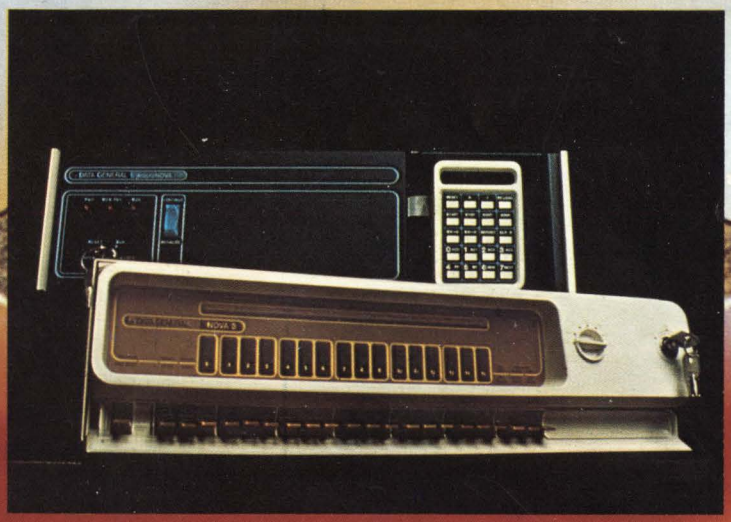
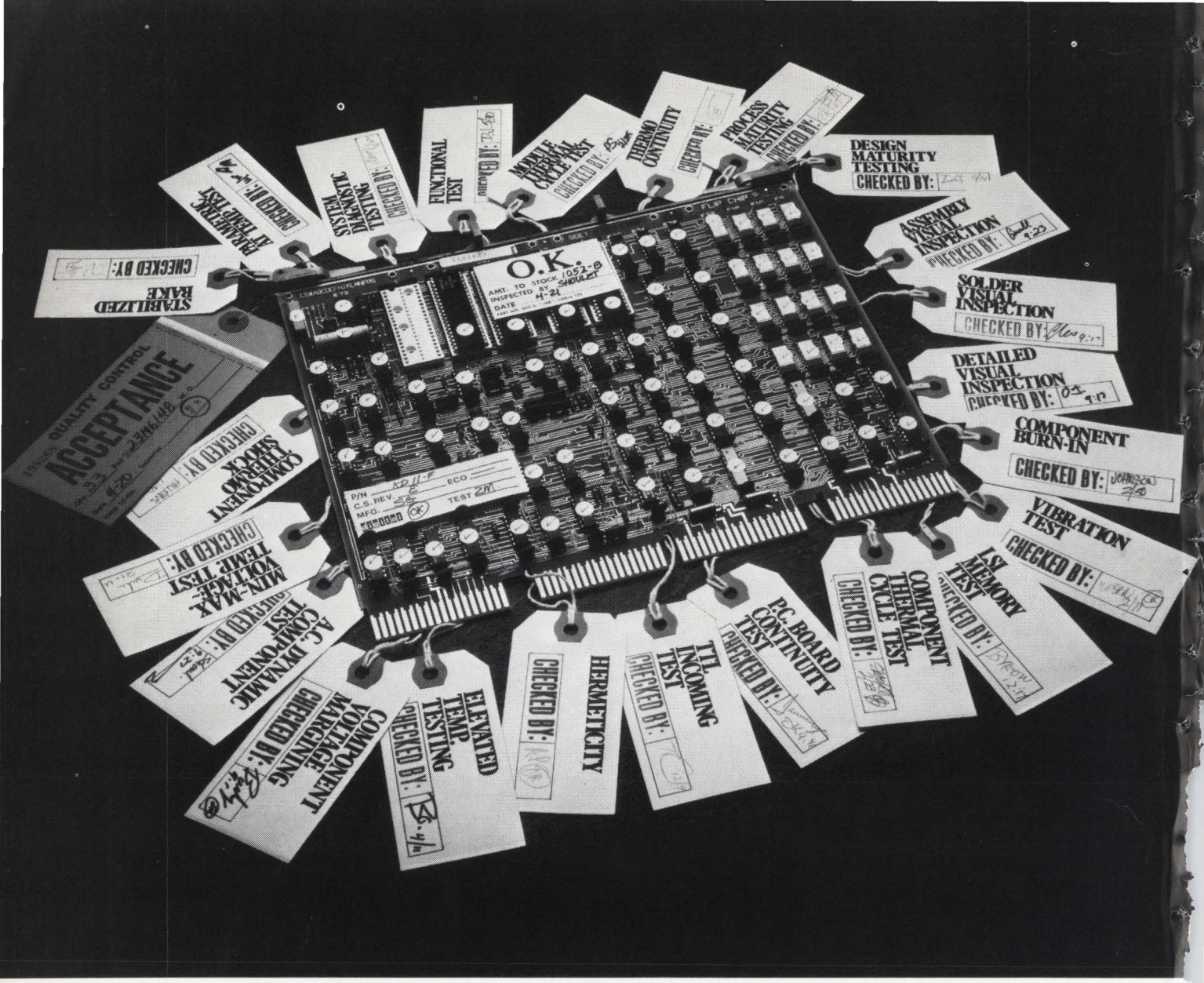
MAY 1976

mini·micro systems

formerly MODERN DATA



Systems on a Chip
Minicomputers and Microcomputers
Source Data Automation
NCC Conference Preview



No other micro can make this claim.

The LSI-11.

No other micro goes through so much testing. So no other micro can ensure you of so much reliability.

We started with a Design Maturity Test that showed zero failures in 384,000 unit-hours for the 4K MOS RAMs, and only one failure in 20,000 unit-hours for the microprocessor chips.

We make each LSI-11 under our special Manufacturing Quality Plan. This begins with 100% testing of incoming components and continues with computer-controlled monitoring at strategic points in the production flow.

And we run a thermal cycle on every LSI-11 that comes off the line.

What it all adds up to is a worst-case MTBF of over 35,000 hours. And that's from data in the field.

LSI-11. The $634* 4K microcomputer on an 8½" x 10" board.

LSI-11. The one micro that's really been put to the test.

For more info, call 800-225-9480 (Mass. 617-481-7400 ext. 6819 or 6817). Or write: Components Group, Digital Equipment Corp., One Iron Way, Marlborough, MA 01752. Canada: Digital Equipment of Canada, Ltd. Europe: 81 Route de l'Aire, 1211 Geneva 26, Tel. 42 79 50. *In 100's. Prices apply to USA only.

digital
COMPONENTS GROUP

CIRCLE NO. 1 ON INQUIRY CARD

we are what we have become

Back in 1968, when this publication first rolled off the press, almost all computers in use were batch-oriented large systems. Our editorial pages reflected this world. During the early seventies, our editorial emphasis began to shift toward the development of minicomputers and computer-communications. With our editorial charter as a product reference publication, we could hardly do otherwise.

This editorial shift and the continued growth of the use of minicomputers over the past two years resulted in a change of readership so that today the dominant portion of our circulation is involved with minicomputers and/or microprocessor-based systems. Our 13,600 readers who participated in our recently-concluded *1976 Annual Minicomputer-Microprocessor Market Survey* (see page 80) reported plans to buy, in the coming year:

362,000 Microprocessors
28,000 Minicomputers
12,600 Microcomputers

These figures should be projectable over at least 60% of our total circulation.

In many applications, the use of microprocessors will preclude the need for conventional central processors. Future systems will consist of individual component-equipment with each component having its own self-contained processor. These components will be able to interconnect in many different combinations. These new systems will further enhance the growing trend toward dedicated turnkey operations and dispersed computer power. MINI-MICRO SYSTEMS will be placing even more emphasis in these directions as this trend accelerates.

Our general editorial goal is still the same – to try to provide you with information on computer-related products or services so that you may be able to evaluate these offerings for the best possible solution to your computer needs.

Hopefully, we can fulfill this goal with even more success as the new mini-micro technology unfolds.

S. Henry Lacks

Publisher & Editorial Director

SC/MP... A MICROPROCESSOR SO SIMPLE AND INEXPENSIVE, IT'S ENOUGH TO MAKE ANY MACHINE THINK.

The "Simple Cheap Microprocessor."

At less than ten bucks apiece in volume, it makes microprocessor technology practical where it's never made sense before. In products like meters,

gas pumps, traffic-light controls, pinball machines, medical electronics, TV games, scales, motor controls, telephones, home appliances.

A whole world of machines and men has been waiting for such a thing.

Well, thanks to National, SC/MP is here now.

And it's not just the cheapest, least-complicated microprocessor on the market. It's also one of the most capable.

It shortens design time because of its architecture, and its ability to interface with standard memories and standard peripheral components.

It requires a minimum number of components and support chips.

Yet it gives you advantages that can't be found in many expensive microprocessors. Like an on-chip clock. Serial I/O ports that are TTL-compatible. Static operation. Bus allocation for multi-processor system design. Plus built-in, programmable DELAY instruction.

It's on your distributor's shelf right now. For technical description of the chip and a complete data sheet, send us the coupon below.

If this thing catches on (and at less than $10 a copy, it's got to), who knows where it could lead? To stuffed dogs that tell shaggy people-stories?

See us at NCC Booth 3220.

National Semiconductor Corporation
2900 Semiconductor Drive
Santa Clara, California 95051

Gentlemen:
SC/MP, eh? I'd like to see that Technical Description, data sheet and a sales brochure:

Name_____ Title_____

Company_____

Address_____

City_____ State_____ Zip_____

National Semiconductor

Ask your distributor for our SC/MP Evaluation Kit.

Publisher, Editorial Dir. . . . **S. Henry Sacks**
Assoc. Publisher. . . . . **William A. Gannon**
Editor-in-Chief . . . . . **Stanley Klein**
Associate Editor. . . . **Barbara A. Reynolds**
Technical Editor . . . . . **Dan M. Bowers**

CONSULTING & CONTRIBUTING EDITORS

Boris Beizer
Ralph Berglund
Maurits de Regt
Ken Falor
L.A. Feidelman
Ivan Flores
Alan R. Kaplan
James I. Leabman
Walter A. Levy
Efrem Mallach
John A. Murphy
Malcolm L. Stiefel

ART/PRODUCTION DIRECTOR
John W. Kelley, Jr.

PRODUCTION ASSISTANTS
Sally Haskins
Linda Ladd Lovett

ADVERTISING PRODUCTION
Manager . . . . . Bernard Greenside

ASS'T TO PUBLISHER
Pamela E. Page

CIRCULATION DEPARTMENT
Carol Grace, Mgr.

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

MINI-MICRO SYSTEMS
5 Kane Industrial Drive
Hudson, MA 01749
(617)562-9305

SALES OFFICES
Sales Mgr. . . . . **Robert J. Bandini**
Mktg. Services Mgr. . . . . **Melvin L. Hayden**

NEW ENGLAND
Melvin L. Hayden, 5 Kane Industrial Drive, Hudson, MA 01749 (617)562-9305

NEW YORK
Irwin L. Werfel, *E. Regional Sales Mgr.,* **Robert J. Bandini,** 18 East 48th St., N.Y., N.Y. 10017 (212)753-0375, (203)255-6293

WEST COAST
David E. Pearson, 7135 W. Manchester Ave. Suite 3., Los Angeles, Cal. 90045 (213) 670-5651

SUBSCRIPTIONS: Circulated without charge by name and title to U.S.-based corporate and technical management, systems engineers, systems analysts, EDP managers, software specialists, and other personnel who qualify under our qualification procedures. Available to others at the rate of $18.00 per year; single issues $1.75. Subscription rate for all foreign subscriptions is $25.00 per year (12 issues). POSTMASTER: Send Form 3579 to: Circulation Dept., Mini-Micro Systems, 5 Kane Industrial Drive, Hudson, MA 01749. Controlled Circulation postage paid at Long Prairie, MN.

Back issues of MINI-MICRO SYSTEMS (formerly Modern Data) are available on microfilm. Contact University Microfilms, 300 North Zeeb Rd., Ann Arbor, Michigan 48106 for ordering information.

BPA

MAY 1976 • VOLUME 9 • NUMBER 5

mini·micro systems
formerly Modern Data

COVER CREDIT:

Data General's new microprocessor-based MicroNova minicomputer and Nova 3 computers are superimposed on a 4K RAM chip. The RAM chip, manufactured by Data General, is used in both the MicroNova and the Nova 3.

DEPARTMENTS

What large OEM's need today:

a short cut into microcomputing

...that's easier to get, easier to use, easier to expand at will.

You've got it. With the new LSI member of our Solution Series. The GA-16/110. A full-fledged 16-bit computer on a single plug-in board. Specifically designed for dedicated computer applications, such as remote data collection and control, terminals, and communications concentrators.

Dollar for dollar, spec for spec: the fastest, most flexible, lowest cost microcomputer *with* full software support and dozens of I/O controllers, now available off the shelf.

Performance twice as fast as the nearest competitor. Powerful repertoire of 120 basic instructions. Memory expansion from 512 words to 64K words. And this "load-and-go" worker, the GA-16/110 system, shares software and I/O compatibility with all Solution Series family members, right up to the GA-16/440 super mini with 2 mega-bytes of memory.

Terrific price/performance tradeoff too. From $474 for a fully-operational 512-word computer. To $1692 for a complete 8K packaged system. (OEM quantities of 200.)

Say you need still more: our GA-16/220 will do the job. By adding more I/O capability, more interactive controls, more displays, you get full minicomputer performance and features at microcomputer prices.

And the rich GA-16/220 software includes: batch operating systems; foreground/background real-time operating systems; indexed file management systems. FORTRAN IV; COBOL; multi-user BASIC; macro assembler; and a lot more. *All* are off-the-shelf software, currently in the field working in applications such as yours.

Compared to any computer family in production today, the Solution Series meets your requirements with the largest variety of configurations and range of performance, backed by the broadest software and I/O support. Hands down, the shortest distance to your microcomputer product is the new Solution Series family from a real solution systems company—General Automation.

For product info, write General Automation, 1055 South East Street, Anaheim, California 92805. (714) 778-4800.

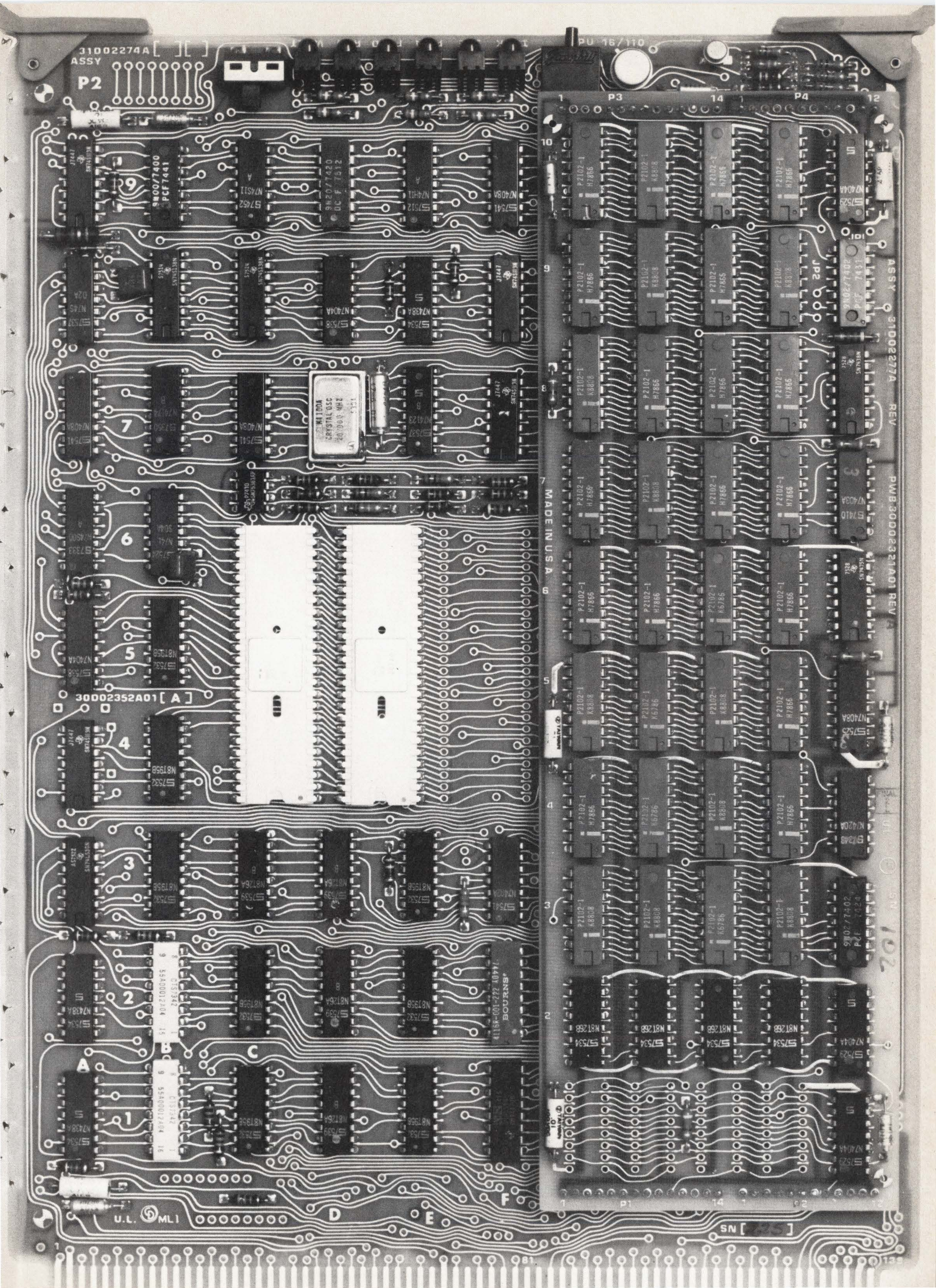
Also General Automation, Paris, France and G.A. Computer Ltd., Ontario, Canada.

GENERAL AUTOMATION

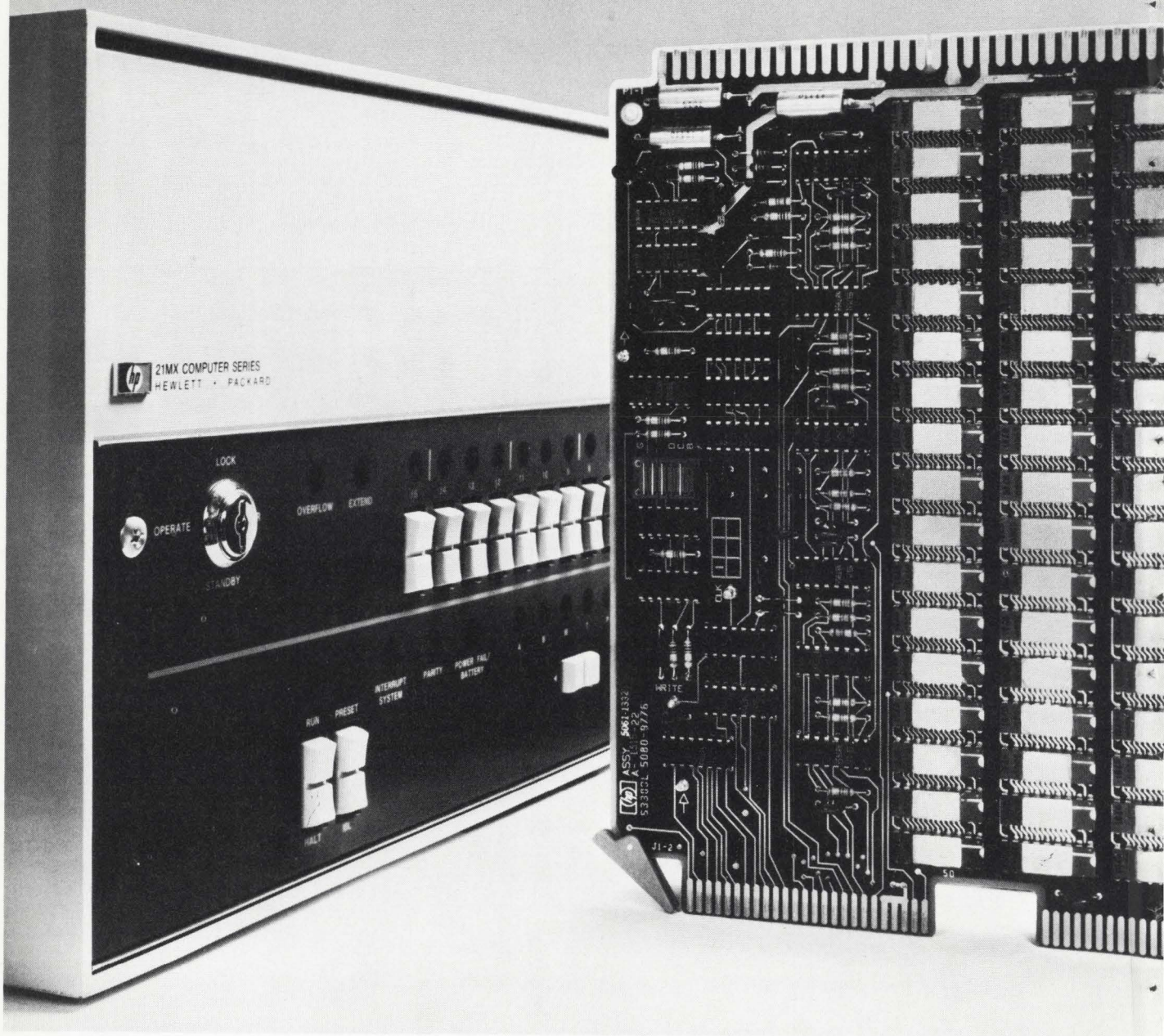
CIRCLE NO. 2 ON INQUIRY CARD

See General Automation at NCC. Booth 2501.

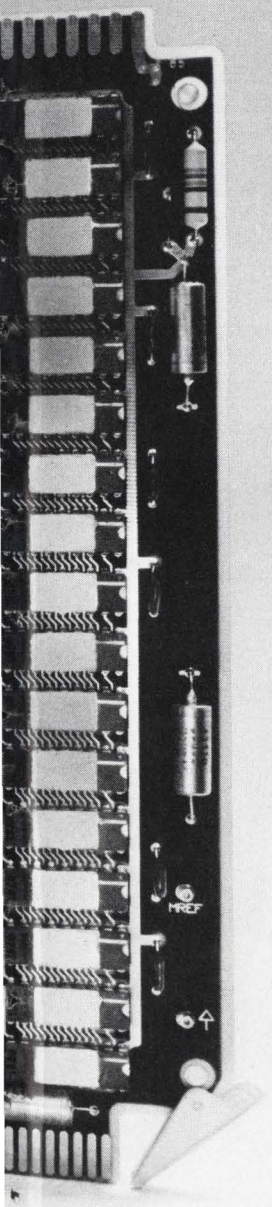
Actual size 7¾" x 11"


31D02274A
ASSY
P2
P3
P4
P1
JP2
MADE IN U.S.A.
30D02352A01 [A]
ASSY 31D02277A REV
PWB 30D02232A01 REV A
U.L.
SN
P2102-1
N8T26B
CRYSTAL OSC
BOURNS

The Hewlett-Packard 21MX minicomputer sets a new price/performance standard.



Announcing 16K word memory with parity for $1386.*



Because the majority of a minicomputer's cost is its memory, the $1386 price for HP's new 16K word parity memory module is a significant price/performance breakthrough. And when you consider the low-cost memory along with the other features of the 21MX, it's a combination that's hard to beat. At any price.

Proven 4K RAM Reliability. Hewlett-Packard pioneered minicomputers with 4K RAM memory. Our unequalled field experience with more than 250,000 4K RAMS has proven their reliability. Solidly.

Doubled Memory Capacity. Now pack double the memory into your dynamic 21MX minicomputer. Put up to 32K words in 5¼" of space, or up to 128K in 13", without giving up a single powered I/O slot.

21MX Performance Extras. Each HP 21MX gives you more of what you buy a minicomputer for. Standard features that often are extra-cost options from others include floating point and extended arithmetic, brownout-proof power supply, ROM bootstrap loader, power-fail interrupt capability, and a full front display panel.

HP's Worldwide Service and Support. We're on the spot to provide installation, service and support for you and your customers throughout the world.

We're Shipping Now. The 21MX minicomputer family with the new 16K memory board is available and being shipped today.

HP Minicomputers.
Today's Price/Performance Leader.

	16K Add On Parity Memory	Computer† with 64K Word Memory
HP 21MX	$1386.*	$11,038.*
DEC 11/34	$2046.*	$12,995.*
Nova 3/12	$2368.*	$14,528.*

†Includes CPU, parity memory, memory management, EAU and battery backup. Source: Datapro
*U.S. domestic price. OEM quantity 50.

There's More. Every HP minicomputer and peripheral is designed from the start for easy, "building block" integration. Spend less time on design, and put your system to work faster. Other HP benefits range from installation and software to providing the level of service you specify. Or HP training, if you prefer to do it yourself. If you want more, call your nearest HP field office. Hewlett-Packard, the leader in 4K RAM minicomputers — and a lot more.

HEWLETT hp PACKARD

Sales and service from 172 offices in 65 countries.
1501 Page Mill Road, Palo Alto, California 94304

"Visit the Hewlett-Packard booth at NCC."

22615

CIRCLE NO. 3 ON INQUIRY CARD

Imagine a microcomputer

Imagine a microcomputer with all the design savvy, ruggedness, and sophistication of the best minicomputers.

Imagine a microcomputer supported by dozens of interface, memory, and processor option boards. One that can be interfaced to an indefinite number of peripheral devices including dual floppy discs, CRT's, line printers, cassette recorders, video displays, paper tape readers, teleprinters, plotters, and custom devices.

Imagine a microcomputer supported by extensive software including Extended BASIC, Disk BASIC, DOS and a complete library of business, developmental, and industrial programs.

Imagine a microcomputer that will do everything a mini will do, only at a fraction of the cost.

You are imagining the Altair™ 8800b. The Altair 8800b is here today, and it may very well be the mainframe of the 70's.

The Altair 8800b is a second generation design of the most popular microcomputer in the field, the Altair 8800. Built around the 8800A microprocessor, the Altair 8800b is an open ended machine that is compatible with all Altair 8800 hardware and software. It can be configured to match most any system need.

MITS' plug-in compatible boards for the Altair 8800b now include: 4K static memory, 4K dynamic memory, 16K static memory, multi-port serial interface, multi-port parallel interface, audio cassette record interface, vectored interrupt, real time clock, PROM board, multiplexer, A/D convertor, extender card, disc controller, and line printer interface.

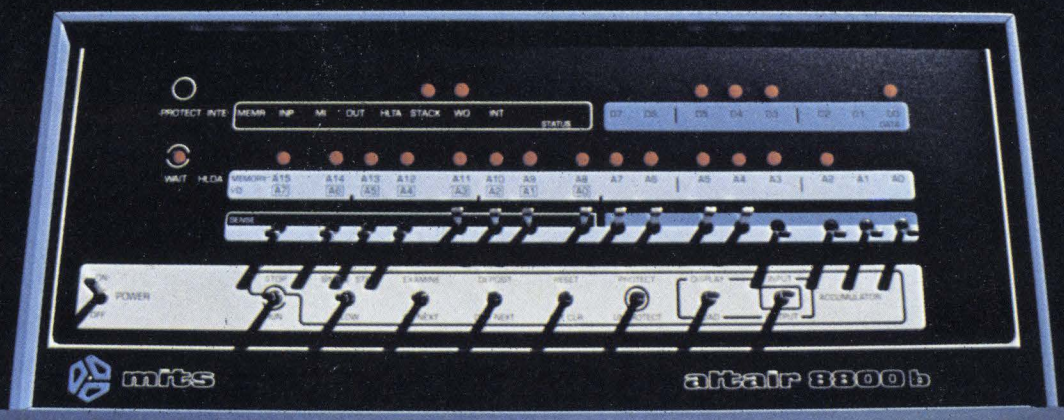
MITS' peripherals for the Altair 8800b include the Altair Floppy Disc, Altair Line Printer, teletypewriters, and the soon-to-be-announced Altair CRT terminal.

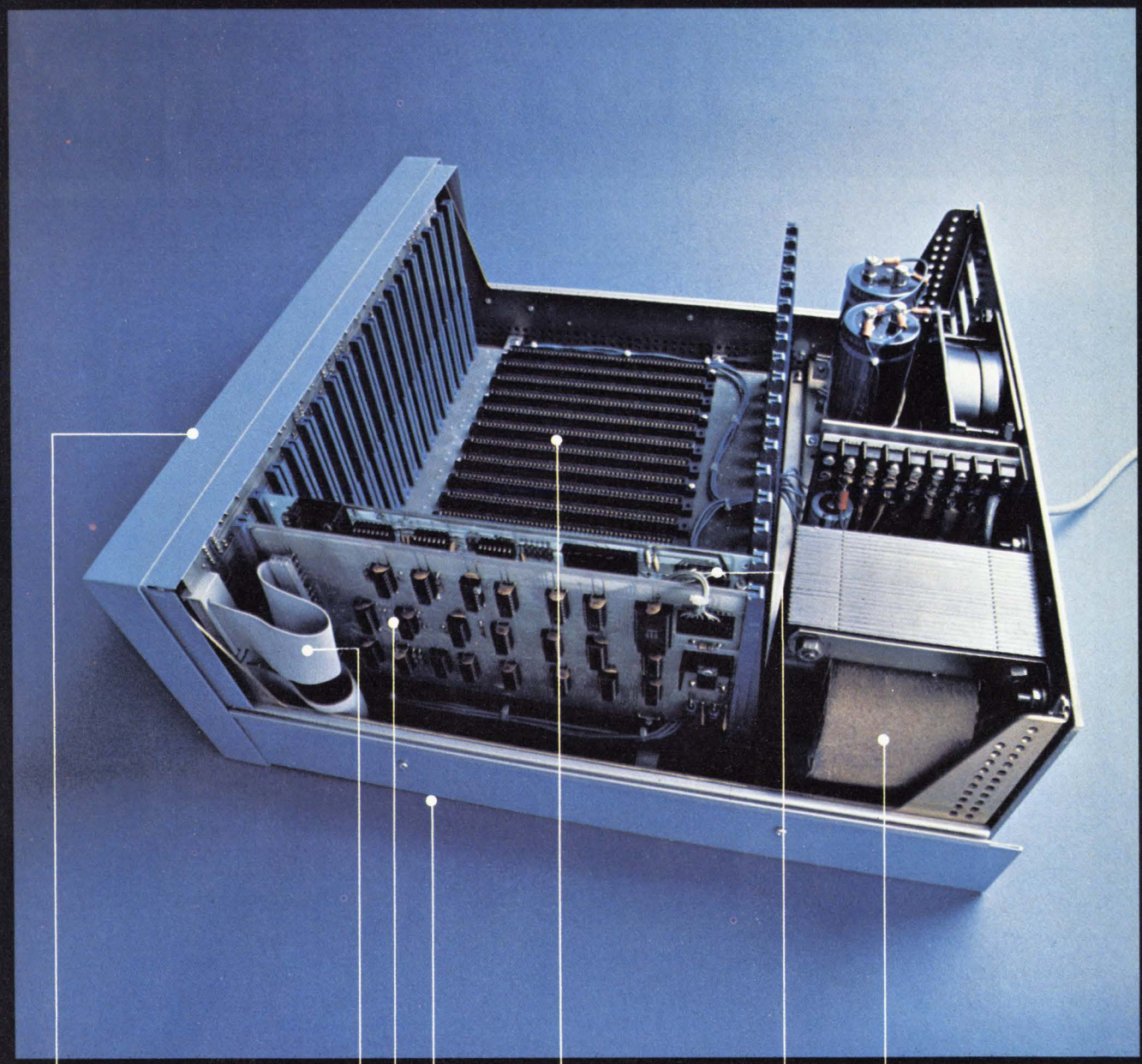
Introductory prices for the Altair 8800b are $840 for a kit with complete assembly instructions, and $1100 for an assembled unit. Complete documentation, membership into the Altair Users Club, subscription to "Computer Notes," access to the Altair Software Library, and a copy of Charles J. Sippl's Microcomputer Dictionary are included. BankAmericard or Master Charge accepted for mail order sales. Include $8 for postage and handling.

Shouldn't you know more about the Altair 8800b? Send for our free Altair information package, or contact one of our many retail Altair Computer Centers.

mits inc. 2450 alamo s.e. albuquerque new mexico 87106

Prices, delivery and specifications subject to change. Allow up to 60 days for delivery.





Redesigned front panel. Totally synchronous logic design. Same switch and LED arrangement as original Altair 8800. New back-lit Duralith (laminated plastic and mylar, bonded to aluminum) dress panel with multi-color graphics. New longer, flat toggle switches. Five new functions stored on front panel PROM including: DISPLAY ACCUMULATOR (displays contents of accumulator), LOAD ACCUMULATOR (loads contents of the 8 data switches (A7-A0) into accumulator), OUTPUT ACCUMULATOR (Outputs contents of accumulator to I/O device addressed by the upper 8 address switches), INPUT ACCUMULATOR (inputs to the accumulator from the I/O device), and SLOW (causes program execution at a rate of about 5 cycles per second—for program debugging).

Full 18 slot motherboard.

Rugged, commercial grade Optima cabinet.

New front panel interface board buffers all lines to and from 8800b bus.

Two, 34 conductor ribbon cable assemblies. Connects front panel board to front panel interface board. Eliminates need for complicated front panel/bus wiring.

New, heavy duty power supply: +8 volts at 18 amps, +18 volts at 2 amps, -18 volts at 2 amps. 110 volt or 220 volt operation (50/60 Hz). Primary tapped for either high or low line operation.

New CPU board with 8080A microprocessor and Intel 8224 clock generator and 8216 bus drivers. Clock pulse widths and phasing as well as frequency are crystal controlled. Compatible with all current Altair 8800 software and hardware.

altair 8800-b

CIRCLE NO. 4 ON INQUIRY CARD

mits
2450 Alamo SE/Albuquerque, NM 87106/505-243-7821

"Big Bucks" Buckley shade with peripherals

had it made in the from the mini OEM.

Buckingham Buxton Buckley III.

Born with a Silver Cloud Rolls in his garage. Bought everything, including his mini peripherals, on price: the highest.

But one day, Big Bucks' bubble burst. His boss (Buckingham Buxton Buckley II) said:

"Cut costs, or heads will roll!"

Now, Big Bucks may have been a high-roller, but he wasn't dumb. He could see the handwriting on the wall.

It said: "*We're the largest independent supplier of minicomputer add-on core memories and have a complete line of mini peripherals to expand your DEC, Data General or Interdata mini without putting the bite on your wallet.*

"Plessey Microsystems.

"P.S.: And all the support you need, too, because we're part of an international billion dollar corporation."

"Hmm," thought Big Bucks. "Largest independent. Won't bite my budget. Billion dollar corporation."

He *liked* that.

So he picked up his phone (French Provincial) and called Plessey (collect).

He found out all kinds of wonderful, money-saving things about Plessey add-on core memories, Plessey single and dual disc drives and Plessey infrared punched tape readers.

From that day on, Big Bucks Buckley bought his mini peripherals from the mini expander, Plessey Microsystems.

The easy street special

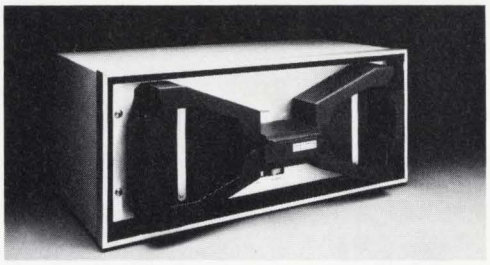
Plessey infrared punched tape readers are an exceptional bargain in mini and micro peripherals.

They're the most advanced punched tape readers available today. A pinch roller/capstan drive improves reliability and lowers tape wear. Advanced electronics permit *asynchronous* operation at any speed from 0 to 1000 characters per second. Infrared optics read tapes with up to 60% transmissivity. And the fine Plessey touch eliminates all mechanical, electrical and photo-optic adjustments.

They're available as an OEM transport, in rack mounts and cabinets, with or without fanfold handlers, in a portable carrying case and as a reader/punch combo.

All with your choice of interfaces for DEC and Data General minis, and many of the popular microprocessors.

And all at prices that, while they might not quite put you on Easy Street, will definitely be a comfort.



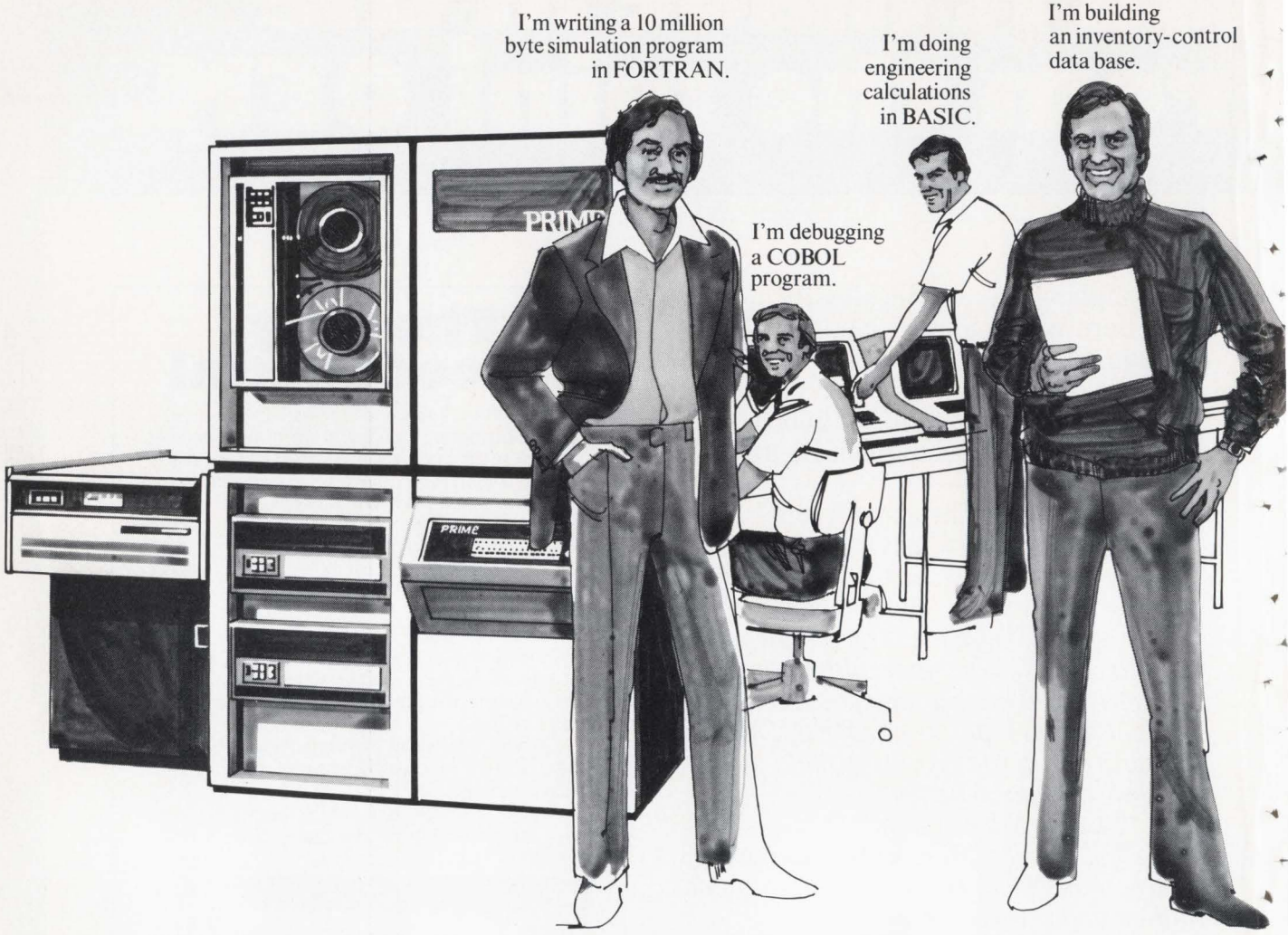
He saved his company a bundle.

And he kept his head.

If you'd like to find out how to expand your mini without emptying your wallet, give the people at Plessey Microsystems a call today.

CIRCLE NO. 9 ON INQUIRY CARD

Plessey Microsystems
(714) 540-9945



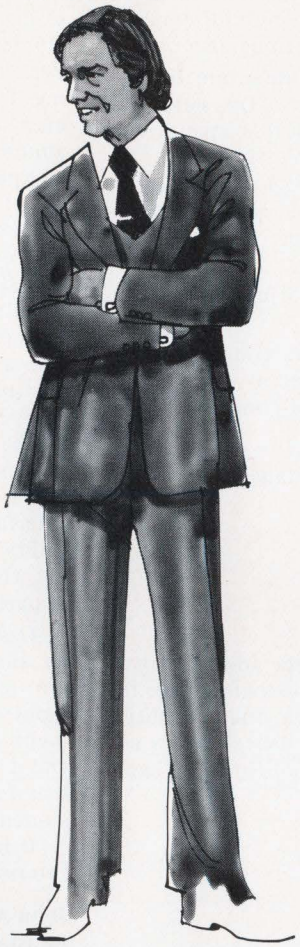
It's amazing what one

It's all done simultaneously on a PRIME CREATE computational timesharing system. There are six CREATE systems to choose from, each designed to provide a different level of performance for end-user applications in engineering, research, education and business. And, they can handle up to 64 simultaneous users, with user virtual memory spaces up to 512 million bytes each.

All CREATE systems are built from a family of compatible central processors and all are controlled by a uniform, multifunction operating system called PRIMOS. This means you can start with the smallest configuration to handle today's work load, and grow in modular steps to the highest level of performance, without reprogramming. It also means that you can plan on the availability of the power and capacity of Prime's new top-end processor, the model 400. Here are the important specifications:

- up to 8 million bytes of MOS main memory
- high-speed, 80 nanosecond cache memory

I'm amazed
one system
can do all that.



Prime computer can do.

- 512 million bytes of virtual memory per user
- up to 64 simultaneous users
- on-line disk capacity of 1.2 billion bytes
- automatic microprogrammed system integrity monitor
- 32-bit arithmetic

There are six entry-level packaged systems in the CREATE series, ranging in price from $20,000 to $140,000. All can be easily expanded with a full range of peripherals, including disks, printers, terminals, electrostatic printer/plotter, unit record devices and data communication controllers.

It's amazing what one Prime computer can do. To find what one can do for you, call or write to: David R. Johnson, Product Manager, Prime Computer Inc., Box 2600, Framingham, MA 01701 (617) 879-2960.

PRIME

See us at NCC Booth #2719.

