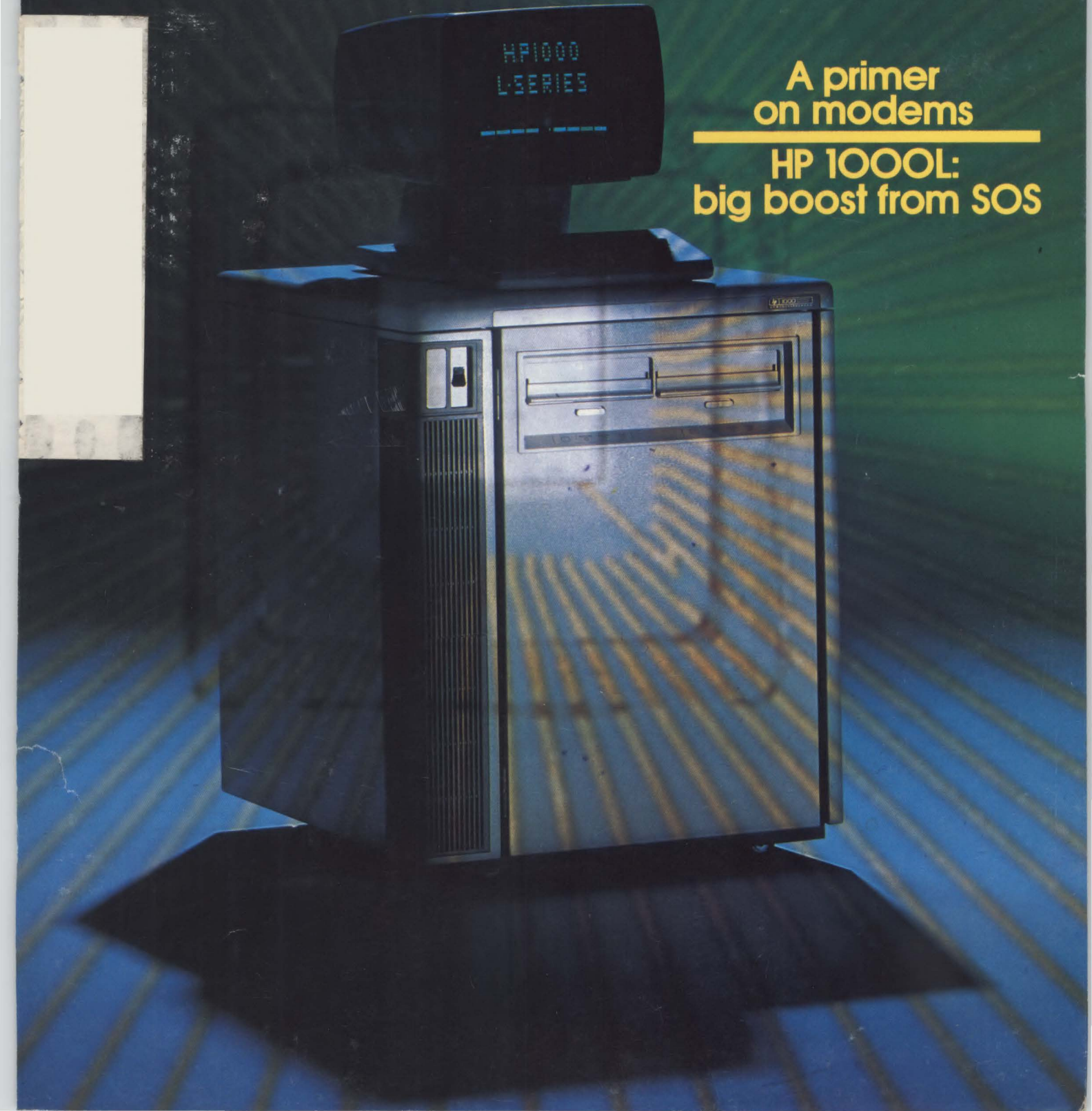
Mini-Micro Systems

A CAHNERS PUBLICATION

MARCH 1980

MINICOMPUTER DATA COMMUNICATIONS



A primer on modems

HP 1000L: big boost from SOS

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and virtually every other country on Earth. Kennedy Company and its digital tape products were pioneers in such demanding applications as telephone toll-ticketing, usage analysis, message switching control and electronic switching systems.

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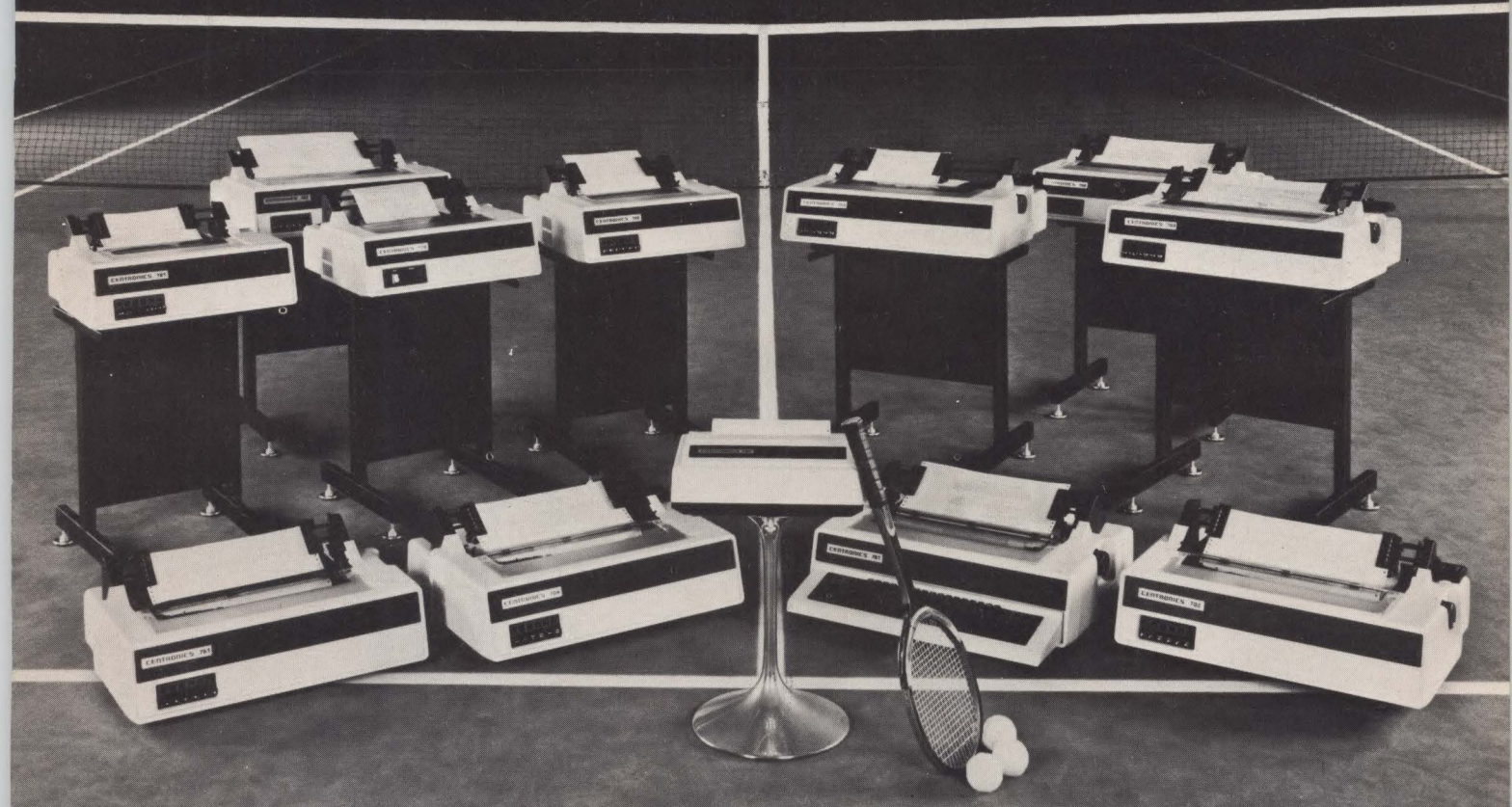

CENTRONICS® PRINTERS
...the advantage

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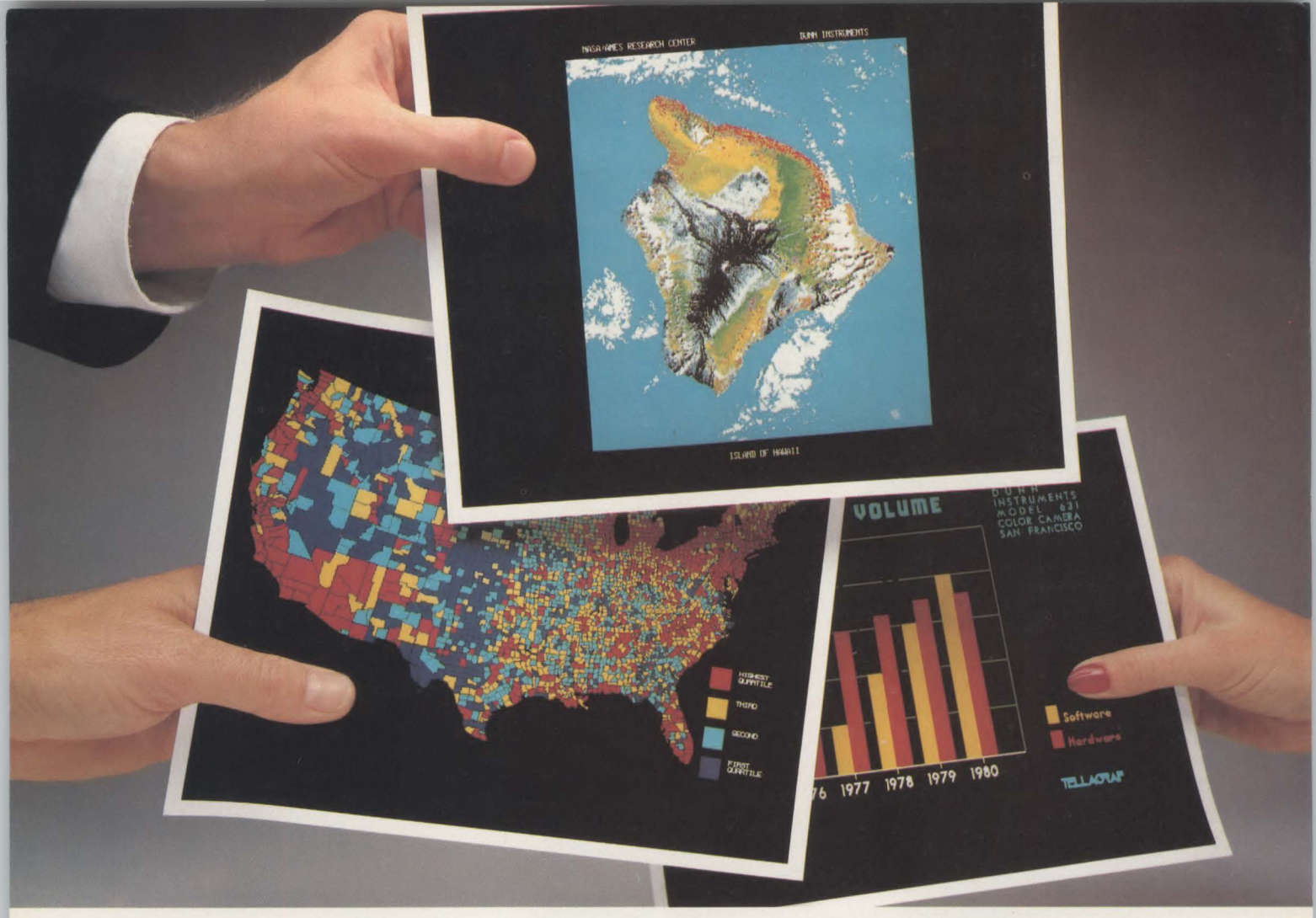

Actual 631 images on Polaroid instant 8x10 film.

Color hard copy is finally at hand!

Color hard copy: the luminescent electronic image, captured in the permanence of photographic prints and transparencies. Dunn Instruments makes it brilliant, accurate and effortless to obtain from an affordable system. At last you can hold the new computer graphics and digital images in your hands.

The source is the 631 Color Camera System. It packs a high resolution, high linearity CRT, sophisticated optics and microprocessor exposure control into a compact, fast and friendly unit. For instant hard copy for immediate analysis, use it with Polaroid Type 808 film to make stunning 8x10 color prints. Add the optional motor-driven 35mm system for beautiful color slides. Or load 8x10 transparency film and produce images you can project overhead.

The 631 economically records the data from any raster scan CRT, for presentation, reproduction, access and display. Applications range from management information graphics to satellite remote sensing. Call or write for more information. We'll arrange for you to get your hands on actual results from the 631 Color Camera System.

Dunn Instruments, Inc.,
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415/957-1600.

CIRCLE NO. 3 ON INQUIRY CARD

The 631 COLOR CAMERA SYSTEM

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LANDSAT image courtesy NASA-Ames Research. Cartographic study courtesy Harvard Laboratory for Computer Graphics. Management information graphics courtesy ISSCO.

DUNN INSTRUMENTS

Mini-Micro Systems

A Cahners Publication

Volume XIII Number 3 March 1980

COVER

The new HP 1000 L series computer is superimposed on photo of its basic technology — a silicon-on-sapphire chip. See p. 91. Cover design by Jerry L. Gross. Photo by Robert Birney, courtesy of Hewlett-Packard Co.

All correspondence regarding advertising and editorial should be addressed to the publication offices at:

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BPA ABP

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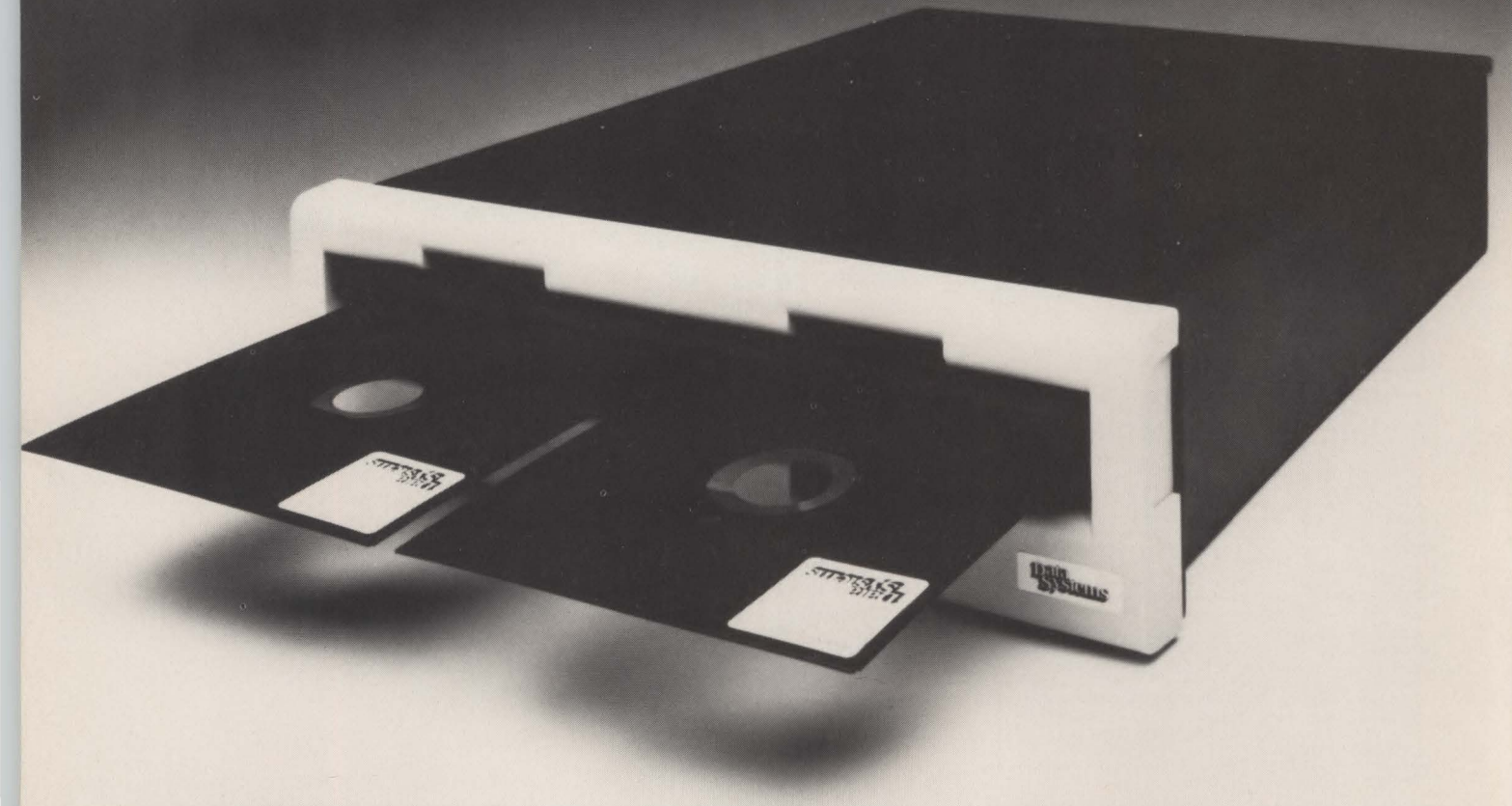

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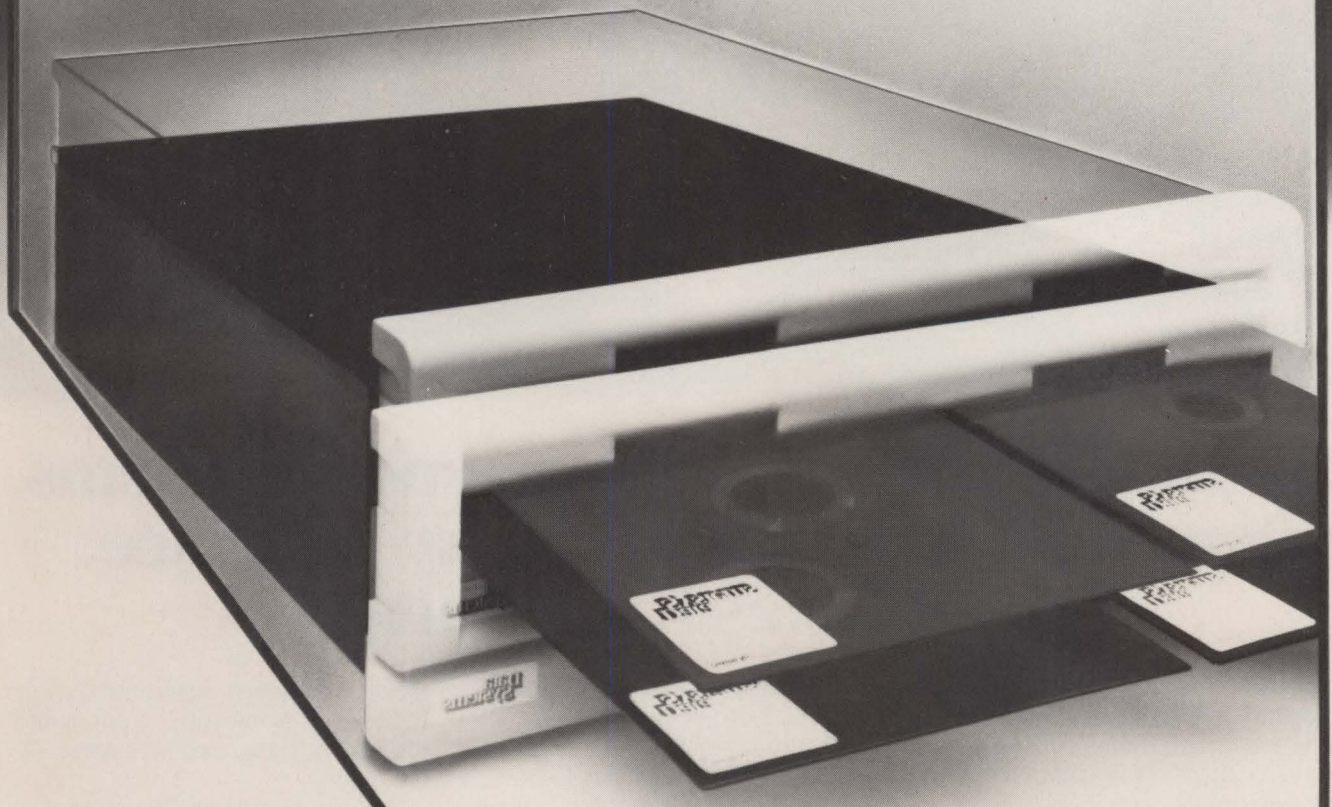

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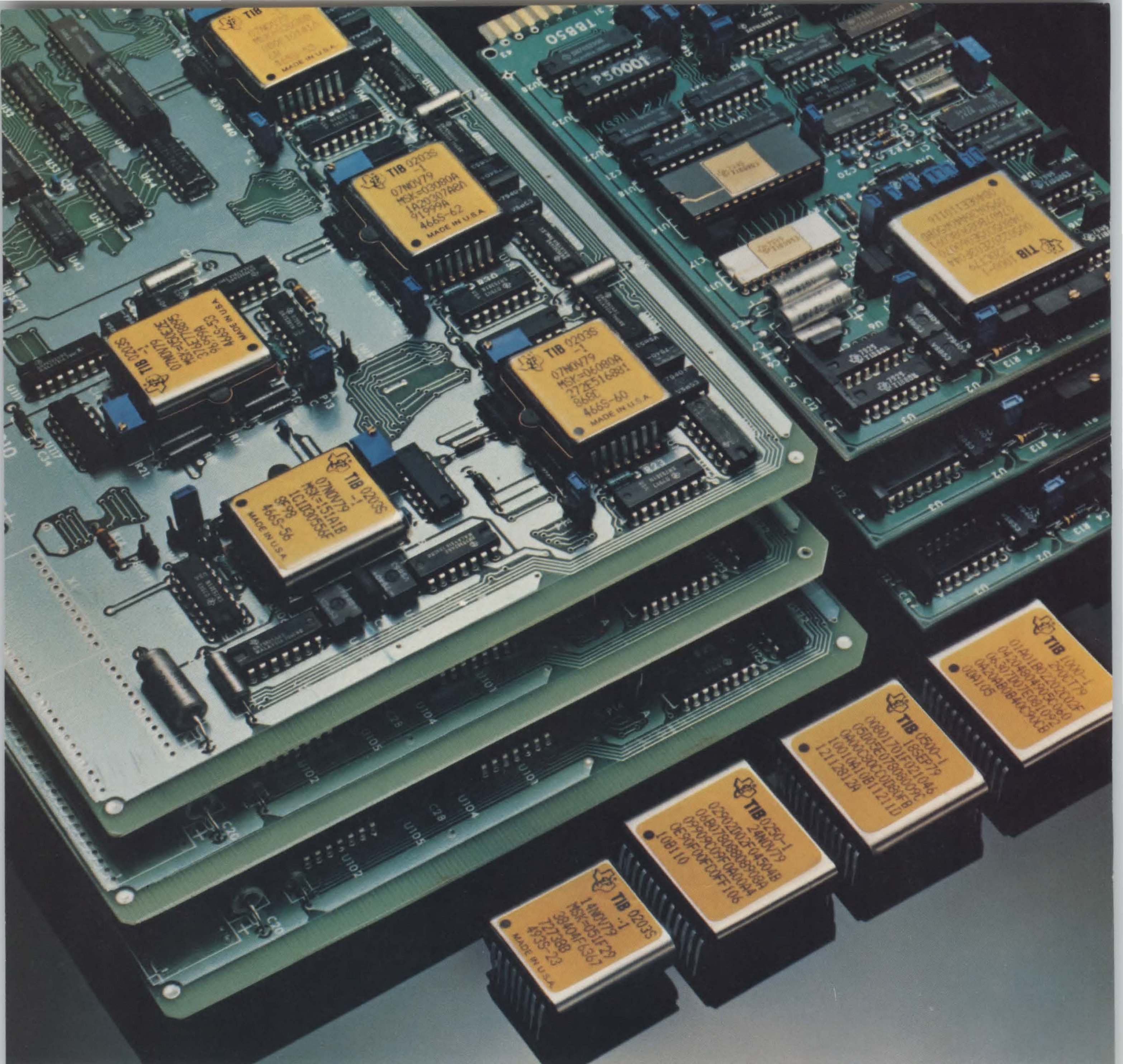

The first family of bubble memory systems. Non-volatile. Compact. Easy interface. From Texas Instruments.

TI's family of bubble memory systems offers you the non-volatility of magnetic storage media, plus compactness, silent operation, solid-state reliability, and lower error rates and faster access times than disk and cassette systems.

Because TI bubble memory systems are easily interfaced to microprocessor systems, many designers have already made their choice.

And, they've chosen from the TI family of bubble memory systems.

It's a design decision that makes sense. That's why you'll find TI bubble memory systems improving the performance of intelligent terminals, word processors, industrial process controls, instrumentation and telecommunications equipment, add-on buffer/cache memories — and more.

Because bubble memories are so small and lightweight, they're ideally suited to portable applications such as small computers, data loggers and a variety of educational

and home entertainment products.

And the innovations keep on coming. In product breadth. Technology. Production.

New bubble memory systems with storage capacities ranging from 23K to 768K bytes are being supplied. All the custom-designed peripheral and support circuitry for bubble memory systems are available.

New wafer processing techniques, including state-of-the-art planar construction — coupled with TI's innovative two-micron technology — are making newer and better things happen all the time.

TI's eight years of experience in bubble memory design and production have provided keen insights into customer requirements.

Requirements that demanded we deliver. And we have. In fact, TI has delivered more bits of bubble memory than all other suppliers — combined.

Only Texas Instruments can offer you a full family of bubble memory systems. A family built on know-how and experience. A family that reinforces TI's established position as the leader in bubble memory technology — and products.

Systems components

TI's complete family of bubble memory systems is comprised of component devices with capacities from 92K bits to 1 megabit.With access times from 4.0 to 11.2 ms.

These various capacities, along with the necessary support circuits, offer you a wide choice of compact systems for ease of use and design configuration flexibility.

The 1 megabit TIB1000, for example, is electrically and physically interchangeable with family members TIB0500 at 512K and the 256K TIB0250. Both are supported by the same comprehensive line of custom interface circuits.

The planar processing techniques, and new refinements in photolithography allow TIB1000 to offer the highest commercial bit density ever — by a factor of two.

Custom support circuits

All TI bubble memory systems contain a complete set of interface and peripheral circuits — including two custom controllers. One for the 92K devices. One for the megabit family. So, it's not necessary to emulate controller function and you save a design step. Both are available.

These circuits, designed specifically for bubble memories, encompass state-of-the-art bipolar and MOS integrated circuit technologies. This provides high level interface between all of today's popular microprocessors and all of TI's bubble memory products.

The 92K TIB0203 is supported by its own family of custom peripheral circuits. The binary TIB0250, TIB0500 and TIB1000 are all supported by a common set of interface circuits.

TI'S FAMILY OF BUBBLE MEMORY SYSTEMS

PART NUMBER	STORAGE CAPACITY	COMPONENTS	BOARD FORMAT
TM990/210-1	23K Bytes	2 92K-bit	TM990
TM990/210-2	46K Bytes	4 92K-bit	TM990
TM990/210-3	69K Bytes	6 92K-bit	TM990
TBB5005	64K Bytes	1 512K-bit	OEM Board
TBB5010	128K Bytes	1 1024K-bit	OEM Board
TM990/211-1	128K Bytes	1 1024K-bit	TM990
TM990/211-2	256K Bytes	2 1024K-bit	TM990
TM990/211-3	512K Bytes	4 1024K-bit	TM990
TM990/211-4	768K Bytes	6 1024K-bit	TM990

Custom support circuits for all families of devices include: coil drivers, sense amplifiers, function drivers, controllers and function timing generators.

An advanced family of support circuits, coming soon, has been designed for parallel operation as well as error correction.

Bubble memory systems

To provide ease of use and a convenient production board, each new member of TI's bubble memory family is available on a completely assembled, fully tested, compact printed circuit board.

TBB5005 and TBB5010 systems

Non-volatile bubble memory systems assembled on a 4″ x 6″ board with custom controller and all other peripheral devices and using the new family components. Features common to both systems include: up to 128K bytes of memory capacity, interface with TMS9900, 8080 and Z80 microprocessors, access times of 11.2 ms, data transfer rates of 85K bits/sec., system expansion capability and a choice of board connector styles.

TM990/210 system

Here's a non-volatile bubble memory system using the production-proven 92K bit TIB0203 device. Up to 69K bytes assembled on a single board, including a full complement of custom control circuits. Interfaces directly with TMS9900-based microcomputer modules. This system is in stock and available for immediate off-the-shelf delivery from your TI distributor.

TM990/211 system

A non-volatile bubble memory system utilizing the TIB1000 with up to 768K bytes capacity. Bus compatible with TM990/100 microcomputer modules, the TM990/211 system features 11.2 ms access time with data transfer rates of 85K bits/sec. A new module, coming, will be able to be combined with the TM990/211 system to provide a megabyte bubble memory system with on-board error correction, direct memory access, and compatibility with TM990 file management.

And the innovations keep on coming

Texas Instruments is firmly committed to innovative, cost-effective bubble memory technology and product development.

So, for a full line of bubble memory systems — standard or customized to your application — turn to the leader — turn to Texas Instruments for magnetic bubble memory products.

For more information, write to Texas Instruments Incorporated, P.O. Box 225012, M/S 308, Dallas, Texas 75265. We'll send you our new 8-page brochure along with details about the bubble memory course offered at the TI Chicago Regional Technology Center.

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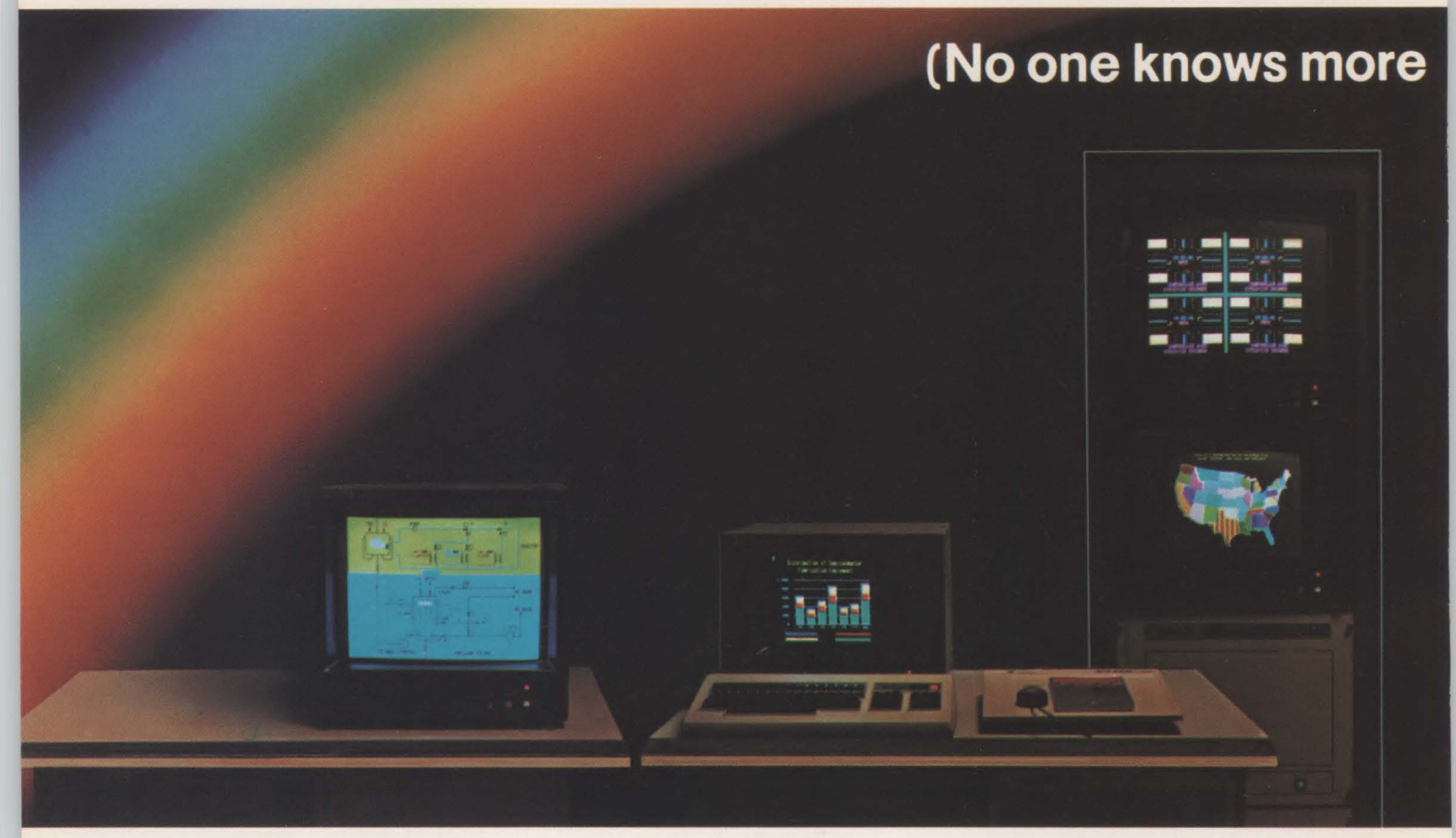
Ask R



What's the best display system for you? Ramtek has the right choices to fit your needs—and budget.

Graphic displays make your computer data work harder. Color, gray scale, or black and white, simple or sophisticated, you'll find what you need in Ramtek's broad line of raster scan systems, the most complete in the business.

Need a management information system?

Ask us about our Colorgraphic terminals. Full color and full graphic capabilities in economy or optimum performance models. Or select our PASCAL-based Colorgraphic computers for stand-alone applications.

Want all the sophistication you can get?

Our 9000 series is modular for your customized applications; the 9050 pre-packages the most popular features for budget-sensitive applications. The powerhouse 9400 sets the state of the art in resolution, vector writing speed and image manipulation capabilities.

Special for process control.

The 2000 series is specially designed for process-control applications.

Require stand-alone capabilities?

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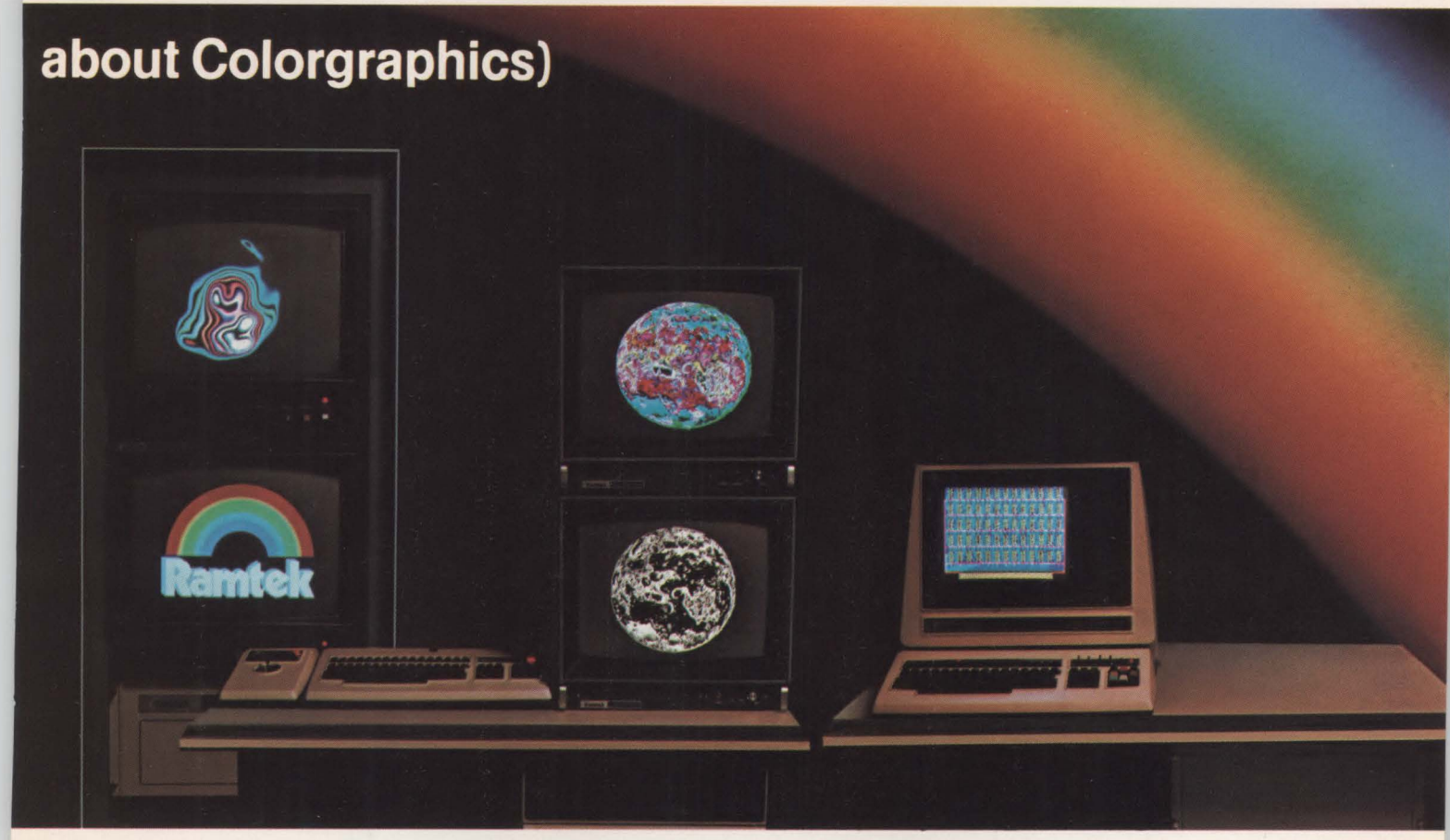
More monitors than ever.

Ask us about our 37 different models of monitors. We offer color, gray scale, black and white, a choice of phosphors, a variety of screen resolutions to 1024 lines, and screen sizes to 25".

amtek.

about Colorgraphics)

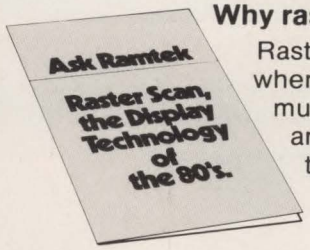


What else can you ask for?

Our hard copy color cameras and large screen projection systems, about interfacing to hard-copy color copiers, printer-plotters, and about our complete line of interactive devices: keyboards, light pens, joysticks, trackballs and graphic tablets.

Intelligent alphanumeric terminals, too.

Ask us about our 8000 alphanumeric terminal series. There are three basic models (including one especially for UNIVAC users) plus options to customize them for almost any data entry or telecommunications use.



Why raster scan?

Raster scan has become the preferred technology whenever computer-based information and images must be displayed. To find out what raster scan is and how it compares with alternative display technologies, write for "Raster scan, the display technology of the 80's." It's Issue Number 2 of Ramtek's "USE OUR EXPERIENCE" series.

Ask today.

For complete information on the Ramtek system that best fits your needs, write Ramtek, 2211 Lawson Lane, Santa Clara, CA 95050. Or, call your nearest Ramtek Office.

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This powerful general-purpose microcomputer system combines a processor, memory, 8-inch *Winchester* disk and cartridge tape drive into one low-profile desktop package. And the entire 10-Mbyte disk can be backed up on one tape cartridge.

Industry-compatible versions of *BASIC, COBOL, FORTRAN* and *Pascal* are available on several operating systems, along with communications software, word processing and business applications packages.

When you need to expand the system, you can do it in the field. Just add our forthcoming Z8000* upgrade. Then you can connect eight terminals and link C8000s together. Directly. In a high-speed local network.

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The Onyx C8000

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Letters

COLORING CORRECTLY

To the editor:

I would like to thank you for the superb coverage Chromatics received in the December issue ("Interactive computer graphics systems," p. 68). However, some of the material presented in your comparative analysis was incorrect. Chromatics has the following 10 models in the CG series, ranging in price from $995 to a high of over $30,000, depending on features and options: 1998A, 1398, 1399, 1598, 1599, 1998, 1999, 1399M, 1599M and 1999M. Your article included only the 1399M, with a stated minimum price of $21,995. The CG 1399M's actual price is $19,995 and includes many nonstandard options in its base price. This indicates that Chromatics is the highest-priced color raster scan terminal rather than the lowest. We would appreciate a correction so that your readers may be more accurately informed. Thanks again.

Donald K. McKinney
Chromatics, Inc.

To the editor:

In the December issue, the table of interactive computer graphics suppliers (pp. 74-77) states that McAuto's Unigraphics is available on Data General Corp. Nova and Digital Equipment Corp. PDP-11 CPUs. The table should show Data General Eclipse and DEC PDP-11 CPUs. Unigraphics' companion product, Uniapt, however, runs on both Nova and Eclipse computers, as well as on a number of other minis including most DEC equipment.

J.J. Moelk
McDonnell Douglas Automation Co.
St. Louis, Mo.

To the editor:

In your article on computer graphics, a chart of interactive computer graphics devices listed the Apple II Plus computer from Apple Computer, Inc. Under the column for features, it was noted that the Apple II has the capability of Tektronix 4010 series graphics as an option, which implied that it was available from Apple. This is not the case. The Tektronix 4010 simulator for the Apple II, Teksim, is available through our company, ABW Corp., as a peripheral. We appreciate the chance to make this clarification.

Terry Wynn, President
ABW Corp.
Ann Arbor, Mich.

To the editor:

It was disappointing to read the section on color graphics in the December issue which included a list of suppliers of color displays, but omitted Aydin Controls. Aydin Controls has been a manufacturer of color display products and systems for 12 years. There was a dialogue between you and some members of my staff, resulting in a picture in the section showing displays from Aydin Controls' model 5216 (p. 70). Consequently, it is hard to understand why you would use Aydin Controls' picture and not list us in your directory.

I. Gary Bard, President
Aydin Controls
Fort Washington, Pa.

AN EARLIER FOSDIC

To the editor:

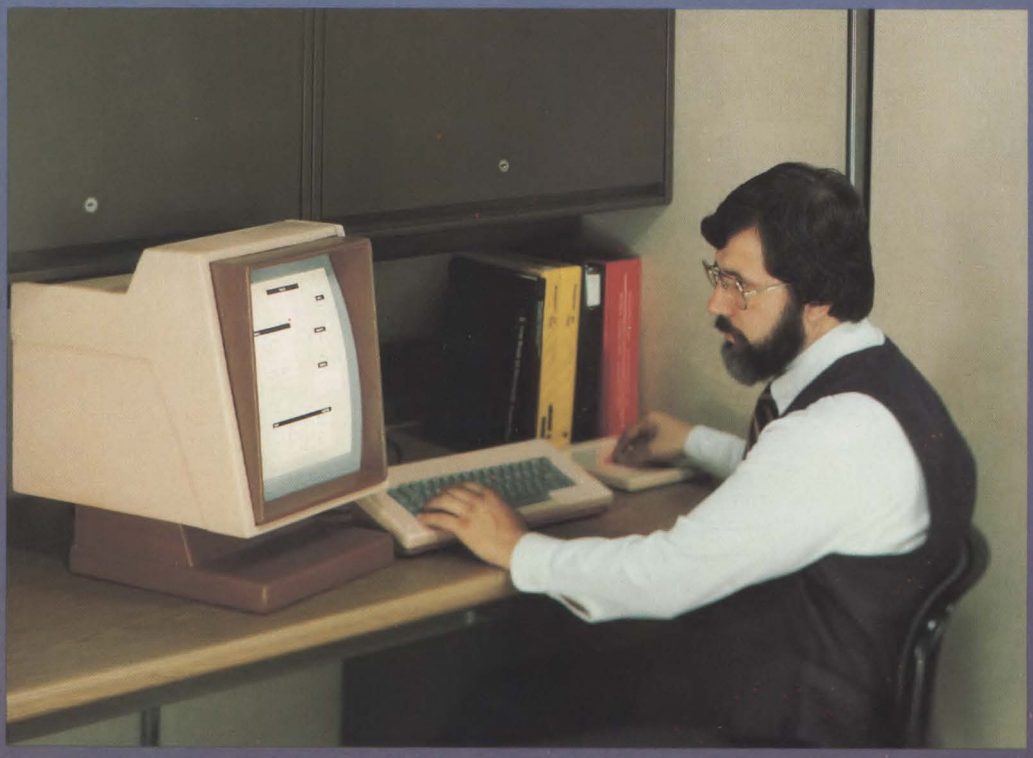
In the otherwise informative coverage of planning for the coming 1980 Census (November, p. 39), we note some inaccuracies that must be corrected. The data input system FOSDIC goes back to much earlier than the reported 1962. It began at the time of the first commercial model of UNIVAC, when Census planners foresaw the need for a better input system than punched cards. In 1951, with Census sponsorship, a group headed by Greenough at the National Bureau of Standards originated FOSDIC. Then, and now, the basic approach has been programmed CRT scanning of microfilmed documents. The work at NBS continued actively until 1975, including the development of other models applied to the work of several government agencies. The first FOSDIC was put in service at Census in 1955. A later version was jointly developed with NBS for the 1960 Census. After this, Anderson began work on the 1970 system, developing, among other things, enhanced pattern-recognition logic and a minicomputer to drive the FOSDIC scanner. For 1980, continued work by a staff under Anderson's direction produced the system described in the article. It is this staff to which the principal credit should have been given in your photograph caption.

McRae Anderson
Bureau of the Census
Suitland, Md.

M. Leighton Greenough
National Bureau of Standards (ret)
Rockville, Md.

PERQ

A Personal Computer for Professionals



- ☐ Microprogrammed processor with language directed architecture
- ☐ 256K byte memory
- ☐ 12M byte disk
- ☐ Interactive Graphics Display
- ☐ 10M bit Packet Stream Network
- ☐ Keyboard and Touch Tablet
- ☐ Speech output
- ☐ RS-232 and GPIB interfaces

In-House Timesharing Goes the Way of Batch
Perq obsoletes most time shared systems the way T/S succeeded batch.

Everyone can have his own computer
Perq gives each user a powerful 16 bit microprogrammed processor, 256K bytes of memory, a 12M byte disk, graphics display, keyboard, etc. at his own desk.

Packet Stream Network Ties Them Together
Interconnection of Perq systems on a 10M bit per second packet broadcast local network brings distributed processing to individual users.

The End of Boom and Bust Computer Resources
Because Perq provides compute power on a per person basis, installations can be expanded incrementally. No need to buy excess hardware to allow for growth, no delaying until your system is saturated before upgrading.

Interactive Graphics and High Quality Text for all
Perq's 768 x 1024 point raster scanned display gives each user full graphics capability, plus high resolution, multiple font, proportionally spaced characters.

Pascal Based Big System Software
Powerful multi-process operating system, flexible file system with distributed data base capabilities, multiple window display support, Pascal compiler, and a screen oriented, formatting text editor gives Perq the features sophisticated users need.

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Printers, large capacity file systems, magtape, etc. can be accessed by a Perq workstation on the Packet Stream Network as easily as if it was local to the processor.

Personal doesn't mean Toy
Perq's 16 bit bipolar microprogrammed processor directly executes Pascal at 1 million P-codes per second. A 4K x 48 writable control store is optional. A full quarter megabyte of high speed RAM with a 32 bit virtual address and 12 megabytes of rigid disk puts Perq far beyond anything else called a personal computer.

And all for an Astonishingly Low Cost
$19,950 base price (quantity one), with everything, plus substantial quantity discounts.

Perq—A Landmark Computer System
Call Three Rivers Computer Corporation at (412) 621-6250 to find out more about this important development in computer technology.

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Letters

SOLID RELATIONSHIP

To the editor:

I was surprised to read the news item in your November issue headlined "Wang-Shugart relationship faces possible strain" (p. 45). The claim that Wang has "become a competitor as well as a customer" of Shugart (as a result of Xerox's acquisition of Shugart) is misleading and inaccurate. Our customer-supplier relationship remains solid and is far from "coming under strain" as the article suggests. Wang and Shugart have enjoyed an excellent working relationship for many years, and I have every reason to believe this relationship will continue in the future.

Dr. An Wang
Wang Laboratories
Lowell, Mass.

INQUIRY HINTS

To the editor:

Your reader inquiry card provides a useful service. I would like to make two suggestions to make it more effective:

1. Ask vendors to always include current price information. Buyers are aware that these prices are subject to change. The delay and inconvenience of having to write or call to obtain price information is both costly and irritating.
2. For PDP-11-compatible equipment, the spec sheet should include the number of bus loads presented to the Unibus by the interface, the number of SPC or hex interface slots required and the availability and type of I/O drivers for various operating systems.

Bob DePree
Center for Information Research
University of Florida
Gainesville, Fla.

DBMS OMISSION

To the editor:

Thank you for your splendid article on data base management systems in the November issue (p. 94). It was a very useful product profile for users and suppliers alike. I was terribly disappointed, however, that the forerunner of most, Microdata's Reality, failed mention in the table of suppliers.

Gerald W. Fleming
Microdata International Corp.
Irvine, Calif.

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CIRCLE NO. 15 ON INQUIRY CARD

Data communications: redoubling the effort


Riggs


Levy

This issue of Mini-Micro Systems bears the first fruits of an expanding effort by our editorial staff in the field of data communications. You will find two major datacomm articles, one of which is the first in a series we think will be important for users of minicomputers who want to learn more about linking them in networks. That article, entitled "Basic data communication techniques," begins on p. 96 . It is followed on p. 111 by contributing editor Mal Stiefel's survey of modems—the important hardware tools that facilitate communications across the voice network.

We're grateful to Micom Systems, Inc., in Chatsworth, Calif., for its cooperation in making available to us the notes for a series of seminars it will be conducting later this year throughout the U.S. and Canada. Those notes, prepared by Micom's Roger Evans, vice president of marketing, form the basis for the series, which will continue in the April and May issues. The series has been edited by associate editor Michael Riggs in Boston, with consultation by Walter A. Levy, our recently named contributing editor for data communications.

We are pleased to have Walt Levy on our masthead. He is president of Edgewood Computer Associates, Inc., a consulting firm specializing in data communications, distributed processing and minicomputer applications. His credentials include more than 21 years in the data-processing field as engineer, executive and consultant. He has been directly responsible for the design and implementation of several major data-communication systems, and a significant contributor to others. The list includes the Defense Department's AUTODIN network, plus efforts for the General Services Administration, RCA GlobeCom, the Federal Reserve Bank of New York, Dun & Bradstreet and General Foods.

Walt is now assisting several clients of Edgewood Computer Associates to design and implement packet-switching and distributed-processing networks, and in planning shared-user data and telecommunications systems.

We are redoubling our commitment to covering developments in this growing field, so watch for installments two and three in the Micom series, plus more articles later, including another major emphasis on data communications in the September issue.

S. Henry Sacks

S. Henry Sacks
Publisher

The Sign of the 80's.

Greater yield has arrived with TI's new *Silent 700 780 Series Electronic Data Terminal Family.**

Clear the road for the most innovative thermal printing data terminals available on the market today. Introducing TI's new state-of-the-art 780 Series of 120 characters-per-second data terminals.

Every model in the four-member family features TI's innovative dual-matrix thermal printhead providing virtually silent 120-cps optimized bi-directional printing, that cuts down on print cycle time and yields four times the printing speed of conventional thermal printing data terminals.

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The Model 787 Portable Communications Data Terminal is designed to improve your communications capabilities. The 787's 1200-bps direct-connect internal modem allows users to plug directly into a standard data jack. With its memory dialing feature, the 787 can dial a stored number and provide audible feedback of the phone line's status. The 787 can also disconnect the phone line with a simple hang-up command, so you can optimize on-line communications and minimize communications costs.

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TI is dedicated to producing quality, innovative products like our new 780 Series Family. And TI's hundreds of thousands of data terminals shipped worldwide are backed by the technology and reliability that comes from over 30 years of experience in the electronics industry.

Supporting TI's data terminals is the technical expertise of our worldwide organization of factory-trained sales and service representatives, and TI-CARE†, our nationwide automated service dispatching and field service management information system. That's why TI has been appointed the official computer and calculator company of the 1980 Olympic Winter Games.

XIII OLYMPIC WINTER GAMES LAKE PLACID 1980

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Semiconductors and computer prices

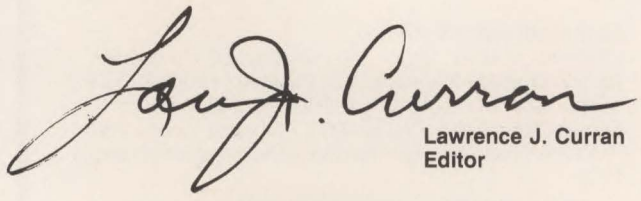
We've used this column before to discuss the contributions the semiconductor and computer industries have made to each other over the years. Faster semiconductor logic and memory circuits quickly show up in computer systems with faster throughput, which, in turn, are often applied in the semiconductor industry to design the next generation of faster circuits—and the cycle continues. These two closely related industries are among only a very few in which *falling* prices have been the norm, not rising prices. Yet companies in each industry continue to prosper, which is evidence that innovative technology and a competitive market can lead to good business.

There are disturbing signs, however, that semiconductor prices may not continue to drop in the traditional learning-curve decline, which shows high prices for a device initially, followed by dropping prices as the device becomes more producible and more sources of supply bring about competition. That's still happening, but several other factors mitigate against its continuing indefinitely, and it's our opinion that prices for computer and peripheral equipment could begin to edge upward.

Among those factors are horrendously high prices for the precious metals that go into semiconductor devices of all kinds, especially certain critical logic and memory ICs, plus a kind of maturity in the semiconductor industry that dictates expanding production capacity only for the kinds of components that will bring the highest prices. This maturity may be best reflected by Intel Corp., the semiconductor innovator turned systems builder, where the emphasis appears to be on managing the company for maximum return on investment, rather than just for growth. Intel management can hardly be faulted for wanting to maximize ROI, but it represents a change from the days when semiconductor companies slashed prices to "buy" market share in the hope of realizing profits later. The profits didn't always follow.

Add to the scenario the theft of already-scarce semiconductor devices, such as programmable ROMs—as Wang Laboratories experienced recently—plus black-market operations commanding price premiums for long-leadtime devices, and it becomes clear that computer makers should be preparing to pay more for components. And computer buyers should be thinking about paying more for systems, because the manufacturer can't absorb increasing costs and still maintain profits.

We have no crystal ball that foretells price hikes, but they seem inevitable in the computer business. The greatest hope to forestall them may be the apparent availability of venture capital to nourish innovative people in either the semiconductor or computer and peripherals businesses who thrive on competition, but who can't get their large-company managements to back them.



Lawrence J. Curran
Editor

Calendar

SHOWS & CONFERENCES

MARCH

20 **Federal ADP Expo '80 of Tidewater,** Norfolk, Va., sponsored by the Federal ADP Council of Greater Tidewater. Contact: Capt. Rex Gray, Exhibition Chairman, HQ TAC/ADB, Langley AFB, Va. 23665, (804) 764-3787.

25-27 **Expo '80,** Los Angeles, sponsored by The Conference Company. Contact: The Conference Co., 60 Austin St., Newton, Mass. 02160 (800) 225-4260 or (617) 964-4550. Other dates and locations available.

26-28 **Viewdata '80,** London, England, sponsored by the British Post Office, the British Radio Equipment Manufacturers' Association, the Association of Viewdata Information Providers and Sam Fedida. Contact: Technology Marketing Analysis Corp., 680 Beach Street, Suite 428, San Francisco, Calif. 94109, (800) 277-3477 or (415) 474-3000.

MARCH 31-APRIL 3

1980 Annual ADCIS Conference, Washington, sponsored by The Mitre Corp. Contact: Mary Broman, The Mitre Corp., 1820 Dolley Madison Blvd., McLean, Va. 22102, (703) 827-6677 or (212) 737-8791.

APRIL

9-11 **"The Practical APL Conference,"** Washington, sponsored by Scientific Time Sharing Corp. (STSC). Contact: Joan Gurgold, Conference Chairman, Scientific Time Sharing Corp., 7 Holland Ave., White Plains, N.Y. 10603 (914) 428-6910.

10-11 **Annual Rocky Mountain Data Processing Exposition,** Denver, Colo. Contact: Lawrence E. Ries, vice president, Meetings, Inc., 8906 West Swarthmore Drive, Littleton, Colo. 80123, (303) 973-0059.

14-17 **Computer Graphics Conference,** Detroit, Contact: Carol Lynn, Engineering Society of Detroit, 100 Farnsworth Ave., Detroit, Mich. 48202, (313) 832-5400.

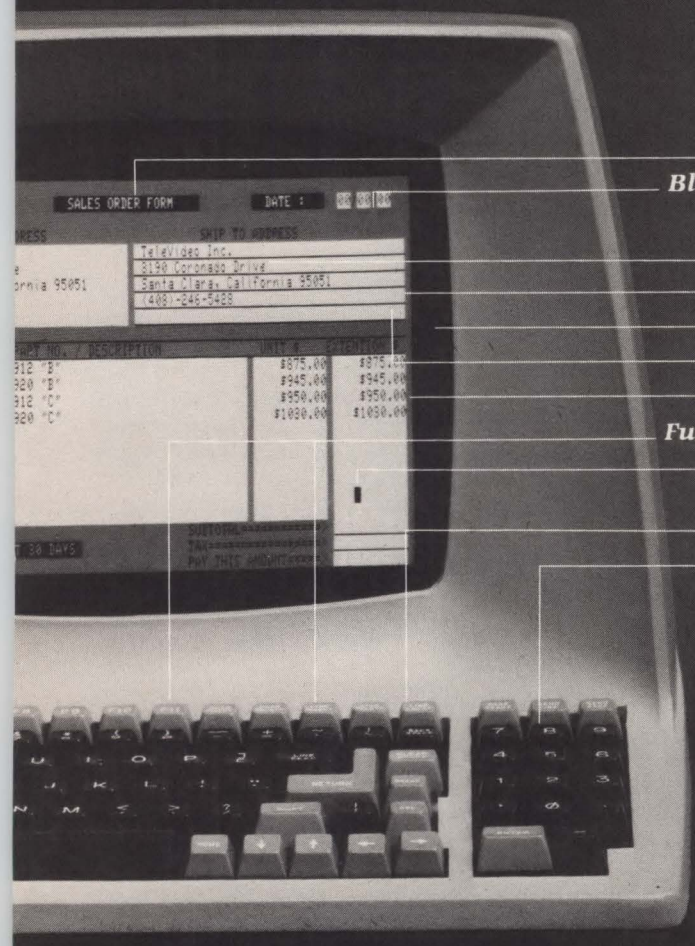
19-20 **Trenton Computer Festival,** Trenton, N.J., sponsored by the Amateur Computer Group of N.J., the Philadelphia Area Computer Society, the Trenton State College Computer Society, the Princeton Section of the Institute of Electrical & Electronic Engineers and the Department of Engineering Technology. Contact: Dr. Allen Katz, Trenton State College, Hillwood Lakes, P.O. Box 940, Trenton, N.J. 08625, (609) 771-2487.

