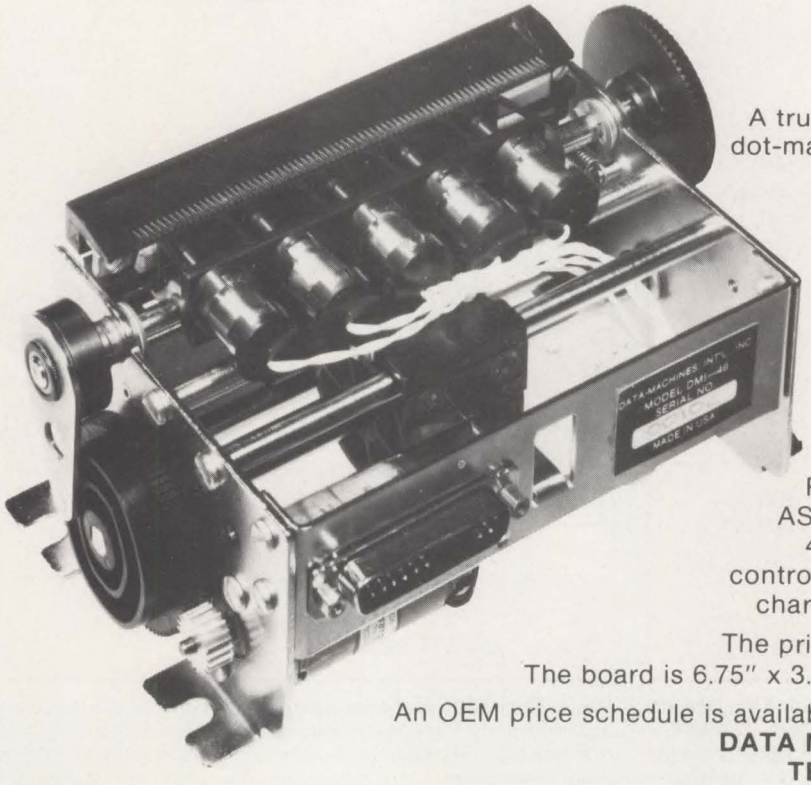
The main section of the 7D02 can arm or trigger the timing option and vice versa, making the 7D02 well-suited to debugging the interaction between a microprocessor and its peripheral hardware. For example, it is possible to set up the 7D02 so that the timing option triggers when the microprocessor manipulates an I/O port in a certain way. If the timing-option probe is hooked to a peripheral chip, the I/O transaction can be monitored. Likewise, if there is an error condition on a peripheral chip, that error can be used to trigger the main section of the 7D02 to discover what the microprocessor was doing when the error occurred. These abilities are especially important when working with an asynchronous bus architecture (such as that of the 68000).

The 7D02's timing option can be used either synchronously or asynchronously. The 7D02's main section is synchronous only and can sample at rates as high as 10 MHz, easily exceeding the speed of even the fastest microprocessor available. This, and the design of the PM100-series personality modules, will enable the 7D02 to support future generations of microprocessors without difficulty.

Each plug-in personality module has all of the hardware and software necessary to support a particular microprocessor. This includes software to do disassembly in the target microprocessor's assembly language. The PM100-series personality modules support most popular 8- and 16-bit microprocessors. ■

Steven Den Beste has been a software engineer in Tektronix logic-analyzer engineering for the last 2½ years, specializing in user interfaces and microprocessor applications.

40 Column, 12VDC, Line Printer Mechanism



A truly simple and rugged alpha-numeric dot-matrix, impact line printer mechanism.

Designed for mobile, portable and severe industrial environments. The mechanism is rated from -20° C to +60° C using pressure sensitive paper. Has optional cassette ribbon. Speeds to 120 LPM. Has multicopy and limited graphics capability.

The DMI-40E controller board accomodates ASCII serial data at RS-232 from 110 to 9600 baud. Also, ASCII parallel at TTL. The board has a 40 character buffer and motor speed control. Print is a 5x7 matrix. Density is 10 characters per inch and 6 lines per inch.

The printer measures 6.89" x 3.58" x 3.16". The board is 6.75" x 3.5" with holes to match printer base.

An OEM price schedule is available. For more details write or phone:

DATA MACHINES INTERNATIONAL, INC.
TERRACE HILL ITHACA, N.Y. 14850
607-273-1515

CIRCLE NO. 74 ON INQUIRY CARD

More Valuable than Oil...?

According to a leading financial journal, two major areas holding back the economic recovery of the United States are: the high cost of oil; and good software. There's not too much POINT 4 can do about the first, but when it comes to good software ... that's another story.

For example, our IRIS Operating System, with over 7000 successful installations, has become the world's leading independently-supplied Interactive Multi-User Operating System for POINT 4 and NOVA*-type minicomputers. IRIS supports multiple languages, including Business BASIC. It is a multi-tasking system that supports time sharing and batch processing tasks.

POINT 4 Data specializes in providing System Builders with fully integrated application software packages which can be easily adapted to customer requirements. MACS, our interactive, fully integrated Management, Accounting, and Control System is written in Business BASIC and designed to operate under IRIS.

For Word Processing applications, POINT 4 Data offers STYLUS, an easy, cost-efficient way to add multi-user, multi-terminals, shared-logic word processing to POINT 4 or NOVA-type computers using IRIS.

The READINET Project Control System was designed for utilization in complex projects typical of the Construction, Aerospace, Government, and R&D industries. It combines interactive computing techniques with PERT/CPM time, cost, and resource allocation analysis. READINET allows the project manager to plan the project, optimize the critical parameters within a set of constraints, and then monitor performance until the project is successfully completed.

But perhaps most valuable of all ... POINT 4 Data offers FORCE, an applications program generator that allows the system designer to specify screen layouts, file formats, data elements, etc. Fully coded, commented and documented programs are then automatically generated by the computer itself ... sometimes in 1/100th the time needed for manual programming.

Good software **can** be more valuable than oil...at POINT 4 Data, we're doing our part to help the economy, you can do yours by calling (714) 754-4114, or write:

POINT 4
DATA CORPORATION

2569 McCabe Way
Irvine, Calif. 92714

The Partnership Company

CIRCLE NO. 75 ON INQUIRY CARD

TOOL Builders for the Minicomputer Systems Industry.

*NOVA is a trademark of Data General Corporation

Who's ready for 10,000 U.S. communities?

Delta Air Freight ships door-to-door between 80 cities covering 10,000 U.S. communities.

See that Delta map below? You can ship just about anything, big or small, between any Delta cities shown. That covers over 10,000 communities in the U.S. You can ship door to door. Or airport to airport. And because Delta has 1500 take-offs daily, Delta can frequently give your shipment same-day delivery.

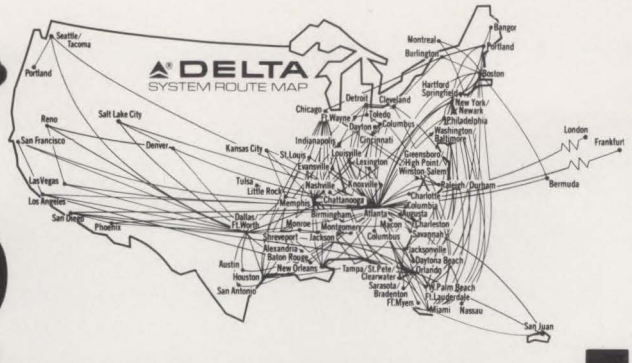
Delta can ship anywhere in the U.S. or the world, via interline connections. In many instances, Delta Air Freight rates are lower than other freight services. And Delta will quote you special low rates tailor-made for your shipments. For full details, call the Delta air cargo representative nearest you.

Other Delta Air Cargo services:

Delta Air Parcel Service. Up to 25 lbs. $15 door-to-door. 10 packages minimum.

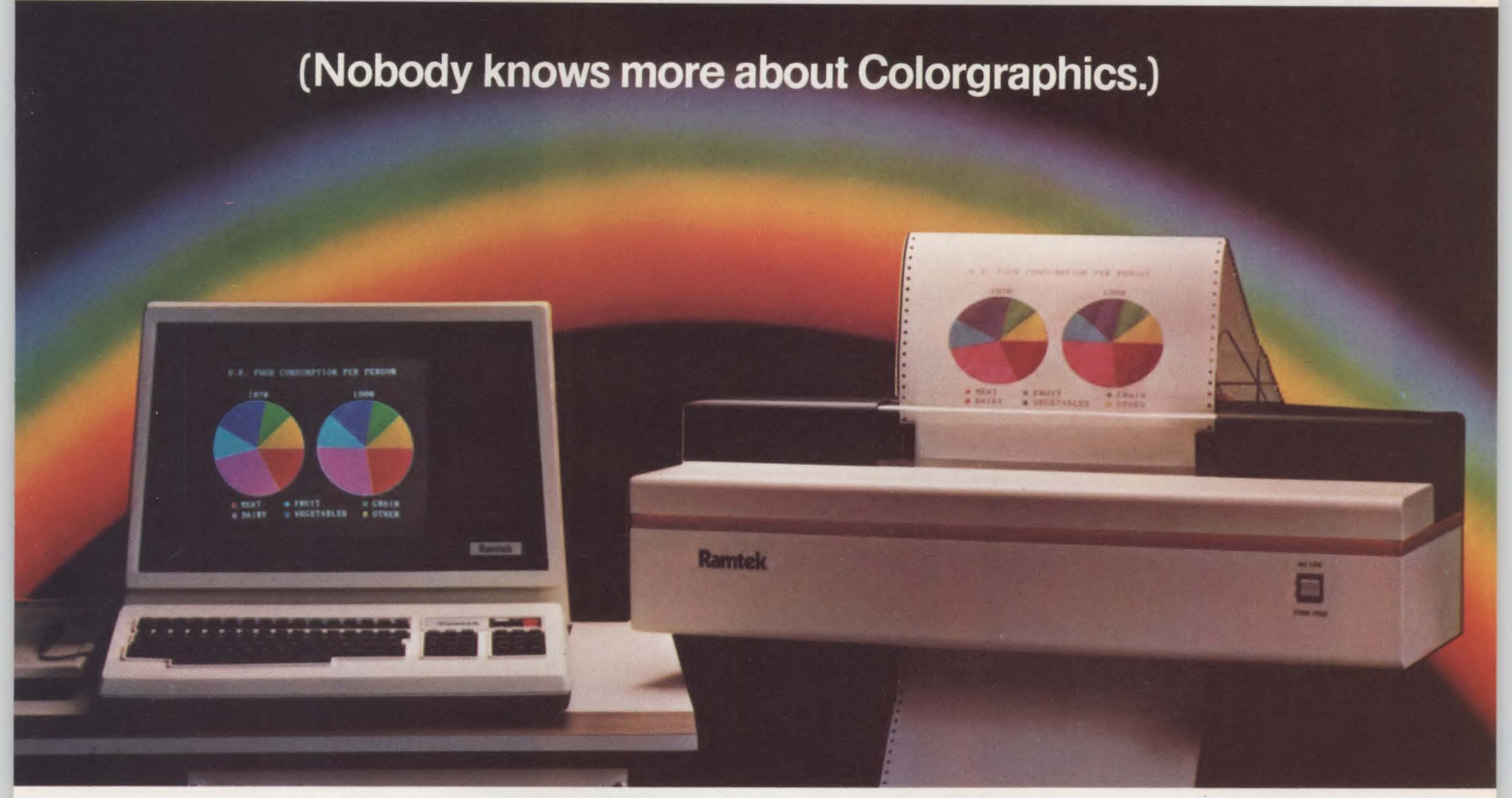
Delta 3-D™ Air Freight. 40% off regular freight rates on high density shipments.

Delta Air Cargo Ready all-around



Ask Ramtek.

(Nobody knows more about Colorgraphics.)



Now, Ramtek offers the first integrated system for MIS graphics users.

Ramtek's new 6214 color graphic computer frees you from buying each of your display elements from a different supplier. Ramtek has put it all together in a true stand-alone color graphics system complete with processor, monitor, console, mass memory storage and UCSD Pascal.™ And full Ramtek support with field service, training and documentation.

You'll get a sharp, bright picture.

The 6214 gives you high resolution—640 x 512 refresh memory for smooth, curved plots. Choose 16 colors from a palette of 64, with no annoying image flicker.

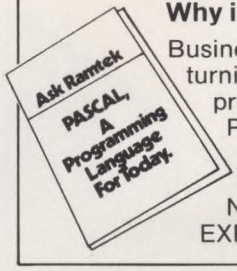
Interactive UCSD Pascal makes programming easy.

Complex programming is simplified with Pascal. Adding Ramtek's GRAFPRO (graphic procedures) software package provides the basic drawing functions, programmable patterns and text fonts you need. To dramatically speed applications software development.

Now, low-cost plain paper and photographic hardcopies.

The new Ramtek 4100 printer/plotter cuts the cost of hard copy. Ramtek's unique four-head design prints full color graphics on plain paper in a single pass. No toners or chemicals are required, and to change ribbons you simply drop in a new cartridge. Add a color camera for transparencies, 35mm slides. and 16mm film.

For MIS, computer-aided design or any application that requires high resolution, high-performance color graphics, look into Ramtek's 6214 colorgraphic computer. To get more information, write: Ramtek, 2211 Lawson Lane, Santa Clara, CA 95050.



Why is Pascal better for business?

Business, industry and education are turning to Pascal for their interactive programming needs. To find out what Pascal offers and how it can benefit you, request "Pascal, A Programming Language For Today." It's Issue Number 1 of Ramtek's "USE OUR EXPERIENCE" series.

Ramtek

Our Experience Shows.

REGIONAL OFFICES: Santa Clara, CA (408) 988-2211, Newport Beach, CA (714) 979-5351, Seattle, WA (206) 838-5196, Albuquerque, NM (505) 884-3557, Dallas, TX (214) 422-2200, Maitland, FL (305) 645-0780, Huntsville, AL (205) 837-7000, Chicago, IL (312) 397-2279, Cleveland, OH (216) 464-4053, Washington, DC (301) 656-0350, Metropolitan NY (201) 238-2090, Boston, MA (617) 273-4590, Netherlands 31 2968 5056.

CIRCLE NO. 76 ON INQUIRY CARD

First compare quality. Then compare cost.

Morrow Designs' 10 megabyte hard disk system: $3,695.

MORE MEMORY. LESS MONEY.

Compare Morrow Designs' DISCUS™ M26™ hard disk systems to any system available for S-100 or Cromemco machines. First, compare features. Then, compare cost per megabyte. The M26 works out to under $200 a megabyte. And the M10 is about half the cost of competing systems.

COMPLETE SUBSYSTEMS.

Both the M10 (8"), and the M26 (14"), are delivered complete with disk controller, cables, fan, power supply, cabinet and CP/M® operating system. It's your choice: 10 Mb 8" at $3,695 or 26 Mb 14" at $4,995. That's single unit. Quantity prices are available.

BUILD TO FOUR DRIVES.

104 Megabytes with the M26. 40+ megabytes with the M10. Formatted. Additional drives: M26: $4,495. M10: $3,195. Quantity discounts available.

S-100, CROMEMCO AND NORTH STAR.*

The M26 and M10 are sealed-media hard disk drives. Both S-100 controllers incorporate intelligence to supervise all data transfers through four I/O ports (command, 2 status and data). Transfers between drives and controllers are transparent to the CPU. The controller can also generate interrupts at the completion of each command ...materially increasing system throughput. Sectors are individually write-protectable for multi-use environments. North Star or Cromemco? Call Micro Mike's, Amarillo, TX, (806) 372-3633 for the software package that allows the M26 and M10 to run on North Star DOS. MICAH of Sausalito, CA, (415) 332-4443, offers a CP/M expanded to full Cromemco CDOS compatibility.

Morrow Designs' 26 megabyte hard disk system: $4,995.

AND NOW, MULT-I/O.™

Mult-I/O is an I/O controller that allows multi-terminal and multi-purpose use of S-100 and Cromemco computers. Three serial and two parallel output ports. Real time clock. Fully programmable interrupt controller. Designed with daisy-wheel printers in mind. Price: $299 (kit), $349 assembled and tested.

MAKE HARD COMPARISONS.

You'll find that Morrow Designs' hard disk systems offer the best price/performance ratios available for S-100, Cromemco and North Star computers. See the M26 and M10 hard disk subsystems at your computer dealer. Or, write Morrow Designs. Need information fast? Call us at (415) 524-2101.

Look to Morrow for answers.

MORROW DESIGNS

5221 Central Avenue
Richmond, CA 94804

*CP/M is a trademark of Digital Research Corp.
*Cromemco is a trademark of Cromemco, Inc.
*North Star is a trademark of North Star Computers, Inc.

CIRCLE NO. 77 ON INQUIRY CARD

Malibu printer can handle both data, word processing

Malibu Electronics Corp.'s model 200 Dual-Mode matrix printer is designed to meet OEM requirements for a single printer that will serve in both data-processing and word-processing applications, Malibu developed an enhanced letter-quality print mode and associated word-processing-compatible firmware.

The printer's character fonts each feature both a high-speed data-processing version. Output speeds range from 165 cps to 250 cps in the data-processing mode and 42 to 60 cps in the letter-quality mode, depending on the font selected. Two character sets are standard on the Dual-Mode 200—one each for data and word processing, both 10-pitch Titan fonts. Numerous alternate character fonts are also available, including sans serif 10-pitch, 12- and 15-character-per-in., proportionally spaced, italics, OCR-A, graphics, scientific and foreign character sets.

The printer can store as many as six different character fonts in ROM with a data- and word-processing version of each for a total of 12 speed/font options. Users can design custom character sets and download them to the printer. Complete "dot control" graphics is provided with resolution as high as 120 horizontal × 144 vertical dots per in.

The Dual-Mode 200's universal forms handling permits the use of single-sheet and pin-feed paper. Multiple part forms (to six parts) are also accommodated. Single-sheet insertion is simplified through the use of a form-feed switch; pressing the switch causes a sheet to automatically feed up to a ready position.

Malibu Electronics' Dual-Mode 200 *is a matrix printer designed to handle both data- and word-processing applications.*

The touch-sensitive front panel gives a user control over font selection with LED font-number display, letter-mode selection and paper-control functions. The LED display also identifies fault conditions.

The Dual-Mode 200 is compatible with several systems. The printer driver supports existing word-processing software with standard daisy-wheel control sequences. An EIA RS232C and a parallel interface are provided.

The Dual-Mode 200, which can be color-keyed to match any system, is housed in a case designed for an office environment.

Volume deliveries will begin in March. Price is $2995 in single-unit quantities, with OEM discounts available. **Malibu Electronics Corp.**, Westlake Village, Calif.

Circle No 160

ATC board gives TI-810 printer a graphics option

Adding graphics and custom character capability to the Texas Instruments 810 RO line printer can be as easy as plugging a board into one of the 810's option card slots.

The ATC TI-810 printer plotter OMNI-graphics board from Analog Technology Corp. contains its own RAM buffer and a ROM that supplants the print head operation instructions normally provided by the 810 ROM. The board occupies the printer's line buffer option slot and requires no electrical or mechanical modifications to the printer. ATC spokesmen say Texas Instruments has indicated that it will honor service warranties on all 810

Which Alphanumeric Printout do YOU prefer?

DIGITEC'S
6410 & 6420
ELECTROSENSITIVE
ALPHANUMERIC PRINTERS
* 64 CHARACTERS

0123456789 ABCDEFGH
IJKLMNOPQRSTUVWXYZ@
<>?=;:/-.,+*)(&%$#"
!'~[]{}

* 21 CHARACTERS/LINE
32 OPTIONAL

* SERIAL/PARALLEL
INPUT

DIGITEC'S
6450 & 6460
THERMAL ALPHANUMERIC
PRINTERS
* 64 CHARACTERS

0123456789 ABCDEFGH
IJKLMNOPQRSTUVWXYZ@
<>?=;:/-.,+*)(&%$#"
!'~[]{}

* 21 CHARACTERS/LINE

* SERIAL/PARALLEL
INPUT

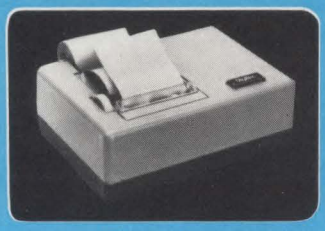
DigiTec's popular 6400 Series Printers now offer you a choice!

DigiTec has added two new thermal models to the tried and proven 6400 Series Alphanumeric Printers. You can now choose thermal or electrosensitive printing and get all the DigiTec benefits with either. Fewer moving parts than impact printers guarantee increased reliability. Plus, non-impact means no hammers to clatter or wear out and no messy ribbons to change. A built-in microprocessor provides the simplest possible interfacing.

Input configurations satisfy all the popular data communication interfaces. The serial models are programmable for either RS-232-C or 20 mA current loop at either 110 or 300 baud while parallel input models accept data at rates up to 1000 characters per second (higher rates optional).

These features combined with compact size, quiet operation and designer-styled good-looks produce dependable printers that are perfect for your application.

Choose either thermal or electrosensitive . . . if it's DigiTec, you've made the right choice.



Dimensions:
7½" W x 5⅜" D x 2⅞" H
Weight: 3½ Lb.

UNDER $300.
in OEM Quantities

DigiTec® UNITED SYSTEMS CORPORATION

918 Woodley Road, Dayton, Ohio 45403
(513) 254-6251, TWX (810) 459-1728

CIRCLE #37 FOR INFORMATION ONLY
CIRCLE #47 FOR DEMONSTRATION ONLY

New Products

printers using OMNI-graphics boards.

The user can choose between two plot modes for hard-copy reproduction of raster-scan data or any information mapped in dot-matrix memory. Plotting resolution is 72 × 120 dots per in. or an optional 72 × 72 dpi. A special escape command allows automatic expansion of all ASCII or plot data. The user also can define and program a 75-character software font based on a 7 × 12 matrix that can be recalled for printing by use of ASCII code. This feature allows printing of special characters, foreign languages, true descenders, underlining, etc.

