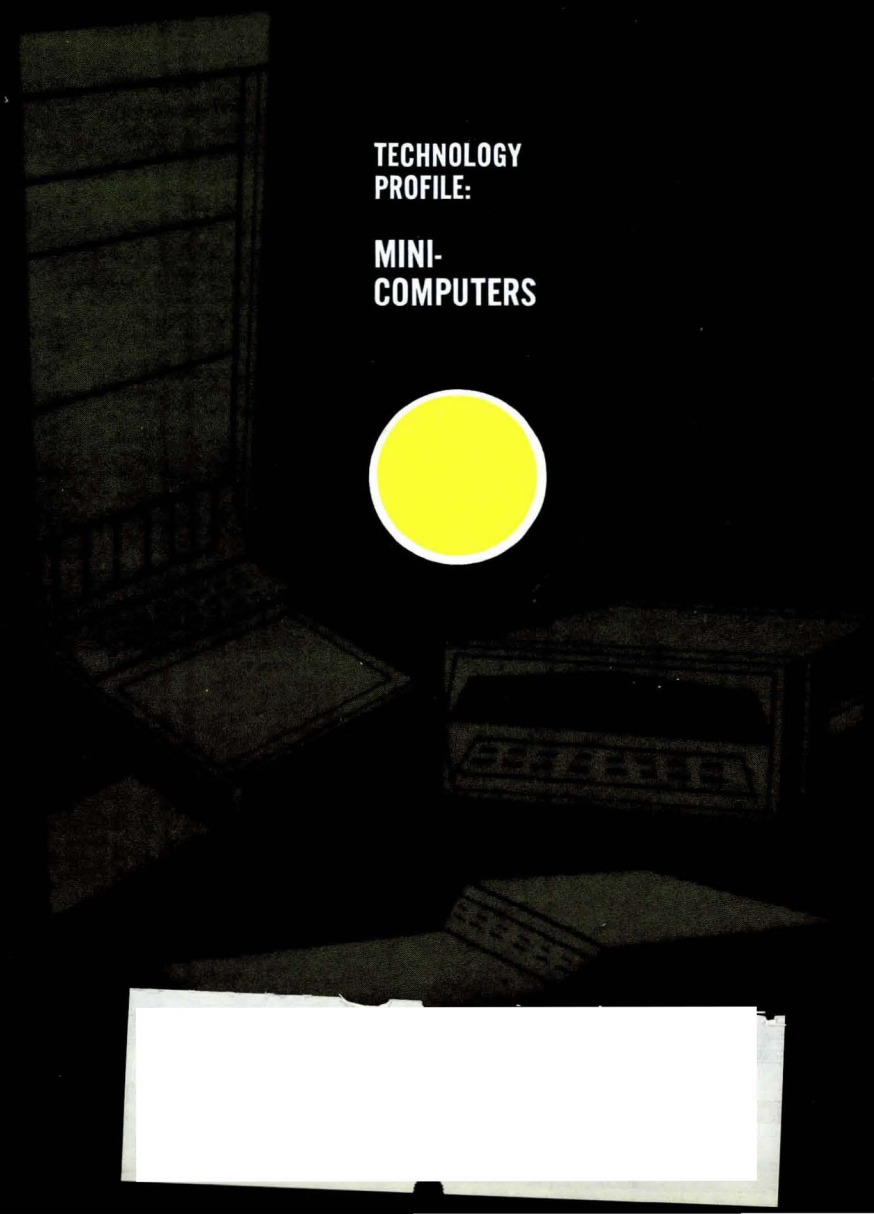
MODERN DATA

PRODUCTS
SYSTEMS
SERVICES

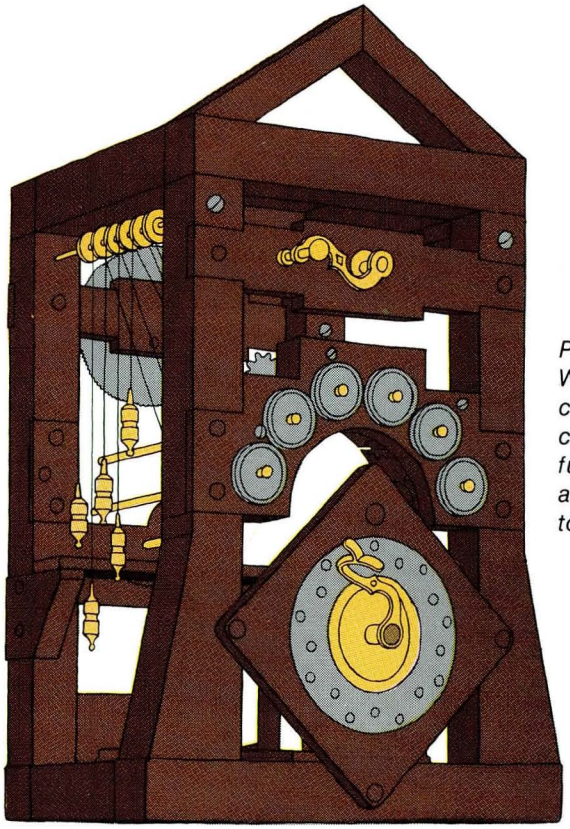
AUGUST 1969



TECHNOLOGY PROFILE:

MINI-COMPUTERS

In 1709, Giovanni Poleni had a wild idea.



Poleni's passion. Wind it up, and you could automatically compute the four fundamental arithmetic operations to three figures.

The Varian Data 620/i is the latest word in 1969. It may give you some even wilder ideas.

Imagine a system-oriented computer that takes only 10½ inches of rack space, yet will out-data any machine in its class. A computer with hardware indexing, over 100 instructions, 1.8 μsec cycle time, 16/18 bit words, easy interfacing capability, optional multilevel priority interrupts, a 4 to 32K memory, and is available in a ruggedized version.

Congratulations. You've just imagined Varian Data's 620/i computer. Now you know why there are over 500 delivered.

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Write for your brochure today. Then tomorrow you can start figuring the money you'll save.

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Only one man in a thousand needs the accuracy of this synchro-to-digital converter...

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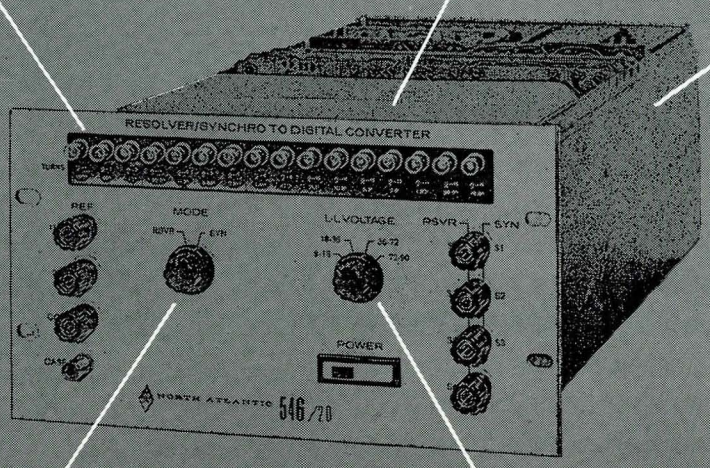
Precision tapped toroidal transformers, solid-state silicon switches to provide ultra reliability in unique electronic servo design.

Angular resolution of 16 bits with 15-bit accuracy.

Analog data continuously converted without data staleness. Binary output continuously available regardless of tracking speed.



Tracks 400Hz Resolver or Synchro data at speeds up to 2000°/sec.

Operates from 9 to 90V line-line voltages in four ranges.

North Atlantic Model 546/20, shown in standard half-rack, is available with options of varying signal-frequency, multiplexed and multi-speed units.

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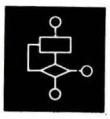
MODERN DATA
PRODUCTS SYSTEMS SERVICES

AUGUST 1969 ■ VOLUME 2 ■ NO. 8

COVER BY WILLIAM KWIATKOWSKI



LETTERS TO THE EDITOR

To the Editor:

I would like to express my appreciation to MODERN DATA, with special thanks to Berglund Associates, for MODERN DATA's "Data Communications Clinic."

There is a need in our industry for a periodic forum for the interface between data processors and data communicators. The "Data Communications Clinic" has made a start in this direction.

Keep up the good work.

Bruce Crawford
Noller Control Systems Inc.
Richmond, Cal.

To the Editor:

Computer inflation to the user-customer is now a reality. IBM's unbundling will amount to cost increases of between 18-30%, depending on the size, dependency and sophistication of the equipment user. This is a case of "pricing synergism" in which two plus two equals five. It amounts to a major price increase for every computer user, be they IBM customers or other vendors.

The customer be damned — he will pay. IBM has set the standards for others to follow and fit in. The "IBM umbrella" is now bigger than ever for their "major competitors" such as other computer manufacturers, software organizations, and IBM's purchase/lease-back companies. This selective group should have few complaints, but unorganized end-users have no voice. The small and medium user will pay the greater percentage of this price increase. IBM has done the following:

1. Satisfied the other special interest competitors by giving them a chance at a "bigger piece of the pie."

2. Entered new areas for "fee for services," which have formerly been free, and opened up this wide area which has vast potential for greater control over customer accounts and profits.

3. Guaranteed and secured the desired growth potential needed to control economically the data processing industry.

4. "Opened the window" to be able to announce IBM's new "fourth generation" computer systems and programming software packages of all kinds.

5. Eliminated most of the potential for new anti-trust suits from its major competitors.

6. Created a new environment and set of rules in the data processing industry for others to follow.

7. Announced the end of another generation of computer hardware systems and software.

8. Created a new, stronger, more competitively-oriented, commission-motivated, cost-controlled, and profit-centered organization in their Systems Engineering Division.

9. Placed its customers in a position where they will not be able to know, budget, and plan within their data processing efforts.

10. Protected the prices and profits on "hardware products" and increased the enormous return in this area by the small reduction of 3% in the total price of hardware and customer engineering services for rental customers.

The historical cost increases of 20% compounded each year will seem small for the 1970's to the computer users because of this announcement.

This is just the beginning of a new logistical plan for growth by IBM; a plan which will slowly unfold with time. IBM should be congratulated on its timing. It has gained the time to organize and put its house in order while others slept. IBM's profits, dominance, and growth are now guaranteed.

George S. McLaughlin, Jr., President
George S. McLaughlin Assoc., Inc.
Summit, N. J.

To the Editor:

Dr. Ivan Flores' article "An Intermemory Transfer Buffer" in the April, 1969 issue of MODERN DATA was well-written and interesting, but I do not fully agree that an "Intermemory Transfer Buffer" will increase system performance. This buffer could introduce a bottleneck in the I/O system and I do not see a functional advantage over main storage buffers. The "Intermemory Transfer Buffer" is static in character and adds problems to system growth. His I/O software would be more complex, but for what extra function? Except for main storage interference, what do we receive for the

extra hardware? A response to these questions would be appreciated.

James M. Cavin
Kingston, N. Y.

The author replies: In the most modern time sharing systems, it is desirable to have the most needed programs and data on the fastest auxiliary memory devices. This means shuttling about these programs when there are several levels of memory. This is especially true for the S/360 Model 67 and Multics. With current equipment, all data passing from one medium to another must also pass through core and use up precious memory cycles. If the intermemory transfer buffer were present, the whole transfer process could be delegated to it, saving time, space, and memory cycles. Hence, such a device would be most important in a multiprogram environment. However, it would also permit such operations as disk-to-printer without any cycle-stealing from the CPU.

Dr. Ivan Flores,
Contributing Editor

To the Editor:

In Mr. French's article on Disk and Drum Memories in your May, 1969 issue, the capacity figures given for the RCA 70/568 are actually the figures in bytes for one magazine, which is 1/8 of a unit. The correct capacity figures are 536 megabytes or 4,295 megabits for a unit. Under index-sequential data organization, the figures are 570 megabytes or 4,457 megabits for a unit. There can be up to eight 70/568 units on a controller, and two controllers per selector channel. Therefore, the unit capacity and systems capacity are much larger than that listed in your article.

Stanley S. Miller
RCA Inf. Systems Div.
Hartford, Conn.

The author's reply: Mr. Miller's observation about the storage capacity of the RCA 70/568 Mass Storage unit is correct. The storage capacity of one magazine is 67 million bytes, not bits, and the maximum storage capacity of a system with sixteen magazines is 1.720 billion bytes or 13.76 billion bits of data.

Michael French
Contributing Editor

MODERN DATA
PRODUCTS SYSTEMS SERVICES

PUBLISHED FOR CORPORATE AND TECHNICAL MANAGEMENT, SYSTEMS ANALYSTS, EDP MANAGERS, SOFTWARE SPECIALISTS, AND COMPUTER SYSTEMS AND OPERATIONS MANAGERS.

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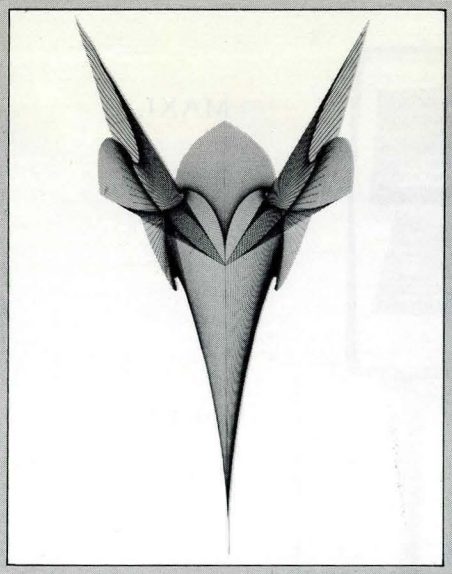

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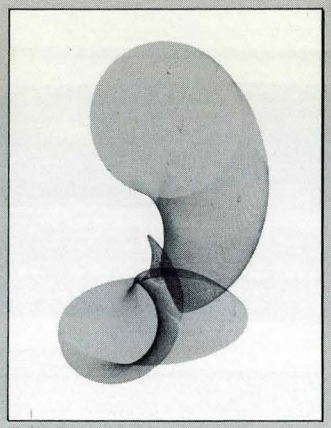

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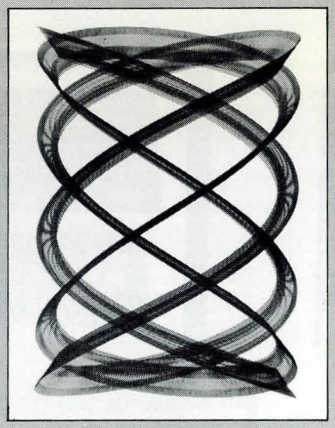

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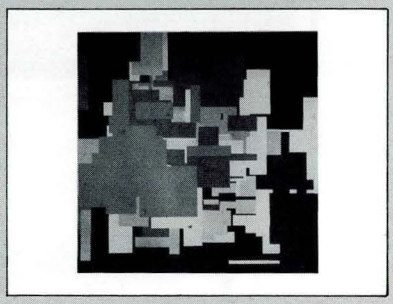

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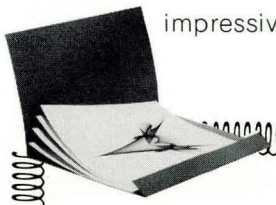

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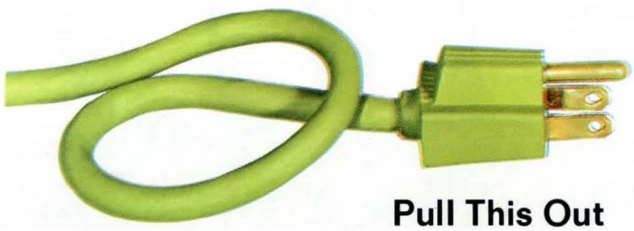
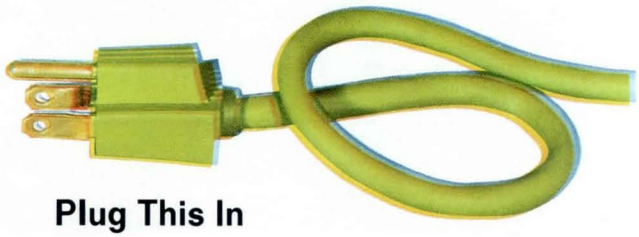
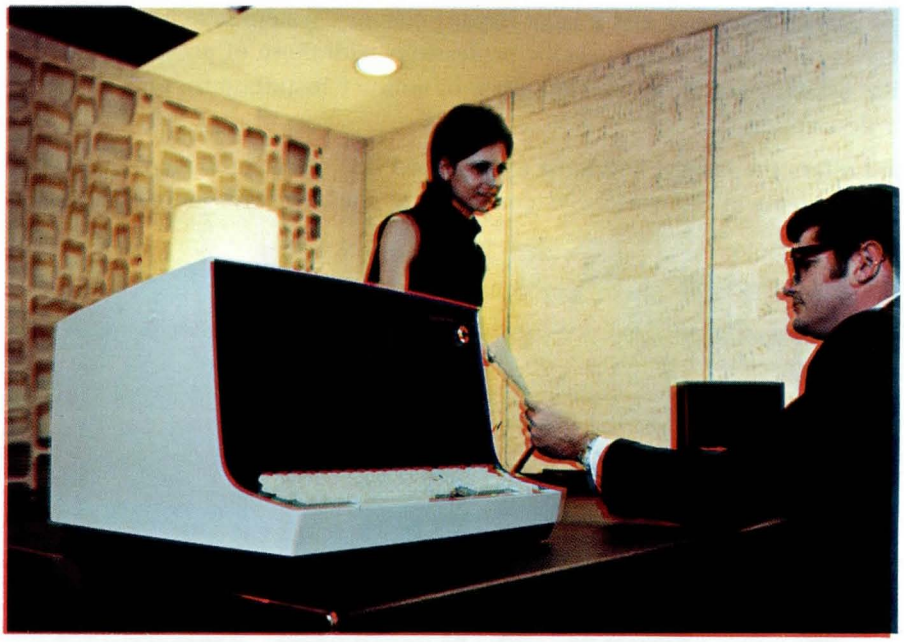
A Tip for Time Sharers
How to Reprogram for the Datapoint 3300



Pull This Out



Plug This In



It's that easy to substitute the Datapoint 3300 for your present data terminal. It's completely compatible with all time share services that now use teletypewriter terminals—no hardware or software modifications are required. And why would you want to change terminals? Read on.

The Datapoint 3300 is the first CRT data terminal designed expressly for the interactive time share computer user. We sat down and figured out what kind of low cost terminal device would enable the working professional and technical executive to communicate most effectively with a remote computer in the process of problem solution. Here's what we came up with.

The Datapoint 3300 utilizes a cathode ray tube screen to display program and file data you want to transmit to the computer — and to receive back the answers. It can accommodate 25 full lines, with 72 characters in each line, in a single display — 1800 characters in one viewing. With this screen, you can take in a complex problem situation at a single glance, make revisions, corrections or deletions for any combination of lines or characters via the keyboard; you can debug on-line; you can in effect make the computer an immediate and powerful extension of your own thought processes.

The Datapoint 3300 is engineered to cut out needless irritations and distractions. Display characters are easy to read, thanks to a high "refresh" rate, which renders each letter and figure totally stable and uniform. The machine is noiseless. No mechanical clatter to intrude upon your thoughts. You can transmit and receive problem and file data at up to 600 bps standard, and up to 2400 bps with optional speed buffer. Your productivity goes up, your "on line" time goes down. No longer are your thought processes shackled by the speed of a mechanical printer.

More: The Datapoint 3300 is styled for the modern office environment. It has the same base dimensions and weighs the same as an executive typewriter.

These are just a few of the reasons why we think you will want to pull the plug on your present data terminal. For further information on the Datapoint 3300, please write to: Computer Terminal Corporation, P.O. Box 6967, San Antonio, Texas, 78209.

Computer Terminal Corporation

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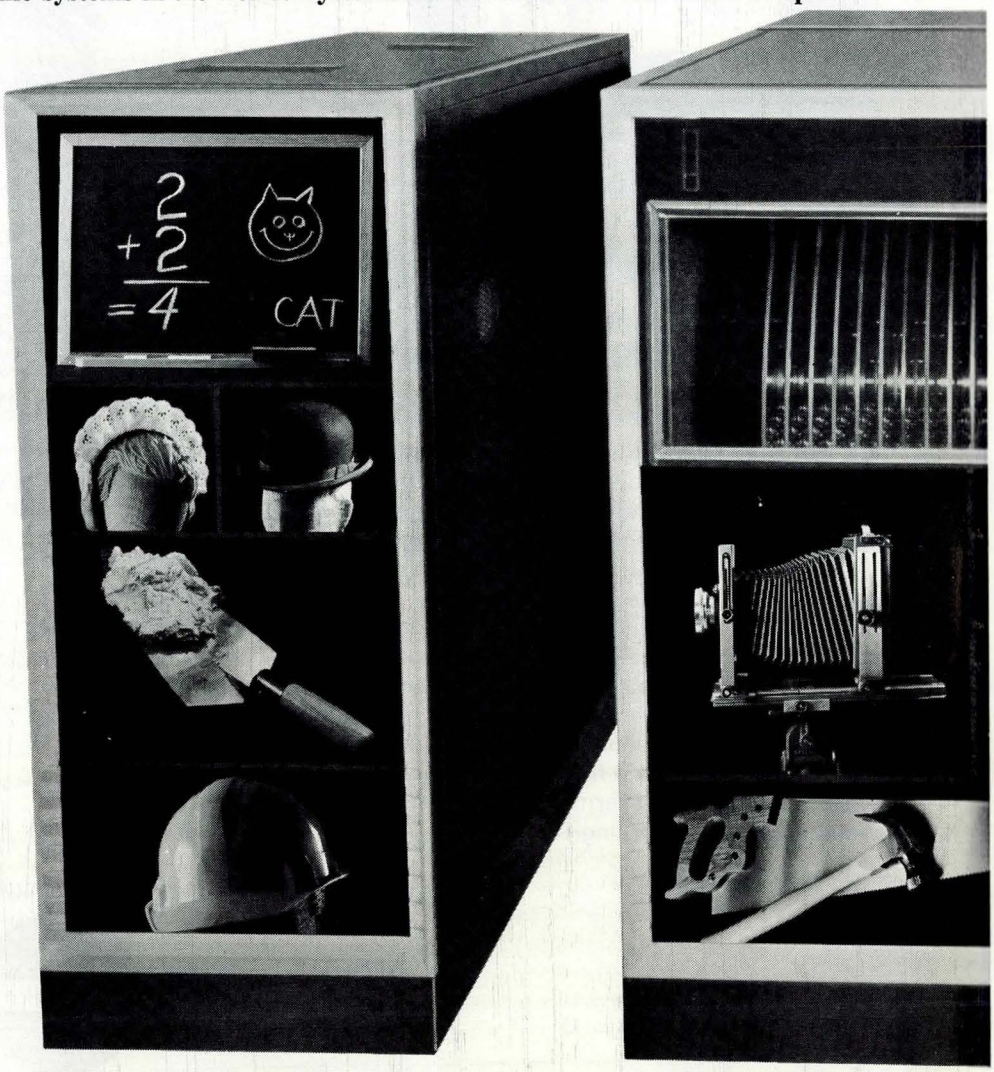
There are almost no limits to the time-sharing capabilities of Bryant equipment.

In this case, a computer and a huge Bryant memory system match the abilities and objectives of people seeking specific professions with those of prospective employers. Similar systems are in use on campuses, in military installations, and businesses of every description.

Bryant offers the largest and most experienced line of random access drum and disc file systems in the world. Systems that are standard with more computer



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manufacturers and independent time-sharing utilities than any other manufacturer. Most recently, with Digital's outstanding PDP-10.

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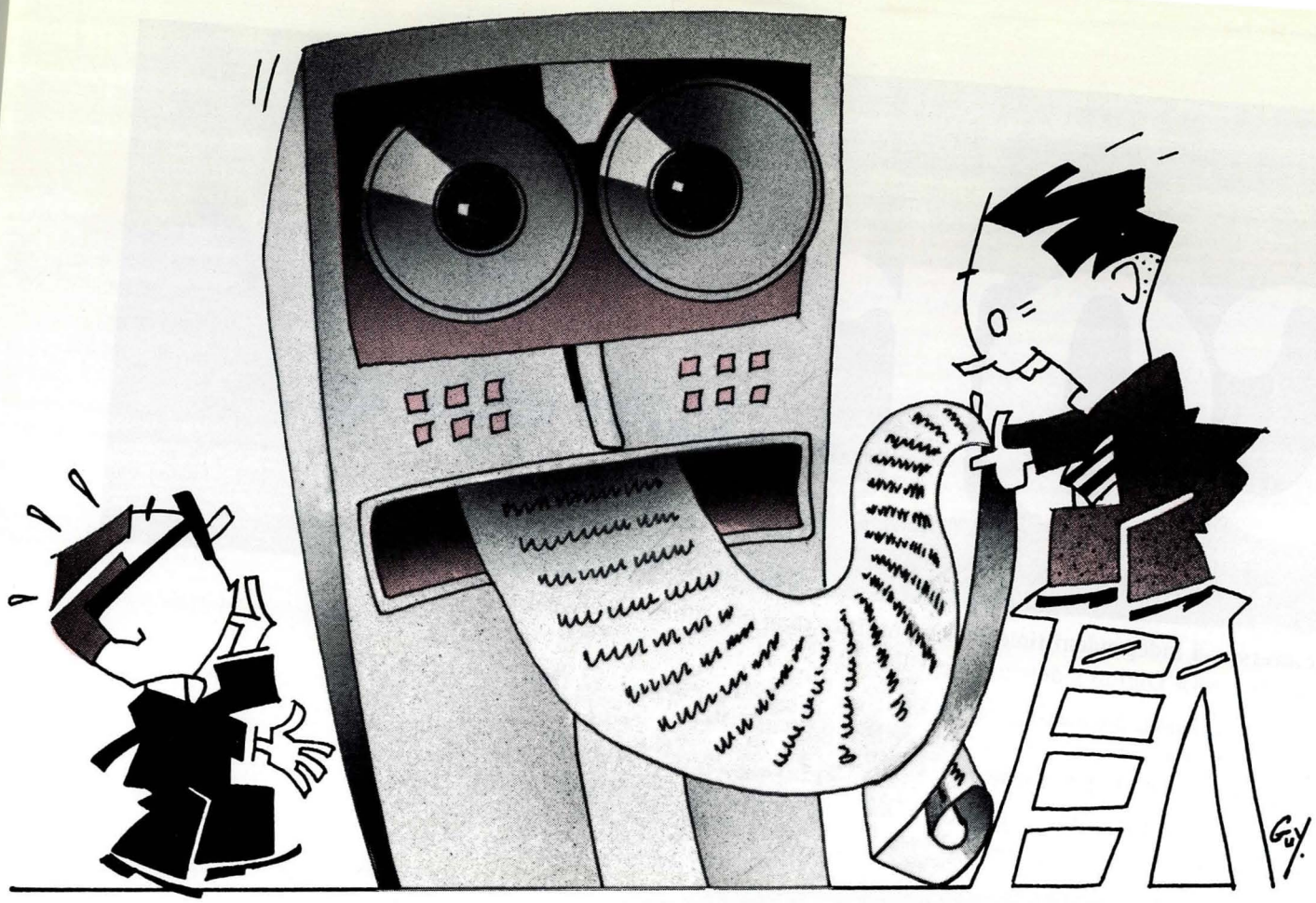


It says: Pardon my prognostication . . . but pandiculation as applied to your present computer is problematic. Provide peripheral paraphernalia permitting more proficient, profitable performance . . . preferably the

MDS 7500 SYSTEM

In plain English, there's a limit to how far your computer's on-line capabilities can be stretched. Switch your slow-down operations to the off-line MDS 7500 SYSTEM.