23-25 **International DP Training Conference,** Chicago, sponsored by Deltak, Inc. Contact: Ross H. Stemer or John P. Montgomery, Daniel J. Edelman, Inc., 221 North LaSalle St., Chicago, Ill. 60601, (312) 368-0400.

28-30 **Federal DP Expo,** Washington, sponsored by The Interface Group. Contact: Peter B. Young, The Interface Group, 160 Speen St., Framingham, Mass. 01701, (800) 225-4620 or (617) 879-4502.

29-30 **Fiber Optic Marketing Conference,** Chicago, sponsored by Information Gatekeepers, Inc. Contact: Barbara Coffin, Information Gatekeepers, Inc., 167 Corey Road, Brookline, Mass. 02146,(617) 739-2022.

COMPARE SMARTS.



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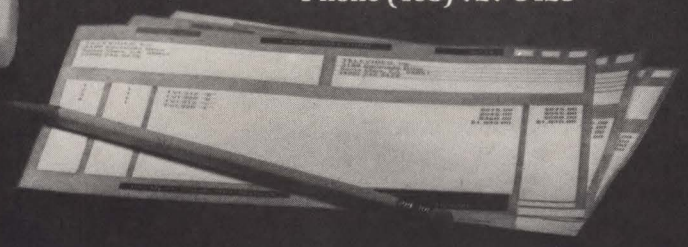

COMPARE PRICE.

CIRCLE NO. 15 ON INQUIRY CARD

Calendar

APRIL 29-MAY 1

Second International Parametrics Conference, Cherry Hill, N.J., sponsored by the International Society of Parametric Analysts and RCA PRICE. Contact: Henry Apgar, ISPA vice president, Box 5009, Westlake Village, Calif. 91359, (213) 889-2211, ext. 2852.

APRIL 30-MAY 2

Computerized Office Equipment Expo - Midwest '80, Rosemont, Ill., sponsored by the Chicago Association of Commerce and Industry. Contact: Industrial & Scientific Conference Management, Inc. 222 West Adams St., Chicago, Ill. 60606, (312) 263-4866.

MAY

6-8 **1980 International Symposium on Computer Architecture,** La Baule, Brittany, France, sponsored by the Association for Computer Machinery (ACM) and the IEEE Computer Society. Contact: Daniel E. Atkins, Department of Electrical and Computer Engineering The University of Michigan, Ann Arbor, Mich. 48109, (313) 763-0038.

6-8 **Micro/Expo '80,** Paris, France, sponsored by Sybex. Contact: Dr. Rodnay Zaks, 2020 Milvia St., Berkeley, Calif. 94704, (415) 848-8223.

7-9 **DPMA Conference and Business Exposition,** Tampa, Fla., sponsored by Tampa Chapter, Data Processing Management Association. Contact: Chris Meyer, chairman, CDP, Tampa Chapter, DPMA, P.O. Box 3052, Tampa, Fla. 33601, (813) 961-3902.

11-14 **Association for Systems Management 1980 Annual Conference,** New Orleans, sponsored by the Association for Systems Management. Contact: Richard B. McCaffrey, Assistant Executive Director, Association for Systems Management, 24587 Bagley Rd., Cleveland, Ohio 44138, (216) 243-6900.

12-14 **Canadian Information Processing Society's Annual Conference,** Victoria, British Columbia, sponsored by CIPS. Contact: Marion Hart or Peter Vanderlee, CIPS, 243 College St., Fifth Floor, Toronto, Ontario, M5T 2Y1, (416) 593-4040.

13-15 **Electro/80 Show and Convention,** Boston, sponsored by Electronic Conventions, Inc. Contact: Robert Myers, Electro, 999 North Sepulveda Blvd., El Segundo, Calif. 90245, (213) 475-4571.

13-15 **"Ideas in Science and Electronics" Show,** Albuquerque, N.M., sponsored by the New Mexico Electronics Representatives Association (NMERA). Contact: Renee Stein, Show Coordinator, ISE, 6201 Copper N.E., Albuquerque, N.M. 87108, (505) 266-5202.

13-16 **MUG '80, Mumps Users Group Meeting,** San Diego, Calif., sponsored by The Mitre Corp. Contact: Dr. Jack Bowie, MUG '80 Program Chairman, The Mitre Corp., Mail Stop No. 641, 1820 Dolley Madison Blvd., McLean, Va. 22102.

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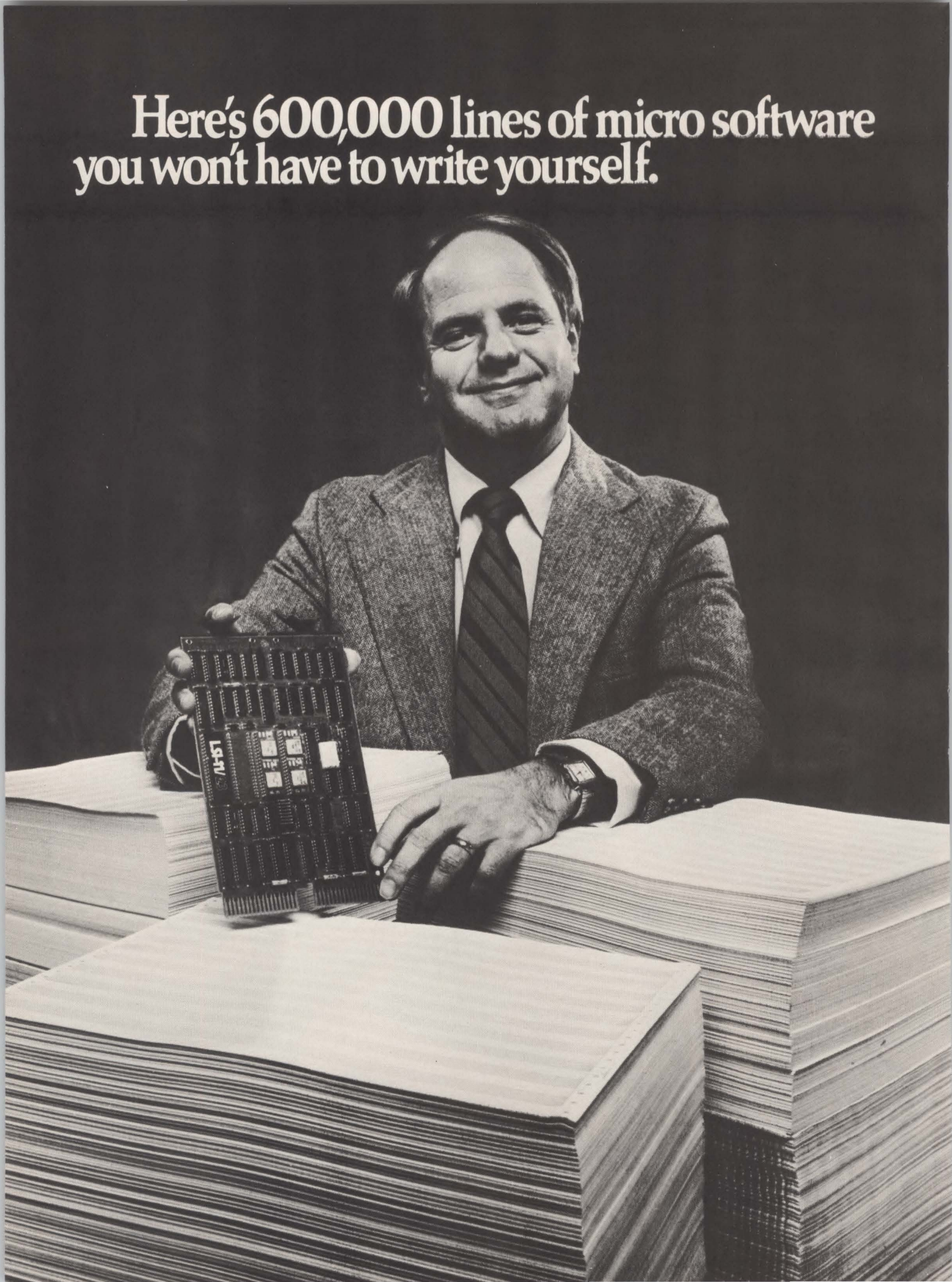
Here's 600,000 lines of micro software you won't have to write yourself.



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RSX-11M can make your most complex application manageable.

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Like an optimized FORTRAN IV-PLUS compiler. Line-by-line assembly. And interactive debugging through every stage of development, with English diagnostics that make it easy to pinpoint bugs before you ever run your programs.

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If you don't need all the resources of RSX-11M, you can use RT-11 – the real-time operating system we designed for smaller applications.

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Program one, and you've programmed them all.

Best of all, Digital's micros are software-compatible. So what you learn on one, you can apply to the others.

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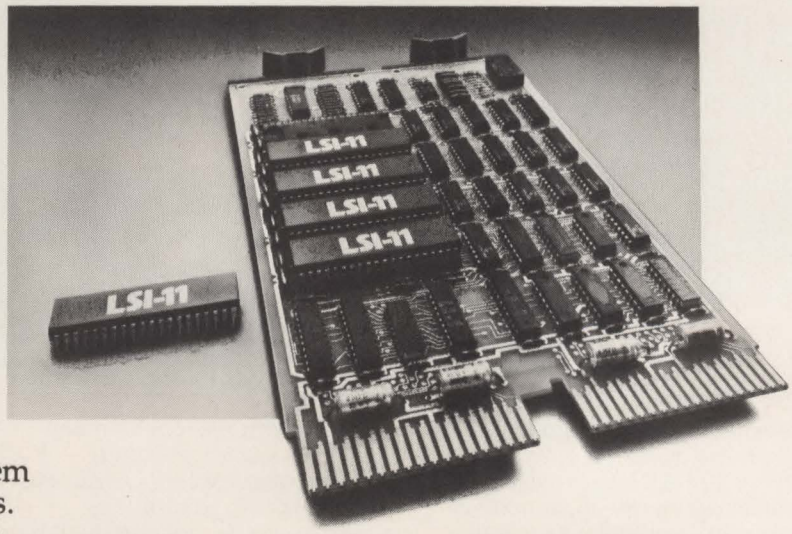

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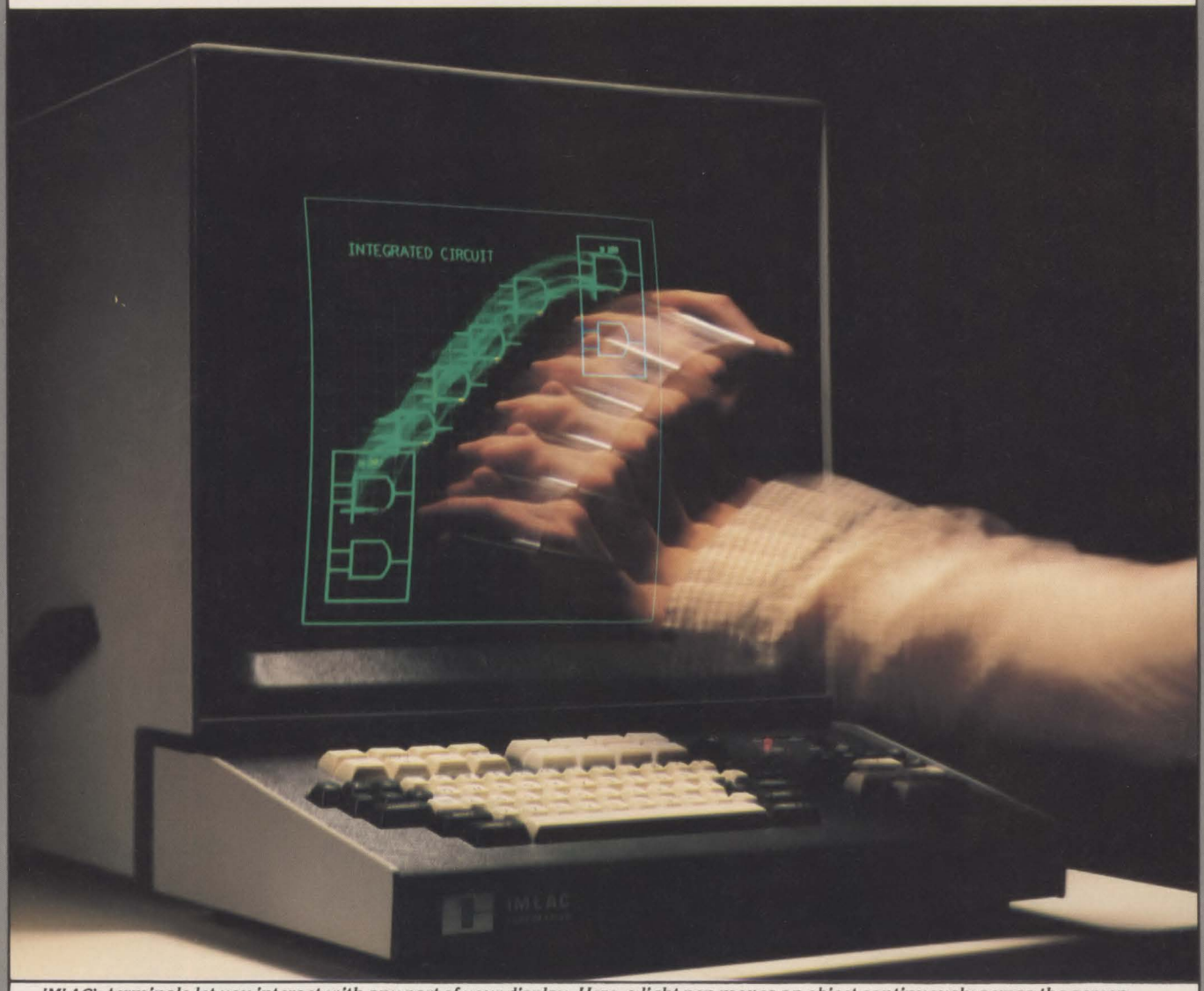

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IBM-COMPATIBLE MINI MARKET GETS ANOTHER COMPETITOR

The latest entrant in the IBM-compatible minicomputer market is Formation, Inc., a Mount Laurel, N.J., peripherals and systems manufacturer founded 10 years ago to support RCA mainframe users left hanging when RCA exited the computer business in the early 1970s. Now looking to feed its growth in greener pastures, the $20-million-a-year company has targeted the lucrative IBM 4300 market with its Formation 4000 minicomputer system — a bit-slice microprocessor-based machine that can run IBM software without modification. Aimed at both OEMs and end users, the system will sell for about $100,000 in a typical configuration that includes 512K bytes of memory, two 70M-byte Winchester disks, three CRT terminals and a printer. End-user versions will be available with Formation's Transaction Management System, which replaces IBM's CICS and DL1 software, as well as with other applications software. According to a company spokesman, Formation plans to expand its manufacturing and marketing forces to support the system, slated for November delivery.

ZILOG TO STANDARDIZE ON A 32-BIT BUS

While Intel, DEC and other microcomputer manufacturers long ago standardized on 16-bit bus structures for their board-level products, Zilog Corp. has taken advantage of its late start in the business to leapfrog competitors. The Cupertino, Calif., firm's new bus standard, to be unveiled next month along with compatible board products, will incorporate 32-bit address and data lines, according to a Zilog spokesman. This will enable the bus to accommodate a 32-bit microprocessor, reportedly in the works at Zilog, as well as the company's existing line of 8- and 16-bit processors. Other features include two board sizes (6.2 × 3.9 and 6.2 × 9.3 in.), three interrupt structures, byte parity, plastic-shielded connectors (instead of exposed edge connectors) and the ability to support segmented and memory-mapped address spaces. The bus will form the basis for a new family of Z8, Z80, and Z8000 microcomputer boards to be launched this spring. Zilog has no plans to phase out its existing boards, the company spokesman insists, although they are incompatible with the new bus.

SLI INDUSTRIES TARGETS A 200M-BYTE 8-IN. WINCHESTER

Picture a Winchester disk that stores 200M bytes of data, yet is only slightly larger than a 1M-byte floppy drive. That's the vision dancing in designers' heads at SLI Industries, Inc., a Woodland Hills, Calif., manufacturer of head/disk assemblies (HDAs). To achieve a 200M-byte capacity, SLI is turning to thin-film technology in an upgraded version of its MiniFox 8-in. Winchester HDA introduced last year (MMS, July 1979, p. 14). However, the conversion will take place in stages. First, the MiniFox's four oxide-coated platters will be replaced with thin-film-coated disks supplied by Poly Disk Systems, Inc., Torrance, Calif. Initial deliveries of the thin-film media version, which will operate at the MiniFox's present 51M-byte capacity, are slated for next month to several unspecified minicomputer manufacturers who plan to build completed drives in-house. By the end of next year, according to one report, SLI plans to replace the MiniFox's present single-density heads with double-density 3350 heads that write at 1000 tpi. Finally, the 3350 heads will be replaced with thin-film heads to produce a 200M-byte 8-in. Winchester.

ADDS TO LAUNCH PUSH INTO SMALL BUSINESS COMPUTER MARKET

Look for CRT terminal manufacturer Applied Digital Data Systems (ADDS) Inc. to plunge into the fiercely competitive small business computer market next month, with the introduction of three systems called Multivision. The new series will comprise the Multivision 1, a $3785 entry-level system that includes 64K bytes of main memory and 700K bytes of dual minifloppy storage; the Multivision 2, an 8-in., 5M-byte Winchester-based system that sells for about $8000, and a high-end Winchester system that includes 256K bytes of memory and costs $12,885. The systems, which will support four users, will be available with a CP/M-compatible operating system, BASIC compiler or interpreter, and word-processing and business applications software. ADDS plans to market the desk-top system through retail computer stores, office equipment suppliers and independent systems consultants.

Breakpoints

DISK MAKERS READY MICRO WINCHESTERS

Look for Tandon Magnetics Corp. to follow Shugart Technology and demonstrate a 5¼-in. disk drive at the NCC show in Anaheim this May. The two-platter 5M- and 6M-byte drive will be fit-and-form-compatible with the Chatsworth, Calif., firm's TM-100, a 5¼-in. double-sided minifloppy device, says president Sirjang Lal ("Juggi") Tandon. It will be available in production quantities by the end of the year. Tandon already is talking to outside component vendors — including makers of read/write heads — and is preparing an additional 80,000 sq. ft. of manufacturing space in Chatsworth to handle the new hardware. Tandon will demonstrate pre-production versions of the unnamed drive in Anaheim, but like many other firms that have not previously participated in the show, he will not be on the exhibit floor. Instead, Tandon is looking at alternate plans, including renting a motor home and parking it adjacent to the convention center.

. . . Also testing the waters for 5¼-in. Winchesters is Britton/Lee Associates, a Los Gatos, Calif., firm, whose principals include Dave Britton, a co-founder and former president of International Memories, Inc. (IMI), the first company to announce an 8-in. Winchester and the first to ship 8-in. hardware in volume. According to Britton, the as-yet-unnamed 5¼-in. drive will incorporate removable head/disk assemblies similar to those used in the original Winchester disk drive, the IBM 3340. Britton/Lee, which plans to license the hardware design, is showing a demonstration unit to unspecified disk drive makers. The demo unit comprises a spindle, oxide-coated media, read/write heads and a voice-coil actuator. Evaluation quantities of the drive could appear by year-end, Britton says, with production units rolling off the assembly lines by third quarter, 1980.

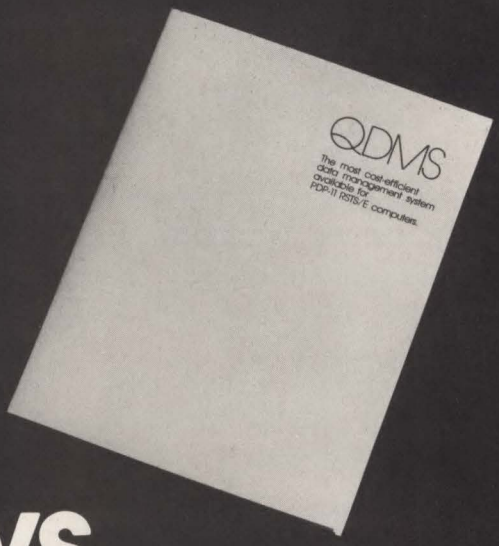
LEXITRON ANNOUNCES SHARED-RESOURCE SYSTEM

A series of recent announcements shows stand-alone word processor manufacturer Lexitron Corp. striking out in several new product directions at once. At February's International Word Processing Association show in New York, the Raytheon subsidiary announced support for six data communications protocols: asynchronous and bisynchronous point-to-point; asynchronous ASCII; and 2780, 3780 and 2741 terminal emulation. The six packages significantly extend the communications capabilities of Lexitron 1202 and 1303 word processors, enabling them to transmit data at rates as high as 4800 bps. At NCC's Office Automation Show in Atlanta, Lexitron unveiled its RayText multifunctional word processing system, which follows in the steps of CPT Corp.'s shared resource system. RayText links a Raytheon PTS/1200 distributed processing system and nine Lexitron 1202 or 1303 terminals via an intelligent hardware interface that operates under software control. The system accommodates four disk drives having a 252M-character total on-line storage capacity. Although the company has yet to integrate DP functions, it is expected to take its first step toward that marketplace in mid-March with the introduction of a Records Management System (RMS). RMS is said to enable Lexitron terminals to prompt users when entering long lists of data.

C. ITOH MOVES INTO DOT-MATRIX, DAISY-WHEEL MARKETS

C. Itoh Electronics, Inc., the five-year-old subsidiary of Osaka conglomerate C. Itoh & Co., Ltd., plans to graduate from a supplier of printer mechanisms to a full-scale vendor of dot-matrix and daisy-wheel hardware. The Los Angeles-based company unveiled its new product mix at the recent Office Automation Show in Atlanta. Included are 25- and 45-cps daisy-wheel printers designed and manufactured by Tokyo Electric Co., and a series of dot-matrix devices based on proprietary technology. C. Itoh is putting together a distribution network to handle the new hardware, say company sources, and has signed an agreement in principle with an unnamed U.S. group to handle service in this country. Price of the 80-column dot-matrix Comet printer (in lots of 100) is $585; the 136-column Comet II is $892. The 25-cps Starwriter and 45-cps Starwriter II daisy-wheel devices are $1440 and $2085, respectively. Deliveries take 30 days. C. Itoh also introduced a line of double-sided 5¼- and 8-in. floppy-disk drives. Designed and manufactured by Toschiba Corp., Tokyo, the drives are pin-compatible with comparable Shugart hardware. C. Itoh's 500K-byte MiniFlexi is form-compatible with the Shugart SA450, but the 1M-byte MaxiFlexi is slightly larger than its SA850 counterpart. Quantity prices for the drives are $210 and $490, respectively, with deliveries in about 90 days.

PDP-11 RSTS/E Users



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*with 3 or more responses

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CIRCLE NO. 21 ON INQUIRY CARD

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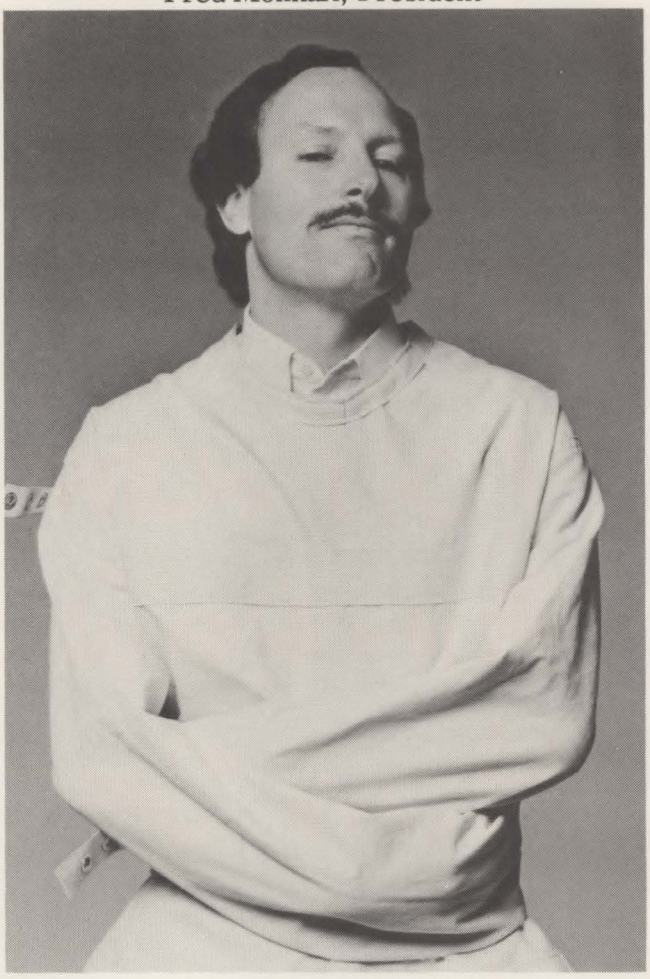
Fred Molinari, President



We worked days and nights, weekends and vacations to develop the intelligent analog peripheral.

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Because now we can offer you a complete microcomputer data acquisition system on a single Multibus™ board.

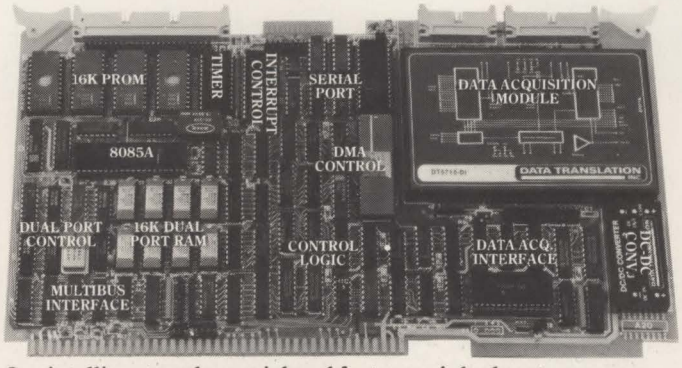
Decentralizing your computer function has finally become a practical possibility.

You see, this intelligent analog peripheral pre-processes data without involving the host CPU.

And thanks to a unique DMA controller, this peripheral also acquires analog data independently, at rates up to 125KHz.

Our new peripheral can function as an intelligent A/D slave. Or as a stand-alone microcomputer with A/D capabilities. Or as a remote system, transmitting data via a serial line.

Convenient? Our peripheral even includes a system monitor in preprogrammed ROM to communicate with the board, debug, and access A/D conversions.



Our intelligent analog peripheral features: A dual port memory controller. A 8085 CPU. Four PROM sockets. Two programmable timers. A baud rate generator. A complete priority interrupt controller. 12 bit A/D with 125KHz throughput to memory. A 16K byte dual-ported dynamic RAM. A self-contained four-channel multi-mode DMA controller. And quite a bit more.

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CIRCLE NO. 22 ON INQUIRY CARD

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The MSC 8001 is a MULTIBUS compatible single board computer designed to provide new dimensions in function and versatility. Built around the powerful eight-bit Z80™ CPU, the MSC 8001 provides a flexible memory addressing scheme and extensive input/output capabilities at prices well below competing single board computer products. Using the MSC 8001 as a master module, you can select I/O and special feature modules to configure a system of virtually any complexity or refinement.

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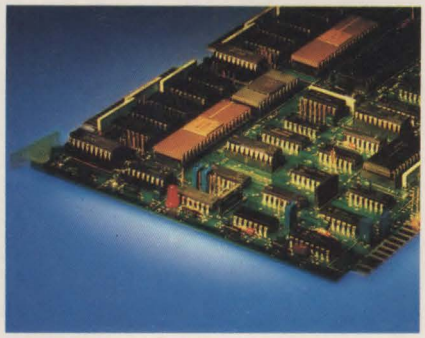

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Expand to meet future needs The MSC 8001 is designed to accommodate a wide range of versatile configurations. Almost any combination of memory, inferface complement, and other options can be configured to meet your specific requirements without hardware modification. For additional information on the MSC 8001 and our other 41 Monolithic Systems Corp. products and systems, please contact us at 14 Inverness Drive East, Englewood, Colorado 80112. (303) 770-7400. Telex: 45-4498.

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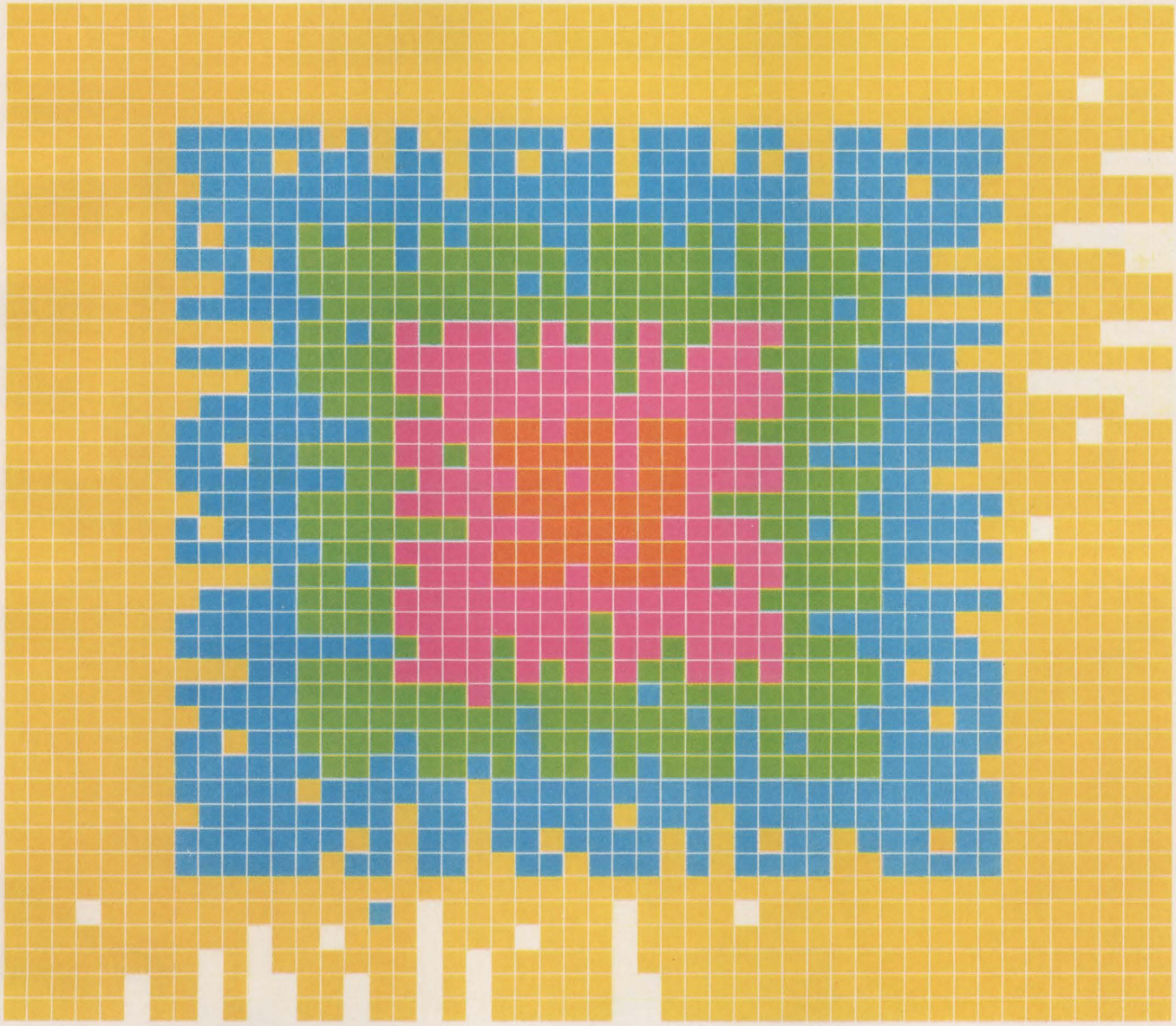

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CIRCLE NO. 23 ON INQUIRY CARD

The brains behind

Hewlett-Packard's 2649 Series terminals are making a lot of OEMs look good these days.

Here are three reasons why:

The HP 2649A. Build in the performance you want. The microprogrammable HP 2649A lets you take full advantage of your knowledge of 8080 assembler and really get "inside" the machine for sophisticated programming. What's more, all the circuitry for each specific function—data communications; keyboard interface—is on a single plug-in module. So you can pick the individual cards you need to refine your product further: serial or parallel I/O boards and RAM, ROM, and PROM memories.

HP also provides a powerful set of development tools to help you get the most from the HP 2649A in the least time. These include a RAM-based development terminal with cross assembler and debug features, comprehensive documentation, and a practical, hands-on training course.

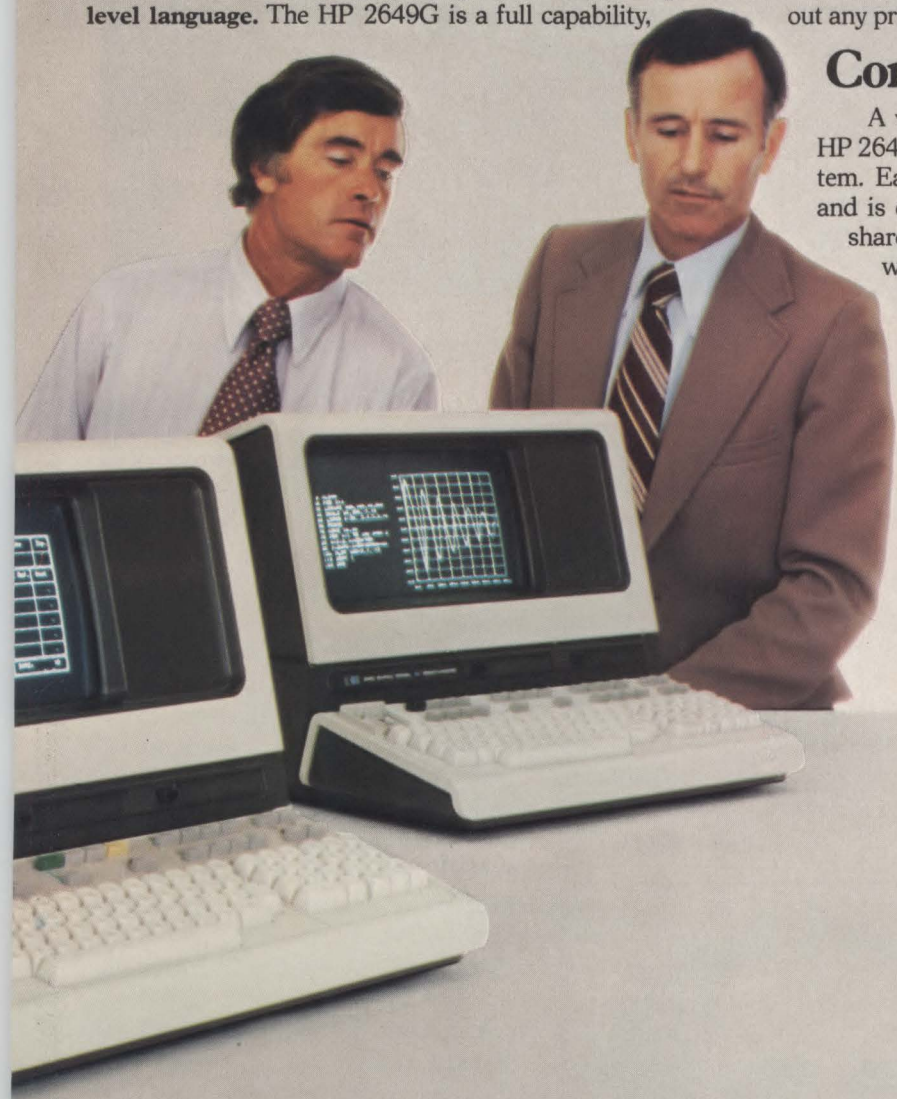
The HP 2649I. Applications programming simplified. The user-oriented HP 2649I lets you do high-level programming in BASIC. You get up to 220K bytes of mass storage on dual cartridge tapes, and

42903 HPT14

some very smart OEMs

eight programmable keys provide menu-like instructions to guide the operator step-by-step through the job. You can even split the HP 2649I memory into four separate user areas for rapid switching between data sets, instruction menus, or data entry forms.

The HP 2649G. High-level graphics with a high-level language. The HP 2649G is a full capability, OEM-discounted graphics station, with raster scan technology, selective erase, pattern definition, and much more. And with AGL, our high-level extension to BASIC, graphics is a snap. Set axis, scaling, and location, for example, with a simple three-statement program. Or you can use our powerful Multi-Plot feature to run simple pie, bar, or linear charts without any programming at all.



Communications made easy.

A variety of serial and parallel interfaces make the HP 2649 terminals an extremely versatile tool in any system. Each works with the RS232C interface standard, and is compatible with most modems. And the optional shared peripheral interface provides communication with a wide range of printers, plotters, and other devices.

Whether you're designing a specialized terminal, controller, microcomputer or graphics display station, the HP 2649 Series gives you a real head start in building your product. And that's what being a smart OEM is all about.

If you'd like to know more about HP's 2649 Series terminals, just call your nearest HP office listed in the White Pages and ask for full details. Or send us the coupon below. We'll be glad to fill you in.

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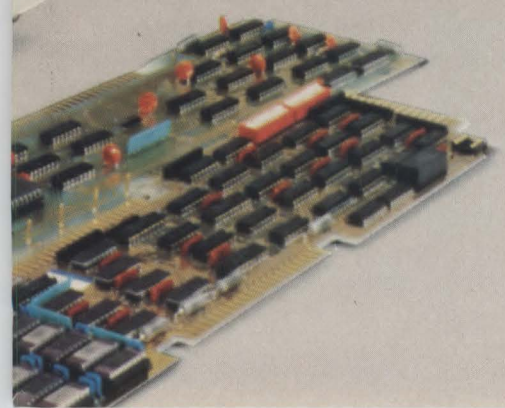

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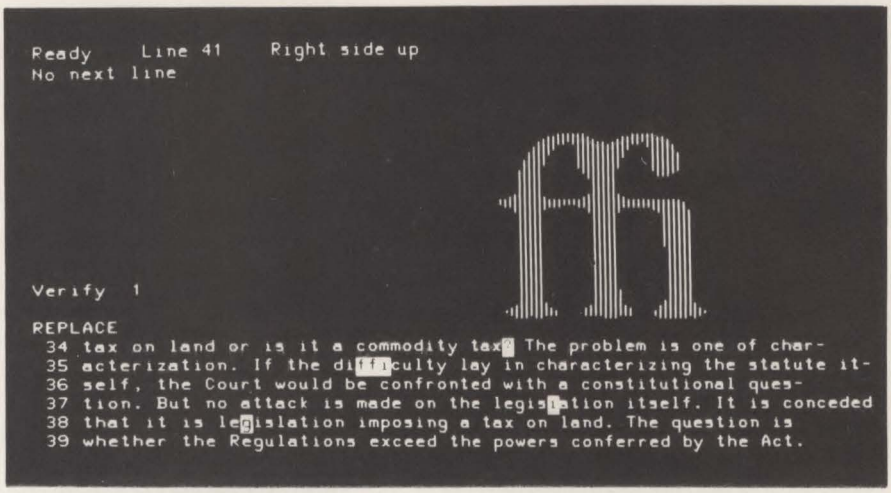
CIRCLE NO. 24 ON INQUIRY CARD

NEWS

KURZWEIL PURCHASE GIVES XEROX A SOLID BASE IN OCR

Xerox Corp.'s recent purchase of Kurzweil Computer Products, Inc., a Cambridge, Mass., manufacturer of optical character recognition (OCR) and voice synthesis equipment, leaves many industry observers wondering what the giant intends to do with the small company. Although neither company has specified any immediate plans for product development or technology integration, the acquisition provides healthy fodder to feed Xerox's office automation product growth.



The Kurzweil Data Entry Machine *highlights characters that it is less than 95 percent sure of so that operators can check copy and confirm OCR reading to assure accurate document commitment to memory.*

Xerox purchased Kurzweil in January for $3.6 million cash advances, with a 1982 pay-out of as much as $8 million to Kurzweil shareholders based on an earn-out formula.

One observer claims that, while Xerox is keeping a hand in the acquisition game, it has no overall product development strategy like IBM or AT&T. But other market sources foresee great potential for Kurzweil's data entry product in Xerox's word-processing and intelligent-copier offerings, especially in variable-font recognition.

For example, the Kurzweil machine could help solve the expense of translating multiple fonts into memory in a word-processing system, one source says. The source explains that the Kurzweil OCR data-entry device could relieve the word processor of this task, while forming the basis for a fine-quality output product, incorporating different typefaces and bold print.

Kurzweil's machine, unlike most OCR systems, is based on a pattern- rather than a matrix-recognition system, thereby bypassing the task of memorizing specific type fonts (MMS, November, 1978, p. 16). In addition to supporting variable-font typing in extended word-processing applications, the Kurzweil system saves time by serving as a substitute for manual data entry, functioning at 15 to 30 cps, rather than the manual two- to four-cps rate.

On the intelligent copier side, which appears to offer the more immediate application, according to a Kurzweil source, the Kurzweil system can function as a data-entry peripheral for the Xerox 9700 intelligent copier, acting to commit print directly into memory for demand document applications. The ramifications in this application are extensive.

Raymond Kurzweil: *his firm took the acquisition initiative.*

For one, the combined system could serve in search and retrieval functions in newspaper data bases. In automated office communications, the Kurzweil system could be used with intelligent copier-to-copier transmissions over telephone lines, or it could be used in an electronic mail network with satellite links between points.

Despite the potential Xerox could derive from the newly acquired technology, Kurzweil will remain virtually autonomous, except for what the company's executive vice president Aaron Kleiner describes as "substantial" funds. These were made available by Xerox for general corporate purposes, including research and development.

Kleiner says his company initiated the acquisition discussions to gain extra capital. That was after Xerox Development Corp. showed an interest in Kurzweil more than a year ago, purchasing $100,000 worth of stock in 1978 and $500,000 last April.

This Dual Floppy/LSI-11 does everything the 11V03-L will do in half the space...

and gives you RX02 software/media compatibility, too!

The MF-211 Dual Floppy/LSI-11/2 system, featuring the low-cost CRDS Double Density Controller, is functionally identical to the DEC 11V03-L, but uses only 10½" of rack space!

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PLUS:

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CIRCLE NO. 25 ON INQUIRY CARD

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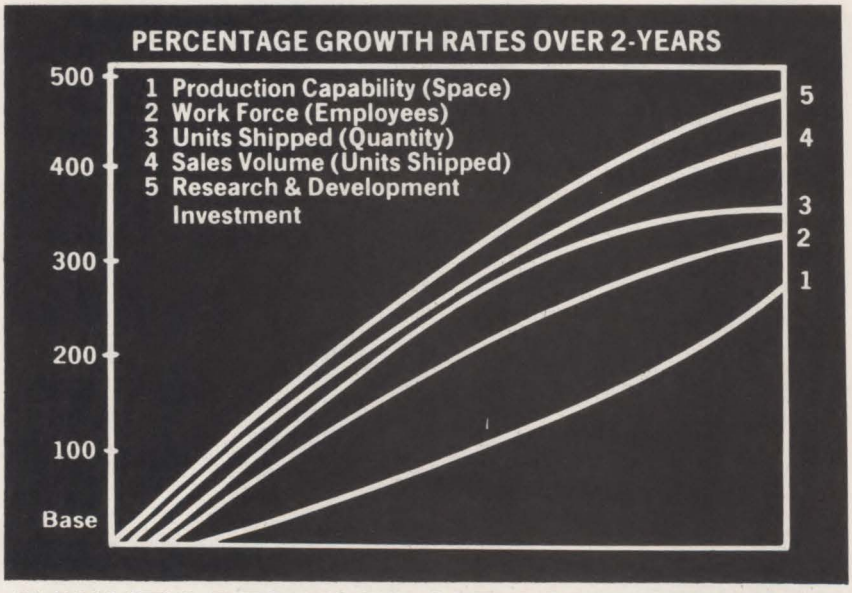

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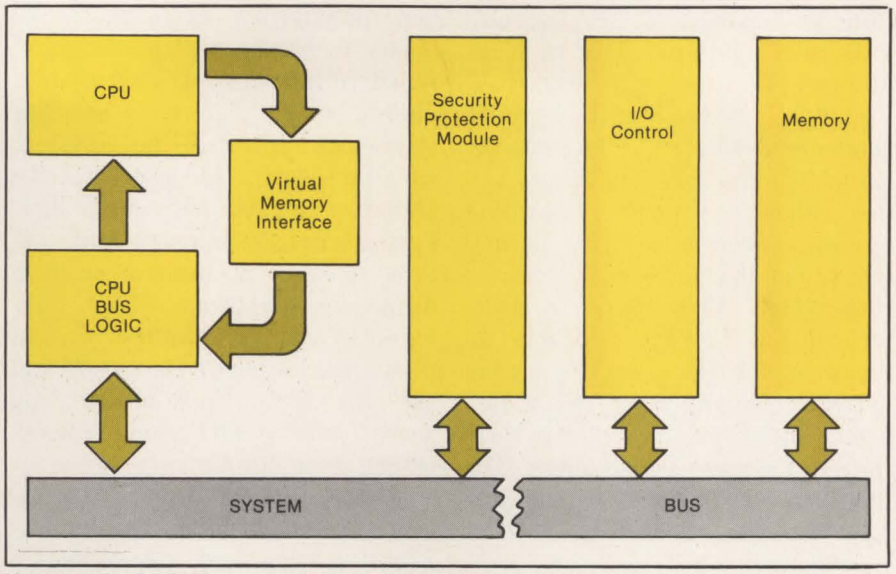
CIRCLE NO. 26 ON INQUIRY CARD

Although there have been no discussions to date about product development, Kleiner admits that "wide-ranging discussions in lots of areas of the business" are on the horizon. And with company founder and artificial-intelligence genius Raymond Kurzweil involved, there may yet be an integrated strategy for the "office of the future" from Xerox. **—Lori Valigra**

HONEYWELL'S SCOMP AIMS TO KEEP DATA SECURE

Until recently, security features have been something of an afterthought in minicomputer systems. But now Honeywell Information Systems, Inc., has developed a minicomputer system specifically designed to prevent unauthorized access to sensitive information.

Honeywell's Secure Communications Processor (SCOMP) is modeled on a similar system developed for the Defense Department by Ford Aerospace & Communications Corp.



Honeywell's SCOMP system *is designed to keep proprietary information secure.*

That system, however, was developed for use only by the Defense Department, which has no plans to distribute it outside the federal government, according to Steve Walker, chairman of the department's Computer Security Technical Consortium.

SCOMP, which will be available for both government and commercial applications, has been in development since June, 1977. Test site deliveries are scheduled to begin next month, with formal introduction slated for the fourth quarter, according to Richard Ziller, special

THE BIG PUSH FOR COMPUTER SECURITY

The development of Honeywell's SCOMP system comes at a time when the Defense Department has begun to push hard for the commercial implementation of secure computer systems. To spark the development of such systems, the Defense Department established its Computer Security Initiative in 1978. Steve Walker, chairman of the department's Computer Security Technical Consortium, says the initiative was established to overcome three stumbling blocks to commercial implementation of secure systems.

The first was a lack of technical expertise among both computer manufacturers and the Defense Department. "We tried for a long time to convince computer manufacturers to build systems with proven integrity, and they kept asking us, 'What do you mean by that?'" says Walker, adding, "We really didn't know ourselves." To gain the required technical knowledge, the Defense Department sponsored the development of two secure operating systems, one for a minicomputer and the other for a mainframe system. The former, called Kernalized Secure Operating System, runs on a PDP-11/70 minicomputer and was developed by Ford Aerospace & Communications Corp. Initial test site deliveries for the system will begin next month, and KSOS will be generally available to Defense Department agencies by the end of the year. The system supports a UNIX operating system for user applications.

The mainframe system, called Kernalized Virtual Memory (KVM) system, is a secure version of IBM's virtual memory operating system for its 370 series computers. KVM is being developed by Systems Development Corp.

The Defense Department is providing the specifications for the KSOS and KVM systems "to anybody who wants them," says Walker. He says he has received requests for the specs from Honeywell, Digital Equipment Corp., IBM Corp. and Sperry-Univac.

Walker says a second barrier has been a lack of market pressure on computer manufacturers. "If they can sell machines without proven integrity, then why should they bother to develop them?" asks Walker. He believes that the biggest reason for user apathy is that they didn't know that it might be possible to build secure systems. "So another big part of my push from here is to make it generally known to people, both in government and in the private sector, that you can expect a reasonable degree of trust to be available with a computer system." To create user awareness of secure systems, Walker has been conducting a series of seminars, with speakers from industry, government agencies and computer manufacturers. The most recent seminar, held in mid-January, drew some 350 attendees, including representatives from 12 computer manufacturers.

A third barrier has been the lack of an organization to certify that secure systems work. To overcome that problem, the Defense Department is sponsoring extensive research into developing certification programs.

projects manager at Honeywell's Federal Systems Division in McLean, Va.

SCOMP is based on Honeywell's commercial Level 6 minicomputer series. To the Level 6, Honeywell has added a primitive operating system, called a security kernel, which handles all security-related processing. This basic system, written in PASCAL, supports an emulator for the UNIX™-operating system originally developed at Bell Laboratories but now widely used in the Defense Department. The emulator enables SCOMP to run existing UNIX applications without modification.

In addition to the new software, Honeywell has added three hardware modules, in the form of printed circuit boards, that enable the Level 6 minicomputers to run the security software without degradation in throughput. For example, the boards implement in hardware a demand paging virtual memory scheme similar to that used on Multics—Honeywell's mainframe operating system. The additional hardware also implements a Multics-type ring structure hardware-protection scheme. It also contains special instructions that enable the system to switch program contexts in as little as 10 microseconds—an important feature because security checking requires frequent context switches.

Honeywell is aiming the system initially at government agencies—especially the Defense Department and intelligence agencies—because that's where it sees the biggest immediate market. However, Ziller notes that some of Honeywell's large commercial customers, such as General Electric and General Motors, have shown interest in SCOMP. Such companies are becoming increasingly concerned about protecting proprietary data stored in word-processing and computer-aided design systems.

A feature of SCOMP that will make it especially attractive to defense and intelligence agencies is its ability to handle multiple levels of sensitive information. This enables users with different security clearances to use the system simultaneously. At present, the Defense Department must limit systems access to users with the same security clearances, or have duplicate systems. The only exception is a Multics system developed jointly by Honeywell and the Air Force that allows "top secret" and "secret" users to coexist on the same system.

Ziller sees the biggest use for secure minicomputer systems as nodes or front-end processors in computer networks. He points out that the federal government is going increasingly into networking and distributed systems. "The key to networking—at least in the Defense Department—is being able to connect systems that are at different security levels so that users can communicate with each other," Ziller says. He notes that very little work is being done to develop secure mainframe systems. As a result, he believes host systems will continue to be dedicated to a single security level, while multilevel secure minicomputers will be needed to provide access control to the host and to monitor messages being transmitted through the network.

MINIBITS

IBM INTRODUCES DISTRIBUTED DATA SYSTEM

IBM's 5280 distributed data system, said to ease reliance on central computers in data processing applications, allows on-site processing in remote locations. The system communicates with other IBM systems, including the System/370, the 4331 and the Series/1. A typical-configuration programmable keyboard/display station with 64,000 characters of main storage, two diskette drives accommodating 1.2 million characters each, a 120-cps serial printer and a communications adaptor—sells for $16,660. Shipments are scheduled to begin in June. In other developments, IBM has revised Series/1 discounts, cutting prices as much as 15 percent on volumes of 100 or more for installations made within an 18-month period. The company also is offering a computer-based energy-management system for the System/1, which is said to generate energy savings of as much as 25 percent.

DBMS INDUSTRY EVOLVES INTO DRMS MARKET

IBM will become more aggressive than ever before as data base management systems (DBMS) evolve into increasingly expensive data resource management systems (DRMS), according to a Creative Strategies International report. The multifunctional DRM systems are used on mainframes and on some minicomputers and small business computers. The report states that the DBMS/DRMS market will grow 74 percent in unit sales during 1979-83. In addition, worldwide use of the software packages, led by a proliferation of IBM 4300s, will climb 17 percent on all installed IBM mainframes. A compound growth rate of about 49 percent in DBMS/DRMS implementation in non-IBM mainframes is also forecast for the five-year period. Further, the report predicts that the DBMS/DRMS market will taper as mainframe and large business computer markets saturate.

UNTAPPED MARKET EXISTS FOR ADVANCED WORK STATIONS

The enormous market for the advanced work station, a multifunctional office utility for information processing, retrieval and communications, has barely been tapped, according to findings by The Yankee Group. Word processing, with a current installed base exceeding 382,000 units, is the primary contributor to the advanced work station market. But to become cost-effective tools for mass marketing by the mid-eighties, work stations must undergo several drastic changes—from design through service. New forms of maintenance and diagnostics, aimed at replacing service visits, include duplexing of main components, remote diagnostics and troubleshooting software packages.