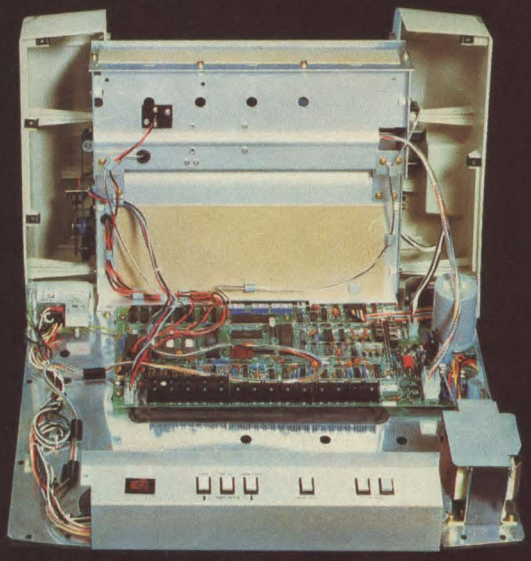
The plotting modes allow data input in two formats, a 7-bit vertical format (the plane of the print wires) or an 8-bit horizontal format. After transmission of the proper line-width identifier, 7-bit vertical bytes or 8-bit horizontal bytes can be serially shifted to RAM on the ATC board. When in the vertical mode, the 810 processor detects overflow, initiates the print cycle and routes subsequent 7-bit bytes to storage in preparation for the next print cycle. In the horizontal mode, the 810 processor detects overflow at each line end and automatically routes the 8-bit byte words to storage until all seven lines are filled, and then initiates the print cycle while subsequent lines are being stored.

To compensate for resolution differences between the host data system and the 810 printer, an expansion factor may be transmitted that will provide automatic printing repetition of the data bits shifted to the printer.

Standard 810 ASCII performance and 150-cps speed are retained with use of the OMNI-graphics board. Data is received on the standard RS232 or TI parallel interface at rates as high as 9600 baud.

Single-unit price of the ATC TI-810 OMNI-graphics board is $975. **Analog Technology Corp.**, Irwindale, Calif. **Circle No 161**

Say Ahh...



Our New grafixPLUS™ 80-column printer opens wide for easy servicing.

Introducing the newest members of our grafixPLUS™ family—the DP-9000 Series 80/132 column printers—built on the same tradition of quality printout, solid design and low cost of ownership established by our 132/220 column DP-9500 Series.

A Case for Serviceability

Not that is comes up often, but want to get inside? Simple. Just remove a few screws and the clam-shell case swings open exposing all major components. This easy access plus built-in self-test and minimum component count yields an MTTR of one-half hour. The 9-wire print head replacement's even simpler . . . two screws and it's out. Without opening the case. And without a service call.

Performance Plus

The DP-9000 Series prints the full ASCII 96 character set, including descenders and underlining, bi-directionally, at up to 200 CPS. Number of columns can go up to 80 or 132, depending on character density—switch or data source selectable from 10 to 16.7 characters per inch. And all characters can be printed double width. The print head produces razor-sharp characters and high-density graphics with dot resolutions of 72X75 dots/inch under direct data source control.

Interface Flexibility

The three ASCII compatible interfaces (parallel, RS-232-C and current loop) are standard, so connecting your computer is usually a matter of plug-it-in and print. Also standard are: a sophisticated communications interface for printer control and full point-to-point communications, DEC PROTOCOL, and a 700 character FIFO buffer. An additional 2K buffer is optional.

When you're ready for a printer (or several thousand), look into the grafixPLUS DP-9000 Series from Anadex—you'll find an open and shut case for quality. Contact us today for details, discounts and demonstrations.

Anadex®
...the plus in printers

CIRCLE NO. 79 ON INQUIRY CARD

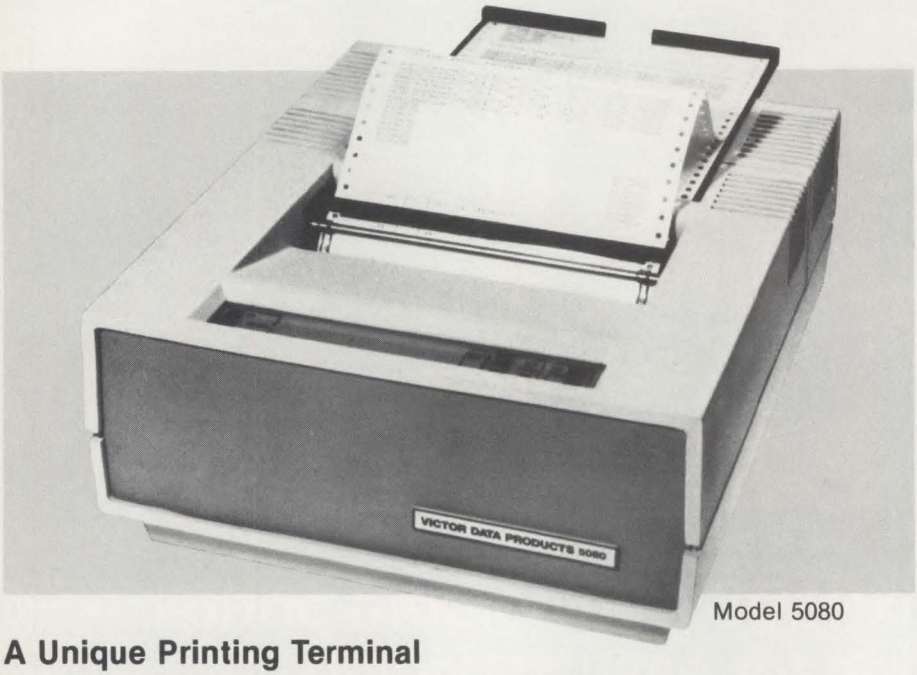
...close please.

SALES OFFICES: San Jose, CA (408) 247-3933
Fullerton, CA (714) 871-0501 • Wakefield, MA (617) 245-9160 • Austin, TX (512) 327-5250

ANADEX, INC. • 9825 DeSoto Avenue • Chatsworth, California 91311, U.S.A. • Telephone: (213) 998-8010 • TWX 910-494-2761

ANADEX, LTD. • Dorna House, Guildford Road • West End, Woking, Surrey GU24 9PW, England • Tel: Chobham (09905) 6333 • Telex: 858762 ANADEX G

VICTOR... Number 1 in Impact Matrix Printing!



Model 5080

A Unique Printing Terminal

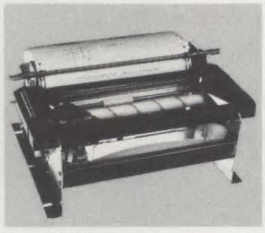
- 80 column, bi-directional printing
- Upper & lower case font
- Full graphics — 480 columns per line
- Top of form & horizontal tabs
- True 100 cps throughput
- Bi-directional friction and sprocket paper feed
- Large 360 character buffer
- Four interfaces — standard parallel & RS232 & TTY & ⟨IEEE-488⟩
- Baud rate switch selectable
- Self-test
- UL/CSA approved
- Intelligent shortest path head return

The Model 5080, shown above, is a heavy-duty printing terminal offered for sale at most competitive prices. Only $995 in single quantity! This printer has been designed to conform to the most stringent computer specifications, including software on/off control, status feedback signals and a busy signal should you fill our extra large buffer. Don't delay, order now to insure early delivery!

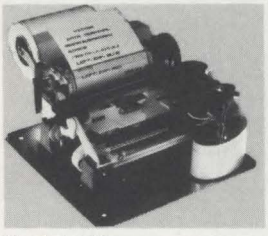
Victor has delivered more than 700,000 industrial, quality matrix printers. These are terminals, mechanisms, and heads designed to solve your problems. Products that are backed by a strong application engineering staff, worldwide service and 50 years of Victor pride in product.

A Complete Line of Impact Matrix Printers

Model 5010



Model 80



Model 130

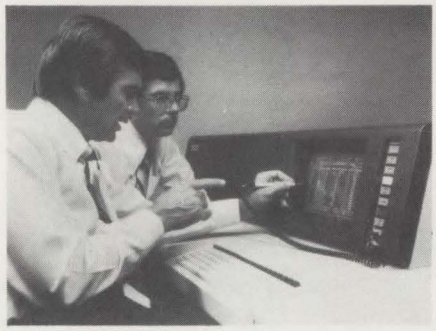
Model 129

VICTOR DATA PRODUCTS
Subsidiary of Walter Kidde & Company, Inc.
KIDDE
3900 North Rockwell Street, Chicago, Illinois 60618
Telephone: 312-539-8200

GREAT BRITAIN — DATAPLUS, 0242-30030 **GERMANY** — BDT, (07 41) 8041 **ITALY** — C.A.I., 23.63.851
SPAIN — CETA, 254 6607 **SWITZERLAND** — ERNI, 01 833 33 33 **CANADA** — MUNRO, (416)676-1042
FRANCE — METROLOGIE, (1) 791 44 44 **SOUTH AFRICA** — EAGLE, 45-1421
SINGAPORE — OG, 917788 or 918592 **HONG KONG** — GILMAN, 3-427144

CIRCLE NO. 80 ON INQUIRY CARD

New Systems



Litton introduces distributed control system

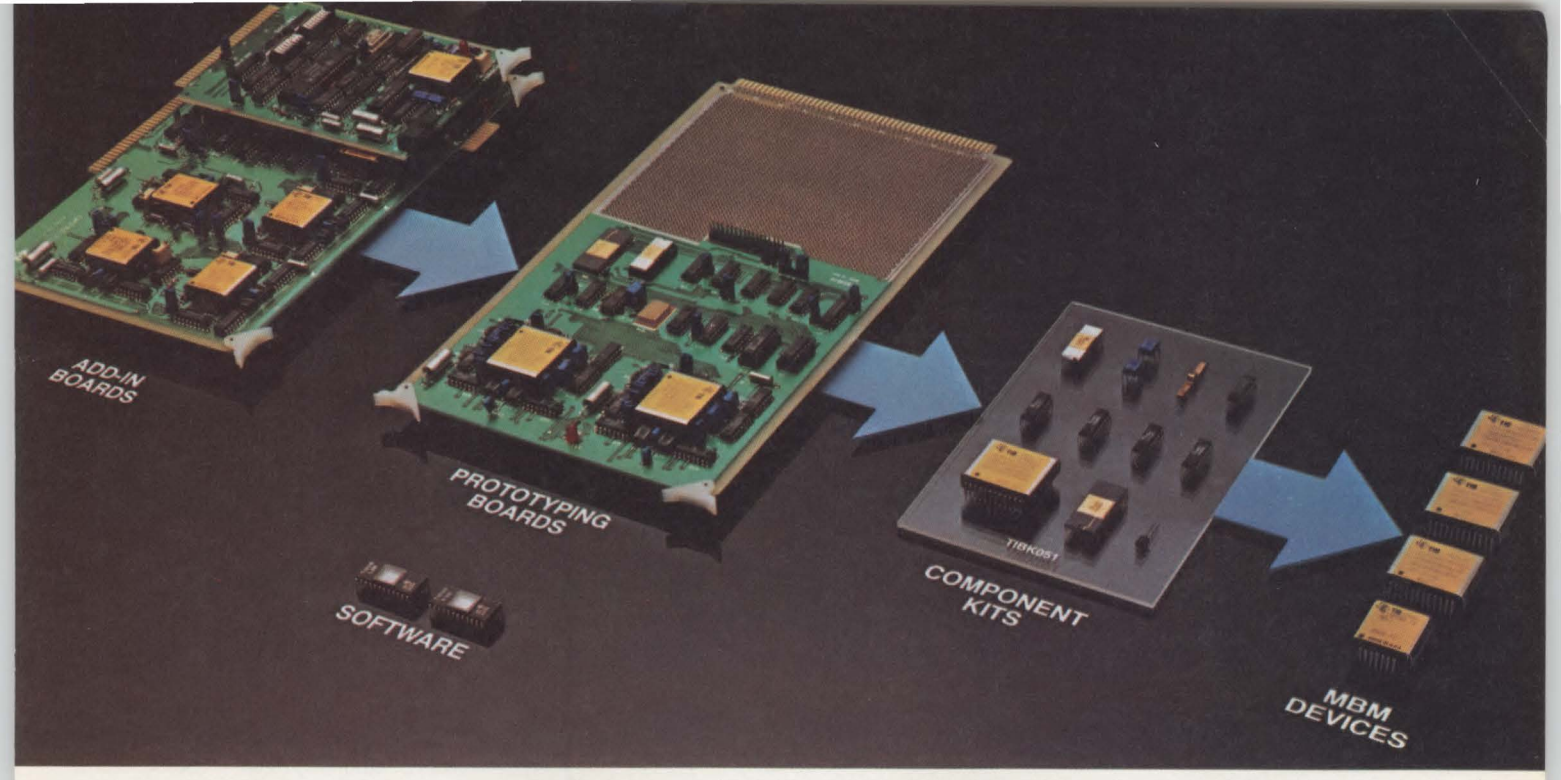
The DCS 5000 distributed control system is a μp-based energy- and facility-management system for industrial plants or commercial buildings. The system's central control console provides supervision and data management for intelligent remote controllers monitoring and controlling physical environments or plant processes. The system uses a light pen for operator commands through the CRT. **Litton Energy Control Systems,** Chatsworth, Calif. **Circle No 162**

Teradyne introduces board-test system

The L200 series systems perform in-circuit and functional testing of analog and digital LSI and VLSI PC boards. It includes a test station, which houses a command processor, channel cards and diagnostic tools; a computer group based on a PDP 11/44; an instrument group, which includes power supplies and test equipment; and system software modeled on Pascal. Prices for the L200 series start at $200,000. **Teradyne, Inc.,** Boston, Mass. **Circle No 163**

QW system handles WP and DM functions

The PDP-11 based QW series of word - processing / data - management systems allows simultaneous use by several users. A low-end QW620 system consists of a PDP-11/23 with 192K bytes of memory; a four-port multiplexer;



More ways to get into bubble memory. And get more out of it. From Texas Instruments.

TI's eight years of experience in bubble memory design and production have provided keen insights into customer design requirements.

So, it makes sense that only TI, the leader in bubble memory technology and products, can offer you more make-or-buy choices for more ways to get into the industry's fastest-growing technology.

It all comes down to a special sensitivity to our customer's needs — no matter what your application, level of sophistication or volume — if you want to get more out of bubble memory technology — talk to Texas Instruments.

Add-in systems

For direct plug-in to most popular microcomputer buses, including TI's TM990 bus. Fully tested, fully assembled systems with capacities ranging from 11K to 1024K bytes. All with associated support circuitry on board.

Prototyping boards

TI supplies the assembled bubble memory and support circuitry — you prototype the interface to your own system — then, when you're ready for volume production, you can build your own boards or have TI build to your specifications.

Kits and components

Design your own non-volatile memory system for your own production. *Less than $100** buys you a 92K bubble memory kit* in unit lots of 1,000, complete with all the support circuitry, including the custom controller. TI's 92K, 256K, 512 K and 1-million bit bubble memory components help optimize cost-effectiveness. Because you buy only as much memory as you need. Only when you need it.

Support, support, support

No matter which route you take. Everything from fully documented user's manuals to development software to a learning-intensive Advanced Technology Seminar at either of our Regional Technology Centers. And, for technical design help, there's our bubble memory applications lab.

Continuing commitment

To innovative, cost/performance effective bubble memory technology. For a full line of standard or custom products. And, for more choices.

For details, send for our newly updated brochure, CL-473A. Contact your nearest Texas Instruments field sales office or authorized distributor. Or write Texas Instruments, Box 225012, M/S 308, Dallas, Texas 75265.

MAGNETIC BUBBLE MEMORY DEVICES, KITS AND PROTOTYPING BOARDS

CAPACITY (KILOBITS)	DEVICE	KIT	PROTOTYPING BOARD
92	TIB0203	TIBK091	TBB5990
256	TIB0250	TIBK021	TBB5902
512	TIB0500	TIBK051	TBB5905
1024	TIB1000	TIBK101	TBB5910

ADD-IN SYSTEMS

BUS STRUCTURE	SYSTEM	CAPACITY (KILOBYTES)
TM990	TM990/210	23 to 69
TM990	TM990/211	128 to 1024
STD	TBB7090/91	11 to 104
OEM (9900,8080, Z80)	TBB5005	64
OEM (9900, 8080, Z80)	TBB5010	128
LSI-11†	MBC11*	46 to 736
MULTIBUS‡	MBB80*	92
S-100	MBB100*	46 to 736

SOFTWARE

TM990/431	Interactive monitor to test and demo TM990/210
TM990/453	Power Basic with file management for TM990/210

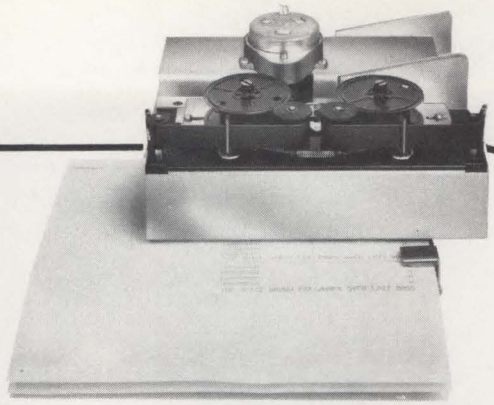
*Available from Bubbl-tec Div. of PCM, Inc., 6800 Sierra Court, Dublin, CA 94566 (415) 829-8705
†Trademark of Digital Equipment Corp.
‡Trademark of Intel Corp.

TEXAS INSTRUMENTS
INCORPORATED

** U.S. prices, subject to change without notice
© 1981 Texas Instruments Incorporated

83744A

CIRCLE NO. 81 ON INQUIRY CARD



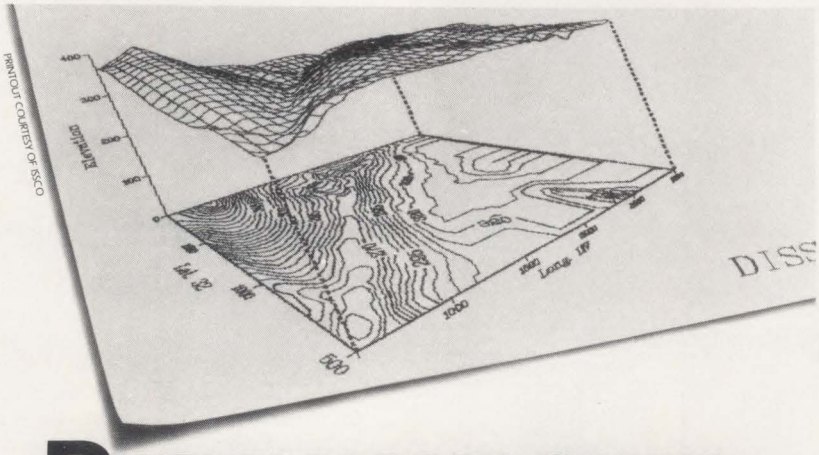
Open For Business

Bring on your forms, any forms. Whether you need to print on bank checks or multipart reports, standard pages or outsize sheets, our alphanumeric DMTP-8 impact form printer has a 50 character/line capacity, edge guide sensor and three open sides to take your work flow as it comes. Everything fits. And with the exceptionally long needle stroke, every message is crisp and clear — even on multiple copies from .003" to .015" thick.

Work it hard. Work it long, even at high-volume POS jobs. With its heavy-duty construction and extra-long life dot matrix print head, the DMTP-8 is made to take it. Other advantages: programmable character pitch, and the long-haul economy of replaceable ink rollers and a self-reversing ribbon with a 10-million character life. And, of course, the price: just $269 in 100's. Write or call now for details.

P A **PRACTICAL AUTOMATION, INC.**
Trap Falls Road, Shelton, Conn. 06484/Tel: (203) 929-5381

CIRCLE NO. 82 ON INQUIRY CARD



Draw your own comparisons.

Our printers will do anything to illustrate a point. Pie charts, bar charts, maps, 3-dimensional representations—you name it.

Printronix is the only printer in its class that also produces high quality alphanumeric printing, OCR and machine-scannable labels, variable-size characters and multi-part special forms.

For the complete picture on graphics capability, call (714) 549-7700 or write Printronix Inc., 17421 Derian Ave., P.O. Box 19559, Irvine, CA 92713.

PRINTRONIX
It's simple, to be reliable.

CIRCLE NO. 83 ON INQUIRY CARD

New Systems

two disk drives with 20M bytes of removable storage; a VT100 video console; and QDMS, QWORD and RSTS/E software. Prices for the QW series start at $39,900. **Quodata Corp.**, Hartford, Conn.

Circle No 164

System performs dynamic graphics

The IGS 400 stand-alone graphics system has a 64K-word system processor, a 50M-byte disk drive, a 128K-word floppy-disk subsystem and a user work station. The work station includes a picture processor, enabling dynamic graphics to be performed locally; two CRTs; a keyboard; a graphics tablet; and a joystick. The IGS 400, including system software, sells for $89,000. **California Computer Products, Inc.**, Anaheim, Calif.

Circle No 165

Sharp system designs programs

The Z80-based YX-3200 business computer system designs programs after posing yes-or-no questions to users. The system includes a 32K ROM, a 64K RAM, as many as eight dual-sided, double-density floppy-disk drives, a 12-in. CRT with an 80-column × 24-line display that can increase character size for group viewing and an 80-cps bidirectional, dot-matrix printer. **Sharp Electronics Corp.**, New York, N.Y.

Circle No 166

DEC introduces entry-level system

The Datasystem 315, intended for use as a small-business system, a network node or a store-and-forward terminal, incorporates a PDP-11/23 μc. The system includes a 64K-byte base memory, a VT100 video terminal, a dual RX02 double-density floppy-disk drive and either the CTS-300 or RT-11 operating system. Prices, including an LA120 printer, start at $17,600. **Digital Equipment Corp.**, Maynard, Mass.

