

modern data

APRIL 1976

ELECTRO 76 in Boston

3813461PSCS93AG 24 31 0675

Mini/Micros in Automotive Industry

SALT LANE

EAST IND
— ANT
GENERAL

The HANCOCK
HOUSE
1660 ORIGINAL
BUILDING

The well known building in East
Boston was the first town hall
in 1732 by James Davenport
Brother in law of Samuel Adams
owned from 1764-1785
by John Hancock
The Continental Congress
were held here in 1774

This is the Oldest
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IN BOSTON

THE MATCHMAKER

Telefile introduces the only disk system flexible enough to match any minicomputer with any of the hot, new 3330-type drives. Big disk storage at a mini price.

Telefile now has available the most flexible large capacity disk system for minicomputers on the market today. The Matchmaker. It comes two ways:

As a disk system for users (DS-16-C) where we match your minicomputer with any of the latest 3330-type technology drives you want. Telefile supplies the complete package.

As an OEM disk controller. You can order just controllers alone (DC-16-C) and mix and match minicomputers and drives to satisfy your customer's whims and storage requirements.

Either way, disk system or controllers alone, you are assured of flexibility, performance features, and price no one else can match.

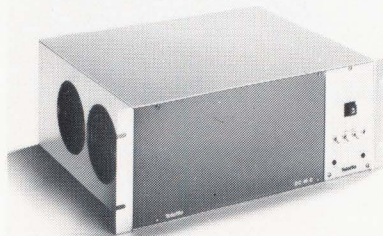
Each system stores up to 1.2 billion bytes.

You can match just the right drives to meet your storage capacity needs all the way from 13.3 million to 1.2 billion bytes per controller. Each DC-16-C Matchmaker controller handles up to four drives. Minicomputers never had it so good.

Choose any of the latest drives.

You've seen them announced one-by-one and they're coming on strong. CalComp's Trident. Control Data's Storage Module. Diablo's 400 Series. The Ampex 9000's and Memorex 677's. Each builds upon IBM 3330 technology, which means higher storage densities and new circuitry for superior reliability.

To switch drives, simply change one controller circuit board. We've timed it at 63 seconds flat!



Compatible interfaces to eleven minicomputers.

We're designing a complete line of compatible interface boards to match up to many minis: Data General, DEC, Interdata, Keronix, D.C.C., Microdata, Honeywell, Lockheed, H-P, Varian, and Cincinnati Milacron. Simply fit our tailor-made computer interface module inside your computer chassis and you're in business. If you have another type mini, we'd be glad to design one for you.

Or you can design your own interface.

Your designers may want a piece of the action. Our general interface board makes it easy. Your board will tie in directly, bringing big disk storage to any 16-bit minicomputer.

A controller so small you can even hide it.

The Matchmaker is our smallest controller yet. It is totally self-contained right down to its power supply and cooling system. It's small enough to tuck away in a drive housing or in a rack above, below, or even behind the computer. Out of sight.

We'll even make you a faceplate.

If you want to show the Matchmaker off, we'll make a bezel to match your computer panel. Private label it and call it yours. There's no end to the flexibility.

Easy "front door" maintenance.

Five circuit boards slip right in from the front of the DC-16-C Matchmaker. A disk interface board, a general interface board, a command/timing board, a memory/address board, and an optional maintenance board for offline disk pack formatting and test exercising.

Unmatched features

- Contains 512-byte buffer for data rate matching
- Variable data search and read
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- Write protection to the sector level
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- Defective track relocation and alternate track addressing
- Overlapping seek capability
- Multi-sector operations across head and cylinder boundaries

We wrote the book on disk controllers, and you can get it free.

For years, we've helped minicomputer users grow their disk capacities. Now our Matchmaker system is a quantum leap forward. A new in-depth, hot-off-the-presses Matchmaker technical manual gives you all the facts. Write for it. Prove to yourself that this is one disk controller no one else can match.

Telefile

Turning minis into maxis with moxie



Please send me your Matchmaker book. I'm interested ___ now ___ later (more than six months from now).

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New Hytype Terminal for OEM's!

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Other features: control panel and switches, audible alarm, variable format control, escape-code functions, full ASCII character set, keyboard overflow buffer, 158 character print buffer, and data error detection. Numeric pad, pin feed platen, and form tractor feed options are available. For complete specifications and features, write

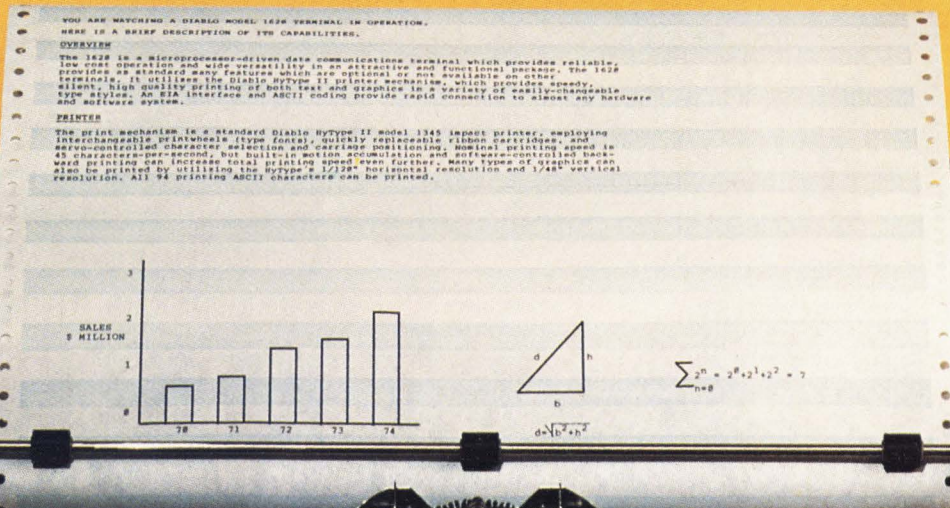
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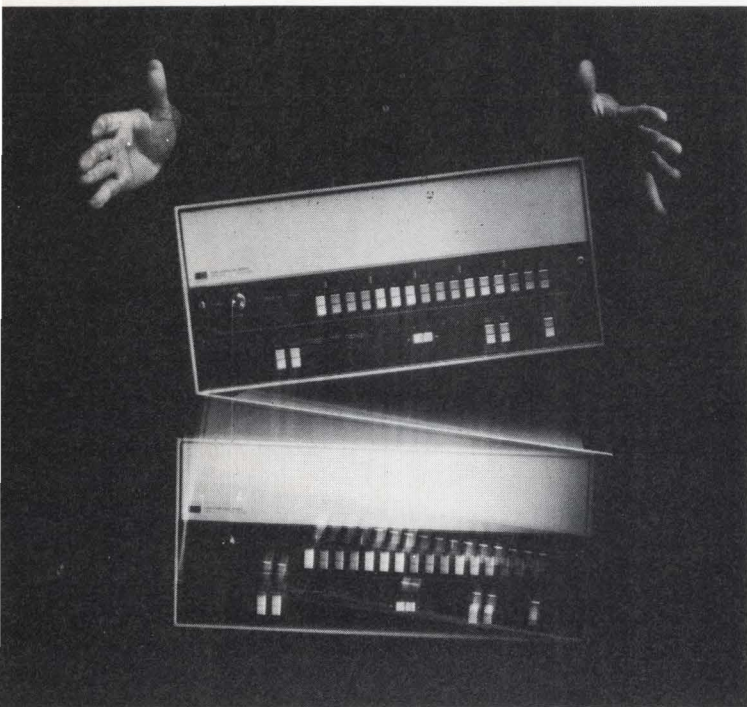
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CIRCLE NO. 1 ON INQUIRY CARD



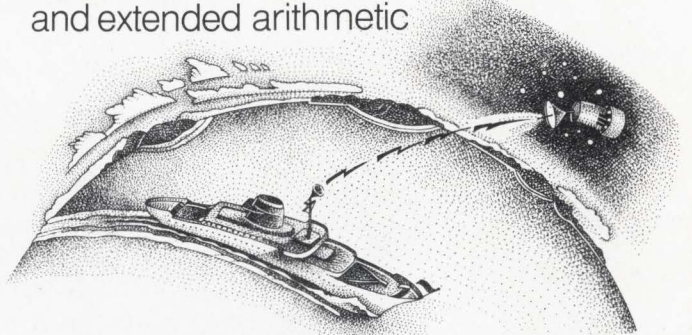
Diablo 1620

THIS OEM ASKED US TO BE TOUGH.



However, you should know that we've incorporated all those improvements into our standard production-line models.

Which means, if you're looking for a tough mini, you ought to check out Hewlett-Packard's 21MX series. All models are user microprogrammable. All are brownout proof and have standard features like a ROM bootstrap loader, memory parity, floating point and extended arithmetic



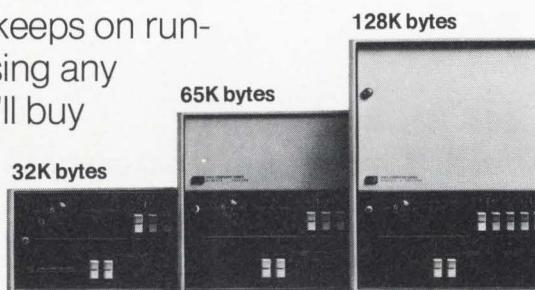
Magnavox Government and Industrial Electronics Company puts a 21MX in its ship- and air-borne satellite navigation systems. Positions can be found to within feet. Reliability is essential.

We don't recommend dropping computers. Hewlett-Packard's or anyone else's. But Magnavox made us an offer we couldn't refuse. "If we drop your 21MX four inches while it's running, and it keeps on running without losing any information, we'll buy a bunch."

We thought about it, made certain improvements, and were able to drop it four inches and have it keep running. Magnavox was pleased. And, in fact, did buy a bunch.

Then, spurred by our success, we let it drop a full ten inches. Sure enough, it kept right on running.

Now we aren't about to guarantee that you can get away with that kind of abuse.



The Hewlett-Packard 21MX Minicomputer Family.

included in the price. All share Hewlett-Packard's tradition of compatibility: Software that ran on our first minicomputers, runs today on the 21MX series.

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APRIL 1976 • VOLUME 9 • NUMBER 4

modern data

18 CORPORATE PROFILE
Beehive Medical Electronics, Inc.

20 DATA COMMUNICATIONS

20 DATACOMM NEWS

A summary of data communications products, services, and events.

22 MINI/MICRO SYSTEMS

22 MINI/MICRO NEWS

A summary of recent minicomputer products, services, and events.

26 MINI/MICRO SCENE

Minimaker in the Chips

Data General's MicroNova family counters the advance of the semiconductor manufacturers into mini/micro territory.

30 APPLICATIONS PROFILE

Mini/Micro Computers in the Automotive Industry

32 An Interview with Ford's Top Computer Man

33 Minicomputer Debugging of Autos

36 MINI/MICRO FORUM

Microtrainers Fill Educational Gap

How to learn micros from the people who gave you *Bugbook*.

38 EXCLUSIVE

Cobol Means Business . . . And So Does Data General

For Eclipse C/300 users, Fortran was nice, but Cobol is even better.

40 ELECTRO/76

COVER CREDIT:

As the site of ELECTRO/76, Boston will offer the newest in mini/micro technology and some of the oldest historical sites in the U.S. Shown is Boston's oldest house, the Hancock House, built in 1660. Photo courtesy of the Department of Commerce and Development, the Commonwealth of Massachusetts.

DEPARTMENTS

- 4 NEWS & COMMENT
- 6 BOOKSTORE
- 10 INTERNATIONAL NEWS
- 12 DC DATASCAN
- 14 CORPORATE & FINANCIAL
- 42 NEW PRODUCTS
- 45 NEW SOFTWARE & SERVICES
- 47 NEW LITERATURE
- 48 INDEX TO ADVERTISERS

READER INQUIRY CARD OPPOSITE PAGE 48
BOOKSTORE ORDER CARD OPPOSITE PAGE 48

AT&T NEVER SAYS DIE

In an effort to win back what it has lost through recent FCC decisions, AT&T is going to battle on the legislative front. Recent decisions that deregulated the interconnect industry and permitted private line services to be established have made AT&T more than just unhappy. So Chairman John DeButts is mounting a massive effort to get Congress to pass a law — by summer — that would put an abrupt end to the private line and interconnect industry. The law — if passed — would not only stop competition, but would permit AT&T to acquire the competitive companies and would revoke the FCC's authority to regulate the private line and interconnect industry.

HONEYWELL'S NEVERENDING SOFTWARE DISPUTE

Honeywell users are not happy about Honeywell's software policy, whereby the software is not included in the sale of used hardware, but must be licensed separately from Honeywell. Various user groups have heard suggestions on how to make Honeywell back down, but there is as yet no unified front. Unfortunately, some individual proposals for action have been misinterpreted as coming from an entire users group. Such was the case with past user group president William White's proposal. White is also vice president of Integrated Computer Services, Inc., which is presently in litigation with Honeywell. White suggested that members increase their dues to develop a national program that would include

a legal and public relations council to fight Honeywell. Although the suggestion may have fallen on sympathetic ears, it was not ratified. The Honeywell Users Coordinating Council did send a warning letter to HIS President Clancy Spangle, explaining that the majority of the user group members were unhappy with the software policy and would discuss resolutions with their individual boards. This was also misinterpreted as a final resolution. Nevertheless, the letter has had an effect and Spangle is suggesting an open dialogue on the subject at the National Coordinating Council meeting to be held in Concord, MA, in June. Stay tuned.

IBM'S MORE POWER FOR MORE MONEY

In most areas of the computer industry, IBM has been the trendsetter — what IBM did became the design aspirations for the other vendors. One recent exception to this was Amdahl's 470V/6, a replacement for IBM's 370-168 processor. Significant about Amdahl's product was that it was a break in the price/performance curve. Amdahl offered almost twice the processing power for the price of a 168. So IBM has now countered Amdahl, offering more power for the 168, but for more money. IBM's Attached Processor System boosts 168 system performance 1.5 to 1.8 times without requiring additional main memory, disk storage or communications channels. Also announced were Systems Network Architecture (SNA) programming improvements for communications users. First shipments of the Attached Processor System will be field upgrades with purchase prices of \$1,748,900.



DTS 102 BIT ERROR RATE TEST SET

- Low Price
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What more could you ask?

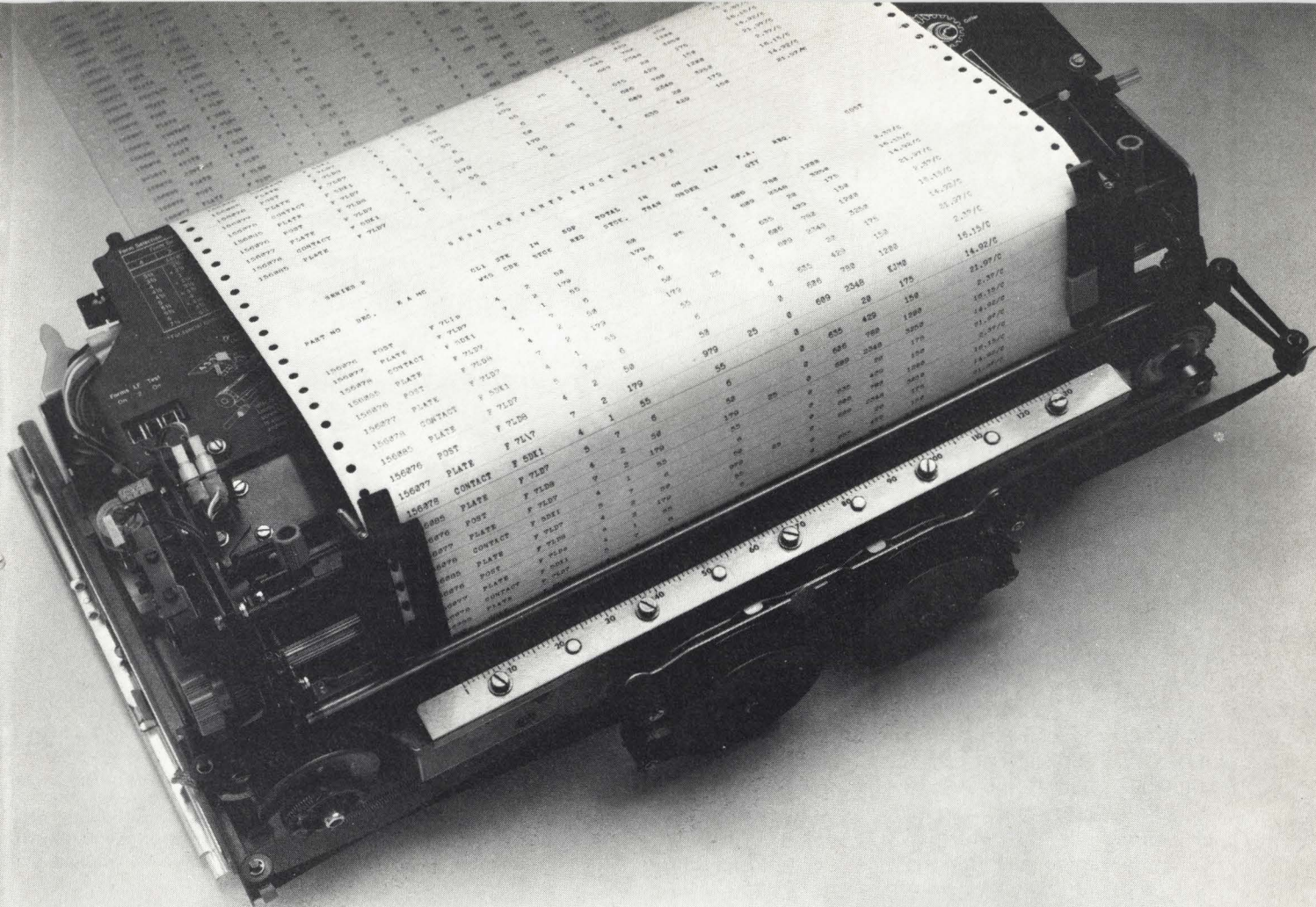
DTS 102 provides a complete data simulation and diagnostic capability, efficiently and inexpensively. DTS 102 tests synchronous and asynchronous systems operating in simplex, half duplex or full duplex mode with 16 crystal controlled speeds and selectable pseudo-random word generation. It also measures and displays turnaround time. Controlled error insertion quickly confirms data processing accuracy and built-in self test circuits provide a reliability check of the DTS 102 itself. An automatic resync feature permits unattended operation for long test runs.

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CIRCLE NO. 4 ON INQUIRY CARD



**The Teletype® model 40 OEM printer.
When you look at it from price and performance,
you'll find it difficult to look at anything else.**

The fact of the matter is simply this:
We don't think any other printer can even come close to the model 40.

