VOLUME 10, NO. 9

SEPTEMBER 1980

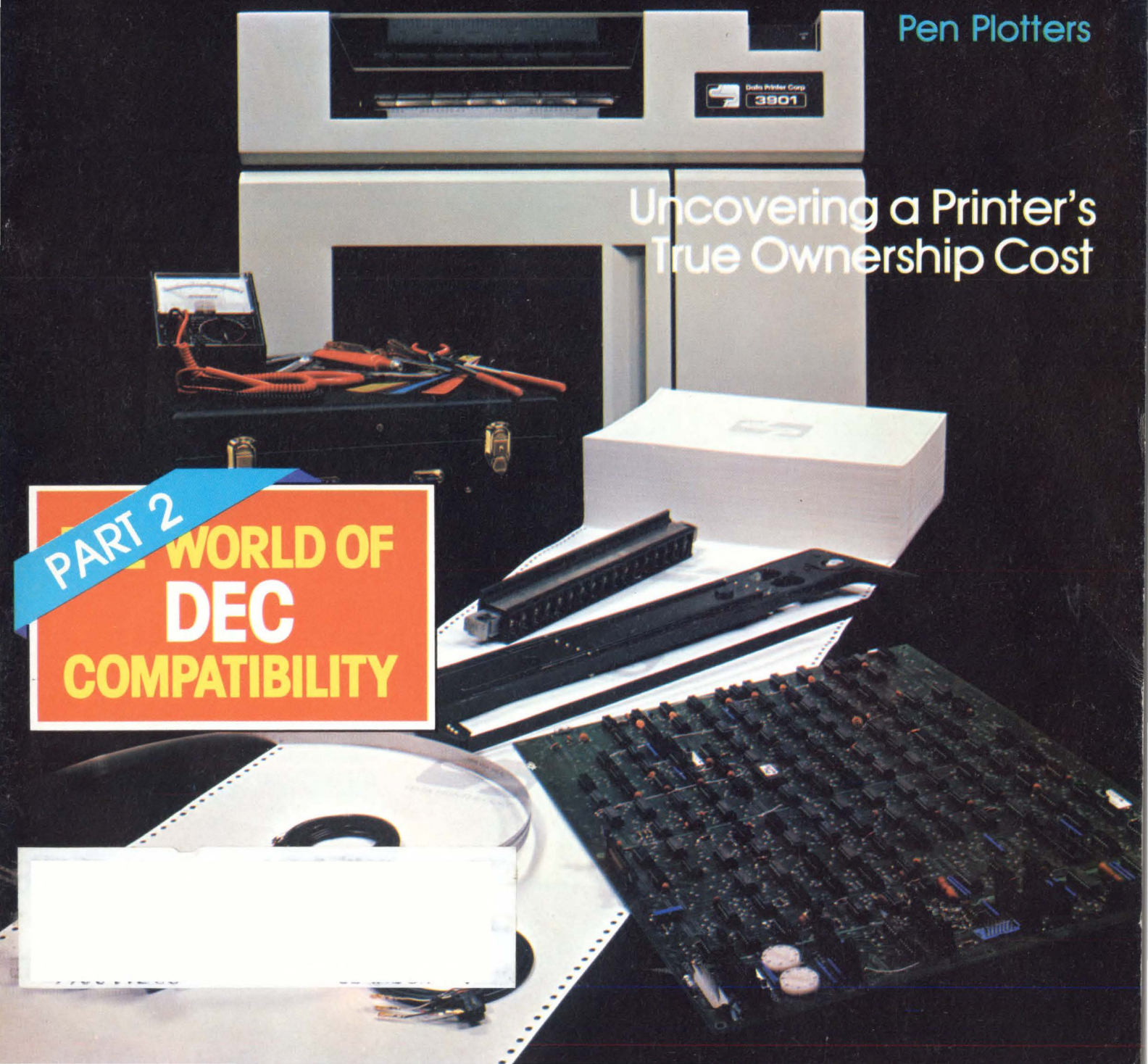
Digital Design

Computers • Peripherals • Systems

Thermal Printing

Color Hard Copy

Pen Plotters



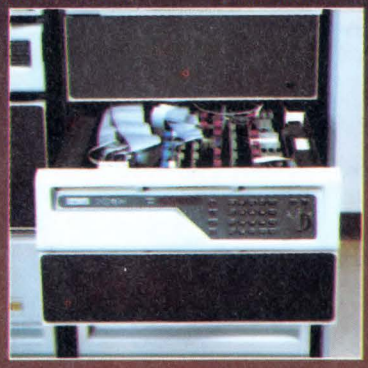
Uncovering a Printer's True Ownership Cost

PART 2

THE WORLD OF DEC COMPATIBILITY

A Marriage of Convenience— for PDP and LSI users!

It's a marriage made in heaven—for DEC PDP-11 and LSI-11 owners who would like a low-cost, quick-to-install, high-density data storage system.
The union consists of Kennedys' Series 5300 fixed media, Winchester technology disk drives and Kennedy emulation controllers. The controllers; which use standard DEC PDP-11 operating systems and diagnostic software, are embedded inside the computer, allowing the Series 5300 to be easily attached to both PDP-11 and LSI-11 minis! In one sweet, short ceremony, Series 5300, with its' one, two or three platter versions and unformatted data capacity of 70M bytes and track density of 300 TPI can be joined with the KSC11 unibus disk controller for the PDP-11; and the KSCO1, for use with the LSI-11; And no software changes or other alterations are required.
Kennedy Series 5300, controllers and your PDP-11 or LSI-11—put them together, plug them in and you have a winning system.

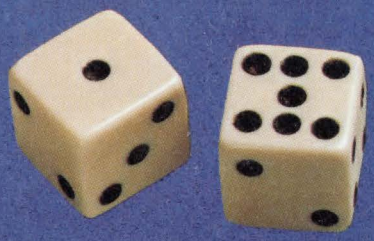


KENNEDY
Subsidiary, Magnetics & Electronics Inc.
1600 Shamrock Ave., Monrovia, CA. 91016
(213) 357-8831 TWX 910-585-3249

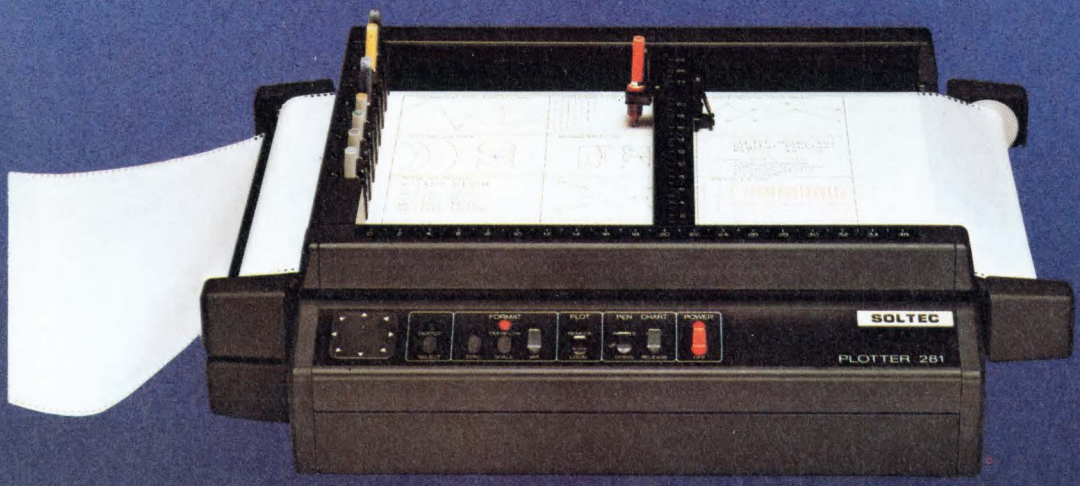
KENNEDY • QUALITY • COUNT ON IT

Circle 2 on Reader Inquiry Card

EIGHT THE HARD WAY...



...EIGHT THE EASY WAY!



Eight the SOLTEC® Way . . . with the NEW Eight Color Digital Plotter

SOLTEC®
CORPORATION

The Soltec Model 281 Digital Plotter utilizes a Z-80 microprocessor that controls the dynamics of the 281 system – including automatic pen changing, off scale data handling, and coordinate transformation.

The programmable pen changing feature allows selection of any combination of up to 8 fibre-tip or drafting pens to produce varying colors and line thickness.

Firmware features include circle interpolation, character plotting, generation of axes and grids, various line types, window plotting and off-scale data handling. Internal self testing, character plotting in 5 fonts, automatic or interactive point digitizing, programmable offsets and programmable limits.

Interfaces available include the RS-232C, IEEE 488 and IPSO.

Plotting can be done on standard 11" × 17" graph paper or on optional continuous roll paper that can be advanced under program control.

Other available options include, 1K byte RAM input buffer expansion and 2K byte ROM expansion for special character sets and/or user defined functions.

For further information or demonstration contact:

SOLTEC® CORPORATION 11684 Pendleton Street, Sun Valley, California 91352
213 - 767-0044 TELEX: 67-4188

Circle 3 on Reader Inquiry Card

This Design Engineer just saved his company $10,000 by choosing a cheaper keyboard.

Now, he almost has enough saved to pay for the headaches.

Buying a cheaper keyboard will not provide the most cost effective solution for your needs. There are no quick, easy substitutions for longevity. At Key Tronic, we are both quality and cost conscious. We offer low cost, capacitive keyboards which are designed to interface with any system in the most efficient manner. High-quality, solid state keyboards cost as low as $40 in high volumes. So before you choose the up-front, seemingly simplest, and lowest cost solution, talk to us. Look at both sides of the coin now. Otherwise, you may be attacked from all sides later!

key tronic
INTERNATIONAL KEYBOARDS

P.O. BOX 14687 — SPOKANE, WASHINGTON 99214 U.S.A. PHONE (509) 928-8000 — TWX 510 773-1885

Circle 6 on Reader Inquiry Card

Complete systems for computer graphics and image processing.

And, we do mean complete! Grinnell systems can include computers, disc drives, terminals and software operating systems. Plus a FORTRAN software and driver package; high resolution TV monitor, camera, and hard copy color printer.

There are also other options to meet any special requirement you might have.

Of course, you may already have some of the necessary hardware. That's why Grinnell systems work with standard TV monitors and cameras, and why plug-compatible interfaces are available for most minicomputers.

We also give you a complete product line to choose from:

GMR 270 Series: 512 x 512 resolution frame buffers and full color pipeline image processing systems.

GMR 260 Series: 1024 x 1024 resolution frame buffers for grey scale, black and white, pseudo color and full color.

GMR 27 Series: High speed, modular graphic and image display systems.

GMR 37 Series: Low cost graphic display systems.

So, whether you want to analyze images from outer space or monitor a process in a plant, Grinnell has a complete system that can do it. For complete specifications and/or a quotation, call or write today.

