MODERN DATA

august 1971

product profiles:

magnetic tape transports

graphic digitizers

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Varian's new 620/L has a dramatic price/performance ratio that gives more computer in less space at lower cost. The 620/L is an advanced design of the reliable, field-proven (over 1300 installed worldwide), systems-oriented 620/i computer.

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varian data machines

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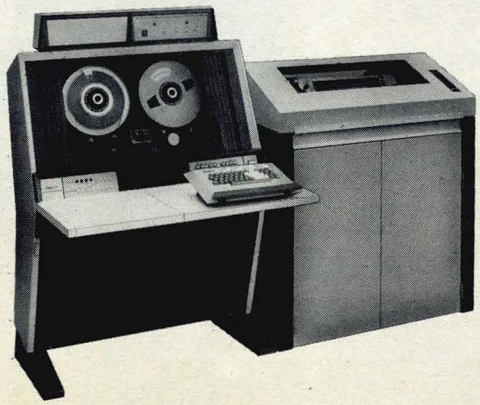
Your branch office operations can have home office computer efficiency with the new Tally Datascribe key-to-tape communication and line printer system.

You can cut data input and output costs to the bone with Datascribe... a total data entry, communication, and hard copy printout system.

A Datascribe communicator and line printer in each branch office location eliminates the keypunch bottleneck at the central computer site. Data prepared at the remote location can be transmitted at high speed to the computer, and processed data returned via telephone for hard copy printout at 600 lines per minute.



Typical Printer—Datascribe configuration

As a bonus, to keep line charges low, Tally uses a unique data compression technique that typically cuts line time by two-thirds by achieving 3600 Baud efficiency over 1200 Baud lines. Error checking routines and unattended answer are standard features.

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8301 South 180th Street, Kent, Washington 98031. Phone (206) 251-5500. Regional offices in Chicago (312) 298-6710 · Dallas (214) 358-3135 · Los Angeles (714) 542-1196 New York (516) 678-4220 · Phoenix (602) 944-4491 · Richmond (703) 231-0259 · San Francisco (415) 989-5375. Abroad in London and Frankfurt.

CIRCLE NO. 2 ON INQUIRY CARD

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In it, we ingeniously used 8″ of spring steel to provide uniform tape tension no matter what the buffer arm position, thus eliminating tape cupping and the resultant data dropout.

We've cleverly developed a rigid, one-piece tape deck panel that never gets out of alignment.

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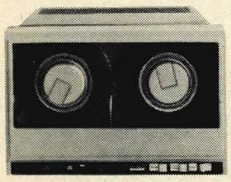
Then we wrapped up all this thinking in our BI 2600 Mag Tape Unit: Precise bidirectional tape travel at 4 to 37.5 ips, with a maximum data transfer rate of 60 kHz. Uniform packing densities up to 1600 bpi. A tape path completely to IBM specifications. 8½″ reels (also available as our Model BI 2610 with 10½″ reels). Industry compatible interfaces. High reliability with plug-in DTL/TTL electronics that have no one-shots and no differentiators. No program restrictions, no delays under any circumstances.

The only buffer arm mag tape units that can't cup your tapes.

Bright? Right.



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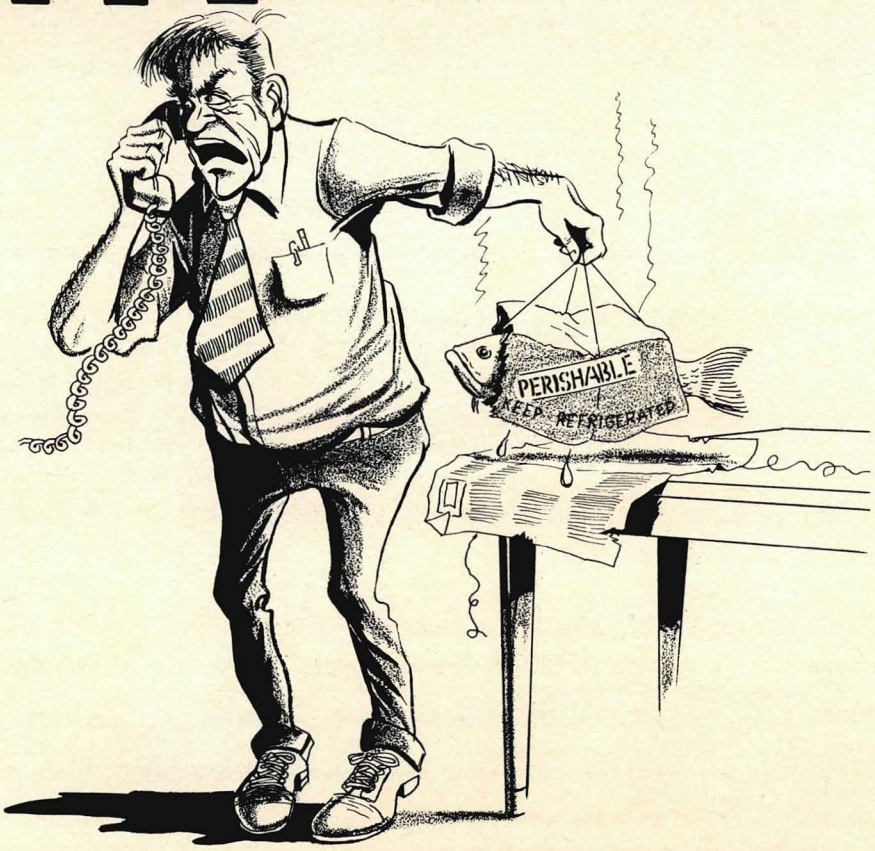
MODERN DATA

AUGUST 1971 ■ VOLUME 4 ■ NO. 8

a thought about you...

ANGRY



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Ultronic Videomaster® compatibility doesn't stop there. All Videomaster equipment transmits USASCII code. The serial I/O interface conforms to EIA Standard RS-232C. Which means compatibility with just about any computer system out there.

The Videomaster comes as a stand-alone terminal, or as a cluster display system with as many as 24 terminals connected to one master control unit. Display format varies from 240 to 1920 alphanumeric characters on a sharp, clear 12-inch screen. Transmission ranges from 1200 to 9600 baud (depending on your system's capacity and the type Videomaster you need) over telephone lines in a start/stop half-duplex mode. There's even a hard copy printer available that works at 30 characters per second to give you permanent copies directly from the video terminal or computer.

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Until bill time rolls around. And then you'll discover that you've saved from 20 to 50% of the cost of comparable equipment. Without losing any of that big-name dependability or security. Because we have our own nationwide service organization. With trained technicians in 56 cities. So we never have to run very far if you run into trouble.

Compatibility, performance, service and cost. Those are pretty strong reasons for changing to an Ultronic Videomaster. Especially when you remember that we can supply most of your data communication needs. Time division multiplexers, frequency division multiplexers, data sets, video and hard copy terminals, communication processors. Just about anything you need.

Ultronic is the kind of change your system could use.

Call Lee Shrout at 609-235-7300. Or write Ultronic Systems Corp., Box 315, Moorestown, New Jersey 08057

Ultronic Video Terminals

GTE INFORMATION SYSTEMS

CIRCLE NO. 6 ON INQUIRY CARD

Peter Denning joined ACM for technical information and contacts.

Now he's involving other members in everything from microprogramming to data banks and privacy.

Peter Denning, 29, is an Assistant Professor of Electrical Engineering at Princeton. He's also an ACM member and chairman of our committee on special interest groups and committees (SIGs/SICs). He wasn't always as active in ACM.

"I joined in 1965 while working on my thesis," says Peter. "Mainly for technical material and a chance to meet other computer professionals. In 1968, I was asked to edit the Operating Systems (SIGOPS) newsletter. I got involved and quickly took on more responsibility. After two leadership positions, I ran for SIG/SIC chairman.

"Special interest groups are what ACM is all about," says Peter. "We've got 27 now, from microprogramming techniques to the impact of computers on society. One out of three ACM members belong to at least one group. I want this share to grow.

"Now I can do something about it. Like help restructure the whole SIG/SIC operation. Some groups may have to be split up, to cover less ground. Others need stronger leadership. A few we should have don't even exist yet, like performance evaluation and computer architecture."

Peter Denning is involved in ACM, the oldest and most respected association in the computer field. He's advancing his career. Sharing his ideas. And making a contribution to the computer profession.

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codex

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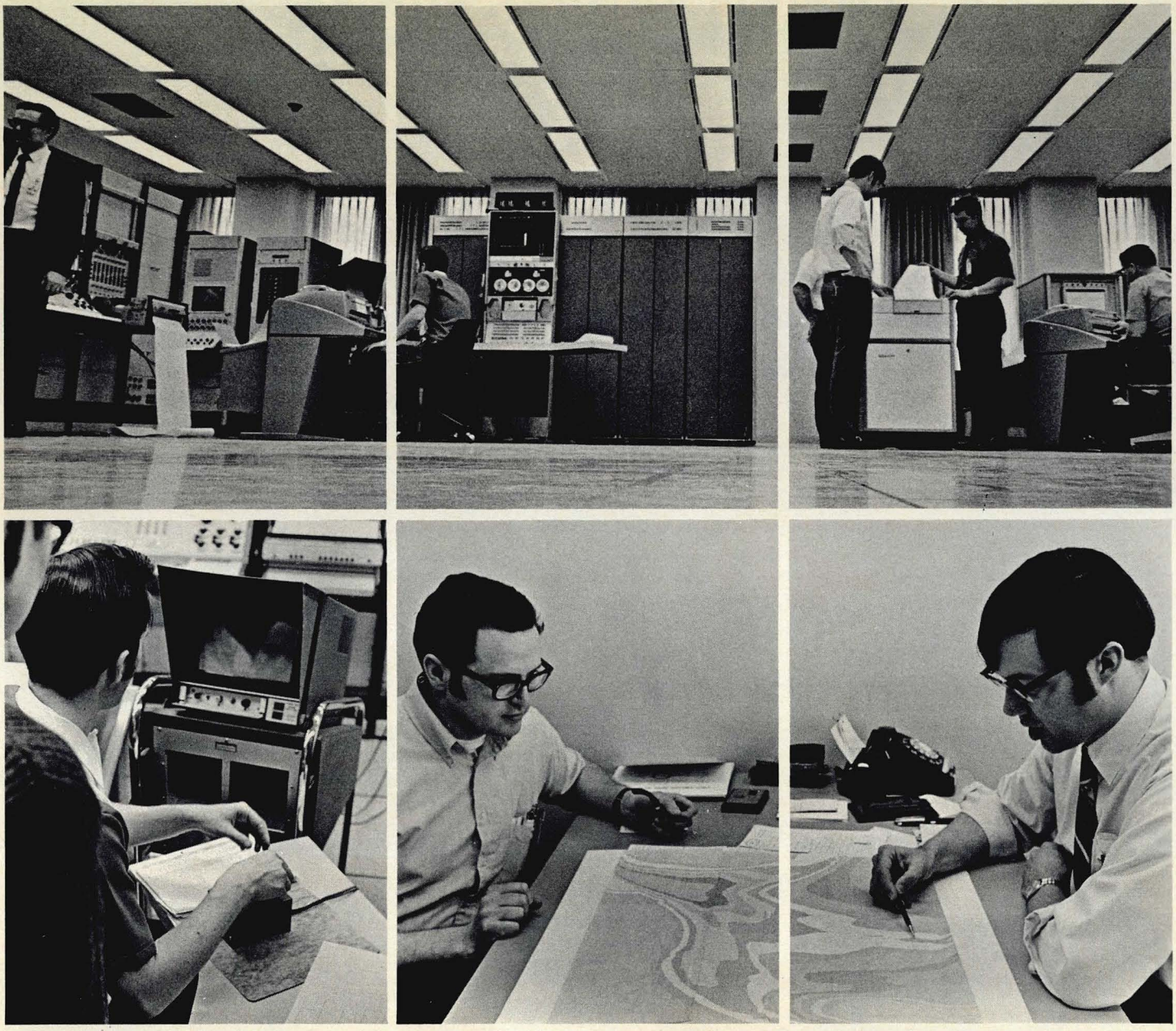


The Gould 4800 helps Battelle-Northwest analyze thermal discharges.

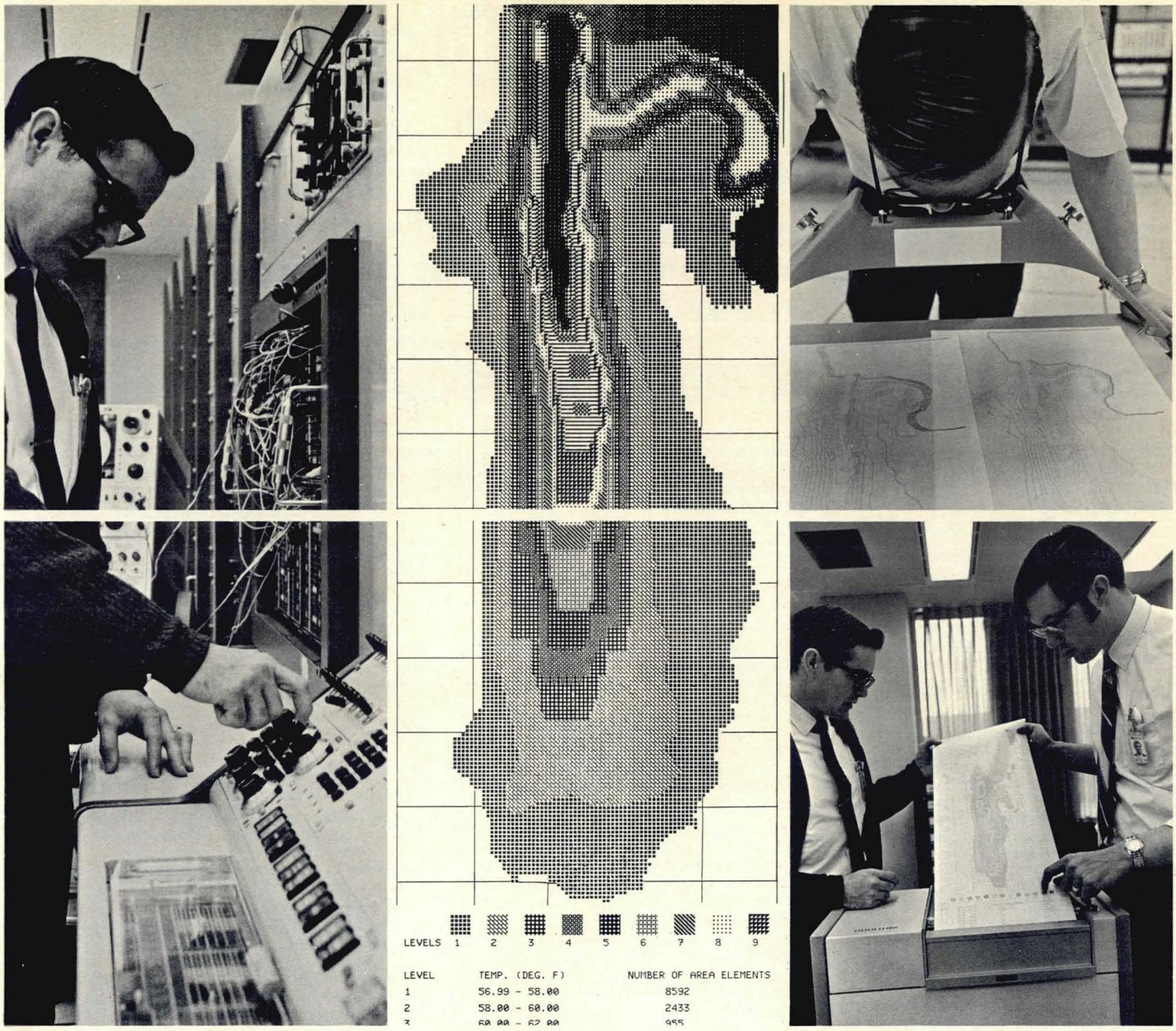
The Gould 4800 high-speed printer is playing a big part in the thermal pollution research being conducted at Battelle-Northwest.

Battelle Memorial Institute, established over 40 years ago, is a not-for-profit research corporation with four major labs and offices around the world. Battelle handles many projects on a contract basis, with heavy emphasis on applied research.

Projects currently underway at Battelle-Northwest in Richland, Washington, include studies that determine patterns of wastewater discharges from industrial and municipal operations and to evaluate their effects on surrounding waters. The research technique, developed by Battelle, consists of collecting aerial infrared and tracer dye imagery of surface water discharges.

Data recorded from the infrared imager is processed by Battelle's computer system, a unique hybrid facility. A Beckman EASE 2133 analog computer is coupled to a DEC PDP 7 digital computer.

The Gould 4800 then prints out isothermal plots, density plots, and contour plots. The contour plots provide two different views.



COMPUTER PRODUCTS

GOULD

Used with a stereoscope, these two views provide simulated three-dimensional temperature contours.

Researchers depend heavily on the Gould 4800's graphics capabilities for output of the simulation and modeling projects. And even with their small computer, they get high speed alphanumerics and graphics.

The Gould 4800 operates with the hybrid system in many other projects at Battelle, ranging from physics to social sciences. In addition, by means of a time sharing system, the 4800 operates simultaneously with an SEL 840 computer for basic math and science calculations.

Battelle's initial investment in the Gould 4800 was less than the cost of impact printer and plotter equipment, and they developed their own interfaces and software for it. Since the 4800 has few moving parts, as well as solid-state electronics, there is also a minimum of maintenance and servicing.

The Gould 4800 high-speed printer. Put it to work for you. Write Computer Products, Brush Division, Gould Inc., 3631 Perkins Ave., Cleveland, Ohio 44114.

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MICROFILM AND ITS APPLICATIONS

CLEVELAND	SEPT. 23
DETROIT	SEPT. 24
MINNEAPOLIS	OCT. 19
MILWAUKEE	OCT. 20
CHICAGO	OCT. 21

CONDUCTED BY:
FREEMAN H. DYKE, JR.

Practical Uses of Microfilming
The importance of microfilming in communication – Selecting microforms – The relationship of microfilm to hardcopy and computer storage – Technical considerations of input and output – Setting standards

Analysis and Evaluation of the Different Types of Microfilm (Microforms), including:
Roll – Cartridge – Cassette – Microfiche – Jackets – Microstrip – Aperture cards – Ultrafiche
Equipment – Methods of input and output – Advantages and disadvantages – Comparative costs – Practical applications

Indexing Microfilm
Arranging the microfilm as the index – Using manual indexes (edged notch cards, uniterm cards, superimposable cards, etc.) – The role of the computer in modern microfilming

Computer/Microfilm Interfaces
Computer Input Microfilm (CIM) – Computer Output Microfilm (COM) – Storage and dissemination

Case Examples of Applying Microfilm in:
Accounting, Maintenance, Engineering drawings, Manuals, Sales, Correspondence, Specifications, Production, Reports and patents, Vendor catalogs

COMPUTER/MICROFILM INTERFACES

DETROIT	OCT. 7
CLEVELAND	OCT. 8
MINNEAPOLIS	NOV. 3
MILWAUKEE	NOV. 4
CHICAGO	NOV. 5

CONDUCTED BY:
FREEMAN H. DYKE, JR.

The State of the Art
Problems of input and output – Discussion of the computer's memory – Improving computer/people communications

Microfilm — Its Role in Handling and Storing Information
Advantages and disadvantages of microfilm
Pros and Cons of various microforms: Rolls, Cartridges, Microfiche, Jackets, Aperture cards, Ultrafiche –
Analysis of advanced equipment and techniques

Computer Input Methods
Punched cards and paper tape – Direct entry – Optical Character Recognition (OCR) – Using microfilm as input to OCR

Computer Output Methods
Remote terminals, printers and photocomposition – Discussion of Computer Output Microfilm (COM): Evolution of the technique – Equipment features – Uses for accounting, inventory control, technical data, publishing and other areas

New and Special Equipment for Various Functions
Storing unitized microforms – Random access to microfilm – Facsimile transmission – Using video tape – Updating engineering drawings

A Look Into the Future of Computer/Microfilm Interfaces

NEW DEVELOPMENTS IN COMPUTER SECURITY

MINNEAPOLIS	OCT. 28
CHICAGO	OCT. 29
DETROIT	NOV. 4
CLEVELAND	NOV. 5

CONDUCTED BY:
DR. BRANDT R. ALLEN

Evaluating and Preventing Exposure to Environmental Dangers
Riot, vandalism, sabotage, national disasters, operational accidents – Special problems of clean uninterrupted power – Air-conditioning hazards

Ensuring Hardware Backup
Availability, compatability, priority planning – Personnel procedures – Measuring costs of delay – Economics of "idle reserve"

Guaranteeing Data Backup
File selection – Storage alternatives and costs – Operating procedures

Ensuring Software Security
Design considerations – Protecting proprietary programs – Using "locks and keys" – Documentation requirements – Program change control – Audit trail preservation

Guarding Against Computer Fraud
Schemes based on input manipulation, program alteration – Master file changes, teleprocessing or multiple means – Areas of greatest exposure – Special problems of teleprocessing

Security Through Operations Management
Hiring, training, separation and rotation – Construction of facilities – File management – Change control – Records management

Internal Audit and Control
Role of the auditor and data control – Control requirements – EDP insurance

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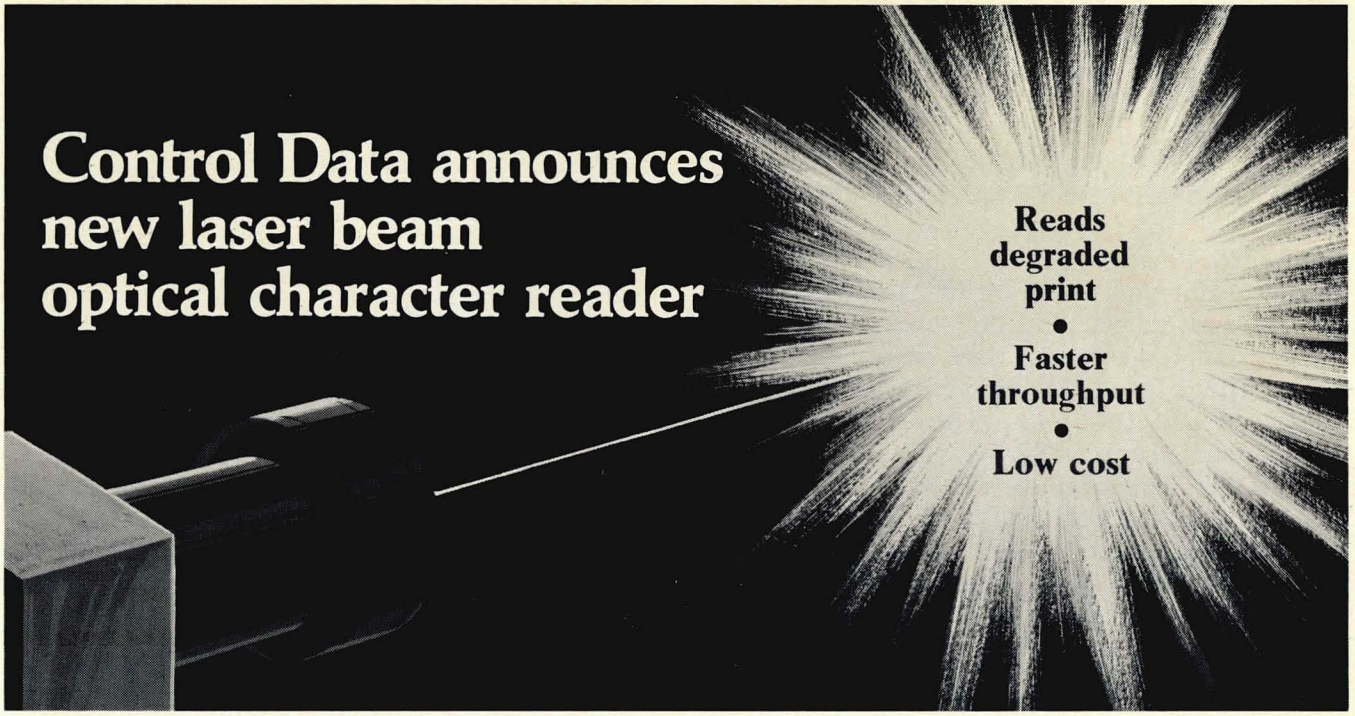
Control Data announces new laser beam optical character reader



Now, for the first time, even data processors with limited budgets can sidestep costly card punching, reduce paper work and cut the risk of human error. Control Data has put the laser beam to work to produce today's lowest cost line of Optical Character Readers (OCR). Units capable of reading even degraded print.