And that's no idle boast. Not when you consider the facts.

Consider: Where else can you get a 132-column, heavy-duty impact printer that delivers over 300 lines per minute for less than \$2000, or an 80-column printer for under \$1400?

The big reason behind the model 40's price/performance advantage is our unique design.

Even though it operates at speeds of more than 300 lpm, wear and tear is less than you'd find in a conventional printer operating at considerably slower speed. Fewer moving parts and solid-state components add up to greater reliability and reduced maintenance.

Here's something else to consider: Where else can you get a printer that delivers the kind of flexibility and reliability the model 40 offers?

For complete information, please contact our Sales Headquarters at: 5555 Touhy Ave., Skokie, Ill. 60076. Or call Terminal Central at: (312) 982-2000.



**The Teletype model 40 OEM printer.
Nothing even comes close.**

book reviews

FORTRAN IV FOR BUSINESS AND GENERAL APPLICATIONS by Harice L. Seeds. Published by John Wiley & Sons, Inc., New York. Paper, 417 plus index, \$8.95.

The nice thing about this paperback FORTRAN primer is that it's a happy medium between programmed instruction (PI) and a "straight" textbook. In an effort to answer all possible questions and to ensure that the student has grasped all the material, PI authors usually nauseate said student with endless repetition. Straight texts allow more streamlined reading, but can leave the independent student in need of assistance to which he may have no access. Seeds opens each chapter with a list of educational objectives, as in PI, and presents a summary every few pages within the chapter, as in most PI. Unlike PI, the book includes nothing between objectives and summary but prose and examples. The student can read like a human being, not a robot. Other positive points: Used in a classroom course, the book allows the student to see computer output from his coding on the very first day of class. The book is well organized, set in easy-to-read Roman type, and is attractively bound. Negatives: Graphics are often ugly and are sometimes difficult to read and, yes, the editing could be better. On balance, the book is a good buy at \$8.95.

— Ernst Barlach

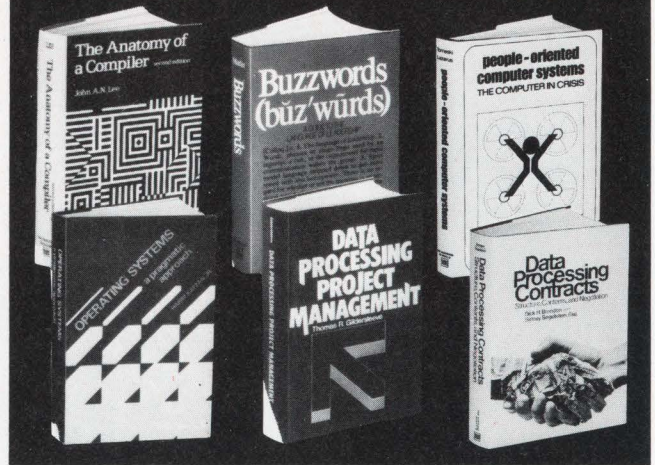
AN INTRODUCTION TO PROGRAMMING: A STRUCTURED APPROACH USING PL/1 AND PL/C-7 by Richard Conway and David Gries. Published by Winthrop Publishers, Inc., Cambridge, MA. Paper, 495 pages plus index, \$8.95.

This second edition follows "embarrassingly soon after the appearance of the first," according to the authors, who have extensively revised the parts of the book dealing with program development and program testing, which were "not very good." This may have been true, but Conway and Gries have little else to apologize for. There are many introductions to programming; few can match this book's intelligent, methodical, ruthlessly honest approach to problem solving and programming. Its chief attraction as a primer is that programming philosophy and strategy are not tacked on at the end of the text, but built right in. And for those readers still skeptical of structured programming, Conway and Gries show how to do it right: instead of the "GO TO for everything" approach, they stress more "natural" methods. In fact, the authors dismiss the whole concept of the "art" of programming, and, with missionary zeal, sell the reader on *consistency, consistency, scientific consistency*. Not surprisingly, they have drawn heavily from the work of Edsger Dijkstra. Even if you wouldn't touch PL/1 with rubber gloves on, you'll learn a lot about *programming* from this book.

— Ernst Barlach

(Mr. Barlach is an independent consultant and a frequent contributor to MODERN DATA.)

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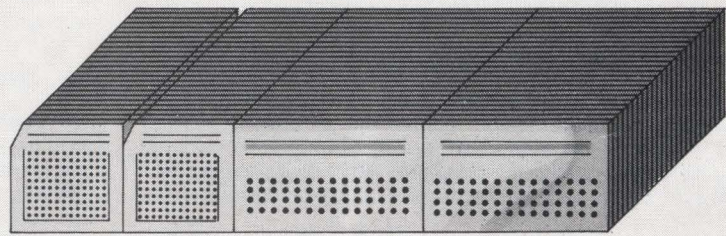
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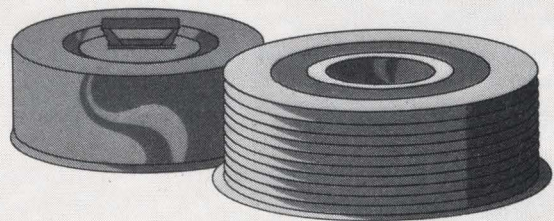
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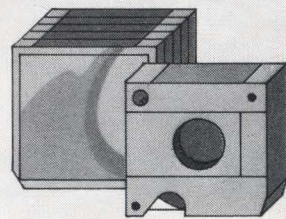
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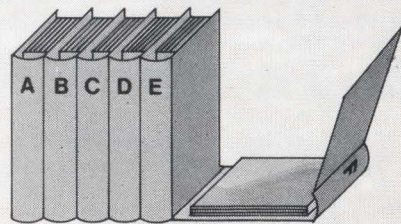
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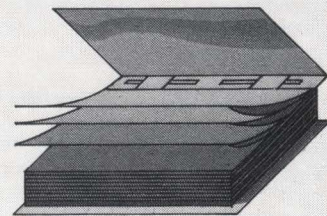
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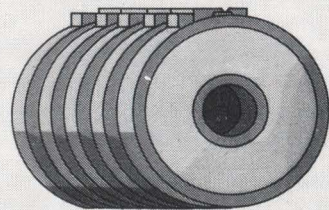
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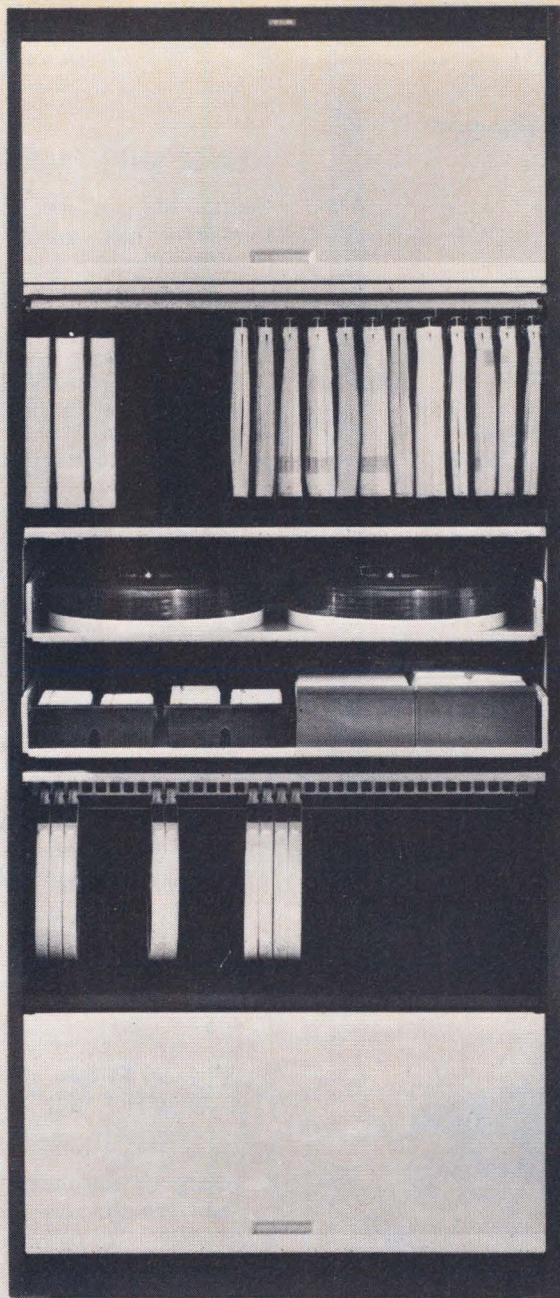


one for printouts,



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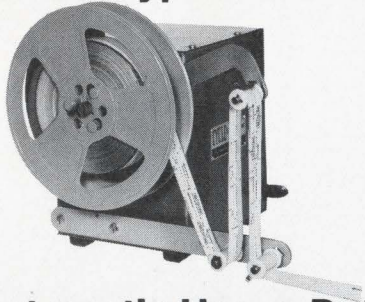
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CIRCLE NO. 7 ON INQUIRY CARD

international news

NEW SPANISH-JAPANESE COMPUTER CO.

Fujitsu, Ltd., of Japan and two Spanish companies have formed a new Spanish computer company—SECISA (Sociedad Espanola de Comunicaciones e Informatica, SA). The Madrid firm will manufacture small Fujitsu models, Facom-U200 and Facom V0. Fujitsu will have a 30 percent interest in the \$13 million venture; the National Telephone Company of Spain (CTNE) and the National Institute of Industry (INI) will each have 27 percent interest.

INTEL AND SIEMENS JOIN FORCES

Siemens of Munich and Intel of Santa Clara have decided to help each other in the field of microcomputer semiconductor products and related software and support systems. Not only does that mean a second-sourcing arrangement, but also joint development of future products.

INTERNATIONAL DATA PROCESSING CERTIFICATE

Over 17 percent more persons went for the Certificate in Data Processing (CDP) exam last year, bringing the number to 2800. (Will it be a trend?) Due to the increasing popularity, the Institute for Certification of Computer Professionals is now going international. The CDP exam, already given in 96 U.S. and Canadian countries, will be given in London; Kaiserslautern, Germany; Singapore; Murdock, Australia; the Canal Zone and Puerto Rico. Write *Institute for Certification of Computer Professionals, PO Box 1442, Chicago, IL 60690.*

WESTERN FLOPPY TECHNOLOGY GOES EAST (THROUGH ENGLAND)

Vilati of Hungary has entered an agreement with Data Processing Instrument of England, an Orbis licensee, to buy and later manufacture the Orbis Model 74 diskette drive. Vilati supplies data processing equipment to Eastern Europe and expects production to reach several thousand drives. The drive will replace the paper tape Vilati presently supplies with its Practicomp 4000 minicomputer.

U.S./JAPAN COMPUTER CONFERENCE PROCEEDINGS

Copies of the 615-page proceedings of the AFIPS-sponsored conference held in Tokyo in August, 1975, are available from AFIPS Press. Over 120 papers from the U.S./Japan conference cover topics such as hardware architecture, programming languages, data communications and networks, data base security and even the imaginative uses of computers. Proceeding copies are \$40 each. Write *AFIPS Press, 210 Summit Ave., Montvale, NJ 07645.*

KEEPING SCORE AT THE OLYMPICS

It took 70 terminals and two dual Honeywell Bull 61/60s (small business computers) to keep track of scores at the 12th Winter Olympics in Innsbruck. The data had to be acquired simultaneously from as many as four contests—all with different scoring systems—and then transmitted immediately to the sportswriters and fans there and viewers here.

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CIRCLE NO. 9 ON INQUIRY CARD

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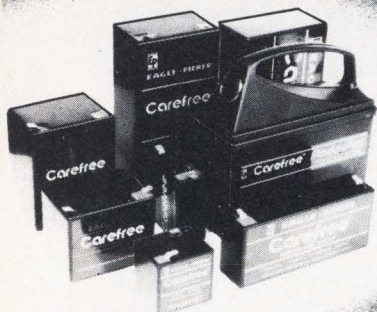
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A COMMON PROTOCOL SUBSTITUTE

The lack of common user protocols (commands) for computer networks has long been a stumbling block for network expansion. Usually, the network user must know different protocols to communicate with the network, to express service demands to computer and to understand the results from the computer. The protocols are often incompatible and machine-dependent. Instead of trying for a standardized protocol system among network computers, which could discourage competition, the National Bureau of Standards is attempting to *compensate* for the nonuniformity of protocols. It has developed a minicomputer, the Network Access Machine, which accepts one protocol system and translates it into the applicable protocol for the specific computer network. Access procedures are stored as macros or files in NAM and given names by the user. The macros are recalled by that name and expanded with various parameters by NAM. The prototype NAM is now being used at NBS to determine its applicability to other Federal agencies. An NBS technical note describing NAM is available by writing *Robert Rosenthal, Computer Networking Section, Room B212, Technology Building, Washington, DC 20234.*

TWO NEW GRAPHICS STANDARDS

The American National Standards Institute has approved two new IEEE (Institute for Electrical and Electronic Engineers) standards: graphics symbols for electrical and electronics diagrams and reference designations for electrical and electronics parts and equipment. And because the Dept. of Defense has adopted them both for mandatory use, drawings and diagrams for DOD contracts will have to use them. Copies of the new graphics symbol standards (IEEE Std. 315-1975) are available for \$8.00 and reference designations (IEEE Std. 200-1975) for \$6.50. Write *IEEE, 345 East 47th St., New York, NY 10017.*

ON MAILING PRINTOUTS

The Postal Rate Commission is suspending the Private Express Statutes. This means that all data processing printouts will have to be carried by the U.S. Postal Service. Although there wasn't much time to object, the *Computer Law and Tax Report* included these user comments in its response to the Commission. The first point of

objection was that data processing information should not be considered a letter, because it is not "unique" and "original" and "does not have the implied action response associated with a message." Most of the objections, however, had to do with the cost and efficiency of the Postal Service. If the Postal Service has trouble handling the mail volume now, how could it handle increased volume and how could it handle immediate delivery needs without an exorbitant charge? Banks are especially concerned because they depend on same-day delivery of posted debits and credits to keep float to a minimum. To avoid these problems, which will eventually effect the public, the *Computer Law and Tax Report* is suggesting an inquiry to revoke the suspension of the Private Express Statutes to allow six months to one year for an economic impact study.

THE GOVERNMENT MOVE FOR EFTS

With all the paper movement in Washington, it's not surprising to see certain agencies of the Federal Government seeking relief by using Direct Deposit of Payments — one of the first steps toward electronic funds transfer. The Treasury Dept. started with Social Security payments. Since the program began early in 1975, over 2 million recipients have received their payments by direct deposit the American Bankers Association reports. The second phase of the program, which involves electronic transfer of payment, began in February in Georgia and is expected to extend throughout the country by the end of 1976. Next to try Direct Deposit will be the Civil Service Commission, which will begin pilot programs in Georgia and Florida in May and move to electronic transfer in the first quarter, 1977.

NEW PUBLICATIONS

A Multiprocessor Design by W.B. Barker describes the design considerations and eventual development of a multiprocessor — the Pluribus — by Bolt Beranek and Newman. Price is \$9.25.

A Minicomputer System of Data Collection and Transmission by K. Niecko and J. Szumilewicz describes the SEECHECK system, which has been installed at their plant. The system is the first of this type to be installed in COMECON countries. Price is \$3.50.

To obtain copies, write *National Technical Information Service, U.S. Dept. of Commerce, 5285 Port Royal Road, Springfield, VA 22161.*

Varian's Data Base Management, TOTAL.

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CIRCLE NO. 11 ON INQUIRY CARD

WU DATA SERVICES TO MAINTAIN KEYDATA TERMINALS

Keydata Corp. of Wellesley, MA, has contracted with Western Union Data Services Company for the maintenance of its approximately 800 terminals under a three-year agreement. Keydata is the nation's first commercial time sharing firm. Western Union Data Services services its leased terminals through its terminal maintenance system called Termicare. The Termicare system combines nationwide field service with centralized terminal diagnos-



L. Edwin Donegan, Jr., Keydata president (seated) and Z.V. Zakarian, Western Union Data Services' president sign three-year agreement.

tic services headquartered at the Termicare Center in Mahwah, NJ. "This step was taken to improve the servicing of our customers' terminals," said L. Edwin Donegan, Jr., Keydata president. "The selection of Western Union Data Services to service our terminals was completed after several months of thorough investigation, during which we found this company well qualified to provide efficient, nationwide service to Keydata Customers."

ORBIS SIGNS THORSON AS REP

Orbis Systems Inc. (Tustin, CA) announced an agreement was reached for The Thorson Company to represent Orbis in nine cities. According to Ray Werner, director of sales, this addition of Thorson will "improve our sales penetration in the Western States. They have an excellent reputation as an organization and have a history of success in the peripherals marketplace." Orbis recently introduced its new Model 76 and 77 diskette drives. The company recently announced several major contracts for the new drives.

MERGERS & ACQUISITIONS

An agreement in principle was reached whereby **Data General** would acquire **Incoterm** (Natick, MA) on a basis of two and one-half shares of Incoterm common stock for each share of Data General stock. However, one month after the agreement, the deal was off.

EG&G, Inc. (Wellesley, MA) and **Rotron** (Woodstock, NY) finalized the merger of Rotron with an EG&G wholly owned subsidiary formed for the purpose of the transaction **Graham Magnetics** (Fort Worth, TX) has approved in principle the negotiations for the sale of the business and

EARNINGS (Losses)

California Computer Products, Inc. reported "a dramatic turnaround from three successive loss quarters" in the second quarter of fiscal 1976, ended December 28, 1975. Pretax earnings in the second quarter were \$251,000, compared with a pretax loss of \$3,205,000 in the first quarter. Revenues for the second quarter were \$31,495,000, compared with \$26,655,000 in the first quarter.

Mohawk Data Sciences Corp. reported net income from continuing operations for the nine months ended January 31, 1976, amounted to \$3,469,000, or \$.51 per share, compared with a net loss from continuing operations of \$9,552,000, or \$1.52 per share for the comparable period last year. Included in net income for the current nine months was the utilization of tax loss carryforwards totaling \$2,265,000, or \$.33 per share.

Hewlett-Packard Co. reported an 11 percent increase in sales and an 18 percent decline in earnings for the first quarter of the company's fiscal year. Sales for the quarter ended January 31 totaled \$235,639,000 compared with \$212,019,000 for the first quarter of fiscal 1975. Net earnings amounted to \$15,076,000, equal to \$.54 per share on 27,751,146 shares of common stock outstanding. This compares with earnings of \$18,413,000, equal to \$.67 a share on 27,405,179 shares during the corresponding period last year.