Circle No 167

MDB makes DEC, DG, HP, P-E and Series/1 Compatible Controllers for every major Line Printer in the world.

Imagine what else we can do!

MDB does it! Lets you pick and choose the exact line printer with the exact speed and performance you need for your system. Because MDB interfaces PDP*-11/03 through 11/70, LSI*-11 & 11/23, VAX* 11/780, PDP-8, Nova,** Eclipse,** P-E, IBM Series/1 and HP 2100, 21MX and 1000 to (ready?) Centronics, Dataproducts, Data 100, Data Printer, Documation, Printronix, GE TermiNet,™ Houston Instrument, Innovative Electronics, Okidata, LA180, Florida Data, CDC and many other line printers. That makes over 100 possible computer/printer combinations including the one you need. Long line options for all combinations are available which allow full speed parallel data transmission at distances up to 3,000 feet.

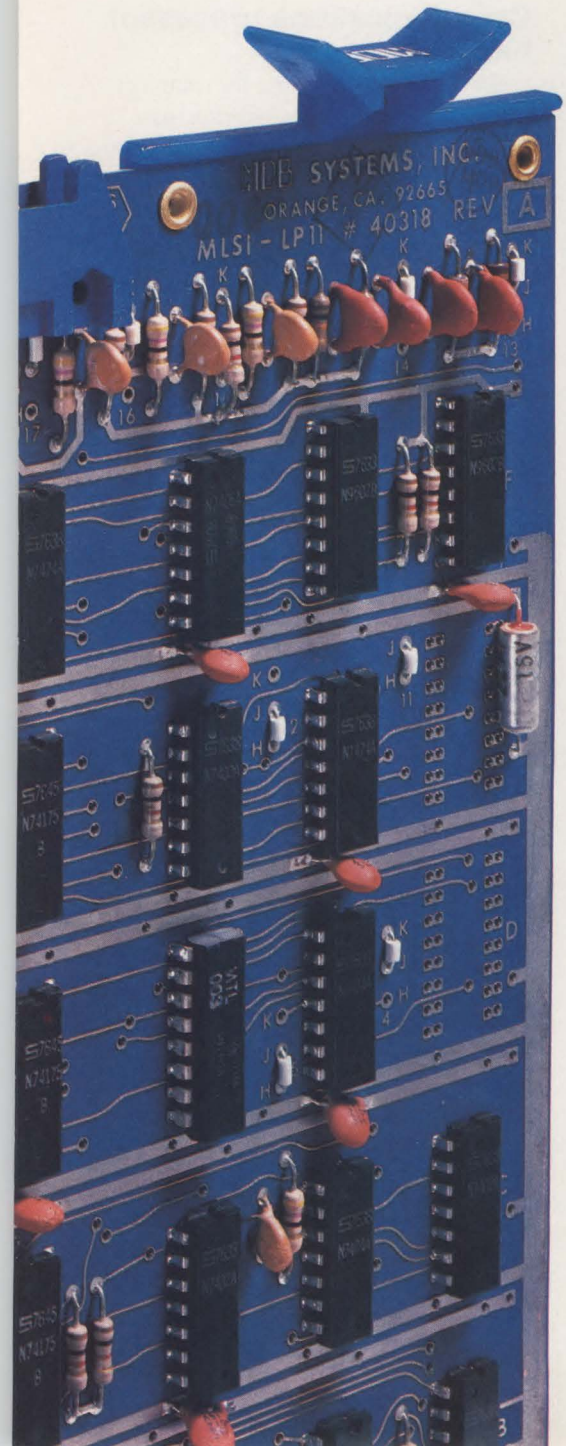
And with MDB you not only get what you want but you pay less for it because an MDB controller with your choice of line printer may cost up to 50% *less* than the host manufacturer's printer system(s).

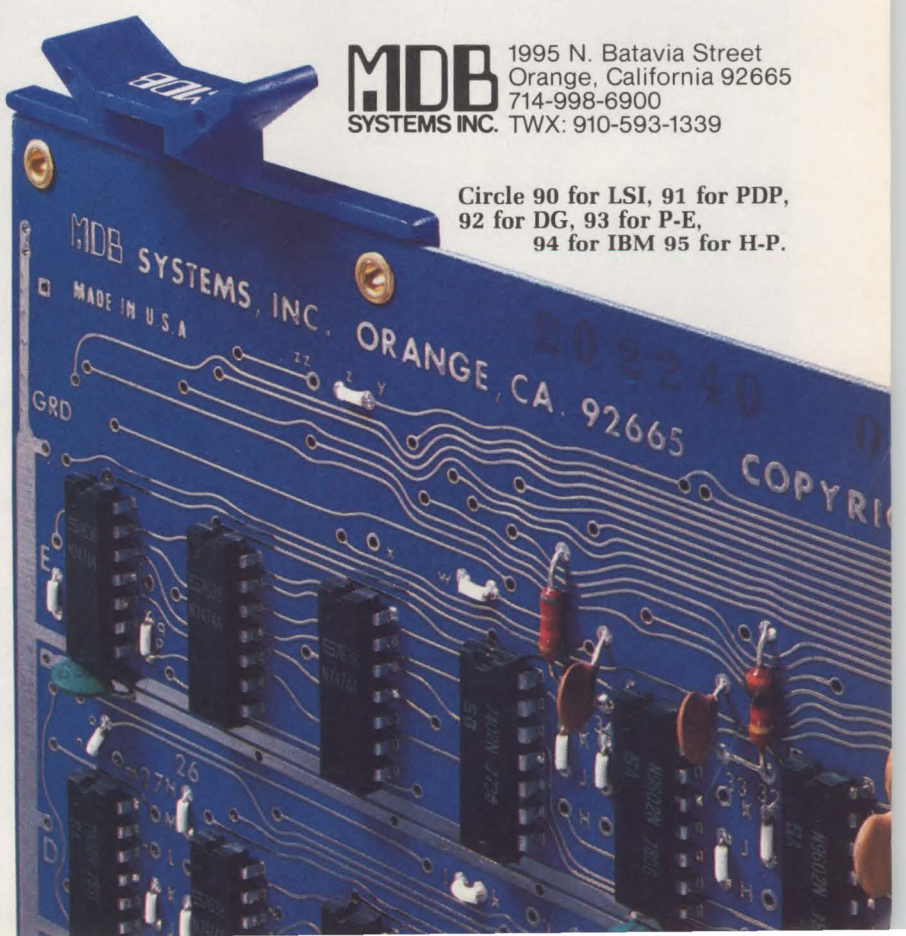
MDB line printer/controllers are single printed circuit boards that require only one host chassis slot. And each controller is completely transparent to the host operating systems and diagnostics. Operation and programming are exactly as described by the computer manufacturer.

What else can MDB do for you? Look at our data communications interfaces, multiplexors, foundation modules and interprocessor links. Our products range from plain vanilla to plain incredible—like the new memory modules that let you program PROM right on the board. All MDB boards are made by hand, warranteed for one full year and delivered in 30 days or less. Imagine. And they're available under GSA contract #GS-00C-02423.

Now it's your turn. Call or write today.

*TM Digital Equipment Corp. **TM Data General Corporation, a computer manufacturer not related to MDB.





MDB SYSTEMS INC.
1995 N. Batavia Street
Orange, California 92665
714-998-6900
TWX: 910-593-1339

Circle 90 for LSI, 91 for PDP, 92 for DG, 93 for P-E, 94 for IBM 95 for H-P.

CIRCLE NO. 84 ON INQUIRY CARD

Don't get held up changing labels.

Now you don't have to wait for an outside vendor to print your machine-scannable labels. Produce your own labels, immediately, on a Printronix printer.

Ours is the only printer in its class that can produce labels using a wide variety of character sizes and styles. And can easily save you 50% on production costs.

Whatever your graphics and printing needs, make a change for the better. Call (714) 549-7700, or write Printronix Inc., 17421 Derian Ave., P.O. Box 19559, Irvine, CA 92713.

PRINTRONIX
It's simple, to be reliable.

CIRCLE NO. 87 ON INQUIRY CARD

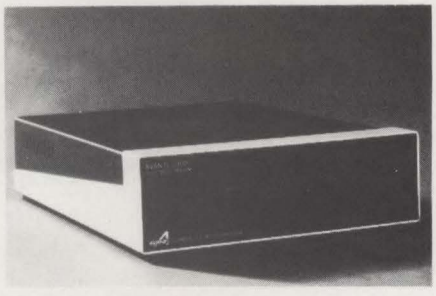
New Products

datacomm

Communications processor has multiple μps

ICOT 257 processors for management of remote networks use a multi-μp architecture and the ICOBUS to handle polling, message editing and processing, queueing, priority scheduling, diagnostics and error recovery, statistics gathering, security, line concentration and message switching for two to 13 full-duplex communications lines. Prices range from $13,000 to $30,000. **Microform Data Systems, Inc.**, Mountain View, Calif.

Circle No 168



High-speed modem has RS449/422 interface

The model 2300 modem, which has an EIA RS449/422 interface, operates in four-wire, full-duplex and point-to-point modes. The 2300M version, which operates at data rates from 64K to 460.8K bps, and the 2300H high-speed modem, which operates from 460.8K to 6.3M bps, sell for $1250 and $1750, respectively, in single-unit quantities. **Avanti Communications Corp.**, Newport, R.I.

Circle No 169

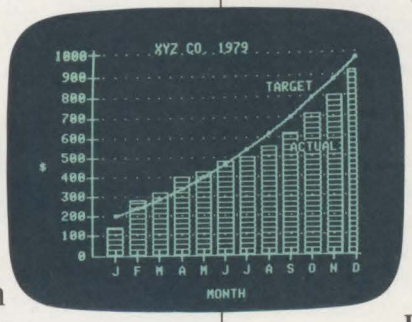
Three good reasons why professionals pick Apples.

1 In research

Apple personal computer systems help you collect, store and analyze data as fast as you can load a disk and execute a program. Because more than 100 companies offer software for Apple, you have the largest program library for manipulating your data in the personal computing world. Need special programs? Use any of Apple's development languages — BASIC, FORTRAN, Pascal.

2 In engineering

Apple personal computer systems let you define models, make trade-offs and refine prototypes. Want to study cause and effect of several variables? Apple computes new results instantly and displays them in colorful, easy-to-read graphs, charts or plots on a video monitor.



3 In production management

Apple personal computer systems make it easy to gather data, analyze productivity, measure yields and facilitate all phases of production control. Want to speed up repetitive tasks?

Rely on Apple's word processing capabilities to write, edit and print your reports.

Apples grow with you.

Whichever system you pick, Apple never locks you into a single configuration. You can use up to four or eight I/O accessory expansion slots to add an IEEE bus, Apple's Silentype™ printer, a modem or a graphics tablet. Add memory up to 64K bytes or 128K bytes. Add up to four or six 5¼" disk drives without adding any overhead.

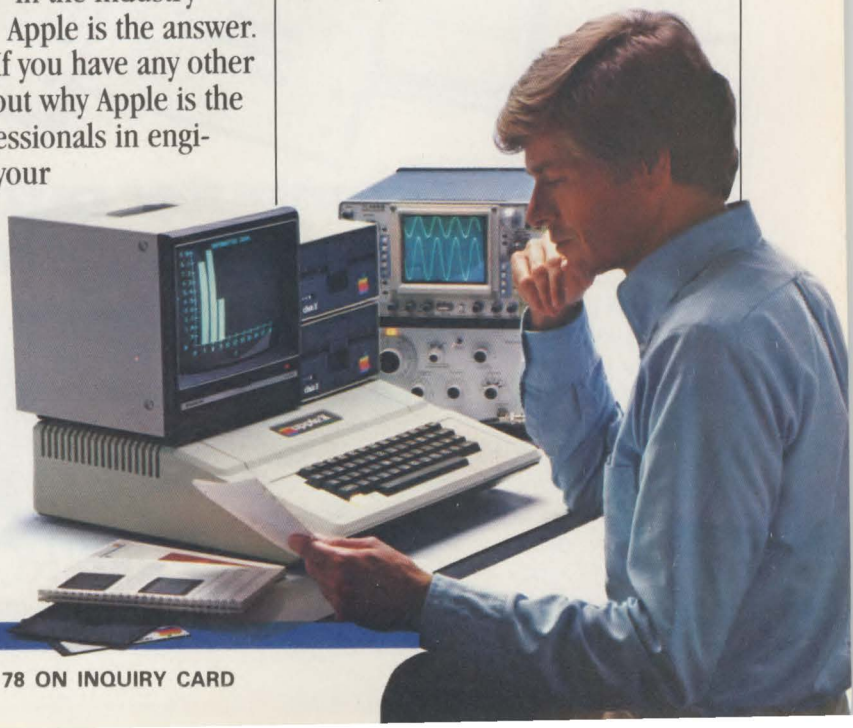
For support, service and the best extended warranty in the industry — Apple is the answer.

If you have any other questions about why Apple is the pick for professionals in engineering, see your nearest Apple computer dealer or call **800-538-9696**. In California, **800-662-9238**. Or write: Apple Computer, 10260 Bandley Drive, Cupertino, CA 95014.

	Apple II	Apple III
Maximum Memory Size	64K bytes	128 bytes
Screen Display	40 column (80 column with peripheral card) 24 Lines Upper Case	80 column 24 Lines Upper Case/Lower Case
Screen Resolution (B&W)	280 x 192	560 x 192
Screen Resolution (Color)	140 x 192 (6 colors)	280 x 192 (16 colors)
Keyboard	Fixed	Programmable
Numeric Key Pad	Accessory	Built-in
Input/Output	8 expansion slots	4 expansion slots plus built-in: disk interface RS-232 interface Silentype™ printer interface clock/calendar
Disk Drives	Add-on one to six drives	One drive built-in, plus interface to support three more drives
Languages	BASIC Fortran 77 Pascal Assembly Pilot	Enhanced BASIC Fortran 77 Pascal Assembly
Typical Configuration Pricing	CPU, 48K RAM, single disk drive, B&W Monitor (9"), Silentype™ printer, and BASIC. **$2875.00***	CPU, 96K RAM, integrated disk drive, B&W Monitor (12"), Silentype™ printer, SOS, Enhanced BASIC. **$4865.00***

*Suggested retail price.

apple® computer inc.



CIRCLE NO. 78 ON INQUIRY CARD

PRINTERS
slip and two station

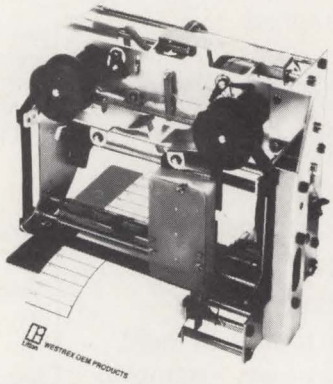
FOR SPECIAL APPLICATIONS
High speed, low cost, compact, alphanumeric, dot matrix printers. Uncomplicated, long working life, easily serviced.

Model MR-1824. Two station. Left station provides selective print to 18 characters, independent paper feed, auto paper take-up, slip insertion/validation plus desirable options. Right station provides selective print to 24 characters, independent paper feed, tear off blade and optional logo print. Both stations provide last line visibility.

Model MS-4000. Accommodates various size slips or forms. Cam-operated, geared friction paper feed. Provided with optional sensor for each top and bottom slip position. Adjustable slip stop for table extension, optional.

Both models available in basic mechanism only or with cables, covers and driver electronics.

Model MR-1824
Two Station
Bi-directional or uni-directional print capability. Speed: 1.4 lines per second.

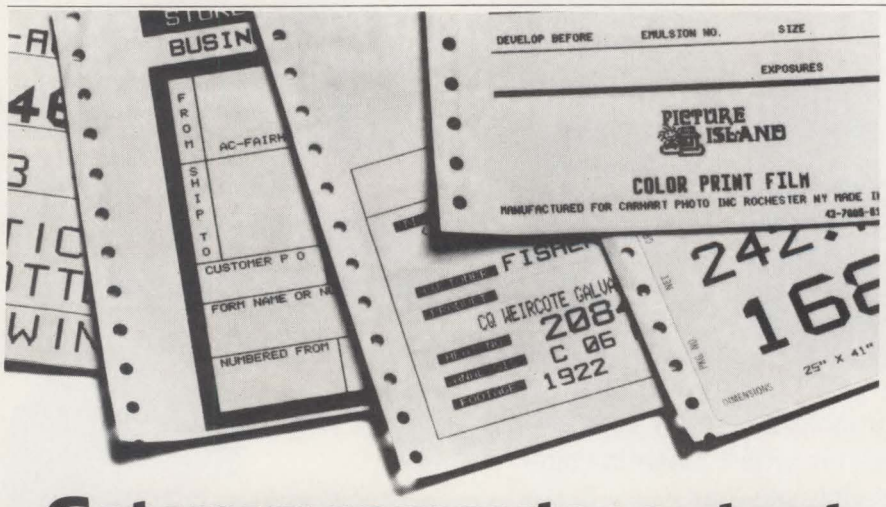


Model MS-4000
Slip Printer
Slip insertion from left side or front. 40 columns (12 cpi) at 2 lines per second. Optional bi-directional capability.

Litton
For full details, write or call us
WESTREX OEM PRODUCTS

1140 Bloomfield Avenue, West Caldwell, N.J. 07006 (201) 227-7290
IN FRANCE — WESTREX OEM PRODUCTS, 103-107 Rue de Tocqueville, 75017, Paris, France

CIRCLE NO. 88 ON INQUIRY CARD



Get your computer output in one form. Or another.

Printronix printers not only print, they prepare forms for everything from invoices to labels.

And our printers finish the job, filling in the blanks as the forms are being printed.

In fact, Printronix printers give you the same high quality in graphics and forms as in classic alphanumeric printing.

To see your output in completed form, call (714) 549-7700, or write Printronix Inc., 17421 Derian Ave., P.O. Box 19559, Irvine, CA 92713.

PRINTRONIX
It's simple, to be reliable.

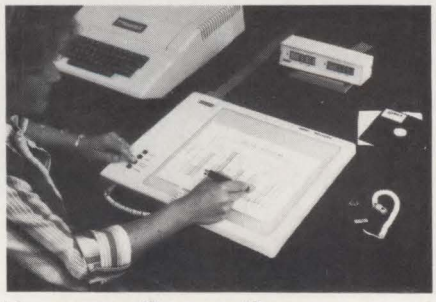
CIRCLE NO. 89 ON INQUIRY CARD

New Products

graphics

Board supports graphics for VT-100

The Graphics-100, an add-in PC board that fits into the option slot of DEC VT-100 series terminals, provides 1220- × 240-dot resolution on an 8- × 4½-in. screen. It provides a separate display memory along with four character text sets, three text rotations for labeling and three type fonts. Graphics 100 memory and VT-100 memory can be displayed simultaneously. Price is $1195. **Selanar Corp.,** Santa Clara, Calif. **Circle No 170**



Honeywell unveils video graphic hard copier

The VGR 4000 produces high-resolution 8½- × 11-in. pictures in 14 sec., using as many as 16 shades of gray. The unit is desk-top or rack-mountable and includes built-in test and diagnostic functions and a copy counter. The copier has no platen and consumes only 100W when on standby. Prices range from $5000 to $7000, with OEM discounts available. **Honeywell Test Instruments Division,** Denver, Colo. **Circle No 171**

COMPARE FLEXIBILITY.

Model 950

- *Advanced editing with wraparound*
- *Smooth scrolling*
- *15 baud rates (50B to 19.2kB)*
- *Protected fields*
- *Underlining*
- *Split screen with line lock*
- *Non-glare screen*
- *Programmable function keys*
- *15 special graphics characters*
- *Versatile screen attributes*
- *Self test*
- *25th status line*
- *Buffered auxiliary port*
- *14 X 10 character resolution*
- *Integral modem option*
- *Tiltable screen*

Tailor this smart CRT terminal to your particular needs and make it your own. It has the flexibility and brains to provide all the performance you need but is priced to make sense whether you need 10 or 1,000.

The TeleVideo model 950 detachable keyboard CRT Terminal has 11 special function keys—22 functions with the shift key—that can readily be programmed to your requirements using 256 bytes of on-board RAM.

You needn't stop there. You can change keys, key functions, even keyboard locations. And the 950's microprocessor based design means you can customize the firmware for your system.

Of course the 950 has premium TeleVideo performance—advanced editing with wraparound, split screen with line lock, and smooth scrolling. It also features a 25th status line, speeds to a true 19.2 kilobaud, and 15 special characters for powerful line graphics.

Contact TeleVideo for a detailed brochure, or call today to discuss how you can use these capabilities to make this terminal uniquely yours. TeleVideo, Incorporated, 2149 Paragon Drive, San Jose, CA 95131. (408) 946-8500.

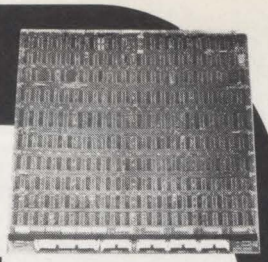
Nationwide Field Service is available from General Electric Company, Instrumentation and Communication Equipment Service Shops.

TeleVideo®

COMPARE PRICE.

CALIFORNIA Costa Mesa (714) 557-6095 • San Jose (408) 946-8500 • MASSACHUSETTS Boston (617) 668-6891
NEW YORK/NEW JERSEY Paramus (201) 267-8805 • TEXAS Dallas (214) 980-9978
CIRCLE NO. 96 ON INQUIRY CARD

NOVA USERS



the fastest Disc Controller you can get is also . . .

- **Designed for exceptional reliability**
- **Priced to fit lean budgets**
- **The first with a Lifetime Guarantee**
- **And more . . .**

Capable of controlling up to four Storage Module Interface Disc Drives in any combination, the Model N6010 Disc controller fits all Data General NOVA, Eclipse, and DG-emulating computers. You get a transfer rate of 1209K Bytes per second, overlap seek, RDOS*, BLISS**, and IRIS*** compatibility, 32-bit ECC error code, a self-contained format routine . . . all on a single embedded controller. It's new from Quentin Research, Inc., 19355 Business Center Drive, Northridge, California 91324. Our telephone number is (213) 701-1006.