GRINNELL SYSTEMS

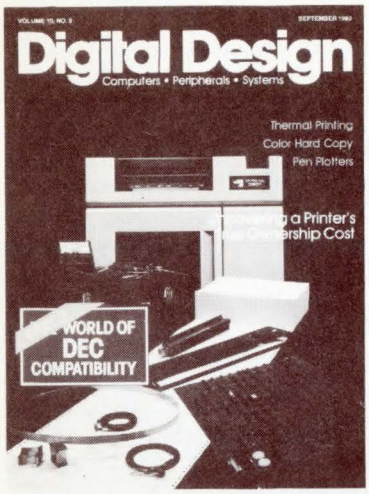
2159 Bering Drive, San Jose, California 95131 (408) 263-9920

Circle 4 on Reader Inquiry Card

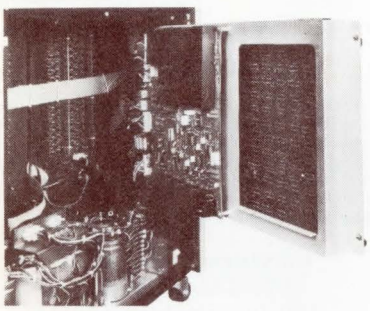
VOLUME 10, NO. 9 SEPTEMBER 1980

Digital Design

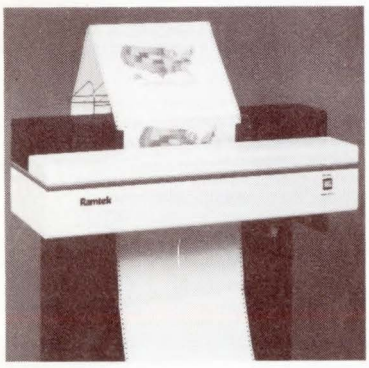
Computers • Peripherals • Systems



ON OUR COVER
Printer costs got you down? Paper and field service expenses alone can exceed initial printer outlay by 500%! Don't ignore total printer costs. (Photo courtesy of Data Printer Corp.)



p. 40



p. 46

DIGITAL DESIGN
Publication number: USPS 407-010
Published monthly by Benwill Publishing Corp., a Morgan-Grampian Company, 1050 Commonwealth Ave., Boston, MA 02215. Controlled circulation paid at Long Prairie, MN 56347.

Features

Departments

Digital Design
Computers • Peripherals • Systems

Group Publisher: Main Office
Harold G. Buchbinder (617) 232-5470

Publisher: L. A. Office
Yuri R. Spiro (213) 478-3017

Editorial Director: Western Office
George King (714) 789-6688

Editor: Main Office
Paul Snigier (617) 232-5470

West Coast Editor
Loren Werner (213) 628-6821

Associate Editor	Harry Shershow
Assistant Editor	Bob Hirshon
Assistant Editor	Katsuzo Suzuki
Assistant Editor	Martha Hawkins
Contributing Editor	Dr. Lance A. Leventhal
Art Director	Richard D. Sarno
Assistant Art Director	David Bastille
Staff Artists	Jacky Brill, Stephen Fischer, Susan N. Genser, Josh Randall, Donni Richman
Production	Jon Buchbinder, Ruth Ellen Katz, Erik W. Slickman
Circulation Manager	David L. Harriman
Circulation	Sarah Binder, Regina Harrington
Composition	Florence Daniels, Cheryl Dunphy, Claudia Majetich, Kathy Shank, Donald Spencer, Harvey Sweat
General Administration	Norman Jolliemore, Esther Shershow

SUBSCRIPTION POLICY

DIGITAL DESIGN is circulated only to qualified research, development and design engineers in all branches of industry, government institutions and universities. To obtain a complimentary subscription, request (on company letterhead) a qualification card from Circulation Director. For change of address, attach old address label from recent issue to new company letterhead or note. Send this plus request for new qualification card to:

Circulation Department
DIGITAL DESIGN
1050 Commonwealth Ave.
Boston, MA 02215

Subscription rates: Domestic subscriptions for non-qualified subscribers, groups, libraries or companies. $25/yr. International subscriptions, $35/yr.

DIGITAL DESIGN solicits editorial material and articles from engineers and scientists. Contributors should submit duplicate manuscripts typed with two spaces between lines. All illustrations should be clear; components on all schematics and line drawings should be labeled. The editors assume no responsibility for the safety or return of any unsolicited manuscripts.

BPA

Published monthly by Benwill Publishing Corporation, a Morgan-Grampian Company, Harold G. Buchbinder, Chief Executive Officer; George Palken, President; Domenic A. Mucchetti, Treasurer; Executive, Editorial and Subscription Offices, 1050 Commonwealth Ave., Boston, MA 02215. Telephone: (617) 232-5470.

Morgan-Grampian also publishes American City & County • Circuits Manufacturing • Contractor • Design Engineering • Electronics Test • Government Buyer • Industrial Distribution • Industrial Product Bulletin • Mart • Minicomputer News • Municipal Index • Personal Computing

Our new double density floppy with built-in controller is based on a very simple theory:

Earlier to market, the fatter the profits.

So don't tie up months and months developing your own controller/formatter for dual-head, double-density floppy disk drives.

We've done it all for you. Our new Remex RFS 4800 intelligent drive packs an IBM-compatible, microprocessor-based controller/formatter onto the same board as the drive electronics.

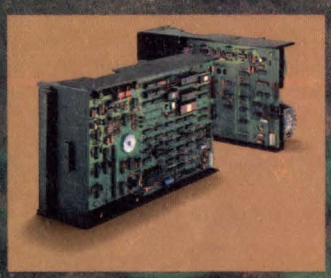
So in addition to our proven dual-head reliability, you get a complete, high-performance subsystem in no more space than our competition requires for their standard "dumb" drive.

Use the Remex RFS 4800 as a double-density drive with a formatted capacity of 1 megabyte or better. Or designate it as the "master" drive, controlling up to 3 additional non-intelligent 1MB "slave" drives.

Tackling double-density controller design can be biting off too much — unless you've got plenty of time. And lots of experience with VFO circuitry for double-density encoding, MFM and MF²M encoding, phase lock/loop problems, and all the other double-density complications.

Instead, use our RFS 4800 and give your system advanced features, such as soft-sector formatting, multiple sector transfers, automatic density switching and fast, easy interfacing with just 15 data and control lines.

Naturally, like all our new floppies, the 4800 is physically compatible with Shugart SA 800/850 products. That includes the RFS 4800's single-headed twin, the RFS 2400. Both, including their slave drives, are available now.



Get to market early. With Remex disk drives. To order, or for more information, write us at 1733 East Alton Street, P.O. Box C19533, Irvine, CA 92713. Or call (714) 957-0039.

Ex-Cell-O Corporation

REMEX DIVISION

Circle 9 on Reader Inquiry Card

Letters

Why Copyright ROMs?

Dear Editor:

With reference to May's Speakout, "When Is A ROM Not A Piano Roll?", I disagree. So you can't copyright a ROM? Who expects to copyright a "uniquely connected array of semiconductor devices"? Although the law can certainly stand updating, in the interim, however, it seems that patent laws are more applicable to a device such as a ROM.

Dr. John B. Mathews
MERP, Inc.
Dayton, OH

The Author Responds

I disagree. The extension of copyright laws *will* discourage copying and encourage innovation. What was understood (but not stated in my Speakout) was that with ICs growing in complexity, most companies will become reluctant to develop new designs – unless there is strong legal protection to prevent copying. If others can rip off, say, Mostek or Intel designs, this erodes innovators' profit margins.

Customers also get hurt. Bugs in the design are copied, and subsequent revisions are forgotten by the IC pirates. Worldwide, OEMs have been stung lately in this game. Also, by all standards of decency, this IC piracy is monumentally unethical, although this seems irrelevant since idealistic appeals to man's nobler moral motives won't stop IC piracy; tough copyright laws will. Our industry is so greatly R & D-driven (in some firms, such costs can approach a third of the firm's profits) that the temptations are just too great. With more complex devices on the way, you can bet the temptations will grow.

Arguments voiced by industry (the copiers, not innovators) that this extension of copyright laws will hurt U.S. firms in overseas markets do hold some truth. But, on the other hand, extended copyright laws will prevent importation of all such products incorporating ICs made from IC masks or designs ripped off from U.S. firms. Not only that, but offending countries still unwilling to engage in cross-licensing copyright exchange agreements could be punished in stronger ways (perhaps even by prohibiting *all* sales of U.S. electronics/computers to the offending nation).

De Anza GIVES YOU A BETTER IMAGE...

DeAnza's new IP8500 is *the* better image processing and display system . . . by a factor of four.

Four times more powerful. Four times more memory. Four times more interaction.

Four memory controllers handle up to four image memories per controller. This gives you an unprecedented capacity of up to sixteen 512x512x8 bit image memories to easily process 8 and 16 bit data with 32 bit results.

To meet your growing image processing needs, the IP8500 offers features you'd expect to pay much more for. Features like independent integer zoom in both the X and Y axis from 2:1 to 8:1 on each memory channel; special functions for histograms, real-time multiplication, rotation and warping, as well as high speed vector generation, up to four separately controlled dual cursor generators, four ASCII overlays and four special function generators.

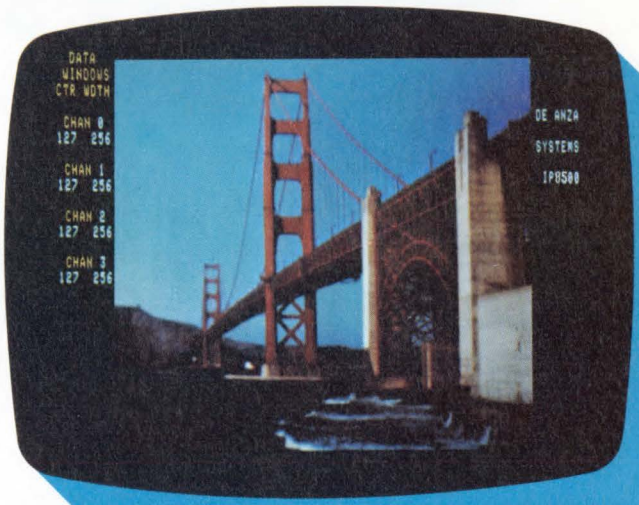
The IP8500 is the better image for people responsible for LANDSAT analysis, non-destructive testing, process control synthesis, remote sensing, three-dimensional computer graphics or other image processing and analysis applications calling for single or multi-station high resolution color, multi-image monochrome or pseudo color displays.