Imitates:

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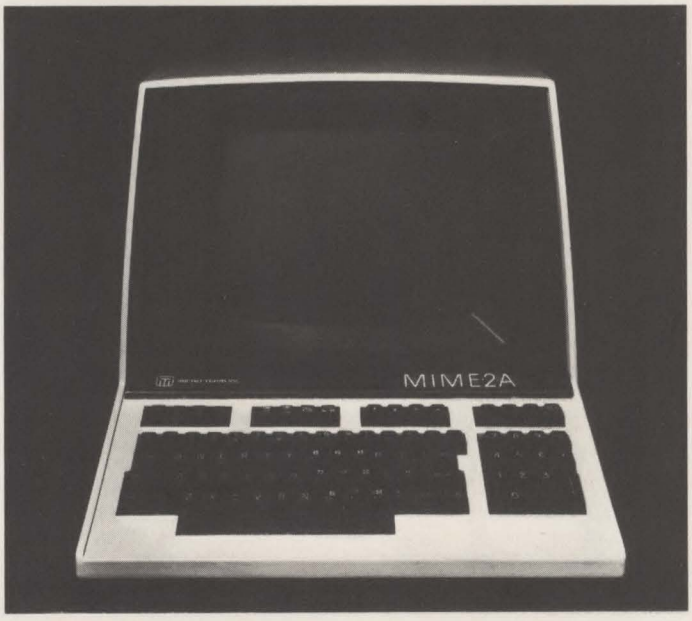

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CIRCLE NO. 27 ON INQUIRY CARD

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CIRCLE NO. 28 ON INQUIRY CARD

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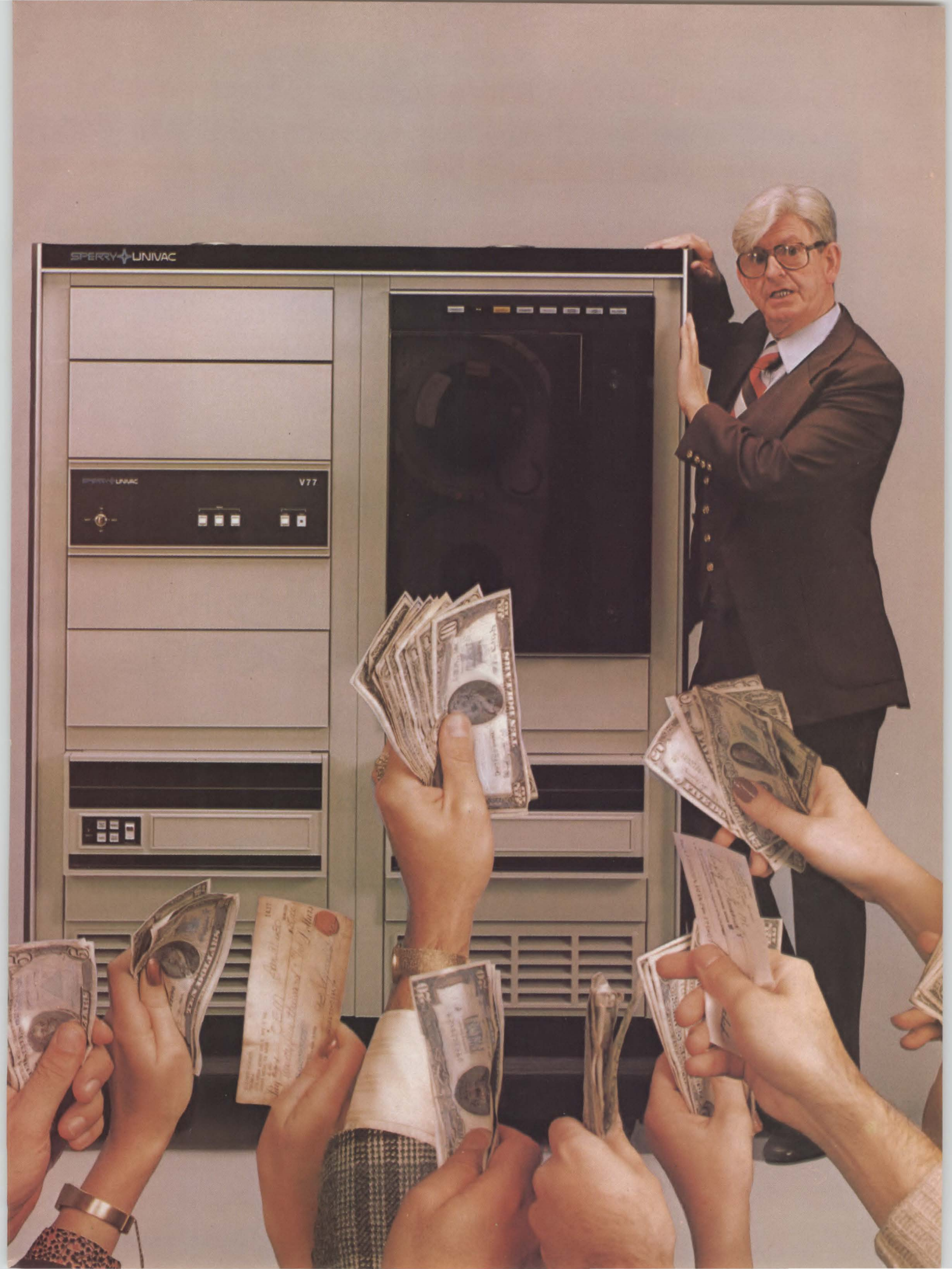
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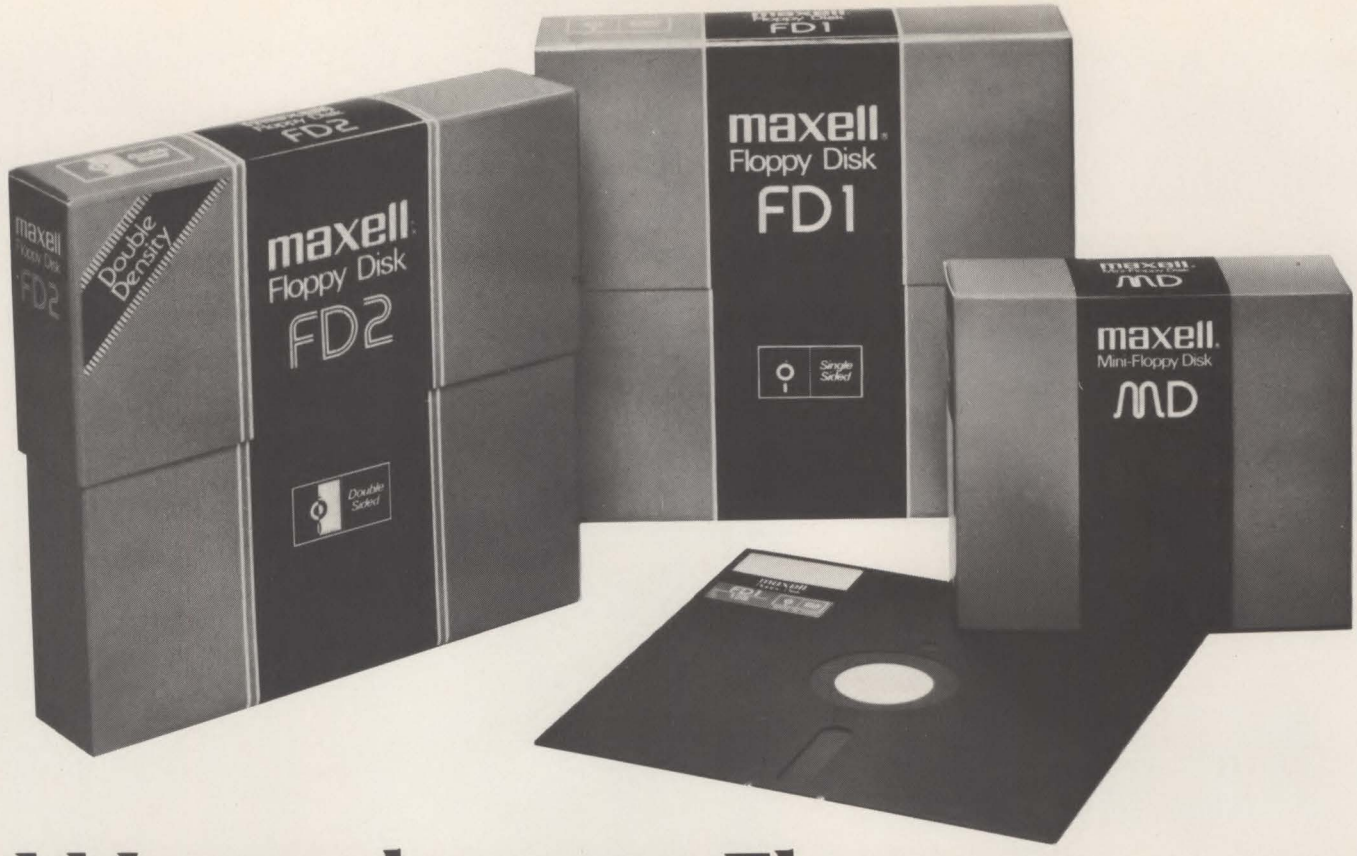

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CIRCLE NO. 29 ON INQUIRY CARD

Key to the acceptance of SCOMP will be Honeywell's ability to demonstrate that it really works as advertised. Indeed, the question of certification has been a major stumbling block in the past to the commercial development of secure computer systems, according to the Defense Department's Walker. As part of its Computer Security Initiative started in 1978, the Defense Department has sponsored research into the development of automatic verification tools for certifying secure systems. That research is continuing in Mitre Corp., Stanford Research Institute and the University of Texas. Apparently, private companies will have to set up similar evaluation programs, or else accept the word of computer manufacturers that their systems are secure.

While Ziller says he's confident SCOMP will work according to specifications, he admits that with present verification tools, there is no way to prove it. He says Honeywell has used verification tools developed by Stanford to certify SCOMP "down to the source code level." No tools are yet available for verifying object code, Ziller says, but he's optimistic such tools will be developed.

—Paul Kinnucan

STUDY FINDS VAST MARKET FOR SMALL BUSINESS COMPUTERS

True or false? About 25 percent of U.S. small businesses now own in-house computers. According to a just-completed study by Focus Research, Inc., the statement is true.

The study on how small companies process data found that about 75 percent of the small businesses surveyed lack computers, indicating a vast untapped small business computer market. The companies surveyed rely instead on a variety of manual systems—bookkeeping machines, service bureaus or a parent corporation's mainframe facilities (Fig. 1).

The 15-month-old research firm's report also determined that most companies that own their own computers cite inventory control as the primary reason, with data processing a close second.

Some of these conclusions surprised the founders of the Hartford, Conn., firm, Gerald C. Chichester, president, and John D. Worthen, executive vice president. "We found that people buy computers to control inventories as a cost justification and also have a high expectation for what the computer can do," notes Chichester.

Unlike most research studies that examine market segments, the 160-page Focus report is based on telephone interviews with top officials of 20,221 companies, each having less than $25 million in sales and fewer than 500 employees. The study's sample was confined to the following: firms with fewer than 25 employees and less than $2 million in sales, which made up 43 percent of those surveyed; companies with 25 to 99 employees and $2 to $5 million in sales, which included 36 percent of the group; companies with 100 to 199 employees and $5 to $10 million in sales, which comprised 12 percent of the sample; and firms having 200 to 499 employees and $10 to $25 million in sales, which made up seven percent of the group. Companies with more than 500 employees accounted for two percent of the sample and were generally excluded from the findings.

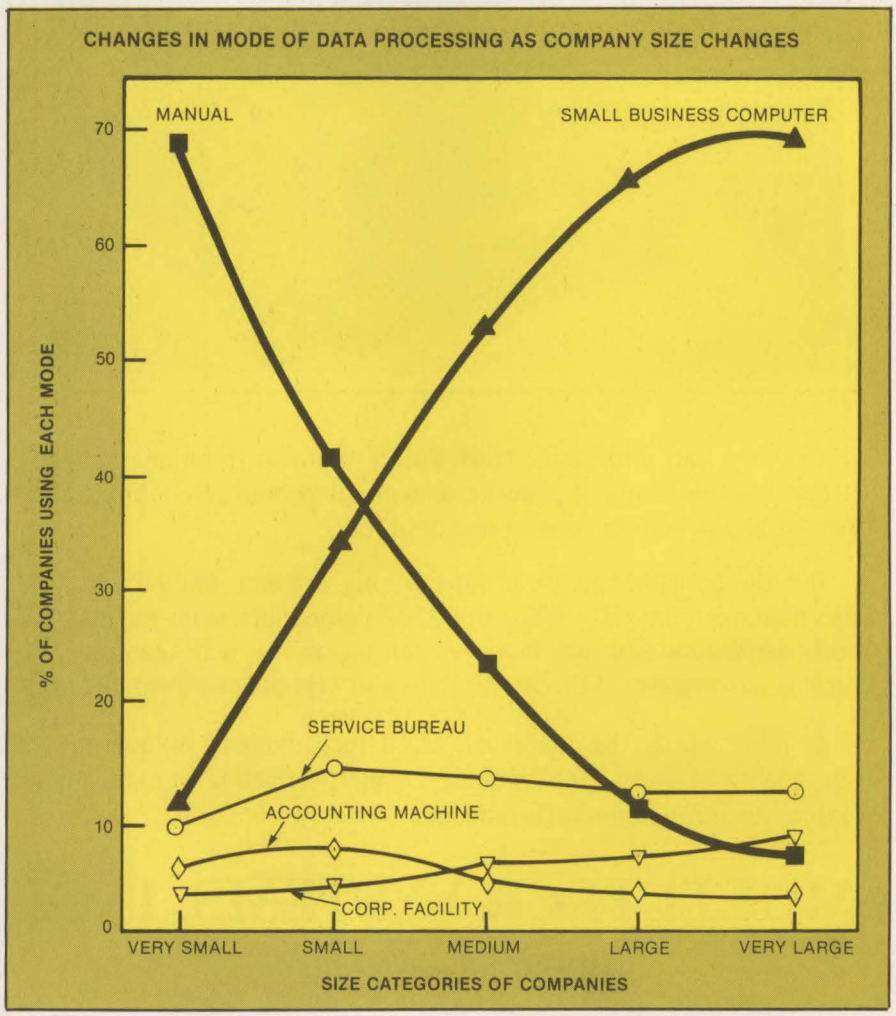

Fig. 1: Manual method *of keeping track of business records is the predominant mode for very small companies, but larger companies turn to small business computers.*

The Focus study does not assess what users are willing to spend for a computer or estimate the size of the small computer market. In fact, the study contains no financial data. Chichester says, however, that this is being considered for a second study.

To learn how small businesses do their data processing, the research firm examined companies in 70 business sectors, including 18 in manufacturing, 16 in wholesale and distribution, 23 in service-related businesses, six in retail and the remainder divided into seven other categories. These firms were located in five geographic regions: southern New England, including Connecticut, Rhode Island and Massachusetts; metropolitan Atlanta; Texas; San Francisco and San Jose; and metropolitan Chicago.

Some finding of the study include:

—Numbers of small businesses with in-house computers are about equal in the regions surveyed. For example, 24 percent of Atlanta's small companies have their own computers, while Chicago and San Francisco have 26 percent penetration.

—Six computer manufacturers control more than 70 percent of the existing small computer market, with IBM holding 38 percent, Burroughs Corp., 11 percent, and Digital Equipment Corp., seven percent.

—Between 10 and 15 percent of all users surveyed rely on service bureaus for their principal method of data processing. This includes batch and on-line services. Focus interpreted this data as evidence that time-sharing/service firms will have a steady market from all sizes of small businesses.

—Word processing is not an important application for small businesses. Of the more than 5200 companies with in-house computers, only 13 identified word-processing applications.

Chichester notes that the study also found that 60 percent of the companies with computers lack in-house programmers. "Most continue to rely on turnkey or near-turnkey systems houses," Chichester says.

The study also determined that a sizable proportion of businesses have considered, but rejected, buying small computers, in the near future. The influencing factors, according to the Focus study, were the companies' sizes and sales revenues. "On the aggregate level, we found that a company's sales volume was the basis for considering a computer, and that cut across all industry segments," remarks Chichester.

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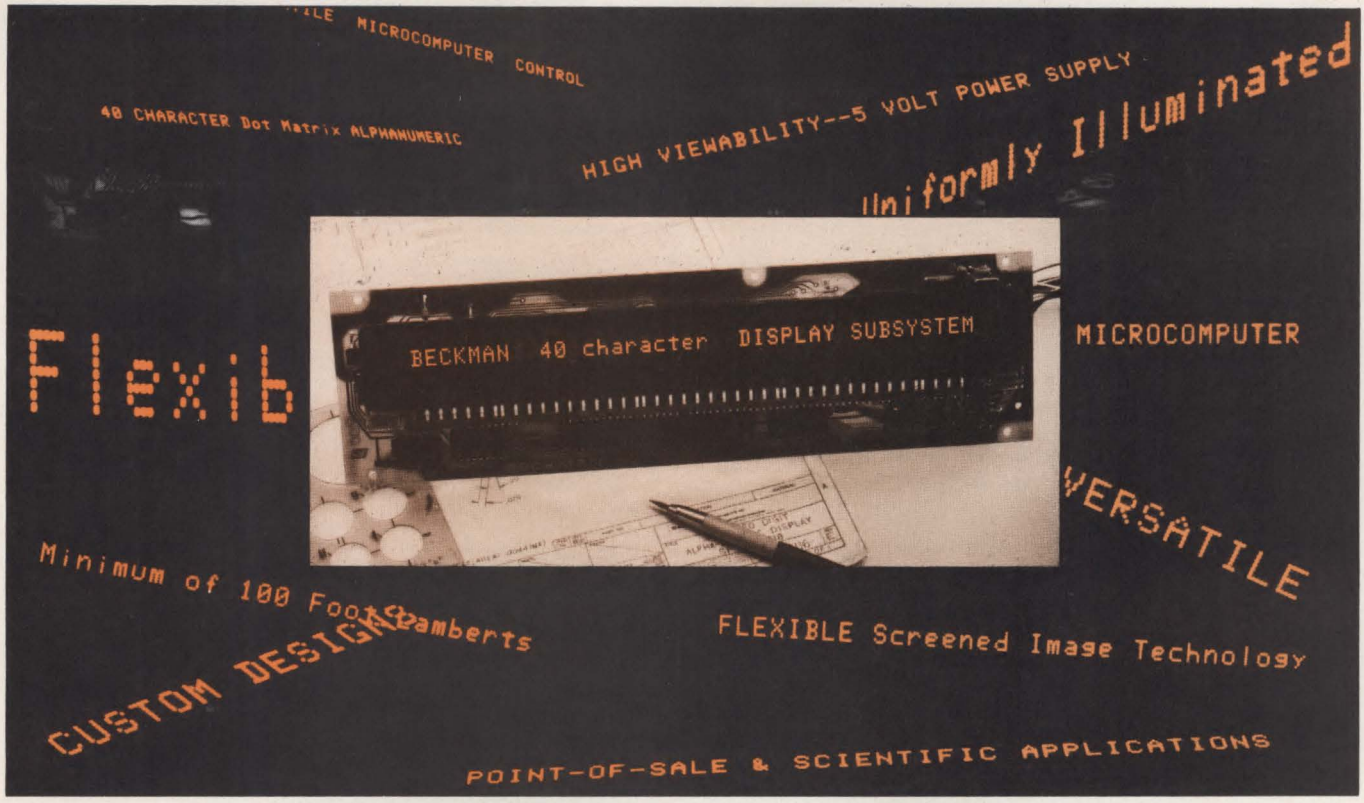

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The SM-810-001 is currently being evaluated by several major users. Obvious applications include: medical/scientific instrumentation, process control and point-of-sale. More importantly, the almost limitless flexibility of the Screened Image concept makes it possible to adapt this display system to your system . . . without the usual, high engineering design and development charges.

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BECKMAN

CIRCLE NO. 31 ON INQUIRY CARD

Yet, the study also found that fewer businesses with computers were contained in certain sectors surveyed, regardless of company size or revenue. Small lumber companies and wood-products manufacturers, for example, have the fewest computers, while small firms building nonelectrical machines have more computer experience because they have operating systems on their premises.

The Focus study, which took nearly a year to complete, began when a client of the company requested the names of 5000 small computer sites in the U.S. The study quickly expanded, and the research

ACQUISITION PLANS FOR SMALL BUSINESS COMPUTERS — BY INDUSTRY (BUSINESSES NOT PRESENTLY USING A SMALL BUSINESS COMPUTER)

	% WITHIN 12 MONTHS DEFINITE	% WITHIN 12 MONTHS POSSIBLE	% TOTAL	% FUTURE CONSIDERATION	% NO PLANS	TOTAL*
AGRICULTURE	4.3	2.9	7.2	20.0	72.9	100%
MINING & CONSTRUCTION	4.0	4.3	8.3	14.9	76.7	100%
MANUFACTURING — PROCESS	3.7	4.6	8.3	16.7	75.0	100%
MANUFACTURING — DISCRETE	4.3	6.4	10.7	20.2	69.2	100%
TRANSPORTATION, COMMUNICATION & UTILITIES	4.3	5.6	9.9	13.8	76.3	100%
WHOLESALE — DURABLES	4.1	4.8	8.9	18.7	72.4	100%
WHOLESALE — NONDURABLES	3.6	4.1	7.7	16.9	75.4	100%
RETAIL	3.3	3.5	6.8	14.3	78.9	100%
FINANCE	2.9	6.2	9.1	14.8	76.2	100%
SERVICES & GOVERNMENT	2.8	3.8	6.6	16.0	77.5	100%

**MAY NOT ADD TO 100% DUE TO ROUNDING*

Fig. 2: Nearly 75 percent *of the companies without in-house computers claim they have no purchase plans, although some plan to buy later.*

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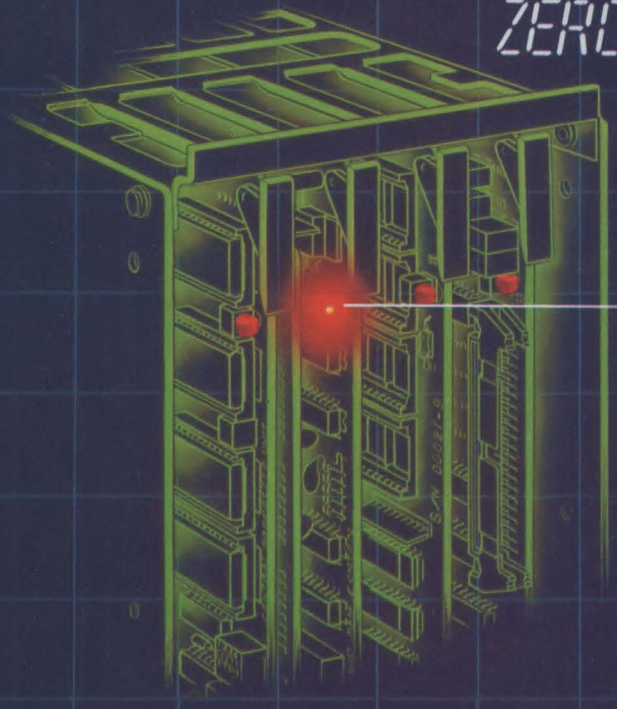
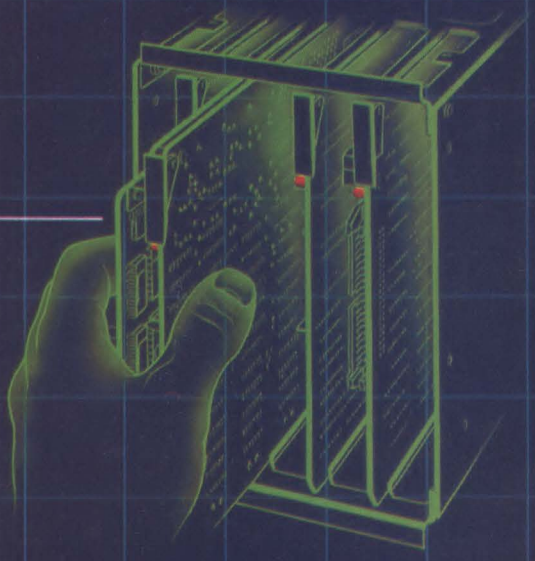
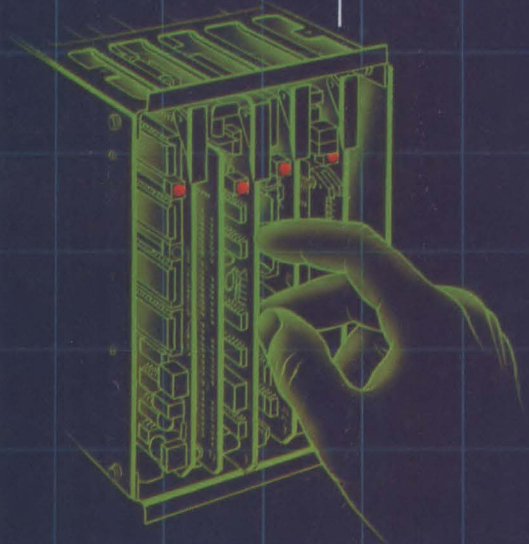


ISOLITE CIRCUIT AUTOMATICALLY TESTS EACH BOARD IN SCOUT SYSTEM.

RED LIGHT SHOWS BOARD BEING TESTED. IF LIGHT GOES OFF, BOARD IS GOOD. IF LIGHT STAYS ON, BOARD IS BAD.

USER REPLACES BAD BOARD WITH SPARE 6.25" X 8.3" CARD IN 3 MINUTES. NO TECHNICAL PERSON OR OEM SERVICE ENGINEER REQUIRED TO MAKE REPLACEMENT. MAINTENANCE COSTS DRASTICALLY REDUCED.





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CIRCLE NO. 34 ON INQUIRY CARD

firm began to document how small businesses accomplish their data processing. The report, which costs $495, also correlates vendor equipment with applications, details levels of programming expertise in businesses surveyed and examines user migration from vendor to vendor. **—Ronald Rosenberg**

NET/ONE INTENDED FOR OFFICE OF THE FUTURE

Widespread implementation of the recently announced Net/One local-area message-handling system could be a major factor in solving interface compatibility problems that face office equipment vendors in the huge "office-of-the-future" market. And it promises to provide in-house data communications network designers with a vendor-independent alternative to local systems offered by long-haul carriers, such as AT&T, Telenet and Xerox Corp.

Net/One, the first product from Ungermann-Bass, Inc., Santa Clara, Calif., is the brainchild of Zilog, Inc., cofounder Ralph Ungermann and Charlie Bass, former head of Zilog's systems division in Cupertino, Calif. The system is aimed at sites planning to use Xerox Corp.'s Ethernet local system (MMS, February, p. 53) or the network unveiled last year by Datapoint.

The office- or building-wide network comprises a series of Z80A-based communications nodes, explains Bass, each equipped with as many as 20 RS232 serial ports for interfacing both intelligent and nonintelligent office equipment, word processors and in-house computer systems. Like Ethernet and the Datapoint concept, the nodes are interconnected via passive high-speed, serial coaxial cable links.

But there the similarities end, Bass says. "Systems intelligence resides in each node, not in the equipment attached to the nodes, as is the case with Ethernet." As a result, users can ship raw data from one location to another and be sure it arrives in compatible form, even though two incompatible pieces of hardware may be involved. "In the case of intelligent devices, users can add addressing," Bass says. "Nodes within the system will packetize and de-packetize the data as required."

Data can also be moved out of the local environment, he goes on. Each node will offer parallel I/O capability for connection to M/F processors and minicomputers. "As in the case of equipment attached to serial ports, Net/One can handle a number of different communications protocols and formats when transmission is to a host processor," he points out, adding, "The nodes handle all error detection and correction, message retransmission and other overhead chores."

Net/One can also be linked to specialized common carrier networks, such as those proposed by AT&T, Telenet and to Xerox' Xten system. "Not only are we set up to handle all vendors selling the office-of-the-future market at the applications end," Bass maintains, "but we're setting ourselves up as a complement to these long-haul networks." Bass would not, however, label Net/One "an Ethernet-compatible system," preferring instead to call it "an Ethernet-like system."

Ungermann-Bass, Inc., plans to offer Net/One off-the-shelf to sophisticated Fortune 500 end users and has no plans to get into the turnkey systems business with its new package. "Net/One just plugs in once coaxial links have been strung through the office or building," Bass says. Ungermann-Bass also plans to offer Net/One to the OEM marketplace and potentially to designers of process-control and military systems.

Future plans call for the use of unspecified 16-bit microprocessors, a move made necessary by the performance demands placed on the Z80A. "We've pushed 8-bit technology to the limit," Bass says, "even though the processors within each node have been off-loaded as much as possible to keep the number of interrupts down."

Net/One will cost around $1000 per port, with delivery to Beta test sites scheduled for next quarter. **—John Trifari**

ICL GETS A SECOND CHANCE IN SMALL SYSTEM MARKET

The lucrative U.S. market for small business computers lures many European manufacturers, who typically do not understand how it works. Many show a naive notion of technology and marketing, and fail on their initial market attack. Some, like England's International Computers, Ltd., get a second chance.

From the start, ICL had a jump on many of its European counterparts, because it was able to buy its way into the American market in 1976 by acquiring marketing and manufacturing rights to Singer Business Machines products. ICL enhanced the memory and speed of the Singer processors and added applications software. The result: It sold 1200 System Ten model 220s worldwide last year. A retail version was marketed to several large users, including Sears, Roebuck & Co.

But, saddled with a disorganized American marketing force, and a modest product by U.S. standards, ICL managed to carve out only a minimal market presence—0.02 percent of the small computers sold here, according to Dataquest. But lately it appears to have made two significant remedial steps to become more competitive and stand out in the crowd of vendors.

One step was to reorganize its U.S. forces by establishing three new divisions and hiring an experienced marketing and sales force. A company spokesman estimates that 30 percent of the marketing staff consists of ex-Singer personnel.

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GT-400	
ENGINEERING HIGHLIGHTS	
• Z-80 microprocessor	• Modular firmware
• Block/character mode	• Function keys (8 std./24 option)
OPTIONAL FEATURES	• Modem cable/ modem printer cable
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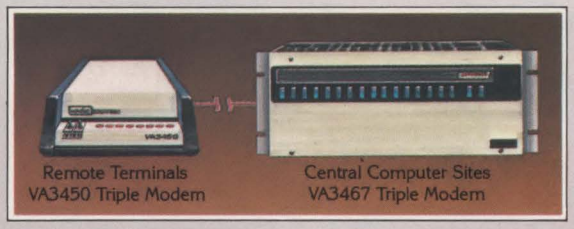

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CIRCLE NO. 36 ON INQUIRY CARD

A second step was introducing the model 320—an upgraded System Ten machine priced between $35,000 and $100,000, depending on configuration. That product will be manufactured at the former Singer plant in Utica, N.Y.

Aimed at the growing market for stand-alone processing systems in small- and medium-sized companies, the 320 is software-compatible with earlier System Ten models, but adds a new feature: 60K bytes of semiconductor memory, expandable to 200K, replacing the ferrite core on existing models. ICL also has added peripherals and plans to introduce a COBOL compiler later this year.

The System Ten 320, *incorporating 60K bytes of semiconductor memory, expandable to 200K bytes, represents ICL's first effort to compete in the U.S. small business computer market.*

The system, which competes against the IBM System/34 and 38 and Univac BC/7, company officials say, will be sold by about 40 dealers nationwide. ICL also established its own nationwide service organization for the 320. In overlapping regions, ICL's organization effectively will replace TRW, which had held the service contracts for 220 users.

"Our overall product-development plan is to create a sequence of upward-compatible computer systems behind the model 320, all using basically the same software and designed to provide an economic

growth path for the user," ICL, Inc., president Richard Bright explains.

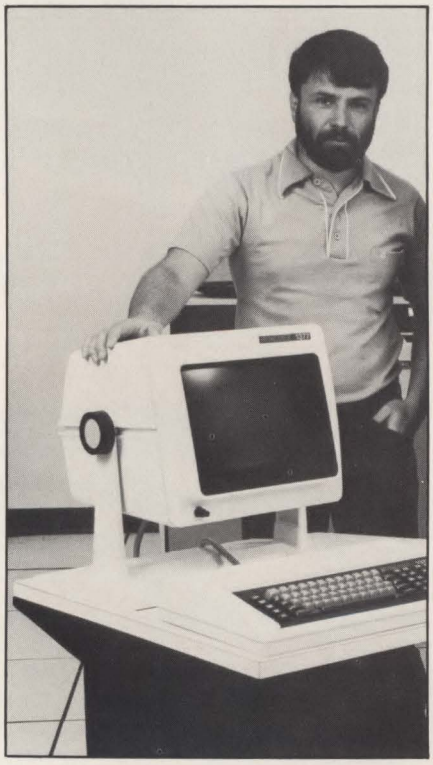
Despite its small market share, ICL's ambitions are to ship 150 units its first year, according to a spokesman from ICL's newly formed Distributive Systems Division in Irving, Texas. It also plans to ship 35 to 40 units of its model 320 retail spinoff, called the 310, which is scheduled for introduction in May. The 310 offers an upgrade path for one-third of ICL's current installed base.

It remains to be seen whether ICL succeeds; not every foreign manufacturer gets a second chance.

—Lori Valigra

IPL SYSTEMS IS HERE TO STAY

Last year's introduction of the IBM 4300 temporarily dried up the market for plug-compatible mainframes (PCMs). But the 4300's long delivery times coupled with recent 5 to 7 percent price increases have caused a PCM resurgence. One manufacturer that survived, IPL Systems, Inc., Waltham, Mass., is gearing up its European marketing efforts.



IPL Systems, Inc. *president Stephen J. Ippolito shows IPL 480/3 model introduced last spring as a response to the IBM 4300 series. The model is said to provide faster instruction execution than the IBM 4341 and offer twice the memory capacity.*

"The concept of the IBM-compatible mainframe is as valid today as ever, but it needs stability," says company president Stephen J. Ippolito. To enhance its market posture, the seven-year-old company recently entered into a five-year nonexclusive agreement with Olivetti Computers of Rome, a wholly owned subsidiary of Olivetti Corp.

The agreement, which exceeds $5

Our Wildest Card Yet

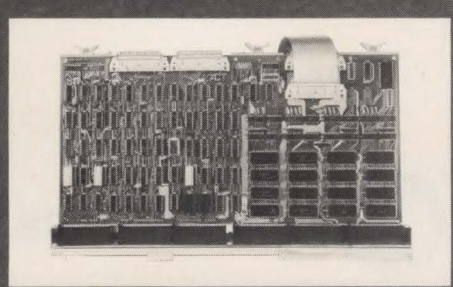
A programmable 16-line multiplexer that beats everything in its class*

PDP-11 users, we have another winner for you. This time it's DMAX/16™, our new programmable multiplexer for connecting your PDP-11 to 16 asynchronous serial communications lines. DMAX/16 makes the most of the 11's DMA capabilities to establish computer overhead at a level far below that of competitive units like the DJ11 and DZ11. It also offers software compatibility with the DH11... in one-fourth the space!

Now, for the first time, you don't need an expansion box or special back planes. DMAX/16 consists of two hex boards which install easily into standard SPC slots and connect to the current loop or EIA/RS-232 panel by separate flat-ribbon cable. As many as 16 units can be placed on a single PDP-11 for a total of up to 256 lines. A DMUX/16™ option allows modem control for 16 channels.

DMAX/16 provides complete program control of the lines, each of which operates with several individually programmable parameters, such as character length and number of stop bits. Parity generation and detection are odd, even or none. The operating mode is half duplex or full duplex. Fifteen software programmable baud rates: 0 to 9600 baud – plus 19,200 baud – and an external baud rate. Breaks may be generated or detected on each line and the unit can echo received characters without software intervention.

Play the wild card now. You'll get top performance and a competitive price advantage of at least $1000 along with immediate response to your order. Write for details and find out why we consider ourselves the leader among manufacturers of DEC enhancements. Able Computer, 1751 Langley Avenue, Irvine, California 92714. (714) 979-7030. TWX 910-595-1729



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You will save half your bandwidth or run at twice the speed! Able does it again!

CIRCLE NO. 39 ON INQUIRY CARD

If you're an OEM or system builder, no doubt you've been subjected to the 8-inch Winchester hustle.

Well, Century Data thinks it's time to rack up the facts and lay them on the table.

First off, the 14-inch Winchester is rebounding. Just as predicted. And Century's new Marksman disk is the perfect example.

Sure 8-inch drives will be available some day. But can you afford to wait?

Today, the need for more storage and less cost is forcing many companies to go Winchester. And we think your best shot is our Marksman drive.

Marksman is the no-risk disk with enormous expandability and optional built-in intelligence. It's also one you can get today.

Built-in intelligence means you won't get behind your competition by spending months designing, testing and debugging your own disk controller. We've already done most of the work. You're up and running in days, not months.

Built-in growth means you won't have to start over when your applications increase. Marksman comes in 10, 20, and 40 MB models, and a lot more to come soon.

For more flexibility, Century offers everything from a 2½ MB Diablo cartridge disk to the 600 MB removable-pack Trident — with lots of mixed and fixed storage in between.

So if you can't afford to get behind, call Century Data, a Xerox Company specializing in mass storage for over 11 years. Our early delivery will put you ahead. Our advanced technology will keep you there.

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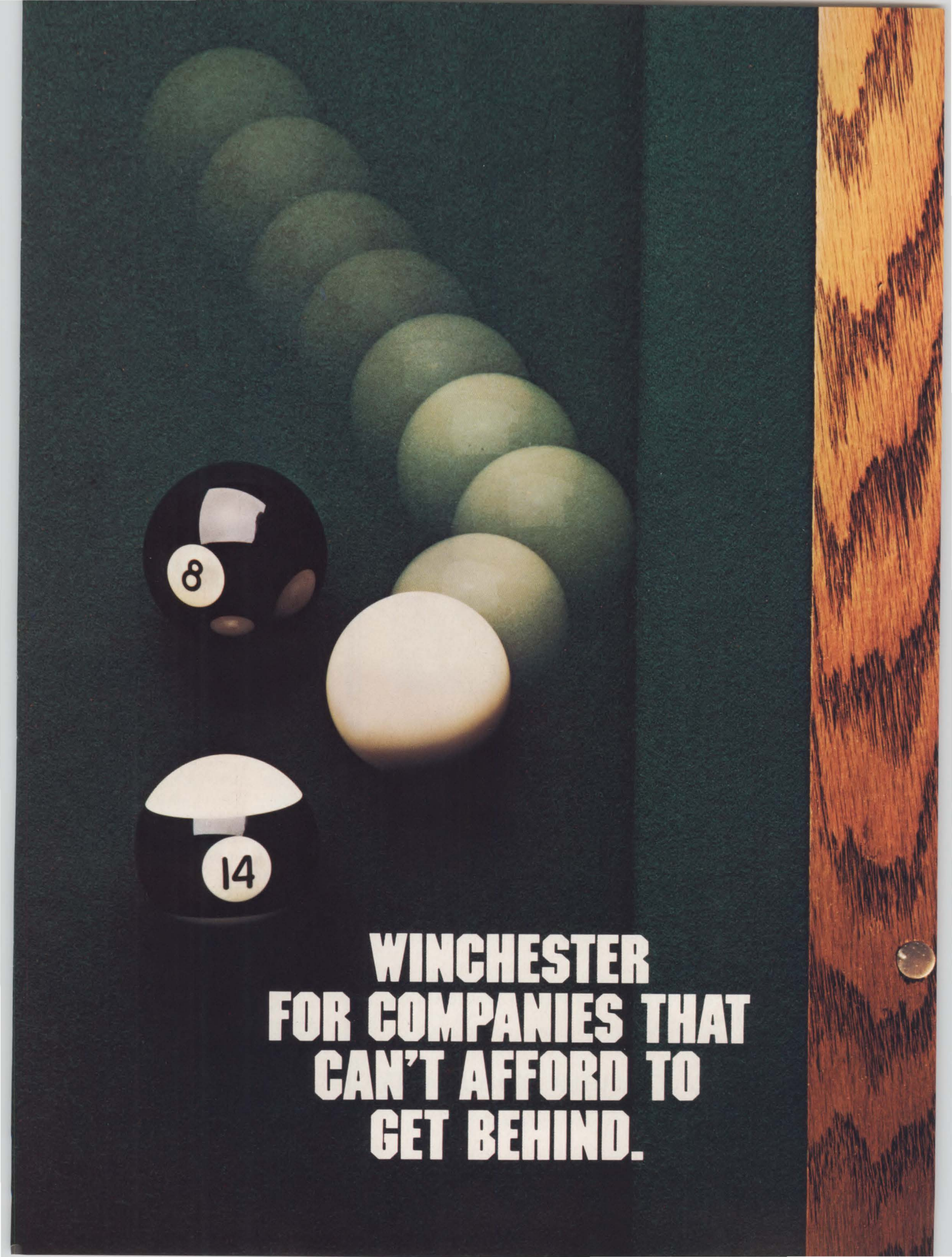
CIRCLE NO. 40 ON INQUIRY CARD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14
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FOR COMPANIES THAT
CAN'T AFFORD TO
GET BEHIND.

million in initial purchase volume, according to Ippolito, "immediately doubles the potential PCM market we can address."

Olivetti will market and service IPL's 480 series, intended as replacements for medium-scale IBM 370, 303X and 4300 products. IPL will continue to manufacture the 480 series in Waltham, Mass., while Control Data Corp. will maintain U.S. and Canadian marketing.

IPL is trying to prove itself financially and technologically able to weather the once-shaky PCM market. Despite that market's decline during the first half of 1979 following the 4300 announcement, IPL was able to increase its annual revenues by about 20 percent to more than $12 million by year's end. The company, which has been profitable since it began volume shipments in June, 1977, was able to increase its staff from 80 to 150 in 1978. It has no bank debt, and uses it profits to support R & D.

Last spring, IPL responded to the 4300 introduction with its Model 480/3, said to provide faster instruction execution than the IBM 4341 and have twice the memory capacity.

In addition to enhanced performance, the 480/3 also has shorter delivery schedules in its favor. In contrast, delivery delays as long as three years plagued IBM's 4300, says Ippolito. "Customers delayed purchase decisions until they could assess IBM's announcement and determine delivery dates," he explains. "Our market improved dramatically around mid-year, when IBM announced its 4300 delivery schedules." The company sold half its total installed base of 130 systems during last year alone.

IPL's R & D efforts have also paid off. "We can react to what IBM announces, which affects how our machine survived," Ippolito says, adding, "We can keep pace with IBM's microcode tricks, and we're the only company able to keep up. We're a small company and can move fast."

Shipments of the IPL system to Olivetti began last December. Olivetti will begin to market the system in Italy, and later extend into Spain and the U.K.

—Lori Valigra

DOT-MATRIX LINE PRINTERS SECURING A NICHE

Dot-matrix line printers, hybrid products that combine the speed of line printers with the printing flexibility of dot matrix technology, are carving a small but secure niche for themselves in the medium-speed (300-600 lpm) printer market—a market now dominated by band

308 DATA ANALYZER

Easily acquire the data you need.

1. Select parallel state, parallel timing, serial, or signature operation. Simply press the appropriate key.

2. Choose synchronous or asynchronous sampling. Use the clock of the system under test or the 308's own internal clock. In either case, sampling rates up to 20 MHz are possible.

3. Enter the word you want to use as a trigger to acquire data. Other keys let you select an external trigger and trigger delay.

4. Press "start" and you're done. Now, you can view the acquired data in the format you want. Or, store the data in the reference memory by pressing the "store" key. Other function keys allow you to acquire new data and compare it with the reference memory.

In each data acquisition mode, all measurement parameters are displayed for your convenience.

Minimum keystroking with the new 308 Data Analyzer from Tektronix.

Of course, the 308 Data Analyzer can do a lot more than we've shown here. For example, there's a self-test routine at power-up, plus seven diagnostics, to ensure accurate results. And the 308 weighs only 8 pounds (3.6 kg), for easy portability.

For the full story, contact your local Tektronix Field Office, or write us.

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printers. Although dot-matrix line printers cost as much as band printers (between $2500 and $3500) and have poorer print quality, they are edging out band printers in applications where graphics, oversized characters or foreign characters are necessary. Even band-printer makers admit there is no substitute for the dot-matrix line printer in such applications.

Although dot-matrix line printers have been sold since 1975, users have been slow to accept the technology. In fact, only three companies—Printronix Inc., Tally Corp. and Okidata Corp.—manufacture dot-matrix line printers. Officials at all three attribute user reluctance to IBM Corp.'s acceptance of band printer technology. "IBM has set a precedent for using fully formed characters with high-speed printers," says Robert Nichols, product manager for Tally's dot-matrix line printer. However, he points out that his company's printer uses a 7 × 8 dot matrix, which produces a denser dot pattern than does the 5 × 7 matrix used by most matrix printers. "The dots tend to overlap so that it comes close to fully formed characters," he says. Nichols also notes that band printers slow down when they use upper- and lower-case character bands or print more than 64 characters per line. This happens because band printers must access characters sequentially and scan mechanically.

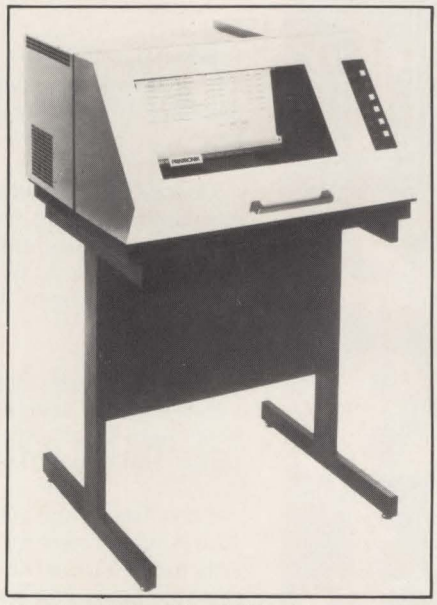


Fig. 1. Printronix's P300 *dot matrix line printer.*

Dot-matrix line printers, on the other hand, print a row of dots at a time by moving the paper to form characters. Mel Posen, senior vice president at Printronix, says that the dot matrix is controlled electronically. "Our printer stores 160 characters, such as upper and lower case or Japanese characters," Posen adds.

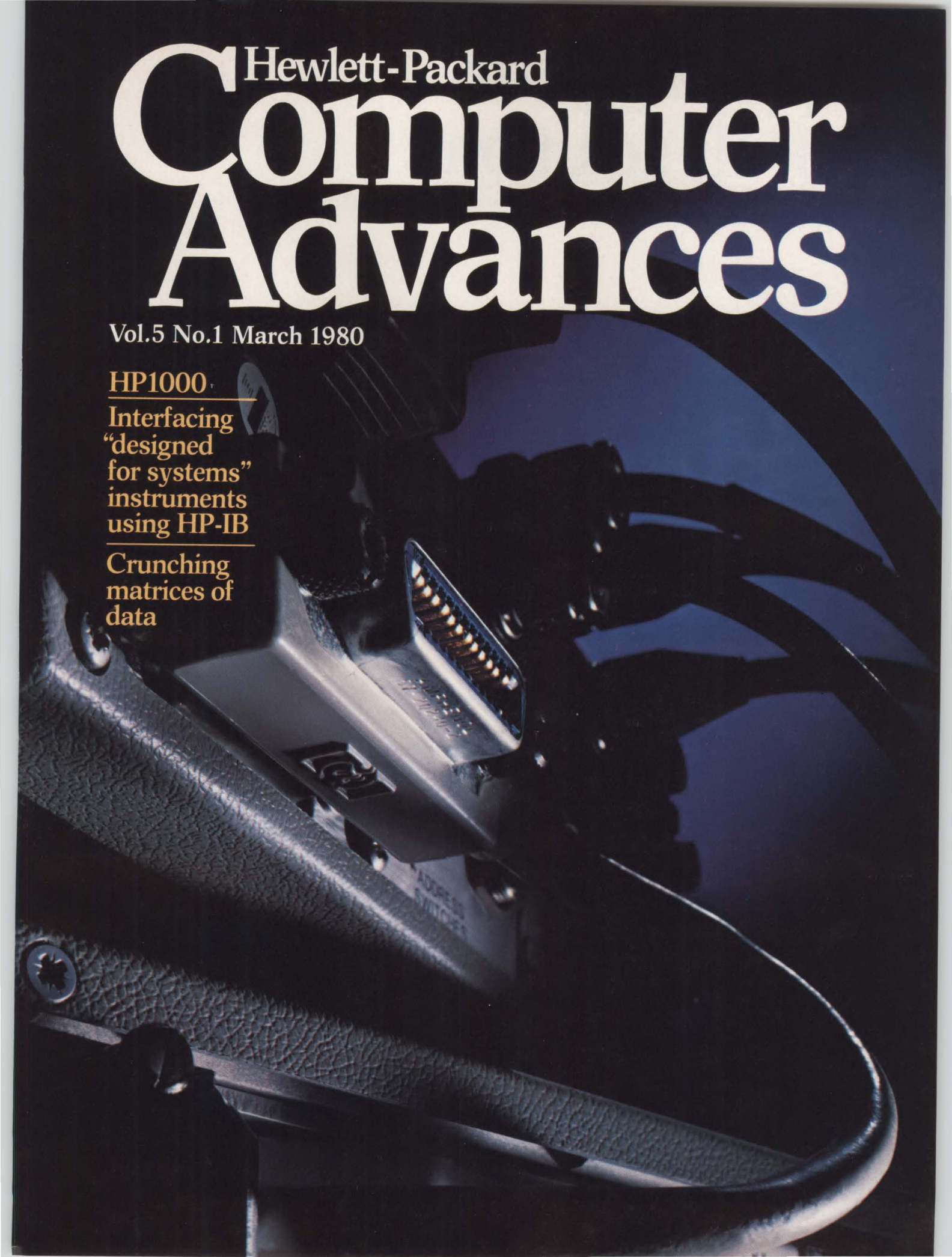
Hewlett-Packard Computer Advances

Vol.5 No.1 March 1980

HP1000

Interfacing "designed for systems" instruments using HP-IB

Crunching matrices of data



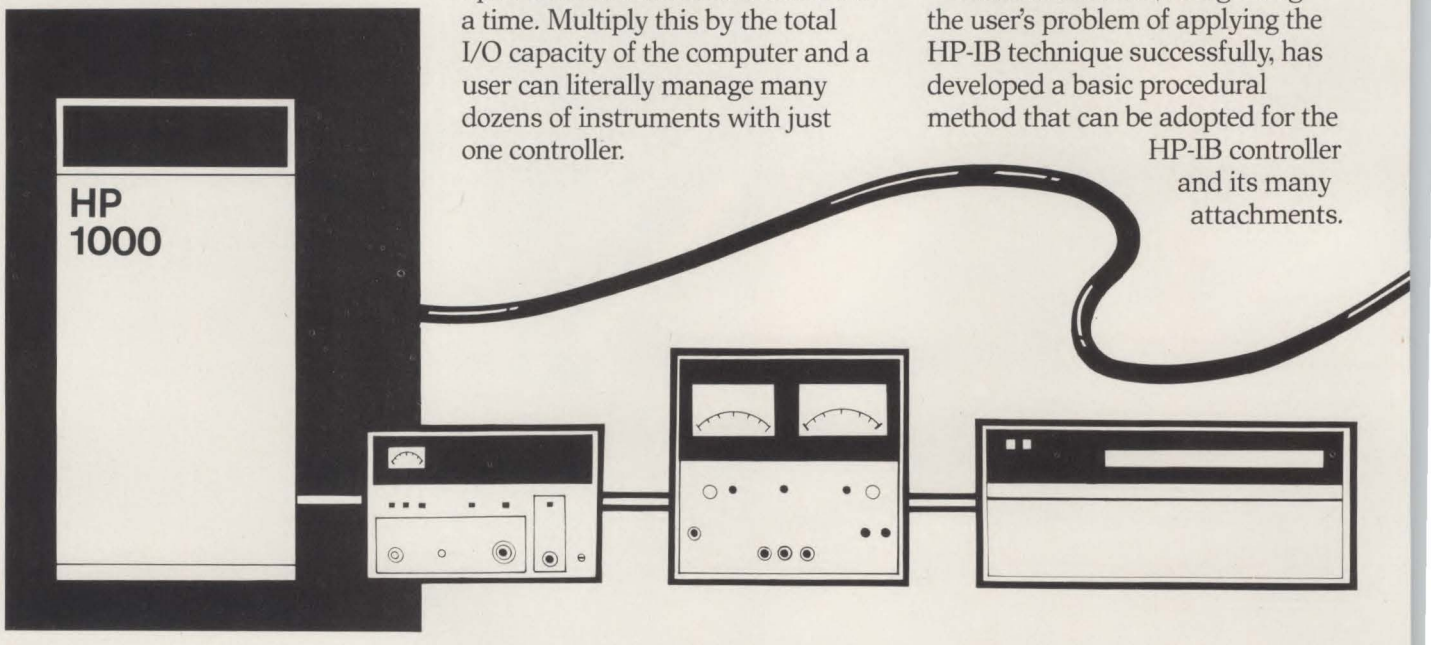
Applying your HP-IB solutions.

Having purchased an IEEE-488-compatible instrument or device is only the first step toward solving your data acquisition and control problem.

The trend is clear! More and more people are beginning to reap the advantages of multi-functional "smart" instruments (those containing microprocessors) to monitor, analyze, and control vital manufacturing and laboratory operations.

And by linking many of these instruments and devices together with a Hewlett-Packard Interface Bus (HP-IB—HP's trend-setting implementation of the IEEE-488-1978 bus standard), users can now obtain more results, faster, and with a greater accuracy than ever dreamed of just a decade ago.

Whether the user has an HP1000 computer system or one of the HP9800-Series desktop computers, only one I/O interface card and driver is required to operate up to 14 instruments and devices at a time. Multiply this by the total I/O capacity of the computer and a user can literally manage many dozens of instruments with just one controller.



HP-IB controller and its many attachments.

◀ *Cover*
A view of an instrument to computer connection using Hewlett-Packard's Interface Bus (HP-IB). Up to 14 instruments can be connected to one computer interface card.

In the past, without HP-IB, a user would have to connect each instrument to a separate I/O card and software driver in order to operate from a computer.

If many instruments were required, the user would usually have to buy another computer. This, however, presented the problem of coordinating the results of two or more instrument-controlling computers—a dilemma that not only reduces speed but increases the chance of error.

Putting it all together

Because today's multi-disciplined engineer has the capability of programming so many instruments at the same time using one computer, the complexity of putting together such a system goes up almost exponentially.

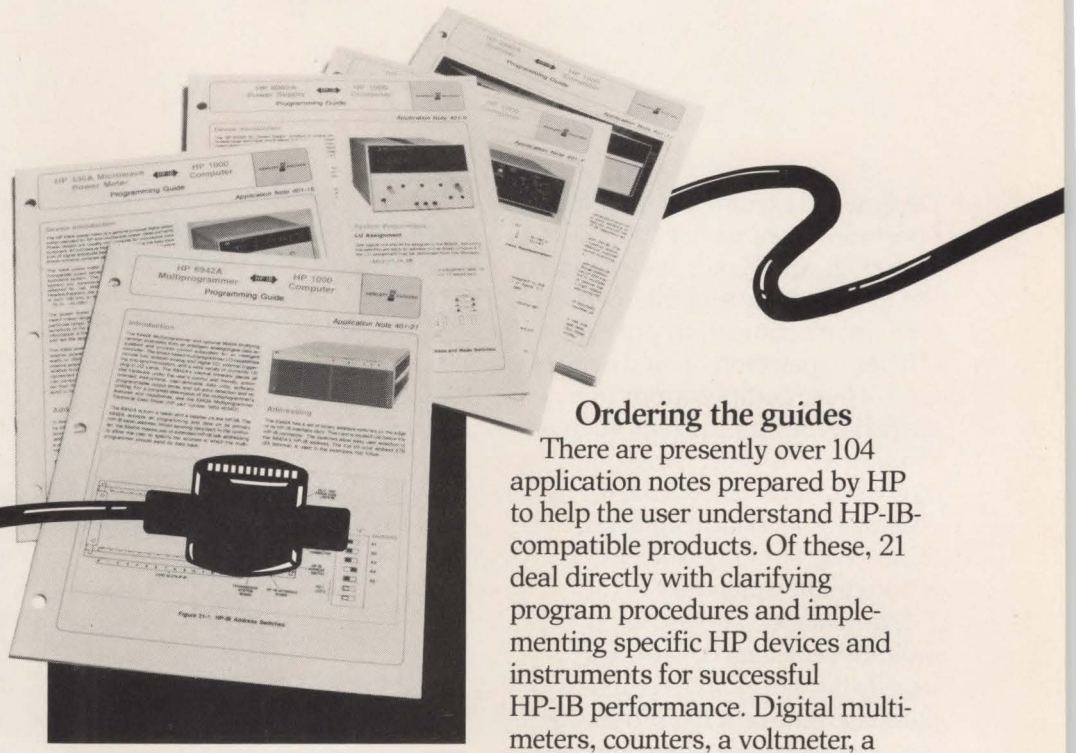
Hewlett-Packard, recognizing the user's problem of applying the HP-IB technique successfully, has developed a basic procedural method that can be adopted for the

To assist the user in building an effective HP1000-controlled HP-IB system based on this procedural method, Hewlett-Packard has begun publishing a series of Programming Guides in the form of Application Notes. As such, these Notes, which number twenty-one to date, highlight the special capabilities of both the controller and the device or instrument slated for system integration.

Hewlett Packard

By following the careful procedures that are detailed in these guides, the user can effectively translate the thousands of hours of HP applications-based experience into an optimized solution to a particular problem.

With the consequent savings in time, energy, and cost, the extra reading is certainly well worth the effort!



Catching the right bus

The world of the interface bus is a dynamically changing one. Not only are more instruments and devices being marketed by HP and other companies continually, but the need to configure greater numbers of them into the system, sometimes over long distances, adds to the complexity of managing the system network.

With such a growing investment in hardware, software, and firmware, it's important to know that you're getting more than just IEEE-488 compatibility. Using HP-IB means transforming a theoretical concept into a working reality.

At present, there are 119 different HP-IB compatible instruments, devices, and computers available from Hewlett-Packard (over 500 products using the IEEE-488 concept are now being marketed by more than 150 manufacturers). In addition, HP offers a bus system analyzer to diagnose software and hardware problems by examining the status of all bus lines, and accessory modules to connect limited or non-HP-IB instrumentation to the network.

DESIGNED FOR HP-IB SYSTEMS

HP-IB: Not just a standard but a decade of experience

HP-IB is much more than just HP's implementation of IEEE Standard 488. It reaches beyond IEEE-488 to cover the operational area as well as the mechanical, electrical, and functional specifications. For example, HP-IB systems incorporate a built-in, high level I/O language that saves you the time and expense of writing instrument software drivers and configuring operating systems. It means powerful interfacing through a system in which a lot of work has been done for you.

Ordering the guides

There are presently over 104 application notes prepared by HP to help the user understand HP-IB-compatible products. Of these, 21 deal directly with clarifying program procedures and implementing specific HP devices and instruments for successful HP-IB performance. Digital multimeters, counters, a voltmeter, a spectrum analyzer, a power supply, a digital clock, and a function generator are among the many devices described.

In Application Note 401-1, configuration procedures are outlined in checklist fashion. Example application programs and utility subroutines are written to clarify concepts, give programming hints, and minimize the task of repeatedly writing the same software over and over again. Other subjects covered in detail include I/O performance, system performance and overhead calculations, processing of very fast input, and optimization of measurement sequences. AN 401-1 serves as a general introduction, with the remaining Programming Guides dealing with the individual products themselves.

Circle A on the reader reply card to receive AN 401-1; for general information on HP1000 systems, 9800-Series desktops, or HP-IB, check B, C, or D, respectively.

The Matrix Machine

Designed to expand the computational powers of the HP1000 Model 45, the Vector Instruction Set (VIS) consists of microcoded CPU instructions that provide efficient operation on matrices of data. These computations are essential for applications such as structural analysis, three-dimensional graphics, image processing, statistical analysis, linear programming, and electronic circuit simulation.

Manipulation of these large multi-dimensional data arrays usually requires that a company purchase time on a mainframe, or buy an expensive 32-bit computer.

With VIS, the Model 45 can be called the *matrix machine*—the fastest small computer solution to many matrix operations today.

How it works

In most small computers, operations on large arrays of data are executed in FORTRAN DO loops, where each pair of numbers *(scalars)* is fetched from memory and combined according to a specific instruction (ADD, SUBTRACT, etc.).

The process is repeated for as many additional pairs of numbers as are needed to complete the operation. With this method, the overhead required to locate the matrix elements can easily account for 90% of the matrix computation time.

The Vector Instruction Set greatly reduces this overhead by acting directly on entire data arrays *(vectors)*. While two scalars are being operated on, the CPU fetches the next pair from memory. This process can reduce matrix computation time by as much as a factor of ten.

A mainframe capability

Working with large matrices efficiently requires access to blocks of data larger than normally addressable in a small computer. For example, a 400 x 400 matrix requires 640,000 bytes of main memory, a size most small computers cannot handle.

However, the HP Extended Memory Area (EMA) feature of the HP1000 system allows a program to access up to 2 million bytes of memory resident data without special segmentation schemes.

The chart on this page shows that the HP1000 Model 45 with VIS and EMA can invert a 400 x 400 matrix in just 11½ minutes. That's mainframe performance—at a fraction of the cost. This model, with EMA and VIS, is priced as low as $46,000.* For OEM and dedicated applications, the F-Series processor is available stand-alone starting at $11,750.*

To learn more about matrix operations on the HP1000 F-Series, check E on the reply card.

*U. S. A. domestic prices only

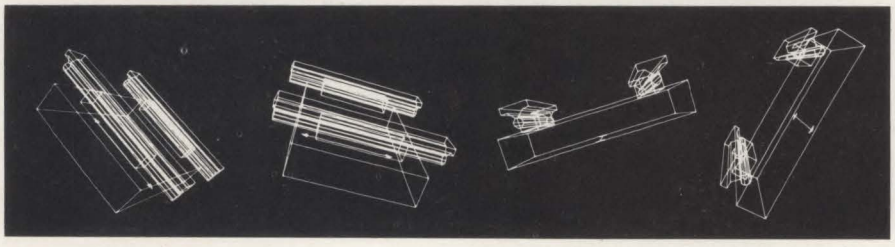
MAINFRAME CAPABILITY IN THE HP1000 COMPUTER

Very large matrices can exceed the addressing capabilities of a small computer; the machine either cannot perform the application or must resort to disc segmentation schemes, significantly reducing performance.