SEND FOR COMPLETE INFORMATION

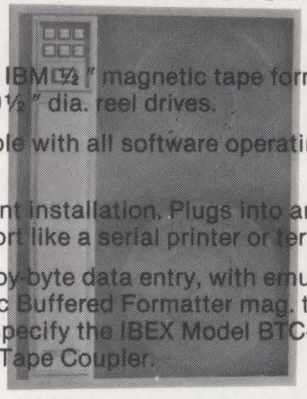
Trade Names of:
*Data General Corporation
**IPI Corporation
***Educational Data Systems, Inc.

QUENTIN™
Research, Inc.

CIRCLE NO. 97 ON INQUIRY CARD

Add IBM compatible magnetic tape to any micro/mini

with The IBEX Model STC-100



- Standard IBM ½" magnetic tape format; 7" and 10½" dia. reel drives.
- Compatible with all software operating systems.
- Convenient installation. Plugs into an ASCII RS-232 port like a serial printer or terminal.
- For byte-by-byte data entry, with emulation of the Pertec Buffered Formatter mag. tape system, specify the IBEX Model BTC-100 Buffered Tape Coupler.

Write or phone for technical data.

IBEX COMPUTER CORP.
18730 Oxnard St. / Tarzana, CA 91356
(213) 705-2517 TWX: 910-493-2071

CIRCLE NO. 98 ON INQUIRY CARD

New Products

interfaces and controllers

DEC announces interface for μcs

The DPV11 double-buffered program-interrupt interface couples an LSI-11 bus to a synchronous modem using RS232C or RS423 interface standards, enabling users to establish X.25 links between LSI-bus systems and packet-switched networks. The DPV11 can operate full- or half-duplex at speeds as high as 56K bytes per sec. Prices start at $550. **Digital Equipment Corp.,** Maynard, Mass. **Circle No 172**

Qume interface has selectable baud rates

The CS-1 intelligent RS232 interface for Qume Sprint 3 printers provides selectable data rates from 150 to 9600 baud with full hardware and software handshaking. Features include a 16K input buffer, margin justification, proportional spacing, micro spacing, auto centering, vertical tabbing and word and character control. The CS-1 sells for $695, with OEM discounts available. **Data Wholesale Corp.,** San Leandro, Calif. **Circle No 173**

Controller and tape interface for LSI-11, PDP-11

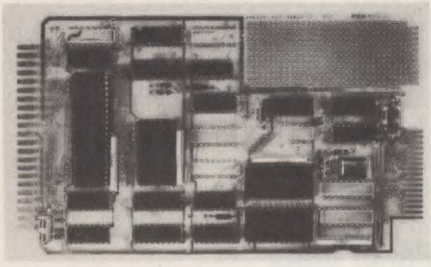
The DQ202 and DU202 controllers for Winchester drives and the DQ130 and DU130 magnetic-tape couplers for standard or streaming ½-in. tape drives interface to DEC LSI-11 and PDP-11 computers. The tape couplers support as many as eight double-density NRZI/PE tape drives. The disk controllers can handle two hard-disk drives with SMD interfaces. The modules sell for $2972 each in 50-unit quantities. **Distributed Logic Corp.,** Garden Grove, Calif. **Circle No 174**

micros

Computer converts dumb terminals

Based on DEC's LSI-11/2 processor, the Smarts Box 16-bit μc provides intelligence for dumb terminals. The unit includes power supplies, cooling fans, two independent RS232C interfaces, 8K to 32K bytes of RAM, space for 8K bytes of ROM, a 60-Hz crystal clock and two vacant Q-bus compatible card slots. Prices for the Smarts Box start at $2560. **North Atlantic Industries, Inc.,** Hauppauge, N.Y.

Circle No 175



Single-board μc has 1K- or 2K-byte ROM

The CDP18S604 single-board μc comprises a CDP1802 CMOS μp, a 2-MHz crystal-controlled clock, 512 bytes of read-write memory, parallel I/O ports, power-on reset, an interface expansion area and a socket for 1K- or 2K bytes of user-selectable ROM. The CDP18S604 can be powered from a 5V, 4A supply. Prices start at $129 in 100-unit quantities. **RCA/Solid State Division,** Somerville, N.J.

Circle No 176

Single-board μc has 6802 processor

The model SBC-02 single-board μc, intended for system development, limited-run production and school or company training programs, includes a 6802 μp with 128 bytes of RAM, 2K bytes of EPROM, parallel or serial I/O and a wire-wrap area. In single-unit quantities, price is $25 for a board with instructions, $75 for a parallel I/O kit and $150 for a wired and tested board. **Star-Kits,** Mount Kisco, N.Y.

Circle No 177

The DS180 matrix printer provides the total package of performance features and reliability required for applications such as CRT slave copy, remote terminal networks and small to mid-range systems. Not a "hobby-grade" printer, the DS180 is a real workhorse designed to handle your most demanding printer requirements. And pricing on the DS180 is hundreds of dollars below competitive units.

High Speed Printing—Bidirectional, logic-seeking printing at 180 cps offers throughput of over 200 1pm on average text. A 9-wire printhead life-tested at 650 million characters generates a 9x7 matrix with true lower case descenders and underlining.

Non-volatile Format Retention—a unique programming keypad featuring a non-volatile memory allows the user to configure the DS180 for virtually any application. Top of form, horizontal and vertical tabs, perforation skip-over, communications parameters and many other features my be programmed and stored from the keypad. When your system is powered down, the format is retained in memory. The DS180 even remembers the line where you stopped printing. There is no need to reset the top of form, margins, baud rate, etc...it's all stored in the memory. If you need to reconfigure for another application, simply load a new format into the memory.

Communications Versatility—The DS180 offers three interfaces including RS232, current loop and 8-bit parallel. Baud rates from 110-9600 may be selected. A 1K buffer and X-on, X-off handshaking ensure optimum throughput.

Forms Handling Flexibility—Adjustable tractors accommodate forms from 3"-15". The adjustable head can print 6-part forms crisply and clearly making the DS180 ideal for printing multipart invoices and shipping documents. Forms can be fed from the front or the bottom. If you would like more information on how the DS180's low-cost total printer package can fill your application, give us a call at Datasouth. The DS180 is available for 30-day delivery from our sales/service distributors throughout the U.S.

datasouth computer corporation

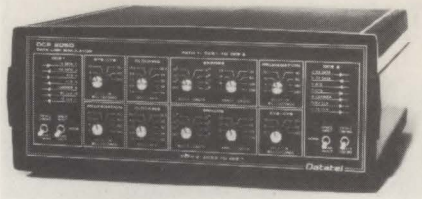
4740 Dwight Evans Road • Charlotte, North Carolina 28210 • 704/523-8500

CIRCLE NO. 99 ON INQUIRY CARD

test equipment

Test meter has five frequency outputs

The TS-6A test tone generator and level-test meter, which measures signal levels at +3 to −50 dBm, terminates a communications line with a 135-, 600- or 900-ohm impedance or bridges the line with a high impedance. The internal tone generator provides a calibrated signal source at four levels and has five frequencies. The unit sells for $315. **Datacomm Management Sciences, Inc.**, Norwalk, Conn. **Circle No 178**



Unit emulates satellite communications link

The DCP 2050 data-link simulator emulates a terrestrial or satellite communications link, inserting delays and introducing errors. The unit tests half- and full-duplex protocols, terminal-to-computer protocols, statistical multiplexers and packet networks. The DCP 2050 sells for $2700 with RS232 interfaces, with quantity discounts available. **Datatel, Inc.**, Cherry Hill, N.J.. **Circle No 179**

Portable unit monitors power-line disturbance

The model 3600, a portable three-phase AC and single-channel DC power line disturbance monitor, monitors AC voltages from 50V to 800V. The unit includes an LED digital display, a keyboard, an internal universal power supply, an internal calibrator, preset and status data printout and an RS232 interface. Price for the model 3600 is $4800. **Franklin Electric**, Sunnyvale, Calif. **Circle No 180**

Panel tests RS232 interfaces

The SP-25MV interface test panel monitors and tests data, control, timing and chassis ground leads of RS232 interfaces. The panel, which accommodates data rates as high as 19.2K bps, provides 3000- and 10,000-ohm load-simulation and positive and negative RS232 operating voltages. A digital voltmeter indicates signal level within a ±20V range. Price is $1200. **Datacomm Management Sciences, Inc.**, Norwalk, Conn.

Circle No 181

TERMINALS FROM TRANSNET

PURCHASE PLAN • 12-24 MONTH FULL OWNERSHIP PLAN • 36 MONTH LEASE PLAN

	DESCRIPTION	PURCHASE PRICE	PER MONTH 12 MOS.	24 MOS.	36 MOS.
DEC	LA36 DECwriter II	$1,695	$162	$ 90	$ 61
	LA34 DECwriter IV	1,095	105	58	40
	LA34 DECwriter IV Forms Ctrl.	1,295	124	68	46
	LA120 DECwriter III KSR	2,495	239	140	90
	LA120 DECwriter III RO	2,295	220	122	83
	VT100 CRT DECscope	1,895	182	102	69
	VT132 CRT DECscope	2,295	220	122	83
TEXAS INSTRUMENTS	TI745 Portable Terminal	1,595	153	85	58
	TI765 Bubble Memory Terminal	2,595	249	138	93
	TI783 Portable KSR, 120 CPS	1,745	167	93	63
	TI785 Portable KSR, 120 CPS	2,395	230	128	86
	TI787 Portable KSR, 120 CPS	2,845	273	152	102
	TI810 RO Printer	1,895	182	102	69
	TI820 KSR Printer	2,195	211	117	80
CENTRONICS	730 Desk Top Printer	715	69	39	26
	737 W/P Desk Top Printer	895	86	48	32
	704 RS232-C Printer	1,795	172	96	65
	6081 High Speed Band Printer	5,495	527	293	198
DATAMEDIA	DT80/1 CRT Terminal	1,795	172	96	65
	DT80/1L 15" Screen CRT	2,295	220	122	83
	DT80/5 APL CRT	2,095	200	112	75
	DT80/5L APL 15" CRT	2,595	249	138	94
LEAR SIEGLER	ADM3A CRT Terminal	875	84	47	32
	ADM31CRT Terminal	1,450	139	78	53
	ADM42 CRT Terminal	2,195	211	117	79
HAZELTINE	1420 CRT Terminal	945	91	51	34
	1500 CRT Terminal	1,095	105	58	40
	1552 CRT Terminal	1,295	125	70	48
QUME	Letter Quality KSR, 55 CPS	3,395	326	181	123
	Letter Quality RO, 55 CPS	2,895	278	154	104
HEWLETT PACKARD	2621A CRT Terminal	1,495	144	80	54
	2621P CRT Terminal	2,650	255	142	96

FULL OWNERSHIP AFTER 12 OR 24 MONTHS • 10% PURCHASE OPTION AFTER 36 MONTHS

ACCESSORIES AND PERIPHERAL EQUIPMENT

ACOUSTIC COUPLERS • MODEMS • THERMAL PAPER • RIBBONS • INTERFACE MODULES • FLOPPY DISK UNITS

OTHER POPULAR TERMINALS, COMPUTER PERIPHERALS AND COMPUTERS AVAILABLE.

TRANSNET CORPORATION
1945 ROUTE 22 • UNION, N.J. 07083 • (201) 688-7800
TWX 710-985-5485

CIRCLE NO. 100 ON INQUIRY CARD

Being first is the difference between lightning & thunder.

WILSON IS NUMBER 1 IN TEST-EXERCISERS

First with new ideas, first with new products, first with new services to QA, QC and Field Engineers...Wilson strikes like lightning to bring you the best in the Test-Exerciser industry.

Pick up a Wilson Testercizer test-exerciser. Open it up and you know right away that there are a lot more reasons why we are first. Every Testercizer is light in weight but very rugged. The well organized panel is packed with everything you need to isolate problems.

WHAT IS A TESTERCIZER?

A Testercizer *both* tests and exercises equipment to pinpoint existing faults and uncover intermittent ones. Used to test a wide range of computer peripheral devices, Testercizers contain all the capabilities to determine the condition of the interface, servo and data functions.

A FULL LINE - There's a Testercizer™ for you...

SX-530
Storage Module
Testercizer $2,250

HAT-500
Head Alignment
Testercizer $549

TFX-500
Tape Formatter
Testercizer $1,295

DX-1000
Disk Drive
Testercizer $2,250

DX-2314
Disk Drive
Texercizer $2,495

TX-1200
Tape Drive
Testercizer $2,250

FX-500
Floppy Disk
Testercizer $1,495

DX-500
Disk Drive
Testercizer $1,295

TX-500
Tape Drive
Testercizer $1,295

CX-500
Communications
Testercizer $1,295

Send For Complete Information

WILSON Laboratories, Inc. 2237 N. Batavia St., Orange, Calif. 92665 / Tel. (714) 998-1980 · Telex 181 598

CIRCLE NO. 101 ON INQUIRY CARD

accessories and supplies

Dataproducts announces bidirectional paper tractor

This bidirectional paper tractor for the vendor's daisy-wheel printers can accommodate paper forms from 2 to 15 in. wide and to .025 in. thick. It includes a graduated scale, two independently adjustable and lockable tractors and a tensioning mechanism. The unit costs $250 in single-unit OEM quantities, and $200 in quantities of 100. **Dataproducts Corp.**, Woodland Hills, Calif. **Circle No 182**

THE COMPLETE PRINTER LINE: 800 243-9054*

Digital Associates offers the widest selection of line printer systems plug-compatible with virtually any minicomputer manufactured. For drum, chaintrain, band, belt or matrix technologies, just call our toll-free number and our experts will help you pick the printer that meets your exact requirements. Digital Associates has 27 different models to choose from so you don't have to settle for second best.

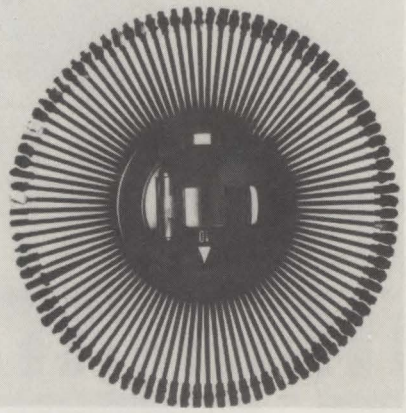
With prices of up to 40% off the minicomputer manufacturer's list, delivery in 30 to 40 days, installation by factory-trained technicians and a nationwide service network, it's easy to see why Digital Associates is the largest independent supplier of minicomputer printer systems.

The Printer Store

Digital Associates Corporation

1039 E. Main Street, Stamford, CT 06902 TWX 710-474-4583

*In Connecticut call (203) 327-9210



Custom print wheels provide company logos

These customized type heads and print wheels can be used to replace standard characters with chemistry, engineering, mathematics, data processing and other symbols. Company logos and custom ideograms can be inserted into any type head or metal or plastic print wheel. Corresponding keyboard buttons for symbols are also available. **Dramco Sales, Inc.**, New York, N.Y. **Circle No 183**

Information cards cover 8080/8085 μps

Micro Chart 100A, the first in a series of technical-information cards, covers 8080/8085 μps. The multicolored, plastic sheets measure 8½ × 11 in. and have punched holes for notebooks. The sheets cover both hardware and software and cost $2.95 each. **Micro Logic Corp.**, Hackensack, N.J. **Circle No 184**

CIRCLE NO. 103 ON INQUIRY CARD

accessories and supplies

Paper dust extractors reduce filter blockage

Placed on either side of a printout stacker, these paper-dust extractors eliminate airborne paper dust produced by printers. The extractors reduce blockage of hardware filters, which can cause inadequate cooling and head/disk touches caused by reduced head-support airflow. The extractors plug into regular electrical outlets. **CRM, Inc.**, Saddle Brook, N.J.

Circle No 185

Well, Yes and No.

YES, we are introducing 5¼" floppy disk drives.

NO, we are not new in the digital recording field; in fact we are a leader in digital cassette recorders with over 200,000 units already sold.

And with a solid 25 years of expertise in magnetic recording technologies – digital, analog, video, and of course our popular stereo tape decks – we *know* how to design and build recorders (to put it modestly).

Now you can have a reliable Floppy Disk Drive or Digital Cassette Recorder – when it bears the name TEAC.

TEAC

TEAC Corporation of America
Industrial Products Division
7733 Telegraph Road Montebello, California 90640 (213) 726-0303

CIRCLE NO. 104 ON INQUIRY CARD

Kit cleans floppy disks

The Clean Cycle kit cleans floppy-disk drive heads while the drives are assembled. Disks that have a scrubber element partially saturated with cleaning solution are inserted into the drive, removing contamination within 30 sec. The kit, which is available in 5¼- and 8-in. versions, contains three cleaning disks and enough cleaning solution for at least 60 cleanings. Price is $55. **Inmac Corp.**, Santa Clara, Calif. **Circle No 186**

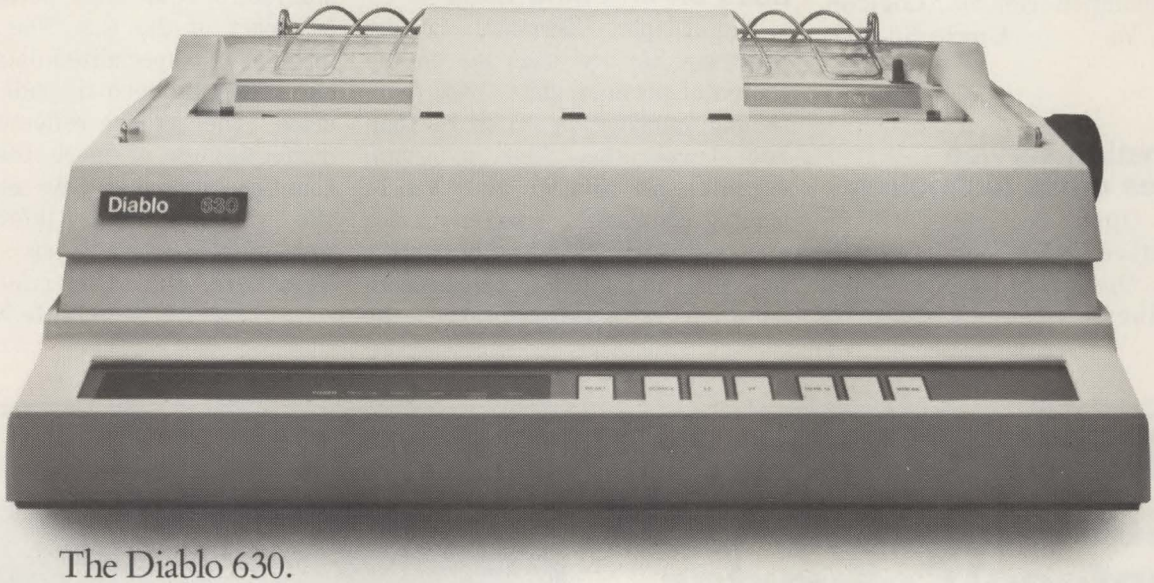
Automatic media loader processes 80 disks per hr.

This automatic floppy-disk loader can stack as many as 50 5¼- or 8-in. single- and double-sided disks and can process 80 disks per hr. A "halt-on-reject" capability enables continuous operation of as many as eight loaders in a systems configuration. In single-unit quantities, the model 110S media loader costs $4975 for 8-in. single-sided drives and $5370 for double-sided drives; the model 050W costs $4675 for 5¼-in. single-sided drives and $4875 for double-sided. **Media Systems Technology, Inc.**, Santa Ana, Calif. **Circle No 187**

Training unit includes tested μp

The 8085AAT μp training unit includes a tested and assembled 8085A μc with a 1K-bit RAM, a 1K-bit PROM, a 1K-bit EPROM, programmable I/O, a keyboard, a display and operating system, a 44-pin edge connector, a CPU card and a 20-mA asynchronous port. Software includes an instruction manual, a user's manual, a 352-page "8085A cookbook" and a 334-page 8080/8085A software-design book. Price is $299.95 for an assembled unit, $249.95 for a kit version. **Paccom**, Redmond, Wash. **Circle No 188**

If you want a choice in print wheels, there's only one choice in printers.

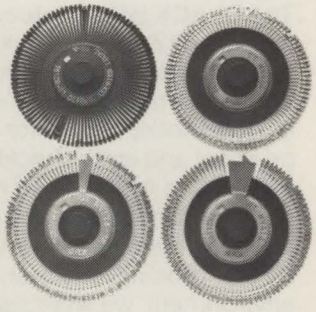


The Diablo 630.

It's the only one that lets your customers use either metal or plastic print wheels. Which means they can choose the print wheel that's just right for the job.

The 630 works as well with a 96-character plastic daisy print wheel as it does with an 88-, 92-, or 96-character metal daisy print wheel. In over 100 different type styles.

Every 630 has a fully strappable power supply. It's as easy to use in Paris, Kentucky as it is in Paris, France. So you only need to stock one printer for international and domestic markets.



It has fewer moving parts than competitive printers, which makes it more reliable. And it offers unsurpassed print quality. Compatibility with Diablo supplies. And bi-directional printing capability.

The 630 is the only printer in the world that uses both metal and plastic wheels.

Once your customers hear they can change their print wheels, they're going to be changing their printers.

To Diablo 630 printers.

Diablo Systems

XEROX

Diablo® and XEROX® are trademarks of XEROX CORPORATION.