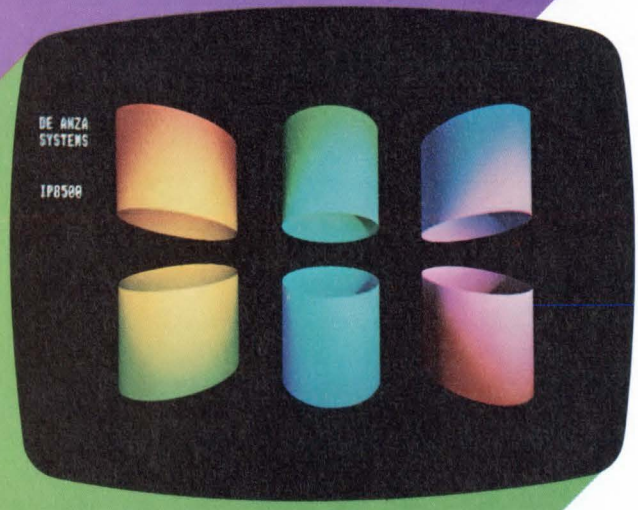
To improve your image X4, find out more about the DeAnza 8500 today. Call or write:

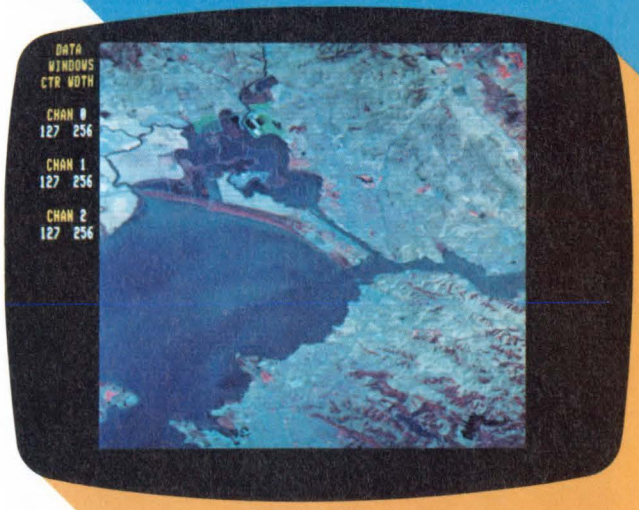
De Anza Systems Incorporated

118 Charcot Avenue • San Jose, CA 95131 • (408) 263-7155
TWX: 910-338-7656

GIVE YOURSELF A BETTER IMAGE

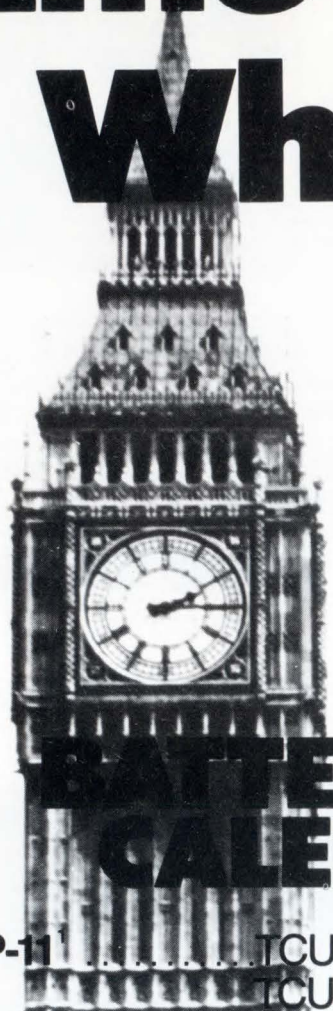






Circle 12 on Reader Inquiry Card

Time is precious Why lose it?



BATTERY SUPPORTED CALENDAR CLOCKS

PDP-11[1]	TCU-100 • $495
	TCU-150 • $460
LSI-11/2[1]	TCU-50D • $325
Multi-Bus[2]	TCU-410 • $325
EXORcisor[3]	TCU-68 • $325
HP 2100	TCU-2100 • $395
Lockheed SUE	TCU-200 • $550
Naked Mini[4]	TCU-310 • $385

Serial Line Clock . .SLC-1 • $640
(RS 232 or 20mA) Microprocessor controlled. Auto message intercept and response. 10 Digit display option $190.

If automatic and accurate date and time entry is important to your system on power-up — you need a Digital Pathways battery supported calendar clock. All Digital Pathways' TCUs have on board NICAD batteries to maintain date and time during power down (typically up to three months). Timing is provided by a crystal controlled oscillator. Prices are U.S. domestic single piece. Quantity discounts available.

For more information on these timely products, contact:

Digital Pathways Inc.
1260 L'Avenida
Mountain View, CA 94043
Phone: (415) 969-7600

[1] *Trademark of Digital Equipment Corp.*
[2] *Trademark of Intel Corp.*
[3] *Trademark of Motorola Inc.*
[4] *Trademark of Computer Automation Inc.*

DIGITAL PATHWAYS

Circle 14 on Reader Inquiry Card

SINGLE BOARD PDP-11* TAPE CONTROLLER

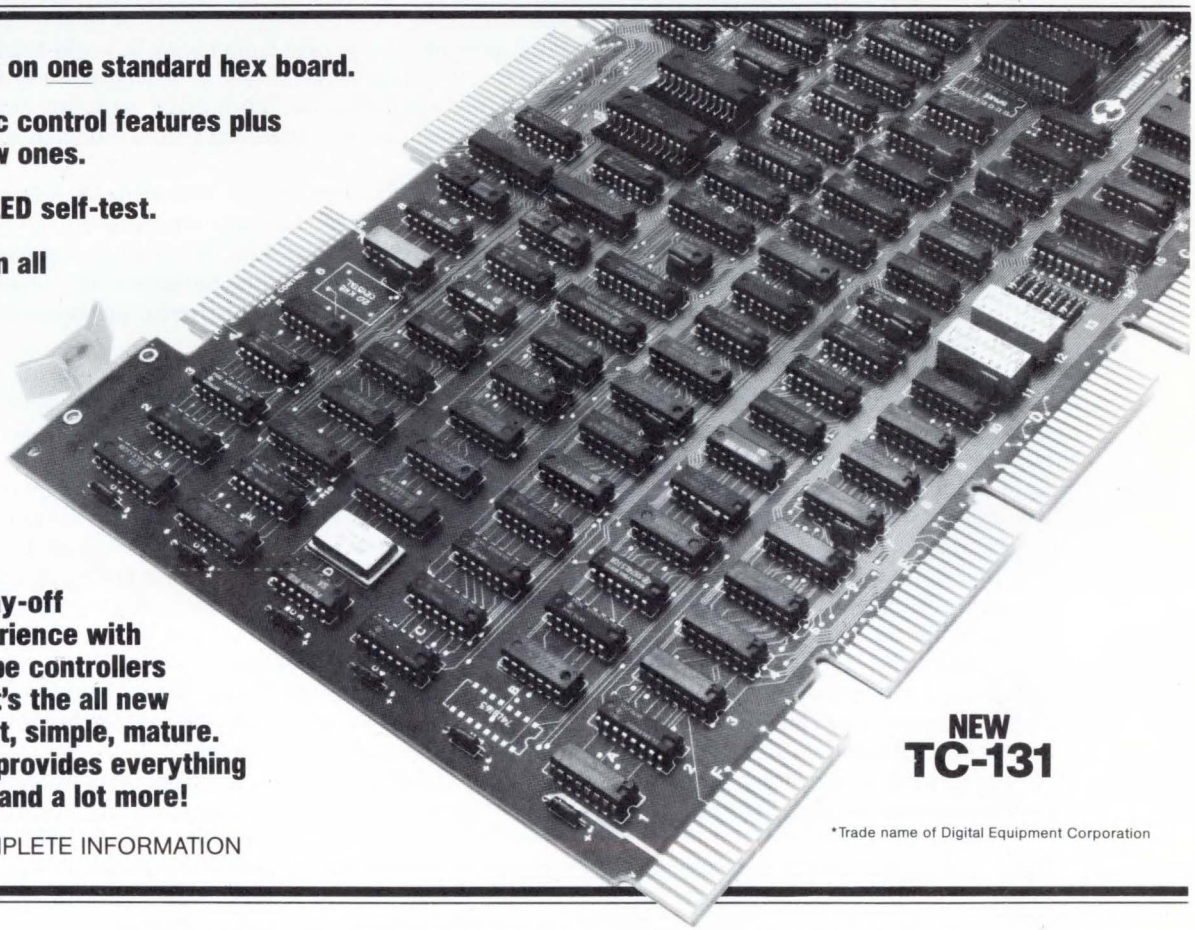
FIRST AGAIN ★ FROM THE NUMBER ONE CONTROLLER COMPANY

★ **PE & NRZ on one standard hex board.**

★ **All classic control features plus many new ones.**

★ **Integral LED self-test.**

★ **Embeds in all PDP-11's.**



NEW TC-131

Here's your pay-off from our experience with over 4,000 tape controllers for PDP-11's. It's the all new TC-131. Elegant, simple, mature. A new star, it provides everything you expect...and a lot more!

SEND FOR COMPLETE INFORMATION

*Trade name of Digital Equipment Corporation

14321 Myford Rd., Tustin, CA 92680

western peripherals

Division of WESPERCORP.

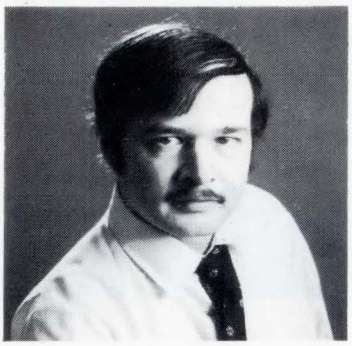
714/730-6250–TWX 910-595-1775 Cable WESPER

Circle 8 on Reader Inquiry Card

Speakout

Paul Snigier, *Editor*

Time Is Running Out



A time bomb is about to explode. It will cost U.S. firms major sales in world markets and enable Japanese and other overseas firms to eventually dominate U.S. home markets. The U.S.' productivity is falling; Japan's and others' are rising. For the first time in 27 years, overall output per man-hour declined in 1974, followed by miniscule increases and a 0.9% decline last year. In reality, things are worse: output per unit began its steady, ominous descent over a decade ago. Among major industrial nations, we now are lowest in productivity growth, while Japan has a growth rate four times higher than ours. Electronics and other firms report a lowering in quality of newer workers, and this is affecting more than production lines. Microcomputer-based systems will only aid us for a short time; our overseas competitors will also adopt them, eventually in far greater quantities than we can.

Meanwhile, U.S. universities and industry are forced to import more of their student enrollment and working engineers; and in another decade, at this rate, one-third of our EEs will be aliens. What on earth has gone wrong?

Irwin Feerst blames collusion between IEEE, aliens, executives and universities; IEEE blames Feerst, and there's enough controversy for everyone. But these are all results – not the underlying causes. Let's put the blame where it really belongs: on the U.S. public schools. They no longer provide the quality and quantity of literate graduates that our universities and industry need to remain competitive in world markets. Citing just how alarming this situation has become, a recently-released University of Michigan study traced over 2,000 H.S. graduates from 87 high schools. Those that quit after the tenth grade were just as qualified as those that graduated! The study recommends to personnel directors that high school diplomas have become useless for screening job applicants.

As for universities, even with remedial math/reading courses for college freshmen, professors warn this cannot solve the problem. In this light, can you blame universities for taking in so many aliens? So, it comes as no surprise when the National Academy of Sciences reported that 42% of our PhDs went to aliens and that 300,000 aliens are enrolled in U.S. colleges. To circumvent this, one university we know of tried to boost its freshmen engineering enrollment with U.S. students; after the first term, the administration told its faculty to mercilessly weed out the extra garbage they'd taken in.

Our public schools have sunk to a deplorable level. Declining SAT scores, violence, mentally lethargic student potheads, ignorant-but-tough-talking inner-city parents, assaults on teachers and students, shakedowns and you-name-it have been covered up by administrators afraid to back up teachers against unruly and disruptive students. Teachers unfairly blame administrators, but forget that administrators have a delicate political situation and are restrained from using effective discipline – the only type that most disruptive students will respect. Aggravating the situation for good students, emphasis has shifted to helping "the special student" – the slow learner. Since their parents are too often very disruptive elements, adminsitrators find appeasement (i.e., keep them quiet) to be politically wise. Since teachers are on the front lines, a growing phenomena, "teacher burnout", has forced dedicated teachers to leave, and nervous breakdowns are rising for the rest. To avoid flak, harried administrators are trying to minimize IQ and standardized tests that might label certain (troublemaking) students. In fact, it's common to pass undeserving students (which, in a sense, makes sense, since keeping them back worsens discipline). School boards are well aware of this, but aren't too interested: they don't win political friends by digging into trouble, but do get elected by cutting costs (and may be more concerned with the political spoils system).