Breaks the $2,000 system barrier

For years OCR has saved substantial time and money for big EDP users. Priced to lease at under $2,000 a month, these new CDC units now make the same economies available for many more applications: retail stores, service bureaus, financial institutions, insurance companies, government organizations.

Reads up to twice as fast as other OCR units

The new Laser Reader processes 1200 documents a minute. It can be equipped for reading any of three different computer fonts. Handles anything from imprinted credit card documents to turnaround billing documents; accommodates sizes up to 4½ by 9 inches.

The new OCR unit is complete in itself; data input is instantly recorded on magnetic tape without need to tie up a central computer system. Control Data also will design and print forms tailored to insure optimum data conversion results from the start.

Broadest family of OCR products

Control Data supplies OCR systems to meet virtually any performance or budget need. Offerings include a versatile combination page and document reader. A unit which reads 90,000 documents an hour. A low-cost reader that can replace up to 90 keypunch stations. And a super-scale system which supplies all necessary input for a data base of 50 million records!

All these OCR systems are backed by fully developed software and a highly specialized sales, analyst and support team. Further information is available by contacting Control Data Corporation, Dept. MD8, Box 1980, Twin Cities Airport Station, MN 55111. Or call our HOT LINE collect:

612/853-3535

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CORPORATION

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NEWS ROUNDUP

IBM EXPANDS MAINTENANCE SUPPORT

IBM's Data Processing Division has announced expanded maintenance support of its teleprocessing systems and adjustments in some maintenance charges and terms for its data processing equipment. The expanded support includes central coordination of IBM's maintenance service — at no additional charge under its standard rental and maintenance agreements — for systems controlled by an IBM central processor that include remotely located IBM teleprocessing equipment. This service will be provided by October 1. In addition, the monthly charges for most optional weekday periods of maintenance — which include service outside IBM's normal working hours — were reduced for purchased IBM equipment, effective July 1. This and other changes are reflected in a revised IBM maintenance agreement. Minimum monthly maintenance charges are not affected. Also effective July 1 were increases in rates for hourly per-call maintenance of equipment and computer programs.

NEW HIS 105 CONVERTS 360/20, S/3 RPG

Honeywell Information System's headlong rush (five new systems in 18 months) into the small-systems market gained significant ground in July with the announcement of the Model 105, an under-$100K (purchase-min. config.), disk-oriented batch system to compete with the IBM S/3 and 360/20. Of particular interest was the disclosure that the 105, which is sandwiched between the HIS 58 and 115 models, will be software-compatible with S/3 RPG as well as S/360/20 RPG. At this writing, IBM still does not provide S/3 users with a vehicle for transferring their present RPG packages to a larger system without reprogramming. Honeywell's director of small systems marketing, Jerry Kantor, stated that initial marketing emphasis for the 105, its RPG compiler, and its "Liberator/20" software would be directed at converting present IBM 360/20 and potential S/3 users — and that present S/3 users were not yet a marketing target. For this reason, only the 360/20 RPG compatibility was mentioned in Honeywell's formal release on the 105. Privately, however, Honeywell marketing V.P.s were eager to discuss the 105's ability to allow present S/3 users to bring their RPG programs over to a very extensive Honeywell 200 line.

SIGNIFICANT TAPE CARTRIDGE

In the absence of clear standards for small magnetic tape transports, new tape cartridges and cassettes for computer peripherals have been turning up with the frequency of a flu epidemic. News of another one, then, would seem to call for the same reaction. Not deserving such ho-hum treatment, however, is news of a cassette/cartridge recently developed by Novar Corp., now a part of General Telephone and Electronics. The Novar cartridge stores 900K bits on 190 feet of 0.15″-wide tape wound on coaxial reels in a 3-⅛″ x ¾″ x 3-$^{9}/_{16}$″ plastic case. Digitronics Corp. likes it so much they have developed a transport for it. The significance, of course, is that Digitronics is majority-owned by North American Phillips Corp. — developer of the closest thing so far to a "standard" mag tape cassette.

LOOKING UP

Indications of better times a-coming have arrived with announcements of several new $multi-million facilities:

- RCA Computer Systems has broken ground in Marlboro, Mass. for a $16 million, 12-story headquarters building that will more than double its capacity (from 1700 to 3700 employees) at that location.

- Memorex is completing the largest construction program in its corporate history. A new 737,000 square foot complex in Santa Clara will house approximately 3,000 employees.

- The Remington Rand Division of Sperry Rand has unveiled plans for a $3 million headquarters facility on a portion of the 148 acres the corporation owns in Blue Bell, Pa.

BITS AND BYTES

"Systems Proficiency" is the theme of the 22nd Annual Western Systems Conference, to be held Oct. 14 in Los Angeles at the Ambassador Hotel. Contact **J.P. Townsend, 714 W. Olympic Blvd., Suite 800, Los Angeles, Cal. 90015** for information.

RCA has announced the development of a classified communications cable system that automatically sounds alarms should an intruder try to tap it to intercept secure information.

NEW SANGAMODEM /4800 bps

Now a synchronous 4800 bps Data Modem with the optimum modulation plan to "fit" a voice facility line (four phase/two amplitude).

Designed to operate over C2 conditioned facilities. However, the integrated switch selectable active equalizer permits back up operation over most DDD lines.

Implementation of the modulation plan assures minimal effect on error performance by phase jitter and frequency offset.

Optimum signal/noise versus error rate performance achieved via synchronous detection.

Standard pseudo random test word generator; local, remote, and operate switch; and signal quality meter permit quantitative testing without auxilliary test equipment.

Sangamo also builds modems at 300, 1200, 1800, 2000, 2400 bps and backs them up with a data test center for remote testing, field service maintenance contracts, factory field maintenance seminars, various sale or lease plans and a full one year warranty.

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ORDERS AND INSTALLATIONS

United Air Lines' new $6.3 million "Apollo" system complex at Denver currently processes some 30,000 passenger information messages an hour on a peak day. By July, 1972, United's present three IBM 360/65 Apollo computers will be replaced by IBM 360/195s, raising the system's capacity to 648,000 messages/hour. Incoterm Corp. of Marlboro, Mass. has contracted with United to supply the Apollo system with approximately 1000 of its SPD 10/20 stored-program CRT terminals over the next 12 months. In turn, Di/An Controls, Inc. of Boston, Mass. will supply Incoterm with $240,000 worth of automatic ticket printers for use with the SPD 10/20s.

Aydin Corp.'s Monitor Systems subsidiary has been awarded a $2.16 million fixed-price contract by NASA for 21 data communication systems to be used in future manned space flight missions.

The U.S. Government has awarded Storage Technology Corp. of Boulder Colo., what is believed to be the government's first competitive contract to replace IBM 2420-7 tape drives and 2803-2 tape control units. The order is for 54 tape drives and 11 control units for installation at Internal Revenue Service computer facilities. Contract options provide for increasing the order to over 100 units.

SHEDDING SOME DARKNESS ON THE DAA ISSUE

The Bell System requirement for a Bell-provided interface between user equipment and the dial-up network has been chafing at modem manufacturers and users. Bell's SJCC exhibit rubs salt into the wounds.

When AT&T announced its automatic Data Access Arrangement (Model F-58012) in May 1969, modem manufacturers were quick to interface to it. Although the F-58012 was clearly described as "a preliminary design — a standard version with some modification of features will be available during the fourth quarter of 1970," the manufacturers reasonably assumed that future models would be fully compatible. Needless to say, they weren't.

In August 1970, AT&T announced a new automatic DAA, the Model 1001A, to replace the F-58012, which would no longer be made available or supported. The 1001A, among other things, differs from the F-58012 in that it does not provide a termination signal.

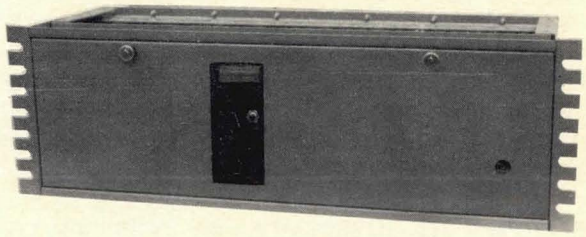
To modem manufacturers, whose equipments were already operating at 2400 bps with the F-58012, news of the 1001A's incompatibility was a bitter pill. It meant substantial expenditures for additional design and production, and the need to carry another "black box." It also threatened a diminished market, since Bell's 201-A data set, although more expensive and slower (2000 bps), might become more attractive to users not pressed for higher speeds and desirous only of the fewest number of system components. Finally, there emerged no assurance that Bell had finally stabilized the design of the DAA. "Two months from now," says one modem manufacturer, "they could change again."

DAA WIRES CROSSED AT SJCC — The no-longer-available Model F-58012 automatic DAA being demonstrated at Bell's exhibit at the 1971 SICC.

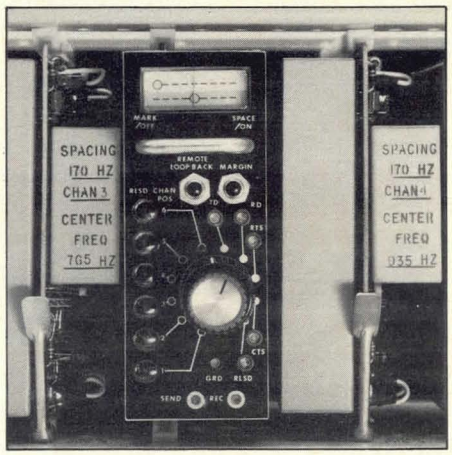
What has all this got to do with SJCC? Nothing at all — except that the now obsolete F-58012 was prominently displayed at AT&T's exhibit as "one of the many Bell equipments now available from your local telephone representative."

PRIVATE LINE DATA MULTIPLEX

What do you get for the money you spend?



TAKE A LOOK AT DIGINET-160 PRIVATE LINE MULTIPLEX--- THE ONE WITH THE BIG PLUS!



In terms of design, features and performance, DigiNet-160 Private Line Data Multiplex is second to none--and it's priced right too! Up to 17 terminals can have their own "private line" to the computer--even though they share a single telephone line * speeds to 600 bps * complete channel speed intermix capability * no data set required (interfaces directly with your telephone line) * channels are fully speed and code transparent * fully automatic * flexibility in mounting (rack mounted shelf, multi-channel cabinet, single channel cabinet)---just some of the features you get with a DigiNet-160 system.

THE BIG PLUS

It's called "GEBITS" (General Electric Built-In Testing System) and it represents the end to "Serviceman Roulette" when a computer port goes bad, a telephone circuit goes out, or a terminal acts up! The built-in GEBITS circuitry (patent pending) of the DigiNet-160 lets you pin-point the problem area in short order and call the right serviceman every time---and it doesn't require a technically trained person to use. GEBITS test procedures are as simple as pushing a button or throwing a switch--and will help you get back on-line in minimum time---and without running up charges for "false alarm" service calls.

Get the complete DigiNet-160 Private Line Data Multiplex story from any of the following:

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Florham Park, N. J. 07932
(201) 377-0720

D. A. Miles
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Mount Prospect, Ill. 60056
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Toronto 395, Ontario, Canada
(416) 789-3281

DATA COMMUNICATION PRODUCTS DEPARTMENT
GENERAL ELECTRIC COMPANY, LYNCHBURG, VIRGINIA 24502

GENERAL ELECTRIC

CIRCLE NO. 11 ON INQUIRY CARD

INTERNATIONAL NEWS

EAST-WEST TRADE UP — The U.S. Dept. of Commerce during the first quarter of 1971 approved the shipment of $6.2 million worth of computers, parts, and accessories to Eastern Europe. Slightly more than a third of this was approved for shipment to Czechoslovakia. In 1970 USDC approved $24.1 million worth of shipments of data processing equipment — $1.1 million worth to Czechoslovakia and $5.2 million worth to E. Germany.

COMPUTERS TO RUSSIA — A U.S. veto has prevented the Soviet Union from using two Western computers, the Washington Post's Moscow correspondent reports. The U.S. veto operates through the control of export licenses for U.S. companies and through a NATO committee which bars strategic exports to Communist countries. At issue recently was the sale by ICL of two large 1906A computers. The estimated gap of about 15 years between Western computer technology and the USSR's is attributed less to basic hardware/software technology than to proper applications planning. Reportedly ICL has made the biggest Western breakthrough having Soviet orders estimated at over $60 million.

PARKING BY COMPUTER — A computer system has been installed in Aachen, W. Germany, to help frustrated motorists find a place to park. The city has set up a central data bank containing information on over 13,000 parking spaces. Forty lighted signs throughout the city direct drivers to parking lots and multi-story car parks where places are vacant. At the actual parking places, the computer counts incoming and outgoing vehicles and decides what to do with the available space. Other congested cities in W. Germany are studying the idea very closely.

QUICKLY AROUND THE WORLD

Two new records for the U.S. Trade Center in Scandinavia were recently set at an exhibition of EDP equipment. New marks now stand for visitors (2,829), and for projected sales ($39.1 million).

The use of Honeywell Keytape units for the preparation of data by the Dept. of Education and Science at Mowden Hall, Darlington, England, is reported to have increased efficiency by one-third.

D C DATASCAN

Harold V. Semling, Jr., Washington Editor

NATIONAL CONSUMER DATA BANK — A high-priority project of the Council of Better Business Bureaus, Inc., is the establishment of a National Consumer Data Computer Bank for use as "an early warning system for consumers." Council President H. Bruce Palmer told a House Small Business Subcommittee that the data bank will contain information on consumer attitudes and responses, sales promotion and advertising practices, and product and service performance. By reporting its findings to industry, trade and professional associations, individual companies, federal and state regulatory agencies, legislative bodies, and responsible consumer advocate groups, the data bank will direct their protection efforts in constructive channels. Within the next few months, 19 local Better Business Bureaus are expected to be tied into the data bank network.

FDA INJURY SURVEILLANCE SYSTEM — The Food and Drug Administration has initiated a nationwide computer system to study personal injuries treated in hospital emergency rooms. The National Electronic Injury Surveillance System (NEISS) will provide information for prompt investigation and possible remedial action. Injuries will be reported daily by hospital personnel using Teletype equipment. During the night, an FDA computer will access each terminal at 100 hospitals, collect and sort data for presentation the next morning.

COMPUTER STANDARDS PROBLEMS — Two problems in the computer standards area are due for top attention by the National Bureau of Standards in fiscal 1972, if NBS gets the $116,000 in additional funding it has requested. NBS Director Dr. Lewis M. Branscomb told a House Appropriations Subcommittee that the first of these problems concerns computer networks, "the most important development in computer utilization during the last five years." Better techniques for measuring the performance of such networks, he believes, will enable the government to get more quality and reliability for its money. The second problem is to devise a validation system to ensure all Cobol programs produce the same results if used in different computers.

IN BRIEF

National Bureau of Standards is investigating the use of computer-aided transcription of stenotype notes as a means of reducing congestion and delay in criminal courts.

The Comptroller General has told Congress that the Army's two computerized management information systems for major equipment needs and for equipment on hand showed "significant weaknesses."

National Bureau of Standards has helped develop a mathematical model for computers which simulates the movement of truck traffic in lower Manhattan. The model can be used to demonstrate the effects of changes in vehicular and street width construction.

21 ways to improve your computer system's performance.

Here are some of over 150 IBM program products to help your computer do more work. And do it more profitably.

There's a program that lets your salesman search the computer's file while he's got a customer on the phone.

A program that helps your company's executives decide which products to make, when to make them, where to ship them.

There are programs that help your programmers become more productive. By letting them spend more time writing programs, less time debugging them.

If you'd like a complete description of these and other programs, just fill in the coupon below. Or call your local IBM office.

Languages, sorts, time sharing

1. PL/I Optimizing Compiler (OS, DOS) Offers greatly increased execution, new language features, improved debugging aids and communication with existing FORTRAN and COBOL object modules.

2. ANS Full COBOL Version 3 (OS, DOS) Contains major improvements in debugging aids, additional functions and ASCII support.

3. FORTRAN IV (H Extended) Compiler (OS) Supports extended precision arithmetic, two new forms of input/output for ease of use, and improved compilation speed and reliability.

4. Interactive Terminal Facility (ITF) (OS, DOS) Provides time sharing for problem solvers using BASIC and Interactive PL/I.

5. OS-Sort/Merge 1 (OS-SM1) (OS) Improved speed and functions over previous OS sorts. Provides support for IBM 3330 Disk Storage.

6. Assembler H (OS) A new high performance assembler language processor for OS users. Requires no reprogramming or conversion for current OS assembler users.

7. 1130 COBOL Specifically designed compiler featuring high speed compilation and fast execution for small to medium IBM 1130 users.

8. APL/360 (OS, DOS) A user-oriented program with a language designed for problem solving and a time sharing capability that lets many users work independently at the same time.

Data entry, data base

9. Customer Information Control System (CICS) (OS, DOS) The link between your computer's data base and the applications you want to put on-line. By providing many of the standard control functions, CICS lets your programmers concentrate on coding the applications. Helps you save implementation time and cost.

10. Data/360 (OS, DOS) A general purpose data-entry program. Data is entered and verified through IBM displays, edited and written out on disk files.

11. Data Base Organization and Maintenance Processor (DOS) A system to integrate data files into a central data base for query applications involving existing multiple customer files.

12. Generalized Information System/2 (GIS/2) (OS) A high-level query and file maintenance system particularly useful for meeting spontaneous information requirements or handling repetitive jobs.

13. Information Management System/360 (IMS/360) Version 2 (OS) Facilitates use of medium to large common data bases and accommodates teleprocessing and batch processing, concurrently or separately.

Applications

14. Project Management System IV (PMS IV) (OS) A powerful program in modular form for resource allocation, cost analysis and precedence input analysis.

15. Requirements Planning (OS) A materials management system designed to determine what, when and how much to order in a manner that will help minimize component inventories.

16. Shop Floor Control (OS, DOS) Establishes and maintains a shop order data base and provides for shop order release, status and inquiry for timely management decisions.

17. Consumer Goods System—Forecasting and Allocation (OS, DOS) Determines what amounts of finished goods to make, order or ship to stocking locations to satisfy multiple objectives.

18. General Purpose Simulation System V (GPSS V) (OS, DOS) Powerful, easy-to-use tool for simulating the behavior of systems in engineering and management sciences.

19. Bill of Material Processor (System/3 Model 6 and Model 10 Disk) Establishes and maintains basic manufacturing files describing the structure of products and their manufacturing procedures.

20. Law Enforcement Manpower Resource Allocation System (DOS) Provides ability to determine field manpower requirements, on as-needed basis and future-plans basis.

21. Mathematical Programming System Extended (MPSX) and Mixed Integer Programming (MIP) (OS) A new, economic optimization system offering greatly extended modeling capabilities.

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CORPORATE AND FINANCIAL NEWS

Thomas J. Watson, Jr. has announced that he is relinquishing his responsibilities as chairman of the board and chief executive officer of IBM and will become chairman of the company's executive committee. T. Vincent Learson, president since 1966 and a member of the board since 1961, has been elected chairman of the board and chief executive officer. Frank T. Cary, executive vice president and a member of the board since 1968, has been elected president.

Reacting to IBM's recent reduction in peripheral prices, Boothe Computer Corp. has announced major price reductions across the entire IBM-compatible CRT terminal line manufactured by Courier Terminal Systems, Inc., a Boothe subsidiary. Courier terminals will be priced 30 to 50 percent below the IBM 2260 and approximately 10 percent under the new IBM 3270. Courier announced further reductions of 10 percent for three-year leases and 20 percent for five-year leases.

BOX SCORE OF EARNINGS

Company	Period		Revenues	Net Earnings (Loss)	Earnings (Loss) per Share
Advanced Systems	12 mos.	3/31/71	2,786,000	436,577	.71
	12 mos.	3/31/70	1,308,000	217,098	.35
Am. Tel. & Tel.	12 mos.	5/31/71	17,526,044,000	2,218,543,000	4.04
	12 mos.	5/31/70	16,251,255,000	2,185,511,000	3.98
Calif. Comp. Prods.	9 mos.	3/28/71	28,250,830	1,604,481	.70
	9 mos.	3/29/70	16,475,496	459,947	.20
Collins Radio	9 mos.	4/30/71	211,663,000	(5,689,000)	(1.92)
	9 mos.	5/1/70	255,960,000	310,000	.10
Data 100	12 mos.	12/31/70	2,748,350	(3,475,422)	(3.11)
	12 mos.	12/31/69	731,018	(919,068)	(.99)
Data General	36 wks.	6/5/71	8,976,000	943,000	.42
	36 wks.	6/5/70	4,422,000	309,000	.16
Data Products	12 mos.	3/27/71	45,282,000	(10,573,000)	(1.66)
	12 mos.	3/28/70	45,372,000	1,822,000	.28
Gen'l. Automation	9 mos.	4/30/71	7,917,000	(60,000)	(.04)
	9 mos.	4/30/70	4,595,000	(1,659,000)	(1.03)
Keydata	9 mos.	4/30/71	4,433,552	2,367	.00
	9 mos.	4/30/70	3,031,046	(725,032)	(.49)
Logicon	12 mos.	3/31/71	9,759,388	223,884	.26
	12 mos.	3/31/70	7,138,657	318,888	.40
Microform Data Sys.	9 mos.	4/30/71	438,289	(2,060,459)	(1.55)
	9 mos.	4/30/70	16,592	(1,986,809)	(2.69)
On-Line Systems	12 mos.	4/30/71	2,465,754	269,660	.60
	12 mos.	4/30/70	1,588,418	218,146	.49
PCS Data Proc.	6 mos.	4/30/71	634,520	50,402	.11
	6 mos.	4/30/70	557,366	(130,541)	(.28)
Wyle Labs.	3 mos.	4/30/71	22,976,000	22,000	.01
	3 mos.	4/30/70	23,619,000	138,000	.04

MERGERS & ACQUISITIONS: **Bechtel Inc.** of San Francisco has acquired the assets of the **Civil Programs Dept. of Martin Marietta Corp.'s Orlando (Florida) Div.** to broaden its capabilities in the computer-assisted planning field . . . **Clasco, Inc.,** a Chevy Chase, Md. computer systems and educational company, has agreed in principle to acquire **Allied Computer Technology, Inc.** of Santa Monica, Cal . . . **Comp-Time Corp.,** a San Diego computer applications and data processing company, has been purchased by Lyle A. Jakus, President of **Jakus Associates,** an engineering services firm in San Diego . . . **Electronic Associates, Inc.** plans to purchase, through a subsidiary, **Visual Educom, Inc.** from **Visual Electronics Corp.** VEC has been operating under Chapter XI since July 1970. The EAI subsidiary would pay $1.6 million in cash while assuming liabilities of approximately $1 million. The EIA subsidiary would also purchase, for $1.5 million from Raytheon Co., a plant facility which Raytheon had planned for Visual Educom's use prior to Raytheon's sale of Visual Educom in January, 1970 . . . **Heller Roberts Instruments Corp.** of Brooklyn, N.Y., has purchased the assets of **Dataline, Inc .** of King of of Prussia, Pa., manufacturers of printed-copy data terminals . . . **Information and Computing Centers Corp.,** Palo Alto-based manufacturer of CRT monitors, has acquired **World Computer Systems Engineering Corp.** of Dallas, Texas. WCSEC manufactures an electronic payroll and accounting information system (EPIC) and electronic security systems (COMSAFE) . . . **Magnetic Head Corp.** of Hauppauge, N.Y., has announced its intention to acquire all shares of stock of **Data Magnetics Corp.** of Torrance, Cal., manufacturer of disk recording heads and ferrite products . . . **Optical Scanning Corp.** of New-

LAWRENCE FEIDELMAN, FRITZ KINDERHAUFEN, and **RALPH BERGLUND,** authors, respectively, of *Source Data Automation, Up the System Down-Time,* and *Communication Clinic,* are presently enjoying a much-deserved summer vacation. Their columns will re-appear in the fall.

town, Pa. and **Infoton, Inc.** of Burlington, Mass. have agreed in principle to the merger of Infoton with OpScan in exchange for shares of common stock of OpScan . . . **Optimum Systems Inc.** of Palo Alto, has acquired the net assets of **Applied Cybernetics Corp.,** Sunnyvale. Applied Cybernetics, formerly a subsidiary of GRT Corp., is a computer service company offering data processing, consulting, and programming . . . **Systems Engineering Laboratories, Inc.** of Fort Lauderdale, Fla. has agreed in principle with **National Micronetics, Inc.** of West Hurley, N.Y., and others to sell the controlling interest in its San Diego-based disk memory subsidiary, **Systems Peripherals Division . . . Tektronix, Inc.** and **Physics International Co.** have announced that Tektronix has purchased the assets of **Cintra, Inc.,** a subsidiary of Physics International which manufactures, among other products, a line of programmable scientific calculators and peripherals.

