



# MODERN DATA

JUNE 1970

MIS  
VS.  
EDP



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**It's fast.**  
**It's Varian's 620/f.**

Varian Data Machine's new "superfast" computer has a 750-nsec cycle time. That means it executes two and a half times faster than the well known 620/i.

And check these other outstanding features:

- 100% upward compatible from the 620/i.
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- Fastest I/O in minicomputers.
- Powerful new addressing modes and instructions.
- Read-only memory.
- All 620/i peripherals plus a new low-cost line.

For full details, request the new handbook. The 620/f — another

development that keeps us the big company in small computers.

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Varian Data Machines, a Varian subsidiary,  
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Telephone 714/833-2400.



**varian**  
**data machines**

**The Big Company in Small Computers**



**SNAP.** A major chemical company which we **CRACKLE**, fondly regard as forward-thinking **INSTRON** just installed one of our PACE analytical data systems with its several GCs and INSTRONS for simultaneous operation and automatic data acquisition. INSTRONS produce stress/strain signals on materials; PACE then makes these signals into meaningful, efficient, and reliable reports. Material-makers rejoice in better testing, better quality of their products. More illuminating details from "INSTRON", Dept. 206D. Please mention tests you have in mind.

**HARD** We are pleased to present the latest **COPIES** advance in translating data into **MADE EASY** quick graphics, a frequently easier-said-than-done process. The new system, known as the 911 DATAPLOTTER, combines our dependable digital data-interpolation techniques with high-precision electro-optics. Result: a system that gives you 8-second, office-size, hard, dry copies from computer-generated digital data, direct or from data stored on 9-track, 800 BPI magtape. The 911 will reproduce smooth (not ratchety, not dot-generated) lines of 0.020" width and 0.002" position resolution, and associated alphanumerics. The whole thing is compatible with relevant IBM 1130 and 360 applications, our own 430 DATAPLOTTER packages, and, chances are, we can make appropriate modifications to most other systems. You'll get a complete picture on how the 911 will help in speeding up PC and IC layouts, business charts, drawings, NC tapes, and a whole slew (no pun) of graphic representations by writing "PIX", Dept. 206D.

**MODEL** Let's not overlook good-old physical **MODELING** testing. These days new computer-control techniques reduce the cut-and-try aspects of Tom Edison's plodding (albeit suc-

cessful) approach. Witness: National Research Council of Canada has completed a two-foot-to-the-mile scale model of 325 miles of the Saint Lawrence River. Our PACE Industrial Data System, employing the EAI 640 digital processor, performs three simultaneous on-line functions. Control, data acquisition and data display. Results from this topographical model furnish valuable information to the Canadian Department of Transport and, at the same time, help validate a mathematical model being refined on another digital system. Ultimately, the simulation will help optimize proposed topographical changes in this vital seaway. A request to "ST. LAWRENCE", Dept. 206D, may help you to speed up the good-old methods of Mr. Edison.

**POLLUTION** Some may be surprised to learn that **PREVENTION** the biggest part of the problem

(CONT'D) facing those who want to restore and preserve the environment is not so much lack of money or of desire, but a shortage of trained manpower to apply existing technology to the task at hand. So reports Union Carbide in West Virginia. Folks there have used 3 of our PC-12 process-control computers for the past decade to monitor and adjust the pH level of the industrial waste stream from the manufacture and treatment of over 400 organic chemicals. Their vigilance permits preservation of proper oxygen balance upon which the life cycle of the Kanawha River depends. Those with money and desire but without knowledge of how computers can help prevent water pollution may ask us to tell all we know about it. We promise to come clean. Address "Sweetwater", Dept. 206D. PACE, EAI and DATAPLOTTER are registered trademarks of Electronic Associates, Inc., West Long Branch, New Jersey 07764.

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**What English queen  
had six fingers  
on one hand?**

Don't lose your head over a little historical trivia. We'll give you a big hint: She lost hers. Not good enough? Henry VIII's second wife?

Not yet? The hexadactyl was Anne Boleyn, of course.

But it's not trivia we want to expand your mind with. It's a simple fact: Vermont Research is the memory company. We're the company that

expands the capabilities of your computer with the best drum and disk memories available. And we're the company that has just expanded our own capabilities.

We've introduced a new controller and two new memories: a disk with a 1 million bit capacity, and a drum with a 143 million bit capacity.

But you probably know that. Otherwise we'd like to help you with your memory.

**Vermont Research  
CORPORATION**

Precision Park - North Springfield, Vermont 05150  
Tel: 802-886-2256 TWX: 710-363-6533

DRUM AND DISK MEMORIES - CONTROLLERS

**EXPAND YOUR MEMORY**

CIRCLE NO. 3 ON INQUIRY CARD

58 MIS VS. EDP

*The author contends that it is time that both the executive manager and the EDP specialist be allowed to return to their respective roles. Let the executive plan his own MIS and let the EDP technologist design the tools to aid him.*

62 PLANNING A DATA COMMUNICATIONS SYSTEM

Part 2—Common Carrier Facilities (Cont'd.)

*Continuing on from last month's article in which the author surveyed AT&T's data communication facilities and services, this month's article gives some practical cost comparison guidelines and also reveals some interesting new services now in the planning stages at AT&T.*

70  TECHNOLOGY PROFILE  
INTERACTIVE CRT DISPLAY TERMINALS

Part 2—Alphanumeric CRT Terminals

*In last month's issue, Part 1 discussed the present and future of the terminal market, terminal interfacing techniques, and software requirements. This month, Part 2 covers the hardware characteristics of alphanumeric terminals and provides a tabulation of the major characteristics of each terminal now being marketed. The last part of the series coming in July will cover graphic terminals.*

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SUBSCRIPTION CARDS ..... OPPOSITE PAGE 1  
 READER INQUIRY CARD ..... OPPOSITE PAGE 96

# Message switching at half the cost?

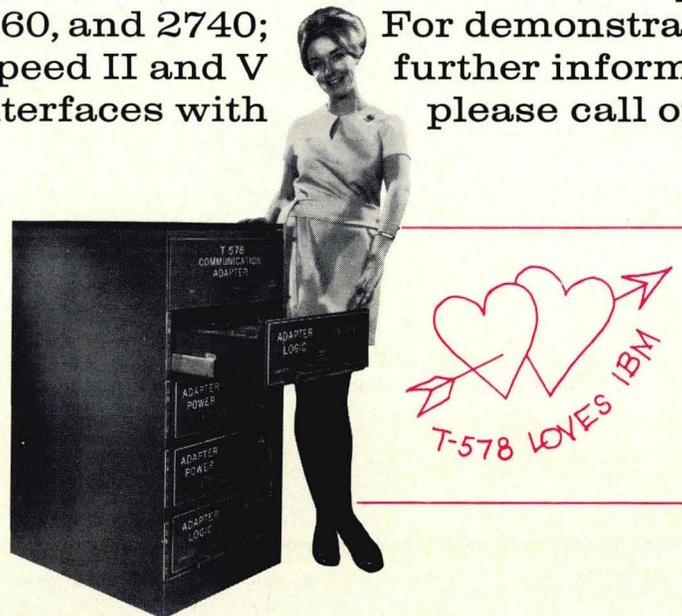
With the T-578  
Communications  
System. Featuring:

- 64 half or full duplex circuits
- speeds up to 2400 Baud
- compatibility with any terminal type—Viatron; Teletype models 28, 33, 35, and 37; IBM 1050, 2260, and 2740; Dataspeed II and V
- interfaces with

## Yes!

all common carrier facilities, including Bell System Plan 86, TWX, and Telex  standard interface to IBM System 360. The turnkey T-578 utilizes an IBM 1130 computer, and the total system leases for less than \$5,000 per month.

For demonstration or further information, please call or write.



**Wells TP Sciences, Inc.**

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# MODERN DATA

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**THIS ISSUE OVER 80,000 COPIES**

# Multiplexer

**I/Onex MODEL 100**



■ Time division, full duplex system concentrates up to 72 110-baud channels over single, full duplex, voice grade line. ■ Fully automatic continuous operation. ■ Built-in modem operates at error rate less than 1 in 10 million bits (8 channel unit). ■ Rapid self-test features. ■ Constant error monitoring. ■ Bit interleaving cuts time delay to less than 20 millisecons round trip on 1,000 mile path. ■ Input/output: data plus 2 control levels per channel, EIA Standard signal levels. ■ Format: any character length to 16 elements. ■ Standard speeds: 110, 135 and 150 baud, intermixed. ■ Total height: 5 1/4" for 8 channels with modem. ■ Immediate delivery.

## I/Onex

Division of Sonex Inc.  
20 East Herman Street  
Philadelphia, Pa. 19144  
(215) 843-6400

999 N. Sepulveda Blvd.  
El Segundo, Calif. 90245  
(213) 772-2181

# Honeywell computers may be applied liberally.

If you're looking for a general-purpose computer that really is general purpose, you ought to know about Honeywell computers. Like the H316 computer below, and other members of the Series 16 family. Then there's the Series 32 family. And the H112 minicomputer.

They're being used in all sorts of applications.

On off-shore oil rigs, they're helping keep free-floating ships directly over the drill.

In supermarkets, they're speeding checkouts and maintaining total inventory control.

In airline systems, they're concentrating data to cut back on expensive telephone line lease costs.

In hospitals, they're providing on-line, real-time access to both in-hospital communication systems and remote data facilities.

And if that isn't enough, try these: Space capsule simulation. Antenna control. Numerical control. Remote manipulator control. Industrial control.

Weather reconnaissance. Weather forecasting. Patient monitoring. Navigation. Target tracking. Fire control. Seismic studies. Travel reservations. Medical research.

Credit verification. River traffic control. Communications. Graphic data conversion . . . Whew.

Now that's what general-purpose computers are all about.

Get more information about Honeywell computers and the uses they're being put to. Write for our Control Applications Kit. So you can consider the alternative: Honeywell, Computer Control Division, Framingham, Massachusetts 01701.

## The Other Computer Company: **Honeywell**

**HONEYWELL INTERNATIONAL**—Sales and Service offices in all principal cities of the world. Manufacturing in Australia, Canada, Finland, France, Germany, Japan, Mexico, Netherlands, Spain, Taiwan, U.K. and U.S.A.



CIRCLE NO. 6 ON INQUIRY CARD



## LETTERS TO EDITOR

To the Editor:

In the News Roundup section of the April, 1970 issue of MODERN DATA, the Christian Research Institute is reported as having awarded a \$1 million contract to DSI Systems. The Christian Research Institute never awarded DSI Systems a \$1 million contract, but only a small contract for five terminals and a letter of intent to use their network if the network became nationwide in the near future. Since the DSI network is not currently in existence, DSI has faulted in their goals and also in their agreement with us.

**James Bjornstad**  
Assistant Director  
The Christian Research Institute  
Wayne, N. J.

To the Editor:

I think you have made an unfortunate decision in excluding (possibly) unsupported software costing less than \$100 from your survey of program packages. There are a significant number of packages developed at public expense in government laboratories and/or public universities which are freely distributed, in the public domain, often well-tested, and sometimes supported to some extent.

In the particular area of computer-drawn flowcharts, I draw your attention to the FLOW2 program available from Naval Ordnance Test Station, China Lake, Cal., documented in CFSTI AD 637 863; and to the MADFLOW program and documentation available from M. Abrams, Dept. of Elec. Engrg., Univ. of Maryland.

**Marshal D. Abrams**  
Inf. Proc. Technology Div.  
Nat. Bureau of Standards  
Washington, D.C.

*Author's Reply: Thank you for your letter concerning our current survey of program packages. We are sorry for your distress at our decision to exclude software costing less than \$100 from the survey. We feel that this was a more than generous break-off point. Almost everyone, at least in commercial operations, who has had experience with a variety of program*

*packages has come to the conclusion that program support determines, almost more than any other single thing, the success and continued usability of a package. This includes such items as user training and the ready availability of a person intimately familiar with the program to assist when bugs develop or modifications must be made.*

*We have run into many nightmare stories of verifiably excellent packages that have become unused at a facility merely for lack of user training; once the original buyer/enthusiast leaves, the program falls into disuse. Of course, digging into a program without the assistance of strong support is an obvious nightmare and one with which many of us are familiar. Most operations simply do not have the time or personnel to permit this. It also represents a high additional price the company pays for an unsup-*

*ported, apparently low-cost package. In fact, we personally feel that the type of support that a program usually requires to maintain high standards of integrity for both the package and supplier necessitates a charge more on the order of \$1,000.*

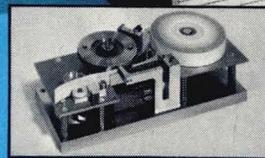
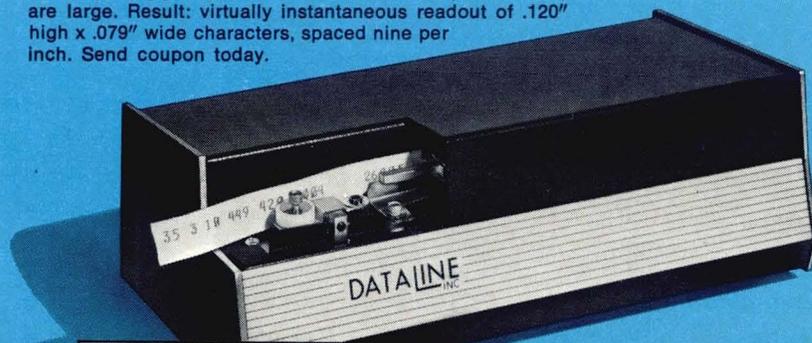
*However, we recognize that some of the packages that are in the public domain and available at low cost are worthy of special attention. I thank you for your letter pointing out two in particular. I am also aware of some important work being done in the Navy (and recently reported on by Grace Murray Hopper) consisting of a complete collection of programming aids for Cobol. I hope to try to write a special feature on such programs sometime in the future.*

**K. Falor**  
Software Forum

## THE OUTSTRIPPER

**NEW DATALINE  
DESK TOP  
STRIP PRINTER  
REDUCES  
LINE TIME.**

More message in less line time. Because this readout terminal sprints as it prints . . . It literally outstrips the field . . . and does it far longer, with a minimum of 100 million maintenance-free operations! Size and weight are surprisingly small, but the 64 characters (ASCII code) are large. Result: virtually instantaneous readout of .120" high x .079" wide characters, spaced nine per inch. Send coupon today.



**DATALINE**  
INC.

The Best in Printed Copy Data Terminals  
181 SOUTH BORO LINE ROAD  
KING OF PRUSSIA, PA. 19406  
TELEPHONE: 215/265-6340

**DATALINE**  
INC.

Sounds great!  
Tell me more.

NAME \_\_\_\_\_  
TITLE \_\_\_\_\_  
COMPANY \_\_\_\_\_  
STREET \_\_\_\_\_  
CITY \_\_\_\_\_  
STATE \_\_\_\_\_ ZIP \_\_\_\_\_  
MD

CIRCLE NO. 7 ON INQUIRY CARD

# Moore New Ideas for Data Processing

## Speed up expediting with your computer

When materials and purchased sub-assemblies aren't ready on schedule, the production operation grinds expensively to a halt. Moore can provide a computer-controlled expediting system that keeps suppliers on their toes. Preparation of queries is quick and inexpensive. Needed information comes back by return mail. System also provides an effective way to appraise vendors. Ask about Idea #401.

## Automated system for rack jobbers

Nobody envies the jobber's routeman all the bookkeeping that goes with his job. And it stands to reason that he could cover a lot more territory if relieved of that chore. Moore has a way to do this. A Moore system, utilizing optical scanning, reduces bookkeeping to drawing lines on a sheet of paper. The system is errorless, widely adaptable, economical. Ask about Idea #402.

## Lower the cost of re-issuing identity cards

When identity or credit cards are prepared in a separate operation from preparation of records, both have to be matched and then prepared for mailing. Time-consuming. Costly. Prone to mismatches and other errors. Moore has a new system which eliminates all these disadvantages. One pass through computer prints plastic card and records simultaneously. Ask about Idea #403.

## Automate ALL the way

A Moore Interstacker device can double the output of your printer. It can be used separately or in connection with a Moore Imprinter-Detacher machine. Ask for a demonstration.

## Moore ideas can make your automation even better

Sometimes a very simple idea can make your ADP setup deliver much more than you thought possible. Moore specialists work closely with the equipment people to get a perfect marriage between paper and hardware. It always pays to call in a Moore man when you talk to equipment people. One Moore idea may be what you need.



**MOORE<sup>®</sup> BUSINESS FORMS, INC.**

Over 675 offices and plants, 2618 salesmen in North America

# Datapoint 3300 & Friends



Meet the newest member of the Datapoint Family — the Datapoint 3300P Printer Unit.

The 3300P printer joins with the Datapoint 3300 terminal and the Datapoint 3300T Magnetic Tape Unit to provide time sharing users with an unprecedented capability for high speed, flexible transmission and receipt of data and for off-line data handling and manipulation.

The 3300P features print speeds up to 30 characters per second • accepts incoming data at 110, 150, 220 or 300 BPS • serves up to five

Datapoint 3300's • formatted report preparation • thermal printing process • plug-in utilization • light weight • compact • handsome styling • easy maintenance (fewer than 25 moving parts).

Just as important, the 3300P is available now, currently in many field installations in fact, as are the Datapoint 3300 and the 3300T. You can find out more about the new 3300P and the whole Datapoint family by contacting any of the Computer Terminal Corporation offices listed below.

## Computer Terminal Corporation



A TEXAS CORPORATION

CIRCLE NO. 9 ON INQUIRY CARD

HOME OFFICE: 9725 Datapoint Drive, San Antonio, Texas 78229, (512) 696-4520

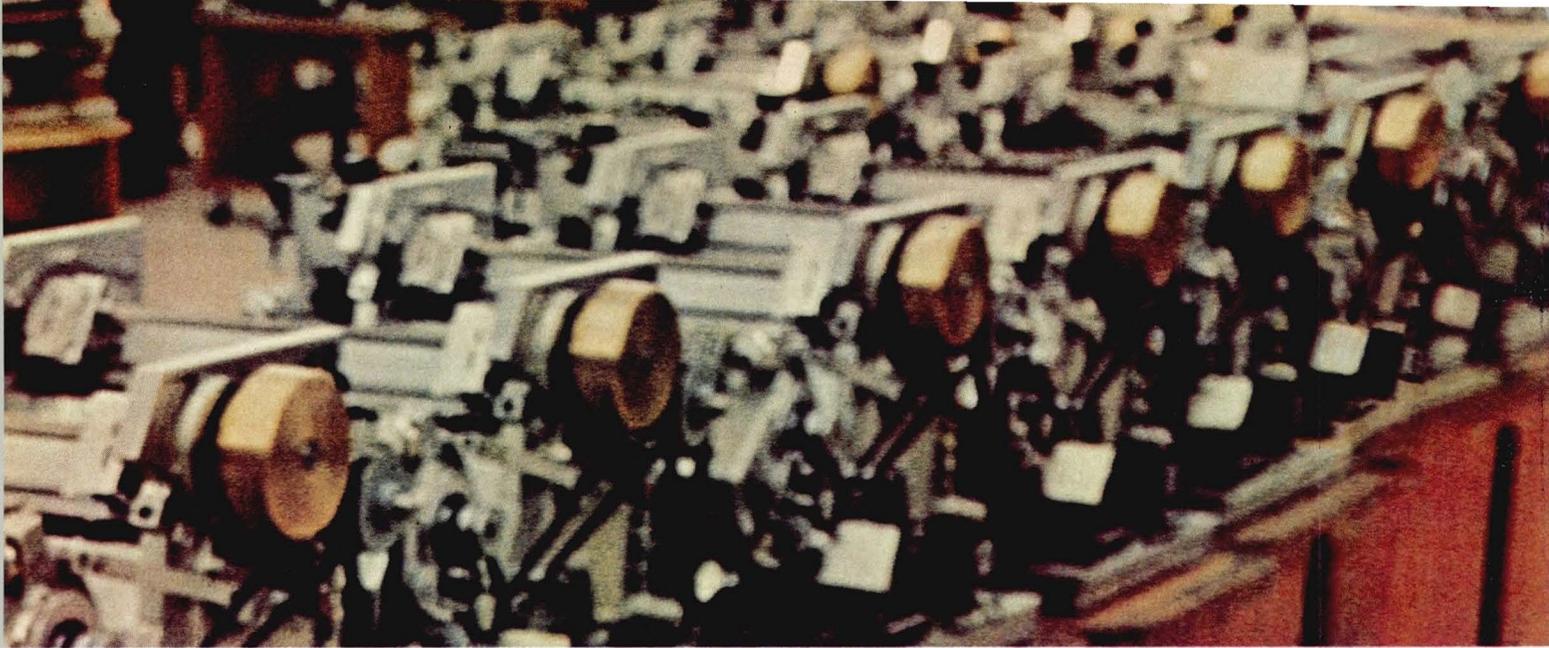
REGIONAL OFFICES: WESTERN — 3807 Wilshire Blvd., Los Angeles, Calif. 90005, (213) 380-2497 • MIDWESTERN — 7851 Metro Parkway, Minneapolis, Minn. 55420, (612) 727-1344  
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**“To most people,  
Mohawk means Data-  
Recorders.**

**Yet today that’s  
only 30 per cent of  
our business.”**

*Comments from Orrin B. Craigie, Vice-President, Marketing.*



“When Mohawk was started back in 1964, the scheme centered around the key-to-tape device. After all, the punch card was an antique. It had been around since 1890. Someone had to develop a way to get information into a computer faster. Mohawk did it by going to mag tape. We figured: the third generation computers talk tape—why not speak their language?”

“Fine. The Data-Recorder has been very successful. Problem is, people always remember us for our tape breakthrough, and nothing else.

“Well, we can do plenty for encores. Forty per cent of our business is in data communications. We make card readers and card punches and card-to-tape converters. We’ve got over 8,000 line printers in operation all over the world. We turn out a fantastic line of digital strip printers.

“Mohawk might have started out with a device, but it wasn’t anything

but a means to an end. The end was to structure a sales and service organization, a marketing network, large enough and good enough that Mohawk could sell and service anything it made anywhere in the country.

“After all, the computer business has always been loaded with hot hardware and brilliant ideas... but service has been quite another story. So the groundwork was laid very firmly for our service system. It’s rather funny, actually. We’re known for a breakthrough. Yet Mohawk’s success has really been based on a very ordinary concept, that of service.”

Mohawk Data Sciences Corp.  
Herkimer, New York



# Remotely interested in accessing a 360, 1108, or 6000?

## This single **COPE** terminal can access all three!

With a COPE remote batch terminal, all you need to access all three of these computers are telephone lines. Access is as simple as dialing a number. COPE terminals achieve this kind of flexibility by simulating IBM 2780, UNIVAC 1004 and CDC user 200 terminals. As for delivery, would you believe 60-90 days?

COPE terminals aren't limited to simulating other terminals, though. They can *really* do their own thing. For instance, all but one of the seven programmable members of the COPE family operate in the full-duplex COPE mode over voice-grade lines. They send and receive data in blocks of 3072 bits in both directions simultaneously. In this mode, they achieve speeds of up to 2000 LPM and 1500 CPM.

COPE terminals offer the industry's best cost/thruput ratio. You can choose from the *seven* systems to get a reading/printing combination best suited to your needs. And you can grow with COPE as your data communications requirements grow. Starting with a COPE 30 series terminal, you can field upgrade to the fastest full duplex system in the industry—the COPE .45.

Peripherals available and being utilized by COPE users today include card readers, line printers, incremental plotters, card punches and mag tape units.

COPE users have no maintenance problems. A nationwide network of maintenance centers, operated by University Computing Company's System Support Division, provides complete back-up

services for COPE terminals.

If you're remotely interested in a *flexible* batch terminal, compare COPE. For more information contact Marketing Coordinator, Data Communication Systems Division, University Computing Company, 2659 Nova Drive, Dallas, Texas 75229. (214) 241-3501.

Terminal Type	Communications Mode		Input/Output Device Speeds (Maximum)	
	Half Duplex	Full Duplex COPE	Reader C.P.M.	Printer L.P.M.
C.30	ATT 201A/B	No	200	240
C.32	No	Yes	200	360
C.34	Option	Yes	300	360
C.36	Option	Yes	300	480
C.38	Option	Yes	600	480
C.41	Option	Yes	600	1,250
C.45	Option	Yes	1,500	1,250



**UNIVERSITY COMPUTING COMPANY**

DATA COMMUNICATION SYSTEMS DIVISION  
2659 Nova Drive / Dallas, Texas 75229

CIRCLE NO. 11 ON INQUIRY CARD





Willardson

Bless our cycle time! Our hero, MAC the Computer, has triumphed again. It's now ramrodding a breakthrough in high-speed X-Y plotting.

In the Xynetics automated drafting system, MAC 16 controls a unique writing head that zips pen along paper at up to 40 ips. Twice as fast as other systems.

And with resolution of  $\pm 0.001''$ . Gad! Great line-drawing speed, but how about that bottleneck: annotation? Under MAC's control, the amazing writing head can put down 120 words per minute in 0.070'' characters. Which, we'll vow, matches the speed of tape-controlled impact typewriters.

And there's more. All because of a revolutionary writing device and MAC. MAC, with 1-microsecond cycle time, an 8K core that works splendidly with FORTRAN IV, and a surprisingly low price.

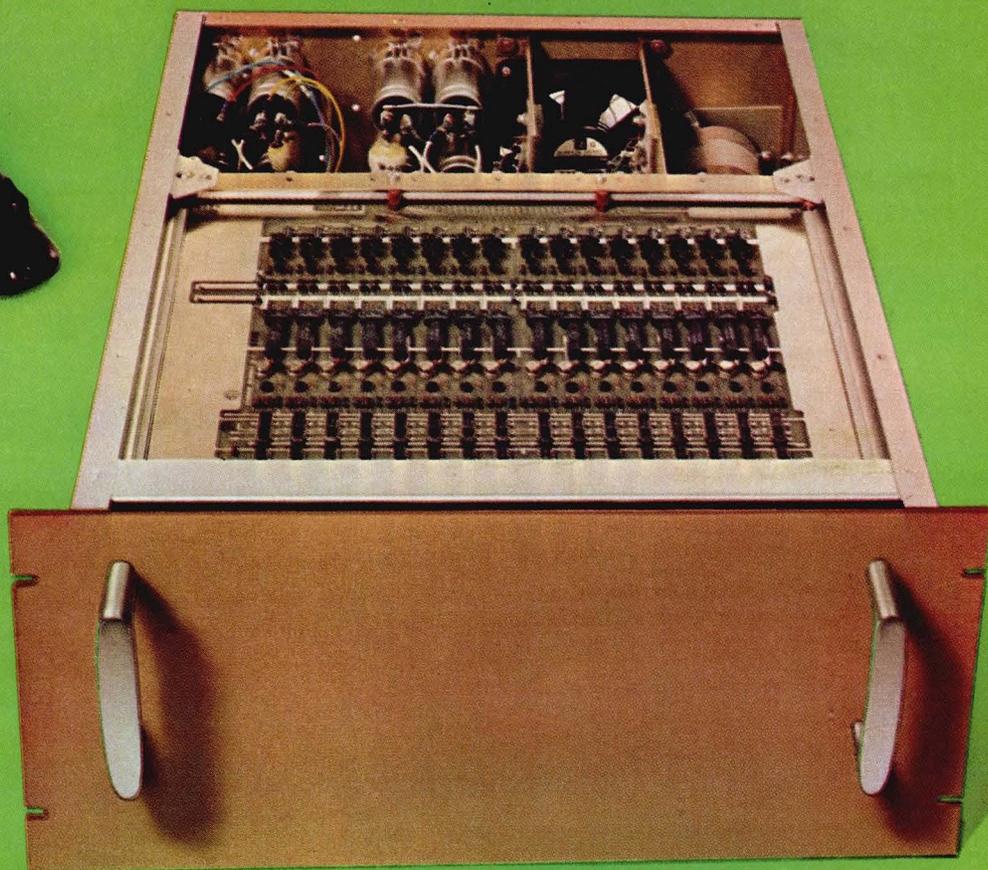
"Hard to believe!" some doubters may exclaim. They, and you, can get the full story by circling our number. That's the way Xynetics got started.

### Lockheed Electronics

Data Products Division  
A Division of Lockheed Aircraft Corporation

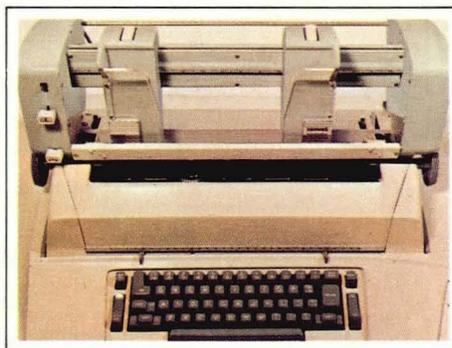
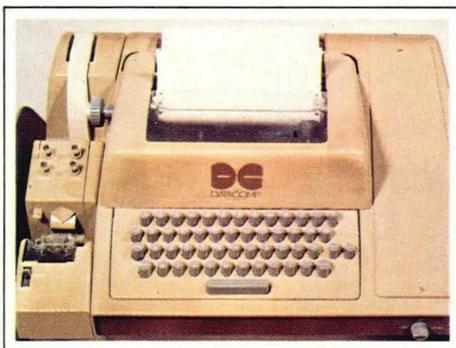
# MAC AND THE AUTOMATIC DRAWING MACHINE

or  
The Speediest Pen  
on Paper



This is the Clary  
Datacomp  
404  
computer

# These are its most popular control panels



The DATACOMP 404 has no flashing lights or cryptic front-panel markings. That's because it was designed to be used by non-computer-type people—like engineers and business-machine operators and secretaries.

## DON'T GET THE WRONG IDEA

It is *not* another lame duck minicomputer. It has a big memory, powerful I/O instructions, a 64-bit main accumulator, two 16-bit index registers and a programmer-selected word length of 16, 32, 48 or 64 bits. Memory capacity is up to 4096 16-bit words in the main frame with options to 65, 536 words in 4096-word increments.

## IT SPEAKS DECIMAL FLUENTLY

Decimal add, subtract, and multiply/divide with automatic scaling are standard instruction features. No need for lengthy decimal/binary code conversion software. Your programmer or your operator can think in terms of decimal—not binary numbers.

## DIRECT MEMORY ACCESS DOESN'T SLOW IT DOWN

DMA is possible up to 470,000 bytes per second—directly between core and

peripheral—without slowing down data processing. Compare this feature with most minicomputers, and you'll find that as their DMA transfer rate approaches specified maximum, data processing stops.

## YOU MAY CONNECT UP TO 256 PERIPHERAL DEVICES, THEN SELECTIVELY DISABLE THEM

And without software! Any device on the I/O bus may be assigned an interrupt priority. There may be as many priorities as devices. This means you can design time-share systems around the 404 with a minimum of executive software overhead.

## EXECUTIVE TIME-SHARE SOFTWARE FOR TWO TO SIXTEEN USERS

The DATACOMP 404 may be time-shared by two to sixteen users—through keyboard, CRT, or other terminals. For scientific/engineering computations, data communications, remote batch, and a wide range of business/accounting applications (including accounts payable/receivable, payroll, ledger card posting, etc.) For example, in an accounting application where the 404 replaces electro-mechanical business accounting machines, up to sixteen accounting keyboards may be used *simultaneously* with one computer. But regardless of the application, each user may create, load and execute programs from his terminal. A large data base is available for all users by the addition of random-access storage.

## COMPLETE SYSTEMS SOFTWARE AND APPLICATIONS PACKAGES AVAILABLE.

## FOR THE COMPLETE STORY ON THE DATACOMP 404, CALL THIS NUMBER TODAY:

213/283-9485. We'll tell you how you can use the DATACOMP 404 as an intelligent terminal or an accounting computer or a sensible "System 3."

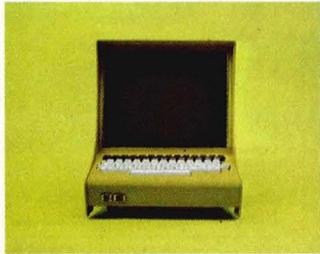


404 JUNIPERO SERRA DRIVE  
SAN GABRIEL, CALIFORNIA 91776  
TELEPHONE: (213) 283-9485  
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# From any angle... the Top Time-Sharing Terminal

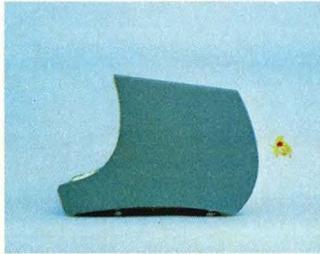
## Let's Face It

Beehive has the slenderest CRT terminal of all—a classy stand alone unit measuring just 12" wide, 14" high and 20" deep. Alpha-103, with an 800 character display is TTY interchangeable. Alpha-105, with 80 char/line 20 line capacity is a direct TTY replacement.



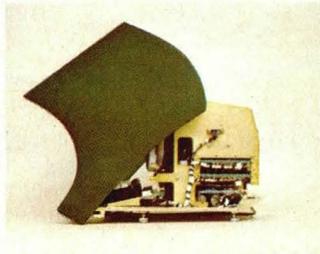
## Aside From That

This terminal is smartly functional with a contoured design which will enhance the looks of any modern office. The curved case bottom makes it easy to lift the 30 pound lightweight which is available in green, blue, yellow, brown and buff—plus dozens of special decorator colors.



## A Little Back Talk

Shows a clean rear panel which makes this Beehive terminal attractive from any angle. All connectors and the AC power cord are hidden beneath the unit, including a BNC to directly connect low cost, large screen TV monitors. You see, all Beehive CRT terminals are EIA Television compatible.



## The Inside Story

Concerns the five modular printed circuit boards, easily reached by lifting the hinged case. Beehive CRT terminals use MOS integrated circuits for both memory and for character generation. The use of MOS results in smaller size, higher speed, lower power consumption and better reliability.



## Underneath It All

Are the cleverly concealed controls for On/Off, Brightness, Contrast, System Reset, and a very important Local/Half/Full Duplex switch. This makes it possible to type and edit text under Local control, and then switch to Half Duplex for high speed transmission of the entire message to the computer.



## The Closer You Get

The more you'll appreciate the flexibility of Beehive's CRT terminals. Note the Teletype keyboard. Plus the 14 optional black control keys for tabbing, 4-way cursor control, text editing and interface with printers, tape cassettes and, of course, the computer.



Beehive Electrotech, Inc.,  
1473 South 6th West,  
Salt Lake City, Utah 84104  
(801) 487-0741



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With an optional forms projector, you have 16 program selectable forms.

And take your choice of cameras. 16 or 35mm. Sprocketed or unsprocketed. Even a 105mm microfiche option.

So if you haven't

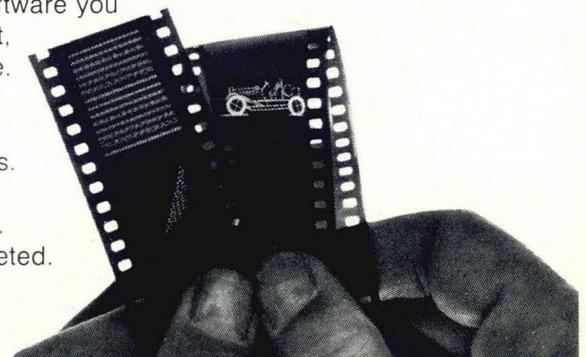
been able to decide between a microfilm system that *plots* or one that *prints*, call your nearest CalComp man today. (CalComp has offices in 34 cities.)

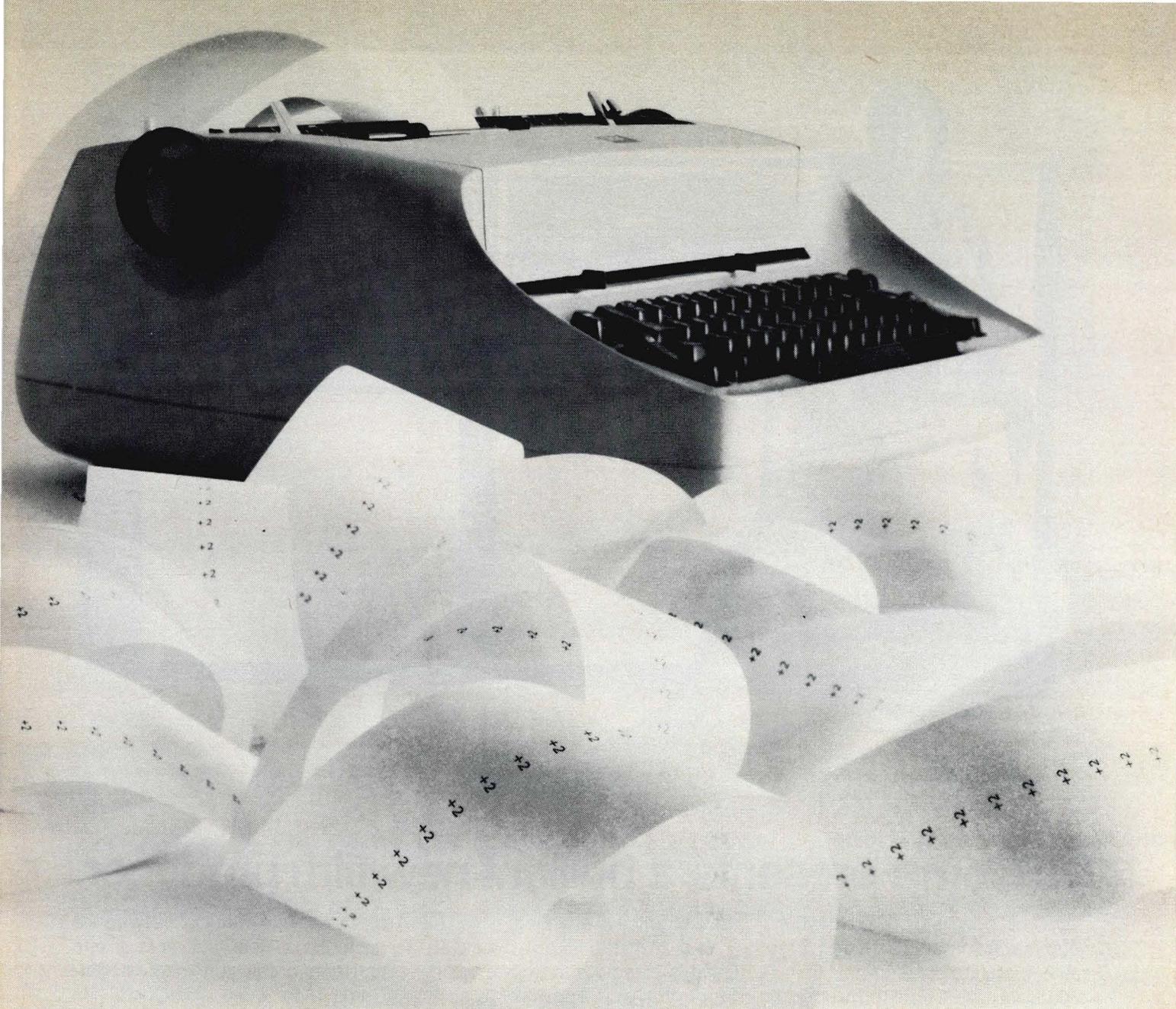
And tell him you want to discuss the brilliant new producer that produces both.