CIRCLE NO. 6 ON INQUIRY CARD

letters

To the Editor:

In reference to MODERN DATA's December chart showing plug-compatible minicomputer peripherals:

1. The rights to manufacture Infotec products, mainly the TDX series, 75 ips, 1/2" IBM-compatible tape drives, were purchased by North Atlantic Industries' Qantex Division. Thus, Qantex is now offering a 75 ips, open reel, magnetic tape storage unit. Infotec should be delisted.

2. Qantex does not offer disk storage peripherals.

3. Qantex does offer cartridge magnetic tape storage peripherals as well as open reel, 75 ips, 1/2" IBM-compatible tape drives.

Leon Malmed, Sales Manager
Qantex
Plainview, NY

To the Editor:

I found the Microdata advertisement on page 37 of your November issue to be rather interesting in that "Reality. A New Business Appliance" had a reverse twist: A left-hand-threaded light bulb!

David M. Stoner
Wren Leasing
Cincinnati, OH

To the Editor:

I need to improve my backgammon game drastically before retiring early to the Caribbean. Do any of MODERN DATA's readers know of any programs that play backgammon? Or that simulate strategies for bearing off, doubling, etc.

George Glaser
225 Warren Road
San Mateo, CA 94402

To the Editor:

I found your October issue quite interesting and read nearly every article. Horace Linde's article on "A Wake for Perf Tape?" was especially illuminating. I find it perplexing, however, that even though there appears to be an abundance of good paper tape readers and punches on the market, apparently all of them are sold exclusively for OEM applications.

We operate a timesharing network and find that although there has been a big price breakthrough in 30-character per second terminals, there is still not a cost effective replacement for the paper tape reader/punch on the ASR-33 teletype. I have written most of the vendors cited in that article and it seems that units that would link an ASCII terminal via an EIA/RS-232C interface and provide teletype compatibility at 30-cps are nonexistent. Dealers who sell and service such a unit are apparently equally rare.

Cassette drives don't offer much of an answer for our applications. They are relatively expensive, as are the tapes used on them. Paper tape equipment uses a cheap, relatively reliable, and disposable medium, which is excellent for timesharing use, especially by students.

It is high time equipment manufacturers address this long ignored need.

John A. Nierengarten, Jr.
Assistant Director, Computer Center
University of Wisconsin-LaCrosse
LaCrosse, WI

NOTICE

Modern Data has changed its name to

MINI-MICRO SYSTEMS

CORRECTION NOTICE

In the Alphanumeric Display Terminal profile (Part 2) in the March, 1976 issue of MODERN DATA, we said Honeywell purchased its CRT terminals from Datapoint. However, Honeywell's popular VIP7700 CRT is of its own design and manufacture. The terminal purchased from Datapoint is the MTS 7500, an "intelligent" terminal.

We inadvertently omitted Digital Computer Controls (Fairfield, NJ) from the list of suppliers in the same profile. DCC's D-100 Series is a standalone TTY-compatible CRT.

Announcing a giant reduction in the Nova line.

You're looking at a whole new family of NOVA® computers. microNOVA. A microprocessor chip, a microcomputer board and a complete MOS minicomputer. All based on the little thing on the tip of the finger.

mN601. The microNOVA CPU.

It's a full-blown, 16-bit NOVA computer. Manufactured by Data General. And fully supported by NOVA software.

And it's not a NOVA computer in name only. This chip has all the NOVA registers, internal data paths and computational elements. The NOVA multifunction instruction set. The NOVA multiple addressing modes. And the NOVA 3 hardware stacking. Plus things that used to be NOVA options: multiply/divide, real-time clock and power fail/auto restart. All standard at no additional cost.

The difference is, all that NOVA has been reduced to a single chip that measures only 225 mils by 244 mils.

Which was no small accomplishment.

For those who need more than a chip, there's the microNOVA computer-on-a-board. A complete, fully-buffered microcomputer that comes with 2K or 4K words of RAM on a single 7½" by 9½" board. You can add on more RAM in either 4K or 8K increments, or PROM boards with up to 4K words. Plus terminal interfaces, general purpose interfacing boards, card frame, power supply and PROM burner.

And for those who need more than a board, there's a fully-packaged 4K word MOS microNOVA mini. It comes with power supply and turnkey console. In 9 and 18 slot versions. Into which you can place as much as 32K words of RAM or PROM. And still have plenty of room left over for I/O.

There's even a microNOVA system specifically for program development. A complete system, with dual diskette drive, terminal and our RDOS-compatible Disc Operating System. Or you can use a Nova 3 system with RDOS. The best development software you can get.

And no matter which microNOVA product you get, you get to use NOVA software like FORTRAN IV. Software that's in use in over 20,000 installations all over the world. So you know it's going to work right the day you get it.

Want to know something else?
Call our toll free number.
800-225-9497.

microNOVA

Nova is a registered trademark of Data General Corporation.

CIRCLE NO. 8 ON INQUIRY CARD

DataGeneral

Data General, Route 9, Southboro, Mass. 01772 (617) 485-9100. Data General (Canada) Ltd., Ontario.
Data General Europe, 15 Rue Le Sueur, Paris 75116, France. Data General Australia, Melbourne (03) 82-1361/Sydney (02) 908-1366.

Introducing the UN-remote

It's an intelligent Remote Batch Terminal. It's a satellite computer. And a very un-remote stand-alone processor. All in one.

It's the MODCOMP Remote Terminal System. And it allows people in your outlying offices or plants to handle a lot of their local computing needs on the spot. Without running up long distance line charges on jobs that can be handled more efficiently at the local level. Without using expensive CPU time on the big central computer when a smaller computer can do the same job a lot more economically with no transmission delay or communications problems. Yet when they need to, they can still use the Remote Terminal System as an RJE terminal or satellite computer communicating directly with your IBM, Control Data or Univac host processor.

MODCOMP Remote Terminal Systems come in three different versions. So you can pick the one you need, depending on how much local computing power you need.

All three systems include a console CRT, 300CPM card reader, 300LPM line printer, plus emulators for IBM 2780/3780 and CDC 200UT terminals. Univac 1004 and HASP Workstation emulators are also available. Peripheral options include mag tape units and faster printers or card readers.

Remote Terminal System.

MODCOMP RTS-1 The basic system, but one that still packs a lot of power. When it's not being used as an intelligent RJE terminal communicating with the central computer, a large number of local tasks can be handled by its MODCOMP II computer with 64K bytes of core memory and built-in dual floppy disc unit.

MODCOMP RTS-2 (illustrated) is the next step up. It can simultaneously handle both remote batch and local processing. And its moving head disc gives you a lot more storage capacity and computing speed.

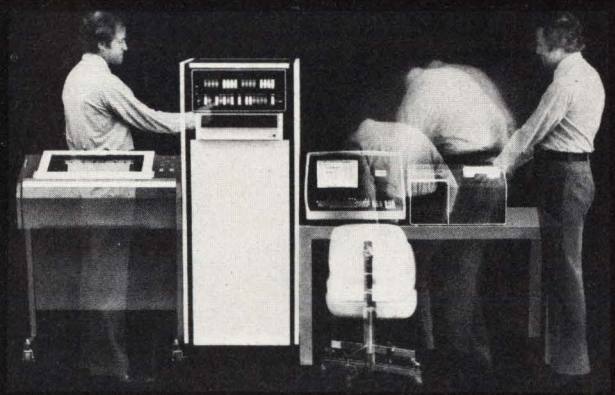
MODCOMP RTS-3 The powerhouse. 128K bytes of core memory. Floating point hardware. And a dual disc unit with 5-million bytes of storage. Running both remote and local processing concurrently, it can handle just about anything you throw its way.

MODCOMP Remote Terminal Systems. They're all part of what we call MODCOMP TSP. Meaning Total Systems Performance.

Which in turn means that a MODCOMP Remote Terminal System will cost you a lot less money than trying to get anywhere near the same performance anywhere else.

For more information, call your nearest MODCOMP sales office. Or write for detailed brochure to Modular Computer Systems, 1650 West McNab Road, Ft. Lauderdale, FL 33309. Phone (305) 974-1380.
European Headquarters: Export House, Woking, Surrey, England. Phone (04862) 71471.

CIRCLE NO. 5 ON INQUIRY CARD



MODCOMP®

THE INTELLIGENT WAY TO GO.

MODCOMP SALES OFFICES: ALBUQUERQUE, NM/ATLANTA, GA/
BOSTON, MA/CHICAGO, IL/CINCINNATI, OH/DALLAS, TX/DENVER, CO/
DETROIT, MI/HOUSTON, TX/HUNTSVILLE, AL/INDIANAPOLIS, IN/
KANSAS CITY, KS/LOS ANGELES, CA/MONTREAL, CN/
NEW YORK, NY/ORLANDO, FL/PHILADELPHIA, PA/
PITTSBURGH, PA/ROCHESTER, NY/SAN JOSE, CA/
SEATTLE, WA/TORONTO, CN/
WASHINGTON, DC
INTERNATIONAL OFFICES
OR REPRESENTATIVES IN
ENGLAND/FRANCE/
BENELUX/WEST GERMANY/
NORWAY/SWEDEN/JAPAN

news & comment

BARBARA A. REYNOLDS / Associate Editor

CIA'S BID FOR PEACE

In what at first glance appeared to be an aboutface, A.G.W. Biddle, president of Computer Industry Association, said the IBM-U.S. Govt. trial was retarding rather than helping the computer industry. As evidence of this, he cited IBM's postponement of its "future system." For this reason and because a final settlement he believes to be at least nine years off, anti-IBM activist Biddle has proposed a compromise. At a recent seminar on the computer industry sponsored by Drexel Burnham Co., Biddle outlined his proposal.

1. *IBM must provide full disclosure of interfaces and protocols.* This would result in more competition and probably more innovation.

2. *IBM should set up a lease finance company with the shareholder's capital.* IBM has so much cash now, it's hard to find uses for it.

3. *IBM must unbundle all products and services.* This would prevent cross-subsidization and allow the user to go to other vendors if it better suited his needs.

4. *IBM should eliminate questionable business practices.* For example, the announcement of nonexistent products should be prohibited as should reciprocity.

5. *IBM should be barred from participation in the computer service industry for an additional 10 years.* The original settlement with Control Data expires in two years.

6. *IBM should be barred from becoming a common carrier in the communications industry.* It's all right to sell and service communications equipment in the data processing market, but IBM should be kept out of domsat.

According to Biddle, this is a better way of restoring competition than the government's proposal to fragment IBM. Actually, it's not that far afield from recent FCC decisions regarding the regulated monopoly, AT&T.

MODCOMP ENTERS TURNKEY BUSINESS MARKET

So it can enter the mini-based business turnkey market, Modcomp is purchasing software house, ECS Information Systems, Inc. (Lexington, MA). Under the agreement, subject to approval by Modcomp's Board of Directors and the shareholders of ECS, an undisclosed amount of Modcomp common stock will be exchanged for ECS' outstanding capital stock. ECS has been around for seven years and has marketed over 175 program packages for small business computers. The initial offering of the combined forces will be three models built around the Modcomp II product line and will be oriented toward four markets: industrial distributors, transportation aftermarket, equipment suppliers and machinery manufacturers. The systems will be sold on a turnkey basis by a separate sales force, concentrating initially in the northeast.

SINGER'S FOSTER PARENT

TRW will be performing the maintenance and support functions of Singer business machines in North America. (For its European foster parent, see International News.) Transfer of management responsibilities began in March and by Dec. 31, the changeover should be complete. This agreement does not cover manufacturing operations, which Singer is reportedly still trying to sell.

THE FERTILE PERIOD OF MINIS

Minicomputer shipments will be multiplying again this year, much faster than last according to MINI-MICRO SYSTEMS' *1976 Minicomputer-Microprocessor Market Survey.* In fact, minicomputer shipments will increase by nearly 40 percent compared with last year's modest 14 percent. Digital Equipment Corp. led the industry in both number of units and dollar value in 1975, and will continue to do so in 1976. Data General was second in both categories in 1975 and will be again in 1976. Business data processing is the fastest growing application area. Miniperipheral product groups will also grow strongly in 1976, and will be led by floppy disks and line/serial printers. An increasing number of microprocessor applications were moving into production, but most were still in the R&D planning or design stages. Intel maintained its substantial lead in the microprocessor area, but Motorola is showing substantial gains. The complete report is available for purchase from MINI-MICRO SYSTEMS for $295.

DEC MOVES FURTHER INTO IBM TERRITORY

Digital Equipment Corp. has raised its top of the line from the Decsystem 1080 to the Decsystem 1088, which is a dual KL10 processor system. Performance improvements over the 1080 range from 1.4 to 1.7, according to DEC. Expected to compete with IBM's 370-158 and 168, the 1088 configurations are priced from $1,225,540. Also included in the announcement was a new disk subsystem – the RP06. Each drive has a 190-megabyte capacity, access time of 28 milliseconds and price of $34,900. Two new software packages announced were Galaxy Batch for batch processing in a virtual memory environment and ITPS-10 for photocomposition and word processing.

WHAT'S COMING

May 24-25 **EFTS – Be Prepared.** Hyatt Recency O'Hare, Chicago, IL. Sponsored by Payment Systems, Inc., 90 Park Ave, New York, NY 10016.

25-27 **Semicon/West '76.** San Mateo Fairgrounds, CA. Sponsored by Semiconductor Equipment & Materials Institute. Contact Golden Gate Enterprises, 1333 Lawrence Expressway, Santa Clara, CA 95051.

27 **Mini and Micro Systems – Trends and Applications.** National Bureau of Standards, Gaithersburg, MD. Sponsored by NBS and IEEE Computer Society, Washington, DC 20234.

June 7-10 **'76 NCC.** New York Coliseum, NY. Sponsored by American Federation of Information Processing Societies, Inc., 210 Summit Ave., Montvale, NJ 07645.

17 **Computer Technology: Directions and Expectations.** National Bureau of Standards, Gaithersburg, MD. Sponsored by Washington, DC Chapter of the Association for Computer Machinery. Contact Dr. Robert Butler, NBS, A247 Techology Building, Washington, DC 20234.

20-23 **Computer Education Workshop.** Illinois State University, Bloomington, IL. Sponsored by IEEE Computer Society, PO Box 639, Silver Spring, MD 20901.

August 2-6 **Computer Organization and Programming Course.** Georgia Institute of Technology, Atlanta, GA. Contact Director, Dept. of Continuing Education, Georgia Institute of Technology, Atlanta, GA 30332.

23-27 **Microprogramming: Concepts Design and Practice Course.** Georgia Institute of Technology, Atlanta, GA. (See above.)

The *Silent 700* ASR Data Terminal. It shares time with good company.

The twin-cassette *Silent 700*® Model 733 ASR data terminal from Texas Instruments is supported by every leading U.S. timesharing service company, a few of which are indicated here.

What's more, it's a powerful alternative to conventional teletypewriters. It's quiet. It transmits and prints data at 30 characters per second. And it reduces connect time and user cost.

Programs are prepared off-line and stored on cassettes, avoiding expensive connect time during data preparation. Result: More users can access the system without loss in response time. More computing time is delivered for the dollars spent.

UCC UNIVERSITY COMPUTING COMPANY
MCAUTO MCDONNELL DOUGLAS AUTOMATION COMPANY
NATIONAL CSS, INC
UCS UNITED COMPUTING SYSTEMS, INC
Optimum Systems Incorporated
CSC COMPUTER SCIENCES CORPORATION
COMSHARE
ADR COMPUTING CORPORATION
On-Line Systems Inc.
Computer Sharing Services, Inc.
computerline corporation
chi CORPORATION
CALL COMPUTER

See this product at the Computer Caravan and NCC.

User programs are stored on cassette locally, reducing the cost of disc file storage at the remote computer.

The Model 733 ASR lists for $2895*, including printer and twin cassettes. Attractive lease rates are available. And it is backed by worldwide TI service and support.

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 2124.

TEXAS INSTRUMENTS INCORPORATED

*U.S. Domestic Price

TEXAS INSTRUMENTS.

CIRCLE NO. 10 ON INQUIRY CARD

international news

ICL ON THE MOVE

Amid speculation that one of its largest shareholders is interested in selling its interest, International Computers Ltd. (ICL) not only purchased Singer's European customer base, but agreed to form a computer media company with Control Data Corp.'s British unit.

About 18 percent of ICL's shares are held by the British General Electric Co. which is reportedly looking for a buyer of those shares. Evidently unphased by that, ICL purchased the international operations of Singer Business Machines Division. The agreement includes Singer's inventories and rental revenues, but not its manufacturing facilities.

A few days after that agreement was announced, ICL said it planned to form a joint company with CDC that would manufacture disks, mag tape, punched cards, printer ribbons, etc. Control Dataset, the new company, will be 75 percent owned by CDC and 25 percent by ICL. Initial assets, valued at $5 million, include CDC's business products operation in the U.K. and ICL's subsidiary, Dataset, Ltd. Not included is CDC's manufacturing facility at Brynmawr, South Wales.

Not more than a week had gone by when ICL had another announcement. ICL has a new addition to its 2900 Series – the medium-scale 2960. (The large-scale 2980 and 2970 were announced in 1974.) The 2960 will be priced between $1.1 and $2.4 million.

CHINA'S SOFTWARE HOUSE

Originally set up in 1969, the Shanghai Institute of Computer Technology appears to have become the major software house in China. It claims to have more than 1300 programs for use in aeronautics, medicine, hydrology, electrical engineering and architecture. Following the more stately Institute of Computer Technology at the Peking Academy of Sciences, the Shanghai Institute is a major technology gatekeeper in the computer industry of China.

GERMANY'S THIRD DATA PROGRAM

Sequel to Germany's "Second Data Program," which ran from 1951 to 1975, is Germany's "Third Data Program." Unlike its predecessor, which fostered medium and large-scale machine development, this government program will concentrate on the small and very large – to the tune of $625 million over the next four years. Beneficiaries will be Siemens, Nixdorf, the German branch of Philips, Kienzle Apparate, Triumph Werke, Anker Werke and Matthias Hohner. With the folding of Unidata, followed by France's aggressive move in the form of the CII-HB merger, Germany must have realized it had to do something to prevent being overrun not just by IBM, but by fellow Europeans. Germany hopes to become competitive across the board by 1980 – except for large systems. Nixdorf has given it a head start in the small business area against IBM's System/32 and Siemens has a head start in the small and medium area, having retained the Unidata-developed 7700 Series.

NEW POLISH MINI

Poland's new mini, Mera 400, comes with a high-speed line printer, paper tape reader, CRT monitor, and disk storage. No additional details of the new Polish mini are available, but it is probably an improvement over the previous minicomputer, the Mera 300. That minicomputer was based on an eight-bit processor known as Momik 8b and was designed to supply the rapidly growing demand for small computers in design offices as well as process control applications. Several U.S. minis have been sold in Poland – among them, PDP-11s, Data General Novas and Wang 2200s.

MODCOMP IN SCANDINAVIA

The Swedish firm of ASEA will be selling, servicing and supporting Modcomp systems in Sweden, Finland and Denmark. ASEA has been a large OEM customer of Modcomp, purchasing over $2 million in equipment and services last year. Modcomp will also use ASEA as its interface to the East.

They're here. The industry's most advanced 100/200 megabyte OEM disk drives.

The new ISS 733-10/11 disk drives are the most advanced random access storage devices ever designed for the OEM market. With features that benefit you *and* your customers.

For example, exceptional speed in head positioning and start/stop times. Compactness. Quietness. Easy waist-high pack loading.

The big news, however, is their field-upgrade capabilities. The 100-megabyte 733-10 can be easily field-upgraded to 200 megabytes. Or you can have 200 megabytes immediately with ISS 733-11. And both can be ordered with, or field-upgraded to, dual port.

Advanced interface design
Our interface permits functional compatibility between ISS 733-10/11 and most current 40, 80, 100, 150, 200, and 300-megabyte drives. This means minimal controller modifications, if any.

Performance features
Integral power supply. Tolerates wide power variations, reduces susceptibility to cycle sags and brown-outs.

Module select plug. Permits flexibility in disk address assignments in multi-drive systems.

Data separation and write data precompensation. All data encoding/decoding is performed in the drive.

Absolute cylinder addressing. Disk addressing done in the drive, not the controller. Simplifies programming.

Industry standard media. 3336 and 3366-11 or equivalent disk packs.

Programmable sector mark. Allows user to select sector size to fit his application.

Important options
Dual port. ISS 733-10/11 can be upgraded from single to dual port in the field. Or dual port can be installed prior to delivery.

Sector counter. Signals the system which data sector is approaching the read/write heads.

Rotational position sensing. Signals the system when the desired sector is approaching the read/write heads. Increases system throughput.

Address mark format. Permits variable record lengths.

Daisy chaining. Greatly reduces cabling.

Round-the-clock ISS support
ISS maintains a complete support facility. Not just spares, but also technical assistance is available round-the-clock. Just call.

We'll be glad to send more information about the ISS 733-10/11. Write or call ISS Marketing, 10435 N. Tantau Ave., Cupertino, CA 95014, (408) 257-6220. ISS is an operating unit of Sperry Univac.

ISS

Technological leadership for the generations ahead.

Sperry Univac is a division of Sperry Rand Corporation

CIRCLE NO. 12 ON INQUIRY CARD

dc datascan

BUCY PANEL ON EXPORTS TO EAST

The Defense Dept. shouldn't worry so much about individual products going to the Soviet Bloc, but should use its energies instead to ensure that state-of-the-art technology doesn't go out of the country at all. These were the findings of the recently released report prepared for the Defense Science Advisory Board by the Bucy Panel, chaired by J. Fred Bucy, president of Texas Instruments. Although the Free World Coordinating Committee (COCOM) has reduced the number of items on the export control list, the list is still too long and contains many obsolete devices. Export approval on a product-by-product basis is cumbersome and involves delays and ambiguities according to the report. End use statements are of no value since there is no way of ensuring that the stated end use ends up being the actual end use. The panel said the important factor in export controls is protecting the U.S. technical lead time. It is therefore necessary to differentiate between "evolutionary" and "revolutionary" technology. Evolutionary technology should be allowed out, but revolutionary technology shouldn't be exported to neutral countries or to Western Bloc countries that reexport it to Eastern Bloc countries (a current practice), the report said. Although other panels have urged reductions in export control lists, the Bucy report, which suggests a whole new approach to exports, is thought to carry more weight with the Pentagon. Copies of the report are available from the *Pentagon Public Information Office, Room 2E761, Pentagon, Washington, DC 20301*

EASIER TO BUY THAN SHARE

Although it is the largest single purchaser of data processing equipment and is known for its rigorous bid requirements, the Federal Government has trouble keeping track of, and controlling, its equipment inventory. What is needed, according to the findings of a recent Interagency ADP Planning Conference, is improved centralized management of ADP at both the GSA level and the central management level within individual agencies. The Conference recommended that GSA be responsible for all procurements up to $1 million. There should be a hardware and application inventory system so one agency knows what another has. To get the greatest benefit from equipment, it should be possible for agencies to share. But they are more likely to share information on individuals than equipment.

SEMICONDUCTOR INTERESTS VS. THE GOVT.

Tariffs 806.30 and 807 allow manufacturers to produce parts domestically, ship them abroad for assembly and then re-import the semi-finished products to the U.S. for finished processing, paying duty only on the value added by the assembly abroad. This is the way the U.S. semiconductor industry operates, but Congress is concerned that too many U.S. jobs are being lost this way so it is investigating the repeal of these tariffs. Among the natural opponents of the tariff repeal is WEMA (Western Electronic Manufacturers Association). And representing that interest recently before a Congressional subcommittee was David Packard, chairman of Hewlett-Packard, and W.J. Sanders III, president of Advanced Micro Devices. They maintained that tariff repeal would necessitate transferring more jobs overseas in order for the companies to remain competitive with their foreign counterparts. Assembly in low wage areas is essential in the semiconductor industry in order to achieve reasonable profits to pay for research and development according to Sanders. In other words, WEMA's contention is that tariff repeal would result in the loss of U.S. leadership in the semiconductor industry.

DOCUMENTATION GUIDELINES

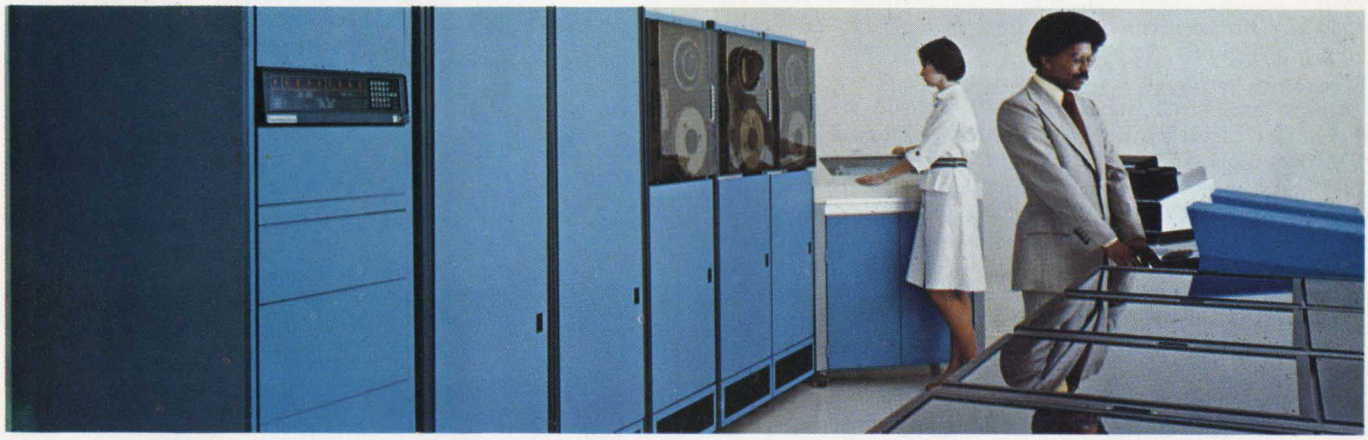
An interagency task group on Documentation for Information Processing Systems has come up with new documentation guidelines for Federal computer operations. They are contained in the NBS Publication, ***Guidelines for Documentation of Computer Programs and Automated Data Systems*** (FIPS PUB 38). Priced at $1.35 a copy, it is available from the *Supt of Documents, U.S. Govt. Printing Office, Washington, DC 20402*.

NEW PUBLICATIONS

OCR (Optical Character Recognition) Software Development by George E. Forsen and Paul C. Kane is an evaluation of an OCR technique on such copy as Cyrillic and Latin text. Most of the correlation processing was performed using modified DIMES software and run on Honeywell 635 and 6180 computers. Price is $5.00.

The Data General Nova 800 Minicomputer as a Digital Controller by John William Pounds, Jr. describes the interface considerations for adapting AID and DIA converters to the Nova. Included is a programmed instruction section to familiarize the new user. Price is $6.75.

INTERDATA 8/32 MEGAMINI LIFE SUPPORT



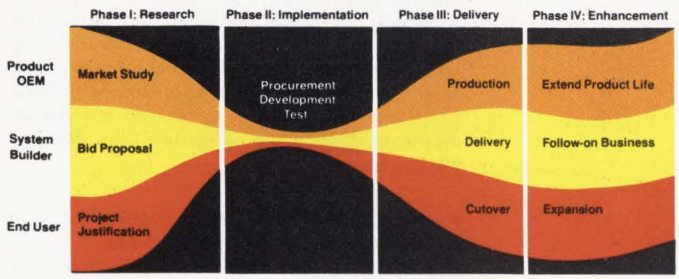
Risk-free computer buying–with power to spare.

You're looking for a computer system so powerful, it takes you over any snags that could cost you extra.

That's why Interdata builds the powerful 8/32 Megamini with 32-bit hardware performance and direct addressing capability of up to one million bytes. With unique software packages that are powerful, flexible and easy-to-use. With Megamini Life Support that means you'll never have to take a risk with:

On-time Delivery. Interdata guarantees on-time delivery of your Megamini. In fact, we've already shipped hundreds of 32-bit computers from production that are completely operational.

Hardware Back-up. Interdata hardware means 32 registers, each 32 bits wide. Fast single- and double-precision arithmetic. Optional, writable control store. And big computer peripherals. It also means that we support you long after your system is operational.



Interdata's computer products and services exist for one reason – to satisfy our customers: The Product OEM, the System Builder and the End User. Each of these computer buyers has a Computer Life Cycle with four specific Phases – Research, Implementation, Delivery and Enhancement. Interdata responds to customer needs during each Phase with Computer Life Support.

Software To Do the Job. Megamini's software optimizes its hardware and gives you a solid systems environment. It includes program development tools like BASIC II, FORTRAN, MACRO CAL and COBOL. And the versatile real-time OS/32 MT (Multi-Tasking) operating system. Megamini software helps you build simple solutions to your toughest applications problems.

No Surprises. Our customer requirement analysis insures that you never have to add more people than you planned on. Or more hardware than you scheduled.

Megamini Life Support. From the moment you decide on Interdata, until you are completely operational, Megamini's capabilities are carefully spelled out. The Interdata/Perkin-Elmer name stands squarely behind every promise with the viability of a $300 million corporation. With Interdata and the Megamini, you're guaranteed power to spare.

Gentlemen:
☐ Send me more about Megamini power.
☐ My needs are:
__Immediate __6 Months __1 Year __For Reference Only

Name _____ Title _____

Company _____

Address _____

City _____ State _____ Zip _____

Telephone (___) _____

INTERDATA®
Interdata, Inc.
Subsidiary of Perkin-Elmer
Oceanport, N.J. 07757 201-229-4040

Come see us at booth 1429 at the N.C.C.
CIRCLE NO. 15 ON INQUIRY CARD

mini·micro systems bookstore

book reviews

HIGH-SPEED DIGITAL MEMORIES AND CIRCUITS *by Harry J. Gray (Vol. 5 of Advances in Modern Engineering Series). Addison-Wesley, Reading, MA, 1976. 122 pages plus bibliography. $6.95, paper.*

Written by engineers for engineers, this book began as notes from a three-week summer session in 1966 at the Moore School of Electrical Engineering at the University of Pennsylvania. The session has been held every year since then and more notes have been compiled. *High-Speed Digital Memories and Circuits* probably won't tell you anything new, but will tell you what was happening with digital memories and circuits up to early 1974. Digital logic circuits, magnetic storage, semiconductor memories, core memories, read-only memories, erasable PROMs and content addressable storage are all covered on the circuit design level of detail (i.e., the diodes, transistors, capacitors and resistors used for each circuit type).

According to author Gray, professor of electrical engineering and computer science at the University of Pennsylvania, the level of treatment is not deep – but you have to be an electrical engineer to agree. There were only two drawbacks apparent: First, in the fast moving memory technology field, a book almost two years old will have to be supplemented for a complete review. (For example, I^2L circuits and bubble technology are treated only lightly.) Second, as a reference book, it needs an index although the table of contents is detailed. Otherwise, the book is professionally done in everyway – from organization to precise documentation of facts. And it achieves its stated purpose – a review of digital memories and circuits – with room to spare. – BAR

INTRODUCTION TO SYSTEMS ANALYSIS *By Gerald A. and Joan B. Silver, Prentice-Hall, Inc., Englewood Cliffs, NJ. 270 pages plus index, $11.95, cloth.*

Targeted at an undergraduate readership, this primer is a rather short treatment of the subject, but a good one. First among its many strengths is clarity: intelligent use of topic sentences, generous application of numbered listings, simple typography, and generally good design make the text easy to read and understand – reportedly an important criterion on today's campus! Secondly, the book is realistic and objective, as demonstrated by its heavy emphasis on the necessity of achieving results with and through existing personnel, whose initial reactions to a systems analyst's proposals are usually negative. A third strength is its completeness – this brief text covers the subject well, including some especially good introductory sections and several represenative case problems. The book does have its weaknesses. Although generally very smooth, the editing is not perfect. Bibliographic references appear in text, but no formal, extended bibliography is given. The authors, who added significantly to the value of their book by including micrographic and word processing equipment in their discussions of business systems, presented a rather weak treatment of the criteria for evaluating computer systems, which gave only lip service to system software and never mentioned industry-specific application packages at all. But perhaps these shortcomings are simply more noticeable against the background of a well-constructed text. That's our opinion, and we add that the Silvers, who did such a fine job on *Computer Algorithms and Flowcharting* last year, have produced another highly useful book. – Ernest Barlach

(Mr. Barlach is an independent consultant and a frequent contributor to MINI-MICRO SYSTEMS.)

#4 INFORMATION SYSTEMS ARCHITECTURE
Borje Langefors and Bo Sundgren. This is the first volume on data base design that provides an integrated treatment of information and data elements, system structuring for data transport reduction, and data base file structuring. All explanations are computer independent. Illus. 366 pp. P324. $19.95

#5 1975 BEST COMPUTER PAPERS
Isaac L. Auerbach. A compendium of papers judged best among scores written in 1974. Twenty-three contributors represent a significant contribution to the state-of-the-art and to the growing literature on computer science. Illus. 257 pp. P372. $17.50

#6 PROJECT MANAGEMENT IN DATA PROCESSING
Susan Wooldridge. A handbook dealing with non-technical problems all managers face in the day-to-day course of their supervisory responsibilities. Valuable coverage is given to methods of preventing high turnover of staff, missed deadlines, exceeded budgets, and friction in working with other departments. Illus. 160 pp. P358. $12.50

#7 SOFTWARE ENGINEERING CONCEPTS AND TECHNIQUES
John Buxton, Peter Naur, and Brian Randell. Two important reports from landmark international software conferences sponsored by NATO constitute this valuable appraisal of engineering concepts and techniques. Pointing the way to the future of software, international authorities examine present shortcomings and suggest alternatives that could overcome such problems in the future. 370 pp. P1151. $14.95

#8 HOSPITAL COMPUTER SYSTEMS AND PROCEDURES, VOL. I: ACCOUNTING SYSTEMS
Raymon D. Garrett. This is the first volume in a unique series designed for the professional who must apply his knowledge of data systems to the specific task of automating hospital functions. Illus. 288 pp. P370. $14.95

#9 SYSTEMS AND MANAGEMENT ANNUAL—1975
C. West Churchman and Robert W. Wesner. Satisfies the urgent need for an authoritative, up-to-date sourcebook of current directions that this field may take in the future. Illus. 620 pp. P378. $24.95

#10 SYSTEMS AND MANAGEMENT ANNUAL—1974
Illus. 620 pp. P1062. $24.95

#11 INTRODUCTION TO COBOL
Ekman-Nilsson. A basic presentation of COBOL, the programming language generally used for the formulation and solution of problems within the sector of economical and administrative data processing. Illus. 167 pp. P340. $7.50

#12 TOP-DOWN STRUCTURED PROGRAMMING TECHNIQUES
Clement L. McGowan and John R. Kelly. Addressed primarily for programmers. The first book to define structured programming—computer science's newest methodology—and set forth its application. 288 pages Illustrated P305/$14.95

#13 OPERATING SYSTEMS PRINCIPLES
S. Kurzban, T. S. Heines and A. P. Sayers. Familiarizes the reader with the design, implementation, and modification of operating systems. 512 pages Illustrated P267/$16.95

#14 RELIABLE SOFTWARE THROUGH COMPOSITE DESIGN
Glenford J. Myers. A set of design measures strategies, and techniques for designing reliable software. 160 pages Illustrated P355/$11.95

#15 STRATEGIC PLANNING OF MANAGEMENT INFORMATION SYSTEMS
Paul Siegel. A basic guidebook for the executives, computer scientists and other system-oriented specialists planning a management information system. 320 pages Illustrated P148/$16.95

#16 CONCISE SURVEY OF COMPUTER METHODS
Peter Naur. Intended as "the computer user's second book", it assumes that the reader is familiar with elementary programming, using FORTRAN or ALGON 60. Included are discussions of the fundamental ideas of data processing, data, computers, and programming 381 pages P1107/$17.50

#17 THEORETICAL ANALYSIS OF INFORMATION SYSTEMS, FOURTH EDITION
Borje Langefors. Explains the basis of systems theory and its related problems, as well as the function of an information system. Also discussed: data and information files, the effect of process grouping, certain data processing problems and the relation between a process and its files. 489 pages Illustrated P256/$19.95

#18 COMPUTERS: AUDITING AND CONTROL
Elise G. Jancura and Arnold Berger. 46 leading EDP authorities demonstrate ways and means of controlling, verifying, and evaluating the results of computerized activities. 498 pages P250/$15.95

#19 TECHNIQUES FOR DIRECT ACCESS
Keith London. Meets the need for an intensive education in direct access devices and correct methods for using them. 384 pages Illustrated P206/$14.95

#20 ACCOUNTING AND COMPUTER SYSTEMS
H.D. Clifton and T. Lucey. An invaluable reference for data processing personnel implementing computer-based accounting systems as well as the practicing and prospecting accountant. Financial and auditing considerations are detailed. 192 pages Illustrated P343/$13.95

#21 BASIC PROGRAMMING WITH QUANTITATIVE METHODS IN BUSINESS
Darl D. Bien and Gregory A. Cook. Offers a unique presentation of the theory of computer language, plus applicable quantitative techniques. Covers the fundamental concepts of flowcharting, BASIC programming, and quantitative business models. 192 pages Illustrated P350/$8.00

From the 100 Best Books of 1974* . . .

#22 INFORMATION TECHNOLOGY: THE HUMAN USE OF COMPUTERS
Harry Katzan, Jr. The computer as friend and ally . . . a top technocrat's look at the electronic marvel that is here to stay. Covers the impact of computers on people, basic computing concepts, and programming languages. 200 pages P199/$12.95

***March, 1975 Issue of Library Journal**

#23 SO YOU'RE GOING TO AUTOMATE
Jack Munyan. Invaluable primer for controllers, small businessmen, and accountants. Sets forth guidelines to be used when converting from a manual (semi-automated) accounting system to a fully automated accounting system. Points out potential problems and how to avoid them. Includes DO's and DON'Ts for converting six major accounting functions: accounts receivable, accounts payable, payroll, cost center analysis, inventory control, and general ledger. 271 pages P271/$10.00

#24 MANAGERIAL DEVIANCE: HOW TO DEAL WITH PROBLEM PEOPLE IN KEY JOBS
Andrew J. DuBrin, Ph.D. Systematic explanation of the strategies you can use to deal with aberrant behavior in executives, managers, and others whose positions are vital to your firm. 288 pp. P1140. $8.95

#25 UNSCREWING THE SMALL INVESTOR
Gary H. Craig. A simple, logical approach to investing, written in everyday English and designed for anyone who is ready to take his wealth seriously, however large or small. 156 pp. P1157. $7.95

#26 HOW TO USE POCKET CALCULATORS
Pierre R. Schwob. Provides fundamental methods of using a pocket calculator with the four standard features (+, −, x, ÷), floating decimal point, automatic constant, and algebraic logic. The material is subdivided by approaches to particular types of problems: the solution of percentages; banking and financial problems; measurement conversions; probability and statistical calculations. Illus. 176 pp. P1172. $10.95

and for fun . . .

THE SCRABBLE® BOOK: WINNING STRATEGIES FOR THE WORLD'S MOST POPULAR WORD GAME
Derryn Hinch. Text, diagrams, and specialized sections of the first complete guide to Scrabble® reveal the finer points of the game while presenting its history, strategy, and aberrations. Illus. 272 pp. (Paperbound, P1194, $4.95) and (Cloth, P1119, $8.95)

TO ORDER:
Fill out the coupon inside the back cover to receive your 15-day free examination copies.

PETROCELLI/CHARTER
Div. MASON/CHARTER PUBLISHERS, INC.
641 LEXINGTON AVE./NEW YORK 10022

NORDEN TO MARKET MILITARIZED PDP-11

Digital Equipment Corp. has granted a license to the Norden Division of United Technologies, which will allow the Norwalk, CT, firm to manufacture and market versions of DEC's PDP-11 minicomputers that meet military specifications. According to Norden President Peter L. Scott, his firm has already begun work on militarized versions of the PDP-11. Deliveries are expected to begin sometime in 1977. Norden, a division of United Technologies (formerly United Aircraft), is a leading supplier of military electronic equipment, much of it related to data processing.

DATA 100 TERMINALS LEASING AGREEMENT

Data 100 Corp. will sell up to $10 million of its computer terminal systems to Lease Financing Corp. (LFC), Philadelphia, PA. Under terms of the non-recourse third-party agreement, LFC will pay Data 100 cash and in turn will receive monthly rental payments from Data 100 customers who lease the equipment. For additional compensation, Data 100 will provide maintenance services and will remarket the equipment for LFC if it comes off rent. Data 100 will account for the transactions as sales. After LFC has recovered its purchase price and specified fees, the two companies will share equally all lease or sale proceeds. Actual sales will begin in the current quarter and will continue through 1976. The agreement is renewable for an additional $10 million on January 1, 1977, at the joint option of both parties.

GE CONTINUES COMPUTER EXIT

Now that the Honeywell stock price is up from last year's lows, General Electric is going to reduce its interest in Honeywell Information Systems, Inc. from 18.5 percent to 11.7 percent in exchange for 800,000 shares of Honeywell common stock. This is the first implementation of the cross-option agreement, which allows General Electric to give up its remaining interest in Honeywell Information Systems in exchange for Honeywell common stock as late as mid-1979.

EARNINGS (LOSSES)

For the fourth quarter ended Dec. 31, 1975, **Data 100 Corp.** has reported earnings, before an extraordinary charge, of $1.4 million or $.34 per common share on a fully diluted basis, an increase of 17 percent over the $.29 per common share reported for the same period a year earlier. For the full year 1975, earnings before the effect of a tax loss carryforward were $4.2 million or $1.01 per common share fully diluted, an increase of 19 percent over the $.85 per common share for calendar year 1974.

Keydata Corp. reported that for the fiscal second quarter ended January 31, 1976, net income was $272,000, or $.10 per share, compared with net income of $102,000, or $.04 per share, in the second quarter of the previous fiscal year. Revenues for the second quarter of fiscal 1976 increased to $3,683,000, compared to $3,258,000 in the same period last year. First-half net income was $481,000, or $.18 per share, against $136,000, or $.05 per share, for the comparable 1975 period. Revenues were $7,346,000, versus $6,412,000 for the first half of fiscal 1975.

Modular Computer Systems, Inc. (MODCOMP) reported that sales and income for fiscal 1975 ended December 31, 1975, increased to $38,499,000 and $2,236,000 or $.75 per share, assuming full dilution, from $26,089,000 and $1,992,000 or $.72 per share for the previous year. In discussing the year-end results, Kenneth G. Harple, president, explained that record revenues were achieved in spite of an industry-wide softening in the industrial market, traditionally MODOCOMP's strongest market segment. He commented further that fourth quarter earnings were slightly impacted by declines in foreign currency exchange rates.

