Mini-Micro Systems A CAHNERS PUBLICATION A CAHNERS PUBLICATION SEPTEMBER 1980



A FLOPPY-WINCHESTER MARRIAGE

Integrating corporate networks

New from Kennedy

Model 6809 Data Streamer™

Kennedy does it again. Data Streamer is ideal for Winchester disk drive backup where fast starting and stopping is not required. Designed to emulate the performance of the IBM 8809, Data Streamer has a wide range of features:

- Tape drive includes built-in industry standard formatter it's a compact package.
- · Contains only four moving parts-hence a much higher MTBF than normal tape drives.
- Streams (read/writes) at 100 ips or, in start/stop mode,
- Data Streamer can be mounted in three ways—vertically in rack, horizontally in drawer or horizontally in a low boy console.

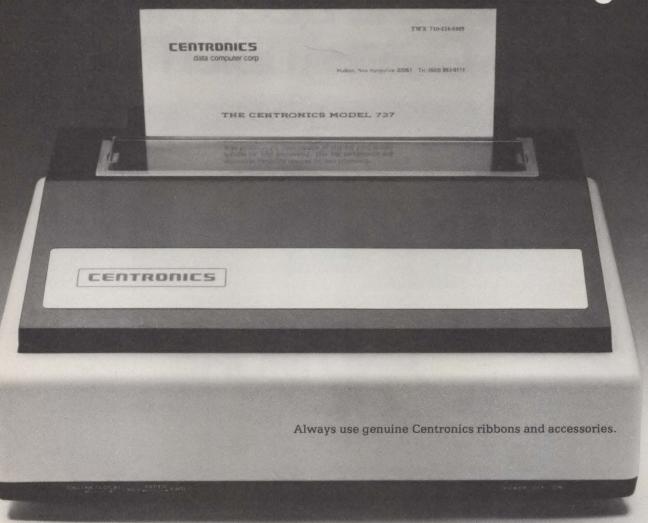
Model 6809 has been designed and built with all the innovative features and reliability that Kennedy products are known for. Additionally, Model 6809 is much less expensive than traditional tape transport/formatter combinations. It's the ideal answer for large capacity disk drive backup.



KENNEDY · QUALITY · COUNT ON IT

CIRCLE NO. 1 ON INQUIRY CARD

CENTRONICS MODEL 737: The Advantage for Low Cost Word and Data Processing



The flexibility and print quality OEMs need is here now. The new Model 737 is the small business printer versatile and reliable enough to meet almost any systems requirement. It's the first low-cost printer to offer print quality suitable for text processing plus the performance and applications flexibility required for data processing and electronic mail. And this latest Centronics breakthrough is priced under \$1000 in the U.S.A.

Outstanding Print Quality

Model 737 is the first small business printer to offer correspondence quality printing. 18 x 9 dot matrix provides high-quality characters with true descenders as well as underlining. Proportional spacing, the ability to justify right margins and serif typeface makes the 737 ideal for text processing applications. Standard business data processing spacing of 10 and 16.7 characters per inch are also resident in the 737, allowing for applications ranging from letters to aged accounts receivable reports. The steel platen assures crisp, clean print impression.

Unexpected Features

Leave it to Centronics to have some surprises in the new Model 737. You get the ability to print subscripts and superscripts. Especially attractive to OEMs requiring superior print appearance and/or chemical or mathematical applications. Centronics gives you its field proven 700 Series printhead, stepper motor paper drive, fewer moving parts, microprocessor electronics and high volume

production to achieve reliability that you wouldn't expect in a compact, low-cost printer.

The 737 is quiet. An optional acoustic cover makes it ideal for office environments.

Pick Your Paper

Run letterhead paper for correspondence, roll paper for general information, or fan-fold paper for standard data processing (payroll, billing, inventory, etc.). You can, with the 3-way paper handling ability of the Model 737.

The Printer of the Future... Today

Never before has one printer offered such high quality, reliability, and applications flexibility at such low cost.

Another workhorse in the Centronics 700 Series is the 730, if you don't need the correspondence quality of the 737. Delivers 100 c.p.s. at even greater savings.

Why Wait?

The new Model 737 is now available for delivery. For more information: call (603) 883-0111, or contact any of our 15 U.S.A. or 9 international sales offices. Centronics Data Computer Corporation, Hudson, New Hampshire 03051.

All Centronics products are supported by the largest worldwide service network of any independent printer company.

centronics Printers ... the advantage

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 51/4-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.

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CIRCLE NO. 3 ON INQUIRY CARD



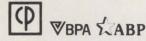
The DSD 880 mass-storage subsystem achieves economy and high performance with a novel system architecture: the first combination Winchester-floppy drive. See p. 89. Photo by Bob Weaver, Photographic Alliance; designed by Pinne, Garvin and Hock; courtesy of Data Systems Design.



DSD 880 deliveries begin Page 15



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A video bandwidth of 30 MHz and a 1200-line resolution make this new CRT monitor the brightest

and sharpest you can get.

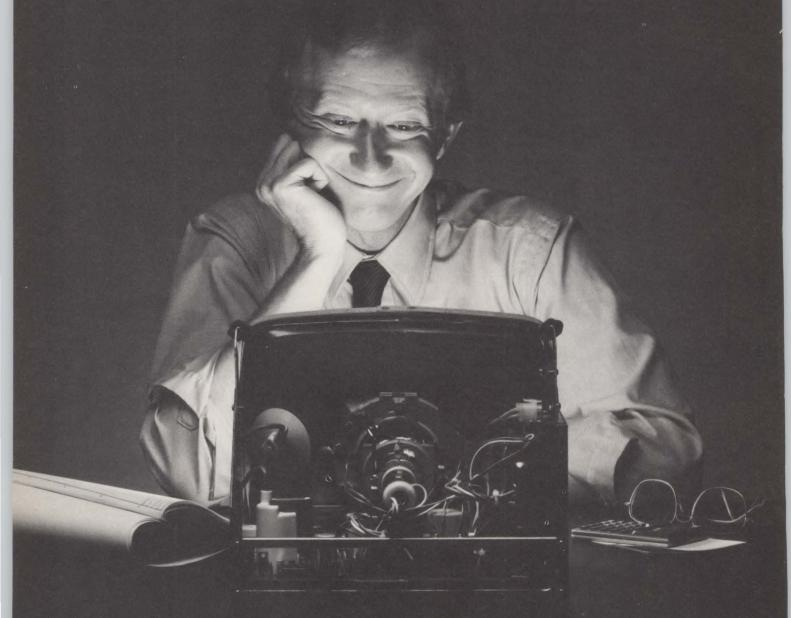
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The high performance and low price offered with this new CRT monitor give you all you need to really outshine your system's competition. For complete information contact your nearest C. Itoh representative or C. Itoh Electronics, Inc., 5301 Beethoven Street, Los Angeles, CA 90066; Tel. (213) 390-7778;

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Breakpoints

IEEE READIES 32-BIT MICROCOMPUTER BUS STANDARD

Encouraged by the success of its 488 instrumentation bus standard, the Institute of Electrical and Electronic Engineers (IEEE) is forging ahead with plans to create a backplane bus standard for microcomputer systems. Functional specifications for the proposed standard, designated P896, are "95 percent complete," says Andrew Allison, chairman of the IEEE backplane subcommittee, and he expects a draft specification to be published by yearend. Standards have a way of becoming obsolete before they're adopted, but Allison doesn't think this will happen with P896. He points out that the proposed standard supports 32-bit address and data paths—enough width to accommodate the 32-bit microprocessors now on the drawing boards at Intel and other major semiconductor houses. In addition, the processor-independent bus will support clock rates as high as 20 MHz and as many as 64 bus masters under a decentralized control scheme—the first such scheme available on a standard bus. Although the draft specification will enable companies to get a head start on building P896-based systems, widespread acceptance is likely to be slow. Indeed, the proposed standard will not be presented to the IEEE for adoption until mid-1981, Allison says.

3M EYES 8-IN. WINCHESTER MARKET

3M has joined those companies eyeing the 8-in. Winchester-disk drive market, which, after a slow start, is expected to grow from an estimated 102,000 drives in 1980 to 544,000 in 1984. Those drives are geared toward storage requirements of less than 100M bytes, according to one industry source. Although a company spokesman declines to disclose specifications or price for the unit, he says it is a compact Winchester drive developed by 3M that is under field evaluation at selected potential customer sites. He adds that 3M wants to advance state-of-the-art magnetic memory technologies, and toward that end will support the proposed ANSI interface standard—X3T9.3. One industry observer notes that although some companies are considering adopting that standard, there has been no demand from users. Only a handful of manufacturers are now shipping 8-in. Winchesters, and none offers the proposed standard. If tests go well, 3M is expected to announce a product in early 1981.

APPLE WILL BUILD DOUBLE-SIDED FLOPPIES

Look for Apple Computer, Inc., to start building 5¼-in. double-sided, double-density floppy-disk drives for use with its Apple III system. Tooling to build the new hardware has already been delivered to the Cupertino, Calif., personal computer maker, say a number of sources, and first hardware is scheduled to be delivered in prototype form by year-end. Where the read/write heads for the new hardware will come from remains unclear, however. Several sources claim that Apple intends to bring this activity in-house, and that it is now evaluating prototype designs. Others say that outside head vendors may be involved, including Information Magnetics Corp. (INFOMAG). Everett Bahre, chairman of INFOMAG's parent company, Computer and Communications Technology, Goleta, Calif., confirms that his company will reenter the merchant floppy-disk-drive head market by the fourth quarter of this year, but he has no comment regarding any dealings with Apple. Mike Markkula, board chairman at Apple, confirms that a double-sided 5¼-in. program is under way at the company, and says he hopes to see hardware "within the next 12 months." Markkula has no comment on where his company's read/write heads will come from, however.

FINDING A CURE FOR THE 'JAWS SYNDROME'

Double-sided floppy-disk drives tend to suffer from excessive media wear and head-failure rates—a phenomenon coming to be known in industry circles as the "Jaws Syndrome." The name derives from the problem's source: the vise-like dual-head mechanisms used in double-sided drives, which can chomp down on a diskette with excessive force, causing damage to both diskette and heads. Now, however, a Japanese manufacturer claims to have come up with a cure for the syndrome. NEC Information Systems, Inc., uses an air shock absorber to cushion head blows in its new FD1160 "Soft-Touch" drive. The result: Media life (3 million

Breakpoints

passes) and head MTBF (15,000 passes) are more than double those available with competitive drives, according to John Cooper, NECIS marketing vice president. The drive, originally developed by NECIS's parent company, Nippon Electric Co., for use in its own systems, is being offered as an OEM product to the U.S. market. It is available immediately and will sell for \$740 in 100-unit quantities.

SHUGART TECHNOLOGY TO CHANGE NAME

Watch for a name change at Shugart Technology early next year. The change should eliminate any lingering confusion between the Scotts Valley, Calif., supplier of 5¼-in. Winchester-disk drives (MMS, April, p. 79), and Shugart Associates, the seven-year-old Sunnyvale, Calif., Xerox subsidiary. Shugart Technology was the first to market a micro-Winchester; Shugart Associates is the leading OEM supplier of floppy-disk drives. Although both firms were co-founded by Alan Shugart, there is no other connection between them. The change will not come without involving the legal staffs of both firms, says one industry source. Reportedly, Shugart Associates has formally requested that the new firm change its name. As far back as the last National Computer Conference in Anaheim, it had asked its sales staff to log in any customer requests for 5¼-in. Winchesters. A source at Shugart Associates confirms that the company had received "a lot of those calls." He feels "the similarity between the two names is very confusing in the market." A spokesman for Shugart Technology notes that some customers have called his firm requesting information on floppy-disk drives. "We gave the callers the number of Shugart Associates." Several new names reportedly are under consideration at Shugart Technology, but none has been selected.

TANDON, REMEX CROSS-LICENSE HARDWARE

Sirjang Lal "Jugi" Tandon may soon be jumping into the 8-in. floppy-disk drive market. According to one source, the president of Tandon Magnetics Corp., Chatsworth, Calif., plans to take out a license on the double-sided 8-in. hardware now sold by the Remex Division of Ex-Cell-O Corp., Irvine, Calif. In exchange, Remex will be granted a license to manufacture Tandon's patented read/write floppy-disk-drive head assembly in-house for its own use. Remex is already one of Tandon's largest customers for these assemblies, and reportedly is now setting up additional production facilities to make the components. In addition to selling these read/write heads on the merchant market, Tandon Magnetics also offers a line of double-sided 5¼-in. floppy-disk drives. Jugi Tandon notes that the deal between the two companies "makes sense," but stresses that nothing has been signed. "It's a matter of deciding whether or not we want to take on additional products," he explains. "Right now we're trying to get out our hard disk (a 5¼-in. Winchester—MMS, April, p. 27), and there are only so many things we can do." Chuck Ouellette, vice president of marketing at Remex, has no comment on the report.

RAYTHEON UPGRADING MINICOMPUTER-BASED NETWORKING SYSTEM

The introduction last month of the hastily developed RDS-7500 processor, which supports multiprocessing in Phase II of the RAYNET minicomputer-based networking system, appears to be only an intermediate step by Raytheon Data Systems' minicomputer/communications division to enhance that system. The upgrade, spurred by user demand for more networking capabilities, is accomplished by changing four or five boards in the earlier RDS-500 processor at a cost of \$10,000 to \$20,000. The system incorporates one Zilog Z80 microprocessor to control each line, and bit-slice architecture in the multiplexor. The company is exploring the possible use of a more powerful microprocessor in about 18 mo. It has evaluated the Motorola 68000, among others.

IEEE STUDIES THREE MICROPROCESSOR STANDARDS

The IEEE's Computer Society has established three new committees to develop three new standards. First, a microprocessor operating system standards group will work on a software bus that will enable incompatible operating systems to talk to each other. The second, a floating-point standards group, will develop an arithmetic standard that is independent of the base of the word the processor uses; i.e., binary, hexadecimal. The third subcommittee will develop a standard to present microprocessor benchmark data to users.



Imagine a computer-aided graphics system that interfaces directly to the mind's eye, that takes a designer's visual perception of his design and does everything but weld it together.

Manufacturing and Consulting Services, Inc. has done it with their AD-2000 software package...CAD/CAM software that does it all—from design to fully annotated drawings to complete numerical control tapes. It can even calculate and assemble a bill of materials for an entire project.

The visual interface that enables

the designer to communicate directly with the computer is a Megatek vector refresh terminal. Dr. Patrick Hanratty, MCS president, tells why.

"Megatek's refresh display is an extremely powerful tool for visualizing, manipulating, experimenting and altering design parameters.

"Megatek systems interface easily to a broad range of computers and enhance the engineer's feeling of direct interaction with his design."

Dr. Hanratty summarized his enthusiasm for Megatek

with this graphic

display of confidence:

"Customers for our software package can select any graphics terminal they want. A large percentage choose Megatek. Price/performance is the reason why. If I were going to put down dollars for a production refresh terminal, I'd put my money on Megatek."

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

MEGATEK/WHIZZARD

COMPUTER GRAPHIC SYSTEMS

CIRCLE NO. 5 ON INQUIRY CARD

LSI-11 DISC CONTROLLER.

10 intelligent hard disc and magnetic tape controllers offer LSI-11,* 11/2, 11/23, and PDP-11* single quad slot

compatibility with up to 60% power saving.

Only DILOG (Distributed Logic Corporation) exclusive automated design, common proprietary architecture and sophisticated bipolar µPs give you • all single board quad size products requiring no external power or chassis . . just a cable to connect the drive . . . you don't need anything else • high reliability • automated self-test including data base protect feature and indicator. And at cost savings of 50% or more.

LSI-11 MAGNETIC TAPE CONTROLLER, Model DQ 120, interfaces 4 industry standard reel-to-reel drives • emulates TM11* • handles 7 and/or 9 track NRZI drives to 112.5 ips • selectable DEC or IBM byte order formatting • data error checking • RT-11/RSX-11* compatible extended addressing to 128K words.

LSI-11 MAGNETIC TAPE COUPLER, Model DQ 130, interfaces dual density (NRZI/PE) formatted drives • emulates TM11 • handles up to eight 9 track 800/1600 bpi industry standard drives at speeds from 12.5 to 125 ips "streamer" mode capability • software or switch selectable density • RT-11/RSX-11 software compatibility

LSI-11 MASS STORAGE DISC CONTROLLER Model DQ 200, interfaces any two SMD flat cable interface compatible hard disc drives for up to 500 MB on-line storage • mix or match compatible Winchester, SMD or CMD • variable sector size • automatic media flaw compensation with bad sector flagging • optimized logical to physical unit mapping • implements Winchester fixed head option.

NEW LSI-11 SHUGART SA4000 WINCHESTER DISC CONTROLLER.

Model DQ 201, emulates DEC RK* runs drivers under RT-11 and RSX-11M* systems · compatible with 14.5 MB SA4004 or 29 MB SA4008 drives • automatic media flaw compensation.

Model DQ 100, interfaces 2.5, 5, 10

or 20 MB cartridge and fixed platter drives in combinations to 80 MB

 RKV-11/RKO5* emulator • handles front load (2315) and/or top load (5440) drives • automatic power fail/power down media protection • RT-11/RSX-11 compatible.

NEW LSI-11 EMULATING MASS STORAGE CONTROLLER, Model DQ 202. Cost effective interface of two 8 and/or 14-inch Winchesters, SMD or CMD hard disc drives without changing controller . . . 8 to 300 MB capacity RP emulator • automatic media flaw compensation.

PDP-11 MAGNETIC TAPE CONTROLLER, Model DU 120, emulates TM-11 and has same features as Model DQ 120 (LSI unit) • software compatible with RT-11, RSX-11, RSTS, IAS and MUMPS

NEW PDP-11 MAGNETIC TAPE COUPLER, Model DU 130, offers features of Model DQ 130 (LSI unit) • RT-11, RSX-11, RSTS, IAS and MUMPS software compatible.

PDP-11 DISC CONTROLLER, Model DU 100 includes features of Model DQ 100 (LSI unit) • RT-11, RSX-11, RSTS. IAS and MUMPS compatible • emulates RK-11

NEW PDP-11 EMULATING MASS STORAGE CONTROLLER, Model DU 202, offers same features as Model DQ 202 (LSI unit).

Write or call for detailed product performance information, OEM quantity pricing, stock to 30 day delivery or warranty data on these DEC 11 compatible products . . . or several soon to be announced new DILOG products. Distributed Logic Corp., 12800-G Garden Grove Blvd., Garden Grove, CA 92643 Phone (714) 534-8950

Telex: 681399 DILOG GGVE

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PDP-11° and LSI-11° **TAPE and DISK CONTROLLERS**



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First Computer Corporation, the world's leading DEC computer system integrator now distributes the complete spectrum of EMULEX Tape and Disk controllers for the PDP-11 and LSI-11 family of computers.

HARDWARE/SOFTWARE TRANSPARENCY

These microprogrammed, emulating Tape and Disk Controllers are fully software transparent to both the PDP-11 hardware and software. The use of these controllers protects you from the impact of future versions of the operating system software. They are so compatible you can plug them into your system and be up and running the standard DEC diagnostics and operating systems in minutes.

ADDED FEATURES

These controllers provide you with added features such as automatic selftesting, onboard pack formatting, and programmable bandwidth control at no additional cost.

DEC PDP-11 or LSI-11 family you are using or which type of storage device is required for your application. We can support 59 different drives from 13 different manufacturers.

HIGHEST QUALITY AND SUPER RELIABILITY

You can be assured of the quality and reliability of these Tape and Disk Controllers because First Computer Corporation specializes in PDP-11 and LSI-11 computer systems. components, and peripherials. Over the years our reputation was built on the quality and reliability of the products we sell. We continue to protect this reputation by selling only the very best.

SUPER FAST SERVICE

Because we are the largest system integrator specializing in PDP-11 and LSI-11 systems, components, and peripherials, First Computer Corporation can satisfy most of your Tape and Disk Controller requirements directly from our stock.

GUARANTEED SATISFACTION

Your satisfaction is fully guaranteed by First Computer Corporation. We believe in every product we sell. If for any reason these Tape and Disk Controllers do not meet your expectations, simply return them freight prepaid and insured, within 10 days of receipt and we will refund your money in full. First Computer Corporation backs each of these products with a full one year warranty.

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Authorized EMULEX Sales Representatives earn full commissions for orders filled by First Computer Corporation. Attractive Dealer discounts are available to all Authorized EMULEX Dealers.

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CIRCLE NO. 7 ON INQUIRY CARD

The intelligent disk architecture in STC 2700 Series Disk

STC's new 2700 winchester disk family combines the intelligence of a microprocessor, 64 Kbytes of RAM, and a high-speed bus interface to offer you a versatile new disk architecture. An architecture that can help you achieve new dimensions in system effectiveness. Relieve CPU overhead burdens. Slash interfacing costs, and more.

Yet, even without its advanced architecture, you'd still choose the 2700 disk family for its attractive price/performance and reliability values.

The 2700 family features formatted capacities of 39, 91 and 195 Mbytes, 27 msec average seek time, and an OEM price of less than \$5,000 (195 Mbytes). With a predicted 8000 hour continuous

operation MTBF, the 2700 will not just keep your customers happy--it will keep your warranty expenses low.

Powerful bus architecture for faster data rates and greater flexibility.

Gone are the speed and configuration constraints of serial, synchronous dataline interfacing. The 2700 disk family incorporates a high-speed, byte-parallel asynchronous interface, with internal serial/parallel conversion, to give you transfer rates up to 2 Mbytes/sec. The full handshake protocol and built-in dual ports support radial, daisy chain or intermixed configurations.

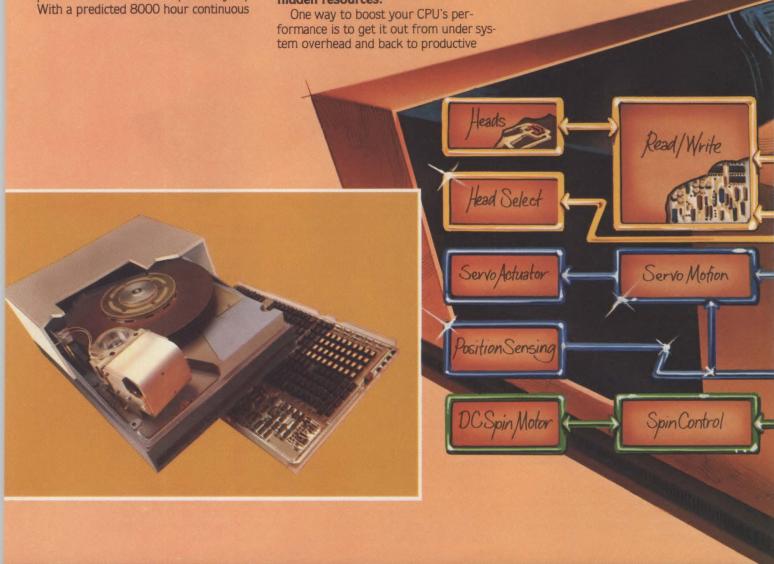
The μp can unlock your system's hidden resources.

computing. The on-board intelligence of the 2700 gives you that capability. Routines such as drivers, data management and utilities can be offloaded to the microprocessor, freeing the CPU and bus for other tasks. But that's only the beginning.

High-level software, including onboard editor and compiler, simplifies algorithm development for custom applications. And you can use the built-in RS-232 port to program right on the disk.

An intelligent controller in each drive. For free.

To help you get to the system level faster and easier, we placed most of the



of tomorrow is shipping today... Drives.

traditional controller functions within the 2700. This includes address mapping, defect management, error detection/error recovery procedures and all device-dependent functions. Since you now only have to build a low-cost interface adapter — your attachment costs are significantly reduced.

Low cost of ownership.

Fewer parts mean fewer failures. So the 2700 contains a minimum number of mechanical parts, only three of which move: spindle, actuator and power system fan. The microprocessor contributes to this simplicity by replacing all sequencing and servo logic with firmware.

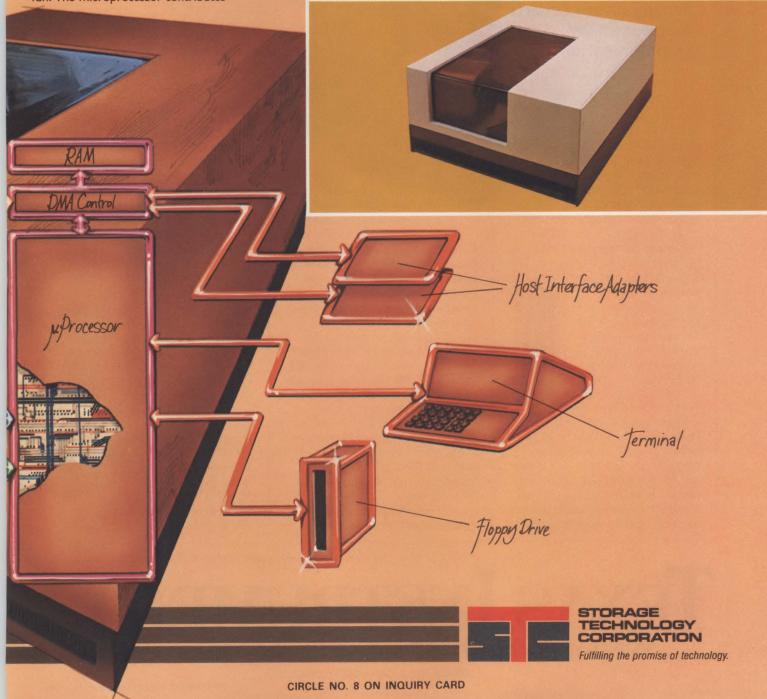
To eliminate scheduled maintenance, the 2700 dispenses with potentiometers. Dynamic adjustments are made internally under microprocessor control. And the 2700's closed-loop air system means no filter changes.

If there's ever a failure, internal diagnostics isolate the problem to one of three subassemblies: logic board, head/disk assembly or power system. And these components uncouple quickly

for fast replacement. All of this translates into high MTBF, low MTTR, to reduce your warranty and field service costs.

To learn more. . .

about tomorrow's disk architecture, today, contact OEM Marketing, Storage Technology Corporation, P.O. Box 6, Louisville, Colorado 80027. Or phone Frank Gunn at (303) 673-3051. In Canada: Ron Reardon, STC Ltd., 272 Galaxy Blvd., Rexdale/Toronto, Ontario M9W 5R8. Phone (416) 675-3350.



Rapid Transmit Authorities.

TI's Portable Models 785 and 787 Data Terminals are experts on interactive communications.

With TI's Silent 700* Models 785 and 787 Portable Data Terminals, you can put state-of-the-art technology right at the heart of your business. Featuring TI's unique dual-matrix thermal printhead, these innovative data terminals can minimize your communications costs with speedy 120 characters-per-second printing. Weighing

only 17-pounds each, the portable 785 and 787 can improve your application efficiency, wherever your work takes vou.

The Model 785 Portable Data Terminal combines speed with remote access capabilities. With the 785's built-in 300/1200-bps acoustic coupler, users are able to transmit and receive data using a standard phone and electrical outlet. Other standard features include automatic modem selection and compatible

speed selection to let you optimize your online communication time. The Model 787 Portable

Communications Data Terminal can handle your application needs with its cost-saving, built-in standard features. The 300/1200-bps direct-connect internal modem allows users to plug directly into a standard telephone data jack for greater communications flexibility. The 787 also features memory dialing and originate/automatic answer operations for additional time and cost savings.

For information retrieval, remote sales order entry, and a variety of other interactive applications, the Models 785 and 787 speed your communications from

coast to coast.

TI is dedicated to producing quality, innovative products like the Models 785 and 787 Portable Data Terminals. 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 factorytrained sales and service representatives, and TI-CARE†, our nationwide automated service dispatching and field service management information system.

If you would like more information on the Models 785 and 787 Portable Data Terminals contact the TI sales office nearest you or write Texas Instruments Incorporated, P.O Box 1444, M/S 7784, Houston, Texas 77001 or phone

(713) 937-2016. In Europe, write Texas Instruments. M/S 74, B.P. 5, Villeneuve-Loubet. 06270, France.



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CIRCLE NO. 9 ON INQUIRY CARD

Shugart Technology/TI deal may set specs for micro disks

The recent decision by Texas Instruments Inc. to second-source Shugart Technology's ST500—the first 5¼-in. Winchester-disk drive—represents a significant step toward market acceptance for the new hardware.

"The days of sole-sourced peripherals are coming to an end. Major OEMs will no longer commit to one supplier," claims Finis Conner, co-founder and executive vice president of Shugart Technology, Scotts Valley, Calif., which introduced the ST500 in May (MMS, April, p. 79).

According to Conner, the nonstandardization of small rotating memories is doing the industry a disservice. He refers specifically to the 8-in. Winchesters that have proliferated over the last two years. "Every time a new drive of this type is introduced, it represents a reinvention of the wheel," he maintains, "and the marketing efforts of the vendors of this type of hardware have suffered as a result."

Because Conner wants to avoid similar difficulties with the 5¼-in. drives, he is pushing for micro-Winchester standardization on many levels—even at the expense of his company's market share. "We anticipate that TI will be an active, aggressive competitor," Conner says. "But the customer will be assured that certain things are the same no matter whom he buys from."

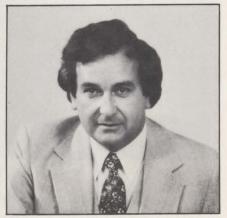
One standard he feels will be created as a result of the deal between the two companies is an industry-wide media size. Like Shugart Technology, TI will use disks that have an inside diameter of 40 mm and an outside diameter of

130 mm. These disks will be supplied by Dysan Corp., Santa Clara, Calif.

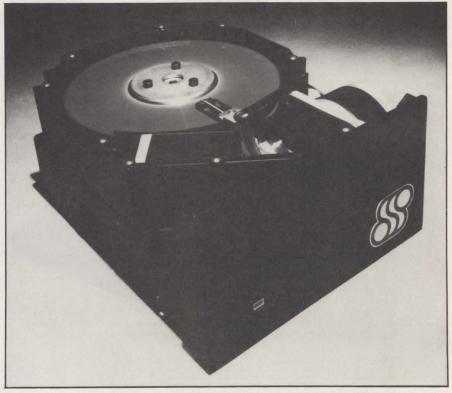
In contrast, disks with outside diameters of 200 mm and 210 mm are proliferating among manufacturers of 8-in. Winchester drives. The 200-mm size has been chosen by suppliers who want to make their hardware mechanically compatible with Shugart Associates' SA850 floppy-disk drive, which has become an industry standard. Manufacturers in this category include Micropolis Corp., Chatsworth, Calif., which offers a three-platter 45M-byte drive; San Jose, Calif.based Priam Corp. and Shugart Associates, the latter with a 5M- to 10M-byte SA1000. BASF and others,

however, have opted to adhere to the 210-mm size embodied in IBM's "Picollo" drive.

The agreement between TI and Shugart Technology is viewed by consultant Ray Freeman Jr., Santa Barbara, Calif., as unique and similar to the second-source practice of exchanging mask sets that is common in the semiconduc-



"The days of sole-sourced peripherals are coming to an end," says Shugart Technology co-founder Finis Conner.



Texas Instruments' decision to second-source Shugart Technology's ST500 5¼-in. disk drive may go a long way toward setting industry standards for the micro-Winchesters.



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tor industry. "I don't know of anyone else in the peripherals field that is second-sourced in this manner," he says. "The deal is more interesting and innovative than the product itself."

It isn't clear what TI plans to do with the ST500; TI policy precludes comment on such contractual arrangements, but another consultant believes that TI's primary intention is to use the drive in its own small systems. Andrew Roman, Roman Associates, International, Newark, Calif., says TI's DS990 microcomputer system is the first logical candidate to include the drive. Further, by securing TI as a "credible second source," Roman says, Shugart Technology "has an endorsement from one of the most powerful minicomputer/microcomputer marketers in the business" for both the hardware and the standardization it represents.

Roman doesn't think TI will be a competitive threat to Shugart Technology, at least initially, pointing out that TI'S OEM marketing organization is accustomed to selling full systems, "while the Shugart Technology people have experience with disk-drive OEM marketing that TI doesn't yet have."

Conner's push to homogenize the specifications for 51/4-in. Winchesters appears destined to extend to other hardware vendors planning to enter the market for small fixed-disk drives. "From the point of view of the OEM customer, it doesn't matter what size the disk itself is," maintains Sirjang Lal "Jugi" Tandon, president and founder of Tandon Magnetics Corp., Chatsworth, Calif. "It does, however, make things very convenient for the media makers." Nonetheless, Tandon says his company will accept the concept of standardized media dimensions, and will incorporate them into its line of 5M- to 6M-byte SA450-compatible 51/4-in. Winchesters, scheduled to be delivered in

evaluation quantities this month (MMS, March, p. 28).

Also leaning toward the standardization of 5¼-in. Winchesters is Shugart Associates, although no specific details of its product line, reportedly called the SA500, have been released (MMS, July, p. 11). A Shugart spokesman says that the company is stressing not only high-volume production of low-cost hardware, but also ease of integration of its product line into existing systems. "If standardization is what's beneficial to our customers, then that's what Shugart will do," he notes.

Shugart Technology is also working toward standardized controllers—another attempt to

avoid what Conner says are the pitfalls facing vendors pushing 8-in. devices. Working with Costa Mesa, Calif., semiconductor manufacturer Western Digital Corp., Shugart Technology has proposed a 5¼-in. Winchester controller that will be provided to any OEM who wants it. Both Shugart Technology and Western Digital may sell board-level products, Conner says, but marketing plans have not been finalized. Evaluation versions, using TTL logic and some custom LSI chips, will start to be shipped this month.

Meanwhile, shipments of the ST500 will begin this month on an evaluation basis to 25 OEMs, Conner says.

—John Trifari

8-in. Winchester shortage doesn't deter Data Systems

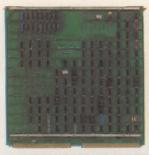
Although slow deliveries of 8-in. Winchester-disk drives have been plaguing some companies (MMS, July, p. 37), Data Systems Design does not anticipate such problems with its DSD 880. The Santa Clara, Calif., company began deliveries last month of evaluation units of the system—claimed to be the first 8-in. Winchester - floppy - disk storage system.

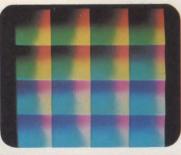
The DEC LSI-11-compatible system provides 8.5M bytes of on-line storage, using a Shugart SA1000 Winchester and an SA850 double-sided double-density floppy-disk drive managed by a DSD-designed controller (see "The DSD 880—a floppy-Winchester marriage," (p. 89). Including the controller and power supply, the system will cost \$7495 in single-unit quantities, with OEM discounts available.

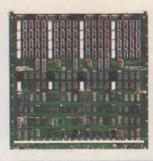
DSD sales vice president George Fink says the company has faced "no problems getting engineering quantities of Winchesters from Shugart (Associates)," and he does not foresee difficulties obtaining production quantities. "We carefully considered all sources of Winchester drives," he says, "and determined that Shugart would have drives available in quantity first." Sources at the Sunnyvale, Calif., disk-drive



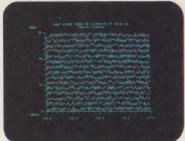
"We're more successful than our competitors think," says DSD co-founder Fink.







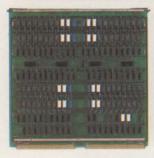


















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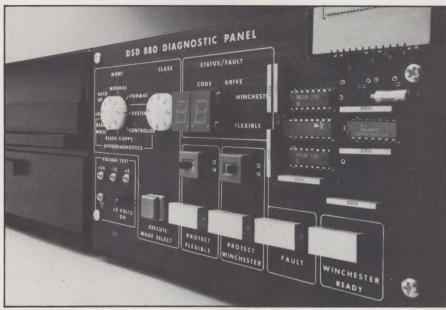
A Division of Genisco Technology Corporation

maker say the company is producing SA1000s at a rate close to 1000 a month, and it expects to produce a total of 20,000 this year.

The DSD 880 Winchester-floppy combo represents a departure from DSD's established floppy-disk expertise. Since its founding in a Berkeley, Calif., garage in 1975, the company has been supplying PDP-11- and LSI-11-compatible 8-in. floppy-disk systems. The product line has grown and now includes

both systems and controller cards. DSD shipped its first LSI-11 floppy-disk drive in 1976, and now, according to Fink, has 8500 systems in the field.

Fink and co-founders Richard Preston, president, and Dick Akers, vice president of engineering, have seen the company's sales double annually in its first five years. Last year's revenues amounted to \$10.1 million. "We're more successful than our competitors think," says Fink.



Data Systems Design has begun shipping evaluation units of its DSD 880, an 8-in. Winchester-floppy-disk storage subsystem.

Siggraph reflects growth in computer graphics market

Officials planning next August's Siggraph computer graphics show in Dallas are preparing for an even bigger and better event than July's gathering in Seattle, which drew 100 exhibitors. That was 20 more companies than exhibited last year in Chicago, and attendance was greater than had been expected.

Tony Lucido, co-general chairman of Siggraph '81, estimates that almost 6000 saw the Seattle show—2000 more than forecast. Lucido is a software engineer at

Intercomp, Inc., Houston. He will be assisted with next year's show planning by Douglas Green, a professor at Texas A & M University.

Sponsored by the special interest group for graphics of the Association for Computing Machinery and now in its seventh year, Siggraph is turning into an important outlet for companies interested in reaching the growing market for computer graphics equipment and software. "This was a high-level show," reports one marketing vice presi-

The 130-employee company does 75 percent of its business in the U.S., and 75 percent of that is OEM sales. Fink expects DSD's European business to grow, and he is considering a sales office in Germany or France. "We have quite a foothold in Europe," he says, attributing the success to the "top-notch group of distributors" DSD has assembled.

In the U.S., the company has set up an extensive network of sales representatives. Northern California and New England are served by DSD's own sales force.

The 880 is not the last hard-disk product from DSD. The company will continue to examine Winchester technology and associated backup requirements, Fink says. But he emphasizes the floppy disk's importance as a backup medium. He feels that ¼-in. tape can play a significant role, but stresses that there is little need for one-to-one backup of a disk provided via cartridge tape systems.

DSD will move to a new 65,000-sq.-ft. facility in San Jose, Calif., this fall. The current output of 50 systems a day will probably be increased by adding another production line.

—Larry Lettieri

dent of the Seattle meeting. "I was surprised to see attendees from all over the country—and the world."

Another first-time exhibitor admits that he was a bit apprehensive about the show at first, given the selection of Seattle as the host city. "I thought we'd see nothing but students and engineers from Boeing," he explains, "but I guess this industry doesn't care where it is."

Others also had high marks for the Seattle choice, although not necessarily from the point of view of the quality of the attendees. "Everything was the right size," noted one exhibitor, a veteran of May's overcrowded National Computer Conference in Anaheim. Anyone can build great performance into a micro. Only Digital helps you get it all out.

This Bridgeport CNC Vertical Milling Machine, controlled by Digital's powerful LSI-11/2 microcomputer, is cutting production times for customers by up to 85%.

In 16-bit micros, great hardware doesn't guarantee great performance.

You need high-powered software too. And only Digital gives you both. Because while everyone else is just getting started in high-performance micros, we've been shipping them for years.

So we give you all the software tools you need to make the most of great

hardware.

We start where the others leave off.

Digital's LSI-11/23 micros offer the only double-precision floating point processor in the industry. Built right into the hardware so it doesn't cost you memory overhead.

You also get a memory management unit so efficient, you can run several real-

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And you get the basic instruction set of our PDP-11 minicomputer family. It can do in one memory cycle what others would take four to accomplish.

But like we said, hardware is only

half the story.

The industry's only highperformance micro software.

Digital's software systems are literally years ahead of the

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The RSX-11M operating system, for example, is the industrystandard real-time software for

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Proven and refined over five years. And you can get it with our LSI-11/23 micros, with high-powered languages like an optimized FORTRAN IV-PLUS compiler and BASIC-PLUS-2.

And for your run-time software you can use RSX-11S, a streamlined version of 11M that takes up an incredibly small amount of memory.

Advanced development tools.

Digital's programming tools are easily the most advanced in the business. So you can concentrate on refining your application software, instead of strug-

gling with it.