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## Time-sharing is like trying to add $2 + 2$ on a typewriter.

Most service bureaus give you a teleprinter terminal and expect you to solve your problems with a computer many miles away. So when their computer gets busy, your teleprinter goes dead. And a dead teleprinter is just another typewriter.

But now there's a different kind of time-sharing that only you can use.

It's called the Interplex System I. It's an in-house system with a 12K general-purpose computer, hard-wired to as many as 16 specially

designed terminals. So you don't need phone lines.

And because it's your own in-house system, you can use it as much as you want without paying an extra cent for it.

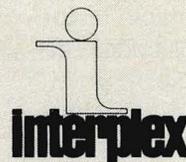
It's easy.

Our new time-sharing terminal is the first to combine BASIC language programming with an electronic calculator in a single desktop unit. So you can do up to 90% of your time-sharing jobs in BASIC without leaving your desk. And for a lot less than you're paying now.

You won't need any more equipment, because the terminal's also

an electronic calculator. So you can even stop in the middle of your own program to run your calculations. And you don't have to wait for anybody else.

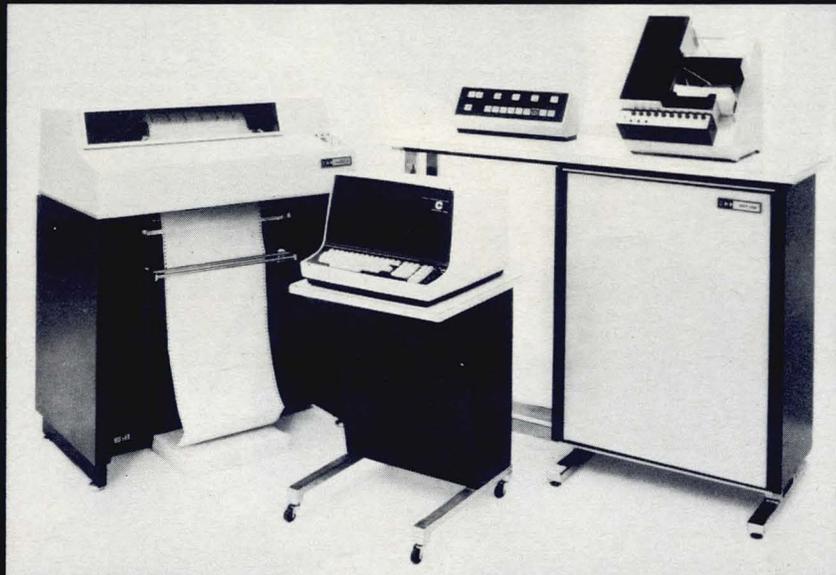
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None of these hardwired terminals can match the flexibility of our DCT-132. It uses software instead of hardware to communicate in several manufacturers' languages. And as technology advances,

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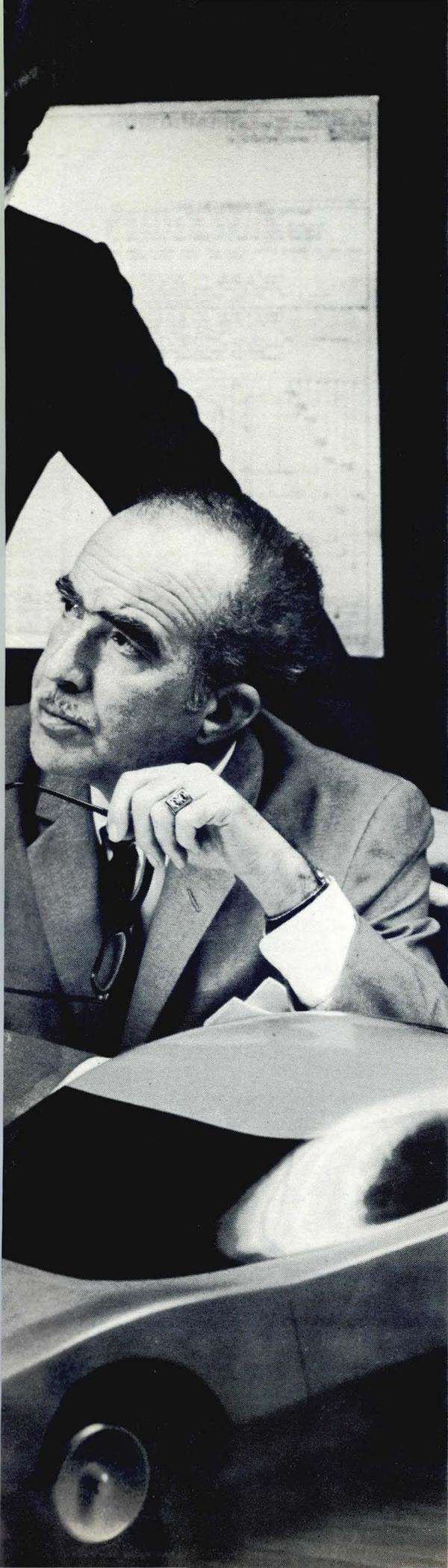
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**Computer downtime  
could cost this user  
his share of a  
multi-billion dollar  
market.**

**That's why he depends  
on Gerber Scientific  
and Hewlett-Packard.**

In the automotive market, being second with a hot new body design just doesn't make it. That's why car manufacturers are turning to computerized drafting systems, like those made by The Gerber Scientific Instrument Company, South Windsor, Connecticut.

The auto industry knows that computers can mean the margin of difference—when they're working. But when they're not, you just might be "last under the checkered flag." That's why trouble-free performance was a key factor in Gerber Scientific's computer selection for its Series 1200 and 700 controls. These drafting systems make it possible to bring fresh new auto design concepts to market in record time. Gerber's systems are also slashing design time and costs in electronics, aircraft, garments, maps and other detailed work that used to take weeks of manual effort.

Sure Gerber Scientific chose our 2114 computer because they knew it could do the job. And was priced right. But more important, they knew they could count on superb reliability—and depend on world-wide HP service and support back-up—if and when needed. We have 141 service centers in the United States and around the world. For an OEM, this can be a very reassuring fact.

There are other reassuring facts about our small computers. Like Direct Memory Access, a feature now available with the new HP 2114B. The DMA option gives you the flexibility to use high-speed peripherals. And it makes possible the acquisition of very high-speed data. Yet this computer's base price is only \$8500. If you're looking for something a bit more powerful, try the HP 2116B. It's the heart of our popular time-share, real-time executive and disc operating systems. Cost: \$24,000.

Get the full story on computers you can depend on. Call your nearest HP sales office or write to Hewlett-Packard, Palo Alto, California 94304; Europe: 1217 Meyrin-Geneva, Switzerland.

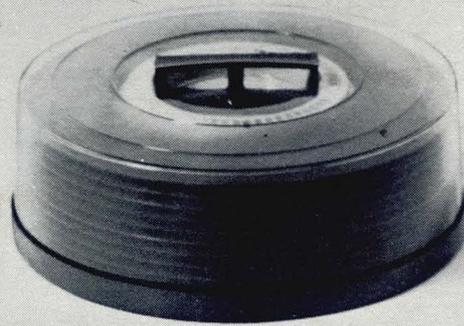
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DIGITAL COMPUTERS  
CIRCLE NO. 18 ON INQUIRY CARD

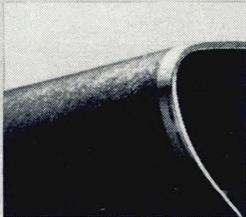
# The salesman who says all disk packs are alike



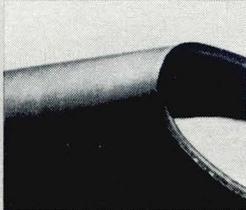
# may not want to talk about the differences.



You can't blame him. Unless you want to be selfish. Unless you're concerned about the "typical" problems that go along with typical performance.



Competitive disk surface



CDC disk surface

Unretouched photos of bent disks shows a difference you get with CDC

If you're going to be that one-way, you'd be better off with a CDC man.

He *wants* to talk about problems, because he has a way to solve them. He'll tell you what makes a CDC disk pack different. And makes it the highest performance, most reliable, longest lasting pack available anywhere.

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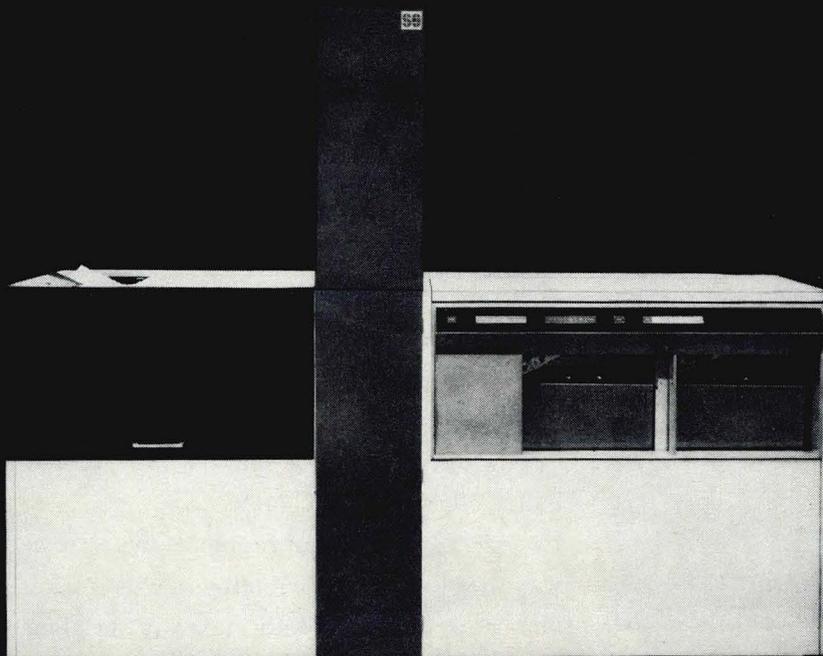
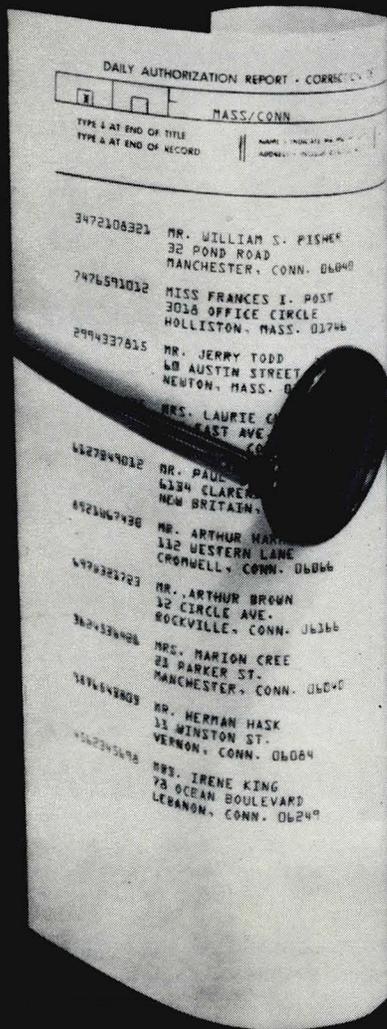


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**I'm an 850  
character 8½ x 11" page  
that wants to move at...  
like 80 pages  
a minute**

**I read you man**



**Right! And not only does the new Scan-Optics 20/20™ Optical Character Reader come on strong with a higher thrupt than any other page reader . . . it also really makes it as a document reader. Like multiple line documents processed at 500 per minute.**

**Would you believe it's the only high-speed combined page and document reader? Right again.**

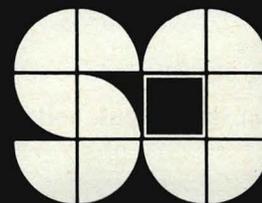
**But thrupt is only one of the many outta' sight advantages of the 20/20.**

**Like it directly converts all kinds of data into computer usable form. No keying in or re-transcribing of source data. Add to this, off-line operation which means you forget about tying up expensive computer time.**

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**Get with the 20/20 scene. Get with Scan-Optics. For info . . . Scan-Optics Inc., Prestige Park, East Hartford, Conn. 06108. Phone 203 289-6001.**

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**Scan-Optics Inc**

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(There is a new high speed plotter afoot.)

## LOUDER!

We said, there is a new high speed plotter afoot that plots any graph, regardless of complexity, on a standard 8½x11 page in less than seven seconds. Quietly.

It doesn't cost \$18,000. Or \$12,000. Or even \$8,000.

**It costs just \$6,500.**

The Matrix 200 is ideally suited to such applications as hard copy output from CRT graphics displays. It gives you graphics output capability for digital computer systems and off-line storage devices.

It is also ideal as a remote graphics hard copy display device in communications applications.

Need a printer/plotter combination? We got. The Matrix 200A can be operated on-line or off-line for alphanumeric printing and graphics — combining the two on a single piece of paper. Printing speed: 600 character lines per minute.

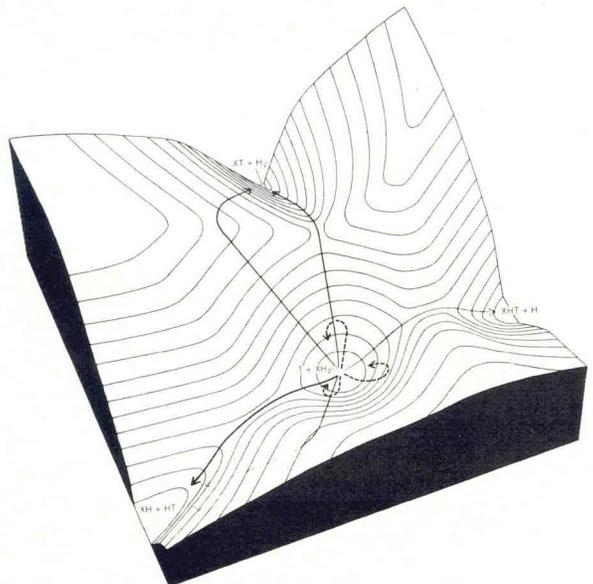
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**The company is VERSATEC . . .  
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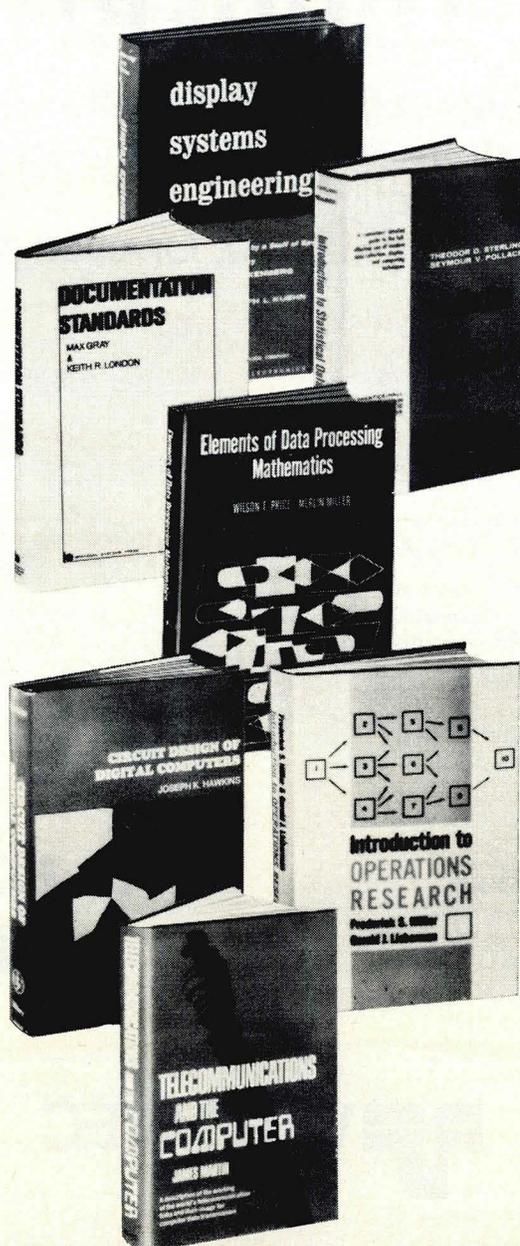
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## NEWS ROUNDUP

### SJCC KEYNOTER DELIVERS CHALLENGE

University Computing Co. chairman Sam Wyly dropped a glove at the feet of the American Federation of Information Processing Society's executive committee in what has been described as "the most relevant keynote address ever presented at a Joint Computer Conference." Wyly challenged AFIPS to establish a special task force to "study the problem of data transmission, to work with existing carriers to overcome it, and to look into alternatives that can be pursued in parallel." Wyly stipulated that the task force "should not include representatives of either the existing carriers or of companies which have proposed data transmission alternatives." The latter companies include Microwave Communications, Inc., and UCC's own Data Transmission Co. (DATRAN) subsidiary. Titled, "Data Transmission: The Critical Challenge of the Seventies," Wyly's address related the data processing industry's urgent need for more and better communications with the needs of the economy as a whole, stating that "Knowledge in all its forms is the main cost, the main investment, the main product of the American economy." He explained that existing common carriers were not only basically unequipped to handle the special requirements of digital communications, but were already overburdened by the unanticipated demand for increased analog (voice) communications. "The data transmission crisis," Wyly said, "is our industry's major problem—the one door to future growth which must be opened."

Asked if he had any comment on Wyly's suggestion for a special AFIPS task force, AFIPS president, Dr. Richard Tanaka, stated that "the subject would be considered."

### EDP TRAINING FOR DISADVANTAGED

Three New York organizations have agreed to implement a program which will move the disadvantaged from the unemployment rolls to the computer room. The pact, signed by Programming Sciences Corp., Marketing Survey & Research Corp., and Social Research Corp., is designed to provide new skills and career opportunities by training computer console operators, keypunch operators, and I/O quality control clerks and placing them in jobs with users of data processing equipment.

### RCA AIMS FOR NO. 2 SLOT

Speaking before his company's 51st annual stockholders' meeting, RCA chairman and president Robert W. Sarnoff stated that domestic shipments of RCA computers nearly doubled in the first quarter of 1970 and, if the past industry pattern continues, the company's scheduled deliveries this year should move RCA from fifth place last year to the industry's number two position. Mr. Sarnoff said that RCA's schedule of domestic shipments this year will account for slightly more than 7 per cent of the projected industry total, as against 3.7 per cent in 1969. "No company other than IBM has achieved this high a share of the market during the past five years," he said.

### QUO VADIS VIATRON?

Viatron Computer Systems Corp. has announced that System 21 products (of \$39/mo. fame) will be available for sale only. The company will no longer rent its products. At the same time, the company raised prices for two products in the System 21 line. Viatron stated that customer demand to purchase System 21 has been sufficiently large to absorb the company's production capacity for the foreseeable future; and that the interest expressed in System 21 by third-party leasing companies as well as leasing arrangements provided by individual Viatron dealers would meet the demands of those customers wishing to lease System 21. The products for which increases were announced are the 2101 microprocessor which will sell for \$1640 and the Viatape Model 5001 recorder which will sell for \$384. In addition, all Model 301 black and white video displays will be sold for \$384. The 2101 microprocessor previously rented for \$20/mo; the recorder for \$4/mo. The first display for each system was previously supplied at no charge. Viatron stated that other new prices would go into effect July 1, 1970. The pricing announcement closely follows a layoff of almost 300 employees, and comes less than two months after Viatron reported to a group of financial analysts that "current direct costs of manufacturing, including current variances, are substantially below the retail price of the machines," and "more than adequate to support the current price structure." (MODERN DATA, May 1970, p. 40.)

# Interactive Graphics

## for the Tektronix T4002 Graphic Computer Terminal

With the introduction of the 4901 Interactive Graphic Unit and Joystick accessory, graphic input capability is now available for the Tektronix T4002 Computer Terminal. The Interactive Graphic Unit is a valuable aid wherever graphic analysis of statistical data is fundamental to: thorough scientific investigation—effective computer-aided instruction—informed decision making.

The 4901 and optional Joystick are *software* supported. The software permits coordinate identification, display rotation and overlaying, menu picking and other frequently repeated functions in graphic formatting.

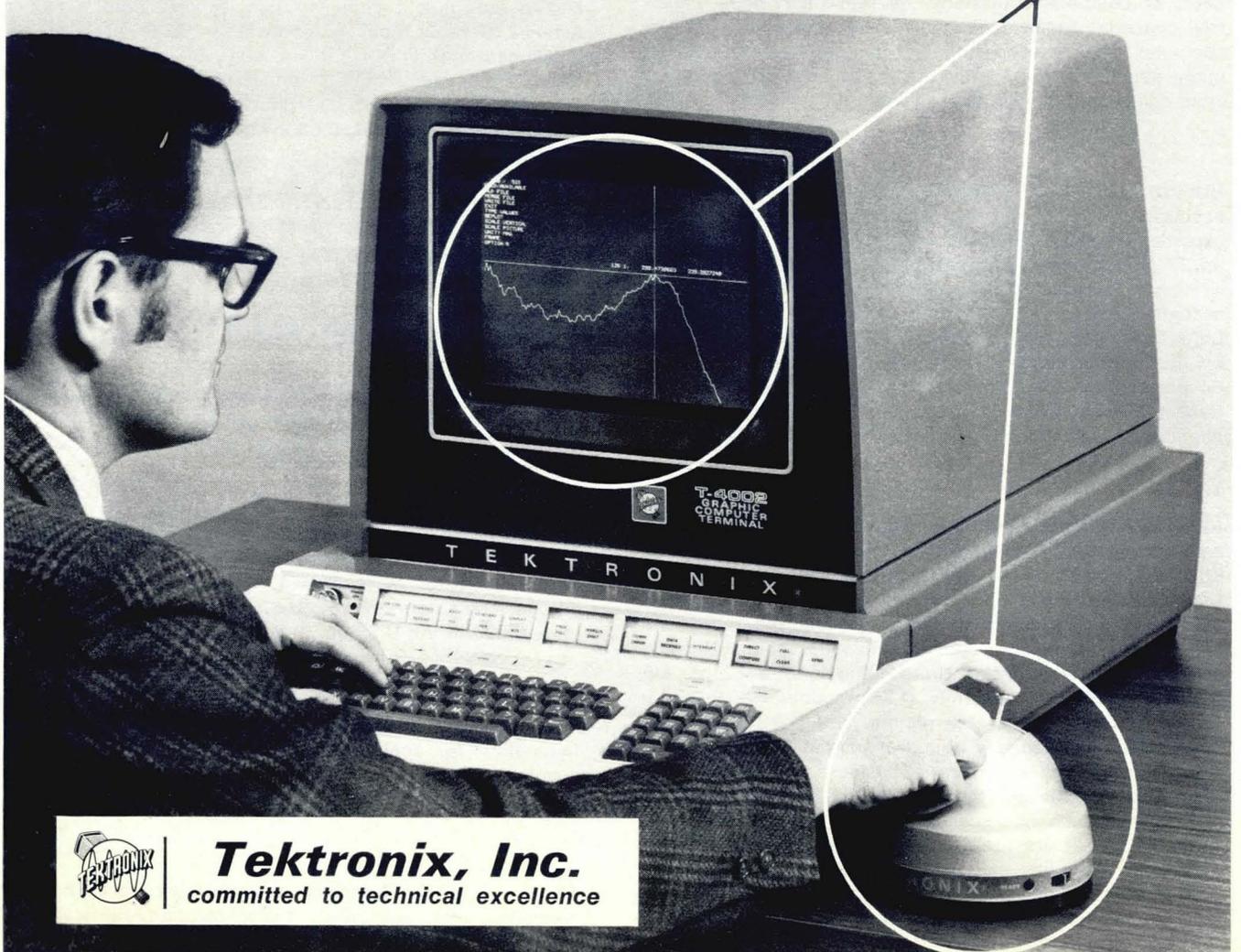
The new 4901 generates a bright, no parallax, orthogonal crosshair cursor. The cursor is easily and accurately positioned with the desk-top Joystick. You enter data points and instructions through the T4002 keyboard. This means complete graphic interface without removing your hand from the Joystick.

Tektronix Application Engineers, especially trained in the capabilities of Tektronix Information Display Products, will discuss with you the full versatility of the T4002 Graphic Computer Terminal. A T4002 demonstration provides an excellent opportunity to discuss software support, machine compatibility, interface options and maintenance. Contact your Application Engineer through any Tektronix office (57 domestic—48 foreign) or directly by calling (301) 825-9000 Baltimore; (617) 894-4550 Boston; (415) 326-8500 Palo Alto. Or write Tektronix, Inc., P. O. Box 500, Beaverton, Oregon 97005.

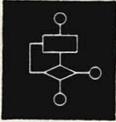
T4002 Graphic Computer Terminal .....	\$8,800
4901 Interactive Graphic Unit .....	\$ 450
Optional Joystick (015-0175-00) .....	\$ 250

U.S. Sales Prices FOB Beaverton, Oregon

*The new, no parallax crosshair cursor is positioned with the desk-top Joystick.*



**Tektronix, Inc.**  
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## INTERNATIONAL NEWS

**SPANISH MARKET** — Spanish business firms and government agencies imported EDP equipment valued at approximately \$28 million in 1969. By 1973, the U.S. Dept of Commerce expects the Spanish market to reach \$56 million, with imports still supplying over 95 percent of the total, and imports from the U.S. projected at \$16 million. Imports of EDP equipment increased by 20 percent between 1966 and 1967 — from \$19 million to \$23 million. In 1968, the increase (to \$25 million) was slightly less than 10 percent because of the country's tight monetary policy. This slower growth rate continued into 1969, with imports estimated at \$28 million. A recent poll of EDP suppliers, however, indicated confidence in renewed rapid growth with imports expected to increase by about 15 percent in 1970 and by 20 percent annually in the period 1971-73.

**SCOTTISH DOUBTS** — Lord Polwarth, President of the Scottish Council for Development and Industry, expressed doubts about the way in which many computers are used. At a recent symposium of the Institute of Electrical Engineers at Edinburgh University, he said that "many industrial concerns are beginning to feel the honeymoon of the computer age is over." Although computers have relieved many people of dull routine tasks, he said, they are too often considered as glorified calculating machines.

**BUSINESS MACHINE TRADE RISES** — U.S. foreign trade in business machines reached new highs of \$1.1 billion in exports and \$375 million in imports in 1969. Exports were up 37 percent over the \$835 million of 1968, and imports were up 45 percent over the \$259 million for the same year, according to the U.S. Dept. of Commerce's Business and Defense Services Administration (BDSA). Electronic computers and parts accounted for the largest segment of exports, 64 percent, for a total of \$728 million in 1969. Major customers included West Germany, the United Kingdom, Canada, Japan, and France.

**KENNEDY ROUND TARIFFS** — With 15 major foreign markets cutting tariffs on business machines by as much as 50% as a result of the Kennedy Round negotiations, U.S. manufacturers could discover important new international marketing opportunities. Countries making the reductions are: Austria, Canada, Denmark, Finland, Japan, Norway, Sweden, Switzerland, the United Kingdom, and the European Economic Community (EEC) nations — Belgium, France, Germany, Italy, Luxembourg, and The Netherlands. What makes the Kennedy Round of particular value to U.S. manufacturers and exporters of business machines is that Europe and Japan — the areas which lead in the consumption of such machines and where demand is growing most rapidly — are the areas in which most of the tariff reductions are being made. In 1968, the 15 countries imported \$1.8 billion worth of business machines, of which U.S. firms supplied \$699 million, or 39%. The U.S. share of the \$865 million EEC import market was 29%.

**JAPANESE OPPORTUNITIES** — Japan's booming economy — the fastest growing among the world's industrialized nations — has opened challenging new business opportunities for American makers of electronic computers and peripheral equipment. In 1969, U.S. companies supplied more than \$91 million worth of computers and peripheral equipment to Japan. U.S. exports of such machines and equipment to Japan this year are expected to exceed \$105 million, making that nation one of the largest markets in the world for U.S. computers. Installed computer systems in Japan reportedly may reach 10,000 units by 1972, a dramatic increase over the 5,600 in use in 1969. Domestic output, which increased 148 percent in value during 1966-68, is expected to supply a large portion of these future needs, which stem from labor shortages coupled with rising production costs. However, imports of certain advanced equipment, peripherals, and software will be required to fill acknowledged technical gaps in key categories.

**FRENCH EDP CAREERS** — One hundred thousand persons in modern-day France are making use of EDP in enterprise and in government administration, reports *Comite France Actuelle*. Seventy thousand of these are EDP specialists — 50 percent of them operational staff, 30 percent programmers, 15 percent analysts, and 5 percent engineers. By 1975, the number of persons directly engaged in EDP activities will have risen to 150,000. At that time, it is expected that operational personnel will have relatively diminished, while the number of analysts will have increased fourfold and that of programmers fivefold. There is strong backing, meanwhile, for a proposal that France's major engineering schools add a terminal year devoted to data-processing.

### QUICKLY AROUND THE WORLD

Air traffic controllers will receive warnings of impending mid-air collisions by mid-1970 under a Government plan for revising Britain's air traffic services, the *Times of London* reports.

At the present time, according to estimates given by Erling Dessau, project manager for the United Nations Computing Research Center at Bratislava, Czechoslovakia, there are 53,000 computers in the U.S., 22,000 in Western Europe, 6,000 in the U.S.S.R., and 1,000 in Eastern Europe.

West European governments have been meeting in Brussels in an effort to speed up technological progress and lay a foundation for cooperative R&D work. One meeting was devoted to computers and software. Experts rather than civil servants were the main participants in these get-togethers.

The U.S. Dept. of Commerce forecasts good prospects for advanced electronic office machines and medical EDP computers in the Danish market.



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## ORDERS AND INSTALLATIONS

McDonnell Automation Co., St. Louis, has announced a four-year contract under which it anticipates cumulative sales of more than \$7,000,000 for providing data processing services to Computerized Automotive Reporting Service (CARS), Inc., of Birmingham, Ala. The new contract, continuing a previous agreement between the two companies, provides auto agencies scattered throughout the U.S. with complete accounting reports, parts inventories, sales analyses, and customer follow-up records.

Atar Computer Systems, Inc. of Canoga Park, Cal. is now testing programs developed for its travel agent common automated reservation system on the firm's new \$2.5 million IBM 360/65 computer. Atar plans to install a communication computer in July and a second IBM 360/65, the largest computer used by U.S. airlines reservations, this fall.

A research and development contract expected to exceed \$2 million for computer peripheral equipment has been awarded to the Electronics Div. of Ferranti-Packard Ltd. by Chicago-based Spiegel, Inc. The contract calls for the development and prototype production of optical scanning and electronic weigh scale hardware for use in a pilot order processing system.

Management Research International, Inc. of Austin, Texas ordered a \$2.8 million Control Data 6400 computer and CDC's KRONOS operating system to expand the firm's information services business.

Colorado Instruments, Inc. of Broomfield, Colo. has received orders totaling \$1.2 million for data collection and data communications systems. The orders came from the Ford Motor Co.'s General Parts Div. in Rawsonville, Mich.; Medical Information Systems Co. in Phoenix; Byron Jackson, Inc., L.A.; and the Univ. of Colorado.

Carte Blanche has ordered a \$1.6 million RCA Spectra 70/55 computer system to handle its credit card accounting and billing functions.

Mauchly-Wood Systems Corp. of L.A., a subsidiary of Scientific Resources Corp. of Philadelphia, has signed an initial contract for \$500,000 with the city of Long Beach, Cal. for the development of a computerized public safety subsystem. Designed to be readily transferable to any city in the 50,000 to 500,000 population range, the system will make all municipal information immediately available, on a selective basis, to any civic department.

Communications Logic, Inc. of Houston, a subsidiary of Computer Complex, Inc., has been awarded an order from On-Line Systems, Inc. of Pittsburgh, Pa. for two computer communications interfaces for the PDP-10 computer. On-Line Systems will provide the necessary software for the communications hardware which has been sold to Graphic Controls Corp., of Buffalo, N.Y. Total value of the order is in excess of \$200,000.

Hazeltine Corp. of Little Neck, N.Y. has received an initial award of \$2.6 million from the Dept. of Defense for the production of Scan Converter Display System to be installed in the F-4 Phantom Jet. The value of the multi-year contract is \$7.1 million.

Huettenwerk Oberhausen AG (HOAG), Oberhausen, W. Germany, one of the oldest and largest integrated steel producing concerns in the Ruhr, has purchased a \$5.2 million Univac 1108 multiprocessor system. HOAG, a member of the Thyssen Group, the largest private steel producer in Europe, will use the computer for a plant-wide, real-time information system.

The Bell Telephone Co. of Canada has ordered a Control Data 6400 computer system valued at nearly \$2 million for use in forecasting future telephone network requirements, communications research products, and the analysis of communications simulation models. The CDC 6400 will be installed at Bell-Canada's Montreal headquarters in June.

Infoton, Inc. of Burlington, Mass. announced a contract to ship 25 of its Vista I CRT display terminals to the Entriken Computer Co. of Fenton, Mich. Entriken integrates mini-computers and peripheral equipment into special purpose systems.

Computer Sciences Corp. of L.A. has been awarded a \$1.1 million contract by the Defense Communications Agency to provide technical assistance in support of the National Military Command System. The NMCSSC provides data processing support to the Joint Chiefs of Staff and other Defense Dept. agencies.

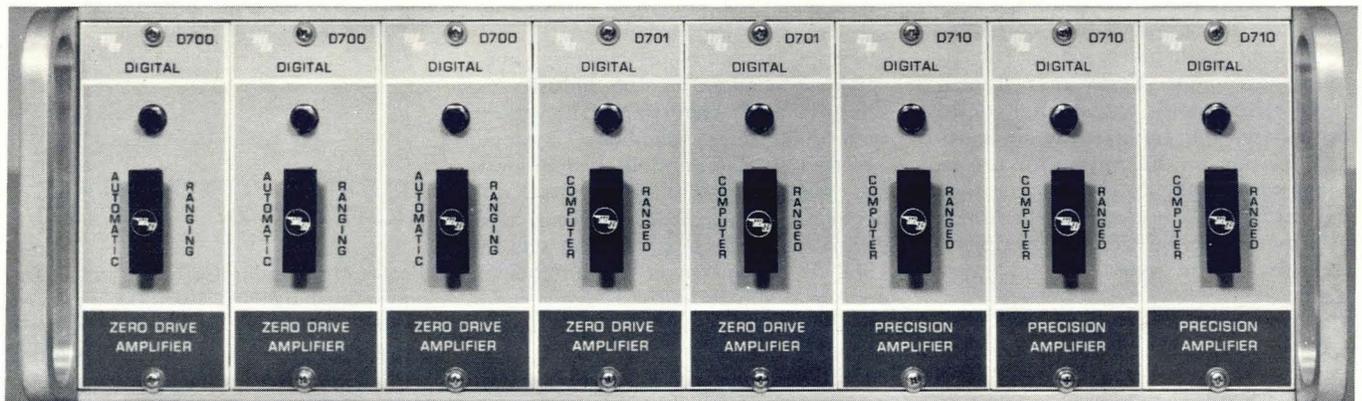
The Bureau of the Census, first user of punched cards eight decades ago, has turned to Honeywell's Keytape encoding devices to speed the preparation of the 1970 agricultural census. The order, valued at about \$1 million, is the largest received by Honeywell since its Keytape unit was announced two years ago.

Collins Radio Co. of Dallas has agreed to supply Viatron Computer Systems, Inc. of Bedford, Mass., with 2048-bit read-only-memory arrays at a target cost of under a penny per bit. The ROM order exceeds \$1 million.

Systems Engineering Laboratories, Inc. has announced orders totaling more than \$1 million from Bell Telephone Laboratories, and the City Public Service Board of San Antonio, Texas for its new SYSTEMS 86/88 computers.

Lockheed Electronic's Data Products Div. has been awarded a contract in excess of \$500 thousand for CR-95 memory systems in a submarine sonar program. Raytheon's Submarine Signal Div. in Portsmouth, R.I. made the purchase.