Milgo Electronic Corp. announced revenues for the first quarter of fiscal year 1976 as \$9,094,000 compared with \$10,207,000 for the same period last year. Earnings after taxes amounted to \$360,000 or \$.21 per share for the quarter and for the same period in 1975, \$1,176,000 or \$.71 per share.

Telex revenues for the quarter ended December 31, 1975, totaled \$25,220,000 as compared with \$24,489,000 for the same quarter last year. Net income for the quarter after provision for state taxes on income was \$1,079,000 or \$.10 per share. Third quarter profit last year was \$365,000 or \$.03 per share.

Revenues of **Cambridge Memories, Inc.** for its first quarter, ended November 29, 1975, were \$4,718,000 as compared to \$5,670,000 for the comparable period a year ago. The company reported a net loss of \$658,000, or \$.39 per share, for the current period, as compared to net income of \$102,000, or \$.06 per share, for the first quarter last year.

Pertec Corporation reported record earnings and revenues for the second quarter and the six months ended December 26, 1975. Revenues for the most recent quarter totaled \$13,014,000, as compared with \$11,538,000 for the same period a year earlier. Six-month revenues reached a record level of \$24,559,000, compared with \$21,540,000 for the half, ended in December, 1974. For the current quarter, net income after taxes totaled \$753,000, or \$.24 per share, as compared with \$619,000 or \$.20 per share, for the same quarter of the previous year. For the first six months of fiscal 1976, income was \$1,627,000 or \$.51 per share, versus \$960,000 or \$.31 per share in fiscal 1975.

Mini-Computer Systems, Inc. reported revenues of \$5,074,726 compared with \$3,019,667 for fiscal 1974. Earnings rose to \$310,135, or \$.50 per

assets of Graham to a subsidiary of **Sun Ventures, Inc.**, for a purchase price of \$14,308,000. The transaction is subject to the approval of a definitive agreement by the Board of Directors and stockholders of Graham and the Board of Directors of Sun Ventures, Inc. The negotiations include the as-

sumption by Sun Ventures, Inc. of certain liabilities of Graham, but does not include the assumption of any liability of Graham or certain of its officers or directors that may result from the class action suit *Lumpkin v. Graham Magnetics, et al*, filed December 31, 1975, in the U.S. District Court for the

share, compared with \$89,474, or \$.15 a share, for fiscal 1974. The 1974 figures have been restated to give effect to the acquisition of Media III, a manufacturing company, during fiscal 1975.

Tymshare reported that its consolidated revenues reached an alltime high in 1975. Gross revenues for the year ended December 31, 1975, were \$56,442,669, with net income of \$4,722,258, or \$1.22 per share. Comparable figures for 1974 were revenues of \$46,455,477, with net income of \$3,298,283, or \$.89 per share. Income after provision for income taxes in 1975 was \$4,597,258, an increase of 46 percent over the 1974 amount of \$3,148,283.

Ampex Corp. reported a 36 percent increase in net earnings on slightly higher sales for the third quarter ended January 31, 1976. The company announced net earnings totaling \$2 million, equal to \$.19 per share, on total revenues of \$60.8 million. This compares with net earnings of \$1.5 million, or \$.14 per share, on total revenues of \$59.4 million for the third quarter of the prior fiscal year.

Western Digital announced that operations for the second quarter ended January 3, 1976, resulted in a net loss of \$790,000 or \$.57 per share, compared with a loss of \$761,000 or \$.55 per share for the second quarter a year ago. The company's net sales for the second quarter were \$2,467,000; an increase of 39 percent over net sales of \$1,775,000 for the same period in fiscal 1975. For the first six months of fiscal 1976, the company sustained a net loss of \$1,136,000 or \$.82 per share compared to a net loss of \$460,000 or \$.33 per share a year ago. Net sales for the six-month period were \$5,504,000; a decline of 1 percent from net sales of \$55,555,000 for the prior year.

Profit margins for **Inforex** continued to improve for both the full year and quarter which ended December 28, 1975. For the year, revenues increased by 10 percent to a record \$57 million, while profits more than doubled to a record \$1.2 million or \$.42 a share before special credits for tax loss carryforwards. For the fourth quarter, aftertax profits also more than doubled to \$662,000 or \$.23 a share. The earnings for 1975 and prior years have been restated in compliance with recent guidelines from the Financial Accounting Standards Board regarding the treatment of foreign exchange rate fluctuations.

Rapidata announced that net income for the year ended December 31, 1975, rose to \$1,278,325, equal to \$.70 per share, on revenues of \$14,772,314. In 1974, the company reported net income of \$514,237 or \$.28 per share and revenues of \$11,511,632.

Fabri-Tek Inc. reported a net loss of \$252,000 or \$.07 per share on revenues of \$6,969,000 for the third quarter ending January 2, 1976. This compares to a loss of \$557,000 or \$.15 per share on revenues of \$8,085,000 in the third quarter of last year. A loss for the first nine months of \$931,000 or \$.25 per share on volume of \$21,606,000 compares to a loss last year of \$119,000 or \$.03 per share on a volume of \$27,075,000. For the current quarter and nine months respectively, the loss included a \$35,000 and \$201,000 foreign exchange loss resulting from decline in the value of the British Pound.

Northern District of Texas
Tymshare, Inc. (Cupertino, CA) has entered into an agreement in principle whereunder it will acquire the business and operations of **Medical Data Systems, Inc.** (Mahwah, NJ) for 82,000 shares of Tymshare common stock . . .
System Development Corporation (Santa Monica, CA) has acquired certain assets and contracts of **Moll Associates, Inc.** (Boston, MA) — a financial data services firm

COMSHARE SELLS AFFILIATE

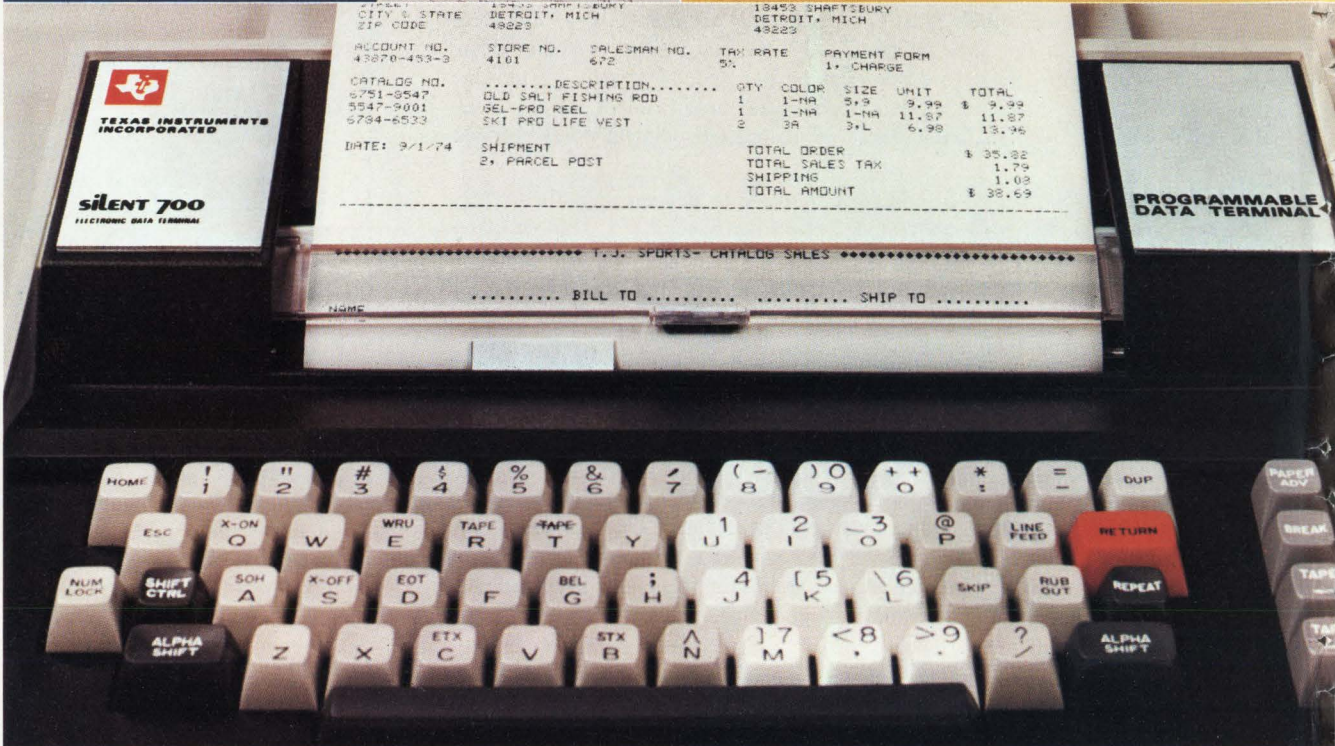
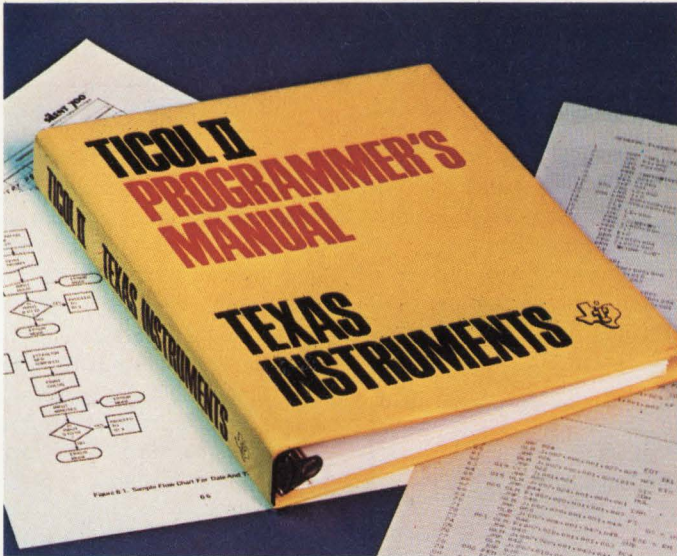
Comshare, Inc. (Ann Arbor, MI) has sold its remaining holdings in an affiliate, Manufacturing Data System, Inc., for \$1,173,000. This was possible as a result of a recent public offering of shares by MDSI. The holdings had a book value of \$73,409 and represented 7 percent ownership in MDSI. T. Wallace Wrathall, vice president of finance, said that proceeds from the sale will be used in support of Comshare's growth objectives. Wrathall added that Comshare has now reached an acceptable working capital position, having increased working capital by approximately \$1,500,000, including proceeds from the sale, since the fiscal year ended June 30, 1975.

PENRIL AWARDED MODEM CONTRACT

Penril Corp. (Rockville, MD) has announced a purchase agreement with Tektronix, Inc. (Beaverton, OR) whereby the Data Communications Division of Penril will provide integral and stand-alone modems for the Tektronix graphic display terminals. The contract provides for the purchase by Tektronix of Penril's 300 baud asynchronous data modems with initial deliveries beginning in the first quarter of 1976.

TAPE DRIVES TO HONEYWELL — \$60 MILLION TO CD

ControlData and Honeywell have signed a five-year agreement, valued potentially at \$60 million, for the purchase by Honeywell of ControlData magnetic tape transports. The equipment is designed to operate at tape velocities of up to 200 inches per second and bit densities of up to 6250 bits per inch. First deliveries to Honeywell are scheduled during the third quarter of 1976.



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Only the *Silent 700*® Model 742 programmable data terminal offers you intelligence, a powerful software language, printing and remote communications in one unit, at a price as low as \$4925. (Leases as low as \$165 per month with maintenance.)

TI's TICOL* II application language delivers the power of a microcomputer to data entry operators. Formats are easily programmed directly on the terminal. No other hardware is required to match your software with your needs.

The intelligent Model 742 boosts operator productivity and reduces the cost of communications. Automatic search lets the operator locate the proper cassette program, load it, and quickly begin data entry. Pre-programmed error recovery enables the operator to instantly correct keying errors. Pre-processing allows the operator to store vital programs on cassette, automatically link them under program control,

validate data, and use fewer keystrokes in the process.

The Model 742 captures data independently of the host computer. Stored on cassettes, data

Data Entry Intelligent Features:

- Data keyed to built-in cassette storage after editing for batch transmission.
- Convenient data entry keyboard (similar to IBM 029 keypunch) with numeric cluster.
- Dup, skip, tab, and special programmed function keys.
- Printer may be off during data entry. Software programs control on/off function for error alert and field prompts.
- Cost-cutting editing power for double key verification of critical fields, checks for length and type of characters, and range checks.
- Pre-processing power for numeric computation and automatic input of fixed field data.

can be polled at night while your terminals are unattended. For example, TI's Model 700 TPS Terminal Polling System with mag tape output is available.

This affordable intelligence includes cassette drives and instant hard copy with printer off/on under program control, for fast, efficient data entry keying. Optional forms printer interface and built-in modems are available.

One other thing.

All *Silent 700* data terminals are backed by TI's worldwide force of service engineers and applications analysts. People who gained their experience in support of thousands of *Silent 700* terminals and Model 900 series minicomputers now in use around the world.

For more information, contact your nearest TI office. Or write Texas Instruments Incorporated, P.O. Box 1444, M/S 784, Houston, Texas 77001. Or call (713) 494-5115, extension 2126.



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Beehive Medical Electronics, Inc.

Salt Lake City, Utah

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BACKGROUND: Beehive Medical Electronics, Inc. was originally organized in 1968 as Beehive Electrotech, Inc. Its present name was adopted in March, 1970, the same year in which a successful public offering provided working capital to aggressively pursue its objectives and goals: the development, manufacture and distribution of computer systems and peripheral equipment used in medicine, business, industry, science and education. Beehive's medical computer system provided the impetus for successful operations and the foundation for its video display terminal product line, which the company says is the largest offered. The computer systems and terminals are manufactured in Salt Lake City and marketed worldwide by company salespersons, national representatives and international distributors. Beehive has factory direct sales offices in Massachusetts, California, Delaware, Illinois and Utah and will have them soon in New York and Texas, also. In addition, the company has sales and distribution representation in all 50 states and 31 foreign countries. Beehive currently employs 250 persons.

FACILITIES: Beehive's present production facilities are contained in five buildings, all located in the immediate Salt Lake City area and totaling approximately 48,000 square feet. The company also leases space in Sunnyvale and Costa Mesa, CA and Washington, DC for use as sales and service centers. The first international direct sales office recently opened in Amsterdam, Netherlands. The company has just completed financial arrangements to consolidate all Salt Lake City operations into one centrally located office, research and production center. The center will consist of an 80,000-square foot building with facilities for manufacturing, quality control, field service, warehousing, administration, marketing, engineering and research.

PRODUCTS/SERVICES: Beehive is a major supplier of video display terminals, ranging from a low-cost Teletype-compatible unit to a fast microprogrammable intelligent terminal. The products are designed to meet OEM as well as end user needs, such as retail department stores, hospitals, reservation systems, and newsrooms. The Teletype-replacement Mini Bee and microprogrammable Super Bee were introduced in 1973. Beehive's most recent product introductions are the Speedi-Bee 8 and the Brilliant Bee. The Speedi-Bee is capable of transmitting 500,000 characters per second. The Brilliant Bee is a user programmable desktop video computer that can expand from a small office computer into a totally flexible computer system by using a

wide assortment of peripheral equipment and options. Also part of the Beehive product line is the BMCS 100 Medical System with specially designed terminals. It is used in large and small hospitals for admissions, pulmonary function analyses, electrocardiogram analyses, clinical lab procedures, and intensive care monitoring. Beehive has also recently developed an arrhythmia satellite processor for the system to monitor irregular heartbeats.

CURRENT POSITION: For the year ended September 30, 1975, the major portion of company sales was for commercial display terminals. During the early part of 1975, Beehive delivered its 3000th Super Bee 2 and its 1500th Mini Bee 2. Foreign sales increased to 16 percent of total sales for the year. Major customers are the Ohio College Library Center, Pragma, Collins Radio, Tracor, Technicon, Intel, the Federal Government, utilities and universities. The Company had a backlog in excess of \$9 million at 1975 year end, and supported \$263,000 in research and development.

OUTLOOK: Based on record first quarter results for 1976 and planned new products, the company expects sales to exceed \$13 million in 1976. This capacity is attainable on a single shift per day basis. Beehive recently reorganized its top management as a step in strengthening its marketing and sales programs. The completion of the new production facility should increase the company capacity to \$30 million per year.

FINANCIAL SUMMARY: Beehive went public in October, 1970, with an offering of 200,000 shares of common stock. At present there are 940,815 shares outstanding with a public float in excess of 325,000 shares. Total shareholders' equity is \$2,476,233 or \$2.63 per share. In June, 1974, the company issued \$1.3 million 10-1/2 percent sinking fund debenture due June 1, 1982 with warrants to purchase 27,000 shares of common stock at \$4.00 per share exercisable through June 1, 1979. There is no long term debt outstanding. Beehive has a current assets to liabilities ratio of 1.70 to 1. Its current line of credit loan limit is \$4 million, of which \$2.4 million has been exercised. The company has no cash deposits or loan agreements subject to compensating balance restrictions. A fire in 1974 resulted in a \$323,227 loss to decrease earnings by \$.20 a share for that year. Present net working capital is \$2,558,000 and total assets are \$8,239,000.

Period	Revenues	Earnings (Loss)	Earnings (Loss) Per Share
FY 9/30/71	825,419	(157,853)	(.17)
FY 9/30/72	2,070,339	49,510	.05
FY 9/30/73	3,779,872	223,706	.26
FY 9/30/74	7,459,903	402,190	.43
FY 9/30/75	9,694,422	500,729	.53
3 mos. 12/31/74	2,123,507	102,291	.11
3 mos. 12/31/75	2,514,790	140,769	.15

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The PM/DS is software, hardware, and media compatible with the DEC, Data General, and Interdata family of minicomputers. It consists of a disc controller (PM/DC) and a dual disc drive (PM/DD) either of which may be purchased separately. The PM/DC will accommodate disc drives made by numerous manufacturers including Diablo, Wangco, Pertec, Caelus, and Iomec. The PM/DD contains five megabytes of storage, 2.5 fixed, 2.5 removable, and may be daisy chained in your existing disc system.

The PM/DS is another step in the Plessey plan to expand—from a leading manufacturer of minicomputer add-on memory, to a complete supplier of a wide range of mini peripherals. If you use DEC, NOVA or Interdata minis you can satisfy all your requirements for disc, memory, and punched tape products with one supplier—Plessey.

Contact us today for details or a demonstration. Whatever you need, you are going to be impressed with what we can do for your minicomputer system and love what we can do for your budget.