For example, you get an interactive debugger that's built right into the processor. With English diagnostics for the linkage editor, FORTRAN, and even MACRO, so you can catch bugs before your programs ever run.

And if you ever need help in your development work, Digital's Command Language will help you solve your problem with clear, English-like statements.

The total approach to micros.

At Digital, we look at micros with a systems understanding. Which is why we offer our microcomputer family — in boards, boxes and systems — with the most advanced high-performance software in the industry.

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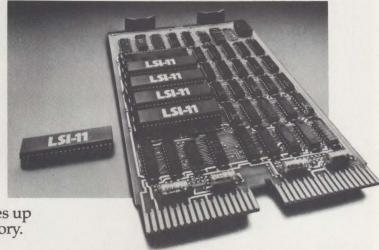
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"Lines at the snack bars were short, the convention floor wasn't jammed, and there was a merciful clarity to the atmosphere inside the exhibit area."

On the down side, many exhibitors at Siggraph were not pleased by the number of guests, students and children in attendance, many of the latter back-packed or in baby carriages. Lucido points out, however, that Siggraph can't be easily compared to NCC or Wescon. and that strollers have never been uncommon. "Siggraph is a family affair," he explains. "We even provide child-care services."

Another Siggraph official agrees that children and students were commonplace, but he says that while there were a lot of young people at the show, "a lot of them were engineers," Still, many exhibitors expressed their displeasure: "They tie up our people for hours," one complained, summing up the feelings of many at the show, especially those at Siggraph for the first time. "They are a constant problem."

Whether they are a problem or whether the family atmosphere, strollers and child-care center stay a part of Siggraph may depend on how successful the show becomes over the next few years. Based on the anticipated market for computer graphics (\$4.5 billion by 1984, according to one report), the prognosis for success on the exhibit floor is excellent. Conversely, the health of the family atmosphere could be in jeopardy. For the first time last year, the show was held in a convention center, and for the first time this year, the show was placed in the hands of a professional exhibition staff.

Already, the character of the attendees is changing, notes Peter Shaw, marketing vice president of Megatak Corp., San Diego, Calif. "At first, the only people attending Siggraph came from the scientific and academic communities," he notes. "Now exhibitors are seeing

in business applications."

But despite increased exhibitor the attendees. Lucido stresses that the show will be kept as vertically graphics."

large numbers of people interested oriented as possible. "We're resisting the temptation to broaden the show and expand it horizontalinterest and a change in character of ly," he says. "Our goal is to make Siggraph the NCC of computer —John Trifari

MINIBITS

MONTGOMERY WARD TO SELL PERSONAL MICROCOMPUTER

Ohio Scientific and Montgomery Ward are developing computer shops in department stores to sell Ohio Scientific's microcomputers. Nineteen shops will be operating by the end of the summer, to be expanded eventually to 100. Ohio Scientific's Challenger 1P and Challenger 4P are cassette-based personal business systems that can be expanded to include floppy-disk drives. Accessories also will be sold, including black-and-white monitors, color monitors, printers, home security systems, modems and system and applications software.

CANON, PANASONIC INTRODUCE MODULAR COMPUTERS

Both Canon U.S.A., Inc., and Panasonic Co. have introduced small computers for professional and consumer use, respectively. Canon's TX series is a desk-top computer weighing 15 lbs. with a built-in printer, a display and telecommunications ability. It incorporates an 8-bit microprocessor, powerful extended BASIC and assembler language. Programmable and nonprogrammable versions will be available, with the latter costing \$1295. Panasonic's hand-held computer system is geared for consumer use. It includes the RL-H1000 hand-held computer, an I/O interface for attaching as many as six additional peripherals, an acoustic coupler/telephone modem, a cassette interface, a video RAM interface for TV hookup, a miniprinter and RAM and ROM memory expanders. Memory expander capsules, by virtue of new data-compression techniques, achieve about a 2:1 compression improvement in memory coding over standard 1-character-per-byte coding.

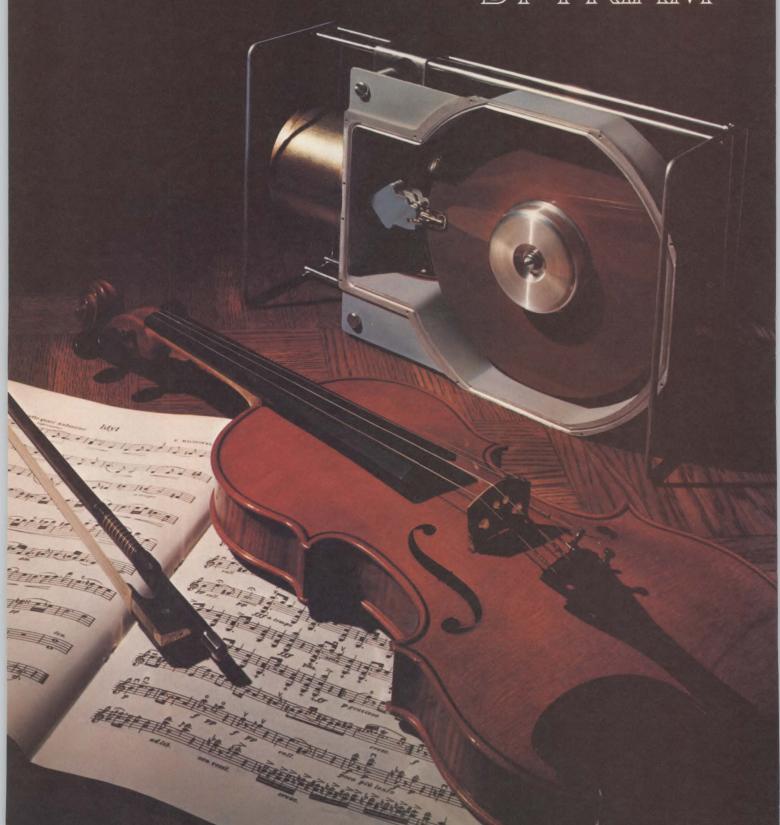
NON-IMPACT PRINTERS TO MAKE BIG IMPACT IN 1980s

Look for non-impact technologies to make a hefty dent in the printer market in the coming decade. By 1988, electrosensitive, thermal, laser and other non-impact printer technologies will have increased their present seven percent market share to 40 percent, according to a recent market study by Frost & Sullivan, Inc., New York. However, impact technologies will benefit as well from a projected 23 percent annual growth in the overall market, which will push printer sales from \$1 billion a year in 1979 to \$10 billion by 1988. Non-impact printers are gaining ground, Frost & Sullivan says, because their electronic basis allows them to offer better print quality and higher speed and reliability than do mechanically based impact printers. In addition, non-impact technologies offer opportunity for higher profit margins, making them popular among printer makers. The report expects ink-jet printers to make the most dramatic gains, going from a negligible market share to 14 percent by 1988. Laser-xerographic technology should do almost as well, soaring from two percent in 1979 to a projected 13 percent by 1988.

GRAPHICS OPTION FOR PORTABLE TERMINAL

A printer/plotter option for portable terminals, printers or computers enables timesharing users to obtain hard-copy output for econometric studies, forecasts and other statistical data manipulations in remote locations. Available for use on Computer Devices, Inc., equipment, the option is said to be one of the first graphics capabilities for portable products. It plots as many as 3420 dots per sq. in. at 24 in. per sec. horizontally between plotted points by firing 35 dots simultaneously. The option costs \$425. With a computer or terminal that prints in both 80- and 132-column formats, the option costs from \$2410 to \$5910.

VARIATIONS ON A THEME BY PRĪAM

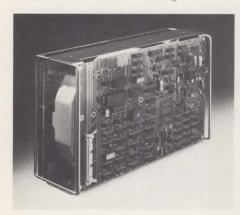


DISKŌS 2050 AND 3450 8" WINCHESTER DISC DRIVES

This Tune May Sound Familiar . . .

Variations are created from the elements of a composition, changed to create a new and interesting idea. PRIAM's DISKOS 2050 and 3450 are variations on a Winchester disc drive design theme that has been proved in concept, performance, and production.

PRIAM design engineers followed the same design composition that has made the 14-inch-disc DISKOS 3350 efficient, reliable and cost effective. They scaled the DISKOS 2050 and 3450 to fit exactly into the space required by a standard floppy disc drive. This noteworthy accomplishment provides capacities of 21 and 35 megabytes, with 40 and 70-megabyte capacities to follow, with the same size and weight.



Interface Harmony

PRIAM's DISKOS 2050 and 3450 play from the same interface music as the DISKOS 3350, so that a single controller can be used with PRIAM Winchester disc drives covering the capacity scale from 10 to 158 megabytes. Head positioning times, data transfer rate, data and command functions and lines . . . every pin connection is the same. And data separation is included in all PRIAM drives, saving you expense in interfacing.

Sing Along With SMD

An optional interface permits you to use PRIAM drives with existing controllers for CDC Storage Module Drives. You can stretch the life of your SMD controller and get on the air more quickly with the low cost, high capacity, and splendid reliability of PRIAM Winchester disc drives.



Presto Positioning

PRIAM's proprietary linear voice coil head positioner provides fast access to data and still lets the DISKOS 2050 and 3450 exactly replace a standard floppy disc drive. Positioning is fast and precise, with an average access time of 45 milliseconds, and a track-to-track time of only 8 milliseconds. Because of the exact positioning provided by PRIAM'S voice coil system, data recovery is positive and reliable. DISKOS drives will tolerate the harsher environments in which computers, word processors, and communications systems of the future will operate.

Brushless DC Spindle Motor

A brushless DC spindle motor provides reliable operation with a simple, low-cost design, doing away with belts and pulleys and extra bearings. PRIAM's DC spindle motor eliminates alternating current entirely from the DISKOS 2050 and 3450. They will operate anywhere in the world without change.

Microprocessor Maestro

Economy, flexibility and reliability result from PRIAM's use of a microprocessor to control head positioning and to perform self test and diagnostics. The number of parts and electrical connections in the system are reduced to lower cost and improve reliability.

Welded Steel Rod Frame

PRIAM's DISKOS 2050 and 3450 mainframe castings are mounted in sturdy welded steel rod frames that permit ready circulation of cooling air. These frames also reduce weight and cost. Heavy metal is used only where it is needed, so the DISKOS 2050 and 3450 weigh only 20 pounds. Shock mounts protect the drives and isolate them from system ground.

CIRCLE NO. 14 ON INQUIRY CARD

Air for Reliability

PRIAM disc drives use a unique air management system to prevent contamination. Valuable data is protected by creating positive air pressure at the spindle bearings, where contamination is most likely to enter. PRIAM drives include permanent absolute filters that constantly purge the air inside the sealed disc assembly.

Specifications

21 Megabytes
35 Megabytes
0.8 Mbytes/Sec
8 milliseconds
45 milliseconds
480
6670
4.62 inches
8.55 inches
14.25 inches
20 pounds

Interface Efficiency

Interfacing DISKOS 2050 and 3450 disc drives to your controller is economical and efficient because it is designed for connection to the most widely used 8-bit and 16-bit microprocessors. Daisy chaining is easy and functional, and overlapped seeks may be used. Data separation is included in drive electronics, so controller design is simplified and reduced in cost.

SMART Interface Option

PRIAM's SMART Interface Adapter provides serialization and deserialization of data, disc formatting, sector buffer, polled or interrupt operation, defect mapping, overlapped commands, implied seek, selectable sector sizes and microdiagnostics. Up to four drives can be interfaced easily to the I/O bus at the byte level.

For a brief and handy history of Winchester technology and its advantages, call or write to PRIAM and ask for a copy of WHO'S SELLING RIFLES TO THE



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Smart modem for minis handles error control

Modems have traditionally been limited to converting digital signals from a computer or terminal to analog wave forms for long-range transmission over telephone circuits. But now modems have gone intelligent. The reason: While mainframe computers and terminals



Micom Systems' Micro5000 is a smart modem able to provide what the company says is error-free transmission between minis and dumb terminals over unconditioned leased telephone circuits.

support the protocols needed for error control when telephone facilities are incorporated into a data communications network, the minicomputers and dumb terminals commonly used with them do not.

To get around this limitation, Micom Systems, Inc., Chatsworth, Calif., has developed a line of smart modems able to provide what the company says is error-free transmission between minis and dumb terminals over unconditioned leased telephone circuits at speeds ranging from 2400 to 9600 bits per sec. Dubbed the Micro5000, the modem family is based on Z80 8-bit microprocessors and is implemented on a single printed-circuit board.

The Micro5000 handles error control by using a cyclical redundancy check (CRC) that determines if any given block transmitted from a computer or terminal was received correctly at the other end. The modem also uses an automatic retransmission-on-error feature. As

a result, data transmission is continuous, with subsequent blocks of data stored in the modem's on-board buffer memory. If the CRC calculation for a block of data checks out, the transmission is acknowledged and the block released from the buffer. If it does not, a not-acknowledged (NAK) signal is returned to the transmitter, and the block retransmitted until the CRC procedure indicates that it has been received correctly.

The Micro5000 can store several thousand characters during these error-control and retransmission cycles. If buffer overflow caused by retransmissions of excessive line outages occurs, however, the modem will send a signal to the

originating terminal or computer telling it to suspend transmission.

The Micro5000 uses a full-duplex transmission protocol similar to IBM's synchronous data link control (SDLC), called add-on data link control (ADLC). As a result, the device requires a four-wire 3002 point-to-point leased line, but does not require that the line be conditioned, say Micom executives. The company reportedly is looking at ways to adapt the Micro5000 for use at lower speeds on two-wire direct distance dial (DDD) lines, but no plans for this have been announced.

The modem is designed for use with Data General, Digital Equipment Corp. and Hewlett-Packard minicomputers, and is priced at \$1500 to \$5500 in single-unit quantities, depending on speed. Deliveries start next month.

-John Trifari

Graphics industry growth may rely on disk drives

Executives at companies offering less-than-\$20,000 computer graphics systems anticipate the use of powerful 16-bit microcomputers and an expanded range of applications for their hardware. But one product line manager warns that a lack of high-capacity rotating memories could limit the market potential for these types of systems.

"Right now we have all the processing power we need," says Gary Sawyer, product manager for Genisco Computers' G-1000, an interactive black-and-white graphics work station. The Z8000-based G-1000 was introduced in July at the Siggraph show in Seattle by the Costa Mesa, Calif., firm. "Now we're looking for higher-capacity data bases and faster data transfer rates," he says.

Both Genisco's requirements

point to 8-in. Winchester-disk drives, Sawyer says, noting that his firm already has explored fixed-disk drives tied to tape cartridge backup. "A complex 3D representation could easily take up 100K bytes of memory," he says. "Data bases incorporating representations of this magnitude will simply overwhelm the floppy-disk drives now common with many graphics work stations."

Moreover, floppy-disk drives are too slow for graphics applications. "Winchesters are an order of magnitude faster than floppy-disk drives, based simply on rotational speed," he says. (Spindle speed for most 8-in. Winchesters is 3600 rpm; Shugart Associates' SA850 1M-byte floppy-disk drive operates at 360 rpm.) "The bottom line is simply this: faster refresh is better refresh.

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I've never heard of anyone complaining about a screen that filled up too quickly," Sawyer says.

The amount of time needed to fill a graphics screen is a function of the bandwidth of the channel connecting the work station to its data base. Until now, most of these systems have been connected via direct, byte-parallel lines, which generate what industry analyst Ken Anderson calls "instantaneous response."

Operator productivity is a direct function of how fast a screen fills, the Simi Valley, Calif., publisher of "The Anderson Report" explains. "One California aerospace firm measured the effectiveness of design engineers using high-end



Industry analyst Ray Freeman: "Rigid-disk drives will be required in low-end systems."

computer-aided design (CAD) systems," he reports. "Productivity nose-dived if the screen didn't fill up in less than ½ second."

In distributed data-processing environments for low-end systems handling business and commercial applications, Anderson points out that byte-parallel connections will not be used, and response times of less than ½ sec. will be impossible. "Bit-serial transmission links will be used instead. Now we have to look at a different set of figures." In such an environment, for example, a 512 × 512 black-and-white screen could take almost 2 min. to fill if the data base and the work station are linked by 2400-bit-per-sec. telephone circuits. Even at 9600 bps—the maximum speed of a voice-grade line—a black-and-white screen will require almost 30 sec. to fill.

Many in the industry predict that as color graphics become commonplace over the next few years, they will present more constraints, Anderson says. He notes that a screen linked to a remote data base could take three times longer to fill than a monochromatic device. "Response times such as these are simply unacceptable," he says.

Disk-drive industry analyst Raymond Freeman Jr., Santa Barbara, Calif., agrees. "You can't wait forever for a screen to fill up," he says. "Rigid-disk drives will be absolutely required in low-end systems." But, he notes, storage subsystems costs will rise. "While users can expect tenfold increases in storage capacities, they can also expect threefold increases in price compared to floppy-disk drives."

Whether the drives in question will be 8-in. Winchesters or 14-in. devices is unclear, says Warren Sullivan, vice president of marketing at Image Resource Corp., Westlake Village, Calif. "Desk-top graphics systems will probably be running data bases as large as 10M-to 40M-bytes. Winchesters will be imperative."

If the graphics industry can't get 8-in. hardware in quantity, it will turn to 14-in. drives. "Designers won't like it, but if there's a shortage of 8-in. devices, they'll look to 14-in. hardware, and cable the drive to an adjacent box," says Sullivan.

Anderson, however, anticipates that the industry's attention will



Industry analyst Ken Anderson anticipates that the computer graphics industry's attention will focus on 8-in. Winchesters.

focus on 8-in. Winchesters, and that a number of systems with higher capacity devices will appear at next year's Siggraph. He also feels that disk-drive makers will be scrutinizing the potential of low-end graphics applications. "Over the next five vears this will be the area of fastest growth," he says. He predicts that the total graphics industry will grow from \$1 billion to \$4.5 billion by 1984. Business graphicsterminals, hard-copy output devices, photo-copy hardware and systems with graphics capability will grow, according to one report, at an average rate of more than 50 percent per yr. to reach more than \$1 billion by 1984—an increase from \$120 million in 1979. "Graphics will become an integral part of small-business and word-processing systems over the next five years. High-capacity rotating memories will be one reason why," Anderson says.

Genisco's Sawyer stresses, however, that readily available hardware, rather than good intentions, will be what's important. "Production quantities of Winchester-disk drives will be vital; the existence of evaluation units is of no value at all," he says.

—John Trifari

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CIRCLE NO. 17 ON INQUIRY CARD

High-speed printing spurs interest in magnetic printers

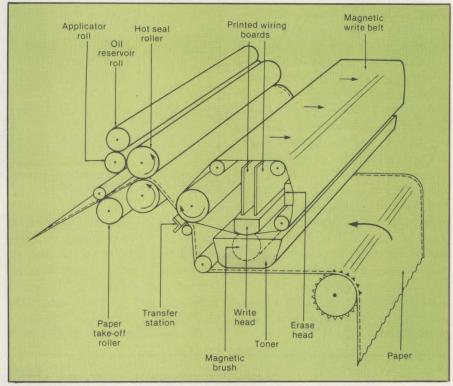
The quest for high-speed, non-impact printers has led some manufacturers to assess the feasibility of expanding electronic copier principles for use in printers. Included in the copier-based developments are laser-based printers from IBM, Xerox and Canon (see "Japanese combine copying and printing," p. 30), as well as renewed interest in magnetic printers.

Because magnetic printers use less than half the power required for their laser-based counterparts, they also cost less. They can be used for mainframe output of 4000 to 8000 lines per min., but when print quality improves, they will be used with smaller computers.

General Electric is the first company to introduce a high-speed magnetic printer. The TermiNet 8000 is a prototype page printer introduced at this year's National Computer Conference (MMS, July p. 11) by GE's Data Communications Product Division. It produces 8000 lpm.

The non-impact printer market will reach \$2 billion in shipments this year, according to International

Resource Development, Inc. CII Honeywell Bull of France, Iwatsu of Japan and Ferix, Inc., Mountain View, Calif., are among others developing magnetic printers. Using magnetic fields on a drum or belt, magnetic printers form an image, which is then transferred onto uncoated paper. The first such printer was marketed by Inforex, Inc., Burlington, Mass., in 1976. Inforex acquired the printer when it bought bankrupt Data Interface, Danbury, Conn., in 1972. Inforex did not have the in-house expertise



General Electric's TermiNet 8000 houses a magnetic write belt from which characters formed from toner are transferred onto paper, then pressure- and heat-fused.

THE CHALLENGING TECHNOLOGIES

When manufacturers enter an essentially virgin territory, they usually do not face any immediate competition. But this will not be the case for magnetic printer manufacturers that are taking on the medium-speed non-impact printer market with non-optical printers using dry toner on plain paper. Aiming to replace Xerox 9700s, IBM 3800s and similar machines, magnetic printer manufacturers will face a battle for that market with 3M, Dennison and others during the next four years. That's the assessment of lan Mallender, president of Advanced Technology Resources Corp., El Dorado, Calif.

The 3M process, called Magnestylus, produces 40 pages per min. in 300-dot-per-in. densities, according to one industry source. The printer combines elements of both magnetic and electrostatic printers, and is said to use electrostatically charged magnetic styli on the outside of a drum at densities of about 300 styli per in.

Magnetic toner is drawn onto the print drum via an internal magnet, and that toner is counteracted selectively by the electrostatically charged styli to form impressions on the outside of the drum. The strength of the electrostatic and magnetic fields can be altered to create a gradation of gray images. This cannot be done by magnetic printers.

Mallender says the 3M printer can

be used for computerized-axial tomography (CAT) scanning output in hospitals. The technology may eliminate the problem of gray residue that magnetic printer manufacturers face. The product is not expected to be introduced for more than a year, but some industry sources say it may be introduced by year-end. The company already sells two limited versions of the Magnestylus as bar-code and baggage label output devices.

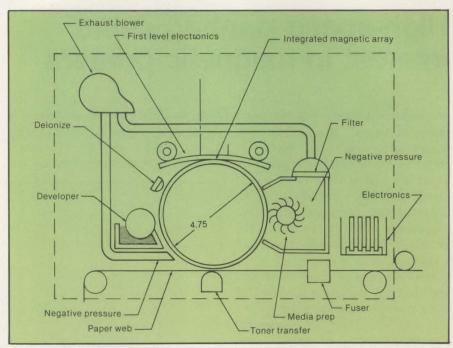
The Dennision printer, under joint development with Canada Development Corp., is an electrostatic printer that deposits ions on a dielectric imaging media in the shapes of characters or dots.

Mini-Micro World

to fully develop the printer, and two years ago, with only about 250 sold, the Inforex 180's production was canceled.

The 180 operated at 180 lpm, sold for about \$2500 and was geared toward terminal output applications. Although it was an inherently simple and low-cost device, the printer had major problems with reliability and print quality. The heart of the 180 was a magnetic recording head covered by a 1/2-in.-wide magnetic tape. A magnetic field created on the tape selectively formed characters that were covered with magnetic toner, transferred onto paper with minimal pressure and then fused to the paper at a temperature of 350°F.

The print quality resembled that of dot-matrix-printer output, but the printed line also held some residual dirt imparted onto the electrostatically charged paper, leaving a grayish background image. Further, the toner, which was recycled after each use, "wore out" as its various components were used at different ratios during the printing process. The toner cost about \$40 per lb.



The Ferix CP 4000 prints 4000 lpm and is believed to have caught the interest of Exxon Enterprises, among other companies.

Inforex, now in Chapter XI bankruptcy proceedings, is trying to sell the patents to the printer. Interested parties have included market contenders CII Honeywell Bull, 3M and C. Itoh. (see "The challenging technologies," p. 29).

The new magnetic printers, while

still developmental, incorporate a variety of techniques to solve the reliability and resolution problems inherent in that technology's write head and toner. Magnetic printers, like laser-based printers, are an extension of electronic copier technology, using magnetic rather

JAPANESE COMBINE COPYING AND PRINTING

Japanese manufacturers of office copiers are actively developing non-impact, high-resolution imaging systems that combine copying with computer-output printing, according to a soon-to-be-released study by the Yankee Group, a Boston research firm. These devices are expected to open a new market niche between low-cost impact printers and high-end non-impact printers now offered by IBM, Xerox and others. That market is forecast to reach \$200 million to \$300 million in end-user sales by 1985. The copier/printers will sell for \$10,000 to \$20,000 and offer at least 200-dotper-in. resolution at speeds of 8 to 12 pages per min.

Ricoh Co., Ltd., has three prototype non-impact printers. The DC 520 and JP 204 are a two-color copier and a two-color ink-jet printer, respectively. The third prototype, the GT 1000, is comprised of a keyboard, an image

scanner and a laser-based printer/copier with a resolution of 300 × 300 dpi at speeds of 30 pages per min. (ppm).

Canon has developed the LBP-10 dot-matrix non-impact printer that produces as many as 10 ppm. Based on a Hitachi semiconductor laser, the LBP-10 differs from the IBM 6670, which uses a gas laser. Semiconductor lasers are smaller, and are said to be more power efficient and less expensive. OEM prices range from \$6000 to \$9000; end-user prices are \$12,000 to \$18,000.

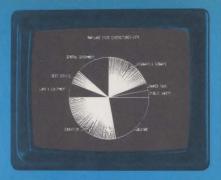
Konishiroku, developers of the primary part of Wang Laboratories' intelligent image printer, produces a two-configuration device called U-Bix. As a copier/printer, it produces 15 ppm, using a 12 × 16 or 12 × 21 dot-matrix pattern. When U-Bix is configured strictly as a line printer, it can print as many as 1678 lpm at

300-dpi resolutions. Price is \$7000 to \$8000.

Minolta recently introduced the EG 301 intelligent printer/copier that employs fiber optics to create images on a photoreceptive drum with dry toner. As a copier, it produces as many as 10 copies per min., and as a printer, it uses a 200 × 200 dot matrix to produce 10 ppm.

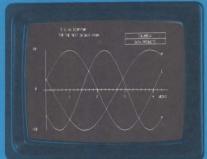
Toshiba's electrophotographic device uses laser light fired through cables onto a selenium drum to produce an image. Speed is 25 to 30 ppm at 300 × 300 dot resolutions. Like Konishiroku, Toshiba is looking for an OEM agreement with a U.S. systems supplier.

The efforts of those companies give Japan a head start in the development of copier/printers that combine imaging with communications, storage and processing, the study concludes.





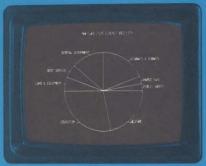


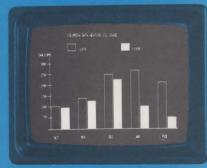






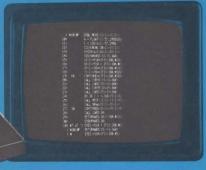


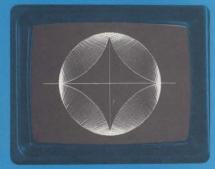






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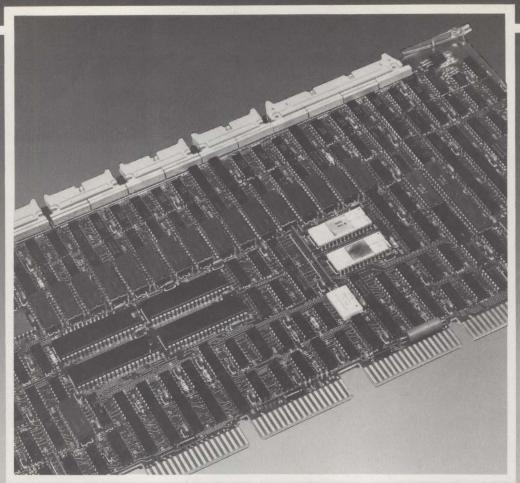
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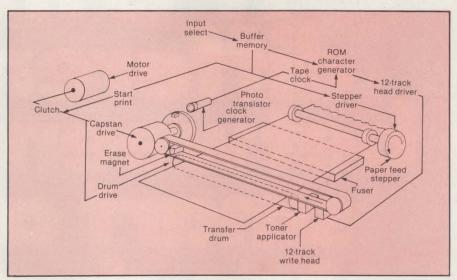
PRINCETON-HIGHTSTOWN ROAD CRANBURY, NEW JERSEY 08512 TEL:609-799-0071 TWX:510-685-2542 than photosensitive media for imaging. While copiers merely reproduce an image, magnetic printers produce an image from digital signal inputs. That image can be retained to generate thousands of copies.

The technique does not require high-powered lasers as a light source to set up charges, which means that magnetic printers have fewer electrical and mechanical parts. Magnetic fields are created by electronic circuits on a magnetic drum or continous-loop magnetic-tape imaging material. The write head forms an image on the imaging material and attracts toner particles to the image, which is transferred and fused onto uncoated paper. The imaging material is then cleaned.

But, no manufacturer has yet introduced a product that overcomes all the obstacles to high-quality magnetic printing, which include the write head, belts, toners and fusing methods. The writing device is critical to making magnetic print quality acceptable, says one industry consultant, and manufacturers developing magnetic printers agree.

"Entering the market with a low-resolution head is a mistake," says Bob Hughson of GE's magnetic printer marketing. He says GE is revising the prototype print head of the TermiNet 8000. Dot density will be increased from 120 to 240 dots per in. in the production models, to be released in 1981. The price has been projected at less than \$20,000. The 240-dpi density is required to get a fully formed character appearance, according to one industry observer.

The write head for GE's prototype uses a cone with a series of electronic ciruits that create magnetic fields for image formation on a rotating Mylar belt. The write head contains 1672 printing dot locations. Each dot is magnetized when the circuits magnetize the belt. The dots attract magnetic



The Inforex 180 was the first magnetic printer commercially available.

toner selectively to form a character image, which is then transferred with slight pressure and electrostatic action to paper. The paper then passes through two rollers—a heat roller and a pressure roller—to fuse the image onto it. Paper is fed through the printer at a constant rate of 16.7 ips.

GE has taken steps to eliminate a major source of reliability problems in magnetic printers: write-head wear. Hughson claims his company decreasing head wear by employing a Mylar belt that covers the write head and protects it from exposure to abrasive iron particles in the toner. The toner can contact the head in printers using drums, thus increasing wear. But belts that contact the head are made of hard crystal, which is also abrasive, according to one source. The CII Honeywell Bull and Iwatsu printers are drum-based.

Conventional write-head technology is not appropriate for magnetic printers, according to Gib Springer, president of Ferix, Inc., a division of Computer Printers International, Mountain View, Calif. Springer is developing a new write head that can better focus magnetic fields and decrease power consumption. Introduction of the product, the CP 4000, is more than a year away. It will

print about 4000 lpm and will cost between \$20,000 and \$30,000. Springer is looking for a merger partner for the technology. Both Exxon Enterprises and a major copier company are evaluating that technology now, one source says.

Another source says that Raytheon Co. recently received a patent for a magnetic bubble recording technique that could overcome resolution problems and fabrication costs of high-density magnetic recording heads. But developing new technologies to achieve better resolution is not an easy matter.

"It's a new technology, and you don't have other people's efforts to fall back on. You invent as you go along," says GE's Hughson.

Toner and fusing methods have also been obstacles to high-quality print. Although better toners are being developed, those available still leave gray residue on the paper. 3M and other manufacturers are developing single-composition toners that are expected to provide superior-quality output.

Most methods of fusing toner to paper involve heat and/or pressure. Pressure fusing consumes less power, but the use of pressure alone crinkles paper because it requires pressure of 500 lb./sq. in.

-Lori Valigra

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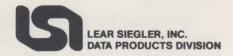
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Semiconductor disk added to CAI's new SyFA line

Computer Automation, Inc., has revamped its SyFA line of network processors, boosting cycle times within the CPU, adding faster main memories and offering an in-house semiconductor disk (SCD) in the process.

Called the System 2000, CAI's new offering is aimed at large-scale distributed data-processing environments that are typically hosted by IBM mainframes. According to George Dashiell, vice president and general manager of the Irvine., Calif., OEM computer and systems vendor, the 2000 can handle all SyFA applications currently running on the firm's older System 1000 processors at speeds 1.4 times faster. As a result, the number of terminals tied to a processor can be increased from 32 to 48 with no increase in program execution times, he says.

Total system throughput has also been increased in the system 2000 by the incorporation of a semiconductor disk device-a random access memory formatted to appear as a rotating memory. CAI sources say the system 2000's SCD will function as a high-speed buffer or cache memory in SyFA configurations in which several processors are accessing the same disk file. "The SCD is designed for networks where disk contention can impact total system throughput," explains one CAI executive. The device will store as much as 2M bytes of data and will operate 10 times faster than the storage module drives (SMDs) used for file storage in SyfA configurations, he says.

CAI's system 2000 incorporates a 50-nsec. memory and a 500-nsec. main memory in 256K-byte modules with error correction and control. (The System 1000 uses a 700-nsec. memory in 64K-byte modules and

does not have ECC circuits.) At least three microprocessor-based frontend devices are also standard with system 200 processors. Called Microboosters, they serve as intelligent interfaces for peripheral and data communications hardware. The 2000's software has been upgraded in the form of SyBOL III, Computer Automation's proprietary business and commercial programming language. Version III of SyBOL is upwardly compatible with the current version of SyBOL III, but reportedly incorporates some enhanced instructions.

CAI's new offering is now undergoing beta testing. Price and delivery information was not available at press time.—John Tritari



Computer Automation's System 2000 is aimed at large-scale distributed data-processing environments that are typically hosted by an IBM mainframe.

Codenoll Technology enters optoelectronics market

A new contender in the emerging optoelectronics market—Codenoll Technology Corp., New York—is banking on the belief that laser technology and high-speed gallium-arsenide illuminators are the "wave of the future" for applications that include both data processing and word processing.

Incorporated last February by Michael H. Coden and Dr.

Frederick W. Scholl, two former Exxon Optical Information Systems division executives, the company intends to capitalize on a market its founders hope will grow as quickly as microprocessors have grown over the last few years.

"We anticipate a development similar to that of other hightechnology markets," says Coden, who is taking the company through

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a public stock offering of 1 million shares in an effort to raise \$5 million. "We're getting into the market at its beginning, and we hope our timing will be as good as that of Intel." He admits that optoelectronic products still have a long way to go to be accepted, but microprocessors had the same problem 6 yrs. ago.

Although still in its formative stages, Codenoll intends to market subsystems incorporating semiconductor lasers and other optoelectronic components for use in fiberoptic, laser-based computer and word-processing equipment, plus video disk and audio disk players. Codenoll's semiconductor laser, which is made of gallium arsenide rather than gas, weighs less than 1 oz. and is less than 1 in. long. It is said to produce 30 times more light than a conventional gas laser weighing 4 lbs. that is 16 in. long.

Four products are scheduled to be introduced by Codenoll within a year:

 Codelink-50 and Codelink-20 high-speed fiber-optic links. The Codelinks are composed of galliumarsenide lasers or light emitting diodes (LEDs) and photodetectors. The laser or LED emits light pulses that are received and decoded by a silicon avalanche or silicon PIN-type photodetector. Codelink-50 will transmit and receive 692 simultaneous telephone converstations over one pair of optical fibers using standard telephone digital transmissions. The Codelinks will support ultra-high-speed communications over fiber-optic lines for dataprocessing, office, process-control and telecommunications equipment.

• Codescan-1, a low-cost alternative to gas lasers used in laser-based printers.

• Codehead-1, a semiconductor laser subsystem expected to be used in video disk players and for measurements. Codehead-1 is said to be as much as 25 times smaller and 150 times lighter than other laser subsystems. It is believed that

thousands of times more information can be stored and played back using a laser beam than is possible with phonograph records or magnetic media.

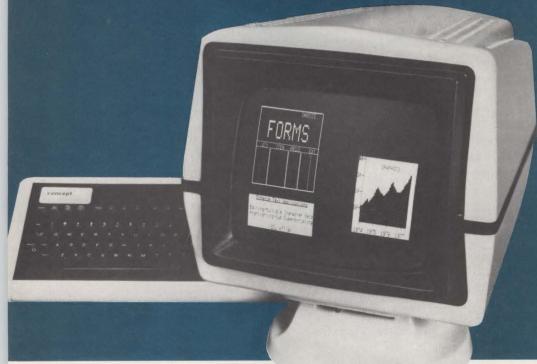
The company initially will purchase all subsystem components—in many cases from potential competitors. However, Coden says he does not anticipate any patent problems. After a year, Codenoll will manufacture its own semiconductor lasers, LEDs, photodetectors and electronic circuits.

One industry source expects the market for semiconductor lasers and related technologies to top \$15 billion by 1990, but another source says the market has not grown as quickly as expected. He says the semiconductor laser market is only a few million dollars, and most of the market is in military systems.

"The semiconductor laser market has been greatly overrated for a number of years," according to John Kessler, Kessler Marketing Intelligence, Newport, R.I. He says that manufacturers have promised price decreases, but prices have risen instead. Semiconductor lasers used in fiber-optic equipment cost about \$1000, he says, and an average manufacturing yield is only one out of 100. He adds, however, that some companies claim yields as high as 30 percent.

Coden is hoping to get a share of the market by achieving a competitive price-performance ratio. He says his chief competitors are Optical Information Systems, Hitachi and Mitsubishi. Hitachi semiconductor lasers are being used in a laser-based non-impact printer from Canon. A gas laser with power supply costs \$3000 to \$7000, Coden says, while an equally powerful semiconductor laser costs \$300 to \$1600. Coden expects to take advantage of what he foresees as the need for higher speeds and more capabilities, such as printing, communications and higher-density memory storage. - Lori Valigra

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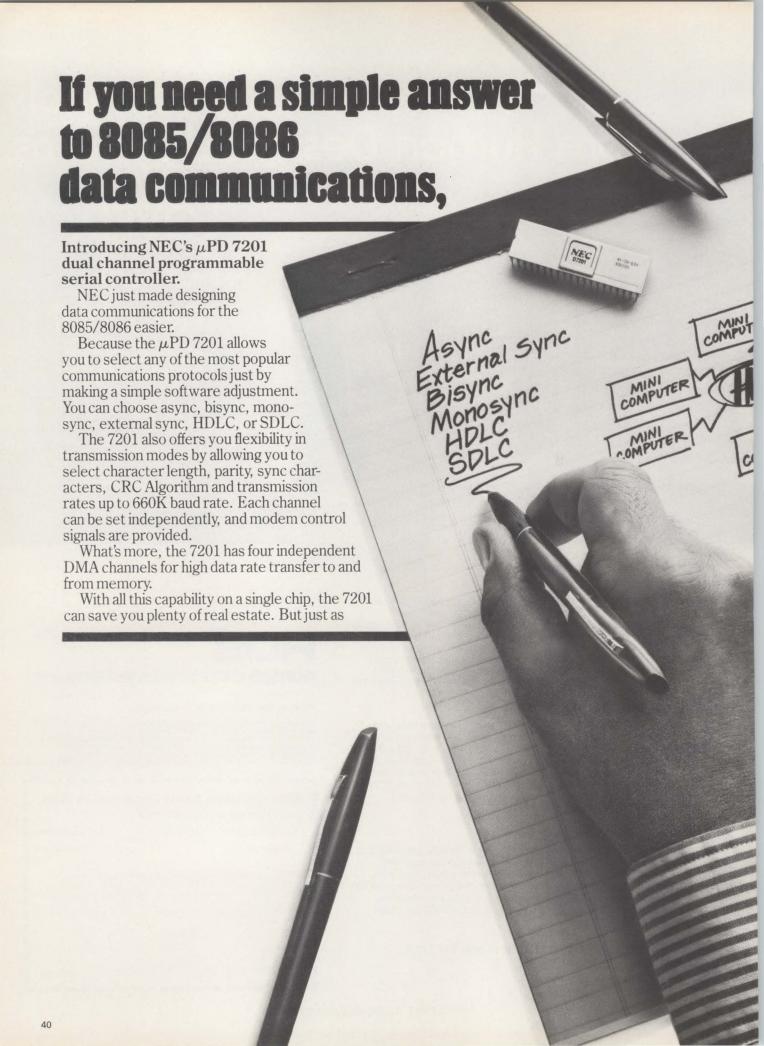
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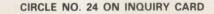
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Crowd of NCC exhibitors prompts industry debate

Computer company representatives attending this month's (Sept. 16-18) Wescon show will probably recall the National Computer Conference crowds they encountered at the same Anaheim, Calif., convention center in May (MMS, July, p. 11). They may also wonder if they can expect relief from the crowding when NCC storms McCormick Place in Chicago next year.