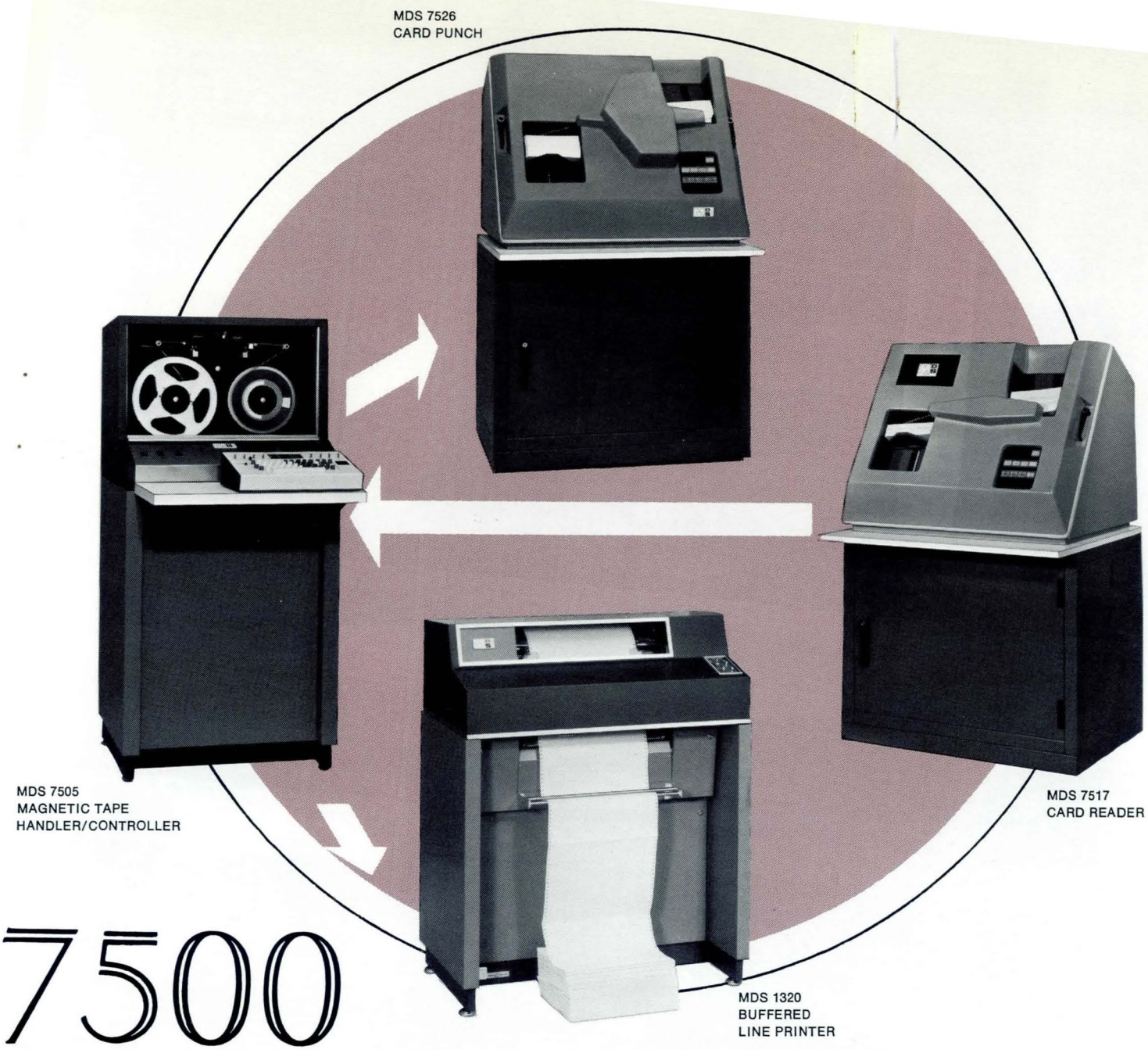
The MDS 7500 System provides a "flexibility package," with multiple off-line capabilities that take the squeeze off your computer. We call it the "Computer-Stretcher." It works equally well adjacent to your computer, or in a remote location.

The 7500 is an off-line data conversion system presently offering five different types each of input and output devices. The complete 7500 System consists of the 7505 Magnetic Tape Handler/ Controller and Keyboard; 7517 Punched Card Reader; 7526 Card Punch; 7515 Paper Tape Reader; 7525 Paper Tape Punch; 1320 Buffered Line Printer.

Units in the system are cable-connected. With the addition of a modem, the system can communicate with another 7500 System, or an 1103 or 6403 Data-Recorder. Switches permit selection of an input and an output device.

A minimum 7500 System consists of the Magnetic Tape Handler/Controller and one of the other units.

The 7505 CONTROLLER is the primary component. It accepts data from magnetic tape, from a data communications module, from cards, paper tape or the keyboard. Data then is channeled to a selected



7500

output unit to produce either magnetic tape records, punched cards, paper tape records, communication messages, or printout. The 1320 Buffered Line Printer can operate simultaneously with any of the other output devices.

OTHER COMPONENT UNITS

7505 MAGNETIC TAPE HANDLER: Input/output medium . . . reads or writes at 800 bpi density on either 7 or 9-channel magnetic tape . . . a 7-channel 7505 also can read 200 bpi tape . . . max. record length, 180 characters . . . BCD, EBCDIC or USASCII tape codes.

7515 PAPER TAPE READER: Reads 5, 7 and 8-channel tapes.

7525 PAPER TAPE PUNCH: Punches data in 5, 7 or 8-channel codes (paper, mylar or mylar-combination tapes).

7526 CARD PUNCH: Rated speed—200 fully punched 80 column cards per minute . . . maximum speed—300 cards per minute, punching 16 columns . . . Hopper/Stacker capacity 1000 cards each.

7517 CARD READER (standard): Reads 80-column cards, face down, at 1000 cards per minute . . . Hopper/Stacker capacity 1000 cards each . . . effective throughput rate approx. 550 cpm.

7516 CARD READER (optional): Reads 51 or 80-column cards, face up (face down optional) at 400 cards per minute . . . Hopper/Stacker capacity 500 cards each.

1320 BUFFERED LINE PRINTER: Prints 132 columns, operating at a nominal rate of 300 lines per minute. It can operate in Edit, List or Line Edit mode.

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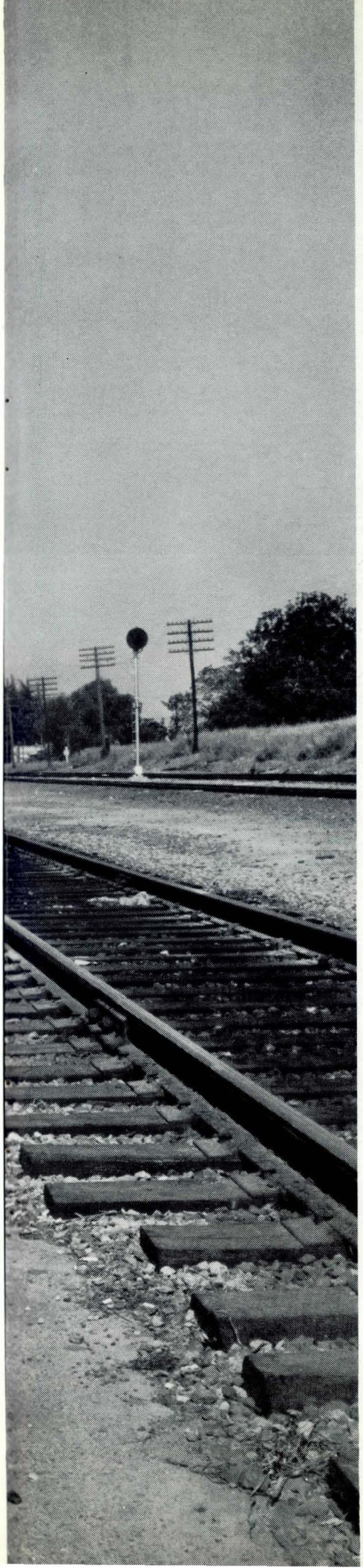

Some small computers aren't delivered.

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We believe that when you buy a small computer, you should get more than just a box of hardware. You should get the same service and support capabilities offered with the big systems.

That's the kind of support that goes along with all our small computers. We have documented training programs, including courses in preventive maintenance. And if you should need help, our parts and service are never more than a couple of hours away.

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Take our HP 2114A, for example. It's very compact, costs just $9950, yet handles 4096 (or 8192) 16-bit words in 2.0 μsec. If you need an even faster, more powerful computer, consider our HP 2116B. It's the heart of our time-share and real time executive systems. Stores up to 32,768 words. Recalls them in 1.6 μsec. Costs $24,000.

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Before you buy any key punch, verifier, key/tape, teletype, data printing, display or terminal equipment you should check out System 21

You'll find it does many different jobs.

And color helps to make it easier.

Color distinguishes read and write fields to reduce input errors.

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You can have eight different letter colors. Eight different backgrounds. Plus automatic turnaround, search and verification. Batch transmission.

Color is only one of the inexpensive options available with System 21.

The basic System 21 station includes a microprocessor with computer logic, a standard keyboard and a video display so any clerk can record, format, display and visually verify data at her desk, replacing key punch/verifier and key/tape operations. Cutting computer input costs in half.

A simple robot provides stand-alone or on-line hard copy printout. Add an inexpensive communications adapter and you can send and receive messages. Feed data directly to your computer.

If you'd like to learn how little it would cost you to have a System 21 computer input and communications network, write VIATRON Computer Systems Corporation, Dept. M-2, Route 62, Bedford, Massachusetts 01730. Or telephone (617) 275-6100.

VIATRON

SYSTEM 21

VIATRON System 21 puts the logic where the problem is

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More software means And that means the

Here's why ... We know and you know that the cost of software for a particular application can drive total systems cost to many times the price of the central processor and peripherals. That's why we've written more than 300 programs and sub-routines with more than 200,000 instructions for the 706. This library (it's growing every day) reduces the cost and time to prepare application programs, gives the 706 capability equal to large, more expensive machines and simplifies and minimizes cost of expansion. □ For facts about the hardware and software benefits of the 706, drop us a line or give us a call. Ask for Data File CB-175. Raytheon Computer, 2700 So. Fairview Street, Santa Ana, California 92704. Phone (714) 546-7160.

RAYTHEON

Assemblers and Compilers	Part No.
Conversational FORTRAN	393296
Conversational FORTRAN-4K	393295
Real-Time FORTRAN IV	392957
Real-Time FORTRAN IV-8K	393297
SYM I/PREP Assembler	393304
SYM 520 Assembler	393294
SYM II Assembler	391878
System Loaders	
Absoluter-Linking-Disc	393255
Absoluter-Linking-Master	393253
Absoluter-Linking-Standard	393254
Bootstrap Loader	390363
Bootstrap Paper Tape	390364
Loader, Initial-Card	393259
Loader, Initial-Master	393258
Loader, Initial-Paper Tape	393260
Relocating Loader-Basic	390682
Relocating Loader-Disc	390012
Relocating Loader-Master	392294
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Resident Loader	391916
RTOS Disc Bootstrap Program	391917
RTOS Installation Program	392341
RTOS-Special Loader	392290
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Card Reader Driver	390019
DIDS Driver	392975
Disc and Magnetic Tape Driver	391040
I/O Monitor	391476
Line Printer Driver	390020
Magnetic Tape Driver-DIO	393303
Plotter Driver	392295
Plotter Interface Routine	392306
Teletype Hi Spd Paper Tape I/O Dr	392292
Teletype Multiplexer Driver	391909
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Monitor-Master List	397175
RTOS-Real Time X-RAY	391881
X-RAY EXEC—Basic	390779
X-RAY EXEC—Standard	391305
X-RAY EXEC Basic Disc and Tape	390826

Monitors and Executives	Part No.
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Monitor Configuration 2 Standard	392298
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Math DP Fixed Point Store	391081
Math MP Floating, DP Fixed Compr	391088
Math MP Floating Load	391075
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less total system cost. Raytheon 706...

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Math MP Floating Underflow	390014
Math SP Cumulative Multiply	391101
Math Subr Storage Constants	391098
MP Floating, DP Fixed MPV and Div	391096
MP Floating Add, Subtract, Norm	391090
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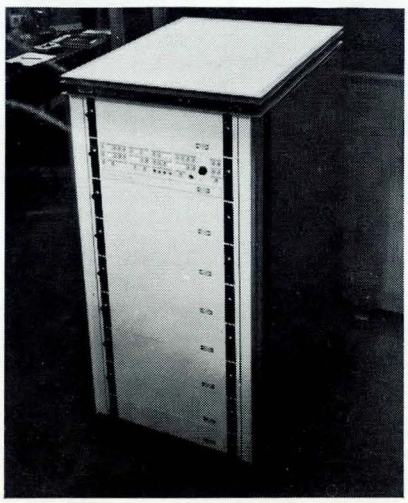

CIRCLE NO. 10 ON INQUIRY CARD

FORTRAN IV-Complex Functions	Part No.
Complex Conjugate (CONJG)	392271
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Application Programs	
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Seismic Software System	392244
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Sort/Merge-Intermediate Merge	393308
Sort/Merge-Merge	393309
Sort/Merge-Primary Sort	393307
Shop Schedule Report System	393311

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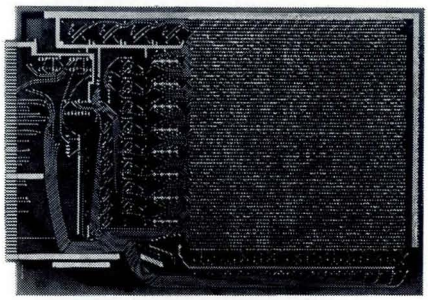
CIRCLE NO. 11 ON INQUIRY CARD

If you're in the market for a mini computer, look at the Micro 800 first.

You'll probably end up with one anyway.

Here's one reason why: Microprogramming



Microprogramming gives you a more efficient system, tailor-made to your requirements, for less money. Since firmware absorbs many functions normally handled by core memory and interface hardware, requirements for both are reduced substantially. On the other hand, standard hardware can be retained even while changing architecture to match your particular demands. With little time and practically no effort, you can optimize computer characteristics for a particular operation without making a single hard wire change.

Here's another: Delivery

We began building 800's before we began selling them, and now we're in volume production. It's only natural then that delivery is off-the-shelf with custom variations taking a modest 30 days extra. Try us. Especially if your requirements are urgent.

Here's one more: Price

The Micro 800 costs $3200 with quantity discounts ranging up to 40%. For $3200 you get a basic processor with 16 multi-purpose registers, 256 words of read-only store, basic console, enclosure and power supply to function as a micro programmed controller. In addition, you get the fastest digital computer in its class with a 1.1μs memory cycle time and a 220ns micro command execution time. Core memory capacity is 0-32K bytes.

We also sell a microprogrammed adaptation of the 800 with 512 words of read-only store, a 4096-word by 8-bit core memory and a teletype interface. We call it the Micro 811 and it goes for $6300. Our third model, the $6900 Micro 810, is like the 811 except that 768 words of read-only store are used to implement an expanded instruction repertoire, including multiply and divide.

Just about any question you'll have is answered in our new mini-seminar booklet. We'll send you a copy gladly. But we'd really rather have you ask for a call from our marketing representative. You'll save a lot of time if you do because we're sure you'll end up with an 800 anyway. It's irresistible.

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CIRCLE NO. 12 ON INQUIRY CARD

Scientific Engineering Programmers:
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At IBM's Components Division in East Fishkill, N.Y., we develop and manufacture semiconductor devices for our computers.

We're looking for Scientific Engineering Programmers to help us design and develop quality control and manufacturing systems to test improved semiconductor devices.

What you'd do

If you qualify, you'd join a project team, or take on an individual assignment, within our advanced semiconductor group. You'd interface with a number of engineering disciplines and give them basic system support.

You'd concentrate in such areas as process control of test equipment, semiconductor processes, analysis of process-oriented engineering data, research or manufacturing records.

And among the tools you'd use are our sophisticated 1800, 1130 and System/360 computers.

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If you're interested, call Dan Pearlman at (914) 897-6405 collect. Or send a brief letter or resume to him at IBM Corporation, Dept. CH1004, Components Division, Route 52, Hopewell Junction, N.Y. 12533.

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Overstuffed with data? And fed-up with confining equipment?

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These fast-acting data acquisition and reduction systems quickly convert analog and digital inputs into a computer-compatible format. Efficient assimilation of data means more effective use of information handling equipment. Not to mention the substantial savings in engineering and research time.

A Datatron system begins by accepting multi-channel analog and/or digital inputs. A self-contained A to D converter then formats the analog data. Finally, the processed data outputs to any commonly-used recording device or directly to a digital computer.

Moreover, the family-size Model 1500 Series systems are conveniently packaged complete with their own output equipment — a digital tape recorder (Models 1500 and 1510), teletype machine (Model 1520), printer (Model 1530), or tape punch (Model 1540). This recommended dose needs only to be connected to the data source to reach full-strength system operation.

On the other hand, if an output device already exists, just the interfacing/converting portion of the system can be taken. In dimensions and price, this system—known as the Model 1000 Series—is truly an economy-size packet.

For an additional pick-me-up, both systems will accommodate such on-the-spot data verification functions as a search and playback mode, D to A converter, and printer readout.

What puts the fizz in Datatron? When taken into your system, thousands of tiny TTL and DTL IC's go to work, bringing fast, fast relief. This type of solid-state design reduces power and size requirements . . . while providing excellent noise immunity (except, of course, for the bubbles).

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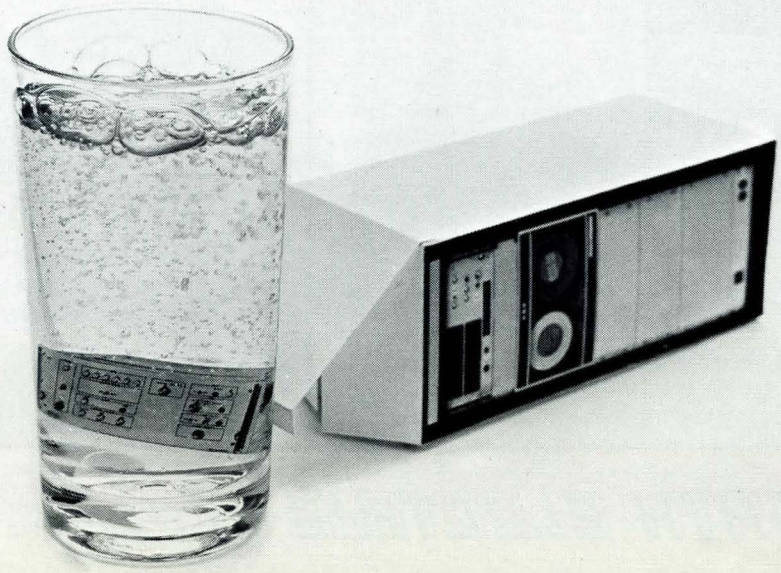

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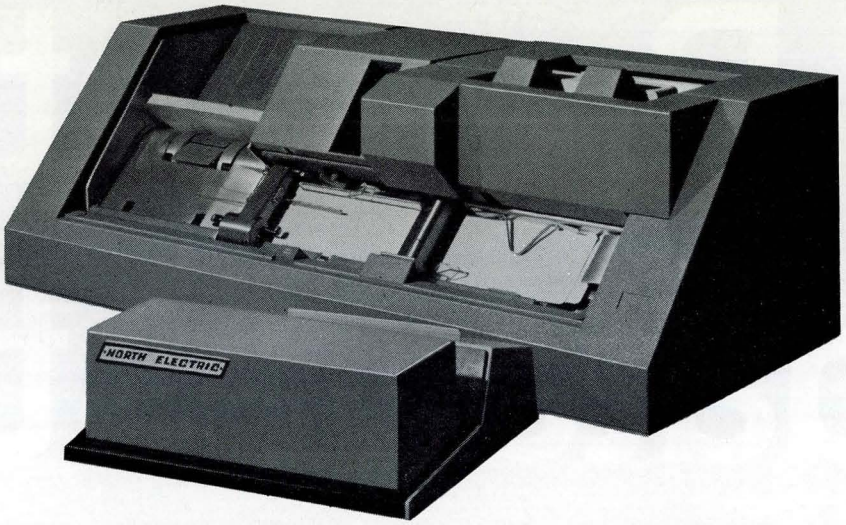
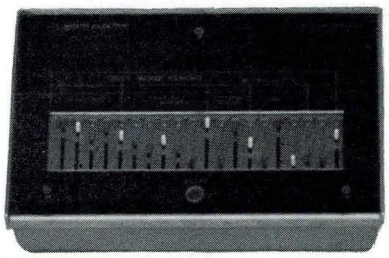


this key punch machine is being operated automatically by a shipping clerk

(...and for less than $95.00 per month.)

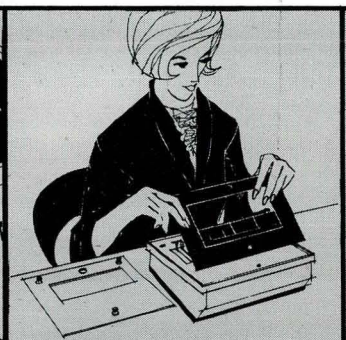


Now with the basic North Electric Message-ComposeR™ System (leased for less than $95.00 per month) an unskilled operator can . . .

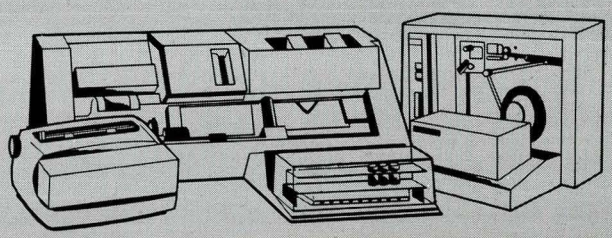
- **Use a simplified keyboard to encode and transmit variable and fixed data.**
- **Visually scan the message for accuracy before transmitting.**
- **Transmit over owned or leased lines . . . or, with North Electric acoustic couplers, transmit over the switched telephone network.**
- **Automatically produce punch cards, key tape or typewritten hard copy at any location.**

The North Electric Message-ComposeR System is a complete system usable by any organization that requires punch cards, key tapes or hard copy (the Message-ComposeR may also be used by real time systems with an adapter unit). In addition to the basic system, Card Readers, Time and Date Generators and Tape Recorders are available to expand the system's capability.

The keyboard of the system permits an unskilled operator to encode a message and scan it visually for accuracy, before transmitting.



Easily changed overlays serve as a guide to the operator. They are laid out in the language of the job and are coordinated with a program plug that automatically encodes required fixed data into the message.



The Message-ComposeR System, can compose and transmit messages to any point of conversion, automatically operating a North solenoid pack to produce punch cards, key tapes or typewritten copy – all three if required.

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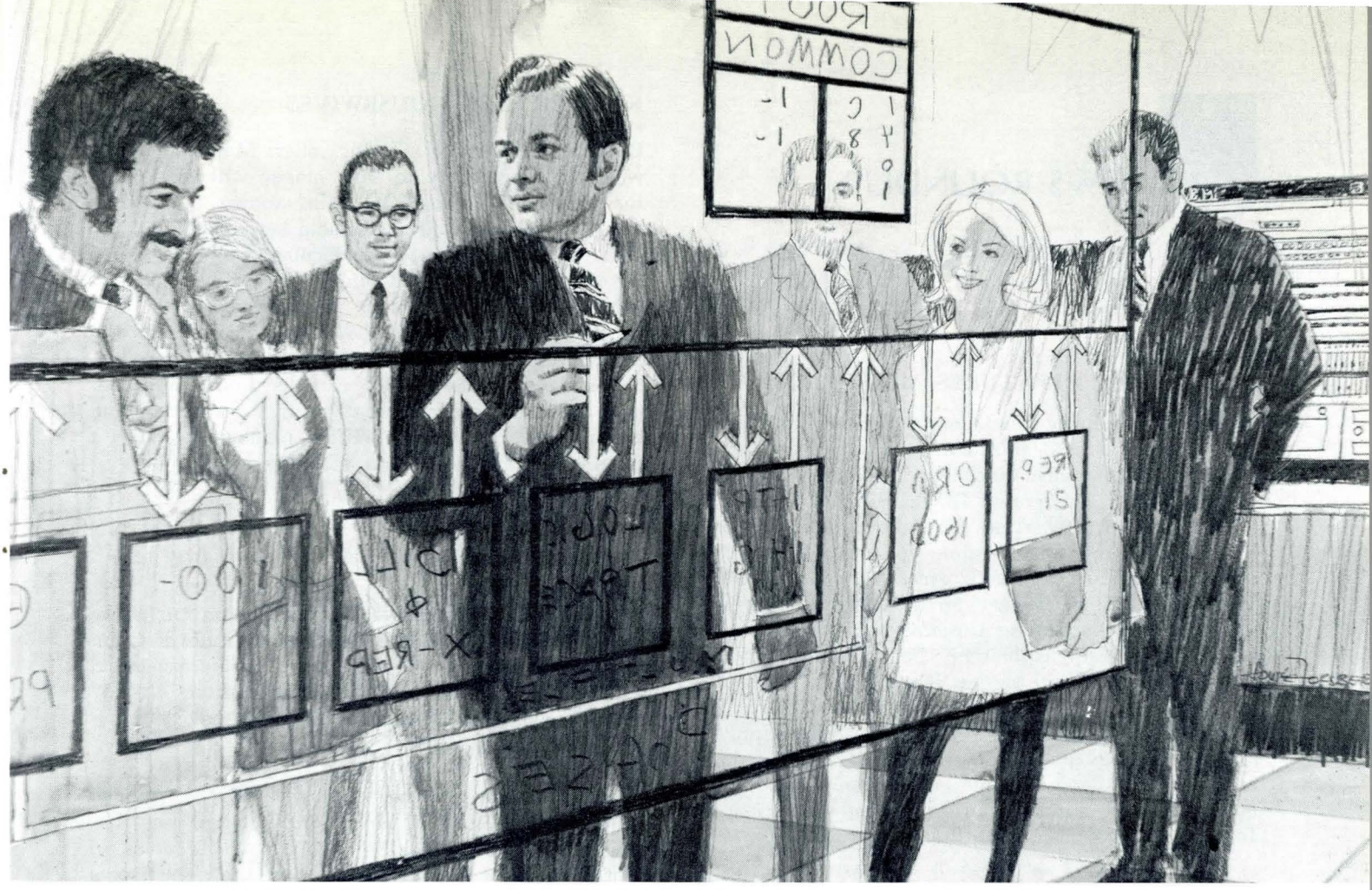
CIRCLE NO. 14 ON INQUIRY CARD

CIRCLE NO. 15 ON INQUIRY CARD →



John Czerkies, Director of Research and Special Projects, conducts a project team briefing session at DDSS. Mr. Czerkies, with 13 years in data processing, has extensive experience in designing complex software systems.

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We think so — and that's why our Research and Special Projects Division was formed. This group of data processing professionals specializes in the use of new technologies to realize the full potential of existing systems.

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The Division has other proprietary programs in the design stage and is prepared to acquire complementary programs from outside sources. It will also enter into joint ventures in such areas as time-sharing, operating systems extensions, tele-processing, project control, systems support programs and language processors . . . as well as consulting on software and hardware problems.

If you would like to have someone take a creative look at your data processing operation, why not check your specific area of interest on the coupon below. Or better still, call us. We will be glad to discuss your requirements with you.

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NEWS ROUNDUP

IBM'S NEW S/3 FEATURES MINI-CARDS

System/3, a complete stand-alone facility for small businesses, utilizes a new 96-column punched card only 1/3 the size of the familiar 80-column card. The system is also the first to incorporate IBM's new monolithic systems technology. Rental prices for the card-only version begin at $945/mo.; disk versions (for files of up to 9.80 million characters) from $1,325/mo. The system's RPG-II compiler will be licensed for an additional $35-45/mo., and an "Application Customizer Service" will be made available for a one-time charge of $180-265 an application. Basic core storage for the S/3 is 8K bytes, expandable to 32K. Memory cycle time is 1.52 μsec. A complete system, including 100/200 lpm printer, multifunction (sort/collate/punch/print/read) card unit, data entry keyboard, and disk file requires only 150 ft.^{2} of non-raised and normally air-conditioned floor space. Initial S/3 shipments are scheduled for early 1970.

ABA URGES PUNCHED-CARD STOCK CERTIFICATES

The Committee on Uniform Security Identification Procedure (CUSIP) of the American Bankers Association has urged the securities industry to adopt a standardized punched-card format for its certificates. The recommendation, in the form of a 29-page report prepared by CUSIP's Security Imprinting and Processing (SIP) task force, said that the task force "considered all factors affecting the acceptance of a standard punched-card certificate, including the present 8" x 12" size, a reduced 4" x 8" paper certificate, or a 'no certificate' system. However, it was concluded that the punched-card size certificate would best meet the immediate needs of the securities industry."

IBM LOWERS SCHOOL DISCOUNT

Effective June 30, 1969, IBM will restrict orders from qualifying educational institutions to a maximum allowance of ten percent. Previous allowances had ranged from ten to thirty percent. IBM also said that maintenance agreements no longer will qualify for an educational discount after November 1. The announcement came within two weeks after the Association of Data Processing Service Organizations, Inc. (ADAPSO) issued a formal statement expressing its opposition to any discrimination in prices charged by hardware manufacturers. ADAPSO said that although favored purchases (govt. organizations, universities, charities, etc.) are "required to agree that their equipment will not be used in competition," they almost always are "in competition to some degree."

KEYPUNCHING HOUSEWIVES

Comput-A-Credit of D.C., Inc., offers Maryland housewives an opportunity to earn money without leaving their homes. The company trains women to use their Touch-Tone telephones as remote keypunch input devices. It then delivers source documents to their homes for keypunching at their convenience. Keypunch machines at a local data center are connected to the telephone system via "Comput-A-Phone" translators supplied by Photo Magnetic Systems, Inc. Comput-A-Credit claims to have already completed one major contract successfully, and now plans to train homebound handicapped people and welfare mothers to make it possible for them to become self-supporting.