CIRCLE NO. 105 ON INQUIRY CARD

services

Development service analyzes automation

The Specification Development Service, for discrete-part manufacturers, analyzes automation-system value and pay-back period. Application areas for the service include materials handling, machinery monitoring, energy management and production control. **Logicon,** Fairfax, Va. **Circle No 189**

Information service updates office technology

The Open Systems/On-Line interactive information service enables *Open Systems* newsletter subscribers to keep track of developments in office technology. Available through the GTE/Telenet data network, the service uses the computer and software resources of EIES at the New Jersey Institute of Technology. Subscriptions cost $750 per year. **Open Systems,** San Francisco, Calif. **Circle No 190**

Pricing service uses on-line data base

The Display Terminal Pricing Strategy Service uses an on-line computer-product data base containing information on more than 700 terminals. The program supplies an annual analysis of leading companies, quarterly price analyses and indexes, bimonthly bulletins, unlimited telephone consultation and a subscription to the vendor's 800-page *Computer Terminals Review*. Annual subscription price is $3500. **GML Corp.,** Lexington, Mass. **Circle No 191**

Retrieval systems has two data bases

The SITE II demographic-retrieval system provides demographic updates and forecasts and analyses of retail-sales potential for any part of the U.S. The system includes two specialized data bases, one reflecting 1980 zip-code boundaries, the other reflecting the demographics of more than 3100 counties. SITE II can be used with the vendor's other information-management and analysis systems. **Tymshare, Inc.,** Cupertino, Calif. **Circle No 192**

What does Rohm and Haas think about the BLACK BOX Protocol Converter model A/S-1?

"Our order delivery system, installed in 1972, was becoming obsolete; it was becoming more and more difficult to service...parts were becoming scarce, and it was a noisy system. We needed to improve it, but we didn't want to effect a lot of expensive software changes. The BLACK BOX Protocol Converter made it possible to transmit data from our IBM 3033 computer to our Texas Instruments Model 820 printers at our manufacturing plants across the country. The BLACK BOX Protocol Converter handles the bi-synchronous protocol and error checking...it converts the code from EBCIDC to ASCII and it converts the protocol from bi-synchronous to asynchronous. We looked at three other protocol converters before choosing the BLACK BOX Protocol Converter. After a trial run in a test environment, we were satisfied that the BLACK BOX Model A/S-1 could handle our application.

The system is working great...we've realized a significant improvement in our terminal up-time, which has improved our delivery time...hence we're better able to service our customers."

Walt Haswell
Manager of Corporate Communications

Protocol conversion means more than just converting codes. It means "total bi-directional communications" using the proper code, at the proper data rates, in a proper specified format. The BLACK BOX ® Catalog's Model A/S-1 Protocol Converter "IS AN" IBM 2770, 2780, 3780, 2741, or 3741. Alone, it can communicate with a bi-synchronous computer port or terminal and maintain system continuity. With an asychronous terminal attached to the A/S-1, it will transmit and receive data, maintaining the prescribed bi-sync format/protocol.

For more information on the BLACK BOX Protocol Converter, contact: Expandor Incorporated, 400 Sainte Claire Plaza, Pittsburgh, Pennsylvania 15241 412-746-2910

BLACK BOX CATALOG
EXPANDOR INCORPORATED

THE ALL BUSINESS PRINTER.

Until now, you got the printer quality you paid for. Now, Dataroyal gives you more. Our new IPS® 5000 150 cps matrix printers offer business system quality and reliability — at hobbyist prices.*

IPS® 5000 models give you MPU-driven, 80 and 132 column bi-directional printing of a 96 ASCII character set in 9x9 matrix with full descenders.

Standard features include a "quiet cover," expandable buffer memory, expandable characters, and more.

Hobbyists will love the IPS® 5000, but our new small printers are all business — designed for those who need high quality output every day.

Join the growing list of OEMs and end users who have looked beyond the largest printer suppliers to find the best. For a demonstration of the IPS® 5000, or larger IPS® 7000, fill out the coupon or call your nearest Dataroyal sales office.

☐ Show me an IPS® 5000.
☐ Send me information.

Name _____
Title _____
Company _____
Street _____
City _____
State _____ ZIP _____
Telephone ( ) _____

Mail to Dataroyal, Inc.
235 Main Dunstable Road,
Nashua, NH 03061

*Under $1,000 in OEM quantities; available 90 days ARO.

DATAROYAL
INCORPORATED
235 Main Dunstable Road, Nashua, NH 03061, (603) 883-4157
2801 Far Hills Avenue, Dayton, OH 45419, (513) 294-6426
160 Centennial Way, Tustin, CA 92680, (714) 838-4530

CIRCLE NO. 107 ON INQUIRY CARD

components

Vector introduces 10- and 19-in. card cages

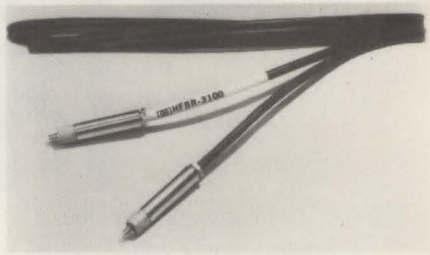
The CCK "S" Series card cages measure 5¼ in. high × 9 in. deep × 10 or 19 in. wide. Slotted side walls and brackets enable cross members to be adjusted both laterally and vertically. The 19-in. racks include snap-in guides for 21 cards; the 10-in. racks have guides for 10 cards. In single-unit quantities, the CCK "S" Series card cages are priced from $36 to $41. **Vector Electronic Co.,** Sylmar, Calif. **Circle No 193**

Motorola's 16K EPROM uses 5V supply

The MCM2716 16K-bit EPROM (2K × 8), which requires a 5V power supply, comes in a 24-pin DIP. The device has a 250-nsec. access time and speeds of 450 and 350 nsec. Two versions with different power dissipations are available. In quantities of 100 or more, the standard MCM2716C sells for $20.80, and the low-power MCM27L16C sells for $24.95. **Motorola, Inc.,** Austin, Texas. **Circle No 194**

68K ROM in a 28-pin package

The MK37000 64K-bit ROM, which is fully compatible with the vendor's n words × 8 Bytewyde memories, interfaces with all 8- and 16-bit μps. The MK37000 has a 250-nsec. access time and output-enable and chip-enable control functions that prevent bus contention problems. The 37000, which comes in a JEDEC-approved 28-pin package, is priced at $25.65 in 1000-unit quantities. **Mostek Corp.,** Carrollton, Texas. **Circle No 195**



Hewlett-Packard offers fiber-optic cables

The HFBR-3100 dual-channel fiber-optic cable and connector assembly consists of two single-fiber cables extruded together and surrounded by a polyurethane jacket. It is compatible with the vendor's HFBR-1001, HFBR-1002 and HFBR-2001 transmitter and receiver modules. Price is $4.50 per m. for cable as long as 5 km., plus a $45-per-termination connector-installation fee for as many as 19 connectors. **Hewlett-Packard Co.,** Palo Alto, Calif. **Circle No 196**

CODATA ANNOUNCES THE CTS-200/6: THE INTEGRATED MULTIBUS* OEM 16-BIT COMPUTER SYSTEM WITH A 5¼" MICRO-WINCHESTER.

The Codata CTS-200/6 is a self-contained 16-bit system which permits specific OEM configuration to match a variety of applications. Now, with the added flexibility of the MULTIBUS concept and a 6.38M Byte Micro-Winchester, it's ideally suited for dedicated process control environments, development systems, distributed networks, or business applications.

A FEW IMPORTANT SPECIFICATIONS

- ☐ 8080, 8085, 8086, Z8000 configurations
- ☐ Dual-density, double-sided 5-1/4" disc drives with 348K Bytes per drive
- ☐ 6.38M Byte 5-1/4" Micro-Winchester disc drive
- ☐ 128K Bytes RAM standard, expandable to 512K Bytes
- ☐ Nine-inch, 80-character x 25-line display
- ☐ Nine-slot MULTIBUS backplane—three left for expansion in standard configuration
- ☐ 82-key, ASR-33 compatible keyboard with 18 special function keys
- ☐ Special I/O configurations and custom interfaces upon request
- ☐ Software: CP/M**, CP-Net**, MPM**, CP/86**, XENIX***, BASIC, Interpreter/Compiler, C-Compiler, FORTRAN, COBOL, PASCAL

* MULTIBUS is a trademark of Intel Corporation
** Are trademarks of Digital Research
*** Is a trademark of Microsoft
Rep inquiries invited

CODATA

For additional information, please call or write. Codata Systems Corporation, 285 N. Wolfe Road, Sunnyvale, CA 94086, (408) 735-1744

CIRCLE NO. 108 ON INQUIRY CARD

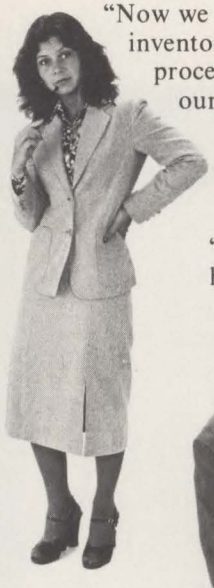
Good News for Your Business System Needs.

"I reuse the same information over and over — I'm glad our MICROSTAR business system has word processing — thanks, I needed that."

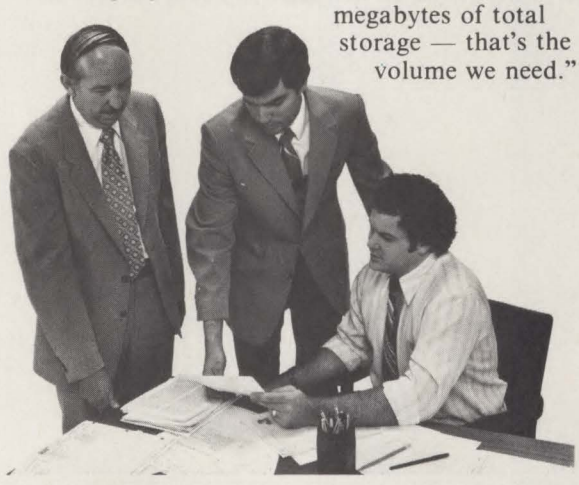
"We started our business with the under $300/month MICROSTAR and it'll grow with our business needs easily."

"I need consistent accuracy — the answer for speedy answers is MICROSTAR."

"Now we control all of our accounting, inventory, sales analysis — even word processing needs — all of us have our own multi-tasking terminal."



"MICROSTAR business systems provide up to a half megabyte of main memory and more than 50 megabytes of total storage — that's the volume we need."



"MICRO FIVE's local dealer understands my exact needs — he's got the complete system to solve my problems."

Hurry, send free details on: ☐ MICROSTAR I and II business systems ☐ dealer information ☐ software

73MMS 1/81

Name _____

Company _____

Address _____

City/State/Zip _____

MICRO FIVE Corporation, 17791 Sky Park Circle, Irvine, CA 92714, (714) 957-1517, TWX 910-595-1960 MICRO V IRIN

MICRO V
MICRO FIVE CORPORATION

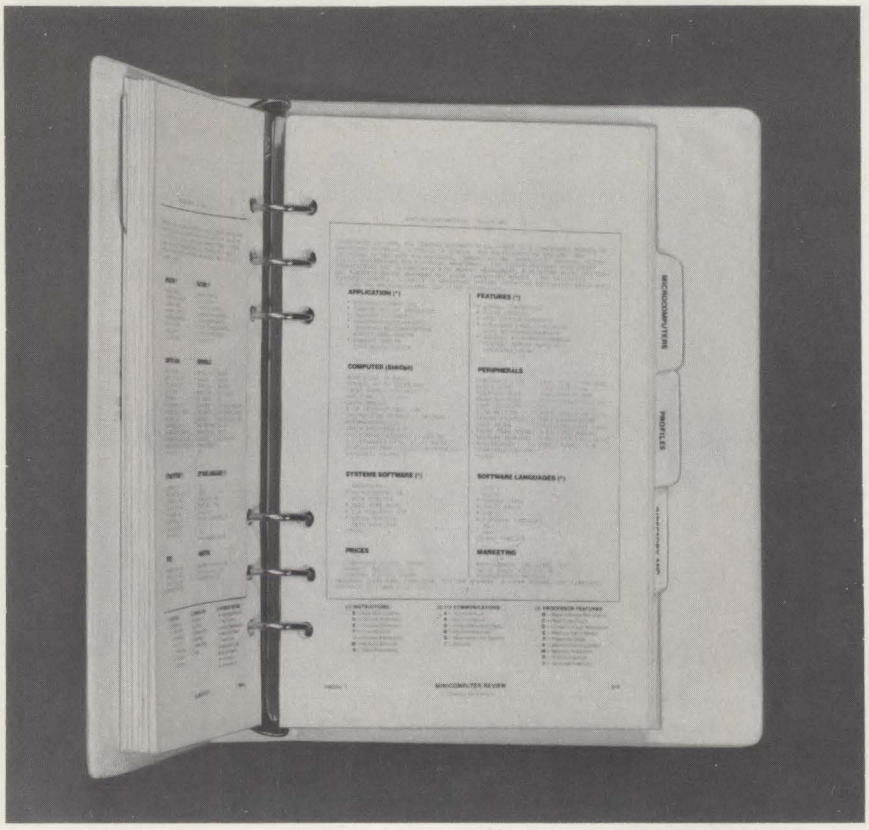
Dealer Inquiries Invited

MICRO FIVE. Everything your business needs.

CIRCLE NO. 109 ON INQUIRY CARD

"The whole world of minicomputers at your fingertips."

THE GML MINICOMPUTER REVIEW CONTAINS THE LATEST INFORMATION ON MORE THAN 1,000 MINICOMPUTERS AND MICROCOMPUTERS MADE BY MORE THAN 270 COMPANIES WORLDWIDE.



- **FEATURES**
- **APPLICATIONS**
- **PRICES**
- **SPECIFICATIONS**
- **SOFTWARE**
- **MARKETING DATA**

GML INFORMATION SERVICES

Our subscribers tell us that the GML REVIEWS are more useable than other similar types of references. The difference is that the REVIEWS are more current and complete. This is because the facts come fresh from on-line data bases that are updated daily. Annual subscriptions include three published updates and telephone consultation privileges that can keep subscribers current to the moment.

Please enter my one-year subscription to MINICOMPUTER REVIEW, including three updates, plus free unlimited telephone consultations for only $175 in North America and $200 overseas.

☐ Bill me ☐ Bill my company ☐ Check enclosed

Purchase Order # _____ (must be enclosed if billed later)

Name _____ Title _____

Company _____

Address _____

City _____ State _____ Zip _____

Tel.(____) _____ Date _____

Signature _____

GML Corporation
594 Marrett Rd., Lexington, MA 02173 (617) 861-0515

CIRCLE NO. 126 ON INQUIRY CARD

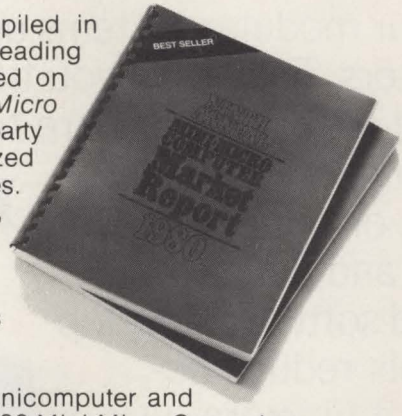
GET THE FACTS

About the $10 billion* minicomputer and microcomputer market
The ninth annual 1980 Mini-Micro Computer Market Report gives you the facts. It is the industry's most comprehensive survey covering past purchases and projected purchases in 22 separate categories including minicomputers, microcomputers, tape and disk drives, CRT terminals, printers, modems, and related equipment. For OEMs and end-users.

State-of-the-industry
If you are marketing to the minicomputer and microcomputer market, the 1980 Mini-Micro Computer Market Report is *must* reading. It gives you 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 applications trends
- analyze industry or product growth trends to better plan marketing directions

Most Extensive Data Base
The 1980 Mini-Micro Computer Report, compiled in conjunction with the computer industry's leading independent research firm, Dataquest, is based on responses received from more than 11,000 *Mini-Micro Systems* readers. Covered by the report are Third-party OEMs such as systems integrators, specialized system OEMs and, software houses and services. Also covered are the sophisticated end-users, located at large corporations with volume requirements, at EDP sites where mini-computers interface with mainframes, and in scientific and engineering areas. The report lists OEM and end-user buying plans separately.



To get the facts about the $10,000,000,000 minicomputer and microcomputer market, order your copy of the 1980 Mini-Micro Computer Market Report today.

*Projections based on statistics compiled for the 1980 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	Denver	(303) 388-4511
New Jersey	(201) 625-9225	Orange County	(714) 851-9422
Chicago	(312) 654-2390	Los Angeles	(213) 933-9525
		San Francisco	(408) 243-8838

I want the facts about the $10 billion minicomputer and microcomputer market.

☐ Send me my copy of the 1980 Mini-Micro Computer Report.

_____ Check is enclosed for $495.00

_____ Purchase order for $495.00 is enclosed

☐ Have your regional sales manager call me

Name _____

Title _____

Company _____

Address _____

City _____ State _____ Zip Code _____

Telephone _____

But no matter what the size, they all give you increased sales, greater security, and lower costs.

Choose from the VIP (315K bytes with optional add-ons up to 1.2M bytes), the Vector 2800 (2M bytes with 91 msec average access time), or the Vector 3030 (32M bytes with 34 msec average access time).

Each one gives you more disk speed and capacity than competitive models. So you can offer a less expensive system with more capacity than your competition, or one with much greater capacity for the same money.

Our multiple configurations with transportable software do not lock you into one level of system. For reliability, Vector builds industry standards into each Economy Sized Computer. Standard software and components include CP/M2® operating system, Microsoft BASIC-80,® S-100 bus, 4 MHz, Z80A processor, RS-232C serial ports.

Our modular systems use common Vector 3 mainframes, boards, and printers. They save you time and money on inventory, service, staff, and training. Software transportability from one system to the next eliminates the cost of rewriting or converting software and data. Our advanced software development tools reduce development time dramatically. And since we have such a wide range of models, we help you make more sales.

All this goes to prove one thing.

That is, no matter what size system you're building, an Economy Sized Computer can be a big help.

For more information, write Vector, 31364 Via Colinas, Westlake Village, CA 91362. Or call 213/991-2302.

Economy Sized Computers™ now come in small, medium and large.

VECTOR

Economy Sized Computers™

printers

Epson MX-80 printer has low price

The MX-80 dot-matrix printer, intended for use with μc-based systems, prints in as many as 12 modes, some of which use multistrike and multipass techniques. The bidirectional unit prints at 80 cps with print densities of 40, 66, 80 or 132 columns in an 8-in. field. An adjustable mini-tractor accommodates 4- to 10-in.-wide paper. The MX-80 sells for less than $650. **Epson America, Inc.,** Torrance, Calif. **Circle No 197**

Spinwriter is aimed at word-, text-processing.

The Spinwriter model 3500Q OEM thimble printer for word- and text-processing has a 3000-hr. MTBF and a 30-min. MTTR. The printer's packaging enables reduction of mechanical parts by 50 percent and of electronic parts by 60 percent, and use of a swaging technique eliminates more than 100 parts. The model 3500Q is priced at $1430 in 100-unit quantities. **NEC Information Systems, Inc.,** Lexington, Mass. **Circle No 198**

Metric printer/plotters provide high resolution

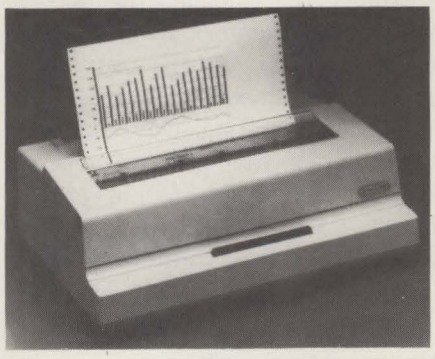
The Quadramet Series of metric electrostatic printer/plotters produce a resolution of 100 dots per cm. (254 dots per in.), which is higher than the usual 200-dpi resolution. The model 9424 plots at 2.54 cm. per sec. at a plot width of 59.51 cm. per sec. The model 9436 plots at 1.27 cm. per sec. across an 89.59-cm. plot width. The Quadramet 9424 is priced at $29,500; the 9436 sells for $39,800. **Benson-Varian, Inc.,** Mountain View, Calif.

Circle No 199

Texas Instruments adds high-speed printers

The LP 300 and LP 600 dot-matrix line printers provide hard-copy output for the vendor's DS990 models 4, 6, 8, 20 and 30. The 132-column units produce high-resolution characters on a 9 × 7 matrix and print a 96-character ASCII set at speeds of 300 and 600 lpm, respectively. Prices for the LP 300 and LP 600 are $9750 and $13,750, respectively, in single-unit quantities. **Texas Instruments Inc.,** Houston, Texas.

Circle No 200



Graphics printer prints seven colors

The IS8001 color graphics printer terminal has an internal auxiliary computer, which enables the unit to interface with the host computer. The printer incorporates a three-color ink-jet print head that provides graphics output in seven colors. The IS8001 uses a 14-in. paper system and generates a 70-character set. The printer sells for $6000. **Printacolor Corp.,** Norcross, Ga. **Circle No 201**

EXPANDING YOUR DEC PDP/11 SYSTEM?

- 50% more data storage,
- 50% increased data transfer rate, and
- 20% faster seek times!
- is software transparent to all DEC Operating Systems, Diagnostics, and Drivers,
- is fully media compatible
- is 11/70 Cachebus, Unibus, or Q-bus compatible

Our subsystems are industry proven, high quality CDC, disc drives and Emulex controllers. Also offered are high performance, reliable magnetic tape subsystems, DZ11's, DH11's, high speed MOS memories, printers, and other hardware. Call or write us for your hardware requirements.

* DEC, PDP/11 are registered trademarks of Digital Equipment Corporation.