Any concern they have about adequate exhibit space is probably best expressed by an Orange County, Calif., executive who is already thinking about next May. He says, "Even though McCormick Place is the largest possible facility for the next NCC, right now it looks like there won't be room for everyone." One reason for the anticipated tight space situation in Chicago is that NCC so far is limited to one floor of the exhibit hall because another show closes two days after NCC starts moving into the hall.

But Gerard F. Chiffriller, AFIPS director of conferences, claims that AFIPS is already negotiating to add more space. Donnelly Hall, located several blocks from McCormick Place, is one possibility. Chiffriller would prefer, however, to use McCormick Place's "Level 20," located just below NCC's Level 42. But the earlier show has booked Level 20 until the Thursday before NCC opens. To set up NCC exhibits by Monday, AFIPS would have to pay overtime labor rates.

Chiffriller says AFIPS will pay the extra costs, even if it involves a loss in floor revenues. "We have always found room for the companies on our waiting list, but often the new space becomes available too late for them to move in and staff large exhibits," he says.

The AFIPS point system is another cause of the frustration afflicting those companies that so far have been unable to get into the show, or that have had to settle for far less space than they planned. Initially, the AFIPS system gave companies points for how long they have been members of AFIPS, for how many times thay have participated in past NCCs and for the amount of exhibit space they have had in the past. The more points a company has, the higher the priority it is given when space for the next show is allocated.

One East Coast hardware vendor points out that the system creates a "Catch 22" situation: "You can't accumulate more points because there is no more room to get, and you can't get more room because you don't have enough points."

Other industry executives agree, claiming that the point system favors larger companies, particularly those that have traditionally supported AFIPS and NCC. "AFIPS is doing the industry a disservice the way it is handling the matter," says a San Francisco Bay Area executive.

The point system was devised in 1977 when a priority systems committee allocated space at that year's conference. Chiffriller says the committee considers only booth size, not admissions. Consequently, Chiffriller argues that the point system works against a Catch 22 by providing a mechanism by which small exhibitors can acquire more space over time. The alternative, he says, was to create a "window" for new and emerging companies, but AFIPS's experience has been that smaller companies often disappear by show time, or exhibit only once.

Many exhibitors support the point system. "Whatever you might

think about it, the point system is a democratic process," says one West Coast hardware vendor. "For sure, it is a lot better then the 'sleep in the door' system of a few years back," when company representatives would stand in line for several hours at NCC, waiting to reserve space for the next year's show. AFIPS has also limited the amount of space allowed any one exhibitor to a maximum of 2000 sq. ft. in an effort to accommodate both old-line supporters and first-time exhibitors.

Another proposed solution to the space problem is a two-show schedule, like the old spring and fall conferences that were held in different parts of the country. Bill Terry, president of the Data Products division of Lear-Siegler, advocates this idea. "Each company would be allowed to exhibit at one conference per year, with space selection based on seniority," he says.

Ralph Gabai, general manager of the peripherals division at Pertec Computer Corp., Woodland Hills, Calif., proposes a two-show concept also, but he prefers to make the split down the lines of OEM vendors vs. end-user vendors. Some, however, don't feel that this solution will work. "My own company does both," points out one exhibitor. "Where do you draw the line?"

Chiffriller responds that AFIPS rejects the two-show format because NCC should be a gathering place for the entire information-processing industry—original manufacturers, integrators and end users. He adds, "Since 51 percent of attendees say they don't attend any show other than the NCC, we must be doing something right."

Another solution proposed by exhibitors is to ban "personal" computer makers from what many feel is an industry-oriented show. But AFIPS already has taken the opposite course, disbanding the



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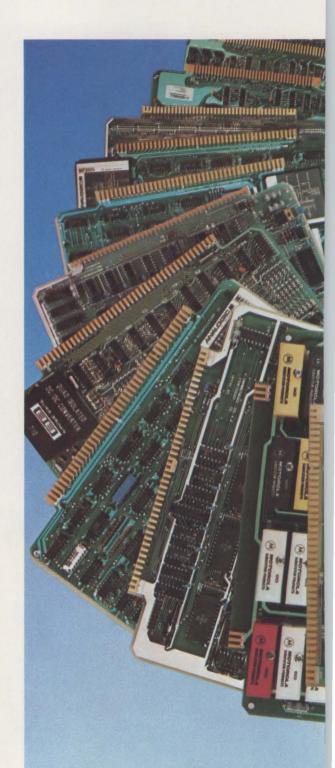
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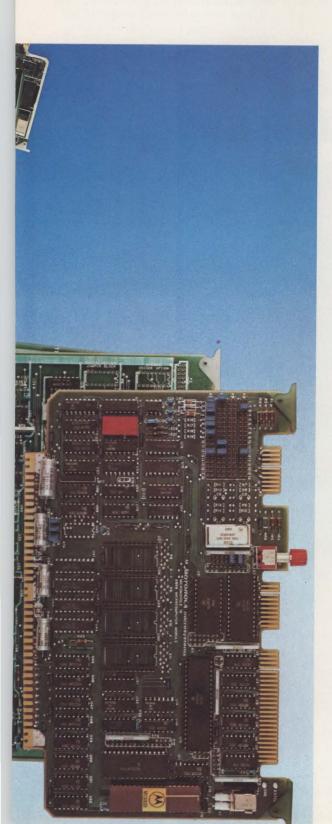
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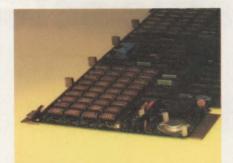
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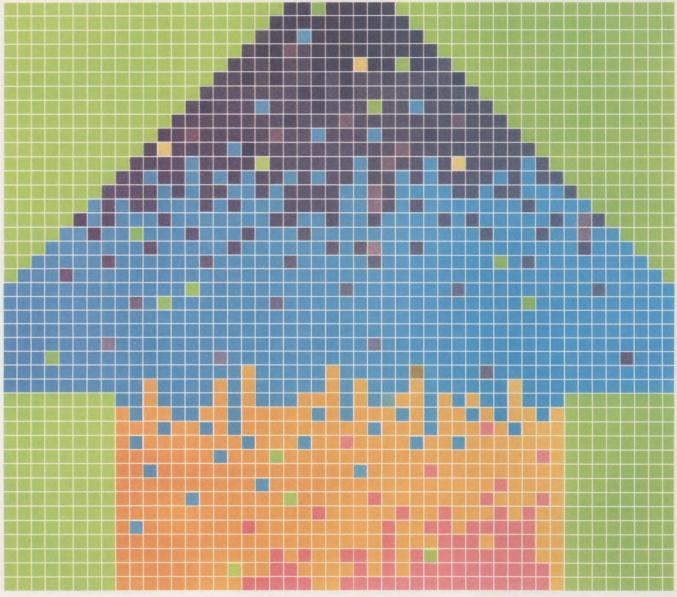
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personal computer show. Next year, it will be incorporated into the main exhibit area—with an interesting side effect. As a result of their past participation in the separate show, many personal computer makers now have enough points to get preferential space considerations.

"The personal computing field was brand new when we introduced it at the Dallas show in 1977," Chiffriller replies, "and we nurtured it by charging exhibitors half price. Today, the whole market has moved into small systems, the personal computer industry has matured, and we are responding to the larger personal computer vendors' requests for equal presence."

AFIPS is taking "the path of least resistance" when it comes to trying to resolve the space problem, claims the marketing vice president of a two-year-old hardware house that was able to obtain far less space for 1981 than it had hoped. "They're giving it to the big guys," he maintains. "If you had a lot of space in the past, you get a lot of space now." AFIPS has to do something about this situation, "but they're simply not responding."

Says Chiffriller, "We're constantly responding to suggestions. For example, we've reduced our maximum area, and we now have limits on frontage. Also, we no longer permit one company to exhibit in multiple locations unless

for totally separate divisions."

Defenders of AFIPS point out that waiting lists are nothing new at NCC. Last year, at the end of the show in New York, there were more than 200 companies waiting for booth space, according to one report. AFIPS accommodated many of these people-although not to the liking of some-by opening new exhibit areas, including the garage at the Disneyland Hotel. Others got space as companies that initially arranged for space dropped out of the show or cut back. "You can expect that a good number of people now on the waiting list will be offered space by the time planning for the show gets serious," notes one exhibitor.

Computerized TV system aids patient recovery

A microcomputer-controlled audio-visual system at Cooper Medical Center, Camden, N.J., may be shortening the length of time patients must stay in the hospital. The television system, which was initiated last September, is hoped to save patients and insurance companies thousands of dollars by educating patients and reducing the number of readmissions to the hospitals, according to Kristine Furey, the center's education coordinator.

The system was conceived three years ago by Ed Williford of E.K. Williford & Associates, a communications consulting firm in Audubon, N.J. The system, which is controlled by a microNOVA microcomputer from Data General Corp., was developed in conjunction with the Television Systems Division of Executone, Philadelphia, and Comcon, Inc., a Cinnaminson, N.J., systems house specializing in real-time applications.

With the system, a patient who is

going to have surgery views a "pre-op" videotape the night before the operation. This lets him know what to expect. A nurse activates the appropriate tape by punching in a code on the patient's telephone

keypad. Seconds later, the patient's television goes on, and he views the videotape, says Williford.

Health care experts believe that better informed patients make better recoveries from their illnesses and return to the hospital less often, because they know how to take care of themselves once they go home.

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stay of the patient in the hospital by any number of hours or days, you are saving money," says Williford. "You are not only saving the patient money, but you are also saving money for third-party insurance providers."

The educational system is part of the television rental system at the hospital. To rent a television, a patient dials a number. The call is routed through the PABX system, which makes a call record, says Paul Golden, systems analyst with Comcon.

The call record goes to the hospital's call-monitoring system for billing purposes and to the microNOVA microcomputer. The micronova determines whether or not that message is for the system. If the message is a request to rent a television, a command is sent to the radio frequency (RF) transmitter, which then commands a Comcondeveloped TV-control device in the patient's room to turn on the TV set. Simultaneously, the microNOVA data base is updated, and the television rental is logged on the system's Teletype-compatible teleprinter. Collections are made later from the logged list. The system is accessible 24 hours a day and operates unattended. The patient does not have to rent a television set to gain access to an educational videotape because two free channels show the selected medical tapes. A third channel runs a daily program of general health-education tapes, informing patients about drinking, smoking and other health problems.

Before a medical videotape is shown, a nurse checks to make sure a doctor did not prohibit the showing of the tape. If it is not prohibited, the nurse keys in the code on the phone. The television then flips off, and 7 to 10 seconds later, flips back on to the channel that is broadcasting the tape.

When the program is over, a tone on each tape informs the system that the tape has finished and tells the microNOVA to set operations in reverse—the tape is rewound, and the television is switched back to its original state. "This is the only system that I know of that uses a regular telephone switch to control video switching and is totally integrated into the telephone system," says Williford.

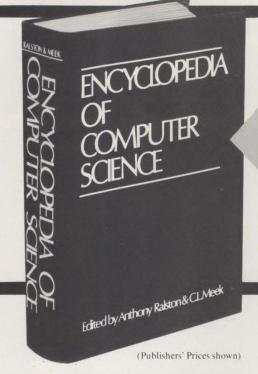
A medical education committee consisting of physicians and nurses approves the videotapes before they are seen by the patients. The system includes a fail-safe capability that prevents patient from seeing the wrong tape. If a nurse dials a wrong number, and a wrong tape begins, the nurse can dial an abort code, and the tape is instantly shut off. The nurses determine which tape a patient should see.

The microNOVA central processor that controls the patient-education television system is about the same size as a standard typewriter. It has a nine-slot chassis and includes 12K bytes of MOS memory, three standard teletype interfaces and one special-purpose Comcon interface. One interface attaches a Teletype-compatible console to the system Another is connected to a short-haul modem, which in turn is connected to the PABX system. A third interface connects the system to the RF transmitter and into the master antenna system. The special-purpose 4210 interface allows the computer to control operation of the videotape jukeboxes.

Comcon programmed the micro-NOVA microcomputer in assembly language under Data General's real-time operating system (RTOS). Program development was done on Comcon's own DG ECLIPSE minicomputer system.

Williford envisions the DG microcomputer handling more of the hospital's tasks in the future. For example, it may be used to help monitor hospital doorways and halls through closed-circuit television, or it could be used as part of a system of doctors' and nurses' education.

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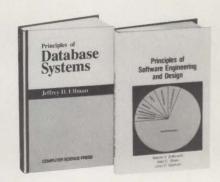
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- 23-24 Fourth Annual Symposium on Electronic Mail, Palo Alto, Calif. Contact: Marjorie Sugarman, The Yankee Group, P.O. Box 43, Harvard Square, Cambridge, Mass. 02138, (617) 742-2500 or (617) 725-1100.
- 25-28 Mid-Atlantic Personal and Business Computer Show, Philadelphia. Contact: National Computer Shows, P.O. Box 678, Brookline Village, Mass. 02147, (617) 524-4547.
- 29-30 The International Standard X.25 Interface Protocol for Packet Networks and Related Network Protocols, Newton, Mass., sponsored by Data Communications magazine. Contact: McGraw-Hill Conference & Exposition Center, 1221 Avenue of the Americas, New York, N.Y. 10020, (212) 997-4930.

SEPTEMBER

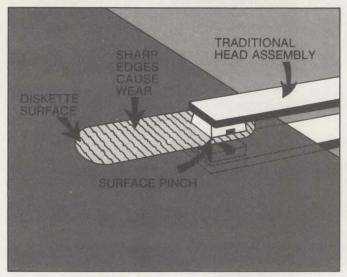
- 22-24 Federal Computer Conference, Washington, D.C., sponsored by Federal Education Programs and Datamation magazine. Contact: Federal Computer Conference, P.O. Box 368, Wayland, Mass. 01778, (617) 358-5181.
- 22-25 Software INFO, National Software Package Conference and Exposition, Chicago, sponsored by Infosystems. Contact: Kim Moloney, Professional Exposition Management Company, Suite 545, 222 W. Adams St., Chicago, Ill. 60606, (312) 263-3131.

OCTOBER

- 3-8 Information Processing Joint Exhibition 80, Tokyo, sponsored by the Eighth World Computer Congress, the Organizing Committee for MEDINFO, the Japan Electronic Industry Development Association (JEIDA) and the Communications Industries Association of Japan (CIA). Contact: The American Federation of Information Processing Societies (AFIPS), 1815 North Lynn St., Arlington, Va. 22209, (703) 243-4100.
- 6-9 Information Management Exposition & Conference: INFO 80, New York. Contact: Clapp & Poliak. Inc., 245 Park Ave., New York, N.Y. 10017, (212) 661-8410.
- 8-10 1980 Western New England Industrial and Business Trade Show, Springfield, Mass. Contact: Mitchell Halperin, Managing Director, Cahners Exposition Group, 221 Columbus Ave., Boston, Mass. 02116, (617) 536-7780.
- 14-16 Mini/Micro Computer Conference and Exposition, San Francisco. Contact: Robert D. Rankin, Managing Director, Mini/Micro Conference and Exposition, 32302 Camino Capistrano, Suite 202, San Juan Capistrano, Calif. 92674, (714) 661-3301.
- 16-19 Mid-West Business & Home Computer Show, Chicago. Contact: National Computer Shows, P.O. Box 678, Brookline, Mass. 02147, (617) 524-4547.

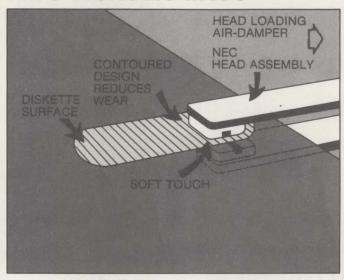
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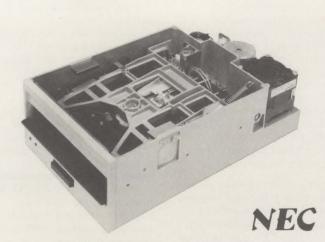
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- 20-22 International Telecommunications Regulation and Policy Symposium, Washington, D.C. Contact: Kathleen Kerns, Telecom Systems Group, Inc., 579 Pompton Ave., Cedar Grove, N.J. 07009, (201) 239-5700.
- 23-24 Third Annual Newport Conference on Fiber-Optic Markets, Newport, R.I. Contact: Kessler Marketing Intelligence, 22 Farewell St., Newport, R.I. 02840, (401) 849-6771.
- 25-29 29th Annual International Data Processing Conference & Business Exposition, Philadelphia, sponsored by the Data Processing Management Association. Contact: Conference Coordinator, DPMA International Headquarters, 505 Busse Highway, Park Ridge, Ill. 60068, (312) 825-8124.
- 27-30 Fifth International Conference on Computer Communication (ICCC/80), Atlanta, Ga., sponsored by the International Council for Computer Communications. Contact: Wayne Adams, ICCC '80 Publicity Chairman, Sperry Univac, Blue Bell, Pa. 19424, (215) 542-4673.
- 27-29 1980 Annual Conference of the Association for Computing Machinery, Nashville, Tenn. Contact: Dr. Gordon Sherman, Technical Program Chairman, ACM '80, University of Tennessee Computer Center, Knoxville, Tenn. 37916, (615) 974-6758.
- **28-30 Interface West,** Los Angeles, sponsored by the Interface Group and *Datamation* magazine. Contact: Peter B. Young, The Interface Group, 160 Speen St., Framingham, Mass. 01701, (617) 879-4502.
- 29-31 Computerized Office Equipment Expo, Houston. Contact: Industrial & Scientific Conference Management, Inc., 222 West Adams St., Chicago, Ill. 60606, (312) 263-4866.

OCT. 30-NOV. 1

Fourth Annual National Small Computer Show, New York. Contact: Ralph Ianuzzi, Show Manager, 110 Charlotte Place, Englewood Cliffs, N.J. 07632, (201) 569-8542.

NOVEMBER

- 2-5 Fourth Annual Symposium on Computer Applications in Medical Care, Washington, D.C. Contact: Michael J. Ackerman, Ph.D., Exhibit Chairman, Naval Medical Institute, Mail Stop 38, Bethesda, Md. 20014, (202) 295-1810.
- 3-4 NASA/AIAA Workshop on Aerospace Applications of Microprocessors, Greenbelt, Md. Contact: Mr. John Y. Sos, NASA/Goddard Space Flight Center, Code 560, Greenbelt, Md. 20771.
- 4-6 Federal Office Automation Conference, Washington, D.C., sponsored by the Federal Office Institute. Contact: Federal Office Automation Conference, P.O. Box E, Wayland, Mass. 01778, (617) 358-5119.
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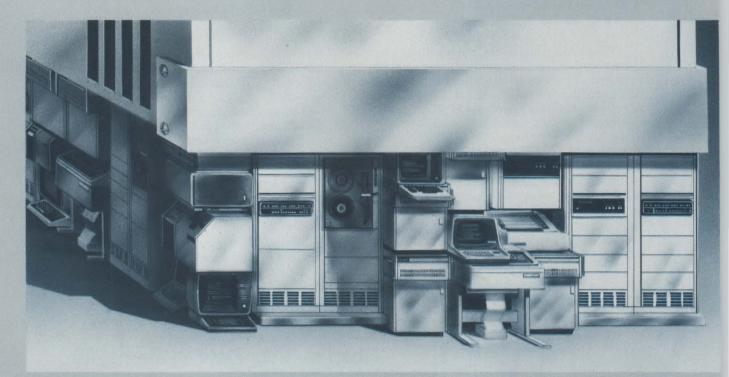
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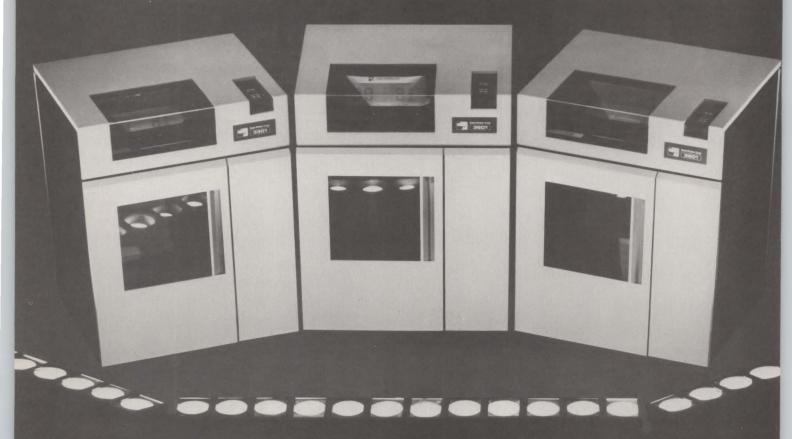
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H-P's portable terminal has user-definable features

The 2675A marks three firsts for Hewlett-Packard Co.: it's the first product from the company's year-old Vancouver, Wash., division; it's the first portable printing terminal introduced by the firm; and it puts HP into a market that it has never been in before.

The 2675A also brings some firsts to portable printing terminals. HP officials say the device is the first to offer user-definable soft keys. These, plus a programmable RETURN key, make it possible to tailor the 2675A to individual applications. HP also believes the terminal to be the only one available with selectable columns per line and "enhanced characters," which is the ability to print compressed or expanded characters.

The terminal is a 120-character-per-sec. thermal device that includes the full 128 ASCII character set. An optional built-in 300- bps modem and phone connector enable the terminal to be used with any modular telephone. An acoustic coupler will be available from HP at a later date, but the 2675A can be used with any available Bell 212A-compatible modem for transmissions at 1200-bps. The terminal's data rates range from 110 to 9600 bps in a full-duplex, asynchronous mode. It uses an RS232C interface.

The terminal includes two 3M-type cartridge-tape drives that provide 640K bytes of on-line mass storage. File access can be made by file name, absolute file number or relative position. A tape format enables information to be updated or rerecorded over a single section of tape.

All these capabilities put the 2675A, selling for \$5000, at the high end of the portable printing terminal range. The optional 300-bps modem costs an additional

\$450. But 2675A product manager Gene Morel justifies the high price by saying that "most portable terminals are dumb. We're not intelligent, but we're bright."

He stresses what he calls the device's configurable abilities, such as the eight soft keys, which can be programmed by a user, by a host computer or via a tape cartridge. This results in single-keystroke initiation of complex or repetitive operations, such as log-on messages or program-calling information, Morel says.

The "soft configuration" of the terminal provides data transmission pacing mechanisms so the CPU doesn't overload the terminal with data, and vice versa. These mechanisms include inquire/acknowledge (ENQ/ACK), a buffering protocol; communication protocol handshakes (X-ON/X-OFF); a protocol for block transfers of data (DC1/DC2)

or a hardware-handshake protocol, which is especially useful to users who need to communicate with non-HP host computers.

All the data required to configure the terminal is stored in the unit's 128-byte nonvolatile, (battery-powered) RAM. Once defined, terminal parameters such as baud rate, protocol and parity are available when the 2675A is switched on, Morel points out.

When discussing the terminal's ease of use, Morel stresses its power-on configuration. "Any of the terminal's functions or any command can be executed simply by powering the terminal," he says. The power-on string can contain as many as 80 characters of log-on data, soft-key definitions and other instructions, Morel says.

Standard printing mode is 80 characters per line, but the 2675A can print 132 columns on 8½-in. paper using a compressed-character print mode. An expanded mode prints 40 cpl, which the company says is useful for titles and labels. A standard line-drawing character set can print forms. It can also



The Hewlett-Packard 2675A portable printing terminal includes built-in modem and thermal printer.

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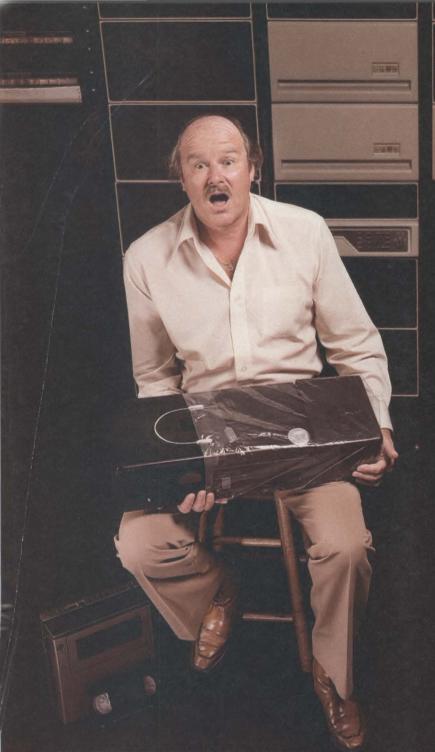
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underline or frame characters for highlighting. The terminal can print bidirectionally as well.

Optional keyboards are available for Swedish/Finnish, Norwegian/ Danish, French, German, United Kingdom and Spanish. Individual key caps are also available.

The 2675A uses HP's low-power silicon-on sapphire (SOS) processor, the MC5, as the central device controller. An Intel 8039 handles the tape cartridge drives.

Morel expects the 2675A to find quick acceptance among current HP system users. "One of our intentions for the terminal was to make it plug-compatible with our existing CRT terminal product line," he points out. The 2675A is compatible with the HP-264X and 262X series CRTs in the character mode, Morel says. HP will use the 2675A

internally to run HP1000 system diagnostics.

Besides reaching the HP customer base with the terminal, the company also hopes to reach the OEM market. "OEMs can program the 2675A's 2K personality PROM and sell into their vertical markets with tailored applications," he says.

Morel thinks there's a market for the 2675A outside HP's existing customers, even though the terminal's price is high. "We think people will buy the 2675A on the basis of its features. And we're selling the configuration features."

The company faces some fierce competition in the portable terminal market from Texas Instruments Inc. Some estimates show that TI has more than 80 percent of that market, with most of its sales coming from its low-priced Silent

700 series, especially the 740 series. But Morel says that HP has no intention of getting any of TI's business. "We're after the high end of the market," he says, "and I think we're competitive there." He lists home programming, time sharing and service bureau customers and the TTY-compatible market, as good candidates for the 2675A.

The 2675A's closest competito: at the high end is Ti's Silent 765. That portable terminal, which has in optional maximum 80K bytes of bubble memory, costs about \$4500 Morel says, "We do cost 20 percen more than the TI 765, but, among other things, we have much more mass storage," He adds "I think people will look twice at the 2675A before buying another terminal, and they'll see that it is very different.

-Larry Lettieri

Two low-cost work stations feature high-end processors

Two new stand-alone raster-scan graphics work stations equipped with high-end 16-bit microprocessors are designed to compete directly with Tektronix storage-tube devices.

The first of these work stations, the Model 8600, marks the entry of Terak Corp.—a 3-yr.-old firm founded by ex-Sperry Flight Systems executives—into the color graphics market.

Both the 8600 and G-1000—Genisco Computer's new low-cost monochromatic raster-scan system—were introduced at the Siggraph show in Seattle in July (see "Siggraph reflects growth in computer graphics market," p.17).

The 8600 is available in two eight-color versions, the first with a 320 \times 240 resolution, the second with a 640 \times 480 resolution. The latter device can be expanded to 64

colors by adding three boards.

Both Terak terminals include two 16-bit microprocessors—an Intel 8086 for control of the frame buffer and display memory and a DEC LSI-11 for applications and systems level control. As a result, the 8600 is Q-bus-compatible, enabling LSI-11 peripheral hardware to be easily incorporated. It also can handle DEC software, including the RT-11 operation system, says Jack Person, marketing director at the Phoenix systems house.

The 8600 will also have the UCSD Pascal operating system, Person adds, along with the UNIX system developed by Bell Laboratories. Language support is equally varied, he notes, and includes FORTRAN, BASIC, APL, ADA, C and FORTH. At the applications level, all color mapping and the number of colors in each map are under software

support, as is character generation, a capability that enables generation of foreign language characters and mathematical symbols.

Person claims that the 8600 desk-top device is the first in the under-\$20,000 range with programmable control of video timing, which enables the device to synchronize with other external devices, such as video cameras, tape recorders and disk units. As a result, users can mix graphics, text and inputs from other sources in one display.

He says the 8600 is also the only device of its type that can emulate the Tektronix 4027 and the Hewlett-Packard 9845B, and it is the first to offer RS232, RS170 and 20 mA current loop interfaces. Also available for the first time to users of low-cost color graphics is split-screen scaling.

The new work station is aimed principally at the education market, and will be sold through Terak's direct sales force, Person says. Prices run from \$14,750 to \$18,750, depending on screen resolution and

Mini-Micro World

the number of displayable colors. Production quantities will be available by the end of this year.

While Terak uses two 16-bit microprocessors to drive a color unit. Genisco Computers, Costa Mesa, Calif., incorporates a single z800 processor into its less-than-\$10,000 G-1000 (MMS, June, p. 5).

The G-1000 is aimed at applications such as computer-aided design (C.D), mapping and data analysis, arl is compatible with the PLOT-10 sitware designed for the Tektronix 414 storage-tube device. Accordig to company sources, raster-scan echnology offers improvements over storage-tube hardware, including selective erase of any portion of the alphanumeric or graphics image. Storage-tube devices generally require that the entire screen be erased and rewritten. Other advantages include higher-contrast black-and-white images (as opposed to variations of green) and a brighter display.

Resolution on the G-1000 is 1024 × 792 pixels, each set by 1 bit. The unit comes with a 19-in. display, a detachable alphanumeric keyboard, a numeric keypad, a power supply and a 19.2K-bps RS232 port. Deliveries will begin in December.

-John Trifari

NEXT MONTH IN MMS

The October issue of Mini-Micro Systems will focus on software, with articles in the feature section devoted

- · A survey of microcomputer operating systems.
- The second in our series of reviews of data base management systems for minicomputers, this time on SEED.
- · An examination of Pascal's weaknesses, with a checklist to use when selecting specific implementations of this increasingly popular programming language.
- · A tutorial on the new families of communication ICs-actually specialized processors-and what they mean for users and configurators.

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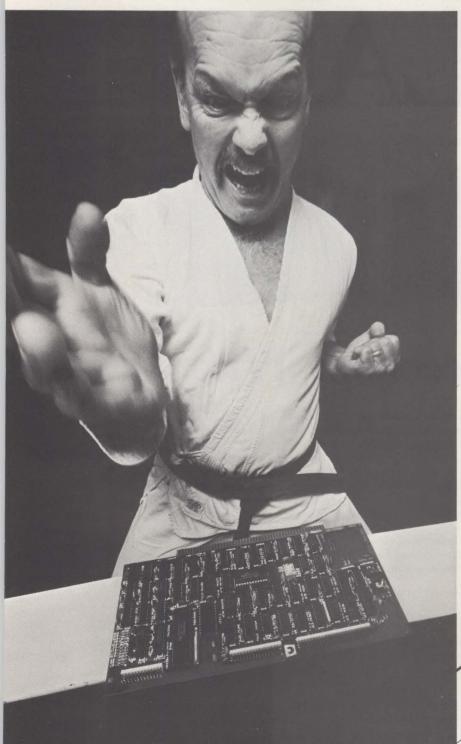
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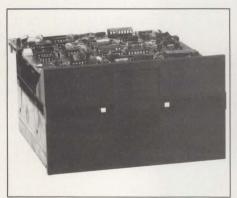
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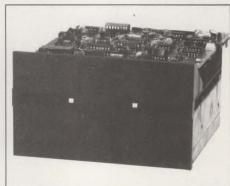
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CIRCLE NO. 40 ON INQUIRY CARD

For Sanders Technology, it's a long road back

Selling a product with innovative technology into a market that appears to be hungry for such a product does not guarantee success. That's a lesson some companies, including Sanders Technology, Inc., have had to learn the hard way.

Sanders was founded by Royden Sanders Jr., the entrepreneur who invented the FM altimeter and who earlier founded Sanders Associates, Inc., a manufacturer of military weapons systems and computer graphics products. But Sanders' new company has suffered a series of setbacks that have prevented its Media 12/7 dot-matrix printer from getting off the ground.

- The company reported losses of \$869,016 for the first quarter this year. The losses were attributed to a German company that renegotiated a \$46-million, 3-yr. contract for 18,000 printers. The company has agreed to buy the same number of printers, but stretched out over six years.
- Following some delays in development—caused partially by a long wait for delivery of direct memory access support chips—the company ran into production problems. It has now sold more than 1500 printers, but that hasn't been enough to generate sufficient capital to support production, according to one source.
- The company has also experienced some problems with user acceptance for the Media 12/7. It has found that users not only scrutinize the quality of the dot-matrix print, but also compare it to daisy-wheel printers. Some industry observers also claim that the Media 12/7 is too powerful. Sanders says his technology is as much as two years ahead of the market. "We gave people so much

intelligence they did not know what to do with it for a while."

- These setbacks have many venture capitalists leery of dealing with Sanders, according to another industry source.
- Finally in May, the Amherst, N.H., company filed for protection under Chapter XI, the federal bankruptcy laws, and it is working quickly to reorganize and prepare a plan to pay off its debts.

The plan was to have been presented to a creditors' committee earlier this month. The company's debt totals more than \$3 million, including \$2 million owed to 400

creditors, \$860,000 to its bank and \$250,000 in debentures. In the meantime, Sanders has discussed a possible merger with several large companies, including Centronics Data Computer Corp., Hudson, N.H., and is still trying to get much-needed cash from venture capitalists.

The 62-yr.-old Sanders says he will do what "is in the best interest of the stockholders." That will be determined by the creditors' committee reaction to the repayment plan. If the plan is approved, the company may come out of Chapter XI as early as the end of next month. But many industry observers don't think it will happen that fast, pointing out that the road back from Chapter XI is a long one.

When Sanders began his venture in 1977, he saw the potential need



Royden Sanders' company has been hit by a series of setbacks, but he has faith in his printer technology and is working to make the company profitable.

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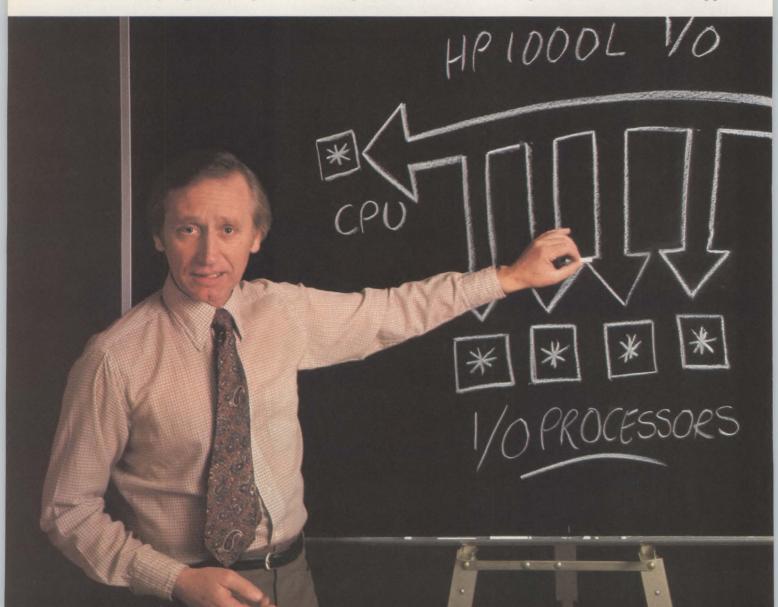
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Mini-Micro World

for a printer that could perform both high- and low-quality printing in mixed word- and data-processing applications. Users typically have to purchase two different printers for draft- and typewriter-quality print. The market for fully formed character printers is estimated at \$225 million this year, and is expected to more than double by 1984, according to International contract was with Fleischauer Data Systems, Inc., and Dataroyal,

Data Corp. That lucrative market Datentraeger GmbH for 18,000 has captured the interest of many printers. That contract seemed to dot-matrix printer manufacturers, guarantee a strong start for including Okidata Corp., Integral Sanders Technology-until Fleischauer renegotiated.

Hope for the company glimmered Sanders first marketed the Media again when, at the same time the 12/7 in 1978, after the delays in German contract was renegotiated, development. The first major Sanders received \$750,000 in capital

COMPARING THE PRINTERS' PRINTING

The wine list is mostly French and somewhat limited, and prices are high. On the less expensive side are the house Beaujolis Lupe-Cholet, '76, at \$10, and the Barra muscadet at \$12.

The wine list is mostly French and somewhat limited, and prices are On the less expensive side are the house Beaujolis Lupe-Cholet, '76, at \$10, and the Barre muscadet at \$12.

The wine list is mostly French and somewhat limited, and prices are high. On the less expensive side are the house Beaujolis Lupe-Cholet, '76, at \$10, and the Barre muscadet at \$12.

This utility quality (1 pags) typeface called Media Max 12 is useful in many applications such as correspondence drafts and teleprinting. One pags typefaces are available in a variety of ucbient. The improved readability of the Media Max typefaces offer a distinct advantage over the typical 5x2 and 7x9 matrix

High quality text output can be produced using one of the members of the Helvesan family, This paragraph is set in 8 point Helvesan Regular. Helvesan is a proportionally spaced, sans serif typeface which the MEDIA 12/7 prints in four passes of the print head. Helvesan is recommended

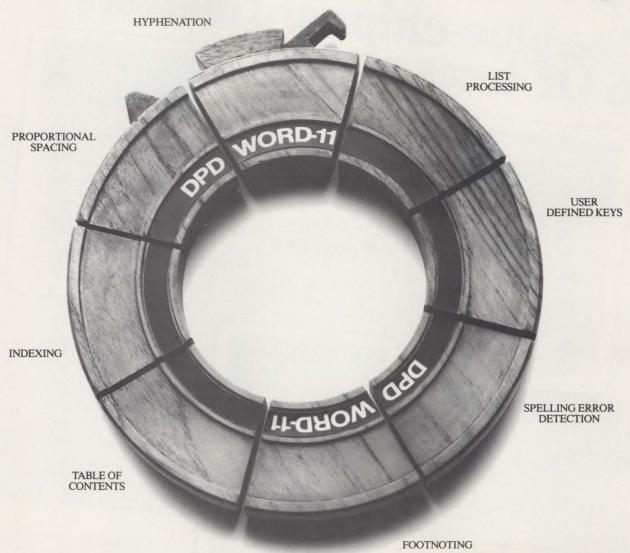
A. > TEXT PRINTING - THE BI-DIRECTIONAL LOGIC-SEEKING CAPABILITY ENSURES OPTIMUM LINE SPEED AT 150CPS.

The wine list the MEDIA

These samples were printed by (from top to bottom) a Qume character printer with a letter gothic 12-pitch plastic daisy wheel; a Wang model 5521 impact-matrix printer; a Diablo character printer with a metal gothic PS daisy wheel; a

Sanders Technology Media 12/7 printer at one pass; a Media 12/7 at four passes; and a Dataroyal 7036 printer at 150 characters per sec. The other samples are enlarged details from the Diablo printer (left) and the Media 12/7.

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Mini-Micro World

from two investors: Frederick R. Adler and Henry Burkhardt III, both Data General Corp. founders.

Two months later, however, Sanders Technology was near bankruptcy, it cut its workforce from 135 to 56, and both Burkhardt and Adler resigned.

One of the company's problems was slow user acceptance. Users not only compared the appearance of the dot-matrix print, they also compared noise levels. Dot-matrix printers are usually quieter than their fully formed counterparts, but they emit a high-pitched noise that many users find irritating.

More serious problems appeared when users tried to interface the Media 12/7 to word-processing systems. The printer does not have a Qume- or Diablo-compatible interface. Because those two companies supply 90 percent of the word-processing market, Media 12/7 users have had to alter their software, according to one industry source. Sanders says he is considering making those interfaces available.

Further, because the printer stores all characters in digital form in the microprocessor, any added character sets are burned into PROM by the company. That may require a customer to return a printer for more typefonts. Additionally, the printer formats copy independently of the terminal, and does not act as a slave peripheral. As a result, the copy that appears on the CRT screen may not appear in the exact line format in print. This makes it difficult for operators to compare printed to screen copy, according to Patricia Seybold, editor of The Seybold Report on Word Processing.

Sanders points out that the intelligence of the 12/7 can be used by small systems houses and end users that write some of their own software. One user, Programmer International, a California software house, will market a wordprocessing software package in

THE TECHNOLOGY BEHIND HIGH-QUALITY PRINTING

Royden Sanders' patented "infinite-matrix principle" involves placing more dots in each dot-matrix character to produce a more fully formed appearance.