The HP1000 with EMA and VIS overcomes this limitation on small machines at a fraction of the cost of a large mainframe. We ran a matrix comparison text between the HP1000 Model 45 and one of the fastest 32-bit computers on the market. Here are the results:

MATRIX INVERSION

Matrix Size	HP1000 Model 45	32-bit computer
50x50	1.8 sec	1.5 sec
100x100	12.3 sec	11.7 sec
200x200	105.0 sec	92.0 sec
400x400	690.0 sec	720.0 sec



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"Few people grasp the difference between dot-matrix and band-type line printers," says Joseph Romasco, marketing vice president at Okidata. However, he expects the market to expand significantly in the next year as more users discover the advantages of dot-matrix line printers. Andrew Roman, a market analyst who follows the printer market, agrees that "the blending of matrix technology with line technology has great potential." He attributes this to the versatility of the technology, which can produce multiple fonts, high-resolution graphics at greater than 200 dots per linear inch, as well as color graphics. For example, he points to a Printronix spin-off, Trilog, Inc., which combines the basic Printronix line printer with a control board and multicolor ribbons to produce color graphics.

While 15,000 dot matrix units were sold in 1979, Roman expects that number to double during 1980. He claims that OEMs are beginning to notice dot-matrix line printers and he believes that several more companies will introduce dot-matrix-based line printers next year. "Most OEMs, system houses and end users are not yet aware of the benefits," he says.

An end user that has discovered the dot-matrix line printer is Hughes Aircraft Co., which uses 14 Printronix printers in the factory to generate vertical bar codes for production control and oversized characters for product identification. "For us, the advantage of the dot-matrix line printer is versatility," says Norton Gillespie, an industrial engineer at Hughes. "We use a bar code reader to get progress reports on parts throughout the factory," he says. Hughes also uses the printers to do plots and graphs. "The plotting isn't as good as with vector graphics, but it makes a fair representation, which is fine for the factory floor," Gillespie says.

While Gillespie lauds the lack of alignment problems with dot-matrix printers, he finds them more difficult than band printers to maintain. "The dot hammers catch a lot of abuse because of the number of hits they have to make," he says. However, he points out that the hammers are easy to replace.

D & O Leasing Co., a distributor of drum, band and dot-matrix line printers, prefers to sell the dot-matrix kind. "We sell band printers only because we can't get sufficient deliveries of dot-matrix line printers," says DeWayne Stark,

Fig. 2. Tally's T300 *prints at 300 lpm.*

president of D & O Leasing. Stark says that his company prefers the dot-matrix type because of its flexibility. "A line printer can't do fancy graphics," he says, adding that his lease customers need the graphics capability.

For example, one customer wanted a dot-matrix line printer so that it could put a picture of its product on shipping labels for easy identification. Another customer used a band printer for two years until the government required them to submit performance charts with their reports. "At first they thought they would have to hire a graphic artist," says Stark, "but with the dot-matrix line printer, they were able to write a program to intermix graphics with print."

Fig. 3. Okidata's Slimline *series prints from 125 to 300 lpm.*

D & O Leasing also supplied dot-matrix line printers to a hospital that had been using a reducing photocopy machine to reduce an oversized printed page from a band printer. When the hospital acquired dot-matrix line printers, the same job could be done with reduced print size and a regular copy machine without the reducing feature. "This saved the hospital $1400 a month in copy machine rental fees," Stark says.

He admits that there are a lot of skeptics about dot-matrix technology. "People want fully formed characters and they don't believe that dot matrix is reliable. I was a skeptic, too," he says. But now he believes dot-matrix printers are easier to maintain and more reliable than band printers. "We service them. I know what it costs to service and to buy spare parts. The dot matrix is not a mechanical nightmare. It has four to five times fewer moving parts than the band printer," Stark says. He also maintains that forms handling is better with dot-matrix line printers. "It moves paper as it prints so that there is less chance of paper jamming than with band printers."

Spectrum Medical Systems, Inc., a $25 million-a-year Data General Corp. OEM, sells Okidata dot-matrix line printers with its Eclipse 350-based system. Spectrum Medical's field engineering manager, Mark Miller, says his company uses the Okidata printer because it is stable, reliable and less noisy than

Mini-Micro World

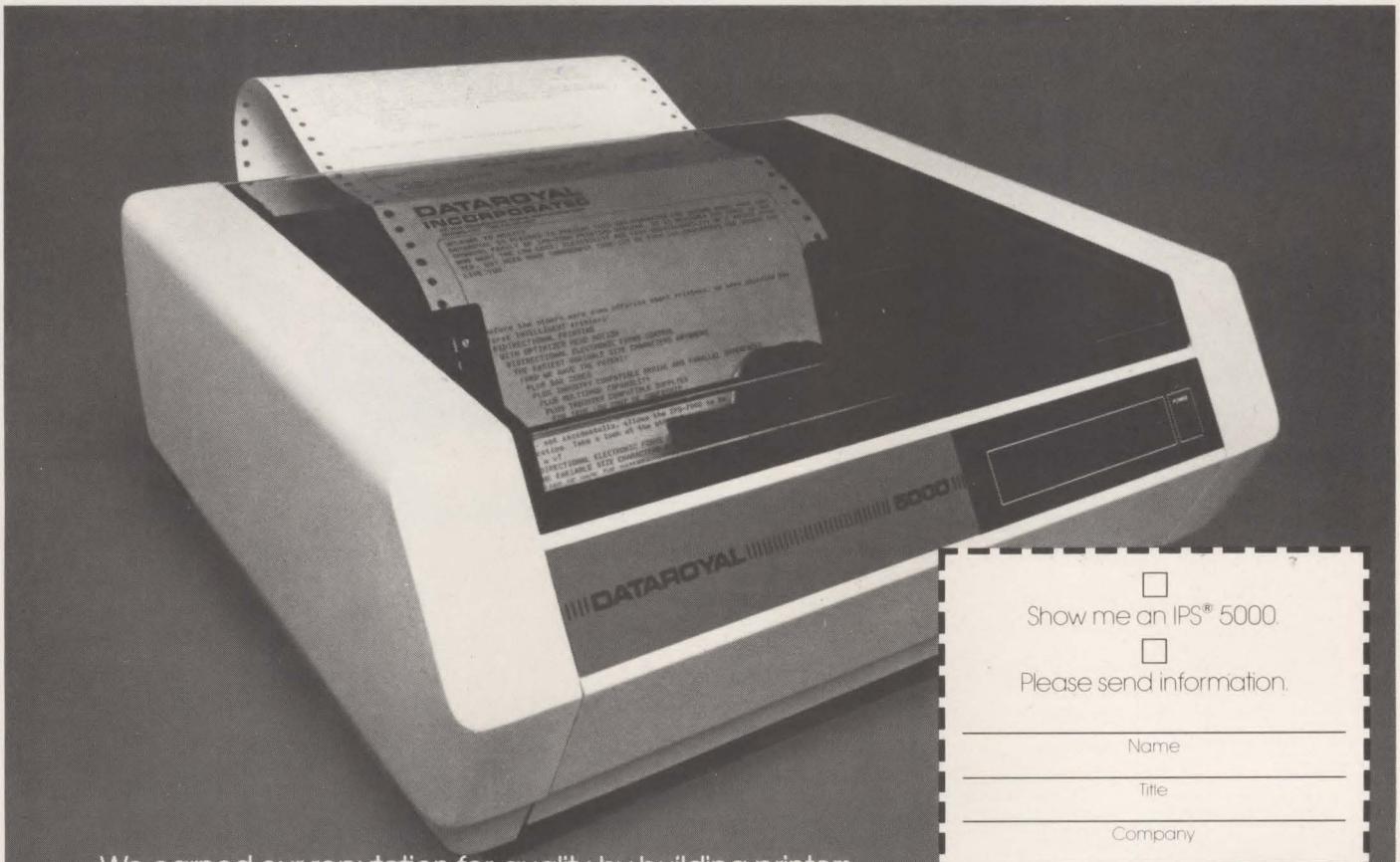
band printers. Spectrum Medical sold some 1000 printers with its system last year. Miller says that less than 20 percent of the systems printer problems could be attributed to mechanical failures. Although most of Spectrum Medical's customers don't need graphics, they do use the expanded and half-sized characters.

Band printer manufacturers are naturally skeptical about the dot-matrix line printer. "A dot-matrix printer operating at 600 lpm will prove less reliable than a comparable band printer," says Dennis King, group manager of product management at Dataproducts Corp.'s line printer division. He concedes that dot-matrix line printers do have some appeal because of the graphics and font flexibility. However, because the prices of dot-matrix line printers and band printers are so close, he claims that dot-matrix line printers will lose ground. "The dot-matrix line printer market first came into being because of its price advantage over drum printers," he says, noting that dot-matrix printers were 40-50 percent cheaper than drum printers. "Now, band has replaced drum."

George Rea, Centronics Data Computer Corp's marketing vice president, views the dot-matrix line printer market as "a niche between serial printers and fully formed band printers." Although he admits that dot-matrix line printer manufacturers will grab some market share from band printer makers, he believes the share won't be very large. "We can provide more speed with a serial matrix printer for half the price of a dot-matrix line printer," he says. But once users are ready to upgrade, he contends that they will turn to a fully formed character line printer. "It's tough to go against the trend that IBM started with band printers," he says.

—Judith Hurwitz

NOW, GET WHAT YOU DON'T PAY FOR.



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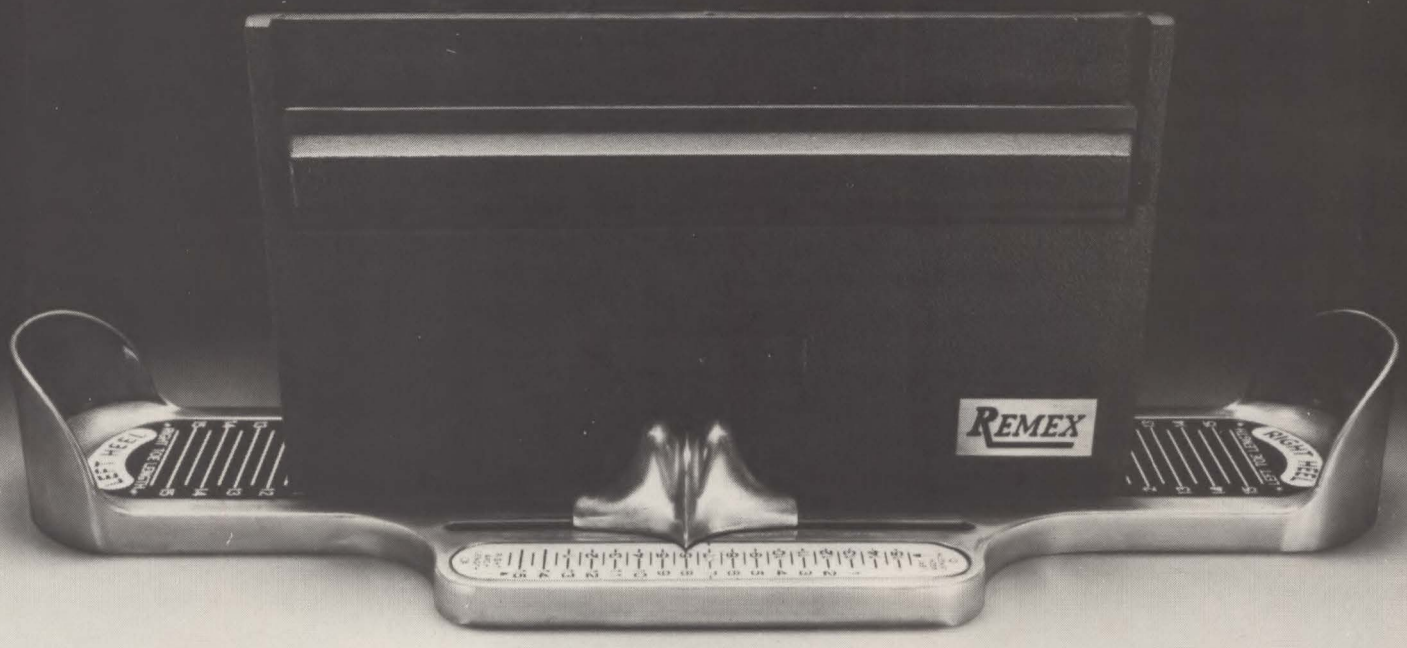

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PEOPLE

NBI'S CARL CARMAN: SEEKING NEW CHALLENGES

Company executives change jobs for a variety of reasons. For Carl Carman, one motive was a desire for new challenges. "I enjoy the challenge of maturing a new industry," says the former Data General Corp. engineering vice president, who recently moved to a similar position at NBI, Inc., a word-processing systems manufacturer based in Boulder, Colo.

The move to NBI had other attractions for Carman, who was recruited by NBI president Thomas Kavanagh, an old friend and a former Storage Technology Corp. executive. For one, there was the opportunity to return to Colorado, where, before joining Data General, he had worked as assistant to the president of Storage Technology. Also, Carman would be returning to the stimulating shirt-sleeves atmosphere of a small company—an atmosphere that he had come to miss at Data General. Perhaps most importantly, NBI dangled an irresistible financial lure—an opportunity to buy a substantial block of shares in one of the hottest companies in the burgeoning office automation market, and to do so at a bargain price.

The 43-year-old Carman evidently thrives on challenges. At Data General, he helped to transform a bare-bones processor company into a full-line systems manufacturer in less than five years. At NBI, he faces a similar task: to build a broad product line that will enable the $13.2 million-a-year company to attain its goal of becoming "a major independent supplier of word-processing systems."

At Data General, Carman played a key role in its metamorphosis into a vertically integrated systems manufacturer. He was recruited from Storage Technology, a leading manufacturer of IBM-compatible tape and disk drives, specifically for his expertise in peripherals.

Carman's contribution to DG's vertical integration drive is now evident. When he joined DG in 1973, the company was essentially a processor manufacturer—most peripherals sold with its systems were being supplied by outside manufacturers. When Carman left DG last fall, the reverse was true. He is particularly proud of the success of DG's CRT terminal and disk drive line, both developed under his aegis. The Dasher terminal series, he claims, has captured "by far and away the majority of terminals attached to DG machines." The DG disk line—the broadest in type (cartridge, Winchester and pack) and storage capacities (5M to 300M bytes) in the minicomputer industry—has been similarly successful, acquiring about 85 percent of the add-on market, according to Carman.

Carman joins NBI at a pivotal point in its history. Founded in 1973 by two former Storage Technology executives, Kavanagh and James May, among others, the privately held company began to grow rapidly two years ago, doubling its sales in 1978 and again last year. To gain capital to maintain this high growth rate, NBI went public for the first time last December, with an initial stock offering of 600,000 shares.

As an incentive to join NBI, Carman was allowed to buy 12,000 shares at $4.85 per share shortly before it went public. As this issue went to press, NBI stock was selling at about $38 a share—a sevenfold paper gain for Carman, although he is restricted from selling the shares for two years.

NBI estimates its word-processing system market share at five percent—an impressive slice for a small company that competes against IBM, Wang, Xerox, Lanier Business Products and other companies with substantially greater financial and marketing clout. The company markets a single product, the System 3000, which is aimed at large text-processing

Carman regards himself *as a systems man who understands both hardware and software.*

Mini-Micro World

applications, such as the preparation of engineering manuals, scientific papers and legal documents. The system is sophisticated—and expensive at $13,900 to $20,000. Moreover, it's basically a single-user system, although it supports a second work station. Carman sees the System 3000 as ultimately becoming the basis for a network of systems linked by high-speed data communications lines.

Carman's immediate goal, however, is to broaden the price and performance range of NBI's product line. "This will make NBI eligible for selection by a wider range of customers," Carman says. The company's biggest customer is the federal government, which accounts for 34 percent of NBI's installed base. Carman plans to expand the NBI product line both downward and upward, adding less expensive systems at the bottom end and more powerful systems at the top. For example, the company reportedly intends to introduce a hard-disk-based multiterminal system in April.

The soft-spoken Carman considers himself "a systems man who understands both hardware and software," a versatility needed at NBI, where he expects to be more involved with software than he was at Data General. "The value added here is primarily in software," Carman notes.

In building an engineering organization at NBI, Carman plans to emphasize a multidisciplinary team approach instead of having separate software and hardware groups as at Data General. Carman believes that such an approach is more productive because it avoids the conflicts that typically arise when hardware and software teams operate independently. "Conflict resolution is always nonproductive," notes Carman.

—Paul Kinnucan

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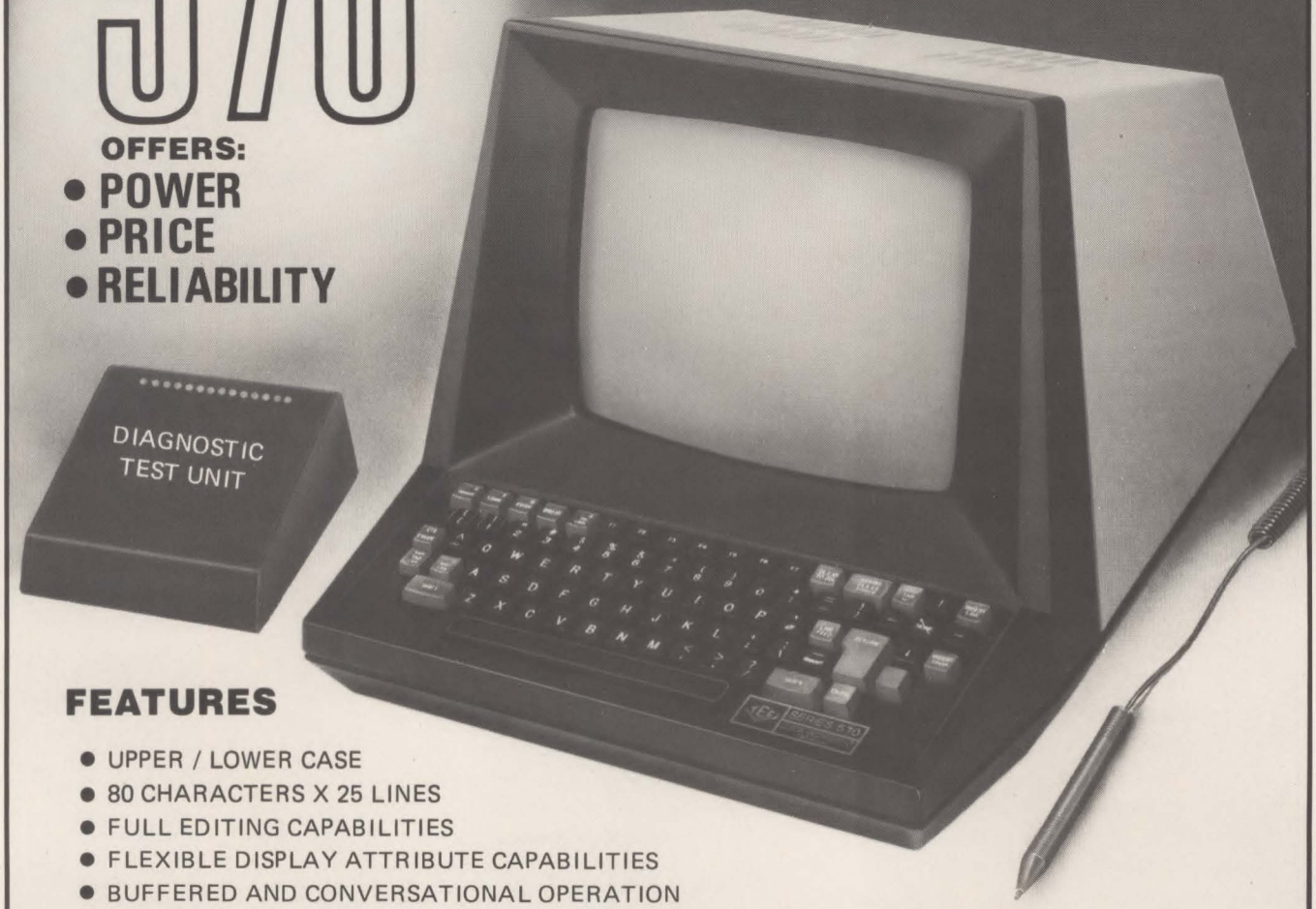

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PRODUCT FOCUS

DECNET'S PHASE III EXPANDS COMMUNICATIONS CAPABILITIES

Large end users, notably banks, insurance companies, government agencies and broad-based scientific research laboratories, are looking to tie their minicomputers and peripherals together to form data communications networks. They want computers to talk to each other as well as to tie into a mainframe over the fewest possible telephone lines.

Many computer vendors are trying to meet these needs by offering computer-to-computer communications tied to X.25 packet-switching systems, such as Telenet and Tymnet public packet networks. One exception is Digital Equipment Corp., which spurned X.25 until recently, but now admits to plans to introduce a product later this year.

Instead, DEC is focusing on expanding DECnet, its once-troubled networking software, with a series of new capabilities: multidrop lines permitting six to eight remote or slave systems to communicate over a single line, message routing through intermediate nodes and centralized or distributed network management. They are part of DECnet Phase III and are available under RSX-11M-Plus, RSX-11M and RSX-11S real-time operating systems.

Within the next 24 months, other DEC operating systems will use Phase III capabilities, which are part of DEC's underlying strategy to sell more hardware. Now each network can expand from the current average of four to five nodes (computers) to 20 to 30 nodes—a fivefold increase. In the last four years, DEC has installed about 2000 nodes among 500 customers.

Phase III will appeal to existing users seeking to expand beyond the point-to-point communications offered under Phase II two years ago. Multidrop capabilities, for example, reduce the need for dedicated lines but require polling overhead. DEC claims that each Phase III node requires about 12K words of memory. Still, users with nodes in various parts of the country will save on tariff costs because of more efficient use of fewer lines. DEC expects commercial and savings banks with automatic teller terminals, for example, to be among the users of the multipoint communications.

Another feature of Phase III is the ability to send messages from one network node to another through intermediate nodes. Each node maintains a routing table for the entire network. Where more than one path exists between the source of the data and destination nodes, the network automatically chooses the least-expensive path, according to line values assigned by the network manager. This capability is designed to increase network reliability and reduce data-communication costs. Moreover, it is transparent to the user, notes Stephan Johnson, DECnet product manager. "The software chooses the least costly path through the network, and also provides alternative routes if the line is interrupted," he says.

Network management under Phase III allows monitoring of all nodes for communication loads, error rates, line conditions and status of all points in the network.

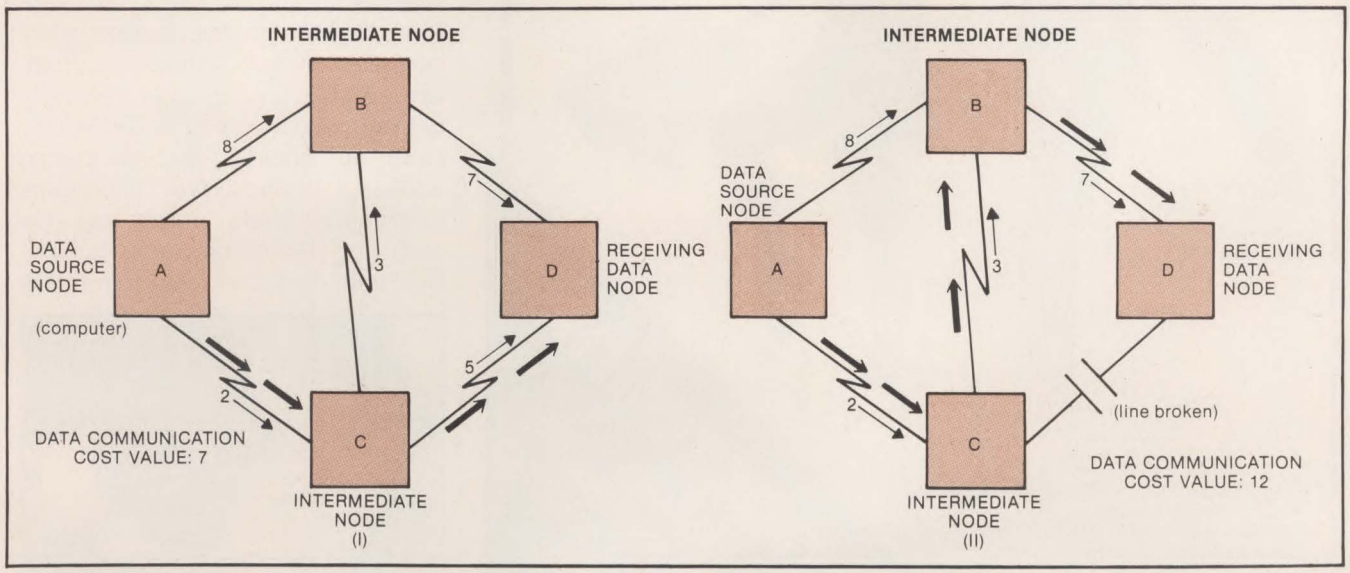

Figure 1. DECnet Phase III *uses adaptive path routing to find the least expensive communications path between the data source computer and the receiving data node A, and to find an alternate route when the main line between these points is interrupted. In diagram I, the most cost-effective path between nodes A and D is through C. If the communication line between nodes C and D is broken, as in diagram II, the message from A would go to node C, then to node B and finally to the receiving data node D. However more expensive this alternate route is, DEC officials say users would rather pay more than lose time (and money) waiting for the line to be repaired.*

In addition, terminal users at one node can perform standard terminal functions on any other node using the same software, such as any RSX-11 system.

License fees for the initial DECnet releases are $5000 for DECnet-11M-Plus, $3500 for DECnet-11M and $1500 for DECnet-11S. Deliveries of the new software have begun, according to a DEC spokesman.

The company also has introduced an SNA emulator, which enables RSX-11M users to directly access an IBM 370 mainframe that supports an SNA network. Known as the RSX-11M/SNA protocol emulator, a DEC user can perform transaction processing and data base management within an SNA hierarchy using 16K to 24K bytes of resident memory. A software license costs $7000.

To the IBM mainframe, a PDP-11 system appears as a programmable cluster controller that can maintain as many as 61 concurrent, interactive, logical connections or "sessions" across four synchronous lines with one or more programs in the SNA host machine.

—Ronald Rosenberg

TOUCH TERMINAL PUTS DATA AT USER'S FINGERTIPS

Businessmen, students and even children who want data "at their fingertips" may get their wish this year in the form of a touch input system that enables users to display data simply by touching a location on a CRT screen. The system comes from Carroll Manufacturing Co., a Champaign, Ill., engineering venture now in the startup phase.

The Carroll Touch Input system, developed partially with technology licensed from the University of Illinois, incorporates a scanning infrared-beam design that CMC president Art Carroll says is superior to other touch technologies. "Systems using surface-wave acoustics—sonar—require a high degree of calibration and generally demand the use of a stylus rather than a finger," he maintains, adding, "Conductive membrane techniques, while simple and low cost, are susceptible to contamination and oxidation, and require a

Art Carroll demonstrates *touch-input system, which is mounted behind bezel of Datamedia terminal at right.*

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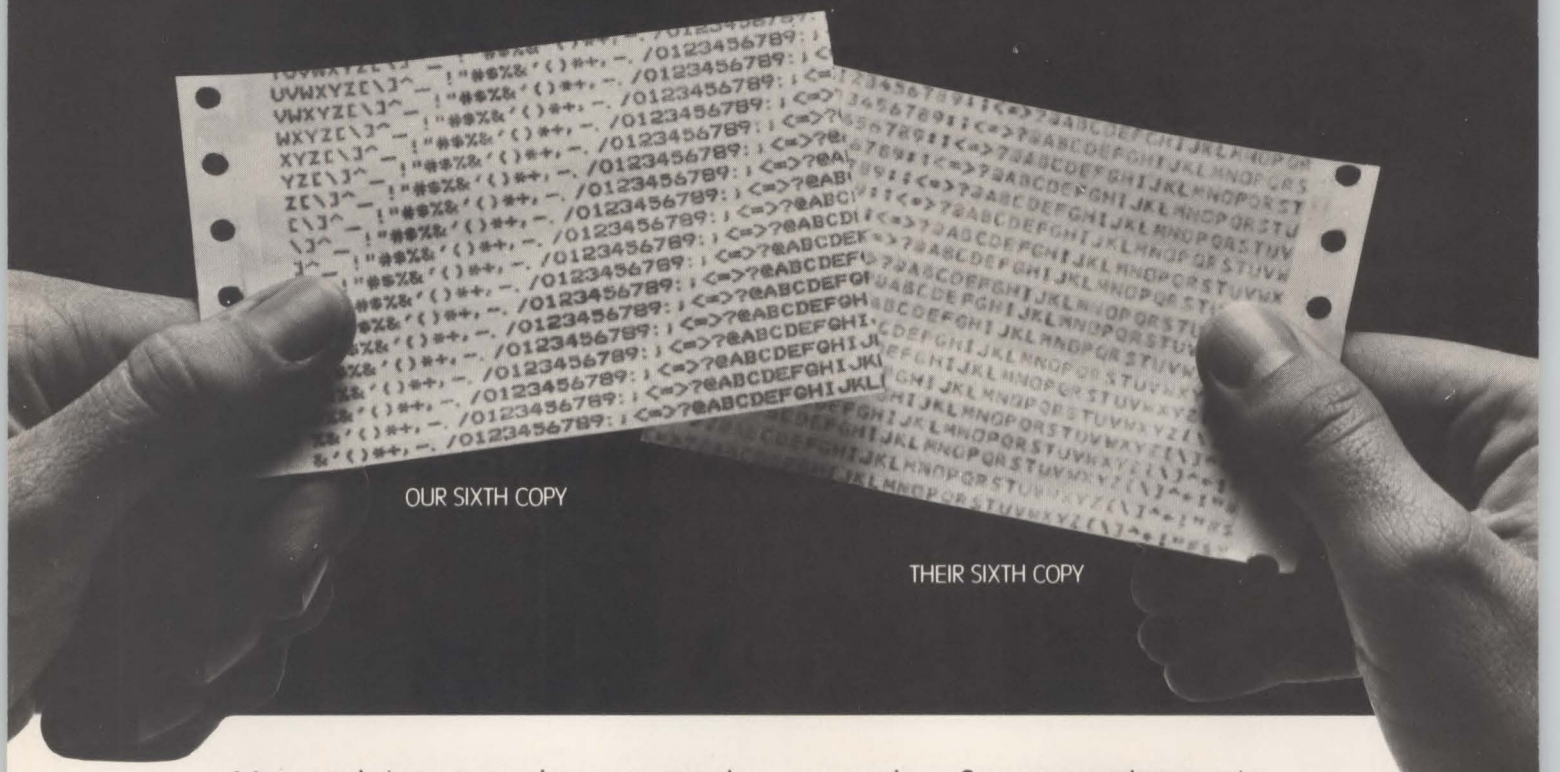

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CIRCLE NO. 53 ON INQUIRY CARD

wire matrix between the viewer and the terminal screen."

The new system overcomes these limitations, however, Carroll notes. "Infrared LED emitters are mounted on the left side and bottom of a 'window frame' surrounding the CRT display," he explains. "On the opposite sides are a complementary array of emitter detectors."

The result is a grid of light beams forming hundreds of X-Y coordinates—or "touch points"—whose locations are transmitted to the system's host electronics. This grid is mounted behind the front bezel of a video terminal. The viewing area is then scanned sequentially by pulsing the LEDs along each axis and detecting the point at which the beam has been broken by a viewer's fingertip.

CMC builds LED frames, and uses full intelligent CRTs, such as those supplied by Datamedia, and modifies them in house. Typically, such a CRT would be programmed with a set of "function areas" analogous to its function keys. Thus, by touching a specific area, a user requests a menu of available programs, and by touching the area around a program, he can pull the required data. If his finger strays and he loses his place, he can hit a "clear" on the screen and start again.

Who will use the system? Carroll feels that the device could interest casual and first-time computer users. "At the top of the list are people who don't know how to type effectively," he notes. This category could include students, businessmen and children. Other potential users include those to whom a keyboard is an impediment—a foreman on a factory floor wearing work gloves or a surgeon in an operating room, for example. And those who haven't the time to type—air traffic controllers, for example—could also use the system.

Touch systems based on University of Illinois technology and marketed by Control Data Corp. are being used for some educational applications under the University's Plato trademark, Carroll says. But his version, based on patented concepts in conjunction with the University of Illinois license, will be the first offered on an OEM basis.

The product has already generated some interest. "We've done touch-point development work for a number of small business system suppliers," Carroll says, "and we're working to build up our volume." The company plans to ship almost 2000 units of various types this year, at a price that will put a $1000 premium on the cost of a video terminal. Says Carroll, "Our goal is to build volume, so that the price will come down to the $200 range. This is the first production year for touch terminals; next year the market should take off."—**John Trifari**

CUTTING COBOL DOWN TO MICROCOMPUTER SIZE

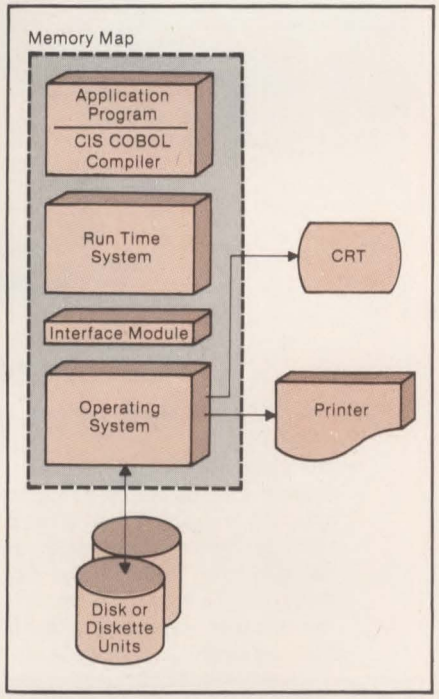
Shrinking computer hardware to microprocessor dimensions remains a technological phenomenon. But squeezing high-level language compilers into 64K bytes of memory or less has precluded using COBOL, a memory-hungry language, in microcomputers. Instead, BASIC has become the predominant high-level business language—one which doesn't have the worldwide recognition, the acceptance of ANSI standards or as powerful a data structure as does COBOL.

But now a British-based company, Micro Focus, Ltd., has "downsized" COBOL for 8- and 16-bit microcomputers requiring as little as 32K bytes of resident memory for a compiler. By using an interpreter instead of a code-generative solution, plus limiting the compiler to a carefully pruned subset of ANSI 1974 standards, Micro Focus claims its CIS COBOL can compile a 1000-line program in less than 10 minutes.

"Our compiler operates much the same way as the PASCAL compiler developed at the University of California at San Diego," claims Peter F. Hewitt, Micro Focus marketing executive for the company's domestic operations in Santa Clara, Calif. "Like the compiler, intermediate code for an imaginary machine similar in function to the 'P-code' generated by UCSD PASCAL is generated by our compiler." From that point on, he continues, translation of this code into the machine language of the target microprocessor is done using an interpreter—again just as at UCSD. As a result, the company claims its COBOL is machine-independent and can be used on small systems with little difficulty.

The COBOL is also portable because the compiler itself is written in ANSI-standard COBOL, which allows it to be transferred to a minicomputer or a mainframe. In addition, the run-time system is written in assembler language, and an operating system interface module ties the software together with a specific operating system.

Still, there are trade-offs to achieve compactness: CIS COBOL can be used only on a single-CRT-terminal system. But this limitation



A memory map *of CIS COBOL shows the compiler, written in COBOL, is delivered in "object" form, consisting of a subset of the intermediate code. The run time system is written in the assembler, and the interface is the link to the operating system, such as CP/M.*

results more from microprocessor hardware limitations than from the software.

COBOL for microcomputer-based small business systems is Micro Focus's only market. It is one that will reach $25 million within the next three years—$10 million in software spent by OEMs and $15 million by end users, according to Brian Reynolds, chairman of Micro Focus, who formed the London-based company three years ago with an ICL Ltd. contract to develop COBOL for an 8080 microprocessor system.

"The image people have of COBOL is that it's a huge, high-level language for data processing on IBM equipment," says Reynolds. "But it doesn't have to require a lot of memory—that's IBM's implementation. We found you can do most routines with far less memory. Where IBM needs 160K bytes for compiler overhead, we can do it in 20K bytes, plus 10K for a run-time interpreter."

To capture a sizable share of the microcomputer COBOL market, Micro Focus offers a compact COBOL with a 32K-byte compiler and a standard version requiring 48K bytes. Each includes full support for random indexed and sequential files, as well as interactive debugging and full screen-handling control. In addition, two utilities, called Forms, permit on-line screen layouts and eliminate the need to write simple data and inquiry programs.

The key difference between the two compilers is that the compact version has fewer verbs while the larger COBOL offers a full Level 2 usage of the interprogram communication facility and program implementation. Both operate in ready-to-run form for Intel 8080, 8085 or Zilog Z80 microprocessors running under the ISIS or CP/M operating system, or a CP/M-compatible operating system. They also operate with Digital Equipment Corp.'s LSI-11 microprocessor using the RT-11 operating system.

Known as compact, interactive and standard (CIS) COBOL, the 32K-byte version sells for $650; the standard one is $850 under CP/M, while RT-11 operating system packages sell for $1200. Micro Focus OEM accounts include Vector Graphic, Onyx Systems, Inc., ABC Computers and Intel, the latter sold as part of its ISIS II development software. Recently, the General Services Administration granted Micro Focus's CIS COBOL certification, making it qualified for use by contractors supplying equipment and software to government agencies. **—Ronald Rosenberg**

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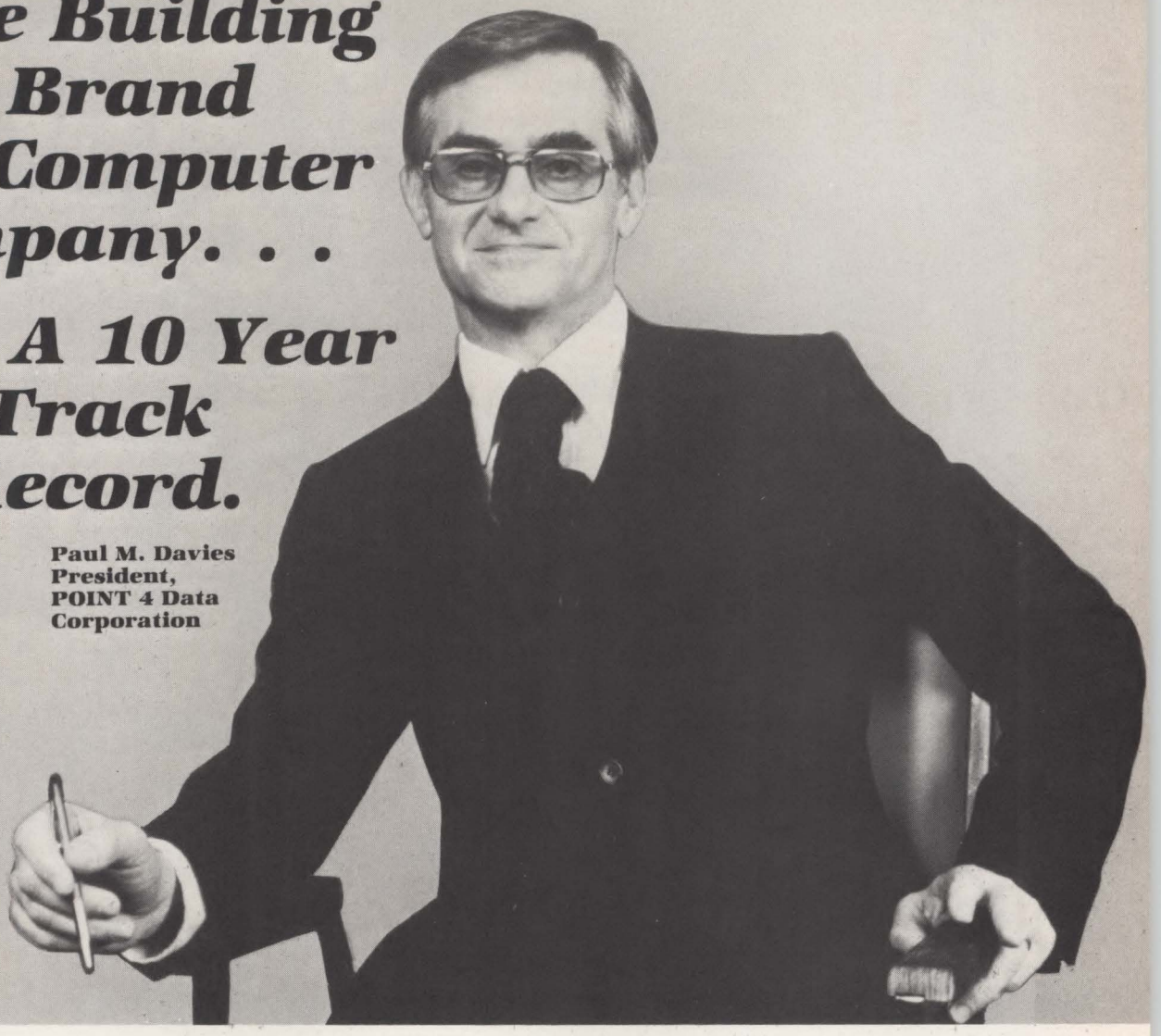

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CORPORATE & FINANCIAL

INTERTEL WON'T STRAY FROM NETWORK CONTROL

Most major data-communication equipment firms—Codex Corp., Racal-Milgo and Paradyne, for example—began as modem manufacturers and only recently moved into network diagnostic and control systems.

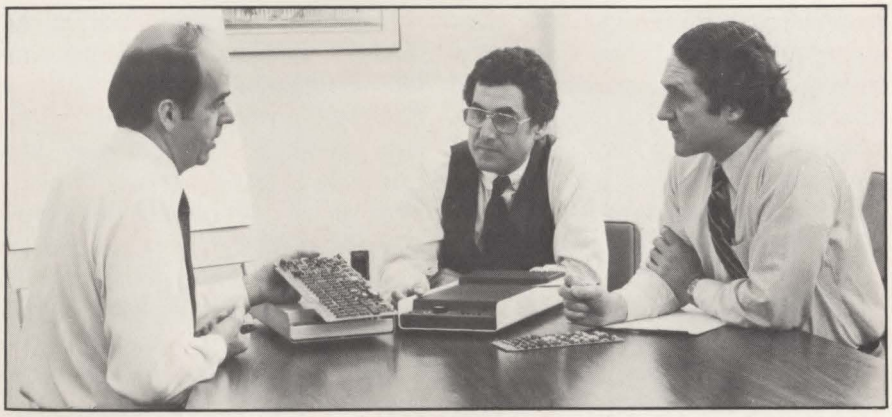
But unlike its competitors, Intertel, Inc. changed directions seven years ago to build the first network-control system—a line of communications equipment that combines diagnostic capabilities, modems and intelligent electronics in one complementary system.

As a result, the Burlington, Mass., company's modem operation took a backseat to network-control systems, which last year accounted for 80 percent of the privately held company's $14.9 million in sales, rental and service revenues. OEM and custom-developed printed-circuit-card modems account for the remaining 20 percent.

Although the modem business is growing, the company remains more committed to network control, which will grow very rapidly, according to company president and founder Jerry L. Holsinger. More large companies, he says, recognize the need to troubleshoot data communication problems and ensure that their networks are running properly.

"We're at a point now in network control where the computer industry was 10 years ago," he says, predicting that Intertel will hit the $100 million revenue mark in five years.

His optimism is buoyed by Intertel's position as market leader in the network-control field. Most of its systems are used in transportation and banking, with such customers as U.S. Air, TWA, Eastern Airlines, Manufacturers Hanover Trust Co. of New York, Federal Home Loan of Des Moines, Sentry Insurance, Exxon and Amtrak.



President Jerry Holsinger, left, *Tony Rotondo, vice presdient of OEM sales, center, and Ralph Lowry, vice president of international and product manufacturing, review Intertel's OEM applications for standard and custom card modems.*

Each of these firms has between a few hundred and a thousand remote locations tied to a large mainframe. Users rent or buy an Intertel network-control system to monitor and diagnose data communications problems. The company's systems include the NCS 4000 and the EMS-One, a third-generation system that can control point-to-point, multipoint or distributed networks. It can also accommodate as many as 6400 drops at transmission speeds from 1200 bps to 9600 bps. By comparison, the company's first network-control device could handle only 12 lines and 40 drops.

Intertel has dominated the market over the years because it has met no real competition. But that is changing as larger modem makers enter the network-control business. "We see them coming along and they're doing a good job of following us," quips Holsinger, adding, "We also have more features on our systems." He is confident that, despite its small size, Intertel can meet the new rivalry because the company is in excellent financial health with no debt (last financing was in 1971 for $600,000) and cash liquidity approaching $5 million.

In addition, the company carries its customers' two- to five-year leases, treating them, for accounting purposes, as sales. Above all, the firm is very profitable, netting an aftertax income of $2.36 million, according to Holsinger.

Intertel's management is short on numbers but long on experience, with top management averaging four years with the company. It has also expanded and hired two Codex executives to steer Intertel to greater growth in Europe, particularly in England, the Scandinavian countries and France. The company hired Ralph Lowry as vice president for both international and product marketing after he had spent six years as senior director of modulator products at Codex. Lowry, in turn, hired David Moore, former Codex senior manager for network products, as director of Intertel marketing. Holsinger expects Lowry and Moore to boost the company's overseas sales, representing five to 10 percent of the company's earnings, to 25 to 30 percent within five years.

Yet, despite the company's success, it has had its share of problems—with Seymour Rosen's nine-month-long presidency a major one. Holsinger had spent a year finding a successor, claiming that he gave up the top post to "look ahead," because the company was growing rapidly and he wanted to do some long-range corporate planning.

Recalling that period in late 1977 and early 1978, Holsinger says

personality differences and disagreements over the company's direction led to Rosen's dismissal and Holsinger's resumption of the presidency. During that period, the company also had a high rate of management turnover. "I was naive to think I could sit in a corner for a while," Holsinger now says. "I hire people now to work together and provide guidance for the company."

Another difficulty facing the company is its modem base, which has shrunk from 30 to 40 percent of the company's revenues to about 20 percent in less than four years. One company official candidly admits that standard end-user box modems are "exceptional box devices," and a year and a half ahead of Intertel's designs. Still, Intertel finds the custom card market very profitable, doubling its business in the past six months and building a five-person OEM marketing and engineering staff.

A recent contract with Data General Corp., estimated at $1 million, includes DG's new family of diagnostic display terminals. Intertel, working with DG specifications, developed a full-duplex modem that automatically switches between voice and data. This enables DG commercial systems users to use a dial-up service support center through the new terminal. The unit's dual speeds and split transmission at both ends allow computer and data terminal commands and conversation over a concurrent voice link. Intertel is also selling a similar device to the OEM market.

Looking to the future, Holsinger says the company will not stray from the straight and narrow—custom network-control systems and OEM card modems. Further, he plans to open sales offices in Cincinnati, Detroit, Pittsburgh and Charlotte, N.C. and to relocate the company's manufacturing plant and executive offices from Burlington to an 80,000-sq.-ft. building less than 20 miles away in Andover, Mass.

Holsinger shakes his head at the thought of following Paradyne into the computer business with a distributed-processing network system, complete with software and IBM communications (MMS, October, 1979, p. 20). Meanwhile, the company is doing R & D in packet-switched network control, limited-distance modem adaptors, dial-up modems and options to the company's line. "I've got plenty of opportunities right here," says Holsinger. **—Ronald Rosenberg**

DATA GENERAL RECOVERS FROM PROFIT DECLINE

Field service, delivery and production-realignment problems, which decreased Data General Corp.'s fourth-quarter 1979 earnings for the first time in its 11-year history, are being solved. According to company president Edson deCastro, "Our financial performance was below our expectations in the fourth quarter." He cites the company's field service revenues, which spiraled from $13 to $20 million in that quarter last year as the reason. In addition, the company expanded its field service force from 1000 to 1422.

Although deCastro recognizes future field service as a "gold mine," the company is incurring high expenses training technicians, who earn full salaries for six to 12 months of learning. "If we are to have a first-rate maintenance organization, it will cost us in profits, but we'll pay that price," says deCastro.

Data General's deCastro: *first-rate maintenance organization costs profits.*

Despite these costs, the company's pretax profit margins for this year's first quarter climbed to 16.1 percent, up from 14.6 percent in the quarter that ended last Sept. 29. First-quarter net earnings were $11.9 million, or $1.50 a share, compared with $1.15 a share last year. Revenues were $137.1 million. DeCastro says full sales and service revenues for the year would be ahead of last year's $506 million, but he declines to forecast any figures.

DG also ran into problems in manufacturing and stocking parts when it accelerated production of the Nova 4 minicomputer. The company also realigned its production facilities and renegotiated semiconductor orders to accommodate the Nova 4, while cutting back on other products, such as the high-end Eclipse, to gain some smaller vendors' shares of the market.

Despite these expenses, DG still managed to cut delivery lead times to three months. And revenues are increased despite December's across-the-board increases of five percent on the Nova 3—the first price hikes the company has ever made on a volume product. The high cost of scarce electronic components, espcially memories, for an established product line, plus higher manufacturing costs, necessitated the increases, says deCastro. "Once the computer design is frozen," he explains, "it is tough to make major changes that will reduce costs."

But the Nova 3 underwent another change in November, 1978, when its price dropped as much as 30 percent, just preceding the Nova 4's introduction in February, 1979. Single Nova 3D units, with 64K bytes of MOS memory, for example, sold for $20,800 before decreases. It then was reduced to $15,500, and now sells for $16,275. A company spokesman said the price cut had no connection with the Nova 4 introduction. **—Lori Valigra**

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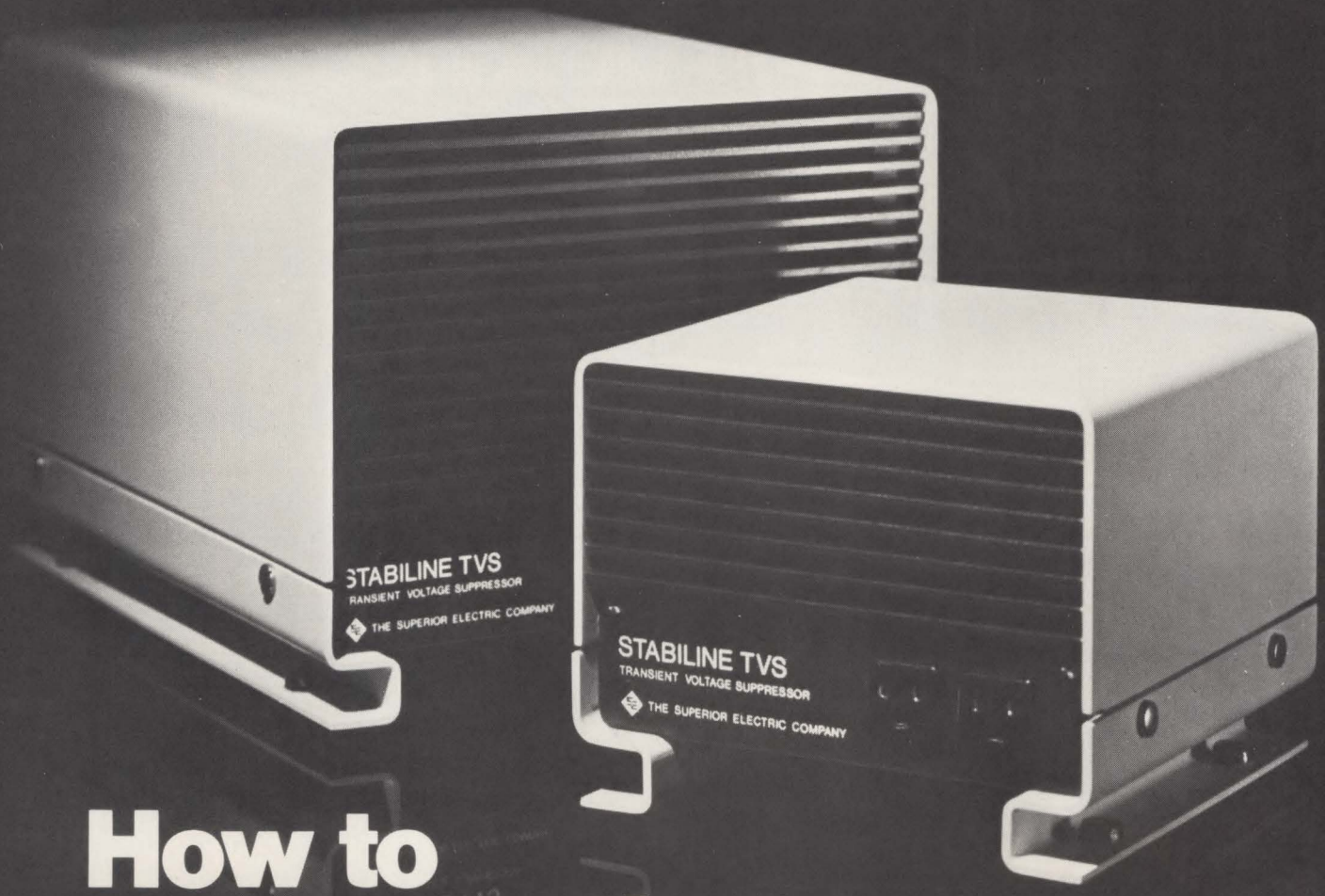

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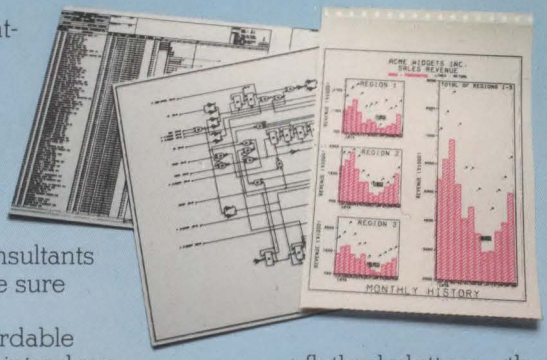

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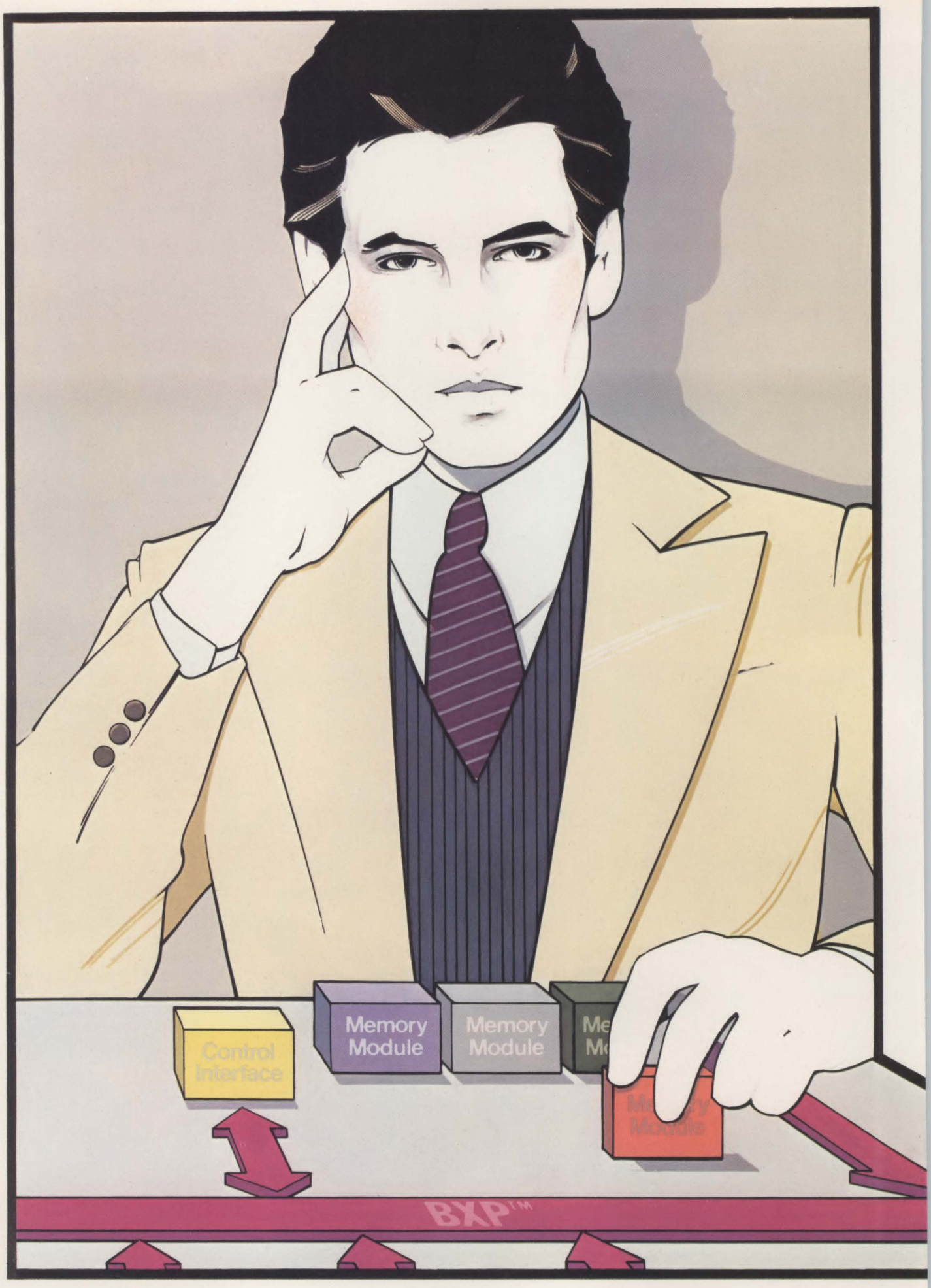
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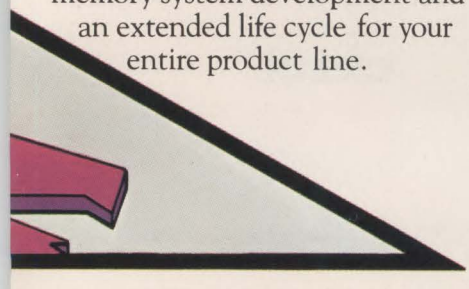

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Series 90 memory modules incorporate Intel's highest performance semiconductor memory components to give your systems the competitive edge. Our static memory modules use revolutionary HMOS* technology to provide capacity from 32-64K bytes each with 100 ns cycle times. Or build with Series 90 dynamic memory modules for 128-256K bytes and cycle speeds of 350 ns.