COMPARE OUR PRICES

OUR MODEL		
DM06	(300MB)	$20,500
DM06/70	(300MB)	$22,500
DM02	(80MB)	$14,550
DM02/70	(80MB)	$16,500
DM-300	(300MB)	$14,500
DM-80	(80MB)	$ 8,550
DM-77	(125IPS)	$ 9,995
DM-45	(75IPS)	$ 8,995
DEC		
RJP06	(200MB)	$44,000
RWP06	(200MB)	$44,000
RJM02	(80MB)	$24,000
RWM03	(80MB)	$25,000
RP06	(200MB)	$34,000
RM02	(80MB)	$18,000
TJU77	(125IPS)	$28,000
TJU45	(75IPS)	$23,000

Our systems are expanded or media compatible versions of standard DEC RP06/RM02 disc subsystems and TU77/TU45 magnetic tape subsystems. These subsystems are 100% compatible with all DEC software, diagnostics, and drivers.

ADVANCED DIGITAL PRODUCTS
A SUBSIDIARY OF COMPUTER SERVICES GROUP, INC.
7584 Trade Street • San Diego, CA 92121
(714) 578-9595

CIRCLE NO. 112 ON INQUIRY CARD

MTI stocks 'em all for faster delivery.

No hidden charges. Prices include delivery. Ask about our "QED" discounts. VISA and MasterCard orders accepted.

	MTI price	Lease Price 12 mo.	24 mo.	36 mo.
VIDEO TERMINALS				
VT100	$ 1695	$ 92	$ 90	$ 85
VT132	2295	110	105	100
ADM-3A	*	55	45	40
ADM-3A+	*	65	60	55
ADM-31	*	75	70	65
ADM-42	*	100	90	85
1410 (Hazeltine)	825	50	45	40
1420	895	60	55	50
1421	895	60	55	50
1500	1045	70	65	60
1510	1145	75	70	65
1520	1395	90	85	80
1552	1350	85	80	75
300 BAUD TELEPRINTERS				
LA34-DA	1045	55	50	45
LA34-AA	1295	66	61	55
LA36	N.A.	95	90	85
Teletype 4310	1085	60	55	50
Teletype 4320	1225	65	60	52
Diablo 1640RO	3085	145	135	125
Diablo 1640KSR	3285	160	150	135
Diablo 1650RO	3185	150	140	130
Diablo 1650KSR	3385	185	175	165
Diablo 630RO	2295	125	120	115
TI 743	1190	65	60	55
TI 745	1585	78	73	68
TI 763	2690	115	110	105
TI 765	2895	130	125	120
(600 baud)				
TI 825RO	1565	75	70	65
TI 825KSR	1645	85	80	75
TI 825RO Pkg.	1750	85	80	75
TI 825KSR Pkg.	1895	98	95	85
1200 BAUD TELEPRINTERS				
LA120-AA	2410	135	125	110
LA180	2195	115	110	99
TI 783	1745	95	90	85
TI 785	2395	130	125	120
TI 787	2845	155	145	135
TI 810RO	1800	105	90	85
TI 810RO Pkg.	2047	115	110	105
TI 820KSR	1895	95	90	85
TI 820RO	1895	90	85	80
TI 820KSR Pkg.	1995	105	100	95
TI 820RO Pkg.	2047	95	90	85
(2400 baud)				
Dataprod. M200	2595	150	135	125
DATAPRODUCTS LINE PRINTERS				
B300 (300LPM)	5535	322	317	312
B600 (600LPM)	6861	393	388	383
2230 (300LPM)	7723	*	*	*
2260 (600LPM)	9614	*	*	*
2290 (900LPM)	12655	*	*	*
ACOUSTIC COUPLERS				
A/J A242-A	242	15	13	12
A/J 247	315	15	14	13
A/J AD342	395	20	18	16
A/J 1234 (Vadic)	895	50	45	40
A/J 1245	695	45	40	35
MODEMS				
GDC 103A3	395	25	24	23
GDC 202S/T	565	42	41	40
GDC 212-A	850	50	45	40
A/J 1256 (Vadic)	825	50	45	40
CASSETTE STORAGE SYSTEMS				
Techtran 816	1050	70	65	60
Techtran 817	1295	80	75	70
Techtran 818	1795	105	95	85
Techtran 822	2295	140	130	120
MFE 5000	1495	100	95	90
FLOPPY DISK SYSTEMS				
Techtran 950	1395	100	90	85
Techtran 951	1995	125	115	105

* Please call for quote.

mti

Applications Specialists & Distributors
Great Neck, New York/Cleveland, Ohio.

N.Y.: 516/482-3500 & 212/895-7177
800/645-8016. Ohio: 216/464-6688

CIRCLE NO. 113 ON INQUIRY CARD

New Software

COBOL compiler is ANSI compatible

This COBOL compiler, claimed to be compatible with the 1974 ANSI standard, runs on the IBM Series/1 computer under the EDX operating system. Level 2 COBOL features include nucleus, table handling, sequential I/O, relative I/O, indexed I/O, sort-merge, segmentation, library, interprogram communication and debugging. The system also supports report writer, packed decimal and screen handling. Price is $8700 per CPU for compiler and run-time library and $3480 per CPU for run-time library only. **Royal International Software Systems,** Tustin, Calif. **Circle No 202**

Total for DIBOL interfaces to DEC

The Minicomputer Total data base management system interfaces to the DIBOL programming language on DEC computers running under the RSTS/E operating system. The package provides a data structuring capability that enables the use of hierarchical, network or multikeyed access methods. Multiple terminals, users and programs can access the data base simultaneously. Price is $22,000, plus $1500 for installation and an annual use fee of $2650. Lease price is $975 per month. **Cincom Systems,** Cincinnati, Ohio. **Circle No 203**

Networking software interfaces to TI 990

The PM550 network software package (NSP) is designed to interface to the Texas Instruments model 990 computer with one or more TI PM550 programmable controllers. NSP allows two-way access to each PM550 controller, through a computer terminal or from a user program. With NSP, programs can be copied and distributed to other controllers or systems. In systems using multiple PM550 controllers, NSP gives the computer both monitoring and control functions. **Computer Technology Corp.,** Milford, Ohio. **Circle No 204**

Development system generates COBOL programs

The Custom development package generates file-update programs and menu-driven programs in COBOL, and generates documentation during the development process. The package is compatible with the DEC PDP-11, Texas Instruments 990 Series, with computers running under the CP/M operating system and with OASIS-supported systems such as Altos, Onyx and Zilog computers and the Radio Shack model 2. **Carter L. Cole Co.,** Woodland Hills, Calif. **Circle No 205**

Microwave circuits design runs on H-P system

Micro-Compact, designed to analyze and optimize passive and active microwave circuits, runs in interactive mode on the Hewlett-Packard 9845 desk-top computer with B and T options. The package accepts two-port linear circuits, and provides analysis and optimization in the frequency domain. Price is $2500. **Compact Engineering, Inc.,** Palo Alto, Calif. **Circle No 206**

Microdata introduces record-sorting facility

M/SORT adds a record sorting facility to the vendor's COBOL-80 language. The program provides ANSI-74 Level II SORT/MERGE, except the collating sequence is alphabet-name function. Extensions to the ANSI standard include compatibility with COBOL-80 file formats and record lengths, support for all data types as KEYS, and a SORT STATUS register to aid in error reporting and handling. Single-copy price for M/SORT is $125. **Microsoft,** Bellevue, Wash. **Circle No 207**

WINCHESTER DISKS
FLOPPY DISKS
DEC® RX02 COMPATIBILITY
LSI-11® Q-BUS

IN A SINGLE ENCLOSURE!

COMPATIBILITY . . .

Add 10M bytes of Winchester disk and 1M bytes of floppy disk storage to your LSI-11 computer with the SMS DSX01172 Disk System 11X. Plug any configuration of LSI-11 modules (including LSI-11/23) into the Disk System 11X's 8 quad slot Q-Bus backplane. Enough power is provided for up to (13) dual height cards and the SMS dual height "Flinchester" controller.

The single dual head floppy disk is hardware, software and media compatible with the DEC RX02. Software selectable IBM 3740, 2/2D formats provide diskette interchange with IBM and other non-DEC systems. On-board bootstrap loads (from Winchester or floppy) and runs your RT-11, RSX-11M and other software automatically at power up. All this plus resident diagnostics in a single 10-1/2" package.

AND MORE PERFORMANCE . . .

The latest 8" Winchester disk technology gives you up to 20% faster data transfers than DEC's RL01. Extended mode operation allows multiple sector and contiguous across track block transfers during Winchester or floppy access. The DSX01172 also runs floppy disk fill and empty buffer operations over 34% faster than RX02. Automatic error retry and automatic flaw mapping are standard features during Winchester disk data transfer.

PLUS GROWTH

For storage needs beyond 10M bytes, the SMS WIN 1426 add-on Winchester disk provides up to 26.4M bytes for Disk System 11X. Choose either a DSX01172 resident 10M bytes Winchester disk or an add-on 26.4M byte 14" Winchester in a low profile 5-1/4" enclosure. The WIN1426 cable connects directly to the SMS "Flinchester" controller resident in the Disk System 11X. And the WIN1426 provides twice the data transfer performance and five times the storage capacity of DEC's RL01.

AVAILABLE SOON!

PDP-11 or LSI-11 Winchester plus floppy disk add-on storage in a single 5-1/4" package!

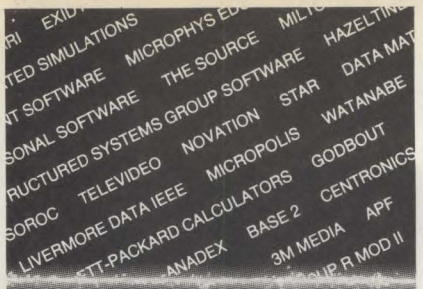
® Trademark of Digital Equipment Corporation

Scientific Micro Systems
777 East Middlefield Road
Mountain View, CA 94043
(415) 964-5700 TWX: 910-379-6577

WESTERN REGIONAL SALES
(602) 978-6621

EASTERN REGIONAL SALES
(617) 246-2540

CIRCLE NO. 114 ON INQUIRY CARD



BYTE WHOLESALE HOTLINES.

Serving the systems house, OEM, computer retailer, and volume end user with wholesale inventory. Fast delivery, and no quantity commitment.

PRINTERS
TERMINALS
COMPUTERS
PERSONAL COMPUTERS
SUPPLIES
STORAGE MEDIA
SOFTWARE
MONITORS
FURNITURE
CALCULATORS
BOARDS
DISK DRIVES
MODEMS

AND MORE HOTLINES FROM THE HOTTEST MANUFACTURERS IN THE BUSINESS.

Call toll free for Byte's 80 page WHOLESALE CATALOG. You'll save time. You'll save money.

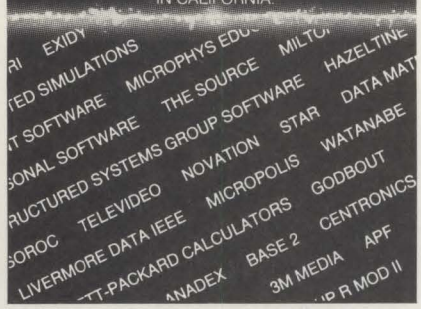
ByteIndustries™

TOLL FREE LINES

800-227-2070

800-972-5948

IN CALIFORNIA



CIRCLE NO. 115 ON INQUIRY CARD

New Software

MTM utilities are used on Series/1

These MTM utilities are used on the IBM Series/1 under the EDX operating system. A batch job invoker enables a program under MTM control to load a sort, job utility or program to another partition as a batch job that is not running under MTM control; the invoking program awaits completion of the batch job before continuing. An MTM menu processor enables the creation of menus and sub-menus using $IMAGE screens. Prices range from $60 to $200. **Wakefield Software Systems, Inc.,** Wakefield, Mass. **Circle No 208**

Millennium announces cross assembler

Combined with the vendor's MicroSystem Emulator, this cross-assembler program transforms a host computer into a development system for the 6801, 6802 and 6803 μps. It can also generate diagnostic programs for production test and field service of 6800-based systems. The package includes a macro assembler generating relocatable object code, a linking loader and a formatter/downloader to transmit assembled programs to MicroSystem Emulator, Analyzer or Designer for program execution and debug. Price is $1500. **Millennium Systems, Inc.,** Cupertino, Calif. **Circle No 209**

File management facilitates data storage

FM-11 is intended to facilitate data storage, retrieval and file maintenance on the DEC PDP-11 computer under RT-11 or TSX operating systems. It is compatible with application programs written in FORTRAN or MACRO-11 and can be used to perform I/O to data fields on any random access device. FM-11 allows pre-allocation of file space under programmer control and performs all maintenance functions for inserting or deleting records. Price is $395 for the RT-11 version and $450 for the TSX version. **MultiCept Corp.,** Rome, N.Y. **Circle No 210**

Mini-Micro Systems receives dozens of news releases each week about new software products that may not warrant the detail included in the foregoing New Software section. Nevertheless, we don't want to deny readers the opportunity to get more information about the latest software developments. Toward that end, we offer the following brief entries, compiled and edited by Malcolm L. Stiefel, contributing editor.

OPERATING SYSTEMS AND UTILITIES. SSM Microcomputer Products, San Jose, Calif., announces a Z80 monitor. **Circle No 392...Cromemco, Inc.,** Mountain View, Calif., introduces a multi-user, multitasking disk operating system, **Circle No 393,** and a diagnostic package, **Circle No 394** for its μcs...**Zilog,** Cupertino, Calif., enhances its RIO operating system for MCZ-1 μcs. **Circle No 395...Harris Corp.,** Fort Lauderdale, Fla., unveils an operating system for diagnostic program execution on its model 80, 100, 500 and 800 computers. **Circle No 396...Hewlett Packard,** Palo Alto, Calif., provides a remote job entry package for its model 300 office computer. **Circle No 397...Ontel Corp.,** Woodbury, N.Y., updates data entry and retrieval software for its line of computers. **Circle No 398...Evil Enterprises,** Woodland, Calif., has a text editor for Data General computers. **Circle No 399...Data Processing Design, Inc.,** Orange, Calif., adds a text editor to its PDP-11-based word processing package. **Circle No 400**

COMMUNICATIONS. Information Engineering, Newmarket, N.H., releases a communications package for CP/M-based computers. **Circle No 401**

concept display terminals from Human Designed Systems.
Loved. For all the right reasons.

Human Designed Systems has wrapped up its package of display terminal performance to make the concept the right choice for you.

Great Looking. The concept display terminal's attractive looks make it an ideal selection for your front office applications. Designed with your operators in mind, concept terminals add a new dimension to "friendly" — incorporating design features, such as a tiltable, high-resolution monitor; deep-set bezel; detached, high-quality keyboard, and an attractive color scheme.

Great Seeing. And behind those looks is a series of features that answers all your applications needs. Starting with four full pages of memory — 96 80-character lines — at the price of one page, plus much more: • full windowing (multiple pages per window, multiple windows per page) capability • multiple user-selectable character sets • I/O capability for networking between multiple communications lines • large buffer for high-speed operation • expanded memory for function key programming • and advanced text editing, data entry/retrieval and business graphics software.

All of this and a $1230 price tag (OEM quantity 75) make the concept display terminal well worth looking at. No matter what you're looking for.

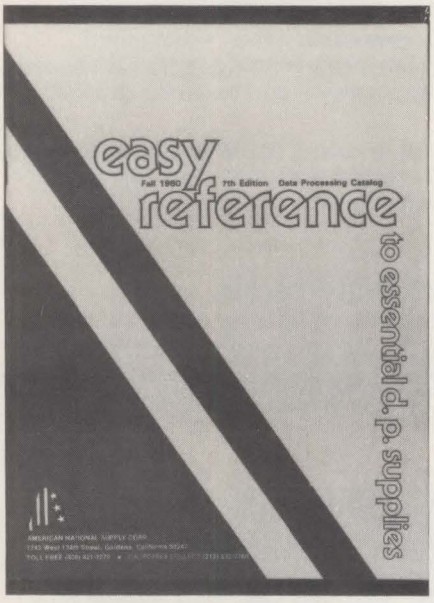
HDS
human designed systems, inc.
3700 Market Street □ Philadelphia, PA 19104 □ 215-382-5000

Boston — (617) 329-3510; New York City Area — Infocon: (201) 624-1372; New York State — Naco Electronics: Syracuse: (315) 699-2651, Rochester: (716) 223-4490; Delaware — Infocon: (302) 239-2942; Washington, DC — International Systems Marketing: (301) 986-0773; San Francisco — (415) 692-4184; Canada — CAIL Systems: Toronto: (416) 782-1151; Switzerland — Mitek AG: 01-66 22 52; West Germany — COMKO Computer Systems mbH: 221-48 30 51.

GOOD LOOKING.

CIRCLE NO. 116 ON INQUIRY CARD

New Literature



Accessories catalog lists CRT work stations

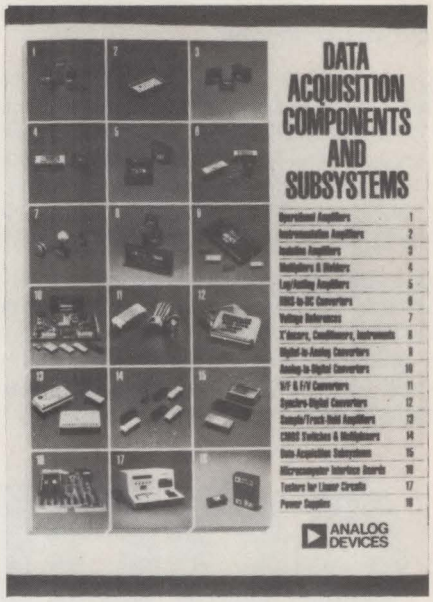
A line of data-processing accessories and supplies is detailed in a catalog. The 44-page booklet details conversational CRTs, serial and parallel interface printers, cables and CRT/printer furnishings and work stations. The catalog also covers printer ribbons, magnetic media, stock forms and special service options. **American National Supply Corp.**, Gardena, Calif.

Circle No 211

Modems, multiplexers detailed in catalog

A line of data-communications products is detailed in a catalog. The illustrated booklet describes time- and frequency-division and statistical modems and multiplexers. The catalog also features network diagnostic and central systems, system appliques, data couplers, bit-error-rate testers and loop products. **General DataComm Industries, Inc.**, Danbury, Conn.

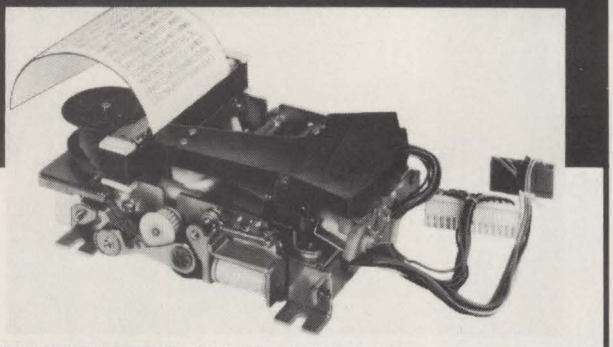
Circle No 212



1000-page catalog details components

More than 500 data-acquisition components and subsystems are detailed in a catalog. The 1000-page

NEW! STAR MICRONICS MODEL DP-822 MINIATURE DOT MATRIX IMPACT PRINTER



STAR'S NEW MODEL DP-822 is the ideal alphanumeric printer for automated banking terminals, desktop calculators, electronic cash registers, medical and scientific instruments— and many other products requiring a reliable, low-cost dot matrix impact printer. It has a replaceable printing head with minimum life expectancy of 15-million characters and is operated by a single 12-volt DC power supply. You get up to 21-column hard-copy printing at a speed of 2.5 lines per second with serial impact strong enough to print two clear copies on carbonless tapes or a single copy on standard 2¼" adding machine tape. A 5 x 7 matrix array yields printed characters in any alphanumeric font up to .071" wide by .114" high. The Star DP-822 costs only $42.95 each in quantities of 1000 units—and control electronics also are available at low cost. Write today for complete information.

©1980 Star Micronics, Inc. 80-1

star micronics, inc
SUBSIDIARY OF STAR MFG. CO., LTD.
PAN AM BUILDING (Suite 2308), 200 Park Ave. New York, N.Y. 10017 • Tel.: 212/986-6770
IN CANADA: LENBROOK INDUSTRIES, LTD. 416/438-4610

CIRCLE NO. 117 ON INQUIRY CARD

MICROCOMPUTER CORE MEMORY
INTEL SBC-80/10
DEC LSI-11

From the leader in memory systems for mini and microcomputer users — non-volatile core memory for Intel SBC-80/10 and DEC LSI-11 micros. For Intel users, it's Dataram's 16K x 8 DR-181, which interfaces to Intel's 8080 family of microcomputers. For DEC users, it's Dataram's 16K x 16 DR-115, which operates with DEC's LSI-11 series of micros. Both are non-volatile core memory designs. Available now. From Dataram. Call today at 609-799-0071.

DEC and LSI-11 are registered trademarks of Digital Equipment Corporation.