The founder of Sanders Technology, Inc., achieved that high-quality print by using a seven-pin print head that makes from one to four passes per line, ranging in speed from 30 to 216 characters per sec. Thus, draft copy is produced at regular dot-matrix print speed, which is reduced to one-quarter the throughput for typewriter-quality print.

Indeed, the four-pass cycle produces print quality that surpasses that of most dot-matrix printers. But in high-quality print mode, the printer functions more slowly than fully formed character printers and, in some cases, costs more. Prices range from \$2500 to \$4000.

The flexibility of such a print technology, based on a Zilog z80 microprocessor, allows the printer to place a 13-mil diameter dot anywhere on a page to within 1-mil accuracy, Sanders claims. Eleven typefaces are stored in ROM in the printer, which can also store signatures in anyone's handwriting to be produced under operator command. With most other printers, operators must manually change fonts to get a different typeface.

September, called PIE, that will allow the Media 12/7 to be used for typesetting-type output on an Apple personal computer.

On top of everything else, Sanders Technology has had production problems, according to one source. Some dot-matrix printer vendors have abandoned the multiple-pass technology because of the precision required to manufacture the printers. One vendor describes the required precision as close to military specifications, which are difficult to attain in high-volume production.

One company that decided against the multiple-pass technology is Dataroyal, Inc., Nashua, N.H. Dataroyal president Ron Huch explains that many factors affect a printer that must be precise to form lines to within 1/1000 in. For example, a pulley that drives the printer must be concentric and properly placed to assure proper spacing of the dots for the characters. If it is not properly positioned, lines and characters are printed unevenly.

Dataroyal has a prototype of a slower, unidirectional printer, but one that prints higher-quality characters on a single pass. It is easier to produce, but Huch acknowledges that this approach does not produce the same high-quality printing that the Sanders Technology printer does.

Sanders still has faith in his patented technology. He admits that low-volume production makes it difficult for him to be competitive with other vendors. Sanders Technology manufactured 90 printers in July and expects to make 200 next month.

Sanders' former optimism about his company's recovery has been tempered to a more circumspect approach. He has retained Wheeler and Curry Associates, Inc., Haworth, N.J., in an effort to save his company. Arleen Curry has taken over as temporary president of Sanders Technology and will consult with creditors and monitor the company's cash flow. Most recently, her firm pulled Diva, Inc., an Eatontown, N.J., manufacturer of data storage controllers, out of Chapter XI and into profitability. Although Curry has a good track record, her job at Sanders Technology is a challenge.

One source says Sanders Technology has as "good a chance as any" to come back. But the road back is difficult, and one creditor says "it depends on the people and product involved, in that order."

—Lori Valigra

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



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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 x 106

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.

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Video terminal maker gets set for rapid market expansion

eo, Inc. "The industry is ready for are U.S. products. a high-volume manufacturer who everything included."

The San Jose, Calif., video display maker says it is about to ship its 20,000th terminal, a number reached after 18 months of volume production. That figure, according to DuBridge, ranks Televideo fourth behind Lear-Siegler, Inc., ADDS and Hazeltine Corp.

In June, Televideo shipped 2300 units and is approaching a rate of 2500 terminals a month. DuBridge compares those figures to leader Lear-Siegler's recently announced 3000 ADM-3 terminals-a-month number (and the 100,000th terminal in its history), and adds that he expects Televideo to catch up with Hazeltine soon.

He likens Televideo's business to the black-and-white television industry. "We manufacture in high volumes and provide a low cost per unit," he says. To do this, Televideo relies heavily on manufacturing the labor-intensive parts of the displays in Korea. The company operates a large production facility near Seoul, where the terminals' video monitors, monitor electronics, power supplies, chassis and cabinets are made, and all but the display logic is assembled. The plant, says Du-Bridge, can produce 50,000 subassemblies a year, which could contribute to at least that many finished displays. "It's just a matter of adding personnel," he points out.

Logic board production and final assembly and testing are carried out at the company's San Jose headquarters. DuBridge points out, however, that more than half of the

"The days of the custom CRT are total value of each terminal is over," says Richard DuBridge, manufactured in the U.S., allowing executive vice president of Televid- Televideo to say that the displays

Contributing to the company's can deliver a product with rapid rise in production is the simple design of the displays. As in the black-and-white TV business, Televideo's product line remains uncomplicated. The four terminals in the line differ only in keyboard style—typewriter or Teletype, with or without function keys. This helps keep parts inventory low, says DuBridge.

> Televideo was founded about five years ago by Phil Hwang. Its first products were video monitors for the then booming video game market. As that business began to soften, Hwang took a different tack. He worked keyboards and logic into his CRTs and entered the computer terminal business.

> Televideo is a privately held company. It has no long-term debts and has not needed outside funding, according to DuBridge. "We've financed our growth internally from the start," he says.

> The decision to gear up for volume production was made 21/2 years ago, according to DuBridge, and large-scale production began in March, 1979. A major factor in Televideo's early success, says DuBridge, has been a contract with General Electric to have GE service Televideo equipment.

> The four terminals in Televideo's line are the 912B and C and the 920B and c. All use an Intel 8035 microprocessor and have 32K of onboard ROM. Besides a choice of keyboards, the only other option available is an extra page of memory via RAM. "We made that optional," DuBridge points out, "simply because of the cost of RAM."

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Mini-Micro World

Televideo stresses the smart, standard features of its terminals. End-user prices range from \$875 to \$995 for a top-of-the-line 920C. All have upper- and lower-case characters, dual-density displays, reverse video and such editing features as underlining, blinking fields or field protect, as well as standard display features, such as character and line insert and delete.

A new display is being readied for "late 1980" introduction. The black-and-white, alphanumeric terminal will have, among other things, a 25th status line for displaying, for instance, switch settings and baud rate. The company is also introducing an integral 300-baud, full-duplex modem—the model 9103—into its existing products this fall.

Televideo has worked with distributors in both the U.S. and abroad. DuBridge breaks down sales into 60 percent domestic and 40 international, where Western Europe, Canada, Australia and Japan account for the bulk of shipments. He says that about half of Televideo's products are sold through distributors, with about the same number going to OEMs. A very small percentage have been sold directly to end users. However, he expects the number to change somewhat as the company begins stressing end-user sales.

Televideo is bullish about the market for display terminals, estimating it to be about 200,000 units a year. "That's the non-IBM market," DuBridge points out. The market for IBM terminals is about the same, he says. Overall, the market is growing about 25 percent each year.

"There's no end in sight for applications," DuBridge indicates, stressing that the consumer market has barely been touched. "As for ourselves, we don't like to see our employees walking 10 feet to use a terminal. There should be one at each desk."

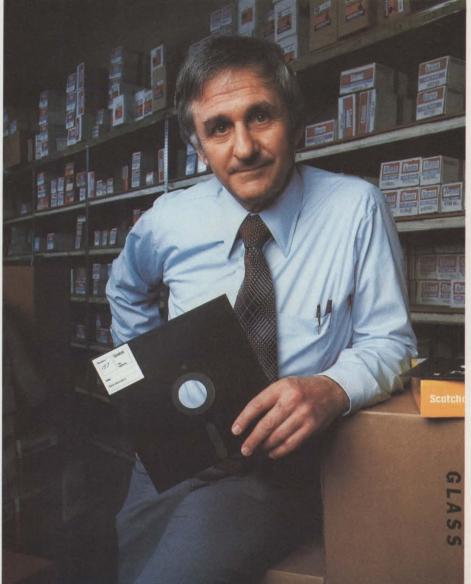
—Larry Lettieri

BOX SCORE OF EARNINGS

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

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

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CIRCLE NO. 47 ON INQUIRY CARD

Axxa Corp.'s Terri Myers thrives in a man's world

Although the computer industry is considered more open to women than other business sectors, upper managment still is largely a men's club. But Therese E. Myers, the recently appointed vice president of product development at Axxa Corp., Woodland Hills, Calif., has managed to enter this predominantly masculine domain.

The 35-year-old Myers was promoted to her new position because of the key role she played in developing Axxa's System 90 office automation system, which was introduced in March (MMS, April, p. 32). Myers was product manager for the System 90, the Citibank spin-off's first product. That system, originally developed for Citibank, has received a lot of media attention. It has been featured on NBC's Today show, and was on the cover of a recent Newsweek special issue on computer technology. Why is the System 90 getting all this attention? It is the first commercial office system geared to executives rather than to secretaries.

Myers is modest about her role in the creation of the System 90, stressing that it was a team effort. "There were about nine of us who did the system. All I did was to make the team gel," she says. "We really functioned well as a team."

Myers says that her major contribution to the System 90 was ideas, and that function will be even more important in her new position. "I'm the one who tosses out the ideas," she says. She then works with the engineering and programming members of the team in refining the ideas into a marketable system.

Myers obviously thrives in a high-technology atmosphere such as the one that prevails at Axxa Corp. Although she began her career as a



Terri Myers thrives in a high-technology atmosphere such as the one at Axxa Corp.

management consultant in accounting information systems, she says she never really liked accounting. "You're always cleaning up after everybody else's messes," she explains.

Myers's first job after graduating from Carnegie Mellon University with a degree in industrial management was with Arthur Young & Co., where she was hired as one of 30 management trainees. As the only woman in the group, she was featured in a *New York Times* article on the Arthur Young program. That article brought her to the attention of Citicorp., where she once had a summer job. Citicorp hired her to do strategic planning for a middle-market leasing program that the bank was creating.

Myers got her first taste of a technological environment when she was placed in charge of finance and administration for the bank's Transaction Technology, Inc., subsidiary, which was developing an on-line Master Charge credit card evaluation and Citibank check-cashing system.

When TTI founder and president Jack Scantlin left to form Lexar Business Communications in 1974. Myers and most of TTI's design team went with him. Lexar's first product was a data-encryption device for which the firm received a 15-year contract from Telex, Myers says. Scantlin then had the idea for an office automation system based on a high-resolution CRT display, which ultimately became the System 90. Lexar approached Citibank with the idea, and they liked the proposed system so much, Myers says, that they bought not only it but also Lexar, giving the new subsidiary a contract to develop 15 pilot systems for an experimental managerial systems project. In January, Lexar went commercial with the system, spinning off Axxa to manufacture and market the system.

One of the happiest times in her life, Myers recalls, was when the System 90 was nearing completion. "There was a stretch of four to five months when we never looked up," she says. Although there were many technical problems to hurdle, particularly in fitting software into the System 90's memory, she says there never was any dissension in the development team. "We were building what we wanted to build," she explains.

Contributing to the heady atmosphere, she recalls, was a feeling of being in tune with the times. Myers, who describes herself as a "huge reader," says an article in *The Economist* greatly influenced her at the time. It described America as it would be in the 21st century. "We were already there," she says.

But working at the leading edge of technology does have its drawbacks. One of these, Myers points out, is the lack of information



Mini-Micro World

on how advanced systems, such as Axxa's System 90, can best increase a manager's productivity. Such information is crucial to Myers because she now is in the product definition stage of a follow-on to the System 90. Thus, she says, one of her priorities in her new job is to conduct productivity measurement studies of Axxa 90 users. "This will allow us to determine what tools need to be developed," she says.

Myers, who appears to enjoy working in a man's world, says sex discrimination has never been a problem for her. With characteristic modesty, she attributes this to luck, saying that she has been fortunate to work for small companies where the opportunity for advancement is greater. She also believes she was lucky in the kind of supervisors she's had. "A lot depends on the man you work for," Myers says with unintentional irony.

-Paul Kinnucan

People in the news . . .

Dr. John D. Patterson has been named vice president, research and development, at Radio Shack, Fort Worth, Texas, a division of Tandy Corp. He will be responsible for all hardware and software development for the company's TRS-80 computer family, and for all development engineering for Tandy's U.S. manufacturing.

Before joining Radio Shack in 1979 as director, Tandy Systems Design, Patterson had been manager, product development, for Xerox Corp., since 1973. Before that, he served as an associate professor of electrical engineering at the University of Texas at Arlington, Texas.

Frank C. Bumb has been appointed president of Kennedy Co., replacing Charles J. Kennedy, who will remain chairman. Bumb previously was president of the data tape division of Bell & Howell.

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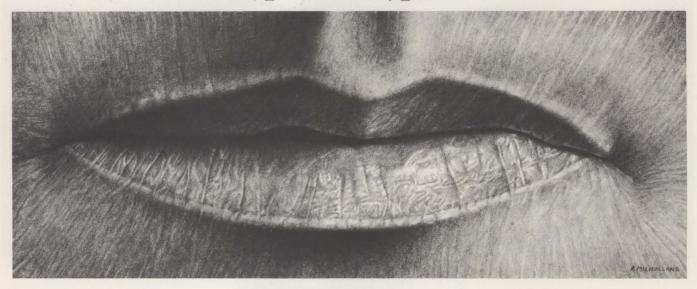
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A vote for X.25



Computers are increasingly finding use in networks of processors and terminals, which, in turn, are being interconnected-albeit with some difficulty-into hierarchies of networks. The network phenomenon will continue to expand as corporate data processing functions become more and more widely distributed, outgrowing the habits of an earlier era that regarded them as the province of a centralized EDP department built around a mainframe computer.

But there's a long way to go before computer users can realize the full benefits of easy data exchange between networks using hardware supplied by competing computer manufacturers. Indeed, confused computer users couldn't be faulted if they concluded that the world of distributed data processing, like the biblical tower of Babel, looks wonderful if they only could understand how to get on with it. Computer manufacturers simply haven't made it easy for users to interconnect networks implemented with dissimilar hardware.

Walter A. Levy, president of Edgewood Computer Associates, Inc., a computer and data communications consulting firm, contends that computer manufacturers present obstacles to efficient internetwork communications. In an article beginning on p.104, Levy says that all vendors—whether they're selling mainframes, minicomputers or independent data network hardware—approach networking as though potential users had no choice but to buy a single company's products. "The main problem," Levy asserts, "is that each vendor . . . has looked at computer networks as though no other vendors or networks were present in the user's environment. Except for the useful but limited provisions of CCITT X.75, there is no applicable set of standards for interconnecting computer networks." X.75 is one of the CCITT recommendations for standards for a system of network operation, called X.25 for short, that is being adopted by international and domestic telegraphic administrations and common carriers that offer data network services. X.75 defines a gateway that allows inter-network communications.

And while the various recommendations embodied in X.25 have limitations—there's no provision for terminal-to-terminal service, for example—the standard is widely accepted among common carriers and providers of packet data networks. Levy characterizes these suppliers as "the only organized force in the industry trying to break down the barriers between computer networks that the computer vendors are busily erecting."

We suggest that the computer industry would do well to set aside selfish interests temporarily, and follow the lead of the packet data network providers by universally adopting the x.25 standard.

Lawrence J. Curran

TAMING A TEMPEST

To the editor:

I enjoyed very much your article on Tempest word-processing systems, "Tempest opens up government market" (MMS, June, p. 111). Dataproducts New England manufactures a wide variety of Tempest equipment, including Tempest printers used in data-processing systems. Frequently, articles written in commercial publications addressing subjects intertwined with the complexity of government regulations and government agencies get confused in the morass of specifications and miss the mark. Yours did not. It addresses the Tempest word-processing market directly and accurately.

Joel T. Herbst Vice President Dataproducts New England, Inc. Wallingford, Conn.

PREVENTING PIRACY

To the To the editor:

The inset, "Protecting microcomputer software from pirates" (MMS, April, p. 53), addressed one facet of the problem

of unauthorized access to files stored on removable file media—software "piracy." As in any form of security protection, the central issue is to make the "cost" of "pirating" the data prohibitive in relation to the cost of an outright purchase of the information, or software, to the "pirate." The techniques suggested in the article represent some of the components that historically have been used to provide file security and prevent unauthorized access to computers, but it omits an emerging technology that should prove to be the most effective deterrent available—cryptography.

Western Digital is keenly aware of the file security problem and has developed solutions based on the DES (National Bureau of Standards, Data Encryption Standard) cryptographic algorithm. It is my belief that cryptography, implemented and used properly, will prove to be a cost-effective way to force the pirates to find other ways to make their money. I encourage reader response on this issue.

Ken Cohen Product Line Manager Western Digital Corp. Newport Beach, Calif.

COROUTINES CONTINUED

To the editor:

This letter is to dispute the assertions of Ronald J. Kleinman relating to coroutines (MMS, July, p. 86), especially that "coroutines are only usable by assembly language programmers." The distinguishing attribute of a coroutine is that it determines its own entry points. Control features to accomplish this are present in all common computer languages. I regularly use coroutines in FORTRAN programs where they are particularly useful for report generation. My preference is to use assigned GOTO for control, but computed or conditional GOTO will also work satisfactorily.

The PDP-11 instruction sequence that you printed is incorrect. The correct version can be found in most PDP-11 processor handbooks in the section on coroutines in the "Programming Techniques" chapter. While this method is certainly "neat," it won't serve for more than two coroutines, and any of several more general techniques are to be preferred.

Daniel Somerville Hingham, Mass.



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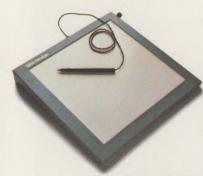
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PRODUCT FOCUS

DSD 880-A floppy/Winchester marriage

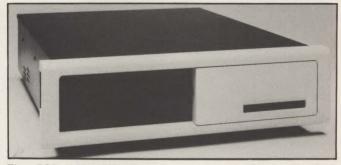
KEN DEEMER, Data Systems Design, Inc.

This mass-storage subsystem achieves economy and high performance with a novel system architecture

The burgeoning demand for small computer systems has prompted a need for compact and relatively inexpensive mass-storage subsystems that outstrips the abilities of floppy-disk drives. Recent advances in hard-disk-drive technology, especially in small Winchester drives, are making those drives attractive for small computer systems because of their increased capacity, performance and reliability versus floppy-disk drives. But because Winchester disks can't be removed from a system, the question of how to provide an adequate backup device is still being debated. The DSD 880, the industry's first combination Winchester-floppy drive that's compatible with Digital Equipment Corp. computers, is intended to quiet the debate.

Winchesters and floppy-disk drives are an ideal combination because they offer clear advantages over other configurations. Winchesters provide high capacity, performance and reliability. Floppy disks offer fast random-access disk backup and loading using industry-standard media, plus convenient, archival storage. Together, the floppy disk and the Winchester provide convenient file copying and loading. Either drive can be used as a primary mass-storage device. Finally, the subsystem can be configured in a small, economical package.

The design of a Winchester-floppy-disk subsystem can be quite complex, however, if the potential advantages and economies of the combination are to be realized. Although 8-in. Winchesters are physically similar to floppy disks, they are not replacements for them. Winchester speeds and data rates are nearly 10 times greater than those of floppy-disk drives, and require different controller architectures. At the same time, simply combining separate disk controllers and



The DSD 880's Winchester is plug-compatible with Digital Equipment Corp.'s RL01, and the floppy disk emulates the RX02.

interfaces into the same package is an expensive solution that compromises many advantages of an integrated system and necessitates several design trade-offs.

Design considerations

Some important aspects of a disk memory subsystem that determine its flexibility and ease of operation should be explicitly addressed. These include:

- Can a user conveniently exchange a subsystem's data with other computer systems' data?
- Can the failure of a Winchester drive bring down the whole computer system?
- Is special software needed for system integration? One way to address these questions is to design a

Winchester so that it logically emulates a large-capacity floppy-disk drive. Common track and sector addressing would simplify the design. A single controller/formatter can be used, provided it can accommodate the different transfer rates of the two drives. A common CPU

The controller uses a bit-slice processor that alternately switches roles between the Winchester- and floppy-disk drives.

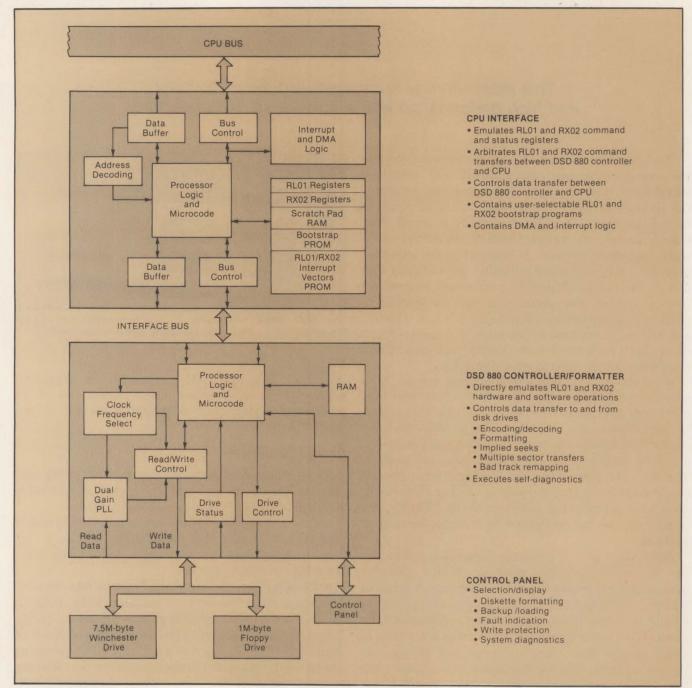
interface can also be used. If the system is intended for plug replacement of another disk memory subsystem, however, extensive modification of the operating system software may be required. Further, the potential speed and performance of the Winchester may be sacrificed if it is constrained to behave like a floppy-disk drive.

A second approach is to configure the Winchester and floppy disks to logically emulate dissimilar devices to achieve the best performance from each. If the devices emulated are a rigid disk and a floppy disk supported by the target operating system, no software modification would be required for full compatibility. This combination, however, may require separate controllers and interfaces for each device.

Synergy—a novel combination

The DSD 880 is a third alternative. Manufactured by Data Systems Design, Inc., Santa Clara, Calif., it offers a Winchester-floppy-disk drive combination that achieves economy and high performance with a novel system architecture. The Winchester is configured to be plug-compatible with a high-performance disk drive, the RLO1, from Digital Equipment Corp., while the double-sided floppy-disk drive emulates a floppy-disk system, the DEC RXO2. It provides 8.5M bytes of on-line storage—7.5M bytes fixed and 1M byte removable.

The DSD 880 is implemented with a controller-



WINCHESTER BACKUP REVISITED

The widely discussed problem of disk backup has confounded manufacturers and has impeded the growth of Winchester-based systems (MMS, August, 1979, p. 44). Several alternatives have been proposed, including floppy-disk backup for Winchesters with capacities as high as 15M bytes, ¼-in. tape cartridges for 15M- to 40M-byte systems, and ½-in. tape drives for higher capacities.

Floppy disks have the disadvantage of having different capacities from Winchesters—backing a 10M-byte Winchester requires at least 10 double-sided floppy disks. But it is seldom necessary to back up the entire disk's contents because only those test data and software files that are modified in daily operation need backup. Part of the disk is reserved for work space and expansion, the operating system software and utilities and applications packages, all of which are infrequently modified.

In fact, only changes to data need to be preserved. If a file is inadvertently destroyed, these changes may be applied to a copy of the original file to restore the most recent version. This selective, or transactional, backup can be conveniently implemented in software. Many operating systems already provide the capability. As files are updated, they are flagged. At the end of the day, a utility automatically copies the file changes onto the backup device. A 1M-byte diskette can easily contain several days' transactions. Complete disk backups can be made every few weeks.

Another adequate method of backup is tape. But tape cannot be used as a system's primary mass-storage device, which contains the operating system, utilities and user programs. Even fixed-removable-cartridge disks are not physically separate devices. Any failure will cause loss of the entire system because both platters are driven by the same spindle.

To transfer information to or from other systems, at least one storage device must have removable media. Floppy disks, ¼- and ½-in. tape, and removable cartridge disks all satisfy this requirement. Disks with fixed and removable media on the same spindle, however, require the user to

shut down the entire drive before inserting a new cartridge. The user must then allow time for the system to come up to speed and stabilize before any loading or copying can be performed.

Loading and copying of individual files require random-access data storage. Floppy-disk drives and removable-cartridge disks offer the fastest file access. Block addressable tape drives—both ¼-in. cartridge and ½-in. reel—can also access individual files, but must search through the tape serially. This search can degrade system performance. Streaming tape drives are designed not for random access, but for loading and copying of the entire disk contents.

Exchange of data between different computer systems—software portability—is easily accomplished if both systems use industry-standard media and recording formats. Floppy disks and ½-in. tapes are accepted industry standards, and enjoy widespread use. But newer, ¼-in. tape cartridges and removable 8-in. disk cartridges are not, and they do not permit data exchange with systems offered by major computer manufacturers.

FUNCTIONALITY

Individual File Accessibility

Speed: Average Access Time

System Device Capability

OFF-LINE STORAGE

Capacity per Media Unit
Cost per Media Unit

Media (\$/1M byte)

Space Requirements

Transportability

WINCHESTER BACKUP (10M bytes)

- a) Full Disk
 - · media units required
 - time for backup
- b) Transactional
 - media units required
 - time for backup

INDUSTRY STANDARD MEDIA
DEVICE COST

		SECONDARY	CONDARY 1/4-in. CARTRIDGE TAPE DRIVE			8-in. FIXED	
	FLEXIBLE- DISK DRIVE	8-in. WINCHESTER DRIVE	STREAMING	START/ STOP	½-in. STREAMING TAPE DRIVE	AND REMOVABLE WINCHESTER	
				TALL THE			
	YES	YES	NO	YES (VERY SLOW)	YES (VERY SLOW)	YES	
	150-200 msec.	30-70 msec.	10-100 SEC. OR MORE	10-100 SEC. OR MORE	10-100 SEC. OR MORE	30-50 msec.	
	YES	YES	NO	NO	NO	YES	
	1M byte	5M-30M bytes	10M-20M bytes	10M-20M bytes	40M bytes	8M-12M bytes	
	\$5-\$10	N/A	\$15-\$25	\$15-\$25	\$15-\$25	\$100-\$150	
	7.5	N/A	1	1	.5	12	
	MINIMAL	N/A	MINIMAL	MINIMAL	LOW	LOW	
	EXCELLENT	VERY POOR	GOOD	GOOD	FAIR	GOOD	
	10	1	1	1	1	1	
	10-12 MIN.	<1 MIN.	3-10 MIN.	7-10 MIN.	3-5 MIN.	<1 MIN.	
	1	1	1	1	1	1	
	<1 MIN.	<1 MIN.	<1 MIN.	<1 MIN.	<1 MIN.	<1 MIN.	
4	YES	NO	NO	NO	YES	NO	
	\$400-\$500	\$1000-\$2500	~\$750	\$1000-\$1500	\$2000-\$3000	\$1000*	
	*F f f d f						

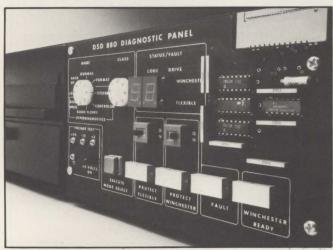
^{*}Excess of fixed/removable 8-inch Winchester drive over fixed-only 8-inch drive.

Device comparison: secondary device configured with 8-in. Winchester for complete memory storage system.

Hyperdiagnostics provide operators a library of user-selectable diagnostic routines and a readout of system status.

formatter that is common to both drives. A single computer interface simplifies system integration. A microprocessor on this interface arbitrates device requests and queues pending instructions. Each disk drive responds to a different device address and interrupt priority.

The system's controller uses a bit-slice processor that alternately switches between the roles of Winchesterand floppy-disk drives. A single phase-lock-loop data separator operates at two clock frequencies to accom-



The DSD 880 is implemented with a controller-formatter that is common to both drives.

modate the different data rates of the two drives. Although the controller can emulate two devices, it cannot do so simultaneously. The computer interface must arbitrate RL01 and RX02 command transfers between the controller and the CPU bus. The interface also:

- Emulates RL01 and RX02 command and status registers;
- Controls data transfers between the CPU and the disk controller; and
 - Executes initial bootstrap loading.

Off-line backup

Several alternatives to the problem of backup have been proposed (see "Winchester backup revisited," p. 91). The DSD 880 provides backup through its controller, which offers stand-alone Winchester backup and loading, independent of the CPU. This ensures that data will not be lost or destroyed in the event of a computer system failure. Backup and loading are initiated from a built-in diagnostic panel. The entire Winchester contents may be dumped onto floppy disks. When a floppy disk is full, the system instructs an operator to insert another one. Record keeping is not necessary because each floppy disk is coded with a

corresponding Winchester track address so that it can be inserted in any order.

Reliability is key

Winchester technology offers potentially greater reliability than do floppy-disk drives. Because reliability will be limited to that of the system's weakest component, innovations are needed to enhance reliability. The DSD 880's reliability will be high because power to the floppy-disk drive is automatically shut off when that drive is not in use. This saves wear on media, bearings, belts and pulleys. The floppy-disk drive will be used primarily for Winchester backup and loading, which will significantly increase the mean time between failures (MTBFs) of the floppy-disk drive, and hence of the overall system.

Self-diagnostics capability

Because DSD's disk memory subsystems are controlled by microcomputers, self diagnostics, or "Hyperdiagnostics," are designed into the company's products. Hyperdiagnostics provide operators and service persons with a library of user-selectable diagnostic routines and an alphanumeric readout of system status or error information. Hyperdiagnostics also permit system diagnosis, floppy-disk formatting, Winchester backup and floppy-drive alignment to be handled in a stand-alone configuration—without tying up computer or test equipment. Subsystem faults are easily isolated, enabling quick servicing. The DSD 880's Hyperdiagnostics are initiated from a display panel located behind a removable front bezel. The panel is easily accessible by qualified personnel, but is usually concealed.

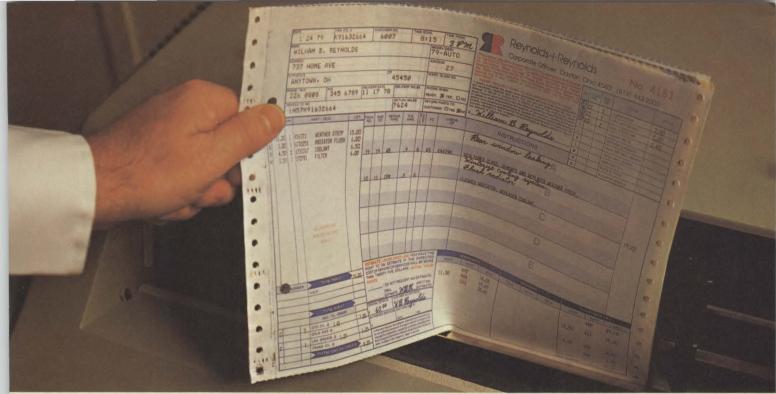
Special software requirements

If an 8-in. Winchester-based system is to be integrated into an existing hardware-software system, software compatibility is very important. Many disk systems will interface with the computer hardware, but require special software drivers and modifications to the operating system. This can place a programming burden on a user or a system integrator—especially to accommodate future software releases or updates.

One approach to software compatibility is to design a Winchester-disk system to be an exact logical emulation of a device that is supported by the existing software. This was achieved by DSD in the design of the DSD 880. Because its Winchester is plug-compatible with DEC's RL01 disk and its floppy disk emulates the RX02 floppy-disk system, it is compatible in hardware, software and media with DEC computers.



Ken Deemer is product manager for flexible-disk systems at Data Systems Design, Inc., Santa Clara, Calif.



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Wang Laboratories: coping with Goliath

PAUL KINNUCAN, Senior Editor

For years, Wang has been chipping away at IBM's markets, but now the industry giant is fighting back with its vast sales and service networks

For years Wang Laboratories, Inc., has grown by exploiting the cracks in IBM's armor. But now the inevitable has happened: Goliath has struck back, and Wang finds itself confronted with the need to wield IBM's sales and service cudgel as well as the slingshot of technology.

Besides having to cope with IBM, the Lowell, Mass., systems manufacturer also faces the problems of explosive growth. Wang's revenues have grown 40 to 60 percent annually over the last four years, and there are signs that this staggering growth rate has begun to take its toll (see "Wang's growth pains," p. 99).

But most observers believe a resurgent IBM is the most serious challenge Wang faces in the 1980s. In decades past, IBM stood aside and watched as Wang and other small entrepreneurial companies made inroads into its market with products that offered lower price and superior performance. In the last two years, however, the industry giant has struck back with state-of-the-art products, such as its 4300 series mainframes, the System 38 medium-scale business system, the 8100 distributed-processing system and the 5120 small business system.

IBM now can match its competitors product-forproduct, on both price and performance. For example, IBM has the 8100 mainframe satellite minicomputer, the System 38 and the low-end 4300 mainframes to compete against Wang's vs series systems. In word processing, IBM's Office System 6, 5820 office administrative system and the new Displaywriter compete against Wang's WPS series word-processing systems and its OIS office information systems. In small business systems, Wang's 2200 series is matched by IBM's System 38 and 5120 desk-top computers.

Although Wang is not alone in having to confront a newly awakened giant, it is especially vulnerable. For one thing, Wang, despite its growth of the last several years, remains a small company with comparatively

limited resources. Wang's \$544 million in 1980 sales and 11,600 employees are dwarfed by IBM's \$23 billion in sales last year and 337,000 employees. "We're still a David compared to IBM," points out John F. Cunningham, Wang's senior vice president in charge of field operations.



IBM's Displaywriter, a stand-alone word-processing system, is one example of IBM's renewed product aggressiveness.







Wang is not alone in having to confront a newly awakened giant, but it is especially vulnerable. Despite its growth, Wang is still a small company with relatively limited resources.

Also, Wang's business is concentrated in small business systems, word-processing systems and corporate data processing—markets IBM dominates, although Wang is the leader in CRT-based word-processing systems. Moreover, Wang competes directly with IBM in the end-user market. In this respect, Wang differs from other minicomputer systems manufacturers, most of whom sell to OEMs.

Wang faces a formidable list of competitors: Xerox, Lexitron (Raytheon) and Vydec (Exxon) in the word-processing market; Hewlett-Packard, Data General and Texas Instruments in small business systems; and Prime and Digital Equipment Corp. in the high-end commercial minicomputer systems market. But Wang has always considered IBM its chief competitor and has boldy challenged the industry giant in its own markets.

Wang has thrived in competition with IBM by riding the leading edge of technology, staying one jump ahead of IBM, which has always had to move slowly to protect its installed base. For instance, Wang preceded IBM into the market with interactive, display-based small business and word-processing systems. Interactive business systems now are rapidly displacing batch systems in the small business market, and word-processing systems are displacing mag card editing typewriters in the word-processing market.

Many other small entrepreneurial companies pursued this "leading edge" marketing strategy in the early seventies, but none did it with more panache and imagination than Wang. For example, Wang was the first to apply microprocessor and floppy-disk technology to word-processing systems. As a result, its first CRT system, introduced in 1976, was significantly cheaper and easier to use than competing systems. It was a year before IBM and other manufacturers caught up, and Wang now leads the industry in CRT display systems.

But competing with IBM has changed dramatically in the last two years. Now that IBM has brought its product lines up to date with products that are competitive in both price and performance, Wang and other IBM competitors can no longer rely on technology alone. IBM is forcing them to play its game of sales and support.

One example of IBM's renewed product aggressiveness is the Displaywriter stand-alone word-processing system announced in June (MMS, August, p. 35). That product is \$1000 less expensive than Wang's three-year-old WPS-5 and has more advanced features, such as a spelling dictionary. As a result, IBM has forced Wang to rethink its direct-sales-only policy in the low end of the market, says Cunningham.

Cunningham exepcts the Displaywriter to make IBM a force in the low end of the word-processing market, selling as many as 50,000 units in the next year, versus only about 2000 WPS-5 systems for Wang.

Until now, Wang's strength has been in multistation systems. Although Cunningham maintains that the low end of the market is not critical to Wang in the short run, he concedes that it cannot afford to abandon it entirely. Indeed, Wang reportedly is preparing an answer to the Displaywriter in the form of a single-station system that a company source says will be unveiled in November. According to this source, the Wang system will be priced competitively with the Displaywriter at about \$8000 and will have better performance.

But Wang cannot compete with IBM on a product basis alone. IBM's Office Products Division has 4000 salesmen, versus Wang's 850 salesmen. Wang's sales force sells both word- and data-processing systems.

Cunningham says that before the introduction of the



Wang's WPS-5 word-processing system is the company's competition for IBM's Displaywriter.



"We're still a David compared to IBM," says John F. Cunningham, Wang's senior v.p. in charge of field operations. He expects the company to reach \$5 billion in sales by the end of the decade. By then, he would like to see integrated-information systems and wordprocessing systems each contrbuting 40 percent (\$2 billion) to Wang's revenues, with the remaining 20 percent coming from small business systems.

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Competing with IBM has changed dramatically in the last two years, now that its products are competitive in both price and performance.

Displaywriter, Wang planned to create a special 60-man sales force for low-end systems. "But that's just a pimple compared to IBM's sales force," Cunningham points out.

Now, he says, Wang has to consider other distribution channels, such as retail stores or dealers. Industry observers speculate that the demonstration centers Wang now is setting up indicate the direction the company will take. Wang now has three centers, and plans to add 12 more by the end of the coming fiscal

year. Cunningham says that these showrooms, which display Wang's low-end word-processing and business systems, will resemble IBM's 50 retail business computer centers, which have been selling 5120 desk-top computers for the last two years.

Other word-processing manufacturers, notably NBI and CPT, have been selling systems through independent dealers. But Wang has a long-standing aversion to marketing through independents—a reflection of its founder An Wang's desire to maintain total control of the company.

IBM's resurgence in product strength is also redirecting Wang's traditional stress on product innovation to an emphasis on service and support. Says Richard Hebert, Wang's vice president in charge of customer engineering, "We recognize that service and support must be an integral part of a product package."

WANG'S GROWTH PAINS

Students of the company believe that Wang's most pressing problem is its rapid growth. Wang's revenues have quintupled in the last four years, its payroll has grown from 3000 to 11,600 employees and its installation base to about 75,000 work stations this year.

Wang had a banner year in fiscal 1980, which ended June 30. Its bookings and revenues soared nearly 70 percent to \$701 million and \$544 million, respectively. Its net income jumped even more dramatically—84 percent—to \$52.5 million.

Wang expects to book \$1 billion in new orders in the next fiscal year—a 43 percent increase over last year. And this is despite a softening in demand in the fourth quarter attributed to the recession. (Revenues grew at a slower 54 percent rate in the fourth quarter.)

Such explosive growth would tax the management skill of even the best-run company, and Wang's management team, headed by the company's Shanghai-born founder and president, An Wang, is considered to be one of the best. Nevertheless, Wang's growth pains recently have become apparent—especially in support and service.

Industry reports, for example, indicate that Wang's service has deteriorated in the past year under the pressure of its rapid growth, with customers complaining about parts shortages, inexperienced service people, slow response time and delays in delivery and installation.

John Cunningham maintains that Wang's service has improved in the last year, but he concedes the problems. He points out that Wang's field service organization more than doubled in size last year, when 1850

people were added. Thus some 45 percent of Wang's 3000 field service employees are new. Another 1200 will be added this year. To improve response time, he says, Wang plans to put more of those people in major metropolitan areas to get efficiencies of coverage.

As for the spare parts problem, Cunningham sites a worldwide shortage of daisy print wheels. Wang obtains the print wheels from a Swiss supplier, Caracteres sa, which has not been able to keep up with demand (MMs, August, p.6). Cunningham says the parts shortage was also caused by an improper mix of spare parts—a problem he claims has been alleviated by the installation of an on-line inventory-control system.

Hebert points out other steps Wang has taken to improve its field service, including merging its home office technical and logistics groups and setting up a Lawrence, Mass., training center, which is to be expanded later this year.

Wang's rapid growth has also caused delivery problems. The company underestimated demand for its Office Information Systems announced last June, and as a result, deliveries fell six weeks behind schedule earlier this year. Cunningham claims that ois shipments are now back on schedule.

But Wang is six months behind schedule on shipments of its vs-100 system. Deliveries of that system—which was announced in June, 1979 and originally slated to begin shipping this June—have been delayed by unanticipated difficulties in integrating the system's software and hardware. Initial shipments of the vs-100 are now slated to begin in January, 1981. Cunningham claims that the

six-month delay has not resulted in any cancellations of the \$20 million in orders that Wang has received since the system's introduction.