RECENT ENTRIES IN THE COMPUTER FIELD: Benchmark Systems, Inc., a "marketing only" service located in N.Y.'s Empire State Building, will offer solutions to hardware marketing problems and make sales for manufacturers of text editing, word processing, data communications, and source data automation devices . . . **Computrans,** a computer consulting division, has been formed by Manatech International Ltd. of Westmont, N.J., industrial and management consultants . . . PHI Computer Services, Inc. of Arlington, Mass., has formed the **PHI Management Services Division** to act as a full-service computer "supermarket" . . . A new distributorship, **Pragma Limited,** has been formed in London to represent manufacturers of data processing peripheral equipment in the U.K.

CORPORATE PROFILE

Featured this month:

ATLANTIC TECHNOLOGY CORPORATION (Over-the-Counter)

Somers Point, New Jersey 08244

DIRECTORS & OFFICERS: **James L. Foy,** Chairman of the Board and Director; **John D. Music,** President and Director; **Patrick E. McMahon,** Vice President-Marketing; **Arthur E. White,** Vice President; **Henry S. Middendorf, Jr.,** Secretary, Counsel & Director; **William T. Hack,** Director; **Thomas J. Sullivan,** Director.

BACKGROUND: Atlantic Technology Corp. was organized in 1962 and until 1968 was primarily engaged as a U.S. Government contractor or sub-contractor for R&D work relating to CRT display systems. In 1968, the company began the development of the ATC 2000 Data Display Terminal, which was put into production in 1970.

FACILITIES: Corporate offices, engineering, and production facilities occupy 5,000 square feet of space in a building owned by the company and located in Somers Point, N.J. An additional facility for assembly operation is located in Linwood, N.J.

PRODUCTS: The company's principal product is the ATC 2000 Data Display Terminal, which is available in a wide variety of remote and local, stand-alone and multi-station configurations, and is plug- and program-compatible with the IBM 2848/2260 and 2845/2265 Data Displays. The company also manufactures a very high brightness display (BRITE-II) for use with airport radars, and a large-screen, high-speed graphic display for use with analog computers. Military contracts include the development of sophisticated CRT systems for the U.S. Army's Night Vision Laboratories.

CURRENT POSITION: Government-related business presently amounts to less than 25% of total sales. Units of the ATC 2000, from which the company expects to derive most of its revenues, were not shipped in quantity until the last quarter of 1970. Existing customers for the ATC 2000 include banks, insurance companies, hospitals, research centers, manufacturing and retailing firms, and educational institutions.

OUTLOOK: In order to increase outright sales and improve cash flow for 1971, the company recently participated in the formation of Anderson Trading Company, Inc., a leasing company. It is expected that units of the ATC 2000 contracted to be rented by an end-user will be sold by the company to Anderson Trading Co., which will own the equipment and lease it to the end-user directly. Atlantic Technology will receive a maintenance, management, and marketing fee out of the monthly rent paid by the end-user to Anderson Trading Co. In turn, for this fee, the company will be responsible for maintenance, management, and marketing expenses.

FINANCIAL SUMMARY: Atlantic Technology's first public offering in August, 1969, consisted of 250,000 shares of common stock offered at $6.50 per share through IBM's initial underwriter, F. S. Smithers and Co. Interest in the offering strongly reflected investors' confidence in the future of the young firm and its then-undeveloped product line. Just prior to the offering (May 31, 1969), the company's liabilities exceeded its tangible book assets such that the book value of the company's 821,333⅓ common shares outstanding on that date was $0.10 per share. Upon completion of the public offering, there was an immediate book value dilution of $5.23 per share in the new shares, and a corresponding increase (to $1.27) in previously issued shares. Directors and officers of the company retained 35.3% of all shares outstanding after the offering, the proceeds of which were used to retire short-term indebtedness (primarily incurred in connection with the ATC 2000), complete development of the ATC 2000, and initiate its production.

The following tabulations are based on years ending Dec. 31.

Period	Revenues	Net Income (Loss)	Net Income (Loss) Per Share
1968	$509,240	$24,099	$.03
1969	189,546	(483,555)	(.44)
1970	585,110	(2,360,968)	(2.15)
Qtr. ended 3/31/70	24,023	(178,032)	(.16)
Qtr. ended 3/31/71	691,898*	132,672	.12

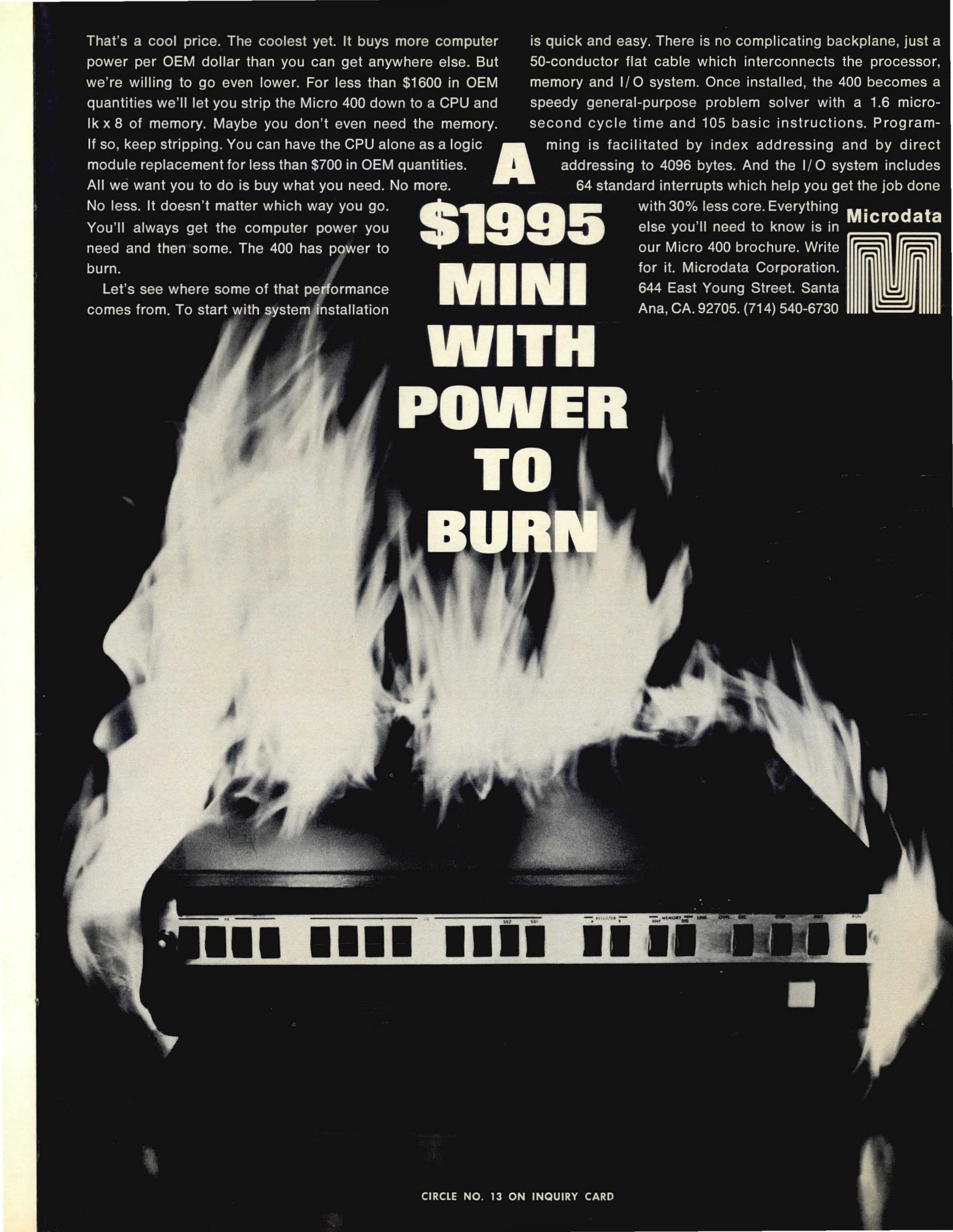
**NOTE: Of this figure, 58% was from sales of previously leased units of the ATC 2000 to Anderson Trading Co., for which Atlantic Technology received $213,000 in subordinated notes.*

That's a cool price. The coolest yet. It buys more computer power per OEM dollar than you can get anywhere else. But we're willing to go even lower. For less than $1600 in OEM quantities we'll let you strip the Micro 400 down to a CPU and Ik x 8 of memory. Maybe you don't even need the memory. If so, keep stripping. You can have the CPU alone as a logic module replacement for less than $700 in OEM quantities. All we want you to do is buy what you need. No more. No less. It doesn't matter which way you go. You'll always get the computer power you need and then some. The 400 has power to burn.

Let's see where some of that performance comes from. To start with system installation is quick and easy. There is no complicating backplane, just a 50-conductor flat cable which interconnects the processor, memory and I/O system. Once installed, the 400 becomes a speedy general-purpose problem solver with a 1.6 microsecond cycle time and 105 basic instructions. Programming is facilitated by index addressing and by direct addressing to 4096 bytes. And the I/O system includes 64 standard interrupts which help you get the job done with 30% less core. Everything else you'll need to know is in our Micro 400 brochure. Write for it. Microdata Corporation. 644 East Young Street. Santa Ana, CA. 92705. (714) 540-6730

A $1995 MINI WITH POWER TO BURN

Microdata



CIRCLE NO. 13 ON INQUIRY CARD

COMPUTER STOCK TRENDS

MONTH ENDED JULY 9, 1971

	EXCH	COMPANY	PRICE					VOLUME (IN 100'S)			EARNINGS	
			1971 RANGE (1)	1 YEAR AGO	CLOSE JULY 9 1971	MONTH NET CHG.	MONTH % CHG.	THIS MONTH (3)	LAST MONTH	AVG. VOL-UME (2)	PER SHARE LATEST 12 MONTHS	PRICE–EARNINGS RATIO
COMPUTERS	N	BECKMAN	27- 46	21 5/8	39 1/2	- 5/8	-1.5	599	1961	1822	1.29	31
	N	BURROUGHS	105-138	90 1/8	123 1/2	-1 7/8	-1.4	3349	5636	7803	3.87	32
	N	CONTROL DATA	48- 83	34 3/4	59 1/8	-5 7/8	-9.0	6501	9443	9304	0.40	148
	O	DATA GENERAL	19- 50	17	50 1/4	+7	+16.1	(3)	-	-	0.54	93
	O	DATACRAFT	5- 11	N/A	8 1/4	-1 1/4	-13.1	(3)	-	-	-	-
	N	DIGITAL EQUIPMENT	53- 85	53 7/8	76 3/4	-4	-4.9	2343	2249	4455	1.19	64
	N	ELECTRONIC ASSOC	5- 9	4	7 1/4	- 5/8	-7.9	433	485	1203	-1.52	-
	O	GENERAL AUTOMATION	11- 26	9 1/4	13 1/4	- 1/4	-1.8	(3)	-	-	-0.03	-
	N	GENERAL ELECTRIC	29- 62	34	61 1/4	- 1/8	-0.2	10000	14544	10925	2.63	23
	N	HEWLETT-PACKARD	30- 45	22 1/2	39 3/4	-3	-7.0	1841	2045	3186	0.84	47
	N	HONEYWELL	83-115	70	97 3/4	-6 3/4	-6.4	4822	7004	5891	2.92	33
	O	INTERDATA	6- 11	N/A	9 1/8	-1 5/8	-15.1	(3)	-	-	-0.12	-
	N	IBM	310-364	254 1/4	316	-8 1/2	-2.6	6755	8858	7408	9.09	35
	N	LITTON INDUSTRIES	20- 34	16 1/8	30 5/8	-1 5/8	-5.0	5676	7315	11497	1.36	23
	N	NCR	38- 49	38 7/8	44 3/4	-1 3/4	-3.7	8507	15789	13963	1.23	36
	N	RCA	26- 41	19 5/8	33 7/8	-6 5/8	-16.3	13778	10260	12890	1.34	25
	N	RAYTHEON	27- 46	20	37 3/4	-2 1/4	-5.6	2505	3600	5783	2.36	16
	O	REDCOR	5- 9	5 1/4	5 7/8	-1 3/8	-18.9	(3)	-	-	-2.81	-
	O	SCIENTIFIC CONTROL	1- 2	N/A	1 1/2	+ 5/8	+71.4	(3)	-	-	-	-
	N	SPERRY RAND	25- 38	26 1/2	33 1/8	-1 5/8	-4.6	8098	8053	16156	2.11	16
	A	SYSTEMS ENGRG LABS	10- 18	12 3/4	11 5/8	- 1/2	-4.1	1114	1792	3533	-0.11	-
	N	SYSTRON DONNER	10- 18	10	15 3/8	-1	-6.1	304	586	1572	0.59	26
	N	VARIAN ASSOCIATES	13- 18	11 1/8	14 3/4	+ 1/4	+1.7	2488	1952	4587	-0.49	-
	O	VIATRON	1- 4	N/A	7/8	0	0.0	(3)	-	-	-	-
	N	WANG LABS	29- 50	21 3/4	42 3/8	-3 7/8	-8.3	546	541	1266	0.91	47
	A	WYLE LABS	4- 6	3 5/8	4 1/8	- 3/8	-8.3	423	412	977	-0.86	-
	N	XEROX	85-119	75 3/8	118 7/8	+7 5/8	+6.8	12485	8443	11447	2.44	49
PERIPHERALS & COMPONENTS	O	ADVANCED MEMORY SYS	17- 37	N/A	18	-1	-5.2	(3)	-	-	-	-
	N	AMP	55- 73	45	67 1/8	-1 7/8	-2.7	1474	1388	1810	1.96	34
	N	AMPEX	17- 25	16 1/8	18 1/8	+ 1/2	+2.8	4715	6743	9569	-1.09	-
	O	APPLIED MAGNETICS	14- 22	9	18 1/8	- 7/8	-4.6	(3)	-	-	0.45	40
	O	ASTRODATA	1- 2	N/A	7/8	- 1/4	-22.2	(3)	-	-	-	-
	O	ASTROSYSTEMS	4- 6	2 3/8	5 3/4	+ 1/8	+2.2	(3)	-	-	-	-
	N	BUNKER RAMO	10- 17	7	12	-1 3/8	-10.2	8250	3748	9632	0.22	55
	A	CALCOMP	21- 33	16	23 1/2	-1 1/8	-4.5	1967	2966	3702	0.85	28
	O	CHALCO INDUSTRIES	2- 4	N/A	2 3/4	+ 5/8	+29.4	(3)	-	-	-	-
	O	CODEX	5- 10	N/A	5 1/2	- 1/2	-8.3	(3)	-	-	-	-
	O	COGAR	20- 71	41	24 1/2	-3	-10.9	(3)	-	-	-	-
	O	COGNITRONICS	4- 9	4	3 3/4	-1 5/8	-30.2	(3)	-	-	-0.40	-
	N	COLLINS RADIO	13- 20	12 1/8	13 5/8	-3 3/8	-19.8	933	1697	2261	-10.08	-
	O	COMCET	4- 11	N/A	8 5/8	-1 1/8	-11.5	(3)	-	-	-	-
	O	COMPUTER COMM	6- 19	8	10 1/4	+ 3/4	+7.8	(3)	-	-	-0.67	-
	O	COMPUTER CONSOLES	7- 11	8 1/2	8 3/8	+ 3/4	+9.8	(3)	-	-	-	-
	A	COMPUTEST	12- 20	17 3/8	12	- 3/4	-5.8	199	277	840	0.72	17
	N	CONRAC	16- 29	13 1/8	24 3/4	-2 3/4	-10.0	333	469	676	1.03	24
	O	DATA 100	8- 13	5 3/4	9 1/8	+ 5/8	+7.3	(3)	-	-	-3.10	-
	A	DATA PRODUCTS	6- 10	8 3/4	6 5/8	- 3/8	-5.3	1474	2937	4599	-1.65	-
	O	DATARAM	1- 3	N/A	1 5/8	0	0.0	(3)	-	-	-	-
	O	DATA RECOGNITION	3- 8	N/A	5	- 3/4	-13.0	(3)	-	-	-	-
	O	DATASCAN	4- 12	7 1/2	8 3/4	-1 3/4	-16.6	(3)	-	-	-0.33	-
	O	DIGITRONICS	4- 8	5 3/4	4 1/4	-1 1/8	-20.9	(3)	-	-	-0.85	-
	A	ELEC ENG OF CAL	5- 9	4	8	- 7/8	-9.8	78	145	279	-0.52	-
	N	ELEC MEMORIES + MAG	8- 17	8 3/4	13	-1 1/8	-7.9	2912	6523	8505	-2.91	-
	N	EXCELLO	19- 24	17 1/2	19 1/4	-1	-4.9	1291	1352	1827	1.21	16
	O	FABRI-TEK	2- 4	4 1/8	2 3/4	- 1/2	-15.3	(3)	-	-	-0.87	-
	O	FARRINGTON MFG	1- 3	N/A	1/8	- 1/4	-66.6	(3)	-	-	-	-
	A	GERBER SCIENTIFIC	11- 21	15	17 5/8	-2 1/8	-10.7	877	1076	778	-0.17	-
	O	GRAPHIC SCIENCES	15- 37	7 1/8	31	-2 1/2	-7.4	(3)	-	-	-0.32	-
	A	HI-G	5- 8	8 1/8	7	+1 1/2	+27.2	333	205	1609	-1.38	-
	O	INFORMATION DISPLAYS	5- 8	5 1/2	6 1/8	-1 1/8	-15.5	(3)	-	-	-0.79	-
	A	ITEL	13- 23	9 1/4	13 7/8	-1 7/8	-11.9	2440	2827	3922	1.28	11
	O	LOGIC	5- 16	N/A	13	- 7/8	-6.3	(3)	-	-	-	-
	A	MILGO	16- 26	19 1/8	17 3/4	- 1/2	-2.7	2062	1380	3657	0.44	40
	N	MOHAWK DATA SCIENCES	23- 47	22 7/8	29 3/4	-9 5/8	-24.4	4998	6307	6470	0.55	54
	O	NORTH ATLANTIC IND	2- 5	N/A	3	0	0.0	(3)	-	-	-	-
	O	OPTICAL SCANNING	10- 18	15 1/2	11	-1 3/8	-11.1	(3)	-	-	-1.74	-
	A	POTTER INSTRUMENTS	16- 25	19 1/2	17 5/8	+1	+6.0	834	1413	2535	0.78	23
	O	RECOGNITION EQUIP	14- 26	18 1/2	16 7/8	-2 1/8	-11.1	(3)	-	-	-0.66	-
	N	SANDERS ASSOCIATES	12- 22	8 3/4	12 3/4	-5 3/8	-29.6	3861	1473	3519	0.16	80
	N	SANGAMO	14- 20	10 5/8	16 1/8	+ 3/8	+2.3	484	513	1261	0.70	23
	O	SCAN-DATA	6- 15	7	11 3/4	+2 3/4	+30.5	(3)	-	-	-	-
	A	SEALECTRO	4- 7	4 3/8	4 1/2	- 1/2	-10.0	105	75	207	-0.15	-
	O	SYKES DATATRONICS	2- 6	5 5/8	4 1/2	-1 1/8	-20.0	(3)	-	-	-	-
	O	TALLY	10- 16	12 1/2	10 1/2	0	0.0	(3)	-	-	-	-
	N	TELEX	15- 22	13 1/4	15 3/4	+ 1/4	+1.6	9964	21911	20737	0.68	23
	N	TEXAS INSTRUMENTS	80-123	67 1/2	115 1/2	-2 3/4	-2.3	1740	1247	2858	2.72	42
	O	VARIFAB	1- 3	N/A	1/2	- 1/4	-33.3	(3)	-	-	-	-

FOOTNOTES: (1) TO NEAREST DOLLAR
(2) AVERAGE MONTHLY TRADING VOLUME SINCE JANUARY 1, 1971
(3) VOLUME IS NOT REPORTED FOR OVER-THE-COUNTER ISSUES AND NEW LISTINGS

EXCH: N=NEW YORK EXCHANGE; A=AMERICAN EXCHANGE; O=OVER-THE-COUNTER; L=NATIONAL EXCHANGE;

All statistics compiled, computed and formatted by TRADE*QUOTES Inc., Cambridge, Mass. 02139