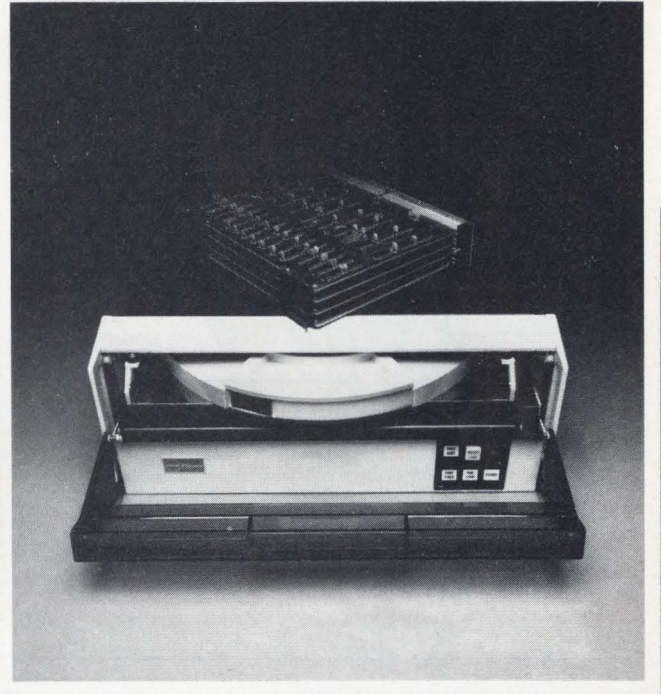


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CIRCLE NO. 13 ON INQUIRY CARD

THE MINI EXPANDERS



THE PLESSEY DS SERIES

**A TURNKEY DATA COMMUNICATIONS SYSTEM
Eliminates Need for Communications Software**

Paradyne Corp. has introduced PIX II, an intelligent data communications system designed to provide IBM 360 and 370 users with a complete high performance terminal facility. It is developed around a modular building block concept with a powerful microprocessor as the Control Module. The PIX II microprocessor has a memory capacity of 32K 16-bit words (equivalent to 65K bytes) plus parity. Memory

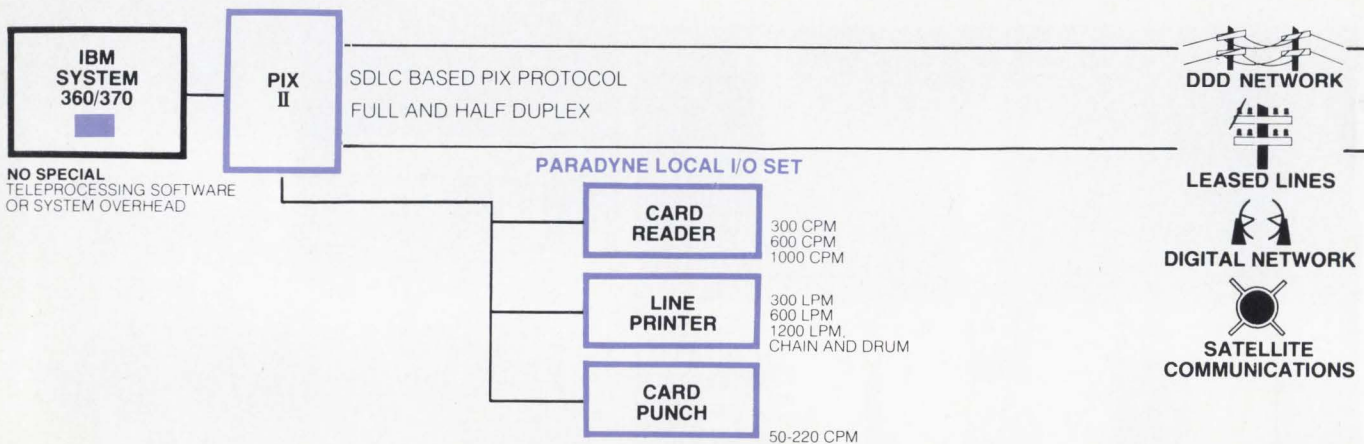
cycle time is 500 nanoseconds. The microprocessor instruction set contains 53 separate instructions with an average execution time of 2.5 microseconds. PIX II uses the basic Paradyne philosophy of extending the multiplexer channel to allow the host CPU to communicate with remote peripheral devices by using standard I/O commands. PIX II employs an SDLC protocol and can operate over a full range of commu-

nications facilities including DDD (half- and full-duplex), leased private lines, wide band transmission, digital networks and satellite transmission links. Data transmission rates available are 4800, 7200, 9600, 19,200 and 56,000 bits per second. The PIX II System contains complete error control, synchronization and line control procedures which eliminate the need for IBM RJE Hardware and IBM RJE Software. PIX

TRADITIONAL REMOTE BATCH OPERATION



PARALLEL INTERFACE EXTENSIONS . . . the PIX concept



**ADDS NEW LINE:
INTELLIGENT TERMINALS**

From its Teletype-compatible CRT base, Applied Digital Data Systems (Hauppauge, NY) is going into intelligent terminals. System 70 will incorporate two Intel 8080 microprocessors and a 20K RAM memory. The workstation will consist of a 1920-character CRT screen, one or two IBM 3740-compatible floppies and a flexible communications interface. A 300-line per minute printer with upper- and lowercase characters is also available. A new Terminal Command Language with English commands permits the operator to edit data input, manipulate data files and control printer output.

System 70's optional communications interface is compatible with IBM 3780 communications protocol. Both point-to-point and dial-up capabilities are available with communications speeds up to 9600 bits per second. The first customer, Data Communications Corp., has purchased 500 terminals to be used in an inventory control system. Shipments should begin in August and price in single quantities is \$7295.

Circle No. 57 on Inquiry Card

**COMPUTER AUTOMATION'S
TERMINAL NETWORK SYSTEM**

Computer Automation, Inc., has entered the commercial systems market with the introduction of SyFA, an in-

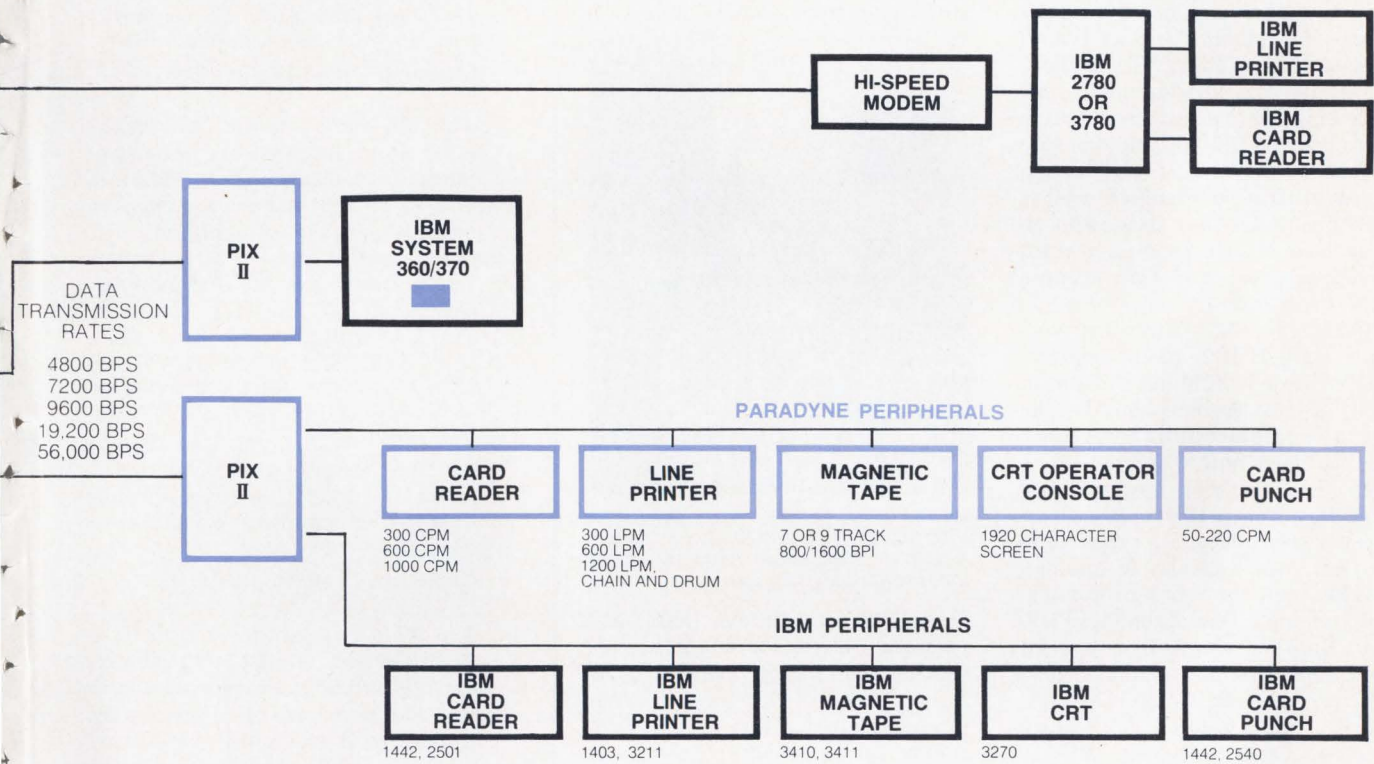
teractive information exchange system designed for use by the administrative and operating levels of business management. The system is based on a new programming language called SyBOL, which can be learned easily by non-technical personnel. With it, the user can execute up to 24 different application programs concurrently via local or remote information stations or display terminals. The hub of the SyFA system is Computer Automation's LSI-2/60 Megabyte processor featuring an extended architecture and instruction set for business applications. It has 64K bytes of interleaved core memory. The system supports up to four 10-megabyte (8.2 usable) disk drives and

II removes the burden of communications from the host CPU and returns to the user valuable computing capacity and programming personnel resources which may now be conserved or redirected to new applications. Completely modular architecture means the PIX II System can now be "tailored" by the user with "standard off the shelf items." PIX II will drive either Paradyne-supplied peripherals or IBM peripherals.

The PIX II System has three modes of communicating. It can operate in the basic host CPU to remote terminal mode, host CPU to remote CPU mode and host CPU to Paradyne local I/O set. Because of its flexibility, a single PIX II system can function in any or all three modes simultaneously. In addition, PIX II is field upgradeable to accommodate expanding user requirements. With PIX II, the user now

has a single source vendor for his communications control, high speed modems and I/O peripheral equipment. PIX II is available in a variety of plans including two-year, three-year, five-year rental, fullpay back lease, and purchase. Typical system, two-year rental prices, including high-speed modems and maintenance, start at \$1600 per month. Initial deliveries are scheduled for April, 1976.

Circle No. 55 on Inquiry Card



eight 80-megabyte (56 usable) drives for users requiring large amounts of online storage. One or two printers can be used on the system ranging from 165 characters per second to 600 lines per minute. Up to 24 display terminals interact with the Megabyter through direct connection or through remote modems or a combination of the two. The price of a basic SyFA system, consisting of a Megabyter, eight terminals, 64K bytes of core memory, and software, is \$57,000. Delivery is within 60 days. Maintenance and installation support will be provided by the Commercial Systems Division of Computer Automation.

Circle No. 56 on Inquiry Card

NO TO DATASPEED 40

AT&T's application to market the clustered version of the Dataspeed 40 CRT terminal has been denied by the FCC on the basis that it involved not just data communications, but data processing. Under the 1956 consent decree, AT&T cannot provide data processing services in conjunction with communications. The tariff, which was to have become effective March 3, was vigorously opposed by IBM, CIA (Computer Industry Association) and (Computer Business Equipment Manufacturers Association). AT&T said it plans to use all legal means to reverse this ruling.

A HARD-TO-IGNORE TELEGRAM

Long distances don't mean much in the wide open spaces of Canada. And this must carry over to its telegrams also. A Canadian Pacific Telecommunications Montreal message center recently sent the world's longest telegram measuring more than 3 miles. Sure to test the endurance of any transmission line and any reader, the message contained 599,000 signatures and urged Prime Minister Trudeau to abolish the provincial language legislation. According to *CP Telenews*, it took 12 CRTs operating around the clock approximately 25 days to complete transmission.

DEC'S NEW MARKET: WORD PROCESSING

Coming through the backdoor of data processing, Digital Equipment Corp. has entered the word processing market. Last year, the DEC Datasystem 310 was hailed as an extremely competitive entry in the small business market. Priced at around \$12,000, the single-terminal system was based around a PDP-8A with 8K words (12-bit) of memory, a dual set of floppies, a VT50 CRT and a choice of printers. This year, DEC added word processing software, replaced the VT50 CRT with a VT 52 (upper- and lowercase characters) and added a special Diablo letter-quality printer. The result — the 310W — is a combined word processing/data processing system with a price of \$22,600 and one sure to find its way into many branch offices of large companies as well as small businesses. For those who already have a 310, there is a word processing package to turn it into a 310W for \$10,600.

In the combined data/word processing market, DEC has no competitors at present. IBM has the lead in small business systems and also the lead in word processing, but has not yet combined both markets. Unlike IBM's Selectric/mag card systems, the Datasystem 310W uses a visual display (no Selectric typewriter) and disk. Visual display technology is fairly new to word processing. Oddly enough, Digital supplies PDP-8s to another visual display word processing system manufacturer. However, the LCS CompuText system is a multiterminal, exclusively word processing, system and is therefore geared to an entirely different market.

Data processing applications such as payroll can be developed by the 310W user in high-level DIBOL, DEC's special version of COBOL, and run under the COS-310 operating system. Optional asynchronous communications are also provided for communication with a host or other 310W computer. But the exciting element is the WPS-8 software, making the Datasystem 310W a totally turnkey word processing system. Salesmen, saleswomen, typists, and presidents can all use the system. Two features make this possible. "Menus" offering a choice of operations appear on the screen. "Cue cards" are then shown with instructions for amateurs on how to

perform a certain operation. Material is typed into the system and is displayed on the 1920-character screen for editing. Characters, words, sentences and paragraphs can be inserted, deleted, moved or duplicated. A shorthand dictionary with frequently used company names, misspelled words can be compiled by the operator with his or her choice of abbreviations. When an abbreviation is typed, it is replaced with the appropriate word. With the "boilerplate" feature, standard pre-stored paragraphs can be inserted in



WORD PROCESSING PLUS OR DATA PROCESSING PLUS? Shown is Digital's modified Datasystem 310, the 310W data/word processing system.

copy. The user can also define and prestore rulers for margins, line spacing and tabbing. The 45-character per second bidirectional printer produces letter quality output. Each floppy can store 100 pages of text for a combined 335,000 words and the system floppy has room for an additional 50 pages of text.

Digital's reasons for entering word processing are twofold. First, Digital expects word processing to be a \$400 to \$500 million market by 1980. Although visual display text editing represents only 10 percent of the present market, Digital believes visual displays will make up 40 percent of 1980's market. Secondly, by entering the word processing market through data processing, Digital has not only found a secure way of entering the market, but has discovered a whole new market aimed at serving all automation needs of a small business or branch office. And with no competitors yet, the market is wide open.

BOARDS AND BOXES

The *PCM-12* from **PCM (San Ramon, CA)** is fully software-compatible with DEC's PDP-8. Designed around the Intersil IM6100 CMOS microprocessor chip, the PCM-12 microcomputer kit has a 2.5-microsecond cycle time, the same instruction set as the PDP-8/E and 12-bit word length. There are 15 card slots and memory is available in 4K/8K RAM/ROM modules to a maximum of 32K words. The PCM-12 can execute all PDP-8 software although the company does not supply it. The kit with processor, 4K memory, power supply and cabinet is \$799.
Circle No. 70 on Inquiry Card

The *IM 4060* four-bit microcomputer from **International Microsystems, Inc. (Gaithersburg, MD)** is said to be the first microcomputer designed around a standard card cage — in this case, a Cambion bin. This gives the user full flexibility in designing his interface circuitry. The IM 4060 uses the Intel 4040 chip with 1K of RAM and 1K of PROM. Also included in the system are a terminal control board, a front panel PC board, supporting all control switches and a specially designed extender card. The software consists of a system monitor and hardware debugger.
Circle No. 71 on Inquiry Card

The *Mini-Micro Designer* from **E & L Instruments (Derby, CT)** is based on Intel's 8080 microprocessor chip and combines ease of programming (direct input via built-in keyboard) with input/output buses via external card edge connections, or through the unique SK-10 interface/breadboarding socket. Internal status/date is shown by three sets of LED indi-

MORE PROCESSING POWER FOR THE NOVA

With Educational Data Systems' Micro-N microprogrammable processor, new horizons open for the Nova. Applications for which microprograms can be written include floating point arithmetic (binary or decimal), character string processing, graphics control, matrix operations, fast Fourier transforms and spectral analysis. And speed is the name of the game. The Micro-N processor occupies one slot of the Nova chassis and includes a high-speed processor with four accumulators, up to 4K

caters. Included in the package is a memory card featuring 1K of read/write memory space. The system is easily expanded with many options. Prices range from \$125 for the simplest kit to \$500 for a completely assembled and tested version with extra features.

Circle No. 72 on Inquiry Card

A hardware/software system called *MINmic 1165* from **Compas (Ames, IA)** allows the microprocessor user to develop his system on a minicomputer. Specifically, the *MINmic 1165* consists of a board that mounts an **MOS/TECHNOLOGY 6502** microprocessor on the PDP-11 bus (requires one small peripheral controller slot), and software for the PDP-11, which supports the *Mm 1165* board. All MCS 6502 memory references are normally directed to the PDP-11. The *Mm 1165* software maps these memory references into the PDP-11 address space and performs the appropriate read or write as directed by the microprocessor. All the microprocessor software can reside in the existing PDP-11 memory and software development can proceed as soon as the board is plugged in and the software has been loaded. The *Mm 1165* software supports address tracing and can be easily modified to support breakpoints or emulation of special purpose hardware. The *Mm 1165* board also contains a ribbon connector that carries all the necessary signals off the board to special purpose hardware via a ribbon cable. *MINmic 1165* sells for \$495, which includes an assembled *Mm1165* board with MCS 6502 processor, *MM 1165* software and manual with full schematics.

Circle No. 73 on Inquiry Card

words of PROM, and up to 64 words of RAM. Both PROM and RAM have access times of 50 nanoseconds and most processor operations take only 100 nanoseconds. With the automatic address modification feature, any number of half-bytes up to 16 can be strung together and processed by a single instruction. The *Micro-N Model 400* with a 64-word RAM is priced at \$1850 in single quantity. The *Model 400-P1*, which is the floating point decimal arithmetic version with a 64-word RAM is priced at \$2250 in single quantity. Write *Educational Data Systems, 17981 Sky Park Circle, Irvine, CA 92707*.