Perhaps more troubling, Wang's small business system revenues grew less than projected this year at 15 percent, and significantly less than the market as a whole, which grew at 25 percent. Cunningham attributes this disappointing showing to the emphasis the company has placed on selling its vs series systems, which are aimed at large companies. To get the vs series going, Wang cross-trained its small business systems sales force to sell the vs series as well. But that strategy worked only too well. Some Wang salesmen discovered they could do better selling the high-ticket vs series, while others proved unable to sell to large accounts.

To get small business systems back on track, Wang has created a separate sales force and restructured commissions.

Cunningham sees this kind of resource juggling as typical of the management problems that Wang must face in the next decade as a multibusiness company. "It would be easy to grow the company by concentrating on selling our big multiterminal systems," he says. But it is better in the long run, he points out, to balance penetration into key markets.

Indeed, Cunningham expects the company to reach \$5 billion in sales by the end of the decade. By then, he would like to see integrated-information systems and word-processing systems each contributing 40 percent (\$2 billion) of Wang's revenues, with the remaining 20 percent (\$1 billion) coming from small business systems.

While Wang appears to face an uphill struggle to match IBM in sales and service, Wang officials maintain the advantages are not all on IBM's side.

Excelling in support and service is vital to Wang because it is counting on large customers to provide most of its new business in the 1980s. "We have targeted the real paper-pushing industries -large insurance companies, government agencies and accounting firms," says Carl Masi, Wang's vice president of market development. With that strategy, Fortune 1000 companies will be vital to Wang.



Excelling in support and service is vital to Wang because it is counting on large customers—Fortune 1000 companies and government agencies—to provide most of its new business in the 1980s. "We have targeted the real paper-pushing industries—large insurance companies, government agencies and accounting firms," explains Carl Masi, Wang's vice president of market development.

These companies are vital to Wang because "that's where the money is," points out Melody Johnson, an analyst with Quantum Sciences Corp., a New York market research firm. Indeed, Fortune 1000 companies are expected to remain the biggest market for Wang's multistation word-processing systems and large-scale commercial minicomputer systems throughout the 1980s. Small firms—lawyers and accountants—are not ready for word-processing systems, Johnson says.

Selling to Fortune 1000 companies also reduces marketing costs, Johnson points out. "Orders are larger, and it's easier to sell continuously to large firms," she says. Thus, large customers are important to Wang as a means to get maximum leverage out of its end-user sales force, which has had one of the lowest productivity rates in the industry-\$650,000 per salesman annually versus an industry norm of \$800,000. Until the mid-seventies Wang sold primarily to small businesses and scientific users, where orders are typically small. In 1976, for example, large customers accounted for less than 1 percent of Wang's revenues. Since then, Wang has stressed major accounts, but they still made up only 20 percent of Wang's new business last year. Wang hopes to push that figure up to 60 percent in the next decade.

But Fortune 1000 companies demand a high level of service and support—the reason they have traditionally

chosen IBM—and Wang knows this. "We have to perform better than IBM in the 1980s." says Hebert.

Wang's own customer-satisfaction surveys indicate that Wang's service is inferior to IBM's. For example, Wang's most recent survey gave Wang a 7.0 rating compared to IBM's 7.6. Wang's goal, Hebert says, is to equal IBM's rating for its general account customers and to better it with major accounts. Specifically, Wang has set a goal improving Wang's customer satisfaction index to 8.0 for major accounts.

To improve service to large customers, Wang has set up a separate major accounts support group; expanded service availability to 24 hours a day, seven days a week; established an "alert system" to assure that no customer is down more than eight hours without the home office becoming involved; and added customer engineers to support customers in remote locations.

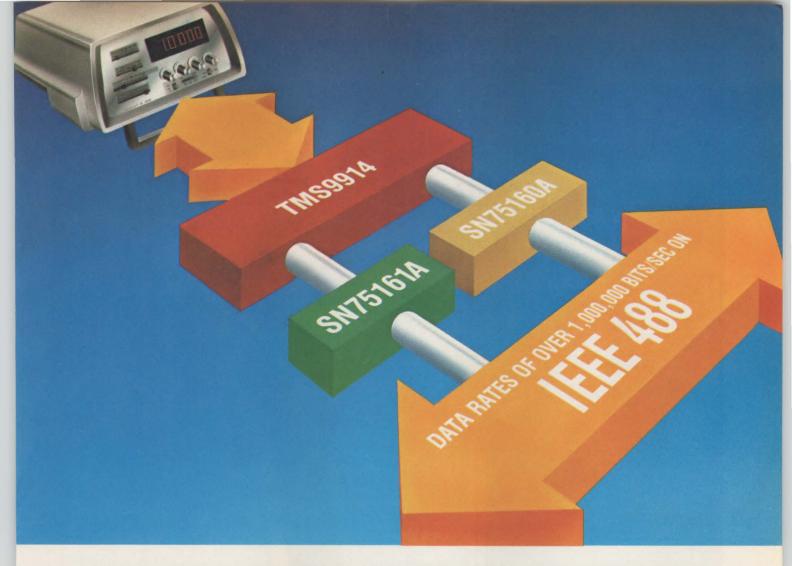
While Wang appears to face an uphill struggle to match IBM in sales and service, Wang officials maintain the advantages are not all on IBM's side. Masi points out that Wang has a potential edge over IBM in its high degree of integration. IBM is plagued by competition between its divisions. This has caused such concern among IBM customers that in June, the company issued a statement clarifying how it intends to allow products from its different divisions to communicate. Wang, on the other hand, has a unified product line and architecture, and an 80-percent commonality in such components as printers and disk drives. Wang's sales, service and engineering organizations also report to a centralized management, Masi points out. "This enables us to react more quickly to changing market conditions." It remains to be seen, however, whether Wang can translate its unity into a real sales edge.

By being an early entrant, Wang also hopes to establish a lead in integrated information systems that combine data processing, word processing and electronic mail. Wang entered that infant market last summer, and so far IBM has not.

NEXT MONTH IN MMS

The October issue of Mini-Micro Systems will focus on software, with articles in the feature section devoted to:

- A survey of microcomputer operating systems.
- The second in our series of reviews of data base management systems for minicomputers, this time on SEED.
- An examination of Pascal's weaknesses, with a checklist to use when selecting specific implementations of this increasingly popular programming language.
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DATA COMMUNICATIONS I

Too many networks, not enough gateways

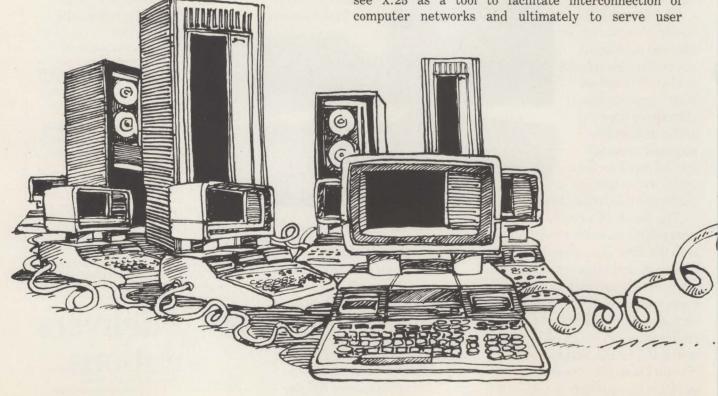
WALTER A. LEVY, Contributing Editor

A standard gateway is needed to interconnect computer systems and networks from different vendors

The 1980s will be a decade of computer network proliferation, with most large companies evolving multiple networks. But because few large organizations have remained loyal to a single computer vendor, the hardware comes from various suppliers, and it isn't easy to integrate dissimilar equipment. Yet as computer costs continue to drop, more hardware is going into place as inter-organizational networks are being overlaid on a shaky foundation. In short, there are too many networks emerging and too few standard gateways to effectively interconnect them.

The main problem is that each vendor, whether a mainframe, mini or independent network supplier, has

acted as though there were no vendors besides itself and networking systems other than its own. Except for the useful, but limited, provisions of the CCITT X.75 gateway standard, there are no currently applicable standards for interconnection of computer networks. And that some vendors have announced a willingness to "support" the X.25 network standard must be taken with a grain of salt, because the word itself is open to many possible interpretations, none of which needs to reflect the full implications of the requirements for network interconnections. Most computer suppliers see networks as a battleground for account control. Their network offerings are usually designed to encourage broader use of their own product-lines. Whereas some see X.25 as a tool to facilitate interconnection of computer networks and ultimately to serve user



to win customers and enhance their competitive that should govern their decision. positions.

interests. Even within a user organization, different two basic approaches: factions may promote different network philosophies and technical approaches to achieve the same objectives. For example, one can safely assume that an EDP manager will favor a host-controlled networking system, such as IBM's SNA, while the telecommunications manager will opt for a common-carrier-oriented networks conforming in some measure to CCITT X.25) networking system, such as X.25.

With so many vested interests involved (see "A short interface a user's various computer systems. directory of vested interests,"p.107), it is often difficult

interests, others see it as just another way for vendors options to cut through to the essential issues and facts

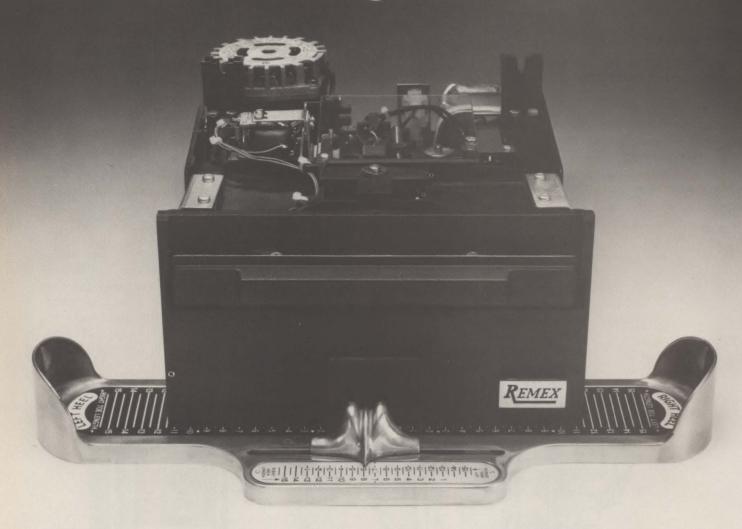
Most users seeking to integrate their computers and But the battle is not just between user and vendor local networks must satisfy themselves with one of the

- Host-controlled networks, such as IBM's SNA or Digital Equipment Corp.'s DECNET, supplied by individual computer vendors and based on their equipment.
- Independent data networks (usually packet data offered by independent suppliers with facilities to

Each has certain advantages and drawbacks, and for those responsible for choosing among the available neither is likely to be a complete and satisfactory answer to a user's needs.



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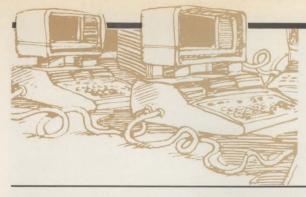
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REMEX DIVISION

DATA WAREHOUSE



The main problem is that each vendor, whether a mainframe, mini or independent network supplier, has acted as though there were no vendors besides itself and no networking systems other than its own. Most computer suppliers see networks as a battleground for account control.

primary supplier's technology. Thus, some minicomputer companies now support IBM SNA, enabling users to connect their minis to an IBM network in a terminal-emulation mode.

How well this will work remains to be seen. Although there are many minicomputers successfully interfacing IBM systems by bisynch 3270 or 2780/3780 terminal emulation, the SNA interconnection problem is much greater. Even so, it is to the advantage of minicomputer suppliers to provide SNA terminal-emulation facilities and thus make common cause with their users. It is unlikely, however, that the other large mainframe suppliers (Burroughs, Univac, Honeywell and Control Data) will offer SNA compatibility or that they and the minicomputer suppliers will bridge each other's proprietary networking systems. An organization using systems from many different sources may have to negotiate various combinations of inter-vendor interfaces, probably spending large amounts of its own money doing product engineering for the vendors.

The great strength of host-controlled networks is their ability to support machine-independent communication between application-program modules. It is very convenient for the planner of a large, complex, multicomputer application to use the same program-design methods and data formats for interprogram communication, regardless of whether the program modules in a dialog are located in the same CPU. The flexibility provided by this type of architecture is an advantage to companies with a large commitment to a single vendor's products, but no benefit to a user with different vendors' products or a very stable application environment.

Independent data networks

The packet data network (PDN) suppliers offer a different approach. Their products take a middle

ground between the various vendors' product lines and the users' organization, offering a common data network that is, in principle, able to interface any computer through a common set of standards or through protocol converters. Universality is the greatest appeal of these systems, but current versions do not provide it, and users now buying them for private networks must accommodate the vendors' continuing development efforts and live with evolving facilities, rather than finished products. However, the interests of users and PDN suppliers are closely related. These suppliers are the only organized force in the industry trying to break down the barriers between networks that the computer vendors are busily erecting.

Independent data networks usually conform to the evolving international standards for data-network operation and interconnection, codified in CCITT recommendations X.25, X.75, X.3 and others. Called X.25 for short, this system is being adopted by all international and domestic telegraphic administrations and common carriers that have elected to offer data-network services. Compared to IBM's SNA or other host-controlled networking systems, it has strong points that appeal to network planners:

- An X.25 network is independent of any connected host computers, which must act like subscribers, accessing the network only by call-placement procedures.
- Operation is not oriented toward any one vendor's products or technology.
- X.25 networks talk to each other through a simple gateway defined by the X.75 standard, while each network retains control of its local environment.
- The network is easy to use and, response-time and protocol-conversion issues aside, does not intrude much on the design of teleprocessing applications that use it.

A SHORT DIRECTORY OF VESTED INTERESTS

In any networking decision, the differing interests of a number of parties are in contention. The main ones are summarized below.

User

- Picking the best supplier for a private multicomputer network
- Integrating separate networks
- Minimizing technical risks
- Minimizing costs

 Promoting local interests when competing with other organizational units

Vendor of Computer Systems

- Promoting exclusive use of its products
- Encouraging users to build larger, more inclusive systems
- Minimizing any obligation to install or support systems

Vendor of Network Services

- Promoting use of services versus installation of private customeroperated system
- Protecting the revenue base of existing services

Vendor of Future Systems

 Preventing users from committing to an existing network technology in anticipation of better methods



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Packet data network suppliers take a middle ground between various vendors' product lines and the user's organization, offering a common data network capable, in principle, of interfacing any computer through a common set of standards.

X.25 networks also have some limitations. They provide a call-placement service, but do not support application-program functions. And today's X.25 networks supply only a few asynchronous terminal and computer interfaces. So far, these restrictions have confined the market for these systems to time-sharing service bureaus. The PDNs now in place were not initially designed to support the synchronous polled protocols and terminals characteristic of private business data-processing networks. Vendors have been upgrading their systems to address these additional needs, but the process is far from complete. Potential buyers of private PDNs still find that important interfacing features are not yet available.

Thus, while a user can expect the X.25 PDN suppliers to be more sympathetic to his needs than individual computer vendors are, he will also find their systems simpler and less complete than, for example, IBM's SNA.

It is also important to recognize that x.25 reflects the interests of the international common carriers more than those of the users. All that x.25 represents is what the common carriers have agreed to allow the users—and still protect the revenues for Telex service. Terminal-to-terminal service on an international data network, or provision for it in x.25, is not available.

Many computer networks are going to be built in the next decade, and almost any vendor in this market is going to thrive. As matters now stand, with large mainframe suppliers selling their own incompatible systems and minicomputer manufacturers offering simple "accommodation products," such as terminal emulators, the gaps will be filled by specialized network vendors, consultants and small systems houses offering adaptors and protocol converters. Thousands of single-user-oriented interfaces will be developed as every organization with a multivendor environment confronts the issues of network compatability. X.25 in its present form does not respond to the problems of multiple-vendor networks, and it is unreasonable to expect significant change in the near future.



Walter A. Levy is president of Edgewood Computer Associates, Inc., a consulting firm specializing in data communications, distributed processing and minicomputer applications.

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Carroll's Touch Terminal, based on the Datamedia Model 3025A, provides a man/machine interaction that is natural, friendly, fast and accurate. By merely touching the display surface, the user can view and

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DATA COMMUNICATIONS II

Microcommunications: an evolving bazaar

STEPHEN A. CASWELL, Bell Canada

On-line electronic fair for mini and microcomputers is creating a new kind of wholesale/retail industry

A diverse range of information access, timesharing, newsletter and electronic message services promises to develop into a vast on-line information industry that will provide something for everybody—from specialized business information to shopping guides. But it is also providing regulators, users and information wholesalers and retailers with as much confusion as promise. Since the start of the timesharing industry, on-line information services have developed steadily. To help this market develop further, two companies—GTE Telenet and Tymnet—have built value-added, packet-switching networks that lower the cost of sending data to one-third what it would cost on the public switched telephone network.

In addition to the commercial timesharing industry, which has existed since the 1960s, a newer set of services for homes is also developing. These services—Videotext and Teletext—use television sets in homes and hotels to provide both consumer and business data. Although in their infancy, there are already signs that these services will also merge with packet-switching technologies.

Videotext services were initially developed independently of commercial timesharing systems. Within the last year, however, two timesharing companies—the Source and Micronet—began offering home-oriented information services before the introduction of Videotext services. The result is likely to be a technological merger, with packet-switching networks adapting to handle multiple technologies.

The growth of packed-switched networks illustrates what happens after an efficient roadway is built. Initially, only a few firms were ready to use these networks, with growth evolving slowly. But momentum increased rapidly as more and more computers went on the network. Today, there are hundreds of data bases available on these networks, and both Telenet and Tymnet are growing at an annual rate of about 20 percent.

Today's information industry has five axes—data base services, timeshared applications programs, newsletters, electronic mail systems and games. All are readily available within the \$2.5-billion commercial timesharing industry.

Data base services consist of either on-line information or catalogs. Catalogs are the most prevalent type of data base because of the higher cost of storing primary information. Lockheed's Dialog service is a typical data base catalog service.

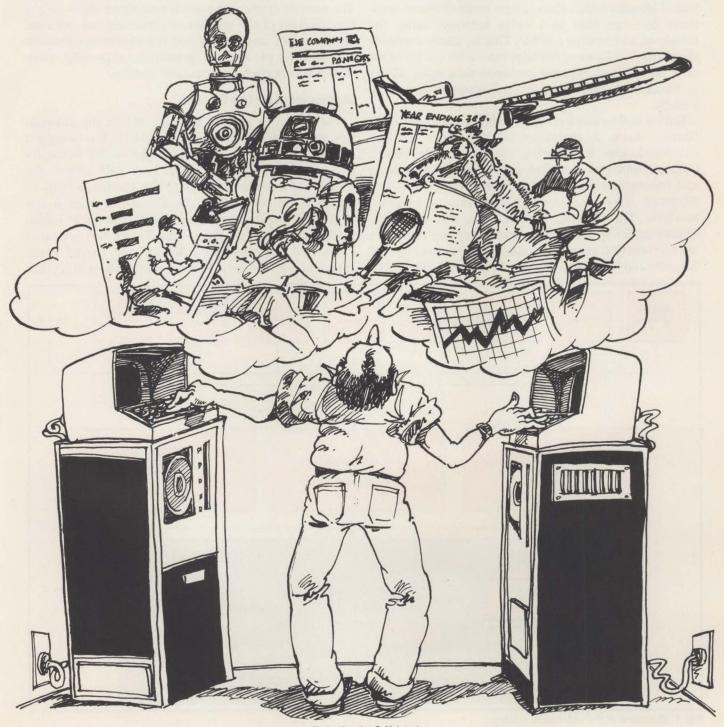
Dialog consists of a series of on-line information catalogs in agriculture, chemistry, energy and almost any other field and can be regarded as a computer users' guide to specialized periodical literature. Because the catalogs are bibliographies, however, they contain only references, not the articles themselves. A user must then procure the articles from an off-line repository. This can be enormously frustrating. Dialog data bases are so comprehensive that it is quite common for users not to have many of the cited references in their corporate libraries. Dialog provides the hard-copy reports by mail in such instances.

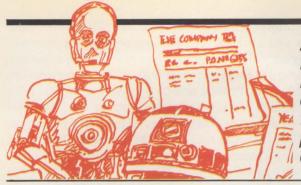
We can see how the industry is likely to evolve by looking further into Dialog. Lockheed does not develop its data bases, but procures them from specialized bibliographic suppliers. The company acts as a retailer of many data bases to many users. The benefits are manifold. Users don't have to learn multiple data base query languages or passwords, and they receive only one bill. Information suppliers don't incur high computer hardware costs to support their customers, nor do they have the high costs of marketing and advertising. Lockheed's Dialog is a forerunner of the information retailer of the future, but such retailers will have vastly more complex wares, including timesharing services, electronic mail services, newsletters and games.

Applications programs still constitute the largest segment of the timesharing industry, with thousands of users logging on to computers everyday. It is difficult to list all the types of available timesharing services. There are more than 30 major timesharing companies providing services that begin with program development and run all the way to on-line packages for mixing chicken feed. For classification's sake, the primary timesharing applications are probably program development; transaction-oriented accounting packages; financial information services, such as portfolio analysis; mathematical modeling; engineering-oriented problem-solving services; and computer graphics. But even this classification only touches the surface. Timesharing applications exist in almost every industry.

The newest on-line services are electronic mail, games and newsletters. Electronic mail, or personal messaging, allows person-to-person communications via storage in computer "mailboxes." These services are available from Tymnet and GTE Telenet as well as from a dozen small private companies, such as the Computer Corp. of America, Cambridge, Mass., the Electronic Mail Corp. of America, New York, Bolt, Beranek & Newman, Cambridge, Mass., and Scientific Timesharing Corp., Silver Springs, Md.

The leading personal messaging users, however, almost all have in-house systems. Texas Instruments, Inc., is usually considered the leading firm in this field, with more than 8000 employees holding mailbox





Applications programs still constitute the largest segment of the timesharing industry, with thousands of users logging on to computers every day. There are more than 30 major timesharing companies providing services that begin with program development and run to on-line packages.

addresses. Digital Equipment Corp.'s in-house system serves an estimated 3000 employees.

Personal messaging frees users from time and location restraints, such as the time-consuming problem of telephone tag. Thus, a new mode of communications develops that is a cross between using the telephone and sending a letter. That is, a user combines the turnaround time of the telephone with the precision of a letter. And because personal messaging allows grouping messages by topic, it also serves as a filing system.

Games and newsletters are the other major services. Games were a mainstay of the first service developed—the timesharing system at Dartmouth College, Hanover, N.H. The games were for students and noncommercial computer users. The Source and Micronet have developed games into commercial services. The Source, Vienna, Va., and Micronet, Columbus, Ohio, are home-oriented evening timesharing systems that take advantage of low rates set by GTE Telenet and the timesharing firm Compuserve for

off-hour usage. The Source uses Telenet, while Micronet, a Compuserve subsidiary, uses its parent company's network.

Games and newsletters are still in their infant stage. The number of evening users is now about 5000—only a tiny fraction of the number of terminals and personal computers in use. Games and newsletter applications are seen as particularly promising, especially when Videotext services for home use mature.

Significance of the Source

The Source is another example of how the information retailer of the future might look. It has become a legend, although its physical impact is far below its psychological impact. Rather than talk about the coming information explosion, the Source set out to create it by convincing GTE Telenet to offer a low nighttime tariff and then convincing information suppliers to provide data. The Source has procured subsets of the information files of the United Press International, the New York Times data base and other

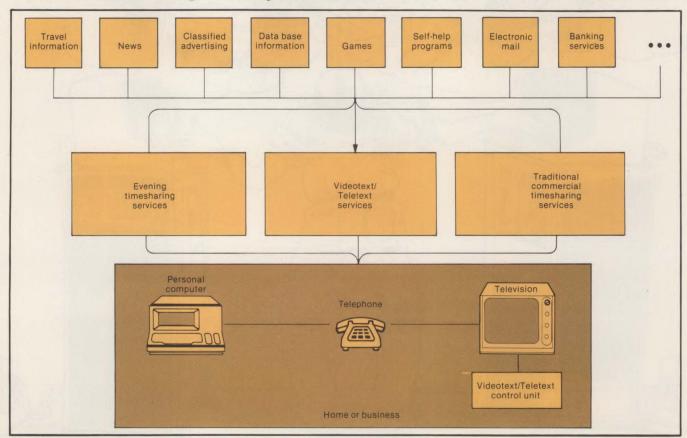


Fig. 1. Structure of the information industry.

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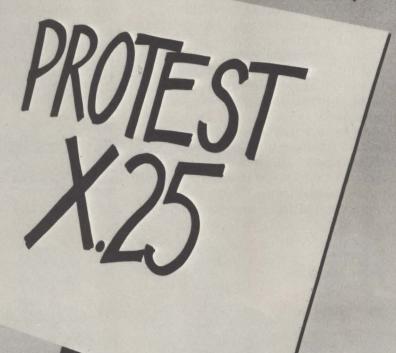
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Detachable keyboards and tilt display, for example, are options with Model 20 and standard with Model 30. These features allow the operator to position the screen at the most comfortable viewing angle. There's also a video enhancement option that gives you a

15-inch smooth scrolling monitor which selectively displays either 80 or 132 column formats in normal size or double height and width.

No matter how you configure Executive 80 terminals, you can be sure of high reliability. In addition to Hazeltine's high quality, Executive 80 has a very smart diagnostic capability that enables it to trouble-shoot its own failures.

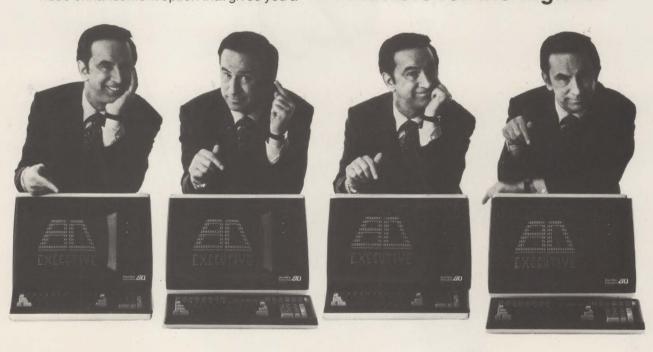
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Personal messaging frees users from time and location restraints, such as the time-consuming problem of telephone tag. Thus, a new mode of communications develops that is a cross between sending a letter and using the telephone. It also can serve as a filing system.

companies. These files are stored at the Source's computer center in Silver Spring, Md. A user sees the New York data base subset or the UPI news wire, but is accessing the Source's computer (see Table 1).

The Source is one of the first examples of the wholesaling/retailing structure for primary information. Lockheed's Dialog has existed for many years, but only to provide secondary source material on-line. The Source has also gone after recreational users who can be expected to access a raft of available newsletters. In addition, the Source has an electronic mailbox that enables home users and computer stores to make inquiries and order from their suppliers.

Both Videotext and Teletext services turn a television set into a terminal that can display 24 lines of 40 characters each. Videotext is an interactive data-base access system that links the TV to timeshared computers via the telephone and a special interface box. Teletext is a broadcast service that inserts pages of information in unused space between the image frames of a TV signal. A decoder connected to the TV is required to retrieve the pages. Of the two services, Videotext is by far the more powerful and has the greatest potential. Teletext is limited to about 200 pages of information per TV channel and does not allow interaction, which is required for individual user applications, TV games and electronic mail. Videotext offers all the features of a full timesharing system, although the terminal is limited by the resolution of the TV screen. This problem can be solved, however, by substituting a higher-quality monitor.

There is also a difference in terminal controls. Teletext uses a hand-held device, much like a pocket calculator, that merely instructs the system's decoder what page to display on the screen. While entry-level Videotext systems use hand-held, calculator-like terminals that have only numerals, the technology can be expanded to accommodate full alphanumeric keyboards.

Both Videotext and Teletext services are under development worldwide. Canada is a world leader in Videotext with its Telidon system. Britain, France, West Germany, Sweden, Finland and the Netherlands are working on systems. In the Far East, the Japanese are working on these services, as well as on interactive wideband services that use coaxial cable. Videotext uses varying transmission rates as high as 1200 bps.

A number of U.S. TV stations are considering Teletext services, while companies such as GTE, AT&T, Warner Communications and Knight-Ridder Newspapers are exploring interactive Videotext services. GTE has a license to offer the British Post Office's Prestel service, one of the first Videotext services to be developed. Knight-Ridder and AT&T are testing Videotext in the U.S. In Coral Gables, Fla., 160 homes now have access to a data bank of 15,000 Videotext pages.

The AT&T/Knight-Ridder trial began in July. The homes will receive continually updated news reports from the Associated Press, Miami Herald and Wall Street Journal; home catalog shopping services from Sears, J.C. Penney, the Grand Union supermarket and small independent merchants; banking services from the Southeast Banking Corp. of Miami; travel services; and a potpourri of other data bases.

Market development problems

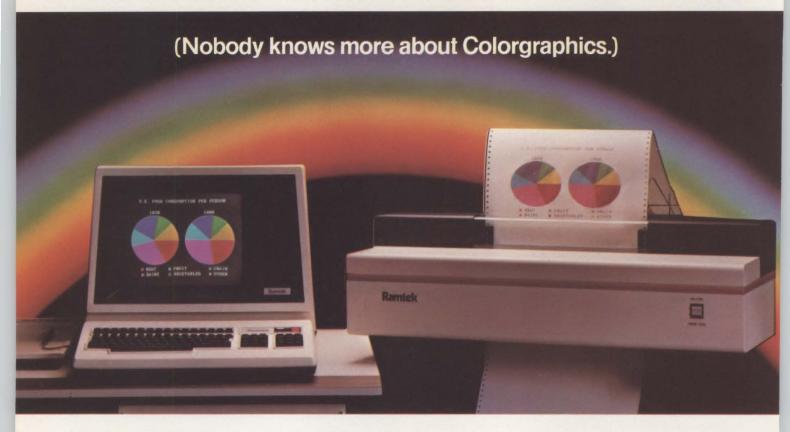
But Videotext and Teletext have drawbacks. Teletext has serious billing problems. Because all the information is always available to all users, billing is on

ANNOUNCEMENTS (UPDATED FREQUENTLY)

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Table 1. The Source library catalog.

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CIRCLE NO 64 ON INQUIRY CAR



Both Videotext and Teletext have drawbacks. Teletext has serious billing problems and a limited storage capacity. Videotext, because it is interactive, offers vastly more information, but at a higher price. Consumers pay for a decoder and interface, and for the data itself.

a flat rate, which forces all subscribers to pay for all the information whether they use it or not. Teletext also has a limited storage capacity, making it primarily of interest to consumers as a news service. The advantage of Teletext is that it is less expensive than Videotext. A decoder can be sold for less than \$200. In addition, the supplier requires only a modest-sized minicomputer interfaced to his broadcast subsystem, along with one or two terminals to enter information. Service can be offered for less than \$10 per mo.

Videotext, because it is interactive, offers vastly more information to consumers, but at a higher price.

GROWTH OF THE INFORMATION INDUSTRY

	1980	1982	1985	1990
Commercial timesharing				
Revenues (millions of dollars) User base (thousands of units)	2500 450	3000		5000
Evening timesharing				
Revenues (millions of dollars)	2	15	100	3100
User base (thousands of units)	8	50	350	10,500
Videotext services				
Revenues (millions of dollars)		4	75	2500
User base (thousands of units)		3	300	14,000

Table 2. Projected growth of the information industry, 1980-1990.

Not only must the consumer pay for a decoder, but for interfacing to a computer port, and for the data itself. Daytime rates are likely to be as high as \$15 per hr., with evening rates from \$2.75 to \$5 per hr. Charges for data will vary dramatically, based on the perceived economics of the suppliers. Some data may cost fractions of 1¢ per page; other data will cost \$1 or more per page.

User perceptions

Perhaps the biggest problem, however, involves the perception of users, who are accustomed to having much of their information subsidized by advertisers. So far, Videotext services require the user to pay directly. A shopper will pay to drive to a store where he expects varying prices for different items, but will that same consumer pay for accessing the computer and also expect to pay varying prices for the information?

This is a question plaguing potential suppliers, with many of them searching for some type of advertising scheme to subsidize the costs. As yet, there is no clear answer to the question of usage. The costs of the British Prestel system are more than \$1000 for a terminal, plus more than \$50 per mo. for a few hours of use. This indicates that the new home services cost too much for the average consumer, resulting in businesses becoming the main target for Videotext vendors. But there's a problem in that commercial timesharing, with its high-quality terminals and far better graphics, has been meeting business users' needs for years.

The result is that Videotext and Teletext developers find themselves in a bind. Teletext is limited in its capabilities, and Videotext is expensive. The answer can come only through the gradual development of a user base, combined with the rapidly dropping cost of the technology required to process, store and communicate information to a mass audience.

The slow development of Videotext services and impending competition from traditional timesharing sources yields a picture of jumbled growth, not smooth development. Communication system vendors probably would like Videotext to evolve into a service reaching home TV saturation levels. But while saturation levels are possible, it is unlikely one service will capture all users. Three types of services—Videotext/Teletext, evening timesharing and traditional commercial timesharing services—will compete for users with the structure shown in Fig. 1.

The wholesale/retail structure is likely to develop with primary sources of information sold to retailers who will provide interfaces to consumers. If the Source and Micronet succeed, it is almost certain that they will be followed by large timesharing companies as well as by firms like AT&T and, possibly, IBM, which can't afford to miss out on a base of 75 million homes accessing information on-line.

The early stages

The industry is just in the earliest stages of the information age. The systems being developed now will provide only the first of the thousands, perhaps millions, of stored programs, games, newsletters, data bases and electronic mail that will follow. Bell Northern Research senior scientist Gordon B. Thompson has a vision that goes even further. He says this early development will copy industrial technology by providing centralized, impersonal sources of information. The real benefits, he suggests, will come when the intelligence of these systems allows for personalization, as well as serendipity—the faculty of happening upon

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The Source is one of the first examples of the wholesaling/retailing structure for primary information.

fortunate discoveries when not in search of them.

Personalization will allow the user to define his own window into the data base so that certain types of information will automatically be delivered. Experiments with the Associated Press data base indicate that it can be customized in this fashion, with users receiving information automatically on preselected subjects. Personalization can be expanded almost ad infinitum, with a different profile for each day of the week. On Thursday, for example, the system could automatically search grocery data and print out a list of stores with the lowest cost per needed item. "The key to releasing the full socioeconomic potential of the new information technology," writes Thompson in Memo From Mercury; Information Technology is Different (Institute for Research on Public Policy, Montreal, June, 1979), "with its communications facilities, computers and intelligent terminals and the like, lies in designing a suitable infrastructure wherein the technology encourages the content suppliers and users to interact in a synergistic way."

By this, Thompson means using the network to provide controlled serendipity. The network, says Thompson, would chart patterns of communications and then tell users of connections that we may have overlooked or not foreseen. The network would also alert users to people who share their patterns. "The effect is a learning web," he writes.

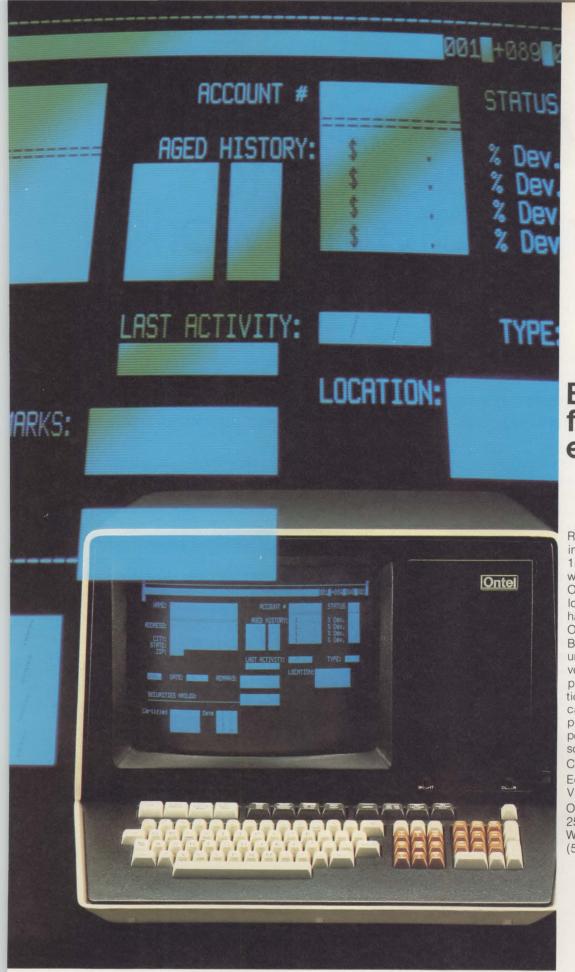
Growth projections

Projecting the growth of the information industry is hazardous. It is difficult enough to get two people to agree on its present structure, let alone what it will look like in the future. Table 2 is a projection from research data obtained from Communications Studies & Planning, London, International Resource Development Norwalk, Conn., Link, New York City, Venture Development Corp., Wellesley, Mass., and the Yankee Group, Boston.

The projection assumes that the existing commercial timesharing industry is a part of today's evolving information industry rather than something distinct from it, and that the newer services will merely franchise a vastly larger number of users with low-cost terminals and small computers.



Stephen A. Caswell, a market planner with Bell Canada, is the principal author of eight multiclient research reports on computer/communications topics. He is also a consultant and former newsletter editor.



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DATA COMMUNICATIONS III

An integrated approach to corporate networks

LEE K. SUDAN, Codex Corp.

Companies considering installing nets should evaluate the trade-offs posed by public data networks, plus vendors of computer and datacomm hardware

The corporate data communications environment is undergoing dramatic changes. Early computer applications, and their associated communications network requirements, were simple: a few terminals accessed centralized host resources. Now there's a trend toward distributed data processing, with host resources being called upon by an ever-widening, geographically distributed user base. Many companies are exploring the feasibility of integrating all office-related functions in corporate communications networks.

Companies that have undertaken corporate networks are learning that they must consider several issues as they plan their systems, and anyone considering implementing a corporate network can profit from that experience. The issues that must be addressed include network availability, reliability and control, plus

integrated functionality and an adaptability to future requirements that may be placed on the network.

Several classes of vendors are offering solutions to the challenge of data-communication networks, and anyone considering undertaking a network should consider the bias of each class. Computer manufacturers have begun to respond to the network aspects of data communications with viable alternatives for users, but most of their solutions limit flexibility and are intended for single-vendor environments: hardware from different vendors doesn't interface easily, if at all.

Another networking alternative for data communications is available in the form of public data networks (PDNs), which predominantly use packet-switching techniques. PDNs offer attractive functionality in certain applications, especially those that share re-

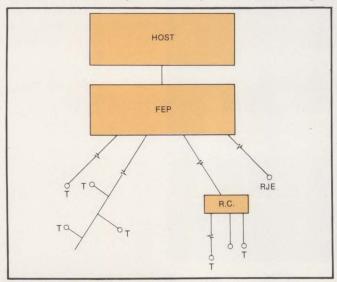


Fig. 1. A hierarchical (centralized) network.

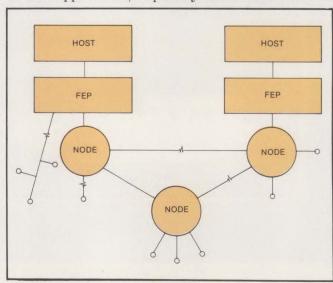


Fig. 2. A distributed (general) network.

sources, such as a host computer. But growing support to limit the variety of data communications disciplines and protocols, coupled with the decreasing cost effectiveness that comes with increasing traffic, could restrict the use of PDNs in corporate communications networks.

Networking alternatives that lend themselves to individualized or customer-tailored applications are also available from some data-communications equipment manufacturers. This class of equipment, along with some typical networks that employ it, will be the principal topic of this article, after we examine some of the fundamental concerns to be addressed before implementing corporate communications networks.

Networking considerations

A basic requirement is that the network should be expandable to meet future communication needs. It is difficult to predict these requirements, but as a rule of thumb, it should be able to meet at least 10 times the present communication needs, which translates approximately into a network life cycle of 10 years.