	EXCH	COMPANY	PRICE					VOLUME (IN 100'S)			EARNINGS	
			1971 RANGE (1)	1 YEAR AGO	CLOSE JULY 9 1971	MONTH NET CHG.	MONTH % CHG.	THIS MONTH (3)	LAST MONTH	AVG. VOLUME (2)	PER SHARE LATEST 12 MONTHS	PRICE–EARNINGS RATIO
SOFTWARE & SERVICES	A	APPLIED DATA RESCH	5- 13	5 1/8	7 1/4	-1 1/4	-14.7	272	534	1055	-0.13	-
	O	APPLIED LOGIC	1- 3	N/A	3/4	- 3/8	-33.3	(3)	-	-	-	-
	O	ARIES	1- 2	N/A	1 1/4	0	0.0	(3)	-	-	-	-
	N	AUTOMATIC DATA PROC	44- 65	29 1/8	65 3/8	+3 5/8	+5.8	988	941	1185	0.82	80
	A	BOLT, BERANEK, NEWMA	6- 8	6 1/2	6 1/8	- 3/4	-10.9	59	196	191	0.24	26
	O	BOOTHE COMPUTER	13- 27	9 3/4	19 5/8	-2 5/8	-11.7	(3)	-	-	1.58	12
	O	BRANDON APPLIED SYS	1- 1	N/A	3/8	- 3/8	-50.0	(3)	-	-	-	-
	O	COMP ENVIRONMENTS	1- 2	N/A	3/4	- 1/4	-25.0	(3)	-	-	-	-
	O	COMPUTER EXCHANGE	4- 9	4 1/2	4 7/8	- 1/8	-2.5	(3)	-	-	-	-
	A	COMPUTER INVESTORS	8- 14	5 1/2	11 1/2	+1	+9.5	293	298	541	0.65	18
	O	COMPUTER METHODS	1- 3	N/A	1 3/4	- 1/4	-12.5	(3)	-	-	-	-
	O	COMPUTER PROPERTY	6- 11	N/A	6 1/4	- 3/4	-10.7	(3)	-	-	0.66	9
	N	COMPUTER SCIENCES	9- 17	9 5/8	12 1/4	-2 7/8	-19.0	5208	5155	8859	0.35	35
	O	COMPUTER TECHNOLOGY	5- 11	N/A	6 1/2	- 1/2	-7.1	(3)	-	-	-	-
	O	CTC COMPUTER	1- 4	N/A	1/2	- 3/8	-42.8	(3)	-	-	-	-
	O	COMPUTER USAGE	5- 16	3 1/2	8 1/2	- 1/8	-1.4	(3)	-	-	-2.05	-
	N	COMPUTING + SOFTWARE	27- 45	20	36 3/8	- 1/2	-1.3	1746	2058	2515	1.22	30
	O	COM-SHARE	4- 8	N/A	4 3/4	- 1/8	-2.5	(3)	-	-	-	-
	O	CYBERMATICS	8- 11	6 1/4	9 7/8	-1 3/8	-12.2	(3)	-	-	-	-
	O	DATA AUTOMATION	1- 4	N/A	1 1/2	- 3/8	-20.0	(3)	-	-	-0.65	-
	O	DATA DYNAMICS	1- 4	N/A	3	- 3/8	-11.1	(3)	-	-	-	-
	N	DATA PROC FIN + GEN	11- 19	9 3/8	13 1/2	-1	-6.8	1384	2091	4621	0.64	21
	O	DATA SYSTEM ANALYSTS	1- 3	N/A	1 1/4	- 1/4	-16.6	(3)	-	-	-	-
	O	DATRONIC RENTAL	2- 4	3	2 1/2	- 1/8	-4.7	(3)	-	-	0.36	7
	A	DEARBORN-STORM	24- 44	12 1/4	41 1/2	+ 3/4	+1.8	704	912	1183	2.57	16
	O	DECISION SYSTEMS	1- 1	N/A	7/8	- 1/8	-12.5	(3)	-	-	-	-
	O	DIGITAL APPLICATIONS	1- 5	N/A	3 3/4	+1 3/8	+57.8	(3)	-	-	-	-
	O	DIGITEK	1- 4	N/A	1 1/2	- 3/8	-20.0	(3)	-	-	-	-
	A	DPA, INC	4- 8	3 3/4	7 1/2	+ 1/2	+7.1	1398	769	1261	0.78	10
	O	EFFICIENT LEASING	1- 7	N/A	6 3/8	- 1/8	-1.9	(3)	-	-	-	-
	A	ELEC COMP PROG INST	3- 7	6 3/4	3 1/2	- 3/8	-9.6	75	96	336	-0.31	-
	N	ELEC DATA SYSTEMS	31- 85	39	54 3/4	-13 7/8	-20.2	(3)	-	-	0.81	68
	A	GREYHOUND COMPUTER	7- 11	6 1/4	8 3/8	-1	-10.6	198	277	566	0.78	11
	O	INFORMATICS	7- 15	5	12 1/8	- 1/8	-1.0	(3)	-	-	0.18	67
	O	INTL COMPUTER	2- 6	N/A	4 1/2	+1 3/8	+44.0	(3)	-	-	-	-
	L	INTL COMPUTER SCI	1- 2	N/A	1 5/8	- 1/4	-13.3	(3)	-	-	-	-
	(N	LEASCO	16- 23	8 1/4	17 1/2	-1 3/4	-9.0	4505	4698	8317	0.12	146
	(O	LEVIN-TOWNSEND	5- 9	N/A	5 7/8	- 7/8	-12.9	(3)	-	-	0.53	11
	(O	LMC DATA	1- 1	N/A	3/4	0	0.0	(3)	-	-	-	-
	O	MGMT ASSISTANCE	1- 2	N/A	7/8	0	0.0	(3)	-	-	-	-
	A	MANAGEMENT DATA	8- 11	10 1/2	9 3/4	- 7/8	-8.2	495	677	561	0.13	75
	O	NATIONAL COMP ANAL	1- 4	N/A	1 3/4	- 1/8	-6.6	(3)	-	-	-	-
	N	PLANNING RESEARCH	16- 26	17 1/4	21 7/8	+1	+4.7	2698	3194	5273	0.68	32
	O	PROGRAMMING METHODS	18- 29	10 1/2	24 1/2	0	0.0	(3)	-	-	-	-
	L	PROGRAMMING SCIENCES	1- 3	N/A	1/4	0	0.0	(3)	-	-	-	-
	O	PROGRAMMING SYSTEMS	2- 4	2 3/4	2 3/8	0	0.0	(3)	-	-	0.14	17
	O	SCIENTIFIC COMPUTER	2- 3	1 3/4	2 3/8	- 1/8	-5.0	(3)	-	-	0.09	26
	O	SCIENTIFIC RESOURCES	1- 2	N/A	1/2	- 3/8	-42.8	(3)	-	-	-	-
	O	SYSTEMS CAPITAL	3- 7	N/A	6 1/2	- 3/8	-5.4	(3)	-	-	-	-
	O	TIME SHARE	1- 2	N/A	1 1/8	- 1/8	-10.0	(3)	-	-	-	-
	O	TRACOR COMPUTING	2- 4	2 1/2	3 5/8	- 1/4	-6.4	(3)	-	-	0.33	11
	A	URS SYSTEMS	7- 11	5	7 5/8	- 1/8	-1.6	361	326	1177	-0.11	-
	O	UNITED DATA CENTERS	2- 7	N/A	3 1/4	-1 1/8	-25.7	(3)	-	-	-	-
	N	UNIVERSITY COMPUTING	21- 38	23 1/4	30 5/8	-6 1/8	-16.6	10440	13426	11138	-1.54	-
	O	US TIME SHARING	1- 3	N/A	1 1/2	- 1/8	-7.6	(3)	-	-	-	-
SUPPLIES & ACCESSORIES	N	ADAMS MILLIS	12- 19	9 1/4	12 1/2	- 7/8	-6.5	477	475	1081	1.08	12
	O	BALTIMORE BUS FORMS	6- 10	N/A	8	-1	-11.1	(3)	-	-	-	-
	A	BARRY WRIGHT	8- 13	7 1/8	8 1/2	- 1/2	-5.5	359	259	865	0.32	27
	A	CAPITOL INDUSTRIES	11- 22	22 3/4	11 5/8	-1 7/8	-13.8	746	1025	1651	0.33	35
	A	DATA DOCUMENTS	18- 29	15 5/8	21 1/2	- 5/8	-2.8	85	89	219	1.41	15
	O	DATA PACKAGING	6- 10	5 1/4	8 1/4	+1	+13.7	(3)	-	-	-0.03	-
	N	DENNISON MFG	22- 35	12	33 3/4	- 1/8	-0.3	1161	1918	2328	1.96	17
	N	DUPONT	130-152	120 1/8	142 1/4	-1 3/4	-1.2	2083	2475	3146	6.35	22
	N	ENNIS BUSINESS FORMS	9- 13	11 7/8	9 1/8	- 3/8	-3.9	581	782	1567	0.37	25
	O	GENERAL BINDING	25- 35	15 1/2	32 1/4	-2 1/4	-6.5	(3)	-	-	0.88	37
	O	GRAPHIC CONTROLS	6- 15	9	12 1/4	-2	-14.0	(3)	-	-	-0.33	-
	O	LEWIS BUSINESS FORMS	10- 15	12 3/4	11 1/2	- 1/4	-2.1	(3)	-	-	0.74	16
	N	MEMOREX	39- 78	61	39 1/8	-6 3/8	-14.0	4738	6361	6778	-0.28	-
	N	3M	96-122	75 3/8	118 1/8	+3 1/8	+2.7	5084	6373	4844	3.41	35
	O	MOORE CORP LTD	37- 42	N/A	39	- 3/4	-1.8	(3)	-	-	-	-
	O	REYNOLDS + REYNOLDS	37- 58	25 1/2	56 1/4	+6 3/4	+13.6	(3)	-	-	1.61	35
	A	SAFEGUARD INDUSTRIES	10- 15	8 1/8	12 1/2	-1 1/8	-8.2	690	944	1196	0.81	15
	O	STANDARD REGISTER	19- 23	20 3/4	20 3/4	- 1/4	-1.1	(3)	-	-	1.53	14
	N	UARCO	25- 33	22 1/4	32	+ 3/4	+2.3	162	182	513	1.75	18
	N	WALLACE BUS FORMS	18- 26	14 1/2	22 1/8	+ 1/4	+1.1	382	194	400	1.19	19

AVERAGES								
	COMPUTER STOCKS	16–26	20.00	21.03	–0.87	3.51		0.48	43.8
	DOW JONES INDUSTRIALS	831–951	700.10	901.80	–14.67	–1.60		2.95	17.2

APPLICATIONS-ORIENTED SERVICE

ROBERT F. GUISE, Jr. • Com-Share, Inc.

In May we stated that one trend you can safely expect in time-sharing is toward more and more applications-oriented service. Let us not go overboard on this happy prospect without being aware of some of the more insidious traps.

In the past, far too much attention has been spent juggling Cobol, Fortran, Algol, and PL/1 into clever little interactive uses which, while interesting and exotic to their designers, involved applications which had little to do with us ordinary mortals. It has been estimated, correctly I think, that the present language array caters to something less than 40 percent of the total universe of potential users. More and more time-sharing companies compete for the same limited marketplace, consisting mostly of applications related to the engineering and mathematical areas. There is a need for these applications and a certain natural affinity exists among users.

But what about the other 60 percent of the potential market? Their need is often "bread-and-butter" applications that work. Here we have experienced something less than rousing success. I think that the Cassandras, who have pointed the finger at a lack of specialized applications as being the downfall of some companies in the industry, have oversimplified the problem. While I do not disagree with the validity of the argument (please understand that the engineering market has supported more than its load of the market in the time-sharing industry), I must say that it is not so easy to whip up a new program here and there on demand which will function effectively in the time-sharing mode.

There is also the consideration, dear reader, that perhaps the market does not want or even *need* some of its more basic applications on a time-sharing, on-line, real-time basis. This fact alone brought the rise in all that talk, a year or so ago, about remote batch processing as being the big new market for time-sharing. I don't, however, think that the facts have borne this out. Most customers are just as happy taking their punched cards to their local data center and probably doing it just as economically to boot.

The concept of a computer utility has validity. But specializing in applications is no more going to provide a solution, or guarantee market acceptance and profitability, than offering free lollipops to new users. Companies offering conventional computing at this transitional stage must begin to *broaden* their services. To make sense out of this statement, it is necessary to return to some of the fundamentals of long-range planning.

One of the most obvious, and least understood, ingredients of planning sessions is the awareness that strategies based upon predictions of a future environment are not simple. In general, we can assume that the demands of the '70s will be for data services remotely accessible and interconnected to other data management systems.

There are basically five variables in the equation: central processors, data storage, communications systems, terminals, and systems software (including building blocks for applications programming). The trick is to determine the value of the coefficients associated with each of the variables. Anticipated advances or breakdowns in the technologies associated with the basic equation will not eliminate any of the variables; they will simply change the relative juxtaposition of their coefficients. For example, in time-sharing services today the inability to provide fast and cheap data storage generally produces a coefficient relationship which severely limits the number of applications that can be put on a system. Most applications requiring large data bases cannot be economically implemented in today's technology.

The successful time-sharing company of the future (i.e., useful and profitable) will direct much of its effort now in building a flexible data management network which will permit growth and change without catastrophic upheavals. The fallacy in most people's thinking is that specialized applications are really a subset of the general time-sharing business. Users will predictably impose greater and greater demands in terms of magnitude, linguistic complexity, interchange, transfer to other environments, and in user facilities as technology grows. We, therefore, must build a foundation on which to hang these embellishments. The trick for time-sharers is to tread the path of systems that are neither too general nor too limited. ▲

Robert F. Guise is a regular contributor ***Time-Sharing Topics***

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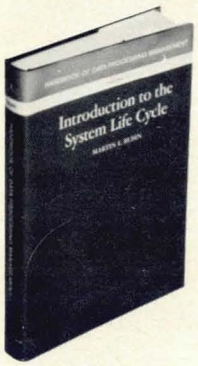

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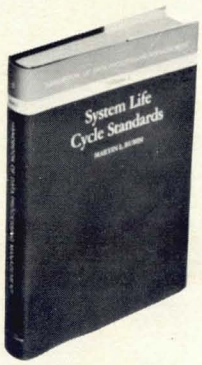

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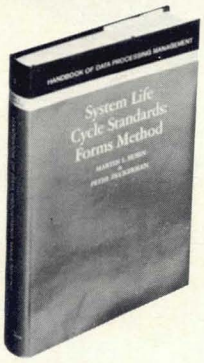

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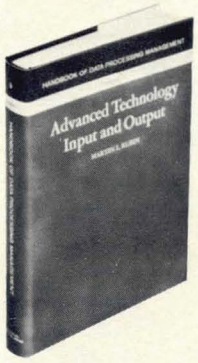

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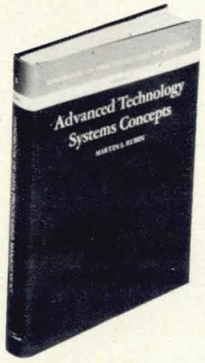

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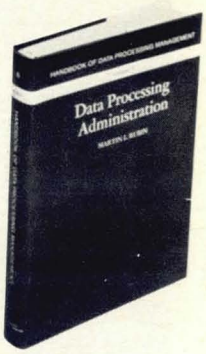

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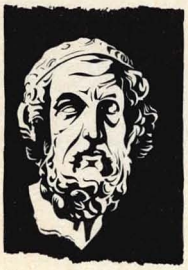


J. P. TIRESIAS • New York, N.Y.

COM is a product which fascinates potential users. The trouble so far has been getting them to buy. Wall Street is particularly disillusioned because, as of this writing, COM companies appear to be printing mainly in the red. That is, those who survived. Experiences like the fade-out of Scan Graphics and some of the forced mergers have blighted the whole technology in the eyes of investors. I maintain that COM's day will come and, if I may indulge in a bit of gut prophesying, it will be no later than the third quarter of 1972 before investors are climbing all over each other to get into the act. The economy will hopefully have turned, new companies will start appearing on the scene again, and lower-priced systems will be marketed.

Evidence the 1971 National Microfilm Convention held in Washington, D.C. this May, which featured COM equipment. Attendance was up by 50 percent from the year before (over 12,000 people). NMA membership increased 72 percent to nearly 5,000 members. Quantor introduced a new $30,000 system and Remington Rand announced entry into the COM field. All this indicates real activity. Still, a year ago there were perhaps 30 or so COMers, and this year there are only about half that number.

A recent and much quoted article in Barron's concluded that COM will succeed when someone invents the $20,000 COM system. Well, at least one company we know of (Century Sciences of Ft. Lee, N.J.) has done so, and I was one of many who attempted to obtain financial support and/or acquisition for the company. Several very large, sincere, and involved business equipment companies looked hard at the situation, found the equipment technically valid, but declined the opportunity "at the time." This led me to believe that the conclusions in the Barron's article have not been generally accepted.

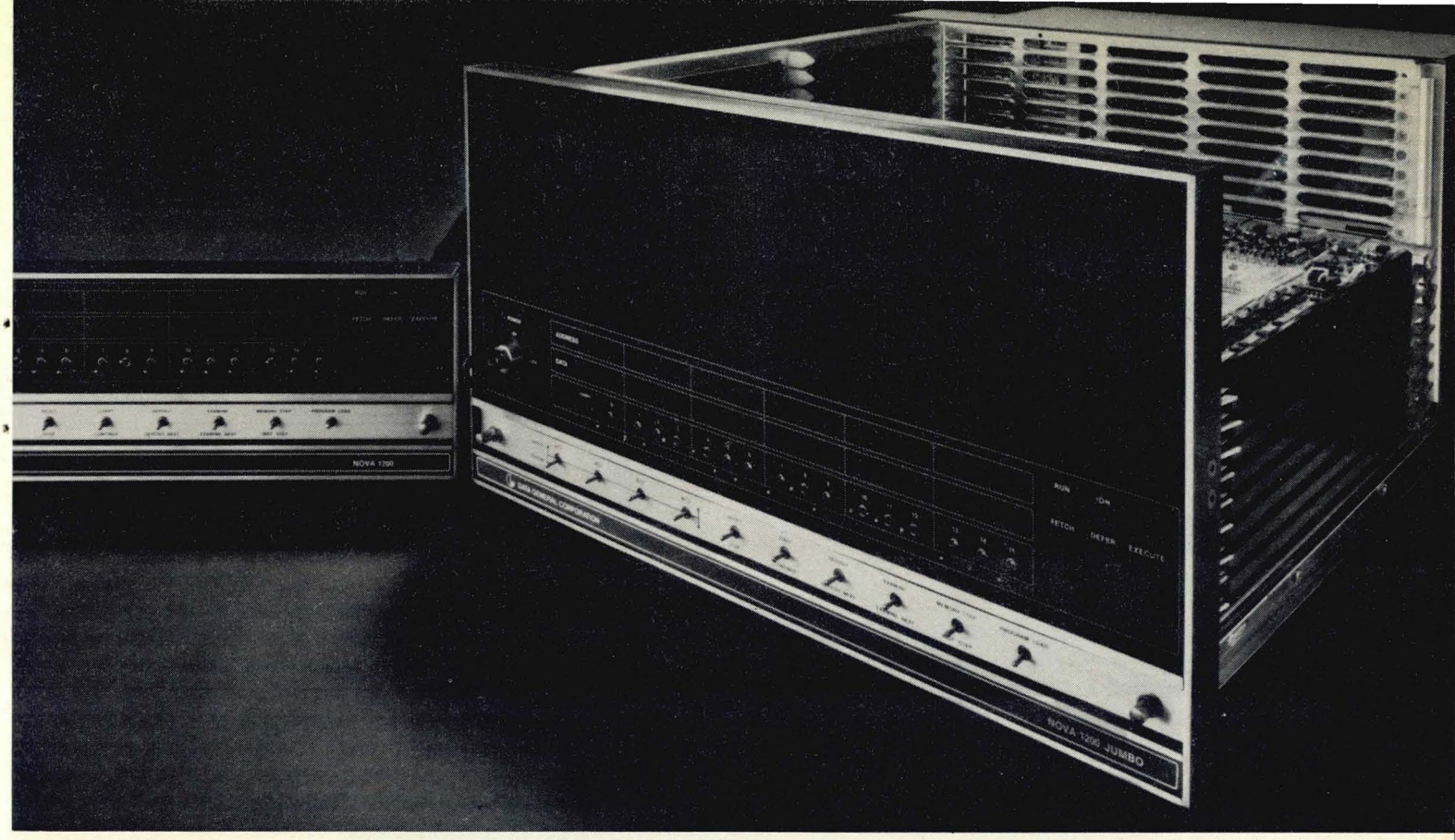
There are an estimated 200 COM service centers where you may bring computer tapes to have them microfilmed and processed. This will be the route to proselytize. There are perhaps 800 COMs installed, about 25 percent of them dedicated to service. Eastman Kodak is in services, although they maintain that they will not compete in cities where there are EK COM services customers. 3M announced entry into extensive service organization operations nationwide at the NMA convention.

Quantum Sciences sees microfilm's growth as slow. In a recent report, "Microfilm – Search For An Image," they stated that "projections for the next five years are about half of previous blue-sky estimates," and that the $380 million a year now will reach about $660 million in 1975. Quantum projects a growth of 15 percent a year. At that rate, concludes Quantum, the $1 billion mark will be conveniently reached shortly before 1980. Quantum calculates that COM presently constitutes about $25 million a year of the total microfilm market and is projected to $67 million by 1975 – a proportionately greater percentage increase. I tend to doubt these figures. The Barron's report put microfilm at $450 million in 1970 and COM at about $50 million, or 10 percent of the total industry. That seems a little more like it!

A glaring parallel exists between COM and OCR, which we surveyed in the May issue. Both methods are obviously needed, are faster, more efficient, and often result in certain savings. Both suffer from poor promotion and initial sales resistance. Both also suffer from certain established interests in keeping these new technologies getting off the ground. Why? Because printers are still being made and sold, and there are more manufacturers of paper and paper record storage equipment than there are of film and film equipment.

It remains, once again, for the user to demand, to explore, and be daring. He must take the plunge once he is theoretically convinced that COM is the thing for him. In 1969-70 COM was an idea ahead of its time. In 1972 COM will come into its own. So what are you waiting for? ▲

J. P. Tiresias *is a pseudonym for an individual at home in both the industrial and financial communities. This column, which represents opinions garnered from many specialists, interprets significant trends in the EDP marketplace.*



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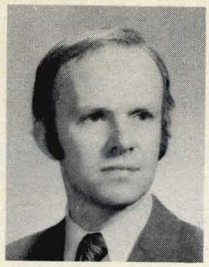
DATANET LIVES



THOMAS DeMARCO • Independent Consultant

My May column on Turnkey Front-End systems has provoked some controversy, and I would like to touch on the subject again. I received nine letters from front-end vendors and zero letters from potential users. I hope that does not imply that there are indeed nine vendors for every zero potential users. That might explain the frustration of two of the letters.

Almost no column I have written in the past two years has failed to fetch at least one letter in the genre "How dare you discuss the subject of . . . systems without saying something nice about my company, Yoyodine, Inc., an acknowledged leader in the field." Somehow I dare.

The majority of these letters came from companies I have never heard of. I would point out that keeping a product secret provides its own reward. The meek shall inherit the earth, but not today.

Letters of quite a different sort came in from Honeywell. They pointed out that I had wronged them in my column by stating that the Datanet 30 had been discontinued after the Honeywell-GE merger. The Datanet 30 is still being actively marketed by Honeywell. I particularly regret my error because I have a great respect for the device and the people who created it.

The story of the Datanet 30 is rather incredible. According to members of the original project, the system was completed without ever being formally authorized by G.E. management. It was a bootleg project with no appropriation. Components were pirated from other projects.

Having discovered the first stored program communications processor alive and well, mysteriously in the midst of a process control project, G.E. was somewhat at a loss. Product planning estimated that no more than ten such machines could ever be sold. In spite of this it was marketed and accepted with great favor. As one letter (not from Honeywell or G.E.) points out: "I have long felt that the reason that the Honeywell Time-Sharing Systems (nee General Electric) are the dominant machines of the time-sharing market is the use of the Datanet 30 as a front-end computer." The system was ahead of its time.

The Datanet 30 is still fairly competitive and remarkably contemporary. With the character buffer option, the line interface is quite clean. Best of all is that aged-in-the-cask software that means you only have to worry about bugs that have not cropped up in the first 2,000 system years of operation.

Today the 30 has both a smaller and a larger sister. The Datanet 305 caters to the very small shop (not unreasonable for ten users), while the 355 handles up to 200 users. Machines in the series are upward compatible and can be duplexed.

Turning to some of the other letters, Mr. Arthur Yaffe of PHI Computer Services (Arlington, Mass.) writes that the PHI Telecommunications Processing System (TPS): *is a three-part system consisting of a Communications Processor Program (CPP), a Communications Access Method (CAM), and a Communications Program Generator (CPG). CAM is used only when the front-end minicomputer is used as other than as a 2701, 2702, or 2703 emulator.*

The price of TPS is somewhat below the 'expensive to outrageous' range. It is interesting to note that PHI also uses a Tempo computer.

Several other readers took issue with my characterization of the costs of front-end processors. Mr. Michael Lipp, writing for Cybermatics: *Using [large second-generation computers for front-ends], the user is hard pressed to realize any cost performance benefits. This is simply not the case when a minicomputer is used as a front-end. This new economy is the major reason for the renewal of front-end activity.*

My judgement would be that the potential benefits of independent processors are just now becoming realizable. Furthermore, I think the costs are not expensive to outrageous, but remarkably reasonable. Turnkey front-end costs will compare favorably with the monthly rental price of the hard-wired communications controllers they replace. I certainly agree with the last observation, although the replacement market has not yet gelled.

Mr. S. E. Anderson (Redcor Corporation) makes a good case for justifying front-end systems in terms of the functions they perform. Still, there are very few front-ends (particularly for the 360) in operation. If costs were in general acceptible to the market, this would not be so.