GRAPHICS SYMPOSIUM

Guest speakers at a pre-SJCC symposium on interactive graphics sponsored by the Keydata Institute of Cambridge, Mass. included several internationally recognized leaders in the graphics area. **Thurber Moffett**, of TRW Systems, spoke of the need for "high technology" companies to understand and apply interactive graphic systems if they planned to remain high technology companies. **Dr. Franz Selig,** supervisor of the Applied Mathematics Section of Mobil R & D Corp., said that "When the man is 'inside' a problem, he becomes an intricate part of the solution . . . graphics must solve problems where man's capability to recognize patterns becomes essential to the whole solution, or where he has to bring his experience into play . . ." In the opinion of **Dr. William Sutherland** of MIT's Lincoln Laboratory, the graphics experimenter "often starts with a very poor understanding of what he wants to do at the console and, of course, with rather poor specifications." This leads to trial-and-error development, always adding tools to the programming environment. **Dr. Robert Collins,** display products manager for Digital Equipment Corp., stated that approximately ten percent of all the systems his company sells have displays associated with them. **Tom Hagan,** senior v.p. of Adage, Inc., spoke of the "synthesis or design effort (between applications programmer and analyst) . . . which generally consists of designing the analysis technique itself." **Don Lingicome,** director of applications for Control Data's Digigraphics Division, expressed his belief that the area of computer-aided design would grow rather slowly because "one needs a large sophisticated data base structure before one gets a practical system on-line." **Philip Lunday** of IBM spoke of the difficulty in finding a trend for the kinds of graphics applications presently being implemented. **Tom Soller,** Manager of Univac's Graphics System Software Group, referred to the "mystic image" which surrounds the subject of interactive graphics. Final speaker at the symposium was **Carl Machover,** president of the Society for Information Display and v.p. of marketing at Information Displays, Inc. Mr. Machover estimated that "there are currently installed approximately 1000 highly interactive graphic terminals." Proceedings of the symposium are available for $25.00 from Mr. Larry Grodman, Gen. Mgr., Keydata Institute, 108 Water St., Watertown, Mass. 02172.

SPIRAS-65 ..... IRASCOPE

CONTEMPORARY TWINS

Twins occur once in every 86 births. Now for the first time is the multiple birth of a Stored Program Controller and CRT Data Base Editing Display. Together these compatible twins offer new concepts in system philosophy; when separated, they stand alone to provide optimized performance per dollar.

Meet SP**IRAS**-65 — A precocious child — A 16-bit Stored Program Controller, expandable to 65K of memory, including as standard: Full hardware arithmetic with floating point — Double precision add/subtract — Relative addressing (±256) — Direct memory access — Trap mode DMC — Multi-level hardware interrupt — Over 200 instructions — Expandable high-speed read-only memory — NIXIE display (octal/decimal) — Octal entry key set — Party line I/O — MSI low inertia board construction .....

SP**IRAS**-65 is a process controller — Data acquisition/processor — Automatic tester — Electronic calculator — General-purpose logical machine — Display controller.....

Meet **IRAS**COPE — A spirited youngster — A CRT alpha/numeric Data Base Editing Display with high resolution monoscope character generator featuring: Insert, delete, correct and repack under keyboard or remote control — 64-character repertoire (expandable to 128) — 1,000-character capacity in 2,000-character field — 60 cycle refreshed memory — Tab functions — Fill-in-the-blank presentation — Split screen — SP**IRAS** or Dataphone interface.

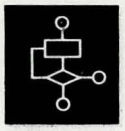
IRASCOPE is a communications terminal — Data generator/monitor/verifier/editor — A program debugging aid — SP**IRAS**-65 peripheral .....

The birth of these interactive system elements resulted from the "overview" open only to a system manufacturer experienced in solving real-time hardware/software problems.

Represented by TEKMARK WEST in Booth 5614 at WESCON

IRA SYSTEMS INC. 332 Second Ave., Waltham, Mass. 02154
617-891-7300 Affiliate of USM Corporation

CIRCLE NO. 16 ON INQUIRY CARD



CORPORATE AND FINANCIAL NEWS

Recent entries in the computer field: "ALEF" Research and Development Ltd., founded in Israel, will specialize in developing application software . . . Alton Associates Corp., Palo Alto, Cal., will offer systems engineering services including the design of software for control and display systems . . . Attwood-Auerbach Ltd., London, England, has been formed as a joint venture of the Auerbach Corp., based in Philadelphia, and Wallace Attwood Co. Ltd. of London. The new company will provide computer consulting services . . . Cybermatics Caribbean Inc., San Juan, Puerto Rico, a subsidiary of Cybermatics Inc. of Fort Lee, N.J., will offer software services with emphasis on on-line systems . . . Daconics, Inc., Sunnyvale, Cal., will provide systems support to users of small- and medium-sized computers . . . Data Access Systems in Landing, N.J. will produce data communication equipment for direct electrical connection to phone lines . . . I/O Devices, Inc. has been formed in Montville, N.J. to develop high-speed serial impact printers . . . Iomec, Inc., Santa Clara, Cal., will produce a series of on-line memory systems . . . Management Computer Network Inc., based in New Hampton, Iowa, will concentrate on unique systems of computerized accounting and related management counseling . . . Omega Computer Corp. in L.A. will operate a computer utility service for financial organizations . . . Optical Data Processing Corp. has been jointly formed by Transducer Systems, Inc., Willow Grove, Pa., and Dividend Clubs Inc., Miami, Fla., to offer optical scanning services to large-volume users . . . Pryor Computer Time-Sharing Corp., Chicago, has been formed as a subsidiary of Pryor Computer Industries . . . Recognition Terminals Inc., to be located near Washington, D.C., will develop a family of remote OCR terminals for parent Recognition Equipment Inc. . . . Remcom Systems, Inc. of Garland, Texas will manufacture remote terminal equipment . . . Semiconductor Electronic Memories, Inc. (SEMI) will produce MSI/LSI memory products at its Phoenix, Ariz. plant . . . Software Services, Inc. will market existing computer programs. The company is located in L.A. . . . Tri-COMP Corp. of Miami, Fla. will specialize in developing total EDP support systems for governmental agencies and the banking industry . . . Virtual Time Sharing, Inc., N.J., will utilize an IBM System 360/67 to provide time-sharing and batch-processing.

Leasco Data Processing Equipment Corp. announced it had suspended further acquisitions of computers for lease in the United States. The company said it was unwilling to accept reduced profit margins on new leases — attributable, for the most part, to increased borrowing costs — in view of competing demands for its resources in the computer service field.

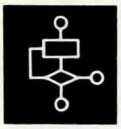
Honeywell Board Chairman James H. Binger said that his company would spend more than half of its corporate research funds on computer operations to attain its goal of $1 billion in annual computer revenue by 1975.

Mergers and Acquisitions: Electronic Memories and Indiana General have merged into Electronic Memories and Magnetics Corp. . . . Automatic Data Processing, Inc. has agreed in principle to acquire Tabulating Services, Inc. The new subsidiary will be known as Automatic Data Processing of Pittsburgh . . . Ennis Brandon Computer Services, Inc. has completed its acquisition of Meyer Higgins Computer Systems, Inc., headquartered in St. Louis . . . Automated Information & Management Systems, Inc. (AIMS) of Cincinnati has been acquired by Ballou Office Service, Inc., also of Cincinnati . . . Communications Disciplines, Inc., a N.Y. subsidiary of Diversified Data Services and Sciences Inc., has acquired an 80 percent interest in Bliss Electronic Corp. of Sussex, N.J. . . . Brandon Applied Systems, Inc. of N.Y.C. will acquire the market research and product-planning firm of Sharp and Oughton, Inc., Kenilworth, Illinois . . . Computer Industries, Inc., California manufacturer of computer terminals and peripheral equipment, has agreed to acquire the assets of Datel Corp., a wholly-owned subsidiary of University Computing Co. of Dallas. Datel is a manufacturer of conversational time-sharing terminals . . . Com-Share Inc., a time-sharing company, has acquired the time-sharing division of Data Central Inc., of St. Louis, Mo. . . . Computer Sciences Corp. will integrate Commonwealth Services, Inc. and Commonwealth Services International, Inc. into its systems group as an operational division. The Commonwealth companies provide engineering and management consulting services . . . Aerojet-General Corp. and Computer Time-Sharing Corp. announced an agreement under which CTC will take over the commercial data processing operations of Aerojet's Computing Sciences Division . . . Control Data Corp. has agreed in principle to acquire Marshall Communications of Santa Ana, Cal. . . . Data Architects, Inc. and Diamond Antenna and Microwave Corp., both of Mass., have merged. Data Architects, a designer of computer-based information systems, is the surviving company . . . Data Memory Inc. of Mountain View, Cal. announced that it has acquired Laser Applications, Inc. of Palo Alto . . . DATA 100 Corp., Minneapolis manufacturer of computer terminal systems, announced a preliminary agreement to acquire Royal Machine industries, Inc., a St. Paul manufacturer of metal enclosures for computer and peripheral equipment . . . Shareholders of Datatab, Inc. and Tabulating and Data Processing Corp. have approved the merger of the two companies. Datatab will be the surviving company . . . Datatron Inc. of Santa Ana, Cal. announced it will acquire control of HFS Manufacturing Co., Inc. and Datakote, Inc.,

BOX SCORE OF EARNINGS

Company	Period	Sales	Net Earnings (Loss)	Earnings (Loss) per Share
Analog Devices	6 mos. 5/3/69	3,071,432	244,926	.20
	6 mos. 5/4/68	2,481,448	171,973	.15
Burroughs	6 mos. 6/30/69	351,298,000	20,665,000	1.25
	6 mos. 6/30/68	299,210,000	15,746,000	.96
Computer Industries	Yr. 12/31/68	11,227,000	930,000	.27
	Yr. 12/31/67	4,631,000	(260,000)	(.09)
Computer Investors Group	Yr. 3/31/69	4,734,310	539,261	.30
	Yr. 3/31/68	1,704,879	307,461	.27
Computer Technology	3 mos. 3/31/69	15,631	424	.08
Cyber-Tronics	Yr. 4/30/69	12,900,822	430,865	.26
	Yr. 4/30/68	12,674,069	58,316	.00
EDP Data Centres	6 mos. 5/31/69	1,313,000	236,000	.31
Gerber Scientific Instrument	Yr. 4/30/69	9,132,810	765,914	.77
	Yr. 4/30/68	8,102,400	468,543	.52
Hazeltine	6 mos. 6/30/69	31,094,000	1,148,000	.59
	6 mos. 6/30/68	27,999,000	774,000	.40
Levin-Townsend Computer	Yr. 3/31/69	75,786,432	13,183,843	3.84
	Yr. 3/31/68	16,873,430	3,908,997	1.85
Management Data	Yr. 2/28/69	5,035,672	448,558	.54
	Yr. 2/29/68	2,807,808	339,263	.64
Farrington Mfg.	Qtr. 3/31/69	8,565,000	173,000	.04
	Qtr. 3/31/68	7,364,000	117,000	.02
Raytheon	6 mos. 6/29/69	613,154,000	16,972,000	1.15
	6 mos. 6/30/68	580,113,000	13,268,000	.90
RCA	6 mos. 6/30/69	1,531,100,000	66,700,000	1.02
	6 mos. 6/30/68	1,479,000,000	63,500,000	.97
Recognition Equipment	6 mos. 4/30/69	11,500,000	(354,000)	—
	6 mos. 4/30/68	6,300,000	(364,000)	—
Sanders Assoc.	9 mos. Apr./69	136,738,000	(360,000)	(.08)
	9 mos. Apr./68	133,274,000	3,930,000	.88
Viatron	6 mos. 4/30/69	248,000	(2,352,000)	(.94)
	6 mos. 4/30/68		(131,000)	(.12)

both of Englewood, Cal. Datakote applies magnetic coatings to substrates of the type used in various memory devices manufactured by HFS . . . EDP Technology, Inc. of Wash., D.C. has agreed in principle to acquire SysteMed Corp. of Newport Beach, Cal. . . . E.P.G. Computer Services, Inc. has agreed in principle to acquire, through a subsidiary, all the assets of H.A. DeFrance & Co., Inc., a cold type composition service . . . Foto-Mem, Inc. of Natick, Mass. is negotiating for the acquisition of Business Information Technology, Inc. (BIT), also of Natick . . . The Interpublic Group of Companies, Inc., N.Y., and Informatics Inc., Sherman Oaks, Cal., have completed negotiations for the joint operation of Dataplan Inc., a N.Y. supplier of computer services in the marketing communications field . . . Newell Industries Inc. announced it has reached an agreement to acquire Computer Measurements Co., a wholly-owned division of Pacific Industries. CMC produces a line of electronic instruments for EDP applications; Newell manufactures magnetic tape recording systems . . . North Atlantic Industries, Inc. plans to acquire a 60% controlling interest in Peripherals General, Inc. Peripherals General will offer a line of IBM-compatible disk-storage equipment.



ORDERS AND INSTALLATIONS

A new $5 million computerized reservations system has been installed by Irish International Airlines in its headquarters at Dublin Airport. The reservations system, called ASTRAL by the carrier, is based on two IBM 360/50 computers with a storage capacity of 600 million characters.

Ampex Corp. has received a $350,000 contract from General Computer Systems, Inc. of Dallas for 100 Model TMZ digital tape memories. The memory units will be incorporated in new keyboard-to-magnetic-tape systems which GCS will manufacture and market.

Cubic Corp. reported receiving contracts totaling more than $3 million for a classified Air Force tactical weapons system and for spare part orders on other defense projects. The announcement brings the firm's present backlog to $21 million.

Milgo Electronic Corp. has received a $288,000 order from North American Rockwell Corp. for the design and manufacture of three special-purpose plotters. The Milgo plotters are part of an intelligence processing system to be supplied to the Dept. of Defense by North American Rockwell.

An SYS Associates' Model 2113 data acquisition and control system has been delivered to the Canadian Government. The system, which converts an IBM 1130 to time-sharing for real-time process monitoring and control, will be used in military research projects by the Canadian Defence Research Board.

Dallas-based Information and Computing Centers Corp. has purchased the use and exclusive world-wide marketing rights to almost 500 geological and geophysical computer programs from Computer Data Processors, Ltd. of Canada. The consideration given for the programs was not disclosed.

Planning Research Corp. has been awarded a $212,000 contract to design a substantive information handling system for the U.S. Dept. of State which will provide for indexing of information from documents and telegraphic messages, selective dissemination of information, and document storage and retrieval.

Data Dynamics, Inc. announced receipt of an $81,600 contract from Palm Beach County in Florida for its newly developed STAX (Scientific Tax Assessing System). The contract covers the first two phases of a four-phase $340,000 program designed to analyze information requirements and implement a data processing system to assist in county assessment of property.

United Air Lines has awarded a contract totaling about $7,000,000 to HF Image Systems, Culver City, Cal., for an automatic microfilm information retrieval system to help provide improved customer service. The contract calls for 3,000 Image Systems units and supporting services, including data programming, microfiche production, and field product support.

A second Univac 494 real-time system is being installed at Keydata Corp's time-sharing center in Watertown, Mass. to back up its large-file business data processing service.

The Univac Division of Sperry Rand will install a $3.6 million UNIVAC 1108 computer system in British Petroleum's headquarters in London.

Electronic Associates, Inc. has announced receipt of an order in excess of $1 million for tire uniformity optimizing computers. The order, which brings to 146 the total of grading and optimizing systems purchased from EAI, was placed by the Akron Standard Division of Eagle-Pitcher Industries, Inc., Akron, Ohio.

Mayor Sam Yorty announced that an $831,000 contract has been awarded to General Research Corp., in Santa Barbara, to design and install an "advanced command/control system" for the Los Angeles Fire Dept.

Applied Dynamics has received an order for more than $739,000 from McDonnell Douglas Astronautics Co. for the manufacture and installation of a large-scale analog/hybrid computing system. The total system will consist of two Applied Dynamics analog/hybrid computers and a McDonnell Douglas-supplied SDS Sigma 5.

General Telephone & Electronics Corp. announced receipt of a $1.9 million Navy contract for a tactical countermeasures trainer. The digital simulator will be used to train students in the operation of airborne electronic countermeasures (ECM) systems.

Computing and Software, Inc. announced receipt of a one year contract valued in excess of $700,000 from the National Aeronautics and Space Administration. The agreement provides for the continuation of scientific computing services at NASA's Langley Research Center, Hampton, Va.

A $2.5 million contract has been awarded Radiation Inc., a subsidiary of Harris-Intertype Corp., for scientific data processing services at the A.F. Missile Development Center, Holloman Air Force Base, New Mexico.

One computer can reveal General Electric's manufacturing secrets

Information Systems

Manufacturing Systems

Hold on, now. We won't give away the store. But we will give you the best ideas you've ever heard for putting computers to work in a manufacturing business.

The idea started more than a decade ago when we locked our computer experts and our manufacturing experts together. We told them to discover new ways computers could help us control our 150 businesses.

The result was a software concept called MIACS. Manufacturing Information And Control System. In simplest terms, it coordinates all the activities that surround the flow of material through your plant (and that covers just about everything).

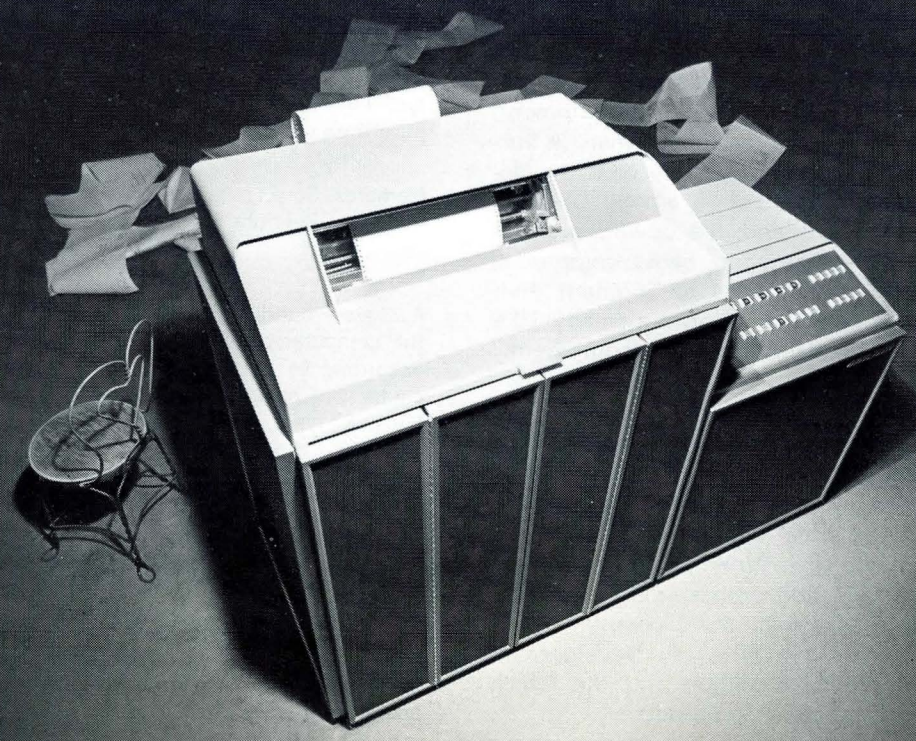
Sounds great, but none of our plants had the money or manpower to install an integrated system all at once. So we've produced a series of self-contained building blocks. Each one links up with the others.

Last year, we offered the first building block outside General Electric. It was GEPEXS, for parts explosion. Now, you can get GEIMS, a new inventory management system.

GEPEXS and GEIMS-400/600 are designed to give you profit-minded results with medium-scale GE-400 computer systems and the large-scale GE-600's. Or you can take advantage of new inventory control software, GEIMS/100, developed for our smaller computer line, the GE-100 series. Your GE Information Systems Sales Representative can tell you more, or you can write Section 290-49, General Electric, 1 River Road, Schenectady, N. Y. 12305.

Some of the most progressive people in the world choose GE computers.

GENERAL ELECTRIC



INTERNATIONAL NEWS

Commerce Dept. market research indicates that the following categories of equipment are among those with the best sales prospects in Germany: CRT input and display systems, digital plotters, OCR systems, graphic film recording and printout systems, high-speed printers, source data-to-tape devices, and data transmission units. US-manufactured computer communications and display equipment is compatible for use with a large majority of German computers, since more than 80% of that country's computers are being produced by US firms or their associates abroad.

Canada's Dept. of Justice, Queens University, and the University of Montreal are jointly undertaking an experimental pilot project in the application of computer technology to legal materials that may eventually revolutionize the administration of the legal process in Canada. Under the project the universities will provide: • the rudiments of a common and civil law thesaurus in a form that will permit its use in any of the more common information retrieval programs now available from industry; • the rudiments of a computerized French-English thesaurus to permit inquiries in either official language; • a pilot series of computer programs and systems for automated legislative drafting and printing; • information respecting investigations and uses of retrieval techniques that pertain, in any way, to material provided by the Department of Justice.

The American Embassy in Bern, Switzerland, reported that business machines were among the top ten imports from the US last year. Imports of business machines, represented in the main by EDP equipment, totaled $12.9 million. The Embassy said that "A further 2% reduction in the foreign labor force by November 1969; the tough competition among US companies established in Switzerland; the development of West German, British, Italian, and Swiss computers; and the efforts of Swiss industries to augment their productivity, are all signs which point to a steady 10% annual rate of growth for data processing equipment."

Czechoslovakia's first computer research center, an important element in the government's plans to accelerate the introduction of technological advances and innovations, has started initial operations in Bratislava with assistance from the UN. When in full operation, it will employ more than 200 programmers and technicians. The center uses a CDC 3300 computer, half paid for by the Czech Govt. The UN Development Program will contribute $1.2 million and the Czech Govt. $6.3 million to the center's support.

The U.S. Dept. of Commerce recently broke down by area the dollar value of U.S. exports of electronic computers, parts, and accessories for 1968 as follows: Canada, $486 million; Western Europe, $298 million (EEC $180 million and UK $80 million); Japan, $59 million; Near East, $3 million; Oceania, $10 million; 19 American Republics, $17 million; and Africa, $3 million. Total exports in 1968 were valued at $486 million — up $54 million from 1967. Decreases in shipments took place in shipments to Africa and the Near East despite the overall increase. Largest increase was found in shipments to Western Europe.

QUICKLY AROUND THE WORLD

The Mitsubishi Bank, in Tokyo, Japan's third largest, has ordered a third Univac 494 valued at $3 million.

Caisse Nationale d'Allocations (National Allowances and Welfare Fund) in Madagascar will install a GE-115 for accounting and centralized information applications.

Digital Equipment Corp. expects to open a new sales office in Frankfurt shortly. The company ranks seventh in the German computer market.

Beginning in September, the Italian Ministry of the Treasury will use a $1.1 million optical reading system from Recognition Equipment Inc. to process 1.8 million monthly pension fund checks.

For the price of a daily paper, Parisians may use the remote terminals at France's LE FIGARO newspaper offices to compute their income tax.

Memorex Corp. recently opened a new $5½ million plant in Liege, Belgium to manufacture computer and television tapes.

A 23-story building, being constructed in Moscow, will house the computer center of the USSR Central Statistical Board. According to the Russo-British Chamber of Commerce, the center will have about a dozen electronic computers of the Minsk-32 type.

The University Institute of Technology at Nancy, France, has recently taken delivery of a $152,000 ICL 1901A computer. It will be used principally for the teaching of programming languages and for instruction in data processing.

Hitachi Ltd. has received an order from the Swiss Federal Institute of Technology for light analog computers following competition with firms from the U.S., Britain, and other countries.

For $11,950.10, you get MAC, 4 priority interrupts and a cup of coffee.

Why coffee? Because you won't be spending any time programming MAC for priority interrupts – since MAC's interrupts (with automatic store and restore) are in hardware, not software. So you've got to have something to do with your time.

And MAC's internal structure saves you still more time by reducing programming.

On the job, the time saving goes on. MAC responds to interrupts in an average 6 microseconds. Which means it can operate with nearly any real-time or time-sharing system.

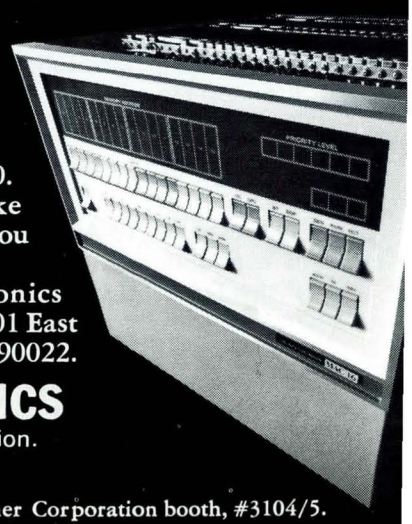
And another thing: MAC's 4 basic interrupt levels can expand to 64.

The same goes for MAC's basic 16-bit, 4K memory. It'll expand to 8K in the mainframe and to 65K with additional chassis.

Nothing mentioned here is exclusive with MAC, of course. Other computers offer 4 hardware priority interrupts and most of MAC's other features. They start at around $25,000.

But if you're spending money like that to get a computer like MAC, you may need a strong cup of coffee.

Write to MAC, Lockheed Electronics Company, Data Products Division, 6201 East Randolph Street, Los Angeles, Calif. 90022.



LOCKHEED ELECTRONICS
A Division of Lockheed Aircraft Corporation.

See MAC in action at WESCON in the Birtcher Corporation booth, #3104/5.

Harold V. Semling, Washington Editor

DC DATASCAN

SAVINGS FROM PLUG-TO-PLUG COMPONENTS — The General Accounting Office estimates the government could save at least $5 million annually by renting tape and disk drives from independent peripheral equipment manufacturers rather than from the systems manufacturers. Furthermore, if these same drives were purchased rather than rented, savings could amount to $23.5 million. GAO strongly urged government officials "to consider immediately the use of plug-to-plug compatible tape and disk storage drives," and suggested that competitive bulk procurement by the General Services Agency might be most advantageous. Agency officials, it also suggested, should investigate the availability of other components from independent peripheral manufacturers which might result in similar savings. GAO believes a standard interface would "promote industry competition and result in certain economies."

CRIME INFORMATION CENTER — Arizona, California, Maryland, Michigan, Minnesota, and New York have received grants totaling about $600,000 from the Dept. of Justice to develop the prototype of a computerized criminal justice statistics system. The total project will cost about $1 million and is intended to serve as the basis of a new statistics and information center being planned by Justice's Law Enforcement Assistance Administration. The federal funds will be used by the states to standardize records, convert existing data to the computer system, and create a uniform statistical model that could be adopted by all of the states.

PRIVACY — The Dept. of Labor is trying to find out if the automation of manpower services and the formation of data banks pose a threat to privacy and the confidentiality of information. A committee formed to study the ramifications of automation will explore the meshing of Labor Dept. data with other information banks.

TAX FOR SOFTWARE — The Internal Revenue Service is considering how to tax computer software. Normally IRS considers the cost of a computer program to be a current business expense. However, some of IRS's regional offices have required firms to write off the cost of a program over its useful life. IRS has told its local units to hold the question in abeyance, pending a definite ruling.

COMPUTERIZED TARIFF WATCHING — The State Dept. will soon implement a computerized "watchdog system" capable of monitoring tariffs negotiated with 74 countries. By the end of this year, embassies in London, Paris, Frankfurt, and Bonn will communicate directly with a computer located in Washington.

EXPORT CONTROLS — The Senate Banking and Currency Committee has approved a more liberal export policy for trading peaceful goods with the nations of Eastern Europe. Under the bill sponsored by Senators Edmund S. Muskie, Walter F. Mondale, and Robert Packwood, the availability of comparable products from other sources would be a consideration in licensing exports. The Nixon administration is opposed to the bill, which would: (1) declare a national policy of encouraging trade in peaceful goods while restricting trade in goods with significant military applications; (2) eliminate "economic significance" as a measure of whether goods may be exported; (3) require regular consultation between the government and American businessmen in setting export standards and licensing procedures; (4) require that detailed reports be sent to businessmen by federal agencies whenever a license application faces delay or denial; and (5) establish an Export Expansion Commission that would study ways of expanding peaceful trade and report back to Congress within a year.

GOVT. PERSONNEL RECORDS — The Civil Service Commission has asked Congress for $225,000 to develop an information system for govt. personnel records. The study would be conducted by an interagency committee, outside consultants, and commission employees. It is estimated such a system could save $50 million a year, since there are now 18 agencies which are developing or have developed their own personnel record systems.

AIR FORCE COMPUTER SELECTIONS — The Air Force's Electronic Systems Division will select a number of computer replacements before year's end. Systems under study include eleven test range computers, at least six Strategic Air Command systems, and various computers at test stations, logistic command posts, the A.F. Rocket Propulsion Laboratory, and the A.F. Academy. Interested companies should contact the Electronic Data Processing Equipment Office, ESD, L.G. Hanscom Field, Bedford, Mass. 01730.

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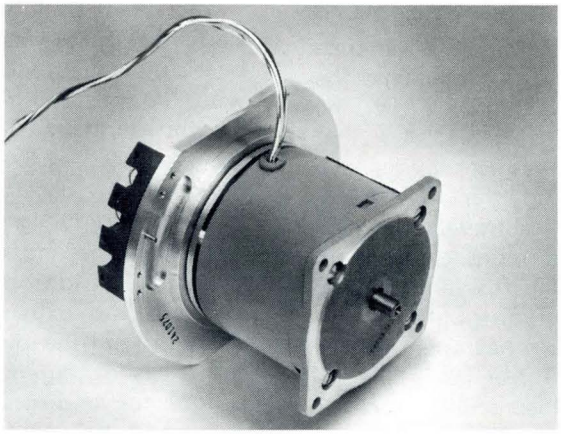

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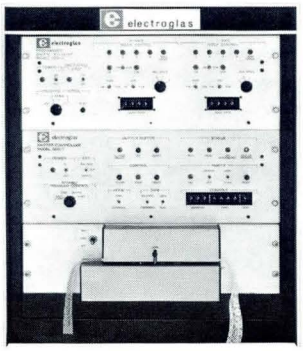

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CIRCLE NO. 20 ON INQUIRY CARD

STOCK TALK

To answer the many questions we received concerning the CATV field, here is a brief evaluation of this new industry.