Network architecture is another important consideration. Most networks can be broadly classified into two physical categories: hierarchical or distributed. Logical classification for networks could be transparent and nontransparent. Hierarchical, transparent networks are most common because of the simplicity of implementing them, and their cost-effectiveness. But these networks provide limited flexibility and are usually suited for applications in which a few geographically dispersed terminals access centralized host resources.

Distributed-node networks, on the other hand, are usually applicable for large networks, and are used because they allow access to distributed host resources; increase network reliability by providing alternate routing; increase flexibility by permitting resources to be added where they are needed; and offer cost-

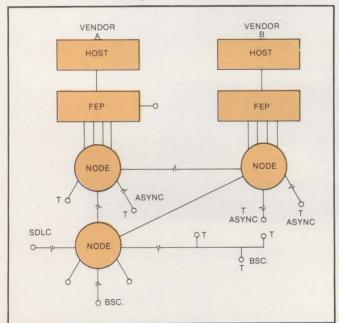


Fig. 3. A transparent (distributed) network.

effective networking by allowing communications facilities to be tailored to traffic requirements. But the high cost of installing, operating and maintaining distributed-node networks means that only companies with extensive networking requirements can afford them.

Future upgrading is another necessary consideration. Ideally, hardware should be modular, requiring only software modifications to meet future user needs. System software should be layered in structure so that future functionality can be added simply by application modules rather than requiring major changes to existing software architecture.

Support for multivendor equipment is also highly desirable because different vendors have strengths in certain applications. An optimum cost/performance data-processing solution usually requires use of multivendor equipment. This trend will grow in the future as vendors continue to offer increased product performance and differentiation.

A central concern

Another important factor to be considered in network design is centralized control. Centralizing of network configuration, monitoring and diagnostic functions increases the effectiveness of network operation. Network design should also consider predictive diagnostics that allow malfunctions to be detected before they disrupt the operation. Network statistics, management reports and other accounting utilities should also be centrally available.

The integration of voice, data and other important office-related functions, such as word processing and facsimile, in a communications network is becoming an important consideration. These will not only facilitate control by providing a single network that saves telecommunication costs but also increase office efficiency by reducing document handling, filing and distribution efforts.

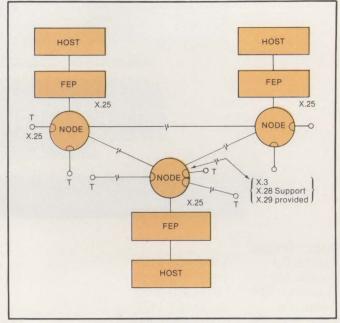


Fig. 4. A nontransparent network.

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One basic requirement is that the network should be expandable to meet future communications needs.

Each communications network would place different emphasis on the design criteria, but these general guidelines can help in implementating a corporate communications network.

Network illustrations

As seen earlier, most networks can be classified in physical terms as hierarchical and distributed, and in logical terms as transparent or nontransparent. Figs. 1-4 are examples of such networks. A hierarchical network (Fig. 1) shows centralized host resources being accessed by a multitude of users in point-to-point and multipoint configurations. It would be desirable in such a network to have redundancy, centralized control and some conformity to the network design criteria outlined earlier.

One implementation of this configuration (Fig. 5) uses communications equipment provided by Codex Corp. The Codex 6500 series front-end processor (FEP) is an IBM 370X plug-compatible replacement operating in the emulation program mode. This series uses Codex NSS-enhanced IBM emulation program (EP) software, which provides functions not available in the IBM implementation of EP. For example, each 6500 FEP can concurrently support as many as four hosts, allowing users the flexibility of accessing resources from any host.

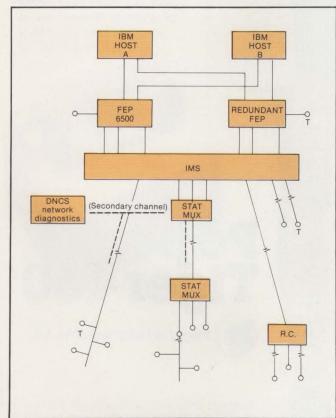


Fig. 5. A hierarchical network using Codex Corp. communications equipment.

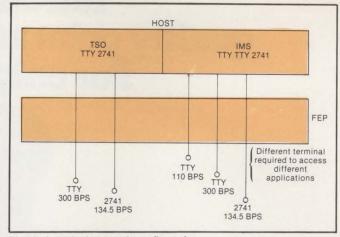


Fig. 6. A typical network configuration.

The terminal-emulation, code-conversion and auto-baud features allow certain multivendor terminals to be used in the network, which results in a very cost-effective implementation of the network (Figs. 6, 7). The dynamic application selection (DAS and MDAS) features (Figs. 7, 8) permit access to different host applications from the same terminals in either point-to-point or multipoint configurations. In addition, dynamic line switching increases network availability by allowing users to switch lines from subchannels of one host to another host in case of host failure.

The partial redundancy of certain critical central logic functions of the 6500 FEP increases the network uptime. In addition, system redundancy, if desired, is achieved by the electronic intelligent matrix switch (IMS). With the IMS, communications lines can be switched from one FEP to a redundant FEP by a single command. Lines can be switched in selected groups in gang or in matrix fashions. The contention, resource-selection and camp-on-queuing abilities of the IMS allow the user to contend for limited front-end ports. Furthermore, the centralized control feature of the IMS permits control of remotely located IMSs from a central site.

The remote concentrator (RC) (Fig. 5) extends networking to appropriate remote sites where there is a concentration of terminals. The capability of RCs to do remote polling and error correction at distant sites, and to transmit data from remote terminals in an error-protected and concentrated form over single (or multiple) group band links, results in reduced response time and transmission delays, increased bandwidth use and savings in communication line costs.

Statistical multiplexors (Fig. 5) allow dynamic allocation of bandwidth only to terminals that are active, and also reduce communication line costs. In addition, they provide error protection by using the automatic repeat request (GO-BACK-N ARQ) schemes. While statistical multiplexors do not provide remote polling, error protection at local sites and other sophisticated functions available using RCs, they are, nevertheless, attractive alternatives for multiplexing a small number of terminals over a single line where the high cost of RCs cannot be justified.

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Centralizing of network configuration, monitoring and diagnostic function increases the effectiveness of network operation.

Powerful centralized monitoring and control functions are available using the distributed network control system from Codex. DNCS offers predictive diagnostics and provides monitoring, testing and restoration of network operation. DNCS, in addition, stores overall network configuration data and other important management statistics and information. It continually monitors the network operation and generates alarms when certain user-programmable alarm threshholds are exceeded.

The user then has a large repertoire of tests, such as bit error rate (BER) poll test and device tests to choose from, which help pinpoint the problem to either the communication line, modem or other associated equipment. Once the problem has been determined, the DNCS allows the user to dial for backup communications lines or switch to remote redundant modems (if available) and restore network operation. DNCS also maintains a complete log of all errors and alarms and other network statistics.

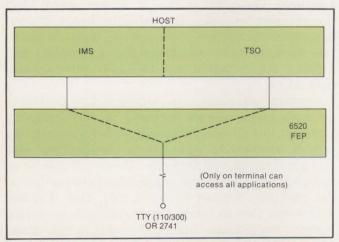


Fig.7. An NSS-1 system with DAS, autobaud and code conversion.

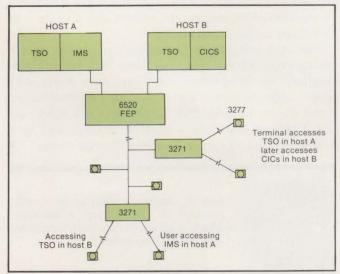


Fig. 8. An NSS-1 system using MDAS.

Another form of network is centered around distributed-node architecture, and a variety of hardis available from suppliers of datacommunications equipment, computers and valueadded networks to implement such a network, including the Codex 6000 series intelligent network processors (INP) (Fig. 9). These INPs are advanced statistical multiplexors that allow alternate routing, data compression, centralized control, and also provide important network statistical and management information. These units support various asynchronous and synchronous protocols (e.g., bisync and HDLC) in a transparent fashion. Using the Codex Digi-phone voice digitizer. digitized voice can be statistically multiplexed along with data over the same network communication links, eliminating the need for separate data and voice networks. (Certain facsimile equipment is also supported.)

The 6000 INPs connect to the 6500 FEPs through a multiplexed network interface (MNI). This single physical connection to the FEP results in valuable savings of ports and space. This network also provides extensive centralized network control, management and diagnostic capabilities. Elaborate network statistics and reports are also available that enable the user to optimize network resources. The ability also exists to have multiple network configurations stored in a nonvolatile memory, which can operate at appropriate times. In addition, the alternate routing ability increases network availability by providing alternate

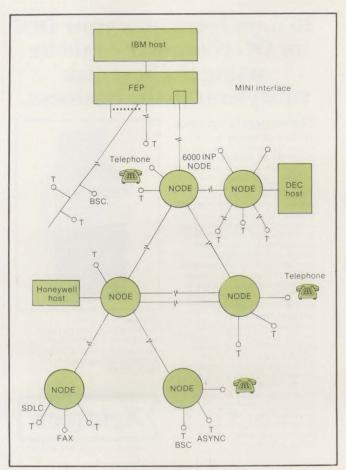


Fig. 9. A typical 6000 INP network.

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The partial redundancy of certain critical central logic functions of the 6500 FEP increases the network uptime.

paths for information flow in case of link failures.

Some other benefits available using 6000 INPs are error protection, bandwidth priority, redundancy and the ability to send supervisory message datagrams to remote locations. The additional ability to support specialized protocols (e.g., IPARS, an airline reservation system) further increases the INP's flexibility and extends its usefulness in certain applications.

Future trends

Here are some general conclusions that should be considered by those about to undertake corporate networks. There is a growing effort to integrate all office-related functions in corporate communications networks. Electronic mail, in which messages can be sent to centralized or distributed sites for later retrieval, is gaining in popularity. New standards for teletext communication may emerge that allow certain terminals to act as communication terminals that can also edit, store messages and do other word-processing functions. These will operate at higher speeds than present telex terminals, increasing line bandwidth and equipment-use efficiency. Faster operation, standardized character codes and communication disciplines will facilitate integration of such terminals into corporate networks.

Certain nontransparent single-vendor computer networks might provide increased network flexibility by supporting other communication disciplines and may provide appropriate gateways to communicate with other nontransparent networks. There will also be an increased emphasis on communications between dissimilar machines. Support for CCITT X.21, X.25, X.75 and X.121—the various international standards governing network integration—will also increase in the future. Most of the VANs providing packet networks already support some levels of X.25, X.75 and X.121 standards. In addition, some computer vendors also provide X.25 interfaces for their machines.

Satellites will play an increasingly important role in communication networks, and there will be continual emphasis on integrating voice and data along with other office-related functions. The communication scene will be quite dynamic for the next few years, and any choice of hardware should be accompanied by a long-term view of corporate needs for expansion.



Lee K. Sudan is director of network products for Codex Corp., a Mansfield, Mass., supplier of data communications systems and equipment.

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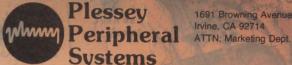
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DATA COMMUNICATIONS IV

Surveying front-end processors

MALCOLM L. STIEFEL, Contributing Editor

The most difficult choice may be between performance and peace of mind

A variety of forces are at work shaping the evolution of front-end processors (FEPs) for data-communications systems. Today's programmable FEPs, which operate mostly with binary-synchronous, teletypewriter and other commonplace communication protocols, will gradually give way to newer schemes. IBM's systems network architecture (SNA), while lagging in widespread acceptance, is sure to gain momentum, as will CCITT'S X.25 international standard, and other such standards yet to come.

In addition, industry observers, especially those who have a financial and emotional commitment to manufacturers of IBM plug-compatible FEPs, are worried about the prospect of an integrated channel from IBM that would absorb FEP functions into firmware. Such a move would leave the independent FEP suppliers in this survey out in the cold, but other observers question whether IBM will take that step in the next five years, if ever. For the present, then, FEP vendors face a flat, uncertain market that is at a turning point in its development—away from bisynch and toward the newer protocols, and away from mainframe-class FEPs toward more versatile network processors.

The contemporary FEP

Front-end processors are minicomputer- or microcomputer-based systems that perform vital functions in communications applications. A front-end processor (FEP) attaches to a host mainframe or supermini and relieves it of the mundane tasks associated with handling communications lines. It recognizes the receipt of complete characters and messages, provides acknowledgement of message completion to remote devices and performs similar functions demanded by communication protocols. It also executes parity checks and error-detection-and-correction algorithms on incoming messages and adds parity and check bits to outgoing messages.

There are two other types of communications processors—message-switching systems and remote concentrators. A message-switching, or networking, system acts as a node in a communication network. It interacts with other nodes and with end-user communications facilities, including front-end processors, hardwired controllers and computer channels. A remote concentrator multiplexes message bits from several low-speed lines onto one high-speed line to cut communication-line costs on long-distance transmissions.

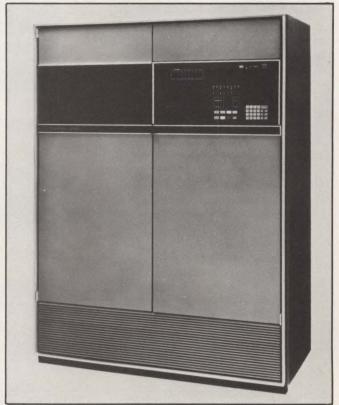


Fig. 1. The NCR Comten 3690 has an integral floppy-disk drive.

FEPs from independent manufacturers often have substantially more functional capability than corresponding units supplied by mainframe vendors.

An FEP is usually supplied with a disk drive, a line printer and an operator's console (Fig. 1). The disks store FEP programs and checkpoint records to facilitate recovery should the FEP fail. The printer logs transactions and dumps the FEP memory to facilitate isolation of problems in the communication system. The processor itself is usually a 16-bit minicomputer with an elaborate interrupt structure and as much as 0.5M byte of main memory. However, the NCR Comten model 3690's memory capacity can reach 4M bytes. One entry in the product table, the Lemcom Systems CMC series, is based on an 8-bit microprocessor with 64K bytes of main memory. And in the case of the Braegen model 4081, the FEP tape and disk drives can be used as peripherals for the host as well as the FEP.

Software includes an operating system and an assembler, although many FEPs are sold as turnkey systems that are not user-programmable. Typical of this group, the Codex 6520 provides standard modules supporting a variety of communication protocols for handling remote terminals and remote computers; the

vendor maintains the software, augmenting it as needed to accept new protocols.

The 6520 connects only to IBM 360, 370, 303X and 43XX processors and computers that are plug-compatible replacements for IBM mainframes, such as the Amdahl 470 series. Most of the units in the table work with IBM hosts, which is not surprising because IBM's market is huge. But a user with a non-IBM computer and a teleprocessing problem may be hard-pressed to find alternatives to FEPs supplied by his CPU vendor. For example, a Univac customer can choose units from Chi Corp. or Cencom Systems, and DEC and Burroughs customers can turn to the Periphonics T-Comm 80. But an IBM customer can select a FEP from any of at least seven vendors.

The IBM bias is not new. When we last examined front-end processors (MMS, October, 1977, p. 58), most were designed for use only with IBM hosts, and most still are. However, only four of the suppliers in the 1977 product table—Chi, Computer Communications, Comten and Periphonics—are also on the present list. The other independents that had FEP products three years ago have either gone out of business or have dropped their FEP lines. This is bad news for the potential user, because he will depend heavily on the continued support of the FEP supplier to make his system successful. The vendor must keep up with changes in protocols and host operating systems and

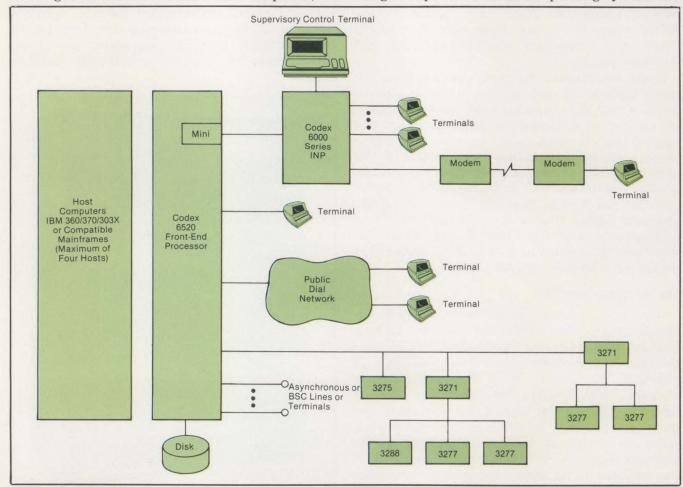


Fig. 2. Block diagram of a network incorporating a Codex 6520 front-end processor with a multiplexed network interface (MNI). The 6520 can handle as many as 240 asynchronous lines, 112 synchronous lines or mixtures.

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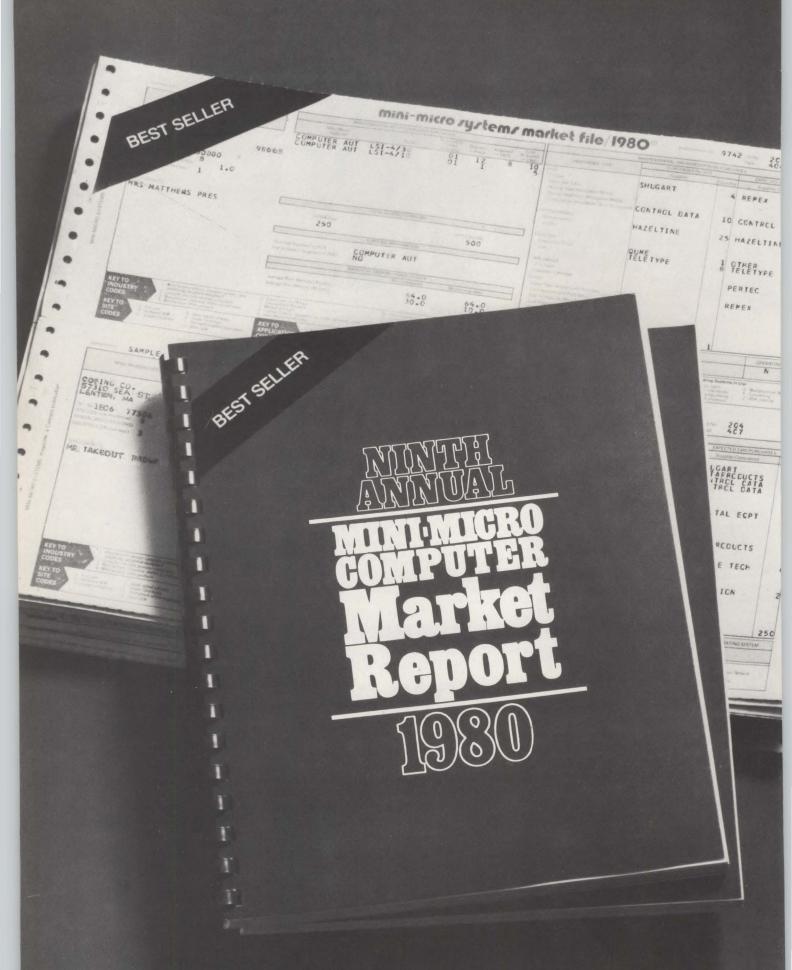
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1979 purchases	1980 buying plan	s	1979 purchases	1980 buying pl	ans
20,915	25,481	Minicomputers	56,439	69,099	Floppy disk drives
11,024	15,613	Microcomputers	16,190	24,737	Hard disk drives
58,965	71,676	Alphanumeric CRT terminals	38,762	48,709	Printers and teleprinters
4,882	6,993	Graphic CRT terminals	3,126	3,528	Data acquisition systems
6,002	7,451	Open reel tape drives	19,493	24,918	Modems
3,566	6,461	Tape cassette and cartridge drives			

That's buying power. And, it's available as a printout or on magnetic tape. For any or all of the 22 separate product categories covered by the Market File. Or by specific manufacturers, such as all those who have purchased or plan to purchase DEC computers. In addition, the 1980 Market File respondents are available on presorted mailing labels.

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panies serving the market. It projects industry purchases in each and every category for the coming year. And, it gives you much more.

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TABLE OF FRONT-END PROCESSOR SUPPLIERS

The following table is provided as a guide to evaluating vendors of front-end processors. *Mini-Micro Systems'* staff prepared the table from its own sources. Some suppliers may not be included, either

Manufacturer	Model No.	Host Computers Interfaced	Devices and Protocols Supported	Communication Line Characteristics	Processor Configuration	Price
Austron Deta Systems, Inc.	model 8911	IBM 360, 370, 30XX, 43XX	DEC minicomputers, graphics systems, IBM 2803 and 3803 magnetic-tape units, ASCII terminals; X.25 protocol	256 subchannel addresses on host, 16 full-duplex lines, 38.4K baud per line, 1M-byte- per-sec. throughput	DEC LSI-11/02 or PDP-11/23 processor, 16-bit word, 256K bytes main storage, terminals, printers, floppy-disk drive, magnetic-tape drive, operating system, assembler	\$12,995 and up
Braegen Corp.	model 4081	IBM 360, 370, 30XX, 43XX; as many as eight hosts per system	card readers, printers; IBM 3270 and 3780, emulates IBM 2821 controller	six full-duplex lines, 19.2K baud per line, maximum of 32 connected devices	16-bit word, 256K bytes of main memory, cartridge disk drive, printers, card readers, CRT terminals, operating system, assembler	\$20,000 to \$200,000
Cencom Systems, Inc.	CSI 1000, 2000 and 3000	Univac 100 series, as many as eight hosts per system	Univac 1004, Teletype, Univac NTR; IBM 2780 and 3780, HASP, Univac Uniscope	Maximum line speed 100K bps, 50K-cps maximum throughput	16-bit word, 1M-byte main memory, disk drive, console, operating system, assembler	\$85,000 to \$950,000
Chi Corp.	ССР	Univac 1100 series	Univac 1004, U-100, U-200; IBM 2780, 3780, HASP; T.TY, extended TTY	50K bps maximum line speed	Perkin-Elmer 7/32, 32-bit word, 1M byte of main memory, disk drive, tape drive, console	\$50,000 to \$350,000
Codex Corp.	model 6520	IBM 360, 370, 30XX, 43XX	IBM 1030, 1050, 2250, 2260/2848, 2265/2845, 2741, 2740II, 27700, 2780, 3270, 3275, 3741, 3767, 3780; Teletype 28, 32, 33,35; IBM System/3, 1130; Dataspeed 40; HASP work station; remote IBM 360/370	240 asynchronous lines, 50 to 9600 baud; 112 synchronous lines, 2K to 230.4K bps; 200K-cps throughput	16-bit word, 64K bytes of main memory, hard- and floppy-disk drives, magnetic-tape drive, line printer, operating system, assembler	\$40,000 to \$200,000
Computer Communications, Inc.	CC-8, CC-8.5	IBM 360, 370, 303X and 43XX and all compatible computers	All IBM and most other terminals; BSC, TTY, SABRE, X.25	as many as 240 synchronous or asynchronous full- duplex lines; maximum line speed of 230.4K bps; max. throughput of 200K cps synchronous for the CC-8, 400K cps for the CC-8.5	16-bit word, 64K bytes of main memory, floppy- disk drive, control console, operating system, assembler	\$43,300 for the CC-8, \$65,000 for the CC-8.5
	CC-80, CC-85	IBM 360, 370, 303X and 43XX and all compatible computers	All IBM and most other terminals; BSC, TTY, SABRE, X.25	as many as 1232 synchronous or asynchronous full- duplex lines; max. line speed of 230.4K bps; maximum synchronous throughput of 200K cps for the CC-80, 400K cps for the CC-85	16-bit word, 512K bytes of main memory, hard- disk drive, control console, operating system, assembler	\$68,000 for the CC-80, \$98,000 for the CC-85

Manufacturer	Model No.	Host Computers Interfaced	Devices and Protocols Supported	Communication Line Characteristics	Processor Configuration	Price
Lemcom Systems, Inc.	CMC-4, CMC-8, CMC-32	IBM 360, 370, 30XX, 43XX	IBM synchronous and asynchronous protocols (Teletype, SDA-2, TA-1, TA-2, TA-3); IBM 2740, 1050, 1060, 2741, 1070, 1030, 2260/2845, 2770, 2780, 3271/3277, 3274-1C, 3770, 3780 terminals; IBM 1130, 1131, System/7 computers; Teletype 33, 35/37 terminals; RS232, WE 301/303 and CCITT V.35 interfaces	4 to 32 full-duplex lines, 56K bps per line, 7K- to 56K-cps throughput	8-bit word, 64K bytes of main memory, operating system, assembler	
Memorex Corp.	model 1380	IBM 360, 370, 30XX, 43XX	start/stop: IBM 1050, 2260/2848, 2265/2845, 2740, 2741; Teletype II: Teletype 33, 35; synchronous: IBM 2770, 2780, 3780, 3271, 3274, 3276, 3275; multileaving work stations	112 full-duplex lines, 230.4K bps per line (four lines maximum); 100K- cps throughput	16-bit word, 64K bytes of main memory, operating system, assembler	
NCR Comten, Inc.	model 3650 II	IBM 360, 370, 3033, 43XX	IBM 3270, 2780, 3740, 2740, 2741, 2260, 2265; Teletype 33, 35, 28, 32 and 38 terminals; IBM 1130 computer	128 full-duplex lines, 230.4K bps per line; 100K-cps throughput	16-bit word, 512K bytes of main memory, disk drive, tape drive, card reader, line printer, HASP work station, operating system, assembler	\$45,000 to \$125,000
	model 3690	IBM 360, 370, 3033, 43XX	IBM 3270, 2780, 3740, 2740, 2741, 2260, 3215; Teletype 33, 35, 28, 38 and 32 terminals; IBM 1130 computer	384 full-duplex lines, 230.4K bps per line; 300K-cps throughput	64-bit word, 4M bytes of main memory, disk drive, tape drive, card reader, line printer, HASP work station, operating system, assembler	\$130,000 to \$550,000
Periphonics Corp.	T-Comm 80	IBM, Burroughs, NCR, Univac, Honeywell, DEC, Data General, Perkin-Elmer	Asynchronous and binary-synchronous terminals; IBM 3270, 2780 and 3780 terminals; IBM 3600 system; SNA/SDLC protocol	104 full-duplex lines, 19.2K bps per line	16-bit word, 2M bytes of main memory, disk drive, tape drive, printer, operating system, assembler	\$50,000 to \$500,000
Rockwell International	Collins FNC	IBM 360, 370, 303X; Univac 1100 series	IBM, Nixdorf and Teletype terminals; SNA/SDLC, BSC and TTY protocols	as many as 1024 full- duplex lines, 56K-bps maximum line speed	one 32-bit processor and one 16-bit processor, eacn with 1M byte of main memory	\$2,000,000 to \$3,000,000
Telefile Computer Products, Inc.	T3600DT FECPX	Xerox Sigma 5 through 9; Telefile 85	RS232	128 full-duplex lines, 9.6K bps per line, 256K- byte-per-sec. throughput	Telefile TCP 16/5 processor, 16-bit word, 1M byte of main memory, disk drive, tape drive, card reader, card punch, line printer	\$70,000



WHEN IT COMES TO PUTTING IT ALL ON DISPLAY, THE ORION-60 STANDS ALONE.

A display terminal that won't standalone can't be as versatile or as adaptable as the Orion-60, the modular plasma display system that stands by itself or interfaces with existing hardware to let you create your own programs.

To begin with, the Orion-60 is an easy touch: besides offering full alphanumeric, floppy disc and rear-projection capabilities, it lets you create displays and enter data simply by touching the

screen with your finger.

That means you can project a slide onto the screen coordinates and plot your own course over it. You can program your own character sets. You can generate vectors of any length to absolute screen coordinates. In short, you'll have a flexible terminal that will keep up with your needs today—and grow with your operations tomorrow.

Of course, since Magnavox was a

Magnavox
DISPLAY SYSTEMS

leader in the development of plasma terminals, you can be sure your Orion-60 will have a bright, high-contrast display free from jitter and distortion.

There's a lot more you should know about the ways this remarkable terminal can help you get more out of graphic displays. For a demonstration, call or write Tyler Hunt at Magnavox Display Systems, 2131 S. Coliseum Blvd., Ft. Wayne, IN 46803, (219) 482-4411.

CIRCLE NO. 76 ON INQUIRY CARD

A multidrop terminal user with a 6520 FEP can access a variety of system functions without repatching connections or redialing.

update customer software. This need for continuing support makes assurances of a vendor's financial stability and commitment to the FEP market a vital prerequisite to buying a system.

These stumbling blocks in the prospective buyer's path are unfortunate, because the independents' units offer not only savings—the touchstone of all plug-compatible products—but also substantially more functional ability than the mainframe vendors' FEPs. Examples are units that replace IBM 3704 and 3705 communication controllers. The Braegen 4081 interfaces with as many as eight hosts, and the Codex 6520 interfaces with four. But the IBM 3705 interfaces with only two. The Memorex 1380 supports line speeds as high as 230.4K bps, while the 3705 is limited to 56K bps. The Austron 8911 connects to non-IBM terminals; the 3705 does not.

Other advantages abound. A multidrop terminal user with a Codex 6520 FEP can access a variety of system functions, such as TSO (time-sharing option) or CICS (customer information control system), without repatching connections or redialing the computer. The 6520 also has a redundancy feature, enabling real-time switching of lines from one host to another in case of failure. The independently supplied FEPs also claim greater throughput—measured in characters per sec.—than their IBM counterparts, and they take host upgrades in stride. For example, when a host 370 is replaced by a 4341, an FEP need be changed very little if it is tied to a byte- or block-multiplexor channel on the host.

The same kind of functional leverage for an independent unit is also evident in non-IBM systems. For example, the Cencom Systems FEP replaces the

REFERENCE LITERATURE

For more information on front-end processors, use the reader circle numbers below.

reader circle numbers below.
Company Circle No.
Austron Data Systems, Inc., Austin, Texas 376
Braegen Corp., Cupertino, Calif
Cencom Systems, Inc., Bethesda, Md 378
Chi Corp., Cleveland, Ohio
Codex Corp., Mansfield, Mass
Computer Communications, Inc., Torrance, Calif. 381
DPF, Inc., Hartsdale, N.Y
Intelligent Terminals, Inc., Los Altos, Calif 383
Lemcom Systems, Inc., Phoenix, Ariz 384
Memorex Corp., Cupertino, Calif 385
NCR Comten, Inc., St. Paul, Minn
Periphonics Corp., Bohemia, N.Y
Rockwell International, Dallas, Texas 388
Tandem Computers, Inc., Cupertino, Calif 389
Telcon Industries, Inc., Ft. Lauderdale, Fla 390
Telefile Computer Products, Inc., Irvine, Calif 391
TRT Data Products, E. Norwalk, Conn 392



The Lemcom Systems CMC-4 is based on an 8-bit microprocessor.

Univac C/SP communications processor. The scorecard reads as follows:

- The Cencom's throughput is 20K to 40K cps; the Univac's is less than 8K cps.
- The Cencom supports 384 full-duplex lines; the Univac supports only 64.
- The Cencom enables different types of terminals to share the same phone line; the Univac does not.
- The Cencom provides on-line diagnostics; the Univac does not.

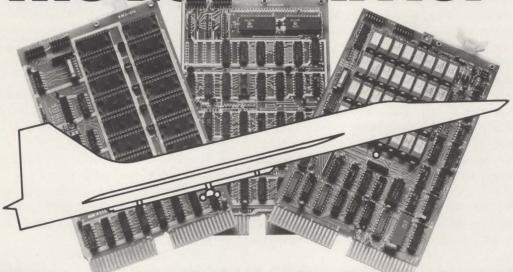
Because independent suppliers are smaller than mainframe manufacturers, they can react more quickly to changes in the market. For example, Lee Sudan, director of network products for Codex Corp. (see "An integrated approach to corporate networks," p. 120), sees the X.25 networking protocol already gaining wide international acceptance. He foresees that in the next few years, the X.21 protocol will replace RS449, ANSI's new asynchronous serial interface standard. The independents can quickly bring hardware and software to market to satisfy the resulting demands.

Sudan points out, however, that old protocols don't disappear, and vendors must continue to support them as well. For example, many companies have enormous investments in the various versions of the binary-synchronous communication protocol. These investments will not easily be forgotten just because some new gimmick has emerged. IBM, in particular, has found customers slow to accept its much-publicized SNA because it requires users to replace old hardware and software. The FEP vendors see this and act accordingly. Thus, of all the vendors in the product table, only Periphonics and Rockwell offer SNA/SDLC capability. But several vendors provide interfaces to such terminals as the IBM 2780, 3780 and 3270 series, which run with old reliable bisynch.



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

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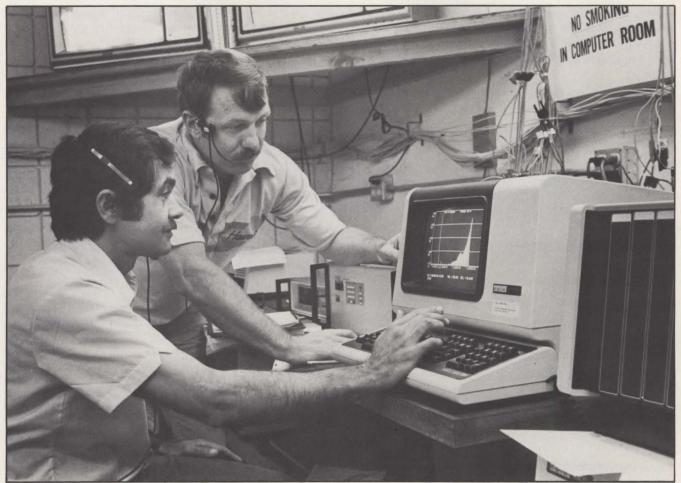
Laboratory mini aids fire research

MINC-11 monitors test fires as researchers develop national fire-protection standards

The fire began in a plastic wastebasket in the corner of the living room. First, a narrow ribbon of white smoke spiraled slowly upward, then became a dense plume as the first flash of open flame burst forth and spread quickly to an adjacent armchair, then to the sofa, drapes, corner table and lamp. The synthetic fabric draperies exploded in flames, and fire leaped up the wall, blistering the ceiling. Black smoke from the

flaming polyurethane foam padding soon filled the upper half of the room.

Suddenly the room was completely obscured by a mixture of smoke and mist as a sprinkler on the ceiling was automatically activated by the heat. The fine spray quickly extinguished the flames, and the room temperature, which had risen from 63°F to 165°F within three minutes after the fire was ignited, began to fall rapidly.



Immediately after a Los Angeles test fire has been extinguished, engineer Wayne Martin, left, and Chief Donald Manning study test results on the CRT terminal of their MINC computer.

The MINC converts all values into graphs, which are displayed on the computer's CRT terminal.

This fire was similar to many that begin by accident or carelessness, and which take the lives of thousands in the United States each year—but this fire was not an accident. It was deliberately set by the Los Angeles Fire Department's Fire Prevention Bureau as part of a series of residential fire-sprinkler tests.

The firemen use a minicomputer to log a wide range of data collected from the tests. The research data will be used to help establish a nationwide standard for residential fire-protection sprinkler systems. If sprinklers were used extensively in homes, fire prevention experts say, loss from residential fires could be cut as much as 90 percent.

The sprinkler tests in the Los Angeles test site are an extension of research initiated about four years ago by Factory Mutual Research Corp., Norwood, Mass., in cooperation with the National Fire Protection Association and the U.S. Fire Administration.

Simulating the 'real world'

"The intial series of tests were conducted by Factory Mutual in a mock-up living room at its research facility in Norwood. We are now taking the information it developed and are applying it to a 'real-world' fire situation," explains Chief Donald Manning, head of the Los Angeles Fire Department's sprinkler test program.

Tests take place in a two-story stucco house that was acquired by the city when it condemned property to

extend Los Angeles International Airport's runways. "By using an actual house, we are able to assure that the information we collect is as valid as possible," Manning says. "Also, it gives us an opportunity to see what happens in terms of room temperatures, carbon monoxide buildup, oxygen levels, smoke obscuration and related factors in other parts of a house when a fire occurs in one room."

To prepare for a test, firemen attempt to simulate the worst possible situation that can exist in a home from the standpoint of flammable furnishings. One problem, Manning points out, is the difficulty in obtaining furniture padded with untreated polyurethane foam. California is one of the few states that has adopted standards for fire-resistant foam and upholstery materials. "We have our furniture especially built so it will be more representative of that found in most other parts of the country," he says.

The rooms in which the fires are set are equipped with several types of probes to collect data on conditions in the room throughout the fire. These include thermocouples placed at 5 ft., 3 ft. and 3 in. from the ceiling to collect temperatures at various points in the room, plus velocity probes to measure air movement, optical densitometers to reference smoke obscuration and intake tubes for collecting air samples to determine oxygen levels and carbon monoxide content at several points in the room. Identical probes are placed in adjoining rooms and at the top of a staircase so that typical escape routes can be monitored.

Sprinkler head spacings are varied from one test to another, as is water pressure and volume at the heads. A special water supply system was installed so that flow and pressure can be controlled accurately via a

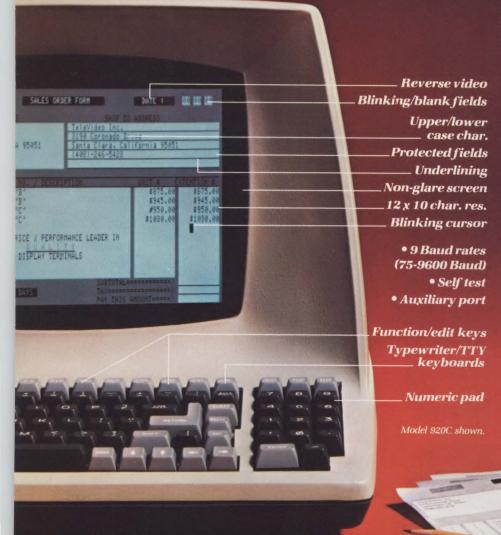






After adjusting all test instruments hanging from the ceiling, left, fire inspector Vern Begley gets set to start a fire in the Los Angeles test facility. In center photo, flames have spread from wastebasket to furniture in about three minutes. Damage from the fire, right, was kept to a minimum by test sprinkler system.

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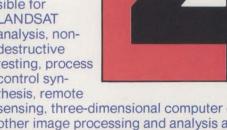
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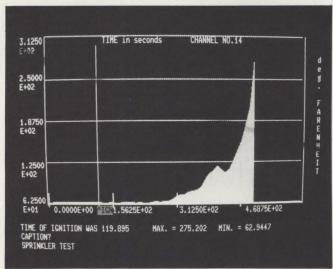


The MINC minicomputer enables test personnel to monitor key factors in a test while it is still under way.

system of flowmeters and valves. This is important, because sprinkler head spacing and water supply are two primary factors that apply to establishing residential sprinkler standards.

Monitoring with a computer

The central unit in the data-logging operation is a Digital Equipment Corp. MINC-11 laboratory computer system, located in the control room in a building adjacent to the fire test house. The MINC data acquisition system incorporates a PDP-11/03 minicomputer with a 64K-byte semiconductor memory, RX02 dual floppy disks and a VT105 video terminal. Other key instruments include a Fluke 8502A digital voltmeter and a Fluke 2204A scanner, both of which are linked to the MINC system via its IEEE 488 bus.



One of several graphs produced by the MINC computer shows the rise and fall of the room temperature during a test fire.

The gas-sampling and velocity probes terminate in an instrument room equipped with Barocel electronic manometers for measuring air pressure, and Beckman infrared carbon monoxide and oxygen analyzers, which determine levels of both gases at each test point. These values, in millivolts, are transmitted to the computer through the digital voltmeter/scanner configuration. Temperature and smoke obscuration values, also in millivolts, are collected by the digital voltmeter directly from the probes. In the current series of tests, 45 separate analog channels are monitored by the system, with one scan taking place every 10 seconds during a test.

Other information is keyed directly to the computer, including details of water flow, sprinkler head spacing, barometric pressure, wind direction and velocity and relative humidity both inside and outside the house. Each sprinkler head is electrically connected to a

separate clock module, which is stopped automatically the instant the head is triggered. The time of activation for each head is also keyed into the system immediately following the test.