Qantel Corp. announced that it had recorded six consecutive months of profitability. While these profits weren't enough to make all of 1975 profitable for Qantel, each successive month since June, 1975, has been more profitable than the last. For the six months ended June 30, 1975, there was a loss of $1,585,000 on revenues of $1,917,000. For the six months ended December 31, 1975, income before taxes came to $108,000 on revenues of $3,778,000.

General Automation, Inc. reported that sales for the second quarter ended January 31, 1976, were $18,293,000 compared with $14,021,000 for the second quarter one year ago. Operations for the quarter resulted in a net income of $111,000 or $.05 per share before extraordinary credit, compared with a net loss of $2,057,000 or $.83 per share for the same period last fiscal year.

National Semiconductor Corp. reported that sales for the 40-week period (three quarters) ended March 7, 1976, were $236,931,000, compared to sales of $178,297,000 for the same period of 1975. Net earnings for the same three quarters of fiscal 1976 were $14,455,000, or $1.09 per share, versus $12,453,000, or $1.01 per share, for the three quarters of fiscal 1975. On a quarterly basis, National's sales in the 12-week third quarter were $74,651,000, an increase of 55 percent over sales of $48,116,000 in the same quarter of fiscal 1975. Net earnings of $3,555,000, or $.27 per share, compared to net earnings of $3,120,000 or $.25 per share for the same quarter last year.

AT&T's earnings for the three-month period ending February 29 were $1.33 per share compared to $1.13 for the corresponding 1975 period. Earnings for the latest 12-month period were $5.27 per share compared to $5.15 for the same period last year. Net income for the three-month period ending February 29, 1976 totaled $831.2 million compared to $689.2 million for the same period last year, an increase of 20.6 percent. For the 12-month period, net income totaled $3.2 billion compared to $3.1 billion for the same 1975 period.

Microdata makes everything on this page.

Together they make up the most powerful OEM computer systems on the market. Completely integrated systems.

Computers. Disc drives. Tape transports. PRISM™ display terminals. Ready-to-use software. Everything but the kitchen sink.

Microdata makes it all. So you get single-source responsibility, support and service.

Our systems utilize micro-programming and stack processing to give you superfast response time and improved overall system efficiency.

With our high-level systems programming language you can cut coding, debugging and software development costs by more than half. If you're looking for an OEM system that does everthing but wash your dishes, contact us today. Microdata Corporation, 17481 Red Hill Avenue, Irvine, CA 92714, P.O. Box 19501, Irvine, CA 92713, Telephone: (714) 540-6730, TWX: 910-595-1764.

Microdata

See us at our NCC Booth #3407.

FOR IMMEDIATE NEED CIRCLE NO. 17 ON INQUIRY CARD
FOR INFORMATION ONLY CIRCLE NO. 18 ON INQUIRY CARD

data communications

DATAPHONE TARIFF

AT&T has filed with the FCC for authority to operate its Dataphone Switched Digital Service on an interstate basis. In its filing, the company said the service, employing a common-user digital network, would provide high-speed, switched data transmission.

The Dataphone Switched Digital Service would be provided initially between 18 cities over digital channels at 5600 bits per second, equivalent to 7000 chars/sec. The 18 cities are New York, Boston, Washington, Chicago, Philadelphia, Newark, Baltimore, Pittsburgh, Cleveland, St. Louis, Detroit, Kansas City, Atlanta, Dallas, San Francisco, Los Angeles, Houston and Minneapolis. AT&T said it expects to expand the service to nine additional cities in 1976.

The proposed usage charges for Dataphone Switched Digital Service are time- and distance-sensitive – customers pay only for the distance and time they actually use. The usage portion of these rates is based on an initial 10-second period with additional time charges computed in one-second increments. There would also be a monthly charge for the dedicated, switched-access line that provides customer entry into the network.

XEROX MAIL SERVICE ALTERNATIVE

Xerox has introduced a typing system that sends and receives information over telephone lines at speeds up to 120 characters per second. The new Xerox 800 communicating electronic typing system communicates directly with computers as well as with a number of competitive word processing systems. The 800 uses standard Bell data sets or equivalents. Unattended receiving units use tape cassettes able to accommodate more than 20 pages of double-spaced text. Cassettes can be played back on the receiving typing system, or on a standard (noncommunicating) Xerox 800. The communicating unit is the newest member of the Xerox 800 product family introduced in late 1974. Like the standard 800, the communicating 800 uses a "daisy wheel" to produce copy at rates up to 350 words per minute, which, according to Xerox, is twice as fast as IBM Selectric equipment. The system will be marketed in two configurations, single or dual magnetic tape. The 800 leases for $290 to $390 a month, depending upon configuration and lease duration. Purchase price is $13,700 for the single tape and $14,380 for the dual-tape version.

Circle No. 87 on Inquiry Card

datacomm news

SERVICE EXPANSIONS

Eleven more major cities have come online to **Western Union Telegraph's** Westar domsat system, bringing the total number to 20. The system now has 94 city-to-city pairs or routes. The new "Satellite Access Cities" are Boston, Buffalo, Philadelphia, Baltimore, Cleveland, Cincinnati, Detroit, St. Louis, Kansas City, Milwaukee and Wilmington. Already on the one-year old Westar system are New York, Chicago, Washington, Atlanta, Dallas, Los Angeles, and San Francisco . . . . . **Telenet Communications Corp.** will install central offices in an additional 22 cities next month, making access to its public datacomm network locally available in 38 U.S. cities. The company recently noted that in the first seven months of service more than 50 customer computer systems were connected to the network. The first 10 additional central offices will serve Baltimore; Cincinnati; Denver; Miami; Milwaukee; Phoenix; Portland, OR; Santa Ana/Anaheim and Palo Alto; and Seattle. These offices should be open this month. Slated for June inauguration are Buffalo; Columbus; Hartford; Indianapolis; Kansas City, MO; Bridgeport/New Haven, CT; Rochester; Salt Lake City; San Jose, Long Beach and Santa Monica; Stamford, CT; and White Plains, NY . . . . . **Tymshare** has announced expansion of Tymnet, its international datacomm network, with new access nodes in Honolulu; Edmonton, Alberta; and Mexico City as well as the recent connection to Westar. The Westar satellite handles about 5 percent of Tymnet traffic during peak hours. Through an agreement with Bell Telephone of Canada, local call access to Tymnet is available to customers in Edmonton and – via DataRoute – in Vancouver, Calgary and Toronto.

DATRAN LSI MODEM CONTRACT

Data Transmission Company (Datran) has awarded a follow-up production contract for 4800/9600-bits per second LSI to **Paradyne Corp.** Datran and Paradyne said the amount of the contract is in excess of $5.2 million.

Paradyne's 1972 contract with Datran represented one of the first applications of large-scale integration (LSI) technology to a datacomm network, according to the two firms. During the last year, Paradyne delivered to Datran more than 2000 LSI modems, which provide local distribution for the Datran network over leased telephone company facilities.

TERMINALS

Diablo Systems (Hayward, CA) has announced a new data transmission unit called HyTerm. The microprocessor-controlled serial printer is capable of transmitting and receiving data from remote or host terminals. HyTerm utilizes Diablo's popular HyType printer, which was enhanced and redesignated HyType II especially for use with HyTerm. The

terminal prints 94 ASCII characters, and can generate all 128 ASCII characters. HyTerm is available in RO and KSR models. Options and accessories include a numeric key pad, and pin feed platens or forms tractor.

Circle No. 90 on Inquiry Card

The Delta 4500 CRT display terminal from *Delta Data Systems Corp.* (Cornwells Heights, PA) is programmable from the keyboard via a resident assembler, debug package and text editor, or downstream loader. The downstream loader permits the central system to load programs in any or all terminals. Available with up to 16K bytes of memory, the Delta 4500 includes programmable function keys that allow storage in memory of frequently used forms, charts and commands. A packed display memory feature is handy for applications requiring many lines of display; for example, with 20 characters per line, the terminal can store and display 100 lines of information.

Circle No. 91 on Inquiry Card

A new microprocessor-based CRT terminal has been added to the Medical Information System manufactured by *Technicon Medical Information Systems Corp.* (Mountain, View, CA). Known as a Video Matrix Terminal (VMT), the intelligent CRT (Model T-2201) is plug-compatible with the T-1201, which it replaces, and requires less space.

Circle No. 92 on Inquiry Card

Tymshare's (Cupertino, CA) new Model 315 keyboard printer operates at 30 characters per second and can create as many as six copies. The 96-character ASCII terminal features a separate 14-key numeric keypad. The 132-column carriage handles paper sizes from 3 to 14-7/8 inches wide. The Model 315 is priced at $2895 or can be leased for as low as $125/monthly.

Circle No. 93 on Inquiry Card

A pedestal-mounted CRT terminal with an integrated modem has been announced by *Western Union Data Services* (Mahwah, NJ). Available as either a standalone configuration or with the company's cassette buffer, the Video 100 is equipped with a Bell 103-type modem for various operational arrangements at speeds up to 300 baud. The Video 100 features a 12-inch diagonal screen and a 64-character display set. The standard display capacity is 24 lines, 1920 characters. CRT and keyboard are incorporated in a single molded case measuring 15-1/2 x 19 x12-1/2 inches. The pedestal-mounted Video 100 with originate-only modem is offered on a one-year lease for $81 a month; with originate/answer modem, $86 a month; with originate/answer and automatic answering, $91 a month.

Circle No. 94 on Inquiry Card

The Plus 70 system from *Trivex Inc.* (Costa Mesa, CA) emulates the IBM 3270. Available CRTs feature 480 or 1920 characters per display. Five keyboard models are available; controllers include a local model for direct connection to the IBM 360/370, a remote model operating at speeds up to 9600 bits per second; and a remote SDLC model. Printers offer 80 or 165 characters per second, 132 characters per line, vertical forms control and tractor paper feed.

Circle No. 95 on Inquiry Card

New Hytype Terminal for OEM's!

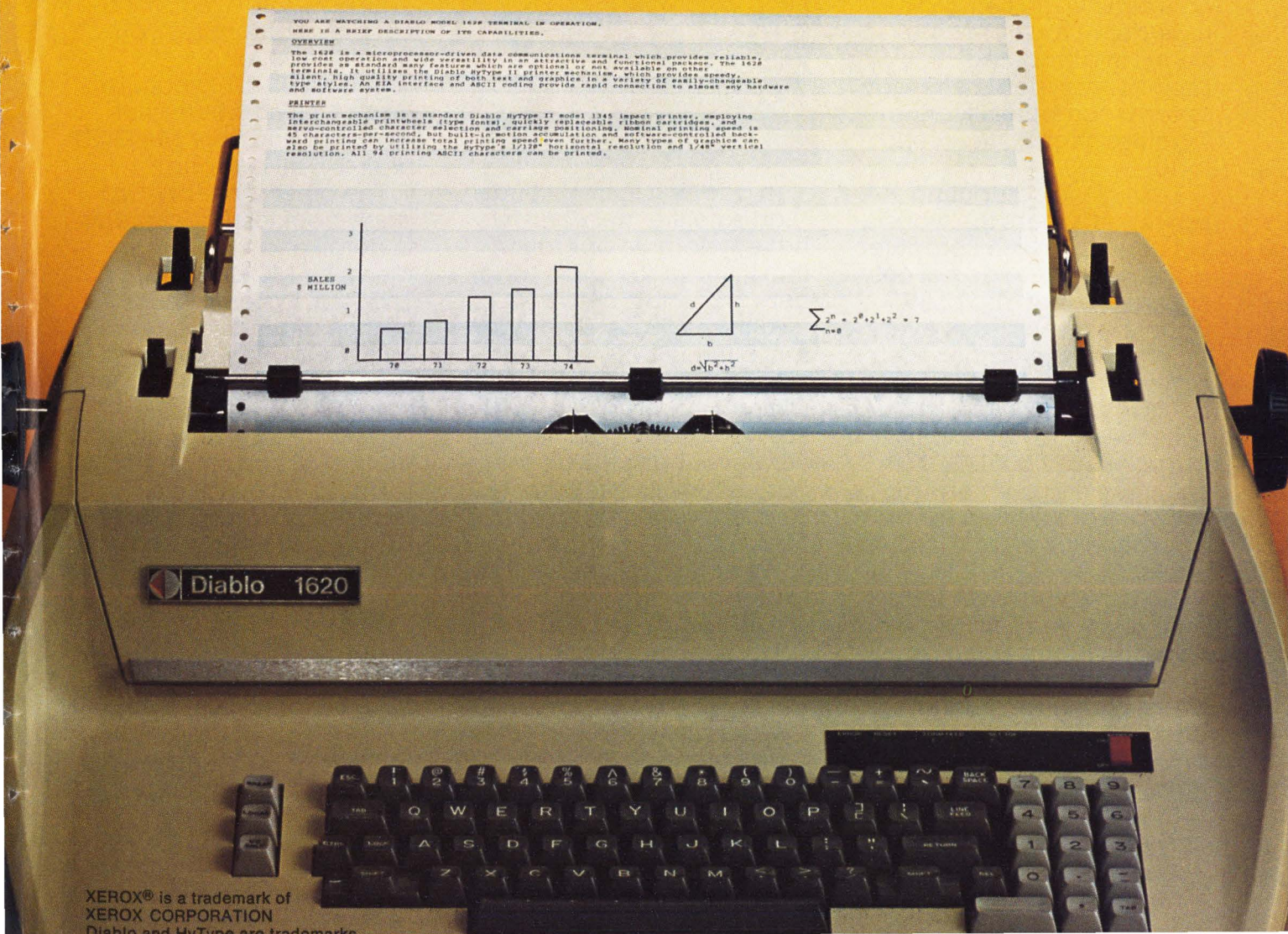
Fine print quality, graphics versatility and high speed tabbing.

We call it HyTerm and we've given it all the proven HyType reliability and maintenance ease. HyTerm is controlled by a microprocessor for speed, efficiency and versatility. It utilizes the new Diablo HyType II Printer mechanism noted for its typewriter print quality and speed. HyTerm is interface compatible to RS-232C and communicates in standard ASCII code. Both Receive Only (RO) and Send/Receive (KSR) models are available. All logic and circuitry, microprocessor, memory, and power supply are contained within the cover. Printer flexibility is maintained so software can initiate the mechanism's unique graphics performance, and its inherent high-speed horizontal and vertical tabbing and backwards printing capabilities. 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 Diablo Systems, Inc., 24500 Industrial Blvd., Hayward, California 94545, or Diablo Systems, S.A., Avenue de Fre 263, 1180 Brussels, Belgium.

Diablo

Diablo Systems, Incorporated
A Xerox Company

CIRCLE NO. 22 ON INQUIRY CARD



When it comes to computer networks, MODCOMP offers you a big advantage.

Experience.

At MODCOMP, we were pioneers in making the concept of resource-sharing computer networks a practical reality. The tieing together of multiple computers in distributed processing systems whereby several computers work together, sharing the work load.

Putting the computing power out where the work is, yet allowing each computer in the network to do not only its own job, but also draw upon the resources of every other computer in the system.

We developed MAXNET as a standardized operating system exclusively for this purpose. And MODCOMP systems using our network software have been in operation for more than two years.

We now have over forty network systems in the field, with another fifteen or so being readied for early delivery. Which means that we have more experience—both in length of time and in numbers of systems installed—than all our competitors combined.

In addition to traditional "host-satellite" networks, we have systems in operation that include so-called "ring" networks, "star" networks, and many more. The important thing is that you can link your computers together in any format you want. Provide each computer with whatever peripherals are best suited to your purpose. And leave the rest to MAXNET.

We figure the best way to give you an idea of what MAXNET can do is to give you some examples showing how other people are now using it.

We invite you to study these case histories. More important, we invite you to get in touch with us so you can get a first-hand look at how well they work. Which is a lot more convincing than just listening to us brag about them.

Meanwhile, we have a couple of brochures you should send for.

Our MAXNET brochure deals with computer networking, and how MAXNET makes it all happen.

The other is a thirty-two page booklet that explains in detail exactly what we mean by MODCOMP "TSP." The Total Systems Performance that has made MODCOMP first choice of many of the world's toughest computer buyers.

If you're into computers at all, the TSP brochure is "must" reading. If you're into resource-sharing networks (and if you're not, you soon will be), the MAXNET brochure is equally compulsory.

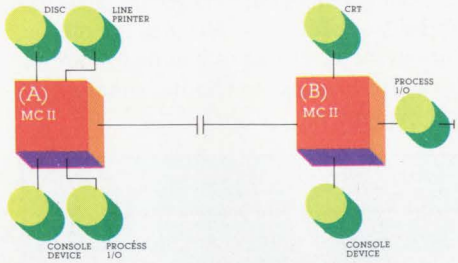
Write Modular Computer Systems, 1650 West McNab Road, Ft. Lauderdale, FL 33309. Phone (305) 974-1380.

European Headquarters:
Export House, Woking,
Surrey, England
Phone (04862) 71471

Case History No. 1
A giant aluminum company chose MODCOMP for this simple two-computer "network."
Computer A is at one of the Company's plants in Pennsylvania. Computer B at a research facility in Tennessee, several hundred miles away. The two computers communicate with each other over ordinary dial-up telephone lines. Using MAXNET, operators at either location have full access to all the resources of both computers. Data, programs, peripheral services can be freely exchanged.

For example, suppose a research engineer at Computer B needs to compile a new program. By a simple terminal request, he can call down language processors from Computer A, compile and edit his program on his own computer, and transmit his listing outputs back to Computer A for printing.

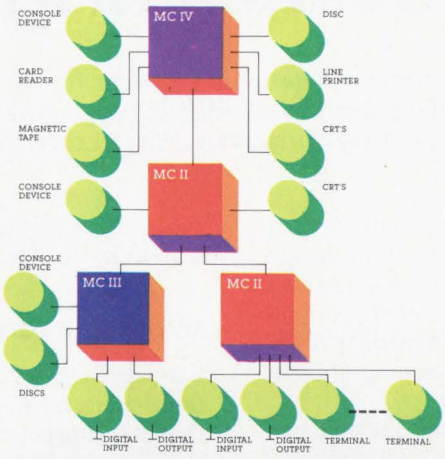
Alternatively, a programmer at Computer A can prepare a program and load it directly down to Computer B. Even though it's the break of day in Tennessee, and the computer is all alone in the office.



This relatively simple system illustrates the flexibility of MAXNET, whether the computers in your network are in adjoining rooms, or a thousand miles apart. It would work just as well if they were on different planets, but nobody's asked us to do that. Yet.

Case History No. 2
This MODCOMP Network is in operation at the central R&D facility of a major oil company. It's a good example of how MAXNET, coupled with across-the-board compatibility of MODCOMP hardware, allows you to start as small as you want to, and grow as big as you need to. Without a heavy initial investment. And without costly re-programming as your system expands.

It started, as part of a long-range plan, with the installation over two years ago of a MODCOMP III. Although this model has now been superseded in our line by later models of the MODCOMP II, it is indicative of the long-term compatibility of MODCOMP systems that the III remains today a vital part of this network.



As the system has since evolved, a 32-bit MODCOMP IV now acts as host computer. Replacing (at a fraction of the cost) the company's former stand alone IBM 1800, the MODCOMP IV is expected to provide 10 to 25 times the throughput of the big machine, which had long since reached its saturation point.

A MODCOMP II acts as communications controller between the host and satellite computers.

The satellites consist of 16-bit MODCOMP II's performing various data acquisition and control functions for a series of pilot plants. The MODCOMP III handles analytical instrumentation, providing simultaneous service to over 80 instruments of various types.

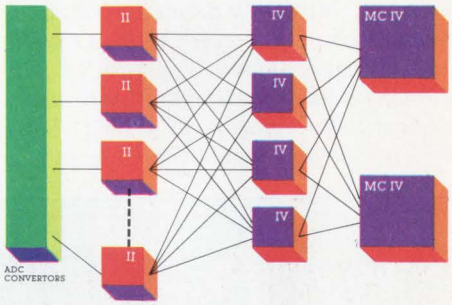
The advantages of this system are, firstly, it's computing power—many times that of the old stand-alone system. It's reliability (the MODCOMP system has had an overall availability of 99.3% of prime time over the past two years). It's expandability, which allows virtually unlimited future growth. And last, but far from least, it's economy and ease of operation.

Case History No. 3
A NASA prime contractor has installed this highly sophisticated MODCOMP hierarchical network to handle complex stress and fatigue test analyses.

Dual redundant 32-bit MODCOMP IV's at the "host" level communicate with an intermediate level of several smaller 32-bit MODCOMP IV's, screening data received from the satellite computers. A large number of 16-bit MODCOMP II satellites interface directly to the various processes. The entire system has built-in redundancy at each level.

Among minicomputer vendors, only MODCOMP has the capability to build a network of this size and complexity, using standard hardware and software products. At a small fraction of the cost for a single stand-alone computer large enough to perform the same multiple tasks. And with far greater efficiency.

It clearly illustrates the unlimited expandability of MAXNET in setting up any kind of network system you need to do your particular job.



For clarity, peripheral devices omitted from this diagram.

Note: The MAXNET systems shown here are all resource-sharing networks of the type commonly used in laboratory and industrial measurement and control systems. For dedicated telecommunications applications, MODCOMP offers a separate software system called MAXCOM. For more information, send for our Data Communications brochure.

A Mini-Micro Systems Staff Review

A Microprocessor-Based Packet-Switching System

After looking at minis, a network manager for 40 New England colleges and universities decided to use *micros* to build a packet switching message processor. Why? Lower cost, of course.

The sharing of information among colleges and universities is not new – it's been going on for centuries. Even the use of datacomm networks for such information sharing goes back a decade or more. But the New England Regional Computing Program (NERCOMP) is developing something *really new* in educational networks, and it's even an innovation in networking at large.

A not-for-profit corporation established for the purposes of institutional sharing and running a regional network, NERCOMP (Wellesley, MA) has maintained a line-switched, multipoint network since 1971. The frequency-division multiplexing system interconnects the computer facilities of seven New England colleges and universities and made these available to users on more than 30 campuses.

When NERCOMP decided to design a new network, one more efficient and error-free than the existing line-switched one, the consortium wanted a packet-switched arrangement, something like the Defense Department's ARPANET or the commercially available TELENET, but on a smaller scale. Packet switching would overcome some of the problems resulting from having to interface a variety of user terminals with a variety of host computer systems.

MINIS WERE TOO EXPENSIVE

But since network costs had to be kept very low for educational users, traditional minicomputer message switchers, although adequate, were too expensive for NERCOMP. (For example, TELENET's Prime minis cost about $40,000.) In fact, NERCOMP figured system costs (and hence the schools' usage costs) would be too high unless a message switcher could be delivered for $10,000 or less.

Three types of interfaces were needed for the network: synchronous, asynchronous, and host. The synchronous interface had to handle data transfers from message processor to message processor. NERCOMP called its message processor the NIMPH (Network Interface Message Processing Hosts). The asynchronous interface had to handle low-speed terminals, and the host interface had to handle communications to and from host computers.

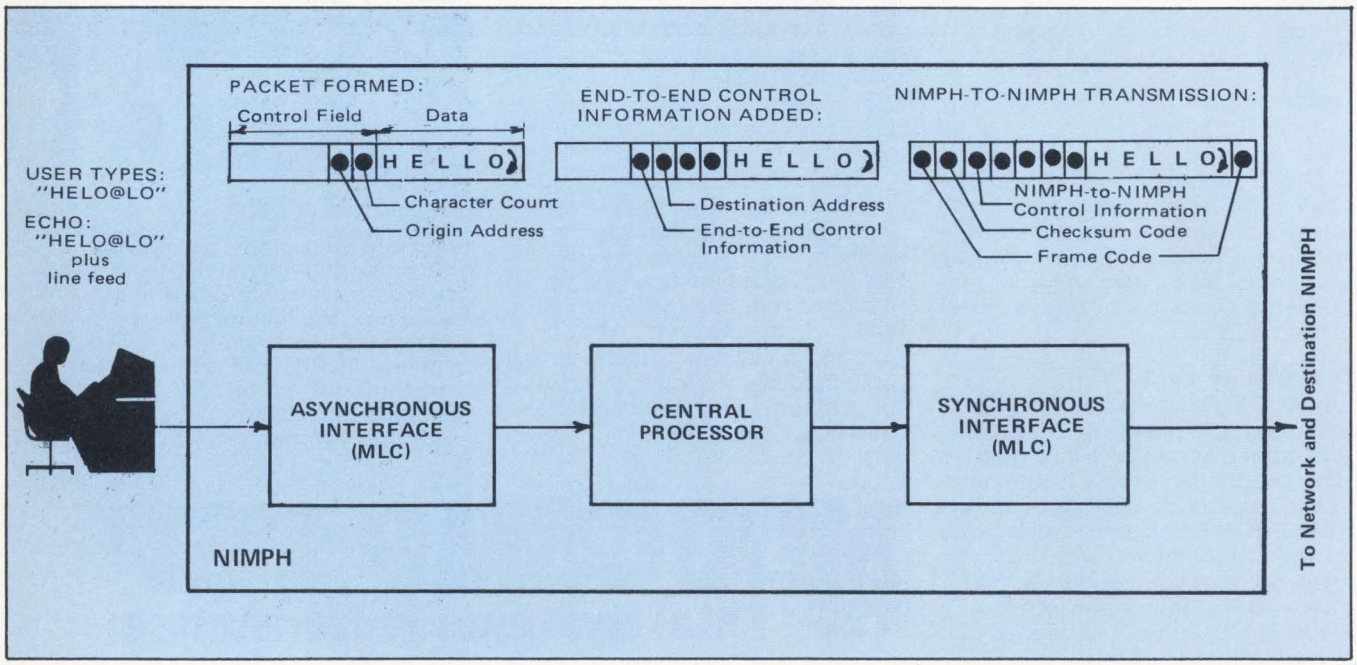
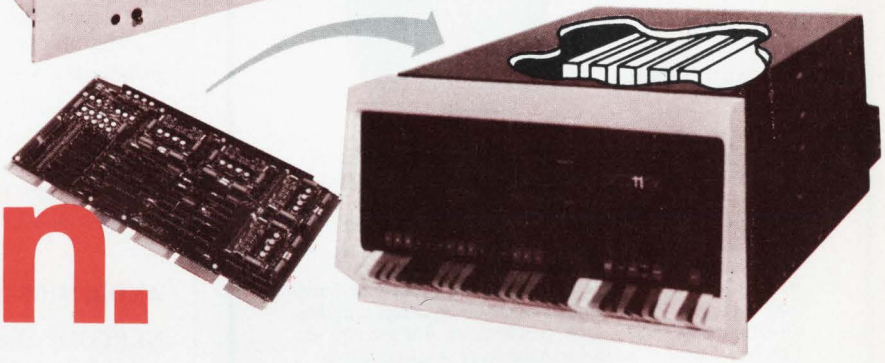


Fig. 1. **Message in Transit Through NIMPH.** *User types "HELLO" (with error and correction) at terminal. Local editing and echoing occur in the asynchronous interface. The central processor adds end-to-end control information, which regulates the flow of message packets through the entire network. The synchronous interface adds NIMPH-to-NIMPH control information. Addresses include NIMPH number (unique for each node in the network) and port number. Control information would include a packet sequence number and provision for acknowledging previous packets on a NIMPH-to-NIMPH or end-to-end basis.*

Add-on.

See us at NCC Booths 1117-1119



Add-in.

Mini-Memory. From Dataram.

Either way, you get more memory, more throughput, more performance.

Everything but more cost.

If you're looking for a way to get more from your minicomputer without putting too much more into it, our family of ADD-ON/ADD-IN mini-memories adds up to the right answer for you.

We're Dataram Corporation, and as the only company dedicated exclusively to core memory products, we make all of our own core, sell raw core to the outside market, string in high volume in three offshore locations, supply stacks to minicomputer manufacturers, maintain our own extensive manufacturing capability, and market a complete line of systems.

Including our new, expanded family of ADD-ON/ADD-IN systems that's ready to go to work for your minicomputer:

Data General	DEC	Varian	Interdata
Nova 830	PDP-8/A	620/f	Model 50
Nova 1200	PDP-8/E	620/i	Model 55
Nova 1210	PDP-8/F	620/L	Model 70
Nova 1220	PDP-8/M	620/L-100	Model 74
Nova 1230	PDP-11/05	622/i	7/16
Nova 2/4	PDP-11/10	V-71	7/32
Nova 2/10	PDP-11/15	V-72	8/32
Nova 3/4	PDP-11/20	V-73	
Nova 3/12	PDP-11/35	V-74	DCC
	PDP-11/40	V-75	116
	PDP-11/45		116E

Whether you're adding it on or in, Dataram will meet your mini-memory requirements with new, reliable 16K single-board design that delivers the performance you want, and saves you money while doing it. Find out more—return this coupon at once, or call us at 609-799-0071.

I'd like more answers about mini-memories for my _____ minicomputer.

☐ Please send information.
☐ Please have a salesman contact me.

Name _____

Title _____ Phone _____

Company _____

Address _____

City _____ State _____ Zip _____

DATARAM CORPORATION
PRINCETON-HIGHTSTOWN ROAD
CRANBURY, NEW JERSEY 08512
TEL:609-799-0071 TWX:510-685-2542

UNITED KINGDOM & IRELAND, GMT Electronic Systems Ltd., Epsom, Surrey, England, Tel. Epsom 20641/**FRANCE,** Munzig International, S.A.R.L., Rungis, France, Tel. 686 1473
WEST GERMANY, O.E.M.-Elektronik GmbH, Stuttgart, West Germany, Tel. 0711-478683/**BENELUX COUNTRIES,** Synelec Information Systems, Brussels, Belgium, (02) 647-67-12
SCANDINAVIA, Munzig International, Vallentuna, Sweden, Tel. 0762-27102/**SWITZERLAND,** Interest AG, Bern, Switzerland, Tel. 031/224481
SPAIN, Aupoca, Madrid, Spain, Tel. 457 53 12/**ISRAEL,** K.D.M. Electronics Ltd., Tel Aviv, Israel, Tel. 58232
INDIA, Industrial Electronic Instruments, Ahmedabad, India, Tel. 79281/**JAPAN,** Matsushita Electric Trading Co., Ltd., Osaka, Japan
AUSTRALIA & NEW ZEALAND, Anderson Digital Electronics Pty. Ltd., Mt. Waverley, Victoria, Australia, Tel. (03) 543-2077

CIRCLE NO. 23 ON INQUIRY CARD

Since these interfaces if supplied by the minimakers would push the cost of the system well above $10,000, NERCOMP's project engineers decided to build their own interfaces using microprocessors.

SO A MICRO-BASED INTERFACE

NERCOMP's engineers decided that a micro-based general purpose multiport serial interface might be the answer to the problem. Dubbed the Multiline Controller (MLC) by NERCOMP, it was made compatible with the Digital Equipment Corp. PDP-11/05 – 45 series and the recently introduced LSI-11. NERCOMP's engineers took into account that the LSI-11 executes PDP-11 code (with minor revisions), but has a multiplexed bus structure compared to the PDP-11's fully parallel Unibus, which features separate address and data buses.

The MLC has 12 programmable asynchronous or synchronous ports. An internal clock permits all standard transmission rates (75 to 9600 bits per second) and there are provisions for an external clock. Now undergoing final evaluation tests, the MLC has resulted in substantial savings for NERCOMP. The company estimates the equivalent hardware from DEC would cost $25,000 compared to the MLC's price of $5000.

AND A MICRO-BASED NIMPH

NERCOMP chose microprocessors for its interfaces because of their low cost and a need for the flexibility inherent in a programmable device. A serendipitous benefit was that because so many of the message processing functions could be handled by the intelligent MLC interfaces, a minicomputer was no longer needed to control the NIMPH. So an LSI-11 could be used there also.

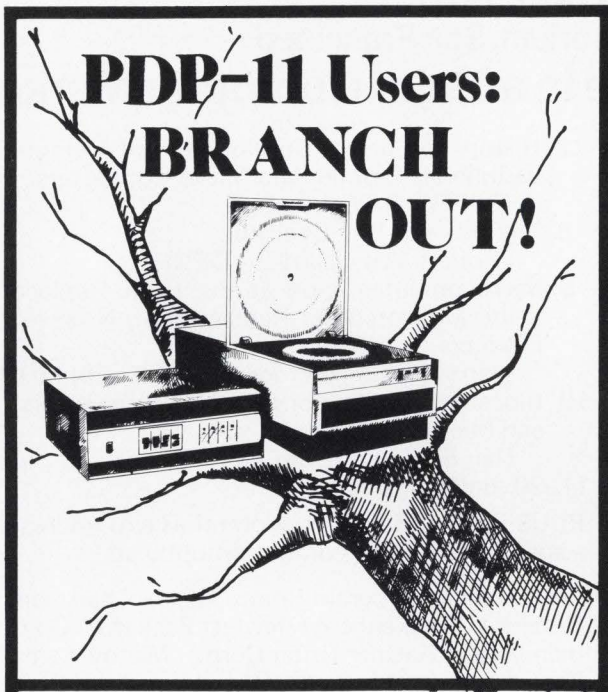
NETWORK RUNTHROUGH

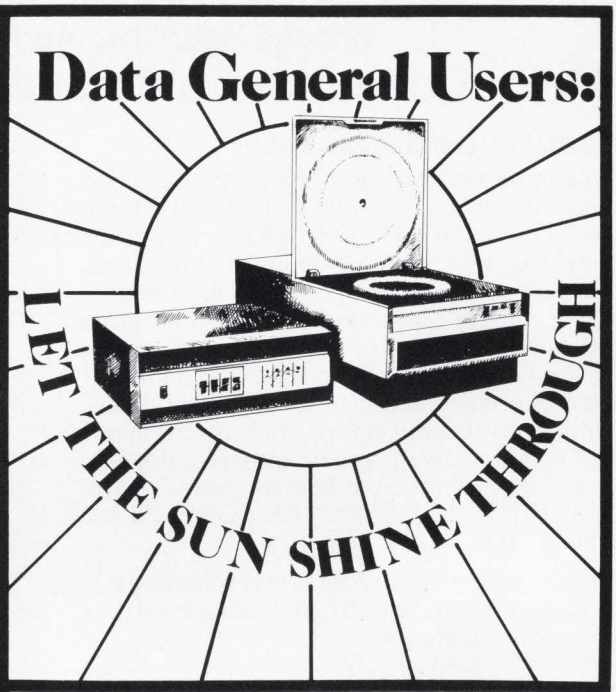
Transmitted from a user terminal as shown in Fig. 1, the message enters the asynchronous interface, which can handle a total of 11 user terminals simultaneously. The interface recognizes the speed of each device, converts from the terminal's code to a system-standard code, edits and assembles the data and transfers it to a central memory at up to 132 characters per transfer (one line of data). The synchronous interface maintains the trunk line status, transmits and receives messages from three or more full-duplex, 9600-bps lines, validates checksum computations to verify transmission and maintains line protocol.

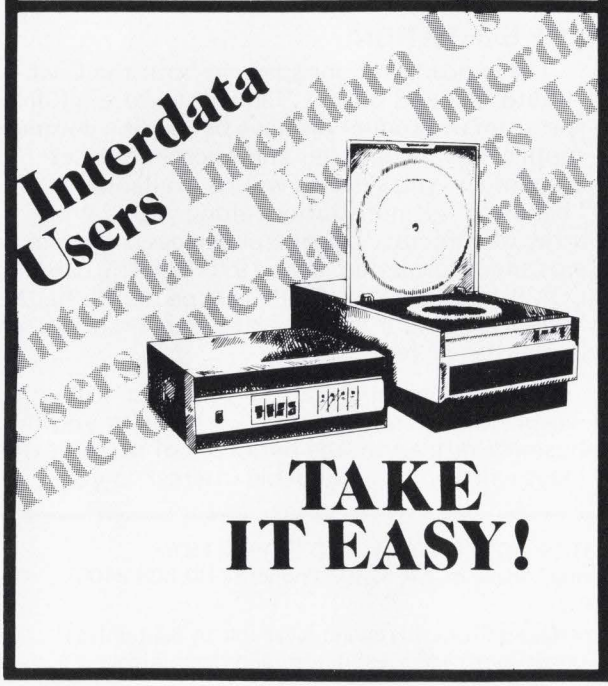
The host interface handles direct transmission to computers by simulating a plug-compatible controller. Other special interfaces for printers, card readers, or any other peripheral can be attached to the NIMPH as long as the interface handles all the functions required to allow the central micro and the synchronous interface to transfer the data. All that is required is that the user have permission to use the NIMPH and that the proper address for the computer was specified.

The NIMPH passed its initial development stage several months ago, and a working prototype now exists based on the LSI-11. NERCOMP would now like to interest other networking organizations in considering such a microprocessor system. While the NIMPH shows considerable promise, it's going to take more development before its full benefits are realized. NERCOMP's NIMPH should have considerable impact as the first message processing system based entirely on LSI technology. ■

DIVA DD-50 Series







The DIVA DD-50 series disc systems allow your DEC, Data General, Interdata or other mainframe minicomputer to operate 30% faster with better usage of your storage capacity for greater system flexibility.

For only $16,000.00, the DD-52 disc system offers you 54.7 M bytes of unformatted data storage with full operating system software transparency.

The DD-50 Series: members of the DIVA family of mass storage disc systems offering MAXI technology at a MINI price!

VISIT DIVA at the NCC-booth 2701!

DIVA

DIVA, INC.
607 Industrial Way West, Eatontown, N.J. 07724
(201) 544-9000 or 800-631-2141

BIG technology ...for the mini user!

CIRCLE NO. 26 ON INQUIRY CARD

Mini/Micro

COMPUTER CONFERENCE AND EXPOSITION

October 19-20-21, 1976
Brooks Hall/Civic Auditorium, San Francisco

A Major Computer Conference in a Major Computer Market

THE CONFERENCE PROGRAM:

Minicomputers and microcomputers--low cost and versatile--are putting convenient and effective computer power at our fingertips in a vast array of products that will affect every facet of our lives, making minis and micros the fastest growing segment of today's and tomorrow's data processing industry. Designed into systems ranging from traffic lights and numerical control, to paint mixers and kitchen appliances, they offer a new versatility and striking competitive advantages in the end products. We'll examine these aspects--and much more--in the conference rooms at the 1976 MINI/MICRO COMPUTER CONFERENCE & EXPOSITION.

Approximately twenty sessions consisting of eighty papers covering both application and design topics are planned.

Some session titles (and organizers) to date would include:

1. Distributed Processing with Minis.
   (Dan Zatyko - General Automation)
2. Military Applications for Microcomputers.
   (Joe Genna - Delco Electronics)
3. The Effect of LSI Technology on Memory Systems.
   (Dan Bowers - Bowers Engineering)
4. Interfacing the Analog World to Minis/Micros.
   (Larry Brown - Calex)
5. Integrating OEM Peripherals into Computer Systems for End-use.
   (Martin Himmelfarb - Digital Design)
6. Microcomputer Software and Hardware Development Aids.
   (Dave Millet - NEC Microcomputers)
7. History to Current Development of Memory Peripherals for Mini and Micro Computers.
   (Bill Frank - Cal Comp)
8. The Make or Buy Decision.
   (Robert Van Naarden - DEC)
9. Microcomputer Applications; Logic Replacement; Minicomputer Replacement, New Products.
   (Jerry Ogdin - Microcomputer Techniques)
10. Industrial Applications for Microcomputers and Microcontrollers.
    (Ian Ebel - Control Logic)

11.-20. Being organized.

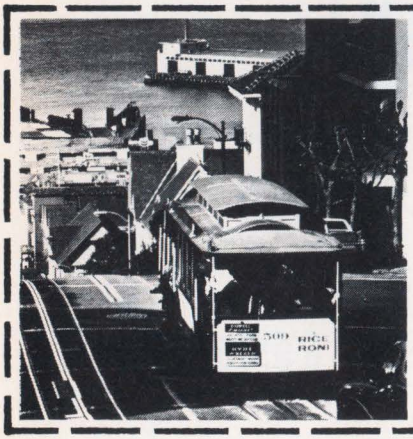
PLUS . . . tutorial sessions on minis and micros and a special session for computer hobbyists!

Conference Program Committee — Chairman: Robert J. Frankenberg (Hewlett Packard); Co-Chairmen: Justin Rattner (Intel Corp.); Manny Lemas (Microcomputer Associates).

THE EXPOSITION:

The exposition floor space in both the Civic Auditorium and Brooks Hall will feature a full spectrum of product displays by leading computer suppliers. Minicomputer and microcomputer systems and sub-systems will be available for "hands-on" demonstration, along with a wide array of computer peripheral devices, software aids and information. This 1976 MINI/MICRO COMPUTER EXPOSITION is expected to be the largest such event in the greater San Francisco area in almost ten years.

If you design mini-micro computers, sub-systems, peripherals, or components, use them in your business--or plan to--the hundreds of product displays will also be of valuable interest to you.



To: MINI/MICRO COMPUTER CONFERENCE AND EXPOSITION
5544 E. La Palma Avenue, Anaheim, CA 92807 Phone: (714) 528-2400

My Primary Interest Is:

☐ **Attending.** Please send me a Preview Program (available in September) listing information on sessions/papers, exhibitors, and containing a complimentary registration form.

☐ **Exhibiting.** Please send a copy of the Exhibit Prospectus.

Name_____

Title_____

Company_____

Address_____ M/S _____

City_____ State _____ Zip _____

Sponsored by: MINICOMPUTER INDUSTRY NATIONAL INTERCHANGE (MINI)

The Intelligent Buy!

Ontel $1795

The remarkable Ontel OP-1 series...
Priced from $1,795...
User programmable...
Modular structure...
Up to 64K of memory...
Designed for field upgrade of features...
Cluster or stand-alone configurations...
Up to three microprocessors...
Easily programmed...
Full range of communications controllers and peripheral interfaces...
Application packages include: word processing, text editing, forms generation...
Unequaled flexibility, versatility and dependability...
Contact me today for complete information...

Frank A. Kirby
Vice-President—Marketing

Ontel Corporation

3 Fairchild Court
Plainview, NY 11803
(516) 822-7800

CIRCLE NO. 28 ON INQUIRY CARD

DAN M. BOWERS / Technical Editor

minicomputers

Part 1 — History and Market Outlook

The minicomputer was born in the early 1960s out of the then burgeoning custom systems business. The custom systems business, in turn, was born from the need and desire to computerize functions which could not be handled by the existing generation of computing equipment, exemplified on the low end by the IBM 1401 and the NCR 315. These were slow, memory limited (16K) machines in the above $100K price class, with no input-output capability beyond their own limited peripherals — mainly magnetic tape — and no real-time capability. Two dozen companies, utilizing digital logic modules made from transistors and discrete components, custom-designed wired-logic systems for those applications such as process control and data acquisition.