Unable to cover up recent leaks to the news media, and faced with lawsuits from semi-illiterate graduates (seeking to make a quick buck) and growing bad public relations, top U.S. administrators recently moved to cover themselves by hiring testing firms to create onerous pre- and post-testing, specific behavioral objectives and accountability (of teachers – not of higher administrators, ineffective Federally-mandated title programs or of the test programs). This nationwide strategy, they hope will "prove" (at least on paper) that U.S. public schools are teaching all basics, and cleverly shifts blame from top administrators to teachers. But principals' and teachers' hands are tied; no effective deterrent to disruptive students exists, and this has harmed the better students, who learn less because of it.

For U.S. universities, engineering schools and our computer industry, the handwriting is on the wall. If something isn't done, and done fast, American industry and universities will get more and worse semi-illiterate graduates, and U.S. productivity will continue its decline. If we fail to reverse this trend, not only will American productivity fall further behind, but increasing sales of computers and other U.S. products will go to Japan and more productive nations.

Time is running out.

Now there's a 20 MHz gate array that outperforms TTL and low power Schottky!

Introducing high-speed CML Monochips.™

In today's competitive design race, Interdesign gives you the edge you need to win. CML Monochips are fast enough, large enough, and flexible enough to satisfy a variety of functions in computer, telecommunications, and instrumentation designs.

With toggle rates to 20 MHz and propagation delays as low as 3 nsec, CML Monochips give you the speed you need with a minimum power requirement.

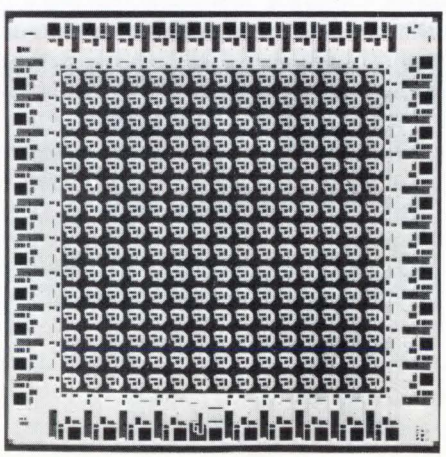
Monochip CML IC's are easy to design because we've simplified the chip's architecture. Our $25 Design Manual gives you everything you need to lay out your own custom 450- or 880-gate array. Working from your layout, we'll deliver 20 prototypes in 8 to 10 weeks for your evaluation. Once you've approved them, we'll make 1,000 to 500,000 parts for you.

CML Monochips give you all the advantages of custom IC's without the cost or lead time of full custom development. For more information, call or write us today. Interdesign Inc., 1255 Reamwood Avenue, Sunnyvale, CA 94086. Telephone: (408) 734-8666. TWX: 910 339 9374.

Circle 19 on Reader Inquiry Card

interdesign

Monochip:™
the semi-custom IC.



Typical Applications

Disk and CRT Controllers

Dynamic and Static Memory Controllers

Keyboard Scanners

Memory Interface Logic

Control Logic—CPU Boards

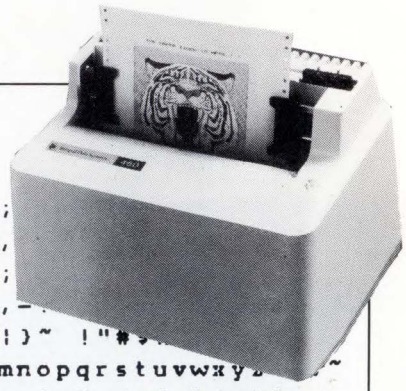
ALU Accumulators

D/A—A/D Controllers

Interdesign is a Ferranti Company

Innovative Design

Impact Printer Fills Wide Open Spaces

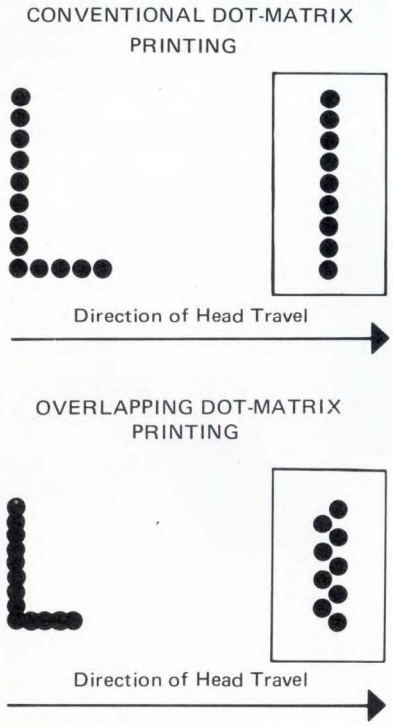


Inexpensive impact matrix serial printers, as a rule, leave much to the imagination. Traditionally, they use a seven-wire print head that traverses the paper horizontally, printing an entire line of type per pass. These seven vertical impact print hammers produce characters that consist of almost as much air as ink. And while the imagination needed to fill in the dots is minimal, anyone required to read pages of such type can speak with authority on the hazards of eye-strain.

Integral Data Systems just introduced a simple solution to swiss-cheese print with its Model 460 Paper Tiger. Rather than using seven print hammers in a single vertical row, Model 460 incorporates nine hammers arranged in two overlapping rows of four and five hammers, respectively. In a single pass, then, the 460 produces characters that, although still somewhat scalloped, are much more solid-looking than those of competitively priced printers. This is the first printer on the market to use this overlapped print head design, according to IDS President, Dr. Jim Vander Mey.

```
 !"#$%&'()*+,-./0123456789:;
pqrstuvwxyz{|}~ !"#$%&'()*+,
 !"#$%&'()*+,-./0123456789:;
pqrstuvwxyz{|}~ !"#$%&'()*+,-
abcdefghijklmnopqrstuvwxyz{|}~ !"#
RSTUVWXYZ[\]^_'abcdefghijklmnopqrstuvwxy
CDEFGHIJKLMNOPQRSTUVWXYZ[\]^_'abcdefghijklmno
456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_'
%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQ
uvwxyz{|}~ !"#$%&'()*+,-./0123456789:;<=>?@AB
fghijklmnopqrstuvwxyz{|}~ !"#$%&'()*+,-./0123
WXYZ[\]^_'abcdefghijklmnopqrstuvwxyz{|}~ !"#$
HIJKLMNOPQRSTUVWXYZ[\]^_'abcdefghijklmnopqrst
9:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_'abcde
*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUV
z{|}~ !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFG
klmnopqrstuvwxyz{|}~ !"#$%&'()*+,-./012345678
\]^_'abcdefghijklmnopqrstuvwxyz{|}~ !"#$%&'()
```

Integral Data Systems Model 460 features bidirectional print speeds of 160 cps and offers correspondence-quality printing and high-resolution graphics.



Unique overlapping dot matrix printing technique, with two staggered rows of print needles, forms correspondence-quality characters in a single pass of the print head.

Ballistic print heads produce the dots that form the character matrix. While not unique to IDS, these heads represent an improvement over earlier, armature actuated print heads. The latter consist simply of a solenoid-controlled arm with a print needle at one end. Energizing the solenoid pulls the arm down, pushing the needle against the ribbon, making a dot on the paper. With ballistic print heads, the print needle is unattached to the solenoid-controlled arm; the arm actually strikes the print needle, the way a hammer strikes a nail. Since the needle is in free-flight, there's no armature inertia. This means more thrust and impact and, according to Vander Mey, higher reliability and three-times longer print head life.

Other features of the 460 are 160 cps proportional-mode print speed (120 cps, monospaced), auto text-justification, serial interface that ranges up to 9600 baud and recognizes X-on, X-off protocol, 5.5 ips paper slew rate, and cartridge ribbon system. Character set includes full descenders and is done in EPROM, allowing users to substitute character sets themselves. Up to four different character sets can reside in the 460 at once.

Enhanced printing, or boldface, is a standard feature, accomplished by changing the timing routine to provide double-width print. If the user is printing at 10 characters per inch, then under enhanced printing it becomes 5 cpi. An optional graphics package provides 84 dots per inch raster graphics capabilities.

Paper Tiger Model 460 is available in unit quantities for $1295; optional graphics package is $99 extra.

– Bob Hirshon

Integral Data Systems, Inc, 14 Tech Circle, Natick, MA 01760.

Circle 200

System Hard-Copies CRT Images At Low Cost

Proliferation of high-resolution raster scan graphics terminals has increased the need for cost-effective, high-resolution hard copy devices. A device that fills this need is the Tektronix 4634 imaging hard copy unit. The $6950 copier uses improved 3M dry silver paper and a fiber optic CRT to produce photographic-quality images from raster scan sources. An average copy costs about $0.20, as compared to a range of about $0.60 to $5.00 for competitive units.

In operation, the 4634 unit selects a narrow window of the entire image and displays it with no loss of resolution on the back of the fiber optic CRT faceplate. The optical fibers transmit this window to the copy medium while the line-scan monitor continues to scan the full image. This procedure generates a series of successive windows that are sequentially presented to the fiber optic CRT and to the copy medium, which is advanced in synchronized continuous movement. Once fully scanned, the image is fixed by a dry heat processor without chemicals.

The copier's 12-level gray scale can produce images from a range of line rates: 525-1029 lines interlaced and 256-512 lines non-interlaced for 50- and 60-Hz systems. The unit accepts composite video, composite sync with separate video signal, and separate vertical-drive, horizontal-drive and video signals. Although it produces a finished copy in 26 seconds, the 4634 initiates images every 12 seconds, because it can expose one image while developing another.

– Loren Werner

Tektronix, Inc, PO Box 500, Beaverton, OR 97077. **Circle 201**

Innovative Software

Does Your System Need a Source Generator?

Most programmers who are all too familiar with the more mundane, usually time-consuming aspects of programming could use a tool to undercut the cost and drudgery of these tasks. Point 4 Data, Irvine, CA, offers such a product. The maker developed FORCE (For On-line Real-time Code Expansion), a software source code generator, primarily for OEM and system house programmers.

FORCE attacks time consumption by automatically coding record layouts, data element descriptions, screen and menu formats, data input and validation, file layouts, report formats, file maintenance and program documentation. Point 4 claims that these functions take up approximately 80% of the development time spent on most application programs.

Designed by Rick Ramras, director of automated software products at Point 4, FORCE architecture enhances standardization, continuity within and between programs, ease of maintenance and program documentation. FORCE is built around a central database handler. You create a database or "dictionary" by entering information such as description of screen format, record layout and data element. FORCE then generates executable code from the input.

The dictionary is independent of individual program modules, and since record layout in the system is defined in the same fashion for each module, standardization produces automatic code update at great time savings. For example, a change in a given record in one program module causes a change to the database. Rather than requiring the usual manual recoding of all other program modules, FORCE automatically, upon demand, recodes all other modules in a matter of minutes. The code generated is free of syntactic and typographical "bugs".

FORCE achieves continuity within and between programs by using standard data elements and record layouts. Since FORCE, not several different programmers, generates large sections of code, the program structure is the same for large segments of a FORCE-generated system. As programmers become familiar with the logic of FORCE-generated code, this uniformity helps them to read, change and maintain software easily – even when someone else originally created these programs.