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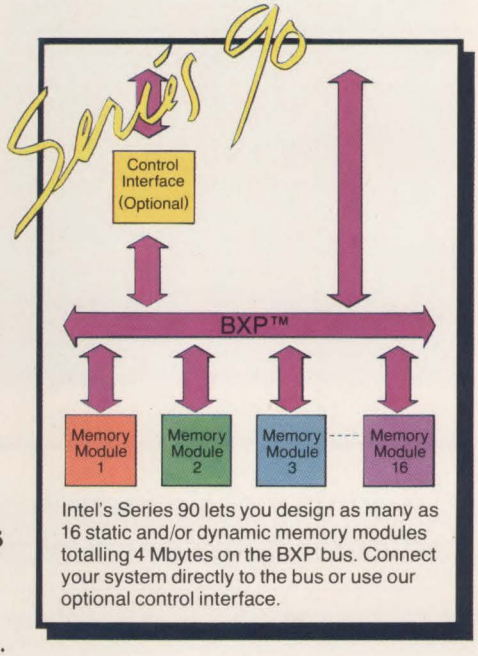

Intel's Series 90 lets you design as many as 16 static and/or dynamic memory modules totalling 4 Mbytes on the BXP bus. Connect your system directly to the bus or use our optional control interface.

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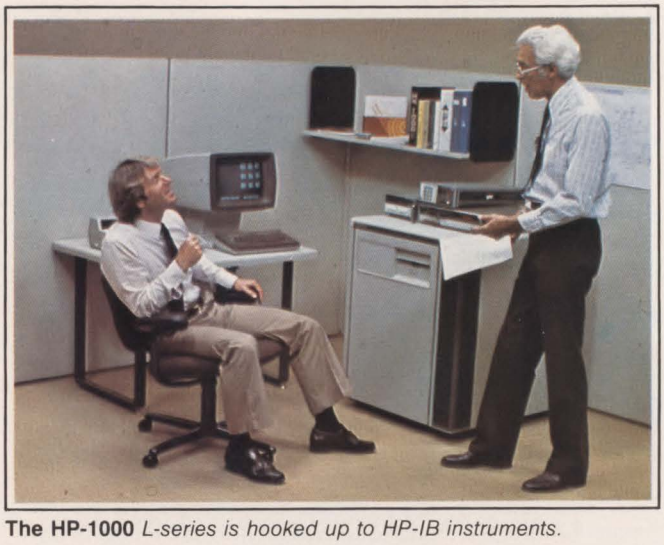
CIRCLE NO. 59 ON INQUIRY CARD

HP 1000 L: big boost from SOS

ORRIN MAHONEY, Hewlett-Packard Co.

Newest entry in Hewlett-Packard technical computer line uses silicon-on-sapphire in distributed intelligence architecture

Computer manufacturers have long taken advantage of new developments in semiconductor technology, and Hewlett-Packard Co. is no exception. But in the case of the Cupertino, Calif., minicomputer manufacturer, the semiconductor technology that makes such a major contribution to the new HP 1000 L series—CMOS on sapphire—resides under the same corporate roof. The L-series is the latest in H-P's 1000 line of technical computers, and is believed to be the first machine for the technical and scientific market to use CMOS/SOS.



The HP-1000 *L-series is hooked up to HP-IB instruments.*

Earlier H-P computers for the commercial market, the HP 300 and HP 3000 series 33, were the first computers ever to successfully incorporate CMOS/SOS circuits, with their inherently higher speed and lower power consumption than conventional MOS or CMOS (MMS, December, 1978, p. 106). Now the L-series is taking advantage of H-P's proprietary CMOS/SOS large-scale integration process in the form of two custom processor chips.

The first of these is a single-chip CPU that performs all the computational and control functions of the L-series computer. The second is an intelligent I/O processor chip, which is contained on every L-series interface board. These I/O processors handle all input-output functions of the L-series computer, supplying substantially improved I/O performance while freeing the CPU to handle its computational and control tasks.

This use of multiple processors leads to a "distributed intelligence" architecture, which maintains its advantages while achieving a high degree of compatibility with the other members of the 1000 family. Compatibility is especially important to an OEM with a significant software investment in a vendor's product line.

A complete system processor

The heart of the L-series processor board is a single-chip CMOS/SOS CPU, which performs all arithmetic, logic and control functions, except for I/O. Also integrated into the CPU chip are a time base generator and memory-protection capability, both critical functions in any real-time software environment. The L-series processor is contained on a single 6¾- × 11-in. printed circuit board. Besides the SOS CPU chip and its support circuitry, the board, which costs $2250, includes two 2K- × 8-bit ROMs containing a number of system level functions. These functions are often optional on other machines selling at the same price.

Functions include a variety of standard boot loaders, which allow the L-series to boot up from hard- or flexible-disk drives, a minicartridge or a plug-in PROM

Outboard I/O processors relieve the inboard CPU of the time-consuming task of controlling I/O operations, giving the L-series good I/O performance and flexibility.

Model 9 *includes one 1.2M-byte flexible-disk drive.*

board. The ROMs also include a comprehensive self-test compability, which executes upon power-up, and virtual control panel firmware, which permits any ASCII terminal to act as a computer control panel with full access to the machine's internal registers. The virtual control panel also allows remote access and diagnosis of L-series computers via hard-wired or modem links. Boot loaders and other capabilities, such as power fail/auto-restart, are selected through simple rocker switches mounted on the PC board.

Complementing the CPU board is a single memory board containing 64K bytes of 16K RAM. Memory parity checking is standard, and, during power failures, memory can be maintained as much as an hour by a simple plug-in battery board. SOS also reduces the parts count in the 1000 L from 337 in previous family members to 65, enabling a lower price.

A look at the I/O processor

Besides the SOS CPU chip, L-series' I/O performance is enhanced through the use of another SOS processor on each interface card. This I/O processor, a custom SOS chip equal in complexity to the CPU chip, executes all L-series I/O instructions and includes a built-in capability for DMA operations. These outboard I/O processors relieve the inboard CPU of the time-consuming task of controlling operations, giving the L-series good I/O performance and flexibility.

There is also a chained DMA mode, in which several DMA transfers on the same interface can be set up and executed without interrupting the central processor (See "How the L-series manages I/O," p. 92). Overall I/O bandwidth is greater than 2.7M bytes—compared to earlier HP-1000 bandwidths of about 2.28M bytes per second. In addition, several interface cards can run at a 2.2M-byte continuous rate. A full set of interfaces is available, including an HP-IB interface (IEEE 488-1975/78)—the link to a wide range of peripherals and instruments—an RS232/449 serial interface and a 16-bit parallel interface. A PROM storage module is also available to provide as much as 64K bytes of off-line nonvolatile storage for programs or data. Special cards for the OEM include a breadboard interface with the I/O processor chip, and an analysis interface card providing plug-in logic analyzer access to the L-series backplane.

Three ways to choose

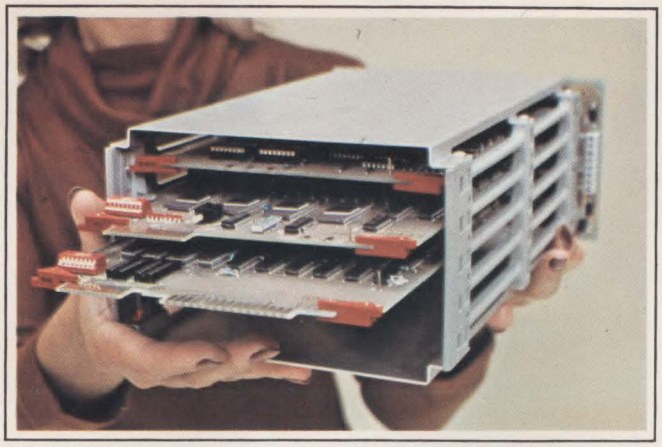
The L-series is offered at three levels of integration. For maximum packaging flexibility, a board-level product includes a CPU and memory boards, each contained on a 6¾- × 11-in. PC board. Five- and 10-slot card cages facilitate combination of standard L-series interfaces with the CPU and memory. The board costs

HOW THE L-SERIES MANAGES I/O

L-series I/O processors handle all I/O functions with minimal CPU interference. Setting up an I/O transfer under DMA is fast and simple. First, the appropriate interface card is selected by outputting the select code of the appropriate interface card onto the address bus. From there, it is loaded into a "global register" that resides in each I/O processor. Any subsequent I/O instructions are decoded and executed only by the interface card whose select code—determined by small rocker switches—matches the global register.

Only three pieces of information usually are needed to initiate a DMA transfer: a buffer address, a word count and a configuration word. The buffer address tells where the data will be transferred to or from in memory. The word count describes how much data is to be transferred. The configuration word specifies such information as input or output, word or byte transfers and status. This information can be transmitted to the interface in several ways. The simplest method is to enter the three control words in three registers in the I/O processor chip, which can be done with a single instruction. Once the information is there, a second instruction will start the transfer. The I/O processor is in charge of all handshaking with the peripheral device. It transfers the information to memory on a cycle-stealing basis, interrupting the CPU only when the transfer is complete.

Another way to set up the interface card for a data transfer is to use the I/O processors' "self-configuring" mode. In this mode, the program tells the I/O processor where in memory the three control words are located, and the IOP configures itself for the transfer by loading the information into its own internal registers. The main advantage of this approach is that the IOP can check at the end of each transfer to see if another transfer is desired and configure itself to perform the next operation. Thus, multiple DMA transfers can be "chained" together, further reducing CPU interrupt processing.



The board-level version *of the L-series contains a five-slot card cage that facilitates combination of the standard L-series interfaces with the CPU and memory.*

$2250. The L-series is also available as a rack-mountable computer containing a CPU, 64K bytes of memory, a 10-slot card cage and a power supply in a 5¼-in.-high package. The modular plug-in power supply contains a built-in self-test capability and an LED indicator, which tells the user that all voltages are up and within their specified limits. The rack-mountable version costs $4450.

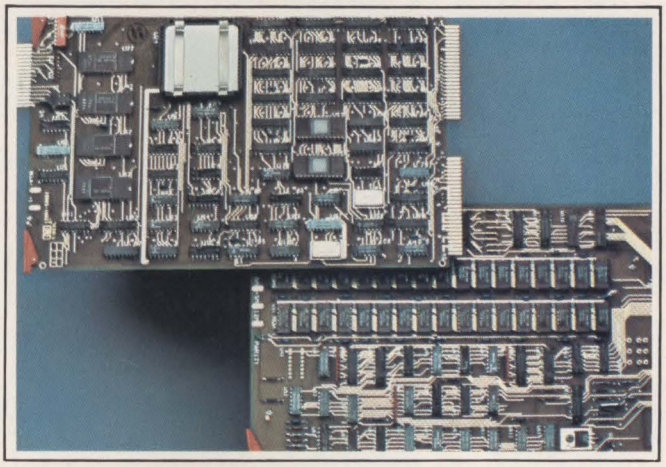
Two fully integrated computer systems complete the HP 1000 L-series line. The model 9, which costs $16,500, comes with two 1.2M-byte flexible-disk drives. Model 10, which sells for $22,500, contains one flexible disk and a new 12M-byte Winchester disk drive. Both systems offer complete software support including HP's RTE-L real-time executive operating system, FORTRAN compiler and assembler. The systems also provide standard hardware capabilities, including battery backup and auto bootup. Most system peripherals, including disks, are connected to the system via an HP-IB (IEEE 488-1978) standard interface. The use of this interface standard for both peripherals and instruments gives the L-series access to a broad line of flexible and hard disks, printers and plotters.

Software and service

Software support for the L-series comes in the form of RTE-L, a new member of HP's family of real-time executive operating systems, which is a real-time multiprogramming system designed to take advantage of the L-series' I/O structure. Under DMA, the RTE-L operating system performs all I/O transfers, improving overall CPU and I/O throughput. RTE-L offers a wide range of configurations, from a small, memory-based execute-only system to a full disk-based system with on-line program development capability. RTE-L supervises execution of multiple, priority-ordered functions in its real-time foreground area, while less time-critical operations can share its swappable background processing segment: The software system supports program development in FORTRAN-IV, BASIC and assembler.

Many L-series users may want to develop programs on a larger system optimized for multistation program preparation. This program development, including RTE-L system generations, can be performed under HP's RTE-IVB multiterminal, multi-user operating system on a larger HP-1000 computer. This software compatibility also provides L-series users access to HP's recently introduced PASCAL compiler. PASCAL is a high-level, block-structured language known for its rich data and control structures, ease of use and maintainability. These features accelerate program design, debugging and documentation.

Besides enhancing I/O operations, CMOS/SOS technology also contributes to high reliability in the L-series in two ways: The high circuit densities associated with SOS dramatically reduce the number of discrete components, and the SOS process itself produces extremely reliable chips. Complementing the basic reliability of the product is a multilayered set of self-tests and diagnostics, which combines with a simple plug-in board approach to minimize system downtime.



The L-series' processor *(top) and memory are each contained on a 6 3/4- × 11-in. PC board.*

One feature of the diagnostics package is a high-level diagnostic design language (DDL), which provides a BASIC-like interpreter with many high-level statements, allowing a user to set up and compare buffers and specific bit patterns. Assembly language routines containing I/O instructions can be created and executed on-line. DDL can be used by an OEM to speed the development of special interfaces, or by a customer engineer to track down difficult system level problems. All L-series interface diagnostics are written in DDL.

Delivery times for the HP-1000 L-series are about eight weeks. ■

Orrin Mahoney, currently product manager for the HP-1000 L-series, has worked at Hewlett-Packard Co.'s Data Systems Division for 12 years.

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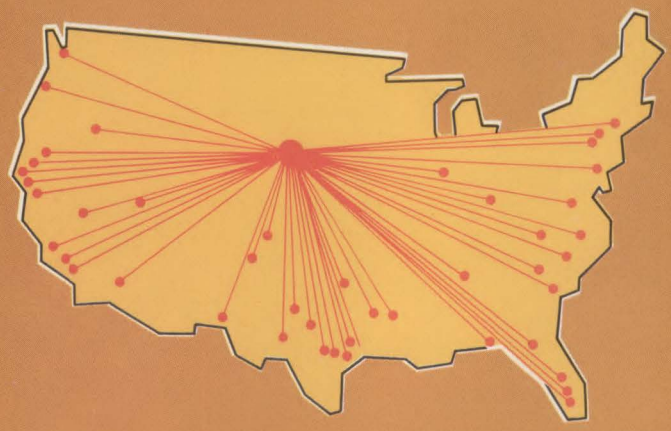


This issue of *Mini-Micro Systems* initiates a three-part series on the fundamentals of data communications for minicomputer users. Each article explains the function and operation of certain types of data communication equipment. Together, they form a comprehensive introduction intended for persons with only minimal exposure to this burgeoning field.

The opening article describes how and why data communication in minicomputer systems differs from data communication in mainframe systems, with particular emphasis on the significance of communication protocols. Embedded in that discussion is an explanation of what distinguishes synchronous from asynchronous data transmission, and of what constitutes a "dumb" terminal. The article continues with an examination of how terminals are connected to and communicate with computers, then finishes with a thorough explanation of modems. The modem section is augmented by a related article in this issue, "A primer on modems," which begins on p.111.

Next month, the series will discuss what users can do to reduce the cost of phone lines and modems when they have many terminals connected to a computer. The bulk of the article will be devoted to describing and comparing the various types of multiplexors that are available. The final article, scheduled for the May issue, will examine what can be done to reduce the cost of computer ports and to optimize user access in large or complex systems.

The series is taken from the notes for Micom Systems, Inc.'s new seminar, "Data Communications for Minicomputer Users." Micom manufactures microcomputer-based hardware for data communications, network optimization and network control. The seminar will be given in 40 cities in the U.S. and Canada, beginning in September. The seminar schedule may be obtained by writing to Micom at 9551 Irondale Ave., Chatsworth, Calif., or by phoning (213) 882-6890.

Basic data communication techniques

ROGER L. EVANS, Micom Systems, Inc.

Surveying types of data terminals, the terminal-to-computer connection, communication protocols and modems

Data communication is such a routine function of every computer system that a user probably does not give it much thought. And in a typical, small-scale minicomputer installation with a few local terminals directly connected to a CPU, there is little reason why he should. Increasingly, however, minicomputers are being linked in distributed processing networks or are being accessed from remote terminals over telephone lines. These applications pose problems that require an understanding of data communication for their solution.

In this article, we discuss the basics of how computers talk to each other and to data terminals, including the use of modems and with particular attention to communication requirements in minicomputer systems. The needs of minicomputer users are often different from those of mainframe users, who almost invariably employ polled terminal configurations supported by special communication protocols.

The significance of a communication protocol

A communication protocol is a set of rules governing information flow in a communication system. These rules define the block format, or "message envelope," which packages each message to be transmitted. This envelope usually contains control characters to mark its beginning and end, along with an address, so that messages can be directed to selected terminals. The envelope also usually includes a sequence number or

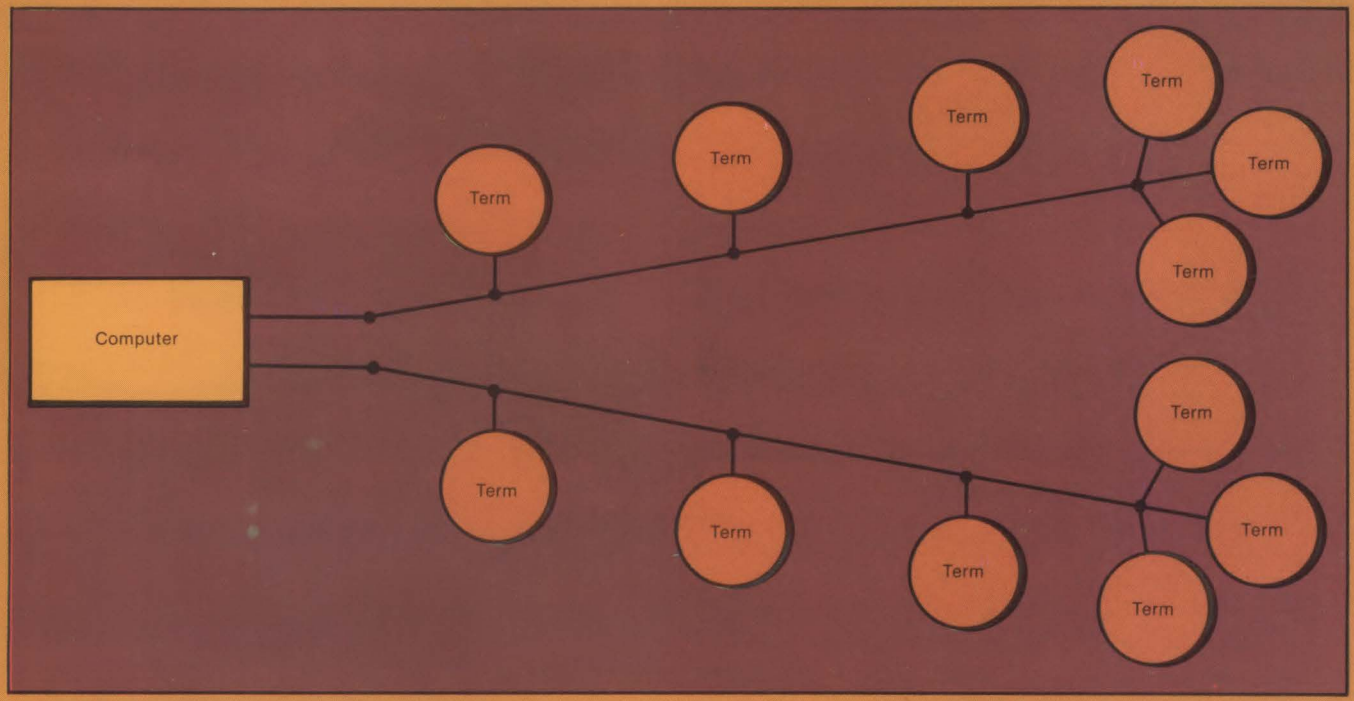


Fig. 1. A typical *polled-terminal configuration. The computer supports a number of terminals on each of its ports. During the polling cycle, it addresses each terminal on the line, in sequence, to exchange messages. This technique reduces line costs and helps ensure data integrity.*

Although relatively simple to implement, asynchronous transmission is inefficient, because 10 or 11 bits are necessary to convey eight bits of data.

block-check character that enables the receiving terminal to test the incoming message for errors. Another part of the protocol defines how a terminal acknowledges a message or, if the terminal detects an error, how it requests retransmission.

A terminal that conforms to an error-checking protocol operates error-free, because it can automatically retransmit-on-error. And all communication protocols enable terminals to be "multidropped," either individually or in clusters, with other terminals on a single line, because they can be selectively addressed, or "polled," by the host computer (Fig. 1). A computer polls its terminals by addressing each one on the line, in sequence. When addressed, a terminal answers NAK if it has nothing to transmit or ACK followed by its

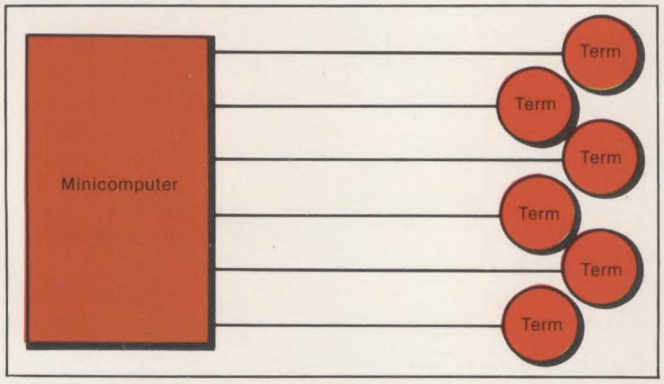


Fig. 2. A typical *"protocol-less" configuration using dumb terminals. Because the computer cannot control the terminals, they must be on separate lines.*

message if it does. If a terminal fails to respond, the computer polls the next one, and repeats this procedure continuously. Using the polling cycle, the computer also transmits messages to terminals. Typically, the ACK-NAK protocol is employed here to ensure that the messages were received correctly or to request a retransmission.

Terminal polling requires three criteria to be satisfied:

- Each terminal must be smart enough to have an address and to respond when it reads that address in a message.
- Each terminal must be buffered. Because line access is at the computer's discretion, a system is efficient only if the message has been entered at the terminal and is in a buffer ready for transmission when the terminal is polled. The host computer must have software to poll the terminal and to support the terminals' communication protocol.

Data communications systems supplied by mainframe manufacturers or compatible with their products can usually meet these requirements, thus taking advantage of the automatic retransmission-on-error capability and also reducing costs by putting multiple terminals on one telephone line. But minicomputers, which typically use "dumb" terminals in one-terminal-per-port configurations (Fig. 2), lack these benefits.

All minicomputer manufacturers, however, offer software support for various communication protocols, especially IBM's BISYNC. In addition, Digital Equipment Corp. supports its own DDCMP, and Data General Corp. supports X.25, the international standard packet-network access protocol. But minicomputer software—not designed to communicate with terminals—instead enables a minicomputer to be connected to an IBM mainframe, emulating an IBM BISYNC terminal. The software, also facilitates computer-to-computer communication within a network of the manufacturer's systems (Fig. 3).

Dumb terminals

A dumb terminal is a Teletype or Teletype-compatible terminal, which operates asynchronously even at speeds of more than 9600 bps (see box). It uses no communication protocol or block format, displaying or printing data just as it receives it, without recognizing any predefined addressing sequence or checking for block errors. The terminal transmits data directly as entered from the terminal keyboard, or from its buffer, without adding any block sequence number or check character. Without a communication protocol, a terminal cannot be addressed, so it cannot be

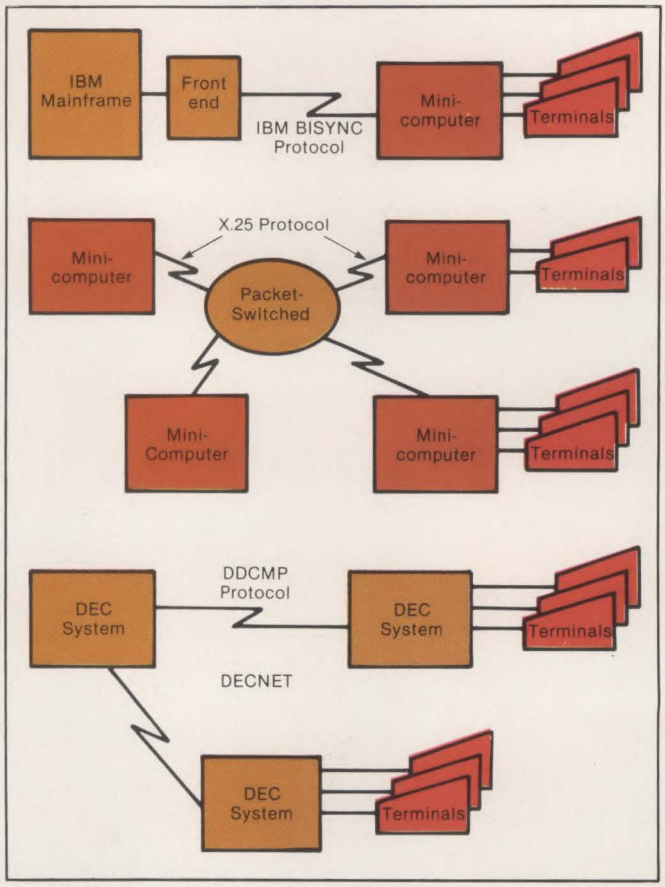


Fig. 3. How minicomputers *communicate using three popular protocols.*

MANUFACTURER	MODEL NUMBER	DATA RATE; MODULATION; SYNCHRONIZATION	TRANSMISSION MODE; CALLING MODE	TERMINAL INTERFACE; LINE INTERFACE; COMPATIBILITY	PRICE	COMMENTS
Codex Corp.	LSI4800, LSI7200, LSI9600, LSI48FP, LSI72FP, LSI96FP	2400 to 9600 bps; QAM; synchronous	full duplex, half duplex; originate/ answer	RS232C, CCITT V.24, MIL188C; four-wire	$4325 to $8750 or $95 to $200/mo.	
	LSI48I	2400 and 4800 bps; DPSK (eight-phase); synchronous	full duplex, half duplex; originate/ answer	RS232C, CCITT V.24, MIL188C; four-wire; CCITT V.27 and V.27bis, Codex LSI4800	$4325 or $95/mo.	multiplexer option provides as many as four channels using any combination of 1200-, 3600- and 4800-bps rates
	LSI48/V.27bis/ter	2400 and 4800 bps; DPSK (four- or eight-phase), QAM	full duplex, half duplex; originate/ answer	RS232C, CCITT V.24/V.28; two- or four-wire; CCITT V.27, V.27bis and V.27ter, Codex LSI4800 and Codex LSI48FP	$4585 or $105/mo.	
	MX2400	2400 bps; DPSK; asynchronous, synchronous	full duplex, half duplex	RS232C, CCITT V.24 or V.28, MIL188C; two- or four-wire; Bell 201B/C, CCITT V.26 and V.26bis	$1425 or $152/mo.	microprocessor-based; capable of network-control functions
	MX48A/B	4800 bps; DPSK (eight-phase); synchronous	full duplex half duplex; originate/ answer	RS232C; two- or four-wire; Bell 208A/B	$3900 or $90/mo.	point-to-point, multipoint or dial modes; FCC registered; auto-call capability, automatic or manual answer
	8300	40K to 64K bps; PSK; synchronous	full duplex; originate/ answer	CCITT V.35; four-wire	$6450 or $215/mo.	group band modem; CCITT V.35-to-Bell 303 interface adaptor available
	296 Biplexer	as high as 19.2K bps; QAM; synchronous	full duplex	RS232C, CCITT V.24 or V.35, MIL188C; four-wire	$5000 or $165/mo.	uses two 9600-bps modems for total of 19.2K bps
Coherent Communications Systems Corp.	FSM-86A, FSM-85A	as high as 300 or 600 baud; FSK; asynchronous	full duplex, half duplex; originate or transparent	RS232, 20-mA current loop; two- or four-wire		the FSM-86A can be multiplexed, with as many as 36 modems on a four-wire line
ComData Corp.	Series 150, Series 302, Series 330, T212A	as high as 300 or 1200 baud; FSK; asynchronous	full duplex, half duplex; originate, manual or automatic answer	RS232, 20-mA current loop, Mil Standard 188, TTL, acoustic; two- or four-wire; Bell 100 Series, 202, 212A	$125 to $895	
	201, 208	2400 baud; PSK; synchronous	full duplex, half duplex; originate, manual or automatic answer	RS232; two- or four-wire; Bell 201, 208A, 208B	$2625 to $2925	
Data Access Systems	68-01	300 baud; FSK; asynchronous	full duplex, half duplex; originate/ answer	RS232; Bell 103, 113	$295	
Data-Control Systems	LM-192A	2400 to 19.2K bps; phase delayed; synchronous	full duplex, half duplex	RS232C; two- or four-wire, Bell 3002, 3080 or 3081		limited-distance modem
	SR-300/400 Series	as high as 56K bps; FM/FSK; asynchronous, synchronous	full duplex; originate/ answer	RS232C, RS449 (optional); standard microwave transmitter interface		multichannel microwave modems
	SR-200	2400 to 19.2K bps; baseband; synchronous	full duplex, half duplex	RS232, current loop; two- or four-wire, Bell 3080 or 3081		conforms to Bell 43401
	SR-100	as high as 19.2K bps; baseband; asynchronous	full duplex, half duplex	RS232C, current loop; two- or four-wire, Bell 3080 or 3081		conforms to Bell 43401
DEI Teleproducts Division	ADT-2	as high as 9600 baud; baseband; asynchronous	full duplex, half duplex; auto-answer emulation, multipoint polling	RS232; four-wire	$225	short-haul modem
	2020	as high as 1800 baud; FSK; asynchronous	full duplex, half duplex; originate, answer, private line	RS232; two- or four-wire; Bell 202	$450	

MANUFACTURER	MODEL NUMBER	DATA RATE; MODULATION; SYNCHRONIZATION	TRANSMISSION MODE; CALLING MODE	TERMINAL INTERFACE; LINE INTERFACE; COMPATIBILITY	PRICE	COMMENTS
Develcon Electronics, Inc.	DS-512, DS-513	300 to 9.6K or 19.2K bps; asynchronous	full duplex, half duplex	RS232; two- or four-wire	$275 to $325	limited-distance modems
	DS-541, DS-548	1200 to 19.2K bps; synchronous	full duplex, half duplex	RS232; two- or four-wire	$425 to $685	limited-distance modems
	DS-558	19.2K to 100K bps; synchronous	full duplex, half duplex	RS232, WE303, CCITT V.35; two- or four-wire	$747	limited-distance modem
Gandalf Data, Inc.	LDS 250/3; LDS 329, LDS 309, LDS 319	as high as 9.6K or 100K bps; PM; synchronous, asynchronous	full duplex, half duplex	RS232, CCITT V.35; four-wire; Bell 303	$450 to $786	
	LDM 404B, LDM 414	as high as 4800 bps; QAM; synchronous or asynchronous	full duplex	RS232; four-wire	$1200 to $1300	2400/2400-bps split channel available
	LDS 100C	as high as 19.2K bps; baseband; asynchronous	full duplex, half duplex	RS232, 20-mA current loop; four-wire	$225	
	LDS 120	as high as 9600 bps; polar return to zero; asynchronous	full duplex, half duplex	RS232, 20-mA current loop; Burroughs bus	$300	
	LDS 140	50 to 9600 baud; binary NRZI; asynchronous	full duplex, half duplex	RS232, 20-mA current loop; two- or four-wire;	$450	
	SM 9600	9600 baud; synchronous	full duplex	RS232; four-wire	$4000	
General Datacomm Industries, Inc.	103A3, 108-3(R), 113BR2, 202-9D(R), 202S	as high as 300, 1200 or 1800 bps; FSK; asynchronous	full duplex, half duplex	RS232; two- or four-wire; Bell 103, 108, 113, 202	$265 to $480	
	201C, 201-7(R), MPF 208B/A, MPF 208-9A, 2400 EP	2400 or 4800 bps; DPSK; synchronous	full duplex, half duplex; leased and private lines, originate, answer, automatic originate, automatic answer	RS232, RS334; two- or four-wire; Bell 201, 208	$875 to $3275	
	4802E(D)	4800 or 2400 baud; DPSK	full duplex, half duplex; private line, switched network	CCITT V.24 or V.28; two- or four-wire	$4428	multiplexer option
	212A	300 or 1200 bps; FSK, asynchronous (low speed); PSK, synchronous (high speed)	full duplex; originate and auto-answer	RS232; two-wire; Bell 103/113 or 212A	$850	
	9601	4800, 7200 or 9600 baud; PAM	full duplex	RS232; four-wire	$6545	multiplexer option
	LDM-1	1200 to 19.2K bps; delay modulation; synchronous or asynchronous	full duplex, half duplex	RS232	$830	
GTE Lenkurt, Inc.	263A, 262A	2.4K to 56K bps; synchronous	simplex, half duplex, full duplex;	RS232, RS334; two- or four-wire	$850 to $3060	
Harvey Hubbell, Inc.	4011/4012-10	as high as 300 baud; FSK; asynchronous	full duplex; originate, answer	RS232; two- or four-wire; Bell 108A, 108C		
Infotron Systems Corp.	DL113B	300 bps; FSK; asynchronous	full duplex; answer only	RS232; Bell 103A, 113A	$215 to $265	
	DL9600	4800 or 9600 bps; PAM/VSB; synchronous	full duplex; originate, answer	RS232; four-wire	$5500 to $6500	optional bandsplitter: four at 2400 bps, two at 4800 bps or one at 2400 bps and at 7200 bps
Intertel, Inc.	M2415, M1524	150 and 2400 bps (alternate voice and data); DPSK, FSK; synchronous, asynchronous	full duplex; originate, answer	RS232; two-wire	$800 to $1050	
	MCS 4800, MCS 9600	as high as 4800 or 9600 bps; QAM; synchronous	full duplex, half duplex; originate, answer	RS232; two- or four-wire	$4400 to $8700	multiplexer option; 150-bps secondary channel option
	M1200, MCS1200, M1236	1200 or as high as 1800 bps; FSK; asynchronous	full duplex, half duplex; originate, answer	RS232, IBM 3600; two- or four-wire; Bell 202, 202C or 202D	$400 to $960	150-bps secondary channel (MCS 1200)
	MCS 2400	2400 bps; PM, four-phase; synchronous	full duplex, half duplex; originate, answer	RS232, IBM 3600; two- and four-wire; Bell 201B	$1750	150-bps secondary channel
	M2400	2400 bps; DPSK; synchronous	full duplex, half duplex; originate, answer	RS232; two- or four-wire; Bell 201	$550	

MANUFACTURER	MODEL NUMBER	DATA RATE; MODULATION; SYNCHRONIZATION	TRANSMISSION MODE; CALLING MODE	TERMINAL INTERFACE; LINE INTERFACE; COMPATIBILITY	PRICE	COMMENTS
Livermore Data Systems, Inc.	STAR	0 to 300 baud; FSK; asynchronous	full duplex, half duplex; originate, answer	RS232 and 20-mA current loop, IEEE 488, TTL and TTY 43 optional; acoustic; Bell 103 and 113 and CCITT V.21	less than $200	
	412	0 to 1200 bps; FSK; asynchronous	full duplex, half duplex, simplex; originate and answer	RS232C, CCITT; two- or four-wire; Bell 202, CCITT V.23	$414	can be converted to 2400-bps synchronous operation with plug-in circuit board
	424	2400 bps; DPSK; synchronous	full duplex, half duplex, simplex; originate, answer	RS232C, CCITT; two- or four-wire; Bell 201, CCITT V.26A and V.26B	$620	
	440/48	2400 or 4800 bps; double sideband suppressed carrier, amplitude modulated, with two carriers in quadrature; synchronous	full duplex, half duplex; originate, answer	RS232C, CCITT; two- or four-wire	less than $2000	two- or four-channel multiplexing capability; single-card modem available for OEMs; asynchronous interface available
Mazdar Corp.	Z9600	0 to 9600 bps; baseband; asynchronous	full duplex, half duplex, simplex	RS232C; two- or four-wire	$167 (single-unit quantities), $117 (50-unit quantities)	
Multi-Tech Systems, Inc.	FM 1200 series, FM 310/310A, FM327, FM 30 (acoustic coupler)	as high as 300, 450, 1200 or 1800 baud; FSK	full duplex, half duplex; originate, answer, answer only	RS232, 20-mA current loop, TTL; acoustic, two- or four-wire; Bell 103, 113, 202B, 202C, 202R, 202S, 202T	$245 to $435	
	MT212	1200 bps; PSK	full duplex; originate, answer	RS232; two-wire; Bell 212A	$510 to $595	
Novation, Inc.	CAT, 4102D, 4113B, 4143A, 4136A, 4202B, 4202T, 4103A, 4103B	300 or 1200 baud; FSK; asynchronous	full duplex, half duplex; originate, answer, originate only, answer only	RS232, 20-mA current loop; acoustic, two- or four-wire, direct connect or leased line; Bell 103	$189 to $569	
Paradyne Corp.	L05-24	2400 bps; DPSK; synchronous	full duplex; leased line	RS232; four-wire; Bell 201C		
	L05-48, L05-72, L05-96	4800, 7200 and 9600 bps; PAMVSB; synchronous	full duplex; leased line	RS232; four-wire		
	MP48, MP48-208	4800 bps; DPSK; synchronous	full duplex, half duplex; leased or dial-up line (auto-answer optional)	RS232; four-wire; Bell 208R (MP48-208 only)		
	MP96, MP96 Rapid Poll	9600 bps; QAM; synchronous	full duplex, half duplex; leased or dial-up line (auto-answer optional)	RS232; four-wire		
	M96	9600 bps; PAMVSB; synchronous	full duplex; leased line	RS232; four-wire		
Prentice Corp.	P-202T, P-202S, 100 series	as high as 300 or 1200 bps; FSK	full duplex, half duplex; originate, answer	RS232; two- or four-wire, switched network; Bell 103J, 113C, 113D, 202S, 202T	$385 to $470	
	SLD	1200 to 28.8K baud; synchronous	full duplex; originate, answer	RS232; two- or four-wire	$690	
	P-212A, P-212C	as high as 300 bps FSK, as high as 1200 bps PSK	full duplex; originate, answer	RS232; two-wire switched network; Bell 212A	$895 to $1035	
	ALD	as high as 9600 bps; polar NRZ-L; asychronous	full duplex	RS232; two- or four-wire	$280	
Racal-Milgo Information Systems, Inc.	MPS 9601	4800 to 9600 bps; eight-phase, two-amplitude; asynchronous	full duplex, half duplex	RS232; four-wire, four-wire dial backup		multipoint, point-to-point

MANUFACTURER	MODEL NUMBER	DATA RATE; MODULATION; SYNCHRONIZATION	TRANSMISSION MODE; CALLING MODE	TERMINAL INTERFACE; LINE INTERFACE; COMPATIBILITY	PRICE	COMMENTS
Racal-Milgo Information Systems, Inc.	MPS 4896	transmit at 4800 bps, receive at 9600 bps; eight-phase; asynchronous	half duplex; automatic or manual answer	RS232; four-wire		
	24LSI Mark II	2400 bps	full duplex, half duplex	RS232; two- or four-wire; Bell 201B, 201C		
Racal-Vadic, Inc.	VA1255	as high as 1200 bps, binary phase-coherent FSK (primary channel), keyed AM (secondary channel)	half duplex; manual originate, manual or automatic answer	RS232; Bell 202	$525	
	VA3455, VA3453, VA3452, VA3451	as high as 1200 or 300 bps; binary; synchronous or asynchronous	full duplex; manual or automatic originate, automatic answer	RS232; direct or two-wire leased line; Bell 212A, 103	$825 to $900	
	VA2440, VA2445	2400 bps, (secondary channel as high as 75 or 250 bps); PSK (secondary channel FSK); synchronous	half duplex; originate, answer	RS232, CCITT V.28; direct connect, two-wire leased line; Bell 201B, 201C	$575 to $725	
	VA3447, VA3437, VA3427, VA3467, VA3434	1200 and as high as 300 bps; synchronous, asynchronous	full duplex; answer only	RS232; direct connection, two-wire leased line; Bell 103, 212A	$650 to $895	
	VS1200P OEM, VA1252, VA1251, VA1250, VA355, VA317	as high as 300, 1200 or 1800 bps; FSK; asynchronous	full duplex, half duplex; manual originate, manual or automatic answer, answer only	RS232, TTL levels, 20-mA current loop; two- or four-wire; Bell 202C, 202S, 202D, 202R, 202T, 202E, 103, 113	$250 to $535	
RFL Industries	6860	1200 baud (concurrent voice); FSK	full duplex	RS232; four-wire	$3265	
	6385	1200 or 1800 baud; FSK; asynchronous	full duplex, half duplex	RS232, TTL; two- or four-wire; Bell 202	$300	
Rixon, Inc.	T212A	as high as 300 bps FSK asynchronous, 1200 bps PSK synchronous	full duplex; originate, answer	RS232; two-wire DDD; Bell 103 and 212A, Rixon T103 and T113	$855	
	T103J	0 to 300 bps; FSK; asynchronous serial binary	full duplex; originate, answer	RS232; two-wire DDD	$550	
	T202T	as high as 1800 bps; FSK; asynchronous serial binary	full duplex, half duplex; originate, answer	RS232; two- or four-wire FCC tariff 260 type 3002; Bell 202 Series	$460	
	T108E/G/J	0 to 300 bps; FSK; asynchronous serial binary	full duplex, half duplex; originate	RS232C or 20-mA current loop (optional); two- or four-wire FCC tariff 260 type 3002; Bell 100 Series private-line modems	$320	
	TA201C	2400 bps; differentially coherent four phase	full duplex, half duplex; originate, answer	RS232; two-wire DDD and two- or four-wire unconditioned private line	$950	multipoint antistreaming capability
	LDM710	as high as 9600 bps; bipolar phase; asynchronous	full duplex, half duplex, point-to-point or multipoint	RS232C, 20-mA current loop; two- or four-wire metallic circuits; conforms to Bell Publication 43401	$295	
	T113C	as high as 300 bps; FSK; asynchronous serial binary	full duplex; originate	RS232; two-wire DDD; Bell 103/113 Series switched network modems	$395	
	T209A	9600 bps; QAM, synchronous serial binary	full duplex, half duplex; originate, answer	RS232C; four-wire private line; Bell 209A	$6300	microprocessor-based; integral four-channel synchronous multiplexer; integral data quality monitor card optional

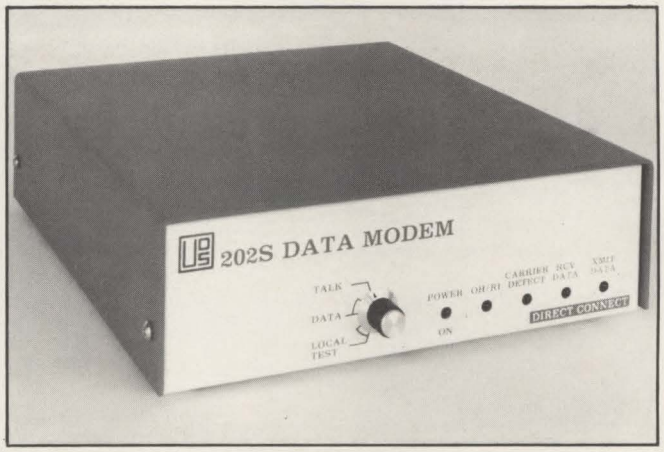
MANUFACTURER	MODEL NUMBER	DATA RATE; MODULATION; SYNCHRONIZATION	TRANSMISSION MODE; CALLING MODE	TERMINAL INTERFACE; LINE INTERFACE; COMPATIBILITY	PRICE	COMMENTS
Rixon, Inc.	T208A/B	4800 bps; PSK; synchronous	full duplex, half duplex; originate, answer	RS232; two-wire DDD or four-wire unconditioned private line; Bell 208A and 208B, Rixon 208A and 208B	$2810	
Rockwell International	R24	2400 bps; DPSK; synchronous	full duplex, half duplex; originate, answer	TTL; two- or four-wire; Bell 201B, 201C	$395	consists of three modules to be integrated into OEM systems
Tekcom, Inc.	TC 3001 (acoustic coupler), TC 3002 (acoustic coupler), TC 3006 (acoustic coupler), TC 4001, TC 5001	300 or 1200 baud; FSK; asynchronous	full duplex, half duplex; originate, answer, automatic answer	RS232, 20-mA current loop; two- or four-wire; Bell 103F, 113A, 113B, 202C, 202D, 202E, 202R, 202T	$195 to $385	
Timeplex, Inc.	M9600	4800 or 9600 bps; AM/VSB; synchronous	full duplex	RS232; four-wire private line	$5250	
	103C/D, R103, R202, 202C/D	as high as 300, 1200 or 1800 bps; FSK; asynchronous, synchronous	full duplex, half duplex; originate, answer	RS232, Mil 188C; two- or four-wire, private line, switched network; Bell 202S, 202T, 103, 113, 108	$349 to $475	
Tran Telecommunications Corp.	Directran M611/M631	9600 bps; baseband; asynchronous	full duplex, half duplex; originate, answer	RS232; four-wire	$350 to $575	
	Intertran M918, M938, M916, M936, M911, M931	100 bps to 250K bps; PPM; synchronous	full duplex, half duplex; originate, answer	CCITT V.35, RS-232; four-wire	$800 to $1900	short-haul modems
	M971-1, M971-2	1200 to 9600 bps, 19.2K to 64K bps; bipolar encoding, synchronous	full duplex, half duplex; originate, answer	RS232, CCITT V.35; four-wire; Bell 303	$950 to $1150	limited-distance modems
Tuck Electronics, Inc.	1510, 1530, 1540, 1541, 1542, 1610, 1630, 1650, 1653	as high as 300 or 1200 bps; FSK; asynchronous	full duplex, half duplex; originate, answer	RS232, 20-mA current loop, TTL; Bell 103A, 202C, 202S, 202D, 202R, 202T	$168 to $395	
	1810, 1880, 1881, 1883, 1884	20 cps; FSK, AM; asynchronous	receive only or transmit only; originate, manual and automatic answer	contact closure; two-wire; Bell 401J, 401A, 401E, 401H5, 401H4	$225 to $675	
	1820, 1830	10 cps; AM; asynchronous	receive only, answer back; originate, answer	RS232; two-wire; Bell 403D, 403E, 407A, 407B	$485 to $507.50	
	2120	1200 to 19.2K bps; PSK; synchronous	full duplex, half duplex	RS232; two- or four-wire	$425	
U.S. Robotics, Inc.	Penril 300/1200	as high as 300 bps FSK, as high as 1200 bps PSK	full duplex; originate, manual or automatic answer	RS232; two-wire; Bell 212A	$799	
	USR-330	as high as 300 baud; FSK	full duplex, half duplex; originate, manual or automatic answer	RS232, 20-mA current loop; two-wire; Bell 100 series	$339	
Universal Data Systems	103J, 113D, 202S	300 or 1200 baud; FSK; asynchronous	full duplex; originate, answer	RS232; two- or four-wire; Bell 103J, 113D, 202S	$375 to $515	
	201C	2400 baud; DPSK; synchronous	full duplex	RS232; two- or four-wire; Bell 201C	$915	
	208B	4800 baud; PSK; synchronous	half duplex; originate, answer	RS232; two-wire; Bell 208B	$2975	
	12-12	1200 baud; PSK; synchronous, asynchronous	full duplex; originate, automatic answer	RS232; two-wire	$600	

Almost every modem on the market today incorporates a diagnostic test facility that enables it to check its own health and display the results, without being connected to a phone line.

Users who deal exclusively with the telephone company also avoid some of the finger-pointing that inevitably crops up in multiple-vendor arrangements: the phone company blames the modem vendor and the vendor returns the blame. If the modem comes from Bell, this situation is averted, although a similar dispute could arise between the phone company and the terminal supplier.

But the modem makers have a ready answer to the finger-pointing problem. Almost every modem on the market incorporates a diagnostic test facility that enables it to check its own health and display the results to the user, without being connected to the phone line. If no faults are detected in the diagnostic test, the modem is presumed absolved, and the user looks for the problem in the terminal or the line. Some vendors carry this process one step further, enabling their modems to conduct remote tests that exercise the line and the terminal as well as the modem itself, to further assist users in fault isolation.

Life would be sweet for independent modem vendors if they had only AT&T to worry about. But the competition is fierce. It is reflected not only in the price structures for modems—a low-speed unit costs a few hundred dollars—but in the rich variety of features designed to attract the potential buyer. For example, the Intertel 2415 modem permits automatic alternation of voice and data—a handy function for the computer company with a remote diagnostic package to test its installations from a maintenance center. The user calls the service center. If, during the conversation, the center decides to send a diagnostic program down the line to test the customer's computer, the data transmission automatically interrupts the conversation, and the people hear a distinctive tone that indicates data is being sent. When the transmission is complete, the voice mode is again enabled, and the conversation can resume.



The Universal Data System *model 202S modem—compatible with the Bell 202S—operates asynchronously at 1200 baud.*

REFERENCE LITERATURE

For more information on the modems surveyed in this article, use the reader circle numbers below.

Company	Circle No.
American Telephone and Telegraph Co., New York, N.Y.	413
Anderson Jacobson, Inc., San Jose, Calif.	414
Astrocom Corp., St. Paul, Minn.	415
Avanti Communications Corp., Newport, R.I.	416
Bo-Sherrel Co., Newark, Calif.	417
Burroughs Corp., Detroit, Mich.	418
Carterfone Communications Corp., Dallas, Texas	419
Codex Corp., Newton, Mass	420
Coherent Communications Systems Corp., Central Islip, N.Y.	421
ComData Corp., Skokie, Ill.	422
Data Access Systems, Inc., Mountain Lake, N.J.	423
Data-Control Systems, Inc., Danbury, Conn.	424
Datapoint Corp., San Antonio, Texas	425
DEI Teleproducts Division, Escondido, Calif.	426
Develcon Electronics, Inc., Doylestown, Pa.	427
Dynatech Data Systems, Springfield, Va.	428
Gandalf Data, Inc., Wheeling, Ill.	429
General Datacomm Industries, Inc., Danbury, Conn.	430
GTE Lenkurt, Inc., San Carlos, Calif.	431
Harvey Hubbell, Inc., Falls Church, Va.	432
Infotron Systems Corp., Cherry Hill, N.J.	433
IBM Corp., White Plains, N.Y.	434
Intertel, Inc., Burlington, Mass.	435
Livermore Data Systems, Inc., Livermore, Calif.	436
Madzar Corp., Fremont, Calif.	437
Micom Systems, Inc., Chatsworth, Calif.	438
M & R Enterprises, Sunnyvale, Calif.	439
Multi-Tech Systems, Inc., New Brighton, Minn.	440
Novation, Inc., Tarzana, Calif.	441
Omnitec Data Corp., Phoenix, Ariz.	442
Paradyne Corp., Largo, Fla.	443
Penril Corp., Rockville, Md.	444
Prentice Corp., Palo Alto, Calif.	445
Racal-Milgo Information Systems, Inc., Miami, Fla.	446
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RFL Industries, Inc., Boonton, N.J.	448
Rixon, Inc., Silver Springs, Md.	449
Rockwell International, Anaheim, Calif.	450
Sonex, Inc., Huntingdon Valley, Pa.	451
Spectron Corp., Moorestown, N.J.	452
Syntech Corp., Rockville, Md.	453
Tekcom, Inc., San Jose, Calif.	454
Timeplex Transmission Products Division, Largo, Fla.	455
Tran Telecommunications Corp., Marina Del Rey, Calif.	456
Tuck Electronics, Inc., Camp Hill, Pa.	457
Universal Data Systems, Huntsville, Ala.	458
U.S. Robotics, Inc., Chicago, Ill.	459
Ven-Tel, Santa Clara, Calif.	460
Versitron, Inc., Washington, D.C.	461

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SEE US AT INTERFACE '80

Industry observers do not predict a modem on a chip emerging in the near future.

Coherent Communications' FSM-86 modem includes a "regenerative repeater" that reshapes and retimes signals, correcting as much as 48 percent harmonic distortion in received signals, to keep the error rate down. Distortion in the output signal is less than one percent. Like several other modems, the FSM-86 also has switch-selectable frequency settings. Without this feature, a crystal in the modem must be changed to alter the carrier frequency (an acceptable limitation in applications that require only one frequency over long periods of time).

The Avanti 3002 has an optional dual-channel capability that enables it to handle two terminals, each operating independently at 1800 or 2400 bps, or a single terminal at 3600 or 4800 bps.

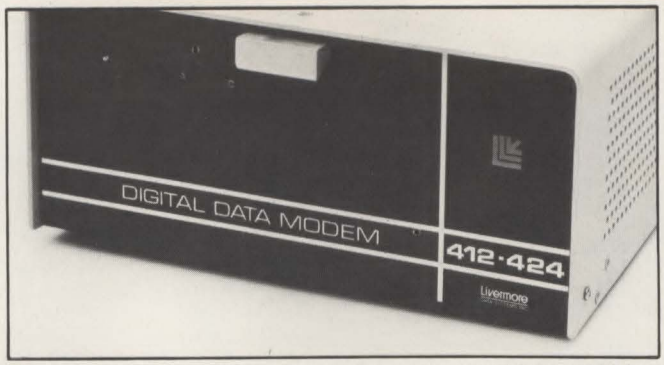
The Avanti 2300 modem *is intended primarily for computer-to-computer and earth-satellite communication links.*

The 300-bps Infotron DL 113B includes an "anti-tailending" feature, intended to ensure computer port security. The modem will not answer a call until at least one second after the previous call disconnects, thereby assuring that the port is cleared and that each user's data is protected. In addition, Infotron's power-distribution method is designed so that failure of an individual modem module does not affect the operation of other modems in a rack. Each modem has its own voltage regulator, so that only one module goes out of action if a regulator should fail.

Features may attract customers, but buying decisions are based on cost. In this volatile marketplace, buyers have quite a bit of leverage, especially when buying in quantity. Besides volume discounts on purchase price, vendors will make deals that include free maintenance over an indefinite period or additional price concessions.

Future trends

Three major trends will develop in the modem market in the next three to five years. First, there will be a growing movement to higher bit rates, as technology improves and more high-speed terminals are installed in the field. Second, RS449 will emerge to replace RS232 as the industry's digital interface



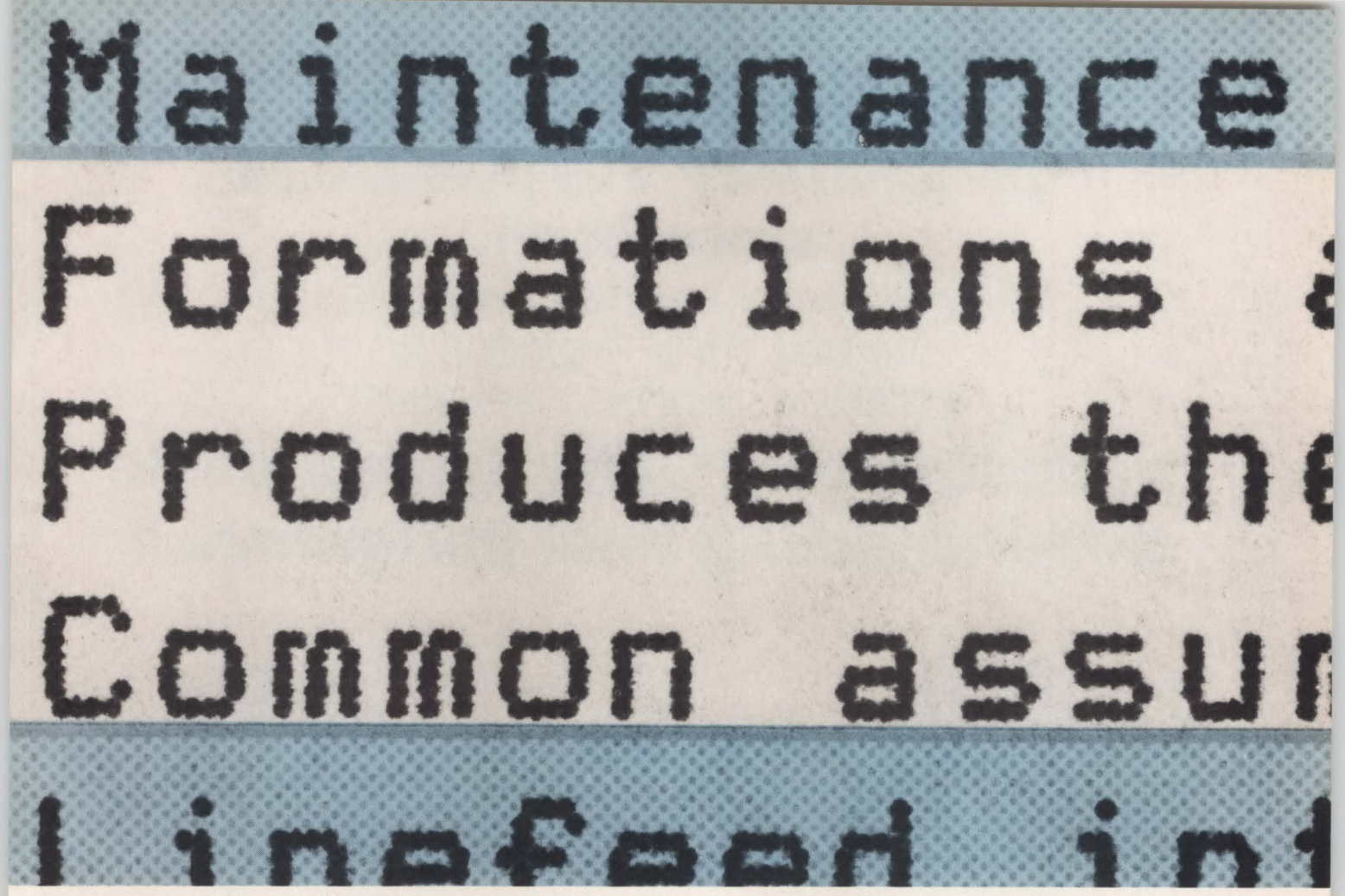
The Livermore 412/424 modem *can be converted from 1200-bps asynchronous to 2400-bps synchronous operation by addition of a single PC board.*

standard (MMS, November, 1979, p. 67). And finally, modems will increasingly be built into terminals, changing the nature of the vendors' business. Instead of furnishing complete units to end users, the modem suppliers will build modem cards for OEMs. Industry observers do not predict a modem on a chip emerging in the near future. Only the equalizer portion, which compensates for line delays and distortion, lends itself readily to IC technology. The interfacing and signal-handling circuitry will continue to reside on circuit boards.