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### THE BATTLE OF THE GIANTS: ROUND ONE

Xerox Corp. has filed suit for patent infringement against IBM in the U.S. District Court for the Southern District of N.Y. The complaint seeks damages for the alleged infringement of 22 Xerox patents by an office copying machine recently announced by IBM. Xerox also seeks an injunction against its giant competitor, claiming that the patents involved in the suit relate to the xerographic office copiers presently marketed by Xerox. The complaint asserts that in 1968, and again in 1970, Xerox refused IBM's requests for a license under the Xerox patents to manufacture and sell xerographic office copiers of the type which IBM has announced. IBM is now licensed under the Xerox patents to use xerography for computer equipment and, pursuant to the license agreement, Xerox says it provided IBM with confidential data, know-how, and trade secret information relating to xerography for use in such equipment. Xerox asserts that the confidential information has been used in connection with office copiers, contrary to the terms of the agreement.

### COMPUTERIZED NEWS FOR INVESTORS

Profile Communications, Inc., a new firm publishing by computer printout to meet individual needs for news and information, has opened for business in Maynard, Mass. The company's first publishing effort will be a weekly corporate and financial news/information service, called *Pro-Com Alerts*, which will be tailored by computer to the specific interest profile of each professional or private investor who subscribes. At its present startup stage, *Pro-Com Alerts* are being offered on 400 publicly-held U.S. companies chosen by a survey of investment professionals. Eventually, the list will be expanded to include several thousand companies. Plans are also underway to meet the news/information needs of individuals with interests in engineering, medicine, and law.

### TELEPHONE INDUSTRY'S GROWTH POTENTIAL

The telephone industry's dynamic growth potential is currently not reflected in the prices of telephone stocks, which are selling at historically low valuations and at around their lowest prices for a number of years, says Moody's Investors Service, Inc.

The industry's growth potential stems from the accelerating demand for communications and technological advances that are improving existing services and creating new ones. The market's disdain for these stocks also gives scant recognition to either the generally satisfactory earnings growth recorded by the companies last year, in the face of higher interest costs and other inflation-stimulated expenses, or their pursuit of substantial rate increases, the Survey says.

Prime evidence of today's conspicuous changes in the industry is the growing transmission of non-voice data via the telephone system, Moody's says. The Bell System now has about 131,000 data sets connected to it, up 56% in a year, and estimated to reach 1.5 million sets by 1980. In several years, the number of non-voice signals carried over phone wires could equal that of voice, Moody's believes.

Simultaneously, regular phone use is growing so fast that it is taxing the capacity of present facilities. Moody's expects that there will be an average of one phone per person in the U.S. by the end of the century, vs. 56 per 100 persons last year and 40 just 30 years ago. At the same time, revenue per phone continues to climb steadily.

Combined revenue growth for the Bell System and the independent phone companies from voice transmission alone is projected by Moody's to increase at a 9% to 10% annual rate over the foreseeable future. This would indicate annual gross of about \$31 billion by 1975, substantially above 1969's \$18 billion. Independents accounted for \$2.5 billion of this total.

In mid-1970, AT&T expects to introduce picture phones as a general business service. Its present high-cost will restrict it very much to being a novelty, luxury item at first. With economies from large-scale business use, the picture phone's unit cost

could drop dramatically to a point where it would be eventually within reach of the average household. By 1980, Moody's says, picture phones could generate revenues of \$1 billion annually.

The strains from increased demand for service and inflation have caused the phone industry to seek rate increases aggressively, the Survey notes. Requests for hikes probably totaled about \$500 million in 1969, and larger requests are expected in 1970 and 1971. It appears to Moody's that the rate of return on investment will have to rise significantly from current levels if the industry is to be able to cope with high interest rates and attract the expansion capital it needs. Thus, regulatory policies of federal and state agencies will play an increasingly important role in the industry's future.

### MAI AND POTTER SETTLE ARBITRATION

Potter Instrument Co., Inc. and Management Assistance Inc. (MAI) have settled their disputes relating to their prior damage claims and the marketing of Potter-manufactured magnetic tape transports for the IBM-replacement market. Under the new arrangement, Potter and MAI, each can market the transports without limitation. If a combination of sales to MAI over the next 18 months, and sales and leases to other commercial customers over the next five years, reaches about \$100,000,000, based on current end-user sales value, MAI will realize a maximum benefit of \$6,250,000. Potter stated that the anticipated after-tax cost to Potter of such maximum was estimated to be less than \$3,000,000. The agreement further stipulates that Potter will make periodic payments to MAI based on Potter's future sales or leases of these transports to other commercial customers, with a minimum of \$2,160,000 payable by Aug. 31, 1974. Potter stated that the anticipated after-tax cost of the minimum payment to MAI will be about \$1,000,000 which will be included in Potter's current financial statement as an extraordinary charge.

**PRICE CHANGES**

Varian Data Machines has reduced the basic price of its 520/i general-purpose mini by 20%, from \$7,500 down to \$6,000. . . . Keymatic Data Systems Corp. has announced price reductions of approximately 25% in the base prices of its Series 1090 Encoders, which record directly on 9-track magnetic tape at 800 bpi. . . . A unit price increase averaging 8% for the Data-Verter line of data acquisition and communications equipment was announced by Digi-tronics Corp.

**MERGERS AND ACQUISITIONS:** American Data Systems of Canoga Park, Cal. has acquired Liberty Consultants, Inc. of Chatsworth, Cal. The purchase was for an undisclosed amount of stock. . . . The American Tabulating Co. of Englewood Cliffs, N.J. has acquired Cybergraphic Systems and Programming

Corp. of Hackensack, N.J. The merged firm, American Tabulating and Cybergraphic Co. will be headquartered in Hackensack. . . . Ronald Simone and Richard Griffith, owners of two Philadelphia area microfilm service organizations (Certified Systems, Inc. and Securitext, Inc.), have acquired a majority interest in Micromation Systems, Inc. of College Park, Md. . . . Computer Learning and Systems Corp. of Chevy Chase, Md., has reached agreement on the acquisition of the Institute of Computer Management, Inc. ICM Schools, located in Baltimore, Pittsburgh, and Cleveland, offer a series of specialized courses in computer programming techniques. . . . Computing and Software, Inc. of L.A. has expanded its proprietary library of programmed applications by acquiring Think, Inc. of L.A. and the Hodes-Daniel Co. of Elmsford, N.Y., C&SI also announced its move into the Canadian data processing market with the signing of a definitive agreement to ac-

quire Aquila Computer Services, Ltd. and Berthiaume, St. Pierre, Theriault and Associates, Inc. (BST) headquartered in Montreal. . . . Datamation Services, Inc. has concluded the sale of Computer Systems and Education Corp. to Northeast Computer Systems, Inc., of Hartford, Conn. . . . Data Network Corp. of N.Y.C. has announced that negotiations for the proposed acquisition of Logistic Distro Data, Inc., also of N.Y.C., have been terminated. . . . Data Products Corp. of Woodland Hills, Cal. has acquired Tranetics, Inc. of Escondido Cal., a manufacturer of magnetic recording heads. . . . Fimaco, Inc., a Philadelphia-based EDP services company, has acquired American Computer Graphics Corp. of Cinnaminson, N.J. ACG serves printers and publishers through the use of computerized photocomposition equipment. . . . Intranet Computing Corp. of L.A. has acquired Universal Data Systems, Inc., a Westminster, Cal. software development firm. UDS, a wholly-owned subsidiary of The Rucker Co., Oakland, Cal., was acquired for Intranet common stock. . . . Systems Engineering Laboratories, of Ft. Lauderdale, Fla. and Computer Peripherals Corp. of San Diego have reached an agreement in principle under which Systems will offer to acquire all of Computer Peripherals' stock. . . . Tracor Computing Corp. of Austin, Texas and Computer Planning Corp. of L.A. announced an agreement whereby Tracor will acquire substantially all of the assets of Computer Planning and its wholly-owned subsidiary, On-Line Sciences, Inc.

**RECENT ENTRIES IN THE COMPUTER FIELD:** Apollo Associates, a new recruiting firm, will specialize in placing computer personnel. The firm is located in N.Y.C. . . . Instar, Inc. (Information Storage and Retrieval Service), will store and retrieve business records. The Wilmington, Mass. firm will provide facsimile reproduction systems and daily mail and messenger service to its customers . . . Payne Computer Services, Inc., N.Y.C., is a consulting concern specializing in facilities management. The new company is a division of Bruce Payne & Associates, Inc., a management consulting firm . . . Personalized Data Systems of Monterey Park, Cal. is another new systems consulting company created in the wake of unbundling . . . Promodata, a British firm with headquarters in Paris, will act as a broker to bring together computer owners and purchasers of used equipment.

**BOX SCORE OF EARNINGS**

Company	Period	Revenues	Net Earnings (Loss)	Earnings (Loss) per Share
Automatic Data Processing	9 mos. 3/31/70	26,958,064	1,985,131	.40
	9 mos. 3/31/69	19,891,451	1,402,016	.29
Burroughs	3 mos. 3/31/70	189,175,000	9,708,000	.56
	3 mos. 3/31/69	163,075,000	7,607,000	.46
Computer Communications	9 mos. 3/31/70	6,975,414	402,269	.33
	9 mos. 3/31/69	4,390,194	(54,758)	(.05)
Computer Instruments	Yr. 12/31/69	6,843,390	(292,426)	(.18)
	Yr. 12/31/68	7,538,795	203,773	.13
Computer Micrographics	6 mos. 2/28/70	809,984	(19,363)	(.02)
	6 mos. 2/28/69	473,093	38,702	.06
Computer Technology	3 mos. 3/29/70	9,687,000	(667,000)	(.12)
	3 mos. 3/31/69	7,395,000	392,000	.07
Cubic	3 mos. 3/31/70	9,555,000	441,811	.20
	3 mos. 3/31/69	7,733,000	375,600	.17
DCS Computer Services	3 mos. 3/31/70	203,872	15,096	.03
	3 mos. 12/31/69	143,502	9,263	.02
Dashew Business Machines	6 mos. 2/28/70	2,004,853	127,141	.05
	6 mos. 2/28/69	1,835,974	149,659	.06
Datatab	Yr. 12/31/69	3,437,882	116,043	.20
	Yr. 12/31/68	2,388,554	173,549	.41
Elec. Computer Prog. Inst.	Yr. 12/31/69	3,265,865	(232,215)	(-)
	Yr. 12/31/68	3,481,113	403,691	.53
General Automation	6 mos. 1/31/70	2,713,000	(1,060,000)	(-)
	6 mos. 1/31/69	622,000	(269,000)	(-)
Hazeltine	3 mos. 3/31/70	15,627,000	410,000	.21
	3 mos. 3/31/69	14,348,000	522,000	.27
Itel	3 mos. 3/31/70	12,447,000	748,000	.19
	3 mos. 3/31/69	7,367,000	649,000	.17
N. American Philips	Yr. 12/31/69	548,959,810	27,424,098	3.13
	Yr. 12/31/68	505,291,670	19,562,526	2.25
Programming Sciences	Yr. 11/30/69	2,505,545	116,124	.06
	Yr. 11/30/68	1,250,037	(507,794)	(.34)
Raytheon	3 mos. 3/29/70	307,146,000	8,806,000	.59
	3 mos. 3/30/69	302,876,000	8,199,000	.55
Sys. Engrg. Labs.	9 mos. 3/6/70	14,429,621	1,252,693	.55
	9 mos. 3/7/69	11,140,523	911,706	.44
Tab Products	9 mos. 2/28/70	14,470,000	327,000	.39
	9 mos. 2/28/69	12,684,000	285,000	.37
Wang Labs.	9 mos. 3/31/70	17,162,495	1,504,691	.39
	9 mos. 3/31/69	15,776,778	1,676,670	.44



## DC DATASCAN

**NO REGULATIONS NEEDED** — Non-common carriers providing data processing services would not come under government regulation, and regulated common carriers would be permitted to provide data processing only through separate corporations under terms of a tentative decision issued by the Federal Communications Commission. The proposed rules would permit common carriers with operating revenues of \$1 million or more annually to engage in the sale of data processing services only through separate corporate entities maintaining separate books and accounts, and operating with separate personnel and facilities. The larger carriers would be required to file copies of agreements with their data processing affiliates.

In proposing that non-common carriers be exempt from regulation, the Commission concluded that data processing services exist in a competitive market and that there is no need to regulate them whether or not they use communications facilities to connect subscribers to centralized computers. It expressed the view that, "The market for these services will continue to burgeon and flourish best in the existing competitive environment."

**GSA ARCHIVAL PACKAGE** — The General Services Administration reports that a project to develop a system for automated control of archival material has been completed on schedule and is undergoing large-scale testing. The computer package is known as SPINDEX II (for Selective Permutation Indexing). It not only will facilitate indexing and reference use of vast amounts of historical source material in individual archives and manuscript repositories, but will provide information compatibility among the users. Administrator Robert L. Kunzig said the computer program was developed by the National Archives and Records Service of GSA with the cooperation of nine other institutions with large archival or manuscript holdings.

*Inquiries about SPINDEX II should be addressed to: Dr. Frank G. Burke, Director, Educational Programs, National Archives and Records Service (GSA), Washington, D.C. 20408.*

**GOVERNMENT INVENTORY** — The General Services Administration has published the Fiscal 1969 edition of an "Inventory of Automatic Data Processing Equipment in the U.S. Government." The document contains information on the number of computers in the government in fiscal years 1950 through 1969 by federal agency, the number of owned leased computers in the government by manufacturer and type/model, man-years devoted to EDP operations 1960-1969, and EDP costs 1960-1969. The organizational and geographical locations of computers installed as of June 30, 1969, are also identified. *The publication may be purchased for \$2.00 from: Superintendent of Documents, Government Printing Office, Washington, D.C. 20402*

**GOVERNMENT-WIDE INFORMATION SYSTEM** — Congressman Emilio Q. Daddario (D.-Conn.) has proposed the creation of a government-wide information system which "would bring modern day management techniques to its vast research and development effort." In an address to an Information Industry Association meeting, he told about the difficulty facing legislators in deciding which government research projects should be funded without any accurate information on the status of these programs. Rep. Daddario proposed that the Science Information Exchange become the agency to coordinate and manage the new system. He said that "the basic ingredient for effective and more efficient management of our scientific research and development is an information system which can furnish, on a real-time basis, data basic to the decision-making process."

**ZIP AND COMPUTERS** — Postmaster General Winton M. Blount announced that, starting in August, mechanized letter sorting will be substantially improved with the installation of ZIP code keyboards and memory units in 136 cities. The program is expected to cost about \$11.4 million and to save the POD about \$13.5 million yearly. The General American Transportation Corp., Niles, Ill., has a \$9 million contract for the keyboards and translators. The Burroughs Corp., Paoli, Pa., will manufacture the letter sorters for about \$2.3 million.

### IN BRIEF

A 208-page study of computer/display interfaces done for the Army by the National Bureau of Standards is now available. The study investigates graphical display languages, data structures, and the interaction with display users.

It is available for \$3.00 from the U.S. Clearinghouse, Springfield, Va., 22151. Request, AD-699-366, "Computer/Display Interface Study."

Scientists at the Dept. of Commerce's Environmental Science Services Administration have established, with the aid of a computer, that Antarctica was once attached to the southeast coast of Africa.

Ways to improve city life through electronics and communications will be studied by the National Academy of Engineering's Committee on Telecommunications. The year-long study is aimed at determining how urban services can be improved by better use of the latest advances in communications and electronics technology.

One hundred Honeywell Keytape units are being used by the Census Bureau at Jeffersonville, Ind. to prepare the 1970 Census of Agriculture.

Mechanized ZIP Code sorting is being expanded by the Post Office. Pleased with its use in Milwaukee, it will be expanded to Detroit, Houston, Philadelphia, Long Beach, Chicago, Dayton, and Oakland.

# Two months ago, Raytheon Computer introduced the new 1.5 $\mu$ s 704 Computer.



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If your PDP-10 could stand expansion, but your budget can't, here's your answer.

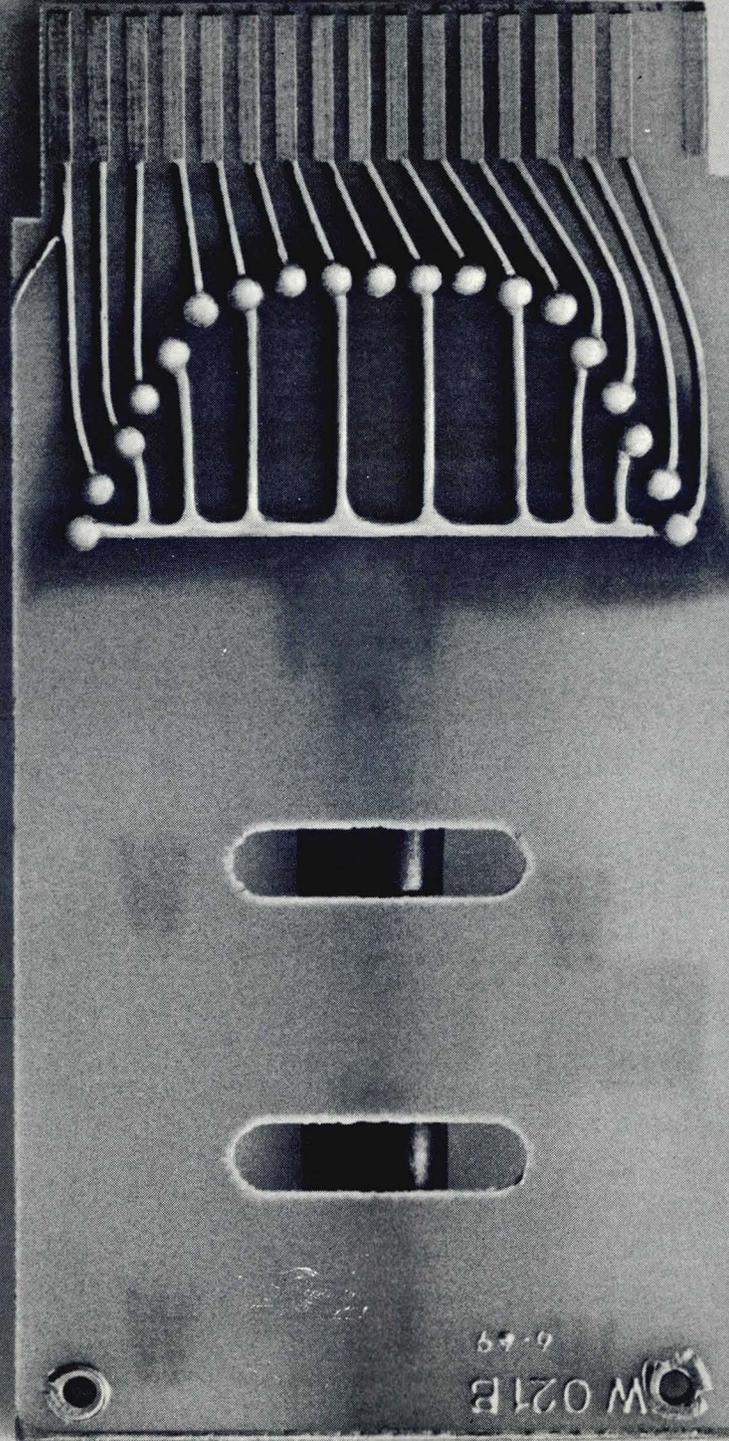
Plug-compatible with PDP-10, our CEK-100 core memory has 1-microsecond cycle time, capacity of 64K words by 37-bits, and is

available with either 4- or 16-port interface.

Those may not be Lockheed exclusives, but this grabber is: the CEK-100 costs just about 1/3 less than the comparable system offered for PDP-10. And that amounts to a walloping savings.

Circle our number and get the full specs on CEK-100, the thrifty PDP-10 expander. From the people who've shipped more bits of high-speed core memory systems than all other independent manufacturers combined.

## The CEK-100 memory fits two things. PDP-10 and a tight budget.



CIRCLE NO. 28 ON INQUIRY CARD

**Lockheed Electronics**

Data Products Division, A Division of Lockheed Aircraft Corporation



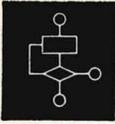
# COMPUTER STOCK TRENDS

	COMPANY	EXCH.	VOL.		PRICE	NET CHG.		P/E	
			(SHARES IN 100's)	1970 HIGH		1970 LOW	FROM MONTH AGO		EARN./SHR. (LATEST 12 MONTHS)
<b>SUPPLIES &amp; ACCESSORIES</b>	ADAMS MILLIS	NY	378	15.2	10.4	11.0	-1.1	0.96	11
	BALTIMORE BUS. FORMS	OTC	-----	21.0	16.0	16.4	-0.4	0.92	17
	BARRY WRIGHT	AM	226	25.3	10.1	10.1	-3.0	0.80	12
	CAPITOL INDUSTRIES	AM	1850	53.5	30.4	34.4	-9.4	1.82	18
	DATA DOCUMENTS	AM	90	35.6	21.6	23.6	-4.0	1.82	12
	DATA PACKAGING	OTC	-----	28.6	12.6	13.0	-7.0	0.77	17
	DENNISON MFG.	NY	956	25.2	13.4	15.0	-4.1	1.34	11
	DUPONT	NY	4329	113.4	92.4	109.0	10.0	7.35	14
	ENNIS BUS. FORMS	NY	231	19.0	14.6	14.6	-1.3	0.95	14
	GENERAL BINDING	OTC	-----	30.4	20.0	21.4	-6.4	0.76	27
	GRAPHIC CONTROLS	OTC	-----	17.2	4.2	9.0	-5.2	1.10	8
	LEWIS BUS. FORMS	OTC	-----	19.4	13.0	13.4	-3.2	0.86	15
	MEMOREX	NY	8882	166.6	78.0	79.4	-37.4	1.83	43
	3 M	NY	3862	114.6	93.0	94.0	-12.3	3.26	28
MOORE CORP. LTD.	TSE	2675	38.0	29.5	35.4	-2.0	1.26	28	
REYNOLDS & REYNOLDS	OTC	-----	48.0	30.0	32.0	-12.4	1.27	25	
SAFEGUARD INDUSTRIES	AM	373	16.1	10.1	10.7	-2.1	0.76	13	
STANDARD REGISTER	OTC	-----	30.0	24.0	24.0	-4.6	1.93	12	
UARCO	NY	159	39.2	28.4	28.4	-7.0	2.21	12	
WALLACE BUS. FORMS	OTC	-----	40.4	32.0	32.4	-7.0	2.16	14	
<b>SOFTWARE &amp; SERVICES</b>	APPLIED DATA RESEARCH	AM	730	24.2	4.1	5.6	-1.7	0.16	31
	APPLIED LOGIC	OTC	-----	18.4	6.2	6.2	-4.2	0.07	87
	ARIES	OTC	-----	11.6	2.0	2.0	-1.4	-----	---
	AUTOMATIC DATA PROC.	AM	5920	47.6	29.4	32.2	-8.4	0.59	54
	BOLT, BERANEK & NEWMAN	OTC	-----	11.2	6.4	6.4	-2.2	0.32	18
	BOOTHE COMPUTER	OTC	-----	25.4	14.0	18.0	-5.0	1.62	11
	BRANDON APPLIED SYS.	OTC	-----	9.4	3.0	3.4	-1.6	-----	---
	COMPUTER APPLICATIONS	AM	788	12.3	4.2	5.0	-2.7	(d)5.51	---
	COMPUTER ENVIRONMENTS	OTC	-----	14.0	7.4	7.4	-1.4	-----	---
	COMPUTER EXCHANGE	OTC	-----	8.2	4.0	4.0	-2.2	0.08	50
	COMPUTER INVESTORS	AM	215	12.3	5.6	6.4	-4.1	0.39	15
	COMPUTER METHODS	OTC	-----	2.4	1.4	1.4	-0.2	-----	---
	COMPUTER PROPERTY	OTC	-----	15.2	8.0	9.0	-4.4	-----	---
	COMPUTER SCIENCES	NY	10477	34.1	12.2	13.0	-8.0	0.81	16
	COMPUTER TECHNOLOGY	OTC	-----	12.3	3.0	4.4	0.5	0.12	33
	CTC COMPUTER	OTC	-----	19.0	1.0	1.0	-6.0	-----	---
	COMPUTER USAGE	OTC	-----	8.0	5.2	6.4	-0.2	(d)1.58	---
	COMPUTING & SOFTWARE	AM	2143	75.6	27.6	30.2	-18.6	1.19	25
	COM-SHARE	OTC	-----	14.6	5.0	5.4	-2.2	-----	---
	CYBER-TRONICS	OTC	-----	15.0	5.0	5.0	-5.6	0.11	45
	CYBERMATICS	OTC	-----	14.2	10.0	10.0	-2.2	-----	---
	DATA AUTOMATION	OTC	-----	24.0	7.4	7.4	-7.0	-----	---
	DATA DYNAMICS	OTC	-----	3.7	1.2	1.2	-1.2	-----	---
	DATA NETWORK	OTC	-----	12.0	1.0	1.0	-0.6	-----	---
	DATA PROC. FIN. & GEN.	AM	4290	32.0	10.0	11.0	-9.0	1.23	8
	DATA SYSTEMS ANALYSTS	OTC	-----	5.4	2.6	3.0	-1.4	0.06	50
	DATRONIC RENTAL	OTC	-----	8.0	4.0	4.4	-1.6	-----	---
	DEARBORN COMPUTER	AM	542	24.1	14.0	14.0	-6.0	1.86	7
	DECISION SYSTEMS	OTC	-----	4.4	2.0	2.0	-1.6	-----	---
	DIGITAL APPLICATIONS	OTC	-----	6.6	1.4	2.4	-1.2	-----	---
	DIGITEK	OTC	-----	4.4	2.4	2.4	-1.4	-----	---
	DPA, INC.	AM	492	10.3	5.0	5.1	-1.1	0.85	5
	EFFICIENT LEASING	OTC	-----	5.0	2.4	2.4	-1.0	-----	---
	ELEC. COMP. PROG. INST.	AM	185	11.4	5.4	6.0	-3.0	0.14	42
ELEC. DATA SYSTEMS	OTC	-----	161.0	67.0	70.0	-89.0	0.39	179	
GREYHOUND COMPUTER	AM	351	14.1	6.7	7.6	-3.6	1.05	6	
INFORMATICS	OTC	-----	43.2	6.2	6.6	-6.6	0.09	66	
INTL. COMPUTER	OTC	-----	7.4	3.4	4.4	-1.6	0.07	63	
INTL. COMPUTER SERVICES	NAT	-----	3.3	1.6	1.6	-0.5	0.20	8	
LEASCO	AM	5863	30.4	12.3	13.1	-3.7	2.51	5	
LEVIN-TOWNSEND	AM	2332	19.3	4.6	5.1	-2.3	4.03	1	
LMC DATA	OTC	-----	3.5	1.4	1.6	-1.0	(d)0.01	---	
MGMT. ASSISTANCE	OTC	-----	3.6	1.4	2.4	0.0	(d)2.07	---	
*MANAGEMENT DATA	AM	-----	25.4	15.6	17.1	-3.2	0.77	22	
NATIONAL COMP. ANAL.	OTC	-----	8.4	3.4	4.0	-1.6	-----	---	
PLANNING RESEARCH	NY	5293	53.2	21.1	22.6	-10.1	0.68	32	
PROGRAMMING METHODS	OTC	-----	27.0	13.0	13.0	-5.0	-----	---	
PROGRAMMING SCIENCES	OTC	-----	33.4	7.0	7.0	-8.0	-----	---	
PROGRAMMING SYSTEMS	OTC	-----	5.4	3.0	3.0	-0.6	0.16	18	
SCIENTIFIC COMPUTER	OTC	-----	3.5	2.0	2.2	-0.6	0.12	16	
SCIENTIFIC RESOURCES	NY	2425	14.5	4.4	6.0	-2.0	(d)0.78	---	
STRATEGIC SYSTEMS	OTC	-----	3.6	2.1	2.4	0.2	-----	---	
SYSTEMS CAPITAL	OTC	-----	6.0	3.4	4.0	-1.4	-----	---	
TIME SHARE	OTC	-----	7.0	2.4	3.0	-2.1	0.13	23	
TRACOR COMPUTING	OTC	-----	7.4	3.2	3.5	-1.7	(d)0.47	---	
URS SYSTEMS	AM	823	28.0	6.4	6.4	-3.4	0.78	7	
UNITED DATA CENTERS	OTC	-----	4.6	2.4	3.5	0.7	0.09	40	
UNIVERSITY COMPUTING	NY	6975	99.3	28.2	33.5	-2.2	2.50	13	
U.S. TIME SHARING	OTC	-----	13.4	5.0	5.2	-5.0	-----	---	

(d) Deficit  
New listing in this issue

All security prices and net change are expressed in dollars and eighths of dollars (e.g. 62.2 is 62 $\frac{1}{4}$ ). Trading volume is not given for over-the-counter stocks. ALL DATA COMPUTED BY SCANTLIN ELECTRONICS, EXCLUSIVELY FOR MODERN DATA.

	COMPANY	EXCH.	VOL. SHARES IN 100's)	1970 HIGH	1970 LOW	PRICE 5-1-70	NET CHG.		P/E RATIO
							FROM MONTH AGO	EARN./SHR. (LATEST 12 MONTHS)	
PERIPHERALS & COMPONENTS	AMP	NY	2274	57.2	46.1	49.0	-4.6	2.03	24
	AMPEX	NY	8085	48.4	21.4	22.0	-13.1	1.44	15
	APPLIED MAGNETICS	OTC	-----	25.4	13.0	14.4	-5.2	0.39	35
	ASTRODATA	AM	1248	34.7	8.3	10.7	-0.6	0.39	25
	ASTROSYSTEMS	OTC	-----	9.2	3.0	4.0	-2.0	0.34	11
	BUNKER RAMO	NY	3053	14.4	9.0	9.6	-3.2	0.53	16
	CALCOMP	AM	3180	33.7	16.6	20.3	-6.1	0.31	64
	CHALCO ENGRG.	OTC	-----	5.0	3.0	3.4	0.2	-----	---
	CODEX	OTC	-----	35.0	8.0	8.0	-8.6	0.26	30
	COGAR	OTC	-----	94.0	47.0	50.0	-19.0	(d)1.27	---
	COGNITRONICS	OTC	-----	13.6	4.0	5.4	-3.4	(d)0.22	---
	COLLINS RADIO	NY	852	37.2	19.2	20.4	-5.6	1.66	12
	COMCET	OTC	-----	50.0	16.0	16.0	-20.4	-----	---
	COMPUTER COMM.	OTC	-----	36.0	17.0	17.0	-14.4	-----	---
	COMPUTER CONSOLES	OTC	-----	22.0	7.4	8.2	-5.2	-----	---
	COMPUTEST	AM	375	28.3	20.2	22.1	-4.3	0.43	51
	CONRAC	NY	378	32.2	15.0	17.0	-7.2	1.20	14
	DATA 100	OTC	-----	16.6	7.0	7.0	-3.4	(d)0.99	---
	DATA PRODUCTS	AM	3961	25.4	12.7	14.4	-3.7	0.35	40
	DATARAM	OTC	-----	15.4	8.0	8.0	-3.4	(d)0.46	---
	DATASCAN	OTC	-----	27.0	14.0	14.0	-8.4	-----	---
	DIGITRONICS	OTC	-----	13.4	7.0	7.0	-1.6	0.18	38
	ELEC. ENGRG. OF CAL.	AM	205	14.5	6.1	6.2	-4.0	(d)0.30	---
	ELEC. MEMORIES & MAG.	NY	2543	40.1	16.5	19.1	-6.6	0.87	21
	EPSCO	OTC	-----	6.6	4.0	4.0	-1.2	0.17	23
	EXCELLO	NY	1009	27.4	22.0	24.7	-1.3	2.59	9
	FABRI-TEK	OTC	-----	8.2	4.4	4.6	-0.8	-----	---
	FARRINGTON MFG.	OTC	-----	17.1	3.6	4.6	-0.6	(d)0.06	---
	GERBER SCIENTIFIC	AM	239	38.5	19.4	21.6	-4.7	0.68	30
	GRAPHIC SCIENCES	OTC	-----	43.0	11.4	12.0	-7.0	(d)1.37	---
	HI-G	AM	-----	16.6	9.0	10.1	-4.9	-----	---
	INFORMATION DISPLAYS	OTC	-----	20.0	7.0	8.0	-8.4	-----	---
	ITEL	AM	-----	25.4	10.3	11.6	-3.4	0.86	14
	LOGIC	OTC	-----	14.2	7.0	7.0	-4.6	-----	---
	MILGO	AM	15371	84.4	25.4	30.3	-42.0	0.19	157
	MOHAWK DATA SCIENCES	AM	6337	87.0	38.6	41.1	-19.3	1.45	28
	NORTH ATLANTIC IND.	OTC	-----	7.6	4.0	4.0	-1.6	-----	---
	OPTICAL SCANNING	OTC	-----	53.0	21.0	24.0	-8.0	(d)0.45	---
POTTER INSTRUMENT	AM	4165	42.6	27.4	33.0	-6.7	0.93	35	
RECOGNITION EQUIP.	OTC	-----	83.4	25.4	28.0	-20.4	(d)0.51	---	
SANDERS ASSOCIATES	NY	917	29.7	12.0	13.6	-1.2	(d)0.53	---	
SANGAMO	NY	916	29.1	14.5	16.7	-4.7	0.41	39	
SCAN-DATA	OTC	-----	53.0	13.0	14.0	-10.0	-----	---	
SEAELECTRO	AM	230	12.6	5.6	6.3	-1.6	0.20	30	
SYKES DATATRONICS	OTC	-----	9.0	5.0	5.4	-2.4	-----	---	
TALLY	OTC	-----	23.0	11.0	11.0	-8.0	(d)2.73	---	
TELEX	NY	18628	159.4	82.1	99.4	-34.3	0.47	38	
TEXAS INSTRUMENTS	NY	2830	134.4	104.0	105.2	-11.2	3.18	33	
VARIFAB	OTC	-----	4.6	2.4	2.4	-0.6	-----	---	
COMPUTERS	BECKMAN	NY	673	63.4	31.1	32.1	-9.7	1.52	21
	BURROUGHS	NY	7940	172.6	122.1	129.0	-15.1	3.42	37
	CONTROL DATA	NY	6552	122.4	40.6	44.0	-8.4	3.19	13
	DATA GENERAL	OTC	-----	34.2	20.6	25.0	-7.2	-----	---
	DIGITAL EQUIPMENT	AM	6076	124.0	80.2	85.0	-13.0	1.31	64
	ELECTRONIC ASSOCIATES	NY	800	11.5	5.4	6.5	-2.1	(d)0.86	---
	GENERAL AUTOMATION	OTC	-----	42.0	13.4	13.4	-6.4	-----	---
	GENERAL ELECTRIC	NY	6894	77.5	67.5	71.3	-2.7	3.07	23
	HEWLETT-PACKARD	NY	3265	45.7	38.2	41.2	-3.5	1.01	40
	HONEYWELL	NY	3417	152.0	114.3	119.4	-8.0	4.25	28
	INTERDATA	OTC	-----	12.6	8.0	8.0	-4.6	0.06	133
	IBM	NY	8650	387.0	286.2	296.6	-29.6	9.01	32
	LITTON INDUSTRIES	NY	5526	38.0	18.1	18.7	-5.5	2.36	7
	NCR	NY	4645	171.6	114.6	121.0	-9.6	4.27	28
	RCA	NY	7624	34.5	23.4	24.0	-6.6	2.09	11
	RAYTHEON	NY	1786	33.5	20.0	23.4	-4.2	2.39	9
	REDCOR	OTC	-----	34.4	12.0	14.0	-16.0	0.14	100
	SCIENTIFIC CONTROL	OTC	-----	8.6	2.6	4.0	-2.2	(d)2.43	---
	SPERRY RAND	NY	9484	40.3	26.3	27.6	-8.2	2.27	11
	SYSTEMS ENGRG. LABS.	AM	3543	49.1	24.4	25.4	-11.1	0.81	30
	SYSTRON DONNER	AM	202	28.5	14.4	15.0	-5.2	1.16	12
VARIAN ASSOCIATES	NY	2411	29.1	16.6	18.4	-4.2	0.97	18	
VIATRON	OTC	-----	50.4	18.4	19.4	-15.6	(d)0.83	---	
WANG LABS.	AM	2435	51.6	28.1	31.0	-12.6	0.66	46	
WYLE LABS.	AM	698	9.4	4.6	5.4	-1.0	0.53	9	
XEROX	NY	15421	115.6	81.2	85.4	-1.4	2.17	39	
AVERAGES	COMPUTER STOCKS			37.5	20.2	21.7	-22.3%	0.87	24.9
	DOW JONES INDUSTRIALS			811.31	724.33	733.63	-7.3%	3.58	12.9



## CORPORATE PROFILE

Featured this month:

### **DATA GENERAL CORPORATION (over-the-counter)**

Southboro, Mass. 01772

**DIRECTORS:** Edson D. deCastro, Pres., Data General Corp.; Frederick R. Adler, partner in the law firm of Reavis & McGrath, New York, and Secretary for Data General Corp.; Henry Burkhardt III, V. Pres. and treasurer, Data General Corp.; Robert E. Fowler, president of Fowler Beach Corp., Rochester, New York; Herbert J. Richman, V. Pres., Data General Corp.; and Richard G. Sogge, V. Pres., Data General Corp.

**BACKGROUND:** Data General Corp. was organized in April of 1968 to design, make, and sell small, general-purpose digital computers. Prior to the formation of Data General Corp., Messrs. deCastro, Burkhardt, and Sogge served in varying capacities with Digital Equipment Corp. Mr. Richman was Eastern regional sales manager of Fairchild Semi-conductor Corp. before he joined Data General.