The letters CATV can stand for either "community antenna television" or "cable television," two different terms for the same thing. When the industry was born about 20 years ago, the community antenna was the important element. Today, to understand the exciting possibilities and the problems of CATV, the correct term must include the word "cable."

The original purpose of CATV was to provide television reception for communities too far from transmitters to pick up the signals which travel only in a line of sight. If all CATV did was improve reception, it would not have stirred up all the fuss and furor it has, but the fact that its system of distribution to individual homes utilizes coaxial cable has opened up a multitude of other possibilities. These lie in the information-carrying capacity of the cable which is 1,000 times greater than that of a telephone line.

The first CATV cables were capable of handling up to five channels. Two-thirds of the cable in use today can handle 12 channels, and cable now being installed can carry 20 channels or more. This same cable has the capacity to lead into the long-talked-about computerized home communications center of the future. Checkless banking, shop-from-your-living-room services, automatic meter reading, burglar and fire alarm surveillance, facsimile newspapers, a library at your fingertips — all these need a two-way information carrier and the new bi-directional coaxial cable now being installed in some systems has the feedback capability to provide these services. This feedback potential also makes pay-TV a likely CATV adjunct.

On a very rough average, it costs about $100 per subscriber to build a CATV system, making it a relatively inexpensive business to enter. The CATV customer pays an installation fee of approximately $10 to $30, and a base monthly fee of $5 or $6. The average system now has 1,500 subscribers, though this figure is expected to increase. The break-even point is about 20- to 30-percent saturation.

Some 2,000 systems are in operation covering 4 million homes and about five percent of our total population. Despite a noticeable slowdown in 1967 due to the uncertain regulatory climate, the number of CATV subscribers has tripled in the past five years. The FCC term for the growth potential of the next five years is "explosive."

Franchises have been granted in another 1,900 communities, though the systems are not yet in operation, and there are about 2,000 more applications pending. The industry estimates that by the end of 1973, 30,000,000 homes, or 50 percent of all those having television, will be part of some CATV system. This figure is predicted to rise to 90 percent by 1980.

In December, the Federal Communications Commission, in a surprise move, announced proposals for new regulations on the CATV industry. These proposals, if put into effect, would in part: limit the number of systems one company could own; define the area of each of the 100-largest markets to be within 35 miles of the main post office; and do away with the need for FCC permission for the importation of distant signals into the 100-largest markets, but substitute the need for permission from the station originating the signal — in effect almost nullifying the Supreme Court copyright decision, since such permission would surely entail payment of a fee.

The effect of the FCC action is difficult to assess. Certainly its near-term effect on CATV stocks was bearish in the extreme, particularly as it coincided with the beginning of a market decline of several months' duration. It put the timing of future industry growth under a cloud of uncertainty for an indefinite period if only because it served as a reminder that the FCC's long regulatory arm is there.

Though the immediate reaction to the proposals was one of widespread gloom, and undoubtedly construction and expansion of some systems has been delayed until the picture is clearer, activity in the industry is continuing apace. Franchises are being sought for and granted. New contracts are being awarded. New subscribers are signing up. Large corporations are continuing to buy into the field and to solidify their operations through the establishment of CATV subsidiaries.

A number of firms are expected to benefit by the growth of CATV. Vikoa is the largest independent manufacturer of CATV cable and electronic equipment. About 43 percent of its sales are in cable products. Another 17 percent of revenues comes from turn-key operations involving the design and construction of CATV systems. The firm has whole or partial ownership of about a dozen systems now under construction or already operating. These systems have roughly 100,000 potential customers and are about 15- to 20-percent saturated. The company is enlarging its activity by buying and expanding existing systems.

TelePrompTer is also primarily a CATV system owner and operator with franchises in 24 communities and about 110,000 present subscribers out of a potential of 1.1 million, for a 10 percent saturation. One of these franchises, which is just now being developed, covers 400,000 homes in the northern part of Manhattan Island. There were about 12,000 subscribers at the end of the year and new subscribers are running about 50 percent of total potential as the system is developed. TelePrompTer expects to have all its present franchises developed by 1972, but plans to add enough new ones by then to double its potential market.

H & B American is the largest CATV system owner and operator by far since its recent acquisition of Continental Cablevision and Jack Kent Cooke Inc. for 1.6 million shares of common stock. It now has more than 60 operating systems with over 230,000 subscribers. The systems are widely-dispersed throughout the country and they are generally in small communities in areas where television reception is apt to be poor, due to mountainous terrain, or limited due to distance from larger cities.

Other recent correspondence:

Q) Several American Exchange Stocks, such as Greyhound Computer, Levin-Townsend, and Randolph Computer, despite accelerating earnings, have relatively low price-earnings ratios. In contrast, I note Computer Leasing and others on this exchange with P/E's of around 50. As a chagrined buyer of Randolph Computer, I'm curious as to how you explain this apparent disparity in the stocks in the leasing business. M.B.M.

A) According to the earnings of the last 12 months for each of the companies you mention, the highest current P/E multiple is 20, and that is Computer Leasing. Once avidly traded at 40 to 50 times earnings, leasers as a whole can inspire little more than an average of about 14. Your own Randolph Computer has a current P/E level of 12 and 13, therefore not out of line with others. But the reason for this drop could be explained first by the accounting methods of the companies: as financial middlemen, they buy and rent computers at prices lower than the factor, by depreciating the cost of the machines over a 10-year interval rather than the four-to-five-year write-off schedule used by the manufacturer. Investors are now questioning whether the third generation equipment will be useable eight-to-ten years from now. The fear is, thus, premature obsolescence, and has been much discussed and over-emphasized, we believe. The critical test will come in 1970-1972 when current leases run out. Second, the proposed repeal of the seven percent investment tax credit has not helped the industry's image. Leasing firms reap huge benefits from the credit. When all factors are balanced, it is evident that the psychological environment for computer leasing stocks is poor at best.

We believe that now is not the time to sell the stock, but rather to hold or even buy those that are backed by fine management, good fundamentals, and broad diversification.

Randolph seems to fit into all three categories, including the third, as Randolph announced last fall that it will be expanding into other areas such as consumer finance, commercial banks, mutual funds, insurance, and other financial services.

Q) There have been optimistic predictions concerning the future of time sharing. Do you believe that companies engaged in commercial time sharing offer favorable investment opportunities and, if so, what particular companies would you recommend? M.D.M.

A) "Optimistic" is much too mild. It is presently one of the hottest brews in today's computer market. There are presently over 100 companies in this trade and their ranks are being swelled by dozens of new entries each month. But in the foreseeable future there could be a weeding and regrouping of time-share firms, primarily among the smaller and intensely competitive companies. General Electric is the foremost factor in the market with about 25 percent to 30 percent of the business in dollar volume. There are also many smaller companies in this field, however, most have deficits, and we are hesitant to make specific recommendations at this time.

COMPUTER STOCK TRENDS

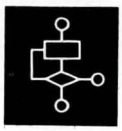
	COMPANY	EXCH.	VOL. (SHARES IN 100's)	1969 HIGH	1969 LOW	PRICE 7-3-69	NET CHG. FROM MONTH AGO	EARN./SHR. (LATEST 12 MONTHS)	P/E RATIO
COMPUTERS	BECKMAN	NY	851	58.6	44.4	47.6	– 6.0	0.93	50
	BURROUGHS	NY	3661	141.3	120.6	141.2	16.6	2.74	51
	CONTROL DATA	NY	6370	159.2	125.1	152.7	6.1	3.43	44
	DIGITAL EQUIPMENT	AM	1753	72.0	61.0	70.0	5.0	2.82	24
	ELEC. ASSOCIATES	NY	802	25.2	16.7	19.0	– 0.4	0.29	65
	GENERAL ELECTRIC	NY	5830	98.2	85.1	90.0	– 2.4	4.02	22
	HEWLETT-PACKARD	NY	3925	95.0	75.2	87.0	– 1.4	1.87	46
	HONEYWELL	NY	2835	140.6	107.6	135.6	1.2	3.60	37
	IBM	NY	5374	254.4	291.6	354.4	36.4	7.71	45
	LITTON INDUSTRIES	NY	5376	74.4	45.4	47.3	– 4.3	2.30	20
	NCR	NY	2730	139.3	108.0	131.4	4.4	3.74	35
	RCA	NY	7098	48.1	40.3	41.2	– 2.1	2.40	17
	RAYTHEON	NY	4221	50.2	30.5	35.1	– 3.4	2.18	16
	SCIENTIFIC CONTROL	OTC	--------	43.4	24.4	32.0	3.0	-------	----
	SPERRY RAND	NY	11816	55.4	44.2	54.5	4.5	2.26	23
	SYSTEMS ENGRG. LABS.	AM	1682	36.0	26.1	34.3	0.3	0.59	57
	SYSTRON DONNER	AM	423	26.2	18.6	21.0	– 3.0	0.98	21
	VARIAN ASSOCIATES	NY	2487	34.2	24.7	28.3	– 2.5	0.51	54
	*VIATRON	OTC	--------	30.4	19.0	22.2	-------	-------	----
	WANG LABS.	AM	363	70.0	45.7	60.3	– 1.5	1.21	49
	WYLE LABS.	AM	1062	20.2	10.5	11.6	– 1.3	0.69	15
PERIPHERALS & COMPONENTS	AMP	NY	1197	54.3	32.5	48.4	3.2	1.46	32
	AMPEX	NY	4521	44.6	32.4	44.0	2.0	1.35	32
	APPLIED MAGNETICS	OTC	--------	39.0	23.0	23.0	– 4.0	0.60	38
	ASTRODATA INC.	AM	1988	29.7	19.3	20.7	– 4.6	0.08	----
	BUNKER RAMO	NY	3324	17.5	10.4	12.6	-------	0.33	36
	CALCOMP	AM	718	37.4	25.2	28.4	– 3.1	0.53	52
	CHALCO ENGRG.	OTC	--------	8.4	6.0	6.0	-------	0.09	66
	*CODEX	OTC	--------	28.0	21.0	24.0	– 4.0	0.14	----
	COGNITRONICS	OTC	--------	38.2	23.0	24.0	– 7.0	(d)0.05	----
	COLLINS RADIO	NY	1336	69.6	44.0	46.2	– 5.6	3.52	13
	COMPUTEST	AM	253	23.4	16.4	18.5	– 1.3	0.46	39
	COMPUTER INDUSTRIES	OTC	--------	52.0	13.0	17.0	1.0	0.27	62
	CONRAC	NY	341	59.3	43.3	47.0	– 0.4	1.29	36
	DATA PRODUCTS	AM	2793	27.7	13.4	17.2	1.1	0.35	48
	DATASCAN	OTC	--------	32.0	20.0	22.0	– 9.0	-------	----
	DIGITRONICS	OTC	--------	22.4	13.0	15.0	1.0	0.26	57
	ELEC. ENGRG. OF CAL.	AM	127	28.3	14.5	14.5	– 2.7	0.58	24
	ELECTRONIC MEMORIES	OTC	--------	62.0	46.0	54.0	2.0	1.46	36
	EPSCO	OTC	--------	20.4	11.0	12.0	– 2.0	0.20	60
	EXCELLO	NY	640	37.3	27.1	28.4	– 0.7	2.61	10
	FABRI-TEK	OTC	--------	12.7	8.0	9.0	– 1.0	0.12	75
	FARRINGTON MFG.	OTC	--------	37.4	19.0	23.0	– 4.0	0.08	287
	GENERAL INSTRUMENT	NY	4459	43.2	26.0	34.7	0.1	1.10	30
	GERBER SCIENTIFIC	AM	174	32.1	21.6	25.5	– 2.6	0.77	32
	INDIANA GENERAL	NY	1130	57.4	40.0	57.4	3.7	1.84	30
	INFORMATION DISPLAYS	OTC	--------	21.4	12.0	12.0	– 3.0	0.13	92
	LOGIC	OTC	--------	23.0	10.0	11.0	– 1.0	-------	----
	MILGO ELECTRONICS	AM	739	34.4	20.2	25.7	– 2.1	(d)0.96	----
	MOHAWK DATA SCIENCES	AM	3841	86.6	59.6	86.5	9.4	1.13	76
	NORTH ATLANTIC IND.	OTC	--------	22.0	13.0	15.0	– 2.0	0.70	21
	OPTICAL SCANNING	OTC	--------	118.0	54.0	67.0	12.0	0.68	98
	POTTER INSTRUMENTS	AM	861	35.6	26.0	28.3	– 3.1	0.57	49
	RECOGNITION EQUIP.	OTC	--------	76.0	54.0	67.0	5.0	(d)0.57	----
	REDCOR	OTC	--------	33.4	23.4	30.0	-------	0.10	----
	RIXON ELECTRONICS	AM	319	22.6	18.2	20.5	– 0.5	0.48	41
	SANDERS ASSOCIATES	NY	2850	61.7	28.0	31.2	– 4.7	0.43	72
	SCAN-DATA	OTC	--------	85.0	37.0	42.0	–13.0	0.89	47
	SEALECTRO	AM	150	15.6	8.2	9.2	– 1.0	0.14	64
	TALLY	OTC	--------	36.0	18.0	18.0	– 5.0	(d)1.58	----
	TELEX	AM	--------	37.5	20.6	36.0	1.2	0.96	37
	TEXAS INSTRUMENTS	NY	3077	127.6	94.6	124.0	0.6	2.53	49
	VARIFAB	OTC	--------	13.0	9.0	13.0	-------	-------	----
	XEROX	NY	14445	100.4	85.0	99.6	10.6	1.83	54

(d) Deficit

** New listing in this issue*

All security prices and net change are expressed in dollars and eighths of dollars (e.g. 62.2 is 62¼). Trading volume is not given for over-the-counter stocks. ALL DATA COMPUTED BY SCANTLIN ELECTRONICS, EXCLUSIVELY FOR MODERN DATA.

	COMPANY	EXCH.	VOL. (SHARES IN 100's)	1969 HIGH	1969 LOW	PRICE 7-3-69	NET CHG. FROM MONTH AGO	EARN./SHR. (LATEST 12 MONTHS)	P/E RATIO
SOFTWARE & SERVICES	APPLIED DATA RESEARCH	OTC	--------	40.0	29.0	32.0	– 8.0	0.67	47
	ARIES	OTC	--------	19.0	7.0	8.0	– 1.0	(d)0.87	----
	AUTOMATIC DATA PROC.	AM	564	83.2	63.2	78.0	– 1.5	1.29	60
	BOLT, BERANEK & NEWMAN	OTC	--------	19.0	12.0	12.0	– 2.0	0.27	44
	BOOTHE COMPUTER	OTC	--------	45.4	25.0	28.0	– 7.0	1.24	22
	BRANDON APPLIED SYS.	OTC	--------	17.0	10.0	11.0	– 1.0	-------	----
	COMPUTER APPLICATIONS	AM	341	21.7	13.3	14.3	– 0.5	0.22	63
	COMPUTER ENVIRONMENTS	OTC	--------	16.0	7.4	8.6	– 1.4	-------	----
	COMPUTER EXCHANGE	OTC	--------	18.0	7.0	7.0	– 5.0	0.04	175
	COMPUTER INVESTORS	AM	100	25.0	12.4	12.5	– 1.6	0.30	40
	COMPUTER LEASING	AM	2459	34.7	13.4	14.6	– 0.4	0.65	21
	COMPUTER SCIENCES	NY	8163	30.0	24.4	30.0	2.6	0.50	60
	COMPUTER USAGE	OTC	--------	40.0	16.0	17.0	– 6.0	(d)1.35	----
	COMPUTING & SOFTWARE	AM	557	56.3	37.0	47.4	– 0.6	0.87	54
	*COM-SHARE	OTC	--------	23.0	14.0	18.0	– 1.4	-------	----
	CONTINENTAL COMPUTER	OTC	--------	14.6	8.6	13.0	-------	0.25	52
	CYBER-TRONICS	OTC	--------	13.0	7.4	8.0	– 1.4	0.19	42
	CYBERMATICS	OTC	--------	15.0	7.0	7.0	– 3.0	-------	----
	DATA PROC. FIN. & GEN.	AM	1750	60.2	31.5	37.4	1.0	1.56	23
	DATRONIC RENTAL	OTC	--------	16.0	7.0	7.0	– 1.0	0.29	24
	DEARBORN COMPUTER	AM	3090	52.6	36.2	42.7	2.3	5.04	8
	DECISION SYSTEMS	OTC	--------	8.6	4.0	5.0	– 2.4	(d)0.34	----
	DIGITAL APPLICATIONS	OTC	--------	15.0	4.0	4.0	– 2.0	-------	----
	DIGITEK	OTC	--------	15.0	6.0	6.0	– 1.0	-------	----
	DPA, INC.	OTC	--------	16.2	10.0	11.5	-------	0.60	18
	EFFICIENT LEASING	OTC	--------	15.4	5.0	6.3	– 0.7	0.18	33
	ELEC. COMP. PROG. INST.	AM	436	38.2	20.5	23.5	– 3.2	0.38	60
	ELEC. DATA SYSTEMS	OTC	--------	84.0	34.0	84.0	8.0	0.23	----
	GREYHOUND COMPUTER	AM	498	28.5	14.6	18.4	1.1	1.29	13
	GRAPHIC SCIENCES	OTC	--------	111.0	45.0	66.0	7.0	0.03	200
	INFORMATICS	OTC	--------	30.6	20.6	29.0	-------	0.45	64
	LEASCO	AM	6745	54.0	28.2	34.4	0.4	2.30	14
	LEVIN-TOWNSEND	AM	2668	57.4	27.0	32.6	– 2.3	3.71	8
	LMC DATA	OTC	--------	8.2	4.0	4.0	– 2.0	(d)0.03	----
	MGMT. ASSISTANCE	OTC	--------	14.7	5.0	6.4	– 0.4	(d)0.35	----
	NATIONAL COMP. ANAL.	OTC	--------	22.0	9.0	10.0	1.0	0.08	125
	PLANNING RESEARCH	AM	1506	33.5	23.7	30.0	– 0.2	0.48	62
	PROGRAMMING METHODS	OTC	--------	20.0	13.4	20.0	– 1.0	0.36	55
	PROGRAMMING SCIENCES	OTC	--------	32.0	15.0	18.0	– 1.0	-------	----
	PROGRAMMING & SYSTEMS	OTC	--------	11.4	7.0	8.0	1.0	0.11	72
	RANDOLPH COMPUTER	AM	1070	43.7	22.2	26.2	-------	1.91	13
	SCIENTIFIC COMPUTER	OTC	--------	8.4	4.0	4.4	– 0.4	0.14	28
	SCIENTIFIC RESOURCES	NY	5179	26.4	14.0	18.0	– 2.6	(d)1.42	----
	STRATEGIC SYSTEMS	OTC	--------	37.0	7.0	7.0	– 5.0	-------	----
	SYSTEMS CAPITAL	OTC	--------	34.0	9.0	9.0	– 6.0	0.18	50
	*TIME SHARE	OTC	--------	13.4	8.4	9.4	– 1.2	-------	----
	*UNITED DATA CENTERS	OTC	--------	12.4	5.4	6.4	– 2.0	0.09	71
	URS SYSTEMS	OTC	--------	31.0	26.0	26.0	– 3.0	0.54	48
	UNIVERSITY COMPUTING	OTC	--------	155.0	29.1	75.2	– 1.6	1.55	48
SUPPLIES & ACCESSORIES	ACME VISIBLE RECORDS	OTC	--------	47.0	32.4	36.3	– 2.5	1.78	20
	ADAMS MILLIS	NY	561	22.3	12.7	16.2	– 0.4	0.87	18
	BALTIMORE BUS. FORMS	OTC	--------	27.4	23.4	25.0	– 1.0	0.80	31
	BARRY WRIGHT	AM	552	29.2	18.0	21.3	– 0.4	0.86	24
	CAPITOL INDUSTRIES	AM	935	52.4	29.0	46.1	– 3.1	0.61	75
	DATA DOCUMENTS	OTC	--------	44.4	31.0	31.0	– 4.0	1.67	18
	DENNISON MFG.	NY	1087	54.7	37.6	42.6	– 3.6	2.31	18
	DUPONT	NY	3188	165.4	130.1	135.1	– 3.2	7.82	17
	ENNIS BUS. FORMS	NY	89	42.2	35.0	35.0	– 3.6	1.68	20
	GENERAL BINDING	OTC	--------	43.0	31.4	34.0	– 5.0	0.65	52
	GRAPHIC CONTROLS	OTC	--------	28.6	17.0	19.0	– 2.0	1.04	18
	LEWIS BUS. FORMS	OTC	--------	23.0	18.0	18.0	– 1.0	0.66	27
	MEMOREX CORP.	NY	3295	89.6	65.0	86.0	3.3	1.51	56
	3 M	NY	2058	112.2	94.0	104.7	– 0.2	3.05	34
	MOORE CORP. LTD.	TSE	1114	37.0	29.6	32.7	– 1.1	-------	----
	REYNOLDS & REYNOLDS	OTC	--------	48.4	35.0	36.0	– 1.0	1.17	30
	SAFEGUARD INDUSTRIES	AM	523	25.4	11.7	12.6	– 3.1	0.45	26
	STANDARD REGISTER	OTC	--------	31.0	23.4	28.0	– 1.0	1.30	21
	UARCO	NY	291	36.2	28.0	34.6	1.0	2.07	16
	WALLACE BUS. FORMS	OTC	--------	34.4	29.0	32.0	-------	2.07	15
AVERAGES	COMPUTER STOCKS			47.2	31.0	36.6	– 8.9%	1.08	33.9
	DOW JONES INDUSTRIALS			968.85	869.76	886.12	– 4.2%	3.80	14.9



COMMUNICATIONS CLINIC

"HELLO CENTRAL, GIVE ME 50 KILOBITS"

COMMUNICATIONS CLINIC is a regular monthly column written by the staff of **Berglund Associates, Inc.** Questions from readers on any aspect of communications and its integration with computers will be answered, as space permits. Address questions to: **Ralph Berglund, Data Communications Editor, 1060 North Kings Highway, Cherry Hill, N. J. 08034.**

In April of 1968, AT&T introduced a new and truly unique service called Data-Phone 50. The new service, tariffed for a three-year trial, provides a dial-up, toll transmission service at 50,000 bits per second, or facsimile at more than one page per minute, within and between New York, Chicago, Washington, D.C., and Los Angeles. The unique aspect is, of course, that it is a switched, toll, wideband service. Western Union announced such a concept some five or six years ago, stating that their Broadband Exchange Service was designed to operate at up to 48 kc. They have not yet, however, tariffed anything beyond 2400 bps. Therefore, the AT&T service is the first of its kind. As a trial tariff, it reminds us of the situation that produced the famous "Yes Virginia, there is a Santa Claus" editorial in *The Baltimore Sun* years ago. AT&T seems to be hoping that users will say "Yes Mother, there is a need for bulk data transmission." Indeed, there was some question, as it was almost a year before any outside user went into service under the new offering. As of mid-July there were three customers. Service Bureau Corporation has a station in each of the four service cities, and is using the service for load sharing and as backup for their leased wideband service. Xerox Corporation is using the service between New York and Washington, primarily, one presumes, for long distance xerography. Finally, the Associated Press is using the service to transmit closing stock prices to the *Los Angeles Times*. We are also told that other customers are considering using the service beginning this fall, and that AT&T is contemplating adding a fifth service city, not yet specified.

Since we view this as a very useful and very competitive service, we are puzzled as to why customer response has not been greater. Prior to Data-Phone 50, a user's only hope for bulk data transmission was the private line, high capacity services such as series 5000 (to four 230.4 kbps channels) or series 8000 (to 50 kbps). As full period services these were very costly. A New York to Chicago 8000 service, for example, costs about $8600 per month in mileage charges. A user had to have a significant communication need to justify this cost. With Data-Phone 50, however, a New York to Chicago call can be made for $2.25 per minute so that the justification problem is substantially reduced.

As presently tariffed, the service is only available within and between the four cities mentioned. If a user is outside of each city's Data-Phone 50 exchange area (base rate area), he can access the service by a foreign exchange service. This would be a private line 8000 service, or part of a 5000 service, (or intrastate equivalents) between his facility and the Data-Phone 50 exchange, for which he would pay on a full-period basis. If the user is across a state line from the base rate area he can access it via a foreign exchange service under the interstate tariff. If he is within the same state as the base rate area, he must access it under the intrastate tariff of that state. These exist in New York and California, and AT&T is ready to file in Illinois as soon as any customer requires.

As we said, D-P 50 appears to be economically very interesting. The cost factors are $275 per terminal per month ($300 per month for alternate digital/facsimile service), $125 one-time installation charge per terminal, $0.20 per minute for intracity transmission, and per minute charges for intercity service as follows:

From/To	New York	Chicago	Washington	Los Angeles
New York	-	$2.25	$1.25	$3.25
Chicago	$2.25	-	1.75	2.75
Washington	1.25	1.75	-	3.25
Los Angeles	3.25	2.75	3.25	-

Rates are for one minute minimums and any additional minutes; fractional minutes are charges as whole minutes.

The service is very attractive for a number of applications, such as load sharing between CPU's; transmitting data to a remote back-up CPU in the event of a local CPU failure; time sharing between a small CPU and a large central system; and data collection. Nevertheless, as with any communication service, it merits comparative price-performance analysis. For example, it should be compared with conventional voice grade Data-Phone service. For New York to Chicago, third shift (after midnight) toll rate is about $.15 per minute. Let us compare such a service at 2000 bps, with D-P 50 to find a break point.

Conventional Data-Phone $/Month for n bits transmitted:

$$(2 \times \$80)^* + n \frac{\text{bits}}{\text{month}} \quad \frac{0.15 \frac{\$}{\text{min}}}{60 \frac{\text{secs}}{\text{min}} \times 2000 \frac{\text{bits}}{\text{sec}}} =$$

Data-Phone 50 $/Month for n bits transmitted:

$$(2 \times \$275)^* + n \frac{\text{bits}}{\text{month}} \quad \frac{2.25 \frac{\$}{\text{min}}}{60 \frac{\text{secs}}{\text{min}} \times 50{,}000 \frac{\text{bits}}{\text{sec}}}$$

$$160 + 1.25\, n \times 10^{-6} = 550 + 0.75\, n \times 10^{-6}$$

$$n = 780 \times 10^6 \frac{\text{bits}}{\text{month}}$$

or, for eight bit characters and 21.6 working days per month, $n = 4.51 \frac{\text{million characters}}{\text{day}}$

*Terminal costs: for conventional Data-Phone, two 201A data sets and telephone lines; for D-P 50, two service terminals.

That is, if the daily volume is greater than 4.51 million characters, Data-Phone 50 is less expensive. Said another way, this is the average daily volume required to justify D-P 50. Since this represents a typical (??) reel of magnetic tape (particularly with throughput degradation due to error checking and control), *one doesn't require much daily volume to justify D-P 50.* If transmission is during prime shift, the toll rates, being better than twice as much would make the breakeven volume even lower.

This column would very much like to hear from any user or prospective user of D-P 50, with an eye towards a guest column dealing with the user's analysis, design, and use of the service.

CORPORATE PROFILE

Featured this month:

TRANSISTOR ELECTRONICS CORP. (over-the-counter)

6700 South Washington Avenue
Eden Prairie (Minneapolis), Minnesota 55343

DIRECTORS: Don V. Hamilton, Chairman of the Board of Directors of Transistor Electronics Corp. (TEC); A. Robert Masters, Pres. of TEC; Kenneth M. Anderson, Sec. of TEC and lawyer with firm of Cant, Haverstock, Gray, Plant and Mooty; Clarence K. Bros, Pres. of Clarence K. Bros, Inc., building construction and rental properties; Cyril L. Fernquist, Vice Pres. of Engineering for TEC; Edward B. Grayden, Vice Pres. and Gen. Mgr. of Grayden and Flemmer, Mfr.'s reps.; S. Jay Marsh, Pres. of Woodard-Elwood & Co., broker-dealer in investment securities.

BACKGROUND: In anticipation of the tube-to-solid-state technological change in the computer industry, TEC was founded in 1958 to produce transistorized indicators that would operate on the low voltages of the new computer circuitry. The growth of the company since that time has been directly related to the fast-paced technological changes involved in man/machine communications not only for computers, but for automated process control, medical research, transportation, security and many other similar systems. Today, TEC is a complete design and production facility for total information display/control systems. Heavy emphasis is placed on research and development with over 10% of gross revenues being allocated to that activity in fiscal 1968 and 1969. TEC sees itself on the threshold of a whole new era in its corporate life and further contends that this position is strengthened by the addition of key management personnel in its marketing, engineering, and general management operations.