FORCE also provides automatic program documentation. The dictionary holds all information necessary to describe screens, menus, data elements and record layouts. On demand, documentation describing each of these system elements is printed out. Since the database is always current, the generated documentation is also automatically kept current.

FORCE efficiency is evident in the following example. A demonstration put 12 lines of code, including eight macro commands, into FORCE in under five minutes. FORCE used less than one minute to generate 168 lines of fully documented BASIC code.

The heart of the FORCE input commands, the MACRO statement, is typified by: 30 REMACRO;DISPLAY,FIRE, 001. Following the line number, REMACRO indicates the type of command – in this case a MACRO. The next entry, DISPLAY, indicates the type of MACRO – in this case a screen display for data entry. The next item, FIRE, indicates the system name – in this case a fire truck repair system. The last input item, 001, indicates screen number 1 from the FIRE system. The single line of code can generate the following BASIC code in 3 seconds:

Continued

```
 80 REMACRO;DISPLAY,FIRE,001 –
    JUN 17, 1980  14:27:01
 90 REM
 90 REM ***********************************
 90 REM * SAMPLE DATA ENTRY SCREEN DISPLAY*
 90 REM ***********************************
 90 REM
 90 PRINT 'CS';
100 PRINT @20,0; "SAMPLE DATA ENTRY SCREEN
    DISPLAY FORMAT";
110 PRINT @4,2; "CUSTOMER NUMBER:                ";
120 PRINT @31,2; "CUSTOMER NAME:                 ";
130 PRINT @22,4; "STATUS CODE:                   ";
140 PRINT @43,4; "ACCOUNT TYPE:                  ";
150 PRINT @0,21; "COMMENT:";
160 PRINT @0,22; "COMMAND:";
170 PRINT @0,23; "MESSAGE:";
180 REM
180 REMSTOP;MACRO;DISPLAY,FIRE,001
```

If you market systems, do you need a source code generator? Ramras, who has been writing successful source code generators since 1969, says, "Within a year, I feel that any system house or OEM that doesn't use a data dictionary-based source code generation system will not be able to compete with those that do."

Microprocessor Development Systems

EXORset 30 is a medium-priced stand-alone MC6809 μP development system. It houses a MC6809 μC with 48 KB of RAM, provides up to 24 KB of ROM/PROM with development and debug firmware, ASCII keyboard with special function keys, two built-in minifloppy disk drives (80 KB each), and a CRT display with alphanumeric and graphic capability. EXORset 30 can function as a terminal for existing EXORcisers.

EXORset 30 runs BASIC-M, a high-level language compatible with standard BASIC. BASIC-M also monitors events in real-time, supports real-time processor interrupts, generates 6809 position-independent code, allows bit manipulation and uses a matrix read command for simplified input of matrix data. EXORset 30 also provides floppy disk-based diagnostic self-test.

Advanced Micro Computers offers two development systems based on its original AmSYS8/8 development system. Called AmSYS8/8012 and AmSYS8/8014, these systems retain the AmSYS8/8's CP/M-compatible operating system, file manager, utilities, assemblers, linker and 64-KB main memory. The AmSYS8/8012 differs from the original, because it uses an Am8085A-based 3MHz CPU and doubles the available mass storage to 1 MB with dual double-density floppy disk drives. Adding a 10-MB cartridge disk to the AmSYS8/8012 turns it into an AmSYS8/8014.

AMC's RTE16/8050 real-time emulator is compatible with both new development systems. This emulator package provides real-time emulation for the nonsegmented AmZ8002 and segmented AmZ8001 μPs. The basic hardware configuration includes emulator, real-time trace, breakpoint and control, and program memory boards. The user tailors the emulator subsystem for AmZ8001 or AmZ8002 emulation by selecting the appropriate emulator pod.

Dual bus structure eliminates bus contention between the system processor and emulator. One bus serves the system processor for memory and I/O data paths, while the other is dedicated to AmZ8000 emulation. The 256 by 48-bit real-time trace buffer gives the user a snapshot of bus activity surrounding specified events.

Twelve high-speed comparators and eight general-purpose delay/iterative counters combine to generate breakpoints, trigger the beginning and end of trace, qualify the trace data and execute jumps to patch areas. PATCH capability allows the user to patch a program by transferring execution to the new program location during real-time emulation.

A 1-MB user memory map can be specified anywhere within the AmZ8000's 16-MB address range. The map can be configured with emulation and user memory intermixed on any 1K boundary, and further, any 1K block within the map can be specified as fast, standard, or user RAM memory.

The system's CRT terminal provides emulation control, and employs a menu-oriented user interface. During emulation, the CRT is divided into several windows, each displaying distinct information pertaining to the emulation state. Typically, windows can display AmZ8000 registers and status, system and normal stack, as well as specific user-requested information.

The emulator's symbolic assembler automatically converts symbolic program statements to binary code. The system's disassembler displays memory as program statements rather than binary object code.

Graphics Software is Compatible in Raster and Vector Refresh Systems

WAND 7200, Megatek's FORTRAN graphics software package, is compatible with four distinct graphics display devices in the Megatek 7200 line. Software developed with WAND 7200 can run on vector refresh hardware and color raster display systems without modification. The display devices can use high-speed parallel or serial communications interfaces.

WAND 7200 also enables the user to define his own coordinate space without concern for the coordinate space of the display device being used. The software automatically converts user coordinates to hardware screen coordinates. Automatic software windowing and clipping allows the user to develop his picture over a larger dynamic range than what can be seen on the screen. He can move the window to view different parts of the picture developed over the entire dynamic range.

C Language Compiler for HP 1000

Available for HP 1000 computers running the RTE-IVB real-time operating system, a C language compiler requires 28k words of memory, and delivers compilation speeds of 300 to 400 LPM conversion of source to relocatable code.

Hewlett-Packard licenses the software from the developer, Corporate Computer Systems, Aberdeen, NJ. HP markets the compiler only to the U.S. government and to the Bell System. Corporate Computer Systems sells to all others and supplies all support.

— Loren Werner

QMS announces IBM 5256 Print Replacement On IBM System 34

NOW AVAILABLE TO IBM USERS!

Labels, Barcodes, Forms creation as well as normal text print can be easily generated at 300 or 600 lines per minute.

MAJOR SYSTEM FEATURES

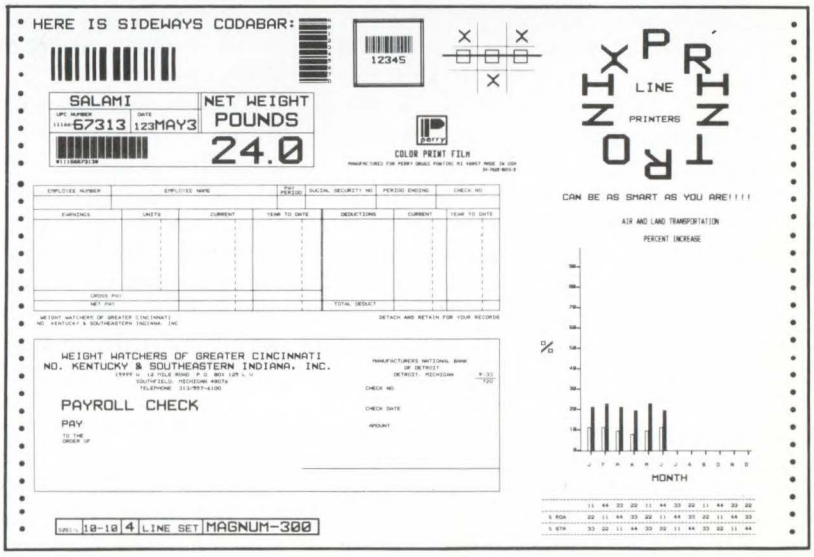
- ☐ Variable size print from point 1 to 10 inches in height (as well as 150, 300, or 600 line per minute normal text print). Also plotting.
- ☐ Variable aspect ratios
- ☐ Line drawing capabilities (forms, boxes, graphs, etc.)
- ☐ Upside down and sideways print capability
- ☐ Bar coding – programming contained on controller in prom
- ☐ Plotting, Logos, etc. mixed with print on labels
- ☐ Mixed sizes on same line – without reversing the paper
- ☐ Label repetition feature – send data once and tell us how many to print
- ☐ Reverse imaging
- ☐ Horizontal and vertical tabbing
- ☐ Self test features (on or off line)
- ☐ Up to 6 part forms generated with high quality

SYSTEM DESCRIPTION

- ☐ Utilizes the rugged reliable Printronix printer/plotter
- ☐ Magnum controller that slips into Printronix spare card slot has a sophisticated computer system that contains algorithms which greatly reduce your programming efforts when printing labels, barcodes, etc. You tell us what to print, how big, and where to place it on the page.
- ☐ Our system provides the most versatile, reliable label/bar coding system on the market. Our users list speaks for itself.

INTERFACE CAPABILITY

- ☐ Magnum 3400 – Emulates 5256 Printer on the IBM System 34 and System 38 via Twin Coaxial Hookup
- ☐ Magnum 3270 – Emulates 3284, 3286 and 3288 IBM Printers on the 3271, 3272 and 3274 "B" Side controllers or direct to an IBM System 3. Also 4331, 8110 via controller.
- ☐ Other IBM Interfaces – Series 1, IBM 2780 and 3780.
- ☐ Burroughs Poll and Select Protocol
- ☐ Datapoint and HP Parallel Interfaces
- ☐ Magnum 300 – Interfaces available for most mini- and micro computers via RS232, current loop, centronics and data products parallel.



QMS MAKES THE BEST PRINTER ON THE MARKET BETTER!

Consult your local member of the Printronix Distributor Group

QMS QUALITY MICRO SYSTEMS
P.O. Box 1644 · Mobile, Al. 36633 · Phone: (205)343-2767

Circle 16 on Reader Inquiry Card

Technology Trends

Anti-Computer Bias Emerges

Paul Snigier, *Editor*

System builders and integrators must now consider a new and growing factor when designing computer-based systems: resistance from end users. It's serious enough that system builders and integrators are starting to worry about it. Why?

For the past 15 years, corporate executives have gladly purchased computers and services to automate the tasks of clerical workers under them – the bank tellers, stock delivery personnel, secretaries, office clerks, etc. But now that the systems are for improving executive efficiency, executives don't like it. Despite computer-based systems that can truly increase top management's efficiency by up to 30%, increasing resistance to the purchase of these electronic (paperless) office systems is spreading. And it's costing sales. It's not the computers that are the problem.

Big savings possible

Systems builders cite many advantages for the automated office systems. By pushing a few keys, an executive can instantly send staff memos to other executives' terminals; he can respond to those sent to him; or he can access vast data bank bases of his firm's sales, shipments, bank data and overseas data; or, if he is out, the stored data is there for action when he returns to his office. The need for conference meetings is reduced, and the need for travel is minimized. The computer system bypasses all the frustrations of busy phone lines, of people "in conference, he'll get back to you" and of discovering problems before they grow. It efficiently exposes incompetent lower-level managers: since communication is so easy and instantaneous, messages of troubles (being covered up in lower levels) tend to surface at top levels before they harm the firm. Electronic mail – whether interdepartmental, between divisions or overseas – instantly passes documents and ideas on to the people involved. The computer systems introduce accountability: when reports are due, and they don't arrive, the computer asks for them (unlike the executive, who may forget). And some computers now function like an electronic calendar with an automatic "tickler" device, automatically notifying the slow subordinate of his overdue assignments. They also notify his boss. Other systems incorporating time management procedures force executives to make the most efficient use of their time – whether they like it or not. A few systems will prioritize tasks; however, all, by their very nature, make it difficult for an executive to not devote a block of time to a given assignment, since it is on the VDT. It also makes the mistakes of higher-up executives more visible to colleagues and subordinate management.