The MINC records all data collected during the test on a floppy disk, and personnel in the control room can monitor as many as three preselected channels while the test is in progress. All values are converted by the program into graphs, which can be viewed on the computer's CRT terminal. Control-room employees also can follow the test's progress on two closed-circuit color television monitors in the control room. Video tape recordings from two camera positions are made for subsequent playback.

The tests, which began last August, were preceded by a series of residential fire tests in the same house, but using smoke and heat detectors instead of sprinklers. For selected scenarios, some of the sprinkler tests are being run under identical conditions, using the same room layouts, type of furniture and test probe locations. Researchers can then make precise comparisons of sprinklered vs. unsprinklered fires in terms of such factors as room temperature and carbon monoxide buildup. "We are very encouraged with the results," Chief Manning says.

'Live' test results

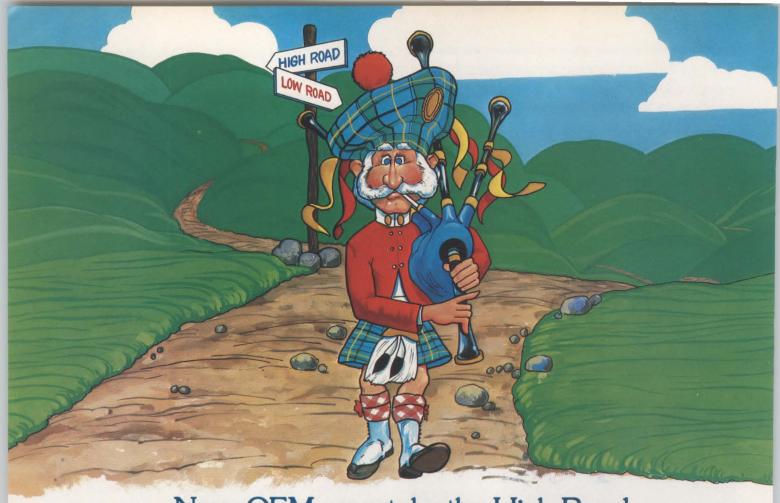
The MINC minicomputer enables test personnel to monitor key factors in a test while it is under way. It also provides a way to study test results without having to wait for a lengthy data-reduction procedure. "In the first series of fire-detector tests, we used strip recorders to log the various data channels, and it took nearly a year for all of the data to be reduced to a form that could be used for proper analysis," he recalls.

"The MINC not only gives us faster and more complete data, but also is very cost-effective," Manning says. "In the first series of tests, the cost for the chart paper we used on the four strip recorders was greater than the purchase price of the computer."

As each sprinkler test is completed, the data is read onto a duplicate diskette, which is sent to Factory Mutual. There, research scientists use another MINC system to study the graphs, both on the display screen and on physical graphs produced on a flat-bed plotter.

"In our work we basically are trying to determine the most effective spacings between sprinkler heads for various types of residential construction, along with the minimum amount of water needed at each head in order to control any conceivable type of home fire," explains Alan P. Symonds, a Factory Mutual research scientist who is serving as instrumentation coordinator for the test program.

"The culmination of our efforts will be published in a report which the National Fire Protection Association will use to incorporate sprinkler standards into Consensus Standard NFPA-13-D, which covers residential fire-protection devices," Symonds says. "Our target for completion of the report and adoption of the standard is November."



Now, OEMs can take the High Road or the Low Road with our Direct-Connect Modem Cards, small enough to mount inside Data Terminals.

As the auld Scottish tune suggests, Racal-Vadic now makes it easy for OEMs to take the high road (1200 bps) or the low road (300 bps), with low cost direct-connect "Modems-on-a-Card," small enough to mount inside CRT displays, teleprinters, POS devices, and other terminals and systems.

The High Road: 1200 bps

Meet the compact VS1200P, a complete modem on a single PC board measuring 5" by 8.35." That's a thrifty 42 square inches of space. It's fully compatible with Bell 202C and S modems. Only better, offering much more in performance, flexibility and test capability. It's registered for direct-connect, too. Connects to the switched network with a

cable that plugs right into a Telco voice or data jack. Built-in 20 pin ribbon connector easily interfaces the VA1200P to your terminal. Price is right, too. Just \$200 in quantities of 100.

The Low Road: 300 bps

The VS300P is a 300 bps full duplex, automatic originate/answer "Modemon-a-Card." Like the VS1200P, it

measures only 5" by 8.35," making it small enough to mount inside most terminals. The VS300P is Bell 103/113 compatible, and FCC Registered for

direct connect via a
Telco voice or data
jack. Mounting holes
on each corner make

it a cinch to install. And the price would put a smile on the face of the thriftiest Scotsman. Just \$200 in lots of 100.

Both Roads: The TI Story

Two of Texas Instruments new Silent 700* data terminals include Triple Modems custom made by Racal-Vadic. Although small enough to fit into TI's portable 17 pound terminal, this remarkable modem combines a Racal-Vadic VA3400, a Bell 212A, and a Bell 103. Imagine, a full originate/answer direct-connect modem with both 1200 bps full duplex and 300 bps full duplex in such a tiny package. And it can even be acoustically coupled.

We did it for TI, and we can do it for you. Phone or write today.

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PROCESS-EVALUATION TEST SYSTEM.

The System 3000 process-evaluation test system for wafer-fabrication process control is designed for high-speed testing, data reduction, easy programming, high throughput and reliable operation. The system can measure threshold, Mfactor, IDSS, BVCEO, IDS curves, C/V plots, sheet resistance and line width and perform Van de Pauw measurements. Included in the system are a 16-bit CPU, dual floppy-disk drives, 48K words of memory, RS232- and IEEE 488-compatible ports and a CRT terminal. Software features include user-defined test commands and full Pascal capability. Price is \$77,000. Accutest Corp., Chelmsford, Mass. Circle No 200

WORD PROCESSOR. The Ideographic word-processing system can be used to create, edit and print documents in conventional Chinese, simplified Chinese, Japanese or English. The system's standard 10-key pad can reproduce 10,000 characters—a capacity that formerly required thousands of keys, according to the manufacturer. A basic configuration consists of a master ois processor with a single diskette drive, a model 5536-iws CRT work station with 64K bytes of memory and a model 5531-IP impact matrix printer. Features include text movement, copy, search, replace, automatic centering, right justification, tabbing and forward and reverse vertical scroll. Prices start at \$5500. Wang Laboratories, Inc., Lowell, Mass.

Circle No 201



DATA-COLLECTION COMPUTER. The M80 data-collection computer, designed to operate in environments too severe for disk drives, printers and other peripherals, is a self-contained system with a rugged carrying case and its own power supply. Based on a z80 microprocessor, the unit includes a patented high-speed cassette drive capable of handling continuous data streams at rates as high as 9600 baud. Modem and terminal RS232C and TTY current-loop ports are also included. A 2K PROM can be programmed to

implement completely interrupt-driven control of the recorder and communication functions. Other features include 30 preprogrammed recorder and communications commands and programmable data rates to 19.2K baud. Applications include data logging, automatic testing, process control, numerical control and medical data acquisition. **Memodyne Corp.**, Needham Heights, Mass.

Circle No 202



SHARED-RESOURCE WORD PROCES-SOR. The Opus 80 is a shared-resource text-revision and information-handling system that provides explanatory menus and extensive operator prompts. A single key is used to select either a full-page display of 58 110-character lines or an enlarged display of 27 86-character lines. In addition, a four-line reference area at the top of the 15-in. screen displays status information. The system includes a 14.5M-byte hard-disk drive, and a 29м-byte (6000-раде) drive is available as an option. The system supports as many as three printers and as many as six work stations. Each work station contains 64K bytes of memory and a 16-bit microprocessor, enabling it to perform most of its own word-processing functions. Hazeltine Corp., Circle No 203 Commack, N.Y.

MICROCOMPUTER SYSTEM. The model 3850A is a stand-alone, floppy-based microcomputer system for software-development and distributed-processing applications. The system includes a Z80A microprocessor, 96K bytes of RAM, parallel and serial I/O, an integral 12-in. CRT, a freestanding 93-key intelligent keyboard, an IBM-3740-compatible 250K-byte floppy-disk drive and a table-top printer. Communications adaptors convert TTL-compatible serial I/O

signals to 20-ma current loop, RS232C, RS422A or RS423A specifications. Price is less than \$10,000. **Xycom, Inc.** Ann Arbor, Mich. **Circle No** 204

LSI-11 SYSTEMS. Based on DEC LSI-11/2 or LSI-11/23 CPUs, these packaged systems have 32K to 128K words of Mos memory and RT-11, RSX-11 or UNIX operating systems. A typical rack-mountable system consists of an LSI-11/23 processor with 64K words of memory, dual floppy-disk drives, a DLV-11J quad serial interface, an eight-quad-slot backplane and a 21M-byte Winchester-disk drive. A fail-safe tape backup is optional. Price is less than \$16,000. Charles River Data Systems, Inc., Natick, Mass.

Circle No 205

JOB-SHOP MANAGEMENT SYSTEM. The COMSHOP V minicomputer-assisted job-shop management system gives job shops quick, accurate job-estimating, job-costing and general-accounting reports. COMSHOP V tracks all direct and indirect costs for each job and helps prepare estimates, taking all costs into consideration. A typical configuration includes 64k bytes of main memory, 20M bytes of fixed-disk storage, a 300-lpm printer, two video display terminals and a modem. Price is \$73,000. Manufacturing Data Systems, Inc., Ann Arbor, Mich.

Circle No 206



PORTABLE COMPUTER SYSTEM. The PSS-1, a self-contained, battery-operated computer system for hydrography and materials handling, enables data collection, processing and recording in the field. With operator-controlled interrupts and status inputs, the system can control external devices, such as distance measuring and depth-sounding equipment, process-control and environmental sensors, position plotters and serial terminals. Prices start at \$21,000. Digital Design & Development, Inc., Hingham, Mass.

test equipment

IEEE-488 INTERFACE FOR LOGIC ANALYZER. The K100-D 100-MHz logic analyzer is now available with an IEEE-488 (GPIB) bus. The interface, which speeds use of the K100-D in automatic and remote testing applications will be built into all newly purchased K100-D logic analyzers at no

increase in base price (currently \$10,500). Price for retrofitting K100-Ds previously purchased without the interface is \$1650. **Gould, Inc.,** Santa Clara, Calif.

Circle No 208

NETWORK ANALYZER. The TP-270 SDLC/ SNA network analyzer measures system response time in on-line IBM 3270-based networks, while enabling users to inspect and project system loading, terminals, lines, modems and communication channels. The device also detects and measures the time intervals involved in all events associated with the SDLC line protocol. Price is \$2875.

Teleprocessing Products, Inc., Simi Valley, Calif.

Circle No 209

We'll restore your floppy disk drive to OEM specs and have it back in your hands in 30 days.*



We're Trans Datacorp, the pioneer in 14" disk drive component remanufacturing. We'll inspect every key component of your floppy and upgrade or replace your heads, spindles, motors and electronics to OEM specifications—and usually *better* than OEM.

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Dedicated to reducing disc maintenance

*after receipt of materials



SERIAL DATA ANALYZER. The model 1640B serial data analyzer, designed to troubleshoot and maintain communication networks and to monitor or simulate elements of digital networks, incorporates two branching modes and a memory bit shift that lets users check transmitted or received data bit by bit or locate clock slips and unknown sync patterns. The unit operates synchronously at speeds as high as 19,200 bps (HDX only) or asynchronously as fast as 9600 bps, full or half duplex across two- or four-wire links. Price is \$5800. Hewlett-Packard Co., Palo Alto, Calif. Circle No 210

RESPONSE-TIME ANALYZER. The RTA-327 response-time analyzer measures the performance of data-communications networks based on IBM 3270, 3270-compatible and NCR 501 terminal systems using BISYNC protocols. All measurements can be made at the CPU or remote controller site via an RS232 interface between the communications controller and modem. Price is \$4875. Datacomm Management Sciences, Inc., Norwalk, Conn.

CONTINUITY TESTER. The CBT-128 is a microprocessor-controlled unit that tests all cables, harnesses, wire-wrapped boards, bare PC boards and backplanes. It automatically tests for opens and shorts, and identifies all errors by location and type of wiring faults, using the user's designations. The CBT-128 tests from 128 to 32,768 points. Prices start at \$2400 for the basic 128-point capability. Sensitek, Moorestown, N.J.

Circle No 212

Tools for Mini-Computer System Builders



Application Software

MACS (Management, Accounting, Control System); STYLUS word processing; READINET PERT/CPM project management system. All are on-line, interactive and run concurrently.

System

Permits interactive definition of menus, screen formats, file layouts, report formats. FORCE generates structured, bug-free programs in Business BASIC to implement your logic. Handles all error conditions and produces extensive documentation.



Point 4 Supermini

High speed computer with Nova*compatible instruction set. Instruction execution time-400 nanoseconds. Directly addresses 128K bytes RAM. Supports over 32 terminals concurrently.



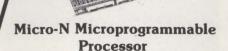
Mighty Mux Multiplexer

Interfaces up to 128 devices to the Direct Memory Access (DMA) channel of any POINT 4 or Nova-type computer. Supports CRT's, line printers, async and synchronous modems, etc.



IRIS Operating System

The most widely used, businessoriented, time-sharing operating system for POINT 4 and Nova-type computers. Supports Business BASIC, indexed random files, assembler, editor, data processing, word processing and data communication simultaneously on 32 or more ports.



Single board, high speed computer for Novas and POINT 4s Extends the instruction set via user-defined macros; e.g. extended precision, floating point, decimal arithmetic.



Policies

POINT 4 markets exclusively through system houses and OEM's, which it supports with lead referals, full one-year warranty on all products, extensive training, reliable service, high discounts, 21 month contracts and no bill-back.



Lotus Disc Controllers

Single board disc controllers for POINT 4 and Nova-type computers. The Lotus 700 controls up to four storage module or cartridge module drives. The Lotus 701 controls up to four 10 Megabyte cartridge drives.

The Toolbuilders

DATA CORPORATION

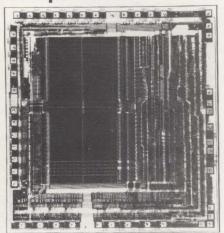
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We're looking for system house partners.

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components



Z8000 MEMORY-MANAGEMENT CHIP. The z8010 memory-management unit (MMU) for the z8000 microprocessor provides dynamic segment relocation and numerous memoryprotection features for each of the z8001 CPU's 8M-byte address spaces. The MMU supplies the memory space with a logical structure independent of the data's physical location; protects the user from inadvertent errors, such as attempts to execute data; prevents a user from gaining unauthorized access to memory resources or data; and protects the operating system from unexpected access by the user. The MMU also supports high-level languages. Each MMU has 64 randomly accessible segments ranging in size from 256 to 64K bytes, which can be mapped into a total physical address space of 16M bytes. The z8010 MMU costs \$187 in quantities of 10 to 99. Zilog, Inc., Cupertino, Calif. Circle No 213

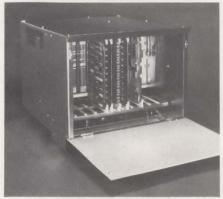


DATA-LINK CONTROLLER. The s6854 data link controller, designed for s6800 and other 8-bit parallel-bus microprocessors, performs communication-link functions for the advanced data-communication control procedure (ADCCP), high-level data-link control (HDLC) and synchronous data-link control (SDLC) standards. The s6854 provides the data-communications interface for primary and secondary transmitting stations in

stand-alone, polling and loop configurations. Data-transmission rates as high as 1.5M bps are possible with the s6854 operating at 1 MHz. An s68A54 version of the device with a 1.5-MHz clock rate is also available. Price in quantities of 100 to 999 in 28-pin plastic packages is \$17.40 each. American Microsystems, Inc., Santa Clara, Calif. Circle No 214

DOT-MATRIX LCD MODULE. The MA-B965B dot-matrix LCD module displays a total of 128 alphanumeric characters and an independent cursor line. The display is in four lines, with 32 characters in each line. The device includes CMOS LSI controlling and driving electronics, together with a temperature-compensated power-distribution circuit. Total power consumption is 60 mw. Price of the MA-B965B is \$240 in single-unit quantities. Epson America, Inc., Torrance, Calif.

Circle No 215

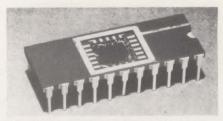


FRONT-LOAD MICROCOMPUTER CHAS-SIS. The M68MMFL microcomputer chassis permits insertion of micromodule cards from the front, rather than the top. The chassis has a built-in power supply for either 110 or 220 VAC operation, a card cage with a 14-slot motherboard and two cooling fans. Price is \$995. Motorola Semiconductor Products, Inc., Phoenix, Ariz. Circle No 216

VF DISPLAY DRIVER. The COP470 vacuum fluorescent display driver drives a multiplexed four-digit, eight-segment VF display directly, without additional logic. Two COP470s can be cascaded or stacked to drive an eight-digit multiplexed display or a sixteen-segment display, and by using more of the small 20-pin DIP chips, the digits and the segments can be simultaneously expanded. Data is loaded serially and held in internal static latches. The device can be operated with its own internal oscillator or with an external oscillator. Compatible with the vendor's COP400 series of microcontrollers, the display driver requires

no refresh from its processor. The COP470 costs \$2.45 in quantities of 100. National Semiconductor Corp., Santa Clara, Calif.

Circle No 217



TIME-SLOT CIRCUIT. The MC14418 is a programmable time-slot assigner circuit (TSAC) that is said to reduce per-channel parts count and simplify hardware design for central-office and private-branch-exchange digital switching. Intended for operation at rates as high as 2.56 MHz on a 5V to 16V supply, the MC14418 supports zero to 64 time slots per frame. Some of the control functions offered include ring enable, ring trip, power down and tone and data control. In a 22-pin ceramic DIP, the device costs \$8.80 in quantities of 100. Motorola Semiconductor Products, Inc., Phoenix, Ariz.

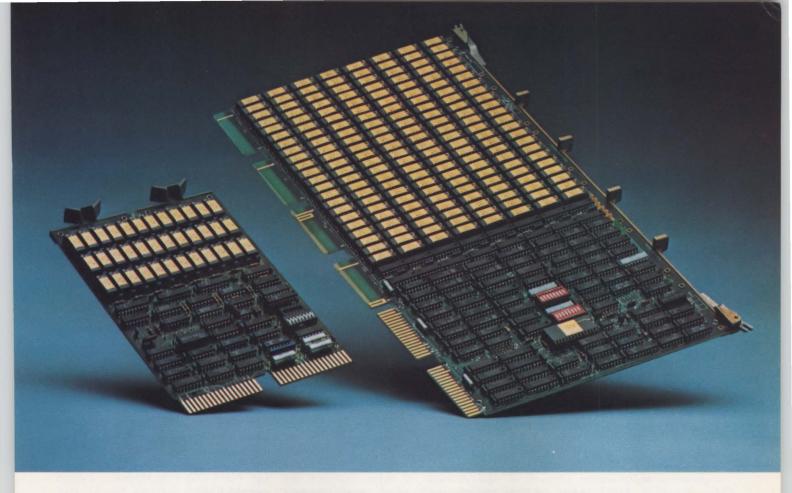
Circle No 218

D/A CONVERTER. The NE5020, a microprocessor-compatible 10-bit D/A converter, provides ±0.1 percent accuracy, with guaranteed monotonicity over an operating temperature range of 0° to 70° c. The 24-pin chip incorporates a voltage reference, application resistors, output summing amplifiers, data-bus-compatible latches and an input buffer amplifier. In quantities of 100, plastic package DIPs cost \$12, and ceramic DIPs cost \$14. Signetics Corp., Sunnyvale, Calif.



16-CHANNEL 8-BIT DATA-ACQUISITION SYSTEM. The DAS-952R single-chip data-acquisition system enables any one of 16 single-ended channels of analog information to be selected and digitized to a resolution of 8 binary bits at a system throughput rate as high as 15.5 kHz. Designed to interface with microprocessors, the 40-pin plastic DIP requires only an external reference, a clock and a connection to a +5v power supply. Price is \$37.50 in quantities of one to 24. Datel Intersil, Mansfield, Mass.

Circle No 220



More memory on board and a custom-design capability. Memory systems from Texas Instruments.

Quality. Reliability. Compatibility. And more memory on board than anybody else can offer. These are just a few of the many user benefits inherent in TI's new add-in memory modules. Here's more:

TMM20000 modules

This high-speed module is fully compatible with the DEC PDP-11 family of UNIBUS† computers. It's the only available module that offers enhanced system reliability through error detection and correction (EDAC) on board.

High-density, 256K x 16 bits organization *plus* 6 bits for EDAC, make TI's new TMM20000 the densest add-in module ever. Operation from a single 5-V supply with low power consumption is another big plus.

Programmable options include modified or extended UNIBUS, I/O page size, control status register address location, and error status register. Twenty-two address lines allow for expansion to 2M words.

TMM10000 modules

Two versions. Both Q-BUS† and Q-BUS PLUS† compatible. Q-BUS for LSI-11/2. Q-BUS PLUS for the newly announced LSI-11/23. The TMM10000-01 with parity. TMM10000-02, without. Both modules use 5-V only technology storage devices for high performance and low power.

These add-in modules, organized 64K x 16 bit words, with an additional 2 bits for parity (01 only) are the densest available on a standard DEC "dual" board. An optional feature allows extended addressing to 1 megabyte. Fast access and cycle times, too.

Basic storage unit

All TI-designed add-in memory systems employ a state-of-the-art 5-V memory technology. The basic storage unit makes possible such module fea-

tures as increased board densities, lower power dissipation, improved performance and enhanced system reliability.

These same advantages will be available to users who require production of custom memory systems.

Custom capability

If you need custom memory systems in production quantities, be sure and talk to TI. We'll custom-design modules for specific applications with the same high quality, reliability and meticulous attention to cost-effectiveness that our standard modules offer.

For price and availability informa-

tion, call your nearest TI Semiconductor sales office or authorized distributor. Or contact Texas Instruments, Box 1443, M/S 6958, Houston, Texas 77001. (713) 490-3746.



TEXAS INSTRUMENTS

INCORPORATED
CIRCLE NO. 83 ON INQUIRY CARD

New Products

disk/tape

FLOPPY-DISK DRIVE SUBSYSTEM. The two-drive 9895A floppy-disk subsystem, designed for the vendor's 1000 Series minicomputers and HP-85 personal computers, uses a double-sided, double-density format to store as much as 1.2M bytes per drive. Said to be the first double-sided floppy-disk drive to incorporate an IEEE 458 interface, the 9895A can also be used with the vendor's Series 9800 Systems 35 and 45 desk-top computers. Price, including controller, is \$6000. Hewlett-Packard Co., Palo Alto, Calif.

FIXED/FLOPPY-DISK MEMORY SYSTEM.

The model 1850 disk memory system incorporates a 1.6M-byte 8-in. floppy-disk drive and a 5M- or 10M-byte 8-in. Winchester in a single cabinet. The two drives also share the same power supply and are tied to a proprietary disk controller/interface that can support as many as two systems. The model 1850 is software-compatible with most TRS-80 and Apple Dos systems. Prices range from \$3495 to \$4695. Lobo Drives International, Goleta, Calif. Circle No 228

160M-BYTE DRIVE. The BD-160 disk drive stores more than 160M bytes on an SMD-compatible removable disk pack. The drive operates at 768 tpi—double the track density of SMD drives—using an MFM recording method. Access time averages 30 msec., and transfer rate is 1.2M bytes per sec. Single-unit price is \$11,000. Ball Computer Products, Sunnyvale, Calif. Circle No 229

DOUBLE-SIDED, DUAL-FLOPPY DRIVE.

The model 9895A double-density floppy-disk drive provides as much as 2.36M bytes of mass storage for the HP 1000 Series L, E and F; the HP-85 personal professional computer; and the HP 9825 and HP Series 9800 Systems 35 and 45 desk-top computers. The drive uses the HPIB, HP's implementation of IEEE Standard 488-1978. A built-in controller enables the 9895A to recognize whether a disk has been recorded on one or two sides and enables it to exchange data in most cases with other systems that use the IBM 3740 single-sided, single-density format, provided additional software exists on the host computer. A 9895A dual-drive with controller costs \$6500. Hewlett-Packard Co., Palo Alto, Calif. Circle No 230

DISK SYSTEM FOR VA. The DD 80 disk memory systems for the DEC VAX-11/780 provide 80M to 600M bytes of storage per drive. The systems, which use removable and fixed media, come with a microprocessorbased disk controller and an SBI-bus interface. Other features include compatibility with DEC's VMS operating system, 7-byte on-the-fly error correction for both header and data and transfer rates as high as 1209K bytes per sec. Prices for a 600M-byte drive with controller start at \$37,000. Diva, Inc., Eatontown, N.J.

HARD-DISK SUBSYSTEM. The model 16 hard-disk subsystem provides from 32M to 96M bytes of bulk storage for the vendor's Series 8000 or Series 5000 microcomputer systems. The subsystem incorporates a removable 16M-byte SMD cartridge drive for backup and a 16M-, 48M- or 80M-byte Winchester-disk drive. Also included is a model 490 hard-disk controller that supports either DMA or programmed-I/O (PIO) data transfer at a maximum rate of 1.2M bytes per sec. Prices start at approximately \$10,000. Industrial Micro Systems, Orange, Calif. Circle No 232

TO EVERYONE WHO'S SAID, "EXPANDING A DATACOMM NETWORK IS A FINANCIAL NIGHTMARE,"



BULL.

Every DCA statistical multiplexor/network processor is modular in design, so you can add DCA components - not replace them - as your network needs expand. Since 1974, this approach to growth has made DCA networks the most adaptable and cost-effective on the market. And we can't begin to describe all the other advantages of a DCA network - call or write for our brochure today.

Digital Communications Associates, Inc., 135 Technology Park/Atlanta, Norcross, GA 30092 404/448-1400.



CIRCLE NO. 84 ON INQUIRY CARD

When It Comes To Add-on Memory...

LOBO Has It All.

LOBO DRIVES manufactures a full line of S-100 computer compatible disk drives. All drives are software compatible with most S-100 disk operating systems and applications software programs. Only LOBO DRIVES offers you the variety and choice of floppy and fixed disk drives. Choose from 51/4 and 8-inch floppies, 51/4 and 8-inch Winchester technology fixed disk drives, and several Floppy/Fixed disk combinations. Each LOBO DRIVES system is thoroughly tested and burned-in and has the famous LOBO DRIVES One Year, 100% Parts/Labor Warranty.



MODEL 400 51/4-INCH FLOPPY DISK MEMORY SYSTEM

A high-speed (298) Msec Access), highreliability (8000 hrs MTBF), low-cost floppy disk memory system. It is available in both soft and hard sector formats, and a choice of single or double density configurations.

- Up to 220 KBytes Capacity
- Single/Double Density
- Soft Sector Format
- Complete Software Compatibility

MODEL 800/850 DUAL FLOPPY DISK DRIVE MEMORY SYSTEM

LOBO DRIVES offers you a choice of single-sided, single or double density (Model 800) or double-sided, single or double density (Model 850) dual 8-inch memory subsystems. Each system comes complete with chassis and power supply, cables, controller and interface.

- Compatible with Most S-100 DOS Systems
- Up to 3.2 MByte Capacity

MODEL 1850 DUAL FLOPPY/FIXED DISK MEMORY SYSTEM

No more worries about back-up. LOBO DRIVES has combined the latest state-of-the-art Winchester technology with the proven reliability and dependability of its Model 850 8-inch floppy disk drive to bring you the ultimate in memory expansion for your S-100 computer. The Model 1850 is the ideal memory system for small business and word processing applications.

- 5 or 10 MByte Fixed Disk Capacity
- 1.6 MByte Floppy Disk Capacity
- Software Compatibility
- Sealed Environment
- Winchester Reliability
- 70 Msec Average Access Time

MODEL 950 DUAL FLOPPY/FIXED DISK MEMORY SYSTEM

All the advantages of Winchester technology fixed disk memory: large capacity (6.38 MBytes), high speed (170 Msec avg. access time), and extended reliability, combined with the convenience of a built-in floppy disk back-up in one cabinet. Only LOBO can bring you the storage capacity of 16 mini-floppies at a fraction of the price.

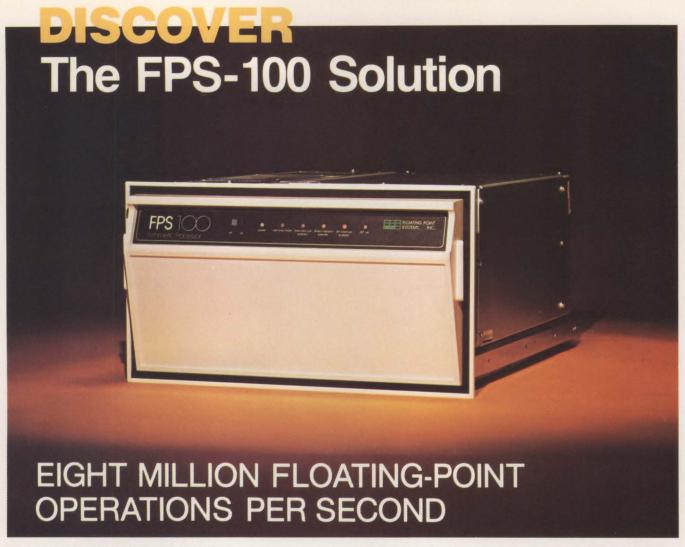
- The Storage Capacity of 16 Mini-Floppies
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If your product uses a general purpose minicomputer for numerically intensive computations, you should investigate the FPS-100. When connected to a mini, the FPS-100 makes a low-cost system with supercomputer capabilities.



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or floating-point formats. It executes up to 8-million floating-point operations per second with 8-decimal digits of precision ... satisfying most applications.

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power supplies

BATTERY BACKUP UNIT FOR ECLIPSE. This single-board battery-backup unit maintains power to the CPU and memory of Data General ECLIPSE S/250, C/350 and M/600 minicomputers. The vendor has enhanced its AOS software to provide battery-backup users with an orderly processing shutdown when an Ac power failure occurs. The backup unit is 7 in. high × 27 in. deep and weighs 81 lb. It mounts in the chassis next to the CPU and is cabled to the CPU bus bars. The unit is air-cooled and rechargeable, requiring no separate AC power. Price is \$2000. Data General Corp., Circle No 221 Westboro, Mass.

AC LINE PROTECTORS. The DLP series of AC line protectors combine the functions of AC line conditioners and uninterruptible power systems to isolate small computers from AC line noise, voltage transients, low-voltage conditions and power failures. The DLP 5, 10 and 15 line protectors supply 60 Hz, 120 VAC power with maximum current outputs of 5A, 10A and 15A, respectively. AC power is produced by an electronically controlled and regulated inverter using digitally controlled pulse-width modulation. The inverter is fed by a 90 VDC supply powered by the AC line or by a 72 VDC battery bank. The DLP 5 costs \$1850, including batteries. Displex, Inc., Glen Cove, Circle No 222

AC POWER CONDITIONERS. The w-model **VOLTECTOR Series 5 AC power conditioners** remove electrical disturbances from power lines to protect minicomputers and word processors. They are effective against both common-mode (line-to-ground) and transverse or differential-mode (line-to-line) forms of interference. Models are rated at 1, 2, 3, 5, 10, 15 and 20 A. Prices range from \$148 (1A) to \$393 (20A). Pilgrim Electric Co., Circle No 223 Plainview, N.Y.

POWER-LINE CONDITIONING REGULA-TOR. Stabiline Computer Regulators provide an output of 120v rms, ±3 percent, over an input voltage range of 95V to 130V, as well as 60 dB common-mode noise rejection. The units come in cabinets to blend with office decors. Stabiline Regulators cost \$325 to \$825, depending on model. Superior Electric Co., Bristol, Conn. Circle No 224

FIVE-OUTPUT SWITCHER. The model cs100 switching power supply, designed for small floppy- or fixed-disk-based microcomputer systems, has five outputs: +5v at 9A, +24V at 2A (4A peak), -5V at 3A, +12V at .5A and -12V at .5A, with a total maximum output of 100W. Input is 115 or 230 VAC, ±10 percent, 47 to 63 Hz. Features include overvoltage protection on the +5v output, 1 percent line and load regulation, soft start during power up and short-circuit protection. Price is \$250 in quantities of one to nine. Microcomputer Power, Inc., Santa Clara, Circle No 225

ULTRA-LOW-NOISE DC/DC CONVERT-ERS. The FC series of low-noise DC/DC converters provides dual outputs of ±12 VDC at ±35 mA and ±15 VDC at ±30 mA and accepts inputs of 4.5 VDC to 5.5 VDC, 10.8 VDC to 15.0 VDC, 21.6 VDC to 30 VDC and 42.0 VDC to 56.0 VDC (5 VDC, 12 VDC and 43 VDC nominal, respectively), depending on model. The units are equipped with a pi input filter to minimize input reflected ripple and have five-sided electrostatic shielding and tapewound toroids to minimize radiated EMI. FC-series converters costs \$59.95. Semiconductor Circuits, Inc., Haverhill, Mass. Circle No 226



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data entry

MICROPROCESSOR-BASED DATA-ENTRY SYSTEM. The UNIQUE Micro/Data collection system, a data-entry system based on Data General's MP100 microprocessor, is designed to operate in small installations that require comprehensive data-entry capability. Its features include data security; real-time

editing, validation and table look-ups; high-volume data entry; and user selectable data-verification methods. Operating as a stand-alone system, Micro/Data can support batch communications over synchronous or asynchronous lines using either RJE (2780/3780) or HASP protocols. The system costs approximately \$17,000 Data Communications Corp., Memphis, Tenn. Circle No 233

REMOTE BATCH TERMINAL. The Alphaverter/Series 400 remote batch data-entry terminal provides alphanumeric capability and programmability. The terminal measures $7\frac{1}{4} \times 14 \times 18$ in. and includes a 55-key typewriter-style keyboard with an embedded numeric keypad, a 5 × 7 dot-matrix impact printer and a cartridge tape drive. Telecommunications are handled via a built-in modem and acoustic coupler, a data access arrangement (DAA), enabling the host to poll the Alpha-verter remotely or an RS232 (V.24) interface to a modem. Small-quantity prices for the Alpha-verter range from \$2850 to \$3800 Digitronics, Cumberland, R.I. Circle No 234

Good News for DEC and Perkin-Elmer Users

That's our way of letting you know that DIVA now offers a disk subsystem with capacities of greater than 600M/bytes per drive, and up to eight drives. They're available for the DEC Unibus® series of PDP-11 minicomputers, the high-speed cache PDP-11/70 series, and the Interdata line of minicomputers, including the 3220 and 3240.

The heart of this system is our Computroller V, a third-generation disk controller that offers you a software-transparent system that allows up to 1209 K/bytes data transfer per second, processor-independent features such as error-correction and self-testing—and a well-earned reputation for reliability.

Especially critical to this reliable operation is the Computroller's internal error correction (ECC) design. It accommodates the increased densities of the new 600 M/byte drives because the 7-byte ECC is on both header and data fields, which calculates and corrects for burst errors up to 11 bits on-the-fly—all internally. In short, you can dramatically increase throughput. The kicker is that you can get it for about 50% less than the computer manufacturer would offer it for—if they had it to offer.

For more information, call or write DIVA, Inc., 607 Industrial Way West, Eatontown, N.J. 07724; (201) 544-9000.

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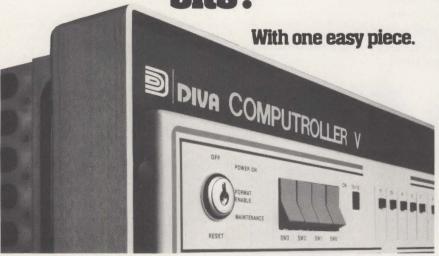
MARK-SENSE READER. The Series 100 MBs mark-sense readers can read marks made with felt-tip markers, ballpoint pens, pencils and other writing instruments. These remote data-collection stations accept card data in any format, reading the data continuously, column by column. These readers can process cards ranging in length from 22 columns to as long as is practical. Price of the 100 MBs Series readers is \$1495 in OEM quantities. Peripheral Dynamics Inc., Blue Bell, Pa.

Circle No 235



SPEECH-RECOGNITION UNIT. The model 7000 is said to be the first low-cost, industry-compatible speech-recognition unit to provide speech-input capability for any RS232C-compatible terminal. The unit, which uses digital-filtering and pattern-matching techniques to analyze audio input, automatically transfers its output to the computer in standard ASCII format. The model 7000 can be trained to recognize as many as 64 words or phrases, each as much as 3 sec. long, and is compatible with all common programming languages, including FORTRAN, COBOL, Pascal and BASIC. Price is approximately \$3000. Heuristics, Inc., Sunnyvale, Calif. Circle No 236

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They do more and cost less than any terminal they emulate.

MIME 314

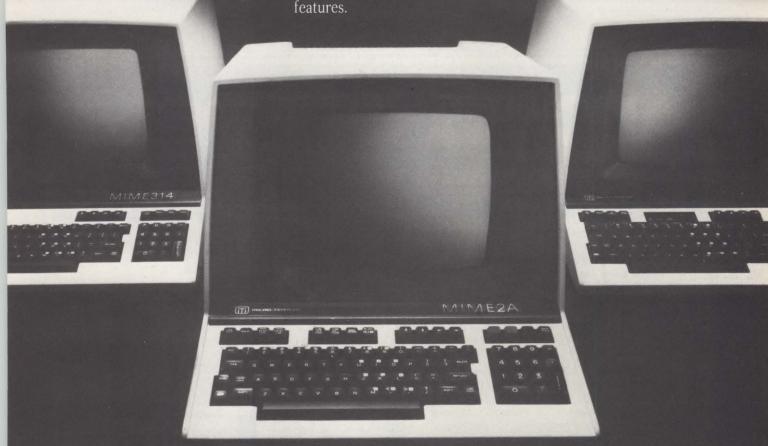
The dumb terminal that turns smart. Imitates the dumb ADM-3A and Hazeltine 1410 and, at the flick of a switch, upgrades into smart. This may be all the terminal you'll ever need.

MIME 2A

The smart imitator that gets smarter. Imitates the DEC VT-52, Hazeltine 1500 and Soroc I.Q. 120 at the flick of a switch. Complete video package even includes smooth scroll. Special Enhanced Mode adds many extra features.

MIME 100

The super-smart MIME. It will do everything the DEC VT-100 does, and for considerably less money. Even extra cost options for the VT-100 are included as standard features on MIME 100.



interactive terminals



EDITING TERMINALS. The model 1250 Super Owl editing terminal, which is available with either of two detachable keyboards or a light pen, has communications modes that minimize host computer loading and maximize host control. Both its configuration details and 12 (shiftable to 24) function keys are programmable from the keyboard or downline from the host. The information is stored in a nonvolatile EAROM, enabling a user to generate messages as long as 400 bytes (total) by depressing a single key. Price is \$1990 with the standard keyboard or \$2085

with the optional extended keyboard; quantity discounts are available. Perkin-Elmer Corp., Flanders, N.J. Circle No 237

PORTABLE GRAPHICS PRINTING TERMI-NAL. The Execuport 400G, a 16-lb. portable terminal with a built-in acoustic coupler, produces 80- or 136-column thermal printout on paper or transparent film. For graphics output, the terminal uses modified ASCII print code with special graphic characters. For alphanumeric output, it uses the standard 128-character ASCII code. Resolution in either switch-selectable mode is 1920 points per sq. in. (40 \times 48). The single-unit price of \$3795 includes a one-year warranty covering all parts and service; quantity discounts are available. Computer Transceiver Systems, Circle No 238 Inc., Paramus, N.J.