Modem vendors are concerned, nevertheless, about the entry of semiconductor manufacturers into the market. Rockwell International already offers a line of modems; others may follow. Other modem makers would prefer to see the semiconductor houses stick to chips, leaving system integration to modem manufacturers. But, despite recent rumblings in the press about the coming decline of the modem business, the vendors are moving ahead and plan to stay around for some time to come.

When will RS449 make its presence felt? "When Bell decides to make it happen," according to Bertram Ralph, vice president of Coherent Communications Systems Corp. He says no customer has yet demanded an RS449 modem. His company expects to be shipping "mixed products"—compatible with both RS449 and RS232—for several years, before the demand for RS232 declines. Bo Sullivan, regional manager for Avanti Communications Corp., concurs, indicating the enormous installed base of RS232-compatible equipment in the field. "They won't throw away that equipment just because of a new standard," he says. ■

MAL STIEFEL, now on the technical staff at Mitre Corp., has worked as a systems analyst, systems engineer, and programmer on military command and control systems, hospital administration, investment securities, and municipal information systems.



This is an unretouched enlargement of PRINTERM's print quality.

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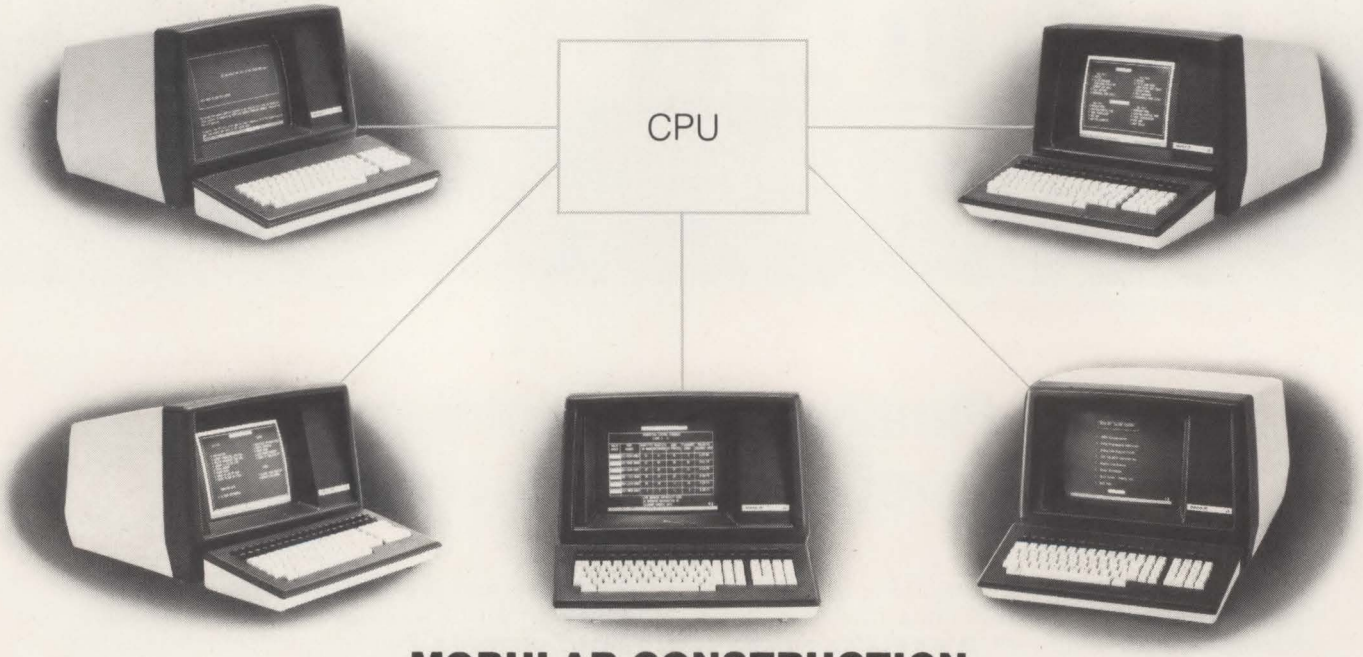

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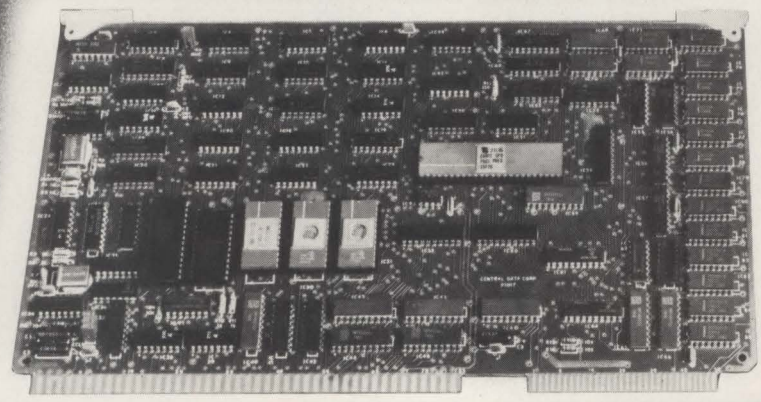
CIRCLE NO. 71 ON INQUIRY CARD

INTRODUCING A NEW STAR IN MEMORY MANAGEMENT

The Multibus Z8000 CPU Board from Central Data



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The Zilog/AMDZ8001 (segmented) 16 bit microprocessor chip. The Z8000 runs at a speed of 4 MHz and the board has full multi-master capabilities.

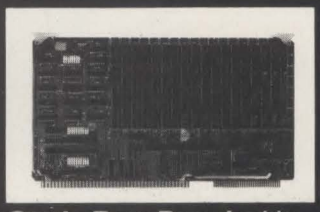
A unique memory management circuit that maps physical memory into 2K pages for a total system-wide memory of 16 Mbytes.

Multi-user capabilities with multiple memory maps that allow efficient usage with no interference.

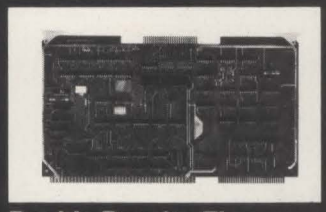
Two 2716 EPROMS, optionally available, that are automatically selected and can be deselected.

On-board peripheral chips that significantly decrease workload on the Z8000. Standard Z8000 CPU Bd. $635. Monitor Option $75. 9511 Option $225.

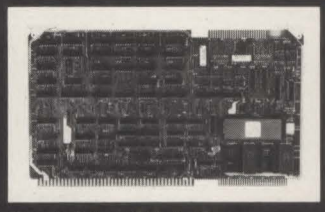
...and the finest supporting cast in the industry.



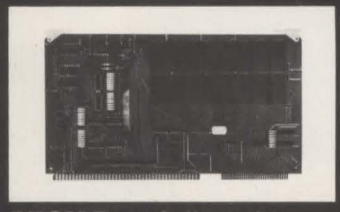
Static Ram Board adds either 16K or 32K of static memory to a Multibus system. 16K — $495. 32K — $880.



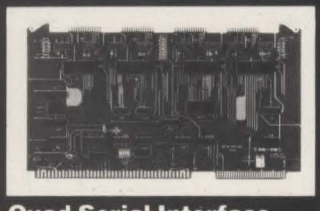
Double Density Floppy Disk Controller adds from one to four double density standard sized floppy disk drives, either single or double-sided. $255.



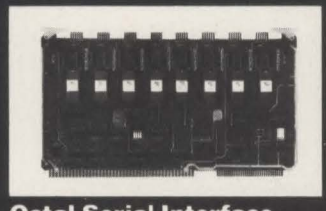
Cartridge Disk Controller Board provides DMA transfers to or from cartridge disk drives with capacities of 10 or 20 Mbytes. $335.



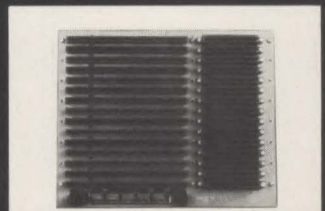
PROM Board allows the user to hook between 1k and 128K of PROM to a Multibus system. $110.



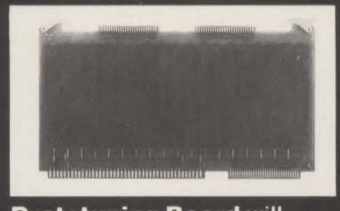
Quad Serial Interface Board hooks up to four EIA RS-232 interfaces to your system. $225.



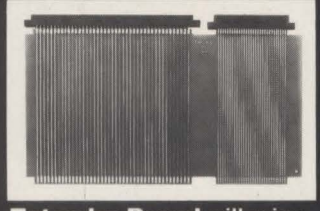
Octal Serial Interface Board allows up to eight EIA RS-232 interfaces. $265.



Mother Board can hold up to 15 Multibus cards with both P1 and P2 provided for each card position. $255.



Prototyping Board will accommodate up to 95 16-pin sockets, allowing the user to wire wrap a prototype circuit. $45.



Extender Board will raise a board being tested up to a height of 6.9 inches. $50.

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CIRCLE NO. 72 ON INQUIRY CARD

Conferences and Shows

Previewing Interface '80

LORI VALIGRA, Assistant Editor

Show's theme will stress the 1980s as the payoff decade for investments in data communications

The eighth annual Interface Conference and Exposition, to be held March 17-20 at the Miami Beach Convention Center, will focus on the operational and economic implications of technological advances in data communications, distributed data processing and networking. Show sponsors expect more than 250 exhibitors and 62 technical sessions to draw approximately 10,000 data comm and EDP professionals.

According to Sheldon G. Adelson, president of The Interface Group, which sponsors the show, "The thrust of this conference will be to position the 1980s as 'the payoff decade' for an ongoing (technology) investment program" in data communications.

Decreased costs and increased productivity of both equipment and personnel will be highlighted in the show's sessions and vendor offerings. On the network side, software and hardware vendors alike are gearing their efforts toward ease of use, protocol standardization for integration, diagnosis and analysis and data base structuring.

In a session called "Packaged Solutions Improve Net Performance," consultant Ralph Berglund will focus on

Decreased costs and increased productivity of equipment and personnel will be highlighted in sessions and exhibits.

an integrated approach to monitoring and analyzing network activity. According to Berglund, IBM's NPDA (network problem determination aid) and other packaged networks boost a network operator's productivity, save money and decrease programming time. Packaged solutions, he explains, are a "systems approach to a systems problem," as opposed to freestanding network monitoring systems, which are incorporated into the mainframe.

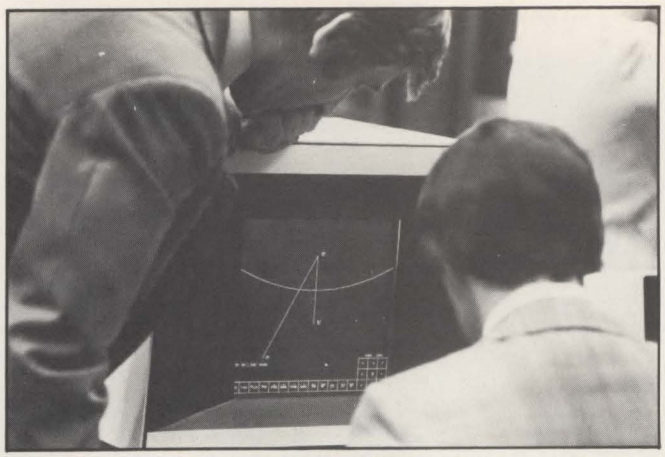
Helen Wood, a computer scientist at the National Bureau of Standards, also advocates a simpler approach to networking. In the session "New Multifunction Network Operating Systems," she will evaluate the combination of hardware and software available to make it easier for unsophisticated users to operate a network. Wood says that protocols of different components must be standardized before chores can be off-loaded onto the operating system. Such chores include translating languages between computers, resolving data formats and tracking data. "Protocol standards are inevitable if we are to have distributed data processing. There is a continuing movement toward facilitating communications between systems and creating standards such as ANSI and ISO," Wood explains.

Integration and protocol problems can be addressed through proper structuring of data bases, according to Dr. Robert H. Holland of Database Design, Inc. In the session "Structuring Hierarchical Data Bases for DDP Nets," Holland will discuss the trade-offs involved in distributing data bases among networks. "People today are not paying attention to the proper structuring of data," he explains, "but are jumping right into . . . physical before logical design." The recent automation of once cumbersome and expensive structuring tasks is the reason for this. But it is also costly to restructure data bases each time an application is added, Holland notes. "Many corporations spend 80 percent of their corporate DP dollar on maintenance of data bases," he says, adding that, with proper structuring, these costs would drop to 20 to 30 percent.

Vendors respond

Vendors are recognizing and responding to users' networking needs with a variety of offerings. For example, Intertel, Inc., will introduce its WRAP option, which adapts non-Intertel modems to the company's EMS-One network control system. The option makes modems completely compatible with all of Intertel's network-control products.

Other companies, including General Datacomm Industries, Inc., and Digi-Log Systems, Inc., will show recently introduced network-monitoring and diagnostic



More than 250 exhibitors *of data-communications, distributed data-processing and networking equipment are expected at this year's Interface '80.*

products, geared toward increased up-time. Digi-log will also introduce a data line monitoring system costing $3000, according to a company spokesman. Comparable systems on the market cost from $4500 to $6000.

Two vendors are focusing on saving operating time. T-Bar, Inc., for example, will exhibit its Multiple Access Switching System, which enables a user to access data communications lines from a command terminal for rapid network restoration, fault isolation and line monitoring. In addition, Sykes Datatronics, Inc., will show an enhancement to its private line network protocol 8A1/8B1. The addition provides straight store and forward capabilities for administrative messages and simultaneous send/receive.

Micom Systems, Inc. will introduce a multidrop terminal concentrator said to save communications costs by enabling a minicomputer to communicate over one telephone line with as many as 16 dumb terminals at as many as eight remote sites.

The standardization of interfaces to enhance communications capabilities and accessing data bases for word processors are considered in a session called "New Ways of Integrating Word and Data Processing on Distributed Networks." Although most word-processing systems are intelligent, accessing DP data bases is a major problem, because most terminal system interfaces are incompatible, according to Ralph DeMent of Digital Equipment Corp. He indicates a need for more communications capabilities on word processors.

Components are the major obstacle in standardizing to implement cost-effective fiber-optic systems, according to Dr. Del Hanson of Hewlett-Packard Co. He will discuss trade-offs involved in fiber-optic installation, such as parameter standardization, fiber design and cabling processes in the session "Fiber-Optics: The New Look in Local Loops."

Vendors in that market segment are offering products with stronger cable and less expensive connections. Canoga Data Systems and Siecor Optical Cables, Inc., will have a multiplexed data communications link operating between their booths through a

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CIRCLE NO. 73 ON INQUIRY CARD

Holland: 'People today are not paying attention to the proper structuring of data.'

one-kilometer fiber-optic cable. Canoga's 16-channel multiplexer, designed for speeds as high as 56K bytes, fits 16 communications lines onto one fiber, thus saving cost. End-user price is $9000 per end for a 16-channel system.

Canoga and other companies are also offering lower capability multiplexers. In addition, Valtec Corp. will introduce an eight-port asynchronous multiplexer that will sell for $6000. ITT Electro-Optical Products will show heavy-duty glass fiber cables, which can be buried directly in the ground by conventional plowing equipment, according to a company spokesman.

All-digital communications

Component integration is a concern in all-digital communications implementation as well as in networking. In "Progress Toward All-Digital Communications," John Nuwer of Atlantic Richfield will discuss the advancements in telephone digitizing and in A-to-D switches. "There is a cost benefit in getting away from separate instruments, such as a facsimile machine, word- or data-processing terminal, or telephone to a box on a desk, which will allow incompatible devices to talk with each other over a network," says Nuwer. He notes that there are many available systems to digitize the human voice. Possible solutions to the problems of digital voice synthesis will be discussed by Alan Kaplan of *Electronic Business* magazine in "Digitizing The Human Voice: The Sound of Systems to Come."

Management issues

To combat the personnel shortage, companies should emulate the training programs offered by IBM Corp., Xerox Corp. and Burroughs Corp. According to Dennis O'Donnell of O'Donnell and Associates, pirating of professionals will decrease, and recruiting efforts will be shifted to training college graduates and personnel in parallel markets, such as the office supplies industry.

Other show highlights are sessions on multipurpose microprocessors, distributed data processing case studies, the data comm school and eight workshops. Registration fee is $95 for four days or $60 for a single day for both sessions and exhibits. ■

WHAT'S COMING IN APRIL:

- High-level languages for microcomputers
- Data communications with minis: Part 2
- Expanding the 8086 family

MANUFACTURER	MODEL NUMBER	DATA RATE; MODULATION; SYNCHRONIZATION	TRANSMISSION MODE; CALLING MODE	TERMINAL INTERFACE; LINE INTERFACE; COMPATIBILITY	PRICE	COMMENTS
Codex Corp.	LSI4800, LSI7200, LSI9600, LSI48FP, LSI72FP, LSI96FP	2400 to 9600 bps; QAM; synchronous	full duplex, half duplex; originate/ answer	RS232C, CCITT V.24, MIL188C; four-wire	$4325 to $8750 or $95 to $200/mo.	
	LSI48I	2400 and 4800 bps; DPSK (eight-phase); synchronous	full duplex, half duplex; originate/ answer	RS232C, CCITT V.24, MIL188C; four-wire; CCITT V.27 and V.27bis, Codex LSI4800	$4325 or $95/mo.	multiplexer option provides as many as four channels using any combination of 1200-, 3600- and 4800-bps rates
	LSI48/V.27bis/ter	2400 and 4800 bps; DPSK (four- or eight-phase), QAM	full duplex, half duplex; originate/ answer	RS232C, CCITT V.24/V.28; two- or four-wire; CCITT V.27, V.27bis and V.27ter, Codex LSI4800 and Codex LSI48FP	$4585 or $105/mo.	
	MX2400	2400 bps; DPSK; asynchronous, synchronous	full duplex, half duplex	RS232C, CCITT V.24 or V.28, MIL188C; two- or four-wire; Bell 201B/C, CCITT V.26 and V.26bis	$1425 or $152/mo.	microprocessor-based; capable of network-control functions
	MX48A/B	4800 bps; DPSK (eight-phase); synchronous	full duplex half duplex; originate/ answer	RS232C; two- or four-wire; Bell 208A/B	$3900 or $90/mo.	point-to-point, multipoint or dial modes; FCC registered; auto-call capability, automatic or manual answer
	8300	40K to 64K bps; PSK; synchronous	full duplex; originate/ answer	CCITT V.35; four-wire	$6450 or $215/mo.	group band modem; CCITT V.35-to-Bell 303 interface adaptor available
	296 Biplexer	as high as 19.2K bps; QAM; synchronous	full duplex	RS232C, CCITT V.24 or V.35, MIL188C; four-wire	$5000 or $165/mo.	uses two 9600-bps modems for total of 19.2K bps
Coherent Communications Systems Corp.	FSM-86A, FSM-85A	as high as 300 or 600 baud; FSK; asynchronous	full duplex, half duplex; originate or transparent	RS232, 20-mA current loop; two- or four-wire		the FSM-86A can be multiplexed, with as many as 36 modems on a four-wire line
ComData Corp.	Series 150, Series 302, Series 330, T212A	as high as 300 or 1200 baud; FSK; asynchronous	full duplex, half duplex; originate, manual or automatic answer	RS232, 20-mA current loop, Mil Standard 188, TTL, acoustic; two- or four-wire; Bell 100 Series, 202, 212A	$125 to $895	
	201, 208	2400 baud; PSK; synchronous	full duplex, half duplex; originate, manual or automatic answer	RS232; two- or four-wire; Bell 201, 208A, 208B	$2625 to $2925	
Data Access Systems	68-01	300 baud; FSK; asynchronous	full duplex, half duplex; originate/ answer	RS232; Bell 103, 113	$295	
Data-Control Systems	LM-192A	2400 to 19.2K bps; phase delayed; synchronous	full duplex, half duplex	RS232C; two- or four-wire, Bell 3002, 3080 or 3081		limited-distance modem
	SR-300/400 Series	as high as 56K bps; FM/FSK; asynchronous, synchronous	full duplex; originate/ answer	RS232C, RS449 (optional); standard microwave transmitter interface		multichannel microwave modems
	SR-200	2400 to 19.2K bps; baseband; synchronous	full duplex, half duplex	RS232, current loop; two- or four-wire, Bell 3080 or 3081		conforms to Bell 43401
	SR-100	as high as 19.2K bps; baseband; asynchronous	full duplex, half duplex	RS232C, current loop; two- or four-wire, Bell 3080 or 3081		conforms to Bell 43401
DEI Teleproducts Division	ADT-2	as high as 9600 baud; baseband; asynchronous	full duplex, half duplex; auto-answer emulation, multipoint polling	RS232; four-wire	$225	short-haul modem
	2020	as high as 1800 baud; FSK; asynchronous	full duplex, half duplex; originate, answer, private line	RS232; two- or four-wire; Bell 202	$450	

MANUFACTURER	MODEL NUMBER	DATA RATE; MODULATION; SYNCHRONIZATION	TRANSMISSION MODE; CALLING MODE	TERMINAL INTERFACE; LINE INTERFACE; COMPATIBILITY	PRICE	COMMENTS
Develcon Electronics, Inc.	DS-512, DS-513	300 to 9.6K or 19.2K bps; asynchronous	full duplex, half duplex	RS232; two- or four-wire	$275 to $325	limited-distance modems
	DS-541, DS-548	1200 to 19.2K bps; synchronous	full duplex, half duplex	RS232; two- or four-wire	$425 to $685	limited-distance modems
	DS-558	19.2K to 100K bps; synchronous	full duplex, half duplex	RS232, WE303, CCITT V.35; two- or four-wire	$747	limited-distance modem
Gandalf Data, Inc.	LDS 250/3; LDS 329, LDS 309, LDS 319	as high as 9.6K or 100K bps; PM; synchronous, asynchronous	full duplex, half duplex	RS232, CCITT V.35; four-wire; Bell 303	$450 to $786	
	LDM 404B, LDM 414	as high as 4800 bps; QAM; synchronous or asynchronous	full duplex	RS232; four-wire	$1200 to $1300	2400/2400-bps split channel available
	LDS 100C	as high as 19.2K bps; baseband; asynchronous	full duplex, half duplex	RS232, 20-mA current loop; four-wire	$225	
	LDS 120	as high as 9600 bps; polar return to zero; asynchronous	full duplex, half duplex	RS232, 20-mA current loop; Burroughs bus	$300	
	LDS 140	50 to 9600 baud; binary NRZI; asynchronous	full duplex, half duplex	RS232, 20-mA current loop; two- or four-wire;	$450	
	SM 9600	9600 baud; synchronous	full duplex	RS232; four-wire	$4000	
General Datacomm Industries, Inc.	103A3, 108-3(R), 113BR2, 202-9D(R), 202S	as high as 300, 1200 or 1800 bps; FSK; asynchronous	full duplex, half duplex	RS232; two- or four-wire; Bell 103, 108, 113, 202	$265 to $480	
	201C, 201-7(R), MPF 208B/A, MPF 208-9A, 2400 EP	2400 or 4800 bps; DPSK; synchronous	full duplex, half duplex; leased and private lines, originate, answer, automatic originate, automatic answer	RS232, RS334; two- or four-wire; Bell 201, 208	$875 to $3275	
	4802E(D)	4800 or 2400 baud; DPSK	full duplex, half duplex; private line, switched network	CCITT V.24 or V.28; two- or four-wire	$4428	multiplexer option
	212A	300 or 1200 bps; FSK, asynchronous (low speed); PSK, synchronous (high speed)	full duplex; originate and auto-answer	RS232; two-wire; Bell 103/113 or 212A	$850	
	9601	4800, 7200 or 9600 baud; PAM	full duplex	RS232; four-wire	$6545	multiplexer option
	LDM-1	1200 to 19.2K bps; delay modulation; synchronous or asynchronous	full duplex, half duplex	RS232	$830	
GTE Lenkurt, Inc.	263A, 262A	2.4K to 56K bps; synchronous	simplex, half duplex, full duplex;	RS232, RS334; two- or four-wire	$850 to $3060	
Harvey Hubbell, Inc.	4011/4012-10	as high as 300 baud; FSK; asynchronous	full duplex; originate, answer	RS232; two- or four-wire; Bell 108A, 108C		
Infotron Systems Corp.	DL113B	300 bps; FSK; asynchronous	full duplex; answer only	RS232; Bell 103A, 113A	$215 to $265	
	DL9600	4800 or 9600 bps; PAM/VSB; synchronous	full duplex; originate, answer	RS232; four-wire	$5500 to $6500	optional bandsplitter: four at 2400 bps, two at 4800 bps or one at 2400 bps and at 7200 bps
Intertel, Inc.	M2415, M1524	150 and 2400 bps (alternate voice and data); DPSK, FSK; synchronous, asynchronous	full duplex; originate, answer	RS232; two-wire	$800 to $1050	
	MCS 4800, MCS 9600	as high as 4800 or 9600 bps; QAM; synchronous	full duplex, half duplex; originate, answer	RS232; two- or four-wire	$4400 to $8700	multiplexer option; 150-bps secondary channel option
	M1200, MCS1200, M1236	1200 or as high as 1800 bps; FSK; asynchronous	full duplex, half duplex; originate, answer	RS232, IBM 3600; two- or four-wire; Bell 202, 202C or 202D	$400 to $960	150-bps secondary channel (MCS 1200)
	MCS 2400	2400 bps; PM, four-phase; synchronous	full duplex, half duplex; originate, answer	RS232, IBM 3600; two- and four-wire; Bell 201B	$1750	150-bps secondary channel
	M2400	2400 bps; DPSK; synchronous	full duplex, half duplex; originate, answer	RS232; two- or four-wire; Bell 201	$550	

MANUFACTURER	MODEL NUMBER	DATA RATE; MODULATION; SYNCHRONIZATION	TRANSMISSION MODE; CALLING MODE	TERMINAL INTERFACE; LINE INTERFACE; COMPATIBILITY	PRICE	COMMENTS
Livermore Data Systems, Inc.	STAR	0 to 300 baud; FSK; asynchronous	full duplex, half duplex; originate, answer	RS232 and 20-mA current loop, IEEE 488, TTL and TTY 43 optional; acoustic; Bell 103 and 113 and CCITT V.21	less than $200	
	412	0 to 1200 bps; FSK; asynchronous	full duplex, half duplex, simplex; originate and answer	RS232C, CCITT; two- or four-wire; Bell 202, CCITT V.23	$414	can be converted to 2400-bps synchronous operation with plug-in circuit board
	424	2400 bps; DPSK; synchronous	full duplex, half duplex, simplex; originate, answer	RS232C, CCITT; two- or four-wire; Bell 201, CCITT V.26A and V.26B	$620	
	440/48	2400 or 4800 bps; double sideband suppressed carrier, amplitude modulated, with two carriers in quadrature; synchronous	full duplex, half duplex; originate, answer	RS232C, CCITT; two- or four-wire	less than $2000	two- or four-channel multiplexing capability; single-card modem available for OEMs; asynchronous interface available
Mazdar Corp.	Z9600	0 to 9600 bps; baseband; asynchronous	full duplex, half duplex, simplex	RS232C; two- or four-wire	$167 (single-unit quantities), $117 (50-unit quantities)	
Multi-Tech Systems, Inc.	FM 1200 series, FM 310/310A, FM327, FM 30 (acoustic coupler)	as high as 300, 450, 1200 or 1800 baud; FSK	full duplex, half duplex; originate, answer, answer only	RS232, 20-mA current loop, TTL; acoustic, two- or four-wire; Bell 103, 113, 202B, 202C, 202R, 202S, 202T	$245 to $435	
	MT212	1200 bps; PSK	full duplex; originate, answer	RS232; two-wire; Bell 212A	$510 to $595	
Novation, Inc.	CAT, 4102D, 4113B, 4143A, 4136A, 4202B, 4202T, 4103A, 4103B	300 or 1200 baud; FSK; asynchronous	full duplex, half duplex; originate, answer, originate only, answer only	RS232, 20-mA current loop; acoustic, two- or four-wire, direct connect or leased line; Bell 103	$189 to $569	
Paradyne Corp.	L05-24	2400 bps; DPSK; synchronous	full duplex; leased line	RS232; four-wire; Bell 201C		
	L05-48, L05-72, L05-96	4800, 7200 and 9600 bps; PAMVSB; synchronous	full duplex; leased line	RS232; four-wire		
	MP48, MP48-208	4800 bps; DPSK; synchronous	full duplex, half duplex; leased or dial-up line (auto-answer optional)	RS232; four-wire; Bell 208R (MP48-208 only)		
	MP96, MP96 Rapid Poll	9600 bps; QAM; synchronous	full duplex, half duplex; leased or dial-up line (auto-answer optional)	RS232; four-wire		
	M96	9600 bps; PAMVSB; synchronous	full duplex; leased line	RS232; four-wire		
Prentice Corp.	P-202T, P-202S, 100 series	as high as 300 or 1200 bps; FSK	full duplex, half duplex; originate, answer	RS232; two- or four-wire, switched network; Bell 103J, 113C, 113D, 202S, 202T	$385 to $470	
	SLD	1200 to 28.8K baud; synchronous	full duplex; originate, answer	RS232; two- or four-wire	$690	
	P-212A, P-212C	as high as 300 bps FSK, as high as 1200 bps PSK	full duplex; originate, answer	RS232; two-wire switched network; Bell 212A	$895 to $1035	
	ALD	as high as 9600 bps; polar NRZ-L; asychronous	full duplex	RS232; two- or four-wire	$280	
Racal-Milgo Information Systems, Inc.	MPS 9601	4800 to 9600 bps; eight-phase, two-amplitude; asynchronous	full duplex, half duplex	RS232; four-wire, four-wire dial backup		multipoint, point-to-point

MANUFACTURER	MODEL NUMBER	DATA RATE; MODULATION; SYNCHRONIZATION	TRANSMISSION MODE; CALLING MODE	TERMINAL INTERFACE; LINE INTERFACE; COMPATIBILITY	PRICE	COMMENTS
Racal-Milgo Information Systems, Inc.	MPS 4896	transmit at 4800 bps, receive at 9600 bps; eight-phase; asynchronous	half duplex; automatic or manual answer	RS232; four-wire		
	24LSI Mark II	2400 bps	full duplex, half duplex	RS232; two- or four-wire; Bell 201B, 201C		
Racal-Vadic, Inc.	VA1255	as high as 1200 bps, binary phase-coherent FSK (primary channel), keyed AM (secondary channel)	half duplex; manual originate, manual or automatic answer	RS232; Bell 202	$525	
	VA3455, VA3453, VA3452, VA3451	as high as 1200 or 300 bps; binary; synchronous or asynchronous	full duplex; manual or automatic originate, automatic answer	RS232; direct or two-wire leased line; Bell 212A, 103	$825 to $900	
	VA2440, VA2445	2400 bps, (secondary channel as high as 75 or 250 bps); PSK (secondary channel FSK); synchronous	half duplex; originate, answer	RS232, CCITT V.28; direct connect, two-wire leased line; Bell 201B, 201C	$575 to $725	
	VA3447, VA3437, VA3427, VA3467, VA3434	1200 and as high as 300 bps; synchronous, asynchronous	full duplex; answer only	RS232; direct connection, two-wire leased line; Bell 103, 212A	$650 to $895	
	VS1200P OEM, VA1252, VA1251, VA1250, VA355, VA317	as high as 300, 1200 or 1800 bps; FSK; asynchronous	full duplex, half duplex; manual originate, manual or automatic answer, answer only	RS232, TTL levels, 20-mA current loop; two- or four-wire; Bell 202C, 202S, 202D, 202R, 202T, 202E, 103, 113	$250 to $535	
RFL Industries	6860	1200 baud (concurrent voice); FSK	full duplex	RS232; four-wire	$3265	
	6385	1200 or 1800 baud; FSK; asynchronous	full duplex, half duplex	RS232, TTL; two- or four-wire; Bell 202	$300	
Rixon, Inc.	T212A	as high as 300 bps FSK asynchronous, 1200 bps PSK synchronous	full duplex; originate, answer	RS232; two-wire DDD; Bell 103 and 212A, Rixon T103 and T113	$855	
	T103J	0 to 300 bps; FSK; asynchronous serial binary	full duplex; originate, answer	RS232; two-wire DDD	$550	
	T202T	as high as 1800 bps; FSK; asynchronous serial binary	full duplex, half duplex; originate, answer	RS232; two- or four-wire FCC tariff 260 type 3002; Bell 202 Series	$460	
	T108E/G/J	0 to 300 bps; FSK; asynchronous serial binary	full duplex, half duplex; originate	RS232C or 20-mA current loop (optional); two- or four-wire FCC tariff 260 type 3002; Bell 100 Series private-line modems	$320	
	TA201C	2400 bps; differentially coherent four phase	full duplex, half duplex; originate, answer	RS232; two-wire DDD and two- or four-wire unconditioned private line	$950	multipoint antistreaming capability
	LDM710	as high as 9600 bps; bipolar phase; asynchronous	full duplex, half duplex, point-to-point or multipoint	RS232C, 20-mA current loop; two- or four-wire metallic circuits; conforms to Bell Publication 43401	$295	
	T113C	as high as 300 bps; FSK; asynchronous serial binary	full duplex; originate	RS232; two-wire DDD; Bell 103/113 Series switched network modems	$395	
	T209A	9600 bps; QAM, synchronous serial binary	full duplex, half duplex; originate, answer	RS232C; four-wire private line; Bell 209A	$6300	microprocessor-based; integral four-channel synchronous multiplexer; integral data quality monitor card optional

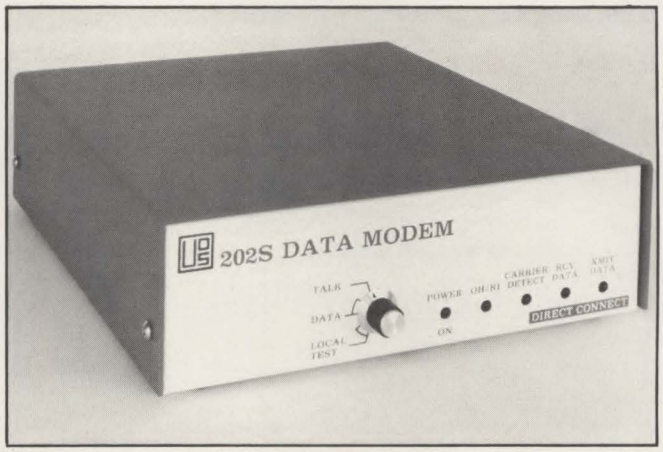
MANUFACTURER	MODEL NUMBER	DATA RATE; MODULATION; SYNCHRONIZATION	TRANSMISSION MODE; CALLING MODE	TERMINAL INTERFACE; LINE INTERFACE; COMPATIBILITY	PRICE	COMMENTS
Rixon, Inc.	T208A/B	4800 bps; PSK; synchronous	full duplex, half duplex; originate, answer	RS232; two-wire DDD or four-wire unconditioned private line; Bell 208A and 208B, Rixon 208A and 208B	$2810	
Rockwell International	R24	2400 bps; DPSK; synchronous	full duplex, half duplex; originate, answer	TTL; two- or four-wire; Bell 201B, 201C	$395	consists of three modules to be integrated into OEM systems
Tekcom, Inc.	TC 3001 (acoustic coupler), TC 3002 (acoustic coupler), TC 3006 (acoustic coupler), TC 4001, TC 5001	300 or 1200 baud; FSK; asynchronous	full duplex, half duplex; originate, answer, automatic answer	RS232, 20-mA current loop; two- or four-wire; Bell 103F, 113A, 113B, 202C, 202D, 202E, 202R, 202T	$195 to $385	
Timeplex, Inc.	M9600	4800 or 9600 bps; AM/VSB; synchronous	full duplex	RS232; four-wire private line	$5250	
	103C/D, R103, R202, 202C/D	as high as 300, 1200 or 1800 bps; FSK; asynchronous, synchronous	full duplex, half duplex; originate, answer	RS232, Mil 188C; two- or four-wire, private line, switched network; Bell 202S, 202T, 103, 113, 108	$349 to $475	
Tran Telecommunications Corp.	Directran M611/M631	9600 bps; baseband; asynchronous	full duplex, half duplex; originate, answer	RS232; four-wire	$350 to $575	
	Intertran M918, M938, M916, M936, M911, M931	100 bps to 250K bps; PPM; synchronous	full duplex, half duplex; originate, answer	CCITT V.35, RS-232; four-wire	$800 to $1900	short-haul modems
	M971-1, M971-2	1200 to 9600 bps, 19.2K to 64K bps; bipolar encoding, synchronous	full duplex, half duplex; originate, answer	RS232, CCITT V.35; four-wire; Bell 303	$950 to $1150	limited-distance modems
Tuck Electronics, Inc.	1510, 1530, 1540, 1541, 1542, 1610, 1630, 1650, 1653	as high as 300 or 1200 bps; FSK; asynchronous	full duplex, half duplex; originate, answer	RS232, 20-mA current loop, TTL; Bell 103A, 202C, 202S, 202D, 202R, 202T	$168 to $395	
	1810, 1880, 1881, 1883, 1884	20 cps; FSK, AM; asynchronous	receive only or transmit only; originate, manual and automatic answer	contact closure; two-wire; Bell 401J, 401A, 401E, 401H5, 401H4	$225 to $675	
	1820, 1830	10 cps; AM; asynchronous	receive only, answer back; originate, answer	RS232; two-wire; Bell 403D, 403E, 407A, 407B	$485 to $507.50	
	2120	1200 to 19.2K bps; PSK; synchronous	full duplex, half duplex	RS232; two- or four-wire	$425	
U.S. Robotics, Inc.	Penril 300/1200	as high as 300 bps FSK, as high as 1200 bps PSK	full duplex; originate, manual or automatic answer	RS232; two-wire; Bell 212A	$799	
	USR-330	as high as 300 baud; FSK	full duplex, half duplex; originate, manual or automatic answer	RS232, 20-mA current loop; two-wire; Bell 100 series	$339	
Universal Data Systems	103J, 113D, 202S	300 or 1200 baud; FSK; asynchronous	full duplex; originate, answer	RS232; two- or four-wire; Bell 103J, 113D, 202S	$375 to $515	
	201C	2400 baud; DPSK; synchronous	full duplex	RS232; two- or four-wire; Bell 201C	$915	
	208B	4800 baud; PSK; synchronous	half duplex; originate, answer	RS232; two-wire; Bell 208B	$2975	
	12-12	1200 baud; PSK; synchronous, asynchronous	full duplex; originate, automatic answer	RS232; two-wire	$600	

Almost every modem on the market today incorporates a diagnostic test facility that enables it to check its own health and display the results, without being connected to a phone line.

Users who deal exclusively with the telephone company also avoid some of the finger-pointing that inevitably crops up in multiple-vendor arrangements: the phone company blames the modem vendor and the vendor returns the blame. If the modem comes from Bell, this situation is averted, although a similar dispute could arise between the phone company and the terminal supplier.

But the modem makers have a ready answer to the finger-pointing problem. Almost every modem on the market incorporates a diagnostic test facility that enables it to check its own health and display the results to the user, without being connected to the phone line. If no faults are detected in the diagnostic test, the modem is presumed absolved, and the user looks for the problem in the terminal or the line. Some vendors carry this process one step further, enabling their modems to conduct remote tests that exercise the line and the terminal as well as the modem itself, to further assist users in fault isolation.

Life would be sweet for independent modem vendors if they had only AT&T to worry about. But the competition is fierce. It is reflected not only in the price structures for modems—a low-speed unit costs a few hundred dollars—but in the rich variety of features designed to attract the potential buyer. For example, the Intertel 2415 modem permits automatic alternation of voice and data—a handy function for the computer company with a remote diagnostic package to test its installations from a maintenance center. The user calls the service center. If, during the conversation, the center decides to send a diagnostic program down the line to test the customer's computer, the data transmission automatically interrupts the conversation, and the people hear a distinctive tone that indicates data is being sent. When the transmission is complete, the voice mode is again enabled, and the conversation can resume.



The Universal Data System *model 202S modem—compatible with the Bell 202S—operates asynchronously at 1200 baud.*

REFERENCE LITERATURE

For more information on the modems surveyed in this article, use the reader circle numbers below.

Company	Circle No.
American Telephone and Telegraph Co., New York, N.Y.	413
Anderson Jacobson, Inc., San Jose, Calif.	414
Astrocom Corp., St. Paul, Minn.	415
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Introducing

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SEE US AT INTERFACE '80

Industry observers do not predict a modem on a chip emerging in the near future.

Coherent Communications' FSM-86 modem includes a "regenerative repeater" that reshapes and retimes signals, correcting as much as 48 percent harmonic distortion in received signals, to keep the error rate down. Distortion in the output signal is less than one percent. Like several other modems, the FSM-86 also has switch-selectable frequency settings. Without this feature, a crystal in the modem must be changed to alter the carrier frequency (an acceptable limitation in applications that require only one frequency over long periods of time).

The Avanti 3002 has an optional dual-channel capability that enables it to handle two terminals, each operating independently at 1800 or 2400 bps, or a single terminal at 3600 or 4800 bps.

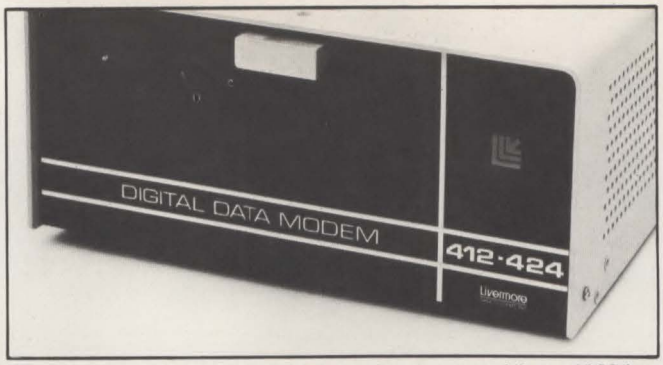
The Avanti 2300 modem *is intended primarily for computer-to-computer and earth-satellite communication links.*

The 300-bps Infotron DL 113B includes an "anti-tailending" feature, intended to ensure computer port security. The modem will not answer a call until at least one second after the previous call disconnects, thereby assuring that the port is cleared and that each user's data is protected. In addition, Infotron's power-distribution method is designed so that failure of an individual modem module does not affect the operation of other modems in a rack. Each modem has its own voltage regulator, so that only one module goes out of action if a regulator should fail.

Features may attract customers, but buying decisions are based on cost. In this volatile marketplace, buyers have quite a bit of leverage, especially when buying in quantity. Besides volume discounts on purchase price, vendors will make deals that include free maintenance over an indefinite period or additional price concessions.

Future trends

Three major trends will develop in the modem market in the next three to five years. First, there will be a growing movement to higher bit rates, as technology improves and more high-speed terminals are installed in the field. Second, RS449 will emerge to replace RS232 as the industry's digital interface



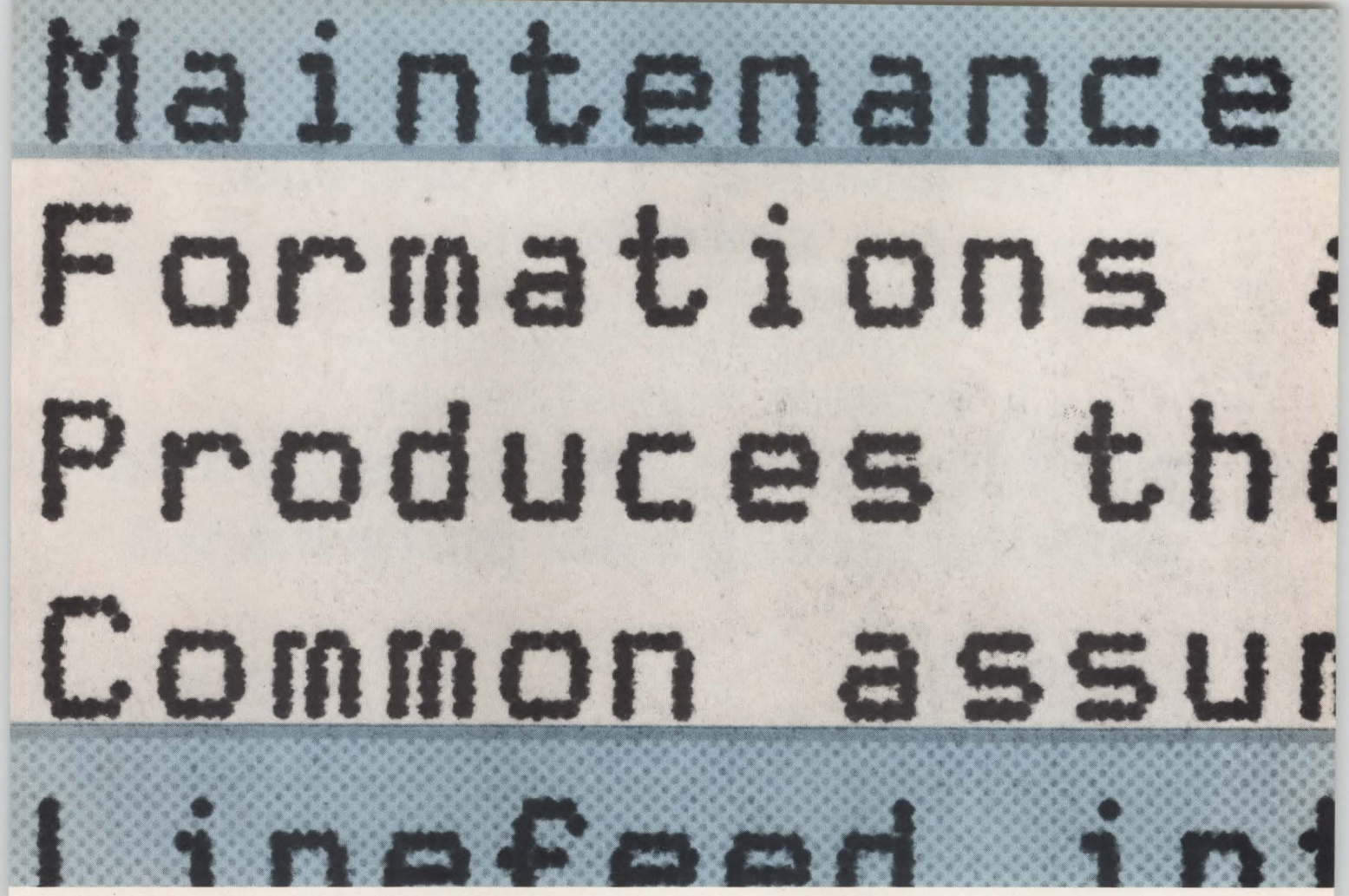
The Livermore 412/424 modem *can be converted from 1200-bps asynchronous to 2400-bps synchronous operation by addition of a single PC board.*

standard (MMS, November, 1979, p. 67). And finally, modems will increasingly be built into terminals, changing the nature of the vendors' business. Instead of furnishing complete units to end users, the modem suppliers will build modem cards for OEMs. Industry observers do not predict a modem on a chip emerging in the near future. Only the equalizer portion, which compensates for line delays and distortion, lends itself readily to IC technology. The interfacing and signal-handling circuitry will continue to reside on circuit boards.

Modem vendors are concerned, nevertheless, about the entry of semiconductor manufacturers into the market. Rockwell International already offers a line of modems; others may follow. Other modem makers would prefer to see the semiconductor houses stick to chips, leaving system integration to modem manufacturers. But, despite recent rumblings in the press about the coming decline of the modem business, the vendors are moving ahead and plan to stay around for some time to come.

When will RS449 make its presence felt? "When Bell decides to make it happen," according to Bertram Ralph, vice president of Coherent Communications Systems Corp. He says no customer has yet demanded an RS449 modem. His company expects to be shipping "mixed products"—compatible with both RS449 and RS232—for several years, before the demand for RS232 declines. Bo Sullivan, regional manager for Avanti Communications Corp., concurs, indicating the enormous installed base of RS232-compatible equipment in the field. "They won't throw away that equipment just because of a new standard," he says. ■

MAL STIEFEL, now on the technical staff at Mitre Corp., has worked as a systems analyst, systems engineer, and programmer on military command and control systems, hospital administration, investment securities, and municipal information systems.



This is an unretouched enlargement of PRINTERM's print quality.

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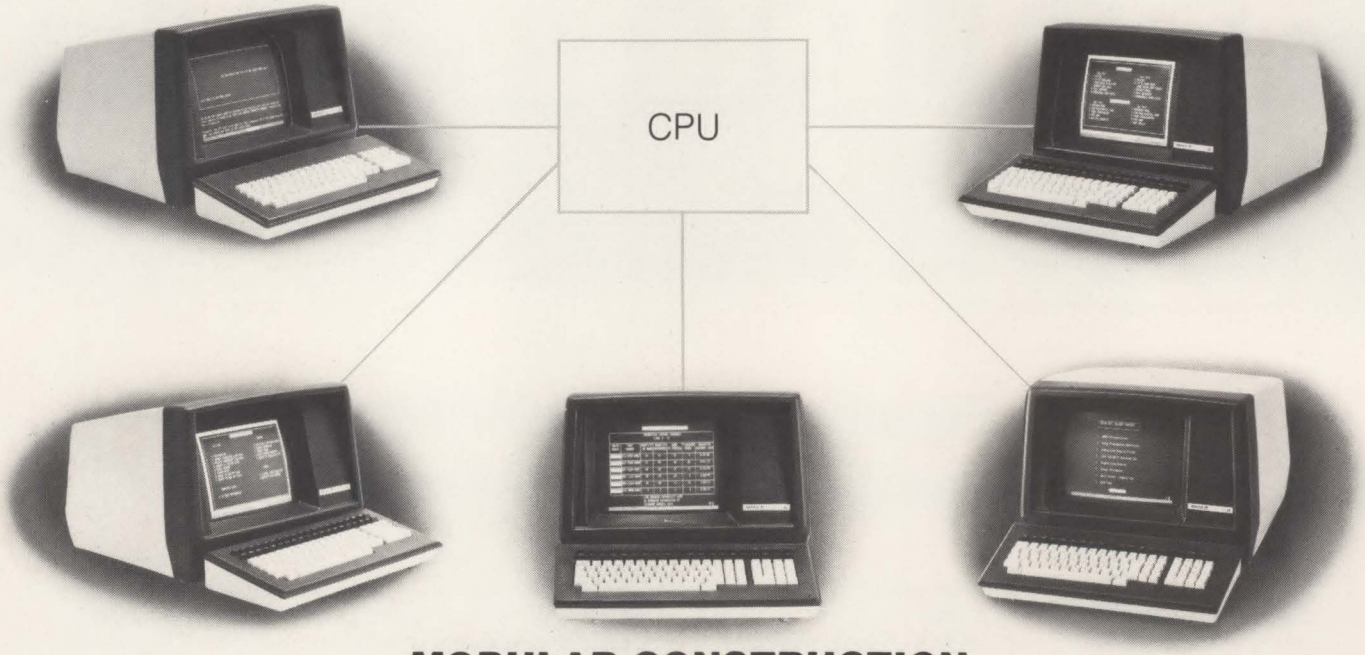

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The Sprint 5 WideTrack is the widest printer on the market today. It spaces 264 columns at 10 characters per inch, 316 columns at 12 characters per inch, and can space in increments of 1/120-inch left or right. Vertical spacing is 1/48-inch up or down, and you control it through the MOS/LSI microprocessor's extensive set of software commands.

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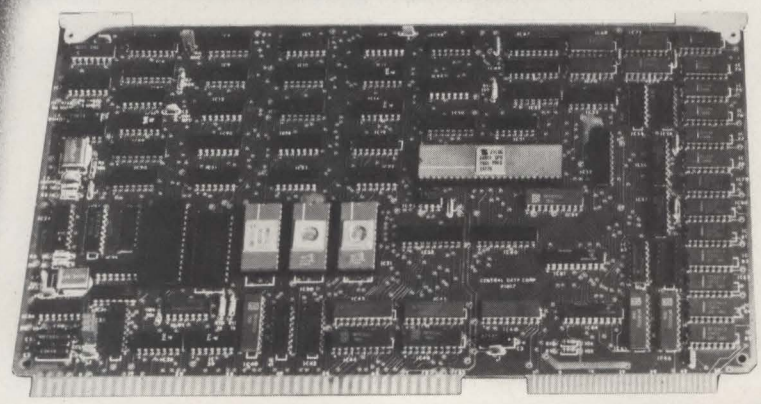
CIRCLE NO. 71 ON INQUIRY CARD

INTRODUCING A NEW STAR IN MEMORY MANAGEMENT

The Multibus Z8000 CPU Board from Central Data



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The Zilog/AMDZ8001 (segmented) 16 bit microprocessor chip. The Z8000 runs at a speed of 4 MHz and the board has full multi-master capabilities.

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On-board peripheral chips that significantly decrease workload on the Z8000. Standard Z8000 CPU Bd. $635. Monitor Option $75. 9511 Option $225.

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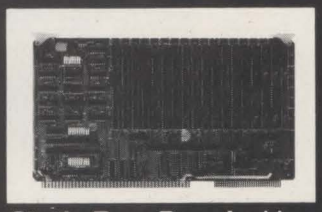
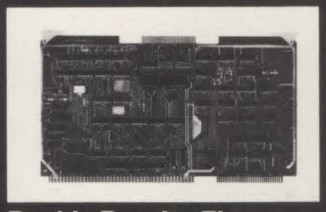
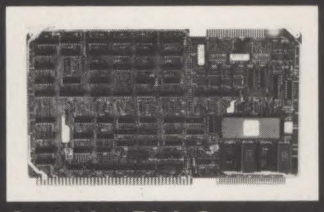


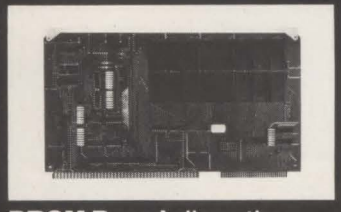
Static Ram Board adds either 16K or 32K of static memory to a Multibus system. 16K—$495. 32K—$880.



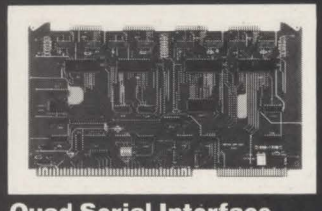
Double Density Floppy Disk Controller adds from one to four double density standard sized floppy disk drives, either single or double-sided. $255.



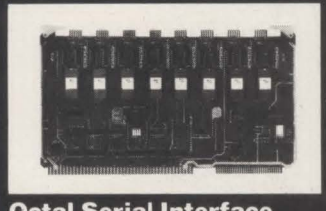
Cartridge Disk Controller Board provides DMA transfers to or from cartridge disk drives with capacities of 10 or 20 Mbytes. $335.



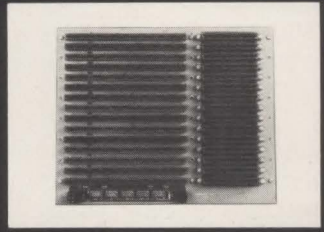
PROM Board allows the user to hook between 1k and 128K of PROM to a Multibus system. $110.



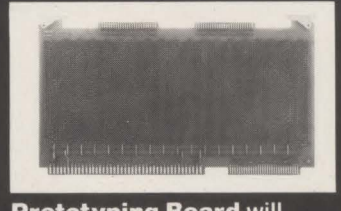
Quad Serial Interface Board hooks up to four EIA RS-232 interfaces to your system. $225.



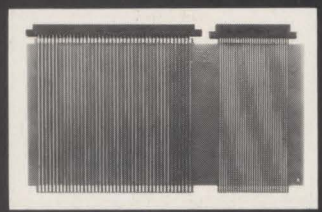
Octal Serial Interface Board allows up to eight EIA RS-232 interfaces. $265.



Mother Board can hold up to 15 Multibus cards with both P1 and P2 provided for each card position. $255.



Prototyping Board will accommodate up to 95 16-pin sockets, allowing the user to wire wrap a prototype circuit. $45.



Extender Board will raise a board being tested up to a height of 6.9 inches. $50.

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CIRCLE NO. 72 ON INQUIRY CARD

Conferences and Shows

Previewing Interface '80

LORI VALIGRA, Assistant Editor

Show's theme will stress the 1980s as the payoff decade for investments in data communications

The eighth annual Interface Conference and Exposition, to be held March 17-20 at the Miami Beach Convention Center, will focus on the operational and economic implications of technological advances in data communications, distributed data processing and networking. Show sponsors expect more than 250 exhibitors and 62 technical sessions to draw approximately 10,000 data comm and EDP professionals.