PRIME'S NEW FAMILY

Prime is adding a top of the line 400 processor to its existing Model 100, 200 and 300 processors to offer a complete distributed processing family — *Tempus*. The 16-bit family is upward and downward compatible. It will be marketed on an a la carte or packaged basis. The new top-of-the-line Model 400 is in the PDP-11/70 performance range. Among its features are up to 8 megabytes of MOS main memory; segmented virtual memory management providing each of up to 64 simultaneous users with a 512MB virtual memory space; high-speed cache memory; automatic microprogrammed system integrity monitor; 2MB/second I/O transfer rate; and online disk storage of up to 1.2 billion bytes. Price for Model 400 with 25 KB memory is \$71,200. Contact *Prime Computer, Inc., 145 Pennsylvania Ave., Framingham, MA 01701*.

LIBERATE A DG CRT

When the engineers at custom systems house, *Systems RDI*, had the first Data General 6012 CRTs delivered, they felt constrained by the teleprinter-type I/O capabilities. They needed an end-user system for order entry and inventory control — one that could input and output data from any screen location and one that could treat data a field at a time. So *CRT.LB* was born, to free the 6012 of its constraints. It operates in Page Mode under *RDOS* on *Nova* and *Eclipse* minis and requires full-duplex screens. Written in *Fortran* and assembly language, all data input and output programs have field lengths and starting locations as arguments. *CRT.LB* has a full set of input and output instructions, specifying screen starting location for the transfer and transfer length. One-time license fee for *CRT.LB* is \$3000. Contact *Systems RDI Corp., 2460 Le-moine Ave., Fort Lee, NJ 07024*.



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For industrial and scientific process control. For high speed data communications and information processing systems. MODCOMP TSP leads the way. Here are a few of the reasons why.

TSP Computers.

Buying a computer to do what you need right now is one thing. But how about two years, five years from now? Or even a few months from now, when you maybe discover you're already outgrowing all that shiny new stuff you just bought. That's when a MODCOMP system proves your safest investment. Now and for the future. Because every one of our computers is fully upward compatible with all the others. From the smallest tabletop mini. To our largest 32-bit machine. So you can add on as you need to. Interchange processors or peripherals. Expand into a distributed processing network. Without expensive reprogramming or engineering changes. We're not called "Modular" for nothing.

TSP Software. Whoever said that manufacturers' software is all alike? MODCOMP users will tell you that our real-time multiprogramming systems are the easiest they have ever used. But simplicity is only part of the story. When we design an operating system, our software team works hand-in-glove with our hardware experts. So that the software will get the most out of all the features we build into our hardware. And vice versa. The results can be seen in super-fast execution times that commonly beat the best any comparable systems can offer.


TSP Networks. The switch is on. From big stand-alone computers to integrated distributed processing networks. Our MAXNET operating system was designed for just that purpose. And it's been out working in the field for almost two years. In measurement and control networks of all shapes and sizes. To find out how a network system might solve your own problem, talk to us. We know more about them than anybody.

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CIRCLE NO. 15 ON INQUIRY CARD

minimaker in the chips

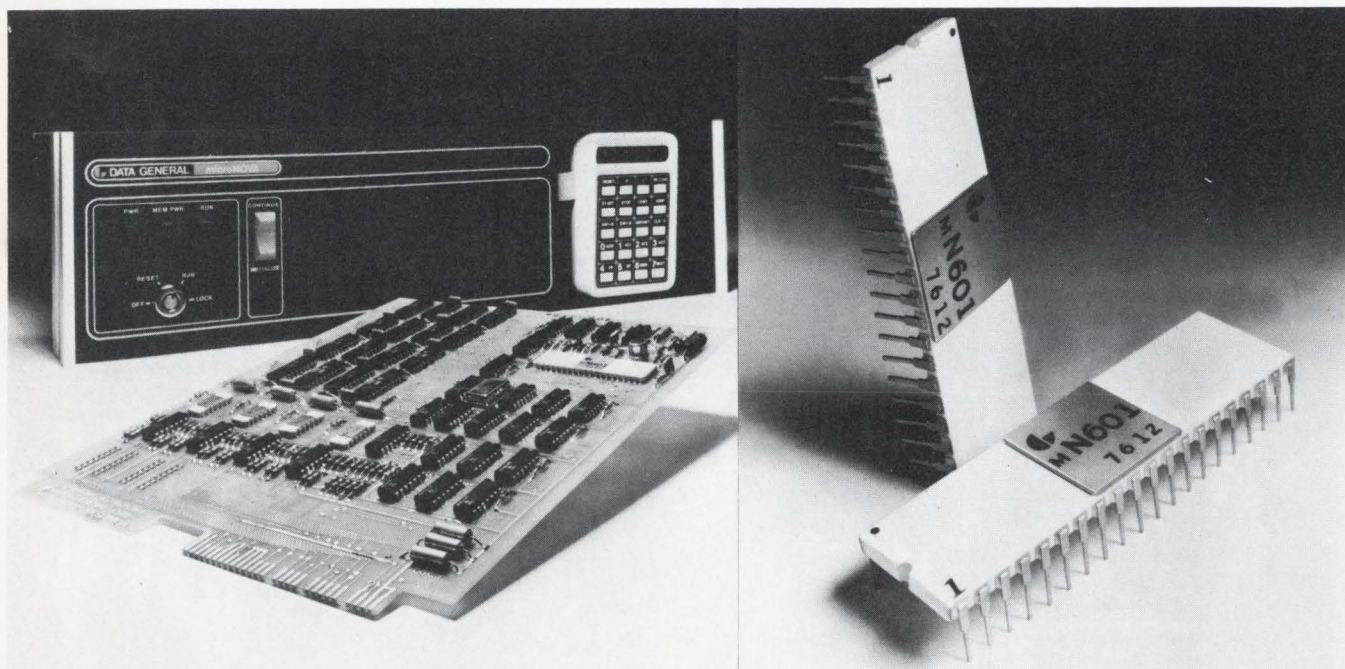
Data General's MicroNova Family

While many semiconductor manufacturers are busy trying to become computer manufacturers, a computer manufacturer is becoming a chip manufacturer. Data General, which last fall announced the manufacture of its own 4K NMOS RAM chip in conjunction with its Nova 3 minicomputer, has at last revealed its master plan — a plan that entails both upward, but especially downward compatibility. For with the introduction of Data General's MicroNova family, it's now possible to start with a Nova 3 mini or MicroNova mini, and branch down to a microcomputer and then to a micro-processor. Data General sees it happening this way in the OEM business instead of starting with chips and moving up.

device identification, busy/done interrupt logic and DMA bus handshaking. The Direct Memory Access Channel permits data transfers of 148K (input) or 173K (output) words per second. There are five types of system buffer elements to round out DG's chip set: a memory bus transceiver, memory address driver, quad sense amplifier and two I/O transceivers.

THE BOARDS

On a 7-1/2 by 9-1/2-inch printed circuit board, DG puts the one-chip CPU, 2K (Model 8562) or 4K (Model 8563) of RAM, the IOC and system buffer elements. The MicroNova



CHIP, BOARD AND BOX FROM ONE SOURCE. With the MicroNova family, Data General moves deeper into the OEM market and still offers Nova compatible-architecture and software.

THE NMOS CHIP SET

But for the purpose of MicroNova family definition, we'll start with the chip set and move up. In addition to the 4K 20-pin RAM DG has manufactured since last fall, there's the one-chip MicroNova processor. It's a 40-pin, N-channel MOS processor with 16-bit architecture, four general purpose registers, hardware stack and frame pointer, real-time clock, hardware multiply/divide and 16 levels of programmed interrupt. There's a 16-bit bidirectional memory bus and a 16-line I/O bus that functions as a 47-line bus thanks to the I/O controller (IOC). The IOC chip, also with a 40-pin NMOS circuit, decodes a 16-megabit per second serial data stream from the CPU to provide the functionality of the Nova 47-line bus. Also part of the IOC's responsibilities are

microcomputer uses the Nova instruction set, including hardware multiply/divide. The software, one of MicroNova's main selling points, is Nova's Real-Time Operating System (RTOS) with a symbolic debugger and libraries for arithmetic subroutines, character handling and I/O. From the basic board, users can expand with 4K/8K RAM or .5K to 4K of PROM to a maximum memory of 32K. There's also a PROM programming board, a general-purpose interface board, and an asynchronous interface board to support teleprinters and DG 6012 CRTs. A diskette subsystem can also be added for a maximum of 315K words (dual-drive) of storage. With the diskette subsystem, the MicroNova can operate under DG's Disk Operating System (a subset of RDOS), which has a command line interpreter, text editor, macro assembler and Fortran IV among its capabilities.

THE BOX

The micro-based minicomputer has a 9- or 18-slot chassis with the CPU/4K RAM on one board, operator control panel, power supply and the same options as the microcomputer. Data General sees this or the Nova 3 as the basis of its program development systems for the MicroNova family.

WHERE THE MICRONOVA FITS

No, the MicroNova micro/minicomputer does not compete with the Nova 3 according to Data General. The MicroNova is oriented downward, towards dedicated applications; the Nova 3 upward. The Nova 3 is faster (700-nanosecond cycle time vs. MicroNova's 960 nsec) and has more features, peripherals, memory and software available.

No, the MicroNova microcomputer is not in the same market as the Intel 8080A-based microcomputers. Data General has a 16-bit microprocessor and has no plans for an eight-bit processor. Although it is manufacturing and selling chip sets, Data General does not see a major portion of MicroNova revenues coming from chip sets. Data General is not just supplying parts, but the software, training and documentation to make the parts work like a computer. The semiconductor manufacturers are not really in the computer business and are therefore still acting as parts supply houses and offering only limited support, whether it be software, training or documentation. Even Texas Instruments' 990/9900 16-bit microcomputer system, with some of the most sophisticated hardware around, does not have the extensive support network of Data General (or Digital).

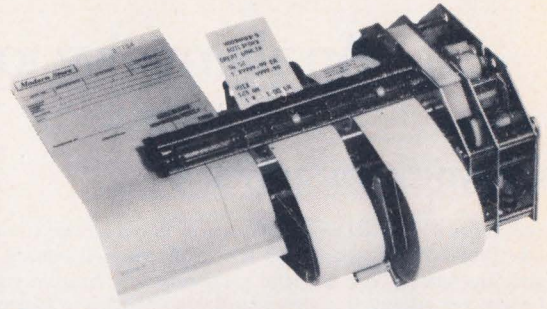
Yes, Data General is in the mini/micro computer business and is therefore competing head on with Digital's LSI-11. Both are using 40-pin NMOS technology in their processors, have similar support arrangements in terms of software, training, documentation and maintenance, and have similar peripheral offerings — teleprinter, CRT and floppy. Both have a single data/address bus. The LSI-11 has PDP-11 architecture with six registers; the MicroNova has Nova architecture with four registers. Floating point arithmetic is available on the LSI-11, but not on the MicroNova. The MicroNova has a faster memory access time (160 nsec vs. LSI's 350 nsec) and cycle time (960 vs. LSI's 1200 nsec). An add instruction takes 2.4 microseconds, register to register, on the MicroNova, 3.5 microseconds on the LSI-11. The MicroNova has a DG-manufactured one-chip processor; the LSI-11 uses a four-chip Western Digital processor. Although Digital is quietly second-sourcing its own chips in Worcester, MA, it is not selling chip sets alone. Memory can be expanded to 32K words on the MicroNova, to 64K words on the LSI-11.

LSI-11s are available now; the first MicroNova shipments will be late fall. The MicroNova CPU is priced at \$95 in quantities of 500. The single-board microcomputer with 4K RAM is \$950 in single quantities; \$589 in quantities of 100. The LSI-11 is \$990 for one; \$684 in units of 100. The micro-based mini with CPU board, board chassis, operator panel and power supply is priced at \$1995 in single quantity by Data General and at \$2495 by Digital.

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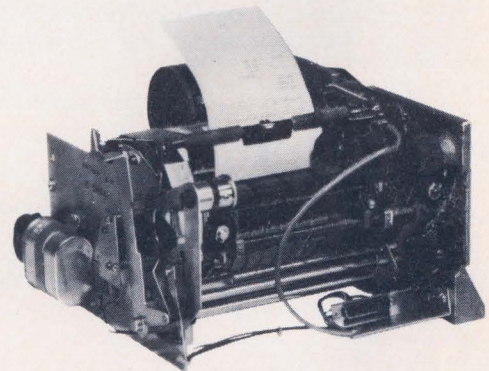
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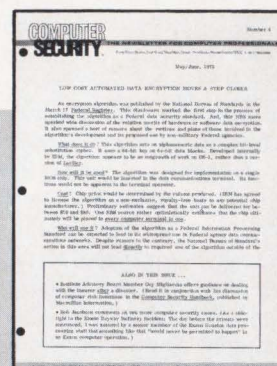
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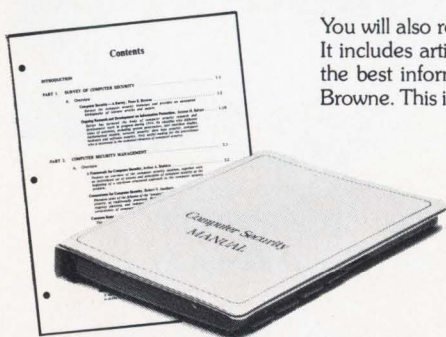
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- ★ Case histories. Robert V. Jacobson, a nationally known authority, contributes two case histories for each issue. Taken directly from the recent news, they provide valuable insight, expert analysis, and solid recommendations.



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mini/micro computers in the automotive industry

INTRODUCING APPLICATIONS PROFILE

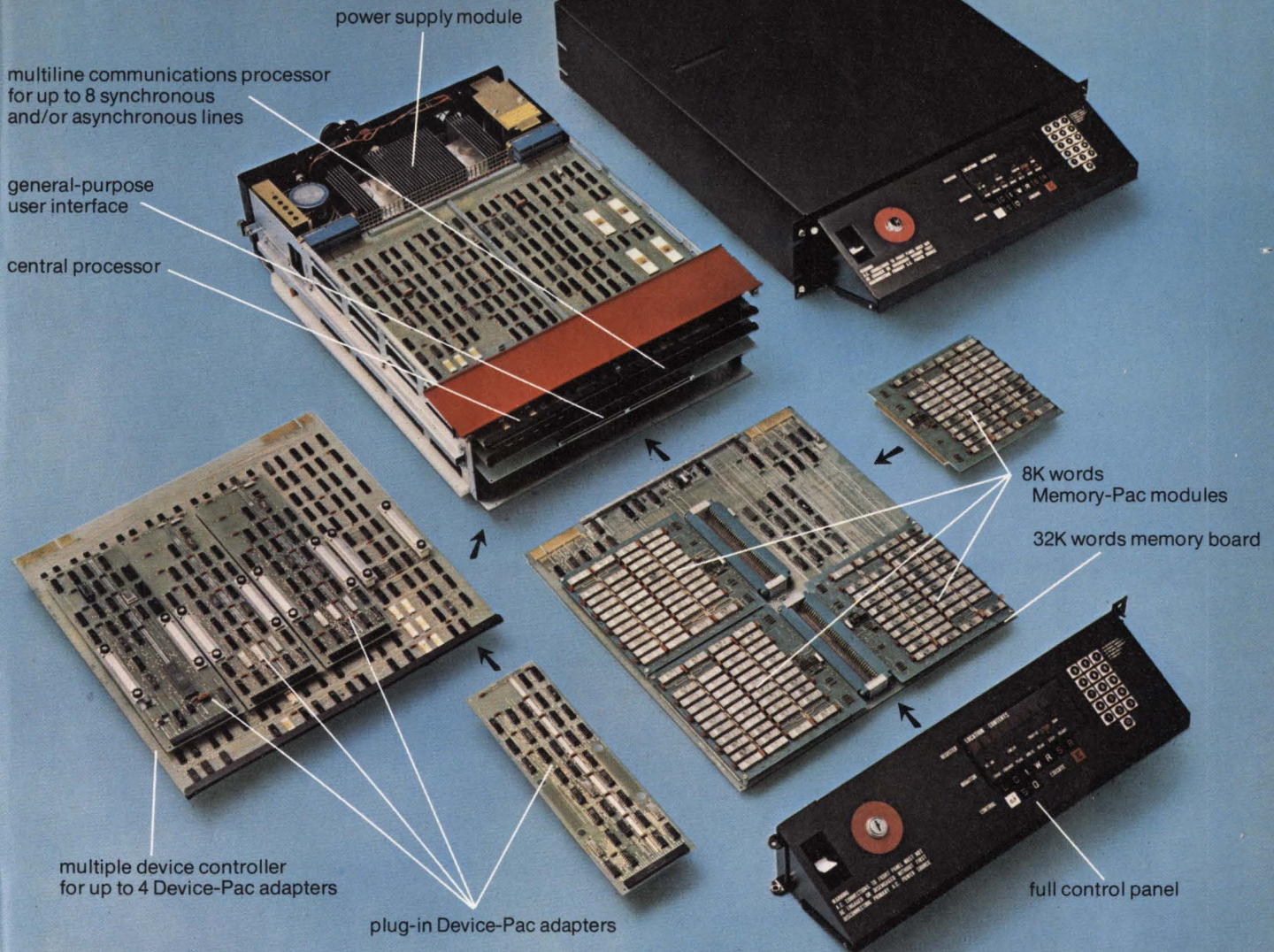
In 1975 MODERN DATA pioneered the new concept of an "Applications Profile." MODERN DATA has always led the industry with Technology Profiles and Product Profiles which are devoted to explaining, exploring, and categorizing particular areas of technology, or particular and well-defined categories of products. In introducing our Applications Profiles last year, we noted that the user can no longer determine the categories of equipment which he needs, as easily as was the case when competing systems consisted of largely standard constituents — mainframe, tape, disk. Then the user only needed to survey the vendors of those particular equipments to make his choices, and the primary area where choice of method could be exercised was within data entry — keypunch, key-to-tape, etc.

In many areas the simple categories of equipment no longer apply: for example, the distinctions between intelligent terminals, remote batch processors and small-scale business computers can be determined only in the application of the user. In 1975 we presented Applications Profiles on "Small-Scale Computing," and on "Data Entry Systems." These were profiles of *solutions*, and the user could begin with a problem which needs to be solved and survey the kinds of solutions which exist for his problem; from that he could determine what methodology and kinds of equipment represent the best solution to his problem. Lastly, by reading our Product Profiles, the user could compare equipments from different vendors. Here, MODERN DATA introduces a specific

industry Applications Profile, — Applications of Mini-computer and Microcomputers in the Automotive Industry. This series will explore the needs and desires of this industry which is most basic to the American economy, study the applications of equipment which are presently in place, and pinpoint future applications and business opportunities in the automotive industry for the vendors of computing equipment.