FACILITIES: TEC has a modern 52,800 sq. ft. plant located near Minneapolis, Minn., and an R&D laboratory in Tucson, Arizona. Current employees total over 300. The company's component products are sold through a network of manufacturers' representatives; however, a fully-trained sales staff is being organized to provide special sales and field engineering support for a new line of CRT terminal systems. The first of a number of regional offices was opened in June, 1969, in the metropolitan New York area.

PRODUCTS/SERVICES: TEC offers complete design, production capabilities, and services for information display/control applications. All devices are pre-packaged and range from modular components to consoles to total systems . . . in volume or as one-time orders. The TEC product line breaks down into five major areas:

★ **Indicators and Switches:** *TEC's indicators and switches provide a steadily growing sales base. Principal devices are low-voltage neon, transistor controlled incandescent and replaceable lamp indicators as well as subminiature display lights. All are produced as standard packages which include all necessary circuitry and wiring. Customizing to individual specifications is enhanced through standardized methodology.*

★ **Readouts:** *Alphanumeric readouts are designed and built by TEC incorporating segmented,* NIXIE, *projection and electroluminescent displays and associated decoder/drivers, memory and counters.*

★ **Electronics Keyboards:** *Keyboards involve custom design, but utilize standard TEC keyboard switches and components. Low-cost and solid state versions are now being developed.*

★ DATA•PANEL **Display Systems and** DATA-LINE **Display Switches:** *These display packages are integrated assemblies of components, circuitry, and wiring which are delivered ready for installation. They are available in any size. Or, they can be a total display system such as the 88-ft. DATA•PANEL Display System produced by TEC for the control room of the San Francisco Bay Area Rapid Transit System (BART).*

★ **Computer Peripheral Systems:** *This third generation family of DATA-SCREEN Terminal Systems are designed to interface with all of today's leading computers. Series 500 CRT Terminals are offered in several configurations including a variety of "stand-alone" interfaces. TEC's avowed goal is to have the broadest line of CRT Terminals in the industry. Perhaps the most notable achievement in this area this year was the introduction of a new Model 520 Programmable Communications Processor designed to provide multi-station operation for as many as 32 CRT's, line printers, card handlers, and teletypewriter terminals.*

CURRENT POSITION: Fiscal 1969 was a good growth year for TEC. Sales reached a record $5,011,506, a 13% increase over the previous year. Since the advent of a new management team in the Summer of 1967, sales have increased by 36%. Despite heavy investment in engineering and organizational phases of operations, net earnings increased 7% to $359,212. Earnings per common share, reflecting a 100% stock dividend distribution in January, 1969, rose from $0.50 to $0.53.

FINANCIAL SUMMARY: As of April 30, 1969, the company had 5,000,000 shares of common stock authorized, and 675,908 shares issued. The following statement of revenues and earnings shows the company's operating results for the five years ended April 30, 1969:

YEAR ENDED APRIL 30

Year	Revenues	Net Income	Net Income Per Share *
1969	$5,011,506	$359,212	$0.53
1968	4,429,545	335,854	0.50
1967	3,671,677	289,742	0.44
1966	3,517,077	332,438	0.50
1965	2,857,777	138,801	0.21

*Based on average number of common shares outstanding during year.

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Drop us a line and we'll send you descriptive literature and complete specs. Motorola Instrumentation and Control Inc., P.O. Box 5409, Phoenix, Arizona 85010.

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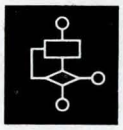

ON-LINE

INTERACTIVE GRAPHICS

THURBER J. MOFFETT, Mgr., Interactive Graphic Systems ■ TRW Systems Group, Redondo Beach, Cal.

EDITOR'S NOTE: This commentary introduces a new monthly column that will discuss various developments in computer technology with particular emphasis on computer graphics and computer-aided design. The author, Thurber J. Moffett, is a nationally-recognized expert in interactive graphic systems. He organized the first joint aerospace/computer industry effort to evaluate interactive graphics in a design environment, served as a consultant to Control Data and IBM during their development of interactive graphic systems, directed Lockheed's computer graphic effort, directed the University of Wisconsin's Annual Automated Design Symposium for the past four years, and he regularly lectures on various aspects of interactive graphics at several universities. Mr. Moffett has also served as an advisor to the U.S. Government on a number of computer-aided design activities.

Someone at the Spring Joint Computer Conference said that it's more important for girls to be pretty than bright because we see so much better than we think. Most girls figured that out long ago, but seeing better than we think also explains why we like movies and television better than homework. Our eyes assimilate information so much more rapidly and painlessly than our other senses. This also suggests how *interactive* may differ from *non-interactive* graphic computing. Since ON-LINE expects to devote some attention to interactive graphics, it's best we try to get this difference straight from the start.

In an evolving innovative activity, terminology tends to be imprecise at first because it's not necessarily the most important thing about getting started. After a while, when work is under way, lack of preciseness won't do, particularly if the work is being done in different places by different people. Too many misunderstandings occur. Such is now the case with computer graphics. We don't know or, at least, yet agree on the difference between interactive and non-interactive graphics. Yet, this is important if we're going to get serious and talk about the economic trade-offs between interactive and non-interactive graphic systems or try to define where the computer graphics market is.

A panelist at the recent Keydata Symposium on Computer Graphics suggested that we should arbitrarily set a standard response time, say 100 milliseconds, or 250 milliseconds, or even a second. Then, in any conversational system, if the response times either way were generally less than this standard, the system was interactive; if generally greater, the system was non-interactive. This purely quantitative distinction, I believe, misses the mark even if it does provide a precise definition and a quite straightforward way of deciding which is which. I object because it doesn't recognize why a man and a machine should interact in the first place.

Our ability to see better than we think would appear to be a better basis. We *see* continuously. We don't *think* continuously, at least not in the creative or intuitive sense. We do that in spurts. This is really what's important. It's why we want to be graphically interactive. Our communication will thereby be more continuous and harmonious. Putting our communications with a computer on this better basis, we suspect, may significantly increase the degree to which our thinking can also be made more continuous and harmonious. It is thus the promise of increasing man's ability to think, and to create, that underlies his desire to become part of a man-computer symbiotic relationship. In short, he wants to become interactive with a computer to increase his intellectual output.

It should follow that the continuity of our thinking process, when we're using a graphic console, should be the measure of how interactive we are. From this, then, it would seem that we remain interactive so long as our thinking process remains essentially uninterrupted regardless of how long the respective response times between us and the computer may be. These periods may be only a few milliseconds for a simple task or they may easily be several seconds or even several minutes for a difficult task. The criteria for interactivity should nevertheless be solely: *does the train of man's thought remain intact throughout the conversation?*

I readily admit that a subjective judgement of what represents uninterrupted thinking now intercedes and that an exercise is implied to define just what that is precisely. I don't think we should try too hard to do that and, in any case, it's probably too difficult to do. In the end, it will be the relative improvement in man's creative processes that will matter and, this, in itself, does not depend on too precise a definition of uninterrupted thinking.

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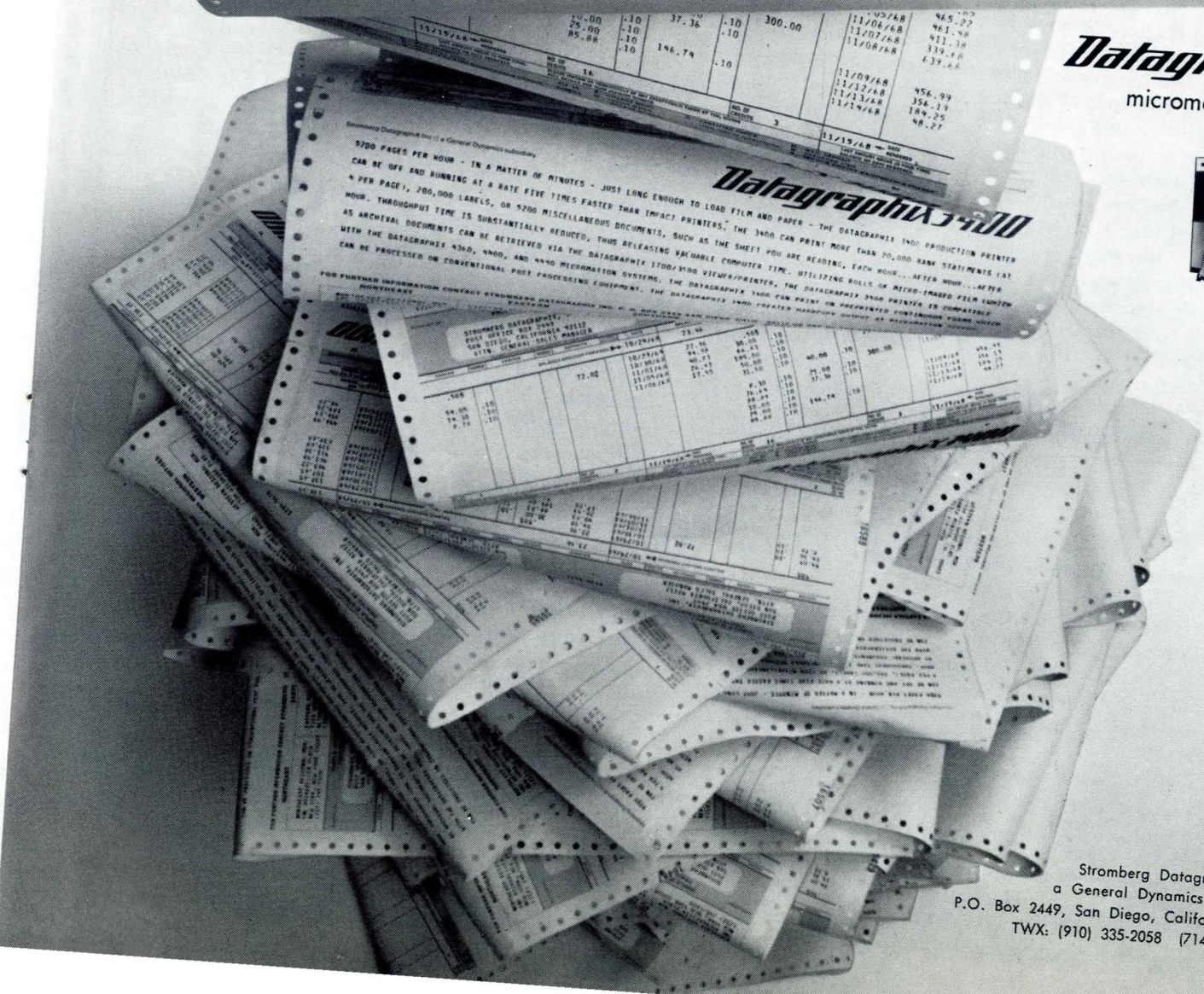

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THE SYSTEMS SCENE

ECONOMICS OF TIME SHARING

EDITOR'S NOTE: The Systems Scene is a new monthly feature written exclusively for MODERN DATA by Jerry Wiener and Tom DeMarco of Mandate Systems, Inc. Mr. Wiener is the President of Mandate. While Manager of Advanced Development at General Electric, he initiated the GE/Dartmouth BASIC project and managed it for GE from its inception through operation and early customer usage. He has since been active in the field of time-sharing both in hardware and software. Mr. Wiener has been granted more than twenty patents for logic and memory devices. He has participated in the design of commercial and special-purpose time-sharing systems realized on IBM, SDS, GE, DEC, and UNIVAC machines among others.

Mr. DeMarco has been active in the field of high-reliability realtime systems starting with the ESS No. 1 system at Bell Telephone Laboratories. He managed the DDT/360 project for time-shared assembly level debugging. He also managed a design project for the French government and has done extensive consulting in Europe.

Focus of the column will be on new developments in systems. Reader comments and questions are invited.

Most of us are familiar with the economics of time-sharing from the user's standpoint. $10 or $15 per hour gives you the right to stare at your on-line terminal. An extra $2 or $3 per CPU minute even allows you to use it for problem-solving applications. When you have finished your task, the system tells you how much you owe. You will probably find the price fairly reasonable for what you have accomplished. Then the phone bill comes!

As communications costs come to represent a major portion of the bill, and more large time-sharing users consider setting up their own in-house systems, the first question that gets asked is, "*How do the economics look from the operator side?*" Most of the first in-house time-sharing systems were run like commercial time-sharing service bureaus. As the market place reacts to the in-house concept, this will change, but for the moment it still seems to be the case. Let's look at the books of a typical commercial house:

No. of Subscribers	120
No. of Lines	40
Avg. No. of Users On-Line	20-24
Charge/Line	$15/hr.
CPU Usage Charge	$2.50/min.
Customer File Charge	$0.20/Kilobit/mo.
Avg. Billable Hrs.	220/mo.
Min. Charge	$100/mo.

Gross monthly revenue on such a system should come to about $75,000, broken down as: **Connect Time Charges** — $66,000; **CPU Charges** — $8,000; and **File Charges** — $1,000. All of the above is predicated on a normal running day of 10 hours with second-shift time available to a development group and third-shift open. If the machine is a general-purpose processor and not too proud to run batch work on third-shift (and if the market for batch time is not as sad as the present New York situation), another $5,000 per month of revenues might be realized. Basic monthly operating costs (in thousands of dollars) might be:

System Rental	**$25**	**Sales & Commissions**	**$20**
Operations	**$ 5**	**Space & Utilities**	**$ 5**
Administration	**$ 5**	**Development**	**$ 5**
		TOTAL	**$65**

These figures do not represent any particular operation but, rather, an averaged summary of several GE, SDS, and IBM systems over the past few years.

Our example indicates a certain measure of profitability, though not a very exciting one in light of the start-up costs, development costs, and the risks involved. Tolerances on the revenues, moreover, are much larger than the resultant margin. Consequently, a detailed survey of present-day time-sharing installations would show a variation over the whole range from profit to complete disaster.

Obviously, stretching the number of enrolled subscribers for a given number of lines can make the operation more profitable. This is possible when subscribers don't have a real need for the system, but only a political motivation. The latter group pays a minimum monthly forfeit for the privilege of telling their friends

that they have an on-line terminal by the desk. (The high incidence of time-sharing library programs that identify leaves, tell fortunes, play blackjack, keno, or n-dimensional tic-tac-toe indicates that a concerted push has been made toward the prestige-conscious user.)

Three subscribers per line turns out to be a good ratio for work-oriented systems. The telephone company uses a factor of 2.5 for their subscriber-to-available-equipment ratio. That was also the design level for the original GE system. Some existing operations use a ratio as high as 5 and their profit ratio is correspondingly attractive. (Their lines tend to get jammed, however, when too many people play their on-line games at once.)

The average number of users on-line at a particular time is another obvious determinant of profitability. In our now sophisticated user community, response time must be good. Systems tend to stabilize at, or below, a customer load that gives response time of about 2.5 seconds since longer response times will make people sign off in droves.

The reason for expensive on-going development is that users demand a good deal of software support and are getting it from the competition-wary time-sharing companies. The day of the "you can have whatever **we** get for free" approach, with respect to compilers and common libraries, has come to an end. The old incremental Berkeley BASIC (available free from SDS) is fast being replaced among the 940 houses. One time-sharing service has reaped handsome dividends by developing an efficient compile-and-go SUPER BASIC.

A good deal of the development effort goes into system tuning to increase capacity and, hopefully, attract and serve more users. This also seems to have paid off. Among the companies using the SDS 940 (they lend themselves nicely to comparison since there are a lot of them and they have taken a number of different approaches), the difference in system efficiency between the best and the worst of them is almost 2:1. Obviously, this has had a marked effect on revenue.

Many companies would like to offer a larger number of language processors on-line in order to attract sales, unfortunately, however, performance (i.e., response time) is noticeably degraded when the number of compilers exceeds three and, at this time, no one is willing to sacrifice that. Of course, it costs nothing to have available compilers (such as SNOBOL) that no one uses. Conversely, systems like TSS that have tried to be all things to all men have ended up performing like TSS.

In-house time-sharing economics are somewhat different; there is no cost of sales, for instance. But a present-day 32-user in-house system would probably end up costing about $50,000 per month to run, and not many facilities could support it. Next month, we will discuss a four-to-sixteen-user system we believe could be made inexpensively and marketed widely.

WHAT HATH BABBAGE WROUGHT DEPT.

ONE of our readers reports that a friend of his was harassed by repeated dunning letters (computer-generated, of course!) requesting payment of a bill for $00.00. His requests to the company to cease issuing the "bills" were never acknowledged, and the requests for payment increased both in frequency and nastiness (*"your bill now includes late payment fees of 12% for a total of $00.00. Continued delay in payment will force us to engage the services of a professional collector, at which time we will also be required to cancel your charge privileges with this company and notify your regional credit authorization bureau," etc. etc.*). Finally, in a flash of enlightenment, the friend sent in his personal check for $00.00. We had hopes that his tale would end here, but no such luck. A week after sending in his check, our reader reports his friend received the following computer-generated letter:

Dear Mr. .....

Our records show an overpayment to your account (recently closed) in the amount of $00.00. Our check is enclosed.

Thank you
Customer Accounts

As if to add salt to his wounds, the check was marked **"Not Valid After 30 Days."**

MODERN DATA will pay $10.00 for any computer- or EDP-related item worthy of publishing in our "WHAT HATH BABBAGE WROUGHT DEPT." Humorous "information" for consideration may include weird memos or operating instructions, unusually solecistic (look it up!) documentation, and offbeat items of a general nature (for review by our offbeat editors). Send all submissions to: **WHBW Dept.**
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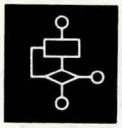


SOFTWARE FORUM

SEPARATE PRICING

SOFTWARE FORUM is a regular monthly column written by the staff of **Cullinane Corporation** exclusively for MODERN DATA. Questions from readers on any aspect of software will be answered, as space permits, in this column. Address all questions to: **Software Forum, MODERN DATA, 3 Lockland Avenue, Framingham, Mass. 01701**

Now that IBM has announced its separate pricing policy, let's examine it from the standpoint of a software house and see if we can predict some of the effects it will have on the software market. The following are some of the highlights of the recent announcement.

1. "System control programs" (operating system programs), as all programs currently in IBM's program library, will continue to be offered without charge.

2. Most future "program products" (application programs, conversion aids, sort programs, and language processors) will no longer be offered free of charge.

3. Programs will be licensed, not sold, and will require separate licenses for separate CPUs — even for identical CPUs within the same company.

4. Charges will be made for the modification or maintenance of existing program products.

5. IBM will move into contract programming.

As we understand it, considerable pressure for separate pricing was exerted against IBM by large commercial users and government procurement agencies who wanted to save money by not having to buy, albeit indirectly, separate operating systems for each of several computers. They must certainly be disappointed. (They may not give up, either.)

There are rumors that operating system alternatives and some future operating systems may eventually be separately priced, but we feel that IBM will avoid this at all costs, for reasons later discussed. However, the pricing of future compiler and general utility programs will certainly be a boon to firms with packages in this area, since it will encourage users to search for the most efficient programs of this type. Because only **future** applications programs will be separately priced, the effects (and relief) on the market will not be immediate but, over the years, we expect that new and better programs will gradually replace those in the public domain.

The setting of prices at competitive levels is extremely important to the continued growth of the program package industry. If IBM continues to express its willingness to compete in this area, it could help to open a new era by improving the acceptance, techniques, and market for program packages; it could develop the proprietary program market in the 70's just as it developed the hardware market in the 50's and 60's. Conversely, the software market **could** degenerate into the situation we have today in hardware, where higher management people tend to consider IBM as the only "safe buy," and so perpetuate IBM's dominance of the market. However, managers, especially new ones, are becoming more sophisticated, and we believe that we will see less buying by name alone. Consequently, we would not expect IBM to dominate software as much as they have hardware (barring serious mistakes made by leading competition).

We will also be interested to see how much and what kind of support will be included in the new, priced IBM packages. We've heard comments that some of IBM's unsupported or inadequately supported program packages have been a business stimulant for software houses. After a company discovers how hard it is to make an unsupported program work, it calls for help. If this is so, then one would think that the worst thing IBM could do to the software independents would be for it to go into the package business in earnest, supporting all packages as they should be supported. However, we feel that the opposite is true: IBM should throw away the programs it doesn't presently support (a package of any appreciable complexity and/or representing a system involving many people or departments is almost worthless without very complete support anyway), and support the rest properly. A standard would be set that is bound to be better than we have now, and the field would expand. The reinvention of the software wheel could really slow down, and maybe eventually stop.

IBM's move into custom contract programming is also very significant and may, in fact, have the most profound effect of all on the software business. Much will depend on how aggressively IBM goes after this market, but smart independent software operations should be preparing now. On the other hand, the separate pricing of the maintenance and modification of existing packages offers independents a new opportunity for business.

The separate charge for multi-installation companies was surprising. It may be reasonable when the actual costs of supporting some types of programs are considered. However, this is a policy which should prove a strong encouragement for the use of non-IBM packages, since few software houses are as restrictive about multi-installation use of their packages. Some offer "quantity discounts" and some restrict only to a division or subsidiary, no matter how many CPU's — especially if little installation cost is involved (the program installs easily or the computer configurations are nearly identical).

STRATEGY

Now let's figure out **why** this is all happening. IBM may be a giant, but it is not a sleeping giant. A little thought will reveal ways in which IBM may be taking advantage of the present situation, and we strongly suspect they are. It certainly does not seem to us that IBM

is evidencing a very defensive posture towards the Justice Department or its protagonists in the courts. Assuming that the total effect of a series of IBM moves is to get the corporation from here to there, we should have a way of intelligently following the pilgrim's progress once we can divine where "there" is.

We feel the next big "there" — the "fourth generation" coming in the next 5 to 10 years — will be network computing as distinguished from single computer applications. Some would put the distinction between time-sharing and batch-processing, but this is too constrictive to appreciate its full potential. Network computing will involve computers talking to computers, exchanging information and referencing a common data base, as well as humans interacting via terminals with a single computer facility. The company which finds that it has a computer managing the warehouse inventory, another directing machine operations in the production line, and a third providing management information to corporate staff, will eventually come to realize that the company could be run much better if they were all hooked together. The advantages (information exchange, ready access to the information generated at each source, etc.) will become increasingly obvious.

The money in this type of network is in the extra hardware required — modems, terminals, concentrators, etc. The explosive growth of this market will result from the large number of single-application computers already established, and from the "common carrier" nature of the dial-up network that will link them all together. What's needed to sell customers is a complete package.

The situation is reminiscent of the early days in computing, when customer companies were unsure of computers in general. What sold them was guaranteed results, with cost secondary; likewise, what will be needed this time around will again be guaranteed results. The company that can offer a complete package, with the systems expertise to make it work, will walk off with the work. Most of the money will come from hardware sales, although the key to those sales will be the support necessary to bundle everything into a complete package.

Therefore, we feel that IBM may have been glad to yield on batch computing as long as they were not locked out of network computing. They will separately price applications programs as long as they can keep their systems programs still attached to their hardware. If they have to spin off, they would spin off their office products division long before their federal systems division, because this is where their network "R&D" is going on.

If this is even partially true, then we may see history repeat itself. For those of us who missed the show the first time around, we will see the legendary ability of IBM to respond quickly and forcefully to its own mistakes. In 1950, IBM didn't have the first computer; perhaps it never had the best computer; certainly it was four years before it had a competitive computer. Yet, IBM was the outfit that made money on the whole situation by coupling adequate hardware with the total package approach and customer hand-holding. In time-sharing, the situation seems strangely parallel: IBM didn't have the first TS system (credit MAC and CTSS with that), and it isn't clear how competitive it is yet (MULTICS vs. CMS and revised TSS). *But who will take bets on when the MULTICS follow-on will arrive? And on how much money IBM will have made from time-sharing in the meantime?*

In all fairness, however, there is another more charitable interpretation of the underlying motivations behind IBM's new pricing policy. Along with those of us who believe that IBM actually welcomes a big fuss about unbundling as a way of drawing attention from its efforts to get into the real profit area of the future, and those who see it as nothing more than a stop-gap concession to the current mood of the trust-busters, there are some who read the situation as an objective attempt by IBM to help itself by helping the industry. And this idea may not be as naïve or simplistic as it first appears. Giant that it is, IBM could not continue to thrive in a totally hostile marketplace, and it is highly unlikely that a company as image-conscious as IBM would be oblivious to this reality. Even a Goliath needs friends.

OTHER PERSPECTIVES ON UNBUNDLING

NO REAL WINNERS

THOMAS DeMARCO, Director Mandate Systems, Inc.

What IBM has finally done in the realm of separate pricing is not nearly as interesting as the circumstances behind the action. The heavy thumbprints of the government are everywhere to be seen. Historically, actions taken under such circumstances have had one of two results:

1. **Everybody loses except some group, favored for no particular reason;**
2. **Everybody loses.**

This seems to be a Type One. But it's futile to speculate on just who comes out ahead. In the long run, no one does.

PROTECTING THE LOOPHOLES

DR. IVAN FLORES, Contributing Editor

The new policy of separate pricing for hardware and software carries a not-so-hidden increase in total cost to the user for the combination hardware/software system. Obviously, if present users of IBM software begin paying for what they have previously received without charge, IBM will be getting a good deal more value from its software. But what alternatives face the user besides the well-known one of buying competitive software?

One alternative is to have a friend at another installation give you a copy of his software or do a SYSGEN on his system using your system parameters. Perhaps without going this far, you might **pay** another installation to do this job for you. Could you be held liable for accepting it?

What about the big user? If he has DOS or OS for several computers, does he buy one standard package or several? If he is supposed to buy several, might he not slip by with only buying one?

Of course, this whole question about copying and/or selling software between users depends upon how much protection is available to the manufacturers.

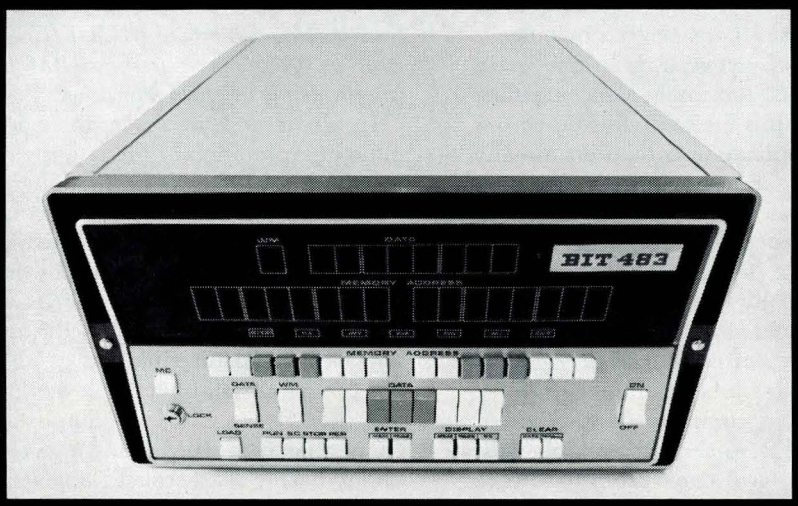
The possibilities are limitless. What about the user who is satisfied with one version of OS360 and believes he won't have to buy any more software as long as he sticks with what he has? Is he justified in expecting IBM to support his original purchase?

Another situation involves users who pay for software only until the system has gone through tests, and then "discontinue" using it.

Here's still another possibility. A large user might alter IBM software and then resell this product to interested buyers. Just what is the extent of his liability in this matter?

Until these questions are settled, it will be very difficult to determine who is going to lose and who is going to gain.

Goes like a son of a Bit.

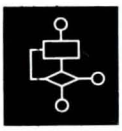


Eat dust, you other mini computers. Here comes the new BIT 483. A powerful general purpose digital computer with proven design performance and unparalleled problem solving capability. Its 350 nanosecond memory access time makes it one of the fastest computers around. And its other standard features make it the cost/performance champion of the minis. BYTE orientation. Variable word length. U.S.A. basic FORTRAN. Binary & decimal arithmetic. Cycle stealing data channel. Priority interrupt. A complete line of I/O options. The new BIT 483 is a thing of beauty. But it's no hot house flower child. It's the latest in a family of miniputers that have been carrying a giant load in the field for years. And it's sired by a company that's proved itself in the toughest proving ground in the world. The OEM market. We're a company that manufactures more than promises. We produce in volume and we service what we produce. So send for specs on the new BIT 483 and let's start talking prices. We guarantee they'll have you champing at the BIT.

BIT, INCORPORATED
5 Strathmore Road
Natick, Mass. 01760

See the new BIT 483 in Booths 5514 & 5515 at the WESCON Show.

JOEL W. COHEN, Digital Design Engr. ■ Sanders Assoc., Plainview, L.I., N.Y.



TECHNOLOGY PROFILE

MINI-COMPUTERS

A review of the capabilities and performance characteristics of digital computers available in the up-to-$20,000 price range.