The increasing requirements of the custom systems business, both in number of applications and in complexity of the systems required, strained both the supply and the talents of the engineers in that business, and the capabilities of the technology. Out of this need came a mass producible, flexible, programmable, I/O-oriented central logic unit which could be used on many different kinds of applications: thus the minicomputer.

THE FIRST COMMERCIALLY AVAILABLE MINI. *The PDP-5 was introduced in September, 1963. It was the first 12-bit mini (the PDP-8 was a very similar mass-produced version). Selling price was about $25,000.*

This wonderous new system was immediately seized upon by systems houses, users, and the minicomputer manufacturers themselves, and used to solve problems extending in every conceivable vertical and horizontal direction. The minicomputer made possible small scale business processors, extending computerization to organizations which previously were restricted to the sharing of time on a large computer, the processing of their data by a service bureau which possessed a large computer or manual and semi-manual methods. Small scale business computers ultimately ranged from the level of electronic accounting machines, up to systems which were more powerful, and in many cases also more expensive, than the 1401 and the 315 of the earlier generation.

In the non-business area, minicomputers were used to control scientific experiments, to upgrade the intelligence and control the operation of a wide variety of instruments and data collection operations, for the control of manufacturing processes, the allocation of inventory, for the control of word processing systems, and all of the applications which previously were the province of custom-designed systems.

THE LARGEST FROM DG. *The business-oriented Eclipse C/300 features microprogrammed architecture. Now with Cobol, Eclipse C/300 prices are in the $100,000 range.*

For the user who wished to implement his own system using a purchased minicomputer (a substantial segment of the market lies in this direction), the manufacturers' offerings began to come with fewer and fewer frills. The ultimate in this direction is the "stripped mini" which consists of only the bare-essential components required to perform the normal functions of the central processor, and sells in the under $1000 class.

Concurrent with this proliferation of the minicomputer industry, the semiconductor people were continuing to improve their product through better yields from their manufacturing processes, and through the ability to put more functions onto a single chip, thereby reducing the prices per logic function from the $10 range of the early integrated circuits to the less than $.10 range of current integrated circuits, and the $.01 range of large scale integration. In 1973 we began to see primitive arithmetic units and logic units on a chip, and we also began to see systems manufacturers taking advantage of these units to introduce terminals and other devices with greatly increased intelligence at greatly reduced prices. By 1975 the true microprocessor

Varian Introduces The V76 It Remembers Time Is Money

The increasing demands of information processing obviously increases your computer time. And time is money. The V76 is a general purpose, microprogrammed computer system for scientific, industrial and data communications application. It outperforms the high class minicomputers such as the PDP-11/70, ECLIPSE, or the HP-3000.

You save money because of the new low cost 64K memory. The dual-ported semiconductor MOS 660ns memory provides the same performance as an identically configured core memory for one-third the price, or less than seven cents a byte.

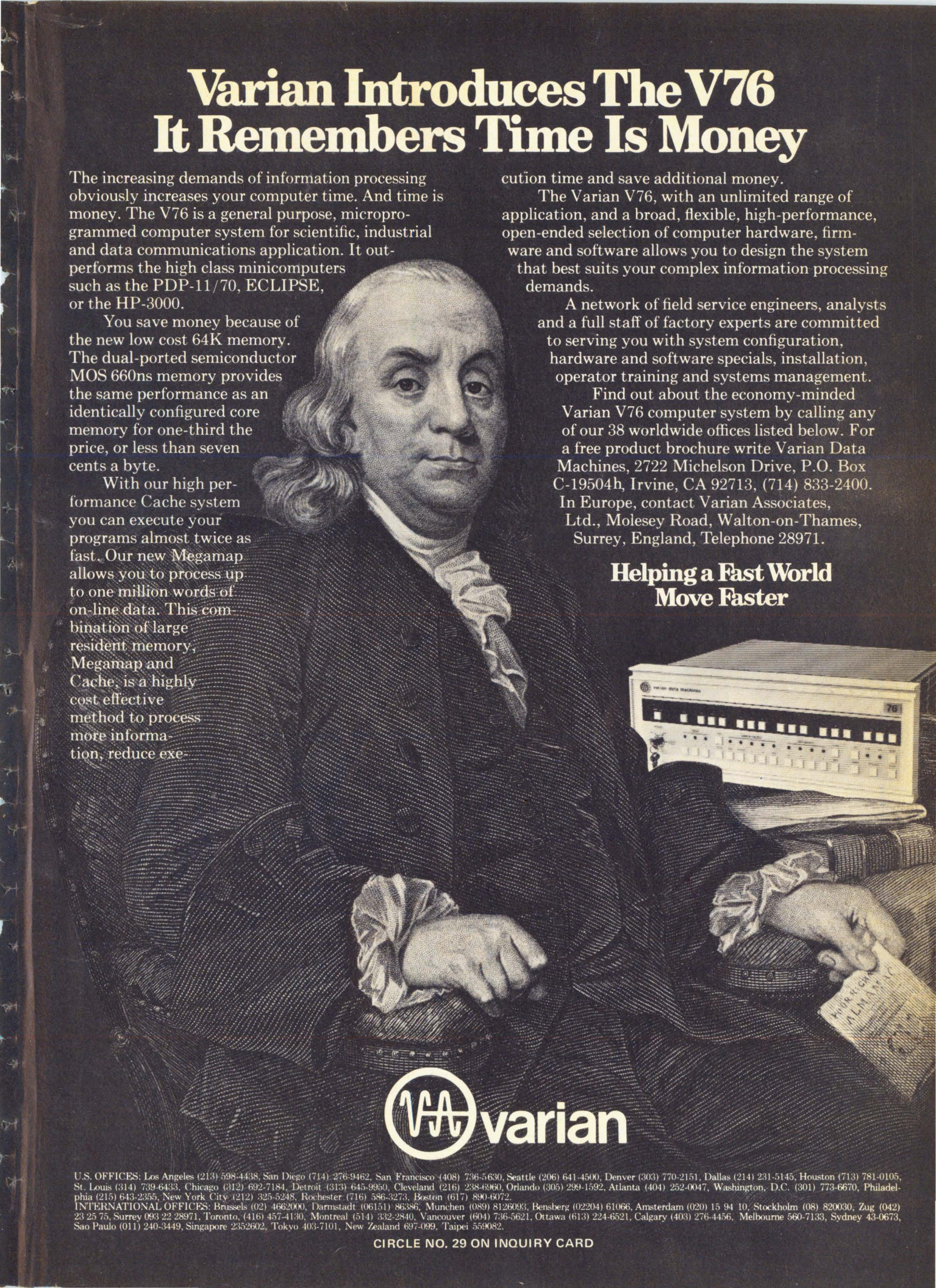
With our high performance Cache system you can execute your programs almost twice as fast. Our new Megamap allows you to process up to one million words of on-line data. This combination of large resident memory, Megamap and Cache, is a highly cost effective method to process more information, reduce execution time and save additional money.

The Varian V76, with an unlimited range of application, and a broad, flexible, high-performance, open-ended selection of computer hardware, firmware and software allows you to design the system that best suits your complex information processing demands.

A network of field service engineers, analysts and a full staff of factory experts are committed to serving you with system configuration, hardware and software specials, installation, operator training and systems management.

Find out about the economy-minded Varian V76 computer system by calling any of our 38 worldwide offices listed below. For a free product brochure write Varian Data Machines, 2722 Michelson Drive, P.O. Box C-19504h, Irvine, CA 92713, (714) 833-2400. In Europe, contact Varian Associates, Ltd., Molesey Road, Walton-on-Thames, Surrey, England, Telephone 28971.

Helping a Fast World Move Faster



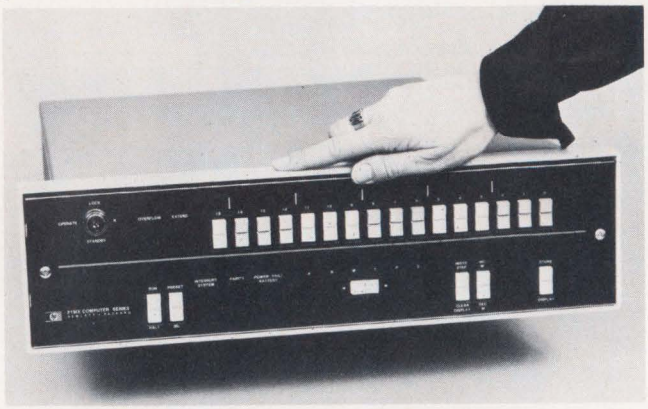
varian

U.S. OFFICES: Los Angeles (213) 598-4438, San Diego (714) 276-9462, San Francisco (408) 736-5630, Seattle (206) 641-4500, Denver (303) 770-2151, Dallas (214) 231-5145, Houston (713) 781-0105, St. Louis (314) 739-6433, Chicago (312) 692-7184, Detroit (313) 645-9950, Cleveland (216) 238-6960, Orlando (305) 299-1592, Atlanta (404) 252-0047, Washington, D.C. (301) 773-6670, Philadelphia (215) 643-2355, New York City (212) 325-5248, Rochester (716) 586-3273, Boston (617) 890-6072.
INTERNATIONAL OFFICES: Brussels (02) 4662000, Darmstadt (06151) 86386, Munchen (089) 8126093, Bensberg (02204) 61066, Amsterdam (020) 15 94 10, Stockholm (08) 820030, Zug (042) 23 25 75, Surrey 093 22 28971, Toronto, (416) 457-4130, Montreal (514) 332-2840, Vancouver (604) 736-5621, Ottawa (613) 224-6521, Calgary (403) 276-4456, Melbourne 560-7133, Sydney 43-0673, Sao Paulo (011) 240-3449, Singapore 2352602, Tokyo 403-7101, New Zealand 697-099, Taipei 559082.

CIRCLE NO. 29 ON INQUIRY CARD

had been introduced, and it was apparent that the industry was facing a revolution of the same magnitude as it had experienced in the early 1950s.

In our Technology Profile on Microprocessors and Microcomputers, January and February of 1975, we predicted that an entirely new set of hardware was about to be presented to us, and that the old software, systems, procedures, etc., were about to become obsolete. Further, we predicted that there would be more business opportunities in the 1975-1977 period than at any time since the 1960s. Nowhere is the effect of this revolution more apparent than in the minicomputer business. Stripped minis in the $1000 range were suddenly confronted with full scale microcomputers in the $500 range.



THE SMALLEST FROM H-P. *The 21MX for both end users and OEMs sells for $5500 with 4K-word MOS memory.*

In this Technology Profile on Minicomputers, which is appearing concurrently with our Systems On a Chip series, we are exploring the present state of the minimicro world, and attempting to prognosticate the future of the minimicro industry. Our *1976 Minicomputer-Microprocessor Market Survey* provides us with some indications of the intentions of buyers towards this equipment in the next 12 months.

GROWTH OF THE MARKET

In 1972, when this publication conducted its first annual survey of the minicomputer market, 1680 respondents reported that they had over 9000 minicomputers; this year the 1976 survey accounted for 10,511 respondents, claiming over 39,000 minicomputers in place.

Respondents in 1972 indicated that they would purchase over 8000 minis during that year in contrast to over 28,000 minis indicated by this year's respondents. Our estimate of the worldwide installed base of U.S.-manufactured minicomputers was 32,000 in 1972 – the 1976 estimate is 190,000.

It is interesting to note that the 1972 survey revealed 42 minicomputer manufacturers; in 1976 the number had dropped to 36. Departed vendors are General Electric, XDS, Redcor, Foto-Mem, SCC, BIT and Datamate. Prime Computer is the only new entry over this timeframe.

Other highlights from the 1976 report (see page 80 for full description and ordering information) indicated that an increase of nearly 40 percent can be expected in minicomputer shipments in 1976. Also, more than half of the survey respondents expected to maintain or increase their expenditures for minicomputers in 1977 while only 10 percent anticipated lower outlays and 35 percent were uncertain as to their spending plans for 1977.

Next month, Part 2 of this Product Profile will summarize the product offerings of all the major minicomputer manufacturers. ■

faster, low-cost mass storage

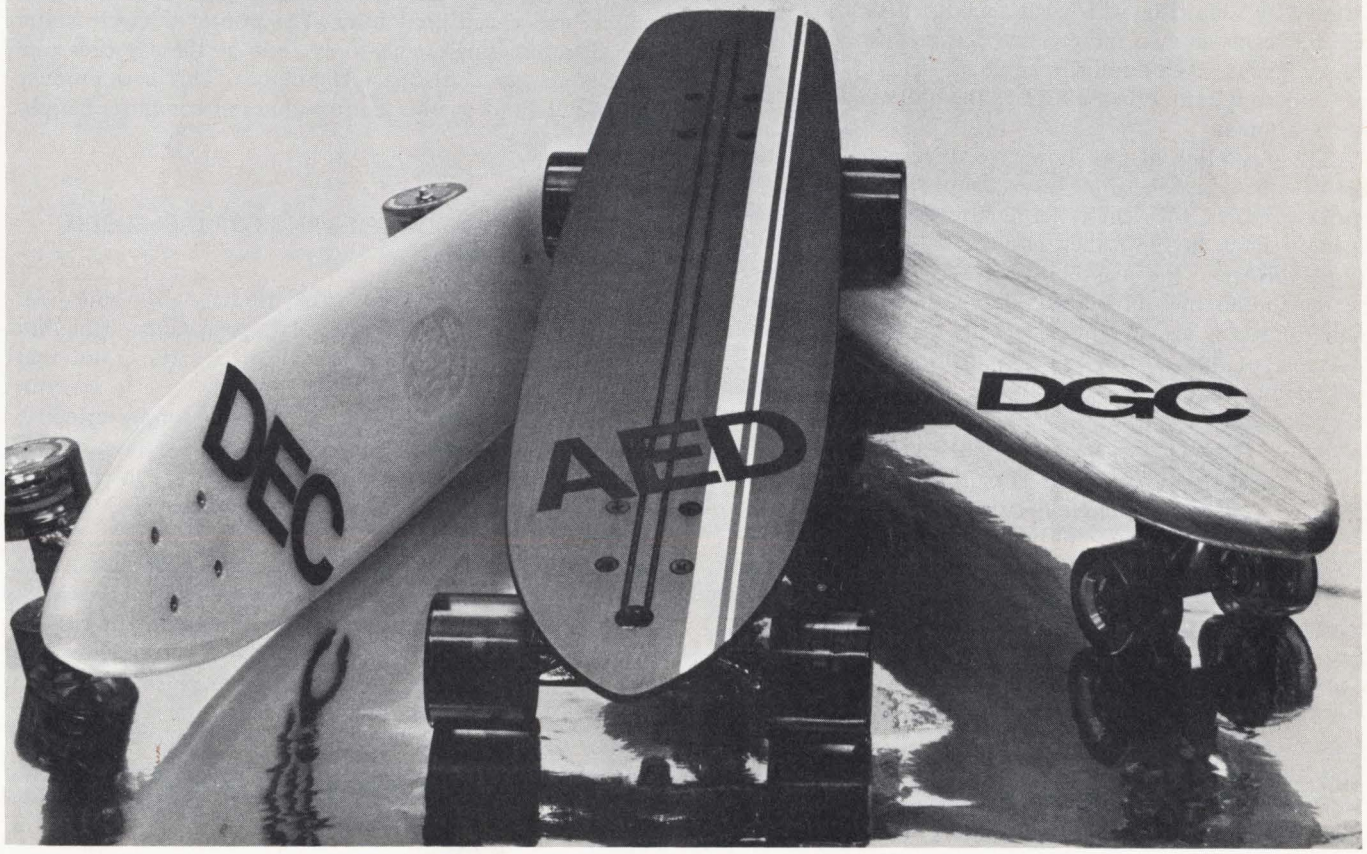
Here is some very persuasive copy about the new AED 8000 mass storage μcontroller for PDP-11 and NOVA/ECLIPSE large disk systems:

Characteristic	AED 8000	RP11-C/RPO3	4231/4331A
Quantity 1 price	$17,500	$33,000	$30,000
Megabytes per drive	67.4→250	40	92
No. of drives per controller	1→15	8	4
Megabytes per controller	540→3,800	320	368
No. of CPUs per controller	4	1	2
16 bit transfer rate	1.6 μs.	6.4 μs.	2.5 μs.
16 bit buffer	256	6	8
Error Correction Code	by controller	none	none
Bootstrap	IPL in controller	CPU ROM	CPU ROM
Micro-processor	40 ns. 24 bits	none	none
· Emulates DEC/DGC controllers	yes	–	–
· Macro Instruction Code	yes	none	none
· Data Scanning & Management	in controller*	in CPU	in CPU
· Variable Sector Length	yes	none	none
· CPU to CPU transfers	bypass the disk	none	via disk
Delivery	60 days	ask them	ask them

*With extra microcode.

ADVANCED ELECTRONICS DESIGN, INC. 754 N. Pastoria St., Sunnyvale, Calif. 94086.
Telephones: (408) 733-3555 and (213) 889-6312 Telex: 357489

European Representatives: ORTEC–France 283-12-56, Germany 089/987173, Italy 738-6294; UK: DICOLL 256-61551.



CIRCLE NO. 32 ON INQUIRY CARD

DAN M. BOWERS / Technical Editor

Travels in Texas

A number of years ago we said that the future power in the computer business would come not from systems houses, not from the peripheral houses, not from the minicomputer vendors, but from a vertically-integrated company with strong capability in LSI semiconductor technology, a full capability in computer systems, an aggressive and knowledgeable marketing force, and solid financial resources. We pinpointed Texas Instruments, Motorola, and Intel as the likeliest comers. Based on observations at a number of TI (not to be confused with the airline of the same initials) facilities in Texas, our opinion is reenforced.

TI MAKES ITS MOVE

Under the broad umbrella of its Digital Systems Division, TI offers a complete line of their silent 700 keyboard printer terminals, ranging from a full programmable version with twin cassette tapes and microcomputer control, down to the new offering of a $1995 portable version, also microcomputer (TMS 8080) controlled, which weighs only 13 lbs. (We are reminded of the first "portable" computer terminal offered by Vernitron, which was a modified Teletype Model 33 and came in two rather large suitcases, *each* weighing about 35 lbs.) TI's terminal people are sold on the concept of hard copy rather than a CRT as the proper configuration for a terminal.

TI's marketing figures show present terminal users to be about equally divided three ways, among time sharing, computer consoles, and remote terminals with a slightly smaller market share. In 1980, they project that the three applications will share the market equally. Significantly, TI sees a tremendous multiplying of remote, and especially portable, terminals over the next 5 years, and they see the importance of time sharing as a terminal market dramatically decreasing. Real estate and insurance are two areas in which they see order-of-magnitude levels of growth in the use of computer terminals, especially portable versions.

In the larger systems area, TI markets the EXS Data Exchange System, a communications-oriented distributed processing system using multiple TI minicomputers and the usual variety of tape decks, disks, printers, etc. Properly marketed, this system could solve the data processing problems of many users who now look only to the large business systems companies (IBM and whatever dwarfs are left). Not well known also is the fact that TI builds one of the largest, fastest and most powerful digital computers, the ASC (Advanced Scientific Computer), which is of the class that only Uncle Sam can afford.

Over in Austin, TI is gearing up for a major push of its 990 family of mini/micro computers, ranging from the 9900 microprocessor chip, up through a microcomputer that includes the 9900 plus 8K bytes of RAM for $512.00, to the 990/10 TTL minicomputer, a complete and software-compatible range of equipment. One gets the impression they learned the business on the 960 and 980 minicomputers and are now prepared to become *a* (perhaps *the*) major power in the mini/micro business.

HOUSTON INSTRUMENTS ACHIEVES A BREAKTHROUGH

"Breakthrough" is a term often used and seldom deserved in our industry. Houston Instruments (which despite its name is located in Austin, having survived a city-to-city move with virtually no loss in personnel) is offering a 2400 lines-per-minute printer which sells for $3000. We call that a breakthrough. The printer uses technology which has long made Houston a leader in the plotting business, combined with some considerable simplification of the paper drive (a stepper drive using no gears or servoloops), and a unique, simple, and cheap print head. The printer is electrostatic and therefore single copy only, but at these speeds one expects to use non-impact techniques. This new product should put Houston into the front lines of computer peripheral marketing.

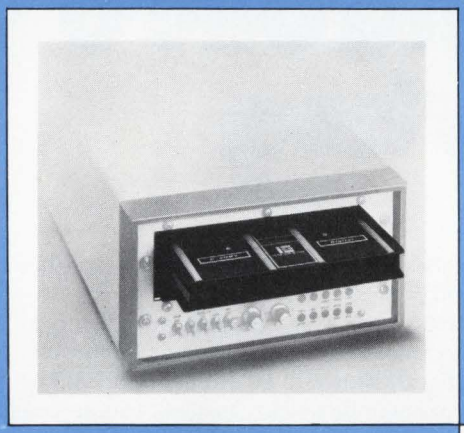
DATAPOINT FLYS ON THE WINGS OF DISPERSED DATA PROCESSING

Another technology whose virtues we have proclaimed for years is distributed or dispersed data processing. Datapoint is running at a $50M clip, providing dramatic proof that this philosophy for computing is not only here to stay but is paying off handsomely for those who supply effective equipment and market it well. Datapoint's time sharing system, Datashare, is notable to the eye for its absence of a processor in the conventional sense. Somewhere in the terminal (or is it the printer, or is it the communications box or do we really care?) sufficient processing power exists to make this business-oriented system apparently very useful. The clientele for their processor systems and intelligent terminals is, in fact, sufficiently large that a nerve center of a half-dozen people is staffed around the clock to provide online maintenance and service advice.

One observation graphically demonstrates a primary reason for Datapoint's success with this user-oriented system; their software catalog runs 75 pages; their equipment catalog runs 28. ■

The most significant concept in tape handling since the open reel

EMERSON'S NEW TAPE PAC® SYSTEM



Model 2005 Tape Drive

A small package with a big capability. You'll get an operating speed of 25 ips and a search speed of 240 ips. 7 or 9 track NRZI (200/556/800 bpi) or 9 track PE (1600 bpi) bi-directional recording. Or a special serial recording format at 3200 bpi.

No reel motors or servos. A dual differential capstan drive. No significant tension or stress variations are imposed on the tape as it's spooled.

Plug-to-plug compatibility with tape drives using industry-compatible NRZI or PE formatters. Easy installation, operation and maintenance.

And you'll get a price that makes the Model 2005 the most attractive tape drive on the market.

Model 2004 Tape Pac®

The first pack to totally protect tape from the environment. A standard Tape Pac® has 600 feet of ½-inch, 1.0 mil magnetic tape. It's capable of handling 0.5 mil tape (1000 feet) with the same guaranteed reliability, increasing data capacity by more than 60%.

Spring-loaded "dust doors" close when the pack is removed from a drive, providing complete media protection. Integral tape guides completely eliminate oxide contact. And the tape is stored in a reel-to-reel configuration on flangeless reels mounted on bearings in the pack.

Add a simple design, controlled tape path and precise pack-to-head positioning.

Result:

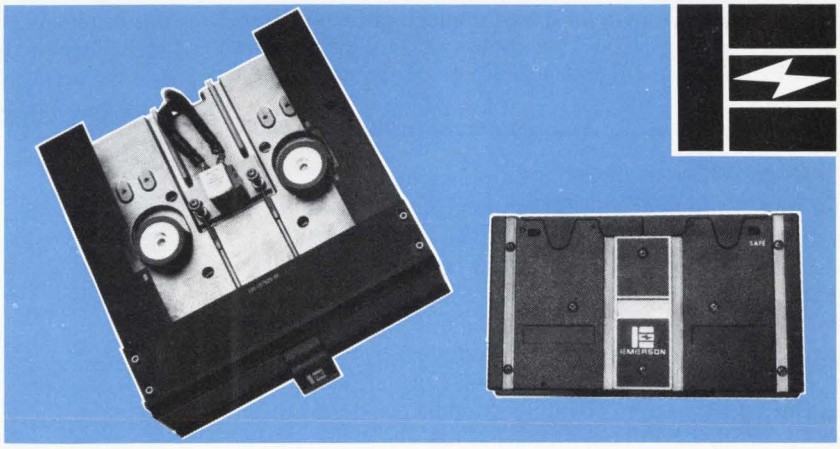
The most significant, innovative concept in tape handling since the open reel. All from Emerson... a quality name in tape technology.

For more about the Tape Pac® System, call Ron Carroll, Marketing Manager, (714) 545-5581. Or write Emerson Electric Co., ICD, 3300 S. Standard St., P.O. Box 1679, Santa Ana, Ca. 92702.

We've pioneered tape handling concepts for military and instrumentation applications for more than 15 years. Now we're applying our technology to the commercial tape market. For applications like source data entry, data communication terminal networks, and mini-computer or microprocessor systems.

Our 2000 Series Tape Pac® System features a tape drive that offers greater performance and reliability than open reel, cartridge and cassette drives. It's as small as a diskette drive but has 50 times more capacity. And our Tape Pac® uses ½-inch computer-compatible magnetic tape that can work in virtually any environment.

You'll find the new 2000 Series has the best cost/performance available...and design benefits you won't find anywhere else.



EMERSON

CIRCLE NO. 33 ON INQUIRY CARD

DAN M. BOWERS / Technical Editor

mini/micro computers in the automotive industry

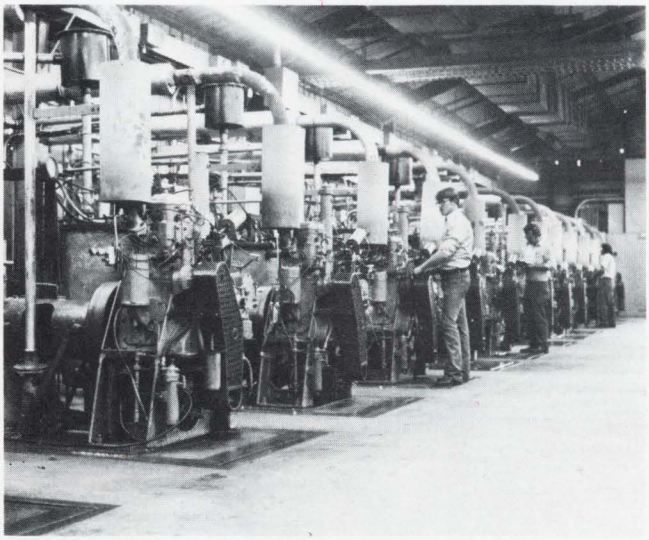
minicomputer controlled production testing

Editor's Note:

Last month, we introduced this Applications Profile in which we are studying the applications of equipment presently in place in the basic American automobile industry and pinpointing future applications and business opportunities for the vendors of computing equipment. This month we present case studies in the use of minicomputers for testing of production parts and assemblies. We are indebted to Hewlett-Packard and Interdata for some of the application descriptions.

The Firestone Tire and Rubber Company has placed its tire uniformity optimizing (TUO) grading machines online to Hewlett-Packard Model 9600 Scientific Measurement and Control Systems, thereby generating uniformity test data instantaneously with TUO operations. Results are impressive compared with a predecessor system in which technicians manually recorded analog TUO measurements, which were batched for later offline calculations. Further, the system can absorb 100 percent sampling should a trend warrant it. Eighteen of the 9600 Hewlett-Packard systems are used in Firestone's U.S. and Canadian tire plants and from four to twelve TUO machines are monitored by each 9600. When tested, a tire is accelerated against a "road wheel," a 34-inch diameter wheel, mounted on load cells. The road wheel transmits the forces received from the tire to strain gauges in the load cells. The ensuing electrical representations of forces in millivolts, are amplified and filtered (from noise of tire tread and the natural frequency of the road wheel) in a proprietary "front end" controller, designed by Firestone, and the signals are then digitally converted and analyzed in the HP 9600.

Key to the process is resolving complex wave forms by Fourier analysis into fundamental and harmonic frequencies. If resulting amplitudes are shown to be out of specifications, necessary adjustments may be quickly made in various controls of the manufacturing process. The importance of uniformity in the manufacture of tires stems from the great variability of the tire's major ingredient: rubber. Each time the tire revolves on the road, its rubber is subjected to cyclic



At Southwest Research Institute's engine laboratory, 50 diesel engines, monitored and controlled by a Hewlett-Packard computer system, are used to test lubricating oils and other automotive products.

DP Dialogue

Notes and observations from IBM that may prove of interest to data processing professionals.

Yesterday a blacksmith, today a welder. Dempsey Faulkinberry learned a new skill with the help of Oklahoma's vocational rehabilitation program.

A Helping Hand for Public Assistance in Oklahoma

When a citizen of Oklahoma applies for public assistance with the proper documents, he or she may be in for a pleasant surprise. Even if the application involves multiple services, such as aid to dependent children, medical care or vocational training, a single interview with a caseworker may cover everything, with the appropriate specialist being called for more technical services. The applicant's eligibility for various services can be determined almost immediately and if assistance payments are involved, a check can be issued within 24 hours.

This fast, efficient service is based on the statewide information system of the Oklahoma Department of Institutions, Social and Rehabilitative Services (DISRS). The system operates under the Customer Information Control System (CICS), and links an IBM System/370 Model 158 computer in Oklahoma City to over 250 IBM 3270 visual display terminals. There is at least one terminal in each of Oklahoma's 77 counties. Through a common data base used by all of the public assistance programs, complete and up-to-date information on any case is swiftly accessible through any terminal, reducing the possibility for delay or conflicting data.

As Charles F. McDermott, comptroller of DISRS, points out, the system establishes both eligibility and non-eligibility with equal speed.

"Take aid to dependent children," he says. "Nationally, over 9% of all cases are found to be ineligible. Here in Oklahoma, the ineligible rate is down to 2%—one of the lowest in the nation—due almost entirely to our ability to cross-check through the information system. That reduction alone is saving the taxpayers of Oklahoma about $600,000 a month."

The system also makes it easier to coordinate public assistance grants with employment opportunities and work training programs. This has contributed to another record for Oklahoma—a higher percentage of people on public assistance are getting vocational rehabilitation than in any other state.

Before the information system was installed, a professional caseworker for the Department typically handled about 60 cases. Now, due to the dramatic savings in time and clerical work, a caseworker can oversee as many as 200 cases.

"The caseworker and the client both benefit from the system in improved morale and a greater sense of purpose," says McDermott. "And the individual who foots the bill—the taxpayer—has the satisfaction of knowing that the State's tax dollars are being spent more productively."

3890 Hits the Trail with Wells Fargo

Between 4 p.m. and 9 p.m. every evening, trucks from 11 regional offices of the Wells Fargo Bank drop off over two million checks and other documents to be sorted and handled at the bank's San Francisco headquarters. All the work must be completed by 11 p.m. the same night.

"Getting the checks from our own 300 branches in Northern California organized, logged and reconciled is a tremendous problem in logistics. Losing time can mean losing a lot of money in the banking business. The faster we can post our own demand deposit accounts and get credit on checks drawn on other banks, the faster we can reduce our float and use the additional money to earn profits," says Watson McKee Jr., senior vice president.

Wells Fargo is the 11th largest commercial bank in the nation.

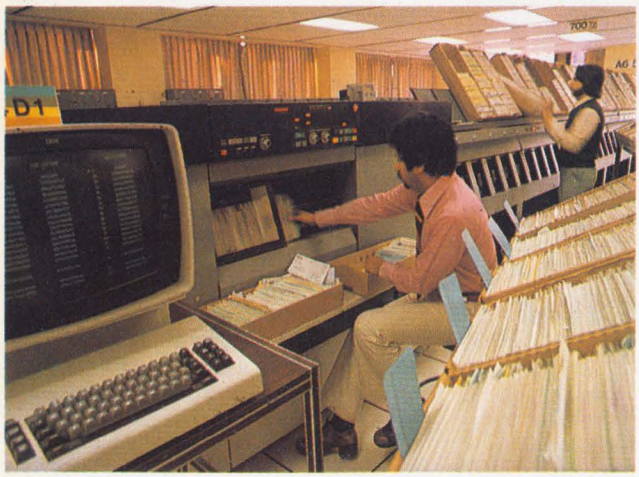
"Since Wells Fargo began using IBM 3890 Document Processors last December, reconciling time, even on peak days, has been cut by two hours," adds McKee. "Now we can capture and sort over 100,000 magnetic ink encoded documents (MICR) per machine per hour—just about double the speed of our older IBM 2956 processors."

With improvements in multichannel character recognition and an extremely sensitive read head, the 3890 has cut the number of previously "unreadable" documents by 50%. It has helped Wells Fargo to lower its reject rate to 1.3%—less than half the national average for banking.

"Re-sorting rejected checks is traditionally the most expensive aspect of the entire document handling operation because it has to be done manually," explains McKee. "The 3890's will save us a considerable amount of money in that area alone."

Equally important, the 3890 provides a full audit trail for every transaction. After reading the MICR code, the 3890 prints a unique item number on the back of each document. It imprints the bank's endorsement legend on the checks, transmits the MICR code and the item number to one of the bank's two System/370 Model 168 computers. It also makes a microfilm of each document for future reference.

After capturing, numbering and endorsing the documents, the 3890 sorts them according to the bank, branch and type of account to which they belong. In addition to checks, documents such as deposit slips, loan payments, master charge receipts and Christmas Club payments are also processed.



At Wells Fargo Bank, operators work with one of eight IBM 3890 Document Processors. Each machine can read and sort over 2,000 MICR encoded documents a minute.

Advanced Features

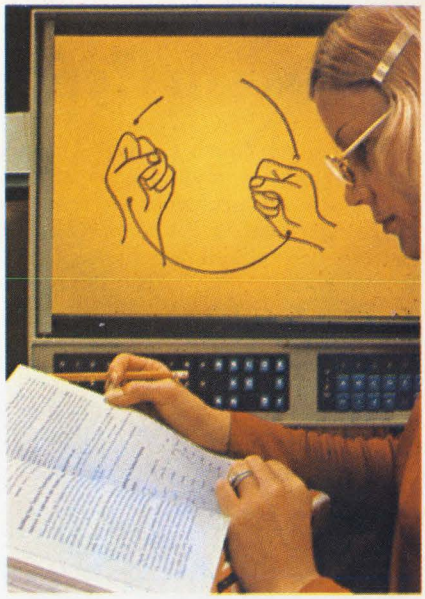
Among the advanced features of the 3890 are a built-in jogger which automatically aligns the documents and a new document separator which virtually eliminates the "piggy-back" problem—two checks sticking together.

With a total capacity of 36 pockets, available in modules of six pockets, the 3890 can grow to meet the needs of almost any operation. Wells Fargo now has eight 3890's, each equipped with 30 pockets, to handle all the work from its branches in Northern California.

Final conversion to the 3890 was accomplished in a little over two weeks—about a month ahead of schedule. According to Mike Macpherson, group manager in charge of installation, "We did nine months of extensive testing and then gradually added offline applications. Moving to online sorting was virtually transparent to our users."

"We've already realized considerable benefits from the 3890," says McKee. "And as new applications come on, such as cycle sorting, we expect the processor to help us save even more money in the future."

Teaching the Language of the Deaf with Interactive Computing



Using interactive computing, a student at Golden West College learns the symbol for "drive" in Ameslan, a sign language for the deaf.

A student at Golden West College in Huntington Beach, California, is using a computer terminal to study a picture. The image she is looking at represents the word "drive" in Ameslan, the American Sign Language of the deaf, used throughout North America.

Over 200 students, most of whom have normal hearing but are interested in communicating with the deaf, are enrolled in Golden West's sign language courses which use computer-assisted instruction programs. The programs include 49 separate lessons which introduce 660 signs corresponding to frequently used words or phrases.

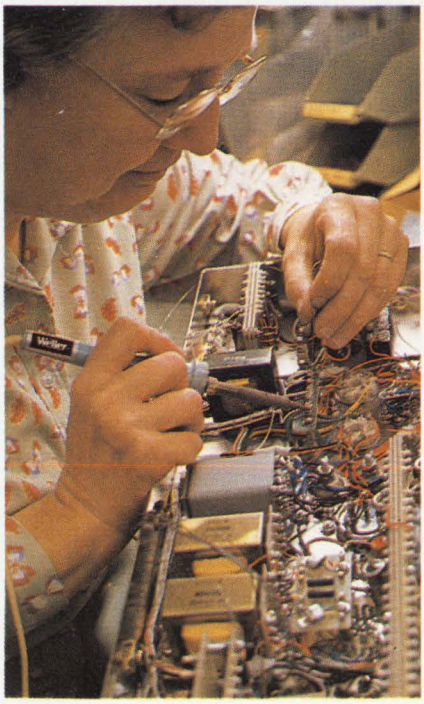
"We see interactive computing as a very powerful and integral component of coordinated instructional systems which also include the traditional classroom and other non-traditional learning activities," says Richard L. Mercer, supervisor of computer services at the college. "Using computer-based practice, simulation and other programs, students can add to their knowledge and improve their skills at their own pace and at their own time—almost as if each has a private tutor."

By typing in the English word or phrase at the terminal, the student activates a microfiche file linked to an IBM System/370 Model 155-II at the Coast Community College District's computing facility. A drawing showing how to make the appropriate Ameslan sign for that word flashes on the screen within seconds. The system can also be used in reverse so that the student can test himself.

"We have found student reaction to computer-assisted instruction overwhelmingly positive," says Paul M. Culton, chairman of the impaired hearing program. "It makes learning fun. And it also serves to correct misconceptions on the spot, instead of next week in class."

The college has over 1,000 learning programs in 55 different disciplines ranging from Ameslan to more traditional subjects like history, science and mathematics. All of the programs were developed using A Programming Language (APL). According to Bob Schaulis, director, information services for the Coast Community College District, "We believe that personal computing—giving many people simple access to the full power of the computer—will become increasingly important in many areas of instruction."

Computer Helps Weston "Get It Out the Door" Faster



Shop Floor Control is one of several IBM programs used to report on the status of work in progress at Weston Components.

When you've got 100 highly complex subassemblies in production on any given day, an hour of lost time can mean meeting or missing a shipping deadline. At Weston Components, an affiliate of Schlumberger, Ltd. at Archbald, Pennsylvania, an IBM computer is helping make every hour count by reducing the paper workload and increasing the controls over work in progress.

"We need very accurate knowledge not only of our inventories and purchasing requirements, but also of the exact status of each job," says Mario Dell'Aglio, director of operations. "A great deal of our business is 'job shop' kind of contracts—specialized components made to order. That means we have to figure out new production scheduling, parts requirements and budgets to fit each new assignment."

To help keep track of orders in various stages of completion, Weston uses several IBM programs which run on the company's System/370 Model 115 virtual storage computer. A data base management program creates and maintains basic information files describing product structures and the manufacturing procedures associated with each product.

"We've used the program very successfully to organize our bills of materials—the lists of parts used in each assembly," says Jack Minelli, Weston's systems engineer. "By automatically generating purchase requisitions for each job, it has reduced our clerical work by 30%. Equally important, it allows us to find out how many of the same parts may be needed on several different jobs, thus saving us money through volume buying."

The program insures that up-to-date information relating to costs, parts availability and inventory can be made available to all the departments that may need it. Since data is only entered once for inclusion in a master file, the chances for errors are minimized.

During the past year, Weston computerized another critical aspect of its business—following the progress of a work order at every stage during production. The job is now being done with the help of the IBM Shop Floor Control Program.

"Now we can keep much better track of the manufacturing process and

(continued on next page)

Advertisement

North Central Airline Lands $7 Million Saving

As one of North Central Airline's DC-9s lands at midnight in Minneapolis, aircraft mechanics are ready in the hangar with a list of parts to be tested, checked and possibly replaced. Within three or four hours, the necessary inspections and repairs are completed and the plane is in the air again taking passengers to Chicago, Milwaukee, Detroit or any one of the 90 cities served by the regional carrier.

The rapid "mini" overhaul is possible because North Central developed a series of unique computer programs to avoid more costly total overhauls, which can keep a plane grounded for days, instead of hours. Called SCEPTRE—System Computerized for Economical Performance, Tracking, Recording and Evaluation—the programs were developed using structured programming, a technique that required 30% less time than the previous method. They access a data base controlled by IBM's Information Management Systems (IMS) which includes a complete maintenance history of each of the carrier's fleet of 50 DC-9s and Convair 580s.

Aircraft mechanics service a DC-9 at North Central's maintenance center in Minneapolis. An online IBM computer system helps make the operation faster and more accurate.

"We're a regional airline, and our profits really depend on keeping all our planes fully utilized," says John Pennington, SCEPTRE project administrator. "With SCEPTRE, we can schedule maintenance time so effectively, it's like having an extra DC-9 in our fleet. That's a $7 million savings right there."

Information such as aircraft performance history and parts inventory and replacement forecasts is stored on an IBM computer at North Central's corporate headquarters in Minneapolis. Using the SCEPTRE programs, a mechanic, pilot, or executive can check on the maintenance status of any plane from any one of 45 IBM 3277 and 3275 Display Stations located in North Central's hangars, machine shops and parts storage areas. The SCEPTRE files can also be accessed through IBM reservation terminals located in airports throughout North Central's system.

"SCEPTRE helps us spot potential problems long before they occur," says Clive Schuelin, systems manager. "The initial justification of SCEPTRE was based on the expectation that by the time the system is completely operational, it will reduce the existing maintenance budget by 10%. With development well underway, we have already received significant dollar benefits."

Weston Components...

(Continued from page three)

establish priorities for work assignments," says Dell'Aglio. "In addition to getting job status reports daily, instead of weekly, the program helps us identify the total time spent at each work station.

"The system provides for the preprogramming of jobs so that the most efficient work sequence, due dates and priorities are followed."

Both program products aim at the same goal—organizing the manufacturing process so that situations like bottlenecks, material shortages and scheduling conflicts can be spotted and corrected immediately.

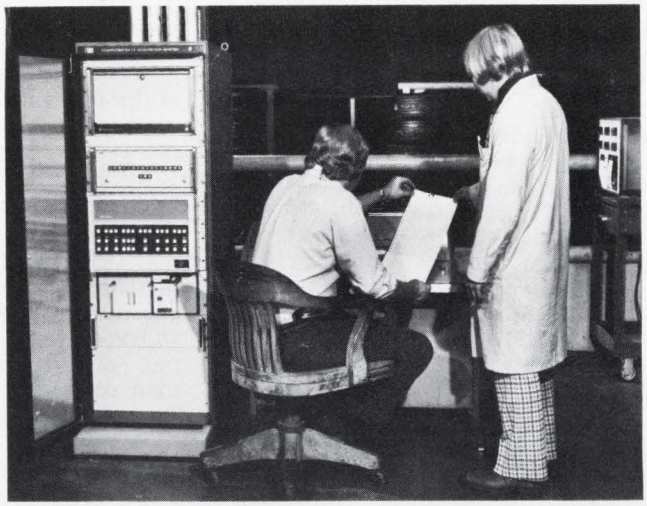
"By taking the paperwork burden off our foremen, we can free them for the really important work—planning to optimize the use of our machines and men and avoid costly disruptions of the work flow," says Dell'Aglio. "And the more precisely we know where we stand on work in the shop, the more responsive we can be to our customers' demands."