Other letters pointed out that I had not mentioned the Univac 418 communications processor (which I left out because it did not seem to be a turnkey system) and that treatment of the Informatics, Cybermatics, and Interdata systems was less than comprehensive. Each of those systems could justify a complete article. The Informatics ICS-500 was described in the February, 1970, issue of MODERN DATA. In operation (at the Federal Reserve Bank of New York, for instance), it has lived up to all its promises. ▲

Mr. DeMarco is a regular contributor to ***The Systems Scene.***

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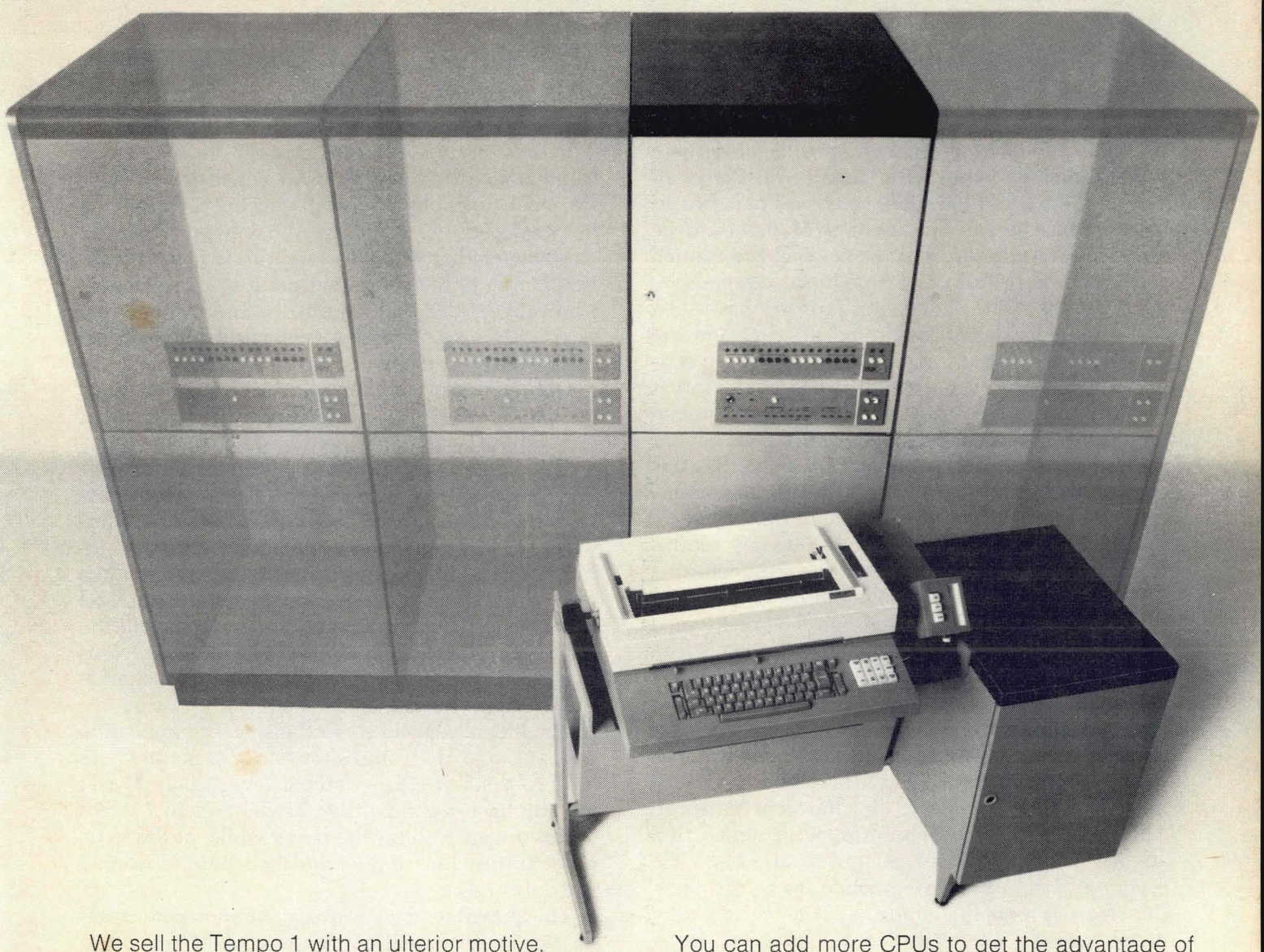

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NATURAL SELECTION

L. A. WELKE • International Computer Programs, Inc., Indianapolis, Ind.

To be all things to all men is not difficult if there are few men to begin with. Being a leader is always easiest when the group numbers one. But as the audience grows, the number of things to be increases accordingly, and the original proposition soon takes on the allure of a politician's promise.

Observers of the data center industry have seen this gossamer-winged syndrome develop and are now seeing it go the way of buggy whips and dirigibles. More and more, it becomes evident that the way to operate a data center successfully is to do a few things extremely well, rather than a lot of things just about well enough. To assume that this change took place solely because of the omniscience of data center management would be to shortchange the influence and drawing sophistication of both the customer and the prospect.

Not too many years ago, the public viewed data centers as being all alike – if you saw one, you'd seen them all. Service agreements were signed on the basis of who bought lunch and the color of the salesman's tie. Work brought into the center was always tailored to a customer's exact specifications; sometimes even to his inexact specifications.

This approach to life had a few inherent faults, not all of them visible to the innocent prospect. And innocent he was. The prospect assumed that anyone who knew about computers also knew everything about business practice and procedure. For reasons equally confusing, the data center people usually assumed that the prospect knew what kind of a system he wanted and needed.

From this situation, a process termed by Darwin as "natural selection" set in; the result being that data centers that specialize, prosper. Some of them now specialize to the point of being single application shops while others serve one and only one industry. Customers, in turn, are playing out their role by dealing with multiple data centers in order to get their total processing done.

L. A. Welke is the founder of *International Computer Programs, Inc.*, publishers of the "ICP Quarterly," a catalog of available computer programs. He is also vice chairman of the Software Committee of ADAPSO.

If the story ended here, it would be a textbook solution to a business problem which is in reality extremely complex. Several questions remain on both sides of the equation. What happens to the data center that wants to expand? Is it to be limited in size to the saturation point of its specialty? And is it to the best interest of the customer to deal with a separate service facility for each aspect of his processing?

Data centers, whether specialized or not, must be able to grow. And when the time is right, grow they will. Their alternatives are as many and varied as a rich widow's. They can open branch offices, acquire existing firms, or attack whole new markets. This can be accomplished either by offering new services or by approaching different industries. The latter is probably the most lucrative alternative since it has the lowest risk factor. This is particularly true when new service comes in the form of a proprietary program package. This makes entry into the new service and/or market quick and professional.

It's difficult, however, to think of an application package that does not already exist. In fact, it's hard to think of a program package which doesn't already have a competitive product against it. All of this augers well for the buyer while, at the same time, putting him in the critical position of making the right choice.

The potential data center customer comes out on top in this situation. Start-up costs on a new application are bound to be lower and the time schedule for conversion, minimized. The most significant factor is that nearly all of his systems requirements have already been determined for him.

Does this mean that the customer must live with a more-or-less standardized system? No, not really. He always has the option of embellishing the standard with as many special frills as his pocketbook will allow. In today's economy, this probably means that Fords come in any color as long as they are black. But this policy was as good for the car buyer as it was for Ford. ▲

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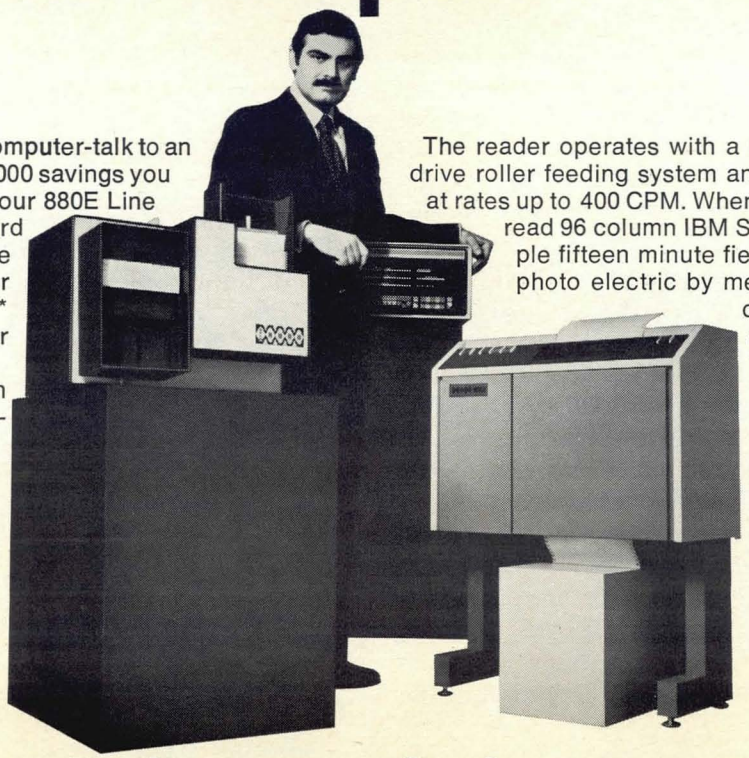

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WHAT HATH BABBAGE WROUGHT Dept.

OR PERHAPS EVEN ANOTHER PURCHASING PROBLEM

The following is the first paragraph of an advertisement for programmers and systems analysts (for Pratt & Whitney Aircraft, East Hartford, Conn.) which appeared in the *Hartford Courant* of March 7, 1971:
"If you are locked into routine programming, you'll enjoy working in our Information Systems group. Variety is the keynote here. Initially, you may be involved with a purchasing problem. Later on, you may be involved with a purchasing problem. Later on, perhaps, with projects in engineering . . . or advanced planning, product support, management sciences, finance, manufacturing."

Submitted by:
A. Nonymous, Pratt & Whitney Aircraft
Somewherein, Conn.

RIGHT!

The following is a "clarification" from the IBM **Installation Newsletter** *of Feb. 12, 1971:*

OS SYSGEN SRL-TNL CLARIFICATION
Some reader's comments for the IBM System/360 Operating System: System Generation SLR GC28-6554 have pointed out an apparent page conflict between the manual and the latest Technical Newsletter, GN26-0613. The following should explain the circumstances as well as the solution for resolving the conflict.

Two System Generation SRL's were printed for Release 19, GC28-6554-7 and GC28-6554-8. The -8 version is obsolete and should be discarded. The GN28-2439 Technical Newsletter was issued against the -7 version for the prime purpose of updating it to a -9 version. The page conflict will exist if the -8 instead of the -7 was updated to a -9.

The difference between -7 and -8 can be determined by checking page 82. The -7 version contains a description of the "Indexed Sequential Access Method (ISAM)," while the -8 version contains descriptions of "Main Storage Hierarchy Support" and "Multiple Wait Option."

Submitted by Allan Mellis, Flushing, N.Y.

PERSONNEL DIAGNOSTIC

A few years ago I was responsible for installing a minicomputer in one of our melt shops and for the subsequent training of the melters in the use of this new process control tool. One of the supervisors in this melt shop became an immediate problem during the training sessions. Being a very quick and impatient man, he tended to slap at the console buttons and typewriter keys with complete abandon. If one of the melters was slow in making a response, this supervisor was unable to contain himself and would jump in and take over the computer operation function. Needless to say he made everyone nervous, and our training program was a disaster. One afternoon he became upset while I was working with one of the slower melters; he jumped in and started pushing buttons saying, "Here, let me show you." Just then the printer spurt out . . . ASS.

He accused me then as he accuses me now of having "rigged" the computer. The truth is the computer knew him for what he was.

Submitted by: K. W. Roessing
Allegheny Ludlum Steel Corp.
Brackenridge, Pa.

ONLY HIS BILL SHOULD BE CUT

Shortly after a friend of mine became a proud father, he received a computer-generated bill from the hospital itemizing the maternity charges. Included was a $10.00 charge for circumcision. What makes this WHBW-able is that his new baby was a girl!

Suggested by: James M. Janiah
Bresnahan Data Center, Addison, Ill.

MODERN DATA will pay $10.00 for any computer- or EDP-related item published in our **WHAT HATH BABBAGE WROUGHT Dept.** Humorous 'information' for consideration may include weird memos or operating instructions, unusually incongruous documentation, and off-beat items of a general nature (for review by our off-beat editors). Send all submissions to:
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CALL: James J. Baker

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PLUS - D/A: The "PLUS" software security and control system, in use worldwide, is now available in a new Direct Access form.

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There are many other secondary features. We've had a great variety of experience with program library systems and have designed features that add much convenience and efficiency to the system. For example: variable number of records per track, use of less or more than one disk pack, reorganization capability, "on-disk" backup, several operations performed with same access, ID features, etc.

You know you need it. Find out details!

CALL: Jean P. Lapointe

Jean was responsible for the development of the highly successful PLUS system which is now in use throughout the U.S., Canada, South America, and Europe. Jean will be glad to talk to you about the advantages inherent in the new Direct Access version.

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GRAPHIC DIGITIZERS

An endless variety of information transducers—those elements that convert information from human- to machine-sensible form and vice-versa—have been created since the advent of the computer. On the frantic business scene, most of these information transducers have khaki personalities — teletypewriters, keypunches, and the like. But the somber, staid engineering and scientific community is served by stimulating, cleverly conceived instruments that stir the imagination, giving the computer the ability to see, hear, touch, smell, and taste. A charter member of this group of transducers is the digitizer, a device that converts information contained in pictures, maps, or sketches into data that can be analyzed, restructured, smoothed, edited, and transmitted by a computer.

This definition implies that the digitizer is a special-purpose analog-to-digital converter. It excludes devices whose primary inputs are analog electrical signals, and those that measure anything but position. In general, the digitizer operates from an image on paper or from a picture on a CRT screen.

To understand the advantages of a digitizer, let's examine a common application — numerical control of a milling machine. If we want the computer to program the machine for a particular part, we can draw a dimensioned sketch, sit down at the console or terminal keyboard, and describe the radius and center of each arc, the slope, origin and end-point of each straight line, and a series of closely-spaced points specifying irregular segments of the contour; alternatively, we can use a digitizer, moving its stylus or optical read head from point-to-point along a contour, entering sample points as needed. The two procedures provide identical sets of data for the computer; the first requires the operator to determine, rather laboriously, the coordinates of each point of interest for entry, whereas procedures using a digitizer are easier, faster and less prone to error, and less expensive if used frequently enough to amortize equipment cost.

TYPES OF DIGITIZERS

The console or terminal with a keyboard is not an analog-to-digital information transducer in the strictest sense; its input is digital (discrete keystrokes by the operator), where the operator is the transducer. When the digitizer is introduced, the operator becomes a monitor or supervisor, and the equipment performs the transformation. Going one step further, digitizers may be classified by their degree of automaticity — by the role of the operator in the process.

At the lowest, least expensive end of the scale there is the manually controlled positional element digitizer (Figure 1) whose position is usually sensed by electromechanical means. The operator moves the element to a position of interest and activates a switch to record or enter the position into the computer. The process is repeated, point by point, until the "picture" is completed. Additional switches or similar means are provided in more sophisticated digitizer systems to denote the end of one contour and the beginning of another, to describe the end-points of straight-line segments, to describe special labeling associated with a given contour, etc.

Many such systems provide optical aids so that the element may be positioned as accurately as possible before each entry is made. Average accuracy (measured over many points) down to 0.005″ is achievable. Of course, the overall input accuracy of such systems is limited by the precision of the source document, whether it be a mechanical drawing, a sketch, a map, or a photograph. This doesn't imply that the output accuracy is similarly limited. Many on-line systems, tied

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Figure 1 • Hand-held, manual cursor of Hewlett-Packard digitizer used to feed coordinates to H-P calculator for analysis.

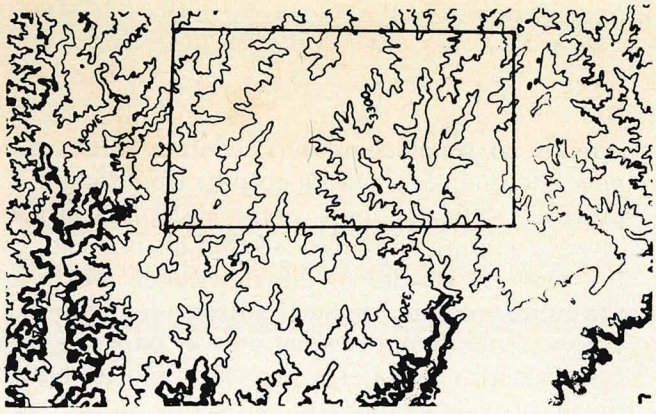
Figure 2 • Actron Industries/Tridea Products Division's ALTAPE/ALDRAFT Systems, an automatic line-following graphic digitizer/plotter system.

directly to small computers, contain software to generate smooth, accurate outputs from rough, imprecisely defined inputs. Some systems also have internal editing capability so that an initial drawing may be readily modified without reentering the entire "picture." Some digitizers are not procurable as separate entities but only as part of a total system which includes a processor and an output device, usually a plotter.

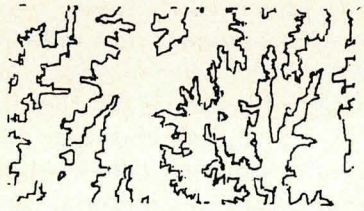
Next on the automaticity scale is the digitizer that "reads" a source document all by itself (Figure 2), following a contour automatically until it runs off the page, returns to the point of origin, or hits a branch. The operator must then tell the digitizer which branch to follow, and reposition the head at the start of another contour. This level of capability is needed where the picture is complex, with many closely spaced line segments. This type of digitizer provides the computer with much more data to operate upon, since the head is driven slowly across the surface of the source document and samples are taken at regular time intervals. The associated processor software is simpler than in the manually-positioned head system; interpolation of straight lines and curves isn't needed — smoothing is sufficient — operator instructions to the device are simpler and require less skill, and thruput is faster because less manual intervention is needed.

At the highest level of automation and sophistication is the raster-scan type of digitizer. Its output is a serial bit stream, quite analogous to the output of a television camera. Vertical position signals are picked off as the horizontal scan is executed, and the combined coordinates are stored for processing. The operator's role, after each run is set up, is to activate an "On" switch and then stare at a "Scan Under Way" light until the job is finished. When the computer receives the output, it breaks into a programmed "sweat;" the amount of data to be processed is, to quote Damon Runyon, "considerably more than somewhat." Since the vast majority of any drawing consists of white space, the program must eliminate the white areas, detect the line signals, and correlate each data point with its neighbors. This is similar to the problem of automatic search radar tracking of aircraft, in which the successive detected positions of the aircraft must be correlated on successive scans.

If the black space is the only area of interest, the digitizer or the processor can be designed to eliminate the white area "on the fly" or as soon as



MAP ORIGINAL



DIGITAL PLOT

Figure 3 • Raster scanned digital plot of map data (courtesy of Visicon, Inc.).

the entire picture is stored in memory. A much smaller memory can then be used, although the number of data points is larger than it would be with any other class of digitizer. A typical raster scan digitizer input, and the processed, plotted output are shown in Figure 3.

Ultimately, the choice of a digitizer depends on several factors: cost; frequency of use; thruput; accuracy; availability of skilled operator; size and complexity of the input medium; output interface requirements; and application, since most digitizers are designed for specific, rather than general purpose, utilization.

APPLICATIONS

Digitizers are applied to many diverse areas — from the simulation of molecular structures to the generation of world and gallactic maps. Two major application areas dominate: automatic drafting,

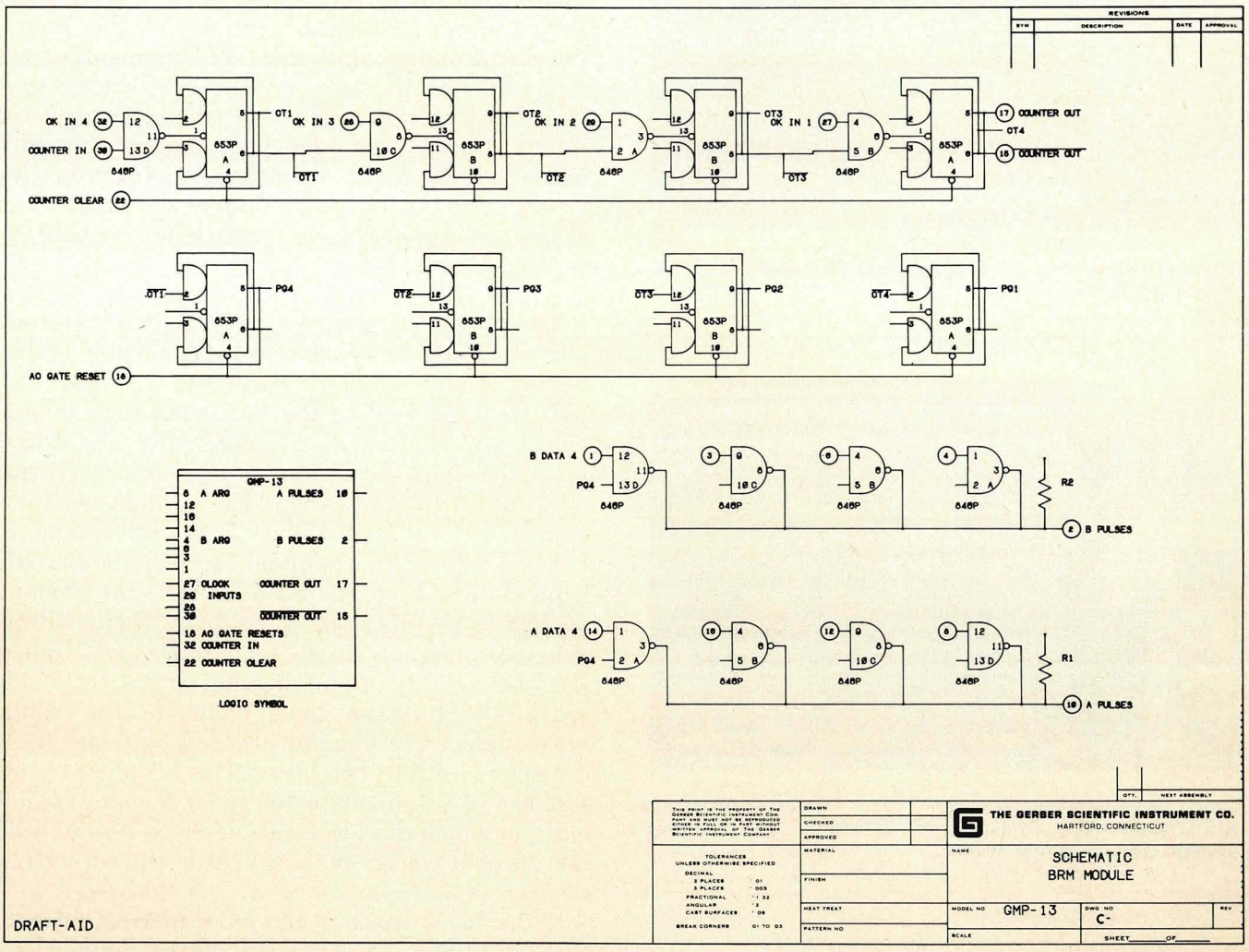


Figure 4 • A camera-ready logic drawing which took two hours to prepare using a digitizer and plotter, versus an estimated seven hours using manual methods (courtesy of Gerber Scientific).

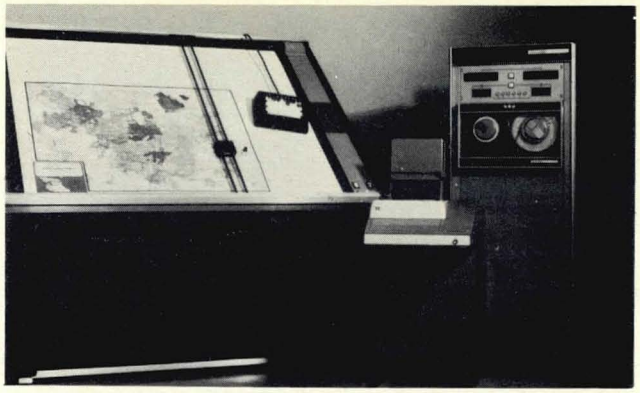


Figure 5 • The Model 785 Graphic Data Digitizer, Calma's large bed system which outputs onto seven- or nine-track magnetic tape.

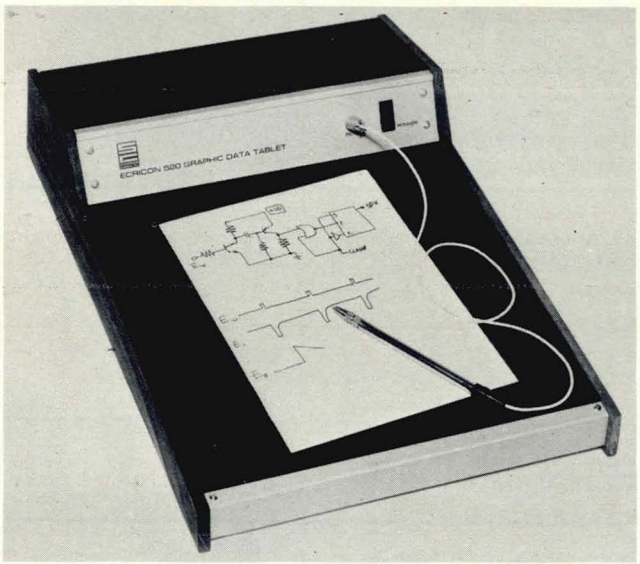


Figure 6 • Shintron's Model 520 Graphic Tablet, a graphic data input device for remote display, N/C system and graphic communications applications.

MANUFACTURERS' DIGITIZERS

Graphic digitizers range in complexity from hand-held pen or cross-hair cursor input devices to automatic, computer-controlled, curve-following systems. The digitizer may trace using manually-controlled input signals — each point and/or symbol denoted by an operator-controlled switch or push-button — or may be automatically clocked using an internal or program-controlled timer, points being registered as the cursor traverses the curve or map. The digitizer can input data on an absolute basis, each point referenced to a common X-Y zero origin, or use an incremental scheme where each coordinate is dependent on the preceeding point.