Is this good?

For the corporation's overall efficiency, this is great; but from the executives' view, there is fear. Computers are about to introduce accountability on the corporate level, and executives don't like it. As an aside, the electronics and computer industries executives (generally far more dynamic than those in static industries) have proven far more likely to embrace the new technology.

Customer resistance has taken several forms, including nit-picking ("Does it justify Swahili? No? Sorry, no sale."). Since automation represents one of the largest future markets for computer systems, it's necessary for computer system designers and integrators to research human factors involved and re-design their systems and adapt them to management.

A workaholic's dream

What are the biases due to? Fear, job insecurity and bruised egos. Outside of the publishing world, most executives cannot type at a data terminal without making significant errors; and, worse yet, they consider it beneath their dignity ("Typing's for secretaries; I dictate.") This alone can make an executive look bad. They see the improved efficiencies as a pain. With portable data terminals, executives can be anywhere (even on vacation, say, in Florida) and be totally accessible for sudden emergencies (and accountable, and in trouble, if they fail to handle the emergency). With the coming growth in satellite communications, there will be no inaccessible place to hide on the globe.

Workaholics, or those that own their businesses, are discovering portable terminals are a blessing: they can work weekends and evenings (at home) and not only access large data bases, but also input information into the computer at any time (even if in a hotel room). Those managers working under such workaholics feel otherwise; it forces them to take their terminals home and do extra work just to keep up.

Then, even if an executive forgets to take his terminal on vacation or home, the electronic messages are always there at his desk terminal for him to see when he gets back (no excuses exist).

The need for meetings and conferences will decline. Traditional executives like meetings, even though most meetings are time-wasteful and often run on without regard to good procedure. The human element (shooting the breeze, chit-chat and other non-productive factors) is now missing, although executive productivity improves. Worse, from some executives' viewpoint, electronic teleconferencing (which has yet to be perfected) will greatly reduce the need to travel. Once video teleconferencing becomes commonplace, and the cost of fuel skyrockets, travel is less justified. Also, the need for shows and conventions will decline. Papers will be accessed (for a fee) over video terminals. This will be extended to products, and manufacturers will be able to teleconference with potential customers. This could seriously impact trade shows (such as NCC, Electro and Wescon).

Since exhibitors judge the success of their exhibiting at a show mainly in terms of orders, this will kill the incentive to exhibit, say, at NCC. Manu-

Solid engineering and 340 lpm speed make the TermiNet 340 a more rugged, productive line printer.

Any way you measure them, TermiNet® 340 line printers are more productive performers

Don't let the compact size of the General Electric TermiNet 340 line printer fool you. Because no matter how hard you work it, it won't quit on you. It's that tough, that dependable and that much better than typical line printers. And it's available now.

A true 100% duty cycle printer

Unlike ordinary line printers, the TermiNet 340 can take the punishment of the broadest range of operating environments—from front office to factory floor—without complaining. The key reason? A tough, ruggedly engineered design. As a result, it keeps on performing under tough-use conditions when other line printers would sputter and break down.

Engineered to stay on the job.

From top to bottom, the compact TermiNet 340 line printer is engineered with long-life components designed to keep the printer on-line. And businesses on schedule.

One reason: extra-thick, heavy-duty, environment-resistant materials chosen for the base and housing. Together, they provide this rugged printer with the impact strength, dimensional stability and resistance to adverse environments needed to keep working.

More reasons: print and ribbon systems that won't wear out prematurely and won't cause the problems other line printers do. Which is why the proven rotating-belt print system will last billions of characters. And why the ribbon cartridge will maintain very high print quality for at least 100 million characters.

Fewer service problems keep it working longer

The fact is, TermiNet 340 line printers are such productive workers, they require very little attention and very little maintenance once they're up and running. Should service be needed, you can count on getting these printers back on-line in a hurry. That's because of convenient self-test features that make troubleshooting easy and fast. And because of a responsive nationwide service network that keeps downtime to a minimum and operating costs low.

Find out for yourself. Mail the coupon today and see why so many companies have chosen the more productive TermiNet 340 line printer to get their work done.

Mail today to:
J. Walsh,
General Electric Company,
TermiNet 794-43,
Waynesboro, VA. 22980
Telephone: (703) 949-1474.

☐ Send me more information about the TermiNet 340 line printer.

☐ Have a sales representative contact me.

☐ I'm also interested in a TermiNet 340 line printer demonstration.

Name _____

Title _____

Company _____

Address _____

City _____ State _____ Zip _____

Telephone _____

Quality that will make a lasting impression

GENERAL ELECTRIC

Circle 15 on Reader Inquiry Card

facturers wish to zero in on a select, concentrated group of potential specifiers and buyers. Teleconferencing will prove a tough competitor for non-regionalized conferences and shows by 1990.

These developments are intimately tied in to the technology creating the electronic office of the near future. For the trade press and consumer publications, this will spell significant changes. If unlimited articles become accessible at an executive's or engineer's terminal (for a fee), why should he bother to receive magazines or tabloids? Those publishing houses that fail to perceive and adapt to these trends will follow the Passenger Pigeon.

Other developments are even more significant. With intelligent voice entry expected to eliminate coding, key-punching and manual data entry througout the firm, information will be processed instantly and be available at all levels. Data entry times will be reduced and productivity increased. The firms of 1990 will function as one unit, with instantaneous information flow and pre-processing of raw data, which is useless without interpretation. Pre-processing of raw data into usable information by computers will result in the assimilation of more middle-level decision-making into computer systems. This is the start of the long-forecast Third Industrial Revolution.

Humanized systems needed

In the long haul, executives' firms will force upon them the need to embrace the computer as a tool to improve executive efficiency. Holdout firms will suffer from lowered executive efficiency; and, although this won't show up immediately on the balance sheets, when it does, these firms will be forced to update their management. With regard to executive resistance to typing, four solutions are possible. First, executives must learn to type. Second, more typo-correcting software is necessary (although this will require more memory and risk slowing throughput). Third, true voice recognition systems will eventually augment and then replace today's keyboard as a means of inputing information. Finally, OCRs (once perfected) will transfer a firm's paper-based information into computer memory.

What does this mean for system designers? In the short haul, don't expect old, traditional biases to change overnight; change your computer systems, instead. Remember those computer systems that will sell are less intimidating and less likely to threaten users' security or egos. This is your job. It will require a new breed of system designer – one with user awareness and more overall understanding of how total systems affect users.

Trillion Dollar Contract Goes To Japan

An interesting development will aid the U.S. electronics/computer industry. A contract signed between the Saudi Arabian minister of finance and a certain leading Japanese industrialist-official calls for the purchase of 280 billion dollars (for starters) – with the total to reach over a trillion dollars – all to Japan for the purchase of high-technology products. Signing a contract and getting paid are different things: the deal is with a government that might not exist in two years. The Saudi situation remains unstable; and Japan need only remember the near-overthrow of the Saudi government last October. (The royal family flew to Switzerland, while fleeing Saudi millionaires blew the lid temporarily off gold.)

At any rate, if things go O.K., expect to see the Japanese semiconductor and computer industries going full blast trying to meet this demand over the next several years. *This development will aid U.S. computer makers:* since Japanese semiconductor and computer manufacturers will be so busy trying to fill this demand, it's not too likely that they'll want to sell to less-lucrative U.S. markets (especially since competition here is rough). Paradoxically, this Arab attempt to dictate terms to the West will have the opposite of its intended effect. For U.S. computer and semiconductor makers, this will spell a period of unexpected growth exceeding that of the marketing studies that we've all seen. In the short term, it may mean a shortage of memory chips, such as 16-k and 64-k RAMs. In the long term, this may mean that the long-heralded Japanese penetration of the U.S. computer marketplace may never materialize. It's even possible that by the time Japan does catch up, it will be frozen out of U.S. markets forever.

– Paul Snigier

10-Mbyte Floppies By 1982? Or 1983?

Will word processing, small business system and personal computer markets drive flexible disk technology in diverging directions? It's already happening.

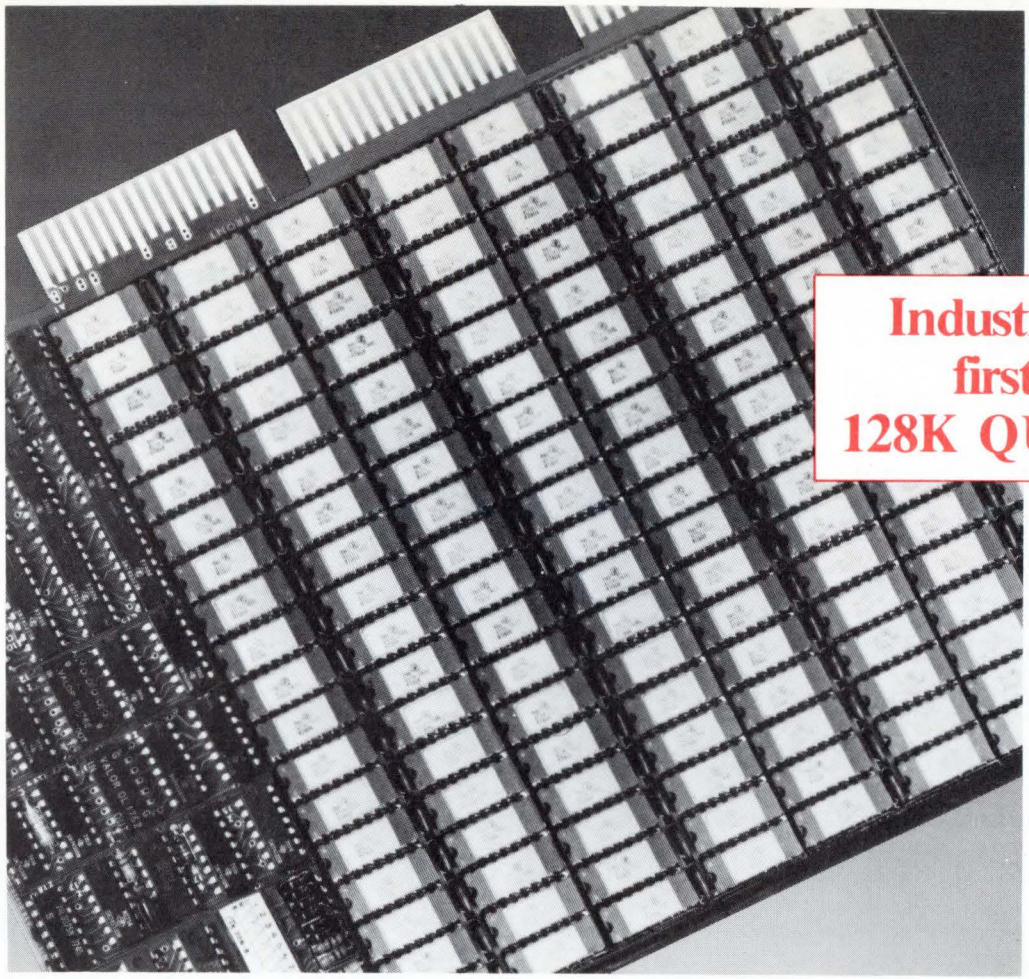
Higher end system manufacturers are clamoring for more memory, faster access time and increased performance says James M. McCoy, product management manager at Shugart in Sunnyvale, CA. But certain WP and PC system applications demand lower-cost, basic performance flexible disk drives.