The Automotive Industry Applications Profile will be presented as a series in MODERN DATA over the next several months and will comprise reports of visits to users in the industry, interviews with key people, analyses of classes of application and organization of those applications from both a marketing and a technological point-of-view. We shall explore computer applications in the control of the manufacturing process, in the testing of its product, in the distribution and marketing of the product, and in the exciting development of the engineering efforts to place a microcomputer in every automobile. In addition to the field work of our own reporters, we shall have input from mini- and microcomputer companies presently actively marketing to the automotive industry and installing equipment for use by that industry.

We begin our profile this month with a report of an interview with the top computer man of Ford Motor Company — an overview of present and future applications in the industry as seen from the top of the world's second largest auto maker.



Shown is the compact, rack-mountable Model 6/36 designed for OEM and system builder applications. The 5 1/2-inch high cabinet houses the central processor, 64K words of memory, a controller for up to four peripherals, and a communications processor which accommodates eight full duplex lines.

The inside story on Honeywell's new mini.

Honeywell's Level 6 minicomputer family offers OEM's and system builders the best of two worlds: A fully open-ended architecture that makes provisions for future developments in technology. And a unique modular packaging design that offers outstanding configurability and serviceability.

Open-ended architecture

- High-performance bit, byte, word and multiword addressing is standard.
- Each 15" x 16" board (central processor, communications processor, mass storage controller, multiple device controller) has its own micro-

processor for more efficient I/O.

- The Megabus™ supports 24 memory address bits, or 8 million directly addressable words.
- Megabus address and data paths are dedicated for bus cycle efficiency, and contention delays are eliminated by distributed control.

Advanced packaging

- The Megabus allows easy configuration by means of unrestricted positioning and addition of boards and modules.
- Modules plug into the 15" x 16" boards for maximum functional density and configurability.

- Hardware self-diagnosis simplifies servicing.

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The Other Computer Company:
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an interview with ford's top computer man

"Control computers are the most important single tool that you are going to have available for increasing productivity during the next decade."

Operating from the international headquarters of the Ford Motor Company, Mayford Roark is the top computer man for the world's second largest automobile manufacturer; all purchases of and applications for computers and control systems throughout the world-wide operations of the Ford Motor Company must be reviewed by Mr. Roark's 70-man group. The computer operations of Ford Motor, like the historical development of the company itself, are highly centralized. One of the world's largest computer centers, in Dearborn, coordinates, collects and controls all operations information throughout the Ford system, from the financial and accounting data to the results of emission testing on a particular automobile from a particular production run.

Ford Motor Company installed its first computer in 1955 and ten years later had only 98 machines. As the average price of mainframes decreased, the rate of installation increased, and there are presently more than 600 computers of all sizes at Ford. Mr. Roark points out that most large increments in the Ford installed base come when a new plant is built and equipment for controlling it is installed. Ford is not particularly eager to replace existing equipment, even relay controller systems, at existing plants, unless there is some clear reason for doing so, e.g., reliability problems.

Mr. Roark is enthusiastic about the potential for computer-aided design and computer-aided manufacturing in the automotive business; however the majority of presently installed systems are involved in industrial control, test, and monitoring operations. We saw computer systems for the

analysis of exhaust emissions (which is becoming a very important area: California, for example, requires 100 percent testing of all autos, and federal specs now require intensive testing on a statistical sample) for the control of glass production, for the mixing of sintering materials in a foundry, for carburetor testing, for numerical control of machine tools, for control of painting and drying, in automatic warehousing, for controlling the assembly of brake cylinders and shock absorbers, and a massive process control system at the Michigan Foundry operation (which pours more engine blocks than you ever saw in one place in your life).

An interesting problem throughout such large manufacturing operations is the cost of electrical power. The Michigan Foundry operation uses some 75 million kilowatt hours per month (enough to light a 50-watt light bulb for every person in Boston). This comes down to about 2 megawatt hours per minute of operation; every megawatt hour used in excess of their stated hourly "demand level" costs the company \$4000 in overage payments to the electric company. Therefore, one of the major functions of the process control computer (an old GE-4020) is to monitor and project power usage, and to shut down one or more of the six melting furnaces if energy consumption becomes excessive towards the end of a given hour.

The impetus for new applications and installations comes in almost equal parts from inside departments of Ford, from computer equipment manufacturers, from computer systems houses (mostly local to the Detroit-Ann Arbor area) and from suppliers of machine tooling equipment to the automobile industry.

Mr. Roark and his group see several trends in usage of computers in the automotive industry. First he believes that reliability of an installation is greatly improved if mini or microcomputers are used for a specific application, rather than controlling a number of applications through one centralized computer. This philosophy extends infinitely downward with minis replacing larger shared computers, and ultimately local microprocessors replacing the present shared-mini installations.



Mayford L. Roark has been director of Ford Motor Company's Systems Office since October 11, 1967. Mr. Roark joined Ford in 1952, and served as warranty and policy administrator and systems planning and development manager before becoming an assistant controller on June 1, 1966. Before joining Ford, Mr. Roark was a budget examiner for the U.S. Bureau of the Budget. Earlier, he was employed by the U.S. Weather Bureau and the Colorado Department of Revenue.

ever, according to Mr. Roark. (Industry sources speculate that the EEC alone could reduce automobile fuel consumption by 20 percent.)

Second, the communication of information within a large plant (the Michigan Casting operation is in a building a quarter of a mile on a side) is a significant problem. The use of existing plant wiring — ordinary electrical wiring — to communicate measurement and control information would be extremely useful.

Lastly we discussed the "on-board computer", now referred to by Ford as The EEC: Electronic Engine Control. The EEC is the microprocessor which many believe will be built into automobiles in the late 70s, to control such functions as ignition timing, fuel mixture, and exhaust gas recirculation to achieve maximum fuel economy while meeting emission requirements. The EEC is in the works, and could become the largest single application for microprocessors

The Ford Motor Company's percentage of total U.S. computers installed is about in line with its share of the gross national product. We suspect that this ratio will increase in the future; we believe the automotive industry is in need of any and all bright ideas which can improve its productivity and therefore its profitability in the new age of expensive fuel, smaller automobiles, and unpredictable yearly sales, and that it represents a prime market for the mini/micro industry.

Ford Motor Company is, as we have recommended to users in general for many years, in control of its own computerization; they have learned the hard way that no one understands their problems nearly as well as they do themselves. It would be beneficial to both the mini/micro vendors and the automotive industry if the vendor's applications specialists became familiar with Detroit's problems and the potential for application of the mini/micro systems to them.

minicomputer debugging of automobiles

Crazy flaws, vibrations, transient distortions and downright dangerous conditions can appear in prototypes of increasingly more complex automotive systems. At Ford's Body Engineering and Product Development Groups, a comprehensive program involving a mix of analog measuring devices, torture chambers, testing apparatus and high-speed minicomputers, is used to isolate faults precisely, to correct them in prototype stages, to define design limits, and to validate final product quality to minimize vibration, noise and road harshness.

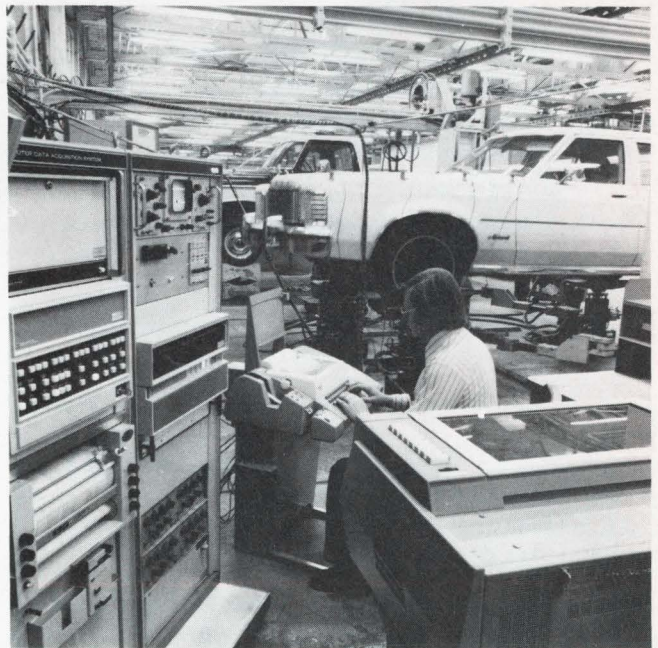
Six HP 9600 minicomputer systems enable Ford technicians to read, process, analyze and plot huge amounts of data sensed by transducers attached to as many as 200 discrete points on a car or one of its bread-boarded subsystems. The Minicomputers utilize the Hewlett-Packard Real Time Executive System, a disk-based operating system which permits real-time operations and also allows multiprogramming. Each 9600 system contains up to 32K words of core, an analog-to-digital converter, disk files, line printer, system console and, as required, digital plotter, video display terminal, digital-to-analog output converter, card reader, and Fast Fourier Analyzer subsystem.

Testing is performed in two basic modes: computer-simulated excitations are based on Ford's extensive data on how roughly various drivers may abuse a car; and actual runs of cars are made over Ford's test track, a motorized decathlon consisting of special challenges like chuck holes, belgian blocks, cobblestones, etc.

THE SHAKER

One of the HP 9600s is dedicated to what Ford engineers called the Shaker System. Stresses and strains are monitored both under simulated normal driving conditions and also to extremes analogous to speeding down a track of railroad ties. Hydraulic rams are placed under each wheel of a car. A pro-

gram of excitations, representing normal and upper limit driving conditions, flows from the computer through a programmable function generator and a two-channel digital-to-analog output converter, activating the servocontrol mech-



At Ford, a minicomputer controls the company's "Shaker System," which entails subjecting a car to vibrations representing a range from normal driving conditions to excessive stress.

anisms of the hydraulic rams. The computer sweeps frequencies from 1-1/2 to 30 Hertz, performing tests on all phase combinations of wheels.

Vibrations sensed from accelerometers attached to critical test points such as the steering column, windshield

UNDERSTANDING SDLC

A 12-page reprint collects and *updates* the series of five articles on IBM's Synchronous Data Link Control (SDLC) line protocol which appeared in MODERN DATA between February and September, 1975. *Not included in the published series but contained in the reprint* are several pages on the derivations of the equations used in the articles. Taken together, the series provides a comprehensive, independent explanation and appraisal of this most important line protocol, *written in the working language of computer-communications users*. SDLC subjects covered include:

1. General Concepts and Structure
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header, various points on the car's suspension, etc., are digitally converted for computer use by an HP Model 2313 analog-to-digital converter. The signals are then transformed by fast Fourier analysis, a microprogrammed function contained within WCS (Writable Control Store) circuit cards within the 9600. Here digital signals over microsecond time intervals, by software routines, are curve-fitted into sine waves: thus voltage as a function of time is transformed into voltage as a function of frequency.

Computer statistical print-outs and plots of results, when analyzed by Ford engineers, enable them to design automobiles with natural frequencies well above those likely to be encountered even in harsh driving conditions, to preclude the resonance effect. Ford officials point out it would be relatively easy to over-design a vibrationless car without such elaborate testing. However, it would drive like an armored tank. One prototype model test, for example, revealed a vibration in a fender panel only when the car was rounding a curve while traveling at 33 to 35 miles per hour. Rather than adding excessive weight to eliminate this resonance-produced vibration, tests provided a simple solution: a slight change in position of a fender brace.

ON THE TEST TRACK

Track testing, instead of simulating stress as in the Shaker System, is done while traveling over a prescribed obstacle course in the company's test track; a car is connected to a multiple channel data collection system which records frequencies transmitted from accelerometers and forces detected by strain gauges, on a 14-channel FM tape recorder. This four-hour accumulation of data is processed on the fly, using microprogrammed routines in the 9600's writable control store. Two basic microprogrammed functions are run with test track data. One is a test of simultaneous maximums. When the car is slammed intentionally into a chuck hole, extreme vibrations will be sensed at various affected points of measurement, perhaps exceeding previous maximum vibrations recorded on all 12 data channels. When detecting a new maximum, the microprogram segregates it, plus previous recorded maximums, from all channels and then prints and plots the results in histograms.

The other microprogram deals with level counts. Levels are programmed into 40 thresholds: from -2 to +2 volts in one-tenth volt increments. When electrical representations of strain-gauged force pass a new threshold, they are cumulatively counted. The process is non-continuous. A reset routine starts and counts over when a count crosses a designated dead band, or reset (from -2 to +2 volts).

TESTING OF PARTS

Individual components (e.g., a tie rod, part of a car's steering linkage) are bench tested in a separate HP 9600-controlled system, at various stepped frequencies determined from track test results. A steering column, for example, may be life-tested for fatigue in many different alloys in an effort to determine the best combination of durability, weight and cost.

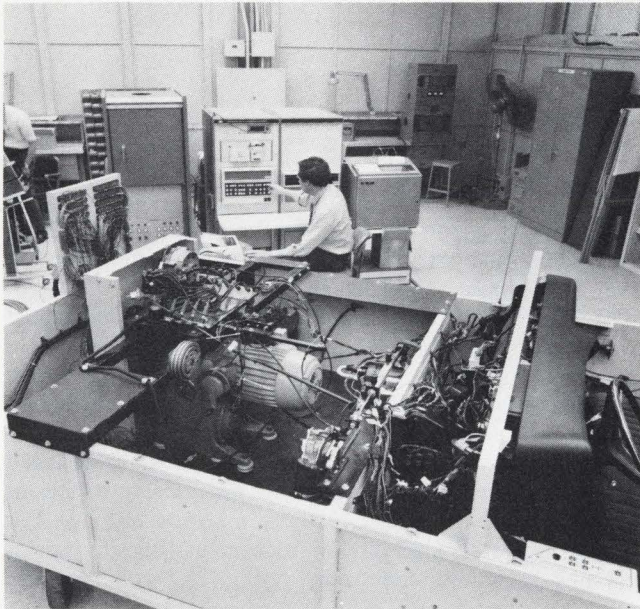
Not all testing expenditures yield usable results. A notable example is another of the company's component tests, run on another dedicated HP 9600, in which Ford spent two years life-cycling microprocessors, to meet the government's functional requirements for a seat belt/ignition interlock system. Since under the interlock a car could not be started without the occupants first buckling up, a high

degree of reliability was required to prevent an incorrect interlock. Consequently, the quantity of microprocessors sampled was large — more than 10,000, under rapid operation while subjecting the circuits to extreme heat, cold, water, vibrations, salts, dust, etc.

FORD'S ESTA PROGRAM

As the electrical systems of a car become more complex — in the last 10 years functions controlled electrically have increased about 150 percent — the chances of undesirable component interaction increase exponentially, and more complex and integrated electrical systems testing is necessary to insure the electrical integrity of the complete vehicle.

Ford's ESTA (Electrical Systems Test Analyzer) program tests electronic subsystems on prototype vehicles and in



Ford's ESTA (Electrical Systems Test Analyzer) allows rapid testing of a large number of electrical functions integrated with the car's entire electrical system.

“bread-boarded” models strung out for mechanical and electrical stimulation. The HP 9600 computer enables the rapid testing of a large number of electrical function combinations in just a few days that otherwise would require many man-months to accomplish.

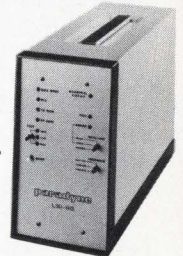
The system measures DC voltage and current at selectable points within electronic subsystems. Through high speed channels online to the 9600, wave forms of significant transients, those that potentially may damage a car's electronic circuits, are captured, and a Peak Detector Circuit captures the peak voltage. These peaks may be of extremely short duration, several hundred nanoseconds, and perhaps 1000 volts in amplitude.

THE ON-BOARD COMPUTER

A new electronic function that is a prime candidate for the company's component and ESTA computerized testing systems focuses on the real-time monitoring of a car's behavior, using microprocessors. In such a system, temperature, oil pressure, charging current, fuel mixtures, etc., will be continuously monitored. As the car's microprocessor senses inputs at variance with programmed standards, this auto-board computer will automatically make the necessary adjustments for the most efficient and pollution free operation. ■

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CIRCLE NO. 18 ON INQUIRY CARD

microtrainers fill educational gap

A MODERN DATA Staff Report

Self-teaching training systems for people without computer programming experience and only a minimal background in digital electronics are permitting students to master the microprocessor well enough in a few days to design it into a simple control circuit. These training systems typically consist of manuals with step-by-step programmed instruction keyed to the novice and a low-cost "skeletal" microcomputer built around a popular eight-bit processor. Each student gains "hands on" experience right from the start of the course. This approach does much to dissipate the mystery and negative attitude of people without previous contact with computers.

Suppliers of training systems say they are meeting an educational need overlooked by formal academic courses and the microprocessor manufacturers themselves, that of assisting dedicated students, regardless of age or education, to understand and use the microprocessor.

A practical mastery of the microprocessor calls for interdisciplinary instruction cutting across a whole range of subject matter from computer programming to computer architecture and logic design. However, an outstanding feature of the microprocessor itself is that it does not make the same demands on the user's background as designing with digital logic or the application of minicomputers.

Many industry observers believe that the penetration of microprocessors into new applications areas is being inhibited by a shortage of trained people, experts in their own specialty fields, who understand and can apply the microprocessor in places where previously a computer-based solution was either impractical or too costly.

Therefore, the training systems are designed to provide an accelerated introduction to microprocessor application, bypassing large "pockets" of formal knowledge that were absolute prerequisites for the practical use of previous generations of computers. A leaf is being borrowed from the military services' experience in training large numbers of unskilled personnel in the operation and service of complex electronics systems by focusing on the essential knowledge.

The manuals concentrate on what is essential to the understanding of using and interfacing the processors and associated support circuit; less emphasis is given to computer theory and the internal operation of the chip. Similarly, the

sections on programming focus on flowcharting and the use of machine and assembly languages with little attention given to the higher level languages.

Once the student has mastered the essentials and gained confidence in his ability to use the processor, he can fill in his own personal knowledge gaps. For example, he may wish to use a floppy disk or teletypewriter to assist him in writing and debugging elaborate programs.

However, many practical control systems can be designed to work well with fewer than 100 processor instructions and these can be written directly in machine language. For shorter programs, machine language may offer the fastest and most economical approach.



Two engineers at E&L Microcomputer Seminar gaining "hands on" experience with micro's through the use of E&L's training system and software.

Nearly all microprocessor manufacturers are offering microprocessor support hardware in the form of assembled boards, kits, trainers and even evaluation systems. However, the instruction manuals provided are likely to prove inadequate for the beginner and little or no attention is given to the solution of practical problems.

Microprocessors can now be economically used where in the past even digital logic was prohibitive. The chips are going into the design of appliances, consumer entertainment products, including games, and automobiles. But whole new applications opportunities are opening in business and industrial equipment and even scientific apparatus that could have used, but could not justify, minicomputer control.