The digitizer can come unsupported, a basic input device for hard-copy or CRT plotting applications, or as a complete, software supported system, utilizing an internal controller, card, paper or mag tape, disk or drum, and CRT or teleprinter peripherals. Input can involve line drawings, graphs, maps, photographs, or microfilm images.

The following table lists the varied models and manufacturers of graphic digitizers and digitizing systems. Additional information on equipment that is of particular interest may be obtained by referencing Table 2 and using the Reader Service Card.

and numerically controlled (N/C) machine tool program tape preparation.

Major drafting application subclasses are: cartography; subdivision mapping; architechtural drawing; mechanical drawing; electrical drawing; and printed circuit artwork generation.

Primarily, the digitizer is most cost effective in high-volume, repetitive applications, where a relatively small number of elements must be repeated many times without omissions and with high accuracy. This sounds like a plotting rather than a digitizer problem, but it's both. The digitizer provides the primary input to the process. Take, for example, logic diagram preparation (Figure 4). The operator can work directly on-line with a plotter at his elbow. Sometimes the output plot is produced on the same surface as the input, so that the operator can view the effect of his work immediately. In any event, the position sensor is moved about the input surface, and the operator selects the symbol (AND gate, OR gate, NOR gate, or other logical element) that is to appear at each point. The plotter draws the specified element entered at the designated position. When all elements have been placed, the operator begins specifying interconnections. Then the diagram is labeled and the work is complete. The plotting commands may be stored on magnetic tape for future editing, if necessary, or the editing may be performed during the digitizing process so that a final, error-free drawing can be generated quickly and economically.

This powerful sort of interactive, on-line system is becoming increasingly common as more and more users discover the economies that can be realized with the improvement in thruput and reduction in the engineering change cycle.

The same remarks are applicable to printed cir-

TABLE 1 – GRAPHIC DIGITIZER DEVICES & SYSTEMS

COMPANY MODEL	DEVICE / SYSTEM DESCRIPTION	PARAMETERS A-Area RS-Resolution AC-Accuracy RP-Repeatability	PRICING SRV-Servicing PRC-Processor SFT- Software PT-Paper Tape MT-Magnetic Tape Transport
ACTRON IND./ Tridea Prod. **Altape Mk 111**	ALTAPE (Automatic Line Tracing and Programming Equipment) converts drawings directly into N/C tapes. System employs Varian 620/i or 620/L with 8K memory. Interfaces to IBM 360/40 and 58, 1130 and GE 635	60" x 48" to 72" x 288" A 0.0001" RS ±0.004" to 0.006" AC 0.002" RP	$ 163,000 to $ 207,000 with SRV · PRC · SFT · PT
AUTO-TROL **3990**	Solid state controlled system with variable scaling, grid round off, and patch-board formatting	20" x 20" to 60" x 80" A 0.001"/0.002"/0.004" RS ±0.004" AC · ±0.001" RP	$ 14,000 – $ 700/month with SRV
BENDIX **Graphscan**	Graphscan comes equipped with either a CRT, TTY or IBM 029 card-punch interface	17" x 17" to 40" x 60" A 0.010" RS · ±0.010" AC ±0.010" RP	$ 6,200 to $ 12,500
Datagrid	System features hand-held, free-moving cursor and a 28-key floating keyboard	30" x 36" to 42" x 60" A 0.001" RS · ±0.005" AC ±0.001" RP	$ 12,000 to $ 35,000 with SRV
BETA INSTRUMENT **Beta Scan 210**	The 210 digitizes data from 16, 35 or 70 mm film at rates up to 100,000 points/second	4096 x 4096 points RS ±0.5% AC · ±0.05% RP	$ 71,000 with PRC · SFT
BOSTON DIGITAL **LTD-1**	____	22" x 34" A · 0.001" RS ±0.01" AC · ±0.02" RP	$ 6,000 (OEM) with SRV
CALMA **280 / 285**	The 280 and 285 offer two operation modes – manual point-to-point, and automatic line (10 intervals)	32" x 42" / 48" x 60" A 0.001" RS · ±0.003" AC ±0.001" RP	$ 18,500 / $ 19,500 with SFT
580 / 585	The 580 and 585 offer two operation modes – manual point-to-point, and automatic line digitizing (72 intervals)	32" x 42" / 48" x 60" A 0.001" to 0.100" RS (sw sel) ±0.003" AC · ±0.001" RP	$ 20,500 / $ 21,500
680 / 685	The 680 and 685 offer two operation modes – manual point-to-point, and automatic line digitizing (72 intervals)	32" x 42" / 48" x 60" A 0.001" to 0.100" RS (sw sel) ±0.003" AC · ±0.001" RP	$ 24,500 / $ 25,500 with MT
780 / 785	The 780 and 785 offer three operation modes – manual point-to-point; automatic line digitizing (72 sw sel intervals); and incremental (varies with stylus velocity)	32" x 42" / 48" x 60" A 0.005" and 0.010" RS (sw sel) ±0.015" AC · ±0.005" RP	$ 30,500 / $ 31,500 with MT
880 / 885	The 880 and 885 offer three operation modes – manual point-to-point; automatic line digitizing (sw sel from 5 mils to 7.5"); and incremental (varies with stylus velocity)	32" x 42" / 48" x 60" A 0.001" to 0.100" RS (sw sel) ±0.003" AC · ±0.001" RP	$ 34,500 / $ 35,500 with MT
985	The 985 employs a low-friction tracing stylus with an X–Y stylus lock. Nova 1200 with 12k memory is used as internal processor. Full range of data input and edit features	48" x 60" A 0.001" RS · ±0.003" AC ±0.001" RP	$ 46,000 with PRC · SFT · MT

TABLE 1 – GRAPHIC DIGITIZER DEVICES & SYSTEMS. . . cont'd

COMPANY MODEL	DEVICE / SYSTEM DESCRIPTION	PARAMETERS A-Area RS-Resolution AC-Accuracy RP-Repeatability	PRICING SRV-Servicing PRC-Processor SFT- Software PT-Paper Tape MT-Magnetic Tape Transport
COMPUTEK GT 50/8 & 50/10	The GT 50 Graphic Tablets use an electro-magnetic detection technique for pen position input	11" x 11" A 0.044" / 0.011" RS ±0.005" AC	$ 1,300 / $ 2,800
COMPUTER EQUIPMENT Digi–Grid	Full range of table sizes, cursors or pens, and I/O options	to 42" x 60" A 0.001" to 0.100" RS (sw sel) ±0.005" AC · ±0.001 RP	$ 13,750 to $ 30,000 with SRV · SFT · PT · MT
CONCORD CONTROL 8-23	Photoelectrically-coupled stylus input with controls for entering absolute origin, curve and file data	22" x 32" A 0.005" RS · ±0.005" AC ±0.005" RP	----
105	----	0.001" RS · ±0.001" AC ±0.005" RP	----
CONSUL & MUTOH Digigrammer	Options include digital printer, X–Y reversable counter display and command keyboard	36" x 60" to 50" x 72" A 0.004" RS · ±0.006" AC ±0.001" RP	$ 27,000 with SRV · PRC · PT
DATA TECHNOLOGY APD +	The ADP + (Adaptable Program Digitizing plus) is comprised of an X–Y digitizing table, a patch panel formatted buffer, and a high-speed paper tape punch.	31" x 36" or 31" x 46" A 0.001" to 0.100"RS (sw sel) ±0.004" AC · ± 0.001" RP	$15,000 with PT
ELECTRONETIC SYSTEMS 11 / 21	The models 11 and 21 use a hand-moveable cursor with footswitch for logging, and console keyboard for numerics, symbols and record controls	12" x 24" / 36" x 60" A 0.01" RS · ±0.01" AC ± 0.01 RP	$ 6,890 / $ 8,800 with SRV · MT (Cassette)
GERBER SCIENTIFIC GCD-1	Control features of the GCD-1 include an X–Y coordinate display allowing reading of head position to .001" a readout buffer for fast cycling, and sw sel absolute or incremental output	42" x 60" A 0.001" RS · ±0.01" AC ±0.005" RP	----
INSTRONICS TCD	----	to 24" x 24" A 0.01" RS · ±0.01" AC ±0.05" RP	----
Gradicon	System consists of three units – digitizer table; readout conversion console; output device	24" x 36" to 48" x 60" A 0.001" / 0.002" / 0.004" RS ±0.004" AC · ±0.002" RP	$ 7,500 and up with SRV · PRC · SFT
KONGSBERG 6500 Series	Horizontal, manually driven, back lighted table with incremental encoders	26" x 67" to 26" x 98" A 0.001" RS · ±0.004" AC	$ 35,000 to $ 50,000
PHOTON System G. Digitizer	----	24" x 36" A 0.005" RS · ±0.0025" AC ±0.0025" RP	$ 21,500 with SRV · PRC · SFT
SCIENCE ASSOC GP-2	Graf Pen Data Tablet uses ball-point pen with tiny spark gap as input stylus	to 72" x 72" A 1 part in 2000 RS ±0.015" AC · ±0.015" RP	$ 2,800 – $ 95/month
SHINTRON 520 Ericon	Graphic tablet device	11" x 11" A 0.011" RS · ±0.5% AC	$ 2,000
VISICON GC-3	Raster scanned drum input device. Interfaces with IBM 360, DEC, HP, Varian and Data General Computers	11" x 17" A 0.0025" to 0.020" RS ±0.0025" AC · ± 0.0001" AC	$ 13,950 – $ 470/month with SFT

cuit artwork generation, where the accuracy requirements, complexity, and repetetive nature of the output demand a mechanized drafting process. Again, as in the logic diagram preparation, the process starts with the designation of pre-stored element positions and interconnections by an operator using a digitizer. Since these drawings often comprise many repetitions of a basic pattern, the operator defines the basic pattern and the manner in which the repeated patterns are to be laid out.

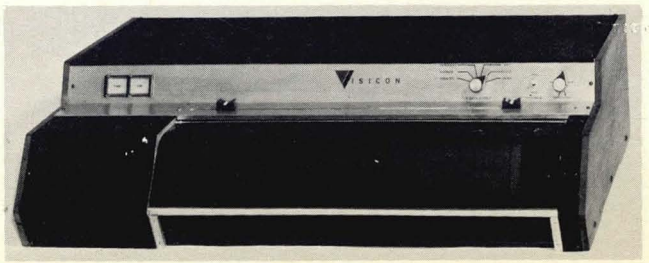


Figure 7 • The GC-3 Graphic Conversion Terminal, a raster scan automatic digitizer produced by Visicon.

The computer then plots the entire drawing.

The same fundamental procedure is used in architectural drawings for apartment complexes, where a pattern is repeated several times. Some companies use similar techniques in plotting subdivision layouts.

Notice that such processes do not eliminate the need for an original, manually drawn sketch which has to be produced with great care in some applications. In fact, manual drafting is often sufficient if a drawing is not characterized by some level of repetetiveness, by some way of using a pre-stored symbol set or pattern over and over again.

We have already outlined how a digitizer can be used to define the contour of a part to be machined. The processor contains an algorithm that produces the N/C tape. The N/C tape system may be looked upon as an extension of the automatic or semi-automatic drafting system, since all of the elements – digitizer, processor, plotter – are present. The N/C tape is produced only after a sketch has been entered, plotted, and approved. These systems also contain such tailor-made features as the capability to specify the center, tolerance, diameter, and depth of drill holes for programming on the N/C tape.

The uses of digitizers in scientific applications and in other engineering areas almost defy classification. Digitized computer inputs are generated from time chart recorders to analyze seismographic data, telemetry, strain guage readings, power line, temperature, altitude, and humidity variations. Oil well logs, weather maps, topological maps, and rainfall and river levels may also be analyzed in a similar manner. In the medical field EKG, EEG, and X-ray information may be entered via a digitizer for computer analysis. These applications don't call for interactive systems; the processing is usually limited to collection of statistical information about a given picture for comparison with a norm or with other pictures. The equipment configurations are simpler and less expensive. In many cases, the data is captured off-line, on tape cassettes or other media, for batch processing later on.

Another application requiring interaction is pattern scaling and modification in the garment industry. (Perhaps this one should be better classified as architectural drawing or structural design.) Optimized pattern layouts are provided for various design or size changes.

Inevitably, as automatic processing systems continue to invade more and more corners of the economy, the digitizer, along with companion information transducers, will find new and more exotic areas of application.

TABLE 2 REFERENCE LITERATURE

For additional information on the digitizing equipment described in Table 1, circle the appropriate number listed below on the Reader Service Card.

COMPANY	READER SERVICE CARD NUMBER
Actron Industries/Tridea Electronics, Monrovia, Cal.	110
Auto-Trol, Arvada, Colo.	111
Bendix Computer Graphics, Farmington, Mich.	112
Beta Instrument, Newton, Mass.	113
Boston Digital, Holliston, Mass.	114
Calma, Sunnyvale, Cal.	115
Computek, Cambridge, Mass.	116
Computer Equipment, Rockville, Md.	117
Concord Control, Boston, Mass.	118
Consul & Mutoh, Evanston, Ill.	119
Data Technology, Watertown, Mass.	120
Electronetic Systems, Downsview, Ont.	121
Gerber Scientific, Hartford, Conn.	122
Instronics, Stittsville, Ont.	123
Kongsberg Systems, Bedford, Mass.	124
Photon/Computer Graphics, Wilmington, Mass.	125
Science Associates, Southport, Conn.	126
Shintron, Cambridge, Mass.	127
Visicon, State College, Pa.	128

For a quarterly-updated service report on

DIGITAL PLOTTERS AND DIGITIZERS

see page 59 for information on

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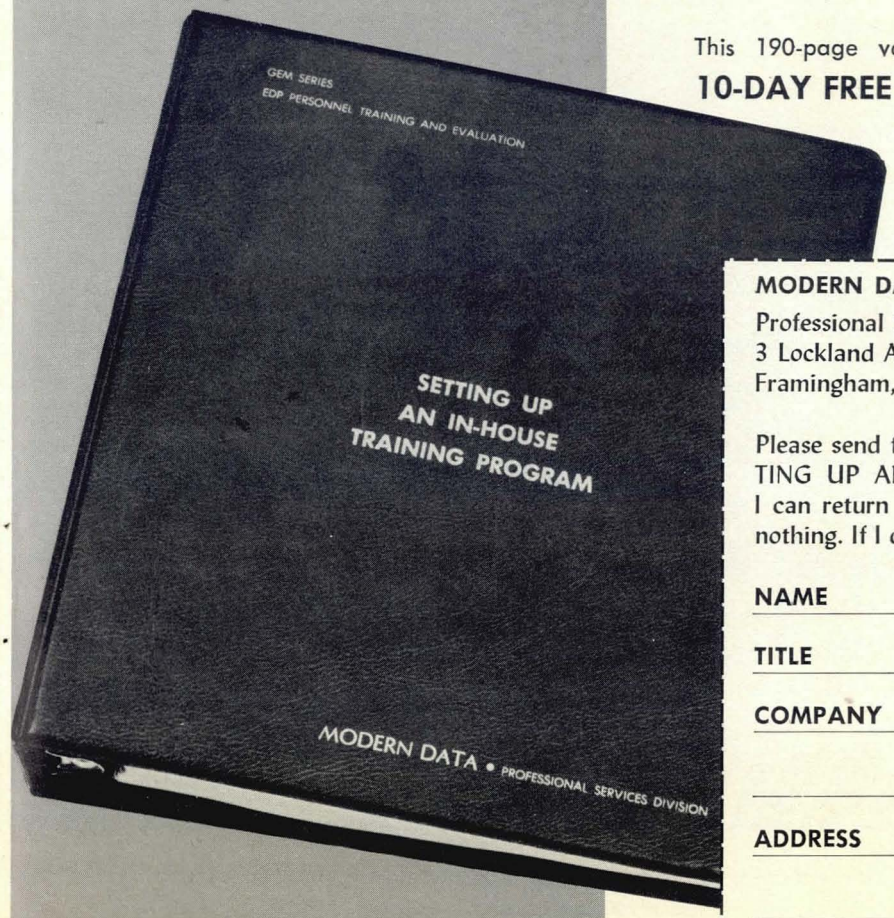

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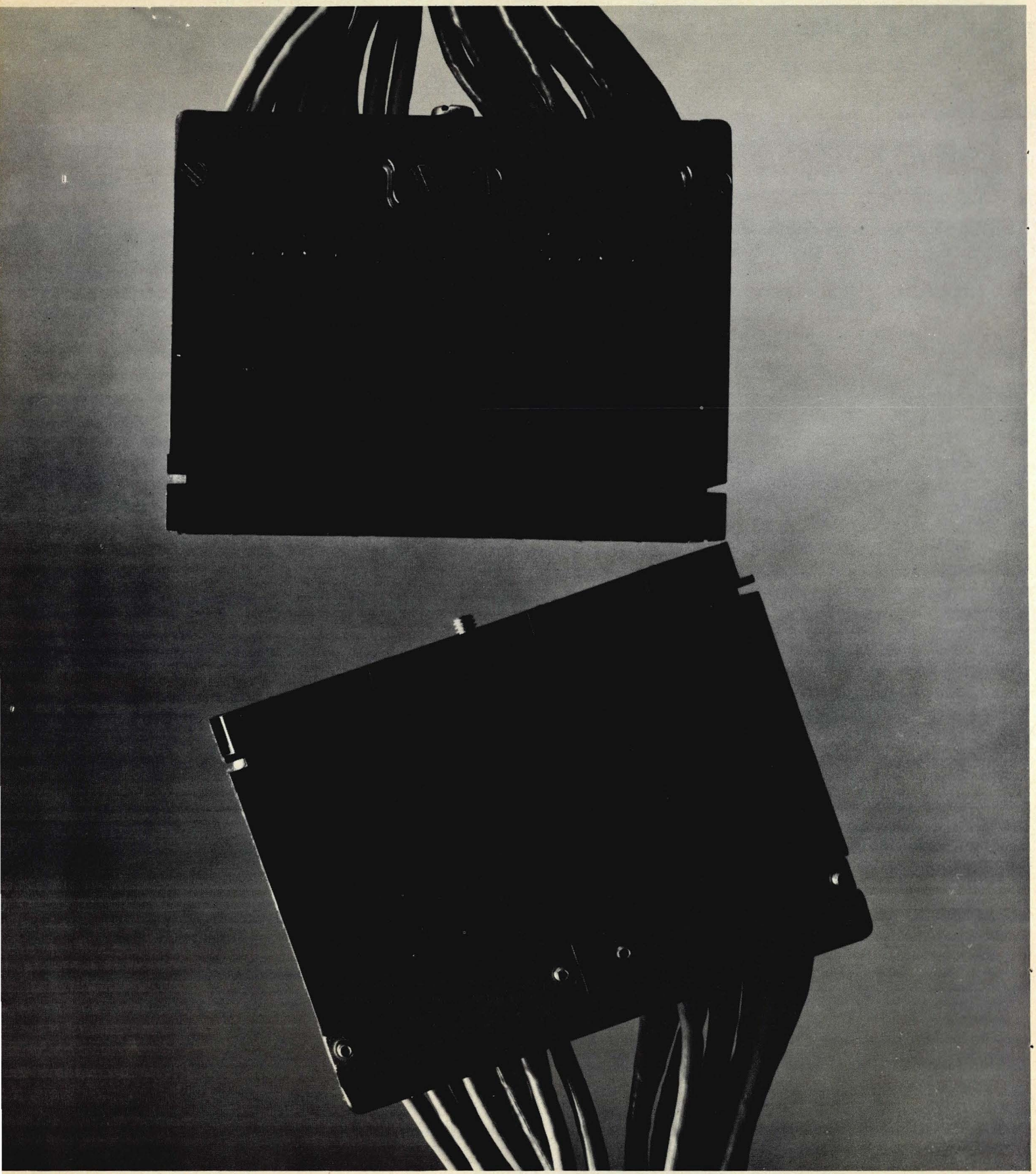

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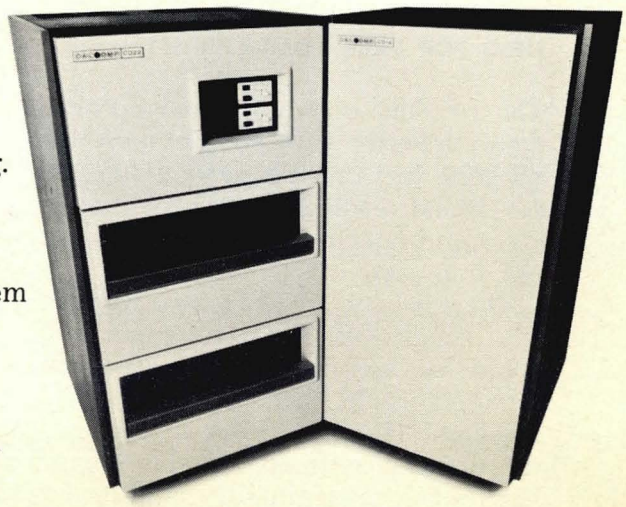

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MAGNETIC TAPE SYSTEMS
Part II—IBM-Compatible Transports

This Profile is the second in a three-part series covering digital, magnetic tape devices. The first, published last month, discussed cassette, cartridge, and other small tape transports that are applied to terminal, data entry, or minicomputer applications. This Profile concerns itself with tape transports which are compatible with IBM code and format specifications. The third, to be published next month, will cover IBM plug-to-plug compatible tape systems.

A tape transport can be said to be *IBM compatible* if any tape recorded on that transport can be read on a similar type IBM transport, and if tapes recorded on the IBM tape transport can be read on the transport under consideration.

What this is really saying is that compatibility will permit completely free interchangeability of tapes between transports regardless of who manufactured them.

IBM compatible as a phrase should not be confused with *IBM plug-to-plug compatible.* The first phrase, as defined above, is limited to the interchangeability of tapes; plug-to-plug compatible relates to the interchangeability of both the tapes (or disk-packs) and the transport system — transports, controllers, interfacing. As "plug-to-plug" infers, the hardware itself is physically compatible; unplug one and plug-in the other.

NEED FOR TAPE COMPATIBILITY

The freedom of tape interchangeability is mandatory from the view point of most users. Any application that involves generating tapes in one location and reading them in another requires that successful operation not be dependent on a specific transport.

There is no necessary reason why tapes must be IBM compatible. Any format and coding scheme could be carefully defined and specified. Manufacturers could then design and build to that standard. However, from a practical standpoint, the dominance of IBM in the computer market has resulted in standards established by IBM becoming accepted by most of the industry.

Many applications for IBM compatible transports involve remote collection of data onto magnetic tape with subsequent processing at a computer facility. Tapes generated at a large computer facility are often read off-line. To save processing time and to avoid the expense of special conversion equipment, it is highly desirable to have the remote equipment compatible with the computer equipment.

For these reasons, most reel to reel recorders used for digital recording are designed to be IBM compatible, even though they might never be used with an IBM computer. Let us now examine what is necessary to make a tape transport IBM compatible.

TAPE GEOMETRY

Heads — Data is written onto tape that is one-half inch ($0.498 \pm 0.002''$) wide. This data is written onto tracks. The early IBM standard called for 7 tracks; the later standard uses a 9-track configuration. Figures 1, 2, and 3 show the track arrangements. It should be noted that there are two distinct track configurations defined, and that these configurations are not at all compatible. 7-track standards call for a write width of 0.048″, a read width of 0.030″, and a center to center spacing of 0.070″. The 9-track configuration uses a write width of 0.044″, a read width of 0.040″, and a center to center spacing of 0.055″. Dimensioning of the tracks is always done from a reference edge of the tape in order to compensate for the effects of tape width variations.

Densities — The number of bits recorded per inch of tape (bpi) on each track is referred to as packing density. For 7-track format, 200, 556, or

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800 bpi are the defined densities; for 9-track, the densities used are 800 or 1600 bpi. The recording method for 200 to 800 bpi densities is NRZI; that for 1600 bpi, phase encoded. Both methods utilize a magnetization or flux change to denote logical "one" or "zero".

It is obvious that using a higher recording density results in increased storage capacity for a given reel of tape. Increased densities cause other problems, which will be discussed below.

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Records — Data recorded on magnetic tape is generally organized into groups of bytes called records. Records are separated on the tape by a length of erased tape referred to as an *inter-record gap*. The 7-track format uses 0.75 inches as the gap length; 9-track employs 0.6 inches.