According to Sheldon G. Adelson, president of The Interface Group, which sponsors the show, "The thrust of this conference will be to position the 1980s as 'the payoff decade' for an ongoing (technology) investment program" in data communications.

Decreased costs and increased productivity of both equipment and personnel will be highlighted in the show's sessions and vendor offerings. On the network side, software and hardware vendors alike are gearing their efforts toward ease of use, protocol standardization for integration, diagnosis and analysis and data base structuring.

In a session called "Packaged Solutions Improve Net Performance," consultant Ralph Berglund will focus on

Decreased costs and increased productivity of equipment and personnel will be highlighted in sessions and exhibits.

an integrated approach to monitoring and analyzing network activity. According to Berglund, IBM's NPDA (network problem determination aid) and other packaged networks boost a network operator's productivity, save money and decrease programming time. Packaged solutions, he explains, are a "systems approach to a systems problem," as opposed to freestanding network monitoring systems, which are incorporated into the mainframe.

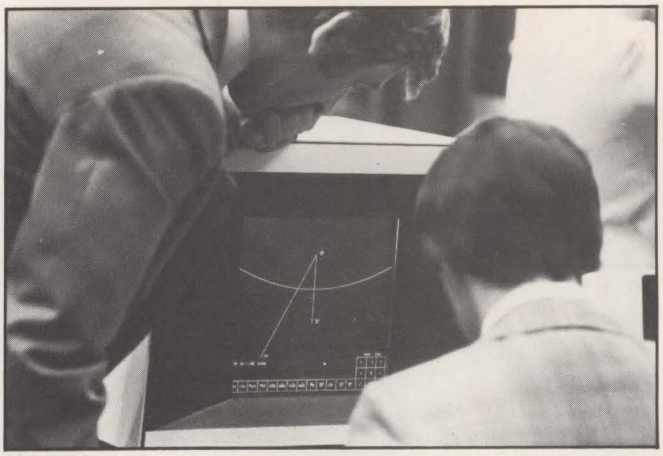
Helen Wood, a computer scientist at the National Bureau of Standards, also advocates a simpler approach to networking. In the session "New Multifunction Network Operating Systems," she will evaluate the combination of hardware and software available to make it easier for unsophisticated users to operate a network. Wood says that protocols of different components must be standardized before chores can be off-loaded onto the operating system. Such chores include translating languages between computers, resolving data formats and tracking data. "Protocol standards are inevitable if we are to have distributed data processing. There is a continuing movement toward facilitating communications between systems and creating standards such as ANSI and ISO," Wood explains.

Integration and protocol problems can be addressed through proper structuring of data bases, according to Dr. Robert H. Holland of Database Design, Inc. In the session "Structuring Hierarchical Data Bases for DDP Nets," Holland will discuss the trade-offs involved in distributing data bases among networks. "People today are not paying attention to the proper structuring of data," he explains, "but are jumping right into . . . physical before logical design." The recent automation of once cumbersome and expensive structuring tasks is the reason for this. But it is also costly to restructure data bases each time an application is added, Holland notes. "Many corporations spend 80 percent of their corporate DP dollar on maintenance of data bases," he says, adding that, with proper structuring, these costs would drop to 20 to 30 percent.

Vendors respond

Vendors are recognizing and responding to users' networking needs with a variety of offerings. For example, Intertel, Inc., will introduce its WRAP option, which adapts non-Intertel modems to the company's EMS-One network control system. The option makes modems completely compatible with all of Intertel's network-control products.

Other companies, including General Datacomm Industries, Inc., and Digi-Log Systems, Inc., will show recently introduced network-monitoring and diagnostic



More than 250 exhibitors *of data-communications, distributed data-processing and networking equipment are expected at this year's Interface '80.*

products, geared toward increased up-time. Digi-log will also introduce a data line monitoring system costing $3000, according to a company spokesman. Comparable systems on the market cost from $4500 to $6000.

Two vendors are focusing on saving operating time. T-Bar, Inc., for example, will exhibit its Multiple Access Switching System, which enables a user to access data communications lines from a command terminal for rapid network restoration, fault isolation and line monitoring. In addition, Sykes Datatronics, Inc., will show an enhancement to its private line network protocol 8A1/8B1. The addition provides straight store and forward capabilities for administrative messages and simultaneous send/receive.

Micom Systems, Inc. will introduce a multidrop terminal concentrator said to save communications costs by enabling a minicomputer to communicate over one telephone line with as many as 16 dumb terminals at as many as eight remote sites.

The standardization of interfaces to enhance communications capabilities and accessing data bases for word processors are considered in a session called "New Ways of Integrating Word and Data Processing on Distributed Networks." Although most word-processing systems are intelligent, accessing DP data bases is a major problem, because most terminal system interfaces are incompatible, according to Ralph DeMent of Digital Equipment Corp. He indicates a need for more communications capabilities on word processors.

Components are the major obstacle in standardizing to implement cost-effective fiber-optic systems, according to Dr. Del Hanson of Hewlett-Packard Co. He will discuss trade-offs involved in fiber-optic installation, such as parameter standardization, fiber design and cabling processes in the session "Fiber-Optics: The New Look in Local Loops."

Vendors in that market segment are offering products with stronger cable and less expensive connections. Canoga Data Systems and Siecor Optical Cables, Inc., will have a multiplexed data communications link operating between their booths through a

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CIRCLE NO. 73 ON INQUIRY CARD

Holland: 'People today are not paying attention to the proper structuring of data.'

one-kilometer fiber-optic cable. Canoga's 16-channel multiplexer, designed for speeds as high as 56K bytes, fits 16 communications lines onto one fiber, thus saving cost. End-user price is $9000 per end for a 16-channel system.

Canoga and other companies are also offering lower capability multiplexers. In addition, Valtec Corp. will introduce an eight-port asynchronous multiplexer that will sell for $6000. ITT Electro-Optical Products will show heavy-duty glass fiber cables, which can be buried directly in the ground by conventional plowing equipment, according to a company spokesman.

All-digital communications

Component integration is a concern in all-digital communications implementation as well as in networking. In "Progress Toward All-Digital Communications," John Nuwer of Atlantic Richfield will discuss the advancements in telephone digitizing and in A-to-D switches. "There is a cost benefit in getting away from separate instruments, such as a facsimile machine, word- or data-processing terminal, or telephone to a box on a desk, which will allow incompatible devices to talk with each other over a network," says Nuwer. He notes that there are many available systems to digitize the human voice. Possible solutions to the problems of digital voice synthesis will be discussed by Alan Kaplan of *Electronic Business* magazine in "Digitizing The Human Voice: The Sound of Systems to Come."

Management issues

To combat the personnel shortage, companies should emulate the training programs offered by IBM Corp., Xerox Corp. and Burroughs Corp. According to Dennis O'Donnell of O'Donnell and Associates, pirating of professionals will decrease, and recruiting efforts will be shifted to training college graduates and personnel in parallel markets, such as the office supplies industry.

Other show highlights are sessions on multipurpose microprocessors, distributed data processing case studies, the data comm school and eight workshops. Registration fee is $95 for four days or $60 for a single day for both sessions and exhibits. ■

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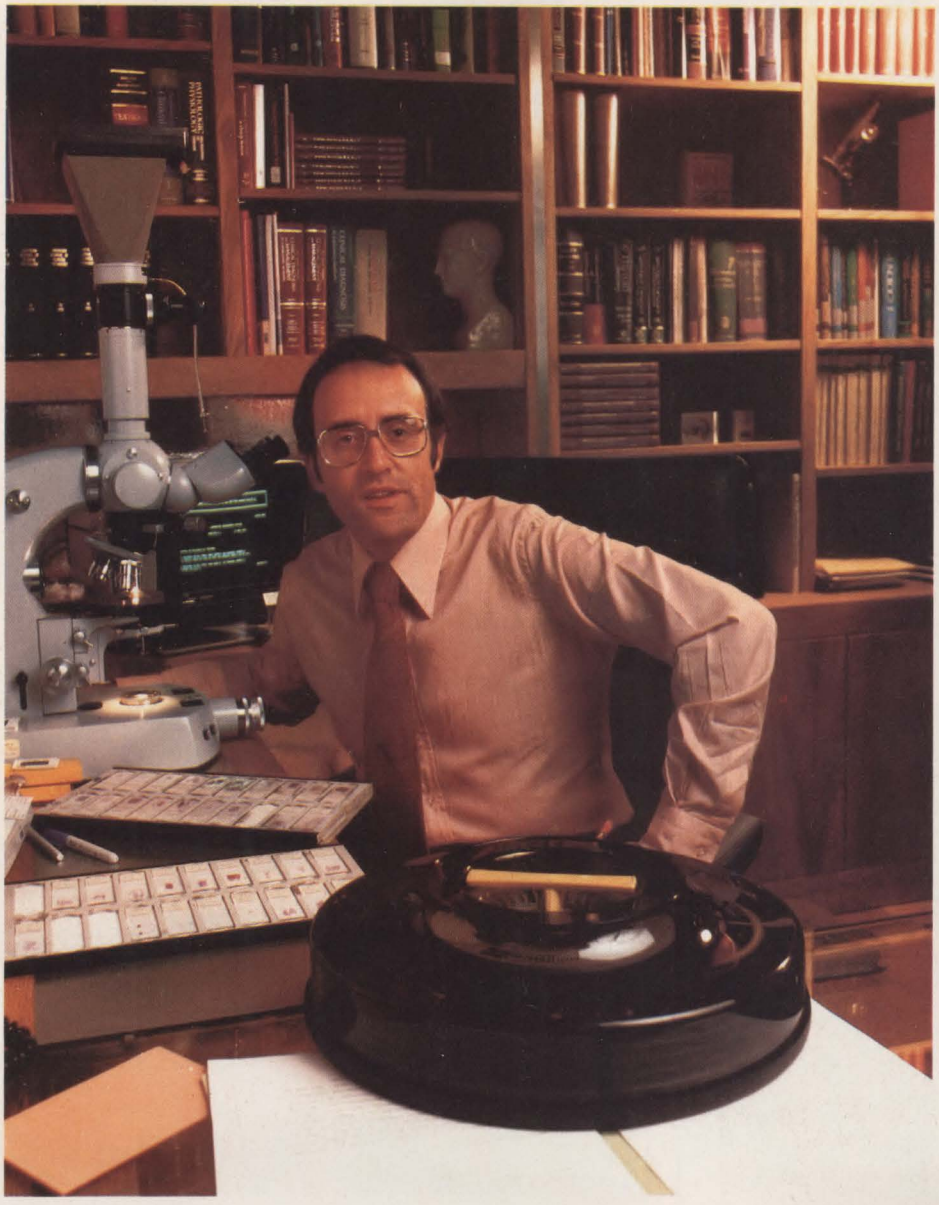

**Dr. David B. Kaminsky,
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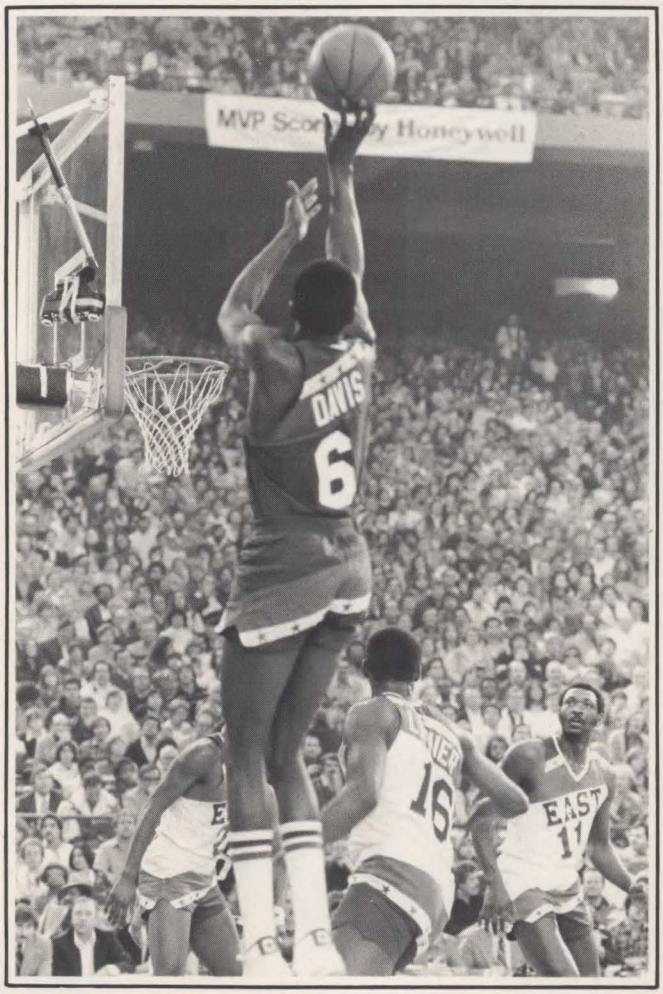
CIRCLE NO. 76 ON INQUIRY CARD

Computers and sports: a natural liaison

THOMAS A. EIFLER, Honeywell Information Systems

Applications are growing so rapidly that nearly every sport is succumbing to computerized scoring and data display

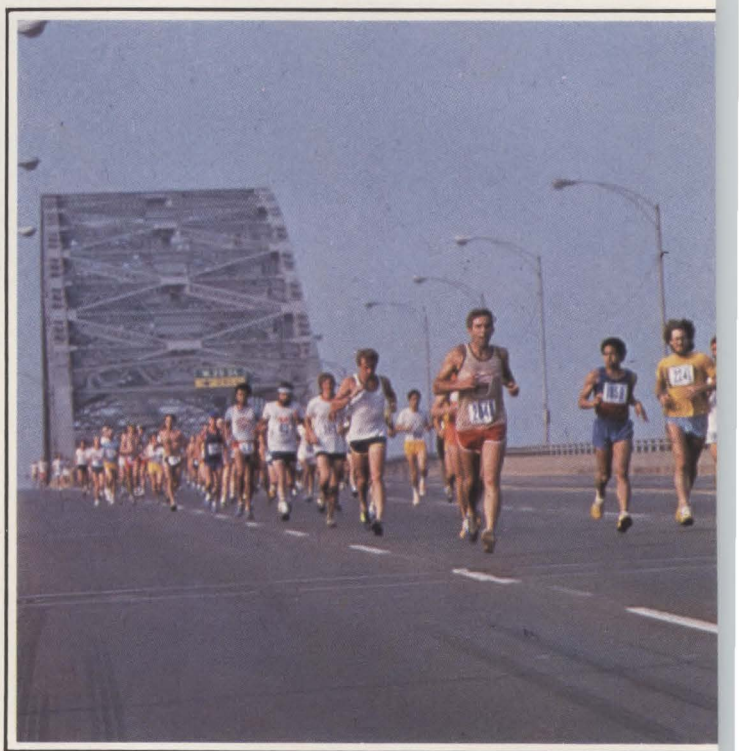
From Austria to Atlanta, from Switzerland to Cleveland, in bowling alleys, on basketball courts and at the finish lines of long-distance foot races, computers are rapidly becoming as much a part of the world of athletic competition as are the joy of victory and the agony of defeat.



West squad's Davis *wasn't MVP in the 1979 NBA all-star game, but Honeywell system enabled quick tabulation of votes naming Denver's David Thompson the winner.*

In this age of instant replay and on-the-spot analysis by TV commentators, there is no margin for error. Final results are expected—or, in some cases, required—immediately upon conclusion of a sports event. The human mind simply cannot tell which runner finishes 6142nd in a race of 7000, or how far ahead of the next runner this individual is. A computer can. And, although the shrewdest mathematician cannot instantaneously calculate the average of several scores given by judges at a gymnastics competition, a computer can.

For the past few years, computers nationwide have been scoring and timing races, including the Gasparilla Long-Distance Classic in Tampa, Fla.; the Chicago Long-Distance Classic; the Cleveland Heart Run; the Purity Supreme Heartbreak Hill Road Race in Boston;



Computer system *simplified scoring of finish in Cleveland Heart-A-Thon.*

and the Boston Marathon. The system the Marathon uses works this way: For about the first 1000 runners in a field of 7000, a button is pushed each time a participant completes the race, notifying the computer that somebody has crossed the line. At this point, the system doesn't know whether this person is male or female, young or old, official or unofficial; all it knows is that a runner has completed the race at a specific time.

The runners then line up in the order of their finish in as many as eight chutes, each at least 100 yards long and holding 300-400 runners. At the end of the chutes, officials record each runner's number, in order. If an unofficial entrant appears, his name and order of finish do not show in the final listing of each participant's statistics. In other words, if the printout generated at the end of the race indicates that a runner finished 1009th, it means that he completed the race after 1008 other official entrants.

Meanwhile, back at the finish line, runners eventually begin to cross the line in groups of 30, 40 or 50. Because the button cannot be pushed quickly enough, a different system is used. A particular runner is "spotted" on his way to the finish line and, as he crosses it, his time and number are recorded. Fifteen seconds later, another runner is spotted. The system then knows that all runners who cross the line between these two runners do so in the 15-second interval between runner A's time and runner B's.

If 600 runners cross in that 15 seconds, the system distributes this information over the allotted time. Thus, a runner's time could be off by a second or two, but once 1000 runners have already crossed the line, this is not important.

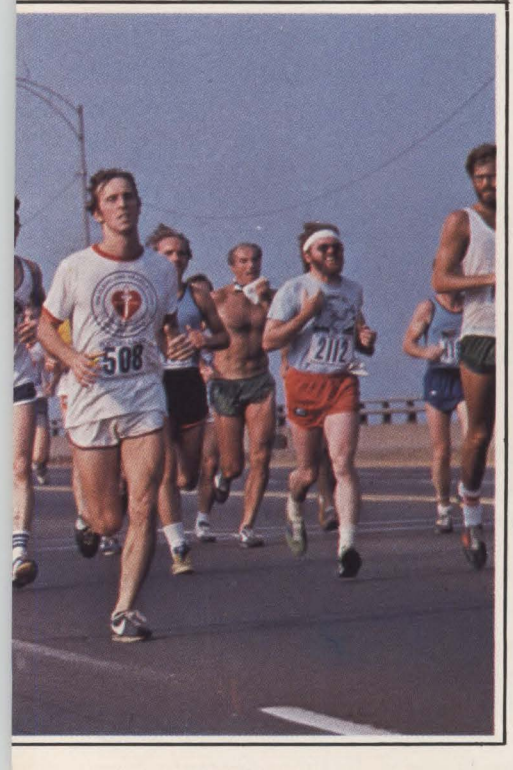
For the first time in the history of sailing, computers and telecommunications were linked in 1979 to follow "live"—almost in real time—TRANSAT, the first two-way transatlantic yacht race. The race covers about 6000 nautical miles (11,000 kilometers) from Lorient, France, to Bermuda and back.

Resources were provided by the ARGOS system of France's Centre National d'Etudes Spatiales (CNES). ARGOS is a global system that collects data by satellite. It comprises portable beacons, a TIROS-N satellite and the data-processing center of the CNES at Toulouse. In this center, a large-scale Cii Honeywell bull IRIS 80 computer stored and processed information collected in the U.S. and France. The data was retransmitted to Toulouse by private land links.

The satellite rotated around the earth, allowing transmission of the competitors' positions, to an accuracy of one nautical mile, to the IRIS 80 at two-hour intervals. Thus, the computer could be asked at any time for updated information. Throughout the race, Cii Honeywell Bull, Honeywell's French computer associate, provided special information services to radio and TV representatives. These services included an automatic display of the paths of the yachts on a color graphics terminal, which was generated by a Cii Honeywell Bull 66/60 computer in Paris from information supplied by the IRIS 80. It was then retransmitted to the TV channel Antenne 2.

Gymnastics

Nadia Comaneci never had it so good. When 81 of this country's finest female gymnasts recently competed against each other at the U.S. Gymnastic Federation's 1979 Junior Women's Championships in Allentown, Pa., a minicomputer was on hand to help both the participants and their coaches keep track of the scoring. Because the meet's winners were considered front-



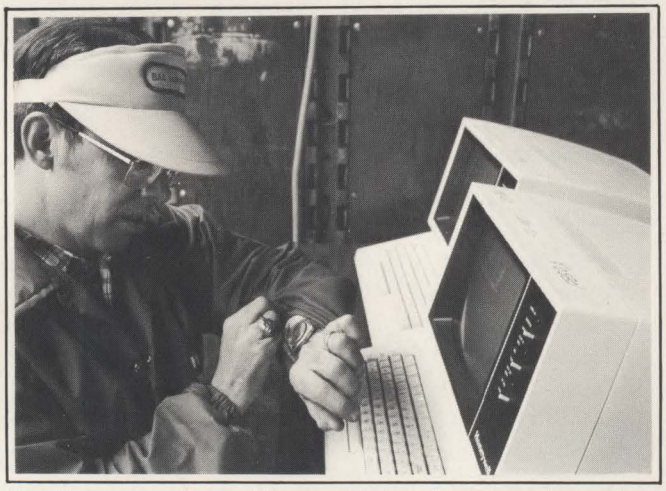
Baton is passed *at Corporate Cup competition in San Francisco, as data is entered into computer scoring system from press box in background.*

Resources for the first two-way transatlantic yacht race were provided by ARGOS, a global system that collects data by satellite.

runners in the race for inclusion on the 1984 U.S. Olympic team, all the competitors—aged 10 to 14—were anxious to learn their standings.

There were two rounds of events—compulsory and optional—with four events in each round: balance beam, vault, uneven parallel bars and floor exercises. Each event was evaluated by a panel of judges—four former high-ranking amateur or professional gymnasts. The averaged scores were first displayed to the audience and then entered into a Honeywell Level 6 model 47 minicomputer. The system tabulated the scores and provided continuous printouts of the results, detailing the standings of each event and the overall standings of each round.

The computer's involvement with gymnastics is not limited to the U.S. At the 19th World Gymnastics



Tom Cusson, *manager of Honeywell's technical support operations in Billerica, Mass., checks data produced by Level 6 computer at finish of 1979 Boston Marathon.*

Championships at Strasbourg, France, in October, 1978, Cii Honeywell Bull provided the data-processing service that handled the scores of about 400 athletes from 40 countries. The system, based on a Level 6 minicomputer, provided newspapers, TV networks, journalists and television audiences with the unofficial intermediate placings as soon as each competitor finished. Television producers received continually updated results tables supplied in video signal form by a character generator linked to the computer. The table could be superimposed on the images being broadcast.

Operating in a real-time, multiprogramming mode, the Level 6 handled several simultaneous competitions occuring in different locations. The placings were printed every half-day on a 300-lpm printer, reproduced and distributed.

Two Cii Honeywell Bull 61/60 computers played a key role at last year's World Figure Skating Championships, held in Vienna, March 13-18, which involved 350 participants from 26 countries. An information system for TV commentators was provided by Honeywell Bull A.E., the Austrian member of Cii Honeywell Bull's international network.

The two computers located at the company's Vienna data processing center collected the competitors' marks via input terminals in the Vienna Stadthalle. The systems operated in parallel and, when necessary, each was switched to the other in seconds with no interruption. Output terminals printed provisional and final results and complete details of each performance.

Other terminals formed part of the TV information system. A video screen displayed the first 10 placings in a current competition and, optionally, the second 10. These lists were instantaneously updated at the end of each performance and a closed-circuit TV conveyed them to the control consoles of TV units, where they were selected for broadcast.

The programs for the computerized results service were modified versions of those written for the 1976 Innsbruck Winter Olympic Games. The changes included competition rule differences and the addition of a new program to provide information to judges.

Basketball

At 1979's National Basketball Association All-Star Game, hosted by the Detroit Pistons in the Silverdome in Pontiac, Mich., sportswriters could wait until the final minute of play before casting their ballots for the game's most valuable player. A Honeywell Level 6 model 33 sorted, tabulated and simultaneously projected the results on two 24-inch CRT display stations—both in full view of TV cameras. Thus players, spectators and millions of television viewers knew who was MVP a minute after the game.

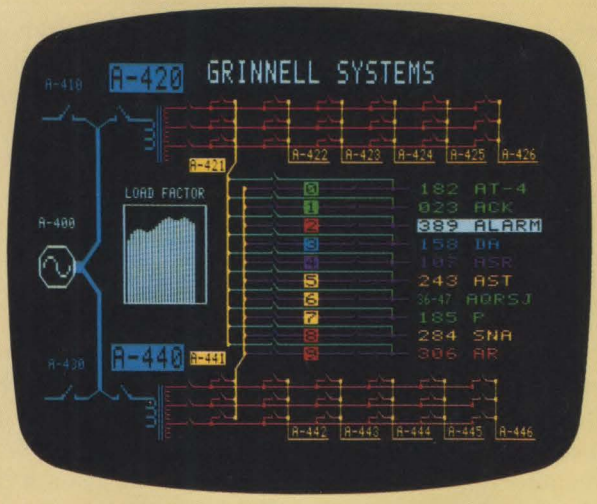
The technique was even simpler than the method that worked so flawlessly at 1978's game in Atlanta, where a computer first monitored the voting. During that game, 20 Honeywell terminals, in clusters of five, were strategically placed near the voting writers and sportscasters. With a minute left in the game and again at the final buzzer, volunteers collected the ballots and rushed them to the nearest terminal cluster, where the votes were entered. Each cluster was connected via dial-up phones to a Level 66 large-scale computer in downtown Atlanta. The results were then projected on a CRT for the CBS camera.

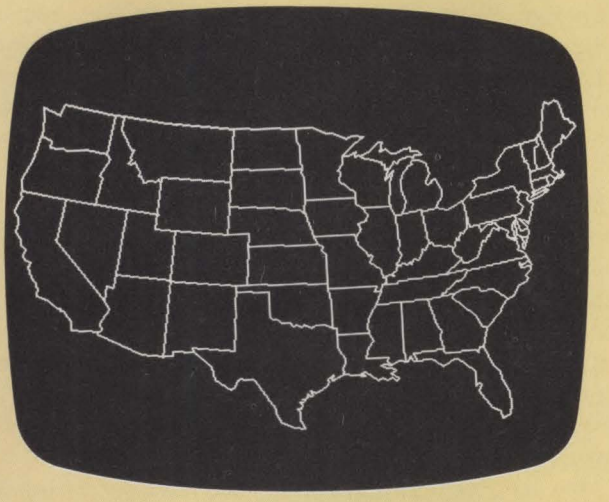
Baseball

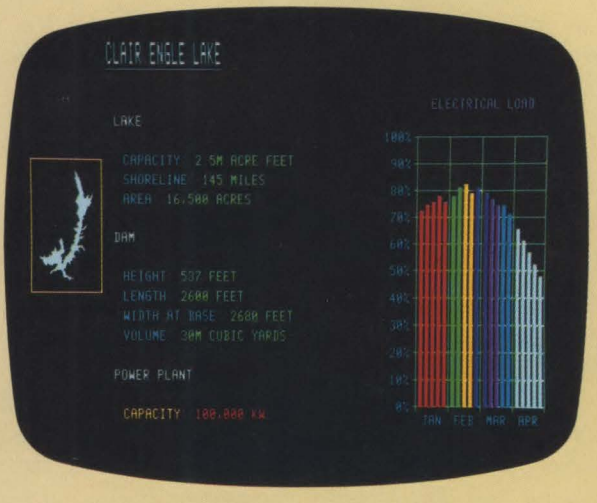
In this age of free agents, arbitration, non-negotiable contract demands, suits and countersuits, one fact of baseball life remains constant: winning teams are those with the best 25-man rosters. To fill those rosters, major league owners and general managers use a variety of techniques, including trading for other players, outbidding the competition for the services of specific free agents and scouting the minors.

But scouting isn't what it used to be. Today, information on a prospect's hitting, throwing, running and fielding abilities is just as likely to emanate from a

Vector graphics. OEM prices.







Now, with Grinnell's GMR-37 graphic display systems, you can have the resolution and input advantages of dot matrix television for about the same price as more limited character-based systems.

And, every GMR-37 display is a complete operating system: display generator, MOS refresh memory, vector and rectilinear graphics, alphanumerics in 4 sizes, bi-directional RS-232 computer interface and RS-170 video interface. Systems, including power supplies, are housed in a 7″, rack-mountable chassis and drive standard closed circuit monitors.

Four basic GMR-37 models can be tailored to fit into almost any computer-based system. Here are just a few examples. (Prices are F.O.B. San Jose, and quantity discounts are available. TV monitors are extra.):

GMR 37-20: $3700
256 x 512 resolution, one channel RGB color plus blink. (Two channels: $4500)

GMR 37-30: $4500
512 x 512 resolution, one channel RGB color plus blink.

GMR 37-60: $4700
1024 x 1024 resolution, one channel B/W.

In addition, you can also have several economical options: independent cursors, joysticks, keyboards, special character sets and 16 bit, plug-compatible parallel minicomputer interfaces.

Further, if you ever want to move up, Grinnell has a complete line of larger systems—all software compatible with the GMR-37—to do things like animation, image processing and real-time frame grabbing.

So, if quality graphic displays are important to your product, look at the GMR-37 line. For a quotation on the system that meets your specific requirements, call or write.

GRINNELL SYSTEMS

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CIRCLE NO. 77 ON INQUIRY CARD

A Honeywell Level 6 model 33 sorted, tabulated and simultaneously projected the results of the MVP ballot at 1979's NBA All-Star Game.

computer as from the pen of a retired player working as a scout for his old club. In fact, 17 of the 26 major league teams—besieged by skyrocketing players' salaries, expensive stadium maintenance and other rising expenses—have abandoned the old, costly system in which each club maintained its own nationwide scouting organization. Instead, these clubs subscribe to the computerized scouting services offered by the Major League Scouting Bureau in Newport Beach, Calif.

The MLSB employs 60 professional scouts who watch baseball games across the country on behalf of their clients in both the National and American leagues. The information they gather is stored in Honeywell's computer service, DATANETWORK. The large data base containing the player performance information is updated daily from the Major League Scouting Bureau's offices in Newport Beach. The client teams, using either video display or teletypewriter terminals, simply dial into Honeywell's large-scale computer systems in Minneapolis and request the profiles.

During the season, scouts in five regions cover high school, college and minor league teams' games. They rate each promising player by his height, weight, ability to play his position and his batting skill. The qualifiable parameters are sent with subjective comments to the MLSB main office, where they are loaded offline onto a cassette, and then dumped online daily into the computers. DATANETWORK's dial-in access and simplified procedures allow non-technical users to process all this information.

Twice a year, reports on the 500 most promising high school and college players are produced for each team and mailed to the scouting director before the free-agent draft in January and June. A much larger and more comprehensive report on all players in the minor league pro system is produced after the draft in June, sent to each subscribing team and updated throughout the minor league season. Client teams and Scouting Bureau personnel, using interactive or batch terminals, have easy access to DATANETWORK in more than 250 time-sharing cities in the U.S. and Canada. When a team dials in and asks for updates, it receives all scouting opinions, including second or third visit impressions by a scout.

This list of the sports-related computer applications is far from complete. Others, ranging from bowling to cricket in England, are succumbing to computerized scoring and data display. A similar discussion of the same topic a few years hence could touch on virtually any aspect of every known sport. If the trend continues at its current pace, we may be near the day when shouts of "kill the umpire" will be replaced by "debug that model 2310." ■

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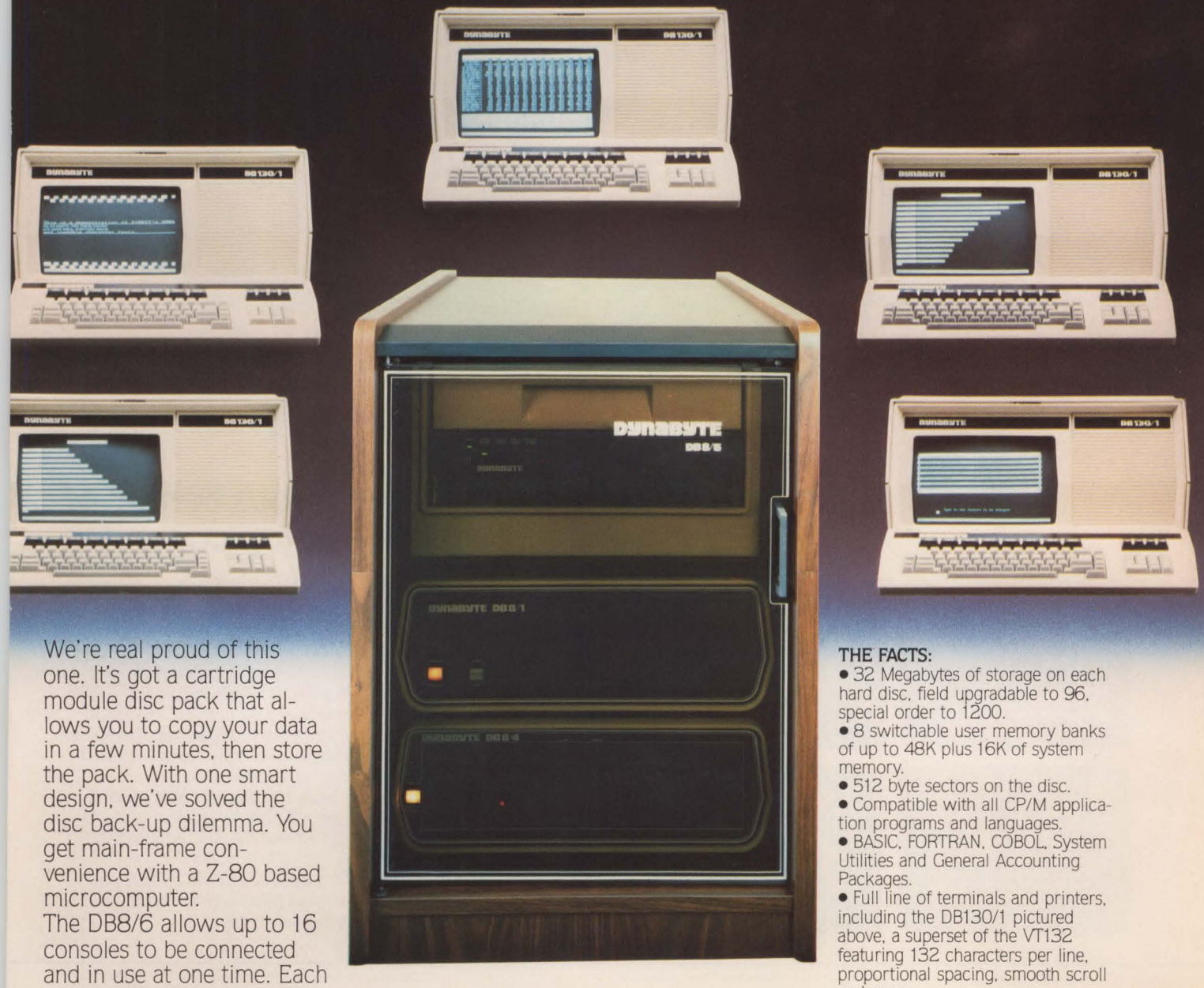
Make room for Dynabyte's multi-user, multi-tasking, cartridge module hard disc system:

THE DB8/6



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The DB8/6 allows up to 16 consoles to be connected and in use at one time. Each user can initiate and run numerous simultaneous tasks from their respective consoles.

THE FACTS:

- 32 Megabytes of storage on each hard disc, field upgradable to 96, special order to 1200.
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- 512 byte sectors on the disc.
- Compatible with all CP/M application programs and languages.
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- Full line of terminals and printers, including the DB130/1 pictured above, a superset of the VT132 featuring 132 characters per line, proportional spacing, smooth scroll and more.

This is the top of the line in our family—completely compatible with our 5" floppy system, our 8" floppy system, and all our software. Check out the Dynabyte DB8/6 for yourself. It represents a whole new era in computer capability.

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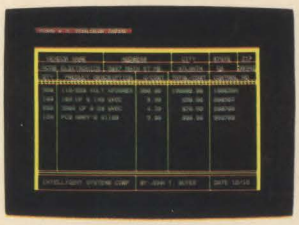
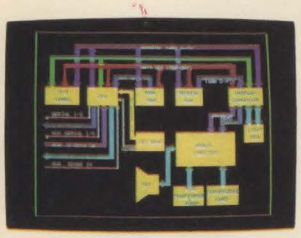
CIRCLE NO. 80 ON INQUIRY CARD

Color communicates better. That's the *obvious* benefit of ISC's new CP/M®2 compatible desktop computer.





What isn't as obvious is the benefit of the CP/M2 operating system. CP/M2 allows Intecolor® 8963 users to choose from an abundance of software. The wide variety of business programs available in CP/M greatly reduces the need for specially-prepared software.

Simply load the CP/M2 operating system disk to run any CP/M program (without modification), whether it's in BASIC, COBOL, FORTRAN IV, or any other programming language. Add the superb readability and improved comprehension of color graphics and you've got unparalleled desktop performance.

The Intecolor 8963 is complete with 19" display, 32K of user RAM, 591K dual 8" floppy disk drive, CP/M2 operating system and a color version of Microsoft® Business BASIC. At just $6395,* it's perfect for the small business.

See the new 8963 at selected computer dealers. Or ask your ISC sales representative for a demonstration and find out how color—and CP/M2—can work to your advantage.

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The Computer of the U.S. Olympic Sports Medicine Committee

*As reported in DATAQUEST Research Newsletter, Nov. 30, 1979; COMPUTER SYSTEMS NEWS, Dec. 3, 1979.

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SIEMENS

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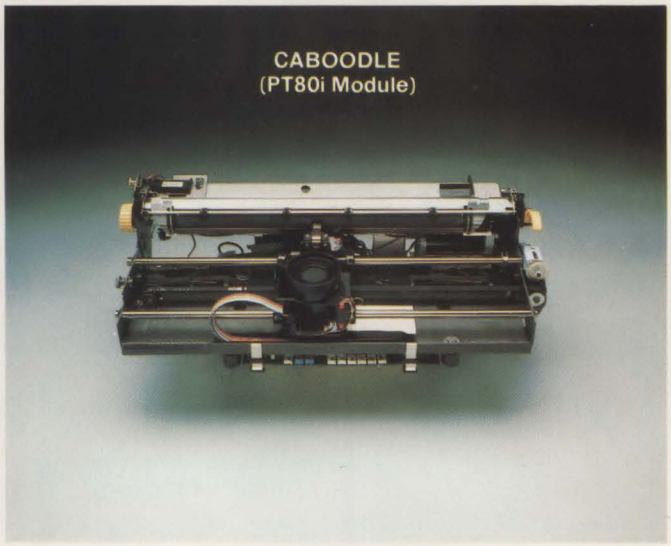

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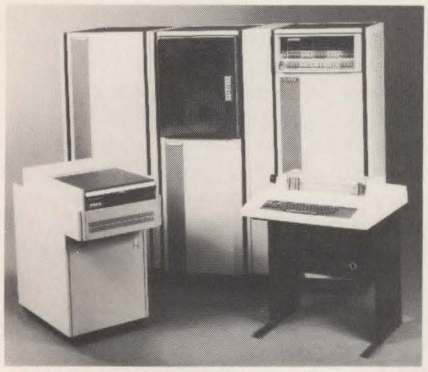


PACKAGED SYSTEMS. Eight systems built around CLASSIC computers range from the 256K-byte 7861 to the 1M-byte 7870 CPU. Peripherals include a 10M-byte disk drive or a 67M-byte disk drive with an 800/1600-bpi tape drive and a choice of either a hard copy console or a model 4611 conversational CRT console device. Prices for the 7861 systems range from $53,000 to $91,400; 7870 systems cost from $103,300 to $124,800. **Modular Computer Systems, Inc.,** Fort Lauderdale, Fla. **Circle No 220**

TIMESHARING MINICOMPUTER SYSTEM. The REPLICA-10 timesharing system, which can be located either at a user's or the vendor's facilities, is based on the vendor's remote computing services for finance, marketing and planning. REPLICA-10 includes hardware, software and installation support services. A REPLICARE support package includes problem diagnosis, field service, software support, software updates and remote diagnosis capabilities. **Rapidata,** Fairfield, N.J. **Circle No 221**

MICROCOMPUTER SYSTEM. The model 80-20 small business microcomputer system incorporates a Z80 CPU, 32K of RAM (expandable to 64K), two 140K-byte minifloppy drives, an ASCII keyboard, a Centronics parallel printer interface, cabinet and power supply. The system also has a 1024-character upper/lower case CRT display. Software for the 80-20 includes BAL (business-oriented BASIC), with sequential, indexed-sequential and random-access file management, and a macro assembler. Other languages are available. Price is less than $3000. **R2E of America,** Minneapolis, Minn. **Circle No 222**

MESSAGE SWITCH. Based on Tandem 16 minicomputers, the MA400 family of message switches for message- and transaction-processing environments supports a variety of line protocols and terminals. Single-switch configurations range from two to 16 processors. Each pair of processors provides as much as 2M bytes of main memory, 4.8M bytes of mass storage and as many as 116 synchronous or 224 asynchronous communications lines. Prices for two-processor systems start at $350,000. **Computer Sciences Corp.,** El Segundo, Calif. **Circle No 223**

GENERAL-PURPOSE SYSTEMS. These two microcomputer systems, intended to serve business and industrial applications, are easily expandable. Both include a Z80 CPU, 64K bytes of RAM, interrupt-driven console capability, a floppy disk controller, dual floppy disk drives and a CRT. The systems have extra slots in their card cages to accommodate additional boards and can be expanded to support as many as four floppy and four cartridge disk drives. Software includes an operating system, high-level languages, a macro assembler, a text editor, a debugger and file management. Prices start at $8460 for the MCZ-1/50 desk-top system, $18,240 for the rack-mounted MCZ-1/70, with quantity discounts available. **Zilog, Inc.,** Cupertino, Calif. **Circle No 224**

DISTRIBUTION SYSTEM. The DMS-1000/SP service parts distribution system, aimed at improving customer service for makers of capital equipment and products requiring parts replacement, is based on a DEC PDP-11. Features include disk drives, video display terminal, printers and application and communications software. The system can commit inventory at order entry time to minimize backorders generated by inaccurate inventory levels. **Distribution Management System, Inc.,** Bedford, Mass. **Circle No 225**

LOGIC TEST SYSTEM. The 3PX630 system generates logic circuit test programs and simulates comprehensive logic circuit functions. The system's FLASH logic circuit simulator program is said to simplify production of test programs by generating digital circuit images with topologies ranging from a single chip to hundreds of complex integrated circuits. Base price including user training, is $105,000. **Three Phoenix Co.,** Phoenix, Ariz. **Circle No 226**

PRODUCTION CONTROL SYSTEM. PCS, a turnkey production control system designed to track, control and measure manufacturing work flow in near real time, can be used as a stand-alone system or as a terminal subsystem in a distributed processing environment. A minimum PCS configuration consists of a data station with two tape cartridge drives, a microcomputer and 4K of 16-bit RAM, a CRT terminal, a 132-column serial printer and one badge/card reader. Price is approximately $20,000. **Digital Datacom, Inc.,** Irvine, Calif. **Circle No 227**

NEWSPAPER SYSTEM. The TMS-11/xe text management system, aimed at medium-sized newspapers, provides text entry, editing and typesetting management capabilities. A typical system consists of two PDP-11/70s with more than a million characters of internal memory each, three disk drives with a total of 200 million characters of storage, two high-speed teleprinting terminals, two magnetic tape units, typesetter interfaces, printers and 24 VT72/t and VT61/t terminals. A minimum configuration costs $387,000; a typical system costs $510,000. **Digital Equipment Corp.,** Maynard, Mass. **Circle No 228**

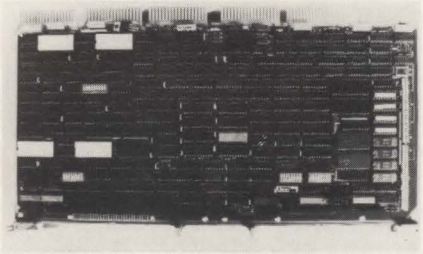
MEMORY BOARD/SYSTEM TESTER. The MD-207/11 test system comes with production- and user-oriented software packages, including automatic shmoo plotting, data logging, statistical analysis, automatic board diagnostics and real-time error logging. Hardware for the 10MHz system includes a DEC LSI-11 computer, dual floppy disk drives and a DEC VT-100 CRT terminal. A split-cycle clock generator with as many as 16 independently programmable phases accommodates timing requirements of synchronous and asynchronous semiconductor memory systems. Base price for the MD-207/11 is $78,500. **Macrodata Corp.,** Woodland Hills, Calif. **Circle No 229**

New Products

interfaces and controllers

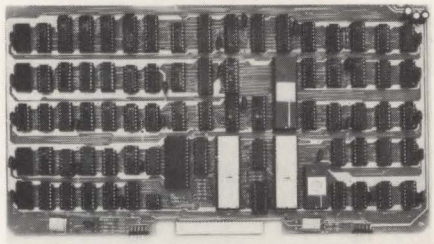
64-LINE INTERFACE FOR LSI-11. This parallel interface for LSI-11/23 and LSI-11/2 microcomputers contains 64 I/O lines organized into four ports with program-selectable data directions. The DRV11-J has a choice of processor interrupt modes: bit interrupts on 16 data lines or four I/O interrupts (one per port) and 12 bit interrupt lines. Interrupt vectors are set under program control, and interrupts can be programmed for either fixed or rotating priority. The DRV11-J costs $420, with quantity discounts available. **Digital Equipment Corp.,** Maynard, Mass.
Circle No 230

COLOR DISPLAY CONTROLLER. This microprocessor-based character graphics system generates a programmable display comprising 254 characters and 64 foreground/background color combinations or eight gray-scale levels. The FS 2500 color video display controller, packaged in a rack-mountable cabinet, produces 64 ASCII upper-case and 31 lower-case characters in an effective 10 × 8 matrix and effective 12 × 9 field. The controller also generates 95 semi-graphics characters. Aimed at process control applications, the FS 2500 costs $4275, with OEM discounts available. **Ramtek Corp.,** Santa Clara, Calif. **Circle No 231**



UNIBUS-TO-DISK INTERFACE. Aimed at OEMs using PDP-11 and VAX computers, the MSC-1101 single-board controller interfaces DEC's Unibus with Winchester and other standard SMD-interface high-capacity disk drives. Features include command chaining, automatic error correction and retry recovery, implied overlapped seek, automatic head and cylinder switching, DMA load regulation and two-drive, dual-port control. The controller uses a channel I/O command protocol said to be better than that used by existing DEC software drivers. To ensure functional compatibility, the manufacturer provides users with software integration packages for various DEC operating systems. The MSC-1101 costs $4850, with OEM quantity discounts available. **Microcomputer Systems Corp.,** Sunnyvale, Calif.
Circle No 232

IEEE-488 BUS INTERFACE. This interface module handles all handshake protocols for controlling and moving data between multiple instruments on the IEEE-488 instrument bus. The model MC68488 adaptor performs talker and listener functions that include primary address recognition, secondary address capability, complete source and acceptor handshakes, programmable interrupts, RFD holdoff to prevent data overrun, serial and parallel polling capability and output trigger synchronization. A software driver called BUSCON performs controller functions, such as sending interface messages and polling serial or parallel devices. Unit price is $199. **Wintek Corp.,** Lafayette, Ind. **Circle No 233**



FLOPPY DISK CONTROLLER FOR INTEL MULTIBUS. The MM-SBC-80 floppy disk controller, intended to replace Intel iSBC-201 single-density and iSBC-202 double-density controllers, supports as many as four Shugart 800/850 (or similar) 8-in. drives in both modes. A user can copy data from a single-density diskette on one drive to a double-density diskette on another, or vice versa; the controller automatically determines the density of the inserted diskette. Other features include a DMA channel, an on-board sector buffer, write-precompensation circuitry, phase-lock-loop operation and CRC error checking. **Micromation, Inc.,** San Francisco, Calif. **Circle No 234**

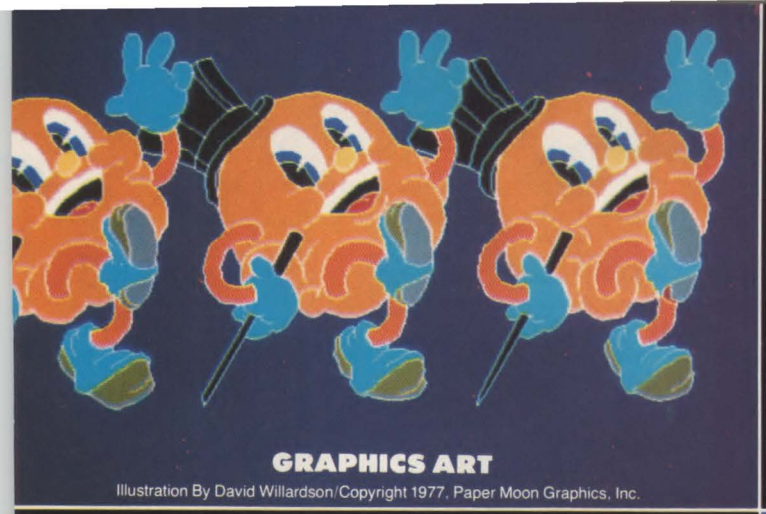
EXORCISOR-COMPATIBLE CRT CONTROLLER. The MCG 6800 color or black-and-white CRT controller, compatible with M6800, 6801E and 6809E microcomputers, generates 128 upper- and lower-case characters in an 80 × 24 screen format with a 25th line. The single-board controller contains independent static RAM sections for display memory, FAC code memory and graphics memory. Other features include 64 software-definable characters, graphics, eight foreground and background colors, a 16-MHz clock and a serial communications port with 16 selectable baud rates. Prices start at $595. **Phoenix Digital Corp.,** Phoenix, Ariz. **Circle No 235**

CARTRIDGE DISK CONTROLLER FOR INTEL MULTIBUS. The model 410 intelligent disk controller provides as much as 80M bytes of on-line storage for any Multibus-based system. The single-board device, which can control as many as four Diablo-compatible drives, uses a channel I/O technique to enable command chaining and concurrent processor and controller operation. Other features include 20-bit addressing, byte or 16-bit word transfers, a pack format command, command chaining and bus-vectored and non-bus-vectored interrupts. **Xylogics, Inc.,** Burlington, Mass.
Circle No 236

MULTIBUS TAPE DRIVE INTERFACE. The TIM-1/MX controller, which interfaces any Multibus computer to as many as four Tandberg TDC3000 DC300A cartridge tape drives, executes tape functions without intervention from the central computer. Incorporating an 8080 microprocessor to handle special read/search functions and improve data integrity, the controller records as much as 3M bytes per cartridge in an ANSI/ECMA-compatible format. Price is $795. **MegaLogic Corp.,** Brookville, Ohio.
Circle No 237

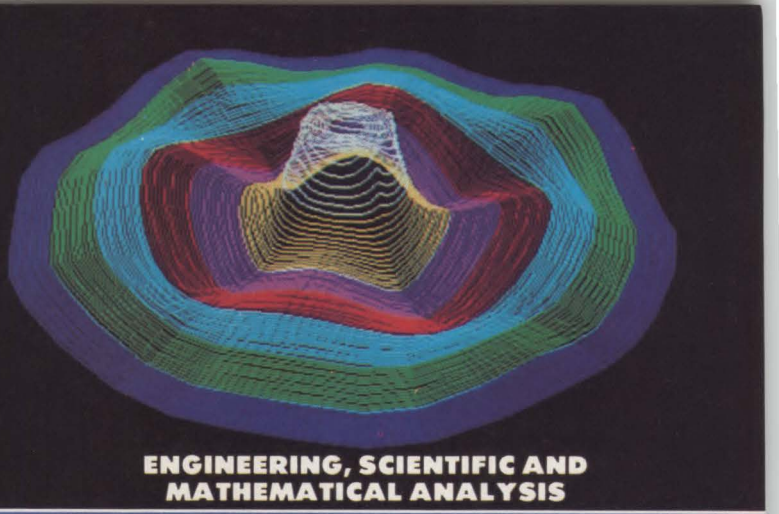
SERVO-LOOP INTERFACE. This single-board interface connects a Multibus processor to an incremental-encoder position feedback device. The PS-10 board incorporates an analog voltage output compatible with most velocity servo loops, a 12-bit incremental up/down position counter and inputs and logic levels for absolute-zero position sampling. Compatible with any incremental position encoding system that provides phase-quadrature signal output, the PS-10 permits slaving of two or more axes to obtain simultaneous position data for multiaxis contouring motion control. The PS-10 sells for $700. **Controlsmith, Inc.,** Nashua, N.H. **Circle No 238**

SPINWRITER INTERFACE. The model C101 IEEE-488 printer adaptor interfaces Commodore computers to NEC 5530 Spinwriter and Centronics-compatible dot-matrix printers. Powered by the printer, the adaptor comes with an 18-in. IEEE cable and a six-ft. printer cable. The device also includes a switch that enables selection of upper- and lower-case printing for word-processing applications or upper-case only for program listings. Price is $225, with dealer discounts available. **FI Electronics, Inc.,** Santa Rosa, Calif.
Circle No 239



GRAPHICS ART

Illustration By David Willardson/Copyright 1977, Paper Moon Graphics, Inc.



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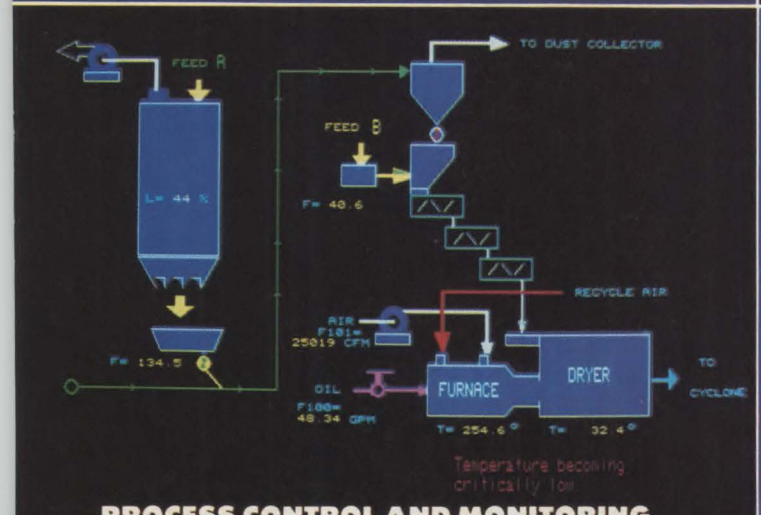
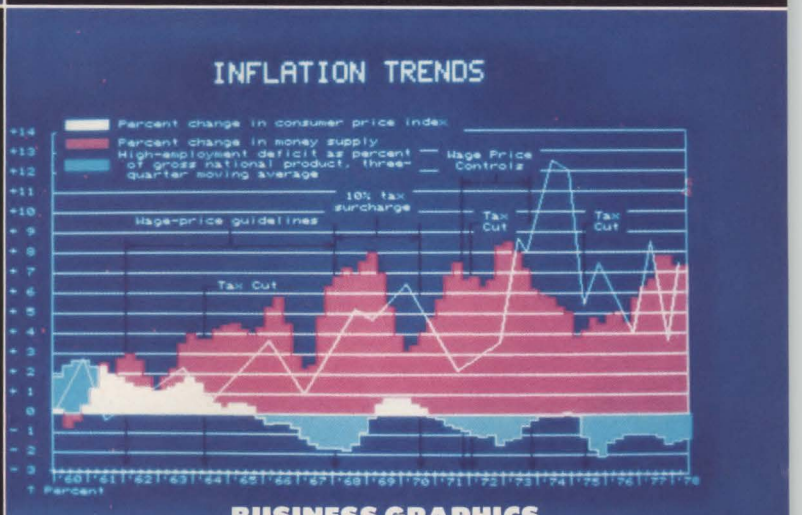


PROCESS CONTROL AND MONITORING



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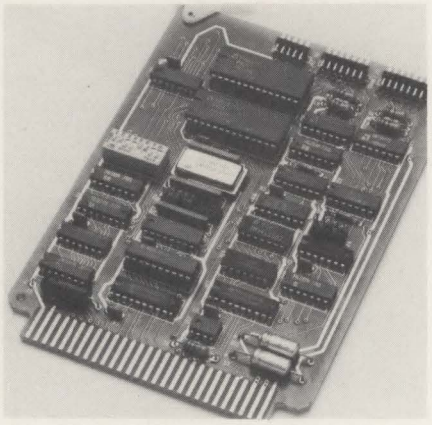
CIRCLE NO. 84 ON INQUIRY CARD

New Products

interfaces and controllers



SERIAL INTERFACE FOR STD BUS. The SB8420 serial interface provides STD BUS systems with two independent RS232C/20MA communication channels. Each channel operates in full-duplex synchronous or asynchronous modes, at switch-selectable data rates from 50 to 19.2K baud. The I/O-mapped device includes an interrupt mask register and output connector, plus a socket and control logic for a 256-byte bootstrap PROM. The SB8420 costs $325. **MICRO/SYS, Inc.,** La Canada, Calif. **Circle No 240**

TAPE CARTRIDGE INTERFACE. The DMN-1 cartridge tape subsystem, which interfaces cartridge tape drives from Data Electronics, Inc., to Data General Micro-Nova computers, enables the drives to emulate 4030-series nine-track NRZI and NOVA cassette units. The stand-alone device supports two 1600- or 6400-bpi cartridge drives having formatted capacities of 3.75M or 14.5M bytes. The DMN-1 comes with firmware, a dual-drive power supply, all data and power cables, a 5.25-in. drive panel and a 120-day limited warranty. Price is $850 in 100-unit quantities. **Alloy Engineering Company, Inc.,** Framingham, Mass. **Circle No 241**

TI PRINTER INTERFACE. The UTI-80 interface for Texas Instruments 12- and 20-column thermal printer assemblies includes DIP switches to select interface mode (parallel or serial), invert print mode and data rate (110, 300 or 1200 baud). A self-diagnostic feature enables continuous printing of the 64 ASCII character set to confirm operation of the interface, power supply and printer. Prices are $185 for the UTI-80 interface, $45 for a printer cable and $70 for a power supply, with OEM discounts available. **Technology Associates, Inc.,** Parker, Colo. **Circle No 242**

micros

6800 PROCESSOR CARD FOR STD BUS. The model 7802 combines a buffered and fully expandable 6800 microprocessor with RAM and PROM sockets on a single STD BUS-compatible card. The card includes 1K byte of RAM with sockets for as much as 3K bytes more, plus sockets for as much as 8K bytes of ROM or EPROM. Other features include three-state address, data and control buses, a crystal-controlled 1-msec. clock, STD BUS-compatible I/O mapping and single +5V operation. The card's STD BUS interface may be disabled for DMA and multiprocessor applications. Price is $360 in single-unit quantities, $210 in quantities of 100 or more. **Pro-Log Corp.,** Monterey, Calif. **Circle No 243**

SERIAL COMMUNICATIONS AND CONTROL. This single-card computer, intended for use in communications and control applications, combines a Z80 microprocessor with serial and parallel I/O, RAM and 2708 or 2716 EPROM. Serial communications are asynchronous RS232 and programmable to all standard rates up to 56K bps. TTL-level parallel input and output controls are 16 lines out and 16 lines in. All inputs include pull-up resistors. The 4½- × 6½-in. card has a 28/56 card edge connector; power requirements are +5V and +12V. Price is $195. **Vantage Data Products,** Provo, Utah. **Circle No 244**

SINGLE-CARD MICROCOMPUTER. The PCU 6800 single-card microcomputer can be used for EXORterm and EXORciser applications and for most processing and control applications, either stand-alone or in a host environment. Based on a Motorola 6800 microprocessor, the card has 40 parallel I/O lines, three timers, an RS232 interface and as much as 16K of RAM and 28K of EPROM or ROM. An on-board or remote four-position dip switch enables users to select from 16 possible baud rates. The PCU 6800 has an internal crystal clock and is available in 1-MHZ, 1.5-MHZ and 2-MHZ versions. Prices start at $525. **Phoenix Digital Corp.,** Phoenix, Ariz. **Circle No 245**

CPU CARD. The 8085-based CPU-1600 operates as a stand-alone single-board computer or interfaces with the vendor's industrial 1600 series memory, digital and analog I/O boards and communications boards for telemetry and data-acquisition applications. The unit includes 2758 or 2716 EPROM, as much as 256 bytes of bank-switchable RAM, a programmable timer, two 8-bit I/O ports, 10 vectored interrupts and memory-mapped I/O. Price ranges from $500 to $1000, depending on configuration, with OEM discounts available. **Multi Tronics,** Dublin, Calif. **Circle No 246**

TI Distributors

ALABAMA: Huntsville, Hall-Mark (205) 837-8700.