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

MEMORY FROM THE LEADER

CIRCLE NO. 118 ON INQUIRY CARD

The World's Largest, Best-Attended Electronics Manufacturing Exposition

nepcon '81 west
Conference/Exhibition

Plus the
semiconductor
symposium & exhibits

hybrid microelectronics
symposium & exhibits

FEBRUARY 24-26, 1981 **Anaheim Convention Center, California**

COMPUTER ENGINEERS: The latest equipment, components and technology on review to help you design, manufacture and test a better product

Plan NOW to Participate

SUPPLIERS: For information on exhibiting, telephone (312) 263-4866, or write The Kiver Organization, 222 W. Adams St., Chicago, IL 60606. Telex 256148

SHOW VISITORS:
Use the coupon below

SPONSORED BY
Electronic Packaging and Production magazine
Semiconductor International magazine
The International Electronics Packaging Society
American Society for Quality Control, Electronics Division
The California Circuits Association
The Arizona Printed Circuits Association

ORGANIZED BY
The Kiver Organization
222 W. Adams Street, Chicago, Illinois 60606
(312) 263-4866 Telex 256148

CEG A Cahners Exposition Group Company

OVER 1,400 DISPLAYS
including a separate area on the exhibit floor devoted exclusively to the
"Electronics Testing Center"

PRODUCTIVE TECHNICAL PROGRAM
PWB Fabrication/Production
Artwork Design & Generation, Etching, Screen Printing, Cleaning (aqueous and solvent), Materials (flex circuits and multilayers)

Hybrid Microelectronics and Semiconductor Processing
Vacuum Deposition, Laminar Flow, Wafer Processing, Micro Lithography, Laser Trimming and Marking

Automated Assembly/Packaging
Component Insertion Machinery, Soldering, Component Trimmers, Lead Cutters, Connector Technology

Electronic Testing
ATE Systems
Wire Harness Cable Testers, QC/QA Inspection, Microcircuit IC Testing

Management Workshop
"Managing Human Resources"

TO: The Kiver Organization
222 West Adams Street, Chicago, IL 60606

☐ Please send me application for FREE admission to the exhibits at NEPCON WEST '81 and include details on the Technical Program

Name _____

Title _____

Company _____

Address _____

City _____ State _____ Zip _____

Telephone (_____) _____ G

CIRCLE NO. 119 ON INQUIRY CARD

booklet details standard data-conversion and signal-conditioning products, linear test systems, computational circuits, subsystems for measurement and control and power supplies. Products included in the catalog range from monolithic integrated circuits to system-level products. **Analog Devices,** Norwood, Mass. **Circle No 213**

Diagrams illustrate static RAM data sheet

The 3359 static RAM is described in a data sheet. The four-page pamphlet covers specifications and operating parameters for the 2048-bit memory devices, which can replace 2111 and 2114 RAMs. The publication also provides charts diagramming recommended operating conditions, DC characteristics, read and write cycles, capacitance and absolute maximum ratings. The sheet includes order information. **GTE Microcircuits,** Tempe, Ariz. **Circle No 214**

New manual features industrial μc

The 990E 16-bit industrial μc is detailed in a guide. The eight-page manual describes the 19-in. chassis and bus structure, motherboard, power supply, CPU card and memory modules. The catalog also examines the μc's addressing scheme and ability to expand to accommodate extra I/O function modules. **Erni & Co.,** Northbrook, Ill. **Circle No 215**

Data sheet explains military static RAMs

Military 2114 static RAMs are detailed in a data sheet. The six-page bulletin lists specifications and AC and DC operating parameters for the 200-, 300- and 450-nsec. RAMs. The data sheet also describes the military screening process for the 4096-bit devices and provides diagrams for read and write cycle timing. **GTE Microcircuits,** Tempe, Ariz. **Circle No 216**

180-page catalog describes IC memories

A line of IC memories is detailed in a catalog. The 180-page booklet describes MOS static and dynamic RAMs, MOS, EPROMs and Bipolar ECL- and TTL-compatible RAMs. The catalog includes block diagrams, tables, graphs and sections on packaging, reliability data, handling precautions, testing procedures, PROM programming and erasing and memory support circuits. **Hitachi America, Ltd.,** San Jose, Calif. **Circle No 217**

How to cut through UPS Bull!

You're probably skeptical of uninterruptible power supply (UPS) manufacturers' claims and boasts. Even ours.

We make just one: "Our's works!"

But, you don't have to take our word for it. Ask any of our customers about LorTec UPS performance and our genuine commitment to customer service.

We'll provide our customer list and you can check us out for yourself.

To simplify your search for the most reliable UPS around, write or call Tom O'Neill, Vice President, at 216/327-5050. And don't forget to ask for our new "UPS Decision Makers' Guide."

LorTec: 15 years of documented UPS dependability. Units from 12.5 kw to 125 kw; 50 Hz and 60 Hz.

LORTEC Power Systems

5214 Mills Industrial Parkway
North Ridgeville, Ohio 44039
216/327-5050

CIRCLE NO. 120 ON INQUIRY CARD

PRINTRONIX LOVES LAX

Just plug right into my Logic A card slot, and within seconds we can make beautiful compressed printing together — with no reduction in my printing speed:

16 cpi: cozily squeezing 132 characters into an 8-inch line while economizing paper by 40%

13 cpi: or snuggling down into a comfortable 10-inch line to present the full 132-character format on an 11" x 8½" sheet for 30% paper savings.

10 cpi: And you can switch back and forth from standard ASCII to 13 cpi or 16 cpi under operator or software control. Plus — your special switch-selectable self-test function can check me out without being disconnected from my computer — thanks, I need that!

Lovingly,
Your P150, P300 or P600 Printer!

You can bring LAX love to your printer by contacting your TRILOG distributor or calling TRILOG direct at (714) 549-4079.

TRILOG

17391 Murphy Avenue, Irvine, CA 92714

CIRCLE NO. 121 ON INQUIRY CARD

Power supplies brochure details half-rack units

The HCR series of 250W low-output, half-rack power supplies is described in a brochure. The four-page bulletin provides outline dimension drawings, design and mechanical features, specifications and a rating table on standard models. The brochure also lists applications, including burn-in systems, pulse lasers, capacitor forming and battery charging. **Electronic Measurement, Inc.,** Neptune, N.J. **Circle No 218**

Honeywell's new booklet details DPS 8 system

The DPS 8 (distributed-processing system) of large-scale, general-purpose computers are described in a brochure. The 72-page booklet details the vendor's distributed systems environment and GCOS 8 multidimensional operating system. The brochure also examines data-base formats and structures, communications/networking software, languages and utilities. The pamphlet includes charts and photos and details product support and maintenance. **Honeywell,** Waltham, Mass. **Circle No 219**

Booklet features precision instruments

A line of precision instruments is detailed in a catalog. The 12-page booklet describes instruments for measurement, analysis and recording of power-system parameters of impedance, admittance, transfer function, voltage, current and phase. The catalog also provides specifications and performance curves and lists free technical literature, engineering notes and applications literature. **Dranetz Engineering Laboratories, Inc.,** Edison, N.J. **Circle No 220**

LITERATURE THAT COSTS

Two-part guide to turnkey CAD/CAM

Turnkey CAD/CAM systems are described in *Turnkey CAD/CAM Computer Graphics: A Survey and Buyers' Guide for Manufacturers.* Part one, which is 252 pages long, explains the technology of CAD/CAM systems and examines work stations, displays, plotters, networks, computers and software. Part two (118 pages) explains the ramifications of turnkey purchases and how to evaluate systems and vendors. The guide sells for $153. **Daratech Associates,** P.O. Box 410, Cambridge, Mass. 02138.

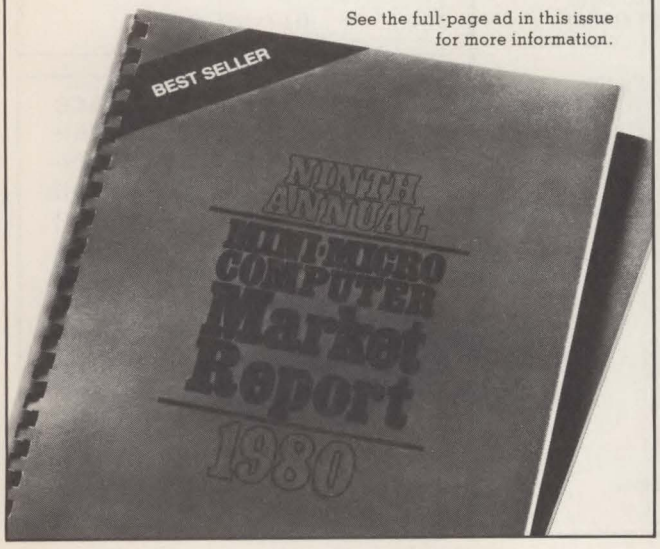
GET THE FACTS

ABOUT THE $10 BILLION MINI-MICRO COMPUTER MARKET

Our Mini-Micro Computer Market Report is the industry's most comprehensive survey of past and projected purchases of minicomputers, microcomputers, and related peripherals. Both third-party OEM and end-user purchases.

Published by MINI-MICRO SYSTEMS and DATAQUEST.

See the full-page ad in this issue for more information.



Multi-User Capabilities for MicroNOVA™

Wild Hare Puts Muscle Into Your MicroNOVA™ By Adding Multi-User Capabilities To DG's DOS!

- Supports up to five users simultaneously executing jobs
- All Data General languages for MicroNOVA™ are supported
- User shared code support
- Independent user directories
- Record lockout facility
- Printer spooling package

Now Data General Users Have A Choice!

WILD HARE COMPUTER SYSTEMS INC

P.O. Box 3581, Boulder, Colorado 80307
(303) 422-1182

CIRCLE NO. 122 ON INQUIRY CARD

Classified Ads

SOFTWARE

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:

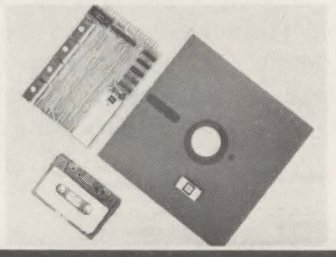
Over 200 graphic output options including Network Diagrams, Gantt, Manpower, Resource & Cost charts on a variety of graphic output devices.

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
1523 Coronach Ave.
Sunnyvale, CA 94087
(408) 733-8651

6800 Family Software



SOFTWARE: WIZRD multitasking DOS, editor, assembler, C, PL/W, PASCAL, FORTRAN, 12K BASIC

FIRMWARE: FANTOM monitor/debugger, MATH long integer and floating point, 4K industrial BASIC

CROSS SOFTWARE: Assembler, PL/W, linker, math/science, simulator

WINTEK

Wintek Corp.
1801 South Street
Lafayette, IN 47904
317-742-8428

CIRCLE NO. 130 ON INQUIRY CARD

IBM SERIES/1 SOFTWARE PEOPLE

Specialized design, programming, and consulting: contract or customized application & systems programming (EDX, PL/I, COBOL, MTM). Series/1 system interface (between MVS and EDX system), MVS conversion consulting and programming, HASP or JES2 modification.

inforscience & management, inc.
3770 E. Fisherville
Downingtown, PA 19335
Telephone:
(215) 269-9324 after 5:00 p.m. 269-8595

imi

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.**

ORDER PROCESSING

Complete COBOL system for TI 990 and NTSC 445 computers. Inventory control and financial systems also available.

GREAT LAKES INFORMATION SYSTEMS LTD.
5 Research Drive
Ann Arbor, Michigan 48103
(313) 663-6402

CIRCLE NO. 131 ON INQUIRY CARD

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

This space should be working for you.
For details call: Linda Lovett
(617) 536-7780

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.

TYPESET-8 AND EDUSYSTEMS USERS

Would you believe there is now a solid state replacement for your RF08 Disk System. Throughput is said by users to be from 5 to 10 times faster. Production time can make the expense worth the upgrade. Only takes up 10 and 1/2" of rack space and needs little if any maintenance.The memory modules also may be used interchangeably with your PDP8-E as back-up modules. ONE-YEAR WARRANTY.

DEO8-256.....$13,500.00

FEDERATED CONSULTANTS INC.
1218 S. Ervay, Dallas, TX 75215
Phone: Brier 214/428-5300 or 214/278-4031

DAS Data Terminals from DASI

THE DATA TERMINAL AND SYSTEMS PEOPLE

MODEL #	PURCHASE PRICE	ANNUAL SERVICE	12-MO. LEASE W/SERVICE	MODEL #	PURCHASE PRICE	ANNUAL SERVICE	12-MO. LEASE W/SERVICE
TI 745	$1595	$216	$ 90	TTY 43 AAK	$1350	$220	$ 70
TI 765	2695	312	135	HAZELTINE 1420	950	180	62
TI 810 PKG.	1955	312	110	GE 2030	1450	230	80
TI 820 PKG.	2295	324	100	DIABLO 630	2430	330	120
DEC LA 34	1095	198	65	DIABLO 1640	3195	363	160
DEC LA 120	2495	330	135	DIABLO 1650	3295	363	165
DEC VT 100	1795	187	95	HP 2621A	——	192	80
VISUAL 100	1595	187	80	HP 2621P	——	324	150
LSI ADM 3	850	180	50	RIXON 212A	895	82	50
LSI 31	1370	286	75	AJ 1234/1256	895	82	50
LSI 42	2095	330	105				

• Quantity discounts available • 5% Discount C.O.D. • DASI is nationwide with nationwide service • Local stocking warehouses • Complete line of supplies

Corporate Offices: Cole Rd. & Camden Ave., Blackwood, N.J. 08012
(609) 228-0700; Toll Free (800) 257-7748. In New Jersey, (800) 232-6510.

District Offices: Atlanta—(404) 449-5435 • **Boston**—(617) 769-6420 • **Chicago**—(312) 967-0440 • **Cleveland**—(216) 473-2131 • **Dallas**—(214) 256-5536 • **Denver**—(303) 741-2922 • **Detroit**—(313) 589-1409 • **Houston**—(713) 682-5965 • **L.A.**—(213) 538-4100 • **Milwaukee**—(414) 963-9008 • **Minneapolis**—(612) 854-4466 • **N.J.**—(201) 227-8880 • **N.Y.C.**—(212) 564-9301 • **Philadelphia**—(215) 667-8315 • **Phoenix**—(602) 263-5034 • **Portland**—(503) 644-8600 • **Rochester**—(716) 377-2080 • **San Antonio**—(512) 655-3274 • **S.F.**—(415) 872-1811 • **Seattle**—(206) 251-5070 • **Wash., D.C.**—(301) 459-3377

TWX # 510-686-2932 **GSA Contract #GS-00C-02234 3-31-80**

CIRCLE NO. 132 ON INQUIRY CARD

LSI-11 SYSTEMS
Ready to Use

TABLE TOP MODELS		LARGE DISK SYSTEM
TT-1	**TT-20**	**TT-160**
100% DEC System		
VT-103	VT-103	VT-100
LSI-11/2	LSI-11/23	LSI-11/23
64 KB Memory	256 KB Memory	256 KB Memory
RX-02 1 MB Floppy	CRDS 20 MB Winchester	2 80 MB Storage Modules
4 Serial Lines	DEI Tape Backup	12 Serial Lines
RT-11	8 Serial Lines	RSX-11M
	RSX-11M	
$ 9,500	**$ 22,000**	**$ 38,000**

Configurations include:
Fast delivery, cabling, manuals, and media.
Thirty day warranty.

ADVANCED COMPUTER SYSTEMS, INC.
250 Prospect Street
Waltham, Massachusetts 02154
617-894-3278

CIRCLE NO. 133 ON INQUIRY CARD

Cahners Publishing Company

Cahners Magazine Division publishes the following business magazines and directories:

- Appliance Manufacturer
- Brick & Clay Record
- Building Design & Construction
- Building Supply News
- Ceramic Industry
- Ceramic Data Book
- Construction Equipment
- Construction Equipment Maintenance
- Design News
- Design News Directories
- EDN
- Electro-Optical Systems Design
- Electronic Business
- Electronic Packaging & Production
- Foodservice Distribution Sales
- Foodservice Equipment Specialist
- Institutions
- Mini-Micro Systems
- Modern Materials Handling
- Modern Railroads
- Package Engineering
- Plastics World
- Professional Builder/ Apartment Business
- Purchasing
- Security Distributing & Marketing
- Security World
- Semi-Conductor International
- Service World International
- Specifying Engineer
- Traffic Management
- U.S. Industrial Directory

The Cahners Exposition Group is the largest producer, operator and manager of trade and consumer shows in the world ... with 67 shows, 3,300,000 square feet of exhibition space and total annual attendance of over three million.

Cahners Publishing Company
221 Columbus Avenue
Boston, MA 02116
617/536-7780

Mini-Micro Systems CAREER OPPORTUNITIES RECRUITMENT ADVERTISING

Recruitment Hot Line

(203) 327-6772/6746

Mail Film To:

Lynn George
Director, Manufacturing Industries Group

Peggy Gordon
Recruitment Advertising Manager
CAHNERS PUBLISHING CO.
1200 Summer St., Stamford, CT 06905

PROGRAMMERS AND ANALYSTS

Free Employment Service

Northeast, Southeast & Midwest U.S.

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.

RSVP SERVICES Dept. MM
Suite 700, One Cherry Hill Mall
Cherry Hill, New Jersey, 08002
(609) 667-4488

RSVP SERVICES, Dept. MM
Suite 300, Dublin Hall
1777 Walton Road
Blue Bell, Penna. 19422
(215) 629-0595

RSVP

RSVP SERVICES
Employment Agents for Computer Professionals

ENGINEERING OPPORTUNITIES IN TELECOMMUNICATIONS

STROMBERG-CARLSON, ONE OF THE SUCCESSFUL AND INNOVATIVE MANUFACTURERS OF TELEPHONE PRODUCTS AND KEY SYSTEMS, INVITES YOU TO JOIN THEIR ORGANIZATION. WE ARE CHALLENGED BY NEW AND EXPANDING MARKET OPPORTUNITIES FOR THE RIGHT PEOPLE IN THE FOLLOWING POSITIONS:

ELECTRONIC DESIGN ENGINEERS

RESPONSIBLE FOR DESIGN AND DEVELOPMENT OF ANALOG/DIGITAL CIRCUITS, CANDIDATE SHOULD HAVE MINIMUM OF FIVE YEARS EXPERIENCE WITH A PROVEN RECORD IN SUCCESSFUL APPLICATION OF MICROPROCESSOR DESIGH — HARDWARE AND SOFTWARE. THE INDIVIDUAL WILL HAVE EITHER PROJECT LEVEL RESPONSIBILITIES OR PARTICIPATE AS A KEY MEMBER OF TASK TEAM WORKING ON STATE OF THE ART TELEPHONE STATION EQUIPMENT.

PROCESS ENGINEERS

RESPONSIBLE FOR PROVIDING ENGINEERING SUPPORT TO HIGH VOLUME MANUFACTURING OPERATION PRODUCING ELECTRONIC TELEPHONE PRODUCTS. SUCCESSFUL CANDIDATE SHOULD POSSESS A BSEE WITH EXPERIENCE IN MANUFACTURING ENGINEERING AND KNOWLEDGE OF DIGITAL INTEGRATED CIRCUITRY AND COMPUTER CONTROLLED TEST EQUIPMENT.

QUALITY ENGINEERS

RESPONSIBLE FOR MAINTENANCE, TROUBLESHOOTING AND PROGRAMMING AUTOMATIC TEST EQUIPMENT FOR HIGH VOLUME TELEPHONE PRODUCTS QUALITY CONTROL TESTING PROGRAMS. BSEE OR BSET WITH EXPERIENCE IN ANALOG AND DIGITAL CIRCUITS AND COMPUTER CONTROLLED TEST EQUIPMENT. SUCCESSFUL CANDIDATE SHOULD HAVE HARDWARE AND SOFTWARE EXPERIENCE, INCLUDING MICROPROCESSORS.

STROMBERG-CARLSON OFFERS A COMPREHENSIVE BENEFITS PACKAGE AND COMPETITIVE STARTING SALARIES IN ADDITION TO A LIBERAL RELOCATION ALLOWANCE TO THIS HIGHLY-DESIRABLE MID-ATLANTIC COMMUNITY WITH A WEALTH OF EXCELLENT EDUCATIONAL, CULTURAL AND ATHLETIC PROGRAMS.

INTERESTED CANDIDATES SHOULD SEND RESUME AND SALARY HISTORY IN CONFIDENCE TO GEOFFREY MCCABRON MANAGER OF INDUSTRIAL RELATIONS, STROMBERG—CARLSON CORPORATION, P.O. BOX 7266, CHARLOTTESVILLE, VIRGINIA 22906

Stromberg-Carlson

A GENERAL DYNAMICS SUBSIDIARY

Design Engineers
Impact Printer Development

Joining the NCR printer design and development team in Ithaca, N.Y. will bring you a rewarding combination of professional and personal satisfactions. Our innovative leadership in printers and application-tailored terminals assures you long-term growth opportunity. And our location -- on Lake Cayuga in the beautiful Finger Lakes region, at the home of Cornell University and Ithaca College -- offers you relaxed living with an exceptional choice of leisure, sports, educational and cultural activities.

We have attractive immediate openings for:

Mechanical Engineers

Requires BS or MS in EE and 2-3 years or more hands-on experience in printer development. Must have solid, demonstrated working knowledge of paper transport, gears, motor drives, and materials selection (metals/plastics) including strength, durability and wear characteristics.

Electrical Engineers

Requires BS or MS in EE and 2-3 years or more experience in product development utilizing a knowledge of electro-optics design, systems architecture, computer-aided design and digital circuitry design.

You will enjoy excellent salary and a truly comprehensive benefits program. For prompt consideration, send your resume and salary history in confidence to: **Mr. Stephen Green, Manager, Professional Placement, Dept. A-138, NCR Corporation, Engineering & Manufacturing, 950 Danby Road, Ithaca, New York, 14850.**

NCR

Complete Computer Systems

An equal opportunity employer

Programmers and Systems Analysts:

THE QUEST FOR THE TOP JOB.

— and why we can find it for you better than you can!

Do-it-yourself, you've built an enviable track record of growth positions. And you feel you may be ready for the big leap to a Number One, or to somewhere in that rarefied area near the top of the pyramid.

Is that any reason to consider Quest as your "business manager?"

It is the best reason. Because:

- Quest is up to the minute on top level openings at top computer companies, local and national.
- Quest will advise you of the salary you can command with demonstrated authority and objectivity.
- Quest introduces you as a VIP, paving the way and arranging only the appointments that you approve in advance.
- You sign no contract with Quest; you pay no fees to Quest. Our corporate clients take care of that.

If you feel you're ready for a top job, or one within striking distance of the top, call toll free or write us without obligation.