DP Dialogue appears regularly in these pages. As its name suggests, we hope DP Dialogue will be a two-way medium for DP professionals. We'd like to hear from you. Just write: Editor, DP Dialogue, IBM Data Processing Division, White Plains, N.Y. 10604.

76-3

IBM®
Data Processing Division

stresses. How the rubber behaves under these stresses depends largely on its elasticity. And the elasticity in turn, depends on how the rubber was processed. Manufacturers of tires strive to control closely the elastic properties that rubber acquires during polymerization and vulcanization. Good performance and a smooth ride require that the rubber be highly uniform – within each tire, and between successive tires.



At Firestone plants, data from tires tested on TUO (Tire Uniformity Optimizing) machines are instantaneously fed to Hewlett-Packard Scientific and Measurement Control Systems computers.

In Firestone's uniformity-optimizing program, various statistical averages, trends within tire samples are made available in hard copy and displayed on video terminals. If a trend develops, it usually can be traced quickly to a specific area of the tire manufacturing process, and with the system's real-time capabilities, tires made "out of specification" are quickly and easily isolated. Because of the time lag in Firestone's previous manual system, such tires would have to be retrieved from warehouse storage – a time-consuming process. Magnetic tape output, compatible for data entry on a System/370, is used for continual yield studies.

CARBURETOR MANUFACTURING AND TESTING

Ford Motor Company General Parts Division uses four Interdata Model 5 minicomputers, in conjunction with a GE 4060 process computer, for automatic fabrication and test of carburetors and carburetor parts. This system was largely developed and programmed by Ford's in-house group, in conjunction with the computer vendors.

The minicomputers perform four basic test and adjustment procedures during the carburetor manufacturing process. The first is concerned with the power valve, which must be tested for leakage when closed and for the vacuum level at which it opens. Pressure pumps are used to apply the input to the carburetor system, and leakage and vacuum level are measured and transduced into the system. The computer automatically causes the adjusting screw to be turned to adjust the spring loading to the proper force.

Similar testing is applied to the T-restrictors used to control the flow of air and fuel. Sample units are tested on the minicomputer system in conjunction with pressure generation and measure of flow, and the results of these tests are used to dictate any necessary changes in the drilling and finishing procedure in the manufacture of the restrictors. Similar test and feedback is applied to the Venturi booster, another flow control device. A fourth tester is applied to the potentiometer, which is used in the fuel gauge; a stepper motor runs a potentiometer through its range, and the computer tests for uniformity of resistance.

Ford found that individual computer control of each operation was more efficient in this application, because of the alternative requirement to wire signals from all test locations to a central computer.

LUBRICATING OIL TESTS

By employing a minicomputer data acquisition and test monitoring system, the engine laboratory at Southwest Research Institute (SwRI), which is engaged in testing lubricating oils and other automotive products, reports it can gather 10 times more data with greater accuracy than possible manually. The former method entailed many slow, manual steps subject to human error and interpretation, such as reading and monitoring meters, logging readings, calculating averages, and plotting results.

The Hewlett-Packard 2100A system collects and logs the data – e.g., temperatures, pressures, speed – prints out summary plots and tabulations in real time, and alerts operators to any of the 800 parameters that threaten to violate specification range limits.

The automated engine laboratory's data acquisition system administers the tests for many of the major oil and chemical companies. Any number of its 50 engines, with 800 sensors, can be operated simultaneously to perform any of the eight different programmed qualification tests.

Major oil and chemical companies submit their lubricating oil product to SwRI for qualification testing against standards defined by the U.S. Army Engine Oil Reviewing Committee, traditionally the lead government agency concerned with engine oil standards. The test procedures are defined in exacting detail, ensuring test consistency. Compression ratio, fuel characteristics, and procedures for flushing the engine and conducting pretest run-in are stipulated, as are the conditions of engine operation. For example, the engines are run at a speed of 1800 ± 10 rpm, with fuel heat rate of 4950 ± 50 btu/min. Temperatures and pressures are also set within strict tolerances.

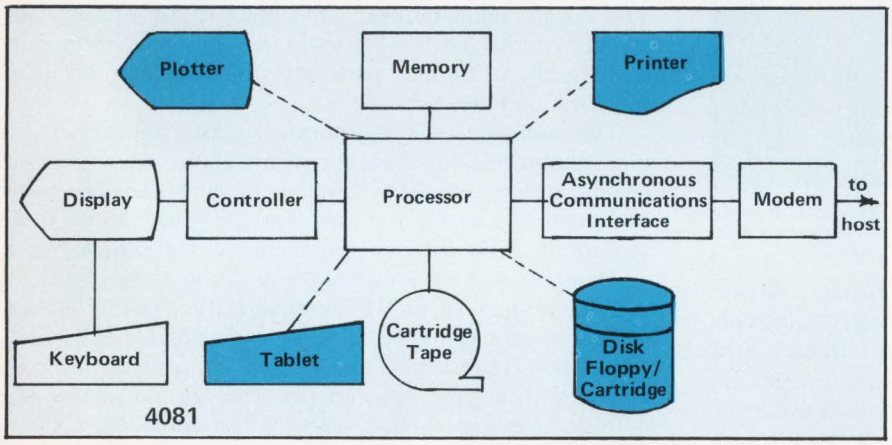
The data acquisition computer system contains capacity for 800 separate analog channels, allowing 16 sequential channels to each engine. The channels are assigned to take readings of: cooling water-out temperature; water-in temperature; oil temperature; intake air temperature; exhaust temperature; intake and exhaust pressures; oil and jet pressure; and humidity. During the test, readings of each of these parameters are made at six-minute intervals by the computer of the particular engines undergoing the 1-H test. Other engines may, at the same time, be undergoing other similar tests with different requirements. The computer calls from memory the appropriate program for each test. Sensors, such as the thermocouple and pressure transducers, convey electrical signals in analog form from the engines under test; the signals are then converted to digital form by a Hewlett-Packard 2402A digital voltmeter. A Hewlett-Packard 8159 scanner expander allows the single scanner control unit to handle all four crossbar scanners. Conversion of units and other calculations are performed by the processor. By means of a keyboard CRT display terminal, an operator or supervisor can request the computer to display operating data for any engine under test to check its status at any time. Typical output plots depict the complete 480-hour test period and exactly how each parameter varied over the period. Plots of the run-in period for the engine are also produced, as are tabulations of data. ■

product focus

BARBARA A. REYNOLDS / Associate Editor

A $27,000 REFRESH GRAPHICS SYSTEM

After the $2995 graphics terminal and the $6995 programmable graphics terminal, it would seem only a natural next step for Tektronix to develop a mini-based graphics display system priced far below that of competitors. The 4081 is a mini-based storage and refresh display system with software for $27,000. That's right, not just the display, but the total system. That includes the 19-inch display, an Interdata 16-bit mini, 32K-byte MOS memory, display controller, keyboard, character generator and function keys, 250K-byte tape cartridge drive, communications interface and software. If that's not enough, a floppy, cartridge disk, 132-column printer, plotter, tablet and additional tape cartridge are optional.



The 4081 story began when Tektronix noticed that many 4014 customers were using a mini interface between the terminal and the host computer to give refresh as well as high resolution storage capabilities. Graphics with storage capability was already possible at a low price with the Tektronix 4006-1, but refresh capability was another matter. Most refresh graphics *systems* started at about $55,000. So Tektronix went to work on developing a firmware-driven display controller and software package for a display system that could be priced under $30,000.

The software package Tektronix developed is extensive and bundled. A Graphic Operating System (GOS) consists of English-language commands for terminal control of programs and peripherals. The Intelligent Graphic Terminal Software (IGT) gives the host complete control of the graphics system to allow program development, and the 4014 Emulator lets the 4014 user take advantage of software already developed until the 4081 programs are up and running. Although all three software packages may not seem necessary, Tektronix said since all three had to be developed, the system was bundled to keep overall cost down. Utilities and diagnostics are also included and an optional programming support package to permit program development on the 4081 is available. Fortran should come within the year.

By accomplishing in software, firmware and memory what was usually controlled by hardware, two compromises had to be made. The $55,000 graphics systems have 10K vector inches of refresh image. Tektronix has 1K vector inches in refresh, but 20K vector inches in storage that can be accessed. Instead of 3 to 7 microseconds to generate a character, the 4081 takes 10 milliseconds per character.

MOTION, HIGH RESULTION AND LOW COST. *Tektronix Graphics Display System.*

So the company philosophy of bringing graphics down in cost so that applications increase continues. If you actually need the sophisticated refresh capabilities and speed of a $55,000 graphics system, the 4081 may not be the thing. But if you would like to do with graphics what you're now doing digitally, if you don't need $55,000 sophistication and if your budget allocation is under $30,000, the people in Oregon have the answer.

Circle No. 100 on Inquiry Card

ADAM WITH A MICRO AND WITHOUT EVE

Adam was first introduced last year with a brochure displaying a bare-bottomed Eve on the cover. Unfortunately, Eve got more press coverage than Adam. But Adam was unique in its own right as one of the first automatic programming systems to be marketed commercially. This year Logical Machine Corp. is back – without Eve – and with a micro-based instead of mini-based Adam.

Four 8 x 10-inch cards have replaced the GRI mini and the peripheral interfaces. Two processor cards provide microprogram control of the entire system. Each contains a four-chip processor based on the Intel 3000 TTL micro. The memory is Intel's in-42 Memory System, consisting of a 32K-byte memory card (eight 4K RAM chips) and one control unit card. Adam's other hardware includes a 1280-character Control Data CRT, a Centronics 165-character per second printer and a Control Data 10-megabyte fixed/removable cartridge disk. Adam's price of $39,950 will remain the same. Because Adam's user is usually an officeworker with no knowledge of computers, whether the system is micro- or minibased shouldn't make an operational difference although Adam will be smaller and easier to maintain.

A DO IT YOURSELF SYSTEM. *Adam helps you write a program in your own language.*

PROGRAMMERS NOT WANTED

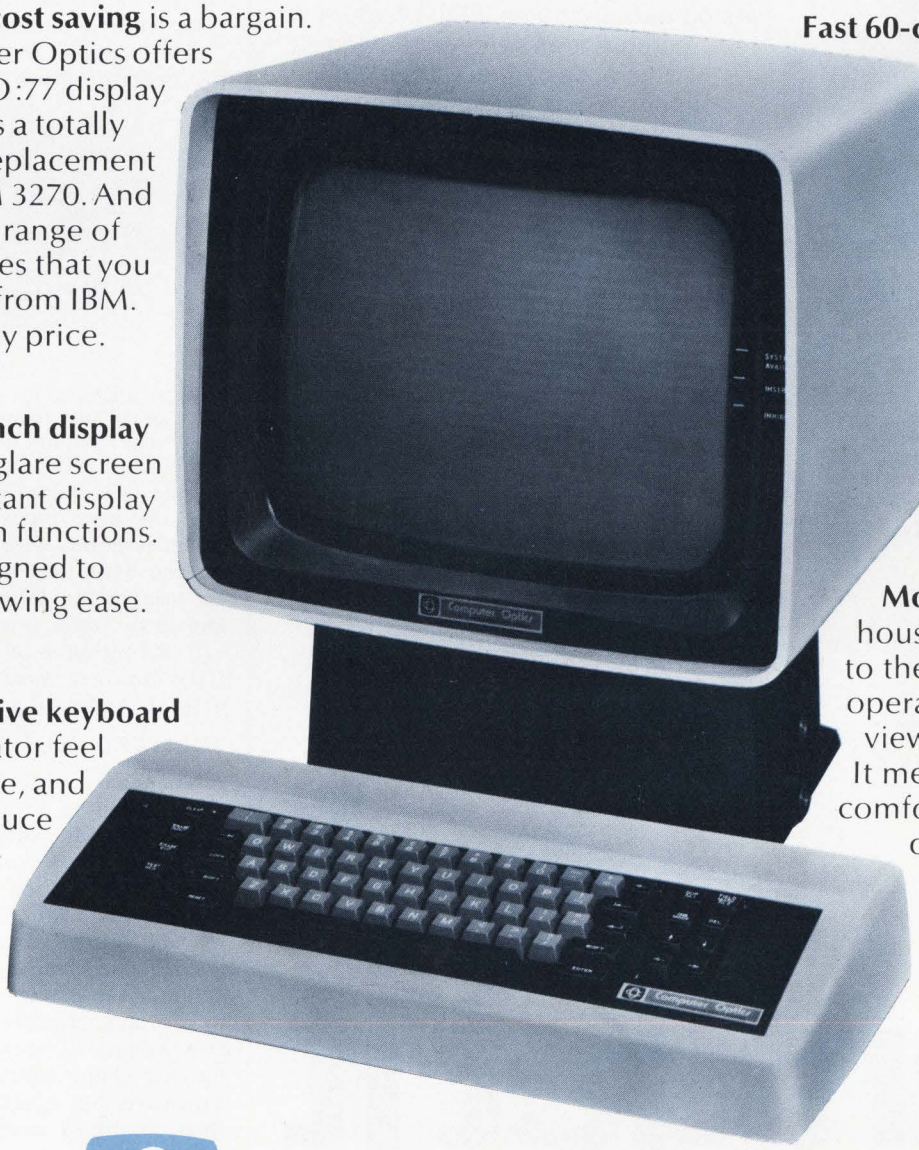
That's right, Adam is based on the premise that the person involved in a process understands it better than a programmer and can therefore come up with a better routine for performing that process. The difficulty is that non-programming people don't think in terms of computer algorithms when solving problems. Logical Machine Corp. President John Peers said

Our 3270 replacement: It's more than you bargained for.

A 45% cost saving is a bargain. But Computer Optics offers more. The CO:77 display terminal is a totally compatible replacement for your IBM 3270. And it offers a range of design features that you can't get from IBM. At any price.

Large 15-inch display with a non-glare screen and a constant display of all system functions. It's designed to ensure viewing ease.

Touch sensitive keyboard lets operator feel each keystroke, and helps reduce errors.



Fast 60-cycle refresh rate for a sharper, steadier image and reduced operator fatigue.

Moveable display housing that tilts to the individual operator's best viewing angle. It means increased comfort for the operator and increased productivity for you.

Computer Optics Inc.

Berkshire Industrial Park , Bethel, CT 06801

Toll free: 800-243-1314 In Connecticut call collect (203) 744-6720

CIRCLE NO. 34 ON INQUIRY CARD

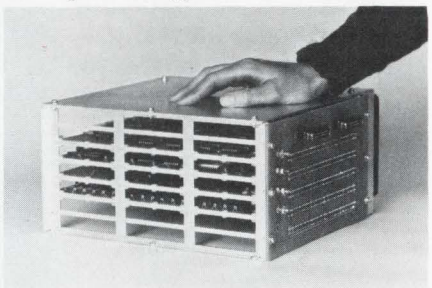
product focus

that's unncessary. As an officeworker organizes a task, he just needs to tell Adam how he is organizing it.

TEACHING ADAM

Every Adam comes with a five-day training period. Although no programming knowledge is necessary, a "friendly" attitude toward computers is. During the first two days, the operators learn Adam's 50-word vocabulary, consisting of nouns (SUM, PROD, etc.) and verbs (ADD, SUBTRACT, ALTER, FORGET, etc.). The next three days the operator spends working out a "program," which he or she can then change when necessary without a programmer's help. This is done by defining new nouns and verbs, with Adam's help, while organizing the "program."

For example, to define a new verb, the operator types "VERB" and de-



A MICROCOMPUTER REPLACES A MINI. *The cage contains four cards; two processor, one memory control unit and one memory card.*

presses GO. Adam displays "called." The operator types the verb name; Adam responds with "does" and waits for the definition. If nouns and verbs are used in the definition that are unknown to Adam, it waits until the original definition is complete and then types the new words that need to be defined. And on it goes.

THE GARDEN OF ADAM

Adam does not fit in everyone's garden. Marketing Vice President Robert Waterbury said Adam is designed for the 5 to 200-person office, not for large companies needing communications. For Adam is a monoprogramming system without communications. Actually, that makes sense since the language and program could vary from operator to operator. However, it is possible for two Adams to access the same disk, but not simultaneously. Adam is also expensive, but costs are probably less than combined costs of a small business system, application package and programmer. Most impressive about Logical Machine Corp. is that it has become profitable less than one year after Adam's introduction and that it is a maverick company heading in the coming direction of "friendly" computers.

There's no need to gnash your teeth over lack of a serial printer alternative anymore. Put away your printer downtime problems and switch to Tally's 120 character per second T-1000 series. You'll marvel at its design simplicity and realistic reliability. No springs or clutches to adjust or break. Instead, printer performance measured in hours rather than minutes.

Other benefits include microprocessor electronics, low acoustic noise level, digitally controlled print head advancement, tractor engagement above and below the print line for positive paper advancement and positioning, and a convenient snap-in ribbon cartridge.

Tally has more to like, so move the other guy aside and call your nearest Tally sales office for all the facts.

Tally Corporation, 8301 S. 180th St., Kent, WA 98031. Phone (206) 251-5524.

OEM Sales Offices:
New York (516) 694-8444
Boston (617) 742-9558
Chicago (312) 956-0690
Seattle (206) 251-6730
Los Angeles (213) 378-0805
San Francisco (408) 245-9224
Business Systems Sales Offices:
Eastern Region (201) 671-4636
Western Region (415) 254-8350

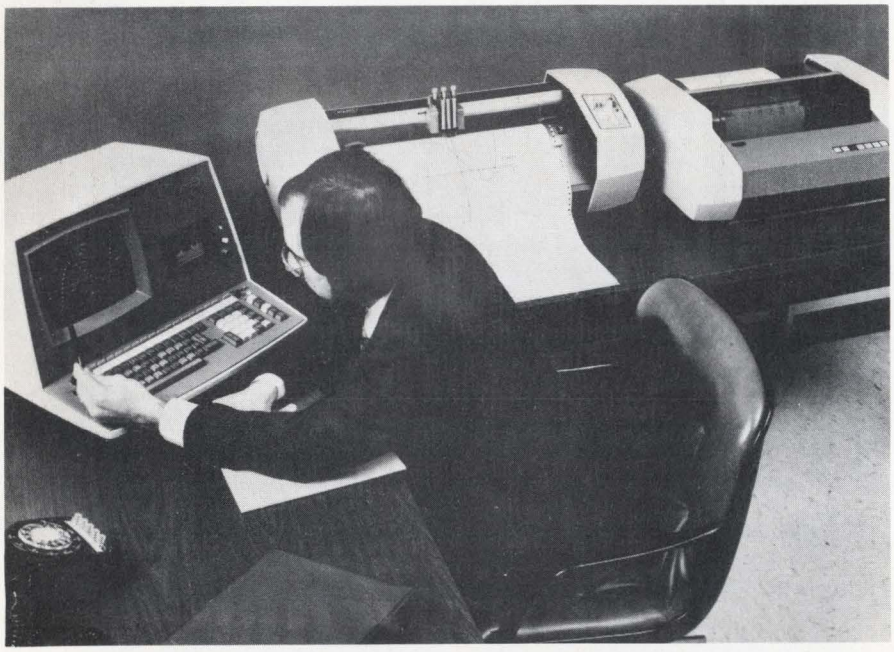
TALLY

CIRCLE NO. 36 ON INQUIRY CARD

WANG'S ALTERNATIVES

When IBM introduced its 5100 portable computer last year, Wang maintained it had a viable alternative with the 2200-S. However, the 2200-S system was a two-box system, weighing 90 pounds, and the 5100 was an integrated 50-pound box. But Wang did offer a savings of a couple hundred over the 5100.

Now Wang has a *real* alternative: the 2200 Portable Computer System. This one-box system weighs 55 pounds and has 8K bytes of RAM, expandable to 32K, a 42.5K ROM to store the Basic interpreter, a 9-inch CRT and a tape cassette unit. The price – $5400 – is identical to that of the 2200-S. But the 2200-S had only a 4K RAM and a 24K ROM. To compare, Wang's 16K-byte system sells for $7000; IBM's 5100 with 16K sells for $8975. What makes Wang's alternative possible? Reduced memory prices and a new processor. Configured with medium-scale integrated circuitry, the new processor has a 1.6-microsecond cycle time.



THE 5100 ALTERNATIVE. *Wang's 2200 PCS can be combined with the company's new micro-based drum plotter or 120-cps matrix printer.*

ANOTHER ALTERNATIVE: MULTI-PROCESSING INSTEAD OF MULTI-PROGRAMMING

The new processor also enabled Wang to drop the price of workstations as part of distributed processing systems. With workstations interfacing to a 2200 CP, Wang can offer the same interactive response capability as large single-processor multiprogramming systems – and provide backup – at a lower price. Each $4900 workstation comes with 8K bytes of RAM, a 12-inch CRT and keyboard, disk multiplexer interface and connector. Up to three workstations can be multiplexed with one disk-based 2200 processor system. The price for a typical system with two workstations, 2200 processor with 5-meagabyte disk, 16K memory, 200-character per second printer, CRT console, diskette for program loading and disk multiplexer is $41,000.

PERIPHERAL AND SOFTWARE ALTERNATIVES

Designed to compete with Digital Equipment Corp.'s LA 36 DECwriter, Wang's new 120-cps printer sells for $2900. The LA 36 prints 30 cps and sells for $2200. Wang's new printer replaces Wang's present 120-cps offering – a Centronics model – and is compatible with the 2200. New features include snap-in cartridge Moebius ribbons, dual-axis printhead and servomotors for head positioning.

To complete with the graphics people, Wang introduced a 8080-based "virtual drum" plotter (the paper moves instead of the drum). By using a microprocessor to control small DC stepping motors, servomotors could be eliminated. Price for the 2272 is $2900.

Wang didn't stop there either. A larger 24 x 80-character CRT screen, a micro-based binary synchronous communications controller, a buffered asynchronous controller, management planning software package and a cash accounting software package were also part of Wang's alternatives.

DEC'S NEW CP AND SYSTEM

According to Digital Equipment Corp., the PDP-11/34 offers "performance equivalent to the PDP-11/40 at cost reduction of 25 to 30 percent." Although it looks from the outside like an 11/04 (small) has the same memories, peripherals and Unibus architecture, the 11/34 processor is far more powerful. The 16-bit MOS parity memory ranges from 32K to 128K words. (Core memory is also available.) Memory management is standard as is the extended instruction set with hardware multiply/divide. Also standard is DEC's "virtual console," orginally introduced on the 11/04. This console/emulator permits machine-level diagnosis to be performed remotely via communication lines. Price of the processor starts at $9290. The standard PDP-11/34 system with bootstrap and clock, 32-K word memory, dual-drive disk and matrix printer is priced at $30,900. *Digital Equipment Corp., Maynard, MA.*

Circle No. 105 on Inquiry Card

CHIP NEWS

One-Chip Computer. It's not just a processor, but a processor with 1344 x 8 ROM and 96 x 4 RAM and 31 I/O channels. The PPS-4/1's 50-instruction set is very similar to that of the PPS-4/2 and PPS-4 microprocessor systems. Price in quantities of 10,000 is under $10. *Rockwell International, Anaheim, CA.*

Circle No. 101 on Inquiry Card

Masterslice CMOS. The three-chip MasterMOS family consists of: MasterMOS-L with over 500 pairs of CMOS transistors and 28 output buffers, MasterMOS-M with 250 pairs of CMOS transistors and 24 output buffers and MasterMOS-S with over 100 pairs of CMOS transistors and 14 output buffers. *International Microcircuits, Inc., Santa Clara, CA.*

Circle No. 102 on Inquiry Card

Eight-bit CMOS Processor. The CDP1802 40-pin processor uses self-aligned silicon gate CMOS rather than aluminum gate CMOS. This makes it speed and price competitive with other MOS processors, yet provides the CMOS advantage of less power consumption. Also new to the CDP1800 family are static RAMs, ROMs and a latching byte I/O circuit. Price in quantities of 100 is $23.50. *RCA, Somerville, NJ.*

Circle No. 103 on Inquiry Card

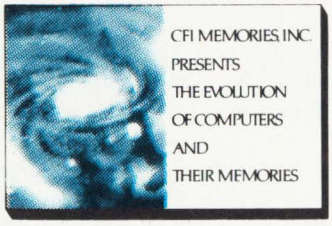
CFI introduces a new bag of tricks. ABRAXAS Magic Media.

We're going to give you a hat full of very good reasons to look at CFI's new line of ABRAXAS™ Magic Media. The amazingly dependable 1600 and 6250 BPI Magnetic Tapes and the mystifyingly reliable flexible Diskettes.

One reason for all this magic is an extraordinarily high level of quality that comes from critical testing and precision manufacturing. Another reason is the professional, personalized service that has always been the hallmark of CFI Memories. A third reason is the complete range of product line we'll be offering to satisfy all your needs.

With customers the world over, CFI Memories is known as a major supplier of reliable and error-free disk packs and cartridges with full factory back-up. The addition of our new ABRAXAS Magic Media is designed to continue our heritage of product superiority.

You can get your hands on our complete line of ABRAXAS Magic Media faster than you can blink your eye. Return the coupon or call us today.



We would like to share with you this beautiful limited edition book. Write on your letterhead for a free copy.

CIRCLE NO. 37 ON INQUIRY CARD

CFI memories, inc. **305 Crescent Way, Anaheim, CA 92801**
800/854-3290, 714/776-8571

I'm interested.

- ☐ Send product data on your ABRAXAS tape.
- ☐ Send product data on your ABRAXAS diskettes.
- ☐ Include information on your disk packs and cartridges.
- ☐ Have your rep call with a quote.

Name_____ Title_____

Phone_____ Ext._____

Company_____

Address_____

City_____ State_____ Zip_____

MALCOLM L. STIEFEL / Contributing Editor

SOURCE DATA AUTOMATION

Part 1

Source data automation does not deal with a single product line; it involves a broad range of devices – optical character readers and printers, magnetic strip encoders and readers, embossed badge systems, digitizers, point of sale systems, environmental monitors, tag readers – in commercial, scientific, and military applications. It also covers key-to-tape, -to-disk, -to-diskette, -to-cassette, to-anything-except-cards, since source data automation is usually concerned with replacing keypunch functions in a data processing system.

What do these diverse elements have in common? They are intended to speed data capture, reduce response time, improve data base accuracy and save money for the user.

Of course, the user must pay the price for realizing the benefits of SDA: larger initial investment, more complex systems, entry devices that can be troublesome to maintain and additional support software. Thus, a decision to upgrade can take time, money, and aggravation. There are risks to be dealt with – the possibility of finding the exotic new sensor so high-strung that it only works effectively during full moons, the chance that operating costs will exceed predictions so that an investment can't be recovered in the desired time, the arrival on the scene of outside influences such as consumer groups that want to discourage supermarkets from installing point-of-sale equipment, and the acceptance of new innovations by employees and customers.

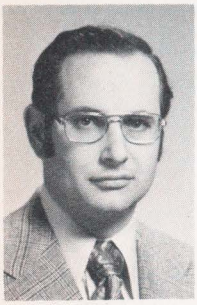
The fact that SDA systems are proliferating gives ample evidence that the benefits outweigh the risks in most cases. SDA is growing; it is found in more and more businesses every day.

SDA originated almost as soon as the commercial first generation computers appeared on the scene several technological eons ago, when a resistor wasn't just someone who didn't want to be drafted. When the punched card reader was built, the age of the turnaround card began.

Right away, the early system designers made a mistake. They printed a stern warning on the card, "Do not fold . . .", sometimes accompanied by a veiled threat such as, ". . . in order that your account may be credited properly." What a challenge to independence! What an outlet for frustration! Accordingly, every conceivable manner of crime was visited upon the cards by the time they were returned to the computer room. They were bent, folded, stapled, mutilated, chewed, tattooed, glued, chipped, clipped, snipped, washed, dried, fried, beaten, eaten, and otherwise manhandled.

Immediately, the system designers said, "There must be a better way." So they turned to optically and magnetically readable documents. The rush to escape from turnaround punched cards and, in fact, from cards in general, has continued unabated ever since.

And so, we arrive at the modern SDA system, with its three distinctive elements: an encoding device, almost always computer-controlled; an automatically sensible element (such as a credit card), which uniquely identifies one entry in the data base; and a sensor, or high-speed conversion device for capturing the data for computer entry.



Malcom Stiefel, a senior systems analyst with Keystone Custodian Funds in Boston, has dealt with military command and control systems, hospital information systems, municipal information systems, and mutual fund accounting systems during his 17-year career as an independent consultant, systems engineer, systems analyst, programmer, and writer. He received a B.S.E.E. from the Polytechnic Institute of Brooklyn in 1959 and has completed graduate work at M.I.T.

CLASSES OF SDA SYSTEMS

Source data automation systems may be classified as either closed loop or open loop, depending on the method of generating the computer-readable element. The distinction is illustrated in Fig. 1, where block diagrams of the two major classes are given.

In the *closed loop system,* there is a turnaround element, termed the "readable element," generated under computer control, or produced in a carefully controlled manner that will be acceptable to the sensor. It can be a piece of paper – an optically readable invoice to be returned with a check, a mark-sense form to be filled in by a test subject, a Universal Product Code marking on a can of chicken soup to be read at a checkout counter, or a tag attached to a pair of socks that will be removed by the clerk when the item is sold. The readable element can be an embossed credit card to be presented to the gas station attendant who, in turn, will imprint price information on an optically readable ticket, along with the account number taken from the credit card. It can be a magnetically encoded credit card, from which the clerk enters the account information onto a bill, simultaneously transmitting the number to a central information bank to verify the customer's credit.

The sensor/entry device in the closed loop system is matched to the input documents. It can be an optical reader, a tag reader, a magnetic ink reader or a mark reader. The sensor/entry device can also be a key-to-tape or key-to-disk station, or even a CRT tied directly to the computer online.

Whatever the components, the closed loop system elements have one thing in common – there isn't a keypunch to be found in the loop.

The *open loop system* is usually found in engineering and scientific applications. The external phenomena to be sensed may be environmental (particulate concentration in the atmosphere, wind speed, wind direction, temperature), optical (infrared radiation from the earth, photographs of

telescope images of the stars), or images stored on pieces of paper (maps, drawings). The sensors, naturally, are elegant, high-performance, complex mechanisms: automatic digitizers that can resolve two points a millionth of an inch apart, handheld cursors that move over a table to capture positional information on magnetic tape on the fly, fog visiometers, converters that digitize spoken words for automatic speech recognition, or sniffers that detect smoke by measuring changes in ozone concentration in a room.

CHOOSING A SOURCE DATA AUTOMATION TECHNIQUE

As in every other aspect of data processing, the choice of an SDA technique to use in a given situation is very much governed by the nature of the application. The nature of the data to be captured is of prime importance to begin with. Where does it come from? One place? Several fixed, well defined locations? All over the world? What is the data rate, in terms of bits per second, or bytes per minute, or events per hour or per day? Even the units of measurement are defined uniquely for each problem. What is the environment? An office? A remote sensor on top of a lonely mountain? Who will be around to maintain the equipment? Will there be a field engineer on site or on call at an hour's notice? Or will the crew come out by helicopter once a week to see if everything's in order? Or will the sensor be totally unattended, left to its own devices, until its batteries fail, or its clock unwinds, or it is consumed by the forces of nature? Granted, most of these decisions don't face the average system designer who is trying to put an accounts receivable package together for a local retailer. But even in that relatively protected and friendly environment, tradeoffs must be made among the varous SDA techniques.

AN OPEN LOOP EXAMPLE

Fig. 2 illustrates the range of choices available to the designer of a meteorological sensor network. The five systems, Figs. 2a through 2e, vary widely in complexity, cost, and capacity. Clearly, there is a need to establish a well understood set of performance criteria for the system before hardware and software can be selected.

Real-Time Monitoring. For example, in Fig. 2a we have a real-time monitoring network, which can operate with direct inputs to the central facility from each sensor, or with transmissions triggered by a polling request from the CPU to the sensors. In either case, we may assume that at least some of the sensors are many miles, perhaps many hundreds of miles from the computer, so transmission lines must be available in the sensor locations, along with continous power sources. If common carrier facilities aren't available, dedicated digital networks must be constructed in order to implement the system. Obviously, this configuration is far more expensive than any of the others (Figs. 2b through 2e); it can only be justified where there is a clear and urgent need for real-time correlation of sensor data for, as example, air pollution alerts in a given region. Otherwise, batch processing is called for, and the expense of a real-time network can be avoided.

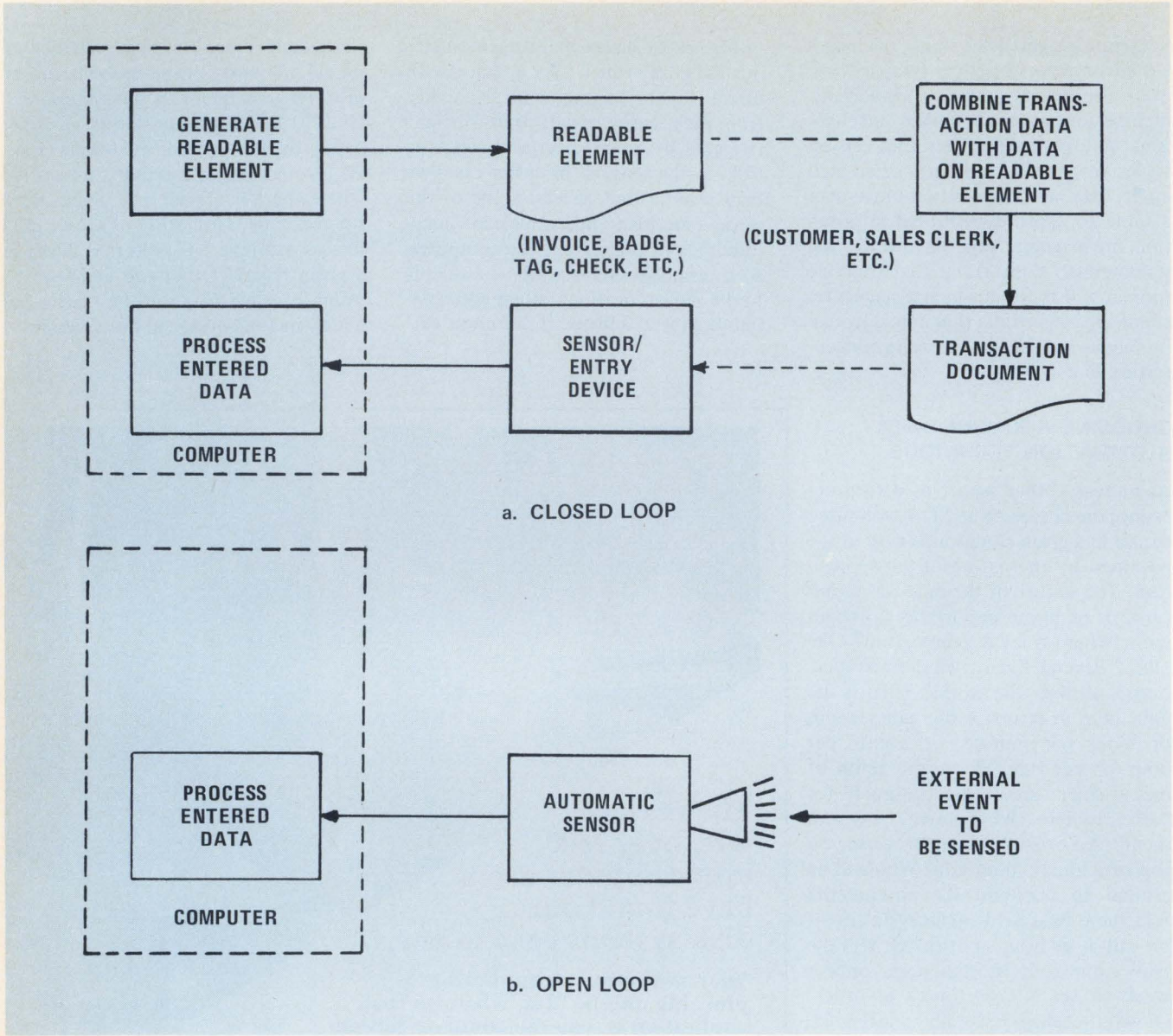


FIGURE 1 – CLASSES OF SDA SYSTEMS

Data Logger. If, instead, the system is to collect data over a year, say, as an input to a nuclear power plant siting study or any other environmental impact study, then periodic collection of data from all sensors for batch processesing is adequate. Even in this case, a host of design choices can be made.

Fig. 2b illustrates a data logger network in which a digital record is captured in real-time on cassette or some other convenient medium at each sensor. At scheduled intervals, a service technician will come to the site, remove and replace the cassette, and take the recorded data back to the central facility for offline processing. This system may also use strip chart recorders for backup to ensure that data is captured for analysis even if the data logger fails. This approach becomes almost mandatory if the sensor is to be located in an area of severe weather, where data loggers aren't likely to flourish. At the central processing facility, programs are stored to manipulate the recorded data (usually consisting of discrete samples taken at fixed time intervals) to produce the desired output, which may be a report of hourly averages of the recorded data over a period of time or some other statistics. A similar program is used in the real-time system, of course, to generate an alarm whenever some instantaneous threshold is exceeded or whenever the time average of the data is above some predetermined value. Note that relatively little can be done in the way of quality control; the data is either recoverable or it isn't. If some secondary medium (such as a strip chart recording) isn't available for checking, the output must be accepted as produced.

Strip Chart Recording. This quality control problem is somewhat alleviated in the system shown in Fig. 2c, where the strip chart is the primary recording element. In this case, instrument failures can also occur, but, in many cases, a trained technician can tell, by examining the recorded data and by comparing traces of different parameters whether the output is reasonable and amenable to further processing.

The bottleneck in this system occurs in the process of transforming the data to computer-readable form. Discrete points, or, more often, eyeball averages, are picked off the chart by clerks and entered on coding sheets. Then the data is keypunched for computer entry. Notice that the critical computation, the integration of the recorded trace over the averaging interval, is done by *eye*. The computer is used only as an editing, collecting and reporting device. The fundamental outputs have a one-to-one correspondence to the data entered on the coding sheets. The power of the com-

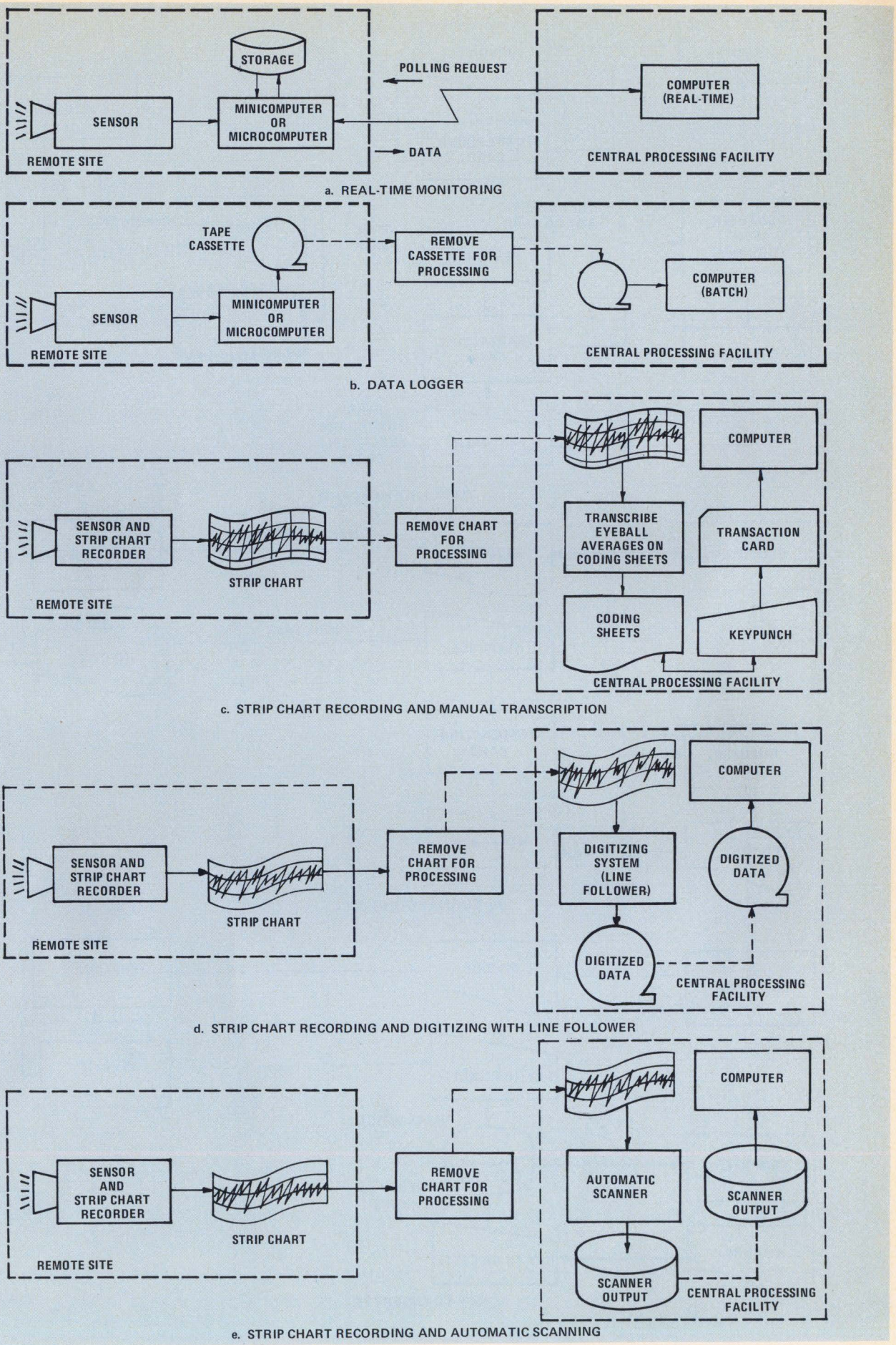


FIGURE 2 – OPEN LOOP EXAMPLE – METEROLOGICAL SENSOR NETWORK

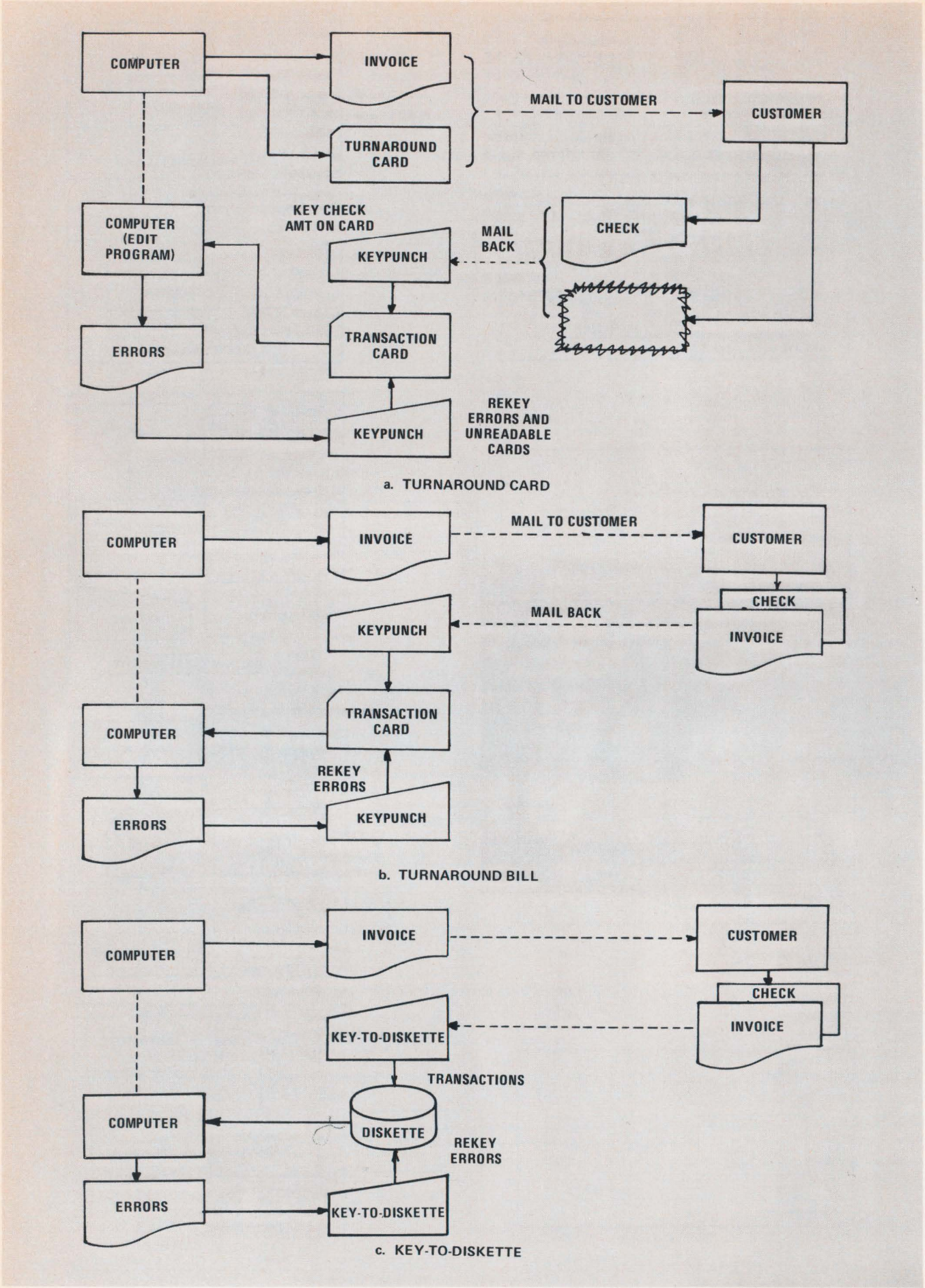


FIGURE 3 – CLOSED LOOP EXAMPLE – BILLING SYSTEM

The NCC opens a new era in printers.