ARIZONA: Phoenix, Kierulff Electronics (602) 243-4101; R.V. Weatherford (602) 272-7144; **Tempe,** Marshall Industries (602) 968-6181.

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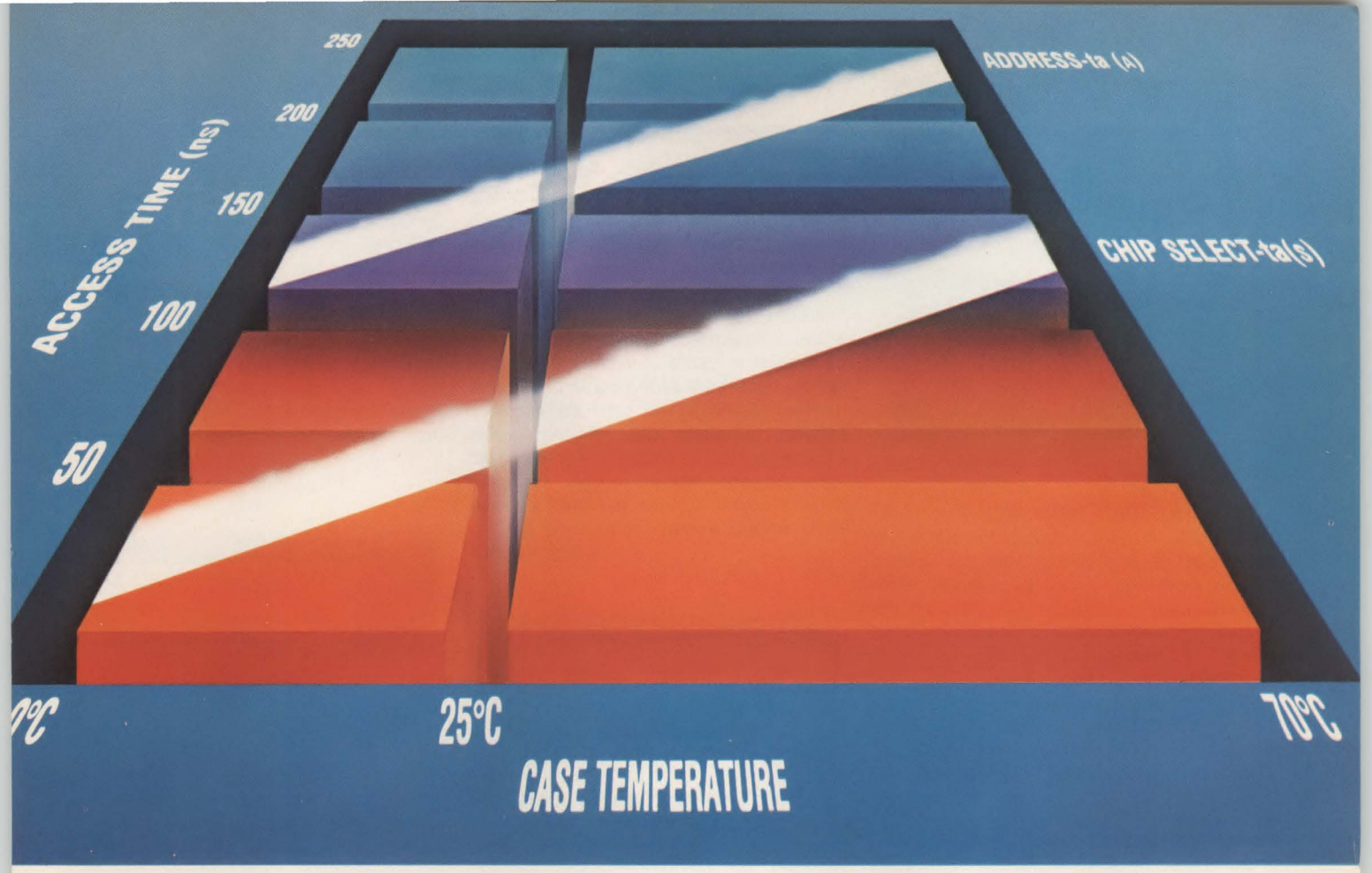
TEXAS: Austin, Component Specialties (512) 837-8922; Hall-Mark/Austin (512) 837-2814; **Dallas,** Component Specialties (214) 357-6511; Hall-Mark/Dallas (214) 234-7400; International Electronics, (214) 233-9323; TI Supply (214) 238-6821; **El Paso,** International Electronics (915) 778-9761; **Houston,** Component Specialties (713) 771-7237; Hall-Mark/Houston (713) 781-6100; Harrison Equipment (713) 652-4700; TI Supply (713) 776-6511.

UTAH: Salt Lake City, Diplomat/Altaland (801) 486-4134; Kierulff Electronics (801) 973-6913.

WASHINGTON: Redmond, United Components (206) 885 1985; **Seattle,** Almac/Stroum Electronics (206) 763-2300, Kierulff Electronics (206) 575-4420; **Tukwila,** Arrow Electronics (206) 575-0907.

WISCONSIN: Oak Creek, Arrow Electronics (414) 764-6600; Hall-Mark/Milwaukee (414) 761-3000; **Waukesha,** Kierulff Electronics (414) 784-8160.

CANADA: Calgary, Cam Gard Supply (403) 287-0520; **Downsview,** CESCO Electronics (416) 661-0220; **Edmonton,** Cam Gard Supply (403) 426-1805; **Halifax,** Cam Gard Supply (902)454-8581; **Kamloops,**Cam Gard Supply (604) 372-3338; **Moncton,** Cam Gard Supply (506) 855-2200; **Montreal,** CESCO Electronics (514) 735-5511; Future Electronics (514) 731-7441; **Ottawa,** CESCO Electronics (613) 729-5118; Future Electronics (613) 820-8313; **Quebec City,** CESCO Electronics (418) 687-4231; **Regina,** Cam Gard Supply (306) 525-1317; **Saskatoon,** Cam Gard Supply (306) 652-6424; **Toronto,** Future Electronics (416) 663-5563; **Vancouver,** Cam Gard Supply (604) 291-1441; Future Electronics (604) 438-5545; **Winnipeg,** Cam Gard Supply (204) 786-8481. S



The fastest 8K EPROM ever. TMS2508. Available now. From Texas Instruments.

High speed. Reprogrammability. Family compatibility. And availability.

Just a few of the many practical reasons why you should consider the newest member of TI's 5-V Family. TMS2508. An 8K EPROM specifically designed for high-speed.

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At 250-ns max access time, 180-ns typical, the TMS2508 is the fastest EPROM on the market. So fast, in fact, that you can design it in for all state-of-the-art microprocessors and not worry about sacrificing performance. The TMS2508 reduces wait states and virtually eliminates the need for any additional wait-state circuitry.

As a bipolar alternative

Because the TMS2508 is so fast, it also allows you to implement many memory applications previously served only by bipolar PROMs. Only minor board modifications are required to make the switch from bipolar to MOS. (For complete details see Applications Note MM-2508.) And, unlike PROMs, the TMS2508 can be easily and quickly erased and reprogrammed. At any time.

High performance

In addition, the TMS2508 offers you such outstanding performance features as 8-bit word configuration, automatic chip select/power down and fully static operation.

So, if speed is what you need, go ahead and design with confidence. Go ahead and specify TI's new TMS2508.

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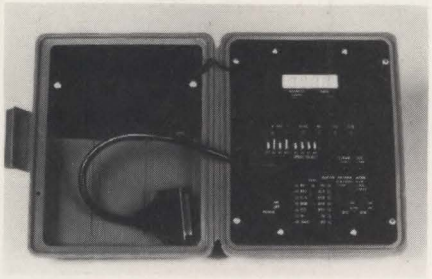
CIRCLE NO. 85 ON INQUIRY CARD

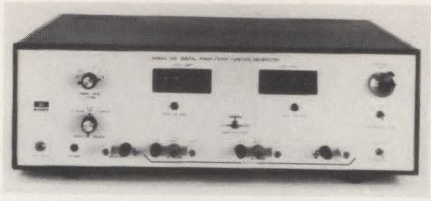
New Products

test equipment

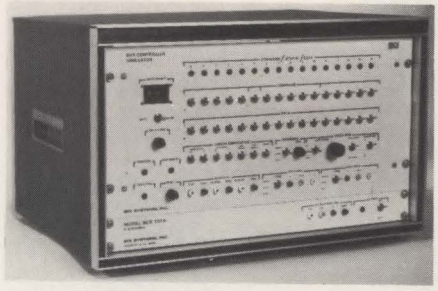


PORTABLE DATA ANALYZER. The Maxichek data analyzer, said to weigh only a fifth as much as its smallest competitor, isolates faults in telecommunications networks, either by simulating computer terminals or the central processor or by performing bit-error-rate or block-error-rate tests to check modems and phone lines. The 2-lb., microprocessor-controlled device connects with communications links using either RS232C or CCITT interfaces. Maxichek can operate asynchronously at speeds from 110 to 9600 bps, full- or half-duplex. The unit supports four standard preprogrammed test messages and one user-entered message of as many 50 8-bit characters. **Astrocom Corp.,** St. Paul, Minn. **Circle No 247**

POLLING TESTER. The model 1700 polling tester can be used to test asynchronous and synchronous modems over either simulated or actual switched networks, private-line point-to-point networks or private-line multidrop networks. The microprocessor-based unit can perform polling tests of on-line equipment to isolate faults and to verify system performance. To help target system malfunctions, the model 1700 distinguishes between outbound and inbound polling message errors and enables the user to inject outbound and inbound errors to verify network continuity. Price is $1800. **International Data Sciences, Inc.,** Lincoln, R.I. **Circle No 248**



DYNAMIC CALIBRATOR. The model 338 digital ramp/step function generator is intended primarily for use as a dynamic calibrator for signal-conditioning devices. Because of its ability to ramp at a fixed rate, be held at a specific level, then continue to ramp to a new limit at the same or a different rate, the unit can also be used in many applications as a cyclic controller. A voltage-source output provides 0 to +12V DC into a minimum load of 250 ohms; a current-source output provides 4 to 20 mA DC into a maximum load of 2000 ohms or 10 to 50 mA DC into a maximum load of 800 ohms. Model 338 costs $2495. **Exact Electronics, Inc.,** Tillamook, Ore. **Circle No 249**



DATA BUS TESTER. Compatible with MIL-STD-1553A/B and MCAIR A3818, the BCS 101A bus controller simulator is designed for use in engineering and systems integration applications and as a portable instrument for fault insolation. The device, which can both send and receive data bus messages, provides several error simulations and an LED display of command, data and status words. **SCI Systems, Inc.,** Huntsville, Ala. **Circle No 250**

PROGRAMMABLE DATA ANALYZER. The INTERVIEW 3000 series of programmable data analyzers employs a form of nonsequential programming that eliminates the need to learn special techniques or instructions. The manufacturer claims that users can train themselves on the machine in 2 or 3 hrs. The microprocessor-based unit has a 7-in., 640-character CRT and a 4M-bit tape cassette drive. Other features include automatic tape control, ability to handle data rates as high as 64K bps, and self-test. **Atlantic Research Corp.,** Alexandria, Va. **Circle No 251**

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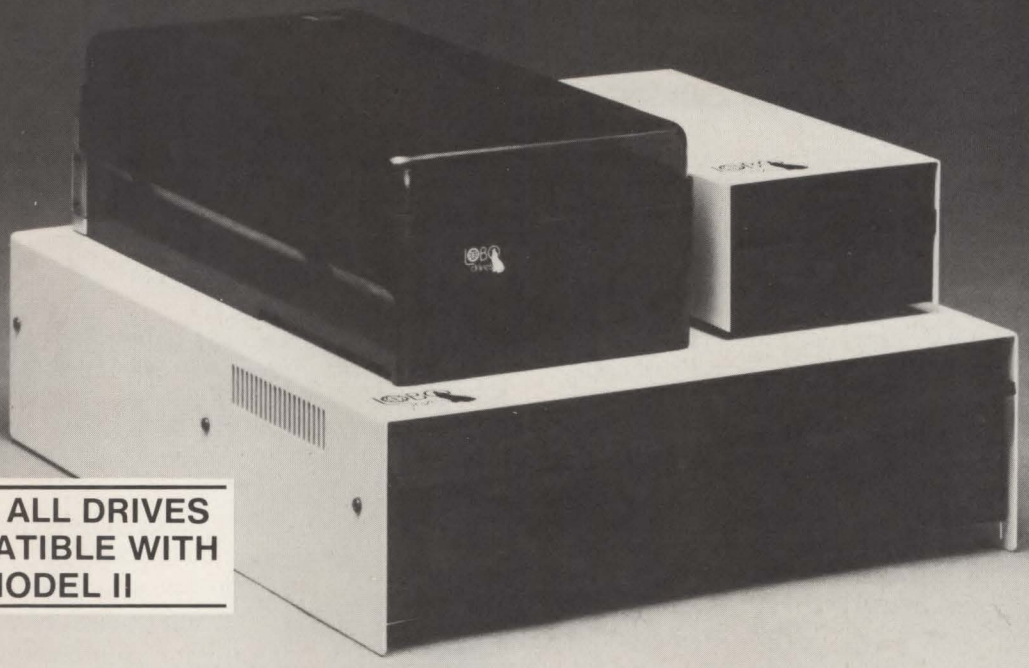

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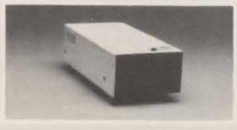
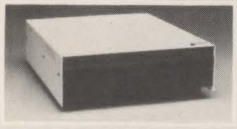
400 SERIES FLOPPY DISK DRIVES



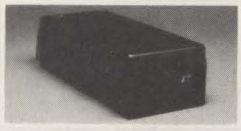
Meet our low-cost 5.25-inch mini drive that records data in either hard or soft sectored format. It is available in single or double density configurations, with a total storage capacity of 220K bytes.

800/801 SERIES FLOPPY DISK DRIVES



Here is our dual 8-inch Floppy disk memory unit. It records and retrieves data on standard 8-inch diskettes to provide 800K bytes of data storage unformatted, or 512K bytes in IBM format per drive. It is also available with double-sided, double-density capabilities, for a maximum storage capacity of 1.6 Megabytes.

7000 SERIES HARD DISK DRIVES



The latest member of our drive family, the Series 7000 is an 8-inch, 10 Megabyte Winchester Technology, hard disk drive. It is fully hardware/software compatible and comes complete with disk controller. Now you can have the convenience, speed, reliability, and all the storage capacity you need.

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CIRCLE NO. 87 ON INQUIRY CARD

The World of the 600 Series Digitizer

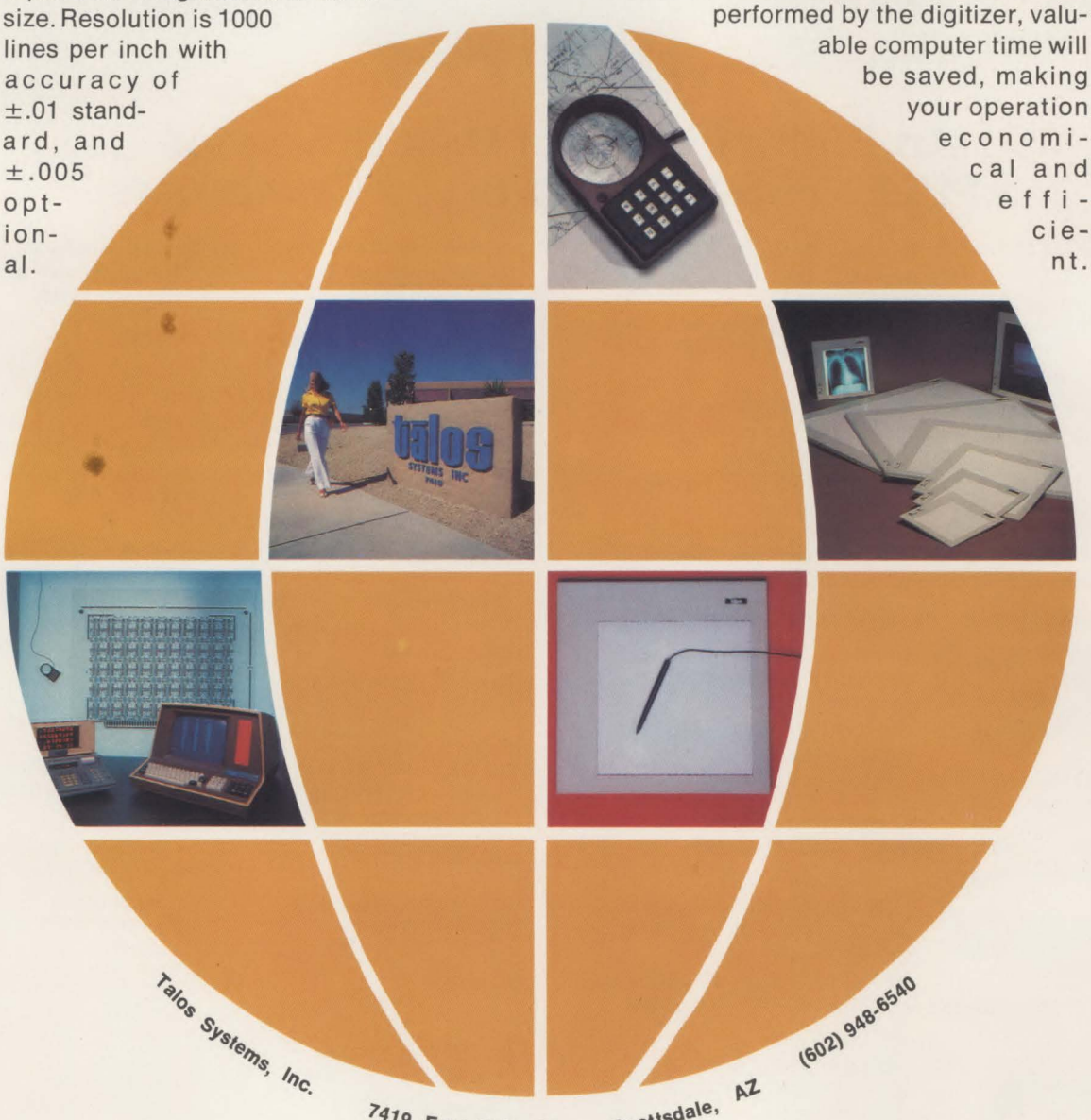
The Talos **600 Series** offers the most complete line of digitizer configurations available. Three types of surfaces are offered, which include — solid with a formica top, translucent for backlighting, or a special finish for rear projection. Each surface type is offered in six active surface areas ranging from 11″ x 11″ to 44″ x 60″, giving the user tremendous versatility in applications.

The technology employed in the 600 Series is the electrostatic "active inch" principle. This principle allows the activation of only the square inch surrounding the pen or cursor. High accuracy and stability can be maintained because we resolve only one square inch regardless of tablet size. Resolution is 1000 lines per inch with accuracy of ±.01 standard, and ±.005 optional.

Our **Smart One** option can be added to the 600 Series tablet to provide a new dimension to your interactive graphics processing. The Smart One is an 8080 microprocessor located in the electronic control box with the digitizer. It provides local processing of digitized data which allows:

- Movable menus
- Switch selectable features
- Relocatable origin
- Assign user's values to origin (X and Y)
- Scaling and increment distance selection
- Skew corrections
- Dual port RS232C capability
- Distance, area and volume calculations
- CRT prompted readout

Because these routine calculations can be performed by the digitizer, valuable computer time will be saved, making your operation economical and efficient.



Talos Systems, Inc. 7419 East Helm Dr. Scottsdale, AZ (602) 948-6540

talos

CIRCLE NO. 88 ON INQUIRY CARD

New Products

design aids

MC6805 DEVELOPMENT SYSTEM ADAPTOR. The MEX6805 support system adapts existing EXORciser and EXORterm equipment to the MC6805 microcomputer. The system provides real-time emulation of the MC6805 and enables the user to run multiple processors in a system (with the debug function limited to one processor at a time). Each MEX6805 includes a printed circuit board module, extender cables for target-system evaluation and an MDOS diskette containing the 6805 macro assembler and the FIVEbug debug/monitor program. Price is $2000 in quantities of one to five. **Motorola Semiconductor Products, Inc.,** Phoenix, Ariz. **Circle No 252**

BREADBOARDING SYSTEM. Said to reduce wiring times by 60 to 90 percent compared to other breadboarding systems, the IMIT-GP/120 comprises a 10- × 12-in. printed circuit card, an assortment of sockets, insulation displacement contacts (IDCS), power connectors, bypass capacitors and a simple wiring tool. The board, which is laid out to facilitate prototyping of devices such as disk and terminal controllers, bubble memory systems and single-board computers, has large power and ground planes for minimum noise and crosstalk at high frequencies. The GP/120 accepts discrete and DIP components having as many as 64 pins. Prices for the GP/120 start at $215. **Information Machinery Corp.,** Chelmsford, Mass. **Circle No 253**

PROTOTYPING INSTRUMENT. The Micro System Designer-Series 1000, an 8- and 16-bit universal prototyping instrument, supports Z80A, 8088, 8086 and Z8000 microprocessors. The instrument has function and hexidecimal keypads, a 16-character display, 2K bytes of PROM, 1K byte (expandable to 64K bytes) of RAM, a peripheral-control processor and a solderless prototyping area. Uses for the device include development of trial circuits, software debugging and hardware/software integration. Features include hardware breakpoint, register, memory examinations, single-step and a code-execution timer function. Price is $1300 to $1650 in single-unit quantities, depending on the personality modules selected, with quantity discounts available. **Millennium Systems, Inc.,** Cupertino, Calif. **Circle No 254**

ELECTRONIC SYSTEM ANALYZER. The T-8, a hand-held microprocessor-based system analyzer for 6800-based microcomputers, connects directly to the unit under test via a 40-pin chip clip. No power supply is required. The T-8 enables a user to single-step through the microcomputer system development program, a user program or a diagnostic program. Field interchangeable interfaces are available for other 8-bit microprocessors. The T-8 with cable, connector and 6800 interface costs $745; additional interfaces cost $50 each. **Patuck, Inc.,** Pennsauken, N.J. **Circle No 255**

New Products

accessories and supplies

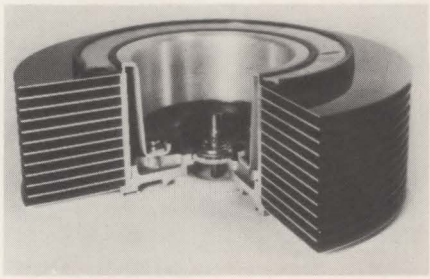
MINIFLOPPY DISK SAVER. The Floppy Saver reinforcing ring, designed to lengthen the lives of minifloppies, prevents a disk drive's clamping hub from tearing a disk's center hole. The ring also prevents scuffing and dimpling when the disk hits the rotating spindle and counteracts data loss caused by improper rotation of disks. The rings, which are punched on a steel die, are made of 7-mil mylar with a paper-protected adhesive backing. Price is $14.95 for a kit with 25 rings and an installation tool. **Tri-Star Corp.,** Grand Junction, Colo. **Circle No 256**

FONT STYLES. These metallized daisywheel printing elements, available in five fonts, can be used on Diablo HyType II 1355 WP word-processing printers, 1380 WB wide-bed printers and Series 1650 printers and terminals. The fonts include: cubic PS 96, a proportionally spaced, 96-character sans serif style; OCR-B, a 10-pitch sans serif style; Financial Forms 10, a 96-character, 10-pitch style that includes all symbols used in financial reporting, but no lower-case characters; USA-Master 12, an 88-character sans serif style; and Spokesman 10, a large, 88-character style for printing speech texts and preparing overhead transparencies. **Diablo Systems Inc.,** Hayward, Calif. **Circle No 257**

RIBBON CARTRIDGES. Multistrike II and III ribbon cartridges, intended for use with the manufacturer's printers, use "fingers" to hold the ribbon close to the printer platen. Both models employ a "Quickload" cartridge design and come with black ribbon. Multistrike III provides 50 percent more character impressions per cartridge than the manufacturer's previous multistrike ribbons. Price in single-unit quantities is $5.50 for the Multistrike II, $7.65 for the Multistrike III. **Qume Corp.,** San Jose, Calif. **Circle No 258**

MINIFLOPPIES. This line of 5.25-in diskettes is available in 35- or 40-track, single- or double-sided and single- or double-density versions. The diskettes, which are certified error-free both on and between recording tracks, come in hard- or soft-sectored versions for all minifloppy drives. **Dysan Corp.,** Santa Clara, Calif. **Circle No 259**

ANTI-STATIC SPRAY. This anti-static spray removes static charges from computer rooms and discourages static buildup. The noncorrosive, nontoxic, nonflammable substance can be applied directly to furniture, floors and carpets. A nonaerosol 16-oz. plastic spray bottle costs $4.95, with quantity discounts available. **MISCO, Inc.,** Holmdel, N.J. **Circle No 260**



DISK PACKS AND STORAGE MODULES. These disk packs and storage modules are guaranteed to have no errors. The Trident series of disk packs is available in 25M-, 50M- and 80M-byte capacities. Storage modules come in 40M-, 80M- and 160M-byte capacities; 100M-, 200M- and 300M-byte capacities are available for IBM, CDC, Calcomp and Ampex disk drives. **Dysan Corp.,** Santa Clara, Calif. **Circle No 261**

Meet the Micro800.
Data Concentrators for the OEM.

Are you designing systems using minicomputers and multiple remote terminals? If so, chances are you could save yourself a bundle with a smart little box from MICOM to let several terminals share one phone line.

Meet MICOM's Micro800 Data Concentrator, the intelligent multiplexor designed with the OEM in mind. Using the latest statistical multiplexing techniques, it operates super efficiently with interactive asynchronous terminals, allocating time on the line dynamically to terminals as they need it. In addition, it provides automatic retransmission-on-error, allowing your terminals to operate 'glitch-less', even on poor phone lines . . . .and it requires absolutely no changes to your existing hardware and software.

There are Micro800 models available to support from 2 to 16 terminals. And, if you're only interested in eliminating those phone line 'glitches', we even have a low-cost single channel configuration for lone terminal installations. So why re-invent the wheel? Why not take a closer look at the Micro800? *We challenge you to build it for less!* And we think you'll even like our packaging.

With over 10,000 Micro800's delivered to date, our smart little box is already in volume production, with quick delivery on all models. And you'll find our OEM discount attractive, too.

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CIRCLE NO. 91 ON INQUIRY CARD

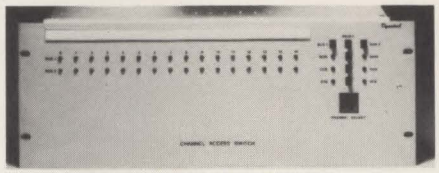
datacomm

DATA ENCRYPTION. The Datalock data encryption device, when placed between a user's terminal and a computer's communication lines, enables the user to encrypt data entered through the terminal or decrypt data returned to the terminal. The unit can also encrypt and decrypt files stored in a computer, encrypt communications between two system users and encrypt data transmissions over chosen communication links. The device comes in two models: the model 150, which is controlled by the user's terminal, and the model 250, which accepts control commands from the computer as well as a local terminal. When not in security mode, the DataLock unit is transparent to system operation. The device can be used with any asynchronous protocol; data rate is switch-selectable from 110 to 9600 baud. Single-unit prices are $2390 for the DataLock 150 and $2950 for the 250. **SPI Data Systems, Inc.,** Palo Alto, Calif.

Circle No 262

DIRECT/CONNECT MODEM. The AJ 1256 modem, aimed at interactive TSO, message network and distributed processing applications, works in a direct connect mode requiring no special telephone or DAA. Registered with the FCC to work with the RJ11 permissive jack or the RJ 41 or RJ 45 "Data" jacks, the unit provides full-duplex, 1200-bps operation and originate/auto-answer modes. The AJ 1256 is compatible with Vadic VA 3400 series modems, the AJ 1255 and the AJ 1234 acoustic coupler. **Anderson Jacobson, Inc.,** San Jose, Calif. **Circle No 263**

ASYNC TO SYNC CONVERTER. The model 400 asynchronous to synchronous converter enables any asynchronous terminal, regardless of character format, to interface with synchronous modems. The device's front panel has a 16-position switch for data rate selection (150 to 39,600 bps); a character format switch; and a green/red LED, which indicates that the system is operating and is error-free or that there are parity, framing or overrun errors. The rear panel houses a fuse, an AC socket and two female connectors for access. The converter is also available in a 7- × 19- × 12-in. rack that accommodates 12 modules. The model 400 costs $295 in single-unit quantities. **Avanti Communications Corp.,** Newport, R.I. **Circle No 264**



CHANNEL ACCESS SWITCH. This channel access switch for large, multichannel systems can be installed locally or remotely to manage RS232 data communications interfaces between terminals (or computer ports) and modems. Like a patch panel, the access switch provides normal-through DTE/DCE connection, noninterrupting monitoring of data traffic and control signals and breaking of the normal-through connection to the DTE or DCE for system reconfiguration or testing. The device operates electronically without patch cords. **Dynatech Data Systems,** Springfield, Va. **Circle No 265**

Outpost 11 has OEM written all over it. Get it into your system.

TANO's Outpost 11 is a highly flexible, easily adaptable microcomputer capable of handling virtually any control, communications, or stand-alone small business computing application. Two points make it the outstanding choice for incorporation into OEM systems: Cost. TANO's high-volume production means Outpost 11 is available at a most attractive price, with multi-unit discounts. Reliability. Modular design using military/industrial grade components yields 6060-hour MTBF performance. Add to that the finest software tools and a variety of interface options (serial line, parallel, digital acquisition or analog acquisition) and you have the most versatile microcomputer in its price range.

If you're an OEM, Outpost 11 has your name written all over it. See your nearest TANO representative and get it into your system. TANO Corporation, 4301 Poche Court West, New Orleans, La. 70129, (504) 254-3500.

TANO

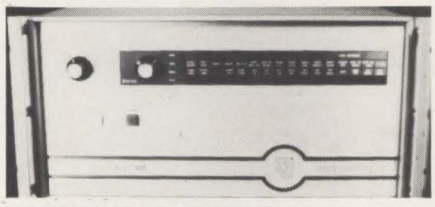
CIRCLE NO. 93 ON INQUIRY CARD

New Products

datacomm

MODEM ELIMINATOR. The E103 modem eliminator replaces two modems or acoustic couplers when connecting an RS232 I/O terminal directly to a nearby computer or one terminal to another within 1000 ft. Aimed at terminal -to- computer, terminal -to- terminal and terminal-to-printer or -plotter communications, the unit enables asynchronous full-or half-duplex operation at rates as high as 1200 baud. The E103 has two 25-pin RS232 plugs for the computer and terminal cables. The unit, which requires no power or maintenance, costs $50. **Western Telematic Inc.** Santa Ana, Calif. **Circle No 266**

LOW-SPEED MODEMS. The P103J originate/auto-answer, P113C originate and P113D auto-answer modems directly replace the Western Electric 103J, 113C and 113D datasets, respectively. The modems provide 300-bps half- or full-duplex transmission and reception of serial binary asynchronous data over two-wire, dial-up telephone facilities. Other features include built-in diagnostics with front-panel LED status indicators that monitor nine conditions and parameters; front-panel jacks for busy out, local digitalk loopback and local analog loopback; switch-selectable options; and rear-mounted edge connectors. In single-unit quantities, prices for stand-alone versions (including modem card and power supply in an enclosure) are $470 for the P103J, $385 for the P113C and $395 for the P113D. **Prentice Corp.,** Palo Alto, Calif. **Circle No 267**



LONG LINE ADAPTOR. The SAI-400 long line adaptor (LLA), designed to support IBM Series 1 and DEC PDP-11 computers, transmits data at speeds as high as 277,000 cps between two to 16 computers within a mile of each other. Other features include an RG62 a/u single-wire coaxial cable hook-up, an address-register and word-count characteristic providing the LLA with its own DMA transfer and a diagnostic mode. Applications include plant networks, data acquisition, front-end systems and CAD/CAM. **Systems Associates, Inc.,** Troy, Mich. **Circle No 268**

SHARING UNIT. The model 6101 sharing unit enables as many as four modems or data terminals to share a common communications device. The unit, which operates at data rates as high as 19,200 bps in both synchronous and asynchronous modes, includes front-panel LEDs that indicate the status of interface signals. Modems and terminals can be located as much as 50 ft. from the unit, allowing a maximum separation of 100 ft. between common and distributed devices. The model 6101 costs $650. **International Data Sciences, Inc.,** Lincoln, R.I. **Circle No 269**

TRANSACTION TERMINAL. The Show & Tel System enables any keypad telephone to transmit or receive digital information from a central computer. Aimed at restaurants, retail stores, service stations and other businesses that use voice lines for transmitting digital data, the unit links to an existing telephone via a handset cradle. The adaptor includes a digital display that indicates the data-entry sequence and information returned by the computer. It also has indicator lights that signal approval of a transaction. **Omtel, Inc.,** Laguna Niguel, Calif. **Circle No 270**

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CIRCLE NO. 95 ON INQUIRY CARD

New Software

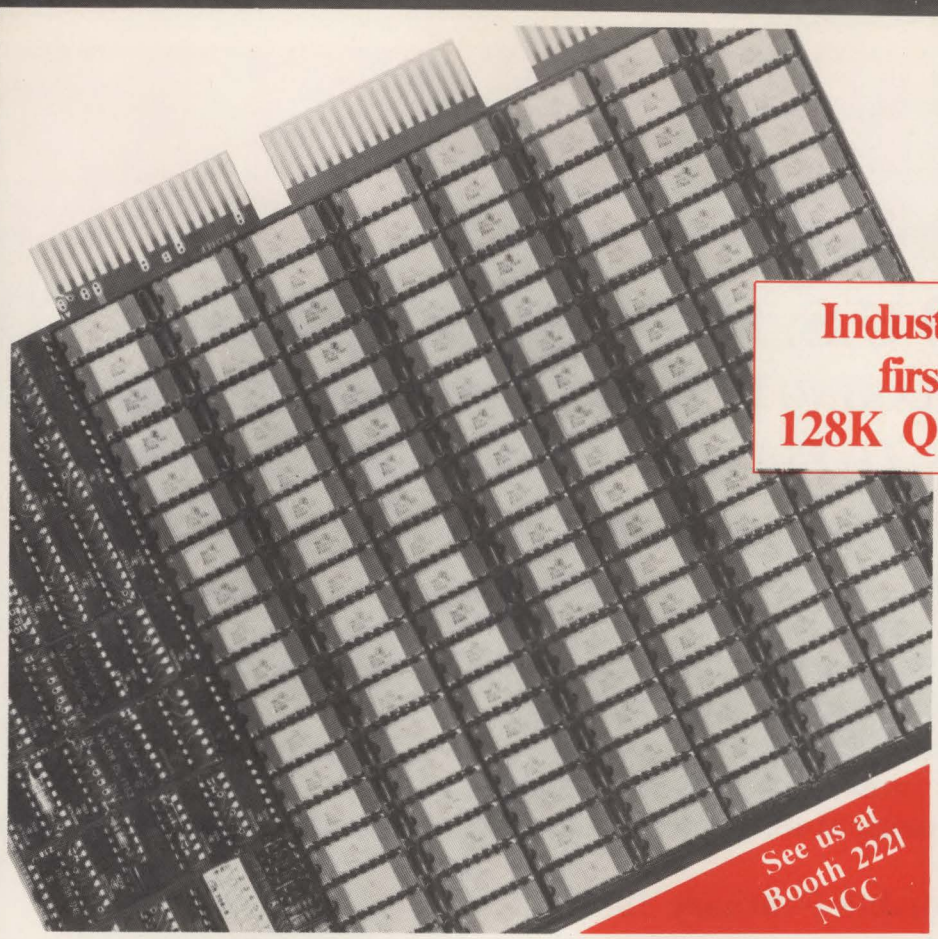
RETAIL ACCOUNTING. The Retail Services System (RSS), a retail accounting and management information system, runs on Burroughs B80, B90, B800, B1800 and B1900 small computers and on all medium-sized Burroughs Systems. RSS is implemented in phases, as needed, with modules for sales audit and analysis, purchases, accounts payable, accounts receivable, item (stock-keeping unit) inventory, perpetual unit and dollar inventory and others. All modules are written an ANSI COBOL; each module is priced separately. **Data Consultants, Inc.,** Johnstown, Pa. **Circle No 271**

DATA BASE MANAGEMENT. This data base management and documentation control system, called Interactive Definition-Oriented Language (IDOL), runs on IBM Series/1 minicomputers. Claimed to reduce application software programming and development time 60 to 80 percent, IDOL provides standardized file mantenance, a report generator, documentation of the developed system for the end user, menus tailored to users' specifications, password protection and file protection. **SMC-Proprietary Systems,** Riverdale, Md. **Circle No 272**

PASCAL GRAPHICS. The PASCAL Graphic Procedures (GRAPHPRO) package, designed to facilitate programming of business, scientific and educational applications on the vendor's RM-6114 and RM-6113 graphics computer systems, is consistent with the August, 1979 SIGGRAPH Core Standards. Routines include text with programmable font; rotation in 90° increments; windowing and clipping; scaling and translation; viewport capability; filled polygons in solid colors; programmable patterns; five standard marker symbols, with others programmable by the user; arcs and circles; and object overlay. Typical applications include business charts, computer-aided instruction, process control, plotting, forecasting and modeling and statistical analysis. **Ramtek Corp.,** Santa Clara, Calif. **Circle No 273**

JOB COST LEDGER. The Job Cost Ledger Module of the automated financial information system (AFIS) is an accounting system that helps companies keep track of multiple jobs under one contract or different projects under multiple contracts. The package permits identification of over- and under-utilized personnel and budgeting inconsistencies. Available for Wang 2200 computers, the AFIS Job Cost Ledger includes a labor schedule routine for as many as 599 employees and 269 contracts. The labor schedule routine reports include personnel by account charged, account charged by personnel, overtime and actual base for payroll taxes, a period closing summary, and a cumulative contract status report. Prices for AFIS with the Job Cost Ledger start at $4500, depending on the number of modules and graphics options selected. **Doty Associates, Inc.,** Rockville, Md. **Circle No 274**

DATA BASE MANAGEMENT. The SIMILE data base management package, based on a CODASYL-like scheme, runs on the DEC PDP-11, under the RT-11 or RSX-11M operating system. SIMILE provides facilities for data collection and validation, data base maintenance, report writing, screen formatting and query in an English-like language. Users with no programming skills and little training can build, operate and maintain application software. Price is $6500. **Small Business Machines, Inc.,** New York, N.Y. **Circle No 275**



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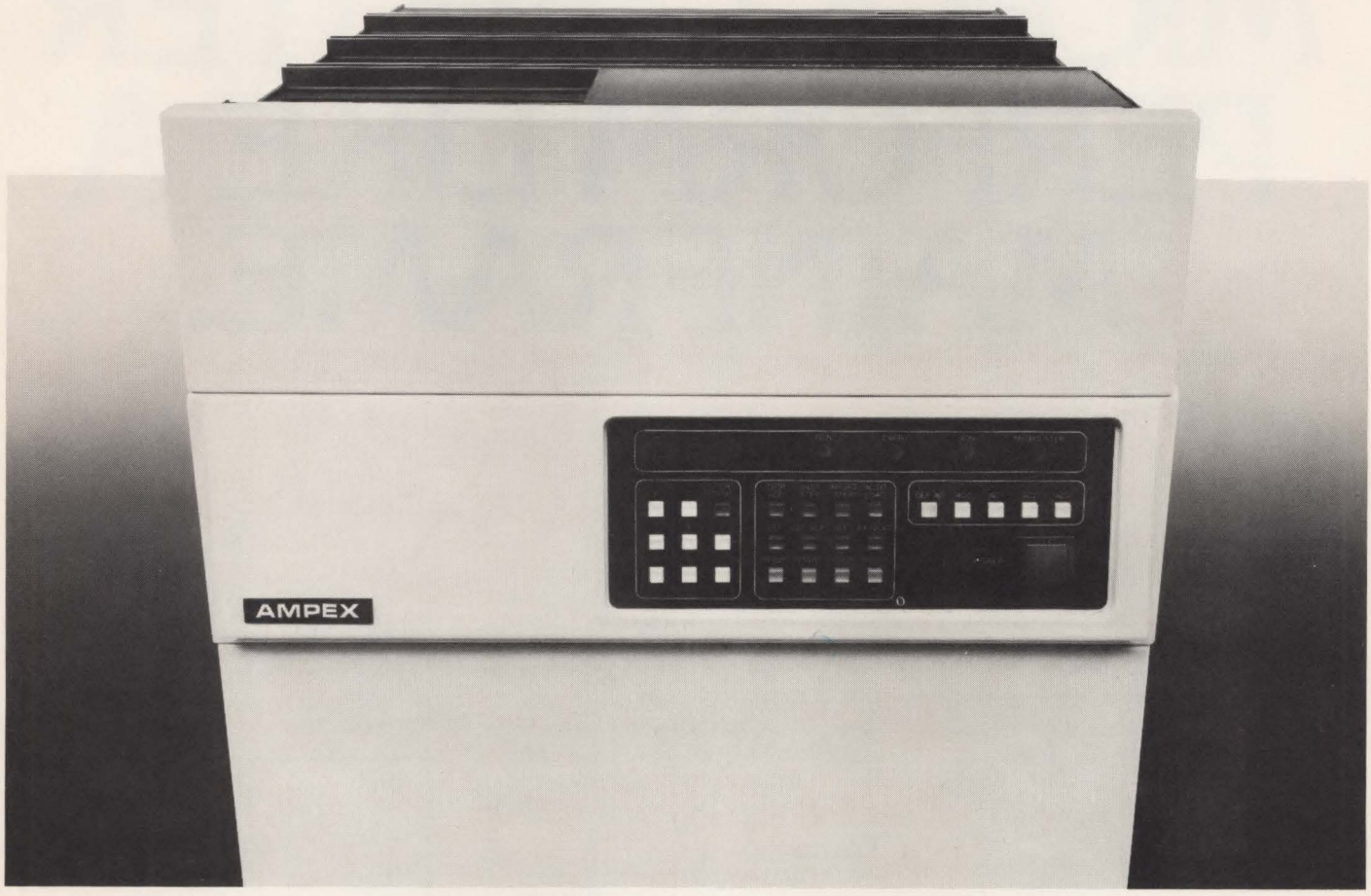

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CIS COBOL is Micro Focus' Compact, Interactive, Standard COBOL which offers the advantages of COBOL... powerful data structure features, English-like language, existing programmer expertise...to provide you with a full commercial language. You won't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

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

Or choose the Standard Compiler.

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

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

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

Forms

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

Forms-2

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

Environment

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

OEMs

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

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

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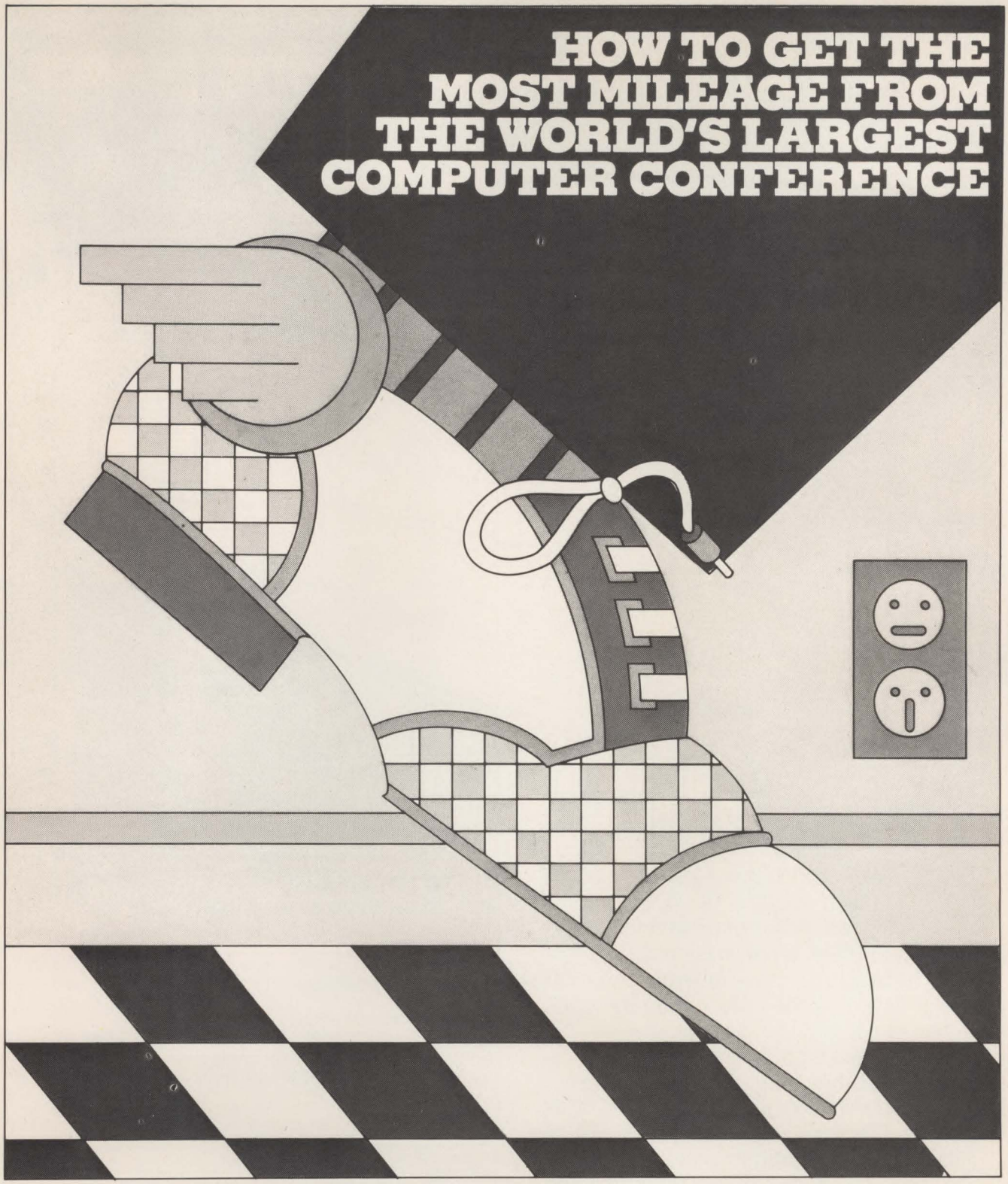

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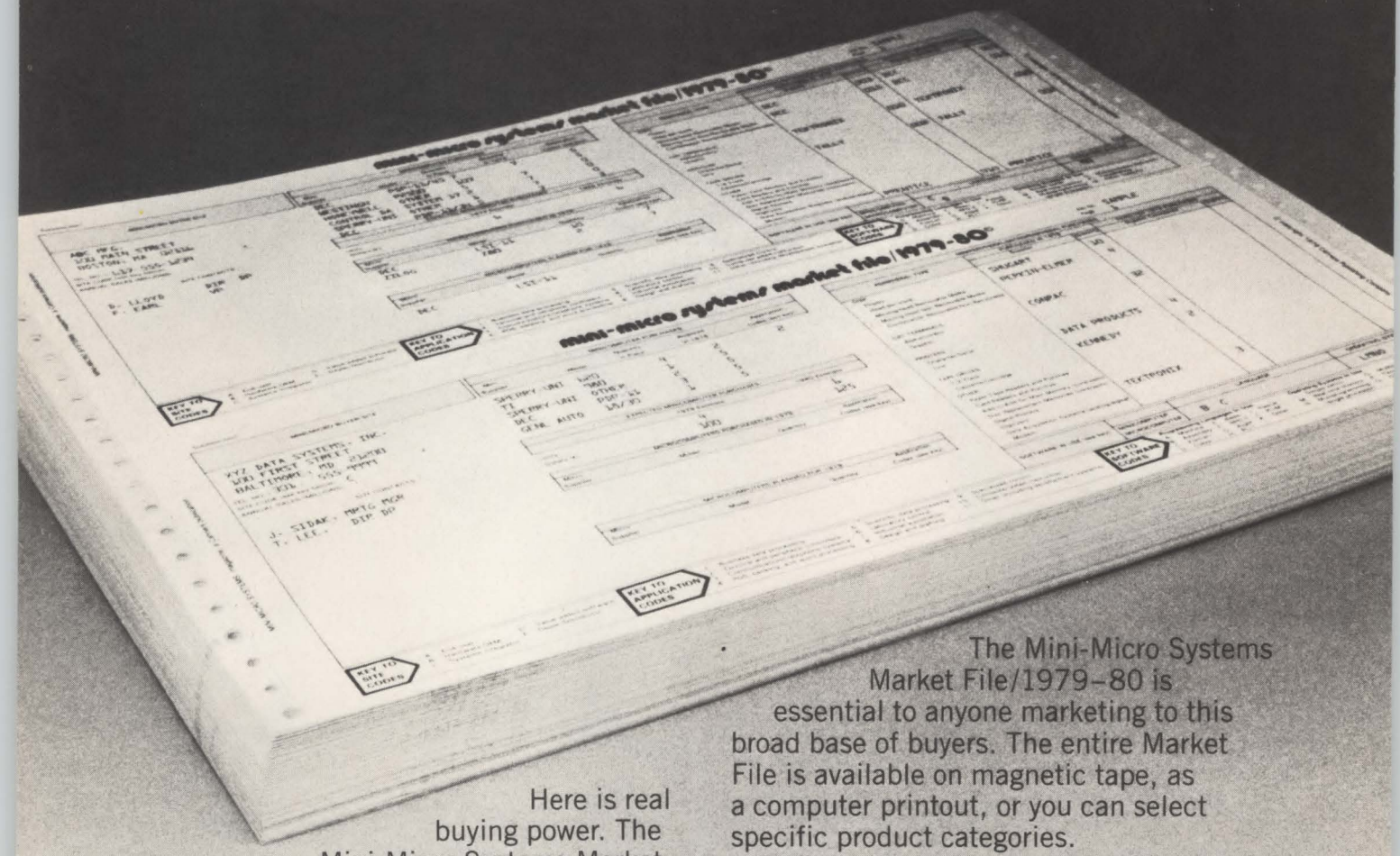

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- **50,000 microcomputers**
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- **32,000 disk drives**
- **85,000 CRT terminals**
- **46,000 printers**
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DIAGNOSTIC MODEMS. The M2415-CR alternate voice/data modem is covered in a brochure. The booklet details how the system links a user's installation to centralized maintenance and support facilities, allowing OEMs to analyze and solve hardware and software problems from any location using a dial-up telephone network. **Intertel, Inc.,** Burlington, Mass. **Circle No 276**

ULTRAVIOLET OSCILLOGRAPH. The SE6300 ultraviolet oscillograph is outlined in a brochure. The six-page publication describes the recorder, which can use 8-in. charts when 12-in. resolution is not needed. Other features detailed include a 13-speed servo-controlled chart drive and a 100w stabilized mercury arc lamp and optical system. **EMI Technology, Inc.,** Stamford, Conn. **Circle No 277**

MICRO REED SWITCHES. A line of micro reed glass capsule switches are described in an eight-page booklet. The pamphlet provides specifications of the switches, including contact ratings, configurations, dielectric withstanding voltages and dimensions. The illustrated publication also includes a background on basic construction and methods of operation. **Fujitsu America, Inc.,** Lake Bluff, Ill. **Circle No 278**

ANALOG I/O SYSTEMS. Microcomputer analog I/O systems are detailed in a selection guide. The 124-page booklet covers applications, specifications, user instructions and prices for more than 80 product families. The publication describes interface boards that are pin-, package- and protocol-compatible with various buses. The guide also covers the DTLIB FORTRAN-callable subroutine library and the DT701 signal-conditioning panel. **Data Translation, Inc.,** Natick, Mass. **Circle No 279**

DATA ACQUISITION SYSTEMS. A line of analog data acquisition systems are detailed in a brochure. The 12-page publication also covers the company's other standard models and computer interfaces. **Phoenix Data, Inc.,** Phoenix, Ariz. **Circle No 280**

AUTOMATION SYSTEMS. Loginet automation systems are described in a brochure. The eight-page booklet details a facilities-management system, which controls plant machinery, energy usage and maintenance dispatch; a production-monitoring system, which analyzes and reports on production lines; a quality-assurance system, which automates quality audit stations; and a production-control system, which automates specific steps in the production line or materials-handling system. **Logicon,** Fairfax, Va. **Circle No 281**

MANUFACTURING APPLICATIONS. An overview of computer applications in warehousing and distribution, in materials handling and on the factory floor is presented in a brochure. The publication, intended for managers in the manufacturing and process industries, outlines solutions to production control problems and provides information on management decision-making. **Digital Equipment Corp.,** Northboro, Mass. **Circle No 282**

DIAGNOSTIC SYSTEM. The Encore 100 data communications diagnostic system is described in a brochure. The four-page publication explains how the system acts as an intelligent monitor and an interactive simulator. The booklet also provides specifications and compares the Encore 100 to the company's PACER diagnostic system. **Digitech Data Industries, Inc.,** Ridgefield, Conn. **Circle No 283**

POWER SUPPLIES. A line of OEM II power supplies is described in a catalog. The brochure details the benefits of these open-frame DC-output units, which are available in single output-low power, single output-high power, dual output and triple output configurations. The 12-page catalog describes conservatively rated capacitors, epoxy glass circuit boards, IC regulated design, UL recognition, 115/230 VAC transformers, all hermetic power semiconductors, reverse polarity protection, overland protection and open remote sense protection. The catalog also includes specifications on input characteristics, voltage/current ratings, regulation, output ripple, transient response, overshoot and optional overvoltage protection and PRA rack adaptors. **Powertec, Inc.,** Chatsworth, Calif. **Circle No 284**

Classified Ads

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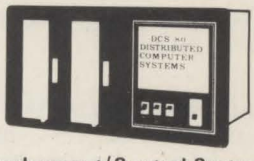

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The DCS/80 is an industrial quality rack-mountable unit which includes dual 8" floppy disks, power supply and 5-slot Multibus card cage. The DCS/80 CPU is an enhanced version of the iSBC 8010 which can contain up to 4k RAM, 16k PROM/ROM, 48 bits parallel I/O and 2 completely independent serial I/O ports. A complete 16k system is $3595.

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Circle No. 411

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Rates: Our rates apply to both display classified and regular classified listings. There is no charge for typesetting regular listings. Attach clean typewritten copy — double-space, please. Plan approximately 50 average words to a column inch — eight lines. Art work for display ads MUST accompany order.

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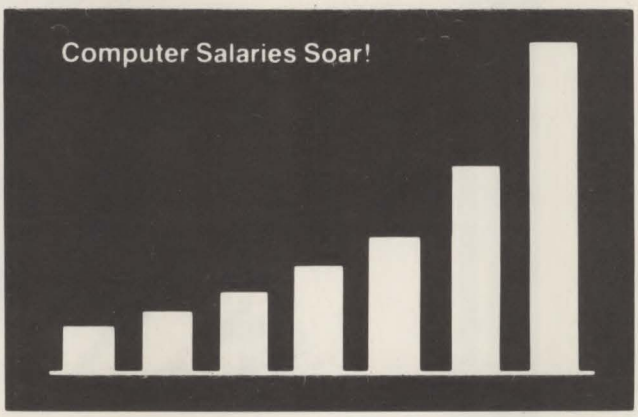

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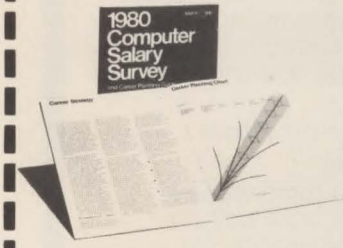

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