Much has been said about the high cost of software, but the microprocessor-based system can be programmed economically by people who have not had formal training and experience as programmers. The "do-it-yourself" approach obviates the need for hiring specialized consultants, even for reasonably complicated systems. The overall design can be handled by one person without recourse to outside logic circuit or programming experts.

None of the companies offering training systems is claiming instant learning: just as in the mastery of any complex subject, the student's progress is proportional to his effort and ability. However, some of the instruction texts are organized so that the student can work at his own pace and periodically check his comprehension.

Some firms are offering formal classroom and lab instruction taught by experienced instructors. These classes encourage student progress and assist him over difficult material. Classes are generally recommended for all who can afford to take the time to attend.

All training is based on the characteristics and instruction set of the processor chip used within the training aid. The device selected is typically a popular, low-priced unit and those now favored are the Intel 8080 and Motorola 6800, both eight-bit, single-chip processors.


The prime objective is the demonstration of the principles, concepts and application of one device and, by extension, all microprocessors. The student is taught to reconsider the problem in a new way, organize it in a sequence of steps, and translate those steps into a flow chart. The tradeoffs between hardware and software options must be carefully evaluated before writing the actual program.

Typical training aids are self-contained units with the processor, memory and I/O circuits mounted on plug-in circuit boards and a power supply. Switches and indicators on a front panel are used to address and display the memory contents as well as the status of the processor.

Access to the program memory is normally by front panel switches in machine language in accordance with the instruction set of the processor being used. The address and content of the program memory may be displayed to facilitate program loading. Most training aids, however, have little or no provision for interfacing with external I/O devices so these functions are simulated with the panel switches and displays.

The Micro-Designer from E&L Instruments goes one step further by providing effective means for interfacing actual relays, external control devices and displays. Thus the trainer is also a hardware and software development tool. One of the prominent firms offering training systems, E&L Instruments furnishes programmed texts called "Bugbooks" that cover the same subjects as the microprocessor maker's manuals, but are also organized as laboratory workbooks. (See MODERN DATA, Dec., 1975, page 49.) Considerable attention is given to practical benchtop experimentation. ■

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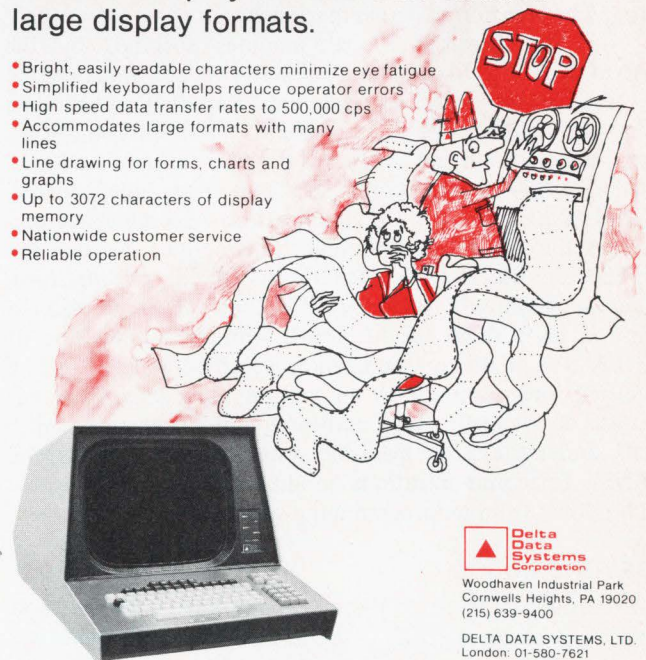
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CIRCLE NO. 19 ON INQUIRY CARD

COBOL Means Business... ...and so does DATA GENERAL

A major COBOL implementation is always newsworthy, particularly when it amounts to nothing less than a full ANSI implementation at the highest level. As it happens, such an announcement was made this month by none other than mini manufacturer Data General, and barely one year after announcing its first end-user commercial system, the Eclipse-based C-300. In that short span, the Southboro, (MA) onetime "iron-maker" has managed to marry some of the most powerful hardware ever offered in the \$100,000 range with as ambitious a package of operating software as anything provided by the established edp "biggies."

Unlike its mini competitors, which, when they were able to offer COBOL at all, traditionally elected to implement one or another of the several COBOL subsets designed specifically for smaller systems ("Required" COBOL, "Basic" COBOL, "Compact" COBOL, "Hypo" COBOL, etc.), Data General's highest-level ANSI-74 implementation means that it can take full advantage of COBOL's *chef raison d'être*: program transferability. Almost from the moment a COBOL program was first successfully transferred between two different computers (ironically, between an RCA 501 and a UNIVAC II, in December, 1960), ease of conversion has been more important than ease of use. The enormous cost of manual conversion, once estimated by the Navy's Grace Hopper to be on the order of 40.5 person-years per 500 programs (typical conversion), will remain — at least until such time as it becomes possible to translate from one language to another as automatically as COBOL programs can today be transferred across machines.

Of the eleven functional modules specified by the ANSI X3.23-1974 standard, all but two are implemented at the highest level. The rarely-used Report Writer module was withheld because other modules contain procedures for report generation and because of the abundance of packaged (and better) report writers available from independents. CAM, Data General's Communications Access Manager, replaces the ANSI Telecommunications module, because the C-300 on which DG's COBOL is offered is a *multi*programming system. (As Honeywell's Robert W. Bemer pointed out in an address to the Tenth Anniversary Meeting of CODASYL, data communications specifications "should be unified and common to all programming languages that must coexist in the same multiprogramming environment," i.e., under the same operating system. In other words, the ANSI Telecommunications module is an anachronism — a holdover from uniprogramming systems.)

BEYOND COBOL

Impressive as it is, "full-implementation" only hints at What's available via DG's COBOL. The extensions DG offers for its COBOL put it far beyond the ANSI capabilities, particularly with respect to file management. Most of these

extensions are through commands to INFOS, an exceptionally flexible data base management system developed concurrently with the design of the C-300 to make the most of that system's powerful hardware.

INFOS runs under the C-300's Mapped Real-time Disk Operating System (MRDOS) with a minimum of 128K bytes of core or semiconductor memory. Besides providing the conventional sequential, random and indexed sequential access methods supported by most COBOLs, INFOS extends its indexed sequential access method (ISAM) to produce a data base access method (DBAM) that offers such additional features as dynamic data base inversion (lets multiple indices access a single record) and multilevel indexing (allows hierarchical key specification).



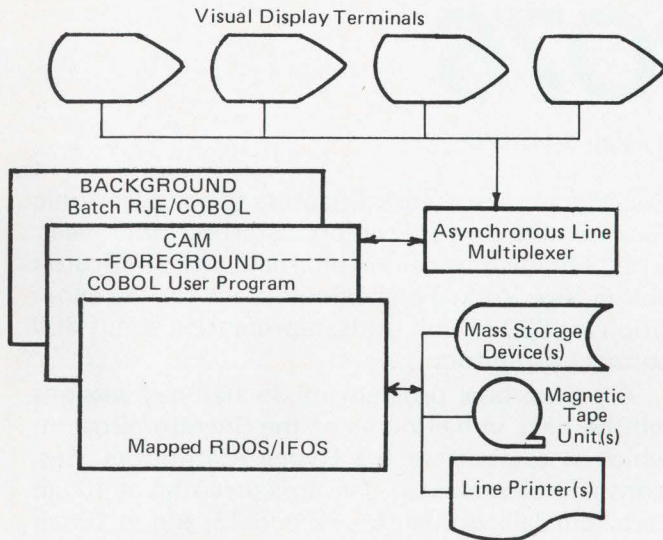
REMOTE DEBUGGING. DG's COBOL has an interactive debugger so users can debug programs from the console terminal, using English commands and free-format input.

Moreover, the INFOS extension is interfaced *directly* to DG's COBOL. That is, INFOS is brought in not through calls, but through verbs, e.g., "Define Subindex," "Retrieve Key." This COBOL-INFOS combination gives the C-300 a data base management capability that matches or exceeds that of machines many times its price. Compared with existing manufacturer-supported minicomputer systems, there is no comparison. Few have any kind of COBOL; those that do rarely include the Sort, Interprogram Communication and/or Segmentation modules; and fewer still have an ISAM.

In addition to the COBOL modules enhanced by INFOS (e.g., Table Handling and Indexed I/O), which under the various ANSI levels routinely provide varying degrees of indexing and referencing, DG offers many other extensions. An example is DG's Debug module. Unlike the standard ANSI batch debugger, DG's is interactive, allowing users to enable and disable breakpoints, and to examine and modify data items dynamically, using such simple commands as "Compute" and "Display."

PARADOX LOST

Clearly, Data General's COBOL was not an afterthought. Had it been, it would have been subject to the same speed, size and architectural limitations that have always discouraged the use of compilers on minis. Essentially, the problem involves a paradox of memory: the more efficient the compiler, the more memory *it* requires compared to the amount of memory required to handle the object code it produces. Compilation, not execution, is the more demanding task.



DG's COBOL FOR REAL-TIME MULTITERMINAL SYSTEMS. While batch COBOL is being run in the background, a COBOL program in the foreground gives terminals real-time access to the INFOs data base via the Communications Access Manager (CAM).

The compilation/execution ratio is less extreme in the case of most scientific compilers (e.g., FORTRAN), but still prevails. Thus, scientific "interpreters" (always resident, statement-by-statement translators), although less memory-efficient, are more commonly used in systems whose cost is primarily dictated by the amount of R/W memory they contain. Compounding this paradox is that the more memory required for operating software, the greater the need for hardware speed.

Data General attacked these problems by developing the C-300 hardware and software jointly, with neither area having precedence. The approach was eminently successful. The design of MRDOS, INFOS, COBOL and the rest of the C-300's software reflects that system's hardware capabilities as the hardware specifications mirror its software requirements. Thus the hardware decision to build an Extended Arithmetic Processor into the C-300 was made simultaneously with the software decision to implement decimal arithmetic in COBOL. And MRDOS and INFOS optimize the C-300's cache and interleaved memories in ways that fully realize the C-300's 200-nanosecond memory cycle.

The system's *application* also enters into the equation. An earlier Eclipse system, the S-200 for scientific applications, did not need as large an instruction set. So while the S-200 contains about 256, 56-bit words of microcode, the C-300's COBOL instruction set occupies more than twice that much ROM.

Surprisingly, the more one learns about DG's COBOL, the more one comes to see it as but one small piece in a very large hardware/software picture. A very large — and very impressive — picture. ■

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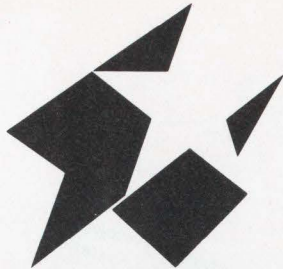
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ELECTRO76

The IEEE Show in Bicentennial Boston / May 11-14, 1976

ELECTRO/76 is the international convention and exposition of the Institute of Electrical and Electronics Engineers, Inc., for 1976. It will be presented in Hynes Memorial Auditorium and the Sheraton-Boston Hotel, May 11-14. Presented for the first time this year, ELECTRO/76 represents a merger of two previous annual events — IEEE Intercon, previously presented in New York, and NEREM, previously held in Boston. Its co-sponsors are the Central New England Council, Region I, and the METSAC Sections of IEEE, and the New

England and New York Chapters of the Electronic Representatives Association. Starting this year, ELECTRO will be held in alternate years in Boston and in New York. Total exhibit space for the exposition are 520 exhibit units, representing about 300 contract exhibitors.

A professional program of 35 half-day sessions will be held in ballrooms of the Sheraton-Boston, which is adjacent to the Hynes Auditorium. Sessions will be presented, five concurrently, at 10 am and 2 pm daily on May 11, 12, and 13, and at 10 am

MAJOR COMPUTER-RELATED SESSIONS AT ELECTRO/76

SESSION 3 MICROPROCESSORS: THE FUTURE IS NOW

Tuesday, May 11, 10 am–12:30 pm Grand Ballroom

Session Organizer and Chairman: Charles Popper, Computer Systems Consultant, New York City.

This session will focus on the microprocessor marketplace, both hardware and software, and describe current and future trends.

Microprocessors: Promises and Practices. Jerry L. Ogdin, Microcomputer Technique, Inc., Reston, VA.

The State-of-the-Art in Microprocessor Software. Geoffrey C. Leach, Sycor, Inc., Ann Arbor, MI.

Microprocessor Interfaces. Robert McKee Smith, Bell Laboratories, Holmdel, NJ.

Microprocessor Futures: Trends and Alternatives. Earl C. Joseph, Sperry Univac, St. Paul, MN.

SESSION 4 COMPUTER COMMUNICATION NETWORKS

Tuesday, May 11, 10 am–12:30 pm Republic Ballroom

Session Organizer and Chairman: Frank Boesch, Bell Laboratories, Holmdel, NJ.

Problems in the design of computer communication networks will be presented. The central theme will indicate how resource-sharing has evolved to produce computer networks with greatly improved reliability, sensitivity, throughput, and response time.

A Comparison of Local Access Techniques for Packet-Switched Networks. Ivan T. Frisch, M. Gerla, I. Gitman, Network Analysis Corp., Glen Cove, NY.

Theoretical Models Used in Designing Computer Nets. Mischa Schwartz, Columbia University, New York City.

The Design of DECNET: A General Purpose Network Base. Stuart Wecker, Digital Equipment, Maynard, MA.

Delay Considerations in Computer Nets. Robert Boorstyn, Polytechnic Institute of New York, Brooklyn, NY.

SESSION 8 DESIGN AIDS FOR MICROPROCESSORS

Tuesday, May 11, 2–4:30 pm Grand Ballroom

Session Organizer and Chairman: Edward A. Torrero, Electronic Design, Rochelle Park, NJ.

This session surveys the hardware and software tools available for microcomputer system development.

Considerations in the Use of Low-Cost Design Aids. Phil Roybal, National Semiconductor, Santa Clara, CA.

Hardware/Software Breadboards. A. Scott McPhillips, Microcomputer Technique, Reston, VA.

Impact of In-Circuit Emulation and High-Level Languages. Jim Lally, Intel Corp., Santa Clara, CA.

Design Aids for Microprogram-Controlled Bipolar Micro-Processors. David Wyland, Ratheon Semiconductor, Mountain View, CA.

Special Tools for Special Problems. Steve Sparks, Motorola Semiconductor Products, Austin, TX.

on May 14. Most sessions will be published in advance as "preprints" and will be available to convention visitors. Average session preprint includes four full papers, including all illustrations, and will be priced at \$3. As a supplement to existing local transit systems, ELECTRO/76 will operate a commuter bus system between locations on Route 128 outside Boston and Hynes Auditorium. One terminal will be at the parking lot of RCA in Burlington. A second location in the Newton area is still to be finalized. Parking will be free, and the bus trip will carry a \$1 roundtrip charge.

The Bicentennial observance will carry over into ELECTRO/76's principal social event — the all-industry reception in the Sheraton Grand Ballroom on opening evening. The party will be called "Yankee Hanky Panky," and will feature an appearance by the famed Concord Minutemen, hors d'oeuvres from giant rounds of Yankee roast beef, commemorative favors for guests, Colonial decor, and even some tea bales.

SESSION 15 COMPUTER TECHNOLOGY ASSESSMENT (Panel)

Wednesday, May 12, 10 am—12:30 pm Commonwealth Room

Session Organizer and Chairman: Dr. Richard E. Merwin
U.S. Army Safeguard Systems Office, Arlington, VA.

A panel of leading experts in computer component design, architecture, software systems, and applications from both industrial and government organizations will assess current and future computer technological advances.

Panelists: *Dr. Walter Beam*, Office of the Assistant Secretary of the Air Force, R&D, The Pentagon, Washington, DC; *John C. Davis*, Department of Defense, Fort Mead, MD; *James E. Thornton*, Network Systems Corp., St. Paul, MN; *Eugene Shapiro*, IBM Corp., Hopewell Junction, NY; *Dr. Ugo Gagliardi*, Gagliardi System Group, Salem, NH; *Keith Uncapher*, Information Sciences Institute, Marina del Rey, CA; *Douglas Ross*, Softech, Inc., Waltham, MA; *David House*, Intel Corp., Santa Clara, CA; and *Vladimir I. Siforov*, POPOV Scientific-Technical Association, USSR (Information Science Development in the USSR)

SESSION 22 CRIME AND COMPUTERS

Thursday, May 13, 10 am—12:30 pm Constitution Room

Session Organizer and Chairman: Jacob Sternberg,
Veripen, Inc., New York City.

First part of this session will discuss computers as "tools and objects of crime," and computers used in crime prevention as elements of a security program. The second part will cover the vulnerability of data and software and the need for security measures. The third group of speakers will describe the role of automated identity, signature, fingerprint and voice verification systems.

Crime and Computers. George H. Warfel, Technical Consultant, Menlo Park, CA.

Risk Analysis and Computer Security. Robert V. Jacobson, Chemical Bank, New York City.

Automated Personal Identity Verification Systems. J.P. Riganati, Rockwell International, Anaheim, CA; Austin Boldridge, A.G.B. Associates Inc., Freehold, NJ; George R. Doddington, Texas Instruments, Dallas, TX; and Claron Swonger, Calspen, Buffalo, NY.

SESSION 23 HIGHER LEVEL LANGUAGES FOR MICROPROCESSORS

Thursday, May 13, 10 am—12:30 pm Grand Ballroom

Session Organizer and Chairman: Michael D. Lippman
RCA Laboratories, Princeton, NJ.

This session examines the higher level vs. assembly language controversy. Several specific higher level languages are explained and compared. Some guidelines are presented to help users decide whether assembly or a higher level language is more cost-effective.

Measuring the Cost-Effectiveness of Microprocessor Languages. Terry Dollhoff, Microcomputer Technique, Inc., Reston, VA.

A Basic Interpreter for Microcomputers. Paul Allen and William Gates, MITS, Inc., Albuquerque, NM.

Interpretive Programming of Small Microprocessor-Based Systems. Phillip K. Baltzer and Joseph A. Weisbecker, RCA Labs, Princeton, NJ.

Forth High-Level Programming Technique on Microprocessors. Elizabeth D. Rather and Charles H. Moore, Forth, Inc., Manhattan Beach, CA.

High Level Languages in Microcomputer Automation. Eugene R. Fisher, Lawrence Livermore Laboratory, Livermore, CA.

SESSION 33 NEW MEMORY TECHNOLOGIES

Friday, May 14, 10 am—12:30 pm Commonwealth Room

Session Organizers: K.J. Harte and D.E. Speliotis,
Micro-Bit Corp., Lexington, MA.

Session Chairman: Sid Fernbach,
Lawrence Livermore Laboratory, Livermore, CA.

This session will discuss the present status and future projections of new memory technologies, and the impact that large, fast, and low cost memories will have on memory hierarchy and system architecture.