The last two years have seen the introduction of a large number of very low priced, physically small, computers. The recent proliferation of mini-computers has made the selection of a machine increasingly complex. The problem has been further complicated by the many unique approaches to data processing which the manufacturers have taken, making meaningful comparisons difficult to perform. It is the objective of this article to outline the general characteristics of the machines which are available and, where possible, to discuss some of the more unique features. A summary of the most significant characteristics is included in Table 1. For the purposes of this article, a mini-computer is a computer whose mainframe costs are in the order of a maximum of $20,000.

REAL-TIME CONTROL

The offering of a large variety of machines has been sparked by the realization that we are in the beginning phases of the extensive use of the computer as a stored program controller. In such applications, the computer is used in place of hardware which would otherwise be designed for a specific purpose, that is, to implement a particular set of control functions. An example of this is the use of specialized hardware for operating an NC (Numerical Control) machine from paper tape. Until the advent of very low cost computers, it was cheaper to build the special controller than to try to relate the general-purpose capability of the scientific computer to the control functions. However, the price and the facility of the mini-computer has changed all that and it is becoming commonplace to use computer software to control processes. The computers are thus being found in a wide variety of applications from communication control (coding, compression, and concentration) to industrial process controls and data acquisition, storage, and retrieval. When used in these applications, the computer acts as an on-line real-time device, continually processing data and either storing or transmitting it.

The real-time environment has raised a host of questions on how the computer should be designed. Input/output facility has become increasingly significant and with it the ability to handle data at high rates. Thus, nearly all the machines have a direct-memory-access (DMA) channel as a standard feature or as an option. The analysis of machine performance, in terms of conventional routines such as math routines, has become less meaningful, and hardware to extend computer arithmetic capability (such as MUL-DIV) is generally optional where it is available at all. The byte has become a standard for information transfer and many machines have some instructions reserved for byte processing as well as I/O on the byte level. The 8-bit machine is, of course, a natural for byte processing and where data is being transferred to the computer as bytes, the 8-bit machine will avoid the necessity to pack input words before storing them. Some machines, such as the BIT 480, the Varian 520i, the Interdata machines, and the Micro 800, offer the ability to process data words of variable length where the words are byte multiples.

Even though the mini-computers are general-purpose systems, in many of the applications in which they are used, they behave as special-purpose controllers, operating in the real-time realm with a developed, stored program. With this in mind, many manufacturers have offered minimal machines as standard equipment allowing the user to purchase as little equipment as is required to perform the particular function which is desired. Where applications are well defined, the availability of "stripped down" machines can result in cost savings. In this vein, a novel approach, used in Data General's Nova, is to allow for the elimination of core memory and its replacement by read-only-memory

TABLE 1 • MINI-COMPUTER CHARACTERISTICS

COMPANY MODEL	BIT 480/483	COMPUTER AUTOMATION PDC 208/808	COMPUTER AUTOMATION PDC 216/816	DATA GENERAL NOVA	DATAMATE 16
MEMORY					
Word Size (bits)	8	8	16	16	16
Memory Size (words)	1K-65K	4K-16K	4K-16K	1K-32K	4K-32K
Cycle Time (usec)	3.0/1.0	2.6/8.0	2.6/8.0	2.6	1.0
Memory Parity	Optional	Optional	Optional	No	Optional
Memory Protect	No	No	No	No	Standard
Direct Addressing (words)	256	512	768	1K	256
Indirect Addressing	Single-level	Multi-level	Multi-level	Multi-level	Multi-level
CPU					
General Purpose Registers	1	1	2	4	2
Index Registers	0	0	1	2	1
Hardware Multiply-Divide	Optional	No	No	No	Standard
Immediate Instructions	No	No	Yes	No	Yes
Double-Word Instructions	Yes	Yes	No	No	Yes
Byte Processing	Yes	Yes	No	No	Yes
I/O					
I/O Word Size (bits)	8	8	8/16	16	16
Priority Interrupt Levels	1/4	2-24	3-64	16-62	8-64
Direct Memory Access Channel	Optional	Optional	Standard	Optional	Optional
I/O Maximum Word Rate (KHz)	250	125	250	312	1000
OTHER FEATURES					
Real Time Clock	Optional	Optional	Optional	Optional	Optional
Power Fail/Restart	Optional	Optional	Optional	Optional	Standard
Largest Disk (megabits)	No	2.1	2.1	2.05	32
Compiler	Basic Fortran	No	Fortran	No	ASA Fortran
Memory for Compiler	8K	—	4K	—	4K
PRICING					
Computer with 4K and ASR-33	$9,760/9,310	$8,000/7,000	$14,900/12,800	$9,650	$16,850
Additional 4K	$1,940	$2,700	$5,050/6,200	$3,650	$6,500

(ROM). The user writes and debugs his program with core memory and then sends a punched tape to the manufacturer where an ROM board is generated to replace the core-software combination. The advantage is that the ROM is both faster and cheaper than the core it replaces and is non-destructive memory.

MICROPROGRAMMING

Another tack which is taken in computer specializations is the tailoring of instructions to a particular application. The approach taken is to use some form of microprogramming which is the implementation of computer instructions (the macro-instruction) from lower-level micro-instruction. Many machines use some form of microprogramming for non-memory reference instructions. Generally, the instruction word is divided into functional parts such that bits or groups of bits correspond to micro-instruction. A particular bit might correspond to increment the accumulator, so that when the programmer forms an instruction word, if he selects that bit to be a one, the accumulator will be incremented.

The microprogram facility of most of the mini-computers is minimal and does not offer much in facility in the implementation of special instructions. The Varian 620i, the Micro 800, the Spiras 65, and the Interdata computers offer extensive microprogram capability by allowing the user to control large sets of micro-instructions, the very same operation used in the generation of the standard repertoire. The machines from the latter three companies also offer read-only-store (ROS), termed "Firmware", which is used to reference the micro-instructions in forming a set of macros. The macro-instructions may, in part or in whole, replace the standard instruction group.

The instruction set of most of the mini-computers is powerful and, among the various manufacturers, a wide variety of sets is offered. The utility of Firmware, that is the ability to generate one's own instructions, will in good part be a function of the ingenuity of the user. He will be required to make an investment to ascertain what macros to generate and in the process he will lose the ability to use standard software. Because of these considerations, Firmware will have the most utility for OEM's where the incorporation of such a specialized controller can be performed in the context of the overall design.

TABLE 1 • MINI-COMPUTER CHARACTERISTICS

COMPANY MODEL	DIGITAL EQUIPMENT CORP. PDP -8L/I/S	PDP-9L	PDP-12C	PDP-15 Model 10	ELBIT COMPUTERS ELBIT 100
MEMORY					
Word Size (bits)	12	18	12	18	12
Memory Size (words)	4K-8K(L); 4K-32K(I/S)	4K-32K	4K-32K	4K-131K	1K-4K
Cycle Time (usec)	1.5/1.6/8.0	1.5	1.5	0.8	2.0
Memory Parity	Opt.(L/I); Std. (S)	Optional	Optional	Optional	No
Memory Protect	Std.(L); No (I/S)	Optional	Optional	Optional	No
Direct Addressing (words)	256	4K	2K	8K	512
Indirect Addressing	Single-level	Single-level	Multi-level	Single-level	Single-level
CPU					
General Purpose Registers	1	1 Std., 1 Opt.	1	1	1
Index Registers	8 (Auto-Index)	8 (Auto-Index)	15 (Auto-Index)	1	0
Hardware Multiply-Divide	No(L/S); Opt.(I)	Optional	Standard	Optional	No
Immediate Instructions	No	No	Yes	No	No
Double-Word Instructions	No	No	Yes	No	No
Byte Processing	No	No	Yes	No	No
I/O					
I/O Word Size (bits)	12	18	12	18	12
Priority Interrupt Levels	1-64(L/I); 1(S)	1(9 Opt.)	1-64	1 (9 Opt.)	1-4
Direct Memory Access Channel	Opt./Std./No	Optional	Standard	No	No
I/O Maximum Word Rate (KHz)	666(L/I)	670	666	1000	—
OTHER FEATURES					
Real Time Clock	Optional	Optional	Optional	Optional	No
Power Fail/Restart	Optional	Optional	Optional	Optional	Standard
Largest Disk (megabits)	3.0(L/I)	6.0	3.0	183.6	1.0(Drum)
Compiler	Fortran, Algol	Fortran IV	Basic, Fortran	Fortran IV	No
Memory for Compiler	4K and 8K versions	8K	4K and 8K versions	8K	—
PRICING					
Computer with 4K and ASR-33	$8,500/12,800/9,995	$19,900	$14,900	$16,500	$4,900 w/o TTY
Additional 4K	$5,500/4,000/3,500	$6,000	$4,000	$6,000	No

The opposite of the purchase of the computer as a specialized controller is the purchase of a "Turn Key" system, in which the computer is supplied by the manufacturer with all the peripheral hardware and software needed to fulfill an application. The system, of course, is offered with a package price and the user has little more to do than operate the system. There are many mini-computer-based systems available such as the Redcor 685 "Data Acquisition System" (using the RC 70) and the Business Information Technology Numericon Tape Generating System, for use in programming tape-controlled milling and contouring machine tools, using the BIT 480.

The wide variety of applications of the mini-computer has led to a wide variety of peripherals to meet these applications. All manufacturers offer the ASR-33 and ASR-35, Teletype Corp's machines, and most also offer high-speed punches and paper tape readers. Additionally, there is a wide offering of magnetic storage devices including tape units and discs, with the maximum available disc storage varying quite substantially among the machines offered. For communications applications, some manufacturers offer data modems as peripherals allowing the computer to be used as a data concentrator. For data acquisition, there are offerings of A/D and D/A equipment and, for output, a variety of plotters, printers, and CRT displays. In the case of peripherals, it is very important that the user determine what deliveries have been made, if any, and, consequently, if operative software is available. Additionally, it is very important to ascertain if device controllers are available and what options will be needed to use the device. Total cost of the devices should be carefully evaluated because, even for the same item, there will be price variations among the manufacturers.

SYSTEMS FEATURES

Mini-computers are parallel processors with single address instructions and core memories, and word lengths of 8, 12, 16, and 18 bits. Memory parity extends the word length by one bit. The parity check is generally optional and, with the high reliability of the computer core memories, it will not be required for most applications. The cycle times vary from 0.8-8 microseconds with the user paying for the speed he gets, so if other factors are equal, the slower machines will cost less.

TABLE 1 • MINI-COMPUTER CHARACTERISTICS

COMPANY MODEL	GENERAL AUTOMATION SPC-12	GENERAL ELECTRIC GE-PAC 30-1/30-2	GRI COMPUTER GRI-909	HEWLETT-PACKARD 2114A/2115A.	2116 B
MEMORY					
Word Size (bits)	8	16	16	16	16
Memory Size (words)	4K-16K	2K-32K	1K-32K	4K	8K
Cycle Time (usec)	2.16	1.5/1.0	1.76	2.0	1.6
Memory Parity	Optional	Optional	No	Optional	Optional
Memory Protect	No	Optional	No	No	Optional
Direct Addressing (words)	4K	32K	32K	2K	2K
Indirect Addressing	Single-level	No	Single-level	Multi-level	Multi-level
CPU					
General Purpose Registers	4	16	Optional	2	2
Index Registers	3	15	32K(Auto-Index)	0	0
Hardware Multiply-Divide	No	Optional	Optional	Optional	Optional
Immediate Instructions	Yes	Yes	Yes	No	No
Double-Word Instructions	Yes	Yes	Yes	No	No
Byte Processing	Yes	Yes	No	No	No
I/O					
I/O Word Size (bits)	12	8 or 16	16	16	16
Priority Interrupt Levels	2-256	2-256	16(Expandable)	8/8-40	16-48
Direct Memory Access Channel	Optional	Yes	Yes	No/Opt.	Standard
I/O Maximum Word Rate (KHz)	460 (bytes)	750/900	570	—/500	625
OTHER FEATURES					
Real Time Clock	Standard	Optional	Optional	Optional	Optional
Power Fail/Restart	Optional	Optional	Standard	Optional	Optional
Largest Disk (megabits)	No	No	3.2	6.56	6.56
Compiler	No	Interactive Fortran	No	ASA Basic Fortran, Algol	Basic Fortran, Algol
Memory for Compiler	—	8K	—	4K(Fortran); 8K(Algol)	4K
PRICING					
Computer with 4K and ASR-33	$5,000	$11,800/14,960	$9,500	$11,950/16,500	$26,000(8K only)
Additional 4K	$3,200	——	$3,250	$5,000/5,500	——

Many of the computers have Memory Protect as an option, allowing the user to disable the ability to write into the protected locations. An obvious application is for program protection when the computer is being used for time-sharing.

All the machines surveyed have one or more accumulators and where indexing exists, one or more index registers. In general, where hardware index registers exist they also serve as registers through which data may be processed and, in conjunction with the accumulators, are termed general-purpose registers. Multiple general-purpose registers can substantially increase the computing power of a computer especially when they are coupled with a large set of inter-register instructions. Inter-register instructions generally require only one cycle time so that where they reduce the number of required memory reference instructions they will reduce the average program operating time. These registers will also prove useful where the requirement exists for the serial shifting or rotating of two computer words at once because provision usually exists for inter-register serial transfer. Here, too, the processing power is paid for in the price of the machine and, if not used, it will add needless expense.

The computer instruction set may be broken up into arithmetic, logical, test, branch, register and inter-register, and input/output. The relative capability of each of these groups varies widely from machine to machine. The instructions may be further categorized as to memory reference and non-memory reference. Generally, when memory is referenced, the instruction requires two memory cycles for completion. Thus, a computer with a one-microsecond cycle time will usually have a two-microsecond store or add time. However, this is not **always** true and should be checked. Each level of indirect addressing usually **adds** one cycle time for completion of the instruction. When memory is not referenced, most instructions usually require 1 cycle time.

Memory reference instructions are either single- or double-word instructions. In either case, the instruction word must include the address field, the operation code, and address modes. There are three modes of interest; direct, indirect, and relative. For each mode there will be an initial address equivalent to the address field and a final address resulting from modification of the initial address. In the direct address mode, the address field is the final address. A typical address field is 8 bits which allows direct addressing of the first 256 locations of the memory. Where the concept of paying is used, the number of words represented by the

TABLE 1 • MINI-COMPUTER CHARACTERISTICS

COMPANY / MODEL	HONEYWELL H-316	HONEYWELL DDP 416	INFORMATION TECHNOLOGY ITI-4900	INTERDATA Model 2	INTERDATA Models 3/4
MEMORY					
Word Size (bits)	16	16	16	16	16
Memory Size (words)	4K-16K	4K-16K	4K-32K	1K-2K	4K-32K
Cycle Time (usec)	1.6	0.96	0.975 or 1.75	3.0	1.5
Memory Parity	No	Optional	Optional	Optional	Optional
Memory Protect	No	Optional	Optional	Optional	Optional
Direct Addressing (words)	1K	1K	32K	2K	32K
Indirect Addressing	Multi-level	Multi-level	Multi-level	No	No
CPU					
General Purpose Registers	3	1	8 (128 Opt.)	16	16
Index Registers	1	0	6	15	15
Hardware Multiply-Divide	Optional	Optional	Optional	No	Optional
Immediate Instructions	No	No	Yes	Yes	Yes
Double-Word Instructions	No	No	Yes	Yes	Yes
Byte Processing	No	No	No	Yes	Yes
I/O					
I/O Word Size (bits)	16	16	16	8	8
Priority Interrupt Levels	16-64	2-48	8-256	2-256	2-256
Direct Memory Access Channel	Optional	Optional	Optional	No	Yes
I/O Maximum Word Rate (KHz)	1000	1000	1000	——	750/900
OTHER FEATURES					
Real Time Clock	Optional	Optional	Optional	Optional	Optional
Power Fail/Restart	Standard	Standard	Optional	Optional	Optional
Largest Disk (megabits)	9.6	9.6	——	No	5.6
Compiler	Fortran IV	No	No	No	Fortran
Memory for Compiler	8K	—	——	——	4K
PRICING					
Computer with 4K and ASR-33	$11,400	$16,900	$12,450	$6,900(1Kbytes)	$12,700/15,700
Additional 4K	$5,500	$8,000	$7,000	——	$6,000

address field is termed page one and the directly-addressable area is termed page 0. In other cases, the first memory page is referred to as scratchpad memory because of its availability from anywhere in the memory. Relative addressing results by obtaining the first address from the address field relative to some reference. For those machines which do not address all of memory directly, a reference will be either the location counter or the page counter. In the latter case, the programmer may directly address all locations in the same page. In the former case, the page is relative to the location of the instruction word and so it effectively becomes a floating page. The usual scheme is to use the "present" location as the center of the floating page.

Many of the machines offer indexing using one or more index registers. Here, the final address results from the sum of the address field and the index register. Another approach to indexing used in DEC computers is "auto-indexing". Whenever one of the auto-index locations is indirectly addressed, the word at that location is automatically indexed. Single-level indirect addressing uses the address obtained by direct or relative addressing as indicative of the location where the final address exists. Where multilevel indirect addressing is available, the programmer may use the word at the addressed location as either the final address or as a pointer to get another word. The higher order bit of the indirect address will usually determine if the word obtained is the final address or a pointer.

The operation code portion of the memory reference instruction provides information on precisely what function the instruction will perform. Usually four or five bits are reserved for the code yielding a fairly large instruction repertoire. The set will include such standard functions as AND, OR, STORE, ADD, and JUMP. Where multiple general-purpose registers are provided for, the arithmetic and logical capability will generally exist between memory and more than one register. Also, as one searches through the available instruction sets, unique instructions may be found such as three-way compares between memory and the accumulator (less than, equal to, or greater than, with subsequent skips) and scan memory (search for equality throughout entire memory). Some of these may prove useful for particular applications. Many machines also offer literal or immediate instructions which use the contents of the address field as the operand and, therefore, need not reference memory. This results in a saving of memory space and some program time is gained in that the immediate instructions generally are ex-

TABLE 1 • MINI-COMPUTER CHARACTERISTICS

COMPANY MODEL	IRA SYSTEMS SPIRAS 65	LOCKHEED ELECTRONICS MAC-16	MICRO SYSTEMS MICRO 800	MICRO SYSTEMS MICRO 810	MOTOROLA MDP-1000
MEMORY					
Word Size (bits)	16	16	8	8	8
Memory Size (words)	4K-65K	4K-65K	0-32K	1K-32K	4K-16K
Cycle Time (usec)	1.8	1.0	1.1	1.1	2.16
Memory Parity	No	Optional	Optional	Optional	Optional
Memory Protect	Yes	Optional	Optional	Optional	No
Direct Addressing (words)	65K	1K	Firmware	512	4K
Indirect Addressing	Multi-level	Multi-level	Firmware	Multi-level	Single-level
CPU					
General Purpose Registers	3	1	16 (Firmware)	3	4
Index Registers	1	4 (in memory)	0-16 (Firmware)	1	4
Hardware Multiply-Divide	Yes	Optional	Firmware	Standard	No
Immediate Instructions	Yes	Yes	Firmware	Yes	Yes
Double-Word Instructions	Yes	No	Firmware	Yes	Yes
Byte Processing	No	Yes	Firmware	Yes	Yes
I/O					
I/O Word Size (bits)	16	16	8	8	12
Priority Interrupt Levels	3	4-64	Firmware	8-64	2-256
Direct Memory Access Channel	Standard	Optional	Optional	Optional	Optional
I/O Maximum Word Rate (KHz)	500	800	910	910	460 (bytes)
OTHER FEATURES					
Real Time Clock	Optional	Optional	Optional	Optional	Standard
Power Fail/Restart	Optional	Optional	Optional	Optional	Optional
Largest Disk (megabits)	5.8	No	No	No	No
Compiler	Fortran IV	Fortran IV	No	No	No
Memory for Compiler	8K	8K	—	—	—
PRICING					
Computer with 4K and ASR-33	$16,800	$11,950	$6,900	$8,100	$9,250
Additional 4K	$5,400	$4,050	$2,500	$2,500	$3,000

ecuted in half the time. For additional facility, some of the computers offer double-word instructions with the first word providing an extended operation code and the second word the address field. These instructions will require twice the execution time as single-word instructions. Another feature is the ability to address data words on the byte level. This allows data to be processed as bytes will be especially useful when the I/O is byte-oriented.

The non-memory reference instructions consist of register change such as shifting, test, and branches based on data in these registers; inter-register instructions which in some computers include arithmetic and logical capability; and the set of I/O instructions. It is with these instructions that the greatest variation exists among the various machines. There is no real method of determining what instructions are more useful than others. Essentially, the user must determine what machines generally are of interest to him for his application and then he should generate trial programs based on the kind of processing required for that application. This approach will give him a feel for which elements of a particular machine's capability are more useful than others.

INPUT/OUTPUT

The use of the mini-computer in real-time applications has yielded the requirements for a powerful I/O. As with other features of the machines, the I/O facility varies quite a bit among the various manufacturers. The standard input/output requirement for the computer is to sense when devices are ready for transfer (and indicate this condition by a program skip), to output control pulses to the peripheral devices, and to transfer data in and out. The I/O channels generally operate on a party-line basis so that many devices may be tied into one channel. The peripherals are assigned device addresses which allow the computer to identify them and allowance is made for multiple control pulses to be transferred at each address, as required. Device controllers are either implemented by the user for tying into the party line or supplied by the manufacturer at additional cost. Data words are transferred into, or out of, the accumulator and where multiple general-purpose registers exist, some computers have the facility for transfer by more than one register. The I/O word size is usually the same as the memory word size with the exception being those machines that offer both byte and word transfer. The party line I/O is common to

TABLE 1 • MINI-COMPUTER CHARACTERISTICS

COMPANY MODEL	RAYTHEON 703/706	REDCOR RC 70/RC 70-00	SCIENTIFIC CONTROL CO. SCC 4700	SCIENTIFIC DATA SYSTEMS CE-16/CF-16	SYSTEMS ENGINEERING LABS SEL 810A
MEMORY					
Word Size (bits)	16	16	16	16	16
Memory Size (words)	4K-32K	8K-32K/4K-32K	4K-65K	4K-32K	4K-16K
Cycle Time (usec)	1.75/0.9	0.86	0.92	1.75	8.0/2.6
Memory Parity	No/Opt.	Standard	Optional	Optional	Optional
Memory Protect	No/Opt.	Standard	Optional	Optional	No
Direct Addressing (words)	32K	32K	1K	1K	768
Indirect Addressing	No	Single-level	Single-level	Multi-level	Multi-level
CPU					
General Purpose Registers	3	3	3	2	2
Index Registers	1	1	1	1	1
Hardware Multiply-Divide	Optional	Std./Opt.	Optional	Standard	No
Immediate Instructions	No	No	Yes	No	Yes
Double-Word Instructions	No	Yes	No	No	No
Byte Processing	Yes	No	Yes	No	No
I/O					
I/O Word Size (bits)	8/16	16	8/16	16	8
Priority Interrupt Levels	1-16	1-32	2-16	3-96	3-64
Direct Memory Access Channel	Optional	Optional	Standard	Optional	Standard
I/O Maximum Word Rate (KHz)	500/1100	1100	1100 (bytes)	572	250
OTHER FEATURES					
Real Time Clock	Optional	Optional	Standard	Optional	Optional
Power Fail/Restart	Optional	Std./Opt.	Optional	Optional	Optional
Largest Disk (megabits)	5.76	16	54	16	No
Compiler	Fortran IV	Fortran IV	Fortran IV	Fortran IV	Basic Fortran
Memory for Compiler	8K	8K	8K	8K	4K
PRICING					
Computer with 4K and ASR-33	$15,000/19,000	$21,500/14,700	$17,900	$18,000	$9,980/11,990
Additional 4K	$8,000/5,600	$6,000	$7,500	$5,000	$5,450

all the computers with some of the computers having the option to expand to more channels.

Word transfer to the accumulators is standard and, additionally, some computers have the provision to transfer single words directly into memory. However, in general, where data is entered into memory it is formatted into block transfers. The approach to block transfer varies among the computers and provision is made for both automatic transfer and transfer under program control. In either case, the computer must keep track of a word count (the size of the block) and it must have access to a continually-updated block address, that is, the location where the next transfer is to occur. In the case of programmed block transfer, the required information is stored in memory and each time a transfer occurs the word count and address are automatically updated. When memory space is available, many blocks may be the in process of being entered simultaneously.

Programmed block transfers of two types exist. The first type requires sensing of device readiness and the execution of the block transfer instruction, followed by a return to the main program. In this manner, the main program proceeds while the data is being entered. The second type of transfer is one in which execution of the instruction dedicates the machine to data entry until the entire block has been entered. In this mode, the computer periodically senses the devices and, if a peripheral is ready, a transfer is made, but if the peripheral is not ready, the computer performs other functions and then senses again. This mode will lead to the highest-speed programmed transfer.

Block transfer facility is of little use without a corresponding interrupt facility. This is because the computer must continually receive information on device readiness and it must also have a means of alerting a program that a block transfer has been completed. With respect to device readiness, the program could be arranged to test the devices periodically but with multiple devices this is impractical and, in many cases, the data just does not arrive periodically. What generally occurs is that each time the device of interest is ready, the program is interrupted and one word of the block transfer is made. The program then proceeds. Where multiple devices are involved they might all be tied unto a common interrupt line and when an interrupt occurs, a "polling" program could then determine which device is ready and perform the transfer. An alternative is to use separate interrupts for each device thus speeding up the effective rates at which the transfers may proceed. When any particular block has been completely transferred the computer must undergo a different in-

TABLE 1 • MINI-COMPUTER CHARACTERISTICS

COMPANY MODEL	TEMPO COMPUTER TEMPO 1	TRANSISTOR ELECTRONICS TEC 520	VARIAN ASSOCIATES 520-i	VARIAN ASSOCIATES 620-i	WESTINGHOUSE PRO DAC 2000
MEMORY					
Word Size (bits)	16	16	8	16/18	16
Memory Size (words)	4K-65K	4K-16K	4K-32K	4K-32K	4K-65K
Cycle Time (usec)	0.9	1.0	1.5	1.8	——
Memory Parity	Optional	Standard	Optional	Optional	Standard
Memory Protect	Optional	Standard	Standard	Optional	No
Direct Addressing (words)	512	4K	1K	2K	512
Indirect Addressing	Multi-level	Single-level	Multi-level	Multi-level	Single-level
CPU					
General Purpose Registers	2	1	6	3	4 (Assigned Memory)
Index Registers	7 (in memory)	2	2	1	2
Hardware Multiply-Divide	Optional	No	No	Optional	Standard
Immediate Instructions	No	Yes	No	Yes	No
Double-Word Instructions	Yes	Yes	Yes	Yes	No
Byte Processing	No	Yes	Yes	No	No
I/O					
I/O Word Size (bits)	16 (8 optional)	16	8/16	16/18	16
Priority Interrupt Levels	4-256	12	4-11	0-64	1
Direct Memory Access Channel	Optional	Standard	Optional	Optional	No
I/O Maximum Word Rate (KHz)	700	1000	660 (bytes)	200	—
OTHER FEATURES					
Real Time Clock	Optional	Optional	Optional	Optional	Standard
Power Fail/Restart	Optional	Optional	Optional	Optional	Standard
Largest Disk (megabits)	N.A.	No	4.2	4.2	—
Compiler	Fortran IV	No	No	Fortran	Fortran IV
Memory for Compiler	8K	—	—	8K	8K
PRICING					
Computer with 4K and ASR-33	$15,000	$13,800	$8,900	$13,900	$10,000
Additional 4K	$4,000	$4,500	$2,500	$6,400	——

terrupt to indicate to the program that this has occurred. The transfers may proceed asynchronously to the main program and, essentially, they just steal time from the main program.

The above functions may be performed automatically, that is, the only programming required would be for the starting of the word count and first address and then an instruction to start the transfer. Additionally, the word count and transfer address can be stored in hardware which is external to the system. Where such facility exists, it is commonly referred to as a Direct Memory Access channel (DMA). Such channels simulate the programmed transfer described above but operate independently of the CPU. They perform a true cycle steal and effectively stall the main program during the transfer. The main advantage is that the transfer is fully automatic, requiring very little time and, thus, it leads to the possibility of very high transfer rates. DMA is commonly offered as an option with these mini-computers.

The computers generally operate on a priority interrupt basis where each individual line is referred to as an interrupt level. Associated with each interrupt level is an address in memory and the address is either hardwired by the user or reserved by the manufacturer. When a particular interrupt occurs, the instruction located at the "interrupt address" is performed, with the rest of the computer hardware status remaining unchanged. The instruction will usually be a data transfer instruction of some type or a JUMP and SAVE instruction which will guide the computer to a service subroutine, saving the contents of the location counter for later return to the main program.

The priorities of the interrupts are hard-wired according to the needs of the user. When an interrupt occurs, and a service routine is entered by a JUMP and SAVE instruction, the entire interrupt facility is disabled until the particular interrupt of interest has been disarmed. During the service routine, more than one additional interrupt may occur and, when the computer interrupt is once again turned on, they will follow the wired priority.