(800) 821-7700, Ext. 114

QUEST SYSTEMS INC®

"Computer Industry Placement Specialists Since 1968"

6400 Goldsboro Road, Dept. 43, Washington, D.C. 20034 • (301) 229-4200
Baltimore: (301) 788-3500 • Philadelphia: (215) 265-8100 • Atlanta: (404) 522-7764

REUTERS REUTERS REUTERS

Put yourself in a better position... in **COLORADO!**

Join one of the fastest growing companies anywhere, and make a career move with meaning for your future.
Storage Technology Corporation is the world's largest manufacturer of high density tape data storage equipment and a major manufacturer of disk subsystems. We have a rapid, stable growth that gives you greater opportunity for advancement.

Listed below are a few of the immediate openings in our Disk/Systems Division:

Hardware/Software Engineers

Positions available on new disk drive product and system product development programs for the following experienced engineers:

Mechanical Engineers

• Head/Disk Assembly Hardware Design • Packaging Design
• Vibrations: Analysis & Experimental

Head & Disk Engineers

• Mechanical & Electrical Engineers • Head/Arm Assembly Design
• Head/Disk Characterization (Mechanical/Electrical)

Recording Engineers

• Read/Write Channel Design • LSI Design
• Coding Schemes/Recording Models

Servo Engineers

• Circuit Design • LSI Design

Logic Engineers

• Logic Design • LSI Design • Microprocessor Applications

Diagnostics Engineers

• Microcode Applications • Subsystem Experience

Power Systems Engineers

Technicians

• All Disciplines Shown Above

Advanced Manufacturing Engineers

• Process Design & Implementation • Testing Design & Implementation
• Tooling Design & Implementation

Engineering Management

• Several Positions Open • Prior Management Experience Required
• Directly Related Experience Required

Software Development Engineers

• DOS/VS Internals • IBM SYSGEN • Diagnostics
• CAD Development

STC offers an excellent compensation package including health and insurance benefits, stock purchase plan, and much more. For immediate response call Rick Baldacci TOLL FREE at 1-800-525-2940, Ext. 5316, or send your resume to his attention at
STORAGE TECHNOLOGY CORPORATION, Dept. MMS 1/2, MD#29, 2270 South 88th St., Louisville, CO 80027.
We are an equal opportunity employer.

STORAGE TECHNOLOGY CORPORATION
Fulfilling the promise of technology.

Precision Mechanism Engineering Openings

The continued growth and development of Tektronix products has created several positions for senior electro-mechanical engineering professionals with our hard copy product design group. If you are ready for a career step-up and find one of the following positions relevant and interesting, we would like to hear from you.

Electro-mechanical Component Engineering Manager

Manage a multi-discipline design team working with electro-mechanical graphic hard copy products. Be a key contributor to the product planning process. You must be able to develop and adhere to product design schedules, and work closely with manufacturing in getting new products introduced. Five to ten years' experience in mechanism-intensive product design is desired.

Senior Electro-mechanical Component Engineer

The successful candidate will be member of a multi-disciplined team and perform the following functions: develop the mechanical architecture of graphic hard copy products and major portions thereof, provide documentation and tolerancing of precision mechanisms, and communicate details to others involved in design activity to insure buildable parts. Five years' experience in mechanism and paper transport design with strong analytical skills, and a BSME or higher equivalency are desired.

Salary is open. Benefits include liberal educational support, insurance and profit sharing programs.

Tektronix, Inc., a Fortune 500 Company, develops, manufactures and markets internationally recognized hard copy units, interactive digital plotters and related computer peripheral equipment. Located near Portland, Oregon we are within a two-hour drive of the mountains and ocean beaches. The close-by natural playgrounds and the City of Portland provide a variety of recreational and cultural interests.

If you feel confident that you have the background for one of these positions, please send a detailed resume and salary history to Gene Lambird, MS Y6-010, Tektronix, Inc., P.O. Box 500, Q-30, Beaverton, Oregon 97077, or call (800) 547-1164.

An equal opportunity employer m/f/hc.

Tektronix®
COMMITTED TO EXCELLENCE

Hardware/Software Engineers

Our growing Digital/Data Group has a need for experienced engineers knowledgeable in the applications of Microprocessors. Skills in digital signal processing (FFT, CVSD, BIT Slice) are needed. Also, the application of Microprocessors to the adaptive control of radios and systems is a requirement. Qualified electrical engineers with 2 or more years experience, interested in joining a dynamic, growing team should contact T. Joseph Daley, Chief Engineer, **Harris Corporation, RF Communications Division,** 1680 University Avenue, Rochester, New York 14610, (716) 244-5830 EXT 3328.

An Equal Opportunity Employer M/F

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 Walt Loescher, BEALL PERSONNEL, P.O. Box 4006ED, Anderson, SC 29622

Discover The Nation's Leading Region For DIGITAL ELECTRONICS

Discover Scenic New England

TELECOMMUNICATIONS to 40K

Design & Support enhancements to X.25 Level III Protocol. Write implementations of the CCITT X.3 and X.29 standards, which will allow an operating system user to access public data networks. Write low-level queing routines for future communications projects. Provide support for synchronous and ring protocols.

MICROPROCESSOR/FIRMWARE DEVELOPMENT to 36K

Become a member of a team developing the next generation of Micro-Processors! Bit Slice Architecture, Real Time, I/O Drivers, Communication Protocols enabling a multi-task environment.

SYSTEMS DEVELOPMENT to 38K

Team Leader developing assemblers, linkage editors, loaders and compilers for Intel 8085 and 8086 based minicomputer/word processing system. Pascal utilized as a microprocessor development language.

DATACOMM PROJECT ENGINEER to 38K

To supervise small group responsible for developing next generation communications hardware. Experience with 16 bit micros, high speed modems, TDM/FDM multiplexers and active filter design are essential. Position reports to V.P. of R & D and requires 10% travel for vendor evaluation and marketing support.

CALL RON STEARN COLLECT
(617)742-1950 or submit resume. Available until 8 p.m. E.S.T.

Gray and Steele Associates, Inc.

240 Commercial Street, Boston, MA 02109
CLIENT COMPANIES ASSUME FEES AND RELOCATION

We know every turn in the job search maze

You could be caught in a dead end job. Or you could wander through a confusing maze of professional opportunities. **OR** you can let us chart a direct course toward your professional goals.

Talk to the experts at Wallach. We've been successfully recruiting professionals like you for over 15 years. Our client companies pay all fees, interview and relocation costs and you get the free benefits of our in-depth knowledge of hundreds of potential employers and our expert counseling and negotiation abilities.

Nationwide opportunities include technical/management consulting, project management, R&D, test and systems evaluation in the fields of Communications, Satellites, Weapons, Intelligence, Computer, Energy, and Aerospace systems. Specific skill areas include:

- **Software Design**
- **Communication Networks**
- **Telecommunications**
- **Minicomputers**
- **Mathematical Analysis**
- **Signal Processing**
- **Digital Systems**
- **Microprocessor Design**
- **Systems Architecture**
- **Applications Programming**
- **Command & Control**
- **Systems Programming**
- **Computer Graphics**
- **EW/SIGINT/ELINT**
- **MIS/OPs Research**
- **Diagnostics**

Puzzled by a maze of career options? Outsmart the maze with a professional guide from Wallach. If you currently earn over $22,000, we can find a better job—the right job—for you! Get started today, send your resume in confidence to: Perri Reeder

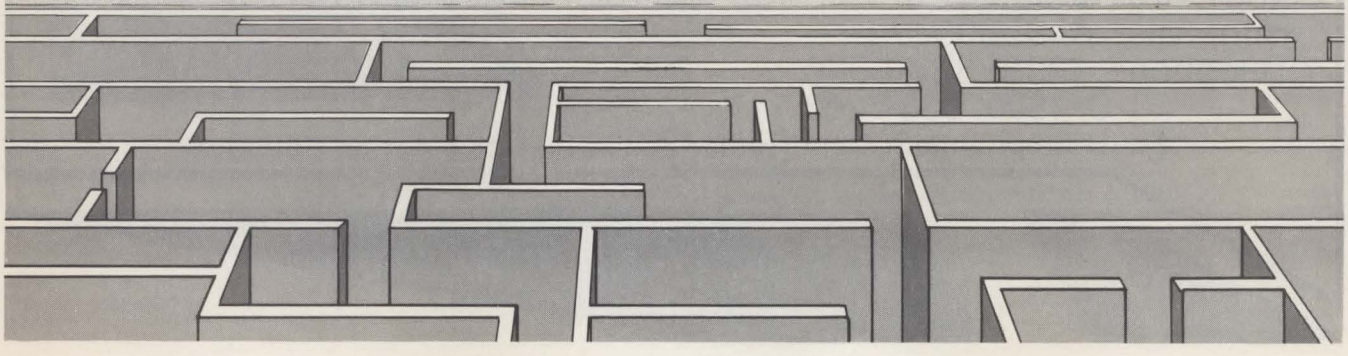
WALLACH
associates, inc.

1010 Rockville Pike, Box 6016
Rockville, Maryland 20852
(301) 762-1100

Professional Employment Consultants

Wallach ... Your career connection

Equal Opportunity Employer Agcy.



AVCO SYSTEMS
AVCO PEOPLE
A PRODUCTIVE RELATIONSHIP

The rapidly growing AVCO ELECTRONICS DIVISION is a successful division of the billion dollar AVCO CORPORATION. AVCO's people have worked on a variety of projects, including the design and installation of the world's largest and fastest real-time computer data acquistion network systems and the largest hierarchal industrial test system. AVCO ELECTRONICS DIVISION is seeking engineers for various assignments. The varying nature of projects that we design, develop, and manufacture requires that we find that effective combination of technical know-how and "hands-on" experience that will get the job done. AVCO wants to give you stimulating work while producing quality systems.

SYSTEMS HARDWARE ENGINEERS

State-of-the-art techniques give us an edge in the highly competitive field of Computerized Control and Data Acquistition. AVCO has immediate openings for systems engineers with three years experience in digital logic design and mini-computer interface.

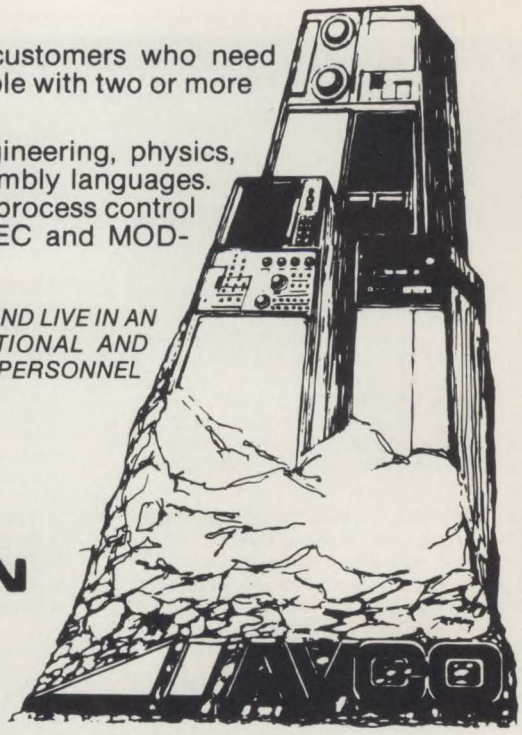
A BSEE is required as well as experience in writing proposals to technical specifications and estimating engineering cost.

SYSTEMS SOFTWARE ENGINEERS

State-of-the-art techniques are required by our customers who need custom systems for their application. We need people with two or more years of experience in scientific applications.

Requires a degree in electronics, mechanical engineering, physics, or math and a background in FORTRAN and assembly languages. Programmer/Analysts need experience in real-time process control systems. Distributed processing experience on DEC and MOD-COMP equipment is desirable.

COME TO THE CITY BETWEEN THE MOUNTAINS AND THE RIVER AND LIVE IN AN UNBEATABLE SUNBELT COMMUNITY WITH MULTI-RECREATIONAL AND CULTURAL DIVERSIONS. FOR CONSIDERATION, CONTACT THE PERSONNEL MANAGER.



AVCO
ELECTRONICS DIVISION
4807 Bradford Drive
Huntsville, Al 35805
Telephone: (205) 837-6500
Or (800) 633-7202

Equal Employment Opportunity and Affirmative Action Employer

Advertisers Index

Advanced Digital Products 58, 175
Alpha Data 34
Altos Computer Systems 92
American National Supply Corp. 94
Ampex MPD 134
Anadex 151
Apple Computer 157
Archive 12
AVCO .....Career
Axiom 124

Baxter Reynolds .....Career
Beall Assoc. of Anderson .....Career
Beall Assoc. of Macon .....Career
Beehive International 25
Braegen Corp. 88
Byte Industries 178

Cahners Publishing 185
Charles River Data Systems, Inc. 37
C. Itoh Electronics 4
Cobar Inc. 48AB
Codata Systems Corp. 170
Columbia Data Products 136
Compiler Systems, Inc. 139
Compumart Corp. 94
Computer Automation 28-29

Data General 56-57, 81
Data Machines International 144
Data Printer 38
Dataproducts 44-45, 106-107
Dataram 140, 180
Dataroyal 169
Datasouth Computer Corp. 161
Datasystems 48
Data Systems Design 2, 132-133
Delta Airlines 146
Diablo 167
Digital Associates 164
Digital Equipment Corp. 123
Digital Pathways 120
Documation Inc. 52

Epson America 80
Ex-Cell-O Corp. 18-19
Expandor Inc. 168

First Computer 9
Floating Point Systems, Inc. 115
General Electric 165
GML Information Services 172
Gray & Steele Assoc. .....Career

Hewlett Packard 49-51
Harris Corp. .....Career
Human Designed Systems, Inc. 179

Ibex Computers 160
Infoscribe 27
Infotron Systems Corp. 15
Integral Data Systems 126
Inmac 40-41
International Data Services 36
Intersil 118

Jefferson Electric Co. 74

Kennedy Co. C2
Kierulff Electronics 31

Leading Edge Products 192
Lear Siegler, Inc. 8
LorTec Power Systems 182

3M Company 43
3M Static Control Systems 30
Malibu Electronics Corp. 109
Mannesmann Tally 96
MDB Systems, Inc. 155
Megatek Corp. 7
Micom Systems, Inc. C4
Micro Data BaseSystems, Inc. 79
Micro Focus 71
Micro Five Corp. 171
Mini Micro Systems 173
Monolithic Systems Corp. 22
Moore Business Forms 131
Morrow Designs 148
Mostek 91
Motorola Semiconductor 10-11
MTI 176

NEC Information Systems 35
Nepcon West '81 181
NCR .....Career

Okidata Corp. 77
Ontel Corp. 55

PEBX, Inc. 72
Peritek Corp. 122
Perkin-Elmer Corp. 87
Phoenix Digital Corp. 59
Point 4 Data Corp. 145
Practical Automation 154
Prime Computer 141
Printronix 154, 156, 158

Quentin Research 160
Quest Systems, Inc. .....Career

Ramtek 147
Reuthers Ltd. .....Career
RSVP Services .....Career

SaRonix 156
Scientific Micro Systems 177
Shugart Associates 82-83
Soroc 16
Sperry Univac 32-33
Star Micronics, Inc. 180
Storage Technology Corp. .....Career
Stromberg-Carlson .....Career
Systems Engineering Laboratories .. 111

TEAC 166
Tec, Inc. 114
Tektronix .....Career
TeleVideo, Inc. 159
Telex Corp. 43
Texas Instruments 1, 142, 153
Timeplex Inc. 73
Transaction Technology, Inc. .....Career
Transduction Ltd. 95
Transnet Corp. 162
Trilog 182

United Systems Corp. 150

Vector Graphic 174
Versatec, a Xerox Company 63
Victor Data Products 152
Virtual Systems 36
Visual Technology 121

Wallace Assoc. .....Career
Wespercorp C3
Westrex OEM Products 158
Wild Hare Computer Systems, Inc. ...183
Wilson Laboratories, Inc. 163

See pages 186-190 for Career Opportunity Advertisers

This index is provided as an additional service. The publisher does not assume any liability for errors or ommissions.

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

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

DENVER
John Huff,
Regional Manager
270 St. Paul Street
Denver, CO 80206
(303) 388-4511

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
Dorset House,
Stamford Street
London, SE1 9LU England
(01) 261-8498

Career Opportunities
Lynn George
Recruitment Advertising Director
Peggy Gordon
Recruitment Advertising Manager
1200 Summer St., Suite 307
Stamford, CT 06905
(203) 327-6772

IF YOU CAN WAIT A MINUTE, WE CAN SAVE YOU $1,000.

With the Starwriter™ Daisy Wheel 25 cps printer from C. Itoh.

A business letter, written on a 45 cps word-processing printer, might take about two minutes to print.

With the Starwriter, it might take closer to three.

The typical 45 cps printer retails for about $3,000.

But the Starwriter retails for about $1,895—thus saving your customer about $1,000.

And therein lies the biggest difference between the Starwriter and the more expensive, daisy wheel printers.

The Starwriter comes complete and ready-to-use, requiring no changes

in hardware or software. It uses industry-standard ribbon cartridges, and it's "plug-in" compatible to interface with a wide variety of systems, to help lower system-integration costs.

Using a 96-character wheel, it produces excellent letter-quality printing on three sharp copies with up to 163 columns, and offers the most precise character-placement available, for outstanding print performance.

C. Itoh's one-year warranty:

3 months on parts and labor, plus 9 succeeding months on parts—supported by one of the best service organizations in the industry.

It's in the Leading Edge Inventory Bank:

Our in-stock, ready-to-ship, warehouseful of popular computer products—from floppy disks to printers to modems—which you can "withdraw" within 24 hours. Simply by picking up the phone. Which means you can use our space, and our money, to warehouse your product—and still be assured of having exactly what you need, exactly when you need it.

CALL TOLL-FREE 1-800-343-6833

In Massachusetts, call collect (617) 828-8150.
"Withdraw" now, and your goods will be on their way within 24 hours.

LEADING EDGE.

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

CIRCLE NO. 125 ON INQUIRY CARD

You don't get the lion's share of the market by pussyfooting around.

You get it by building the most reliable tape and disc controllers available. Our very first production units built in 1975 are still going strong.

Wespercorp controllers work, right from the moment they're installed.

That's because we thoroughly test and document the performance of all of our controllers under actual operating conditions before they leave the factory.

You get it by building one of the best service organizations in the business.

Should you ever need service, we'll be there fast. Anywhere in the world. We even fly our own airplane, so you won't have to wait.

Wespercorp controllers fit DEC (LSI-11, PDP-11) and Data General (NOVA and Eclipse), and Perkin Elmer (Interdata) computers. We can fill orders in 30 days ARO. Sometimes even faster.

Get the complete story on our entire line. Call or write us today.

Wespercorp, King of the Jungle, 14321 Myford Rd., Tustin, CA 92680.
Ph. (714) 730-6250.

WESPERCORP™
Number 1 in controllers.

Multidrop co[illegible]unications for minicomputer users. Save lines, save modems, save money.

If you're supporting asynchronous dumb terminals remotely on your minicomputer system, you're probably resigned to the high cost of those point-to-point leased phone lines. It's the price you pay for using low-cost terminals, right?

Wrong! With MICOM's unique Micro900 Multidrop Concentrator, you can multidrop those dumb terminals at several different remote locations, singly or in clusters, and share a *single* multipoint telephone line. You can slash your telephone bill immediately *without special software.* What's more, the Micro900 provides automatic retransmission-on-error to ensure *error-free* data transmission on the multidropped telephone line. It is ideally suited for use with DEC, Data General, Hewlett-Packard, or any other available minicomputer system.

If the Micro900 sounds too good to be true, so did our point-to-point Micro800 Data Concentrator, the single location cluster controller for dumb terminals. Yet more than 20,000 Micro800's are already in service, installed by the user as painlessly as plugging in a terminal. And for added convenience, we now offer multidrop and point-to-point versions of our Micro8000 Concentrator Modem which combines both concentrator and high-speed modem in a compact low-cost unit.

So if you use dumb terminals, but you want to enjoy inexpensive state-of-the-art communications efficiency, right down to the last drop, send for complete details of the Micro900 today . . .we *know* you'll love it.

Is the cost of leased phone lines becoming a real grind?
For multidrop lines with dumb terminals, try our Multidrop Concentrator...
the perfect economy blend.
Does the cost of multidrop terminals leave a bitter taste?

MICOM™ MicroComputers for DataCommunications™

MICOM SYSTEMS, INC.: 95[illegible]e. • Chatsworth, CA 91311 • Telephone (213) 882-6890 • TWX 910/494-4910
Regional Sales and Servic[illegible]iness Center • 1004 W. 8th Ave. • King of Prussia, PA 19406 • (215) 337-4855
Regional Offices: Atl[illegible]stor[illegible]) 235-8870 • Chicago (312) 823-9330 • Dallas (214) 258-0774
MICOM-BORER [illegible]ading, Berkshire RG20JT, England • (0734) 866801 • Telex 847135

[illegible]rom these stocking reps...

[illegible]00 • **Arkansas:** (214) 620-1551 • **California:** Anaheim (714) 635-7600/Lodi (209) 334-1961
[illegible]7-8070 • **Connecticut:** (203) 226-4281 • **Delaware:** (609) 779-0200 • **Florida:** Coral Springs
[illegible]aii: (808) 261-3751 • **Idaho:** (801) 466-6522 • **Illinois:** (312) 255-4820 • **Indiana:**
[illegible]317) 846-2591 • **Louisiana:** (800) 327-6600 • **Maine:** (617) 235-5520 • **Maryland:**
[illegible]nnesota: (612) 425-4455 • **Mississippi:** (800) 327-6600 • **Missouri:** Independence
[illegible]5-5850 • **Nevada:** (714) 635-7600 • **New Hampshire:** (617) 235-5520 • **New Jersey:**
[illegible]Las Cruces (505) 524-9693 • **New York:** East Aurora (716) 655-4322/Loudenville
[illegible]3070 • **North Carolina:** (800) 327-6600 • **North Dakota:** (612) 425-4455 • **Ohio:**
[illegible] 224-3145 • **Pennsylvania:** East (609) 779-0200/West (412) 892-2953 • **Rhode**