The Centronics 700 Series.

A breakthrough in the cost of ownership.

We picked one of the most important trade shows in the country to introduce our new 700 Series printers and teleprinters. And for a good reason—they represent the most important breakthrough in engineering and price to be announced since Centronics created the standard of the industry with the serial dot matrix printer.

Featuring unique modular construction, the 700 Series' electronics, printing and forms handling modules let you increase performance as the need arises.

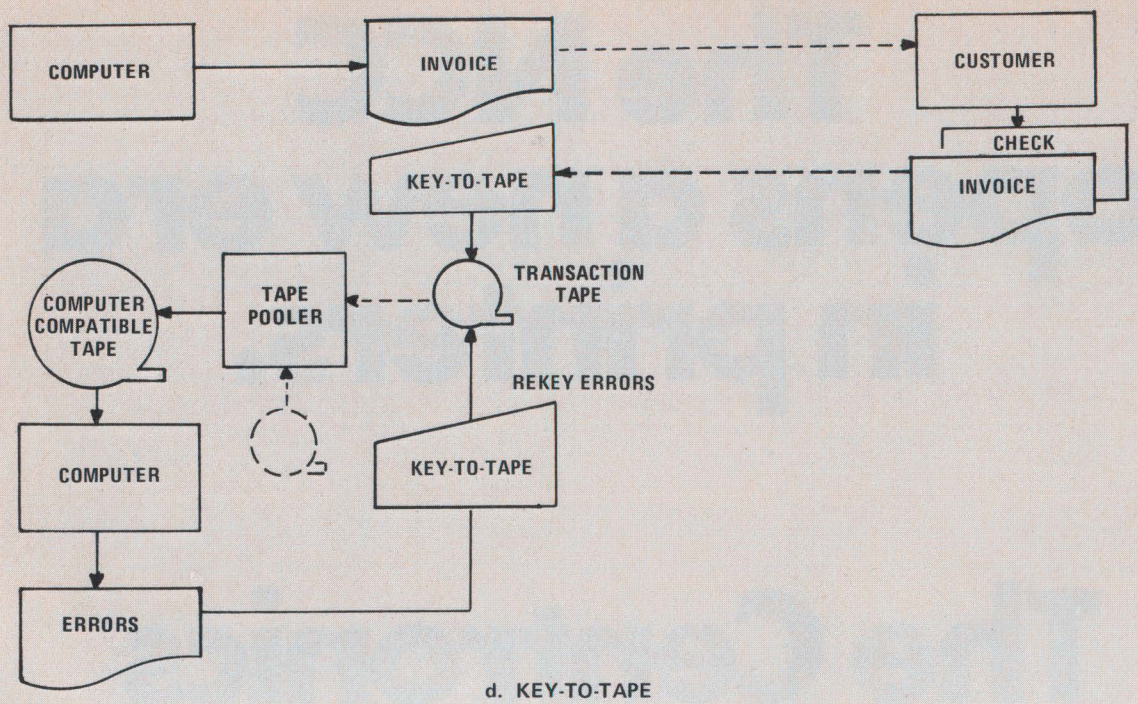
Available in four different models (there are others on the way), the 700 Series comes with the most wanted features and options, many not offered anywhere else. Plus a full range of interfaces that let you link them up with virtually every kind of computing device. And, of course, the 700 Series is backed up by our outstanding sales and service team.

The new 700 Series. From the most experienced, successful manufacturer of printers in the business—Centronics. See them and our full line of low, medium and high speed quality printers. Our booth number is 3300.

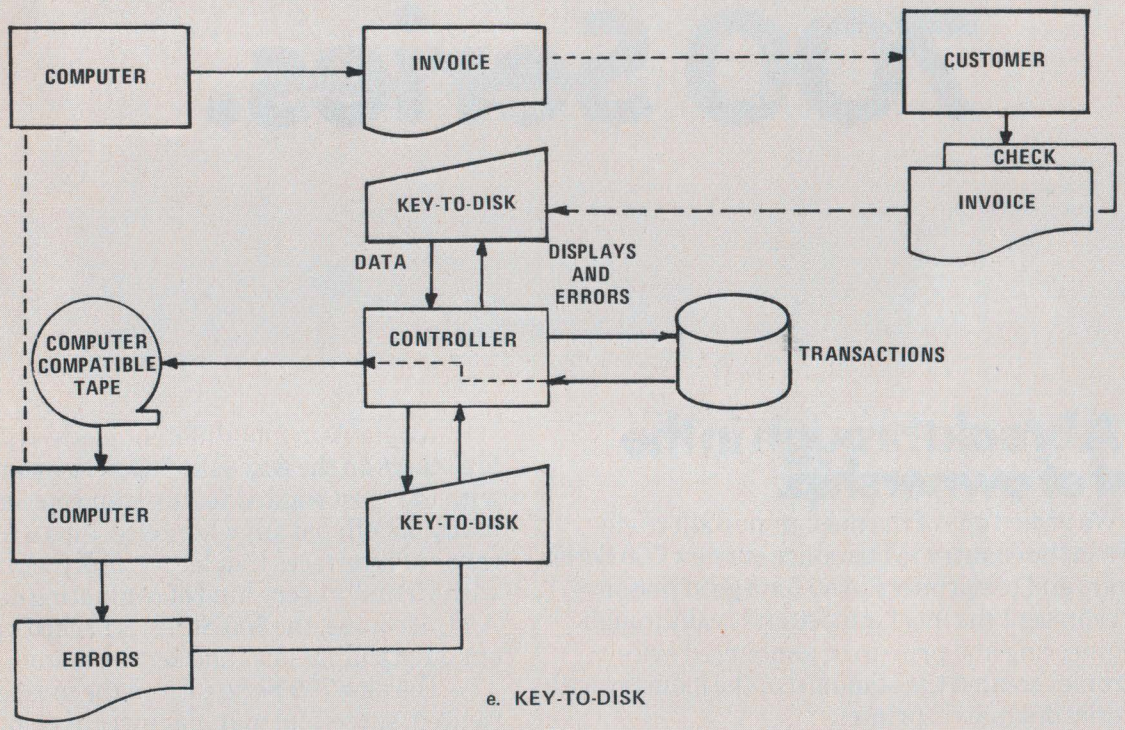
CENTRONICS® PRINTERS

Centronics Data Computer Corp., Hudson, N.H. 03051, Tel. (603) 883-0111, Twx. 710-228-6505, Tlx. 94-3404; Eastern Region: (617) 272-8545 (MA); Central Region: (513) 294-0070, Twx. 810-459-1784 (OH); Western Region: (714) 979-6650, Twx. 910-595-1925 (CA); **Centronics Data Computer (Canada) Ltd.**, Ontario, Tel. (603) 883-0111, Twx. 710-228-6505; **Centronics Data Computer (UK) Ltd.**, Cheam, Surrey, England, Tel. 643 0821-4, Tlx. 851 945756; **Centronics Data Computer, GmbH**, 6 Frankfurt/Main., West Germany, Tel. 663321/22, Tlx. 841 413224; **Centronics of Puerto Rico**, Dorado, Puerto Rico, Tel. (809) 796-1881, Tlx. 3859349

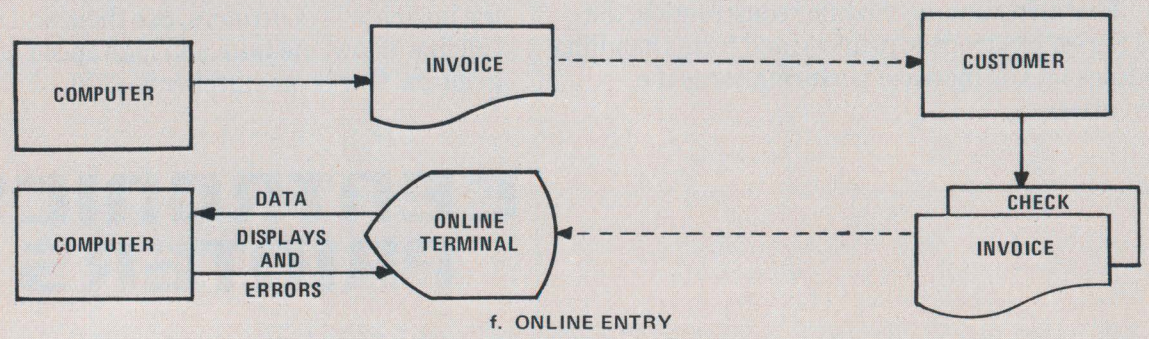
CIRCLE NO. 40 ON INQUIRY CARD



d. KEY-TO-TAPE



e. KEY-TO-DISK



f. ONLINE ENTRY

FIGURE 3 – CLOSED LOOP EXAMPLE – BILLING SYSTEM (continued)

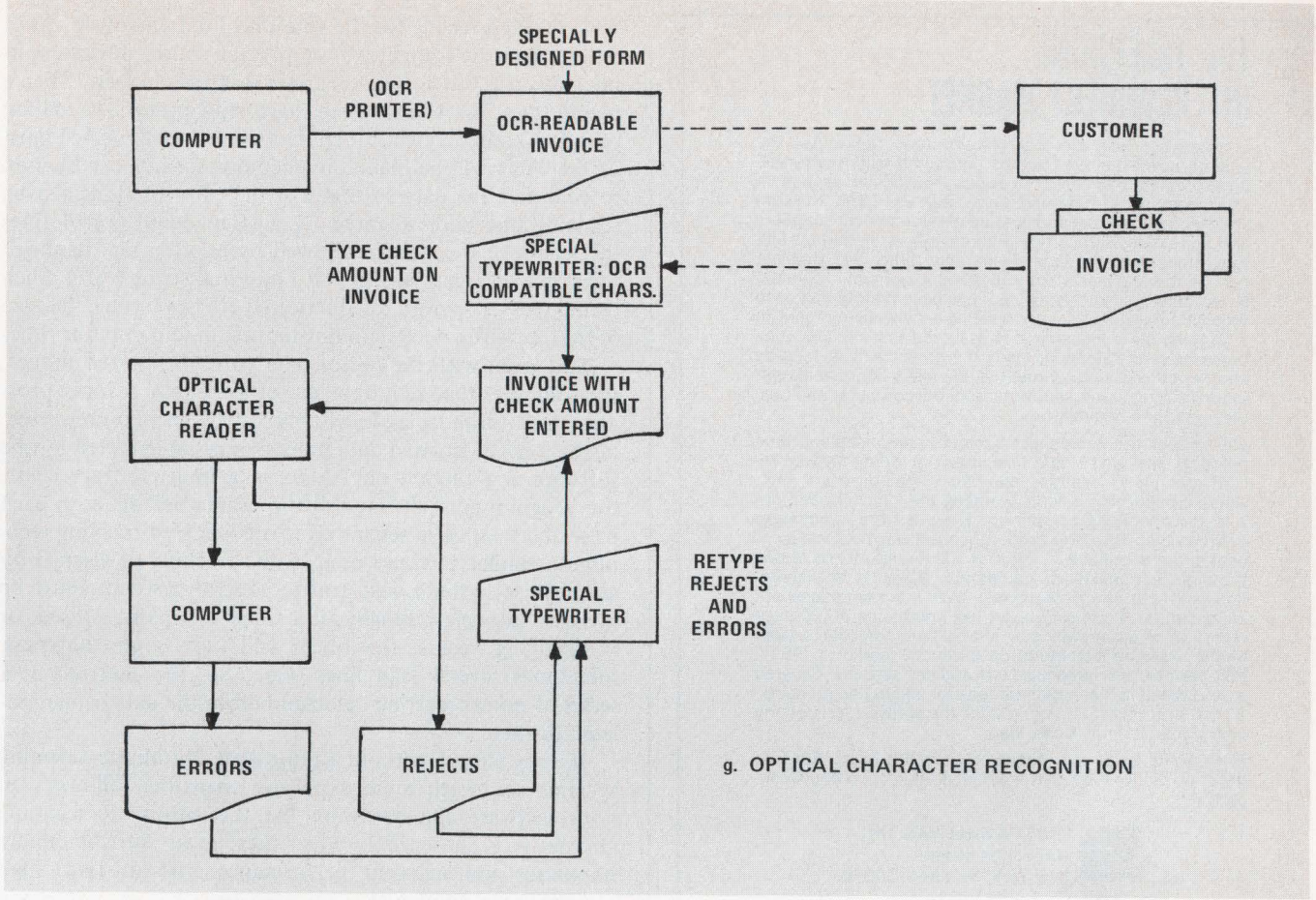


FIGURE 3 – CLOSED LOOP EXAMPLE – BILLING SYSTEM (continued)

puter to perform numerical integration is wasted in this configuration. Moreover, quality control for the transcription process is extremely difficult to maintain. The transportation clerks are usually low paid personnel, poorly motivated, and bored to tears after only a few hours of staring at strip charts and picking off numbers.

So why is it done this way? Because the method is relatively inexpensive. Software is simple, easy to maintain. Computer time is minimal. Labor costs, as indicated above, are modest in many cases. (Of course, this isn't always true either. In some companies, junior engineering personnel will perform the hated transcription function a few hours a day in addition to their other duties. In such an instance, labor costs will rise sharply.)

Figs. 2d and 2e illustrate configurations that can be used effectively where the volume of data to be processed is large enough to justify additional mechanization. In Fig. 2d, the strip chart data is transformed to computer-readable form by a semi-automatic *line follower,* a device that records the (x, y) position of a handheld cursor on some convenient medium, usually magnetic tape. There is a minimum amount of keying required (not shown) in this operation, to identify the date, time of recording, and parameter descriptions, on each strip chart section to be digitized. The strip chart is placed on the digitizing table, which looks very much like a drafting table. The operator keys in the necessary descriptors, and moves the cursor over the chart, following each parameter carefully. The cursor position is captured on magnetic tape and the tape is processed offline to generate the necessary statistical reports.

In this case, the computer performs the numerical integration. The operator time to digitize one section of a chart this way is perhaps an order of magnitude less than the time needed when manual transcription is performed, and the results are far more accurate. The line follower should be used if the volume is large enough to justify the cost of the digitizing equipment ($4000 to over $100,000, depending on the sophistication of the system; $25,000 is average) and the inevitable software development cost, which will usually exceed the equipment cost. The more expensive systems will be interactive setups, intended mainly for design tasks and used only incidentally for strip chart digitizing. The systems at the lower end of the spectrum will be batch-oriented, with little, if any feedback available to the digitizing operator. Checking outputs takes place after the central computer has processed the data. Incorrect sections are redigitized and reprocessed before final outputs are run.

The final option, depicted in Fig. 2e, has its place in such applications as analysis of seismic data, where the accuracy requirements are stringent and where enormous amounts of data are collected, or where sampling rates (in terms of the number of data points to be taken per inch on the strip chart) are very high. Such applications are usually suited to the automatic collection schemes, Fig. 2a and 2b, but sometimes historical data, available only on strip charts, must be examined. Then an automatic scanning system comes into play. In this system, the strip chart will be mounted on a drum rotated past the optical sensor, or the chart will be placed on a table and the sensor will be moved over it, capturing data as it goes. In either case, the sensor will be equipped with filters to suppress grids and other extraneous background marks as much as possible so only relevant data will be sensed. The output, invariably on magnetic tape or a high-capacity disk, will consist of a raster scan, line by line, point by point, with the presence of data signified by a "1," and the absence signified by a

"0." To get a feeling for the amount of data involved, let us assume that the scanner will sample the source document at intervals of 0.001 inch, along lines 0.001 inch apart. Then a record for a 24 x 10-inch strip chart will contain 240 million bits or 30 million eight-bit characters. Naturally, since most of the chart will be blank, an encoding scheme can be used to compress the data so that a string of zeros along a given scanning line is represented by a 10-bit word that defines the length of the string, followed by another bit "naming" the string as a data string ("1") or a null string ("0"). Such techniques can permit a reduction of 10:1 or more in the size of the file, with a corresponding reduction in computer time.

Still, even with the use of data compression techniques, the computer time requirements of automatic scanner processors are formidable. Inevitably, some background noise, in the form of isolated data points, must be detected by the software and filtered out. Also, in a multiple trace chart, the program must distinguish the points belonging to each trace and treat them separately. Sophisticated tracking techniques, similar to those used in the tracking of aircraft by air defense systems and traffic control systems, must be brought into play. Finally, if a thick pen point is used, or if smudging occurs, the traces will have some thickness sometimes several scan lines wide. So, the centroid of a series of points must be detected before the data is manipulated further.

It goes almost without saying that automatic scanning systems are much more expensive than line followers, in both software and hardware. So the automatic scanning alternative is chosen only when there is an overwhelmingly important and stringent performance criterion (e.g., high sampling rate) to be met.

A CLOSED-LOOP EXAMPLE

Figs. 3c through 3g focus on some of the ways of implementing a turnaround billing application using several of the basic methods of source data automation – to be compared with the configurations in Figs. 3a and 3b, which use the keypunch. Note that the choice of equipment in these cases is governed by the total entry volume and total processing costs of all functions performed by the system, including inventory control, accounts payable, general ledger, order entry, payroll, etc. But we will examine only the accounts receivable subsystem in some detail in order to understand how it differs in the various configurations.

In each case, the computer generates a turnaround document (bill or punched card) to be sent to the customer. The customer returns the bill (card) with a check. Then the amount on the check is correlated with the data on the bill, in computer-readable form (punched card, disk, tape, diskette, or, in Fig. 3f, directly in the data base itself).

Keypunch. In Fig. 3a, only the check amount is punched (and verified; verification should be implicitly understood wherever it can be used except in the OCR subsystem) into the turnaround card. In Fig. 3b, the entire card is punched from the information on the bill. The remainder of both processes is the same; the software is identical and the error-correction process is the same. Of course, the turnaround card system will also involve rekeying of damaged, unreadable cards.

Key-To-Diskette. The key-to-diskette system, Fig. 3c is quite analogous to the system of Fig. 3b. In both cases, a complete computer-readable record is created from information on the bill. The difference lies in the computer input routines, computer input speed, and in the relative con-

Strike it rich with Roytype's new gold computer ribbons.

When it comes to fill-in letter writing and scanning, Roytype Gold Scanoptik™ computer ribbons can't be beat. Their write is jet black, clear, nonsmearing, character after character.

They'll save you money two ways. First, you'll get up to one million lines per ribbon. Second, the writing quality of Gold Scanoptik ribbons is so good that major utilities and other commercial customers have reported rejection rates as low as ½ of 1%.

Gold Scanoptik ribbons are work savers, too. They incorporate a special cohesive ink formulation that doesn't "dust" on impact. Downtime and maintenance are held to a minimum.

Your Roytype salesman can tell you about Gold Scanoptik or other multipass film ribbons for computers, typewriters and accounting machines. Give him a call or mail the coupon.

J. T. Dessureau
Roytype Division of Litton Industries
1031 New Britain Avenue
West Hartford, Connecticut 06110
203-523-4881

Please send further information on Roytype Gold Scanoptik computer ribbons for _____ computer printer to:

Name _____

Address _____

City _____

State _____ Zip _____

Litton **ROYTYPE**
Impression and Imaging Products

CIRCLE NO. 42 ON INQUIRY CARD

venience of handling and storing diskettes and punched cards. In both cases, each station is a stand-alone unit; if one goes down for maintenance, the others are not affected.

Key-To-Tape. The key-to-tape system, shown in Fig. 3d, is also a stand-alone system. Like the key-to-diskette system, it affords convenient handling and storage, and much higher input rates than the card systems. However, in many cases, the tapes (or tape cassettes) aren't compatible with the mainframe so another element, the tape pooler, is introduced, to combine the outputs of several keying stations onto a single tape for entry into the main computer. Obviously, this increases the cost-per-station of the key-to-tape systems. Moreover, the key-to-tape systems, having come along several years ago, do not have full record displays, as some of the newer key-to-diskettes and just about all of the key-to-disk systems do. Instead, one character-at-a-time is displayed, eliminating the possibility of eyeball verification and reducing the ease of correcting records while they are being keyed.

The key-to-tape system also affords variable length records, unblocked but much longer than the traditional 80-column keypunch record, and longer than the newer 96-column card records. This feature, which also is available in key-to-diskette and key-to-disk systems, allows almost all records to be created in single blocks, eliminating the aggravation of multiple card inputs.

Key-to-Disk. The key-to-disk system, shown in Fig. 3e, is more powerful than its counterparts, but it has its drawbacks too. On the positive side, each station in a typical clustered system (several stations sharing one stand-alone processor) that can be programmed to perform sophistcated validity checks on the data so that the data being entered into the main computer will be almost free of errors. As noted above, full record displays are available to facilitate editing and retrieval. Some of the newer systems also have a stand-alone sorting capability to further reduce the load on the mainframe.

On the other hand, the cost-per-station of key-to-disk systems tends to be higher than the others, and larger numbers of stations (16 or more) must be acquired to make the system cost-effective. Also, the programming techniques required in many of these units tend to be complex so that the data entry supervisors, who usually have the programming responsibility, may have some difficulty in setting up the programs for some applications. Pooling is required in some of these systems to produce a computer-compatible tape from the data on disk. The most glaring problem with these systems relates to downtime. When the processor of the key-to-disk system goes down, all stations are down, and all operators are unproductive. Similarly, in some systems, it is necessary to shut down all stations while the data on disk is being spooled to tape.

Online Entry. The downtime problem remains with the online entry system shown in Fig. 3f; if the computer goes down, everything stops. Also, the timesharing software needed to support an online operation is costly, and it takes a mainframe partition, thereby reducing the throughput of batch jobs running concurrently. These disadvantages are counterbalanced by the lovely convenience of online operation: no error-correction loop; immediate update of the data base; no intermediate storage media to worry about; and editing and display programs produced by the programming staff, not by the data entry supervisor, so the supervisor can concentrate on the task at hand.

TABLE 1

FACTORS IN A TRADEOFF STUDY

A. SYSTEM PERFORMANCE REQUIREMENTS

1. **Traffic charactersitics**
   a. Current and predicted average rates
   b. Hour-to-hour and day-to-day variability
   c. Number and geographic distribution of data collection sites
2. **Transfer function requirements**
   a. Response time
   b. Data accuracy
   c. Allowable system downtime
   d. Operating hours (number of shifts, number of days a week)
3. **Environmental considerations**
   a. Indoor/outdoor
   b. Noise, temperature, relative humidity
   c. Availability of electric power
   d. Availability of communication lines
4. **Other constraints**
   a. Factors peculiar to the system which may preclude certain data capture techniques
   b. Factors peculiar to the system which may dictate the use of certain data capture techniques

B. COMPARISON OF SOURCE DATA AUTOMATION TECHNIQUES

1. **Costs** *(Hardware, software, material, labor, maintenance)*
   a. Startup
   b. Operating (for various postulated input traffic loads)
2. **Personnel**
   a. Number of people needed
   b. Skill levels
   c. Nature and duration of training
3. **Materials** *(paper, ink, badges, etc.)*
   a. Availability
   b. Encoding requirements
   c. Information capacity
4. **Equipment**
   a. Ease of operation
   b. Expandability to accommodate traffic increases
   c. Flexibility to accommodate new applications
   d. Compatibility with existing installation
   e. Error-correcting techniques
5. **Software**
   a. Amount of mainframe application programming needed to support new SDA technqiue
   b. Ease of programming of entry device itself

Online entry is particularly popular in small systems where everything is done online – there's no concurrent batch operation to worry about, and the typical system has only two or three entry terminals, not dozens. Relatively few data entry formats are needed; the operation is easy to maintain.

Optical Character Recognition. Last but not least is the optical character recognition (OCR) system shown in Fig. 3g. In this instance, the bill is designed in accordance with fairly rigid specifications; special characters must be used in printing the bill and data must be printed in certain areas only. Again, as in the case of the turnaround card, the amount of the check must be entered onto the bill when it is returned, using a typewriter with special OCR characters. And unreadable documents must be retyped, along with documents rejected by the optical reader.

The advantages of this approach are: high capacity, little or no error correction needed once the data has been entered into the computer and minimal labor cost. These must be weighed against the fairly high equipment cost, maintenance cost, and the relative inflexibility of these systems – changes in the design of input forms can't be made at will.

THE TRADEOFF STUDY

Table 1 lists the factors that need to be considered by a user investigating some new application or studying alternatives to an existing data entry method. The feasibility study first addresses the performance requirements that the new subsystem will have to meet and then a comparison of the characteristics of various classes of devices (e.g., key-to-disk, OCR, online) that can do the job.

Item A 4 in Table 1 deserves some explanation. The "other constraints" that will limit the set of choices in a given case can be almost anything deemed important by the decision-makers. For example, the users may determine that the system must accept all existing input documents received from customers, including barely comprehensible notes scrawled on the backs of envelopes. This lets out OCR. Or, the system may be subject to wide variations in day-to-day traffic, coupled with a sustained rapid growth in the average daily traffic. This may eliminate key-to-storage systems from consideration if it is also determined that the inevitable overloads cannot be sent to service bureaus for keying. In another case, a magnetic stripe reading method can't be used because the stripe can't carry the 400 characters of information needed for each account. On a more mundane level, a device may be scrubbed from the study because the head of the committee has had some bad experiences with similar units in the past.

In Item B3 of Table 1, the term "encoding requirements" refers to the method of producing the computer-readable element, and the term "information capacity" refers to the number of characters of data that can be captured from one element. The value of the latter parameter varies widely. In a point-of-sale system, the optical wand may be asked to read the 10-digit Universal Product Code; on the other end of the spectrum, an optical character reader in a health insurance firm may be required to read several hundred characters from each document.

Next month, Part 2 of this Profile will discuss the operating characteristics of specific devices. ■

1976 National Computer Conference

June 7-10, 1976 in New York

There's something for everyone in New York and judging from the number of participants, there will be something for everyone at this year's NCC, too. Over 300 organizations have rented over 900 booths to spread over three floors of the New York Coliseum. Whether the drawing card this year is New York, the bicentennial or the improving economy is hard to tell, but there are also two other landmarks marked by this year's NCC: the 25th anniversary of the electronic digital computer as a commerical reality and the 25th anniversary of the first Joint Computer Conference – NCC's predecessor. Conference Chairman Dr. Carl Hammer, director of computer sciences for Sperry Univac in Washington, DC, and Program Chairman Dr. Stanley Winkler, manager of applied technology for IBM at Gaithersburg, MD, have organized – with the help of many – 126 sessions in three general groupings. For the socially concerned, there's "Computers and People." "Systems" covers computer design and systems management. And computer and data base architecture and software are the topics of "Science and Technology." There will also be four plenary sessions at the Grand Ballroom of the New York Hilton. A special feature this year are eight full-day professional development seminars also held at the Hilton, dealing with Structured Programming in Cobol, Computer Networks, Design of Online Systems, Management Auditing of Computer Operations, Micrographics and Data Processing, Structured Design, Management of Software Engineering and Computer Applications of Learning Technology. Open to NCC registrants, the registration fee for each seminar is $50.

If that's not enough to keep you off the streets, there's the National Student Computer Fair, Computer Graphics Art Exhibit, Telenet's networking demonstration, NCC Science Film Theater and the Multimedia presentation by Mimi Garrard Dance Theater.

But if you'd rather be on the streets, New York offers its own non-contrived versions of Adventureland, Fantasyland and Never-Never Land, all within walking distance of your hotel.

CONFERENCE AT A GLANCE

		MONDAY AFTERNOON	
		2:30 pm - 4:00 pm	4:15 pm - 5:45 pm
COMPUTERS AND PEOPLE	SOCIETAL CONCERNS	*Saul Padwo* WORLD ENVIRONMENT FOR DATA PROCESSING	
	COMPUTER PROFESSION	*Margaret Fox* 25 YEARS OF JOINT COMPUTER CONFERENCING	*Walter Anderson* INFORMATION PROCESSING iN THE YEAR 2000
	ISSUES IN COMPUTING	*Ronald A. Frank* ROLE AND OBLIGATIONS OF THE TRADE PRESS	*H. W. Bomzer* DATA PROCESSING CAREER PATHS
	APPLICATIONS SERVING PEOPLE	*Genevieve Greenwald-Katz* COMPUTERS IN ARCHITECTURE	
SYSTEMS	COMPUTER SYSTEMS	• *John C. Davis* STORAGE SYSTEMS	
	SYSTEMS MANAGEMENT	• COMPUTER *John V. Soden* LONG-RANGE PLANNING FOR COMPUTER USAGE IN LARGE ORGANIZATIONS	
	NETWORKING	*Peter E. Jackson* LEGAL & REGULATORY TRENDS IN COMPUTER COMMUNICATION	*Ira Cotton* PROTOCOLS FOR COMPUTER NETWORKS
	BUSINESS AND INDUSTRY SYSTEMS	*Carol Johnson* ENHANCING LIBRARY SYSTEMS	*Greg E. Mellen* AIR TRAFFIC CONTROL
SCIENCE AND TECHNOLOGY	COMPUTER & DATA BASE ARCHITECTURE	*Noah S. Prywes* IMPACT OF SYSTEM DESIGN AUTOMATION ON DATA BASE ARCHITECTURE	*Liba Svobodova* COMPUTER STRUCTURE
	SOFTWARE	*Margaret Butler* SOFTWARE SHARING	*Alan G. Merten* TRANSFERABILITY OF APPLICATION PROGRAMS & DATA BASES
	COMPUTER SCIENCE	*Nathaniel Macon* COMPUTER ARITHMETIC AND NUMERICAL METHODS	
	APPLICATIONS OF COMPUTER SCIENCE	• *Edward Feigenbaum & Saul Amarel* AI APPLICATIONS IN MEDICINE AND SCIENCE	

TUESDAY MORNING		TUESDAY AFTERNOON	
8:30 am - 10:00 am	10:15 am - 11:45 am	2:30 pm - 4:00 pm	4:15 pm - 5:45 pm
DATA SECURITY			
Eldred C. Nelson DATA SECURITY IN THE DOD	*Naomi Seligman* DATA SECURITY IN INDUSTRY	*Rein Turn* DATA CRYPTOGRAPHY	*Dennis K. Branstad* SECURITY IN COMPUTER NETWORKS
	PIONEER DAY		
Anita J. Cochran COMPUTING IN EUROPE	*John G. Brainerd* ORIGINS OF ENIAC	*Herman Goldstine* DEVELOPMENT OF ENIAC	*Richard E. Merwin* POST-ENIAC TRANSFER OF TECHNOLOGY
PUBLIC ACCESS TO COMPUTERS			
Janet Kiehl PUBLIC ATTITUDES TOWARD COMPUTERS	*Evelyn R. Murphy* PERSONAL COMPUTERS	*David H. Ahl* PUBLIC ACCESS TO COMPUTER POWER	
CRIMINAL JUSTICE SYSTEMS			
Bernice Pantell THE ALEMEDA COUNTY LAW ENFORCEMENT SYSTEM OF THE FUTURE		CRIMINAL JUSTICE INFORMATION SYSTEMS AND USE OF CRIMINAL RECORDS	
COMPUTER SYSTEM DESIGN			
Nancy Betz INTERACTIVE SYSTEMS	*Stephen S. Yau* COMPUTER SYSTEMS RELIABILITY AND MAINTAINABILITY	*Gerald Estrin* MODULAR COMPUTER DESIGN	
SYSTEM MANAGEMENT AND PLANNING			
Edward O. Joslin ECONOMIC REQUIREMENTS AND WORKLOAD ANALYSIS: ESSENTIAL ELEMENTS OF SYSTEMS ANALYSIS		*David S. Alberts* ECONOMICS OF SOFTWARE QUALITY ASSURANCE	*David S. Alberts* FUTURE DIRECTIONS OF QUALITY ASSURANCE
Franklin F. Kuo PACKET RADIO & SATELLITE NETWORKS	*Robert E. Kahn* PROGRESS IN PACKET NETWORK INTERCOMMUNICATIONS	*Louis Pouzin* INTERACTIONS BETWEEN PRIVATE & PUBLIC DATA NETWORKS IN EUROPE	(SEE "SECURITY IN COMPUTER NETWORKS" ABOVE.)
WORD PROCESSING & OFFICE AUTOMATION			
Harvey L. Poppel COMMUNICATIONS, COMPUTERS & WORD PROCESSING	*David Farber* COMPUTERIZED MESSAGE SYSTEMS	*Howard L. Morgan* WORD PROCESSING & OFFICE AUTOMATION	
COMPUTER ARCHITECTURE			
Yaohan Chu HIGH LEVEL LANGUAGE COMPUTER ARCHITECTURE		*Anne M. Gulick* MULTIPROCESSING	*Tomlinson Rauscher* APPLICATION ORIENTED COMPUTER ARCHITECTURE
SOFTWARE DESIGN & ENGINEERING			
Edward Yourdon STRUCTURED DESIGN		*Raymond T. Yeh* SOFTWARE ENGINEERING — WHAT TO EXPECT IN THE NEXT DECADE	
James S. Ketchel TECHNOLOGICAL FORECASTING	*Joyce A. Amenta* SOFTWARE FOR SYSTEMS	*Murray Turoff* IMPLEMENTATION OF COMPUTER CONFERENCING	
ARTIFICIAL INTELLIGENCE			
Iris Kameny INFERENCE AND SPEECH RECOGNITION AND UNDERSTANDING		*Marvin Minsky & Seymour Papert* ARTIFICIAL INTELLIGENCE & EDUCATION	*Leonard Friedman* THE PRESENT AND FUTURE OF MOBILE ROBOTS

CONFERENCE AT A GLANCE (continued)

		WEDNESDAY MORNING		WEDNESDAY AFTERNOON	
		8:30 am - 10:00 am	10:15 am - 11:45 am	2:30 pm - 4:00 pm	4:15 pm - 5:45 pm
COMPUTERS AND PEOPLE	SOCIETAL CONCERNS	• PUBLIC POLICY ISSUES I •			
		WELFARE PAYMENTS AND THE COMPUTER	*Marilyn E. Courtot* DATA BANKS IN THE FEDERAL ESTABLISHMENT	*Anthony J. Patinella* EFTS: THE POLICY QUESTIONS	*William R. Weber* EFTS: IMPLEMENTATION PROBLEMS
	COMPUTER PROFESSION	• COMPUTERS AND THE PHYSICALLY HANDICAPPED •			
		Robert Gildea COMPUTERIZED BRAILLE TRANSLATION	*Steven L. Jamison* COMPUTERS AND SIGN LANGUAGE	*Harry G. Hedges* COMMUNICATION AIDS FOR THE NON-ORAL	*Harry G. Hedges* READING MACHINES FOR THE BLIND
	ISSUES IN COMPUTING	• INDUSTRY & UNIVERSITY RELATIONSHIPS •			
		Marshall C. Yovits INDUSTRY NEEDS & VIEWS OF COMPUTER SCIENCE GRADUATES	*Marshall C. Yovits* COMPUTER SCIENCE GRADUATES & INDUSTRY	*Marshall C. Yovits* INDUSTRY AND UNIVERSITY — PROBLEMS AND SOLUTIONS	
	APPLICATIONS SERVING PEOPLE	• MEDICINE AND HEALTH CARE I •			
		Thelma Estrin COMPUTERS AND BIO-CYBERNETICS	*Robert S. Ledley* ALGORITHMS IN COMPUTERIZED TOMOGRAPHY	*Richard Shepard* DATA BASES IN BIOLOGY AND MEDICINE	
SYSTEMS	COMPUTER SYSTEMS	• MICROPROCESSORS •			
		Reg E. Kaenel UNDERSTANDING AND USING MICROPROCESSORS		*Barry R. Borgerson* MICROPROCESSOR SYSTEMS	
	SYSTEMS MANAGEMENT	• COMPUTER SYSTEM PERFORMANCE & EVALUATION I •			
		Philip J. Kiviat COMPUTER PERFORMANCE MANAGEMENT		*Gerald Estrin* MEASURES OF PERFORMANCE	*Stephen T. Swift* PERFORMANCE INFORMATION SYSTEMS
	NETWORKING	*Teresa O. Green* USE OF NETWORKS IN SCIENCE & EDUCATION	NETWORK ARCHITECTURE	*Stephen R. Kimbleton* NETWORK OPERATING SYSTEMS	
	BUSINESS AND INDUSTRY SYSTEMS	• COMPUTER-ASSISTED MANUFACTURING •			
		Thomas L. Boardman COMPUTER-AIDED MANUFACTURING AND DESIGN		*W. Barkley Fritz* COMPUTERS IN THE SHIPBUILDING INDUSTRY	
SCIENCE AND TECHNOLOGY	COMPUTER & DATA BASE ARCHITECTURE	• DATA BASE ARCHITECTURE •			
		Etelle Grinoch DATA BASE STRUCTURE	*Susan Brewer* RELATIONAL DATA BASES	*John L. Berg* DATA BASE DECISIONS	
	SOFTWARE	• PROGRAMMMING LANGUAGES •			
		Herbert Maisel PROGRAMMING LANGUAGE DESIGN		*Paul Oliver* PROGRAMMING LANGUAGE STANDARDS: SUCCESSES AND DISAPPOINTMENTS	
	COMPUTER SCIENCE	*Enrique Ruspini* APPROXIMATE REASONING		*John McLeod* ENERGY MODELS	*Roger M. Firestone* COMPUTER PHYSICS
	APPLICATIONS OF COMPUTER SCIENCE	• COMPUTER GRAPHICS •			
		Steven Levine SOUND — ANOTHER DIMENSION IN COMPUTER GRAPHICS	*Joseph Scala* TEACHING THROUGH COMPUTER GRAPHICS	*Richard Speer* COMPUTER GENERATED FILMS	*Jackie Potts* COMPUTER GRAPHICS SOFTWARE

THURSDAY MORNING		THURSDAY AFTERNOON			
8:30 am - 10:00 am	10:15 am - 11:45 am	2:30 pm - 4:00 pm	4:15 pm - 5:45 pm		
● **PUBLIC POLICY ISSUES II** ●					
Neal Gregory DATA COMMUNICATION POLICY	*Francis Gregory* PRIVACY: THE POLICY QUESTIONS	*John Salasin* PRIVACY: THE PSYCHOLOGICAL & SOCIOLOGICAL IMPLICATIONS		SOCIETAL CONCERNS	COMPUTERS AND PEOPLE
Gopal K. Kapur EXECUTIVE MANAGEMENT MUST BECOME INVOLVED	*Roy F. Keller* CONCEPTS IN PROGRAMMING AND ADP INSTRUCTIONAL SYS.	*Louise Etra* NEW BREED OF ARTIST TECHNICIAN	*Patsy Scala* ARTISTS & THEIR USE OF COMPUTERS	COMPUTER PROFESSION	
● **SOFTWARE PRODUCTIVITY** ●					
Lloyd Baldwin PRODUCTIVITY PAYBACK FROM PACKAGE APPLICATION SOFT.	*Eugene I. Lowenthal* HIGH LEVEL LANGUAGES FOR SOFTWARE DEVELOPMENT	*Larry A. Welke* QUALITY AND PERFORMANCE MEASUREMENTS FOR SOFTWARE		ISSUES IN COMPUTING	
● **MEDICINE AND HEALTH CARE II** ●					
David J. Mishelevich TOWARD THE INTEGRATED HOSPITAL INFORMATION SYSTEMS		*Bernice J. Proctor* PATTERN RECOGNITION IN CLINICAL MEDICINE		APPLICATIONS SERVING PEOPLE	
● **MINICOMPUTERS** ●					SYSTEMS
S. Ron Oliver MINIS VS. MAXIS		*Carol Brown* USE OF MINICOMPUTERS IN LARGE ORGANIZATIONS		COMPUTER SYSTEMS	
● **COMPUTER SYSTEM PERFORMANCE & EVALUATION II** ●					
Jeffrey P. Buzen ISSUES IN COMPUTER SYSTEMS PERFORMANCE	MARKOV PERFORMANCE MODELS	*William E. Perry* COMPUTER SYSTEMS AUDITABILITY AND CONTROL		SYSTEMS MANAGEMENT	
Susan Poh NETWORK MEASUREMENTS		*Thomas Pyke, Jr.* NETWORK ACCESS		NETWORKING	
● **COMPUTER-CONTROLLED PUBLICATION** ●					
Norman W. Scharpf COMPUTERS IN TYPESETTING		*Dennis R. Neary* INTEGRATION OF MICROFILM AND COMPUTER		BUSINESS AND INDUSTRY SYSTEMS	
● **DEVELOPING DATA BASE SYSTEMS** ●					SCIENCE AND TECHNOLOGY
Fredric C. Gey SOCIO-ECONOMIC FACTORS IN DATA BASE MANAGEMENT		*Patricia Berglund* MANAGEMENT INFORMATION SYSTEMS	*Norman F. Hirst* AN INTRODUCTION TO MUMPS	COMPUTER & DATA BASE ARCHITECTURE	
Edward Miller AUTOMATED SOFTWARE TESTING AND EVALUATION		*Paul Schneck* WHY (OR IF) FORTRAN WILL SURVIVE		SOFTWARE	
● **MATHEMATICAL PROGRAMMING** ●					
Patricia J. Eberlein ALGORITHMS FOR UNCERTAIN FORMS	*Jean-Paul Jacob* SIMULATION VS. MATHEMATICAL PROGRAMMING	*Darwin Klingman* OPTIMIZATION OVER GRAPHS AND NETS		COMPUTER SCIENCE	
● **COMPUTER STUDIES IN THE HUMANITIES** ●					
Joseph Raben COMPUTERS IN MUSICAL & HISTORICAL RESEARCH	*Naomi Sager* COMPUTATIONAL LINGUISTICS	*A. K. Joshi and C. Rieger* NATURAL LANGUAGE PROCESSING		APPLICATIONS OF COMPUTER SCIENCE	

SYSTEMS-ON-A-CHIP

PART 1

THE REVOLUTION IN FULL FLOWER

DAN M. BOWERS / Technical Editor

In our Technology Profile on Microprocessors and Minicomputers, January and February of 1975, we likened the present time period to the era a dozen years ago when (relatively) inexpensive, fast, I/O oriented minicomputers appeared on the scene and revolutionized our industry, wiping out and creating whole subindustries, such as digital logic modules and minicomputer systems houses, in the process. We predicted (as indeed, we have been predicting since mid-1973) a period of violent and traumatic upset during 1975-1977, a period which will offer more business opportunities than at any time since the mid-1960s.