Floppy disk drive capacity increases will continue due to areal bit densities increases of one order of magnitude providing five to 10-MB capacities on a single 8″ diskette. Eventually, 5-MB minifloppies will become standard. The floppy shows no signs of being dethroned by competing technologies.

There are two requirements for such track densities; improved media stability and more sophisticated head positioning/actuating systems. Since the mylar diskette substrate now in use suffers from anisotrophic deformation from both thermal and hygroscopic effects, this limits open-loop-actuator, floppy-disk-drive effective-track-density to twice the current 48-TPI standard.

Three solutions

Serious media interchange problems start at 96 TPI; and, to achieve higher track densities requires more stable media or various track-following actuator technologies. Will inexpensive track-following servo systems allow track densities to surpass, say, 200 to 300 TPI? Yes, and experts foresee this as occuring in the near future. Finally, thinner and higher-energy magnetic coatings, and more sophisticated encoding and data recovery techniques will increase linear bit density. Ad-



Industry's first 128K QUAD

128K x 18 FOR LSI-11/23®

Dataram Corporation, first to offer a 128K x 18 single-board PDP®-11 ADD-IN, has done it again.

This time with an incredible 128K x 18 semiconductor ADD-IN for DEC®'s LSI-11/23!

This industry first, the DR-113S, is packaged on a standard DEC 8½" x 10" quad board. But more than just being a "first," the DR-113S is also a "best," saving you not only space and money, but also greatly reducing overhead circuitry, optimizing MTBF, and minimizing power consumption. And the DR-113S is also available in 64K and 96K configurations.

From Dataram Corporation, the people who provide everything you need to make a big thing out of the LSI-11 —
• PDP-11/03L compatible chassis • 16K x 18 core ADD-IN • 32K x 18 semi ADD-IN (dual-size board) • BULK CORE and BULK SEMI Disk Emulation Systems • BULK MINI • Tape, Disk, and SMD controllers • and even DEC-manufactured LSI-11 and LSI-11/23 microcomputers and other accessories.

☐ Please tell me more about Dataram 128K x 18 memory for my LSI-11/23 microcomputer.

☐ Please send me information about your other LSI-11 compatible products.

☐ Please have a salesman contact me.

Name _____

Title _____ Phone _____

Company _____

Address _____

City _____ State ____ Zip _____

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

Technology Trends

vances in magnetic materials, head construction and LSI will lead to inexpensive R/W channels. Doubling today's 6800-BPI linear density is an attainable goal.

Ultra low-cost floppies coming

To produce floppy disk drives for consumer systems at costs comparing to cassettes, units will provide the most basic data handling performance by removing unnecessary functions. McCoy sees this done through eliminating the head load solenoid and index sensor; simplifying or droping the spindle motor servo and allowing greater speed variation; providing a simple, low-performance head actuator mechanism; and consolidating common electronics in the host system. Mass-production (as yet unseen in the computer peripherals industry) will push costs to lows undreamed of now.

– Paul Snigier

Portable Terminals Hit Consumers

The broadening of portable terminal markets will parallel the calculator in the 1970s. But the broadening of the portable terminal market will hurt some traditional suppliers.

Language translators a dud?

Expect hand-held terminals to grow sophisticated. Nixdorf, Friends-Amis and other hand-held language translator suppliers are creating software for special-purpose hand-held terminals for many uses. Nixdorf will announce an under-$500 hand-held electronic mail terminal that sends and receives written messages over a telephone line.

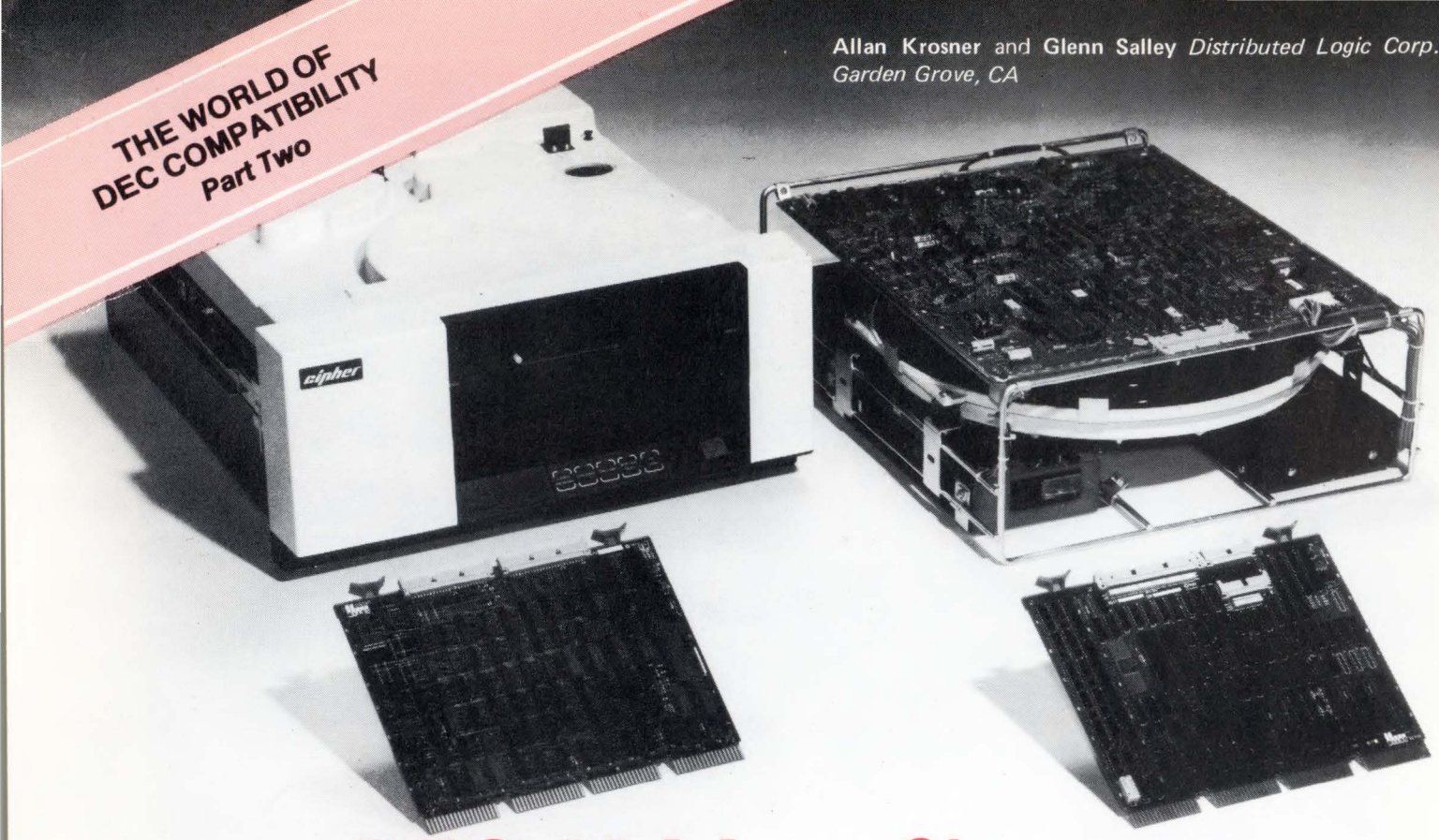
Markets explode

According to our sources, Motorola and two other firms are marketing data terminals which operate over two-way radio channels for inventory control, construction management, and public safety applications. Our editors investigated Motorola's hand-held terminal, used by Police departments to scramble messages with sophisticated encoding techniques. This year's shipments of such portable radio data terminals will be under $5 million. In ten years, this market is likely to soar above the $100 million water line.

– Paul Snigier

THE WORLD OF DEC COMPATIBILITY
Part Two

Allan Krosner and **Glenn Salley** *Distributed Logic Corp., Garden Grove, CA*



DEC-11 Mass Storage Peripheral Controllers

DEC's PDP-11/LSI-11 architecture is unique and DEC's software support is unequaled. Hardware architecture allows users tremendous flexibility in CPU-to-peripheral, CPU-to-memory, memory-to-peripheral and peripheral-to-peripheral interaction. This flexibility is a double-edged sword when designing peripheral devices into the system, since required peripheral controllers are the most complex of any for machines of this class. This complexity manifests itself even more when considering peripheral controllers for electromechanical mass storage devices such as disk and magnetic tape drives.

In a computer-based system, controllers for disk and magnetic tape drives are the most functionally complex elements, outside of the CPU. Most such peripheral controllers are a system within a system: they contain an interface to the CPU I/O bus, an interface to the mass storage device and a powerful transactionally oriented μC with memory as the central decision making element.

Decisions, decisions. . .

End users, system houses, system builders and hardware OEMers can fill their mass storage requirements by: (1) selecting a peripheral controller and mass storage device sub-system package offered by DEC, (2) selecting bundled or unbundled peripheral controllers and mass storage devices from the many independent suppliers, (3) contracting for or designing their own peripheral controller for an electromechanical mass storage device offered by an independent manufacturer.

1. DEC

When buying mass storage peripherals from DEC, with few exceptions, the user has the advantage of DEC technical support and service on his overall system including the peripheral. If there's a problem he doesn't have to get involved, he just calls DEC. This is certainly the most desirable path for the end user without any software or hardware expertise, and it's probably the preferred path for small software system houses, or dealers without any hardware expertise who are dependent upon DEC service for system maintenance at their customers' site. For the latter, this would be a more significant consideration where a disk is involved as the "system" device rather than as merely a data storage device or when considering magnetic tape drives. This is because when the disk is used as a "system" device, it is in most cases synergistically interrelated with the CPU in terms of providing a foundation upon which an applications problem is solved; when either one malfunctions the whole system is down. Where disk or magnetic tape drives are used strictly as data storage devices and not as system devices, generally they can be serviced off-line without the system being down completely when correcting a malfunction.