SOFTWARE

For the mini-computer, assemblers are absolutely essential for efficient programming and, as such, they are

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widely available throughout the industry. There are 1-, 2-, and 3-pass assemblers in use and, of course, the multipass assemblers increase assembly time but also, generally, have additional features which may be of interest. The standard library of most manufacturers includes hardware and software debug routines and math routines with MUL-DIV, and sometimes floating-point and double-precision arithmetic. The availability of any of these should be ascertained from the manufacturer. Computers are also available with some machines but they generally require additional storage capability to be of any use. Some manufacturers quote the availability of compilers (such as FORTRAN) but gear their compiler to their own requirements in some non-standard format. One of the advantages to some of the older computers is that where extensive deliveries have been made, user libraries exist and, in some cases, documentation is available. Where similar applications have existed, the software may prove of value to a potential user and may also help him ascertain how efficiently a particular machine may implement his requirements.

More extensive software beyond that already mentioned is not widely available. Where the requirement exists for executive routines such as real-time executive monitors, the user should check with the manufacturers for availability and, in general, such software will be part of overall systems developed by the manufacturers.

PRICING

As a group, the mini-computers are small in size and low in price. The manufacturers have been able to achieve low prices by use of the latest core memory and integrated circuit technology and by offering minimal systems where the user is able to choose the capability he requires to implement his system. In addition, the larger number of available computers has created a competitive situation. Many manufacturers also offer liberal price reductions for quantity purchases which may reduce the prices substantially below those quoted in Table 1.

Where minimal capability is not acceptable, the manufacturers offer a wide variety of options both as additions to the mainframe and as peripheral devices. Inclusion of such devices in a system may dramatically affect the pricing relationships. Thus, additional memory might be more costly to add to a machine with an initially lower price tag than to some other machine with a higher price tag, offsetting the original price advantage. Such situations may arise out of the requirement for expansion cabinets or power supplies, which some computers have, while others may have provided for this in the mainframe design. Another case is the requirement to purchase certain options in order to be able to purchase others. Thus, for one computer, the purchase of a disc might also require purchase of a priority interrupt module, while for a different machine, the interrupt facility may already be included. Here, too, any initial price advantage might quickly fade away. The potential user should try to evaluate the mainframe expansion capabilities and compare them to his needs. Then he should try to ascertain what peripherals he might need and, finally, price out the resulting system.

When substantial system expansion is required the system prices will be significantly higher than those listed in Table 1 and the prices may no longer be in the "mini-computer category". The mini-computer may then become part of what is essentially a small computer system. The user might then give some consideration to a larger-scale computer which might, in the final analysis, be competitive.

Since new models, and modifications to existing models, are frequently being made, the reader is cautioned to check out the data listed in Table 1 with the manufacturers. **For more information on the mini-computers described here, use the reader inquiry card in the back of the magazine. The appropriate reader inquiry numbers are listed in Table 2.**

TABLE 2 • REFERENCE LITERATURE

For more information on the mini-computers described in this article, circle, on the reader inquiry card, the appropriate numbers listed below.

Company	Reader Inquiry Card Number
Business Inform. Tech., Inc., Natick, Mass.	120
Computer Automation, Inc., Newport Beach, Cal.	121
Data General Corp., Southboro, Mass.	122
DataMate Computer Syst., Inc., Big Spring, Tex.	123
Digital Equip. Corp., Maynard, Mass.	124
Elbit Computers Ltd., Haifa, Israel	125
General Automation, Inc., Orange, Cal.	126
GE-Inform. Syst. Div., Phoenix, Ariz.	127
GRI Computer Corp., Newton, Mass	128
Hewlett-Packard, Cupertino, Cal.	129
Honeywell, CCD, Framingham, Mass.	130
Information Tech., Inc., Sunnyvale, Cal.	131
Interdata, Oceanport, N.J.	132
IRA Systems Inc., Waltham, Mass.	133
Lockheed Electr, Data Prods. Div., L.A., Cal.	134
Micro-Systems, Inc., Santa Ana, Cal.	135
Motorola Instru. and Control, Inc., Phoenix, Ariz.	136
Raytheon Computer, Santa Ana, Cal.	137
Redcor Corp., Canoga Park, Cal	138
Scientific Control Corp., Dallas, Tex.	139
Scientific Data Systems, Santa Monica, Cal.	140
Systems Engrg. Labs., Fort Lauderdale, Fla.	141
Tempo Computers, Inc., Orange, Cal.	142
Transistor Electronics Corp., Minn., Minn.	143
Varian Data Machines, Irvine, Cal	144
Westinghouse Elect. Corp., Pitts., Pa.	145

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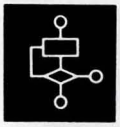


RETAIL INFORMATION SYSTEM

When three big names in three big fields team up to produce a system —— you can be sure it will be a big system.

A new computerized information system intended for the retail department store industry may very well be the most significant new development in retailing since the credit card. Certainly it is one of the most ambitious.

Known as the "Retail TRADAR Information System," it combines the joint efforts of three major concerns: General Electric Co. — prime developer and co-marketer of the new system; the J. C. Penney Co. — prime user and also co-marketer; the Dennison Manufacturing Co. — producer of the newly-developed MERITag (Magnetic Encoded Retail Information Tag) merchandising tickets and credit cards which will serve as the basic input media. Dennison will also provide special coders to produce and verify the merchandising tickets, and readers for alternate batch processing. William M. Patten, Penney's chairman, described the TRADAR system as "a retailer's dream come true," and as "a major step forward in fulfilling the long recognized need of multi-store operations for a point of sale data retrieval system."

TRADAR is basically a family of unique terminals and communication devices used with special software designed for standard GE computers and peripheral equipment. The system has been under intensive development by GE's Information Systems Equipment Division for the past few years and recently has been undergoing testing and evaluation at a J. C. Penney store in Glendale, Cal.

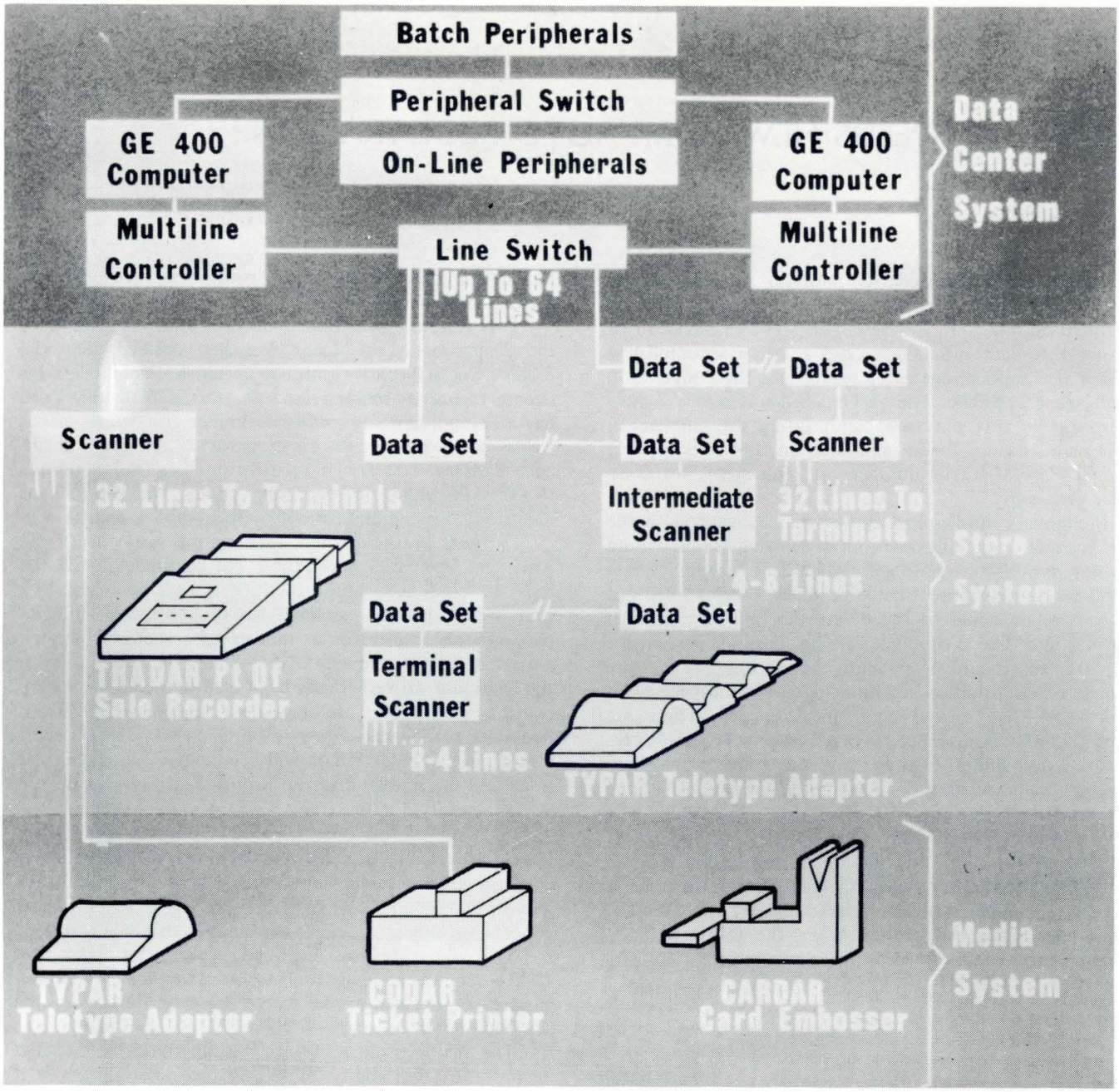
POINT-OF-SALE TERMINAL

Key element of the system is the TRADAR point-of-sale terminal, which reads the Dennison MERITag merchandise tickets and charge cards under computer control. The TRADAR terminal performs all normal register calculations, including all applicable taxes or discounts and the customer's change on cash sales, automatically verifies each credit transaction, and permits an immediate review of sales and merchandise activity at any time during the day. Another feature of the terminal is a visual display panel which guides the sales clerk through each step of the transaction.

SYSTEM ORGANIZATION

Penney's TRADAR System is organized around three subsystems: the Data Center Subsystem, the Media Subsystem, and the Store Subsystem. The first of these, located in Buena Park, California, consists of two GE 400 computers and related peripheral and switching equipment. The Data Center controls the operation of all store systems, collecting and recording point-of-sale transactions, while simultaneously handling normal batch processing and media conversion tasks. The Media Subsystem includes the magnetically encoded merchandise tags and plastic credit cards — together with the machines which produce them. The store Subsystem consists of the point-of-sale terminals, Teletype adapters, scanners, and data sets.

TRADAR can handle as many as 1500 point-of-sale terminals and will eventually replace all of Penney's cash registers and much of its EDP equipment. By reducing the time spent on sales operations, the system permits sales clerks to spend more time selling merchandise. Furthermore, the automatic collection of all merchandise data is expected to improve inventory turnover substantially by allowing tighter control and faster, more accurate re-ordering. Penney's also believes TRADAR holds potential as a research tool to determine consumer buying habits and trends.



TRADAR'S FUTURE

Penney and GE have signed a $10 million contract to expand the system into approximately 50 Penney stores in the Los Angeles area, starting immediately. The two companies will also work together to market the system within the retail department store industry. Dr. Thomas A. Vanderslice, general manager of GE's Information Sales and Service Deputy Division, said the system demonstrates GE's intention to become "a major supplier of information systems products to the retail industry."

OCR SPEEDS NEW YORK AUTO REGISTRATION

Zip codes and Social Security numbers are well on the way to becoming part of the registration records for motorists in the State of New York. The massive job of getting this data into the record is being accomplished with a new optical character reader and the cooperation of the general public. The vast majority of motor vehicle registrants in this state are handprinting the numbers in their plate renewal forms, and then an IBM 1287 optical scanner "reads" these numbers at high speed for computer processing.

Preliminary studies had shown that conversion to the new scanner, including revision of existing forms, would pay for itself if we could get a document acceptance rate of 50 percent; that is, if half the renewal forms filled out by the public could be "read" on the first pass through the machine. The acceptance rate has been 70 percent, of the cards that could be put into the machine, so that the changeover—in addition to capturing two critical pieces of information—has proved economical as well. There are some six million auto license plate owners in New York, and the desirability of bypassing the conventional keypunching step preparatory to computer processing became obvious some time ago.

We began using an IBM 1282 optical character reader in 1964. All the key information on the license renewal form—the license data, motorist's identification number or a re-entry number—were preprinted on the form by our computer's high-speed printer. When the forms were returned, the 1282 "read" this key information and punched it into the document, which was then ready for further machine processing.

This system worked well, but not too long afterwards the Department of Motor Vehicles decided that the driver's Social Security number should be included in his license record. A major reason for this is that New York has a compulsory automobile insurance law, which means we have to exchange information with a number of insurance carriers. The Social Security number (SSN), unique to every individual in the United States, was the obvious identifier to speed and simplify information exchange.

Further, it is expected that in the near future the American Standards Association will recommend that the SSN be used as a prime identifier. We could foresee a time when the SSN would have to become an integral part of the record for a number of reasons. One such reason is that we expect to interchange information with the National Driver Registry. As automobile ownership continues to climb, and the movement of people from one state to another comes to be taken for granted, swift interchange of license data will become very important. It is all but inevitable that the prime identifier will be the Social Security Number.

In none of these anticipated situations, of course, does the use of the SSN tie into tax records. This is certainly true here in New York, where it is purely an identifying number. While some citizens have expressed concern on this score, the great majority have cooperated.

The zip code was included because the U.S. Post Office requests it. Once the decision was taken to incorporate the SSN into the license record, addition of the zip code posed no great problem.

The major problem lay in getting the SSN into the record. The desirability of having the registrant write it into his application for license renewal was obvious, but this was only the first step. Unless we had a machine readable document, we would be faced with an impossible keypunching operation. The 1282 could only read machine-printed data, so the solution had to be found elsewhere.

This led to a study of the IBM 1287 optical character reader, which was introduced right about that time. The 1287 could capture numbers written by the general public—if the public could be educated and guided to write the numbers so that the machine can read them. This meant a redesign of existing forms and preparation

VINCENT L. TOFANY became New York State's eighth Commissioner of Motor Vehicles on January 1, 1967, after a distinguished career in local government and political administration in Monroe County. Commissioner Tofany is Vice Chairman of the State of New York Interdepartmental Traffic Safety Committee, a member of the Governor's Committee on Compensating Victims of Automobile Accidents, a member of the National Board of the Library of Presidential Papers, a director of Region One, American Association of Motor Vehicle Administrators, a director of the Greater New York Safety Council, and serves the Queens County Crime Prevention Board as Motor Vehicle Law Consultant.

Commissioner VINCENT L. TOFANY ■ Dept. of Motor Vehicles, State of New York ■ Albany, New York

of accompanying literature to explain the new procedure. Since this would obviously be costly, we made a detailed study of the factors involved.

The study included trial runs before we put in an order for the machine. Using a program known as PERS–Program to Evaluate Rejects and Substitutions–we were able to determine, with a good degree of accuracy, what might be expected in the way of results.

These studies indicated that if we could get an acceptance rate of 50 percent, the investment in the changeover would be justified. They also showed that we had good reason to expect this rate would be achieved, and that the public could be expected to handprint machine-readable numerals.

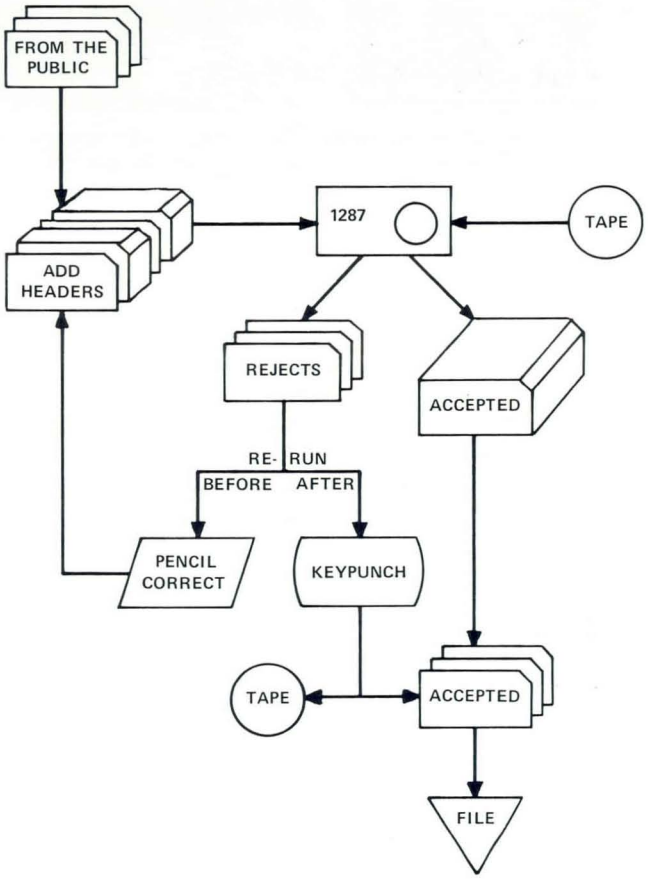
Accordingly, beginning in October of 1967, we issued new renewal forms which asked the public to cooperate, on a voluntary basis, by handprinting the SSN and zip code. The new forms include an area with 10 sample numbers indicating how they should be handprinted. This area is directly above the spaces calling for the SSN and zip code. Supplementary literature called the registrants' attention to this change and further explained how the numerals should be entered on the form.

The bulk of the information on the form is still preprinted. The registrant makes no entries as to name, address, and vehicle data unless there are changes to be made; then, he simply crosses out what's printed and writes in the correction. Then, forms with corrections are keypunched and the rest are fed into the 1287, which reads preprinted as well as handprinted numbers.

Although the request for Social Security numbers was on a voluntary basis, only three percent of the registrants have failed to include it. Thus, the 1287–which went into operation in March of 1968–has had a full workload.

As the renewal forms come in, they are marked in pencil for reference purposes, batched behind a header card, and fed into the machine. About one-third of the forms are not suitable for the machine because there is writing in the scan field or an improper insertion. The forms that should be accepted are marked in pencil for reference purposes, batched behind a header card, and fed into the machine. The 1287 program seeks the reference mark, then a preprinted plate scan number, and finally the SSN and zip code. The existence of a plate scan number verifies that the particular document is a renewal.

If the plate scan number and handprinted numbers are readable, the data is transmitted to the IBM System/360 Model 40 which controls the 1287 operation. The Model 40, in turn, puts the data on tape, from which it is later transferred to 2321 Data Cell Drives, which are mass-storage, on-line units that permit fast reference to all stored data from remote terminals.



This chart shows program flow of N.Y.'s auto renewal registration forms through the IBM 1287 Optical Character Reader. The 1287 operates under control of an IBM System/360 Model 40. Data is transmitted from the 1287 to the computer, which then puts it on tape.

If the data to be "read" is not readable, the card is discharged into a reject hopper. At present, these rejects are being keypunched. We are studying several methods of reducing the keypunching job, including the possibility of making corrections right at the 1287 keyboard. The number which cannot be "read" is displayed on the machine, and can be corrected directly by operator intervention. We have hopes of making this a reasonably fast and smooth procedure, further reducing the need for manual punching.

The machine works at high speed, analyzing each number and mark in detail. If the character is broken or unclear, it is rescanned several times in a fraction of a second before it is rejected. Thus, there is considerable room for variation in handprinting numbers, and this fact has undoubtedly contributed to the high acceptance rate.

This chart shows program flow of N.Y.'s auto renewal registration forms through the IBM 1287 Optical Character Reader. The 1287 operates under control of an IBM System/360 Model 40. Data is transmitted from the 1287 to the computer, which then puts it on tape.

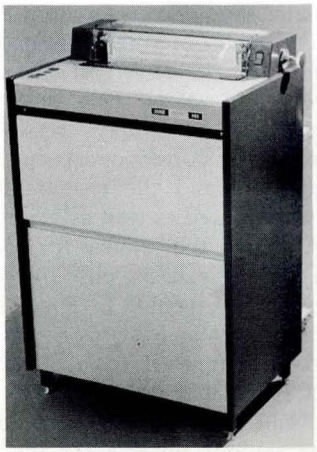
The machine is currently used on one shift, in a multiprogramming mode; that is, as data is "read" into System/360 on the 1287, the computer performs other work. Since additional computer time is available, the Department's Division of Research can use it for statistical studies, such as the results of eye tests. Accident statistics are now processed through mark-sense equipment, and this may become another application for the 1287.

An indication of the interest in this type of application lies in the fact that a number of companies have been in to see our operation. It has been gratifying to have industry come to a state government facility for information, and we have been pleased to cooperate.

The ultimate gratification, of course, comes in the fact that we are well on the way towards incorporating a prime identifier in our records. That we have been able to do this with an even greater degree of economy than had been originally hoped for, is a very welcome bit of "frosting on the cake."

NON-IMPACT TELEPRINTER

New communications terminal uses ink-stream technique



Designated the 960 Videojet, A. B. Dick's new non-impact printer utilizes a stream of controlled ink droplets to print on conventional business forms at 250 cps. This is the usual rate for data transmitted over standard voice-grade telephone lines for computer time-sharing and other data network systems. The 960 automatically answers the Dataphone subset used in these systems, prints the information transmitted, and terminates the Dataphone call — unattended.

In contrast to Teletype's Inktronic terminal which employs 40 stationary nozzles, each responsible for printing two characters, the 960 uses one nozzle driven in a horizontal plane. The movement of the nozzle provides horizontal deflection of the ink droplets, and high voltage plates provide vertical defiection.

Character spacing and line length are set to the computer industry norm, 10 char./in. and a line length of 136 characters. However, the character spacing is variable from five to fifteen char./in. allowing up to 204 characters on a single line. The 960 accommodates the 80-character line common in communications networks, and prints on continuous business forms ranging in weight from 20 to 125 lb. stock, in any width from 3½ in. to 14⅞ in. Utilizing Videojet offset ink and continuous form offset masters, the 960 can also produce direct image masters for reports requiring distribution.

A. B. Dick has clearly aimed the 960 at the on-line communications market, but its low price ($7000) makes it equally attractive as an output printer for a mini-computer system. As A. B. Dick's salesmen are quick to point out, it makes little sense to spend more for the slave than the master.

For more information about the 960 Videojet, Circle No. 188 on Inquiry Card.

Rent the midi computer
at mini prices
— $645 month

RC 70

The Rentable MIDI*

Standard features include:

- 860-nanosecond cycle time
- 8K 16-bit word memory (user expandable to 32K)
- ASR 33
- High-speed multiply and divide
- Memory parity and memory protect
- Hardware fill switch
- Roll arrow feature
- Bi-directional index register

The RC 70 has no hidden costs—it does today's job and is user expandable in 4K increments to meet future requirements.

- Complete line of peripherals and interfaces available
- FORTRAN IV, Compiler, and Assembler
- Two-week delivery and field installation
- **PURCHASE: $21,500 (FOB destination)**
- **1 YEAR RENTAL $645 month**

***MIDI COMPUTER:** Submicrosecond 16-bit computer compactly packaged with megacycle throughput word rate for OEM and system requirements. The MIDI classification includes the RC 70, 516, SIGMA 2, 2116B, 810B, 1700, and as DEC says *the PDP 15.*

RC REDCOR CORPORATION

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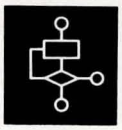
CIRCLE NO. 27 ON INQUIRY CARD

FAY B. HERMAN ■ Staff Contributing Editor



A UNIQUE APPROACH TO EDP EDUCATION

For the past sixteen years, Detroit Michigan has been the center of a unique educational venture, with business, industry, and university joining to provide unrestricted university-level courses for the man who wants to know more about the business/industrial complex in which he functions.

The computer personnel gap is widely bemoaned. Technology may work ahead in a vacuum unless something is done, state the doomsayers. But training is expensive and employment musical chairs the order of the day; just as you get a man trained, he moves.

The problem is well documented. The solution, obvious: more and more education. In fact, today, education keynotes discussions from cures for poverty to producing more automobile mechanics. In response to demand, educational institutes packaged as Project Head Start, graduate schools, the Job Corp., junior colleges, home study courses, organization seminars, and private trade schools are sprouting across the country. All serve worthwhile purposes. But a yawning chasm still exists, because, for all the proliferation, little except adult education classes, where learning is geared to fun and personal fulfillment, offer flexible, open-ended education—education to learn, not necessarily to earn a certificate. For the working adult, whose prime objective is increasing his professional strengths, starting from a previously acquired base of knowledge rather than from "beginning principles," there is little opportunity. The primary avenues open to him are on-the-job training and, occasionally, a chance to grab at the gold ring of company-sponsored classes. Otherwise it is catch-as-catch-can, a desert with infrequent oases.

Business people are often too caught up in the ebb and flow of the daily cycle to be actively concerned with the lack of practical, professional, after-hours education. Not so the university student, who, with growing awareness of the paucity of "open" courses in his own bailiwick, is taking matters into his own hands. The result is the "free university," where anyone who wishes may drop in on lectures and discussions on subjects from the exotic (Zen Buddhism) to the practical (How to Start Your Own Business). For business people, such a loose set-up is impractical. Students are already in the academic environment; they have only to cross campus to attend. Nonetheless, the idea has merit: a school whose objective is to offer courses in a diversity of areas, at times convenient to its students, instructed by men daily involved in consideration of their subject and in which entry is restricted only by individual interest, allowing course content and level of sophistication to develop naturally. Long before the free university came to the fore, just such a function was spelled out for those employed in management, supervision, and technological positions as the role of the Applied Management and Technology Ctr. of Wayne State Univ., Detroit, Mich.

PHILOSOPHY

AMTC, borne of need out of foresight, came into existence in the spring of 1952 as a division of the School of Business Administration, of the then city college, Wayne University. In 1953, the first year of operation, course offerings were sparse, as were initial facilities—three rooms in an old house on university grounds. But the philosophy on which the Center's establishment was based was designed to insure success. The stated purpose was to develop a comprehensive program of practical, after-hours courses for individuals working in the areas of management, supervision, science, engineering, technology, and general business, with the objective of upgrading industry-based students through a program adaptable to the needs of the diverse businesses of the community. The courses were to be self-contained, leaving an individual free to elect as many or as few as he required. The program was to be flexible, allowing inclusion of new courses as new developments or demands required. The sessions were to be oriented toward problem-solving rather than toward teaching students a trade. Facilities were to be informal and to include modern audio-visual aids. Grading was to be essentially eliminated on the assumption that no one ever completely fails. Instead of "text-book" instructors, the faculty was to be comprised of individuals successfully working in the field in which they were to teach. Prerequisites were to be minimal or non-existent,

leaving the Center open to all who might wish to apply. Classes were to be small, from ten or fifteen to twenty-five students per section.

As a result of putting these ground rules into practice, AMTC has become an integral part of the Detroit business scene. How AMTC began, where its financing comes from, who its teachers are, how the program developed, and other aspects of the operation should be of distinct interest to the data processing community. For the Detroit AMTC experience suggests that such programs could be successfully initiated in other metropolitan areas, offering, as does Detroit, a wealth of well-attended EDP courses along with courses in other disciplines designed to meet the needs of the area's business community.

HISTORY

AMTC came into being in the spring of 1952, the brainchild of the man who has been its director ever since, Dr. Spencer Larsen. Initially classroom space and hence staff and enrollment potential were limited. The first offering of sixteen distinct subjects, in February, 1953, was heavily concentrated in the area of materials management and handling. As word of the program spread bringing demand for an enlarged curriculum, the Center began its trio of space-imposed moves, at the same time expanding operations to what are now eleven suburban high school locations, each with a curriculum specifically designed to suit the needs of area residents. Throughout the early years, pupil enrollment grew from an initial 610 to approximately 6000 students currently, as did the number of class sections, from 23 in 1952-53 to approximately 350 today. Recently the Center settled down in its permanent home located in the city's midtown business district and minutes away from the University's main campus. Here classrooms are set up in conference fashion, with students ranging around large tables, so that the whole resembles a business meeting. The objective is to break down barriers established by formal classroom arrangements and open sessions to discussion and consultation.

FINANCING AND THE BUSINESS COMMUNITY

A crucial aspect of any new program is financing. As part of a major university, it would be expected that at least a portion of AMTC financing would come from that source. Furthermore, tuition would be expected to meet another large part of total expenditures. But that is only a part of the AMTC story. From its inception, the Center has had the full cooperation of a list of 91 business and industrial firms, both local and national, who make their homes in Detroit. Now listed as Founders in the Center's catalogue and no longer solicited for funds, these firms initially contributed heavily to Center support and were largely responsible for its ability to function in the lean early years. In 1952-53, the first year of operation, 21% of revenue came from tuition, and another 7% came from the University in the form of space and services. But the bulk of support, 71%, came from industrial grants. By the next fiscal year, the need for outside support dropped, accounting for only 55% of the operating budget; and by 1958-59, grants fell to 6%. A measure of the acceptance of the AMTC role in the community was indicated by the increased business support in the year 1960-61. When student tuition dropped 5% over the prior fiscal year, business and industry stepped up their contributions from the previous year's 10% to 19%.

For the past eight years the Center has been largely self-supporting, the bulk of its funds coming from tuition, with some support from the University and some from the State Office of Education (Wayne University changed from a city to a state college in 1956-57). Yet the Founders, though unsolicited, continue to make voluntary contributions as a mark of their esteem for the Center program.