**FACILITIES:** Data General's headquarters are located in Southboro, Mass. At this location, the company currently occupies 70,000 square feet. This space is used for executive and administrative offices as well as manufacturing and consists of the company's original 10,000 square foot area, opened in March, 1969, and two recent additions of 20,000 and 40,000 square feet respectively. Ground has recently been broken for an additional 150,000 square foot plant adjoining the present facilities. The new addition, which will be available by the end of 1970, will accommodate the planned expansion of the company. When the new plant is complete, Data General will have a total of 220,000 square feet of space at its Southboro headquarters. In addition to its Southboro facilities, Data General also operates a 12,000 square foot printed circuit board plant in Hudson, Mass., and expects to contract shortly for a new 15,000 square foot manufacturing site in Hull, Quebec, Canada. Data General presently employs more than 200 people.

**PRODUCTS:** Data General Corp.'s current product line consists of the Nova and Supernova minicomputer systems and their related peripherals and systems software. In addition to the systems software, Data General also re-

cently announced what is described as the single largest package, of high-level software ever to be introduced at one time by a minicomputer manufacturer. The new software includes a complete Algol 60 compiler, two varieties of Fortran IV, and a device-independent disk operating system.

Data General's computers are further described as follows:

- **NOVA:** The Nova is a 16-bit general-purpose computer whose design is based on medium-scale integrated (MSI) circuitry. Its basic price is \$7,950, including 4K core memory and teleprinter interface. The memory is expandable in 2K or 4K blocks to a maximum of 32K. At the customer's option, Data General will provide read-only memory (ROM). As many as 62 devices may be connected to a Nova, and the computer includes a data channel for use in high-volume data transmission involving high-speed, I/O devices. The Nova was Data General's first product and is said to be the first minicomputer in the industry to use MSI.

- **SUPERNOVA:** The Supernova is a 16-bit high-speed minicomputer designed for use in those applications where other small computers have previously proved ineffective. ADD-time for the Supernova is 300 nanoseconds in read-only memory and 800 nanoseconds with core. The Supernova is fully compatible with the Nova, and programs written on either computer may be run on the other. Supernova options include a bootstrap loader, memory application and protection (MAP), and a high-speed data channel. A Supernova with 4K core memory and teleprinter interface is priced at \$11,700. First deliveries of the new high-speed computer were completed in April.

**CURRENT POSITION:** In its first two years of operation, Data General Corp. has become one of the leading manufacturers of small computer systems. By May, 1970, more than 500 Data General computers had been delivered. Sales have grown rapidly to the present profitable status and are expected to increase. The establishment of a Canadian subsidiary and the opening of European sales offices are

recent events which will give the company a strong position in the expanding world market.

**OUTLOOK:** Data General Corp. is currently in a period of rapid expansion which is expected to continue for some time. Rather than simply consolidating its position as a major minicomputer manufacturer, the company has moved to broaden its approach to the market in terms of geography, marketing, and technology. Most observers anticipate that Data General will be one of the companies to increase its share of the rapidly expanding market for small computers during the coming year. Over the longer run, it is expected that Data General will be able to achieve a minimum 10 percent share of the total market for small computers within the next few years. This market is expected to grow at an annual rate in excess of 20 percent to a total value of at least \$750 million by 1975.

**FINANCIAL SUMMARY:** Data General's stock was first sold to the public in November, 1969. The company recently reported sales of \$2,528,000 for the first half of fiscal 1970, almost 2½ times the \$1,034,000 reported for all of fiscal 1969. Earnings for the 24 week period ended March 14, 1970, would have totaled \$152,000 or \$0.08 per share, had taxes been payable on the income of the first half. Since no taxes were, in fact, payable because of a tax loss carried forward, actual earnings for the first half amounted to \$307,000 or \$0.16 per share. Comparative figures for the first half of fiscal 1969 are not meaningful, since the company was then in the early stages of its business development.

Sales for the second quarter of fiscal 1970 (the 12 week period ended March 14, 1970) rose to \$1,413,000 from the \$1,115,000 of the first quarter of 1970. Earnings jumped sharply from \$88,000 or \$0.05 per share (including \$0.03 per share tax loss carried forward) in the first quarter to \$219,000 or \$0.11 per share (including \$0.05 extraordinary gain from tax loss) in the second quarter.

Data General's current financial position is extremely strong, with more than \$2,400,000 held in cash and short term investments and nearly \$1 million in accounts receivable. The company also continues to have available a substantial line of credit from the Chase Manhattan Bank.

Fiscal Year 1970	Revenue	Net Income	Per Share
Half ended* 3/14/70	\$2,528,000	\$219,000**	\$0.16**
Quarter ended** 3/14/70	1,413,000	88,000**	0.11**

\*Comparative figures for previous years not meaningful, since the company was just then beginning operations.

\*\*Includes extraordinary gain in the form of a tax loss carried forward. This equalled \$0.08 per share for the half and \$0.05 for the quarter most recently ended.

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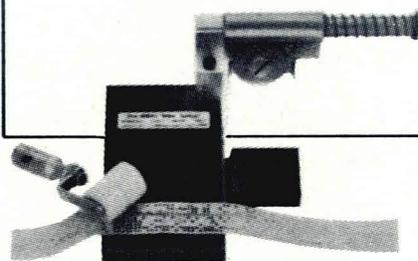
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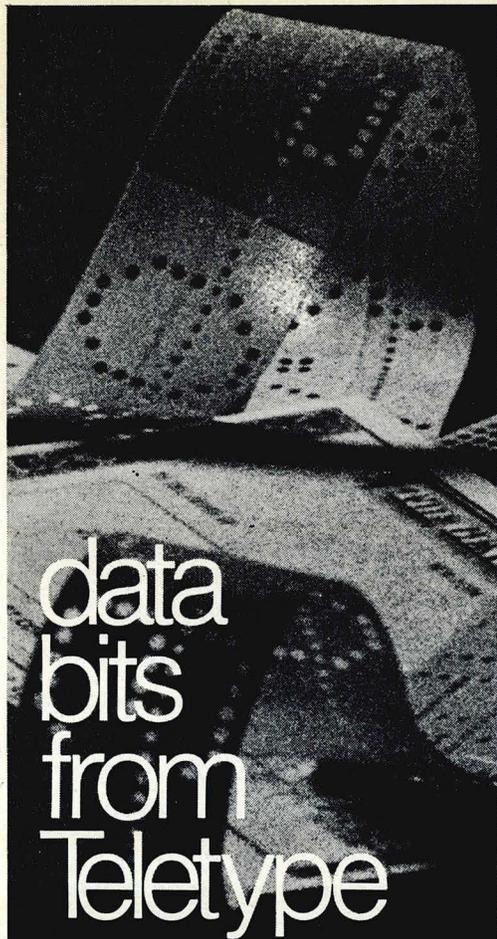
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A large insurance company with over twenty benefit paying offices across the country has slashed payment authorization time from seven days to 24 hours or less using Teletype® equipment and a computer.

Local offices put benefit application data on punched paper tape. The tape is placed in a Teletype terminal's tape reader at the end of each day. Then the home office computer automatically polls each unattended terminal during the night. The entire data collection process runs about 1½ hours.

The computer sorts incoming data by policy number and produces all of the significant facts required to make accurate payment decisions. This data is transmitted to the local offices where it is reproduced in easy-to-use page copy form by Teletype automatic send-receive sets. Helping the insurance company provide the type of payment service policyholders really appreciate.

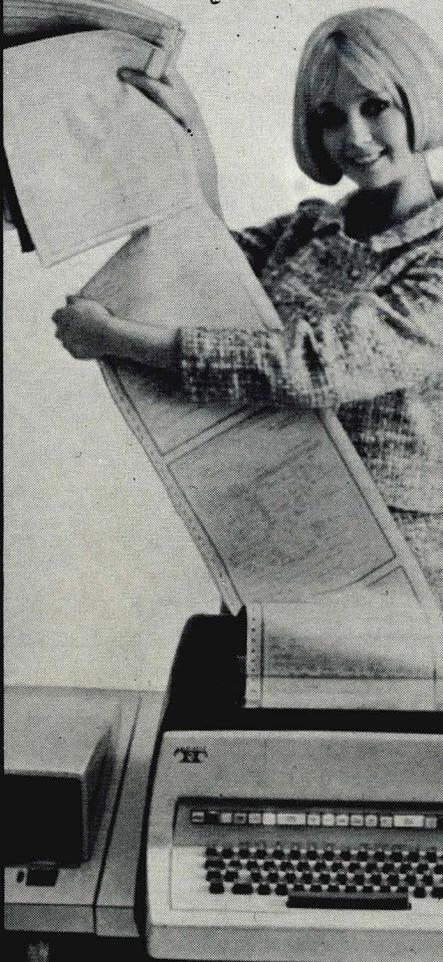
## finicky forms filled on-line

The model 37 has a large number of interesting data communication capabilities. One that means business to many people is its ability to produce multiple copy business forms on-line.

This heavy-duty terminal has: horizontal and vertical tab stops that can be set on-line by operator or any remote terminal using ASCII code. Full and half-line space (forward or reverse). Optional pin feed platen and form feed out control. Types in upper and lower case. Sends and receives data at 150 wpm. It really makes form filling operations fly fast.

With the model 37 it is even possible to add up to 32 special characters to the normal compliment of letters, numerals, symbols and punctuation marks found in its typebox.

It's a great time-sharing tool, too. The first terminal that enables you to take full advantage of ASCII capabilities.

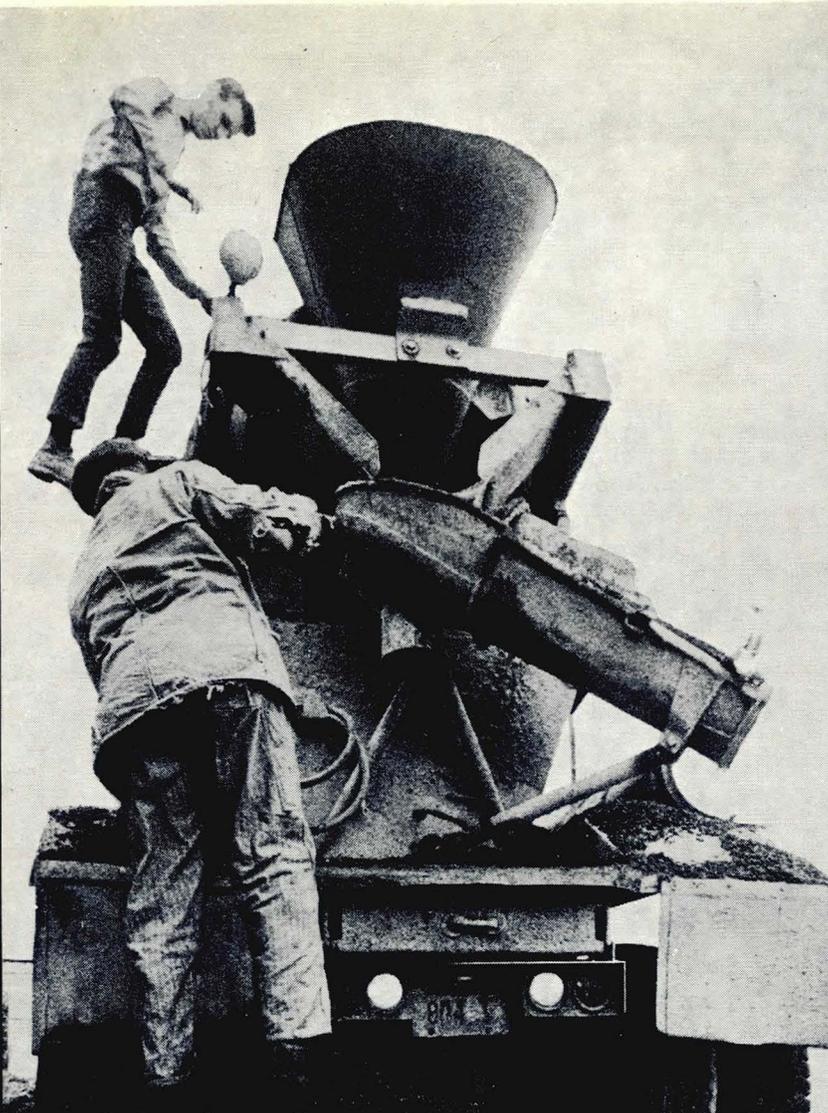


## new magnetic tape data terminals

Visualize 150,000 characters of information tucked neatly into a compact 3" by 3" by 1" tape cartridge. Making data easier to use, move, handle and store. A reusable tape that brings new economy to communication system operations. Teletype magnetic tape data terminals give you these important benefits, plus on-line speed capabilities of up to 2400 characters per minute.

These magnetic tape terminals are compatible with Teletype model 33, model 35, model 37 and Inktronic KSR equipment. Will send and receive data at both high and low speed. Tape recording, loading, message search, editing and other related functions are extremely simple.





## fast data flow keeps cement on the go...

One of the nation's largest cement and building materials producers uses Teletype equipment and a computer to help keep its vast marketing complex under control.

Company manufacturing facilities, warehouses and sales offices span from Hawaii to Florida. Teletype tape-to-tape terminals and automatic send-receive sets are used to move order, billing, and shipping data, as well as administrative information. Teletype terminals are also used as a management tool to generate financial, statistical and marketing data using a time-sharing computer.

Taped order information sent to manufacturing and distribution centers is received by Teletype equipment that produce it on multiple copy business forms. Making possible far faster customer service and improving operational efficiency.



## recommended reading

Teletype has a number of brochures on equipment, applications, and case history data. A short description of what is available is contained in: "How to get answers to your questions about Teletype equipment." Write for your copy.

Teletype data communication equipment is available in send-receive capabilities of up to 2400 words per minute. Included are hard-copy, magnetic-tape and paper-tape terminals, error control devices, options and accessory equipment to fit most data communication system requirements. For information, write:

### **TELETYPE CORPORATION**

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***machines that make data move***

Teletype is a trademark registered in the U.S. Pat. Office



COMMUNICATIONS CLINIC

## COMMUNICATIONS AT SJCC

Communications Clinic is a regular monthly column written by the staff of **Berglund Associates, Inc.**, consultants in telecommunications. Readers are invited to submit questions on any aspect of communications or suggestions for future Clinics to:

**Communications Clinic**  
c/o **Berglund Associates, Inc.**  
1060 Kings Highway North  
Cherry Hill, New Jersey 08034

Relying on frequent infusions of Atlantic City's salt water taffy to sustain our energies, we managed to cover most of the thousand-odd booths at SJCC. It has become almost an intellectual impossibility to assimilate everything on display at these shows or to develop any comparative viewpoint or perspective. This is not due to just the size of the show, but the fact that the industry is becoming increasingly a marketing game. In appraising products and companies we find, more and more, a veiled line between shadow and substance. We have become jaded with explanations of why "our data set is superior," or why "our CRT replacement for a Model 33 is obviously the best." It's getting so bad that we won't be surprised at the next JCC, to see the acoustic coupler that plays soft melodies to lure a user to sleep after a hard day's time-sharing.

However, in dutiful compliance with the law of averages, we did see some new, interesting, and worthwhile products. In the pure cost-effectiveness class, the blue ribbon was won by the Codex TM-8 Data Multiplexer. This is a time division multiplex designed to accommodate any combination of 1200 bps to 4800 bps circuits into a single 9600 bps circuit using the Codex AE96 9600 bps modem. For example, one can multiplex eight 1200 bps circuits, or four 1200's and one 4800, or six 1200's and one 2400, or any combination of 1200's, 2400's, or 4800's adding up to 9600. The uniqueness of the TM-8 is that it is the first to accomplish this without overhead, i.e., borrowing from the throughput of one of the multiplexed channels. Earlier versions might handle four 2400 bps circuits, but at least one had to be operated slightly below 2400 bps. That channel was used by the system to transmit framing data from end to

end so that if circuit #1 at one end was Macy's, circuit #1 at the other end was also Macy's. The TM-8, however, derives its framing from the companion modem, the Codex AE96, so all multiplexed channels can operate fully at their nominal rate. Also, the multiplexed channels are hardware-scrambled at input and unscrambled at output. Hence, if phasing slips accidentally, so that Macy's does get Gimbel's traffic, it will be scrambled and not readily interpretable.

Codex prices a four-2400 bps channel system at \$18,200 per end or \$36,400 for the full system. Assuming a 30:1 ratio for monthly cost, the mileage breakpoint for the system (interstate rates) is about 38 miles. That is, for a system with four 2400 bps terminals located 38 miles from the CPU, the Codex system breaks even. For distances greater than 38 miles (or monthly cost ratios greater than 30:1), the Codex system starts to save money, and the payouts can be very significant. This is something that can make the 9600 bps class of service even more meaningful to users than it has been to date.

Applied Digital Data Systems of Hauppauge, N.Y. picked up the blue ribbon for technical achievement with their new acoustic coupler. The nonlinear characteristic of a telephone microphone causes a second harmonic of the transmitted signal. This harmonic falls in the band of the received signal frequencies, and can cause errors if the received signal strength is low. ADDS has gotten around this by deliberately adding a third harmonic with the transmitted fundamental. The result is an inter-modulation term between the fundamental and the third, which cancels the second harmonic. The effect is to allow another 10 db of signal attenuation before performance is theoretically comparable to other couplers.

We also looked at the ADDS portable CRT terminal called the Envoy. While it is certainly unique, we're not sure what applications justify the approximately \$800 premium over portable hard copy conversational terminals.

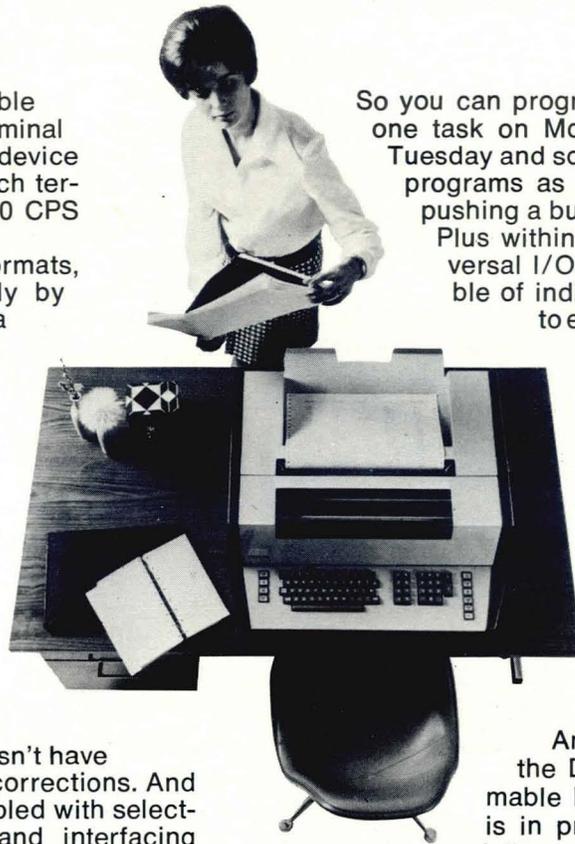
An honorable mention for useful uniqueness goes to I/Onex of Philadelphia, Pa. for their Auto-set. This is an array of up to eight 103 data sets packaged with common power supply in an attrac-

# Finally. A remote batch terminal with a built-in modem.

The Daedalus 711 Programmable Data Terminal. Here's the terminal which can be a data acquisition device during the day and a remote batch terminal at night transmitting at 100 CPS via its own modem.

It's also the terminal which formats, edits and verifies data remotely by means of stored programs at a practical, nearly-errorless speed over standard voice grade lines. Which means our terminals will provide your communications system with a number of economies. First, the Daedalus 711 Programmable Data Terminal transmits only pertinent data. So your CPU doesn't get bogged down doing routine tasks. Secondly, it shortens your transmission time and reduces your transmission costs. Third, it means you transmit correct concise data that doesn't have to return to the terminal site for corrections. And fourth, you don't have to be troubled with selecting and purchasing modems and interfacing them into your system.

Our modem, by the way, is in the bottom drawer next to the memory. The memory that makes the Daedalus 711 Programmable Data Terminal programmable. The memory we use for storage of programs and data.



So you can program this terminal to do one task on Monday, another one on Tuesday and so forth. And then change programs as often as necessary by pushing a button.

Plus within this terminal is a Universal I/O. Which makes it capable of individually addressing up to eight peripheral devices.

And there's dual magnetic tape cassettes to provide you with an economical, reusable medium for your message.

Another medium, hard copy, comes out of our simple, computer-type printer which is twice as fast as the typewriters you find in other terminals.

And the best part about the Daedalus 711 Programmable Data Terminal is that it is in production and is being delivered. Contact us for more

information about the 711: Daedalus Computer Products, Inc., P.O. Box 248, North Syracuse, New York 13212, (315) 699-2631.

*Daedalus. The new company making computer history happen overnight. Every night.*



tive cabinet measuring 17" wide by 5¼" high by 15" deep. Most 103 type offerings for use with the DAA have been individual, free-standing units. As such, they have still consumed a lot of space in multiple set installations. The Autoset combination of eight sets in a small cabinet, priced at \$2350, seems to us to be a very worthwhile offer.

Among conversational terminal introductions, the blue ribbon went to Electronic Information Systems, Inc. Broomfield, Colo. Their Telewriter comprises an SCM typing mechanism with solid-state encoding (in lieu of type-bars); solid-state format conversion (in lieu of a commutator); and individual solenoids to activate each type mallet. All of these features would appear to give the Telewriter a good reliability index. Priced at \$1030 with TTY interface, or \$1295 with acoustic coupler, we view this as an offering very competitive in price and performance.

**TDM UPDATE**

In last month's Clinic on multiplexing we said that the cheapest TDM pricing we had seen was \$5000 per initial installation, plus \$150 per channel. In talking to some suppliers at the show, however, we found a bit-interleaved system at \$2750, plus \$150 per channel; another one at \$5200 for 18 channels; and a third at \$6150 for 18 channels, but including a modem. These smaller capacity (i.e., total channels accommodated) systems come still closer to direct price competition with FDM.

**ORDER ENTRY UPDATE**

In the April Clinic we described an order entry problem, and the design considerations and procedures which led to the selection of Model 33 Dataphone Teletypewriter for that system. Since publication, the terminal selection has changed to Model 35 Dataphone Teletypewriter. This change was necessary because the Model 33 is not appropriate where more than one or two copies are required on multi-part printing. In the case considered, the bill of lading had too many copies to allow using the Model 33.

Another consideration was the absence of tabbing features on the Model 33. This need not reject the Model 33, *per se*. The user should calculate whether the extra toll costs for transmitting the spaces and line feeds outweigh the lower monthly cost of the terminal.

**TRAFFIC ENGINEERING UPDATE**

One result of our March Clinic on traffic engineering was a debate by mail with a knowledgeable colleague. His contention is that Erlangs are poorly or incorrectly defined as CCS per 100 seconds; that more properly an Erlang equals simply 36 CCS. We agree if, and only if, the CCS load is measured over one hour. That is, a load of 360 CCS equals 10 Erlangs if the load occurs in one hour, but 1 Erlang if the same load is distributed uniformly over ten hours. In practice, CCS loads are on a per hour basis and, for these, one Erlang does equal 36 CCS. To be rigorous, however, we still hold out for Erlangs being CCS per 100 call seconds, etc. Comment from anyone else? ▲

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CIRCLE NO. 33 ON INQUIRY CARD



## Don't be a go-between. Let your instruments and computer communicate directly.

You shouldn't have to hand-type data to get your research or production test results processed on a computer. Nor control test conditions manually when the computer could be doing it for you.

Instead, use our new HP 2570A Coupler/Controller. It automatically transfers data from a group of instruments to a central computer or time-sharing terminal—or records on punched tape for off-line processing. *And* it allows the computer to control your test conditions.

Up to seven devices at a time can be interfaced through the 2570A to a central computer or time-sharing

terminal. Plug-in cards for the 2570A mate with measuring instruments like digital voltmeters and counters; with stimuli like voltage sources and frequency synthesizers; and with logging devices like teletypewriters, high-speed tape punches and graphic plotters.

Because the 2570A communicates in ASCII, it can be used with most computers and commercial time-sharing services. Plug-in program cards take care of instrument housekeeping, simplifying your computer program.

Mainframe price for the 2570A Coupler/Controller is only \$1625; interface cards average around \$600 per

device. With this low-cost Coupler/Controller, you can bring all the computing power, memory capacity and sophisticated program library of a large computer to bear, inexpensively, on your research or production test problem. Your local HP field engineer has all the details. Give him a call or write Hewlett-Packard, Palo Alto, California 94304; Europe: 1217 Meyrin-Geneva, Switzerland.

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DATA ACQUISITION SYSTEMS

06003R



## SOURCE DATA AUTOMATION

### AN SDA ANALYSIS

Performing a Source Data Automation analysis is similar to performing a computer system analysis except that the boundaries for the analysis are no longer limited to the machine interface but are human-oriented. That is, a Source Data Automation analysis is concerned with the processing of data from point of origin and, therefore, looks at the manner in which data is gathered, collected, recorded, and transmitted to the computer system. The ideal is to record data in a machine-readable form that can be automatically input to a computer without manual intervention.

The commencement of an SDA analysis involves two simultaneous efforts: (1) **gathering information on SDA equipment**, and (2) **gathering information on the present computer in-**

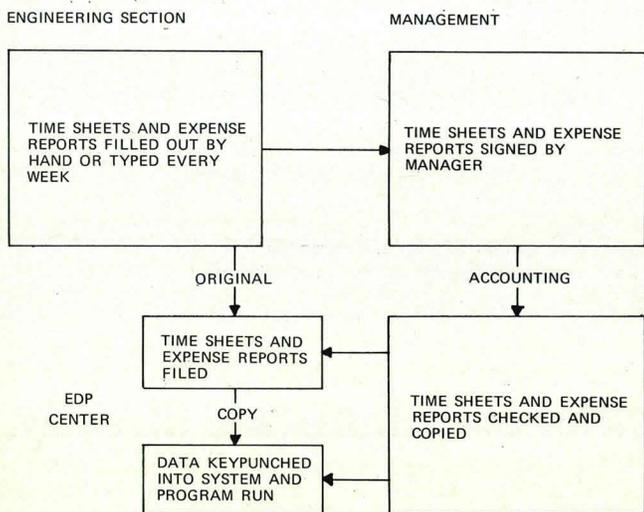
SOURCE DATA AUTOMATION is a monthly column written by Lawrence A. Feidelman and the staff of **FAIM Information Services, Inc.** Questions from readers on any aspect of SDA will be answered, as space permits.  
Address all questions to: **SDA, MODERN DATA, 3 Lockland Avenue, Framingham, Mass.**

**put system.** The first part of the analysis requires a knowledge of the SDA state-of-the-art, which can be obtained by technical seminars and various publications on the subject, including future articles in this series. The more difficult task is the one we are about to discuss — analyzing the present computer input system.

**STEP 1: ORIENTATION** — A general meeting of all personnel involved in the analysis group should take place at which each individual is told the types of data required and made familiar with the study's objectives. The makeup of this group must consist of both of the following types of personnel: (1) *senior personnel familiar with present system operations both from a user and machine standpoint, and,* (2) *systems personnel with SDA experience who can envision system designs using various types of SDA equipment.*

**STEP 2: AREAS OF INVESTIGATION** — The selection areas of investigation should depend upon the existence of some or all of the following conditions: (1) *large data processing volume,* (2) *high input cost,* (3) *excessive data handling,* (4) *lengthy computer turnaround time,* (5) *unnecessary repetition of data,* (6) *high personnel requirements,* (7) *excessive use of computer for input processing,* and (8) *slow response time.* The number of system functional areas selected by these conditions can often be reduced by eliminating those areas which have the same characteristics.

**STEP 3: ANALYSIS** — The analysis for each of the selected areas should involve consideration of the following factors: (1) *present workload re-*



AVERAGE WEEKLY VOLUME

DOCUMENT TYPE	DOCUMENTS	CHARACTERS PER DOCUMENT	PUNCHED CARDS
TIME SHEETS	10,000	30	10,000
EXPENSE REPORTS	3,000	70	3,000

Fig. 1 — Typical Information Flow Diagram

quirements, (2) present procedures, (3) personnel requirements, (4) document types and quantities, (5) machine record formats, (6) response time requirements, (7) man-machine interface, (8) types of SDA equipment to meet needs, its state-of-the-art reliability, and availability, and (9) cost of SDA implementation.

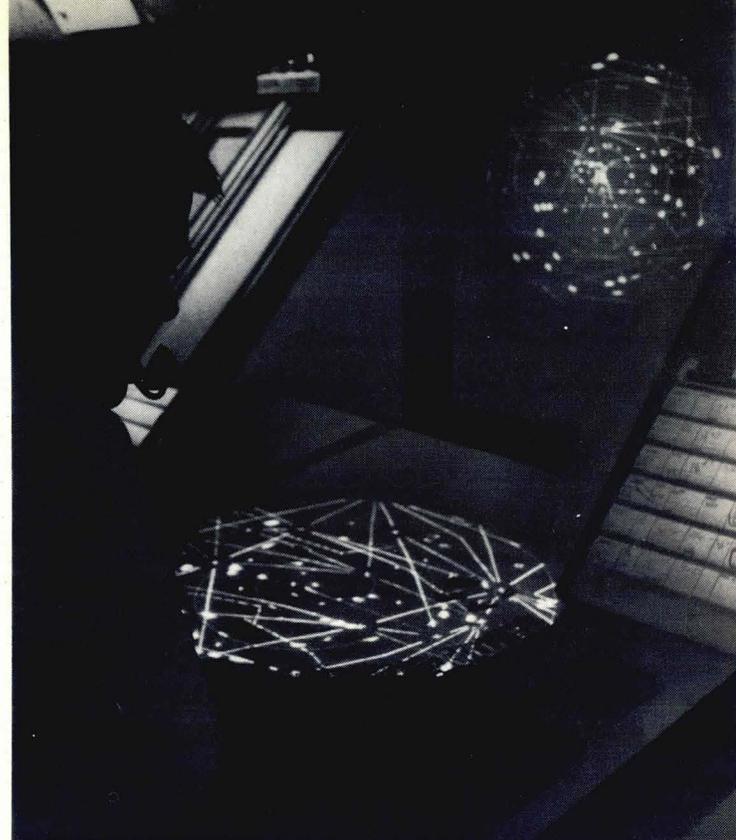
These factors can be analyzed by tracing the system data flow from source to computer via a system information flow diagram. An example of this is shown in Fig. 1 for processing work and payroll information. It represents the: (1) *type of data (given by document name)*, (2) *point of initial preparation*, (3) *method of preparation*, (4) *movement of data through system*, (5) *daily volume in terms of documents and characters*, (6) *copies*, and (7) *any computer feedback*.

**STEP 4: REORGANIZING SYSTEM GROUPINGS**—Based upon the gathered data, the system analyst may need to reorganize the system functional groups to determine the feasibility of certain types of SDA systems. The groupings are determined by such system considerations as: (1) *where data is generated (i.e., office or outdoors)*, (2) *how data is generated (i.e., hand-typed or machine-printed)*, and (3) *whether data is batched or in real-time*. The actual system, of course, may well result in only one grouping. Information for each group can now be consolidated and summarized.

**STEP 5: DETERMINING USER REQUIREMENTS**—The system analyst can now indicate the specific user requirements for each grouping. These requirements should define the essential user needs and form a basis for developing the system. Performance factors are then generated to measure the feasibility and applicability of implementing various SDA techniques.

**STEP 6: DOCUMENTATION**—The result of the SDA analysis effort is a technical report which clearly describes the system's characteristics, existing problem areas, and data volumes; and points out the feasibility of employing SDA. It should also provide detailed cost estimates for candidate SDA systems. Recommendations should be given for proceeding into the system design phase.

NEXT MONTH'S ARTICLE WILL DISCUSS THE VARIOUS CLASSES OF SDA EQUIPMENT COMMERCIALLY AVAILABLE.



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CIRCLE NO. 35 ON INQUIRY CARD



The Systems Scene is a regular monthly column written by Jerome Wiener and Thomas DeMarco of **Mandate Systems, Inc.** Readers are invited to submit comments and questions on new developments in systems to: **The Systems Scene, MODERN DATA, 3 Lockland Avenue, Framingham, Mass. 01701**

In an era when hundreds of authors are vying for the honor of producing the most offensive book of the year, a strong candidate is the Bureau of the Budget. The book is called *The Budget of the United States Government, Fiscal Year 1971*. (Government Printing Office, Washington, D.C. \$1.50.) Open to any page and you are bound to find either items that should not be there at all, or items that are overpriced by an order of magnitude. The census falls handily into both categories.

The 1970 decennial census will cost in excess of \$250,000,000 or about \$1.25 per head counted. With the kind of epistemological splendor that can only be found in government (where the last six zeroes are ignored) two justifications are offered for this expenditure.

1. It is called for in the Constitution.
2. "We can't know where we're going if we don't know where we are at."

Somehow, no Supreme Court judge felt that the 1960 census was inadequate under the provisions of the Constitution. Expenditures for that census were less than half the 1970 figures. In fact, the framers of the constitution themselves were quite content with the first census (1790), a rough head count taken by mounted enumerators. That census was fairly effective, economical, and, best of all, performed without the ugly threat of compulsion.

As for the second justification, it is absolutely irrelevant to the spending of \$250,000,000. We could probably know our present population to within 0.1% for a total expenditure of two million dollars. Counting the other quarter million people and picking up some pointless statistics about cooking fuel, clothes dryers, and concrete slab foundations will have to account for the remaining \$248,000,000.

The enumeration called for in the Constitution could be performed at essentially no cost. Ten years ago, we paid \$127,982,000 to find out that the population of the United States was 179,323,175 on April 1, 1960. The Internal Revenue Service reported, at the same time and for free, that on April 15, 1960 there were 176,325,912 exemptions claimed.

The IRS figures could be used without modification to provide a free 98% accurate census every year. Some sophisticated sampling techniques would refine the accuracy even more at a relatively-small cost.

Suppose, for the moment, that it were absolutely essential to collect all the information presently being collected in the census. It still boggles the mind to think of how \$250,000,000 can be spent in the process. (Remember that the six computers and numerous sense mark readers used in the census were purchased or developed under separate appropriation and do not figure in the \$250 million.)

For a start, the decennial census has a dedicated team of 75 full-time programmers; not just this year, but every year. **Thus, programming manpower for each census is 750 man-years.** (The Bureau of the Census also has another 75 programmers that do something else.) The combined capacity of this team, assuming they are all completely incompetent, is a staggering 247,000 lines of code per year or 2.5 million lines per census. That makes a pile of program listings 60' high!

Total cost of programming will run about ten million dollars. It is difficult to believe that the greediest software house would dare to bid the job at more than one million.

But why bother to save on a programming staff of 75 when the bureau has a peak staff of over 23,000 employees and pays an average GS salary of \$9,803? Most of these employees are enumerators, engaged in ferreting out information that people choose not to give. A census that was totally voluntary would cost at least \$150,000,000 less (but would still be an atrocious waste).

And now, most important of all, is the question: Why is our cooperation in the census mandatory? Do we really want our government to collect information, under threat of force, on every single citizen of our country? Do we want our government to build a data bank with the name and address of every single citizen, his race, age, sex, and number of children?

That data bank is being built now with slight regard for what we want. There are loud protestations from the government that the information will be kept absolutely confidential. **But the information is all there.** The confidentiality guarantees can be changed or ignored. Murphy's Law calls to mind chilling visions of a government printing-out names and addresses of minority group members to be eliminated or of women with more than two children to be sterilized.

Can't happen here? History has shown that governments can change and become capable of any excess. Rights are not protected by giving unlimited powers to the state and trusting that they won't be used, but rather by limiting the powers of government. ▲

Q. What do you call the first and only  
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that actually  
cuts your computer overhead,  
saves you line charges,  
interfaces to any terminal,  
concentrates data,  
controls hundreds of lines,  
or just a few,  
and gives you remote batch and  
on-line operations at the same time?

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ON-LINE

## A NEW POINT OF VIEW

On-Line is a regular monthly column concerned with various developments in computer technology particularly in the areas of computer graphics and computer-aided design. The author, Thurber J. Moffett, is a nationally-recognized expert in interactive graphic systems. Readers are invited to submit comments and questions regarding subjects covered in this column to: **On-Line, MODERN DATA, 3 Lockland Avenue, Framingham, Mass. 01701**

Donald E. Craig, principal consultant to Auerbach Corporation, was a Commander at the Naval Ship Engineering Center four years ago. He and a crony, Wallace E. Dietrich, Technical Director of the Computer-Aided Ship Design and Construction Office, were then promoting a Computer-Aided Design Office within the Naval Ship Engineering Center. Today it is running nicely under Wally.

The two have recently worked together again collaborating on a new observation about the future of computer-aided design and manufacturing. They start by pointing out that, in a hardware-producing environment, marketing and design data are the principal determinants of major manufacturing activities. Cost estimates of potential product designs along with market analysis form the basis of marketing decisions. Design data also impacts field support and user maintenance. Engineering decisions, therefore, highly influence the entire life cycle of a hardware unit. Studies have shown that, in the United States, white-collar labor constitutes approximately half of all labor costs and consists largely of information handling. Even the costs large manufacturers carry as material costs follow this pattern at the supplier industry level. Hence, it can be assumed that a large fraction of the cost of many hardware items is for organizing and handling data originating primarily from design data. The studies have shown, for instance, that engineers and scientists normally spend 20-30% of their time in data searching.

Craig and Dietrich conclude from this, as have many others, that there is clearly a significant cost saving potential in capturing design data as it is developed in such a way that it can be used

directly by marketing, manufacturing, and support functions. They point to the irony in today's practices which still permit the discarding of computer-prepared design data after it is used in the immediate design process, despite a generally well-informed industrial management that understands that much of this data must be regenerated from source data to make it machine usable again for later processes.