In this Technology Profile, which will extend through both this month and next, we revisit the revolution to find it in full flower. We shall examine the effects thus far upon the various parts of our industry, study the options now available to the user, and, as usual, predict where the revolution will lead, based on the more specific insight which another year has made available to us.

The computer-on-a-chip is at the heart of the new revolution, but we are now seeing many more systems on the chip than just the computer – memories, modems, I/O units, A-D and D-A. We therefore have a revolution due to the *System-on-a-Chip,* hence the general title of this Profile.

The scope of the revolution is unlimited; however, we shall limit our Profile to the areas which are currently experiencing the greatest impact (mini/microcomputers, peripheral equipment, communications, storage), and the systems-on-a-chip that are at the heart of the revolution (microprocessors, modems-on-a-chip, ROMs, RAMs, D-A and A-D, I/O adapters, the CCD).

MICROPROCESSORS ARE EVERYWHERE

Before the advent of the microprocessor, the programmed logic array parade (PLA), which was a one-chip, complex, logic unit, was used in some digital systems to replace acres of discret logic. Also, the read-only memory (ROM) began to be used more than a decade ago as a mechanism for replacing large amounts of sequential logic circuitry. The concept now known as ROM-control was known a decade ago as firmware, and had its real beginnings with the first introduction of IBM's System/360 in 1964. There is nothing really dramatically new about present systems, except the considerably greater number of circuits which can be placed on a single monolithic chip.

We observed last year that the primary impact of microprocessors, RAMs and ROMs, etc., is not in the low-cost of replacement of standard hardware, but in the new methods of operation which they make possible, such as super-intelligent-terminals, peripherals-with-a-processor, intelligent modems, intelligent instruments, etc. Distributed intelligence is the new watchword, centralized processing is on the way out. We envision entire networks of communications devices, terminals, peripheral equipment, etc., without the presence of a central processor in the usual sense: microcomputers in each of the peripheral equipments will perform, in a dispersed manner, the functions now allocated to the central computer. Modular central processors, modular programs which can be executed in any of many different subprocessors, and many other new ways of processing are being developed, and an entire new set of hardware tools is being presented to us, and the old software, systems, procedures, etc., are fast becoming obsolete.

Last year we observed that the first equipment manufacturers to take advantage of the microprocessor's capability were in the instrument field; intelligent, microprocessor-controlled instruments were commonly available a year and a half ago. In the past year we have seen the emergence of microprocessor-controlled printers, terminals, and disk controllers; remote control of traffic signals, remote and unattended communications repeaters, the "intelligent disk" – in short any function which was previously performed by TTL logic can be performed by the microprocessor. It is strictly an economic tradeoff to determine whether the cost is less using the microprocessor, and this is usually determined by the complexity of the function to be performed, and the number of TTL chips that would have been used to perform it. In the case of the microprocessor controlled printer, for example, the microprocessor is used for such functions as control of chains, synchronization of printed characters with the rotation of the chain, code conversion, input/output control, etc.

These applications are entirely separate from the use of the microprocessor as a computer in the conventional sense. There is clearly much activity in that direction as well, and the microcomputer, which is a combination of the microprocessor, memory and I/O chips to produce a complete processor equivalent to the minicomputer that we have been using for years, is now seriously challenging the con-

"Oh, they're all arguing over how Teletype sold 600,000 model 32 and model 33 data terminals."

The Teletype® model 33 is the standard of the industry because it delivers outstanding economy, reliability and versatility in a wide range of applications. From message communications to computer input/output. On switched network as well as private-line systems.

For more information about the model 33, write or call: Teletype Corporation, Dept. 40X, 5555 Touhy Ave., Skokie, Ill. 60076. Phone 312/982-2000.

TELETYPE

Teletype is a trademark and service mark registered in the United States Patent and Trademark Office.

CIRCLE NO. 46 ON INQUIRY CARD

ventional minicomputer industry. We have predicted for some time that the conventional minicomputer manufacturers are in the same position as the manufacturers of digital logic modules were more than a decade ago; they must adapt their products to the new technology, or find some other business in which to make a living.

OTHER SYSTEMS ON A CHIP

The impact of other LSI chips is equally important. Semiconductor RAM has been available for many years, and each year the economic tradeoff between semiconductor storage and conventional magnetic (e.g., core) storage for high speed memories moves further toward the advantages of semiconductor memory. The charge-coupled device (CCD) appears to be the first serious challenger to the long dominance of magnetic surface storage for mass and archival memory. Modems on a chip will seriously impact what has become a substantial business, packaged modems.

It is, as we said, a real live revolution, and no element of the industry will escape unscathed. Companies which do not presently have plans encompassing both the technological development of new products taking into consideration the swift advance of technology, and a comprehensive business plan will not survive the next several years.

THE GARAGE SHOP PHENOMENON

Having been among the leading practitioners of garage shops for a decade, we will be the last to denigrate these small, hustling operations, which represent capitalistic enterprise nearly at its purest, and in its most exciting form. The system on a chip provides, as we said last year, opportunities for the astute, brave, and the daring (and even the foolhardy) to begin their own business on a shoe string. We estimate that there are presently more than 100 companies actively promoting products, companies and products which were unknown or nonexistent a year and a half ago.

Microcomputers can be manufactured by any company which can buy the basic chips and put them on a PC card, supplying such software, service, etc., as their expertise provides. Microcomputer peripheral controllers offer similar opportunities, and there has long been a group of small companies providing specialized controllers and interfaces using the old technology. Microcomputer development systems are all the rage. There are dozens of companies giving seminars, offering training courses, and offering consulting services in the business of learning to use the microprocessor; some of these even have more knowledge and experience than those whom they purport to teach.

Few of these shops will survive in their present form, because the nature of the revolution, while it presently encourages the development of small operations, is such that two years hence the business will shake out into substantial companies competing in each of the segments of the industry – processors, software, peripherals, etc. After the revolution has thoroughly shaken the technology, solid companies will again have the advantage as the small computer industry pursues the vast new markets which have been opened during the period of the revolution. At that time, the usual virtues of sound financing, expert marketing, efficient manufacturing, and astute management will again outweigh the expertise of the development engineering departments.

What, then, is the future, for today's small enterprises, the epitome of capitalism, the brave and venturous souls, etc.? Many will be acquired by larger companies which see that the quickest and frequently the cheapest way into this new era is to bring in the people and the organization that are already organized and familar with the new technology. Unfortunately, many of the established companies will continue with their "we can do it better than anyone" philosophy, and will miss the boat. More than half the garage shops will go "down the tubes," but then this is the usual fate of approximately that many new businesses. Few will combine among themselves to make larger companies, because they are presently geographically dispersed, their technological capabilities overlap considerably rather than complementing one another, and they also are highly endued with the we-can-do-it-better philosophy.

IN OUR PROFILE THIS MONTH

We begin our profile this month with a brief review of the nature and capabilities of the microprocessor, courtesy of Roy Twitty of National Semiconductor Corp. Following that, and following all of Mr. Twitty's and our glowing words about the potential of the microprocessor, we present a caution, "Beware the Microprocessor," by Donald McDonald of Technology Marketing, Inc. Finally, we present some unique ideas for future systems and equipment, by Marty Jarosz of Northeast Services.

Next month we shall continue with a discussion of computer memory, a new Microprocessor Score Card from Microcomputer Technique Inc., and other commentary on where the revolution is leading us.

THE LSI MICROPROCESSOR

ROY TWITTY / National Semiconductor Corp., Santa Clara, CA

Similar to the central processing unit (CPU) of a computer, a **microprocessor** manipulates data by interpreting and executing coded program instructions. This general purpose data processing device is contained on large-scale integrated (LSI) circuits, which are produced by means of metal-oxide-semiconductor (MOS) technology.

A microprocessor consists of an accumulator, an arithmetic-logic unit, a scratch-pad read/write memory, a register and decoder for instructions, a program counter and address register stack, a timing and control section, a parallel data and input/output bus, and a controller for input and output of data.

When the microprocessor (CPU) is incorporated as a CPU in a working system along with a data-storage memory, a program memory, and input/output (I/O) circuitry, it is called a **microcomputer**. Some firms produce complete microcomputers – CPU, data-storage memory, program memory and input/output circuitry – on one or two MOS-LSI circuits. The tendency in such cases is to call the unprogrammed circuits a **microprocessor system**, which term is also used to describe unprogrammed multi-circuit sets that include memory and I/O options.

MICROCOMPUTERS

The microcomputer is a smaller version of a minicomputer,

COMPATIBILITY UNLIMITED!

GENESIS ONE ® peripherals. Totally plug-compatible with IBM 3271/3272 Model 2 Controllers. And System/3! And the 3790!

And the connection is *direct.* Just plug in our sensational low-cost G77 ™ Display Terminal and G-Series Printer and they're instantly ready for work. The G77 is the plug-in replacement for IBM's 3277. The G-Series Printer replaces IBM's 3284, 3286 or 3288. Both our units offer much more in terms of price advantages, extra features and superior performance than their IBM counterparts. Most important of all, our compatibility and superiority have been *proven in use* in just about every type of industry and installation. Read some raves:

Unbeatable price-performance!

"I had never seen actual plug-to-plug compatibility before . . . we could pull the IBM unit out, put Genesis in without any interface, and get the same results for less money. Having tried Genesis out for a year, we are pleased with the quality and dependability of the equipment . . . and have not had a single failure."

Bob Sisinni, Thermo-King
Minneapolis, Minn.

"The G77 is plug-to-plug compatible in every respect except price, and that makes it a very attractive alternative."

Jim Grisson, Compo Industries
Waltham, Mass.

"We have been using the G77 for over a year and have found the performance is equally as good as IBM's 3277. However, its price is far more attractive."

Bill Taylor, Southland Life
Dallas, Texas

"Moving away from IBM was a big step for us, but the G77 looked so promising we placed an order for 6 of them. They proved to be totally compatible and extremely reliable. We now have over 40 installed with 20 more on order, and we would recommend them to anyone."

James Cranwill VP, Franklin Life
Springfield, Ill.

For a demonstration on *your* IBM Controller, or System/3, or the 3790 — or for more information — send in the coupon. We'll prove that Genesis One gives the most compatibility for your money!

GENESIS ONE ® COMPUTER CORPORATION an MAI company
300 East 44th Street, New York, N.Y. 10017 D11-5

☐ Send me your literature.
☐ Phone me to set up a demonstration. (Phone No.)_____

Name _____

Title _____

Company _____

Address _____

City _____ State _____ Zip _____

CIRCLE NO. 44 ON INQUIRY CARD

which is generally a more powerful computer based on bipolar transistor-transistor logic (TTL) semiconductors. The terms "micro" and "mini" refer not to limitations in performance, but rather to physical size. Both "micro" and "mini" computers can be made nearly as powerful as large computers that cost many times more.

An MOS-LSI microcomputer costs one-half that of a mini; it requires far less power (a fraction of a watt); it is far smaller (an 8 by 10-inch circuit board versus the size of a typewriter); and it can be equipped with about the same memory capacity. While the mini processes data faster, the micro is sufficiently fast to handle manually-fed data, which is all that is required for most computer terminals, cash registers, industrial controllers and instrumentation.

The microcomputer consists of three sections:

1. The microprocessor, or data processor (CPU), which contains the basic control logic, the circuitry for decoding instructions, and logic circuits for processing arithmetic functions.

2. Memory circuits: one type for storing data, and another which contains the microcomputer's program instructions. The data-storage unit is known as a random-access memory (RAM), or read-write memory. Program instructions are contained in a read-only memory (ROM), which is permanently encoded with information that tells the microcomputer what to do.

3. Input/output (I/O) LSI devices or circuitry used to interface the microcomputer with keyboards, displays and other peripheral equipment.

The integration of semiconductor and computer technologies in MOS-LSI microcomputers provides many features unavailable in some big computers. One example is a register stack that allows the CPU to be interrupted quickly to handle short subroutines. Others are the ability to handle serial input-output functions directly from the CPU, or to build controller functions into input/output circuits so that peripherals can be handled independently of the CPU.

Integration of technologies also permits the "architecture" (the arrangement of CPU, memories, I/O devices and auxiliary components) of microcomputers to be varied according to their intended use. One form of architecture may facilitate arithmetic operations for lengthly numerical analysis, while another architecture may emphasize input and output operations for control and monitoring applications.

MICROCOMPUTER CAPABILITIES

Basically, microcomputers are classified by the number of bits that can be handled at one time. The smallest and least expensive can handle a block of four bits. Machines in this category include FIPS (Four-bit Integrated Processing System) made by National Semiconductor Corporation, the 4004 by Intel, and the PPS-4 and PPS-4/2 from Rockwell International.

Eight-bit microprocessors, such as National's SC/MP and IMP-8, are the most popular type for general control applications. National popularized the "bit slice" building-block approach to larger processing capability by connecting four-bit devices in parallel. In the IMP-16, four 4-bit slices are connected together to form a machine of 16 bits, which is the word length used by most minicomputers. A complete 16-bit microcomputer, known as PACE (Processor And Control Element), in the form of a single integrated circuit was recently introduced by National, and is an economical substitute for a minicomputer in many applications. The longer word length for instructions and addressing provides higher overall throughput and simplifies the programming.

MICROCOMPUTER APPLICATIONS

The microprocessor portion was first developed for use in sophisticated calculators, and to replace the inflexible circuitry known as "hard-wired logic." The greatest future impact of microcomputers will probably not be in the low-cost replacement of standard hardware, but rather in the new methods of operation which they make possible. The largest market for microcomputers will be found in new applications that were once technically impossible or which could not be justified economically. In five years, new applications could encompass as much as 70 percent of sales.

The microcomputer market in 1975 accounted for almost $100 million in sales, a figure that would obviously be much higher were it not for the economic recession of the nation. This year, the market is expected to exceed $180 million, and by the end of the decade, factory sales could reach from $350 to $500 million. By 1983, microcomputers will be a $1 billion business.

Although the application of microcomputers is more evolutionary than revolutionary, their use will be pervasive by the end of the 1970's, and almost everyone will be affected by them in some way. There will soon be one in every new car, and in a few years, they will enter the home. They will be able to communicate via telephone or television to provide stock market reports, newspaper items, local library services, special entertainment such as games of strategy, and control of systems in the house from the lights and lawn sprinklers right down to the coffee pot. They will make it possible to phone a department store, scan selected merchandise via TV, order the items, and be billed automatically at the bank. The microcomputer will soon be in the hands of a new generation of designers who will be trained to regard it as a simple device, much as today's engineers look at semiconductor components or commodity products.

BEWARE THE MICROPROCESSOR

DONALD MC DONALD / Manager, Computer Development, Technology Marketing, Inc., Costa Mesa, CA

When it comes to incorporating a computer function into a piece of equipment, many designers start by asking "How can I use a microprocessor?" That's the wrong question. It proposes a solution before the problem has been defined.

Instead, designers, engineering managers – and indeed top corporate line executives – must go back to basics by first asking "What is it I'm trying to accomplish?" Only when that question is properly and fully answered can appropriate decisions be made.

Thus a warning for everyone concerned, from executive to designer: *don't be fooled by the apparent ease with which a microprocessor can be selected and implemented in a product.*

At Technology Marketing, Inc., we have encountered

many misconceptions among both line executives and designers regarding the use of microprocessors. The misconceptions include overestimating the capabilities of microprocessors in general and underestimating the complexities involved in their use; they also include a lack of understanding of the differences among the available microprocessors in function and performance as well as the support available and required from the supplier during development.

This leads to problems from two different sources. Most designers like to use the latest technology available, and many are intrigued by the idea of the microprocessor, which often sounds like a great solution to their problem when they read about it. Similarly, corporate executives can easily succumb to the glamour of a "computer on a chip" and direct their engineers to use it without fully understanding the level of expertise needed to design one into a system and attain the required cost and performance goals.

The potential trap is that it is equally or more complicated to design using a microprocessor as it is to incorporate a minicomputer into a system. When a minicomputer is to be used, an executive will generally recognize the degree of complexity involved, and will either hire computer experts or retain the services of a skilled computer engineering firm. But the microprocessor appears so simple, those precautions are too often overlooked.

All too frequently the equipment manufacturer finds late in the game that he is locked in with a microprocessor that has insufficient capability, or throughput that limits system performance. He may then discover he needs far more software, ROM, main memory or supporting components than anticipated. In some instances, a company ends up spending three or four times as much in development costs than they had budgeted without achieving a satisfactory design in terms of either performance or cost or both.

Unless a designer has very detailed experience with a microprocessor, he can fall into a very insidious trap – the amount of code needed to implement specified functions can be excessive. The designer may not discover this until well into the design process – in fact, the program may even be into prototype production before it is discovered that, with all peripherals online and the data loaded, the system throughput is inadequate.

The pain of bailing out the design at this point can be excruciating. It may mean adding considerably more memory than planned, or investing in a large-scale software development program. Even then, the finished product is likely to be an unhappy compromise that disappoints the designer and his management.

At TMI we're not against microprocessors. Properly used, they are a very cost-effective solution to a broad range of applications and we have used them in several designs for our customers.

But they're not a panacea. It's a mistake for an executive to order the engineering department to use a microprocessor unless the department has the requisite level of computer experience. If you're intent on using one, make sure the right people are assigned the design task, and keep track of the development program so you know early enough if the microprocessor and the way it is being used are appropriate for the job.

MINICOMPUTERS – MICROCOMPUTERS – PERIPHERALS

WHAT ARE THE THE REAL COST HANG-UPS?

MARTY B. JAROSZ / Vice President, Northeast Services Inc., Wallingford, CT

In the past five years, manufacturers have gone from $3000 mini CPUs to $20 micro CPUs. In simple control situations – hardware replacement, small RAM/ROM memory requirements, and non-peripheral applications – these advancements have been great cost savers. But in many applications, the real cost saving can be less than 10 percent!

Why has technology been spending most of its effort in an area that accounts for less than 10 percent of the "real" total cost? Let's look at a typical mini system, consisting of a CPU, 6K memory, DMA, power fail restart, chassis, power supply, control panel, teleprinter interface, real-time clock, autoload, 16-bit I/O interface, high-speed paper tape reader/punch, moving head disk, and printer. What has pricing done on this typical system in the past four years? See Table 1.

Let's look at these items individually.

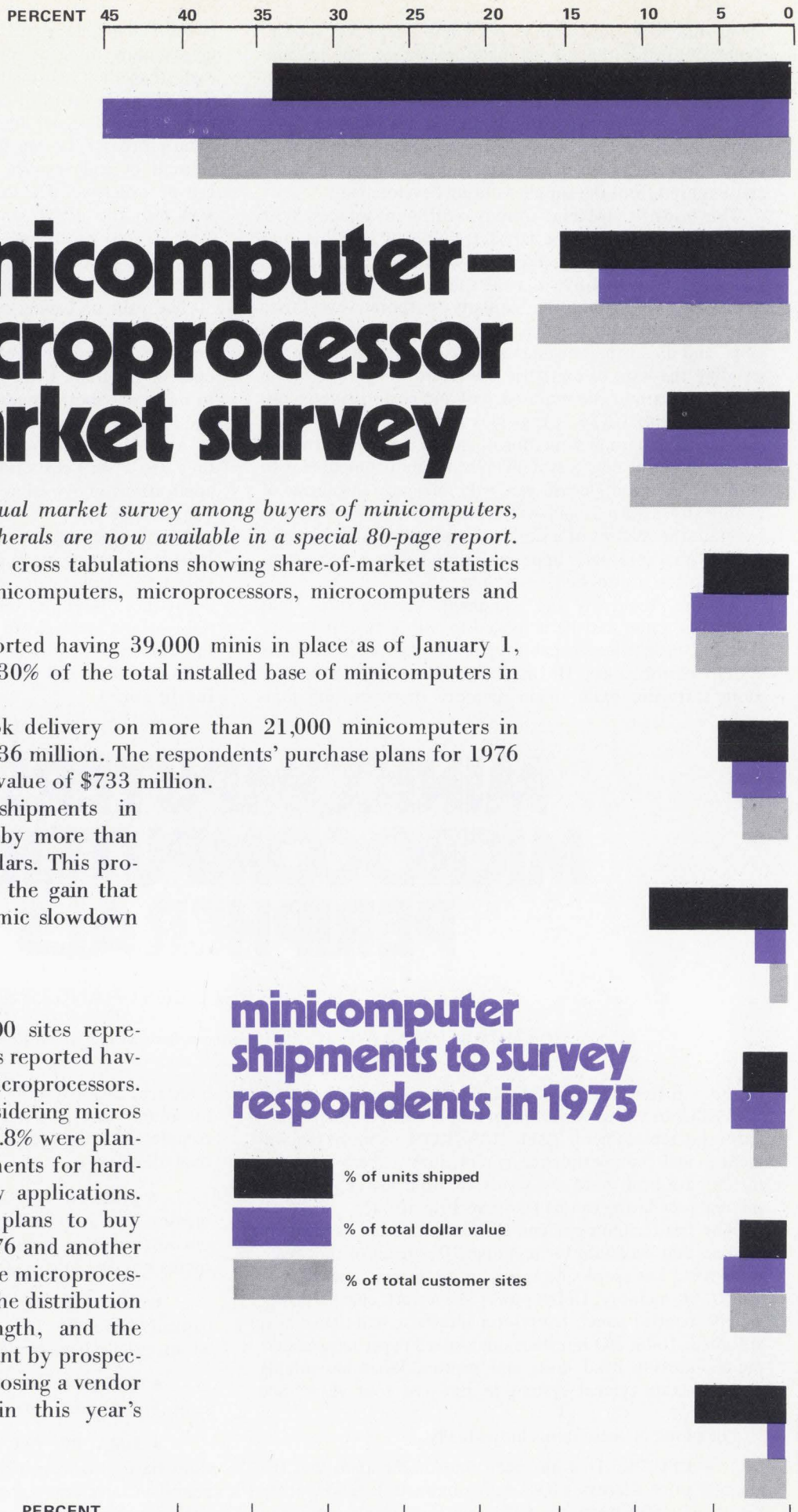
- **CPU/2K.** This has been one of the areas that the greatest price decreases have been obtained. It is now possible to pay 500 times the CPU cost for a single peripheral interface. The real problem is that the CPU never accounted for more than 10 percent of the total cost; therefore, if completely eliminated, the total savings can not be more than 10 percent.

- **Memory.** This too has shown remarkable price decreases. The problem here has been that as price per bit decreases, memory requirements increase and they seem to increase to the square of the dollar decrease.

- **Chassis/Power Supply.** These prices have stayed basically the same. This is due to the fact that as technical advances have been made, component cost has increased.

- **Control Panel.** These prices have stayed basically the same, but in some systems have actually increased in cost.

- **DMA, PF, TTI, RTC, AL.** These prices on CPU options have also decreased, but in many cases only because manufacturers are doing in memory what had previously been done with hard-wired circuits.



announcing 1976 minicomputer–microprocessor market survey

The results of the fifth annual market survey among buyers of minicomputers, microprocessors and miniperipherals are now available in a special 80-page report.

The report features over 60 cross tabulations showing share-of-market statistics for all major vendors of minicomputers, microprocessors, microcomputers and miniperipherals.

The survey participants reported having 39,000 minis in place as of January 1, 1976 – accounting for nearly 30% of the total installed base of minicomputers in North America.

The survey respondents took delivery on more than 21,000 minicomputers in 1975 at a reported value of $536 million. The respondents' purchase plans for 1976 include 28,000 minis at a total value of $733 million.

Worldwide minicomputer shipments in 1976 are projected to increase by more than 30% in terms of units and dollars. This projected growth is nearly double the gain that was achieved during the economic slowdown of 1975.

MICROPROCESSORS

Nearly one-half of the 5,700 sites represented among the survey replies reported having an active interest in microprocessors. About 8.3% of these were considering micros as substitutes for minis while 35.8% were planning to use micros as replacements for hard-wired logic or for entirely new applications.

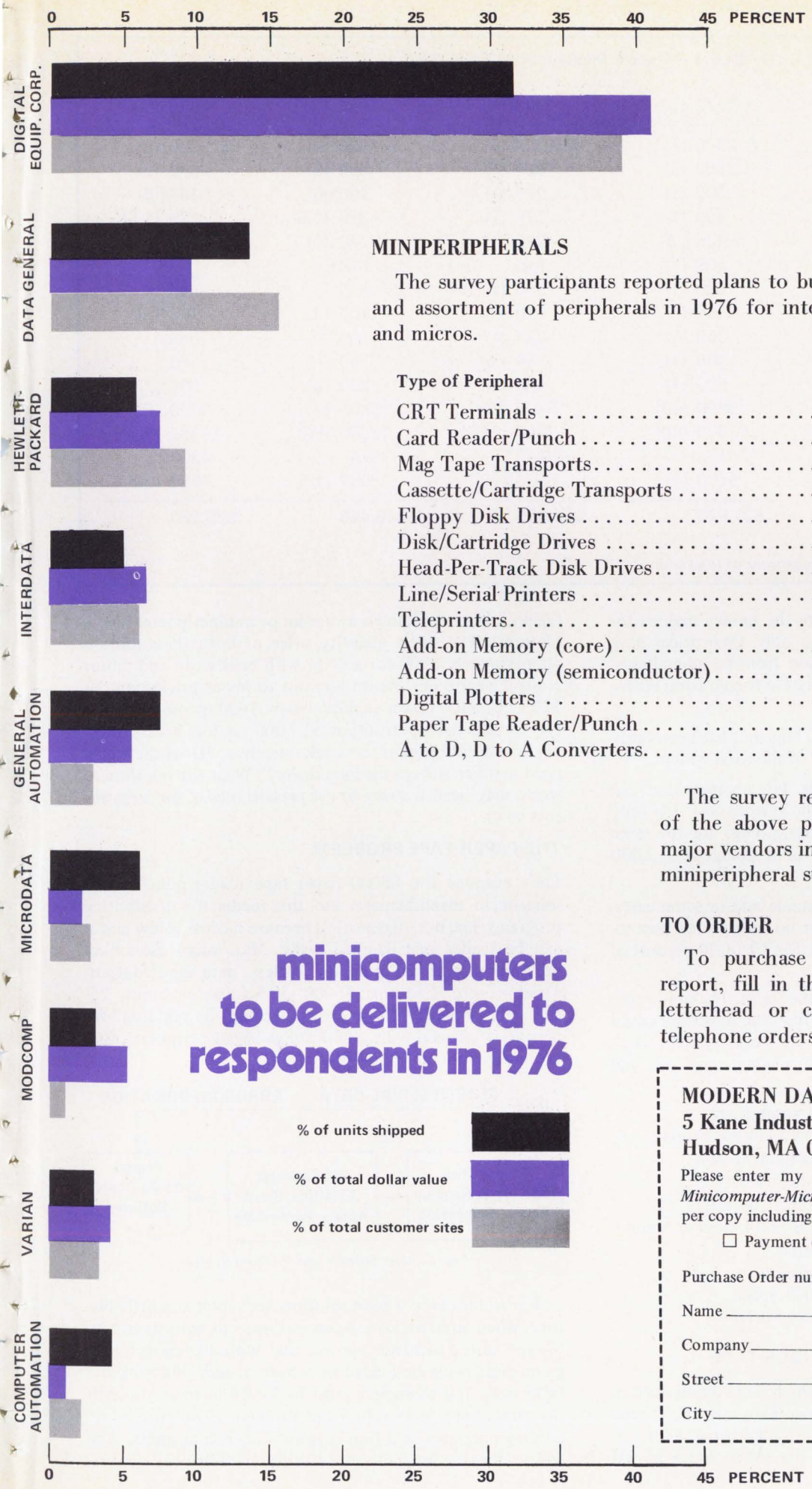
The respondents reported plans to buy 362,000 microprocessors in 1976 and another 576,000 (up 59%) in 1977. The microprocessor vendors being considered, the distribution by application and word length, and the factors considered most important by prospective buyers of micros when choosing a vendor are tabulated and analyzed in this year's survey report.

minicomputer shipments to survey respondents in 1975

% of units shipped

% of total dollar value

% of total customer sites



minicomputers to be delivered to respondents in 1976

% of units shipped

% of total dollar value

% of total customer sites

MINIPERIPHERALS

The survey participants reported plans to buy an unprecedented quantity and assortment of peripherals in 1976 for interconnection with their minis and micros.

Type of Peripheral	Qty to be Purchased By Survey Participants
CRT Terminals	45,558
Card Reader/Punch	2,067
Mag Tape Transports	10,276
Cassette/Cartridge Transports	4,257
Floppy Disk Drives	9,909
Disk/Cartridge Drives	13,285
Head-Per-Track Disk Drives	3,033
Line/Serial Printers	12,357
Teleprinters	18,466
Add-on Memory (core)	7,412
Add-on Memory (semiconductor)	2,650
Digital Plotters	809
Paper Tape Reader/Punch	3,659
A to D, D to A Converters	7,413

The survey report charts the percent share of the above prospective orders for all the major vendors including over 100 independent miniperipheral suppliers.

TO ORDER

To purchase a copy of the 1976 survey report, fill in the coupon and clip it to your letterhead or company purchase order. No telephone orders accepted.

MODERN DATA SERVICES, INC
5 Kane Industrial Drive
Hudson, MA 01749

Please enter my order for one copy of the *1976 Minicomputer-Microprocessor Market Survey* at **$295** per copy including U.S. postage.

☐ Payment enclosed ☐ Bill me

Purchase Order number _____

Name _____

Company _____

Street _____

City _____ State _____ Zip _____

TABLE 1 – Recent Minicomputer Price History

	1972 (%)	1973 (%)	1974 (%)	1975 (%)
CPU with 2K Memory	$ 2500 (8)	$ 1125 (4)	$ 900 (3)	$ 650 (2)
4K Memory	2200 (6)	1525 (5)	550 (2)	550 (2)
Chassis	300 (1)	275 (1)	100 (.5)	100 (.5)
Power Supply	400 (1)	375 (1)	375 (1.5)	375 (1.5)
Control Panel	225 (.5)	225 (1)	275 (1)	275 (1)
DMA	300 (1)	Incl.	Incl.	Incl.
Power Failure Restart	350 (1)	250 (1)	Incl.	Incl.
Teleprinter Interface	150 (.5)	100 (.5)	100 (.5)	150 (.5)
Real-Time Clock	350 (1)	225 (1)	Incl.	Incl.
Autoload	400 (1)	175 (.5)	50	50
16-Bit Digital I/O	500 (1)	500 (2)	500 (2)	500 (2)
Paper Tape Reader/Punch	5800 (18)	5700 (20)	5600 (21)	5600 (22)
Moving Head Disk	13000 (40)	13000 (45)	13000 (50)	12000 (48)
Floppy Disk (Dual)	NA	NA	NA	4300
Printer	5500 (17)	5500 (18)	4950 (18)	4950 (20)
	$31,925	**$28,925**	**$26,400**	**$25,200**

NOTE: (%) Denotes approximate percent of total cost

• **16-Bit I/O.** These items are the money makers for manufacturers. In many cases the only time prices have been decreased is when competition from peripherals systems houses or build/buy decisions have forced competitive pricing.

• **Paper Tape Reader Punch.** This unit has been fairly stable at a cost of 18 to 22 percent of the total system.

• **Moving Head Disk System.** For an item that can account for 40 to 50 percent of the system cost, the only improvements have been to increase storage for the same cost. Do we really need 10 megabytes of storage at $13,000 on a $20 CPU?

• **Printer.** Prices have been stable and in some cases, there have been speed increases for no or little real cost increase. A slow printer can account for 17 to 20 percent of the cost of a typical system.

As shown, costs will go down on some items. The only problem is, if these items were obtained *free*, the most that could be eliminated is 10 percent of the total systems cost.

Let's look at the remaining 90 percent cost area and their functions.

1. **SLOW SERIAL STORAGE** – Program Load
   – Input Output Storage
2. **MASS STORAGE** – Random Access
   – Batch Access
3. **PRINTER** – 10-60 Characters
   – 100-300 Lines Per Minute
4. **SYSTEM INTERFACE** – Serial
   – Parallel
   – High Speed
   – Low Speed

THE FLOPPY DISK AND CARTRIDGE TAPE

We believe that two peripherals, which were announced in the past few years, are outstanding. They are the floppy disk – developed by IBM (which is *not* known as a mini or miniperipheral manufacturer) and the 3M cartridge by 3M (again, 3M is *not* known as a mini or miniperipheral manufacturer). The single quantity price of both these units is approximately $700 for a drive with read/write and motor control electronics. As we attempt to lower pricing on our $20 CPU, $400 power supply/chassis, $600 memory, $5600 low-speed serial input/output, $13,000 random access memory and $5000 printer, let's ask ourselves, "Does the world need another storage media pioneer?" What the mini/micro world may need is a way to use *present media,* but in lower cost ways.

THE PAPER TAPE PROBLEM

Let's examine the $5000 paper tape reader/punch: Most mini/micro manufacturers use this media for distributing programs, updates, diagnostics, because its cost is low and it can be mailed and handled easily. Mini/micro users have used paper tape for program loaders, data input/output, variables, etc. Can this $5000 300-character input, 75-character output (with no error checking) be replaced? We believe it can and will: a $5000 low-speed peripheral does not make sense on a $20 CPU.

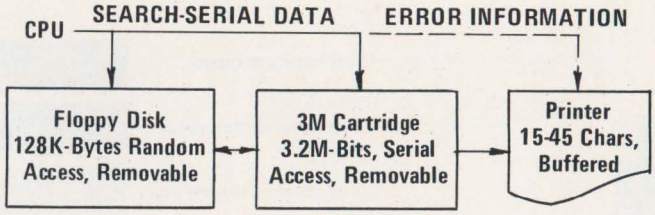


Fig. 1 : Mass Storage and Printing System

For an idea as to a good solution, let's look at a little history. When Mohawk Data Sciences came out with their key-to-tape unit, a disadvantage was that with a keypunch program cards could be loaded in 5 to 6 seconds, but with the MDS units 160 characters must be keyed in to accomplish the same thing. MDS solved this problem at *no cost* by recording programs on 2 foot strips of 1/2-inch magnetic tape and reading the programs into the unit with two key strokes.

A Capsule Report from Entrex Key-Disk Users...

Concurrent Data Entry

"In Charlotte County, the Sheriff's Office retrieves tag registration data, the Tax Collector posts the latest real estate tax payments, the Assessor calculates land values, while my department is printing out paychecks for all of them."

—Honorable Dick R. Lawhorne, Elected Clerk of the Circuit Court Charlotte County, Punta Gorda, Florida

Communications

"We enhanced our on-line system with an ENTREX communications-based system, because it offered greater reliability, less cost, and increased capabilities. We now receive 25,000 Bank-Americard transactions from our customers in Akron, Toledo, and Dayton per day."

—Glen Davis, Senior Administrative Officer, City National Bank Columbus, Ohio

ISAM Files

"Utilizing ENTREX's ISAM feature, we have developed an extensive file network, which is used throughout the company to provide access to vital operational data at speeds matching on-line mainframe lookup."

—John R. Steiger, Manager of Management Information Systems VariTyper Division, Addressograph Multigraph Corp. East Hanover, New Jersey

Productivity

"The batch balancing, conditional verification, and data generation features of the ENTREX System have doubled our productivity."

—R. J. Denton, Vice President, Bancshares Dataline Corporation Chattanooga, Tennessee

System Compatibility

"ENTREX's system compatibility allowed me to upgrade from System 380 to System 480 with minimal reprogramming and no disruption to productivity."

—Bill Pearce, Data Entry Manager, Data Processing of the South, Inc. Charlotte, North Carolina

Pre-Processing

"The Department of Public Aid has cut mainframe processing time in half by pre-processing data on the ENTREX System."

—Garry E. Paddick, Chief, Bureau of Information Services Illinois Department of Public Aid Springfield, Illinois

We offer a range of products to meet the diversified needs of all our Users, including cost/effective keypunch replacement, communications-based remote data entry, and powerful source data generation and pre-processing systems.

If you would like to hear more about us, our representative will be happy to explain why our User-oriented design philosophy has made us the technological leader in source data processing. Call today.