Semiconductor Memories: The Impact and Momentum of Current Technology. Ronald J. Whittier, Intel Corp., Santa Clara, CA.

Magnetic Bubble Memories. John Ypma, Rockwell International, Electronics Research Division, Anaheim, CA.

Electron Beam Memories. Dennis Speliotis, Micro-Bit Corp., Lexington, MA.

Progress in Memory and Storage Technologies. George Feth, IBM Corp., Yorktown Heights, NY.

Impact of Large and Fast Memories on System Architecture. Max Paley, Palyn Associates, Inc., San Jose, CA.

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DISK CONTROLLER FOR PDP-11

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32K-Byte Mini Core. The DR-716 single-board core memory system is pin-compatible with Interdata's Model 50, Model 70, 7/16, 7/32, and 8/32 minicomputers. A 16K-byte version is also available. By means of an internal jumper, the DR-716 can be set to operate at either 750-nanosecond or 1.0-microsecond cycle time. Parity is available at no additional cost. Single quantity pricing is \$1980 for 32K bytes and \$1485 for 16K bytes. *Dataram Corp., Cranbury, NJ.*

Circle No. 129 on Inquiry Card

1/2-INCH TAPE PAC DRIVE

The 2000 Series Tape Pac System uses an enclosed reel-to-reel mounted tape. The dual differential capstan drive has a bidirectional read/write speed of 25 inches per second and a search/rewind speed of 240 ips. The capstan motors are independently controlled through a closed loop servo, which maintains accurate tape speed and uniform tension. No reel motors or associated complex servos are needed with this design. Recording densities are 200, 556, 800, 1600 or 3200 bits per inch. The data transfer rate is 40K bytes/record at 25 ips, with a recording density of 1600 bpi. The tape pac has integral tape guides, which results in no oxide contact. Price for the tape drive is \$2295; the tape pac is \$70 in volume quantity. *Emerson Electric Co., Santa Ana, CA.*

Circle No. 155 on Inquiry Card

Intel Eight-Bitters. The in-481 series stores 16K bytes per board. Compatible with 8080A microprocessor-based systems is the in-481-1. Its cycle time is 600 nanoseconds and its access time is 450 nsec. The in-481 is compatible with 8008 or 8001-based systems. Cycle time is 1100 nsec and access time is 650 nsec. Single unit price for each is \$975. *Intel Memory Systems, Sunnyvale, CA.*

Circle No. 127 on Inquiry Card

65K Bytes On One Card. The 65K-byte single-card core memory is plug-compatible with Interdata 74, 7/16, 7/32 and 8/32 minis, Data General Novas and Digital Computer Control's D-116. Access time is 240 nanoseconds and cycle time is 650 nsec. However, the memory interface can adjust its timing specifications to those of the mini. *Pushpa International Corp., Westminster, CA.*

Circle No. 128 on Inquiry Card

Calculator R/W Memory. The EM-30 Extended Memory System is a plug-compatible 32K-byte memory for the Hewlett-Packard 9830A programmable calculator. It occupies the same two card slots as the standard HP memory and is fully compatible with all 9830 Basic software and ROM options. *Infotek Systems, Covina, CA.*

Circle No. 126 on Inquiry Card

DISK MULTIPLEXER

With the Model 2230MXA/B Disk Multiplexer, up to four Wang System 2200 processors can share a single disk drive on which each processor's data is stored as part of either a common, or split data base. Access to the disk drive is on a daisy chain basis, with a master controller polling each processor sequentially. With this technique, all processors sharing the disk have virtually concurrent access at all times. The multiplexer is installed by replacing existing disk controller boards with multiplexer boards. One master board connects the disk drive with the master processor, and a slave board for each additional processor connects to the master processor. Price for the master board is \$800; the slave board is \$500. (That's much less than Wang's earlier Model 2224 multiplexer.) *Wang Laboratories, Inc., Tewksbury, MA.*

Circle No. 148 on Inquiry Card

TYPESETTING CRT

The VT61/t alphanumeric display terminal is specifically intended for data input. Its fixed forms and block mode capabilities permit the user to format a wide range of material including classified ads, box scores, billing information and editorial text. Basic editing functions can be executed on the 1920-character screen using the standard typewriter keyboard and special 19-key function control pad. Various character display colors are available. The new terminal is compatible with Digital's line of typesetting systems. It can be "mixed and matched" with Digital's VT20/b editorial terminals in computerized typesetting systems to achieve maximum performance while optimizing terminal costs. Price is \$2950. *Digital Equipment Corp., Maynard, MA.*

Circle No. 137 on Inquiry Card

MICRO-CONTROLLED PRINTERS

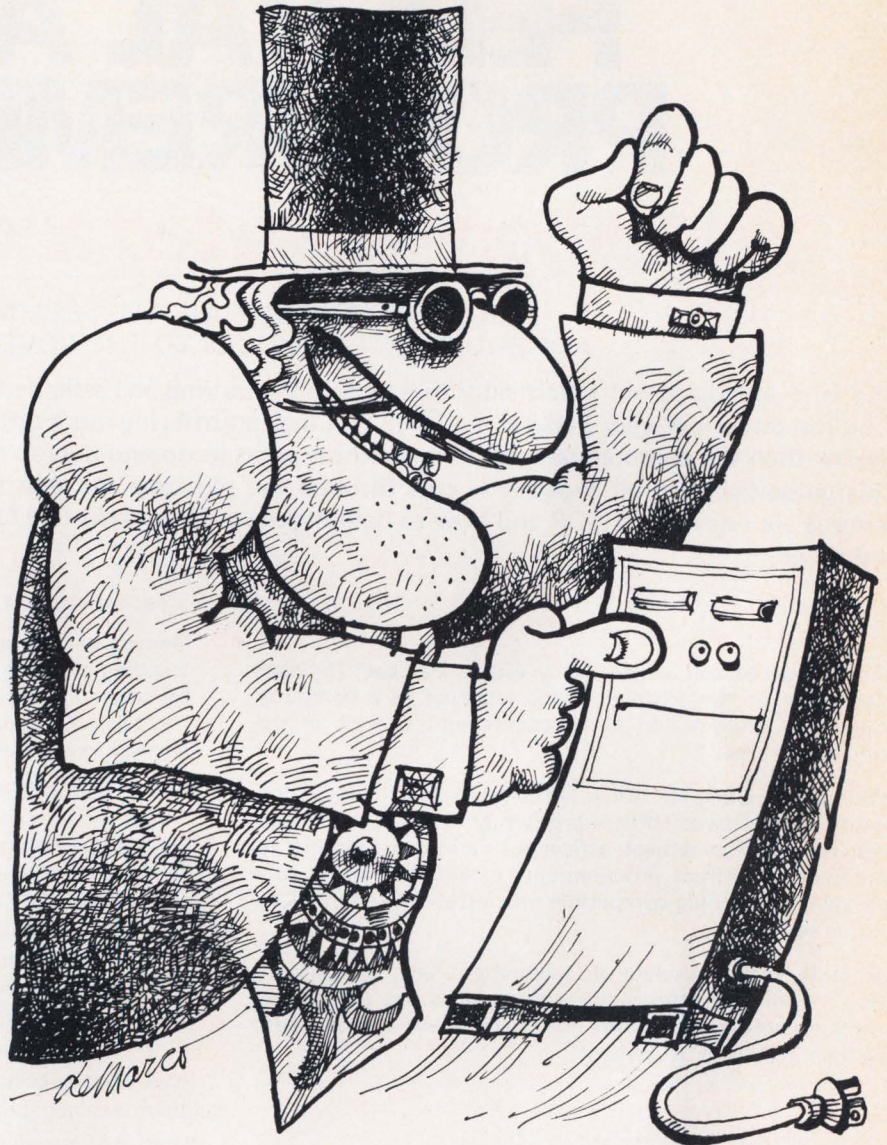
The Model 4600 series of matrix printers use a microprocessor to act as an intelligent unit regulating I/O transfer from the host processor. Since printing head speed, timing, and actual printing are under microprocessor control, effects due to variations of these factors can be minimized. Thus the printer can control and correct for overshoot and misregistration of characters. In addition, the microprocessor can analyze the space and character requirements several lines in advance, and this look-ahead feature optimizes the printer output. Bidirectional printing is also possible. ROM control is used for most of the vertical control functions and this eliminates the need for a vertical format unit. The result is an increase in effective printing speed. Speeds available are 60, 120 and 180 characters per second. Prices start at \$5600 for the 60-cps printer. *Sycor, Inc., Ann Arbor, MI.*

Circle No. 134 on Inquiry Card

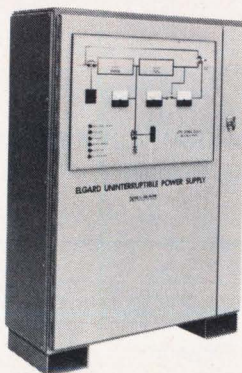
UNIBUS ADAPTER FOR LSI-11

The UA/11-A is equivalent to the DEC bus extender, which makes the LSI-11 bus and Unibus act as one bus. Maximum data rate is 650K words per second, LSI-11 bus devices and Unibus devices share both buses. The Unibus adapter allows the Unibus four-level priority to use the one-level interrupt on the LSI-11 with priority arbitration. Price is \$650. *Associated Computer Consultants, Goleta, CA*

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The author of this guide, Terry Miller, has had 15 years experience in the Federal sector working as a computer equipment analyst and as a procurement analyst in the contracting area.

While at the GSA, Mr. Miller authored many solicitation documents and reviewed RFPs submitted by other Federal agencies. He was the project officer for various mandatory requirements contract procurements including ones for tape and disk drives, plug-compatible memories and remote computing services.

Mr. Miller is the President of Government Sales Consultants, Inc., a firm that offers consulting services and seminars to computer-related companies and Government agencies seeking help in ADP procurement.

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UTILITY RATE STRUCTURE ANALYSIS

NEWRATES enables a utility to examine interactively the changes in revenue realized when the structure of a rate class is altered. Comprehensive data is produced by comparing billing via a present rate schedule with a proposed rate schedule. Comparisons are made on base rate billing as well as gross billing. Factors that may be calculated for each individual customer include: Fuel cost adjustment (electric utility customers), purchase gas adjustment (gas utility customers), state taxes, local taxes, rate "ratcheting," and summer/winter rate provisions. The service is available through the MARK III network. *General Electric, Vienna, VA.*

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SMALL RSX-11 VERSION

RSX-11S provides realtime operating system support for PDP-11 configurations smaller than those that could previously run RSX-11 software. It is a core-only subset of the RSX-11M operating system, and allows multi-

tasking. It is particularly suitable for use in harsh environments where a disk might be unreliable. Program development must be performed on a host PDP-11 operating under RSX-11M, Version 2. Application tasks may be written in Fortran IV, Fortran IV Plus, or Macro-11. The minimum PDP-11 configuration to run RSX-11 must have 8K words of memory, a realtime clock, a hardware loader, and a load device. *Digital Equipment Corp., Maynard, MA.*

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SYSTEM MONITOR

PRESTO is a system activity monitor for OS/Vs users that not only measures system performance in real time but allows the system operator to alter and improve system activity immediately. PRESTO can display system utilization information on a 3270, or it can be written to a log file on a snapshot basis at user specified time intervals. PRESTO requires 4K of core and is available for users of VS1 and VS2. *Synergetics Corp., Burlington, MA.*

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ACTUARIAL LANGUAGE

SUPERACT actuarial programming language retains the essential command structure of ACT, developed by BCS for its time sharing system. However new English-like commands make it possible to handle varying interest, select and ultimate mortality, rated mortality, projected mortality, FPT, NLP, CRVM, Canadian, and Illinois Standard reserve methods, joint multiple life mortality, multiple decrement, and cash, reduced paid up and extended term values — either minimum or graded reserved. *Boeing Computer Services, Inc., Dover, NJ.*

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BIORYTHMS ON 5100

Personal biorythms can be calculated and graphed with the IBM 5100 in either APL or Basic. The program requires 32K and is priced at \$275 for the APL version and \$345 for the Basic version. *Bam Data Service, Binghamton, New York.*

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A series of cross-assembler and simulator packages, developed for airborne and microprocessor systems, includes ASEM 14, a one-pass cross-assembler designed to translate symbolic code for the F14 airborne computer that runs on a standard PDP-11 under the DOS operating system; and SIM14, an interactive simulator designed to allow

programs to be developed and checked out without the use of the airborne processor. SIM 14 is capable of simulating both analog and digital inputs and contains a debug module which handles all user debug requests, enabling users to display registers, dump locations, set breakpoints, and change the contents of specific addresses. It runs on a standard PDP-11 under the DOS operating system. All programs can be customized and are presently available for

RCA, CDC, Hughes, and Northrop processors. Prices start at \$850. *Computer Interactive Services, Inc., Brookline, MA.*

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T-S MICROPROGRAMMING AIDS

Microcomputer programming software available over Tymshare's data communications network includes assembler/simulators for the Texas Instruments TMS 1000 microcomputer and for the TMS8080 and Motorola M6800 microprocessors. The TI microchip programming aids, developed by TI's semiconductor group, run on Tymshare's TYMCOM-370 systems. The Motorola assembler/simulator package, developed by Wintek Corp., is designed for TYMCOM-X systems employed by Tymshare for timesharing use. (Tymshare also offers similar software from Intel, Rockwell and National Semiconductor). *Tymshare, Cupertino, CA.*

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COMPILER GENERATOR

The COGENT compiler generator is a machine-independent programming system that accepts a metalanguage description of a computer language and automatically produces a compiler for that language. Compilers produced by COGENT consist of assembly language statements or source language statements to be translated by an existing compiler. Minicomputer core requirements are 24K 16-bit words. IBM 360/370 requirements are less than 256K bytes. A perpetual license is \$32,000. *Virtual Systems, Inc., Orinda, CA.*

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ELECTRICITY CONSUMPTION ANALYSIS

GE Mark III users can access the Electricity Consumption Analysis Data (ECAD) via MAP. ECAD contains monthly data since January, 1971, on four electric utility operation variables for five customer sectors, and 11 correlated weather and economic variables for 63 utilities, providing a total of more than 1900 time series. The 63-utility sample constitutes two-thirds of U.S. kilowatt-hour consumption and has been selected to reflect a variety of system operation conditions in all nine U.S. census regions, facilitating cross-sectional, as well as time-series analyses. *General Electric Center for Energy Systems, Washington, DC.*

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WORD PROCESSING OPERATION

The two-color booklet, *Keys to Typing Productivity*, explains how to organize the word processing typewriter keyboard into *what* keys, *how* keys, and *code* keys. The *what* keys tell the editing typewriter what action to perform, such as record, playback, duplicate or edit. The *how* keys tell the typewriter how to perform the action selected, such as playback by word, by line or by paragraph. The *code* keys control such formatting functions as spacing, tabbing, underlining and carrier return. A color-coded diagram of an editing typewriter keyboard accompanies the text to illustrate each group of typewriter keys. Also included in the 4-page booklet is a breakdown of control buttons and indicators on the system console. *Redactron Corp., Hauppauge, NY.*

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DATA COMMUNICATIONS

A detailed outline of Data/Comm, a generalized binary synchronous communications (BSC) package, is contained in this 4-page brochure. Data/Comm allows interfacing to any terminal or mainframe supporting the BSC protocol. Also discussed are hardware and software features of the Entrex Communications product line. *Entrex, Burlington, MA.*

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SBS REPORT

Descriptive literature is available of an industry report on the techno-economic and regulatory impacts of Satellite Business Systems, the IBM joint venture in telecommunications. The literature discusses the scope of the study and the implications for the computer and telecommunications industries. A complete table of contents of the study is included. *ComQuest Corp., Palo Alto, CA.*

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MM1 MICROCOMPUTER

This brochure describes the MM1 microcomputer's features, including the Poly-Buss, address spaces and design options. Details are provided on the central processor, options boards, PROM memory, RAM memory, digital I/O and programmer's console. Software information in the brochure includes the system monitoring/debugging program, editor, assemblers and I/O control system. *Control Logic, Inc., Natick, MA.*

Circle No. 269 on Inquiry Card

EDP AUDIT

This article describes how to conduct a data processing installation audit. "How Good is your EDP?" contains facts on what part of the system to evaluate, how to develop checklists for performance evaluation and how to carry out the evaluation. It is aimed at allowing inhouse personnel to perform data processing evaluations and to uncover problems in hardware, software, and peopleware. *Management Information Corp., Cherry Hill, NJ.*

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METRIC CONVERSION CHART

This 8-1/2 by 11-inch metric decimal conversion chart includes number, fractional and letter drill sizes up to 1 inch. The direct reading scale can be used for determining the closest metric, decimal or fractional equivalent when selecting or classifying materials, wire, hardware or machining operations. Multiplication of both sides of the scales allows extension of the chart to all ranges within the metric and decimal systems. *Siltran Digital, Silverado, CA.*

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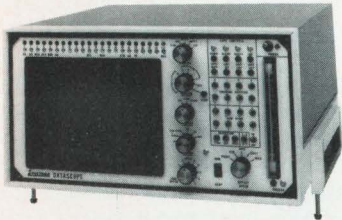
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index to advertisers

AMPEX MEMORY PRODUCTS DIV	Cover 3
BOWERS ENGINEERING CO	39
COMPUTER OPTICS, INC	Cover 4
COMPUTING DEVICES COMPANY A DIV. OF CONTROL DATA CANADA, LTD	4
COMPUTER SECURITY INSTITUTE	28, 29
DELTA DATA SYSTEMS CORP	37, 39
DIABLO SYSTEMS, INC. A XEROX CO	1
DIGITAL DEVELOPMENT CORP	11
DONALD INC.	37
EAGLE-PICHER INDUSTRIES, INC	12
ELGAR CORP	43
HEWLETT-PACKARD	2
HONEYWELL INFORMATION SYSTEMS	31
INTELLIGENT SYSTEMS CORP	23
KYBE CORP	10
MODERN DATA	34, 44, 46, 47
MODULAR COMPUTER SYSTEMS	24, 25
PARADYNE CORP.	35
PLESSEY MICROSYSTEMS	19
ROBINS INDUSTRIES CORP. DATA PRODUCTS DIV	10
SOFTWARE INTERNATIONAL CORP.	45
SPECTRON CORP	48
SWEDA INTERNATIONAL OEM PRODUCTS	27
TAB PRODUCTS CO.	8, 9
TELEFILE COMPUTER PRODUCTS, INC	Cover 2
TELETYPE CORP	5
TEXAS INSTRUMENTS INC. DIGITAL SYSTEMS DIV.	16, 17
21st CENTURY RESEARCH	42
VAN NORSTRAND REINHOLD CO	6, 7
Tab Card between Cover 3 and Page 48	
VARIAN DATA MACHINES	13