The government has found that in defense industries there are about 800 generic pieces of technical data used between the start of conceptual design and the hardware's removal as an operational system from service 10 to 30 years hence. More than half of these pieces are used in the early design and marketing stages, i.e., the earliest decisions tend to be the more important, even though they involve only relatively-small numbers of people.

The foregoing characteristics have prompted many to think that industrial integrated data handling systems should be centered around design data systems instead of around the planning, production, or cost accounting data systems on which they have traditionally been based. After analyzing the relationship between list structures of several engineering and manufacturing functions, Craig and Dietrich concluded that another approach might be more fruitful. They suggest that most of the necessary subfiles and links between subfiles exist in a complete material control system and that these systems, therefore, provide an excellent nucleus for integrated on-line design and manufacturing systems. They think material control-based integrated systems can be made operational more quickly and suspect that the development of such technical/business integrated data systems will be the most important near-term trend. They expect this trend to lead eventually to a reversal of the time sequence of product definition first and factory creation second by pointing the way to more nearly automatic, intelligent, and versatile manufacturing facilities with the capability of adapting themselves to new products—thus minimizing time and the need for large increments of new capital investment. ▲

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(This is the answer. Turn page for question.)



# WHAT HATH BABBAGE

## WROUGHT DEPT.

**MODERN DATA** will pay \$10.00 for any computer-or EDP-related item worthy of publishing in our "WHAT HATH BABBAGE WROUGHT DEPT." Humorous "information" for consideration may include weird memos or operating instructions, unusually 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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Entries become the property of **MODERN DATA**.

### THE 1010<sup>2</sup> COMMANDMENTS

The EDP school at which I am employed has a computer room and a large number of students. To alleviate the problem of crowding in the computer room and to insure all students equal time on the computer, the instructors developed some general rules and guidelines for the smooth operation of the laboratory periods. This prompted one student to write the following.

1. Thou shalt not cheat others of their turn.
2. Thou shalt not list thyself twice.
3. Thou shalt not mistreat the RPG generator.
4. Thou shalt not leave used cards on the CPU.
5. Thou shalt not call thy mistakes machine errors and run again unfairly.
6. Thou shalt not run before thy neighbor.
7. Thou shalt not leave the CPU running.
8. Thou shalt not holler at, spindle, or mutilate one another.
9. Thou shalt not leave the machine without non-processing.
10. Thou shalt not be the seventh person in the computer room.

#### Submitted by:

Joseph W. Trammel, Instruction Mgr.  
Computer Learning of Tidewater  
Norfolk, Va.

### MURPHY, THE TIME-SHARER

Ages ago an eminent scientist by the name of Murphy set forth an irrefutable law comprised of three hypotheses. Briefly stated, Murphy's Law says:

1. If anything can go wrong it will.
2. Nothing is as simple as it seems.
3. Everything takes longer than it should.

Scientists throughout the ages have proven these laws again and again; in fact, many times non-scientific persons have experienced their veracity. While Murphy lived before the age of computer time-sharing, it is obvious that the old gentleman foresaw this age when he formulated his hypotheses.

Consider a few proofs of Murphy's Law when computer time-sharing.

#### Hypothesis 1: If anything can go wrong it will.

You have just completed typing a large quantity of data to the computer. You are about to save it when:

- a. You kick the terminal power plug with your foot.
- b. The terminal becomes hopelessly jammed.
- c. The phone company unplugs you.
- d. The computer center has a power failure.
- e. A friend slaps you on the back and you bump the "off" switch.
- f. Lightning strikes your terminal.
- g. A bulldozer knocks over a telephone pole.
- h. A violent electrical storm disrupts all communications.
- i. In swatting at a mosquito you hit the "off" switch.
- j. You discover that you really weren't "on-line" after all!

#### Hypothesis 2: Nothing is as simple as it seems.

You wish to make a minor modification to an existing program (which is used regularly by 300 people). Taking full advantage of the ease in modifying a program with computer time-sharing, you:

- a. Replace the wrong statement.
- b. Add a line of "garbage" to the program, rendering it inoperable.
- c. Use a previously-used statement number.
- d. Cause the program to loop endlessly. (This takes 15 minutes to discover.)
- e. No longer can duplicate the test problem results. (Further checking shows that the original program has never given correct results.)
- f. Destroy the old program and forget to save the revised program.
- g. After result (f) you discover that you don't have a listing of the program.

#### Hypothesis 3: Everything takes longer than it should.

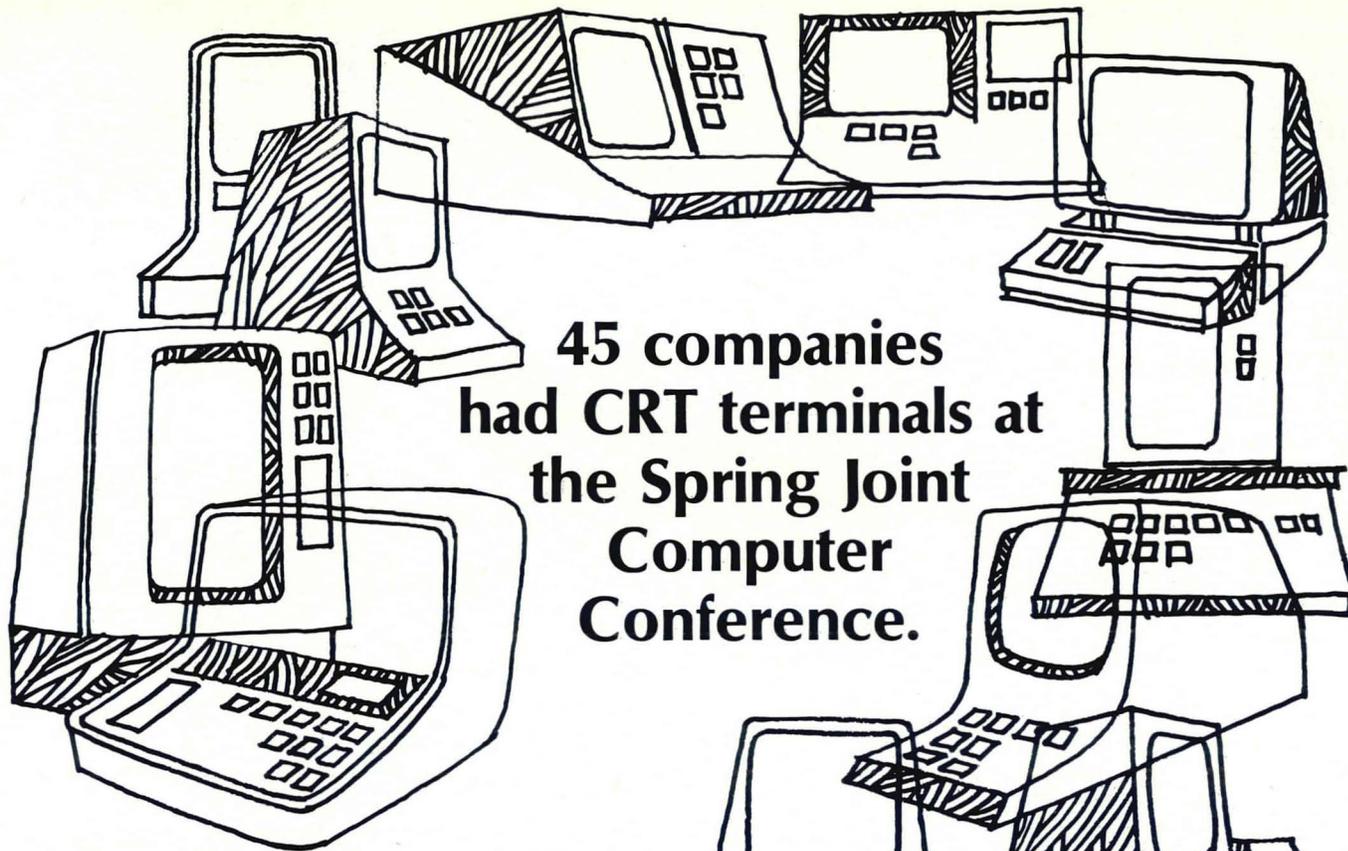
It is five minutes before a very important conference (which includes the company president). You need some additional calculated results and a program is available on the time-sharing service. Taking full advantage of the "instant results" provided by time-sharing, you rush to the terminal and discover that:

- a. There is no paper at the terminal.
- b. A 6'5", 250-pound bully is already using the terminal.
- c. The telephone has been disconnected.
- d. You can't remember your "ID."
- e. The last user became frustrated and buried an axe in the terminal.
- f. The computer has just been taken "off-line" for a 10-minute test.
- g. Management has removed all the terminals as part of an austerity program!

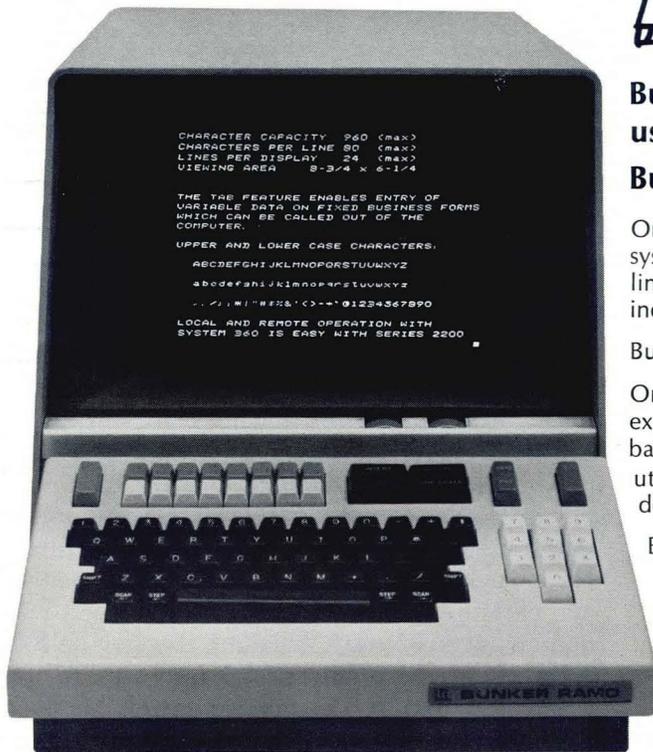
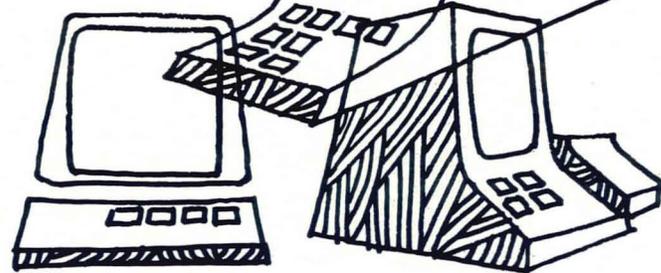
While these are just a few isolated examples which proves that Murphy may have been a time-sharing user, more evidence is being collected each day to substantiate this possibility. Therefore, the user of time-sharing will do well to remember that Murphy's Law does control him when he is at this terminal. Hopefully, a forewarned user can minimize the wrath of this law.

#### Submitted by: G. L. Kaes

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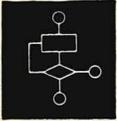
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## MIS VS EDP

**EXECUTIVE:** "Want to make a deal?"

**EDP SPECIALIST:** "What kind of deal?"

**EXECUTIVE:** "I'll stop attending EDP seminars if you'll stop trying to tell me how to manage my business!"

It is true that a corporation is a system: it has inputs, executes processes upon them, and produces outputs. But this is no reason for believing that the business system is within the domain of the system analyst. The system analyst understands systems and procedures, application analysis, and programming. **But he does not necessarily understand company policy, the elements of management, and how to get people to work with each other.**

If a system analyst does not understand management, how can he plan a management information system, whose function it is to aid the management process? Who planned the management information systems before computers came upon the scene? True, managers did not then have the benefit of EDP, but they did make decisions, decisions based upon information which these managers had previously organized.

Several different systems are being discussed here. The relationships among them may be given as in Fig. 1. The business system exists within an environmental system consisting of suppliers, consumers, competitors, and others. To aid the business system in its varied tasks, there exists within it a management information system. This management information system is part and parcel of the business system. However, there may be technological systems which are used to improve the capabilities of the management information system. In the old days these consisted of filing cabi-

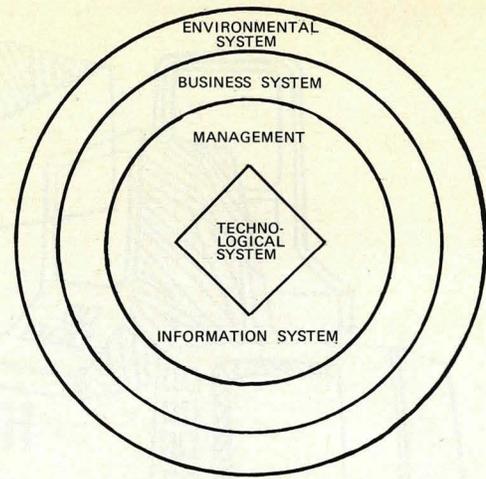


Fig. 1 Relationship between a business system, MIS, and the business environment.

nets, typewriters, cash registers, adding machines, calculators, punched card systems, mimeograph machines, accounting machines, bookkeeping machines, etc. Recently, computers have been added to the list.

We, as technologists, should step back and take a better look at all these systems before making "suggestions" to management. To begin with, what type of system is the business system? We know it is dynamic, not static. By dynamic, we mean that it possesses feedback. This implies that it is often difficult to determine which are the inputs and which the outputs. For instance, a saturation of the market with a product this year may cause a reduction in the number of incoming orders next year. The business system also is adaptable to changes in its environment. People often refer to this by saying that a business is a growing thing.

To find out what is meant by adaptability, let us focus our attention upon an entity we all consider to be adaptable: man. In Fig. 2, which is an illustration of a youth playing a violin, a continuous loop exists between the boy and his violin. The music produced by his bowing is picked up by his ears and fed to his brain; the brain, in turn, supplies signals to his hands and arms to guide the bowing. A second loop relates the budding maestro to the sheet music on a stand before him. He looks at the music and plays. As he completes one measure, he refers back to the music to determine what to do next. All along the way he follows other sheet music directions referring to speed, volume, and style. The music controls his playing.

There is a third loop here. The youth foresees for himself a future as a concert violinist. To adapt himself to this environment that he forecasts for himself, he goes Thursday to his violin teacher who shows him how to read music and how to play. He returns home and practices according to the guidelines the teacher has given him. The following Thursday he returns to the teacher for



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more instruction. This third loop is an adaptability loop. It enables the youth to reach his long-range goal.

The business system may also be described with 3 loops, as shown in Fig. 3. The 3 loops are:

- THE OPERATION LOOP—executes a process upon an element in its environment;
- THE CONTROL LOOP—monitors the operation loop and modifies it;
- THE ADAPTABILITY LOOP—regulates the previous two loops to assure that the system reaches its goals.

Where does planning fit in? Planning is the engine which drives the adaptability loop. But not as directly as many of us think. It is simple-minded to think that to plan all one need do is to set objectives and then determine what resources are necessary to achieve them. Can **anyone** plan to become a concert violinist? There are many interacting forces: many individuals each with his own goals, background, and point of view; many departments and sections, each with its own mission; many external influences provided by government, banks, competitors, stockholders, and teachers. If we don't fully understand the behavior of the three loops, we cannot hope to be able to plan. And if we do understand, then we know that

all we may try to do is insert a planning function in the adaptability loop with the hope of guiding the direction of adaptability over the long run.

The modified loop diagram is as shown in Fig. 4. The operation loop is as before: inputs from the environment are processed to produce outputs returned to the environment. Some of these outputs are monitored to see how things are going; the processing is modified to bring the operation loop back to the way it is supposed to operate. This is determined by the plan. In contrast to this control of day-to-day operations, the plan also presents guidelines for evaluating long-range performance to see if long-range goals are being reached. If not, the plan is modified.

If the business system is dynamic and adaptable, why do we insist on describing it by means of an organization chart which is the most static type of model that can be found? The organization chart tells as much about the business system as a floor plan tells about the home of a family. Good models show the dynamic nature of the operation, control, and adaptability loops.

A management information system is a translation of this dynamic adaptable model of the corporation into a set of data items plus a group of procedures. This information system itself is dynamic and adaptable, that is, it can be depicted by operation, control, and adaptability loops. The op-

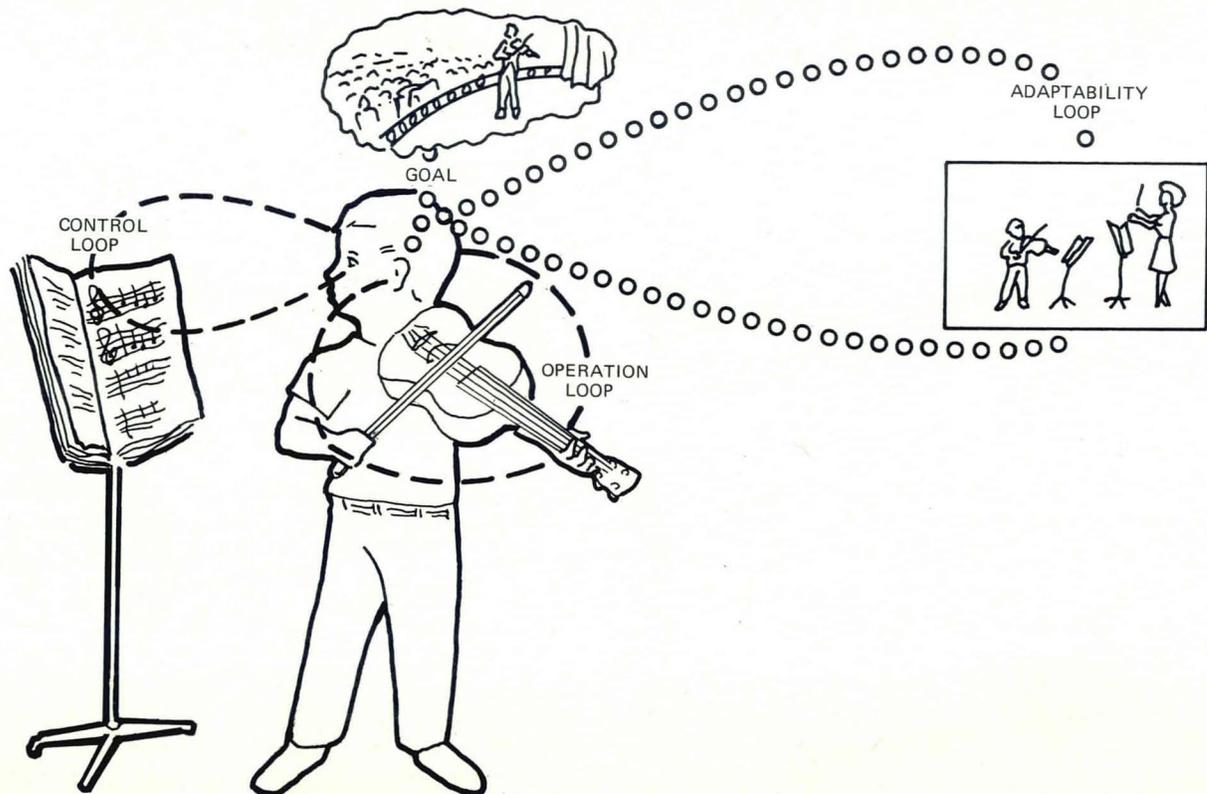


Fig. 2 The adaptability loop of the budding maestro.

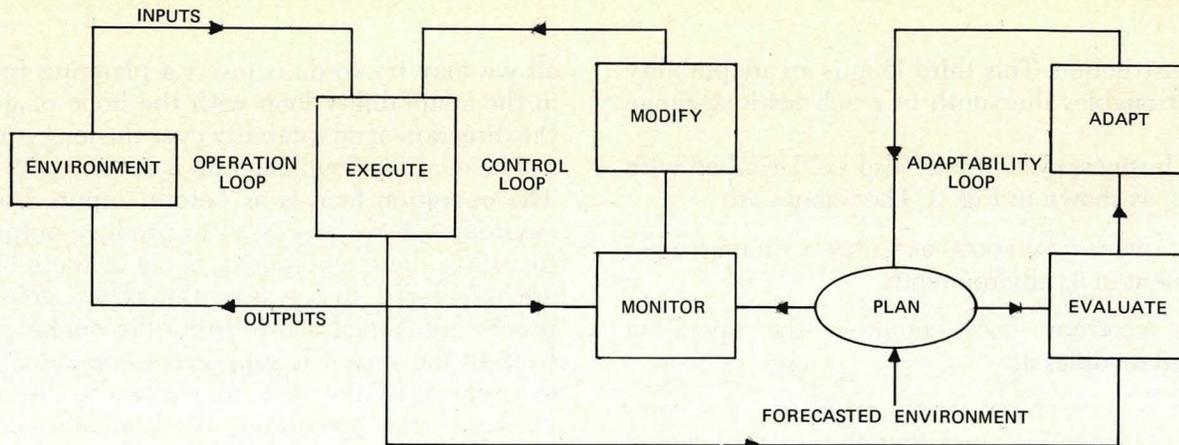


Fig. 4 The place for planning within the three loops.

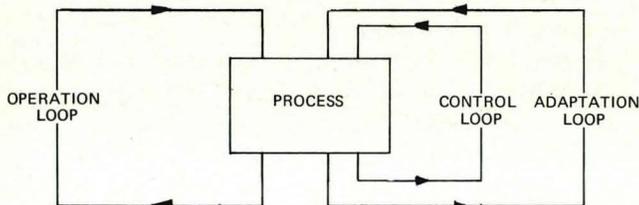


Fig. 3 The three loops of the business system.

eration loop executes all the functions needed to aid the 3 loops of the business system. The control loop of the information system monitors the output—reports, displays, messages—to see if the information system is operating according to plan. Statistics of use and of value achieved through use are kept for this purpose. If the information system is not conforming to the plan, changes are made in the data, relationships among data, or in the procedures, to bring the performance back to what is expected. The adaptability loop forecasts an information system for the future and a plan is made to reach these long-range goals. Periodically, the operation of the information system is compared with these goals to see if the system is approaching them. If not, modifications are made.

The MIS is not anybody's model of the corporation. It is a reflection of how the executive sees the corporation. The executive makes the decisions. The executive must use his own models.

*But you ask, what does the normal executive know about modeling?* Plenty, we answer. What is a financial statement but a model? What is a schedule but a model? What is an accounting system but a model?

If the executive is his own modeler, what are all the operations research men, management science people, mathematicians, system analysts, and programmers doing? They are all technologists with specific areas of expertise who can aid the executive by supplying specific techniques to add rigor to the modeling.

The executive plans his MIS; the EDP technologist designs tools to aid him. Which is counter to the way things have been going. When

computers first arrived, data processing experts convinced their managers that here lies a new tool that managers must understand in order to improve their decision-making. **The managers fell for the line and have been so busy trying to fathom the mysteries of data processing that they neglected their real task: management.**

The more the manager became involved in data processing, the more the EDP man tried to tell the manager how to manage. Of course the manager did not listen. The net result has been frustration for both the manager and the EDP man.

It is time that both the manager and the EDP technologist be allowed to return to their respective specialties. Let us remove the EDP handcuffs from the manager so that he can return to management. Let us remove the management blinders from the EDP technologist so that he can see what the manager is telling him.

**This confusion between executive and EDP technologist was increased by the manufacturer's concentration upon building computers which were general-purpose.** These were then programmed by programmers to accomplish tasks required by the manager. Because he was thoroughly confused by the jargon, the manager was forced to learn EDP to try to get the machines to do what he wanted them to do.

This situation was bad. **But it became intolerable with the advent of MIS!**

Let the executive plan his own MIS. Let the EDP technologist design the necessary EDP tools — data bases, procedures, and processing systems—and submit requirements to the manufacturer. **And then, let the manufacturer configure computing systems out of an array of hardware and software modules to meet these requirements.** In this 3-cornered situation, let the EDP technologist have the additional sensitive task of bridging the gap between executive and manufacturer, a task of supreme importance for assuring a responsive well-integrated management information system. ▲

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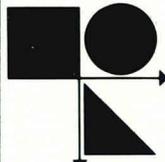
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## PLANNING A DATA COMMUNICATIONS SYSTEM

### Part 2 — Common Carrier Facilities (Cont'd)

**C**ontinuing on from last month's article in which the author surveyed AT&T's data communication facilities and services, this month's article gives some practical cost comparison guidelines and also reveals some interesting new services now in the planning stages at AT&T.

Evaluating a data collection or distribution system in terms of communications costs alone is roughly comparable to evaluating a racehorse by examining his neck and ribcage. One really does not get the entire picture. Nevertheless, there are factors which can and should be reviewed.

Our central point of reference is going to be data transmission over a distance of 1000 airline miles from point-to-point. This will be examined using service on the DDD Network, private line voice grade data circuits, WATS, and wideband transmission. Also to be included will be various transmission speeds. Some standards should be set at this point: (a) a word will consist of six characters; (b) a character will consist of ten bits, information and control; (c) the DDD rates will be representative full-time rates; and (d) since terminal charges vary so widely, only very general statements will be made as to their cost.

Let's take a look at Fig. 1 which depicts the amount of time, in minutes, to send 5000 words of data at varying character rates. Note that there is a leveling effect as the maximum speed is approached. For a 40 percent increase in character rate, from 120 cps to 200 cps, there is a 40 percent decrease in transmission time required; for a 20 percent increase in character rate, from 160 cps to 200 cps, there is a 20 percent decrease in transmission time. That does not include operating or set-up time. If the call requires human intervention on both ends, add one minute for operating time. If the called station is equipped for unattended service, the times on the graph are valid.

In Fig. 2, the cost curve for the transmission of 5000 words at the same character rate takes the same shape as the time curve, which one would expect. Fig. 3 plots the cost of the Bell System DATA-PHONE data set that would be required at the various speeds. There is an interesting effect here: while the cost to transmit 5000 words at the maximum rate is about one-ninth that of the minimum, the monthly cost for the maximum rate data set is only three times the minimum. That will vary somewhat from one carrier to another.

It is clearly, then, to the users' advantage from a

communications stand-point to transmit data at the higher character rates. There is a significant increase in throughput for the cost incurred. That cost advantage must be weighed, however, against the increased cost of terminals, for they will undoubtedly be more expensive at the higher speeds.

Cost considerations become more complex when comparing one service with another to determine optimum economic advantage. Let's compare DDD, WATS, and private line services to determine at what point on the cost curve one becomes more economical than the others. The transmission distance is still 1000 miles and, since the difference in rates between private line and exchange data sets are minor, facility costs only will be compared. This comparison is going to be made on a monthly basis since both private line and WATS are billed by month. A 22-day business month will be used.

In Fig. 4, these cost comparisons are brought more clearly into focus. The charges apply whether you transmit at ten cps or at 200 cps. The WATS and private line charges are fixed. The crossover point for DDD and private line is two hours per day of data transmission. (On DDD charges, a ten percent Federal Tax is applied, which, in this case, brings the two hour a day DDD cost above that of a private line bill.) The crossover point on WATS is closer to two-and-a-half hours. A representative Band 3 WATS charge and applicable Federal Tax was used here. That does not constitute a completely valid comparison of the advantage of WATS. By definition, WATS is not normally used for two-point service as we are illustrating. If a user had several remote locations in a region 1000 miles from a data center, WATS could prove to be far more economical than DDD or multiple private lines. And, there are other considerations, for example, with private line data channels the speed can be increased to 240 characters per second using data sets. Also, as stated above, WATS is either one-way outgoing or one-way incoming. This could affect the user's system procedures and not just the communications.

Where does wideband service fit into this comparison? On a private line basis, it is unfavorable. The monthly charges for the most common wideband service would be over \$10,000, more than ten times that of one private line circuit. It should be noted here, however, that the transfer rate capacity of that wideband service is 5000 characters per second or about 25 times that of a voice grade facility. This cost and transmission rate disparity negates any direct comparison of voice and wideband services. On DATA-PHONE 50, however, it might be possible to take

advantage of high speed data transfer at less cost than dedicated wideband facilities. The key to DATA-PHONE 50 would be the proximity of the communicating locations to a wideband switching location. In our example, New York and Chicago can be considered because they are close to being 1000 miles apart. The cost of access at each end to the wideband network plus the usage cost would have to be reviewed. An important point should be made here: normally, one does not suddenly decide to subscribe to wideband but, rather, the need for wideband develops over a period of time as the data processing applications become more critical and the information to be transmitted becomes voluminous.

## INTERCONNECTION

So far, we have dealt with data services offered in total by the Bell System. For many years, data transmission on the DDD Network was provided only through carrier supplied data sets. Since 1969, however, the rules have been changed and users have been allowed to provide their own data sets, connected to the network by acoustical coupling or electrical connection. Electrical connection to the DDD Network is provided by the telephone company through a Data Access Arrangement (DAA) which is primarily a device to limit the output of user-provided terminal equipment in order to protect the integrity of the network. This DAA must be provided, installed, and maintained by the telephone company.

## PROSPECTS FOR THE FUTURE

The Bell System will continue to offer new communications services and communications terminals to keep pace with technological advances in the data processing/data transmission field and to meet user requirements. Many of the future offerings do not readily lend themselves to specific groupings but there are certain categories that can be defined. Initially, let's look at the area of data sets and communications terminals. DATA-PHONE data sets have historically been provided in the half-duplex or full-duplex mode. Recently, however, the need for a simplex, or one-way transmission only, mode has developed. Simplex data sets that transmit only, or receive only, are now available at slow speed—the 100 Series up to 30 cps—and at voice grade speeds—the 200 Series up to 120 cps. And, since fewer component parts are required for one-way transmission, these data sets are less expensive than half- or full-duplex sets. Significant savings may be realized in data systems that encompass large numbers of remote distribution or data collection points.

The 203 DATA-PHONE data set has been introduced recently as a tariff offering and can be provided at transmission rates of 1800 bps (180 cps) and 3600 bps (360 cps) on DATA-PHONE service in either the simplex or half-duplex mode. On private line service, the 203 will operate at 2400 bps and 4800 bps in the simplex, half- or full-duplex mode. The



ROBERT M. HINKELMAN • Staff Supervisor,  
AT&T Co., Camden, N.J.

extension of the 203 data set on private line to operate at 7200 bps, 720 cps, is now under development. Use of the 203 data set on the DDD Network nearly doubles the long standing maximum rate of 2000 bps, 200 cps, which should mean a considerable savings in transmission time.

A new communications terminal has been introduced, the Magnetic Tape Transceiver, that combines the capability of off-line preparation and storage of data with the ability to transmit and receive data at high speeds. The transceiver is a teletypewriter terminal that will permit storage of data on a magnetic tape cassette rather than in paper tape. The cassette provides high volume accumulation and retention of repetitive information such as customer locations and billing information. Variable information is entered from the keyboard. Data transmission can be handled in two ways. If the data on the cassette is to be sent, data sets that operate at variable voice grade speeds may be used. For on-line operations such as time-sharing, however, a telegraph grade data set is used. A switch on the transceiver determines the selected mode. A switch on the transceiver permits convenient, high volume storage of data, the convenience, economy, and flexibility of magnetic tape over paper tape, simplified error detection and correction of input, and high-speed transmission to minimize line time.

DATREX (Registered Trademark) service will be introduced in the near future. It is a low-cost, private line system that provides concentrated access from remote teletypewriter stations to a customer-provided multiport computer. At a user location, a large volume of teletypewriter stations require access to a computer, though not all stations are on-line simultaneously. With DATREX, a Bell System line concentrator would be provided with direct lines to the teletypewriters and direct trunks to computer ports. The initial service will be provided on an "originate only" basis from the teletypewriters to the computer. The station line terminations will be packaged in groups 32, up to 128, and the trunks will come in quantities of 8, 16, or 32.

In Fig. 5(A) DATREX on a local basis is shown with direct trunks from the concentrator to the computer. In Fig. 5(B), the stations and concentrator are at a remote location. The teletypewriters, which will be 33 or 35 type on DATREX, will be connected to the concentrator locally on direct lines. The service may be expanded to include model 37 or a user-provided terminal in the future. In Fig. 5(B), however, the concentrator is connected to a 1A Data Station—a telephone-company-provided frequency division multiplexer. A multiplexer is a device that enables the user to derive a number of lesser grade channels from one voice grade channel. Derivation is accomplished

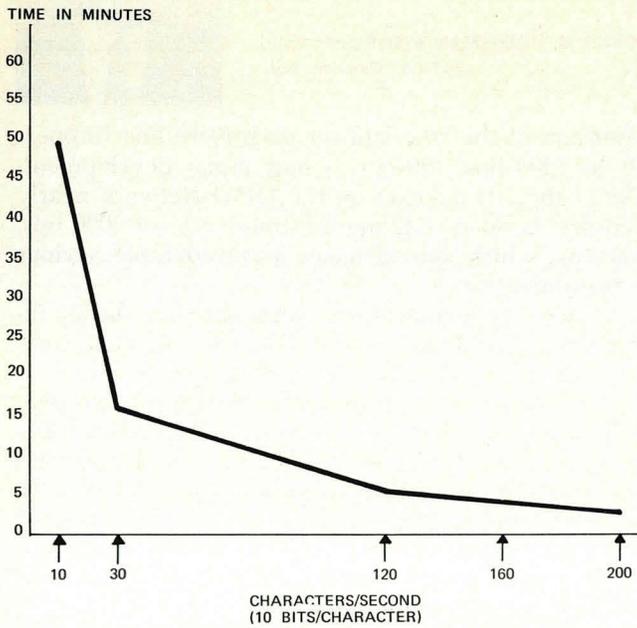


Fig. 1 Transmission time to send 5000 words using the DDT networks.

here by selecting sub voice frequencies in the voice bandwidth. The 1A should be introduced about the same time as DATREX. The data station is connected to a private line data channel to the central computer center. At the center, the channel terminates in a data station that interfaces the computer. Utilizing the data stations to capacity, seventeen (17) five-level channels or eight (8) eight-level telegraph channels will be derived from the one voice grade data circuit. The 1A Data Station will be introduced, in the near future, as a stand-alone service offering what is designed, initially, to work with five-level (28-type) and eight-level (33 & 35 type) teletypewriter equipment. Later, user-provided terminals will be included. It was shown here with DATREX to illustrate a potential application.

The benefits of both services dovetail to a certain extent. Both systems will reduce the number of trunk, or access, lines to the computer. With DATREX, the number of computer ports should be decreased. The customer can exercise much greater control over communications. Cost control of data transmission should also be derived from either service since the terminals no longer access the computer on a one-line-per-terminal basis.

Now under consideration as a service offering is a common user wideband network. This would be a nationwide network of wideband facilities, comparable to a miniature DDD, for use by anyone as the need arises. The customer would probably pay a minimum monthly charge for a terminal and access, locally, to the wideband network. The customer would be billed for his usage of that network on a time and distance basis. One significant point is that this network would

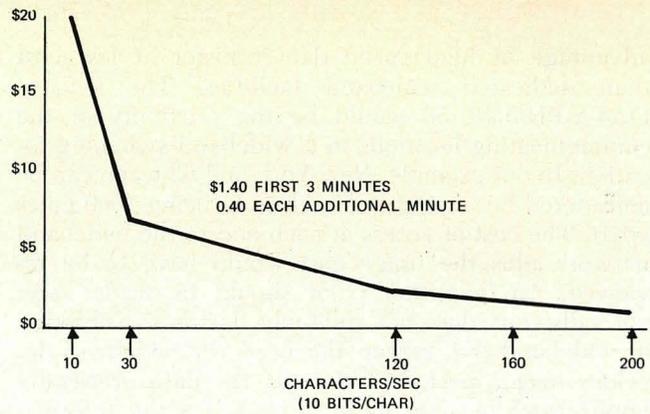


Fig. 2 Long distance daytime charges to send 5000 words 1000 miles.

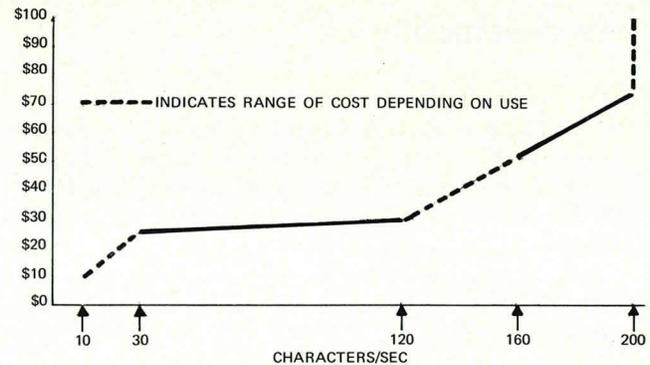


Fig. 3 Cost of a DATA-PHONE data set at various speeds.

be far larger in size than the present DATA-PHONE 50 Network.

The network would be for wideband data transmission only, both digital and analog. Automatic alternate routing would be standard. Stations would be equipped for manual or automatic answer. Touch-Tone sets would be used for signalling and a uniform numbering plan would be included. The most important factor is that the user would have access to this network on a local basis regardless of his location. It should be stressed here that the network is being analyzed for market potential and may never become a service offering.

In the field of private line teletypewriter systems, the 85 and 86 Data Selective Calling Systems have been introduced. The 85A1 and 85A2 are the two offerings provided on half-duplex service utilizing 33, 35, and 37 teletypewriter equipment. The 85A1 system operates at 100 wpm with 33 and 35 equipment. The 85A2 operates at 150 wpm with 37 equipment only. The 1967 USASCII code is used.