INTELLIGENT TERMINAL. Based on the minimas series of smart CRT terminals, the Master weighs approximately 20 lbs. and draws 50w. The terminal uses two microprocessors: a 28 to control the video display and a 6800 to provide intelligence. The unit also includes 48K bytes of user RAM; system routines are contained in 4K bytes of

ROM. The MASter can be downloaded from a host computer, floppy disk or tape drive. Its video display uses a 7×9 dot matrix in a 9×13 field on a 12-in. CRT, displaying all 128 ASCII codes, 24 lines of 39 or 80 characters, a 25th line status display, inverse or normal background and any combination of inverse, half-intensity, blink, double-wide, underscore and nondisplay attributes. The keyboard has a numeric pad and cursor, status configuration and editing function keys. Price is \$1995. Micro Application Systems, Inc., Minneapolis, Minn. Circle No 239

FRENCH/ASCII TERMINAL. The LGR-2F terminal includes an ASCII upper- and lower-case character set and an upper- and lower-case French character set to CSA specification z243.4 set 1 and set 2. All control codes can be displayed as symbols on the screen to assist in program debugging. Other features include an 80 × 24 display on a 12-in. CRT and a detached keyboard with a 15-key numeric pad. The LGR-2F also includes an RS232C interface with 103-type modem handshaking and operates at eight data rates ranging from 110 to 9600 baud. Cybernex Ltd., Mississauga, Ontario, Canada. Circle No 240

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The VIURAM family of video interfaces with advanced features makes your display I/O a natural extension of your computer software, not a choke point. Our direct-access display hardware, by avoiding cumbersome serial methods, provides maximum efficiency, FAST character and pixel thruput, and extreme ease of software design. BUS, CPU time spent in display refresh and update is held to an absolute minimum, freeing the computer for other tasks and freeing the software designer to concentrate on his application.

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CIRCLE NO. 92 ON INQUIRY CARD

data acquisition

REMOTE DATA ACQUISITION SYSTEM.

The RIM line of data acquisition system modules for Data General computers is aimed at applications where a data or signal source is located at a distance from the computer. RIM modules may be located as far as 500 ft. from a central processor when 4-MHz transfer

rates are used. At 1km. distances, 16-kHz operation is possible. System modules include A/D converters, 64-bit digital I/O, multiplexors, line controllers, a resistance temperature converter, thermocouple converters and several other signal-handling modules. As many as 16 modules of any type may be daisy-chained on a single line. Precision Data Systems, Tucson, Ariz. Circle No 241

33-NSEC. A/D BOARD. The TDC1014PCB A/D converter evaluation board contains all the components needed to perform a 6-bit A/D conversion in 33 nsec. The 41/2- \times 51/2-in. board accepts and digitizes a 1V peak-to-peak signal from a 75-ohm source at sample rates from DC to 30M samples/sec. The TDC101PCB is powered by +5 and ± 15 V supplies, with the reference voltage generated on the board. The board comes with its own 44-pin card-edge connector and operating instructions. Price is \$168 in 100-unit quantities. TRW LSI Products, El Segundo, Calif.



Want more zest in your PDP-11?

Plug a UMC into your PDP-11 and get a microprocessor system on your UNIBUS.

The UMC is a modular system of boards and support software. It plugs into your UNIBUS, shares work with your PDP-11 and gives you powerful independent processing.

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UMC Serial I/O Board. Up to 16 full-duplex channels with independent microprocessors and programmable baud rates. Extra boards serve extra lines.

UMC Terminal I/O Board. Has 8 full-duplex RS-232C channels, a Z80 microprocessor, 32K bytes RAM and space for 16K bytes PROM.

UMC ProtoHex Board. For custom wirewrap work.

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UMC Software Application Packages. For various protocols 2770, 2780, X.25, HASP, 3270, ADCCP and others.

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CIRCLE NO. 93 ON INQUIRY CARD



APPLE II DATA ACQUISITION. The minimux 800 series of remote multiplexing components enables an Apple II microcomputer user to create his own data acquisition and controls system. Applications include energy control of commercial and industrial facilities, remote site monitoring, lighting control, remote video camera control, liquid storage tank gauging systems and others. A starter kit that includes an RS232C or Apple II interface, minimux 801 I/o terminal with eight inputs and seven outputs and a minimux 802 analog terminal with one 8-bit resolution input channel and seven outputs sells for \$895. American Multiplex Systems, Inc., Fullerton, Calif. Circle No 243

DEC-COMPATIBLE ANALOG BOARDS.

This pair of half-quad-size analog boards interfaces with DEC LSI-11, 11/2 and 11/23 microcomputers. The model 1113AD low-level analog digitizer board has a software-programmable gain amplifier that allows 12 bits of resolution over ±10, 20, 50, 100 and 500 mV inputs. The model 1113 EX expander card expands to as many as 128 low-level input channels in 16-channel increments. An optional cold junction compensation circuit allows direct interfacing of thermocouples. The boards range in price from \$1045 (eight channels) to \$1470 (16 channels) per pair. ADAC Corp., Woburn, Mass. Circle No 244

WE FOUND A HOLE The business community is paying a high price for the r pace of developments in dat

paying a high price for the rapid pace of developments in data communications. Because new equipment has a nasty habit of rendering current models obsolete.

Teletype Corporation is doing something about it. In our industry we're one of the few companies manufacturing its own customized MOS Chips. And it's helping us build future flexibility into our data terminals.

Modular design and built-in electronic adaptability let us redefine and enhance our equipment long after it's gone on line.

So our customers can have the newest features. Without absorbing losses in the form of prematurely obsolete equipment. Or paying for brand new terminals. Or disrupting their entire system.

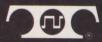
In business, keeping pace with data has become crucial. The distance between managers and critical information has widened to alarming proportions.

Teletype Corporation is helping bridge that gap. As a member of the Bell System, we're coupling their communications knowledge with our own research and development.

And it's working. We're making early obsolescence a thing of the past. So you won't have to fear the future.

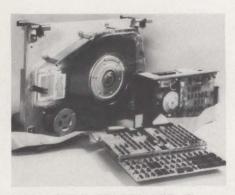


TELETYPE WHERE DATA BECOMES INFORMATION.



interfaces and controllers

CARTRIDGE TAPE CONTROLLER. The model 570 controller uses bit-slice technology to support as much as 68M bytes of tape storage on the DEC Q-bus. The quad-sized board, which provides software compatibility with operating systems that support TM11/TU10 tape systems, handles most popular 6400-bpi cartridge tape drives. Features include data-integrity verification and mixed-capacity capability. Price is \$1125 in OEM quantities. Xylogics, Inc., Burlington, Mass.



INTELLIGENT CONTROLLER. The ISC 4000, a microprocessor-controlled multidevice storage control unit, simultaneously supports as many as four fixed disks and four backup devices. A proprietary microprogramming design and controller architecture enables the unit to be attached to a wide range of computers and drive types without control unit replacement. The ISC 4000 scans data on each disk to make data- and address-dependent decisions. Differences in data rates between Winchester disks and slower system channels are handled with a 2048-byte buffer; maximum data rate is 2.5M bytes per sec. The ISC 4000 provides for overlap on disk seeks and tape motion on all drives in the system, and all read, write and scan data commands can implement implied seeks and multisector operations. Data Management Labs, Inc. San Jose, Calif. Circle No 246

LINE-PRINTER CONTROLLER. This line-printer controller for 16- and 32-bit Perkin-Elmer computers resides on a halfboard that contains Centronics, Data-products and Data Printer interfaces. The controller, which accommodates printing speeds as high as 500K bytes per sec. (3700 lpm), is software-compatible with both os/16 and os/32 and with host-supplied diagnostics. Low-power Schottky ICs are used to reduce power-supply drain to 0.5A at 5V—said to be half the power required by equivalent

Perkin-Elmer controllers. Price is \$650 in single-unit quantities, with OEM discounts available. Macrolink, Anaheim, Calif.

Circle No 247

FLOPPY-DISK CONTROLLER/RAM CARD.

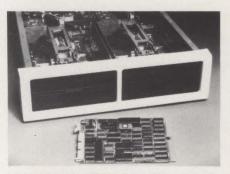
The FFD-1, a MULTIBUS-compatible card designed around Western Digital's FD-1795 formatter/controller chip, contains 32K bytes of dual-ported RAM and a multimode DMA disk-drive controller. The board, which can control as many as four single- or double-sided 8-in. floppy-disk drives, supports both FM and MFM recording formats. Nonstandard sector lengths of 512 or 1024 bytes can also be used. The command repertoire of the FD-1795 includes single/multiple-sector read and write with automatic sector search and entire-track-write for disk formatting. Data transfers can be either programmed I/O or DMA. The on-board RAM, which can be used as either a disk data buffer or as system memory, can be enabled or disabled in 4K-byte increments through programmed I/o commands. Matrox Electronic Systems Ltd., Montreal, Quebec. Circle No 248



CARTRIDGE TAPE CONTROLLER. The IC-180, a full DMA cartridge tape controller for the DEC PDP-11, emulates the TM-11/TU-10 ½-in. magnetic-tape system. Built-in trimode formatting enables users to select drive type and format with densities from 1600 to 6400 bpi. The controller mounts in any two adjacent SPC slots and connects with the cartridge drive via two ribbon cables. Western Peripherals, Tustin, Calif. Circle No 249

DATA CONVERTER. The DC-6 parallel-to-serial data converter can be introduced into terminal-to-modem systems using normal software without disturbing system configurations or capabilities. Features include flexible output formatting, selectable data rates from 112.5 to 9600 baud and ability to add formatting characters. The DC-6 accepts as many as 32 bits of parallel data and can transmit as many as 34 characters in response to one data-ready pulse. Science Accessories Corp., Southport, Conn.

Circle No 250



FLOPPY-DISK DRIVE CONTROLLER. The FO2CTR floppy-disk drive controller, a dual-width z80-based board that provides DEC RX02 emulation, plugs directly into an LSI-11 backplane. The device can identify a drive as either one- or two-headed and establish the correct stepping rate and other control signals and uses a guessing algorithm to recognize single- or double-density (RX01 or RX02) formats. The FO2CTR runs RXO2 diagnostics as well as on-board, self-test diagnostics. Other features include I/O for single- or double-sided drive support, a DEC Q-bus interface, DMA interrupt logic and a phase-locked loop for FM and MFM recording techniques. A 512-byte hardware bootstrap is built into the controller's LSI-11 interface section. Price is \$1170 in single-unit quantities. Advanced Electronics Design, Inc., Sunnyvale, Calif. Circle No 251

TRS-80 INTERFACE FOR STD BUS. The XID-TRS card directly interfaces a TRS-80 microcomputer with an STD BUS, enabling the TRS-80 to be used as a low-cost development system for STD BUS products. z80 firmware for STD BUS applications can be assembled and edited, then transferred directly into the STD BUS system for execution and debug. In the debug mode, the TRS-80 serves as the console device through which the DOT-80 debug firmware (located on the XTD-TRS card) is accessed. The board can also be used to expand the hardware I/O capability of the TRS-80 with STD BUS cards for A/D and D/A conversion, industrial control and other applications. Price is \$260. Xitex Corp., Dallas, Texas. Circle No 252

PRIORITY-INTERRUPT CONTROLLER FOR STD BUS. This priority-interrupt controller adds vectored-interrupt capabilities to 8085-based STD BUS systems, relieving the CPU from having to poll all devices to locate a service routine. The SB8301 accepts 16 discrete interrupt inputs, resolves priority and generates CALL instructions during the interrupt acknowledge sequence. An expansion connector enables cards to be cascaded to support as many as 64 prioritized interrupts. Price is \$285 in quantities of one to nine. Micro/Sys, Inc., La Canada, Calif.

Want to improve your memory? BASF has a small suggestion.

The 6108 uses a ball bearing. friction-free head positioner traveling in a spiral cam. resulting in less susceptibility to vibration or uneven wear.

Main capstan features a double ball race for more accurate and friction-free operation.

THE NEW BASF 6108 IS ONLY 2.1" HIGH. THREE-108 DRIVES FIT IN THE SAME VERTICAL SPACE IS TWO OF OUR COMPETITION'S.

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ew Products

model 9655 controller interfaces Exorcisercompatible microprocessor modules to 1600-bpi read-after-write operation. The transports. A dedicated microprocessor- synchronization, error detection and servo controls without imposing on the main system processor, simplifying the system software

INTELLIGENT TAPE CONTROLLER. The required for tape operation. The unit can support two transports configured for Quantex model 200 minicartridge tape model 9655 performs all encoding, bit based system with firmware provides data controls. Price is \$550 in single-unit buffering and formatting and all movement quantities, with quantity discounts available. Creative Micro Systems, Garden Grove, Circle No 254

WINCHESTER CONTROLLER. The MICRO-MODULE 9000 Winchester-disk drive controller is said to contain all the essential functions of a universal controller in less than one-eighth the space of previous controller designs. All that is needed to incorporate the unit into a system is to add an interface for the host computer and the disk drive. MICROMODULE 9000 will interface first to the Memorex 101 Winchester-disk drive. The controller costs less than \$600. Microcomputer Systems Corp., Sunnyvale, Calif. Circle No 255

DISK CONTROLLER FOR DG6067. The Spectra 10 single-board controller enables attachment of SMD disk drives to Data General-compatible computers running under the RDOS, AOS, IRIS OF BLIS/COBOL operating systems. Features include 2K-byte (foursector) RAM buffering to prevent data-late errors; 32-bit ECC, correcting error bursts of up to 11 bits; automatic position verification to eliminate sector, head and cylinder addressing errors; and dual on-board LED error-status displays for user diagnosis of each of the two on-board microprocessors. Price is \$3000 in OEM quantities. Spectra Logic Corp., Santa Clara, Calif. Circle No 256

GPIB INTERFACE MODULE FOR HP-85. The HPIB interface module, said to be the most complete implementation of IEEE Standard 488 available for a desk-top computer, enables the vendor's HP-85 computer to control a wide variety of instruments in many data-acquisition applications. The module, which uses an on-board processor to manage the interface bus protocol, enables the computer to communicate with as many as 14 instruments per interface card and to achieve data-transfer rates as high as 25k bytes per sec. Price for the HPIB module is \$395; a companion I/O ROM costs \$295. Hewlett-Packard Co., Palo Alto, Calif. Circle No 257

GROUND-ISOLATION INTERFACE. The OPTO232 series of noise-suppression and ground-isolation interface modules handles from two to 16 data/signal lines, as well as ground lines, between RS232C data-terminal (DTE) and data-communications (DCE) equipment. Separate power supplies for DTE and DCE circuitry ensure 2500v ground-toground isolation, while 6N139 optoisolators provide 1500v of isolation for each data/signal line. Maximum data rate is 40K bps. The OPTO232-2, which accepts protective-ground. signal-ground, transmit-data and receive-data lines, costs \$215; the OPTO232-6, which also handles request-to-send, clear-to-send, data-set-ready and data-terminal-ready signals, costs \$240. Interface of Illinois, Skokie, Circle No 258



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printers

DOT-MATRIX PRINTER. The DP-824 dot-matrix impact printer, for use with electronic cash registers and scales, retail instruments and telecommunications equipment, prints as many as 1.2 40-column lines per sec. on standard 31/2-in. adding machine

tape, double-stock carbonless tapes, fanfolded stock or labels on stock as wide as 41/2-in. Maximum printing width is 3.3 in. Matrix size is 5×7 , 9×7 or 7×7 , under software control. In quantities of 100, price is ticket and label printers, medical and scientific \$89.95 for the standard printer with adding-machine paper feed, \$95 with sprocket-feed. Star Micronics, Inc., New York, N.Y. Circle No 259

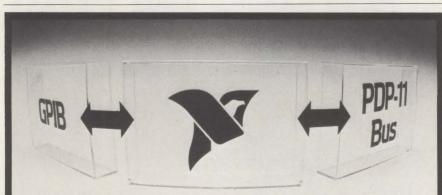
LINE PRINTERS FOR IBM SYSTEMS. The models 6665, 6680 and 6610 IBM-compatible line printers operate at 650, 800 and 1000 lpm, respectively. Features include field upgradeability, system interchangeability and electronic partitioning, enabling the printers to accommodate a variety of computer interfaces and controllers. The printers can be used with IBM System/3, 34, 360, 370, 303X, 43xx and Series/I, plus most other minicomputers. The 6665, 6680 and 6610 cost \$16,000, \$18,500 and \$20,300, respectively. Decision Data Computer Corp., Horsham, Pa. Circle No 260

IMPACT PRINTER WITH GRAPHICS. The 80-column De-800sg dot-matrix printer includes full graphics capability and microprocessor control. Features include tractor feed, a 2k-character buffer, hardware UART and complete display storage from a standard video terminal. The printer can hold as much as 8K bytes of EPROM firmware and 4K bytes of RAM to control hardware functions, multiple character sets and graphics. The De-800sG accepts paper widths from 1.5 to 10 in. and up to five-part forms. Data rate is programmable from 110 to 9600 baud. Price is \$995, with OEM discounts available. Data Electronic Devices, Inc., Salem, N.H. Circle No 261

LETTER-QUALITY PRINTER. The Typrinter 221 daisy-wheel printer uses five microprocessors to provide complete text formatting, including right justification and proportional spacing, and can respond to formatting commands embedded in text, eliminating the need for additional textformatting software. More than 20 fonts are available, and the unit can print white characters on a black background to highlight information. Said to be compatible with all computers using Centronics, RS232C or IEEE-488 interfaces, the Typrinter can also function as an electronic typewriter. Price is \$2750. Howard Industries, Inc., Anaheim, Calif. Circle No 262

GRAPHICS PRINTER. The GP-100 is an electrosensitive graphics printer for the Lear Siegler ADM-3A dumb terminal. It plugs directly into the RG-512 PC Retro-Graphics card, which enables the terminal to print complicated computer graphics, including point plotting and automatic vector generation, in less than 20 sec. within a 6.7- \times 5-in. area on 81/2-in., roll-fed paper. Alphanumerics can be printed at 170 lpm. Price is \$1995. Digital Engineering, Inc., Sacramento, Calif.

Circle No 263



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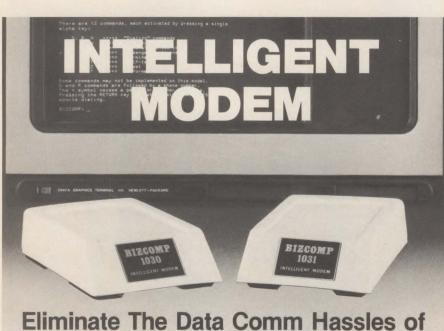
UNIVERSAL DEVELOPMENT SYSTEM.

Said to be the first microcomputer development system able to emulate any 4- to 32-bit mircroprocessor from any family in real time, the ECL-3211 can run at speeds as high as 30 MHz, either stand-alone or down-loaded from a host in single- or multi-user

configurations. The only changes required to emulate a new processor are to load emulation software for the chip and to plug in an adaptor card for the chip family. Multiple processors can be emulated simultaneously by adding emulator boards and pods. A basic ECL-3211 system, including an LSI 11/2 CPU, 64K bytes of RAM, a 1M-byte double-density dual floppy-disk drive, a 512- × 64-bit trace buffer, a VT103 terminal, a DEC RT-11

operating system and software and full hardware and software emulation support for one chip family, costs \$23,990. Emulation support, including assembler and linkers, is \$1500. Assembler/linkers are available for \$750 each. Emulogic, Inc., Westwood, Mass.

Circle No 264



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LOGIC ANALYZER. The model 7D02, a three-wide plug-in board that converts the vendor's 7000-series oscilloscopes into logic analyzers, is said to be the first such device to give a user the choice of which test or function to perform through an if-then-else program structure. Plug-in personality modules adapt the 7D02 to the target microprocessor and support mnemonic decoding for a variety of 8and 16-bit chips. The basic instrument can be expanded from 28 to 44 channels. A timing option provides eight additional channels for a total of 52 synchronous, 10-MHz lines, or it can provide eight channels of asynchronous data at rates as high as 50 MHz using the 7D02's own clock. The 7D02 costs \$3975. Tektronix, Inc., Beaverton, Ore.

Circle No 265

DEVELOPMENT SYSTEMS. The Amsys8/ 8012 and Amsys8/8014 development systems for 16-bit microprocessors have 3MHZ AM8085A CPUS and dual double-density floppy-disk drives. The Amsys8/8014 also has 10M bytes of hard-disk storage. Both systems have two serial ports and one Centronics-type parallel port. Software includes a CP/M-compatible operating system, a file manager, utilities, assemblers and an Amz8000 macro assembler and linker with an Am9080A/8080A-to-Amz8000 source-code translator. The systems reside on two chassis. One has a card cage with 11 extra slots to accommodate the RTE16/8050 real-time emulator and Am96/4016 prototyping options. The other houses the floppy-disk drives. Price is \$10,900 for the Amsys8/8012. \$22,400 for the Amsys8/8014. Advanced Micro Computers, Santa Clara, Calif. Circle No 266

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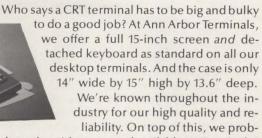
UNIVERSAL PROM PROGRAMMER. Using the vendor's plug-in personality modules, the M980 PROM programmer can program more than 450 different devices from its keyboard. from another device or from peripheral equipment via buffer memory. The unit's software and eight-digit hexadecimal display accommodate chips as large as 64K × 16 bits. Operations include checksum, blank check, duplicate, verify, read and program and self-test. Blank checking or verifying a 2716 PROM takes 5 sec. The 22-lb. M980, including a 4K × 8-bit CMOS RAM buffer and a carrying case, costs \$2450. Pro-Log Corp., Monterey, Calif. Circle No 267

Z8000 EMULATOR. The ZSCAN 8000, a self-contained analyzer/emulator for use in developing z8000-based products, can run as a stand-alone unit or as a front-end peripheral interfaced to a development system. Any computer with an RS232C interface can be used as a host. The zscan 8000 has two operating modes: an emulation mode for testing and debugging on a target system and a software-development mode in which the device becomes a logically transparent path between a CRT and the host. Other features include prompts, error messages, hardware trigger logic, memory mapping and trace. Price is \$4500. Zilog, Inc., Cupertino, Calif. Circle No 268



MC6809 DEVELOPMENT SYSTEM. EXonset 30, a stand-alone system intended for developing software and hardware for the MC6809 microprocessor, can also be used as a terminal in an exorciser system. The desk-top unit includes an MC6809-based microcomputer with 48k bytes of dynamic RAM and provision for as much as 24k bytes of ROM or PROM, two 80k-byte minifloppy-disk drives, a 9-in. 22 × 80 CRT, an ASCII keyboard, a power supply and two empty bus slots than can accept Micromodules or compatible user-built modules. The system's Exorbug monitor firmware handles system initialization, interrupts, command interpretation and object-code debugging. ExoRset supports an extended BASIC called BASIC-M, which is implemented both as an interpreter and as a compiler. Price is \$5995. Motorola Semiconductor Products, Inc., Phoenix, Ariz. Circle No 269





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New Software

NETWORK OPERATING SYSTEM, CP/NET. an operating system for microcomputer networks, enables independent microcomputers to access common facilities, such as peripherals, programs and data bases. Applications range from multiterminal word processing and data base systems sharing disks and printers to industrial process-control systems using single-board computers as slaves. CP/NET consists of one or more masters running the MP/M operating system and one or more slaves running the CP/M or MP/M operating system. The logical operating system is separated from the hardware environment, with all hardware-dependent code in one I/o module. Through modifications, a network can be constructed with shared memory, serial links or parallel I/O with protocols such as x.25, binary synchronous or SDLC, using the 8080, z80 and 8085 microprocessors. Digital Research, Inc., Pacific Grove, Calif. Circle No 270

NETWORK OPERATING SYSTEM. NETCOM is intended for medium- to large-scale users in distributed-processing environments. Features include down-line loading of software, dynamic load balancing between processors and the ability to change the number of host and remote processors without affecting application programs. Composed of a remote network and a host network, running in a hierarchy of Data General microNova and Eclipse computers, NETCOM is said to be able to support an unlimited number of users in on-line, real-time applications. The remote network consists of multiterminal clusters connected in a multidrop fashion. The host network consists of network-control processors and application processors. Price is \$50,000 plus \$1000 per cluster controller. Telecom Network Technology Inc., Toronto, Ont. Circle No 271

MICROCOMPUTER FORTRAN. FORTRAN-77, which is compatible with the ANSI 1977 standard, runs under the UCSD system software package on microcomputers using 6502, 6800, 6809, 9900, Z80, 8080 or LSI-11 microprocessors. Programs are compiled into a pseudocode that can be executed by the UCSD system interpreter and operating system. The complete UCSD system with FORTRAN costs \$400; with FORTRAN and UCSD Pascal, the cost is \$500. Users who already own version 11.0 of UCSD Pascal can add the FORTRAN compiler for \$200 Softech Microsystems, Inc., San Diego, Calif.

MULTITASKING EXECUTIVE. The RMEX-6800 and RMEX-6809 real-time multitasking executives, running in 2K bytes of memory, are intended for 6800 and 6809 microproces-

sor applications. RMEX provides task communications, time references and interrupt control to process asynchronous events in real-time applications. Inter-task communication is via messages sent from one task to another through the receiving task's communication area. RMEX dispatches messages to tasks and queues based on priority. Each task is set up as an independent entity with a defined input and output protocol. The user combines tasks from his library with RMEX to meet system requirements. Price starts at \$595. Phoenix Digital Corp., Phoenix, Ariz.

SOFTWARE DEVELOPMENT. PDSFORT, an application-software development system for Hewlett-Packard 3000 computers, generates program specifications, design documentation and code interactively. Running in 20K bytes of memory, PDSFORT extends HP FORTRAN into a structured language that accepts English-language inputs and provides program documentation and code through use of an editor, a program-design module and a preprocessor. Features include user-controlled or automatically indented listings, boxed DO constructs, an INCLUDE function, string-replacement functions and a help facility. Price is \$3000. Mini Computer Application Software, Orcutt, Calif.

Circle No 274

PICOFORTH. picoforth, a subset of polyforth, is available for 1802 (disk or PROM) and 8080 microprocessors. Designed for interactive evaluation, picoforth includes facilities for programming, debugging and testing single-task applications. The package includes the polyforth assembler, compiler, text interpreter, editor, disk utilities, and basic documentation. A file-management option is also available. Price is \$495. Forth, Inc., Hermosa Beach, Calif.

ATLAS COMPLIER. The Mica compiler for ATLAS, a U.S. Department of Defense standard test language, runs under RSX-11M on the DEC PDP-11/34 with 42K words of storage and two RK05 disks. Written in Coral 66, Mica analyzes an ATLAS source program syntactically and semantically before generating executable machine code ready for input to a linking loader or interpreter. The compiler includes a precompiler; a resource analyzer/ allocator; and a code generator, which can be targeted to any piece of automatic test equipment. The system retains and produces on demand records of the actual items of test gear or machine utilities called up in particular tests. ATE Associates, Inc., Northridge, Circle No 276

DATA ENCRYPTION. PSYPHER, a system for encryption of data and programs, is designed to prevent breaches of password security and to ensure privacy. Running in 8k 16-bit words on DG, DEC, IBM or CDC hardware, the system transforms binary, ASCII and EBCDIC files into unintelligible, randomized bit patterns or random character streams. Each copy distributed has its own unique algorithm so that a "copy" of PSYPHER from one installation cannot be used to decode a file encoded using a copy of the program from another installation. In addition, each copy has its own execution password allowing access only by authorized users at a given installation. The encryption keys are two integers between 1 and 2.1 billion chosen by the user at encode time. Stand-alone run time on a Data General Eclipse \$130 is approximately 71K bytes per min. in binary processing mode. MBS Consulting, Oakland, Calif. Circle No 277

PASSWORD PROTECTION. Citizens Information Security Systems (cissy) runs on IBM Series/1 minicomputers under version 1.1 of the EDX operating system. CISSY controls access to the Series/1 by as many as 32 users at a time. Once a user supplies his assigned code, he can load only those programs approved for his use. cissy runs in the background, accepting partition assignments for each terminal. Features include automatic time-out, Teletype and 4978/9 terminal support and optional dial-up support. cissy sells for \$2495; source code can be ordered for \$500 at the time of purchase. Citizens Savings Bank, Ithaca, N.Y. Circle No 278

SMALL-C COMPILER. The Small-c Compiler—available to CP/M users on a single-density 8-in. diskette—supports a subset of the c programming language and provides an interface to assembly language. The distribution disk includes an executable Small-c compiler, the run-time support library and CP/M I/O functions as assembly language source code, the complete source code for Small-c and a short demonstration program written in Small-c. Price is \$15 plus shipping. The Code Works, Goleta, Calif.

Circle No 279

DATA MANAGEMENT. DataBank provides file-maintenance, data-management and report-generation functions for the the Radio Shack TRS-80 model II microcomputer. Typical applications include mailing-list maintenance, inventory and accounting records, student or personnel files and patient/client data systems. Files can span as many as four disk drives and contain as many as 32,767 records. Price is \$249 per installation. Data Access Corp., Coral Gables, Fla.

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RELATIONAL DBMS. ORACLE, a relational data base management system written in c, runs on DEC PDP-11 and VAX-11/780 minicomputers under the RSX, IAS, UNIX and VMS operating systems. ORACLE supports SQL, a relational data language with facilities for query, data manipulation, data definition and data control. ORACLE includes a data dictionary, a forms transaction processing system and a report writer. The forms transaction processor enables a user to generate interactive data base applications without programming. The report writer integrates data base report writing with word processing, enabling formatted data from the data base to be interleaved with formatted text within a single report. An ORACLE license costs \$48,000 or can be leased for \$2000 per month. Additional licenses are available at a 50 percent discount. Relational Software Inc., Menlo Park, Calif. Circle No 281

SCREEN EDITOR. VISTA provides screen editing for DEC PDP-8 minicomputers. Features include version maintenance with audit trail, full wordwrap, multiple named pickup/putdown areas and iterative search and replace. Insertions can be made by

character, line or block, while deletions can be by character, word, string, line or screen. The VISTA program communicates with the terminal through a separate module called the video characteristics module (VCM). All device-dependent characteristics of a terminal are isolated at this level, and the user modifies the VCM file to enable VISTA to drive that specific type of terminal. A perpetual object license for VISTA, along with VCM files for certain display terminals, costs \$150. Dewar Information Systems Corp., Oak Circle No 282

ACCESS METHOD. KFS-80, an Indexed Sequential Access Method for the Radio Shack TRS-80, provides keyed and sequential access to multiple files, with record lengths as great as 240 bytes. Sectors are dynamically added to the file as necessary. A sector-buffering mechanism reduces disk accesses by "remembering" which sectors are in memory. A BASIC subroutine that uses 8K bytes of memory, KFS-80 is merged into the user's application program. Minimum configuration for the package is a dual-drive 32K-byte model I or model II system. Price is \$49.95 for the model I version, \$79.95 for the model II version, on diskette, including the KFS-80 subroutiine, a utility program for file maintenance, a demonstration program and a user manual. Automated Resource Management, Inc., Irvine, Calif. Circle No 283

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.

SYSTEM-CONTROL PROGRAMS. Operating system announcements are featured this month. Lifeboat Associates, New York, N.Y. offers CP/M2 for the Radio Shack TRS-80 model II. Circle No 393 . . . S&H Computer Systems, Inc., Nashville, Tenn., unveils a time-sharing operating system for DEC PDP-11



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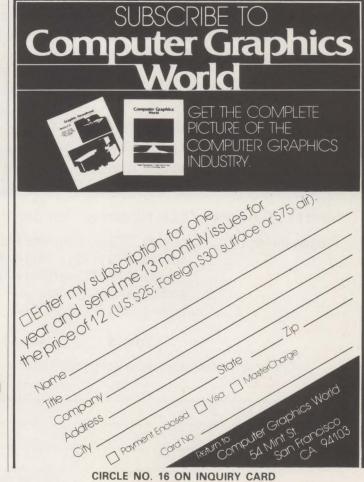
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New Softwa

and LSI-11 computers. Circle No 394 . . . Artec Electronics, Inc., San Carlos, Calif., adds multi-user capability to its microcomputer systems. Circle No 395 . . . And Honeywell Information Systems, Waltham, Mass., announces a new release of the GCOS operating systems for its Level 6 minicomputers. Circle No 396

DEVELOPMENT SUPPORT. Computer Automation, Inc., Irvine, Calif., provides program and file allocation support and a high-level language for its Naked Mini computers. Circle No 397 . . . A package from General Automation, Anaheim, Calif., helps define file and screen layouts in transaction-processing applications running on its InstaCode computer systems. Circle No 398 . . . Microproducts, Palos Verdes, Calif., introduces a development system for the 6502 microprocessor. Circle No 399 . . . Point 4 Data Corp., La Palma, Calif., brings out an automatic programming system for its line of minicomputers. Circle No 400 . . . Micro Media Magazine, Garland, Texas, offers a high-level translator that produces output code in BASIC for use on microcomputers. Circle No 401 ... Systems Engineering Laboratories, Ft. Lauderdale, Fla., provides routines for symbolic debugging, program documentation and alignment and indentation of FORTRAN code for its minicomputers. Circle No 402 . . . Intel Corp., Santa Clara, Calif., provides a breakpoint facility on the Intellec development system for the 8089 microprocessor. Circle No 403 . . . Intel also has Intellec-based development software for its 2920 signal-processing chip. Circle No 404

WORD PROCESSING AND OFFICE AUTOMATION. Automation Development, Inc., Stoneham, Mass., offers an officeautomation system, including word processing, communications and information retriev al, for the DEC PDP-8 computer. Circle No 427 . . . Resource-11, Gaithersburg, Md., unveils a word-processing system for the PDP-11. Circle No 428 . . . Software Research Associates, San Francisco, Calif., provides word-processing software for Data General computers running under Aos and for DEC PDP-10 and PDP-11 computers. Circle No 429 . . . MicroPro International Corp., San Rafael, Calif., provides word-processing software for microcomputers running under the CP/M operating system. Circle No 430 . . . Artsci, Inc., North Hollywood, Calif., has word-processing software for Apple computers. Circle No 431 . . . CPT Corp., Minneapolis, Minn., adds the ability to handle 15 foreign languages on its model 8000 and 6000 word-processing systems. Circle No 432 . . . Lexitron Corp., Chatsworth, Calif., provides IBM 2770 emulation software for its VT series of word-processing systems. Circle No 433

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New Literature

VOLTAGE REGULATORS. A line of Ac line voltage regulators is described in a catalog. The 12-page, illustrated publication provides operating characteristics, dimensional drawings, selection guidelines, specification charts and graphs containing physical and operational data. The catalog details the line's performance capabilities, such as tight regulation and brownout protection, ultra isolation and waveshaping. The publication also includes data on control transformers and stepdown transformers. Sola Electric, Elk Grove Village, Ill. Circle No 284

PCB BUS BARS. Mini/Bus Pc board bus bars for use in large-scale memory units are described in a brochure. The 24-page, illustrated publication includes configurations, applications and electrical characteristics. The catalog also includes standard specifications, ordering information, mounting guidelines for each configuration and reprints of technical design articles. Rogers Corp., Chandler, Ariz.

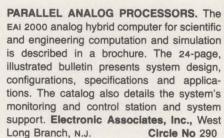
Circle No 288

GRAPHICS SYSTEM. The A/E (architecture/ engineering) graphics system is described in a data sheet. The pamphlet details the system's hardware, software and BASE A/E userware package. The literature also details the system's ability to integrate architectural,

mechanical, electrical and other disciplines.

Applicon, Inc., Burlington, Mass.

Circle No 289



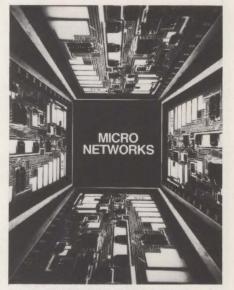
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LSI Products for High Speed Digital Signal Processing

VLSI COMPONENTS. Digital signal processing VLSI (very large scale integration) components are detailed in a catalog. The four-page, booklet describes the systems' word size, multiply time, power dissipation and package type. The catalog covers A/D

and D/A converters with parallel correlation rates of 15 MHz and 20 MHz. The brochure also examines static, serial-shift registers with TTL-compatible interfaces. TRW LSI Products, El Segundo, Calif. Circle No 291



DATA CONVERSION COMPONENTS. A line of high-reliability data conversion components is detailed in a catalog. The 250-page book includes charts, diagrams and data sheets and lists military and commercial applications, A/D and D/A converter specifications and technical briefs. The publication also describes DIP converters, data acquisition systems, instrumentation amplifiers, track-and-hold amplifiers and analog I/O boards. Micro Networks Co., Worcester, Mass.

Circle No 292

ON-LINE DISPLAY SYSTEM. The model 290, an IBM 3270-compatible on-line display system, is described in a brochure. The six-page, illustrated booklet details the display station and its peripherals, configurations and communications abilities. Northern Telecom Systems Corp., Minneapolis, Minn. Circle No 293

DIGITAL SWITCH UNITS. The DSU-2400 series of digital switch units are described in a brochure. The four-page pamphlet, which includes photos, diagrams and a configuration guide, details rack mounting, gang switching and RMS-104/108 remote monitor switches. The publication also lists digital switch units, rack adaptors, cables and accessories. Spectron, Moorestown, N.J.

Circle No 294



ELECTRONIC EQUIPMENT. A line of data processing peripherals, communication equipment and general-purpose test instruments that are available for rent is detailed in a catalog. The 170-page, illustrated booklet describes general-purpose electronic test equipment, telecommunications, industrial data processing peripherals and microprocessor development systems. Leasametric, Inc., Foster City, Calif.

Circle No 285

LAB PRINTER. The model AP20L 20-column lab printer is described in a bulletin. The literature details specifications and operation of the thermal printer, which includes plug-in dedicated interface modules. Gulton Industries, Inc., East Greenwich, R.I.

Circle No 286

ECLIPSE MV/8000. The 32-bit ECLIPSE MV/8000 computer system is described in a brochure. The pamphlet details the system's hardware, software and applications. The brochure also examines software and peripheral compatibility, security and reliability capabilities. Data General Corp., Westboro, Mass.

Circle No 287

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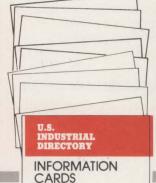
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New Literature



POWER SUPPLIES AND CONVERTERS. A line of AC-DC linear and switching power supplies and DC-DC converters are detailed in a catalog. The eight-page publication, which includes charts and diagrams, provides electrical and mechanical specifications and ordering information. The brochure also includes details on low-power DC-DC converters in 24-pin DIP configuration. Power Products Division, Computer Products, Inc., Fort Lauderdale, Fla. Circle No 295

LITERATURE THAT COSTS



INTEGRATED CIRCUITS. A line of integrated circuits are described in the Analog Data Book. The 464-page book details operational amplifiers and comparators, cmos analog switches and multiplexors, data conversion and voltage reference products and communication devices. The \$2.95 publication provides specifications, performance curves and circuit diagrams and chip and packaging information. The book also includes a 20-topic analog applications section. Harris Semiconductor, P.O. Box 883, Melbourne, Fla. 32901.

MICROCOMPUTER COMPONENTS. A line of microcomputer components is detailed in the "Microcomputer Components Data Book." The 245-page catalog describes the vendor's z80 and z8000 microprocessors and their peripherals, the z-bus and the vendor's family of dynamic and quasi-static RAM. The \$5 publication also provides a functional description of each component, architecture and programming information, a pin description and electrical specifications. Zilog 10460 Bubb Rd., Cupertino, Calif. 95014.

MICROCOMPUTERS. The UPI-41A microcomputer for dedicated single-chip controller applications is detailed in a users manual. The \$5 booklet, which includes interfacing examples and application notes, describes the instruction set, bus interfacing and development support of the system. Intel Corp., 3065 Bowers Ave., sc3-3, Santa Clara, Calif. 95051.



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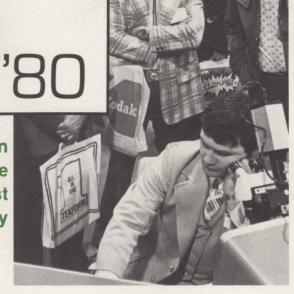


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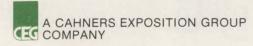
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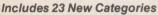
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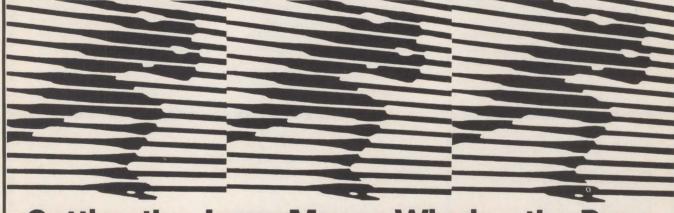
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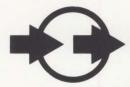
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