As one individual close to the heart of operations commented, "The organization couldn't have made it without an expert fundraiser." True enough. But funds alone don't make an educational institution. The Founders knew this. Thus, aside from direct financial contribution, the city's businesses encourage qualified employees to teach at the Center, publicize the school program within their organizations, and contribute time and energy to the various committees which assist in Center operations. Instructors, whom AMTC pays by the classroom hour an amount commensurate with the level of professional talent it hires, are listed in the school catalogue published each fall. The list is lengthy—over 200 names in the latest issue—and impressive. Each name is followed by an enumeration of degrees held, job title, employer, and, in the majority of cases, a telephone number where the instructor can be reached for consultation.

CURRICULUM

Today there are 22 major catalogue headings which broadly cover the Center's 165 courses. To insure that each curriculum adequately reflects the changing needs of the business community, each grouping has a curriculum advisor who is required to teach at least one section in addition to his duties as curriculum overseer. Thus the AMTC program is both governed and taught by men intimately involved in their particular discipline. Because of this, new developments in any given area can be quickly and authoritatively

turned into new courses, while emphasis on those which are outmoded or of declining interest can be readily adjusted. As an example of program flexibility, the 1968 catalogue listed 23 new courses in a special pink centerfold, designed to call them to the immediate attention of those familiar with previous listings. Of these, six were in the area of data processing. These were:

Visualizing Computer Fundamentals–designed to dispel the computer mystique to the newcomer to EDP;

PL/1 Advanced–a continuation of a previously offered PL/1 course;

BASIC for Time Sharing;

Computer Language Workshop–an advanced course for individuals seeking practical experience in working with COBOL;

Real-Time Systems–Advanced Concepts; and

Simulation–a computer approach to decision-making with a prerequisite of basic programming skills, preferably FORTRAN, and intended to teach management personnel basic procedures in decision-making with the aid of computer simulation.

Computer or related courses not only accounted for over 25% of the new courses in 1968, they also constituted approximately 15% of the total offerings of the Center and were given to 1/6 of the student enrollment. (In 1967-68 there were 56 computer sections with total enrollment of 990 students, including 158 women, the majority of the school's female enrollment.) The computer curriculum also contained the most frequently-offered course: *Introduction to Computers and EDP.*

Enrollment in a session (all of which meet once a week for twelve two-hour periods, either evenings or Saturday mornings) requires simple one-way mail communication: the student forwards his tuition along with a completed admission form from the readily available class schedule, and thereafter is considered enrolled. Those in need of help may obtain guidance by calling the Center Director or Assistant Director or by contacting an instructor.

Tuition for the 1968-69 school year is $45 per class, except in special instances, such as the Computer Programming Workshop where the fee is $74. Companies may request an in-plant class section to train their own personnel with no advance in tuition. Refunds in full are available if requested in writing prior to the third class session.

Once a class has begun, little is made in the way of formal demands. The Center's objective is to offer meaningful courses to those who want to learn, with emphasis on the working man, not the recent high school graduate. Thus, policing activities are kept to a minimum. Students are expected to attend 75% of their class sessions to receive a "complete." Students are advised to purchase recommended texts, selected and used at the discretion of the instructor (both city and university library facilities are available for additional reference). However, prerequisites are kept to a minimum and may be waived with the instructor's consent; the use of regular examinations, or in fact any examinations at all, is left to the discretion of the instructor. Grades are played down–those who do not meet minimum attendance requirements are simply marked "incomplete." A student who drops out after the third session may return, without additional payment, to complete the course at a later date. No one "fails." The assumption is that everyone gets something out of a course, depending upon his particular background and interest. At AMTC, the emphasis is on learning and doing, not on passing judgement.

Although AMTC is not "degree-centered," it does encourage students to follow through on an educational program specifically designed to meet their own long-range goals. In recognition of this use of the Center, foundation courses are offered in such areas as mathematics and statistics, physics, chemistry, psychology, sociology, government, English and communications, and business and industrial organization. Further, various Certificates of Attainment are available to those who notify the Center of their eligibility. A Certificate of Attainment is available after six courses, a Major Certificate after twelve courses, and an Associate Certificate after eighteen courses and the passing of a final oral and/or written examination administered by a representative faculty committee.

From an organization dedicated to education for the sake of learning, not for recognition, certification might appear out of keeping. Certainly the possibility exists that some individuals, particularly those who feel pressured by company emphasis on continuing education, will follow through on a course of studies primarily for the "paper." Nonetheless, given a society which expects "recognition" for educational accomplishment, the Center stands out. It offers attainment awards as an option rather than as an ultimate goal. Even with the "paper," the emphasis remains with individual incentive to learn.

CONCLUSION

AMTC has a broad base of business and industrial support in the Detroit metropolitan area and even beyond because it provides local businessmen with what they want. It also has wide acceptance among its student body, many of whom feel it has influenced their job advancement. Certainly AMTC has its problems. For example, in common with every educational institution, the Center shares the concern that although it is possible to evaluate an individual's potential as an instructor in terms of his past experience, it is difficult to judge his ability to teach. But, here as elsewhere, attempts are being made to minimize the difficulty–through staff meetings, through student critiques, and by leaving the advisors' doors open to students and instructors alike.

Overall, AMTC is a success. To date three schools, the University of Missouri, the University of Wisconsin at Milwaukee, and Oakland University, Rochester, Michigan have initiated similar programs, each geared to its own locale. More are needed. The data processing industry and its users, involved as they are in seeking solutions to problems in a multitude of disciplines, could well give the initial push toward similar programs across the country. The reward is in better-educated, better-motivated personnel, with the bonus of a better-educated public, as individuals in other areas come to sample what the computer world has to offer. ►

NEW PRODUCTS

MODEM

The DCM-151 modem connects directly to private or leased voice-grade telephone lines up to a distance of 5 miles. Full-duplex operation with Teletypes is available on a four-wire connection; simplex operation with Selectric terminals on a two-wire connection. The device is designed for economic data transmission up to 150 Baud between building or user areas in an industrial complex, university campus, or computer-aided-instruction system. Data input/output levels comply with the EIA RS-232B specification, and the frequency shift keyed tones are transformer-coupled to the transmission lines. The DCM-151 is compatible with, and is a functional replacement for, the IBM Limited Distance Line Adapter, Type 1A or 1B. Price of the unit is $349: monthly rental is $15. *Anderson Jacobson, Inc., Mountain View, Cal.*

Circle No. 182 on Inquiry Card.

DATA ACQUISITION AND CONTROL SYSTEM

COMPAS, a completely pre-programmed data acquisition and control system, can be leased for one year at $1,969 per month with 90-day delivery. Previously these systems, which are used to gather and then transfer process information in digital form for real-time computer control, were only available for purchase on a custom system basis. The COMPAS system will include SEL's 810B 16-bit computer with an application-oriented operator's control panel, a complete low-level "Accurelay" analog input subsystem, contact sense digital inputs, electronic switch digital outputs, analog control outputs, and an ASR-33 Teletype. The 810B provides 8,000 words of core memory with a full cycle time of 750ns. *Systems Engineering Laboratories, Fort Lauderdale, Florida.*

Circle No. 212 on Inquiry Card.

MASS STORAGE TAPE MEMORY

A magnetic tape unit for use with the recently-announced Datapoint 3300 time-sharing data terminal is capable of storing 800,000 characters in replaceable cassettes. The 3300T magnetic tape unit is essentially a cartridge tape transport with storage buffer and the controls needed to provide on-line data storage, off-line message preparation, high-speed off-line message retrieval (either forward or reverse), on-line transmission, and editing capability. In use, the 3300T unit is located immediately adjacent to the Datapoint 3300. The combined system retains all the features associated with the Datapoint 3300 alone, which include complete interchangeability with standard TTY equipment, data transmission rates up to 4800 bps (with optional buffer), a flexible 1800-character CRT display, modern styling, and a self-contained solid-state 64-character keyboard. *Computer Terminal Corp., San Antonio, Texas.*

Circle No. 193 on Inquiry Card.

SINGLE-STATION CRT

A new "stand-alone" version of the NCR 795 data display terminal has its power supply, logic, keyboard, and screen in a self-contained unit. Designated the NCR 795-620, the terminal is priced at $8,750 and may be used with the NCR794-640 teleprinter, which is $1,750. *The National Cash Register Co., Dayton, O.*

Circle No. 205 on Inquiry Card.

DATA ACQUISITION SYSTEMS

VIDAR 5400 Series digital data acquisition systems are assembled from off-the-shelf instrument modules, each of which plugs into the next unit with a single "data-bus" cable. Up to 1,000 data-input channels are accommodated with scanners which expand in 10-channel increments. Data inputs can be DC, AC, resistance or binary-coded decimal. Output is encoded in computer-compatible format on punched or magnetic tape, or printed by teletypewriter or on paper tape. Options include analog-display modules, system digital displays, and digital limits comparators. Prices start at $4,500. *VIDAR, Mountain View, Cal.*

Circle No. 234 on Inquiry Card.

COMPUTER ROOM PLANNING KITS

Two new scale model planning kits are available for computer room planners. The 360 kit, consisting of 35 items, is designed for concerns planning new installations. The models are scaled ¼″ = 1′0″ and sell for $59.00 with a planning grid board. For larger installations, a 65 item kit is available for $99.00. *"Visual" Industrial Products, Inc., Oakmont, Pa.*

Circle No. 207 on Inquiry Card.

NEW PRODUCTS

DATA ACQUISITION SYSTEM

The Redcor RC785 computer-controlled data acquisition system is centered around Redcor's 16-bit (8K memory), 860-nanosecond, real-time digital computer. The system includes a 32-channel front end, an IBM compatible magnetic tape transport, a system control panel, an ASR 33 Teletype, and complete operational software, including FORTRAN IV, data acquisition executive, calibration histogram, and peripheral handlers and diagnostics. The RC785 can perform real-time data editing and compression in the form of limit-checking and peak and slope detection, with subsequent output to magnetic tape. Taped data can be subsequently analyzed either by the RC785 processor or by the facility's digital computer center. *Redcor Corp., Canoga Park, Cal.*

Circle No. 216 on Inquiry Card.

TYPEWRITER-TO-TERMINAL CONVERTER

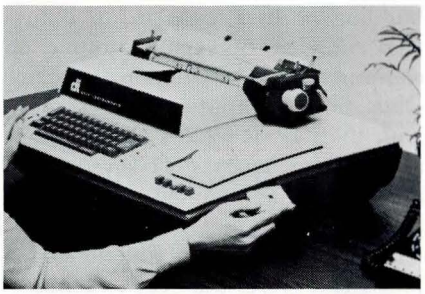
An inch-thick baseplate, connected to a small logic console and inserted between the base cover and printing mechanism of an IBM Selectric typewriter, enables the typewriter to transmit and receive ASCII, EBCDIC, or Selectric codes at speeds up to 175 wpm. The Tycom unit operates over any two-wire system, and accommodates all functions of the Selectric, including remote tab set and clear, and operation of the five IBM Typamatic keys. An optional paper tape reader and punch may be added. *Terminal Equipment Corp., Pompton Lakes, N.J.*

Circle No. 190 on Inquiry Card.

PLOTTING TELEPRINTER

In addition to providing all the features of a conventional teleprinter, the typagraph terminal is capable of varying character spacing in 0.020" increments under program control. Any character or symbol on the print head can be used for plotting along the actual curve in any direction: up, down, right, or left. Specifically designed for the offices of time-sharing users, the typagraph is enclosed in a teak cabinet. *Typagraph Corp., San Diego, Cal.*

Circle No. 194 on Inquiry Card.



DATA GATHERING SYSTEM

The "Dataplex" system permits secretaries or typists to prepare data for computer input while it is being originally typed, as a byproduct of normal typing duties. The Dataplex terminal contains a modified electric typewriter, a cassette tape recorder, and a telephone coupler. Each key stroke on the typewriter is automatically recorded on the cassette tape. One cassette can normally hold a full day's typing. When the secretary is not typing information destined for the computer, the terminal can be used as a conventional typewriter. The Dataplex processor is the recipient of all cassettes created by up to hundreds of remotely-located terminals. The processor consists of an automatic cassette reader, a small computer, an input/output writer, and a computer tape drive. Using proprietary FORMOL (FORMat Oriented Language) software, the processor re-organizes, edits, and formats raw cassette data into computer-compatible tape. The Dataplex processor will rent for $695/mo.; terminals will rent for $84/mo. *Data - Instruments Co., Sepulveda, Cal.*

Circle No. 192 on Inquiry Card.

SEMI-TELETYPEWRITER

A specialized hard-copy, send-only semi-teletypewriter for $250 each in OEM quantities uses a proprietary, coded proximity sensor to generate an 8-bit code. The keyboard itself is a standard 4-row typewriter keyboard with upper and lower case. *Electroterm Data, Levittown, Pa.*

Circle No. 187 on Inquiry Card.

KEYBOARD-TO-DRUM SYSTEM

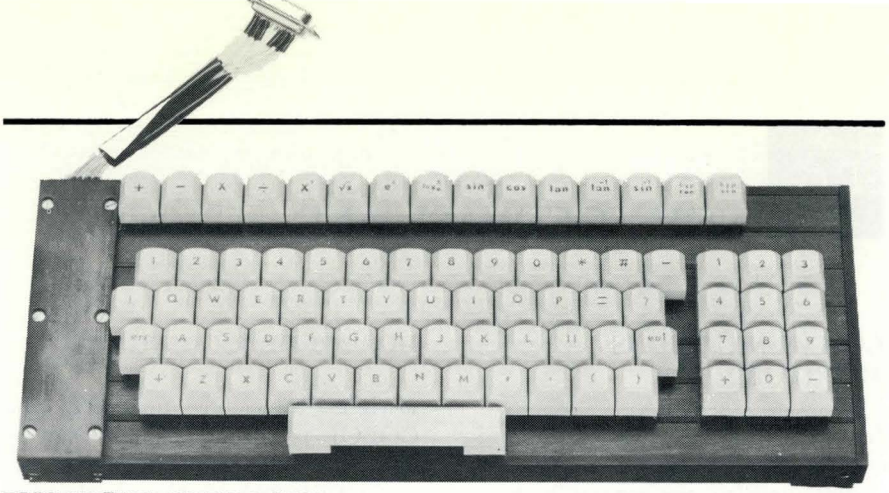
The "key-edit" data preparation system uses a multiple control CPU, a high-speed temporary-storage magnetic drum, and a magnetic tape or disk drive to service up to 32 keyboard input terminals. Input data, format information, and column numbers are displayed in "letters and figures" at each operator station, and check digit calculation and batch totalling capabilities are standard. Automatic pooling is achieved since the files are stored on the drum until released to the tape or disk pack for processing. *Consolidated Computer Services, Ltd., Toronto, Canada.*

Circle No. 189 on Inquiry Card.

MEMORY SYSTEMS

Designated the ALPHA 10.2 and ALPHA 12.2 memory systems, these units consist of basic modules of 1024 to 40,960 bits with expansion to larger capacities through the use of multiple modules. Cycle times are 1.50 microseconds for the ALPHA 10.2 which has a maximum module size of 1024 x 10, and 1.75 microseconds for the ALPHA 12.2, with module capacities to 4096 x 10. Packages employ 23 mil cores, three-wire 3-D organization and integrated circuits except for final drivers and selection. The ALPHA 10.2 and 12.2 require 65 and 130 cubic inches, respectively, for complete memories including registers and temperature compensation regulator for the memory drive voltage. Only silicon semiconductors, none in plastic packages, are used. *TETRA Corp., Minneapolis, Minn.*

Circle No. 230 on Inquiry Card.



ENCODING KEYBOARD

A completely assembled, fully encoded keyboard is being offered in volume at a cost of $68.00 for 65 key positions with no additional set-up charges. Besides low cost, the new keyboard is flexible with respect to the number of keys, row-to-row alignment, field selection, key style, key stroke, code selection, logic levels, and check bit; and is offered with self-cleaning gold-impregnated contacts. *Synergistics, E. Natick, Mass.*

Circle No. 195 on Inquiry Card.

CARD SET MEMORY

A 72-inch^3 memory system consisting of plug-in cards has a memory capacity of 160 words by 8 or 16 bits per word. Designated the CM-1 Series, the memories feature an access time of 2 ms and low temperature coefficient cores. Address decoding, drive circuits, timing, data logic and temperature compensating circuitry are all included. *Ferroxcube Corp., Englewood, Col.*

Circle No. 210 on Inquiry Card.

MAG TAPE UNIT

The 6x40 magnetic tape unit features a read-after-write dual stack head, speeds of up to 37.5 ips, and a rewind speed of 150 ips. The unit can be ordered either in 9-track, 800 bpi or 7-track dual density configurations, and is compatible with the IBM 729 and 2401 (Model 1) and IBM 2415 (Models 1-3 and 1-6). *Peripheral Equipment Corp., Chatsworth, Cal.*

Circle No. 240 on Inquiry Card.

NEW SOFTWARE AND SERVICES

COMMUNICATIONS MONITOR

Intercomm is a software communications monitor designed to allow S/360 users to convert easily from batch processing to an on-line communications environment. It offers centralized control of multiple on-line application programs in COBOL, BAL, PL/1, FORTRAN, ALP, or RPG, and is said to take full advantage of the IBM 360's hardware features, the data management capabilities of OS and DOS, and the access techniques provided by BTAM and QTAM. In addition to handling all I/O and teleprocessing duties, Intercomm performs the task of scheduling and overlapping all processing programs as they are required. These processing programs may or may not reside in the main storage area and can be called upon according to a predefined priority sequence. *Programming Methods, Inc., New York, N.Y.*

Circle No. 236 on Inquiry Card.

ACCOUNTS RECEIVABLE

A new accounts receivable system, A/R-70, can specify either the Open Item or Balance Forward method of accounting by individual account. A/R-70 can be operated on any IBM System/360 with a minimum of 32K core, under either DOS or OS operating systems. The system generates five comprehensive reports including an Edit Report, Accounts Receivable Posting, Aged Trial Balance Report, Past Due Listing, and a Customer Status Report. An additional capability of A/R-70 is the generation of customer statements on an Open Item or Balance Forward basis. The system is priced at $16,000, which includes documentation, installation, and four days of on-site support. *National Software Exchange, Inc., Great Neck, N.Y.*

Circle No. 285 on Inquiry Card.

DOS-360 DEBUGGING AID

Designed especially for BAL and COBOL programmers frustrated by data exception errors while testing, the DEEP/360 support package is said to eliminate premature job cancellations caused by invalid data. DEEP/360 "repairs" faulty data, re-executes the affected instruction, reports the action via console messages, then continues with the user's program. The purchase price of $225 includes a BAL source listing, a job stream for cataloging DEEP/360 into the user's relocatable library, and operating instructions. *Macro Services Corp., Boston, Mass.*

Circle No. 237 on Inquiry Card.

INFORMATION RETRIEVAL PACKAGE

RAPS, for Retrieval Analysis and Presentation Systems, combines high-level retrieval and reporting capabilities with mathematical calculations. The basic 32K system contains two special-purpose compilers which tranform RAPS language statements into retrieval programs, sort parameters, and output programs. The output program is compiled from RAPS language into FORTRAN source code. *Leasco Systems and Research Corp., Bethesda, Md.*

Circle No. 297 on Inquiry Card.

PROGRAM EVALUATOR

System 6403, a new proprietary software system for the analysis and optimization of computer programs, predicts a program's performance by determining the mean value and standard deviation of its running time, and its core and channel utilization. *Data Systems Analysts, Inc., Philadelphia, Pa.*

Circle No. 242 on Inquiry Card.

RPG AID

A new documentation package is said to allow any third generation RPG program to be translated into easily understood English cross reference lists. "AID" features English descriptions of file definition specifications; cross-referenced lists of datanames and labels; alphameric, hexadecimal, and numeric literals; and a cross-referenced list of all indicators. Although "AID" is designed for IBM System 360 Mod 30 DOS, it is also available on a service basis. *Data Management Concepts Inc., Chicago, Ill.*

Circle No. 272 on Inquiry Card.

MATERIAL CONTROL SYSTEM

A system designed to operate on an IBM 360 utilizes a materials data bank in apportioning available production materials to planned production needs. Through the use of a manufacturing delivery plan and bills of material, requirements are scheduled into weekly time periods. Each week, pick lists are generated for the stockroom to use in issuing specified materials and quantities to production. *Chilton Computer Co., Dallas, Texas.*

Circle No. 287 on Inquiry Card.

DIGITAL FILTERING

DIGIFIL, a software package for digital filtering, generates the parameters for lowpass, highpass, bandpass, and band-reject digital filters. The package is said to have applications in acoustics, process control, analysis of geophysical data, radar, telecommunications, and general data reduction. It digitally duplicates the characteristics of certain important classes of electrical or electronic circuits so that their equivalents may be implemented on a computer. DIGIFIL will operate on most computers having FORTRAN II or higher level compilers. *University Software Systems, Los Angeles, Cal.*

Circle No. 274 on Inquiry Card.

CUSTOMER/VENDOR FILES

"CUSTOMER LIST" consists of two programs written in IBM 360-COBOL. The package will operate under DOS or OS with a minimum of 32K, and requires a reader, printer, and two storage devices. The system will create and maintain files which allow for a six line address, area code and telephone number, and a history section. Users may specify up to ten selection codes for each record which may be used for label printing. The programs are fully documented and supported. *Automated Information and Management Syst., Inc., Cincinnati, O.*

Circle No. 273 on Inquiry Card.

GUIDANCE PROGRAM

An "Interactive Occupational Exploration System" is intended to help students explore occupational possibilities. Access to the computer data file is by means of a standard teletypewriter located in the guidance office. The data file contains occupational information coded from the U.S. Department of Labor's Dictionary of Occupational Titles. The student inputs characteristics which are important to him in choosing a job, and the computer responds with a correlated list of occupations. *Interactive Learning Systems Inc., Boston, Mass.*

Circle No. 289 on Inquiry Card.

ON-LINE DEBUGGER

XBUG is a utility program that enables users to debug 360 assembly language programs on-line. The package runs on any DOS configuration. By typing in commands at execution time, the user can create breakpoints, interrogate registers and core locations, change register and memory contents and alter program flow. XBUG interrupts cancel routines to transfer control back to the user on program checks, etc. The XBUG package is priced at $1,000 with additional copies at a lower price. *Mandate Systems Inc., New York, N.Y.*

Circle No. 288 on Inquiry Card.

OPERATIONS SCHEDULER

DEADLINE! a software system developed specifically for planning and scheduling computer center operations, evaluates equipment and configuration alternatives and determines whether established deadlines can be met under varying workloads. The system can also be used to evaluate staffing level, shift, and overtime alternatives. Additional capabilities include multi-processing scheduling, consideration of primary and alternate equipment availabilities, consideration of inter-job dependencies and inherent physical delays, leveling of machine and manpower requirements, and several unique schemes for handling job priorities and updating schedules. DEADLINE! is offered on a purchase or lease basis with single computer center purchase rights at $7,000. *Synergistic Cybernetics Inc., Alexandria, Va.*

Circle No. 245 on Inquiry Card.

NEW LITERATURE

VOTE COUNTING SYSTEM

Illustrated brochure describes the VOTRONICS electronic vote counting system and explains how it can be used in small school elections or with high-speed computers for large elections. *Cubic Corp., Votronics Div., San Diego, Cal.*

Circle No. 305 on Inquiry Card.

BUSINESS COST SURVEYS

"The Cost-of-Doing Business" is the title of a brochure which describes a new survey approach to gathering and analyzing cost data. "Cost-of-Doing Business" studies compile data on a specific industry and are used by members of that industry to gauge their performance. *Resource Mgmt. Corp., Bethesda, Md.*

Circle No. 316 on Inquiry Card.

COMPUTER ROOM CARPETING

The feasibility of utilizing shockfree carpeting in computer room installations is explored in a new market information bulletin. The bulletin answers such questions as: "Why use carpeting in computer rooms?" and "What is the sensitivity range of computers?" *Brunswick Corp., Chicago, Ill.*

Circle No. 318 on Inquiry Card.

PROGRAM ROYALTIES

Bulletin describes a unique arrangement whereby authors of computer programs are offered an opportunity to make their programs available for on-line use and collect royalties based upon the rate of usage. *Remote Computing Corp., No. Hollywood, Cal.*

Circle No. 319 on Inquiry Card.

TAPE SEALS

A complete line of seals for magnetic tape reels is described in a four-page brochure. The top-of-the-line "Data Seal" features a stainless steel retention slide, which maintains the seal's circular form; and a "fail-safe" lug, which is said to eliminate completely the possibility of tape falling from the seal even in the event of band fracture. *Engineered Data Products, Inc., Ferndale, Mich.*

Circle No. 314 on Inquiry Card.

DATA BANK PROGRAMS

The "DCS/MIP" (Dynamic Computer System Multi-purpose Information Processor) is described in brief text and several explanatory illustrations in a six-page color brochure. DCS/MIP is a set of System/360 assembler language programs which provide for creating, maintaining, retrieving, and selecting records for a data bank. *Dynamic Computer Systems, Houston, Tex.*

Circle No. 320 on Inquiry Card.

NEW LITERATURE

VISUAL CONTROL SYSTEMS

A 28-page illustrated catalog and price list describes full line of magnetic, visual control systems. Magnetic symbols are provided for EDP and PERT flowcharting, programmer scheduling, and EDP installation layout. *Methods Research Corp., Staten Island, N.Y.*

Circle No. 306 on Inquiry Card.

MEMORY PRODUCTS

Descriptions and specifications of the complete line of Ampex magnetic tape drives, core memories, and memory components for computer manufacturers and users are contained in new quick-reference pocket catalog. *Ampex Corp., Redwood City, Cal.*

Circle No. 304 on Inquiry Card.

TIME-SHARING SYSTEMS

General Electric's family of GE-400 time-sharing systems is described in an illustrated 28-page booklet. Included are sections defining time-sharing, benefits to users, and types of individuals who find it most helpful. The GE-410, -430 and -440 systems are described in detail, and a glossary of time-sharing terms is included. *General Electric Information Systems, Schenectady, N.Y.*

Circle No. 312 on Inquiry Card.

DIGITAL DATA ACQUISITION

"How To Make Measurements Automatically" is the title of a 16-page brochure which compares the costs of automatic data handling with chart recorder/visual/manual methods. *Vidar Instrumentation and Telecommunication Products, Mt. View, Cal.*

Circle No. 300 on Inquiry Card.

PROCESS COMPUTER

A 36-page reference manual covering the Bailey 855 process control computer describes the 25-bit machine's main frame organization, instruction and data format, internal logic control, data paths, and command structure. *Bailey Meter Co., Wickliffe, Ohio.*

Circle No. 303 on Inquiry Card.

ADVERTISERS' INDEX

CIRCLE NO. 31 ON INQUIRY CARD →

360 Programmers get turned on by the INTERDATA Mod 4

Naturally—the INTERDATA Mod 4 has 360/40 performance and programming ease—yet only costs $15,000 for a basic system.

Give it a "programmer's inspection" and you'll recognize the strong similarity with the 360. The Mod 4 can directly address up to 65K bytes of core and provide byte handling for character manipulation. You'll also find a 360 instruction subset tailored to real-time scientific and industrial environment with 16 hardware registers to speed and simplify the program. Any programmer experienced with the 360 can move to a Mod 4 and go right to work.

FIRMWARE makes it happen

FIRMware is the way INTERDATA achieves 360/40 performance by emulating key characterestics through micro-program techniques. *No, the Mod 4 will not accept 360 software directly.* So please don't throw your 360 away. You'll want to keep it for your business needs. However, your industrial, scientific and communications projects belong on the inexpensive INTERDATA Mod 4 or other members of its family.

For the information you need to evaluate INTERDATA computers—use the reader service card or for even faster service, call Tom Dunn collect at 201-229-4040. Who knows, you may get turned on, too.

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The Peripheral People offer

a new, quiet, lightweight portable output device that prints with heat

EM-T1 Thermal Page Printer

The new EM-T1 Thermal Page Printer utilizes a principle developed by NCR which converts electrical signals directly into characters or symbols. Non-impact printing! It prints 300 words per minute with heat. The only noise you hear is the rustle of paper. A five by seven dot matrix head prints 96 alpha (upper and lower case) numeric and symbol characters on a low cost thermochromic paper which won't flake, peel or abrade. You can't smear it, it's insensitive to light and it will reproduce in any common paper copier. The EM-T1 requires only 50 watts power and weighs approximately 10 lbs. It is quiet (including no RFI), exceptionally reliable and amazingly fast.

Unit Features & Specifications

Physical: 11 1/2"W. x 9 3/4"D. x 3 1/2"H. Approx. 10 lbs., no mechanical printing elements.

Code Format: ASCII Serial Input (Parallel and additional codes available).

Line Length: 80 columns.

Electrical: 50 watts operating, 16 watts idle; 115 VAC, 50-60 Hz; 230 VAC, 50 Hz.

Speed: 300 words per minute, 30 cps.

Applications: mobile communications; fixed and portable terminals; communications printing; small systems page printer; output writer for computer consoles.

For more information, write for EM-T1 spec sheet.

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