The systems consist of telegraph grade facilities, appropriate outlying stations, and a line controller. The line controller, in this case, is a user-provided computer. The computer assumes responsibility for controlling the on-line activities of each station by polling for traffic, analyzing all messages, and routing them to the appropriate receiving stations. The outlying stations have been improved over past systems by replacing the electro-mechanical internal controls with solid-state electronic controllers. These electronic controllers provide a more flexible, faster outlying station that can be more readily adapted to

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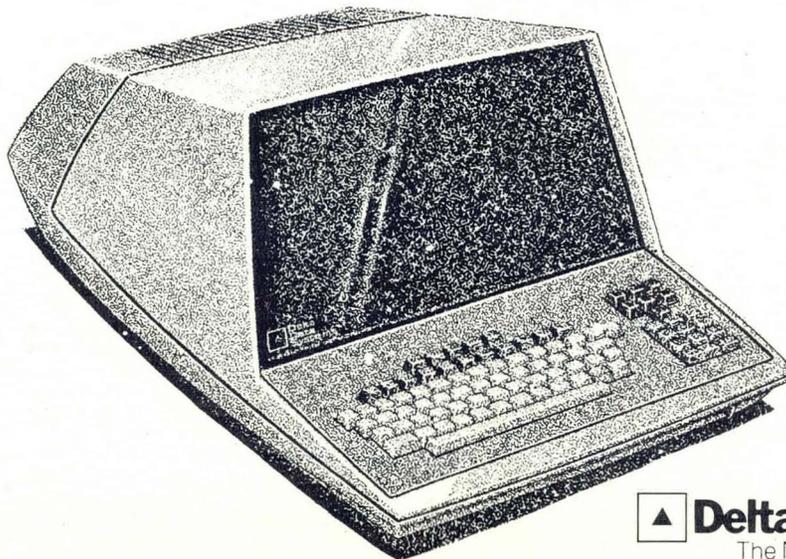
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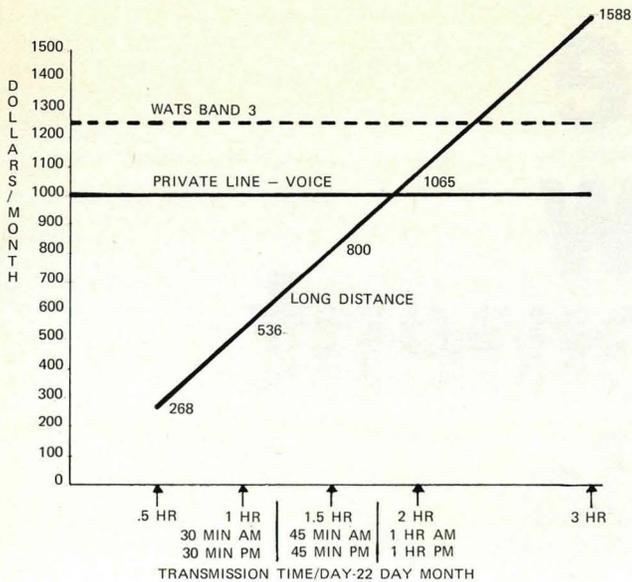


Fig. 4 Cost comparison of Long Distance, WATS, and Private Line for 1000 mile transmission.

computer systems that have different operational procedures.

The 86 systems are similar to the 85 except that the facilities and equipment are arranged for additional optional features. The 86A network is provided with 33 and 35 equipment at 100 wpm, half-duplex, while the 86B utilizes 37 equipment at 150 wpm on full-duplex. On all systems, a user-provided terminal may be substituted, with a specified interface arrangement, for teletypewriter station equipment.

PICTUREPHONE (Registered Trademark) service will be introduced this year. It will give the capability of talking to and seeing the called party. PICTUREPHONE will bring an added dimension to telephone communications. True face-to-face dialogue will be created without the physical presence of all participants at the same location.

This service will be introduced, initially, in selected areas of the country only. It will be available in part of the Borough of Manhattan, New York City, and the Golden Triangle area of Pittsburgh, Pennsylvania. In each city, PICTUREPHONE will be offered on an intra-exchange basis. However, a long distance call will be possible from New York to Pittsburgh. The schedule for expanding this service to other areas is indefinite.

The equipment provided to a PICTUREPHONE subscriber will consist of four components: a display unit with a picture tube, camera tube, and loudspeaker built in; a control unit containing a microphone; a twelve button Touch-Tone telephone; and a special service unit housing a power supply, logic circuits, and transmission circuits. The service unit will be installed out of sight.

The PICTUREPHONE system will utilize existing telephone facilities as much as possible. Subscribers will be able to make voice-only calls from PICTUREPHONE sets. Optional features, such as loudspeakers,

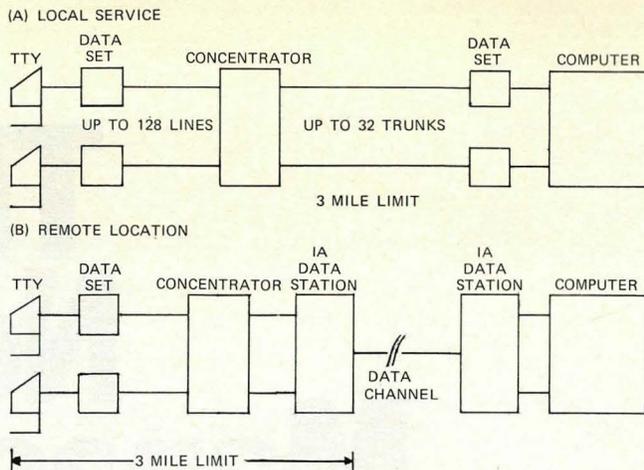


Fig. 5 DATREX, a new private line system that will be introduced by Bell in the near future.

card and automatic dialers, and key telephone systems also will be available. PICTUREPHONE service lines will be provided with voice-only extension or PBX attendant answer, if requested. Special light indicators will be provided to identify PICTUREPHONE calls.

The applications of PICTUREPHONE service are almost limitless. In addition to individual face-to-face conversation, conferences may be held without traveling to a central location. Objects may be displayed, as well as graphic and written material, eliminating the need to transport them to the distant point. In the data field, it will be possible to display computer output on a PICTUREPHONE SCREEN. The subscriber's dialogue with the computer will be via the Touch-Tone set. These are just a few of many potential uses.

**SUMMARY**

I hope this article has laid the foundation for a broad appreciation of diversity and potential complexity of data communications. It is an inexact science that demands considerable attention and knowledge. Also, like the data processing field, data communications is changing rapidly if for no other reason than to be compatible with new developments in computers and terminals. By design and of necessity, the information presented here has been introductory in nature. Hopefully, the reader has a better appreciation of the many facets of data communications and that appreciation will generate questions that should be answered in planning a data communications system.

COMING IN AUGUST ....  
 PART 3  
 Data Communications Terminals

# Lean Mama

## RCA announces a low cost 4K x 18 expandable memory system.

Our new one-microsecond-or-faster system plugs into mini-computers, data buffers, terminal devices and specialized industrial processors. And RCA's famous reliability and flexibility plug in with it.

The heart of the system is our Lean Baby, a planar 3-wire, coincident-current memory stack with continuous stringing for greater reliability.

But there's more. Byte operation. Built-in timing and registers. Three

operating modes: clear/write, read/regenerate, and read/modify/write. 7400 series T<sup>2</sup>L logic. All standard.

Words can be 8 to 19 bits long. And modular construction permits expansion to 32K. Whatever system size you need, it fits a standard EIA 19-inch rack.

If you have special requirements, check these options. Parity bit. Power supply. Expansion logic. And parallel

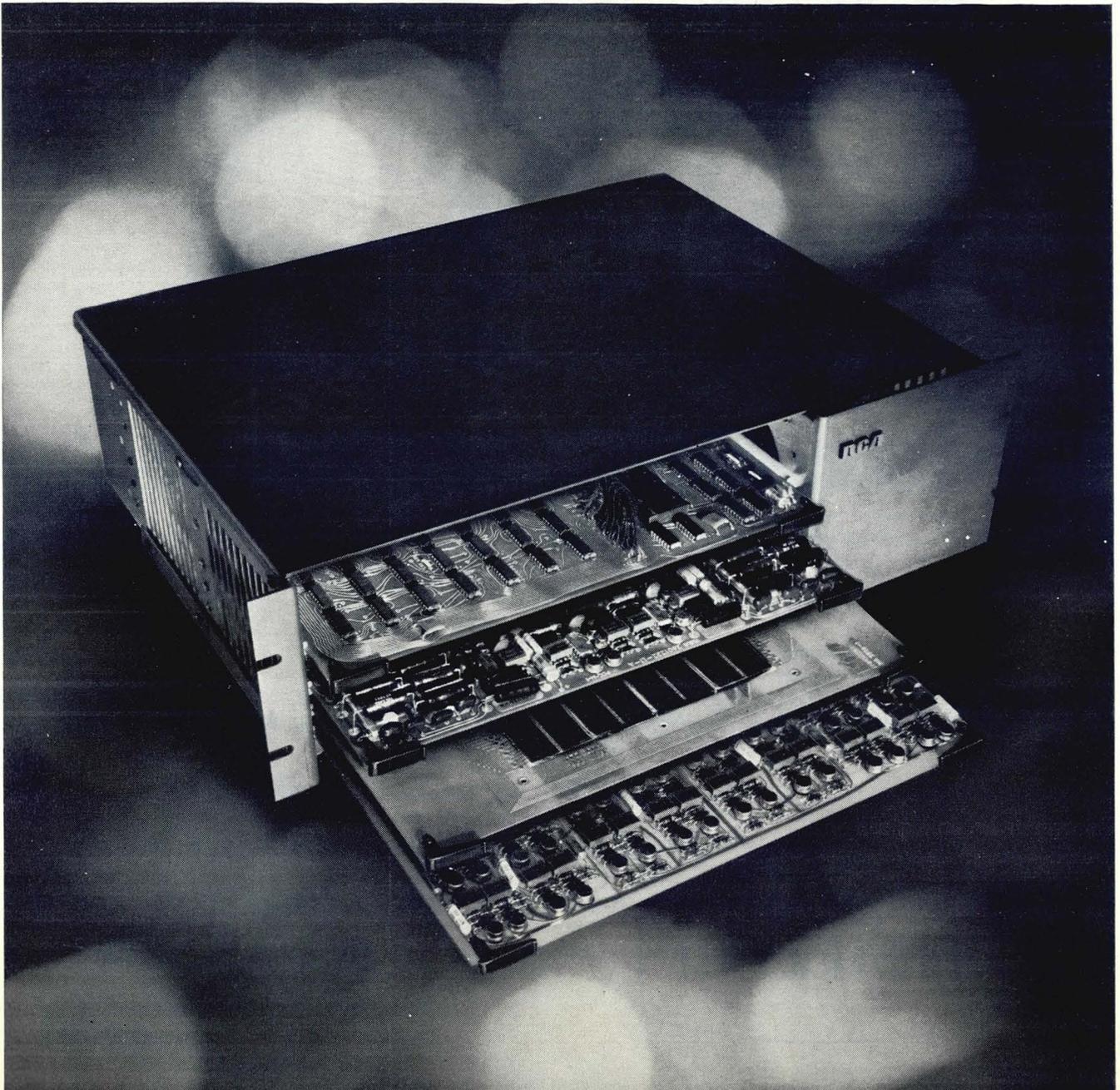
operation for 38-bit words.

Expand your computer's mind. Write RCA Memory Products, Needham Heights, Mass. 02194. Or call 617-444-7200.

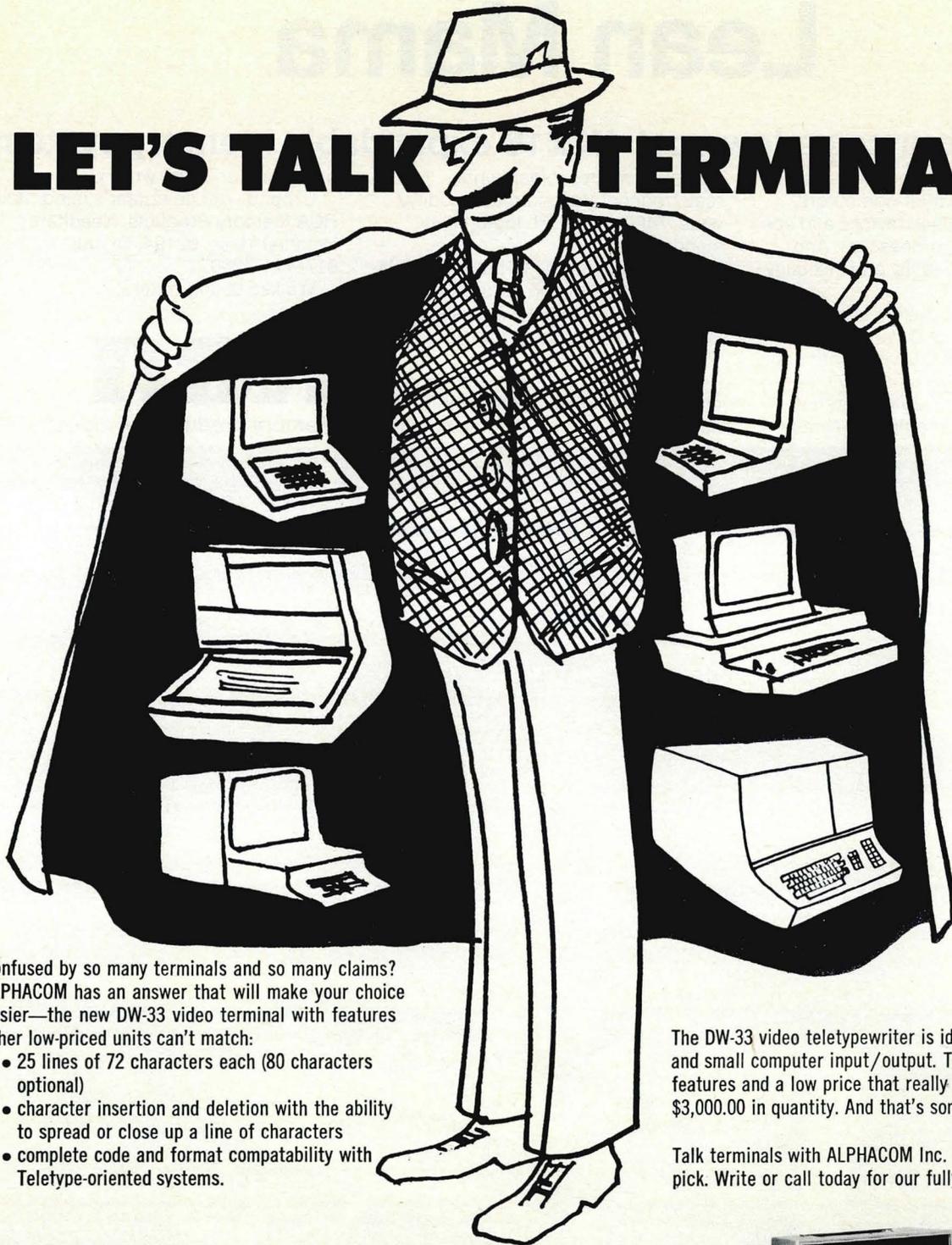
We like taking orders.

# RCA

Memory products for industry



# LET'S TALK TERMINALS



Confused by so many terminals and so many claims? ALPHACOM has an answer that will make your choice easier—the new DW-33 video terminal with features other low-priced units can't match:

- 25 lines of 72 characters each (80 characters optional)
- character insertion and deletion with the ability to spread or close up a line of characters
- complete code and format compatibility with Teletype-oriented systems.

The DW-33 video teletypewriter is ideal for time sharing and small computer input/output. There are many other features and a low price that really is low . . . under \$3,000.00 in quantity. And that's something to talk about.

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# Put the other plotter maker on the spot. Ask him for a comparative demo. His and ours. We'll show up.

What you'll find (if he accepts the challenge) is that our incremental plotter is faster, more effective and costs less.

And here's what you get for all that less money. Delta Control.\* An exclusive. Lets you move up to 1443 steps in X and Y from a single command. (That's not a special or an extra, either. It's standard.) That's why we can reduce computer write time as much as 30:1.

What's their name is trying to duplicate Delta. By adding on a computer. Which cost you thousands extra. Many thousands.

You'll find we out-versatile the other brand, too. Because ours is the only incremental plotter that can operate on-line or from three off-line inputs: mag tape, punched tape and punched cards. And, computer extra or not, we're the only ones with programmable step size, speed control and a foul-proof manual plot interrupt.

In case that's not tempting enough, we throw in the software. No charge.

At this point, when the other guy's folding his hardware and silently stealing away, we

toss in the clincher. We can deliver in 30 days.

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\*patent pending



**UNIVERSITY COMPUTING COMPANY**

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## INTERACTIVE CRT DISPLAY TERMINALS

### Part 2 — Alphanumeric CRT Terminals

**EDITOR'S NOTE:** This article is the second in a three-part series which updates the original Technology Profile on CRT Terminals which appeared in the July, August, and September 1968 issues of MODERN DATA. Now out-of-print, the original series generated thousands of requests for reprints and follow-up surveys. The purpose of this updated series of articles is to present background information on the characteristics and uses of interactive CRT display terminals together with a comprehensive listing of companies supplying them. Part 1 of this series (May) discussed the present and future of the terminal market, terminal interfacing techniques and problems, and software requirements. This article (Part 2) covers the hardware characteristics of alphanumeric and limited-graphic terminals, and provides a tabulation of the important characteristics of each terminal now being marketed. Part 3 (in July) will describe and tabulate terminals with full graphic capability.

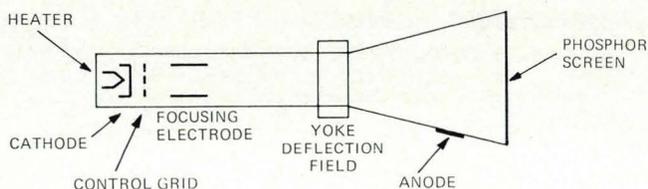


Fig. 1 Basic elements of a cathode-ray tube.

A typical alphanumeric CRT terminal is designed for either local or remote interfacing to a computer system, and has four major parts: the keyboard; the cathode-ray tube and deflection system, the memory and control logic, and the interface.

This article describes each of these major parts only to the degree that a basic understanding and appreciation of the various approaches implemented in their design would interest a prospective purchaser. As with all broad categories of user equipment, a knowledge of trade-offs and options is required of the user before he can intelligently choose the equipment best suited for his own particular application and price requirements. The text of this article briefly describes the generalized trade-offs applicable to all interactive CRT display terminals. The two tables which follow relate these trade-offs with the specific options available in today's marketplace. Table 1, Alphanumeric CRT Terminals, covers the keyboard CRT terminals that do not provide a graphic capability. Table 2, Alphanumeric CRT Terminals With Limited Graphics, covers the few alphanumeric terminals that also provide a matrix of dots or a grid of lines which can be selectively intensified for simple graphic presentations.

#### CRT OPERATION

The basic parts of a cathode-ray tube are shown in Fig. 1. A heater causes a stream of electrons to be emitted from the cathode. This stream is then either accelerated toward the phosphor on the face of the CRT, or terminated by applying an appropriate voltage to the control grid, thereby deter-



EDWARD N. CHASE



DR. DONALD B. BRICK

TABLE 1 • ALPHANUMERIC CRT TERMINALS

Manufacturer	Alphacom	American Terminal Systems			Applied Digital Data Systems	
Model	DW-33	265	266	267	Envoy 600	Envoy 640
<b>Screen Size, In.</b>	9x7	7x5	7x5	7x5	4x3	4x3
<b>Char./Unit</b>	1800	128, 256, 512 or 960	256, 512, 1024 or 1920	320, 640, 1280 or 2400	512	1024
<b>Positions/Line</b>	72	32	64	80	32	64
<b>Lines Per Unit</b>	25	4, 8, 16 or 30	4, 8, 16 or 30	4, 8, 16 or 30	16	16
<b>Insert by:</b>	character	none	see OPTIONS	see OPTIONS	none	character
<b>Delete by:</b>	character	page	see OPTIONS	see OPTIONS	none	character
<b>Tabulation</b>	no	horizontal	horizontal	horizontal	none	format
<b>Page Roll</b>	yes	yes	yes	yes	yes	yes
<b>Split Screen</b>	optional	optional	optional	optional	no	yes
<b>Format Entry</b>	optional	none	none	none	N/A	—
<b>Interface Type</b>	20ma or 60ma loop	RS232B or loop	RS232B or loop	RS232B or loop	acoustic (integral coupler)	acoustic (integral coupler)
<b>Duplex Mode</b>	half & full	half & full	half & full	half & full	half	half
<b>Bit Rate</b>	110	up to 9600	up to 9600	up to 9600	110 & 300	110 & 300
<b>TTY Substitute 2260/65</b>	yes	no	yes	yes	yes	yes
<b>Substitute</b>	no	no	no	no	no	no
<b>Polling</b>	no	optional @ \$500	optional @ \$500	optional @ \$500	no	no
<b>Char./Codes</b>	64 ASCII	64 ASCII	64 ASCII	64 ASCII	64 ASCII	64 ASCII
<b>Display Method</b>	5x7 video	4x12 video	4x12 video	4x12 video	5x7 video	5x7 video
<b>Phosphor</b>	—	—	—	—	—	—
<b>Options</b>	RS232B interface, printer, answer back	lower case, parallel interface, printer	Same, plus insert & delete by line & char. @ \$600.	Same as 266.	—	—
<b>Purchase Price</b>	\$3,500	\$1,790	\$2390	\$2490	\$3195	\$3695
<b>Monthly Lease</b>	—	—	—	—	—	—
<b>Expansion</b>	single unit	single unit	single unit	single unit	single unit	single unit
<b>Remarks</b>	A buffered teletypewriter substitute with editing.	Message terminal; 8 lines @ \$1970, 16 @ \$2300.	Edit terminal; 8 lines @ \$2590, 16 @ \$2790, 30 @ \$3190.	Keypunch/teletypewriter substitute; 8 lines @ \$2690, 16 @ \$2990, 30 @ \$3490.	Portable. Black characters on white background. Editing in conversational mode is possible.	Similar to 600, but with character insert & delete.

**NOTE:** Purchase prices are for standard terminal configurations (including keyboard and interface) without maintenance. Lease prices include maintenance. See text for a complete explanation of pricing.

TABLE 1 • ALPHANUMERIC CRT TERMINALS .....Cont'd.

Manufacturer	Applied Digital Data Systems (cont'd)		Atlantic Technology		Beehive Electrotech	
Model	Consul 800	Consul 840/880	ATC 2000 (960)	ATC 2000 (1920)	Alpha 101/102	Alpha 103/105
Screen Size, In. Char./Unit	7x5 512	7x5 1024, 1600, @\$500	10.5 x 8 960	10.5 x 8 1920	9x7 800	9x7 800
Positions/Line	32	64 or 80	40, 64 or 80	40, 64 or 80	40	40
Lines Per Unit	16	16 or 20	48, 30 or 24	24, 15 or 12	20	20
Insert by:	none	character	character	character	none	none
Delete by:	none	character	character	character	character	none
Tabulation	none	format	format	format	horizontal	none
Page Roll	yes	yes	no	no	no	yes
Split Screen	no	yes	yes	yes	optional	optional @ \$400
Format Entry	N/A	yes	yes	yes	optional	optional
Interface Type	RS232B	RS232B	RS232B or S/360 local	RS232B or S/360 local	RS232B	RS232B or parallel
Duplex Mode	half	half	half	half	half & full	half & full
Bit Rate	110 & 300	110 & 300	1200, 2400 or 4800	1200, 2400 or 4800	up to 2400	110-300, 2400 optional
TTY Substitute 2260/65	yes	yes	no	no	no	yes
Substitute	no	no	yes	yes	optional @ \$500	no
Polling	no	no	yes	yes	no	no
Char./Codes	64 ASCII	64 ASCII	66 ASCII	66 ASCII	64 ASCII	64 ASCII
Display Method	5x7 video	5x7 video	5x5 stroke	5x5 stroke	5x7 video	5x7 video
Phosphor	—	—	P31 (green)	P31 (green)	—	—
Options	Built-in acoustic or hardware modem @ \$425	same	lower case @ \$1200, printer @ \$4100, limited graphics	same	printer, lower case, parallel interface	tabulation @ \$200, block xmit @ \$200, cassette
Purchase Price	\$2995	\$3495	\$8250	\$10,000	\$3495	\$3495
Monthly Lease	—	—	\$260	\$300	—	—
Expansion	single unit	single unit	1 @ \$12,250, 4 @ \$27,250	1 @ \$12,500, 2 @ \$16,000	single unit	single unit
Remarks	Transmit by character, message or page. Edit submode changes char and retransmits entire line.	Similar to 800. Formats are displayed in gray on white, keyed data in black.	Has edit & control features not in 2260. Also expands at 240 and 480 chars.		TTY-interchangeable, but xmits by blocks. Model 102 is IBM compatible.	Cursor & selective erase cost \$200 each. Buffered unit.

**NOTE:** Purchase prices are for standard terminal configurations (including keyboard and interface) without maintenance. Lease prices include maintenance. See text for a complete explanation of pricing.

mining to what degree the phosphor is excited. The focusing electrode shapes the electron stream into a narrow beam, which is then deflected by an electrostatic or electromagnetic field (or both) to excite the phosphor on the inside of the glass faceplate at the proper position. The yoke provides deflection in both horizontal and vertical directions, with the strength of the field determining the amount of deflection in each. The tables show this screen size in inches wide by inches high. Most manufacturers replying to MODERN DATA's request for information supplied only a CRT dia-

gonal measurement, so screen sizes may be only to the nearest inch.

In the shadow-mask type of color CRT, there are separate control grids and focusing electrodes for the three beams used to generate the red, green, and blue primary colors. After being deflected, the beams pass through a mask of regularly-spaced round holes to reach the phosphor. Each of the beams passes through at a different angle, and the mask is aligned with a pattern of red, green, and blue phosphor dots such that each beam excites only the dots of its assigned color. The Delta

TABLE 1 • ALPHANUMERIC CRT TERMINALS .....Cont'd.

Manufacturer	Bunker-Ramo (Conn.)		Bunker-Radio (Calif.)	Burroughs		Computek
<b>Model</b>	2205/17	2212	BR-700	B9351	B9352	100
<b>Screen Size, In.</b>	8.75 x 6.25	4x3	8.75x6.25	12x9	7.5x8.5 or 8.5x7.5	9.3x7
<b>Char./Unit</b>	888 or 960	444	960	1019	960	1000,1095 or 1040
<b>Positions/Line</b>	37 or 80	37	80	80	40 or 80	50,73 or 80
<b>Lines Per Unit</b>	24 or 12	12	12	25	24 or 12	20,15 or 13
<b>Insert by:</b>	character	character	line	optional line & char	none	see OPTIONS
<b>Delete by:</b>	line & character	line & character	line	optional line & char	none	see OPTIONS
<b>Tabulation</b>	format	format	no	horizontal	horizontal	optional
<b>Page Roll</b>	no	no	no	no	no	optional
<b>Split Screen</b>	yes	yes	yes	optional	optional	optional
<b>Format Entry</b>	no	no	yes	—	—	optional
<b>Interface Type</b>	RS232B or parallel	RS232B or parallel	RS232B	RS232B	RS232B	RS232B or parallel
<b>Duplex Mode</b>	half	half	half	—	—	half, full & echo
<b>Bit Rate</b>	1200-2400	1200-2400	up to 2400	up to 4800	up to 2400	up to 1,000,000
<b>TTY Substitute</b>	no	no	no	no	no	optional
<b>2260/65 Substitute</b>	no	no	no	no	no	no
<b>Polling</b>	yes	yes	yes	—	optional	no
<b>Char./Codes</b>	62 ASCII	62 ASCII	63 ASCII	64 ASCII	64 ASCII	64 ASCII
<b>Display Method</b>	5x7 sawtooth	5x7 sawtooth	5x7 sawtooth	stroke	stroke	7x9 dot
<b>Phosphor</b>	P31 (green)	P31 (green)	P31 (green)	P4 (white)	P31 (green)	P4 (white)
<b>Options</b>	lower case, monitors, printer, tape punch	same	monitors, lower case, printer	printer, programmable cursor, multiplexer	printer, modem expander	line & character edit, cassettes, printer
<b>Purchase Price</b>	\$6895	\$6030	\$56,550	—	—	\$5,200
<b>Monthly Lease</b>	\$216	\$198	\$2,623	—	—	none
<b>Expansion</b>	1 @ \$16,055, 9 @ \$53,155	1 @ \$15,190, 18 @ \$61,120	1 @ \$56,550, 16 @ \$148,100	1 to 4 units	single unit	single unit
<b>Remarks</b>	Highly modular and flexible. Expands to 18 or 36 units at reduced chars for each.	Same system except for financial-type terminal. Expands to 36 units at 222 chars. each.	Drum file of 96 to 384 pages for local or on-line management information.	Also expnds to 8 units @ 507 chars, 16 units @ 251 chars.	Up to 16 units to one line.	Has firmware processor. Quantity sales preferred.

**NOTE:** Purchase prices are for standard terminal configurations (including keyboard and interface) without maintenance. Lease prices include maintenance. See text for a complete explanation of pricing.

Data Systems Delta 1/2000 is the only color CRT terminal in the tables; Viatron has optional color monitors.

Since nearly all CRT terminals use phosphors that glow for only a very short time after being excited (usually about 50 microseconds and seldom more than one-tenth of a second), the picture must be constantly rewritten (refreshed) for a flicker-free presentation. An exception is the direct-view storage tube, whose phosphor can store an image if excited for a sufficient time with a high-energy electron beam. A separate, diffuse low-

energy beam "floods" the entire screen, causing the phosphor elements with the image to glow more brightly than the others. The high-energy beam can also be used to present unstored information by exciting the phosphor for less time than that required to store the image. Displays of this type are referred to as having "write-through" capability. Storage tubes typically have low image brightness and contrast, and are best used in subdued light; also, the time needed to write the stored image may be slow, usually at the rate of 20 microseconds per point.

TABLE 1 • ALPHANUMERIC CRT TERMINALS .....Cont'd.

Manufacturer	CompuTek (Cont'd)	Computer Consoles	Computer Terminal	Computer Transceiver Systems	Conrac	Control Data
<b>Model</b>	400/12	520-724	Datapoint 3300	Execuport 220TV	201	214
<b>Screen Size, In. Char./Unit Positions/Line Lines Per Unit</b>	8.25x6.4 3400 85 40	11.25x5.75 960, 1920 @ \$1200 80 12, 24 optional	9x7 1800 72 25	N/A 800 40 20	7.5x8.5 or 11x7.5 960 dot, 640 stroke 40 or 80 24 or 12 dot, 16 or 8 stroke	8x6 1000 or 1040 50 or 80 20 or 13
<b>Insert by:</b> <b>Delete by:</b> <b>Tabulation</b> <b>Page Roll</b> <b>Split Screen</b> <b>Format Entry</b>	none none none none yes yes	line & character line & character horizontal optional @ \$300 yes yes	none none no yes optional no	none none none yes no no	see OPTIONS line optional no optional optional	— — — no no no
<b>Interface Type</b> <b>Duplex Mode</b> <b>Bit Rate</b> <b>TTY Substitute 2260/65</b> <b>Substitute Polling</b>	RS232B full up to 20,000 no no no	RS232B half 1200, 2400 optional na yes yes	RS232B or loop half & full 110-600, 1200-4800 @ \$400 yes no no	acoustic (integral coupler) half & full 110, 165 & 300 yes no no	RS232B or loop half & echo up to 2400 no no optional	RS232B half & full 2000, 2400 no na —
<b>Char./Codes</b> <b>Display Method</b> <b>Phosphor</b>	96 ASCII curve & stroke storage P1 (green)	59 ASCII 5x7 video —	64 ASCII 5x7 sawtooth P31 (green)	64 ASCII 5x7 video N/A	69 ASCII 5x7 dot or 3x3 stroke P4 (white) or P31 (green)	64 ASCII 5x7 sawtooth P4 (white)
<b>Options</b>	vertically oriented CRT, parallel interface	computer tape, printers, paper tape, lower case	cassette @ \$2250, printer, coded cursor	cassettes, TTY instead of thermal printer	character insert & delete, parity xmit, printer	—
<b>Purchase Price</b> <b>Monthly Lease</b>	\$7,400 none	\$10,090 \$252	\$5000 \$164	about \$5400 —	see REMARKS none	\$6250 \$140
<b>Expansion</b>	single unit	1 @ \$10,090, 6 @ \$28,790	single unit	single unit	single unit	single unit
<b>Remarks</b>	FORTRAN software for format control by computer. Upgrades to vector & curve graphics.	Also for offline data entry. Expansion reduces number of lines per unit.	Buffered. Cursor can be optionally programmed from computer.	Video is attached to Execuport 300 thermal printer. Any TV receiver for CRT.	Sold only to Original Equipment Manufacturers; user price customarily \$6000 to \$8000.	Controller in separate box.

**NOTE:** Purchase prices are for standard terminal configurations (including keyboard and interface) without maintenance. Lease prices include maintenance. See text for a complete explanation of pricing.

**DEFLECTION METHODS**

For refreshed CRTs, one of three patterns of deflecting the beam to generate the picture is used: video; sawtooth; or programmed scan.

**Video scan** is used in TV sets: the electron beam is swept through odd-numbered horizontal lines of the picture on one pass, then through the even-numbered lines on the next pass, thus drawing a complete 525-line picture in one-thirtieth of a second. Characters displayed by video must, of

course, be made of dot patterns, with the beam unblanked (that is, the phosphor excited) for each dot of each character. Terminals with video scan control logic often use inexpensive TV sets for CRTs, and these terminals can also be interfaced to closed-circuit TV Systems.

With the **sawtooth scan**, the beam is deflected to consecutive character positions, then at each position it is deflected through a series of short horizontal or vertical strokes to describe a rectangle whose dimensions are the character width and height. Except for the monoscope and

TABLE 1 • ALPHANUMERIC CRT TERMINALS .....Cont'd.

Manufacturer	Control Data (Cont'd)	Courier Terminal Systems		Data 100	Delta Data Systems	
Model	216-4	Executerm 1	Executerm 60	73	TeleTerm 1	TeleTerm 2
Screen Size, In. Char./Unit	8x6 1000 or 1040	6.4x4.8 256, 512 optional @ \$320	6.4x4.8 240, 480 optional @ \$450	9x7 960, 1920 @ \$800	11x9 500, up to 2500 optional	11x9 500, up to 2500 optional
Positions/Line Lines Per Unit	50 or 80 20 or 13	40 15	40 6, 12 optional	80 12, 24 optional	80 27	80 27
Insert by: Delete by: Tabulation Page Roll Split Screen Format Entry	optional line & char optional line & char optional horiz & vert no no no	character character horizontal yes optional @ \$350 yes	character character horizontal yes yes yes	— — horizontal yes — —	none none format yes yes yes	line & character line & character horizontal yes yes yes
Interface Type Duplex Mode Bit Rate	RS232B half & full 2400	RS232B half & full 110, 150, 300, 600, 1200	RS232B full 1200 & 2400	RS232B full & echo 110-1800	RS232B half & full up to 4,000,000	RS232B half & full up to 4,000,000
TTY Substitute 2260/65 Substitute Polling	no na —	yes no no	no yes yes	yes no no	yes no no	no optional optional
Char./Codes Display Method Phosphor	64 ASCII 5x7 sawtooth P4 (white)	63 ASCII 7x8 sawtooth —	64 ASCII 7x9 sawtooth —	64 ASCII 5x7 video P4 (white)	64 ASCII 7x9 video —	64 ASCII 7x9 video —
Options	printers	lower case @ \$150, answerback @ \$200, printer @ \$2150	line addressing, printer, multi-station adapter	printer, numeric keyboard	lower case or 80x27 line graphics, printer, cassette	same
Purchase Price Monthly Lease	— —	\$3800 \$137	\$5150 \$235	under \$4000 under \$120	\$3000 \$90	\$3500 \$100
Expansion	6 units @ \$35,500	single unit	single unit	single unit	single unit	single unit
Remarks	Expansion of 1-12 total of display & printer units.	Has a switch for conversational or edit mode.	Conditioned private line service required.	Buffered. Characters either white on black or black on white. Available in October 1970.	Buffered. Any 27 consecutive lines in memory are displayable.	Optional 2260 substitute with MultiTerm 2 controller.

**NOTE:** Purchase prices are for standard terminal configurations (including keyboard and interface) without maintenance. Lease prices include maintenance. See text for a complete explanation of pricing.

shaped-beam methods of character generation described later, characters drawn this way are made of dot patterns. Character width, character-to-character spacing, and line-to-line spacing can be separately adjusted.

**Programmed scan** indicates that the beam is deflected to sequential positions as directed by the control logic. This is the most efficient display method, as it minimizes the number of unintensified moves that must be traced by the deflection system. However, it requires more expensive CRTs with yokes capable of high-precision deflec-

tion. Characters drawn this way can be formed of either dots or consecutive short line segments (strokes). Stroke characters are easier to read. All storage tube terminals use programmed scan and draw characters of closely-spaced dots.

Some sawtooth scan terminals, and all programmed scan terminals, can bypass a character position if no character is to be displayed there. Thus, the number of character positions per line times the number of lines of characters per unit can exceed the number of displayable characters the control logic holds (characters per unit in the

TABLE 1 • ALPHANUMERIC CRT TERMINALS .....Cont'd.