ENTREX

168 Middlesex Turnpike
Burlington, Mass. 01803. 617-273-0480

Atlanta, GA, 404/634-6391 • Baltimore, MD, 301/997-3310 • Boston, MA, 617/273-0480 • Charlotte, NC, 704/568-3510 • Chattanooga, TN, 615/892-1302 • Chicago, IL, 312/782-5427 • Cleveland, OH, 216/741-3636 • Clifton, NJ, 201/472-0382 • Columbus, OH, 614/861-4280 • Dallas, TX, 214/630-3343 • Detroit, MI, 313/355-0108 • Hartford, CT, 203/563-3866 • Houston, TX, 713/467-3715 • Indianapolis, IN, 317/352-1739 • Kansas City, MO, 816/531-1931 • Los Angeles, CA, 213/879-1960 • Louisville, KY, 812/283-1169 • Madison, WI, 608/221-1547 • Miami, FL, 305/949-4544 • New York, NY, 212/682-2130 • Oklahoma City, OK, 918/582-0572 • Philadelphia, PA, 215/265-2270 • Pittsburgh, PA, 412/341-8686 • St. Louis, MO, 314/727-0480 • San Francisco, CA, 415/692-5551 • Springfield, IL, 217/789-7709 • Toronto, Ontario, 416/495-1234

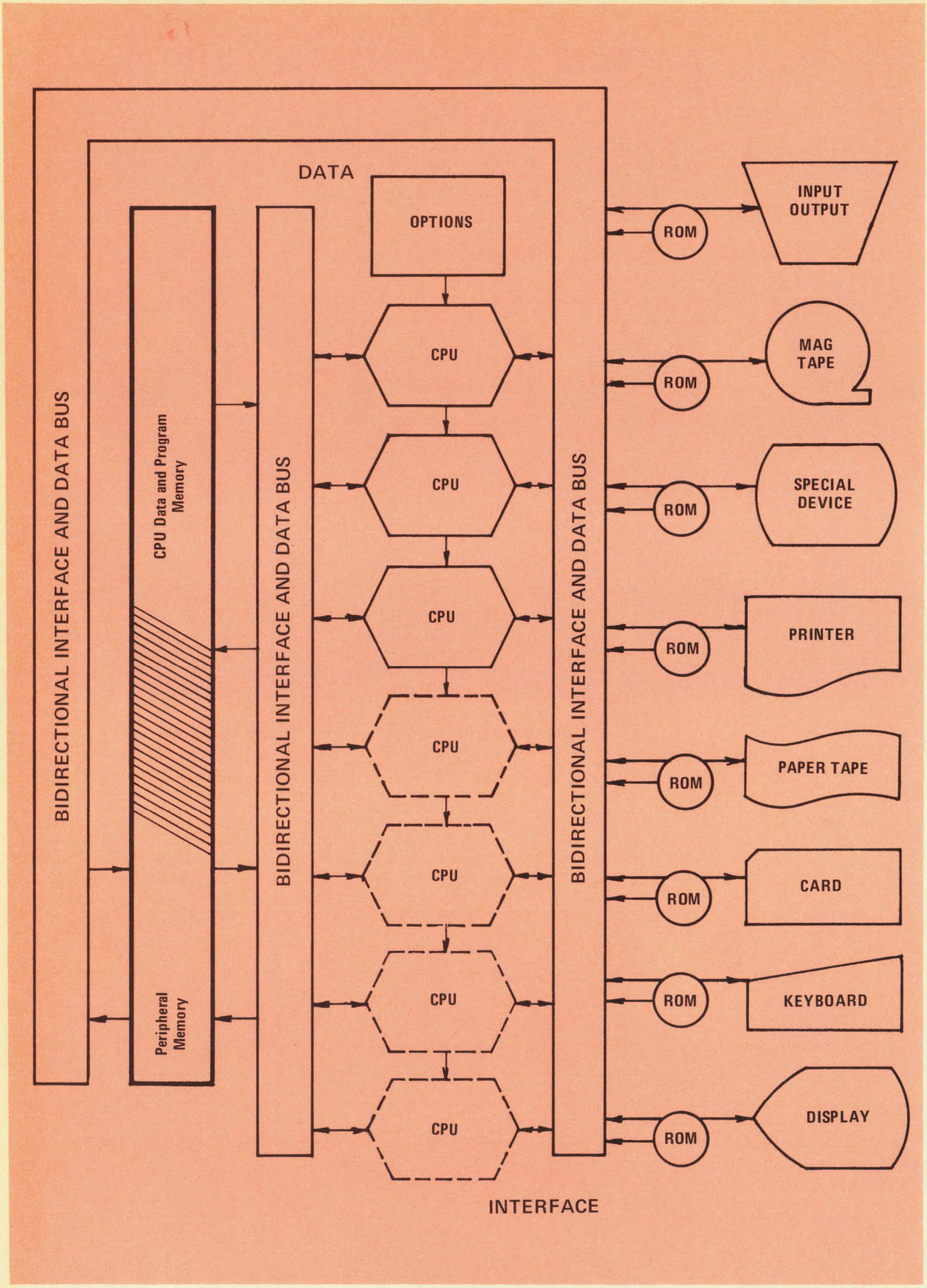
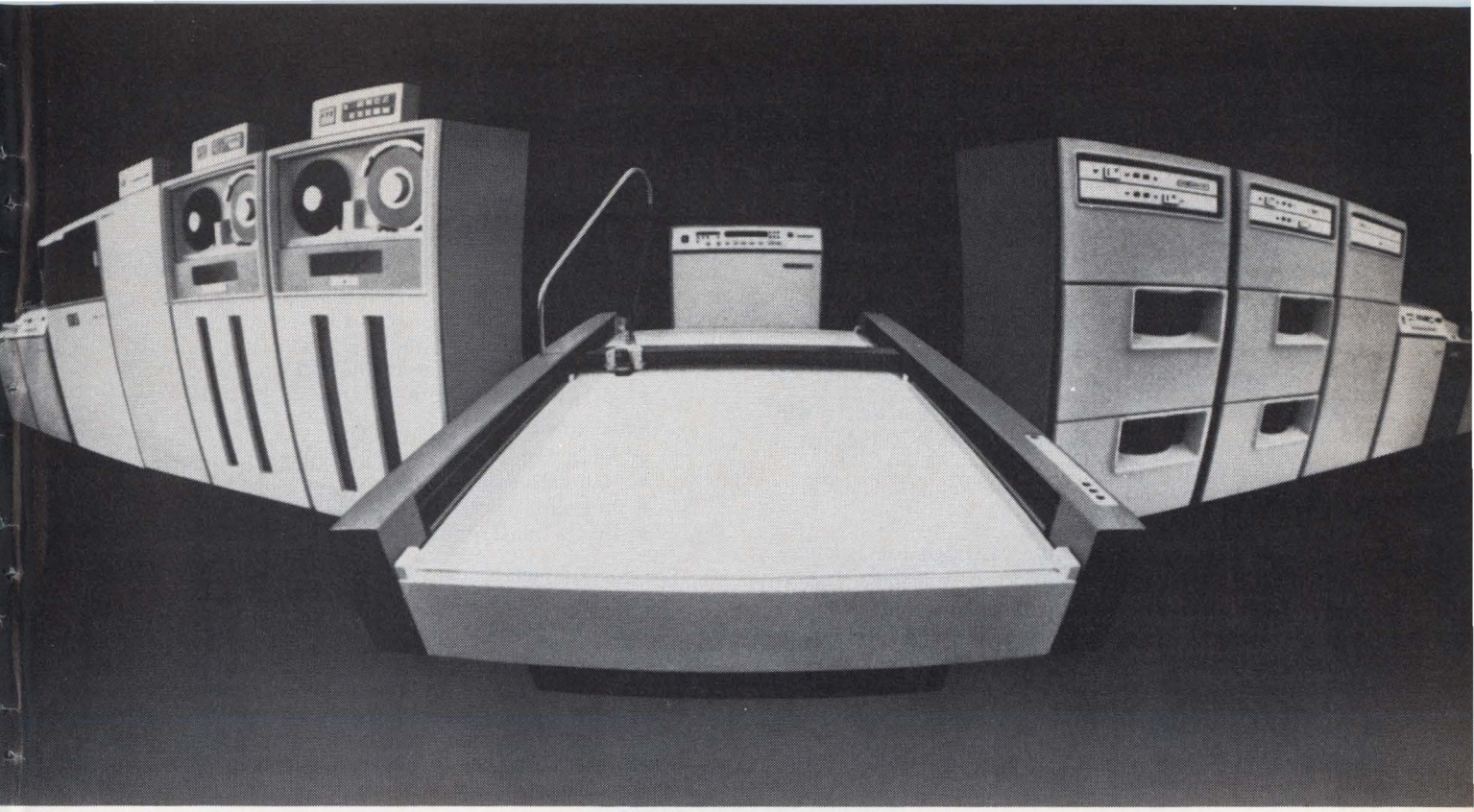


Fig. 2 : The Multiple CPU System



Peripheral vision.

CalComp looks at the future as if it were wrapped around the computer.

The computer remembers an incredible amount of data, but no matter how large its brain becomes it will always need help. It needs more "brain cells." Our memory systems provide that.

In the mind of the computer there are pictures. Man can see these pictures because we taught the computer to draw. Today, CalComp is a world leader in the manufacturing of computer graphic equipment.

The information that spews out of the computer fills rooms with paper that is hard to retrieve. Our Computer Output Microfilm systems can reduce a roomful to a drawerful, and puts the information at your fingertips.

The information that is stored on computer tape is only as useful as the computer's access to that information. Our Automated Tape Library is the first system to give the computer automatic access to thousands of reels of tape—in seconds.

Our sales for fiscal 1975 were in excess of $120,000,000. And our backlog of orders at the beginning of fiscal 1976 was the largest in company history.

We've spent 17 years perfecting our peripheral vision.

Contact us for our view of the future. Write or call California Computer Products, Inc., MD-M5-76,2411 West La Palma Avenue, Anaheim, California 92801. (714) 821-2011.

CALCOMP

CIRCLE NO. 39 ON INQUIRY CARD

How much paper tape is usually read at one time – 4K words, maybe 16K words? Each 4K would take approximately 30 seconds on a 300-character reader, more than 15 minutes on a 10-character per second reader. We believe the solution is a magnetic tape strip micro/mini reader/writer, with specifications:

- Single-track read/write
- 4.8-ips tape speed
- 200-bpi recording density
- 9600-bps transfer rate
- Length Variable with 4K words less than 40-inches

We believe that such a magnetic strip reader/writer will easily outperform paper tape equipment for 1/20 the cost – a $300 peripheral for a $20 CPU.

DISK MEMORY

Most mini/micro manufacturers use cartridge disk as a massive (10 million 8-bit bytes) random access storage. It is so massive that many users store all programs, updates, diagnostics, and even games on it, and in most cases still have a large percentage of storage area vacant. Can this $13,000, 10-megabyte random access device be replaced? We believe it can and will: a $13,000 peripheral does not make sense on a $20 CPU.

We suggest that a random access mass storage peripheral for mini/micros should consist of the combination of a 128K byte mini floppy disk, random access, removable medium, and a 3.2M-bit 3M cartridge serial access, removable medium. (See Fig. 1.)

The specifications would be as follows.

Random access unit

- 128K-byte storage
- 11-msec access per track
- 167-msec latency per revolution
- 250-kHz transfer rate

Serial access unit

- 3.2-million bits storage
- 30-ips read/write speed
- 90-ips for word/reverse speed
- 48kHz transfer rate

The cost of such a dual system, with R/W, control, and interface: about $4000.

PRINTERS

A printer is one way of putting in usable form the results of the operations of the mini/micro computer. In many cases

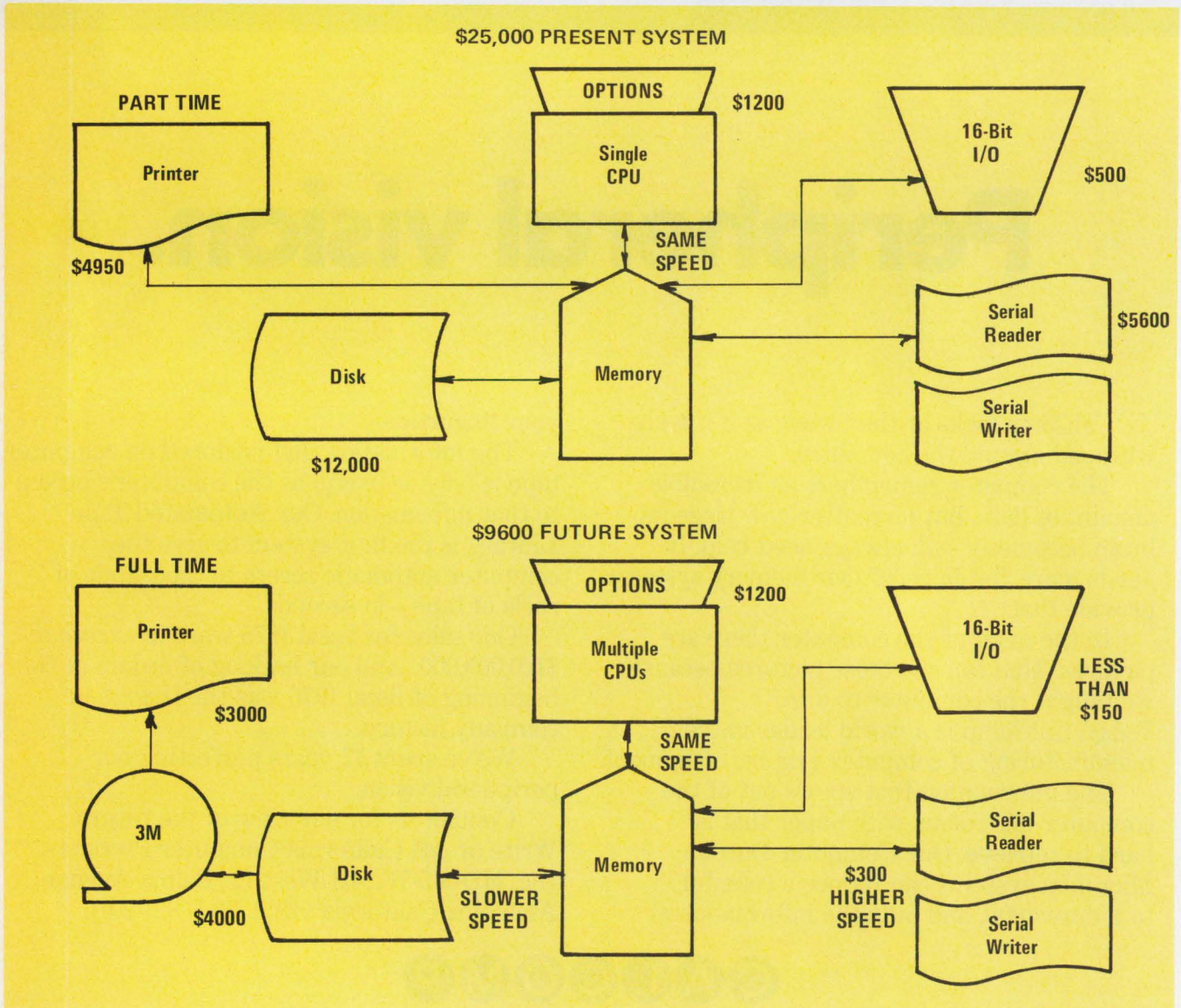


Fig. 3 : The Old and New Systems

If you punch cards, read cards or do anything else with cards,

we want to talk to you.

We want to talk to you about the Tab 501 Data Entry Microprocessor.

About the unique versatility and operating capabilities resulting from its built-in microprocessor, RS-232C interface and unmatched performance characteristics:

- Minicomputer card input or output.
- Data transmission via modem or cable for terminal applications.
- Interfacing to virtually any type of data entry or processing system.
- On-line or off-line versatility.
- Reading, punching, printing, verifying and interpreting capabilities.
- Attractive purchase or lease plans.

We want to tell you about our standard features.

- Constants from memory—up to 220 columns.
- Up to 28 program levels with automatic sequencing.
- Instant verification.
- Completely automatic error correction.
- High speed character duplication.
- Exceptionally quiet.
- Unparalleled operator acceptance of over 2,000 installed units.
- Easy to learn—easy to operate.

Let's talk about "specials." We want your specials. Special applications. Special operating characteristics. Special interfaces. Special keyboard requirements. Because the Tab 501 Data Entry Microprocessor has this unique flexibility, we can give you what you want —easily and inexpensively. It's worth talking about.

Gentlemen: Let's talk.

Name_____

Company_____

Address_____

City_____ State_____ Zip_____

Telephone_____

Let's talk:

☐ Interfaces.

☐ Special requirements.

☐ Terminal applications.

☐ Send more information.

TAB
PRODUCTS CO

2690 Hanover Street
Palo Alto, California 94304

See us at the N.C.C. Booths #2707, 2709, 2711.

CIRCLE NO. 48 ON INQUIRY CARD

this unit operates less than 10 percent of the time. The problem is that when the information being processed is ready, it must be sent to the output device. Therefore, most printers are used for a small amount of time and print at a much faster rate than is really required, but for only short periods of time. Can this $5000 (100-character per second, 80 column) printer be replaced? We believe it can be and will: a $5000 part-time peripheral does not make sense on a $20 CPU.

Offline printing has been an accepted operation for many years in large computer systems, requiring only a $10,000 computer tape drive and a $40,000 high-speed printer. We can add a printer to our micro/mini mass storage system, (See Fig. 1.) using an RS-232-compatible offline printer, on demand of the 3M storage device, with buffered carriage return and line feed. 3M-to-printer operation would be available when 3M is not in staging to floppy disk. The complete cost would be about $3000.

THE INTERFACING PROBLEM

Interface cards ranging from $500 to $2000 are used to logically tie a foreign device to the I/O bus of the computer. The interface card does the logical start, stop, handshaking, and data transfers that are required. Can this $500 to $2000 interface be replaced? We believe that this concept must also come to pass, ince a $20 "smart" CPU can not afford a $500 to $2000 "dumb" interface for each and every part-time device.

We suggest that a system would internally have multiple $20 microprocessors working on data and interfacing, as shown in Fig. 2. From the low order end, as many "data" micro-CPUs as required would be working on internal functions doing basically the same operations as performed by today's normal CPUs. Working from the high order end, these micro-CPUs would be working as "interface" micro-CPUs. Under emergency conditions, "data" micro-CPUs could be interrupted to perform "interface" micro-CPUs functions or vice versa. Dedicated ROM would be micro-programmed to handle all interface requirements; ROM-to-interface-micro-CPU assignment would be on availability, starting at most significant micro-CPUs. The cost, of interface, microprocessor, ROM and cable would be less than $150.

We believe that selective microprocessor/ROMs/cables could easily out perform hard wired interfaces, for 1/3 the cost, resulting in a $150 interface for a $20 CPU.

THE NEW MINI/MICRO SYSTEM

Let's look at our old and new system (See Fig. 3.):

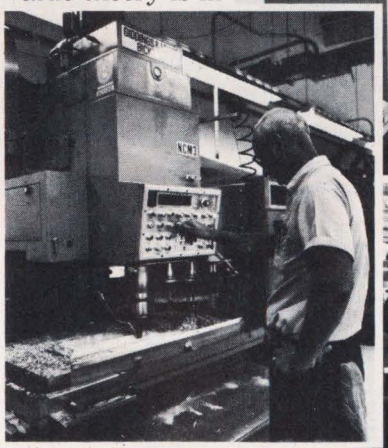
	Present	(%)	Future	(%)
CPU/Memory	$ 1200	(5)	$ 1200	(12.5)
CPU Options	950	(4)	950	(10)
16-Bit Digital I/O	500	(2)	150	(1)
Serial Reader/Writer	5600	(23)	300	(3)
Mass Storage	12000	(48)	4000	(41)
Printer	4950	(20)	3000	(31)
	$25,200		$9,600	

The future of high performance minis and/or micros are secure. But, for the best growth, we must stop running with "logic technology" and look at the true costs and where they lie with each mini/micro system. The time may come when a system is designed with peripherals, cables, ROM, and interfacing microprocessors – AND – a multiprocessing CPU may be available at NO COST! ■

The simple promise of every Documation product: More value for every dollar.

It's a promise everybody makes. But not everybody can deliver. At Documation we can and do deliver more value for your dollar in every product we make. Consistently.

In five short years, we've built a major company around the philosophy that we will offer the best price performance, most cost effective products available. We started our company with a better idea – the Vacuum Pick system of card-handling. Our first card-handlers weren't cheaper – but they were better than anything else on the market. So people bought them. And the word got around that our card-handlers were so reliable that they needed very little service. And people bought more of them. The proof of our value theory is in our sales.



To build better products you have to have better ideas. So we put together one of the best engineering departments anywhere. Our engineers don't wait to see what our competitors are going to do. They do it themselves. First.

Witness the Documation-developed microprocessor. It's the cost-efficient heart of both our LC50 Multifunction Card Processor and our DOC2250 high-speed impact line printer.

We don't just design it better, we build it better. At Documation we call the way we do things vertical integration. You might call it do-it-yourself. Our machine components have to be precision-milled. So we mill them ourselves on computer-controlled automatic milling machines. Material comes in our door as raw metal and goes out as precision parts in our equipment. We even use computer controlled coordinate measuring machines to assure the accuracy and precision of the parts we manufacture.

But the real test of value for our products is the value they can add to your products. Take a look at what our two newest products can do for you. With the LC50 you can build a DP system with greater output at a greatly reduced cost and add some 706,000 small business firms to your list of potential customers.

The DOC 2250 is our fighting machine in the printer field. It lets you sell a printer that's about twice as fast as the 1200 line printers at just about the same cost. Or sell a printer that's a touch faster than well known 2000 LPM printers at around half the cost.

It's really very simple. The more value we offer you, the more value you can offer your customers. So contact Mr. Roy Ostrander, V.P., Box 1240, Melbourne, Florida 32901. Telephone (305) 724-1111. It could be the most valuable contact you'll ever make.

DOCUMATION
INCORPORATED

CIRCLE NO. 49 ON INQUIRY CARD

HARDCOPY FROM A VIDEO SOURCE

Versatec's Video Interface allows production of hard copy output on Versatec electrostatic printer/plotters from any video source – cameras, digital generators or terminals with video generator ports. The interface, packaged in a rack-mounted module, accepts video signals conforming to EIA standards RS-170, 330, 343, 375, or 412. Without software, it translates video signals into raster data to produce hard copy of any desired alphanumeric or graphic display. The interface has its own memory, which allows it to pick up one line on the fly from each field as refreshed. Price is $2950. *Versatec, Santa Clara, CA.*

Circle No. 133 on Inquiry Card

With the Varian interface, hardcopy output is produced from a video source using the Statos printer/plotter. The interface is compatible with RS-170 type video signals and will copy a typical screen image in 5 seconds. The picture size is controlled by moving jumpers on the pc boards. Ratios from 1:1 to 16:1 can be achieved. Interfaces and software drivers for most minis are available. *Varian, Palo Alto, CA.*

Circle No. 167 on Inquiry Card

KEY-TO-DISK SYSTEMS

Mohawk's 2410 Systems are newer versions of its 2409 systems with expanded memory. Each model has a 64K-byte MOS memory, expandable to 128K. Disk capacity ranges from 30K to 150K 125-character pages. The

2410 can support concurrent operations in a 32-keystation configuration. Among the 45 "free" software options are Table Handling, Source Document Control and General Registers. With a three-year lease, monthly charge for a 32-station configuration with 150K-character disk, tape drive and software is $123 per keystation. *Mohawk Data Sciences Corp., Parsippany, NY.*

Circle No. 186 on Inquiry Card

A/B BACKUP SWITCHES

Two A/B backup switching modules are available: one for EIA RS-232 and one for 50-kilobit service. Each switch provides switching between two modems and a single terminal, or between two terminals and a single modem. The RS-232 A/B switch switches all 25 circuits in the EIA RS-232 interface. The 50-kilobit switch is compatible with, and switches, the interface to Bell System 303 Data Sets. Both modules may be desktop-mounted or four modules may be assembled side-by-side. *Cooke Engineering Co., Alexandria, VA.*

Circle No. 154 on Inquiry Card

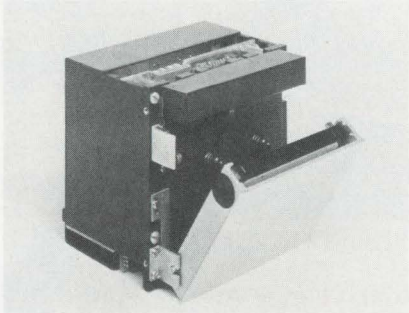
WHAT $20,000 BUYS

It buys a minicomputer system with a Texas Instruments 960B 16-bit processor and 8K memory, a TEC-450 programmable CRT, a Centronics 306 matrix printer, a Tri-Data dual-drive tape unit and software. *Automation Control Engineering, Winston Salem, NC.*

Circle No. 173 on Inquiry Card

TAPE SYSTEM FOR MICROS

The CS-400 Digital Cassette Tape Transport System uses Braemar's recently announced CD-200 transport, read/write amplifiers and phase encoding and decoding circuitry. It requires only one supply voltage (between 14 and 30 volts) and is totally TTL compatible. The CMOS package accepts and delivers serial digital data at TTL levels at an 8K baud rate. The unit operates at a nominal density of 800 bits per inch at 10 inches per second, with other speeds and densities optional. The system uses the Manchester phase encoding technique and a proprietory "Auto Sync" decoding scheme, which features internal compensation for any bit to bit variations encountered. Single quantity price is $600; price in quantities of 1000 is $350. *Braemar Computer Devices, Inc., Burnsville, MN.*



Circle No. 169 on Inquiry Card

MINI FLOPPIES

The *DSD 210 Floppy Disk System* is completely interchangeable with the DEC RX8/RX11 floppy disk system. Included in the system are two or four diskette drives, a microprocessor controller, an interface to the minicomputer, a control panel with individual write protect switches, power supplies, and all cables. Diskettes are written in IBM format. Transfer rate is 250 kilobits per second. Diskette capacity is 250K bytes. Price for a dual-drive system is $2995. *Data Systems Design, Berkeley, CA.*

Circle No. 161 on Inquiry Card

The *Model 75 Diskette Drive* is an IBM 3740-compatible drive with a formatted storage capacity of 243K bytes. Transfer rate is 250 kilobits per second. Average positioning time is 35 milliseconds. With the voice coil head positioning system, full stroke seeks are possible in less than 100 msec. *PerSci, Inc., Los Angeles, CA.*

Circle No. 162 on Inquiry Card

The *HP 421 Floppy Disk System* for HP 21XX users consists of a controller, up to four disk drives and a user-oriented software package. Data can be transferred at over 240 kilobits per second, with an average access time of less than 1/3 of a second. Storage capacity is over one million bytes with four drives. HP-standard disk operating systems RTE-II and RTE-III are supported. *Dicom Industries, Inc., Sunnyvale, California.*

Circle No. 163 on Inquiry Card

ARRAY PROCESSORS

The V Series of vector floating point processors offer fast execution time of mathematical functions in areas such as seismic exploration, geophysical research and speech analysis. Intended for dedicated OEM applications, this series is not as powerful as the minicomputer controlled MAP Series. The V Series use a 32-bit hexadecimal floating point format. Either bipolar memory with a 125-nsec cycle time or MOS memory with a 500-nsec cycle time is available. Program memory is field expandable to 756K bytes. Price for a Model V-20, which performs a 1024-point fast Fourier transform in 10 milliseconds, is $9500. *CSP Inc., Burlington, MA.*

Circle No. 150 on Inquiry Card

new products

COMMUNICATIONS MULTIPLEXER FOR PDP-11

The microprocessor-based DP-11 Communications Multiplexer uses one common set of I/O device addresses and a single interrupt regardless of how many channels are serviced. All data transfers are performed via DMA. The module consists of one control board, which drives either one or two interface boards. Each interface board can contain either four or eight asynchronous channels. Up to 128 channels are possible on a PDP-11. Three selectable baud rates are possible within each group of 16 channels. Single quantity price for four channels is $1550; $1900 for eight channels. *Xylogic OEM Components Group, Inc., Burlington, MA.*

Circle No. 171 on Inquiry Card

PROGRAM LOADER FOR PDP-8

Autoload 8 is a complete bootstrap and loading system on a single plug-in quad PDP-8 Omnibus-compatible circuit card. It includes a hardware boot, miniature tape drive, and the necessary software to create, verify and load tapes containing core images up to 20K words. Some typical PDP-8 load times are 30 seconds for the assembler and 110 seconds for a 16K program. The bootstrap occupies the top page of core and can be actuated regardless of the status of the PDP-8. Prices start at $950. *Betatech, Inc., Bedford, MA.*

Circle No. 184 on Inquiry Card

EIGHT NEW PLOTTERS

The eight electrostatic plotters from Versatec offer a choice of 22 or 24-inch paper width, vertical plotting speed of 1 or 2 inches per second, and resolution of 100 or 200 dots per inch. Four models offer character generator and simultaneous print/plot option for display of captions, legends, and other alphanumeric data while plotting. Special features include a shaft encoder that determines timing and writing location and a servo paper drive that gradually decelerates and stops paper movement without overshooting. This prevents the start-stop gaps and distortion associated with earlier electrostatic plotters. All models use dual array writing heads to produce an overlapping dot structure for perfectly continuous plot lines and a high contrast image. Prices range from $13,500 for 22-inch plotter with 100-dot resolution to $22,400 for 24-inch plotter with 200-dot resolution. *Versatec, Santa Clara, CA.*

Circle No. 181 on Inquiry Card

BOARDS AND BOXES

Microkit, Inc. (Santa Monica, CA) has a standalone program development system for the 8080. Included in the Microkit-8/16 are an 8080

processor, 8K RAM, 960-character CRT, 53-character keyboard, two cassette units, two RS-232 interfaces and software. Price is $3850.
Circle No. 125 on Inquiry Card

A German-made line of microcomputers is available from *Quatro, Inc.* (Jenkintown, PA). The three systems are manufactured in Germany by Steinmetz Krischke Systemtechnik, GmbH (SKS). Very similar to the IBM 5100 from a hardware standpoint, they have from 4K to 64K bytes of memory and use a 5-inch CRT display with a 1/4-inch tape cartridge and an extended keyboard. Besides the scientific market, they are oriented toward data entry, word processing, interactive or batch processing and communications. The rock-bottom 100 Series priced at less than $4000 comes with this software: formatted and unformatted data entry, format generator, verify, convert, listing and communications (asynchronous only). By moving up to the 300 and 400 Series with dual cartridges or floppies, more software is available. Peripherals available include a variety of printers, floppies, tape transports, CRTs and even a credit card reader.
Circle No. 130 on Inquiry Card

Mycro-Tek, Inc. of (Wichita, KS) has expanded its line of microcomputers with the MT 80 A single-card microcomputer. Designed for the OEM, the MT 80A has an 8080 CPU, 2K of EPROM, 256 bytes of RAM, 48 programmable I/O bits and an RS-232 port on a single 4.5 x 7.5-inch printed circuit card. An optional card converter gives single 5-volt only operation. A switchselectable RS-232C clock rate gives most standard baud rates from 110 to 9600 baud. An operator control panel and memory card with 4K-byte RAM and 2K-byte EPROM can be added.
Circle No. 127 on Inquiry Card

Microcomputer Associates, Inc. (Santa Clara, CA) has a series of microcomputer system cards based on the 8080A, 6502, 6800 and the 2650. Each 4.25 x 7-inch card contains a crystal-controlled clock, 1K x 8 static RAM, 2K x 8 PROM sockets, 24 bidirectional I/O lines, fully buffered address/data lines and DMA capability. Price in quantities of 100 is $295.
Circle No. 128 on Inquiry Card

An industrial microcomputer is available from *Comptrol, Inc.* (Cleveland, OH). With its HI-NIL buffered input/ output circuits, the IMC-40 is immune to industrial noise. It features an 8Kbyte program memory, subroutine nesting to seven levels, decimal and binary arithmetic logic modes, 60 instructions, 24 scratch-pad registers, 5120-bit data storage and unlimited I/O expansion. The IMC-40 is directly compatible with most existing industrial logic card systems, and includes a complete array of interface modules, peripheral equipment and software.
Circle No. 129 on Inquiry Card

The Microscope Programming System from *Tranti Systems, Inc.* (North Billerica, MA) can be used for most microprocessor program development. The integral unit contains a full alphabetic keyboard, plus 10-key numeric pad and control keys, a CRT display, a small alphabetic printer, a magnetic tape cartridge device, and an expandable

memory with up to 57K of user space. The software package is resident in ROM and consists of three parts: monitor, editor and assembler. The editor and assembler are interrelated since the software assembles the program as it is entered. Prices start at $6995.
Circle No. 126 on Inquiry Card

MICROPROCESSOR DEBUGGING WITH A CRT

Motorola Display Products was busy manufacturing microprocessor-based intelligent CRTs. But when it came to hardware and software debugging, the engineers had to resort either to a scope, displaying a waveform that had to be translated into software language; or a logic analyzer, displaying Is or Os; or an expensive $8000 to $18,000 analyzer that had a broader bandwidth than was needed for microprocessor debugging. So putting Motorola's background in microprocessors as well as CRTs together, the engineers come up with the MPA-1 Microprocessor Analyzer. Interfaced directly to the address and data buses of the microprocessor through a probe buffer, it continuously

monitors bus activity during program execution and displays it on a 9-inch CRT. A trigger word can be set to any location in the address space of the microprocessor with the thumbwheel switches on the front panel. Then depending on the operating mode selected – start display, end display or free run – the MPA-1 captures the appropriate 32-word segments of program execution and displays them on the CRT in hexadecimal (four address characters followed by two data characters). Probes are presently available for Motorola 6800, Intel 8080A, Rockwell PPS-4 and others. An F-8 probe will be available in the future. Price of the MPA-1 with one probe is $2985. *Motorola Display Products, Carol Stream, IL.*

Circle No. 174 on Inquiry Card

LINE PRINTERS

The Series 4100 line printers use fully buffered, 136-column, impact type, drum printing mechanisms to print a modified ASCII 64 or 96-character set. Printing rates range from 300 to 600 lines per minute. The printers are software-compatible with all Harris computer systems. Prices range from $14,000 to $19,500. *Harris Corp., Fort Lauderdale, FL.*

Circle No. 176 on Inquiry Card

new products

OEM PRINTER

The DMTP-6 Series alphanumeric serial input printer is designed for panel or base mounting. Three column sizes are available: 35, 60 and 80. Printing is performed at 110 characters per second by a 5x7 dot matrix with a full 64-character set. Price for 35-column unit in quantities of 100 is $182.50. *Practical Automation, Inc., Shelton, CT.*

Circle No. 175 on Inquiry Card

DATA ACQUISITION

The Series 101 portable Data Acquisition System features the ability to standardize test parameters and to correct data for temperature changes and similar variables whose effects can be calibrated. It can accept 64 input channels (50 ac/dc and 14 ac) and is capable of digitizing 12 channels at rates of up to 20,000 samples per second. It features realtime, interactive system performance monitoring and reporting. Various options are offered for the addition of FM oscillators, mixer amplifiers, FM discriminators, and remote amplifier gain switches. *Systems Consultants, Inc., Jericho, NY.*

Circle No. 151 on Inquiry Card

DATA ENTRY FOR COMPUTEK

Intelligent terminal manufacturer Computek is adding to its present Series 200 to offer a complete data entry system starting at about $15,000. The basic Series 200 terminal has Computek's own processor with a 650-nanosecond cycle time, 32K bytes of memory, and a 400 to 2000-character CRT screen. To come up with the Computek Data Entry System (CDES), the company added from two to six IBM-compatible floppies, a 165-character per second matrix or 220-line per minute printer, and data entry software. The three-part software consists of: Easy form, which permits file formatting on the fly; the CDES Supervisor Program, which displays status information and provides initialization procedures; and one or more data entry programs, which operate in conjunction with the real-time operating system to initiate and control all terminal activities. CDES can perform I/O tasks such as communications with the host processor and data entry simultaneously. Prices range from $15,625 for a single terminal system to $19,900 for a four-terminal clustered system. *Computek Inc., Cambridge, MA.*

Circle No. 168 on Inquiry Card

MATRIX PRINTER

Okidata's new 132-column matrix printer features a proprietory printhead with 22 pin drivers instead of the standard seven or nine and with constant current drivers to more than triple head life. The desk-top or pedestal-mounted model prints 5x7 matrix characters at 125 lines per minute or 265 characters per second. It is available with parallel and RS-232 serial interfaces. The OEM printer sells for under $1700 in quantities of 100. *Okidata Corp., Moorestown, NJ.*

Circle No. 185 on Inquiry Card

SELECTRIC INTERFACE FOR 5100

The Tycom 5100 makes an input/output terminal out of the Selectric II for the IBM 5100. The desk-top control unit consits of power supply and interface card with a self-test feature. Data can be transferred at a maximum rate of 15.5 characters per second. Price is $2495 with the use of a customer-owned Selectric. *Tycom Systems Corp., Fairfield, NJ.*

Circle No. 148 on Inquiry Card

ASYNCHRONOUS INTERFACE FOR PDP-8

The data communications interface for DEC's PDP-8 features programmable multiple speed capacity for up to 64 lines. It is compatible with either the PDP-8 Omnibus or the older external bus. *Standard Information Systems, Inc., Wellesley, MA.*

Circle No. 182 on Inquiry Card

ARRAY PROCESSOR FOR PDP-11

Data from external data acquisition/output/display devices can flow directly into the 32-bit floating point MAP processor and data demultiplexing can be done on the fly. The hardware interface performs block transfers of data between the host PDP-11 computer and the MAP. A programmable demultiplexing feature is provided as well as features for data reformatting, fixed point and floating point conversions bidirectionally, as necessary. Data transfers, including all memory protocol requirements, can be accomplished at a rate of one million 16-bit words per second. *CSP, Inc., Burlington, MA.*

Circle No. 183 on Inquiry Card

new software & services

INTERACTIVE FINANCIAL SERVICE

The Interactive Financial Modeling System (IFMS) uses English language equations to define problems for subsequent "what-if" analysis. Uncertain future situations can be described using built-in probability subroutines. Available through Cybernet, the system is said to allow the businessman who is not a programmer to build a financial model of his company and, in a conversational mode, explore how financial changes or specific actions may affect his company. Profit and loss analysis, pricing strategies, inventory planning and cost reduction programs are typical applications. *Control Data Corp., Minneapolis, MN.*

Circle No. 201 on Inquiry Card

EXTENDED HASP-11

Oregon Research Institute has expanded support for its HASP-11 communications system to the new DEC operating systems, RSX-11M and RT-11. HASP-11 is already available under DOS and RSX-11D. The system can be used either as a replacement for any of the standard HASP Remote Workstations or as a "central" to communicate with other remote workstations. The multileaving line protocol with data compression and transparency is employed for transmission, while non-transparent or transparent data can be received. Prices start at $3000 (RT-11) and $3500 (RSX-11M) for single systems. Sources are available for an additional $1000. Multiple copy discounts and OEM discounts are available. *Oregon Research Institute, Eugene, OR.*

Circle No. 210 on Inquiry Card

AFFIRMATIVE ACTION

Developed for the Wells Fargo Bank of San Francisco, the EEO-Affirmative Action Reporter contains nearly 70 reports including a series of goals and timetables, which form the basis of an Affirmative Action Program. These reports represent both the current status of the organization and the areas where additional emphasis may be needed. It also plots both in numbers and in graph form the progress made toward the organization's goals and points out any problem area for further action by the EEO Officer. The turnkey read-only system operates on IBM 360/370 computers and is priced at $20,000, which includes training and support. *Cullinane Corp., Wellesley, MA.*

Circle No. 208 on Inquiry Card

INTERDATA RJE

The Interdata Telecommunications Access Method, ITAM/16, supports asynchronous terminals and includes a Remote Job Entry package for the company's 16-bit computers. With the package, it is possible to emulate an IBM 2780 or 3780 remote terminal. Required for operation are 32K bytes of memory, a real-time clock, a control console and appropriate data set adapters. Price is $1200. *Interdata, Oceanport, NJ.*

Circle No. 205 on Inquiry Card

CHASE ECONOMETRICS

The IDC computer network using the XSIM language provides access to Chase Econometrics. Forecasts on 500 macroeconomic variables, 230 monetary factors, 400 industries and 12 countries, plus agriculture and insurance are included. Users also have access to forecasting models for factoring in private data to produce their own individual forecasts. *Interactive Data Corp., Waltham, MA.*

Circle No. 206 on Inquiry Card

SYCOR'S ITS PACKAGE

Sycor, Inc. has developed an interactive Teletype simulator (ITS) program module for use on its Model 350 terminal. The program allows the user to communicate with a Teletype, another Model 350 or Model 340 with ITS, or a time sharing computer operating in a compatible environment. The field-installable communications adapter allows the Model 350 to transmit the ASCII-character set at 75-1200 bps in half-duplex, full-duplex or full-duplex with Echoplex modes. The program operates in two modes: local and online. ITS is part of Sycor's flexible disk library and must be generated by the company's TAL language generator. The cost of the disk library, including ITS, is $35. *Sycor, Inc., Ann Arbor, MI.*

Circle No. 203 on Inquiry Card

"HIGHER" OS FOR VARIAN

Previously available only to IDI's computer graphics customers, Fortran-based HIGHER OS is now available to all varian users. HIGHER uses dynamic memory allocation, and features a simplified control language, comprehensive file system, I/O device independence, a Fortran compiler, job isolation, interrupt processing, and extensive debugging facilities. Price is $4000 including training and installation. *Information Displays Inc., Elmsford, NY.*

Circle No. 229 on Inquiry Card

VARIAN DATA ENTRY PROGRAMS

VIDEO (Vortex Interactive Data Entry Operation) is offered as an added feature to Varian's expanding commercial data base system capabilities. VIDEO handles all the functions related to batch entry, such as sort, create, update, verify, and list. A key to disk online data entry system, the VIDEO package can be extensively applied in data base systems. It runs under VORTEX, Varian's real-time operating system that can operate Cobol, Fortran and RPG II. As a result, VIDEO can operate on a multiterminal environment and run concurrently with other VORTEX functions such as data base management, data communications and remote job entry. Price is $1000. *Varian Data Machines, Irvine, CA.*

Circle No. 207 on Inquiry Card

PDP-11 VIRTUAL DOS/BATCH TIME SHARING

DOS users can now exploit the upper range of the PDP-11 series and expand into a multiprogramming environment without costly conversion and retraining by utilizing Varatek's MX operating system. With MX, each terminal is a virtual DOS/Batch system capable of executing all the standard DOS/Batch program requests (EMTs), keyboard commands and batch stream commands. A swapping algorithm allows virtual systems to share partition space with a minimum of swapping overhead, utilizing generic partition pool structures. According to Varatek, approximately 30 percent larger programs can be executed under MX than under a standard 28K DOS/Batch. *Varatek Computer Systems, Inc., Andover, MA.*

Circle No. 204 on Inquiry Card

M6800 HIGH-LEVEL LANGUAGE

PL/M6800 is a high-level programming language for the Motorola M6800 microcomputer. It is accessible on the General Electric Information Services computer network, or can be purchased directly for in-house installation on IBM 360 or 370 computers. PL/M6800 has a one-pass compiler which produces optimized object code in a format directly usable by the Motorola MINIBUG/MIKBUG and EXbug Loader Function. The compiler can provide a source program listing, object code listing, assembler code listing, and symbol table dump. It is compatible with the Intel PL/M language. *Intermetrics, Inc., Cambridge, MA.*

Circle No. 223 on Inquiry Card

new literature

PAPER TAPE PUNCH

A new paper tape punch 4-inches high, 4-inches wide and 6-inches long, equipped with a brushless transistorized DC motor, is described in this two-page bulletin on the 6110 Paper Tape Punch. An OEM product, the 6110 Paper Tape Punch is designed for mini and microcomputers, data communications equipment, business machines, automated tools and process control systems. *Epson America, Torrance, CA*

Circle No. 256 on Inquiry Card

DATA LOGGER/ALARM SCANNER

This 16-page brochure describes the Digitrend 200 Digital Multipoint Data Logger/Alarm Scanner, which can monitor up to 24 process points of temperature, pressure, force, etc. The Digitrend 200 will scan low-level analog inputs from thermocouples, platinum RTD's, transmitters, transducers, or millivolts; convert the signal to digital form; digitally linearize it when required; and display and print the data on a strip printer in digital form. Specifications and prices are included in the brochure. *Emerson Electric Co., San Diego, CA.*

Circle No. 263 on Inquiry Card

ELECTROSTATIC TONING

Described in this six-page brochure is the patented toning system used in the Statos printer/plotters. The electrostatic microprocessor-controlled plotters interface to most minis or over communication lines to other computer systems. Diagrams illustrate the company's point that the old toning method had to be exposed to the toning fluid for too long a period and was therefore not acceptable for high-speed printer/plotters. The Statos method uses a helically grooved rod to alternately scrape off old and apply new fluid to the charged paper. *Varian Graphics, Palo Alto, CA.*

Circle No. 271 on Inquiry Card

ONLINE BUSINESS MINI

The DASL (Data Access System Language) online business computer system is described in this six-page brochure. The minicomputer's hardware and software components, options and the business-oriented language developed for the system are included. Illustrations and a sample DASL program are also provided. *Ball Computer Products, Inc., Oakland, CA*

Circle No. 259 on Inquiry Card

EDP SUPPLIES CATALOG

This 84-page catalog includes over 1500 items, such as word processing supplies, microform retention and retrieval systems, keypunch furniture and accessories, storage and filing systems for cards, disk packs, reels, and binders. New this year is a larger section devoted to minicomputer accessories. *Visible Computer Supply Corp., Westchester, Illinois.*

Cirele No. 252 on Inquiry Card

CRT TERMINAL

This two-page product sheet describes the APL/ASCII Elite 1520A, a Teletype-compatible CRT that includes full upper- and lowercase display and true APL overstrike characters. The two-color sheet lists the specifications and features of the video terminal, which is designed for interactive applications, data entry and information retrieval. *Datamedia Corp., Pennsauken, NJ.*

Circle No. 273 on Inquiry Card

index to advertisers