The gap is used to permit a tape transport to start and stop between records, as well as to identify records.

Each record is made up of a group of data characters followed by one or two special characters used for error checking.

In the 7-track format, a *longitudinal redundancy check character* (LRCC) is recorded 4 bit positions after the last data character of a record. This character causes the flux direction to be reset. Since the recording format is NRZI, resetting the flux level causes the total number of logical "ones" to be even. In reading tapes, this criteria of an even number of bits can be used in checking for errors.

The 9-track NRZI format uses another character referred to as a *cycle redundancy check character* (CRCC). This character is recorded 4 bit positions after the last data character. It is followed 4 bit positions later by an LRCC.

The CRCC is generated as follows: There is a CRC register which is originally reset. As each data character is recorded, it is exclusive OR'ed with the contents of the CRC register. Between characters the contents of the CRC register is then shifted around one position. If shifting causes the leftmost bit of the CRC register to become a "one," then the bits being shifted into positions 4, 5, 6, and 7 are inverted. Following the last data character insertion and shifting, the contents of all positions except 4 and 6 are inverted. The CRC character is then written, and can be used in correcting single track errors.

In phase encoding, a record is made up of 40 characters that are all "zeros"; an all "ones" character; the data characters; an all "ones" character; and 40 all "zeros" characters. The all "zeros" characters are referred to as the *preamble* and *postamble*, and are used for synchronizing the read electronics. The all "ones" character defines the start of the data. The timing and identification characters are made symmetrical to permit reading in either direction with the same circuitry.

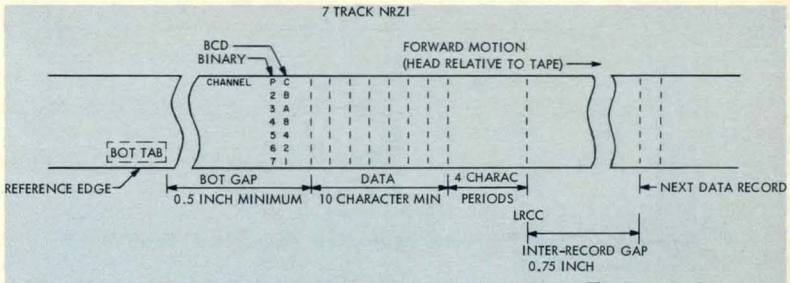

Figure 1 • 7-Track NRZI Format (courtesy of Peripheral Equipment)

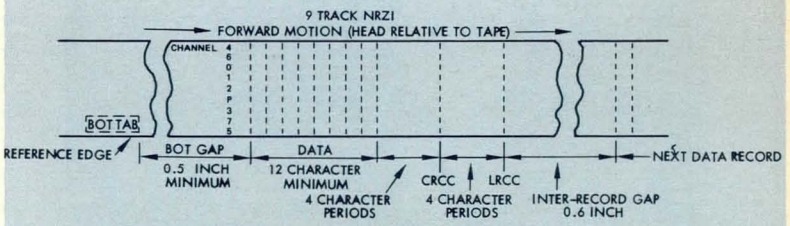

Figure 2 • 9-Track NRZI Format (courtesy of Peripheral Equipment)

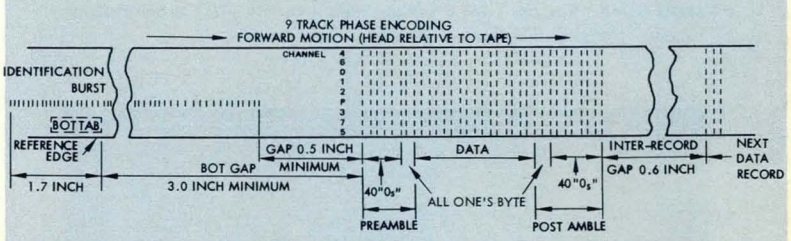

Figure 3 • 9-Track Phase Encoded Format (courtesy of Peripheral Equipment)

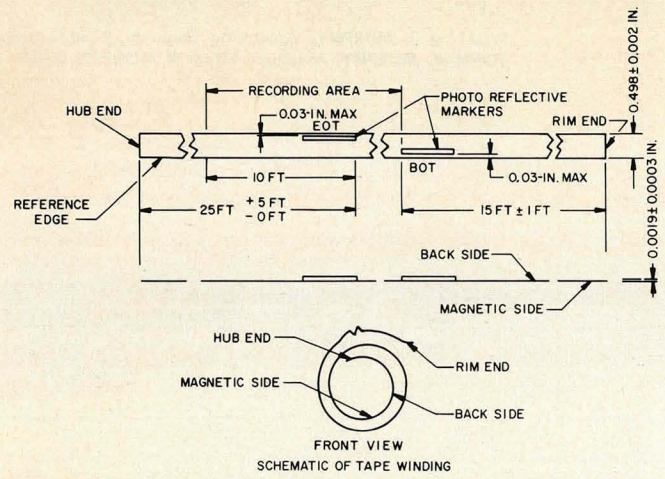

Figure 4 • Tape Markers, Recording Area, and Tape Wind (courtesy of USAI)

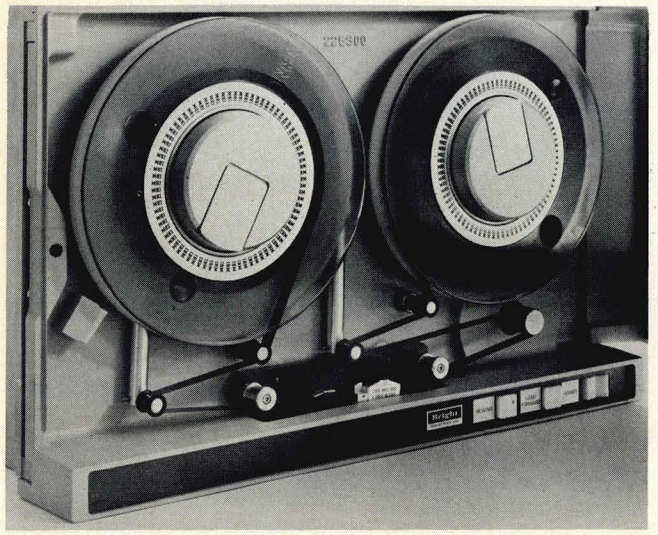

Figure 5 • Bright Industries Mode BI2600, an 8-1/2" magnetic tape drive offering 7- or 9-track compatibility with a maximum transfer rate of 60 KHz.

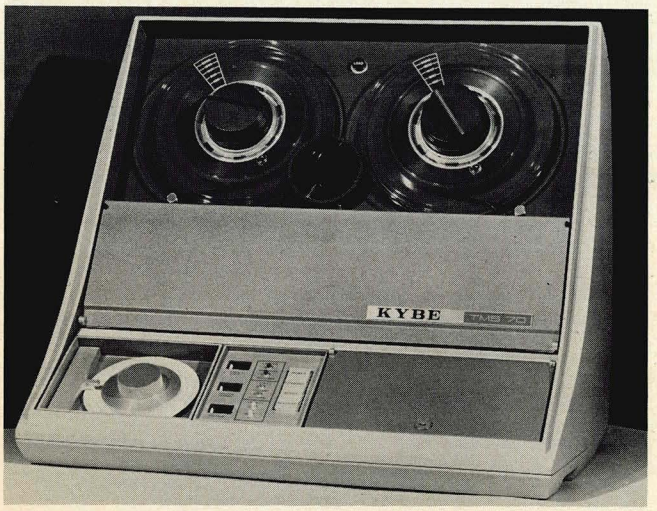

Figure 6 • The TMS-70 magnetic tape tester-cleaner, designed by Kybe for small- to medium-size tape-oriented computer installation.

Parity – Each character in a record is written with an additional bit called a parity bit. A parity bit is generated by looking at the total number of logical "ones" in the data character, and determining whether that number is odd or even. The parity bit is then set or reset such that the parity of the entire character (data plus parity bit) is a constant.

In the 9-track format, parity is defined as odd. Therefore, an even number of "ones" in the data will result in the parity bit being a "one"; an odd number will cause it to be a "zero".

In the 7-track format, both even and odd parity are used, depending upon the data. If the data is recorded in BCD form parity is defined as even (the total number of "ones" in both the data and the parity bit is an even number). When data is recorded in pure binary, odd parity is used.

Files – A number of records grouped together in some logical fashion is referred to as a file. A file is identified by writing a special file mark after the last data record. For NRZI recording, this file is a single character record consisting of an ASCII DC_3 for 9-track, or a 8-4-2-1 for 7-track. This character is followed by the conventional LRCC.

In phase encoding, 40 "zeros" are written on tracks P, 0, 2, 5, 6, and 7. Tracks 1, 3, and 4 are dc erased.

Tape Tabs – A reflective strip is affixed to the mylar side of the tape next to the reference edge approximately 15 feet from the physical beginning of the tape. This strip is known as a *beginning of tape* (BOT) marker. It is sensed by the transport with a photodetector. Information is not recorded on the tape until after the BOT marker is sensed. NRZI recording calls for a 0.5 inch minimum gap between the end of the marker and the beginning of the first record. In the phase encoded systems, a 3 inch minimum gap is defined. Phase encoded systems also call for an identification burst to be recorded on the parity track 1.7 inches before and 2.5 inches into the beginning of tape gap.

An *end of tape* (EOT) marker is located 25 feet from the physical end of the tape, but next to the edge opposite to the reference edge. Data may be recorded up to 10 feet beyond the EOT marker. Transports must be able to distinguish between an EOT marker and a BOT marker, and two photodetectors are used.

INTERCHANGEABILITY

The preceding discussion has been concerned with the general specifications of tape compatibility. Problems really occur when tapes are interchanged between units; the accumulations of

TABLE 1 • CONTINUOUS TAPE TRANSPORTS

COMPANY & MODEL	REEL SIZE (inches)	MAXIMUM READ/WRITE RATE	READ/WRITE SPEED (inches/second)	INTERFACE	PRICE (single unit)
AMPEX TMX	8½	10 kHz	7.5 to 12.5	OEM	$3,000Q
TMY	7	10 kHz	6.25 to 12.5	OEM	$2,100Q
TMZ	10½	60 kHz	10 to 37.5	OEM • Data Gen Nova, Supernova (opt)	$3,200Q
TMA	10½	180 kHz	37.5 to 112.5	OEM • Data Gen Nova, Supernova (opt)	$5,000Q
ANDERSON JACOBSON AJ 707	8½	20 kHz	5 to 25	OEM	———
BRIGHT INDUSTRIES BI 2600/2610	8½ 10½	60 kHz	4 to 37.5	OEM	———
BUCODE 2010	8½	40 kHz	10 to 25	OEM	$3,500
2045	10½	72 kHz	10 to 45	OEM	$3,375
20290 Series	10½	320 kHz	75 to 200	OEM	$11,550
CIPHER DATA PRODUCTS 100X Series	10½	72 kHz	12.5 to 45	OEM	$3,700
CONTROL DATA 92000 Series	10½	———	50 to 200	OEM	———
9500 Series	10½	120 kHz	37.5 to 150	OEM	———
DATACOM TC 8	7 10½	30 kHz	6.25 to 150	SEL 810 • DEC PDP-8, -9, -11, -15 • Data Gen Nova • HON 316, 516 • Raytheon 704 • CDC 3300, 6600 • IBM 1130	———
DATUM 5091	7 8½ 10½	60 kHz	6 to 75	DEC PDP-8, -9, -11, -12, -15 • HP 2114, 2115, 2116 • HON 124, 316, 416, 516 • Data Gen Nova • Varian 620/i • XDS CE16, CF16 • Micro 810 • IBM 1130	$8,000**
DECISION Series 31	10½	30 kHz	27/37.5	Data Gen Nova, Supernova	$8,800*
DIGI-DATA Minidek	7	———	12.5	OEM	$1,450Q
DIGITAL INFO. DEVICES V Series	8½	37 kHz	18.75 to 37.5	OEM	$3,000Q
DIGITRONICS 1610/1620	10½	60 kHz	37.5	OEM • DEC PDP-8	$4,880*
DYNACOUSTICS 1205	10½	———	12.5 to 75	HP 2114, 2115, 2116, 2100 • HON 112, 316, 516 • XDS Sigma 2, 3 • DEC PDP-8, -9, -11, -15 • Raytheon 703, 704, 706 • Data Gen Nova, Supernova • Computer Auto. 808, 116, 216	$8,500**
ECLECTIC 640	10½	19 kHz	24/37.5	DEC PDP-8, -9, -11, -15	$7,750**
INFOTEC TDX Series	10½	120 kHz	7.5 to 75	OEM • Major Minicomputers	———
KENNEDY 8707/8709	7	20 kHz	12.5	OEM	$3,975*
8107/8109	10½	72 kHz	10 to 45	OEM	$4,695*
8197	10½	72 kHz†	10 to 45†	OEM	$6,800*
3112 Series	10½	36 kHz	10 to 45	OEM	$3,125

FOOTNOTES: (†) Read-Only — (*) Transport with Controller — (**) Transport with Controller & Mini Interface — (Q) Quantity Price

PRODUCT PROFILE:

MAG TAPE SYSTEMS — Part II

....Cont'd

TABLE 1 • CONTINUOUS TAPE TRANSPORTS . . . Cont'd

COMPANY & MODEL	REEL SIZE (inches)	MAXIMUM READ/WRITE RATE	READ/WRITE SPEED (inches/second)	INTERFACE	PRICE (single unit)
MOHAWK DATA SCIENCES 2000	10½	45 kHz†	45†	OEM	———
2001/2002	10½	36 kHz	45	OEM	———
2003	10½	72 kHz†	45†	OEM	———
2004	10½	72 kHz	45	OEM	———
PER DATA Series T-1	10½	120 kHz	25 to 75	OEM • Data Gen Nova, Supernova • HON 316, 516 • Varian 520/i, 620/i • DEC PDP-8, -11 • HP 2114, 2115A, 2116B • Lock. MAC 16	$4,000 $8,500*
PERIPHERAL EQUIPMENT 7000 Series	7	20 kHz	6.25/12.5	OEM	$2,370
6000 Series	10½	120 kHz	12.5 to 75	OEM	$4,000
POTTER INSTRUMENT SC 1035/1037	10½	———	5 to 45	OEM	$2,850
SC 1051	10½	———	75	OEM	$3,950
SC 1081/AT 1082	10½	———	150	OEM	$7,950
AT 1092	10½	———	200	OEM	$10,850
PRECISION INSTRUMENT PI-1217/19	10½	72 kHz	10 to 100	OEM • DEC PDP-8, -9, -12, -15 • Data Gen Nova, Supernova • HON 316, 516	$3,500
SANGAMO ELECTRIC TH-7/TH-9	7	1 kHz	30	OEM	$2,000
TEAC MT-8	8½	10 kHz	12	OEM	———
MT-10	10½	20 kHz	24	OEM	———
TEXAS INSTRUMENTS 959	10½	96 kHz	60 to 120	OEM	$11,750
979	10½	72 kHz	15 to 45	OEM	$4,350
WANG COMPUTER PROD. Mod 712	7	10 kHz	12.5	OEM	$3,255
Mod 812/825	8½	20 kHz	12.5/25	OEM	$3,300
Mod 1025/1037/1075	10½	60 kHz	25/37.5/75	OEM	$4,200
WILLARD LABORATORIES Series 7/9	7	20 kHz	12.5	OEM • Major Minicomputers	$2,300
Series 10	10½	40 kHz	25	OEM • Major Minicomputers	$3,550*

FOOTNOTES: (†) Read-Only — (*) Transport with Controller — (**) Transport With Controller & Mini Interface — (Q) Quantity Price

TABLE 2 • INCREMENTAL TAPE TRANSPORTS

COMPANY & MODEL	REEL SIZE (inches)	MAXIMUM READ/WRITE RATE		INTERFACE	PRICE (single unit)
		INCREMENTAL Read/Write (steps or char/sec)	CONTINUOUS Read/Write (Hz)		
CIPHER DATA PRODUCTS 70	7	——/300 cps	1 kHz/——	OEM	$2,050
70H	7	opt/1,000 cps	20 kHz/20 kHz	OEM	$3,250
85	8½	——/300 cps	1 kHz/——	OEM	$2,350
85H	8½	——/1,000 cps	20 kHz/20 kHz	OEM	$3,500
100H	10½	——/1,000 cps	20 kHz/20 kHz	OEM	$3,900
DATRAN 8501/8502	8½	500 cps/——	24 kHz/——	Photon Quest - EMMA Photo Artwork Generator • Kongsberg Mk-I, -III Auto Drafting Tables • Superior Electric N/C Controllers	$5,300
8505/8506	8½	350 cps/——	600 Hz/——		$4,600
8511/8512	8½	——/1,000 cps	——/24 kHz	OEM	$5,825
8551/8552	8½	350 cps/750 cps	24 kHz/24 kHz	RS-232-B	$6,625
DIGI-DATA Ping Pong	10½	2,500 cps/2,500 cps	20 kHz/20 kHz	OEM	$3,450
KENNEDY 1600/1610	8½ 10½	——/500 cps	——/——	OEM	———
1600R/1610R	8½ 10½	——/500 cps	1 kHz/——	OEM	———
1600IR/1610IR	8½ 10½	150 cps/300 cps	——/——	OEM	———
PRECISION INSTRUMENT PI-1387	7	——/200 cps	——/——	OEM	$2,450
PI-1207/1209	10½	100 cps/600 cps	30 kHz/30 kHz	OEM	———
TEAC MT-8	8½	450 cps/450 cps	——/——	OEM	———
MT-10	10½	650 cps/650 cps	——/——	OEM	———

tolerances result in sufficient performance degradation to cause errors to occur.

Probably the single most important contributor to difficulties in interchanging tapes is known as *skew*. Data is written as characters, which occur as groups of parallel bits; these groups are written across the tape. When originally written, the bits will ideally fall on a line perpendicular to the reference edge. A read head will ideally coincide with such a line, so that the data appearing at the read amplifier will be exactly time coincident. As usual, the ideal does not occur in practice, and hence the bits appearing at the read amplifier are not in perfect time coincidence. These time errors (known as inter-channel time displacement or skew errors) are caused by angular misalignment of the read or write head, gap scatter of either head, and dynamic tape motion. The head errors are usually fixed, hence static, and most transports compensate for such errors electronically.

The dynamic errors, however, present a much more difficult problem. The tape has a width variation that can cause it to skew in the transport guides, thereby causing a misalignment. To remedy this, single edge guides are often used, so that the tape is always guided from the reference edge. However, long curvatures in the reference edge of the tape from a true straight line can still cause tape misalignment. Tape stretching due to non-constant forces across the width of the tape also contribute to skew error. Thus, there is always some degree of skew encountered in any transport.

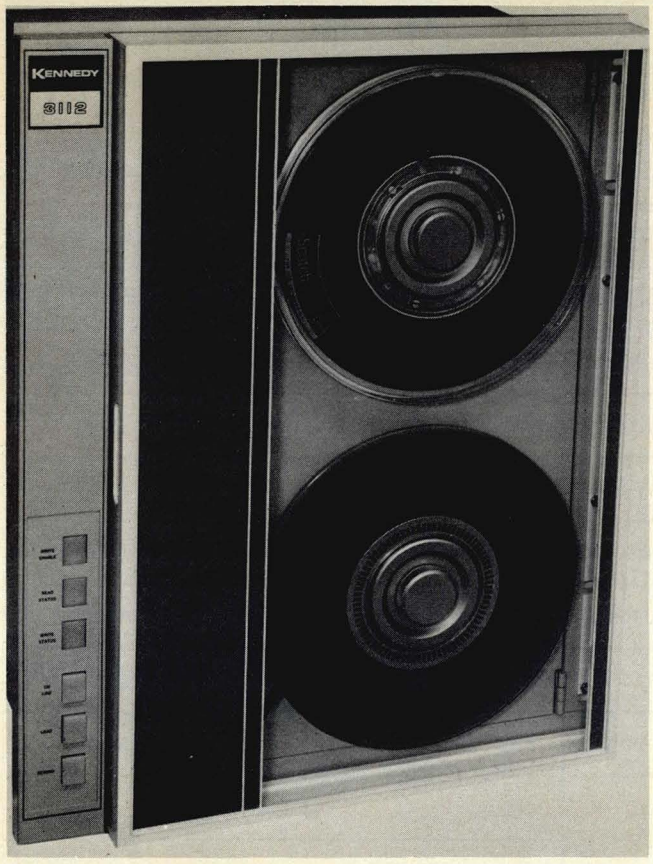

Figure 7 • The 45 ips Kennedy Series 3112 Synchronous (continuous) Magnetic Tape Transport, a 10-1/2" drive offering read-after-write.

When a tape is read on another transport, a different set of similar error conditions is encountered which can either add or subtract to the errors as written. It is the worst case combination of these cumulative errors that must be considered.

As skew is encountered, the time between the first bit of a character and the last bit of that character increases. As long as this time is relatively small, there is no real problem. However, as this time gets significant compared to the time between bits, it becomes impossible to tell whether a bit belongs to the current character or to an adjacent character.

In an NRZI system, only logical "ones" are recorded. Logical "zeroes" are defined as the absence of a "one". Hence if the bits are skewed by one half a bit time, there is no way of knowing whether a particular track has a "zero" recorded or a skewed "one".

For this reason, the maximum worst case skew tolerated in an NRZI system is 40% of the time between bits; the average on a good transport is less than 10%.

Since the significance of skew errors is related to the time between bits, it is obvious that packing density is a very important parameter in determining the performance of a recorder. At 200 bpi the system is relatively forgiving, but at 800 bpi very close tolerancing is mandatory. In fact, it is probably true to say that 800 bpi is about the economic limit for packing density in an NRZI system. Skew is the prime reason for this, but pulse crowding on the tape and other effects also contribute.

A phase modulation system is not plagued with this difficulty to nearly the extent of an NRZI system. The phase encoding technique is inherently self clocking on a per-track basis, and both "ones" and "zeroes" are uniquely recorded. Under these conditions, it is possible to clock each track separately and feed the data into an electronic deskewing system. The probability of mis-assignment of a bit to the wrong character is thus much lower. Phase encoding has other advantages, such as restricted bandwidth, lower operating thresholds, which make it an inherently more reliable technique. These properties also make it possible to operate at higher packing densities; hence the current use of 1600 bpi in phase encoded systems.

EQUIPMENT

A large number of manufacturers make equipment which is designed in accordance with IBM standards. Tables 1 and 2 provide lists of various manufacturers and pertinent details.

One thing that should be obvious from the preceding discussion is that IBM compatibility is not a unique performance specification, but that there are different variations in terms of track configuration, recording density, and format.

Another point to note is that only tape geometry is defined. Tape velocity and transfer rates are not defined as such. Hence tapes that are recorded at 1 inch per second (ips) can be played back at 112.5 ips. Start-stop times are not defined, only inter-recorded gaps. Therefore, transports can have considerable variations in these parameters yet still be completely IBM compatible.

Since compatibility is defined in terms of the tape geometry, it is the sum of all the factors that affect the recorded data on tape that determine compatibility. A transport supplied with a 7-track IBM head and read/write electronics will not necessarily generate IBM compatible tapes. It must be used with a controller designed to generate the appropriate gaps and special characters. Some manufacturers offer such controllers, others depend upon the user to supply his own. A controller is in general unique to a given transport. Transport prices are generally dependent upon their speed and start/stop characteristics. As the velocity is increased, the demands on the reel drive system and the tape drive increase quite rapidly. The start/stop characteristics must be kept under better control in order to assure proper formatting. In

general, transport speed should be kept as low as is reasonable for the applications.

There are a number of other considerations in evaluating a transport which are too lengthy to discuss in detail. The everpresent demand for reliable and gentle tape handling is always a consideration. Tape cleaning facilities should be considered. Mechanical reliability and simplicity of maintenance are important. The ease of use for the operator is another important feature. Restrictions on operating environment as well as the effects of power line variations are factors that will affect overall performance. The existence of program restrictions must be taken into account. And last but not least, provision for interfacing the transport to other equipment will have to be made.