Manufacturer	Delta Data Systems (Cont'd)	Digital Scientific	Foto-Mem	Hazeltine	Honeywell
<b>Model</b>	TeleTerm 3	2102	Foto-Vision	1760 2000	2317 VIP
<b>Screen Size, In. Char./Unit</b>	11x9 500, up to 2500 optional	N/A 800	8x6 1440	7x5 or 9x7 1760 or 1998	9x6.25 1998 888 or 960
<b>Positions/Line Lines Per Unit</b>	80 27	32 25	72 20	55 or 74 32 or 27	74 27 37 or 80 24 or 12
<b>Insert by:</b>	line & character	none	character	line & character	character
<b>Delete by:</b>	line & character	none	character	line & character	line & character
<b>Tabulation</b>	horizontal	none	none	format	format
<b>Page Roll</b>	yes	no	yes	no	no
<b>Split Screen</b>	yes	no	no	yes	yes
<b>Format Entry</b>	yes	no	no	no	no
<b>Interface Type</b>	RS232B	RS232B	RS232B or parallel	RS232B	RS232B
<b>Duplex Mode</b>	half & full	—	—	—	half & full
<b>Bit Rate</b>	up to 4,000,000	110, 1200, 2400	300	up to 2400	110-1200, 9600 optional
<b>TTY Substitute 2260/65</b>	no	no	no	no	yes
<b>Substitute</b>	yes	no	no	no	no
<b>Polling</b>	no	no	no	no	— yes
<b>Char./Codes Display Method</b>	64ASCII 7x9 video	64 ASCII 5x7 video	64 ASCII 10x14 video (5x7 pattern)	64 ASCII 5x7 video	64 ASCII 5x7 video
<b>Phosphor</b>	—	N/A	—	—	P31 (green)
<b>Options</b>	same	cursor @ \$500, printer, parallel interface	cassette, paper tape, blink, printer, disk	96 ASCII codes, printer, cassettes	cassettes, printer, monitors
<b>Purchase Price</b>	\$4500	\$4870	\$3205	under \$5000	\$2995
<b>Monthly Lease</b>	\$120	\$130	—	none	\$88
<b>Expansion</b>	single unit	single unit	single unit	single unit	single unit
<b>Remarks</b>	Includes all features of TeleTerm 2.	Buffered. Uses any TV set as CRT. Line & character positions computer-addressable. Cursor optional.	Will interface with FM-390 mass optical memory for archival storage.	Unprotected data is brighter. Addressable cursor.	Addressable cursor. First delivery July 1970.
					Expands at 960, 888, 480, 444 & 222 chars per unit; 9, 18 or 36 units maximum.

**NOTE:** Purchase prices are for standard terminal configurations (including keyboard and interface) without maintenance. Lease prices include maintenance. See text for a complete explanation of pricing.

tables). For applications with tabular or textual information having many blanks, the ratio of meaningful data that can be displayed to refresh-memory storage is increased.

**CHARACTER GENERATION**

The monoscope and shaped beam methods of character generation have the character definitions built into the CRT. In the monoscope CRT,

the character set is etched into a polished metal plate and the electron beam is scanned over the etching of the character to be displayed. A secondary emission of electrons from the etched area is amplified and directed to the faceplate. Terminals using monoscope CRTs are more expensive, but have extremely well-defined characters.

The character set for the shaped beam CRT is stencilled into a thin metal sheet. The beam is scanned over the stencil of the character to be displayed on its way to the faceplate, and the dis-

TABLE 1 • ALPHANUMERIC CRT TERMINALS .....Cont'd.

Manufacturer	Honeywell (Cont'd)		Hypertech	IBM		Infoton
<b>Model</b>	2323 VIP	7210	GTU-1	2260	2265	Vista-1
<b>Screen Size, In. Char./Unit</b>	9x6.25 960	8x6 1024	— 240 or 300	9x4 960	9x4 960	9x7 320, 640, 640, 1280
<b>Positions/Line</b>	80	—	20 or 25	80	64 or 80	32, 32, 64, 64
<b>Lines Per Unit</b>	12	—	12	12	15 or 12	10, 20, 10, 20
<b>Insert by:</b>	character	—	—	none	none	none
<b>Delete by:</b>	line & character	—	—	none	none	none
<b>Tabulation</b>	format	—	format	no	optional @ \$180	none
<b>Page Roll</b>	no	—	no	no	no	yes
<b>Split Screen</b>	yes	yes	3 records	no	no	no
<b>Format Entry</b>	no	—	yes	no	no	no
<b>Interface Type</b>	RS232B	—	RS232B	RS232B or S/360 channel	RS232B	RS232B, others optional
<b>Duplex Mode</b>	half & full	—	—	half	half	half & echo up to 2400, 9600
<b>Bit Rate</b>	1200-2400	up to 9600	—	1200, 2400	1200, 2400	optional
<b>TTY Substitute 2260/65</b>	no	—	no	no	no	yes
<b>Substitute</b>	no	—	no	the real thing	the real thing	no
<b>Polling</b>	yes	—	no	yes	yes	no
<b>Char./Codes</b>	62 ASCII	64 ASCII	63 ASCII	64 ASCII or EBCDIC	64 ASCII	64 ASCII
<b>Display Method</b>	5x7 sawtooth	—	5x7	sawtooth	stroke	5x7 video
<b>Phosphor</b>	P31 (green)	—	—	P39 (green), P4 (white)	P39 (green)	P4 (white)
<b>Options</b>	printer @ \$2150, \$3150 or \$3300	—	cassette	printer, nondestructive cursor, line addressing	printers @ \$5215, line addressing, destructive cursor	printer, cassette, paper tape in & out
<b>Purchase Price</b>	\$10,500	\$5750	—	\$23,310	\$14,625	\$1495 (320 chars)
<b>Monthly Lease</b>	\$258	—	—	\$570	\$369	\$73
<b>Expansion</b>	single unit	single unit	single unit	1 @ \$23,310, 8 @ \$47,430	single unit	single unit
<b>Remarks</b>	Made to Honeywell specs by Bunker-Ramo, these units are similar to B-R 2205.	Preliminary data. First delivery July 1970.	Offline or online entry of formatted data. Keyboard entry program for format control.	Also expands to 16 units @ 480 chars, 24 units @ 240 chars, both 40 chars per line.	1 to 16 units per S/360 communication channel. May be networked with 2260s.	Unbuffered. 640 chars @ \$1995, 1280 @ \$2495.

**NOTE:** Purchase prices are for standard terminal configurations (including keyboard and interface) without maintenance. Lease prices include maintenance. See text for a complete explanation of pricing.

played letter takes the shape of the stencil.

Thus, with the monoscope and shaped beam methods, the control logic interprets the binary-coded representation of a character as a position on the plate or sheet; all other methods have the dot or stroke patterns for each character stored in digital form within the control logic. The sequence of unblanking commands for the video scan obviously does not correspond to the ordering of characters on the CRT. There is an extra step, a digital-to-video conversion, in which the control

logic converts the character code to the proper video pattern and writes it into a serial-bit-transfer circulating memory which is used to refresh the picture.

Five dots wide by seven dots high is the most popular matrix for the design of characters, although other sizes are common. The tables show the character matrix width by height (if applicable) and the display methods: storage; monoscope; shaped; video; sawtooth; dot; or stroke. The last two are required in the tables only for the

TABLE 1 • ALPHANUMERIC CRT TERMINALS .....Cont'd.

Manufacturer	Infoton		ITT	Logitron	Mark Computer Systems	
Model	Vista-2	Vista-3	Alphascope 3100	Logiport/1	880	920
Screen Size, In.	9x7	9x7	7.5x4.4	7x5	7x5	9x7
Char./Unit	320, 640, 640, 1280	640,1280	720 or 1360	512	256	1024
Positions/Line	32, 32, 64, 64	64	80	32	32 or 8	64 or 16
Lines Per Unit	10, 20, 10, 20	10,20	9 or 17	16	8 or 32	16 or 64
Insert by:	line & character	line & character	character	none	character	character
Delete by:	line & character	line & character	character	none	character	character
Tabulation	format	format	optional	none	format	format
Page Roll	yes	yes	no	yes	—	—
Split Screen	yes	yes	optional	no	yes	yes
Format Entry	yes	yes	no	no	yes	yes
Interface Type	RS232B, others optional	RS232C, others optional	RS232B or parallel	acoustic (integral coupler)	RS232B or parallel	RS232B or parallel
Duplex Mode	half	half	half	half & full	—	—
Bit Rate	up to 2400, 9600 optional	up to 2400,9600 optional	1200 or 2400	110, 300	—	—
TTY Substitute 2260/65	no	no	no	yes	—	—
Substitute	no	yes	yes	no	—	—
Polling	no	yes	yes	no	—	—
Char./Codes	64 ASCII	64 ASCII	67 ASCII	64 ASCII	—	—
Display Method	5x7 video	5x7 video	5x7 video	5x7 dot	—	—
Phosphor	P4 (white)	P4 (white)	P12 (orange)	P4 (white)	—	—
Options	same	same	printer @ \$84, preprocessor @ \$4390, scrambler @ \$109	—	—	—
Purchase Price	\$1995 (320 chars)	\$4,000	—	\$2,950	\$3800	\$4300
Monthly Lease	\$95	\$170	4 units @ \$643	—	—	—
Expansion	single unit	single unit	multiples of 4 units to 64	single unit	single unit	single unit
Remarks	Buffered. 640 chars @ \$2495, 1280 @ \$2995.	Buffered. 1280 characters @ \$4,500	One line on CRT reserved for program information activated by 1 of 5 function keys.	Portable unit with built-in acoustic coupler.	Preliminary data. First delivery June 1970.	

**NOTE:** Purchase prices are for standard terminal configurations (including keyboard and interface) without maintenance. Lease prices include maintenance. See text for a complete explanation of pricing.

purpose of distinguishing programmed scan terminals.

**CHARACTER MEMORY**

Video scan and storage tube terminals need not retain the binary-coded character after the pattern has been written into the circulating memory or phosphor, and can be unbuffered. Other terminals must retain the character codes in a separate character memory, as the control logic continuously reads and decodes consecutive characters to re-

fresh the picture. This buffering permits text editing features to be included in the control logic. Most terminals have a memory character capacity equal to the number of displayable characters plus a few for logical control; a few terminals have additional character memory for local information storage.

The tables indicate the character code for the terminal and the number of different characters that can be displayed. More than 64 characters generally indicates lower-case letters are available.

TABLE 1 • ALPHANUMERIC CRT TERMINALS .....Cont'd.

Manufacturer	Megadata	The National Cash Register		Photophysics	Raytheon	
<b>Model</b>	S/R 1000	795-100	795-620	'45'	DIDS-401	DIDS-402
<b>Screen Size, In. Char./Unit</b>	N/A	9.5x7.5	9.5x7.5	7x5	8.5x6.5	8.5x6.5
<b>Positions/Line</b>	800, 1600 optional	1024	780	1000	520, 1040 @ \$660	520, 1040, @ \$660
<b>Lines Per Unit</b>	40, 80 optional	64	64	40	40 or 80	40 or 80
	20	32	32	25	13	13
<b>Insert by:</b>	none	line & character	line & character	character	character	character
<b>Delete by:</b>	none	line & character	line & character	character	character	character
<b>Tabulation</b>	none	fixed spacing	fixed spacing	optional	optional @ \$110	none
<b>Page Roll</b>	—	no	no	optional	no	no
<b>Split Screen</b>	no	optional	optional	optional	no	no
<b>Format Entry</b>	no	optional	optional	optional	no	no
<b>Interface Type</b>	acoustic (integral coupler)	RS232B	RS232B	RS232B	RS232B	RS232B
<b>Duplex Mode</b>	—	half & full	half & full	half full & echo	half	half
<b>Bit Rate</b>	up to 660	1000-2400	110-2400	110-1200, 2400 optional	2000 or 2400	1200
<b>TTY Substitute 2260/65</b>	yes	no	no	yes	no	no
<b>Substitute</b>	no	no	no	optional	optional	no
<b>Polling</b>	no	yes	yes	optional	optional @ \$400	optional @ \$440
<b>Char./Codes</b>	64 ASCII	64 ASCII	64 ASCII	64 ASCII	64 ASCII	64 ASCII
<b>Display Method</b>	5x7 video	stroke	stroke	5x7 video	monoscope	monoscope
<b>Phosphor</b>	N/A	P4 (white)	P4 (white)	—	P31 (green)	P31 (green)
<b>Options</b>	—	printer, NCR 315 interface	printer, conversational mode	line insert & delete, 40x25 line graphics, blink	printer adapter @ \$3949	multiplexer @ \$1160, printer adapter @ \$4200
<b>Purchase Price</b>	\$3350	\$9625	\$8750	\$9950	\$16,010	\$6600
<b>Monthly Lease</b>	—	\$275	\$250	\$250	on request	on request
<b>Expansion</b>	single unit	1 @ \$9625, 3 @ \$15,575	single unit	single unit	1 @ \$16,010, 64 @ \$307,840	single unit
<b>Remarks</b>	Portable, with built-in coupler. Uses any TV set as CRT.	Built by Sanders to NCR specs.; design similar to Sanders 720.	Similar to Sanders, 620.	Has integral electro-photographic printer for hardcopy.	Memory and editing logic are in terminals, not controller.	

**NOTE:** Purchase prices are for standard terminal configurations (including keyboard and interface) without maintenance. Lease prices include maintenance. See text for a complete explanation of pricing.

**KEYBOARD ENTRY AND EDITING**

All terminals, except the Digital Scientific 2102, display a cursor symbol to show the position of the next character to be keyed in. Except for the IBM 2260, where it is an optional feature, the cursor is nondestructive and can be freely moved from one character position to another without erasing any characters it bypasses. Control keys are provided to move the cursor, and most terminals permit moving the cursor left or right one character, go-

ing to the leftmost character of the next line (or going down one line), going to the leftmost character of the previous line (or going up one line), and going to the leftmost character of the top line. Terminals with extensive editing features have more freedom of movement for the cursor.

Most terminals with editing have **character replace** as the primary edit function; that is, typing a letter on the keyboard will place it at the cursor position (erasing the letter previously there) and space the cursor to the right. The majority also

TABLE 1 • ALPHANUMERIC CRT TERMINALS .....Cont'd.

Manufacturer	Raytheon (Cont'd)		RCA		Sanders Associates	
Model	DIDS-402 (M8)	DIDS-402-3	70/751	70/752	620	720
Screen Size, In.	8.5x6.5	8.5x6.5	8x5.5	8x5.5	9.5x7.5 or 7.5x9.5	7.5x9.5 or 9.5x7.5
Char./Unit	1040	480, 520, 960, 1040	1080 or 972	1080 or 1134	750	1024
Positions/Line	80	40, 40, 80, 80	54, 60 or 81	54 or 81	64 or 52, 84 optional	52 or 64, 84 optional
Lines Per Unit	13	12, 13, 12, 13	20, 18 or 12	20 or 14	32 or 40	40 or 32
Insert by:	line & character	character	line	line	line & character	line & character
Delete by:	line & character	character	none	none	line & character	line & character
Tabulation	none	none	format	format	see REMARKS	see 620 REMARKS
Page Roll	no	no	no	no	no	no
Split Screen	no	no	optional @ \$375	optional @ \$850	optional	optional
Format Entry	no	no	—	—	optional	optional
Interface Type	RS232B	RS232B	RS232B or parallel	RS232B or parallel	RS232B	RS232B or parallel
Duplex Mode	half	half	full	half	half & full	half & full
Bit Rate	1200	up to 2400	up to 2400	1200	110, 300, 1200, 1800, 2400	up to 47,500
TTY Substitute	no	no	no	no	no	no
2260/65					with 731 buffer on	with 731 buffer on
Substitute	no	yes	no	no	S/360	S/360
Polling	yes	yes	optional @ \$940	optional @ \$850	yes	yes
Char./Codes	96 ASCII	64 ASCII	64 ASCII, 96 optional	64 ASCII	64 ASCII	64 ASCII
Display Method	monoscope	monoscope	monoscope	monoscope	stroke	stroke
Phosphor	P31 (green)	P31 (green)	P4 (white)	P4 (white)	P4 (white)	P31 (green)
Options	—	multiplexer @ \$1160	variable start-of-transmission position @ \$0	printer adapter @ \$1700, switch @ \$5900	printer, conversational mode, multiplexer	printer, multiplexer
Purchase Price	\$10,000	\$6600	\$25,430	\$8325 (\$6400 after 11/70)	\$5500	\$6353
Monthly Lease	on request	on request	\$443 + \$50 for cable	\$164 (\$110 after 11/70)	\$180	\$192
Expansion	single unit	single unit	1 @ \$25,430, 2 @ \$28,300	single unit	single unit	1 @ \$6353, 3 @ \$11,709
Remarks	With lower case.		Expands to 4 units @ 540 chars, 8 @ 270 chars. Controller takes 1-4 clusters of units.	Video data switch for 1-8 terminals per line. 3% off without unbundled software.	Optional "fabulation" is 4 spaces to right or down. 731 buffer required for S/360 operation.	Expands to 6 units @ 512 chars, 12 @ 256 chars.

**NOTE:** Purchase prices are for standard terminal configurations (including keyboard and interface) without maintenance. Lease prices include maintenance. See text for a complete explanation of pricing.

permits all or part of a line to be erased without affecting other lines. Tables indicate those terminals which additionally provide for insertion and deletion of lines and characters within a line.

For **line insert**, all lines below the cursor move down one, leaving room for a new line to be entered. With **line delete**, the line with the cursor is erased and all lines below move up. **Character insert** and **character delete** are similar, with letters to the right of the cursor shifting to the right or left as characters are inserted or deleted. Some models, such as the Spiras Irascope, permit only

blanks to be inserted, after which **character replace** is used to enter the inserted information.

A large number of the buffered terminals provide protected and unprotected character fields (identified as **Split Screen** in the tables), which facilitate the entry of formatted data. The protected data, or format, is sent by the computer or recalled from local storage on command, and the operator enters the variable information in the blank, or unprotected, areas of the screen. The tab key places the cursor at the next unprotected character. Certain off-line data entry units, such as

TABLE 1 • ALPHANUMERIC CRT TERMINALS .....Cont'd.

Manufacturer	Spiras Systems	Stromberg Datagraphix	Sugarman Laboratories	Sycor	TEC	
<b>Model</b>	Irascope	1110	Video-T6	Key-Cassette	540/545	550/555
<b>Screen Size, In. Char./Unit Positions/Line Lines Per Unit</b>	9.5x7 1008 40 to 80 32	10x10 1030 80 35	11x9 1600 80 20	— 310 31 10	9x6.5 256 32 8	9x6.5 512 32 16
<b>Insert by: Delete by: Tabulation Page Roll Split Screen Format Entry</b>	character character optional @ \$250 no optional @ \$750 optional	character character — no yes —	character character horizontal yes yes yes	none none format no yes yes	optional line & char. optional line & char optional no optional no	optional line & char optional line & char optional no optional no
<b>Interface Type</b>	RS232B	RS232B or parallel	RS232B or loop	optional RS232B	parallel, RS232B @ \$400	parallel, RS232B @ \$400
<b>Duplex Mode Bit Rate</b>	half 1200, up to 9600 optional	— 2000 & 2400	half & full 110 to 2400	— 100 to 1200	half up to 48,500	half up to 48,500
<b>TTY Substitute 2260/65 Substitute Polling</b>	no no	no yes yes	yes optional optional	no no no	no yes yes	no yes yes
<b>Char./Codes Display Method Phosphor</b>	64 ASCII monoscope P31 (green)	64 ASCII shaped P31 (green)	64 ASCII 5x7 video white or green	62 ASCII 5x7 —	64 ASCII 3x3 stroke P4 (white), P31 optional	64 ASCII 3x3 stroke P4 (white), P31 optional
<b>Options</b>	lower case @ \$995, cassette @ \$1900, printer @ \$995	multiplexer	cassettes, printer buffer	printer, second cassette, 9-channel computer tape	printer adapter, panel display, editing @ \$425	same
<b>Purchase Price Monthly Lease</b>	\$5995 —	— —	under \$6,000 —	\$8,000 \$175	\$4,750 —	\$4,900
<b>Expansion</b>	single unit	single unit	single unit	single unit	up to 32 units	1 @ 22,257, 16 @ \$66,612
<b>Remarks</b>	Also a peripheral for SPIRAS-65 computer. Specialized versions available.	Available with programmed controller for local storage.	Transmits by char, line or block. Any letter may be black on white or versa.	Designed for off-line entry of data onto cassettes. Has ROM miniprocessor.	Line addressing available. Multistation controller is programmable.	

**NOTE:** Purchase prices are for standard terminal configurations (including keyboard and interface) without maintenance. Lease prices include maintenance. See text for a complete explanation of pricing.

those made by Hypertech, Sycor, and Viatron, also have character copy and left-zero-fill features. Most terminals with formatting permit the formats to be entered from the keyboard and most transmit only the unprotected data as the message.

Almost all teletypewriter-substitute terminals, and some others, have a **page roll** feature (also called **scroll**). If the screen is full, all lines will move up one and the top line is lost when a new line is entered at the bottom. This feature is useful for conversational mode applications, especially with dial-up time-sharing systems.

### INTERFACING

Since terminal interfacing problems were discussed in detail in Part 1 of this series, only brief descriptions of the table entries are given here. Interface type can be current-loop teletypewriter, a plug conforming to standard RS232B of the Electronic Industries Association, for serial transmission over data lines, parallel computer interface, built-in acoustic or hardwired modem, or some special type. Transmission modes are indicated in the tables as **half-duplex** (computer to

TABLE 1 • ALPHANUMERIC CRT TERMINALS .....Cont'd.

Manufacturer	TEC (Cont'd)	Ultron Systems	Univac		Viatron	
<b>Model</b>	560/565	Videomaster 7000	Uniscope 400	Uniscope 300	System 21 (2101)	System 21 (2111)
<b>Screen Size, In.</b>	9x6.5	9.5x7.5	10x5	10x5	—	—
<b>Char./Unit</b>	10000	960	480,512,960,1024	1024	320	320
<b>Positions/Line</b>	50	80, 64 optional	80,32,80,64	64	20	20
<b>Lines Per Unit</b>	20	12, 15 optional	6,16,12,16	16	16	16
<b>Insert by:</b>	optional line & char	none	line & character	line & character	none	character
<b>Delete by:</b>	optional line & char	none	line & character	line & character	none	optional character
<b>Tabulation</b>	optional	optional	horizontal	horizontal	format	format
<b>Page Roll</b>	no	no	—	yes	no	no
<b>Split Screen</b>	optional	optional	—	yes	yes (4 records)	yes (4 records)
<b>Format Entry</b>	no	—	—	—	yes	yes
<b>Interface Type</b>	parallel, RS232B @ \$400	RS232B	RS232B,CCITT, others	RS232B	RS232B	RS232B
<b>Duplex Mode</b>	half	half	—	—	half	half
<b>Bit Rate</b>	up to 48,500	1200 & 2400	up to 9600	up to 4800	600-1200	600-1200
<b>TTY Substitute</b>	no	no	no	no	no	no
<b>2260/65 Substitute</b>	yes	yes	no	no	no	no
<b>Polling</b>	yes	yes	in multiplexer	yes	no	no
<b>Char./Codes</b>	64 ASCII	64 ASCII	64 ASCII, 96 optional	64 ASCII	64 ASCII	64 ASCII
<b>Display Method</b>	3x3 stroke	5x7 video	stroke	stroke	—	—
<b>Phosphor</b>	P4 (white), P31 optional	P4 (white)	P31 (green)	P31 (green)	—	—
<b>Options</b>	same	printer, programmable concentrator, multiplexer	multiplexer for 1-31 units, 50 Hz, printer adapter	function keys with overlays	cassette @ \$184, print robot @ \$1200, computers, others	same
<b>Purchase Price</b>	\$5,150	\$4,980	\$3,655	\$15,140	\$2,498 (no cassettes)	\$2,784 (no cassettes)
<b>Monthly Lease</b>	—	\$156	\$110	\$410	\$51 (no cassettes)	\$58 (no cassettes)
<b>Expansion</b>	up to 8 units	single unit	single unit	1 @ \$15,140, 24 @ \$99,120	single unit	single unit
<b>Remarks</b>		Has line addressing.		Computer can unconditionally transmit. Expands to 48 units at 512 chars.	Designed for entry of data onto cassettes, but will function on-line.	Input & output to cassettes, reformatting & key verification provided.

**NOTE:** Purchase prices are for standard terminal configurations (including keyboard and interface) without maintenance. Lease prices include maintenance. See text for a complete explanation of pricing.

display alternates with keyboard to display and computer), **full-duplex** (computer to display simultaneous with keyboard to display and computer) and **echoplex** (computer to display simultaneous with keyboard to computer). Terminals that are teletypewriter substitutes are hardware-compatible with them and do not require reprogramming. Terminals that are IBM 2260 or 2265 substitutes will operate under OS or DOS BTAM

and QTAM without rewriting software. Polling features may be built into the terminal or multiplexers optionally available for clustering terminals in polling configurations.

**LIMITED GRAPHICS**

Certain terminals include a matrix of dots or a grid of horizontal or vertical lines, parts of which can be intensified for simple graphic presentations.

TABLE 1 • ALPHANUMERIC CRT TERMINALS ..... Cont'd.

Manufacturer	Video Systems			Wyle Computer Products		Xerox Data Systems
Model	VST/1000	VST/2000	VST/5000	600 Computerminal	800 Computerminal	7550/7555
Screen Size, In.	9x7	9x7	9x7	6x4.5	9x6	9x6.5
Char./Unit	648	1296	1296	256	1024	2048
Positions/Line	36	72	72	32	64	86
Lines Per Unit	18	18	18	8	16	32
Insert by:	none	none	none	none	none	line & character
Delete by:	none	none	none	none	none	line & character
Tabulation	none	none	none	horizontal	optional	no
Page Roll	no (page flip)	no (page flip)	no (page flip)	view 8 of 32 lines	no	yes
Split Screen	no	no	no	yes	optional	no
Format Entry	no	no	no	no	no	no
Interface Type	RS232B or loop	RS232B or loop	RS232B or loop	RS232B	RS232B	parallel, optional RS232B
Duplex Mode	half & full	half & full	half & full	full	ha'f	echo, optional half
Bit Rate	110,150,300	110,150,300,600,1200	110,150,300,600,1200	600,1200	110-2400	150 (1800 for 7555)
TTY Substitute 2260/65	yes	yes	yes	no	no	no
Substitute Polling	no	no	no	no	yes	no
	no	no	no	yes	yes	no
Char./Codes	64 ASCII	64 ASCII	64 ASCII	56 ASCII or IBM 1050	64 ASCII	96 ASCII
Display Method	video	video	video	3x3 stroke	5x7 video	monoscope
Phosphor	P4 (white)	P4 (white)	P4 (white)	P4 (white)	—	P31 (green)
Options	printer, magtape	printer, magtape, 2400 bps	printer, magtape, 2400 bps	printer driver @ \$500, function keys & lamps	printer driver, line addressing, keys & lamps	block transmit, printer adapter
Purchase Price	\$3,990	\$4,590	\$4,990	\$4,750	—	\$10,000
Monthly Lease	\$141	\$155	\$185	—	—	—
Expansion	single unit	single unit	single unit	single unit	single unit	single unit
Remarks	Buffered. One of two pages is displayed; the second appears when first is filled.	Buffered. One of two pages is displayed; the second appears when first is filled.	Buffered. One of four pages is displayed from total of 5184 retained characters. New pages appear successively as pages are filled.	1024-char memory for 32 lines storage. Semi-custom keys & lamps for 11 or more units.	Custom formatting available for units ordered in quantity.	Transmits by single chars. High-speed 7555 is \$12,500 purchase.

**NOTE:** Purchase prices are for standard terminal configurations (including keyboard and interface) without maintenance. Lease prices include maintenance. See text for a complete explanation of pricing.

These are described, with the matrix width and height, in Table 2. Displays having graphics as an option and all other units are in Table 1.

**PRICING**

All prices are for terminals with keyboard and communications interface and include those features not listed as optional. Purchase prices do not

include maintenance. Monthly lease prices are for one-year lease contracts or the minimum lease period, whichever is greater, and include maintenance. Prices shown for those terminals using a customer-supplied TV receiver for the CRT include \$100 (\$3 per month) for the TV.

Purchase prices may also be shown for multiterminal-with-single-controller configurations under "Expansion." If the one-terminal expansion price

TABLE 2 • ALPHANUMERIC CRT TERMINALS WITH LIMITED GRAPHICS

Manufacturer	Computer Communications			Computer Optics		Delta Data Systems
	Model	CC-30	CC-33	CC-36	CO:70	CO:75
Screen Size, In.	8x6.5	8x6.5	8x6.5	9.5x7.5	9.5x7.5	9x7
Char./Unit	800,960 optional	800,960 optional	800,960 optional	3000	1500	960
Positions/Line	40	40	40	100	100	40
Lines Per Unit	20,24 optional	20,24 optional	20,24 optional	30	15	24
Insert by:	none	none	none	character	character	line & character
Delete by:	none	none	none	character	character	line & character
Tabulation	none	none	none	optional	optional	none
Page Roll	no	no	no	no	no	yes
Split Screen	yes	yes	yes	yes	yes	yes
Format Entry	yes	yes	yes	yes	yes	yes
Interface Type	RS232B	RS232B	RS232B	RS232B	RS232B or parallel	RS232B or parallel
Duplex Mode	half & echo	full	half & echo	half & full	half & full	half & full
Bit Rate	up to 50,000	up to 50,000	up to 50,000	110 to 2400	110 to 2400	up to 150,000
TTY Substitute	no	yes	no	no	no	no
2260/65	see REMARKS	no	no	yes	yes	yes
Substitute	see REMARKS	no	no	yes	yes	yes
Polling	yes	no	yes	yes	yes	yes
Char./Codes	64 ASCII	64 ASCII	64 ASCII	88 ASCII	88 ASCII	64 ASCII
Display Method	5x7 video	5x7 video	5x7 video	16x18 video	16x18 video	5x7 video
Phosphor	P4 (white)	P4 (white)	P4 (white)	P31 (green)	P31 (green)	—
Graphics Grid Size	108x85 dot	108x85 dot	108x85 dot	100x30 line	100x15 line	128x64 dot
Options	light pen, printer, card reader, parallel interface	light pen, TTY, printer, card reader	light pen, impact printer @ \$10,000	transmit blocks, line insert & delete, cassettes	same	light pen, printe., lower case, cassettes
Purchase Price	\$7,670	\$8,545	\$23,900	\$8,750	\$9,825	\$5,500
Monthly Lease	\$215+\$125 installation	—	—	—	—	—
Expansion	single unit	single unit	single unit	single unit	1 @ \$9825, 8 @ \$33,200	optional
Remarks	A 2260 substitute under OS or DOS with CCAM software. Programmable cursor. TV receiver CRT.	A superset of the CC-30.	Real-time & batch unit; includes card reader & printer. CC-30 superset.	High-quality serif letters. Horiz & vert. line graphics. Lines of text are addressable.		Conversational mode. programmable cursor.

**NOTE:** Purchase prices are for standard terminal configurations (including keyboard and interface) without maintenance. Lease prices include maintenance. See text for a complete explanation of pricing.

differs from the single-terminal purchase price, both a self-contained terminal and one terminal with a multiterminal controller are available. For the maximum number of units under Expansion, the number of characters per terminal is the same as for one terminal unless otherwise indicated under "Remarks."

For more information on the CRT terminals described in this article, refer to the reader inquiry numbers listed in Table 3.

**NEXT MONTH. . . . .**  
 Part 3 of our Technology Profile  
 on Interactive CRT Display Terminals  
 will be . . . . .  
**GRAPHIC CRT TERMINALS**

**TABLE 3 • REFERENCE LITERATURE**

For more information on the CRT display terminals described in Tables 1 and 2, circle the appropriate numbers listed below on the reader inquiry card.

Company	Reader Inquiry Card Number
Alphacom Inc. (formerly Alphameric Data), Cranbury, N.J.	200
American Terminal Systems, Chatsworth, Cal. . . . .	201
Applied Digital Data Systems, Hauppauge, N.Y. . . . .	202
Atlantic Technology Corp., Somers Point, N.J. . . . .	203
Beehive Electrotech Inc., Salt Lake City, Utah . . . . .	204
The Bunker-Ramo Corp., Stamford, Conn. . . . .	205
The Bunker-Ramo Corp., Canoga Park, Cal. . . . .	206
Burroughs Corp., Detroit, Mich. . . . .	207
Computek Inc., Cambridge, Mass. . . . .	208
Computer Communications Inc., Inglewood, Cal. . . . .	209
Computer Consoles Inc., East Rochester, N.Y. . . . .	210
Computer Optics Inc., Bethel, Conn. . . . .	211

TABLE 2 • ALPHANUMERIC CRT TERMINALS WITH LIMITED GRAPHICS . . . . . Cont'd.

Manufacturer	Delta Data Systems (Cont'd)			General Electric		International Computer Terminals	Unicom
Model	Delta 1/2000	765	775	785	SPD 10/20	CT-3000	
Screen Size, In.	13x10	11x9	11x9	11x9	9.5x7	—	
Char./Unit	960	1012	1012	2024	960 or 1920	400	
Positions/Line	40	46	46	92	64	40	
Lines Per Unit	24	22	22	22	15 or 30	10 or 20	
Insert by:	line & character	—	—	—	line & character	line & character	
Delete by:	line & character	—	—	—	line & character	line & character	
Tabulation	none	horizontal	horizontal	horizontal	yes	—	
Page Roll	yes	no	no	no	yes	yes	
Split Screen	yes	no	no	no	yes	—	
Format Entry	yes	no	no	no	yes	no	
Interface Type	RS232B or parallel	RS232B	RS232B	RS232B	RS232B	RS232B	
Duplex Mode	half & full	half & full	half & full	half & full	half & full	half & full	
Bit Rate	up to 150,000	1200	2000,2400,4800	2000,2400,4800	up to 4800	—	
TTY Substitute	no	no	no	no	yes	no	
2260/65	—	—	—	—	yes	—	
Substitute	yes	no	no	no	yes	no	
Polling	yes	no	optional	optional	yes	no	
Char./Codes	64 ASCII	ASCII	ASCII	ASCII	ASCII	64 ASCII	
Display Method	5x7 video	video	video	video	7x10 video	5x7 video	
Phosphor	—	P4 (white)	P4 (white)	P4 (white)	—	—	
Graphics Grid Size	128x64 dot	46x22 line	46x22 line	92x22 line	—	—	
Options	same	function keys, party line	same plus special keyboards, printer, non-modem interface	same as 775	multiplexer, printer, paper tape reader, 2K core	polling.	
Purchase Price	—	\$6010	\$7000	\$8060	\$9000	—	
Monthly Lease	—	—	—	—	\$150 (5-year)	—	
Expansion	optional	1 @ \$6010, 2 @ \$9500	1 @ \$7000, 2 @ \$10,700	single unit	1 @ \$9000, 2 @ \$11,390	single unit	
Remarks	Multicolor CRT. One to 7 colors selected from console or computer.	Party line permits any one of 8 displays to access controller.			Contains 1K, 16-bit minicomputer. Programmable to emulate any terminal. Large quantity discounts.	Preliminary data.	

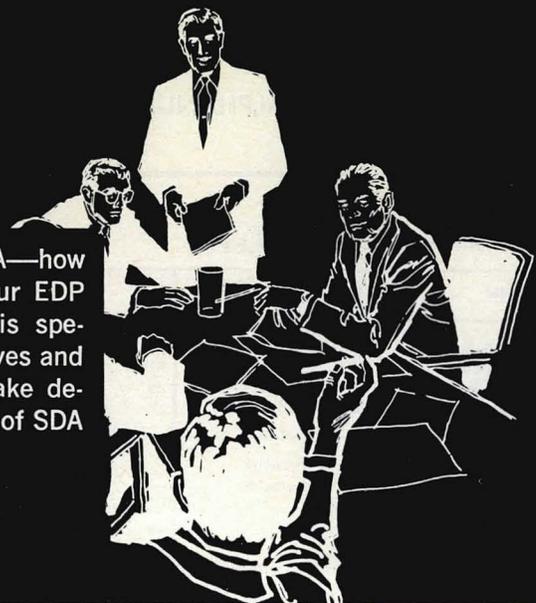
**NOTE:** Purchase prices are for standard terminal configurations (including keyboard and interface) without maintenance. Lease prices include maintenance. See text for a complete explanation of pricing.

Computer Terminal Corp., San Antonio, Texas . . . . .	212	Mark Computer Systems Inc., Plainview, N.Y. . . . .	230
Computer Transceiver Systems Inc., Paramus, N.J. . . . .	213	Megadata Computer and Commu. Corp., Deer Park, N.Y. . . . .	231
Conrac Corp., Covina, Cal. . . . .	214	The National Cash Register Co., Dayton, Ohio . . . . .	232
Control Data Corp., Minneapolis, Minn. . . . .	215	Photophysics Data Systems, Mountain View, Cal. . . . .	233
Courier Terminal Systems Inc., Phoenix, Ariz. . . . .	216	Raytheon Co., Norwood, Mass. . . . .	234
Data 100 Corp., Minneapolis, Minn. . . . .	217	RCA Computer Systems, Cherry Hill, N.J. . . . .	235
Delta Data Systems Inc., Cornwall Heights, Pa. . . . .	218	Sanders Associates Inc., Nashua, N.H. . . . .	236
Digital Scientific Corp., San Diego, Cal. . . . .	219	Spiras Systems Inc., Waltham, Mass. . . . .	237
Foto-Mem Inc., Natick, Mass. . . . .	220	Stromberg DatagraphiX Inc., San Diego, Cal. . . . .	238
General Electric Co., Oklahoma City, Okla. . . . .	221	Sugarman Laboratories Inc., Great Neck, N.Y. . . . .	239
Hazeltine Corp., Little Neck, N.Y. . . . .	222	Sycor Inc., Ann Arbor, Mich. . . . .	240
Honeywell Inc., Wellesley Hills, Mass. . . . .	223	TEC Inc. (formerly Transistor Electronics), Eden Prairie, Minn. . . . .	241
Hypertech Corp., Harwood Heights, Ill. . . . .	224	Ultrinsic Systems Corp., Moorestown, N.J. . . . .	242
Infoton Inc., Burlington, Mass. . . . .	225	Unicom Inc., Fairfield, N.J. . . . .	243
International Business Machines Corp., White Plains, N.Y. . . . .	226	Univac (Sperry Rand Corp.), Philadelphia, Pa. . . . .	244
International Computer Terminals Corp., Framingham, Mass. . . . .	227	Viatron Computer Systems Corp., Bedford, Mass. . . . .	245
International Telephone and Telegraph Corp., East Rutherford, N.J. . . . .	228	Video Systems Corp., Pennsauken, N.J. . . . .	246
Logitron Inc., Cambridge, Mass. . . . .	229	Wyle Computer Products, El Segundo, Cal. . . . .	247
		Xerox Data Systems, El Segundo, Cal. . . . .	248

# SOURCE DATA AUTOMATION

A two-day seminar sponsored by Faim Information Services, Inc. and MODERN DATA.

The basic concepts of SDA—how they can be applied to your EDP operations—this seminar is specifically directed to executives and managers who have to make decisions on the applicability of SDA to their EDP operations.



## SEMINAR OUTLINE

### Introduction To Source Data Automation

Fundamental principles of the Source Data Automation design concept: definition of terms; basic purpose; design philosophy; interface with the EDP system; benefits; how it can fit into your system.

### Source Data Automation State-of-the-Art

A discussion of the various types of SDA equipments available, their characteristics, manufacturers, their strong and weak application areas. Types of devices to be described will be:

Optical Character Readers  
Mark Sense Readers  
Bar Code Readers  
Remote Scanners  
Magnetic Readers

Keyboard-To-Tape Devices  
Portable Data Recorders  
Alphanumeric Display Terminals  
Touch-Tone Telephone

### Economics Of Source Data Automation

A quantitative comparison of various Source Data Automation devices considering total system costs, volume of data, error rates, operating factors and various data preparation complexities. Specific breakeven points will be presented graphically.

### Decision-Making Criteria In Source Data Automation

Description of factors that need to be considered in SDA device selection; a quantitative methodology for SDA selection given with specific examples.

### Implementing And Operations On SDA System

Description of actual SDA application in which problems and solutions in operating an SDA system will be discussed.

### Trend Analysis Of Source Data Automation

A discussion as to the SDA State-of-the-Art technology for the 1970's including technical breakthroughs, equipment marketing, and application areas.

## SDA STATE-OF-THE-ART REPORT

Included with the seminar will be a newly-published Source Data Automation State-of-the-Art report describing present commercially-available SDA equipment and their characteristics. The text will cover the topics discussed at the seminar in full descriptive form and contain SDA equipment comparisons in terms of performance and cost. Included in the price is a one year updating of report so as to include newly-announced equipment. Updating frequency will be at least quarterly or sooner depending upon SDA equipment news.

## INSTRUCTORS & SPEAKERS

### Lawrence Feidelman, Director & Principal Instructor

The seminar will be under the personal direction of Mr. Lawrence Feidelman, who is a noted authority in the Source Data Automation field. He has performed Source Data Automation studies for the government as well as industry. He has written numerous articles and lectured on the Source Data Automation field. He is a frequent lecturer for the American Management Association, has lectured on SDA for American University and various professional societies. He is presently Assistant Vice President and Manager of the Cherry Hill office of FAIM Information Services, Inc. He received his B.A. degree from New York University and his M.S. degree in Computer Information Science from the University of Pennsylvania.

### Bennett Landsman, Instructor

Mr. Landsman, a senior systems analyst with Faim, has recently completed a Source Data Automation study for the Department of Agriculture and an equipment Source Data Automation design analysis for a data processing company. He is a major contributor to the Faim SDA State-Of-The-Art report.

## REGISTRATION

Registration for the seminar, including the SDA State-of-the-Art Report with a one year equipment updating, is \$210. Checks should be made payable to Faim Information Services, Inc. and forwarded with the registration coupon below. Your registration will be acknowledged by return mail.

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<input type="checkbox"/> New York City	June 16 & 17	Warwick Hotel	
<input type="checkbox"/> Boston	July 14 & 15	Hotel Sonesta	
Hours: 9 A.M.-5 P.M.			
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Important Note: There will be a late cancellation fee of \$25.00 if cancellation notice is not received at least one week prior to start of seminar.			



## To make life easy for these input devices we designed a new 360-compatible terminal.

Fingers are error prone.

So we designed a terminal keyboard that's not. With the keys in the right places to make it easy to use.

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74 square inches of viewing area with a 64 alphanumeric character repertoire. Full edit control. Complete compatibility with IBM 360's without software change. Can be interfaced with other systems, too. Format and hard copy options. Full, easy-to-use alphanumeric keyboard. Multi-drop capability.

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There are some 6,000 video terminals on-line right now. And we use them ourselves in our own worldwide data network. So there's lots of on-line experience behind the design and development of the Videomaster 7000.

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At Ultronic we have the hardware and hard experience to give you a complete data communication system from video terminals to FDM, TDM, modems and front-end controllers. We understand systems because we have one of the world's largest. We'll be happy to help get yours on line.

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CIRCLE NO. 43 ON INQUIRY CARD



## NEW PRODUCTS

### PRINTOUT CABINETS

Modular units for the compact lateral suspension of frequently referred-to EDP records in nylon post binders may be placed on desk or counter tops, or may be stacked one on top of another. They may also be placed side by side or back to back. Nylon post binders can be quickly fitted with T-bars and slid into the movable hanger tracks under the top of each unit. Binders can be added, removed, or replaced from any position. The units are priced at about \$65 per unit. *U.S. Tabulating Binder Corp., Niles, Ill.*

Circle No. 289 on Inquiry Card.

### TAPE TRANSPORTS

A line of continuous transports with limited electronics includes the Series 0700, with 7" reels, the Series 0800, with 8- $\frac{1}{2}$ " reels, and the Series 1000, with 10- $\frac{1}{2}$ " reels. All models are presently available in both 7- and 9-track. The 7-track is offered with selectable densities of 200 bpi, 556 bpi, and 800 bpi; the 9-track with 800 bpi. Both models are available with read/write or read-after-write heads. Tape speeds up to 37- $\frac{1}{2}$  ips are available. Features include 180 degree wrap-around capstan, mechanical read azimuth adjustment, electronic write head deskewing, tape cleaner, solenoid-operated file protect, optical compliance arm-sensors, reel motor failsafe brakes, and the use of proprietary design capstan and reel motors. Single quantity prices for the Series 0700 are \$2750 for the Model 0707-1 7-track, or Model 0709-1 9-track read/write; and \$3500 for the Model 0707-2, or 0709-2 read-after-write. *Cipher Data Products, Inc., San Diego, Cal.*

Circle No. 284 on Inquiry Card

### REGISTER-RECORDER

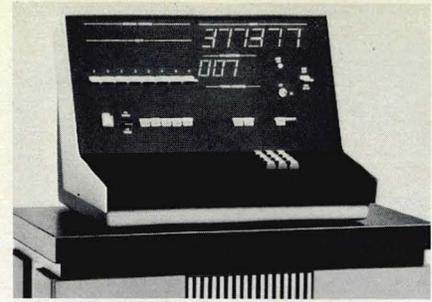
The SPICE register-recorder performs functions similar to those of a conventional cash register except that the system components automatically lead the sales clerk through its operation by a series of sequential lights, thereby facilitating the input of sales and inventory data for transmission to a computer normally located at a time-sharing center. The computer verifies that all entries of the item number by the sales clerk are valid. All required computations, such as price, extensions, sales taxes, totals, and change are performed automatically through the system. Information transmitted to the computer by the register-recorder is stored on magnetic tape which is converted by a communications controller, and then fed into the retailer's central computer system. *Alpex Computer Corp., Danbury, Conn.*

Circle No. 282 on Inquiry Card.

### REMOTE OCR SYSTEM

A compact optical character recognition system for office installation, Unit ROCR System/70 is an extension of Cognitronics Remote Optical Character Recognition (ROCR) operations, and utilizes the same components currently employed in the company's commercial ROCR service centers. ROCR System/70 can process up to 1800 documents per hour in-house or from remote scanners. It consists of the standard Cognitronics remote desk-top scanner with automatic feed, a display console and keyboard, and a central processing unit in one desk-sized package. A magnetic tape unit is also available. *Cognitronics Corp., ROCR Div., New York, N.Y.*

Circle No. 285 on Inquiry Card.



### BUSINESS MINI

The Atron 501 "Datamanager", unlike conventional minis, is strictly a business-minded computer for manipulating volumes of data in addition to normal business calculations. Data editing operations, such as MOVE ITEM and LEFT JUSTIFY which can take 30 or more instructions in most large or small processors, require only one instruction. The processor is specifically designed to handle data in strings as well as single characters. This advantage allows the user to operate on volumes of data with each instruction. The basic machine sells for less than \$6,000 in quantity and includes four high-speed buffered I/O channels with full buffer address control into available direct memory access ports. To complement the 501, Atron also supplies high- and medium-speed card readers and printers, magnetic tape drives, fixed head disk systems, and TTY and communications subsystems. The Datamanager is available in a stand-alone cabinet, rack-mounted, or packaged to customer specifications. *Atron Corp., St. Paul, Minn.*

Circle No. 277 on Inquiry Card.

### TAPE AND CARD FOLDER

Up to 35 data processing cards and program sheets or up to 20 feet of perforated tape with its program sheet are accommodated in a new folder. The folders are made with both right and left hand pockets and are made of heavy Kraft stock. A diagonal cut on the opposite side makes identification of contents easier. Prices are \$12.30 per hundred in 100 lots up to 500, and \$11.00 per hundred in lots over 500. *Econ-100, Minneapolis, Minn.*

Circle No. 307 on Inquiry Card.



## The Established Standard of Excellence In Digital Cassette Recording

**For \$285 in OEM Quantities**

Two and a half years ago, International Computer Products, Inc., began development of Philips-type magnetic tape cassette recording devices for digital applications. Tests quickly demonstrated that audio tape drives were not built for the rigorous, precise demands of digital recording. So ICP engineers designed a drive system specifically for digital use—the DigiDeck. It demands evaluation by any manufacturer contemplating a digital cassette recorder in his system. Here's why:

- Read/write speed is 500 characters a second.
- Two independent read/write channels effectively doubles

capacity or enables redundant recordings.

- Servo-controlled spindle speed eliminates the need for capstan or pinchroller and results in less wear on the cassette and recording head. Since the tape touches only the head, greater tape life and reliability is assured.
- Motor speed control electronics is bidirectional and adjustable to fit most applications.
- Read/write electronics and EOT/BOT sensing are included.
- All these features are standard in this compact (5 in. h. x 4 in. w. x 7 in. d.) package that weighs about two pounds.
- Delivery is 30 days ARO.

*Available now with  
Read After Write option.*

The DigiDeck is a subsystem of these other ICP products:

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**KeyCerte:** Key-to-tape system for direct incremental recording on cassettes.

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Reading, Mass. 01867  
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## NEW PRODUCTS

### MINI-DISKS

Two economy-line disk memories, the 7102 and 7102E, are minimum capacity models featuring a 17-msec. average access time to 560K bits of storage, and read/write and track selection electronics. The 7102E is priced at \$2700 in unit quantities and is packaged without rack-mounting hardware or power supply. The 7102 Model provides rack-mounting hardware and a compatible power supply for an additional \$500. *Data Disc Inc., Palo Alto, Cal.*

Circle No. 301 on Inquiry Card.

### DISK CONTROLLERS

Information Data Systems has announced two models of its 5000 Series disk memory system controllers, one for use with the Interdata Model 3, and one for the Data General Nova. The controller systems utilize IDS's standard 7000 Series disk memory units, which offer capacities up to 2.4 megabits with an average access time of 16.5 msec. *IDS, Inc., Detroit, Mich.*

Circle No. 313 on Inquiry Card.



### DISPLAY TERMINALS

The CO:70 communications terminal display system features a 3,000-character upper- and lower-case alphanumeric presentation plus complete editing capabilities. Additional features include: an 88-character ASCII set, and protected formatting. *Computer Optics, Bethel, Conn.*

Circle No. 297 on Inquiry Card.

### CARD READER

The C600 Series of 600 cpm 80-column card readers includes a table model and a rack-mounted unit. Protective features include: feed stop and operator attention lights for "output hopper full," "output hopper empty," and "three successive pick failures;" a motor shutdown on card jam; and a front cover interlock switch. Input hopper capacity is 900 cards and the output hopper capacity is 1,000 cards. Unloading on-the-fly is always permissible and loading on-the-fly is permissible as long as there are 200 or more cards in the input hopper. The C600 units read data column by column. *Peripheral Dynamics, Philadelphia, Pa.*

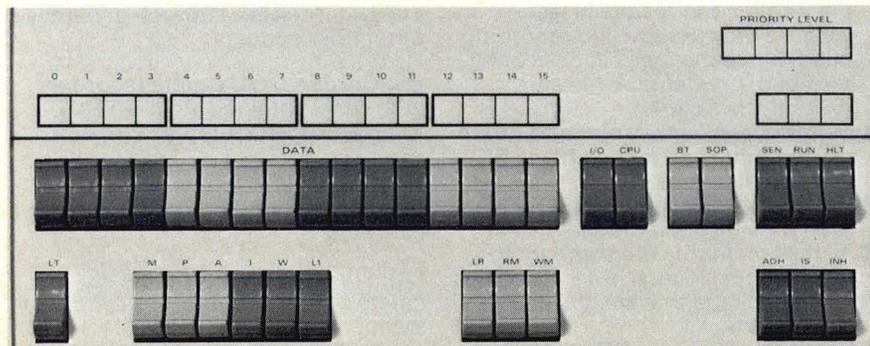
Circle No. 316 on Inquiry Card.



### TAPE CONVERTER

The Digi-Data "System 31" provides a means for converting computer-compatible magnetic tape to IBM MTST or Model 50 tape. A code conversion option is available to convert from computer code to MTST code. The system is a fully off-line unit—not wired to the computer or the MTST. A full 24,000-character cartridge is written in four minutes. Typical applications are: transferring master name and address information from the computer for special letters, transferring computer-sorted information to MTST tape for typewriter printing, and as a return unit for MTST information processed in the computer. *Digi-Data Corp., Bladensburg, Md.*

Circle No. 303 on Inquiry Card.



### NEW MINI

Lockheed's latest mini, the MAC Jr., retains most of the features of the company's earlier MAC 16 and is compatible with the 16's peripheral devices and most of its software. The MAC Jr. is priced under \$8,000 in its basic 4K con-

figuration with 4 hardware priority interrupts and integral power supply. The MAC Jr. is also available with a maximum of 8K 16-bit words of 1 usec. memory and 16 hardware priority interrupts. *Data Products Div. of Lockheed Electronics Co., Los Angeles, Cal.*

Circle No. 275 on Inquiry Card.

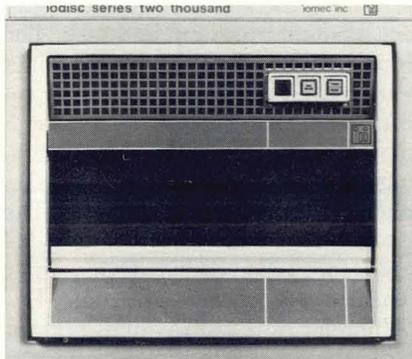
### MINI-DRUM MEMORIES

A line of mini-drum memories for small computers features head-per-track design. Prices start at \$1500, which includes 8 data tracks, 2 clock tracks, and all read-write electronics packaged on a drum assembly of 9 cubic inches. Data storage capacities range from 131K to 5 million bits. *California Peripherals Div. of Datum, Inc., Anaheim, Cal.*

Circle No. 279 on Inquiry Card.

## FIVE NEW DISK SYSTEMS

Iomec, Inc.'s new Iodisc Series 2000 memory systems range in capacity from 24 to 96 million bits and use either removable disk cartridges or combinations of removable cartridges and fixed disks. Iodisc 2011, smallest of the new units, has a capacity of 24 megabits on one removable disk cartridge operating on one drive. Iodisc 2012, shown, has 48-megabit capacity on one removable cartridge and one fixed disk operating on one drive. Iodisc 2023 goes up to 72 megabits on two removable cartridges and one fixed disk operating on two drives. Iodisc 2024, largest of the new systems, has 96-megabit capacity on two removable cartridges and two fixed disks operating on two drives. *Iomec Inc., Santa Clara, Cal.*



disc 2012, shown, has 48-megabit capacity on one removable cartridge and one fixed disk operating on one drive. Iodisc 2023 goes up to 72 megabits on two removable cartridges and one fixed disk operating on two drives. Iodisc 2024, largest of the new systems, has 96-megabit capacity on two removable cartridges and two fixed disks operating on two drives. *Iomec Inc., Santa Clara, Cal.*

Circle No. 293 on Inquiry Card.



## DESK-TOP LINEPRINTERS

The first models of a new family of low-cost, impact line printers are desk-top models designed to handle a wide range of printing requirements. The units incorporate a character belt mechanism with individual characters which snap on and off the belt, allowing special characters or special codes to be easily accommodated. The



## TAPE CERTIFIER FOR USER MARKET

The Kybe Model TMS-200 (for Tape Management System) is said to be the first computer magnetic tape certifier designed and priced for the computer user instead of

the tape manufacturer. The TMS-200 performs all basic functions of currently-available tape certifiers at considerably less cost. Purchase prices range from \$13,500 for a certifier configured for 7-channel, 800-bpi tape — to \$19,500 for a certifier configured for 7- and 9-channel, 800-bpi and 3200-fci tape formats. The units rent under a one-year contract for from \$540 a month to \$770 a month. The TMS-200 counts and charts errors on magnetic tape, has a start-stop function which allows for manual correction of errors, and automatically cleans the tape prior to the test run. *Kybe Corp., Waltham, Mass.*

Circle No. 318 on Inquiry Card.

## SCAN CONVERTER

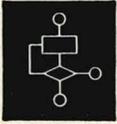
The Execuport 220 TV scan converter displays the input/output of a data transceiver on any conventional TV set. The unit is compatible with CTSI's portable, high-speed thermal page-printing data transceiver, the Execuport 300, and displays 40 characters per line on 20 lines. Additional features include page roll capability and a cursor. Unit price is about \$1,500. *Computer Transceiver Systems, Inc., Teaneck, N.J.*

Circle No. 302 on Inquiry Card.

## DISTRIBUTED TERMINAL

The APT-1000 office computer/computer terminal from Fedder Data Centers is designed to be linked with Fedder's own large-scale processing centers. It can, however, also function as a stand-alone unit for input preparation, output printing, verification, totaling, editing, and formatting. The APT-1000 features a standard typewriter keyboard, a separate set of numerical keys in the familiar 10-key format, and a 30 cps printing unit. When used with Fedder's Data Centers, the APT-1000 will enable Fedder customers to accumulate data and transactions during the normal daily business hours without the need for the central computer. Each night, the APT-1000 will automatically interchange the data with Fedder's IBM 360s. Later, the same evening, the computer "calls" the APT-1000 and transmits a summary report of the data received earlier. The standard APT-1000 will automatically inter-tape cassette drives with a total on-line capacity of 250,000 characters and two levels of memory for programs and data. Optional features include punched card readers and punches, paper tape readers and punches, 7- or 9-track magnetic tape units, line printers, and random access storage devices. *Fedder Data Centers, Inc., Baltimore, Md.*

Circle No. 283 on Inquiry Card.



## NEW SOFTWARE AND SERVICES

### SOFTWARE BUILDING SYSTEM

AED, a system for building machine-independent, modular software systems, is said to embody a new and fundamental advance in software technology — one that makes it possible to configure software to a customer's specifications, as hardware has been for years, by assembling completely developed and thoroughly tested modular components, and connecting them into an integrated system. The AED System consists of a high-level, general-purpose language with special features for system programming, and a teachable engineering discipline to guide its proper usage; a library of fully-debugged "off-the-shelf" software components that are incorporated directly into the system being built; and high-level system-generating systems for producing made-to-order components as well as for assembling, modifying, and testing the system. AED-built systems are said to operate on any-generation hardware, and application programs can operate on small or even mini-computers. *SofTech, Inc., Waltham, Mass.*

Circle No. 354 on Inquiry Card.

### EXEC 8 ANSI COBOL

A Cobol compiler to run under Univac's EXEC 8 operating system conforms with American National Standards Institute (ANSI) standards, and operates in the sign-over-punch mode. It includes indexed sequential file access capabilities as direct Cobol verbs. Univac is also developing conversion aids which convert from competitive data formats to Univac data formats, and from competitive source code to Univac ANSI source code. *Univac Div. of Sperry Rand, Philadelphia, Pa.*

Circle No. 351 on Inquiry Card.

### BACK-OFFICE PACKAGES

A group of computer programs is designed to help brokerage houses solve back-office paperwork problems. Called Brokerage Accounting System Elements (BASE), the programs enable an IBM S/360 to calculate the effect of security trading on most key areas of brokerage house activities. BASE can generate up to 75 reports that reflect the status of purchases, sales, stock records, dividends, transfers, customer statements, and "fails". The packages can be used with any S/360 Model 30 or larger having at least 64,000 bytes of core storage and operating under DOS. BASE is scheduled to be available under a license agreement in the second quarter of 1971 at a monthly charge of \$800. *IBM Data Processing Div., White Plains, N.Y.*

Circle No. 347 on Inquiry Card.

### FORTRAN UTILITY SYSTEM

A FORTRAN Utility System called "FUS" automatically debugs, times, and checks out FORTRAN programs on batch or time-sharing computers. The first part of FUS is called FADS, for Fortran Automatic Debugging System. FADS is a comprehensive symbolic display system that offers programmers the ability to examine in detail the computational flow of FORTRAN source code at all desired points of interest. The second part of FUS is called FATS, for Fortran Automatic Timing System. FATS automatically times desired subroutines and displays a complete CPU report. FACS, for FORTRAN Automatic Checkout System is the third part of FUS. FACS automatically displays all source statements not used during execution. FUS now operates on IBM and Univac computers. *Digital Solutions Inc., Edison, N.J.*

Circle No. 345 on Inquiry Card.

### PROJECT REPORTING SYSTEM

TARGET is a proprietary package designed to help management optimize the use of existing manpower. The TARGET system has six levels of reporting and provides the capability to control the activities of analysts and programmers in a data processing installation. The system includes current time and cost data, and critical status and summary information of each project, system, program, and task. The reports also include programmer and analyst backlog and history information. An analyst worksheet is generated weekly, thus documenting the effort expended and remaining on a given project. The package uses 44K and is now available for IBM S/360 DOS users. The three-year lease price of \$4,500 includes user's manuals and installation assistance. *Computer Business Consultants, Chicago, Ill.*

Circle No. 339 on Inquiry Card.

### SYSTEM MANAGEMENT FOR OS/360

SYSMAC provides a set of tools for managing S/360 in a multiprogrammed environment. It Monitors, Accounts, and Controls the major computer activities under OS/MVT. A 600 to 4,000 byte region contains OS/MVT interface programs which record the computer resources used for each job. This includes CPU time, accountable core time, core size, number of job steps, terminal connect time, number of tape and disk mounts, number of cards read and punched, and the number of lines printed. This data is used to develop the logical billing for each job as if it were running in the computer by itself. All collected data is logged by time of day and may be used by the installation to develop computer utilization analyses. A package of seven application programs produce four monthly reports designed for the computer center, the computer user, financial management, and general corporate management. Prices start at \$4,900. *Hygain Technologies, Inc., Westport, Conn.*

Circle No. 344 on Inquiry Card.

## COMMERCIAL PAPER SYSTEM

A commercial paper system to reduce the borrowing costs of subscribers is designed for firms with a high volume and high turnover of borrowing for finance operations. The program can be substituted for either manual or for older computer-based programs. It allows regular monitoring of weighted costs of individual loans of equal face value but differing maturities; balancing cash positions between bank accounts; and locating idle cash to reduce need for borrowings. Cash requirements can be projected on a day to day basis, thus permitting borrowings to be concentrated on low-cost, unsecured one-to-five-day notes. The program is available on a custom-designed basis or through the developer's time-sharing service. *Allis-Chalmers, Milwaukee, Wisc.* Circle No. 337 on Inquiry Card.

## COMMUNICATION SYSTEM

OSCAP (Operating System Communication Application Program) is designed to give the user a complete message switching capability in an OS/360 multi-programming environment. OSCAP provides all the classical message switching functions including message retrieval; header analysis and formatting including time and date stamping, and sequence numbering; and disk queuing and intercept. Messages, which can be of any length, may be routed to multiple or alternate destinations. Any user-designated terminal can act as supervisor and broadcast messages and inquire of the system. Network statistics are kept for printed reports and off-line billing routines. The system operates under OS/360 MFT or MVT without any modifications, and requires one pack of an IBM 2311 or 2314. Core requirements are dependent upon the network size, but typically a 20-line system containing 50 terminals would require a 40K-byte partition. OSCAP may be purchased for \$40,000 or leased for \$1,500 per month. *Complex Systems Inc., New York, N.Y.*

Circle No. 338 on Inquiry Card.

# Hardwire or Acoustical

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Whether your needs are for a hardwire coupler to connect directly to a standard telephone line (through a Data Access Arrangement) or for an acoustical connection, the new RFL Model 13AO/TTY is your best bet. It does both, and it's a *simple* transition from hardwire to acoustical.

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compact unit (5"x4"x12") which operates over 2 or 4 wire circuits up to 300 bits per second, full or half-duplex. Unlike other couplers, it has built-in transmit and receive filters, to assure optimum operating performance.

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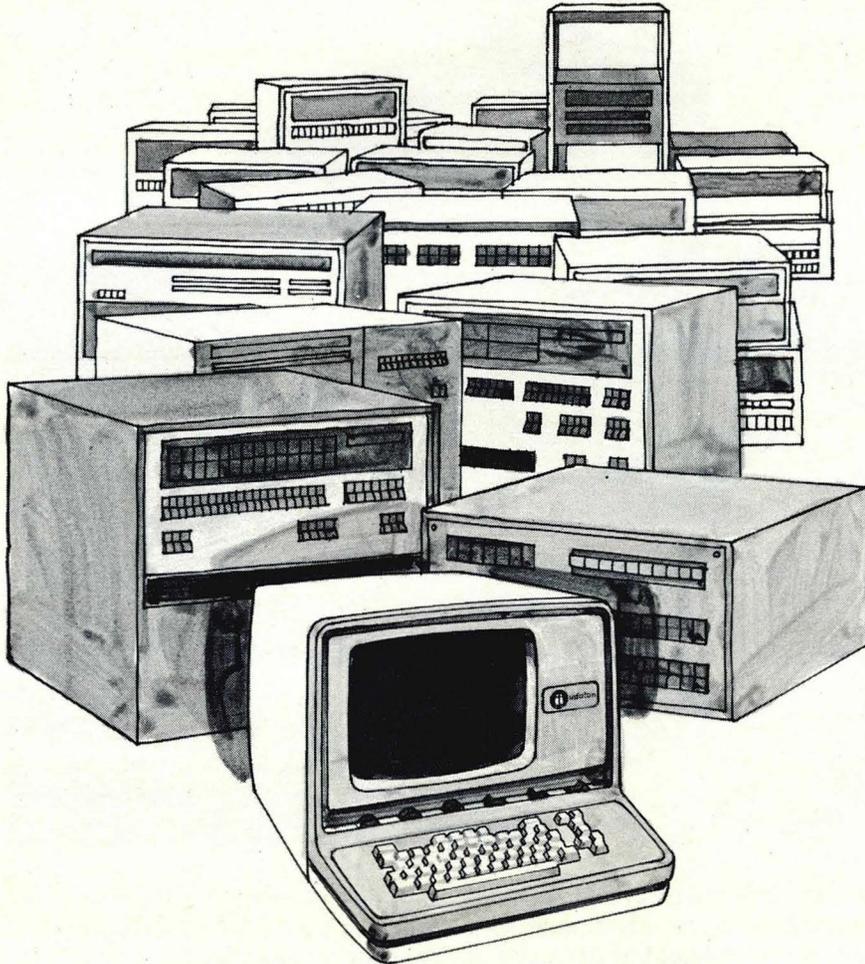
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**CLOTHING INDUSTRY PACKAGE**

MIRG, for Manufacturers' Internal Report Generator, is said to be the first control system dedicated to the special requirements of the ready-to-wear clothing industry. The goal of this system, to be of-

ferred on a service basis, is to provide manufacturers with reports and analyses of sales, production, and inventory, while handling garment ticketing, shipping, and billing. *Systems Interaction Corp., New York, N.Y.*

Circle No. 355 on Inquiry Card.



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**SOFTWARE MONITOR**

SUPERMON, written in Assembler F (or G) level, is an MVT Software Monitor which enables the OS/360 MVT user to monitor hardware and software performance over a given period of time. A series of reports is produced which aid in the identification of areas of low utilization and performance bottlenecks. There is a series of up to eleven reports, followed by a page which summarizes both these reports and the run itself. Monitoring is performed by counting various events and using a sampling technique. The program consists of 3,000 cards and is available for \$310.00. *COSMIC, Athens, Ga.*

Circle No. 342 on Inquiry Card.

**SORTING SUB-PROGRAM**

UNISORT is an assembly language sub-program which calls OS/360 Cobol sort routines with a sort area size specified by the calling program. UNISORT also makes it possible to perform a sort within a level E Cobol program; allows CALLS to other subroutines from sort input and output procedures; and can itself be called by Fortran, PL I, or assembly language programs. UNISORT is available with source and object decks, and with programming and installation instructions for \$350. *United Computing Corp., Carson, Cal.*

Circle No. 350 on Inquiry Card.

**DIGITAL FILTER PROGRAM**

A new digital-filter program for designing a wide choice of digital filter types (Chebyshev, elliptic, Gaussian, etc.) also allows for user-specified transfer functions. Filters can be of the lowpass, bandpass, bandstop, or highpass types. The program calculates digital filter coefficients in both decimal and binary form, and gives the locations of the poles and zeros of the desired filter function. It also prints and plots the frequency and time response characteristics for complete filter design and analysis. *Technology Service Corp., Santa Monica, Cal.*

Circle No. 349 on Inquiry Card.



## NEW LITERATURE

### TEXTBOOK SERIES

IBM and Addison-Wesley's new "Systems Programming Series" of texts for primary and advanced systems professionals are described in this 12-page brochure. Topics covered include a profile of the reader audience, the subject matter of the various books in the series, and a statement of aims and objectives. *Addison-Wesley Publishing Co., Reading, Mass.*

Circle No. 433 on Inquiry Card.

### COMPUTER SUPPLIES CATALOG

Sixteen-page catalog presents the entire line of pressure-sensitive EDP supplies manufactured by the W.H. Brady Co.'s Computer Supplies Div. Included are descriptions of tab labels produced on continuous fan-folded, pin-feed, liner-carriers; keypunch correction seals; latch leaders and connectors for reel-to-reel hook-up of magnetic tape; splices for punched tape paper; seals for correcting MICR bank checks; and self-sticking magnetic tape markers. *W.H. Brady Co., Milwaukee, Wis.*

Circle No. 434 on Inquiry Card.

### SUPPLIES CATALOG

A new supplies catalog lists over three hundred rolled and folded paper products for data communications and business machines, and a complete line of perforated tape handlers. *Paper Manufacturers Co., Philadelphia, Pa.*

Circle No. 426 on Inquiry Card.

### RETAIL STORE OPERATIONS

Specialized services for computer-based control of retail store operations are described in a four-page brochure titled "Retail EDP Systems: For Retailers Who Would Rather Be In The Retail Business Than The Computer Business." The brochure details the application systems available to the industry. *Scientific Resources Corp., Retail Services Operation, Montgomeryville, Pa.*

Circle No. 416 on Inquiry Card.

### 3-D PLOTTERS

A series of applications memos from Spatial Data Systems, Inc. describe some of the uses of their three-dimensional digital plotting systems. These console-type systems produce 11" x 17" plots by means of a series of vertical wires firmly fixed into lightweight, removable plotting boards which become permanent, removable hard-copy records. Plots are visible from any angle, displaying mathematical functions or empirical data involving any three variables. *Spatial Data Systems, Inc., Goleta, Cal.*

Circle No. 417 on Inquiry Card.

### PORTABLE TERMINAL

A six-page brochure describes the PortaCom, an ASCII keyboard which weighs less than 30 pounds and is hand-carried in its own attache case. *Data Products Corp., Systems Div., Woodland Hills, Cal.*

Circle No. 413 on Inquiry Card.

### MAG TAPE UNIT & CONTROLLER

Specification sheet on the Daedalus Model 119 tape unit & controller describes the IBM-compatible unit's manual controls and indicators, error conditions recognized by the controller, and complete operating parameters. The Model 119 is available as an optional accessory to the Daedalus 711 Programmable Data Terminal and interfaces directly with the terminal's built-in universal I/O. *Daedalus Computer Products, Inc., North Syracuse, N.Y.*

Circle No. 408 on Inquiry Card.

### CAPABILITIES BROCHURE

Brochure describes Computer System Architects Inc.'s consulting services for developers of computer-related products. The brochure contains sections on nature of services, business methods, and corporate make-up. *Computer System Architects Inc., Cambridge, Mass.*

Circle No. 406 on Inquiry Card.

### DOCUMENTATION SYSTEM

A twelve-page brochure describes DOCUMATIC, an automatic documentation system for programs written in IBM S/360 RPG. *Data Usage Corp., Ft. Lee, N.J.*

Circle No. 415 on Inquiry Card.

### MINICOMPUTER PROGRAMMING

The P-2000 Fundamental Executive, P-2000 Programmer's Console Program, and the P-2000 Formatter for use with Westinghouse Electric's Prodac 2000 Series of computing control systems are described in three illustrated bulletins. The 16-page bulletin on the Fundamental Executive describes in detail the software system of the Prodac 2000. The four-page bulletin on the P-2000 Programmer's Console Program describes operation of minimum and basic programmer's console configurations. The P-2000 Formatter is a set of Fortran routines in the P-2000 program library. *Westinghouse Electric Corp., Hagan/Computer Systems Div., Pittsburgh, Pa.*

Circle No. 401 on Inquiry Card.

### GLASS MEMORY MODULES

Four-page illustrated application note describes the use of glass digital memory modules in high-speed buffers for computer terminals and other data transmission systems. *Electronic Products Div. of Corning Glass Works, Corning, N.Y.*

Circle No. 407 on Inquiry Card.

### FACSIMILE TRANSMISSION

A 12-page brochure describes facsimile transmission of priority documents, graphs, charts, and photographs. *Facsimile Communications Industries, Inc., New York, N.Y.*

Circle No. 428 on Inquiry Card.

### COBOL PROGRAM GENERATOR

A new booklet describes improved and additional capabilities in the SCORE III Cobol Program Generator, a reporting and file management system. *Atlantic Software Inc., Philadelphia, Pa.*

Circle No. 432 on Inquiry Card.

## NEW LITERATURE

### CASH MANAGEMENT PROGRAM

"Accounts Payable/Cash Management" is the title and subject of a 6-page foldout brochure which describes a comprehensive, modular Cobol system consisting of eight processing programs. The system uses two main files: the master file, and the monthly cost distribution is a month-to-date file of costs categorized by a flexible five-level, 19-digit, cost distribution. *URS Data Sciences Co., San Mateo, Cal.*

Circle No. 418 on Inquiry Card.

### REDCOR CONVERSION MODULES

The latest issue of the Redcor Conversion Module short form catalog contains updated specifications on all of Redcor's user-oriented conversion modules. This line includes the spread of individual circuits needed to construct a wide variety of multiplexers, analog-to-digital converters, DACs, simultaneous sample and holds, data distributors, and other data handling functions similar to this class of products. *Redcor Corporation, Woodland Hills, Cal.*

Circle No. 404 on Inquiry Card.

### DEC'S FOCAL

A 32-page softcover pamphlet entitled FOCAL describes Digital Equipment Corp.'s conversational language for a variety of engineering applicants. The pamphlet explains in simplified terms how the PDP-8/L and PDP-8/I small computers are programmed to solve such problems as square roots, sinusoidal expressions, and series evaluation. *Digital Equipment Corp., Maynard, Mass.*

Circle No. 429 on Inquiry Card.

### VENTURE FINANCING GUIDE

Twelve-page brochure entitled "A Guide to Venture Capital Financing" has been prepared to assist new and aspiring entrepreneurs in their efforts to raise capital and finance their new ventures. *American Science Associates, New York, N.Y.*

Circle No. 431 on Inquiry Card.

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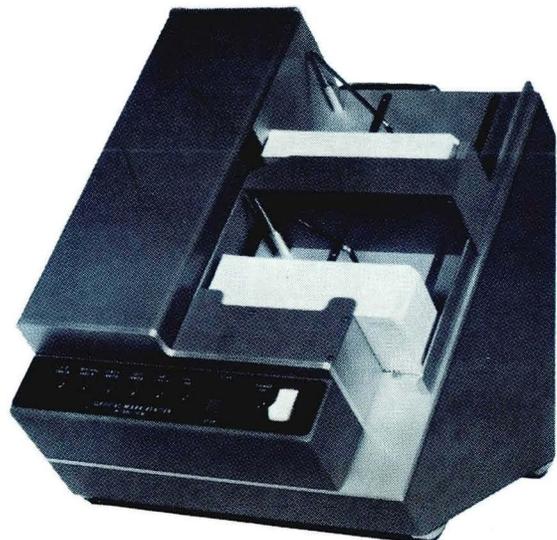
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