TAPE TRANSPORT TABULATIONS

The following tables present information on IBM compatible tape transports and tape products used at EDP facilities. Table 1 covers **continuous mag tape transports** — transports that read/write IBM compatible tape synchronously. Table 2 lists **incremental tape equipment** — transports that write data asynchronously in unit steps, each step initiated by the completion of a previous one, and that read data either in a continuous (synchronous) or incremental (asynchronous) manner. Table 3 presents a **check-list of magnetic tape products** and their manufacturers; products include tape format devices, test equipment, tape converters, and filing systems. ▲

Departures from IBM compatible tape formats involve cassette, cartridge, and other special-purpose small-size drives (see last month's Profile), and, at the other extreme, new high-density, high-capacity, high transfer rate tape systems that are outlined below.

Data Recording Systems and **Orion Products** manufacture high-density, high-transfer rate mag tape transports that utilize the "Newell" principle — a mechanical drive technique of transporting tape from one roll to another by using a capstan in direct contact with both rolls. Data Recording's **Datacord ADR-2015** records on ½ inch tape using a 4-track, 20,000 bpi format. Switch-selectable speeds of from 15 to 960 ips allow transfer rates of up to 20 Megabits/sec per track. Orion's **Alpha GW** uses 1 inch tape and records on 30 tracks using a packing density of 10,000 bpi. Transfer rates of 4.5 MHz at 300 ips and 280 KHz at 18.75 ips are switch-selectable. Another model, due out this year, will operate at 36 MHz.

Ampex and **International Video** utilize video recording techniques to produce extremely high-density, high-capacity mag tape systems. Ampex's **Terabit Memory (TBM) System** uses video-type rotating heads to record data transversely (normal to tape motion) using an FM technique; a logical "one" is represented by 5.75 MHz, a "zero" by 6.75 MHz, with center frequency at 6.25 MHz. A data block of 1.04 million bits requires only 1 inch of video tape, an effective packing density of 710,000 bits per square inch or track density of 7,500 bpi. The system, operating with four channels in parallel, has a transfer rate of 3 MHz. International Video's **IVC-1000** uses a helical scan recording technique and offers a packing density of 1 million bits per square inch of tape. The self-threading tape cartridge system can store over 80 billion bits per reel, and records at rates of 8 Megabits/sec.

TABLE 3 • CHECKLIST OF OTHER MAGNETIC TAPE PRODUCTS

COMPANY	FORMATTERS	EXERCISERS, ANALYZERS	CERTIFIERS	CLEANERS	REWINDERS	DEMAGNETIZERS	TAPE CONVERTERS	MAGNETIC TAPES	TAPE REEL STORAGE PRODUCTS	OTHER TAPE PRODUCTS & REMARKS
ADS ANKER							Cas			
ADVANCED DIGITAL SYSTEMS									→	Automatic Tape Library Control System
ADVANCED TRANSDUCER SYS.			√	√	√					
AMPEX	√	√						√		
AUDIO DEVICES								√		
BASF SYSTEMS								√		
BELL & HOWELL						√				
BUSINESS SUPPLIES								√		
CERTRON								√		
COMPUTER-LINK			√	√	√					
DATA DEVICES			√	√	√					
DATA DOCUMENTS								√	√	
DATASCAN							PT			
DATATRON	√									
DATUM	√									
DECISION	√									
DIGI-DATA	√						PT, MC			
DYTRO							Cas			
ECLECTIC	√									
ELECTRONIC LABORATORIES							Cas			
P.G. FORET				√	√					
GENERAL KINETICS			√	√	√	√		√		Tape Rehabilitation Service
GRAHAM MAGNETICS			√	√	√			√		
INCRE-DATA							Cas			
INDEL				√	√	√				
KENNEDY	√									
KYBE			√	√	√					Tape Rehabilitation Service
LOCKHEED ELECTRONICS							PT			
3M Company								√		Visual Tape Magnetization Viewer
MEMOREX								√	√	
MPH ELECTRONICS					√					
PER DATA							PT, MT			
PERFECTION MICA									√	
PERIPHERAL EQUIPMENT	√									
PRECISION INSTRUMENT		√				√				
RCA/MAGNETIC PRODUCTS								√		
RECORTEC			√	√	√					
REMINGTON RAND/Office Sys.									→	Automatic Tape Filer
SUPREME EQUIPMENT & SYS.									→	Automatic Tape Filer
SYS COMPUTER							PT, MT			
SYSTEMS DEVELOPMENT	√									
VIRGINIA PANEL			√	√	√	√			√	
WANG COMPUTER PRODUCTS	√	√								
WRIGHT LINE				√	√				√	

Cas – Philips Cassette-to-Magnetic Tape • MC – Magnetic Card-to-Magnetic Tape • MT – Magnetic Tape-to-Magnetic Tape
PT – Perf. Paper Tape-to-Magnetic Tape

TABLE 4 • REFERENCE LITERATURE

To obtain additional information on the tape transports and magnetic tape products cited in Tables 1, 2, and 3, circle the appropriate numbers listed below on the Reader Service Card.

COMPANY	READER SERVICE CARD NUMBER
Ads Anker, Oak Brook, Ill.	129
Advanced Digital Systems, Herkimer, N.Y.	130
Advanced Transducer Systems, Rexdale, Ont.	131
Ampex, Redwood City, Cal.	132
Anderson Jacobson, Sunnyvale, Cal.	133
Audio Devices, Glenbrook, Conn.	134
BASF Systems, Bedford, Mass.	135
Bell & Howell, Pasadena, Cal.	136
Bright Industries, San Francisco, Cal.	137
Bucode, Hauppauge, N.Y.	138
Business Supplies, New York, N.Y.	139
Certron, High Point, N.C.	140
Cipher Data Products, San Diego, Cal.	141
Computer-Link, Burlington, Mass.	142
Control Data/OEM Products, Minneapolis, Minn.	143
Data Devices, Tarzana, Cal.	144
Data Documents, Omaha, Nebr.	145
Data Recording Systems, Sunnyvale, Cal.	146
Datacom, Ft. Walton Beach, Fla.	147
Datascan, Clifton, N.J.	148
Datatron, Santa Ana, Cal.	149
Datran, Norwalk, Conn.	150
Datum, Anaheim, Cal.	151
Decision, Oakland, Cal.	152
Digi-Data, Bladensburg, Md.	153
Digital Information Devices, Lionville, Pa.	154
Digitronics, Albertson, N.Y.	155
Dynacoustics, Hayward, Cal.	156
Dytro, Hicksville, N.Y.	157
Eclectic, Dallas, Tex.	158
Electronic Laboratories, Houston, Tex.	159
P. G. Foret, Sudbury, Mass.	160
General Kinetics, Reston, Va.	161
Graham Magnetics, Graham, Tex.	162
Incre-Data, Albuquerque, N.M.	163
Indel, Tulsa, Okla.	164
Infotec, Plainview, N.Y.	165
International Video, Sunnyvale, Cal.	166
Kennedy, Altadena, Cal.	167
Kybe, Waltham, Mass.	168
Lockheed Electronics, Edison, N.J.	169
3M Company, St. Paul, Minn.	170
Memorex, Santa Clara, Cal.	171
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For a quarterly-updated service report on

MAGNETIC TAPE TRANSPORTS

see page 59 for information on

MODERN DATA's TechFile series

NEW PRODUCTS

360/370 DISK MEMORY

A disk memory system for 360/370 computers, offering twice the storage capacity of disk memories currently in use, has been placed on the market by Itel. The 3100 Disk Memory System has a cost-per-byte capability comparable to that offered in next generation IBM systems, and permits System/360 users to extend the life of their computers; the disk system can also be used on IBM 370 computers. The system consists of a controller and up to nine 3101 disk drives, eight on-line and one spare, and stores 466 million bytes of information. Each drive offers a storage capacity of 58 million bytes, and has an average access time of 29 millisec. A unique feature is a switch which permits the drive to read packs recorded in standard 203 cylinder 2314 format. *Itel/Data Products, San Francisco, Cal.*

Circle No. 321 on Inquiry Card.

DATA ACQUISITION SYSTEM

Built around a 704 Computer, the system will perform a variety of data gathering, logging, processing, storage, and control functions in applications such as industrial and scientific testing and research, and process analysis and control. Basic elements include the 16-bit general-purpose computer, a 32-channel multiplexed, 12-bit A/D converter; four channels of D/A conversion; I/O control for 32 discrete signals; up to four 1600 cpi read-after-write transports; and an ASR-33. A software package is available with the system, including a basic acquisition and control program; assemblers and compilers, among them conversational Fortran; loaders, peripheral I/O routines, monitors, and executives; utility, diagnostic, and test programs; and a math library. *Raytheon Data, Norwood, Mass.*

Circle No. 315 on Inquiry Card.

BUSINESS SYSTEM

The Basic/Four is a low-cost business computer system for small- to medium-sized companies. The system is available in four models ranging from a single-terminal and disk system for processing one job at a time, to multiple-terminal systems capable of handling several users at once. The models are "upward compatible," so that a user can start with a minimum system to suit his immediate requirements but still have the capability to expand. A minimum system Model 300 includes an accounting machine terminal, a CPU, and a fixed and removable cartridge disk memory with a minimum capacity of 2.1 million characters, obtainable on a lease/purchase basis for $550 per month. *Basic/Four, Anaheim, Cal.*

Circle No. 325 on Inquiry Card.

SYSTEM/3 STORAGE

Modular/3 is a multi-purpose storage system for data processing departments as a companion to IBM's System/3. Modular/3 is designed to be purchased in units of three, each module with a specific function. One cabinet provides storage for eight 5440 disk packs. Another provides visible vertical storage for printout binders; the third stores instruction and service manuals. *Martin Yale Business Machines, Chicago, Ill.*

Circle No. 327 on Inquiry Card.

KEY-TO-DISK SYSTEM

The LC-700 is a multiple-station, key-to-disk data entry system designed for user volume requirements of from 9 to 20 input stations. Each station keyboard has 14 control and 37 alphanumeric characters, and a display panel that signals last character, error, insert, verify, and other control information. Other features include an IBM-compatible disk and tape drive, a miniprocessor with memory protect and automatic power failure/restart, and a supervisory control console. *Logic Corp., Cherry Hill, N.J.*

Circle No. 331 on Inquiry Card.

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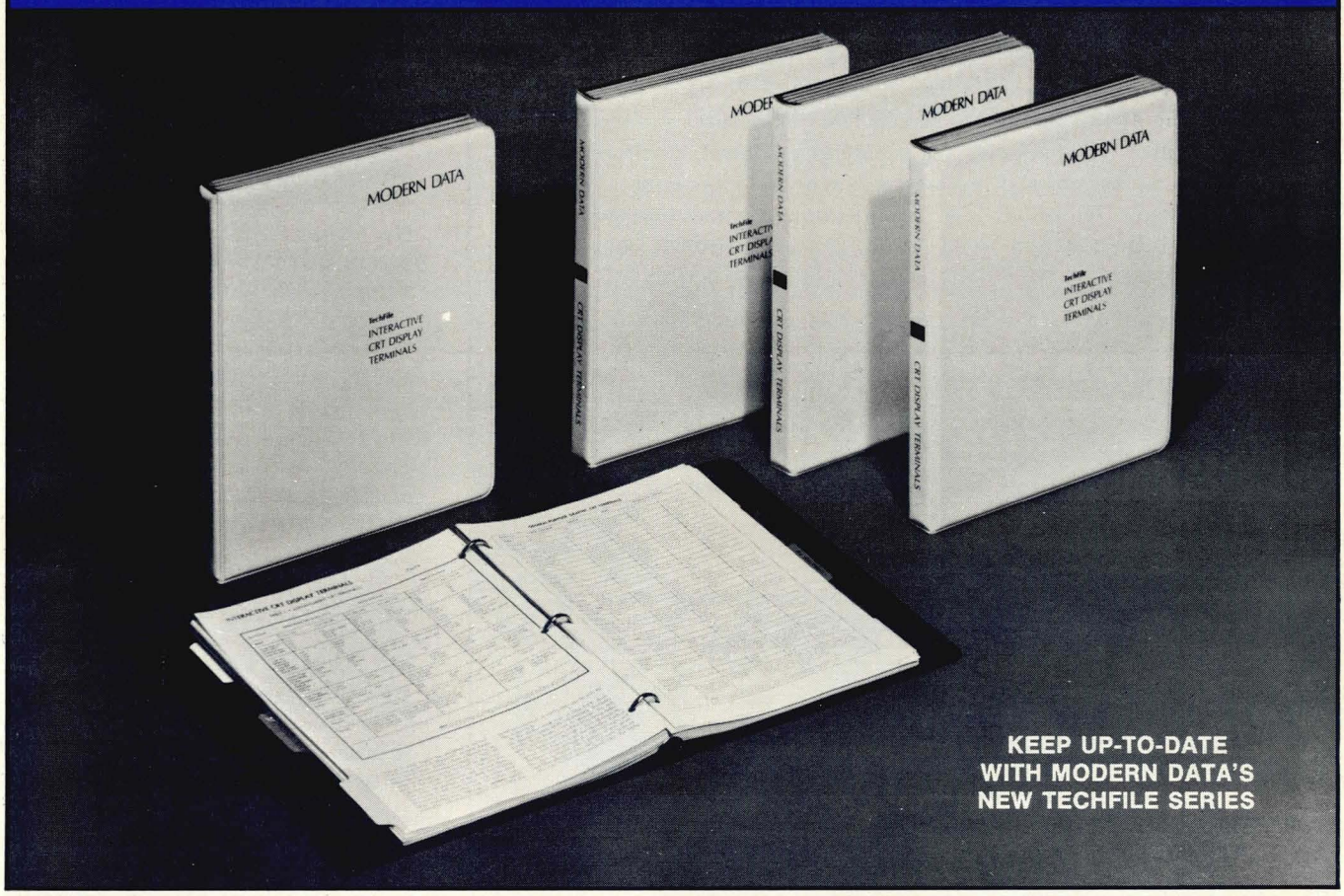

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NEW PRODUCTS . . . Cont'd

AUTOMATIC FILING SYSTEM

The Trans-A-File System uses digital techniques to bring total automation to the filing cabinet. Retrieval can be via high resolution graphic display monitors, printed hard copy, microfilm and other film media, or digital signals for distribution to remote locations over commercial data links. Because the retrieved image is an electronic duplicate of the original image in the master file, no document is ever out of file, misplaced, or lost. File organization, searching, updating, purging, and sorting are all done automatically under control of built-in automated routines. Cross-indexing using integral system hardware, is also a feature of the Trans-A-File System. *Trans-A-File Systems, Cupertino, Cal.*

Circle No. 330 on Inquiry Card.

INCREMENTAL CASSETTE RECORDER

A true bit-by-bit incremental cassette unit, the UIW-101 recorder allows serial NRZI data to be recorded at random rates of 0 to 300 bits/sec. A modular packaging approach allows control and write electronics to be mounted on any IC mother board or stacked on the transport. Price for the recorder is $189 in single units and $99 OEM. *Memodyne, Newton, Mass.*

Circle No. 322 on Inquiry Card.

KEYPUNCH OPERATOR EVALUATOR

The Challenger can be used for screening keypunch job applicants or for upgrading an operator's skill. The unit measures a new applicant's ability during a 15 minute test by recording errors made and automatically reducing or increasing speed in relation to operator ability as source data is verified. *Challenger Co., Dayton, Ohio*

Circle No. 319 on Inquiry Card.

DATA SET

A low-cost 300-bits-per-second data set that is compatible with WE 103 Series Data Phones has been introduced by Ultronic. Designated the Data Pump 103/300, it is an asynchronous data set that operates full- or half-duplex over switched network or leased voice-grade circuits. Purchase price of the standard, acoustic coupled originate-only model is $350.00. Originate-only and answer-only versions for hard wire operation in DAA applications can be purchased for $325. *Ultronic Systems, Mt. Laurel, N.J.*

Circle No. 323 on Inquiry Card.

360 CORE MEMORY

Lockheed's MM-365 Memory System provides additional main memory for 360 Models 65 and up. The MM-365 is a direct replacement for the IBM 2365 Processor Storage System, at half the cost, and requires just one-third the floor space and one-half the power of the IBM system. *Lockheed Electronics, Los Angeles, Cal.*

Circle No. 320 on Inquiry Card.

MARK READER

The MR-300 optical mark card reader can read key-punched cards, pencil marked cards, or a combination of both at rates of up to 300 cards-per-minute. The MR-300 features a vacuum pick finger which eliminates the usual restrictive throat and allows the unit to pick up damaged, worn, or bent cards. The read station uses a fiber optics bundle to transmit light from the light source to the card. Reflected light is transmitted back to the read station's photo-transistor sensing elements by a receiving bundle. Read amplifiers instantly compensate for any change in background reflectivity. The operator does not have to make any adjustment changes for different card colors or type of marking pencil. These features enable the MR-300 to read soiled or smudged cards. *United Business Communications, Shawnee Mission, Kansas*

Circle No. 309 on Inquiry Card.

NEW SOFTWARE AND SERVICES

RECEIVABLES/CUSTOMER DATA

The Accounts Receivable/Customer Information System is an ANS-COBOL system designed to process any combination of balance forward, open item, installment, and deferred or post-dated receivable obligations maintained within the same account, and provides for both direct and automatic transfer from one type of obligation to another. In addition, the system develops a Customer Information Data Base which contains historical and budgeted information for sales analysis and credit and collection processing. Price of the system, which uses 44K of an S/360-30 or larger, is $12,500. *Fortex Data Corp., Chicago, Ill.*

Circle No. 376 on Inquiry Card.

OS/360 DOCUMENTATION

Documatic is an automatic documentation system for programs written in the Report Program Generator (RPG) language, available for users of IBM OS/360. The system produces an English language description of the program, rather than a flowchart, allowing persons with no knowledge of RPG and a minimal understanding of data processing terms to understand the program being documented. Minimum configuration for Univac equipment is a 9200 card system with 12K memory; for IBM System/360, Model 20, an 8-card system. Documatic leases from $80 per month and can be purchased from $1600. *Data Usage, Ft. Lee, N.J.*

Circle No. 381 on Inquiry Card.

INVENTORY SYSTEM

Remote Computing Corp. has added to its time-sharing library an inventory system that produces inventory accounts payable, accounts receivable, and other related reports for finished goods inventories of up to 30,000 items. Called APRIL (Accounts Payable, Receivable, Inventory Library) this system which is suitable for batch or on-line operation, can process reports associated with inventory management for wholesale distributors, cash sale retailers, and manufacturing firms. A user can easily learn to update and correct his input data for processing by this business package. APRIL automatically updates all files affected by any transaction and generates reports when required. The user can also request a report on a specific inventory item or accounts payable balance, and checks and be produced at the users's remote terminal device when required. *Remote Computing, Palo Alto, Cal.*

Circle No. 379 on Inquiry Card.

NEW LITERATURE

MANAGEMENT SERVICE

Infonet, a data processing network that provides inventory management and production control services for manufacturing operations, is detailed in an eight-page booklet. *Computer Sciences, Los Angeles, Cal.*

Circle No. 413 on Inquiry Card.

REMOTE BATCH TERMINALS

Data sheets present features and specifications on a new family of intelligent remote batch terminals ranging from IBM 2780 plug-to-plug compatible replacements to intelligent high-speed (50 kb) multi-leaving terminals acting as IBM 360/25+ Hasp remote work stations. *M&M Computer Industries, Inc., Orange, Cal.*

Circle No. 411 on Inquiry Card.

PHOTOTYPESETTING SYSTEMS

Photon's family of phototypesetting systems is catalogued in a tabloid-sized data sheet. *Photon, Wilmington, Mass.*

Circle No. 417 on Inquiry Card.

STORAGE EQUIPMENT

Storage cabinets for MTST tapes and disk packs are described in a product flyer. *ICA, Minneapolis, Minn.*

Circle No. 406 on Inquiry Card.

DATA COMMUNICATIONS

An eight-page catalog presents descriptions and specifications on a line of modems, multiplexers, and other data transmission equipment. *Milgo/ICC, Miami, Fla.*

Circle No. 407 on Inquiry Card.

TESTING SYSTEM

A computerized testing system for the checkout and maintenance of electronic modules, assemblies, and systems is described in a series of data sheets. *PRD Electronics, Westbury, New York*

Circle No. 416 on Inquiry Card.

NEW LITERATURE . . . Cont'd

SALES CONTROL SYSTEM

An applications report describes a sales control system which provides computer-like data management without the large investment of a computer, which, in addition, requires no programming, is self-formating, and can be operated by anyone familiar with the standard typewriter keyboard. *BCD Computing, Buffalo, N.Y.*

Circle No. 404 on Inquiry Card.

BILLING SERVICE

A four-page brochure is available describing FAB (Fixed Amount Billing System), a computerized service for the automatic billing, collecting, and accounting for fixed amount payment enterprises such as apartment or office property owners, property management companies, and car, truck, and equipment leasing firms. *PHI Computer Services, Arlington, Mass.*

Circle No. 405 on Inquiry Card.

DATA STATIONS

The CT300 Series Data Stations are described in a new product folder. The CT300 employs an alphanumeric strip-printing keyboard terminal with cassette storage as the basic data station, with an acoustic coupler and card reader as options. *Transcom, Bloomfield, Conn.*

Circle No. 402 on Inquiry Card.

VIDEO TERMINALS

The Series 760 Video Communications Terminals, a family of CRT displays with capacities of from 32 to 80 characters per line and 4 to 30 lines per display, are described in a product folder. *Acme-Divac, Hawthorne, Cal.*

Circle No. 412 on Inquiry Card.

DATA TABLET TERMINAL

The DAC100, a data tablet to cassette data entry terminal, is described in a three-page fold-out. *Data Appliance, Glastonbury, Conn.*

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INDEX TO ADVERTISERS

Double Your 360 RJE Throughput.

You say your line printer is running at half its rated speed? And you've been told the problem is your "2400 bps line." The problem, sir—plain and simple—instead lies with the ordinary dial-up modem you're using.

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PRODUCT NEWS

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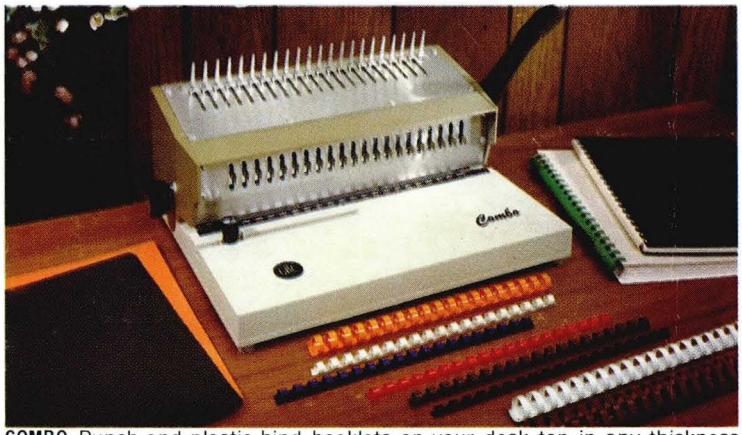

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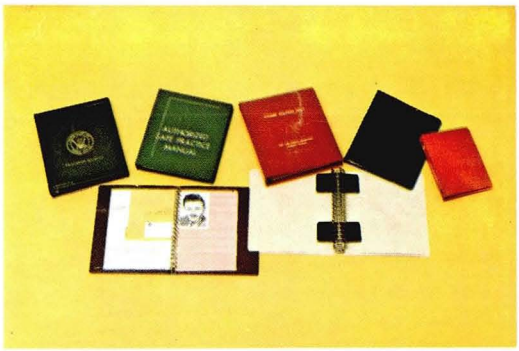

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PHOTO ID SYSTEM A complete, low cost photo identification system including camera, desk stand, laminator, and die cutter. Check number **44** for complete information.

GBC THERM-A-BIND with unique GBC THERM-A-TAPE Inexpensive permanent binding for stored records, reports and documents. Binds up to 6" thick. Perfect for EDP printouts. Check number **42** for data.

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ELECTRIC COLLATOR 8 DESK TOP Assembles up to 7200 sheets an hour, including loading time. Twelve-bin model can handle 8400 sheets an hour. Check number **46** for complete information.

THE 20 APC Automatic Production Control lets you select cycling and collating time, in excess of 10,000 sheets an hour. No foot switches, or pedals. Check number **47** for complete information.

ROLLOMATIC 20 High speed automatic collator will gather sheets from 5½" x 8½" up to 11" x 17", from 16# weight to light weight covers. Cycling speed, 1,300 sets of 20 sheets per hour. Check number **48** for complete information.

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