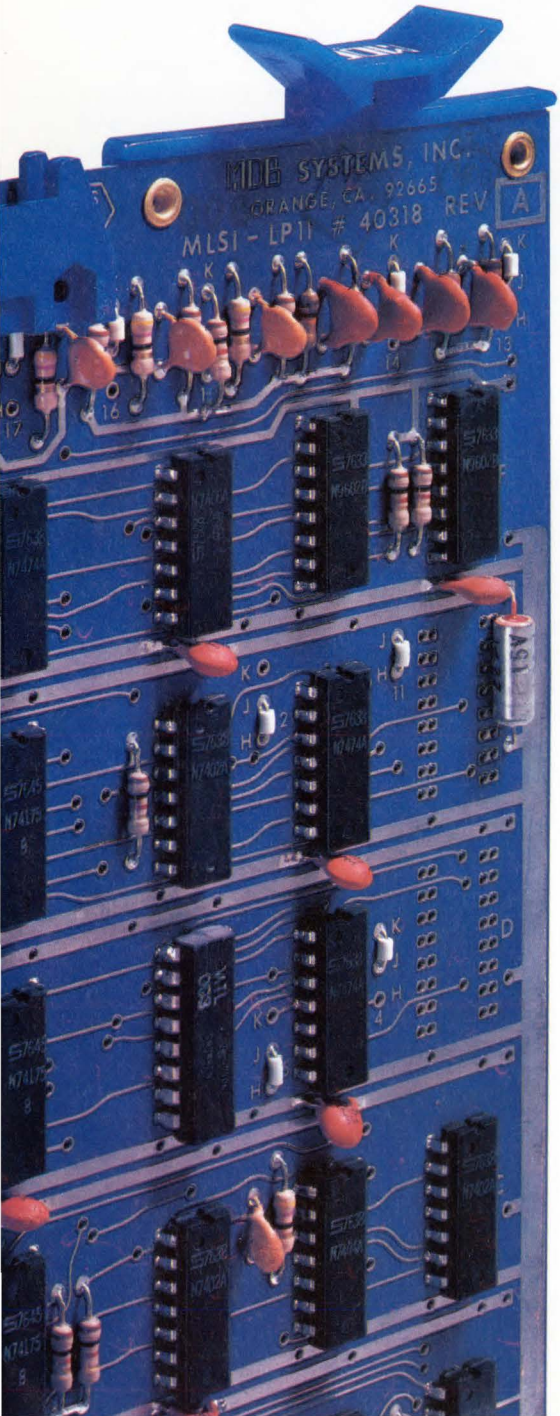
Independent suppliers

There are two overall classes of independent manufacturers in this category. The first are the disk or tape drive manufacturers; the second, peripheral controller manufacturers. Our firm falls in the second category.

The user has a number of options available to him when obtaining product from these manufacturers. He can pur-

MDB makes DEC, DG, HP, P-E and Series/1 Compatible Controllers for every major Line Printer in the world.

Imagine what else we can do!



MDB does it! Lets you pick and choose the exact line printer with the exact speed and performance you need for your system. Because MDB interfaces PDP*-11/03 through 11/70, LSI*-11 & 11/23, VAX* 11/780, PDP-8, Nova,** Eclipse,** P-E, IBM Series/1 and HP 2100, 21MX and 1000 to (ready?) Centronics, Dataproducts, Data 100, Data Printer, Documation, Printronix, GE TermiNet,™ Houston Instrument, Innovative Electronics, Okidata, LA180, Florida Data, CDC and many other line printers. That makes over 100 possible computer/printer combinations including the one you need. Long line options for all combinations are available which allow full speed parallel data transmission at distances up to 3,000 feet.

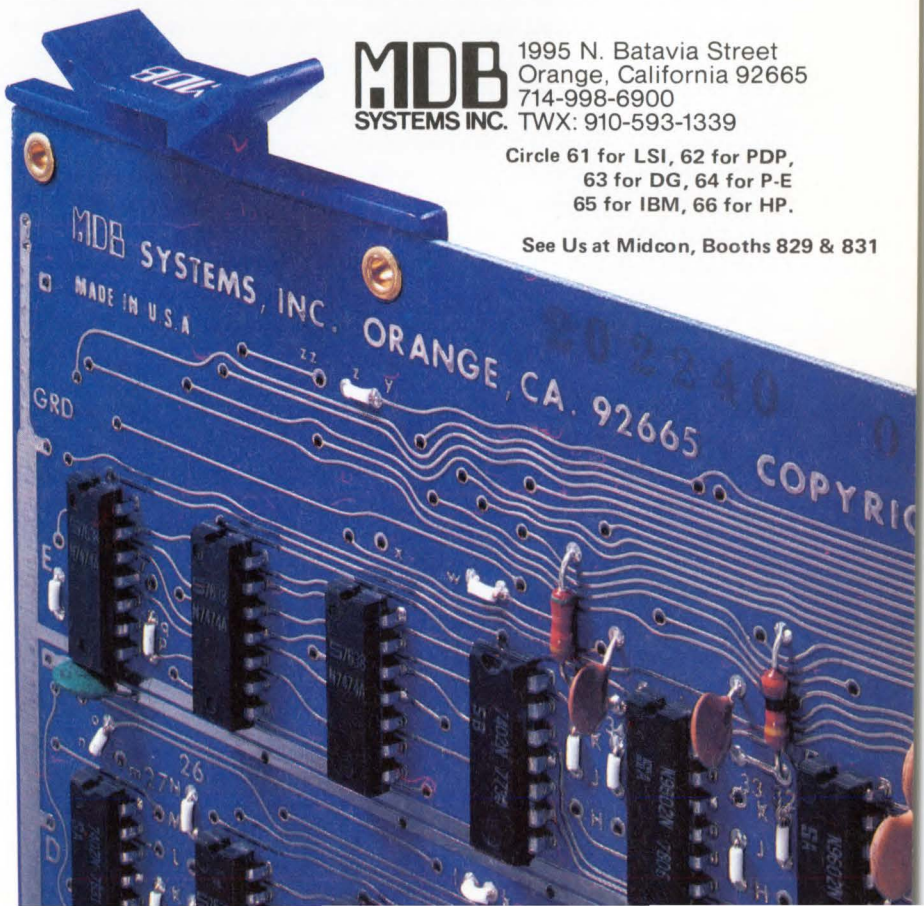
And with MDB you not only get what you want but you pay less for it because an MDB controller with your choice of line printer may cost up to 50% *less* than the host manufacturer's printer system(s).

MDB line printer/controllers are single printed circuit boards that require only one host chassis slot. And each controller is completely transparent to the host operating systems and diagnostics. Operation and programming are exactly as described by the computer manufacturer.

What else can MDB do for you? Look at our data communications interfaces, multiplexors, foundation modules and interprocessor links. Our products range from plain vanilla to plain incredible—like the new memory modules that let you program PROM right on the board. All MDB boards are made by hand, warranteed for one full year and delivered in 30 days or less. Imagine. And they're available under GSA contract #GS-00C-01960.

Now it's your turn. Call or write today.

*TM Digital Equipment Corp. **TM Data General Corporation, a computer manufacturer not related to MDB.



MDB SYSTEMS INC.
1995 N. Batavia Street
Orange, California 92665
714-998-6900
TWX: 910-593-1339

Circle 61 for LSI, 62 for PDP, 63 for DG, 64 for P-E 65 for IBM, 66 for HP.

See Us at Midcon, Booths 829 & 831

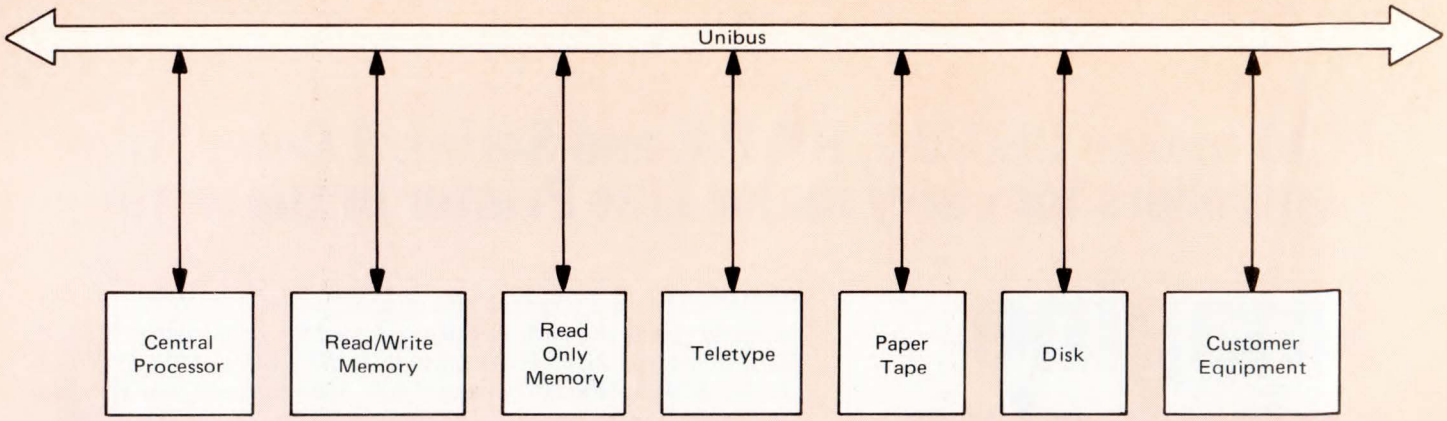


Fig 1 PDP-11 system simplified block diagram.

chase the peripheral controller directly from the controller manufacturer and the disk or tape drive directly from the drive manufacturer and perform his own mass storage subsystem integration. This is the lowest cost acquisition option and the path chosen by most *quantity* equipment buyers. Some of the peripheral controller manufacturers, including our firm, offer subsystem integration services whereby the user can purchase the drive from the drive manufacturer and have it drop shipped at the controller manufacturer's facility where it is integrated and tested with the controller and then shipped out as a completely operational mass storage subsystem. Some peripheral controller manufacturers also offer complete peripheral subsystems including both the controller and the drive. There are also a number of "distributors" which offer "bundled" mass storage subsystems including independently manufactured peripheral controllers and drives which they purchase individually from their respective manufacturers, integrate and offer as a package. The advantages of purchasing disk and tape drives from independent drive manufacturers are well known and include those of price, delivery, and obtaining the latest in state-of-the-art electromechanical drives. The latter advantage is true when considering mC/μC compatible mass storage devices for any of the CPU manufacturers. The majority of the CPU manufacturers' R&D resources tend to go into the development of software, new CPU architectures, and system configurations: whereas, the independent drive manufacturers channel all of their R&D resources into mass storage device development. It is not uncommon for a mC/μC supplier to lag behind the disk and tape drive manufacturers in terms of peripheral technology by as much as two years or more, although this gap is closing.

In general, there are two classes of independent DEC compatible peripheral controller manufacturers. The differences between the two classes are subtle, but real. One class consists of those that offer peripheral controllers which are intended to interface with those devices in DEC's family of drive offerings which are supplied to DEC by independent drive manufacturers. The main thrust of these controller companies is to allow either themselves or a "distributor" to get under the DEC price umbrella and offer quick delivery on a functionally and almost physically equivalent product to DEC's. (The drives are physically equivalent even though the controllers may vary in their implementation.)

The other class of independent DEC peripheral controller manufacturer is the one that concentrates on offering the DEC computer user a sensible approach to taking advantage of the latest in the state-of-the-art offerings of the drive manufacturers. (Drive technologies which DEC does not yet offer.) Examples of this are 8″ and 14″ high-performance Winchester disk drives, embedded formatter 1/2″ magnetic tape drives, and streaming 1/2″ magnetic tape drives. In general, the offerings of these manufacturers are compatible with a particular DEC software set and, where necessary, media compatible such as with magnetic tape or certain cartridge disks, even though the drives which they are controlling bear no physical resemblance to and are advanced from a specification standpoint over DEC supplied peripherals. For example, a controller might make a high performance Winchester disk drive appear to the software as a DEC RL01/RL02 cartridge disk drive or a microstreamer magnetic tape driver appear to the software as a classic start/stop DEC TM-11 reel to reel tape drive. Other peripheral controller offerings from this type of company might be more universal or esoteric devices for the sophisticated user that can't solve his applications problem with DEC standard software oriented devices; for example, those users that in order to optimize data base transactional timing and access methods, such as is the case in some specialized image processing applications, must logically map a disk drive to a special algorithm. The main thrust of this class of manufacturers, rather than competing with the DEC peripherals directly, is to enhance the DEC CPU offering by allowing the user to select from a broad variety of state-of-the-art peripheral devices.

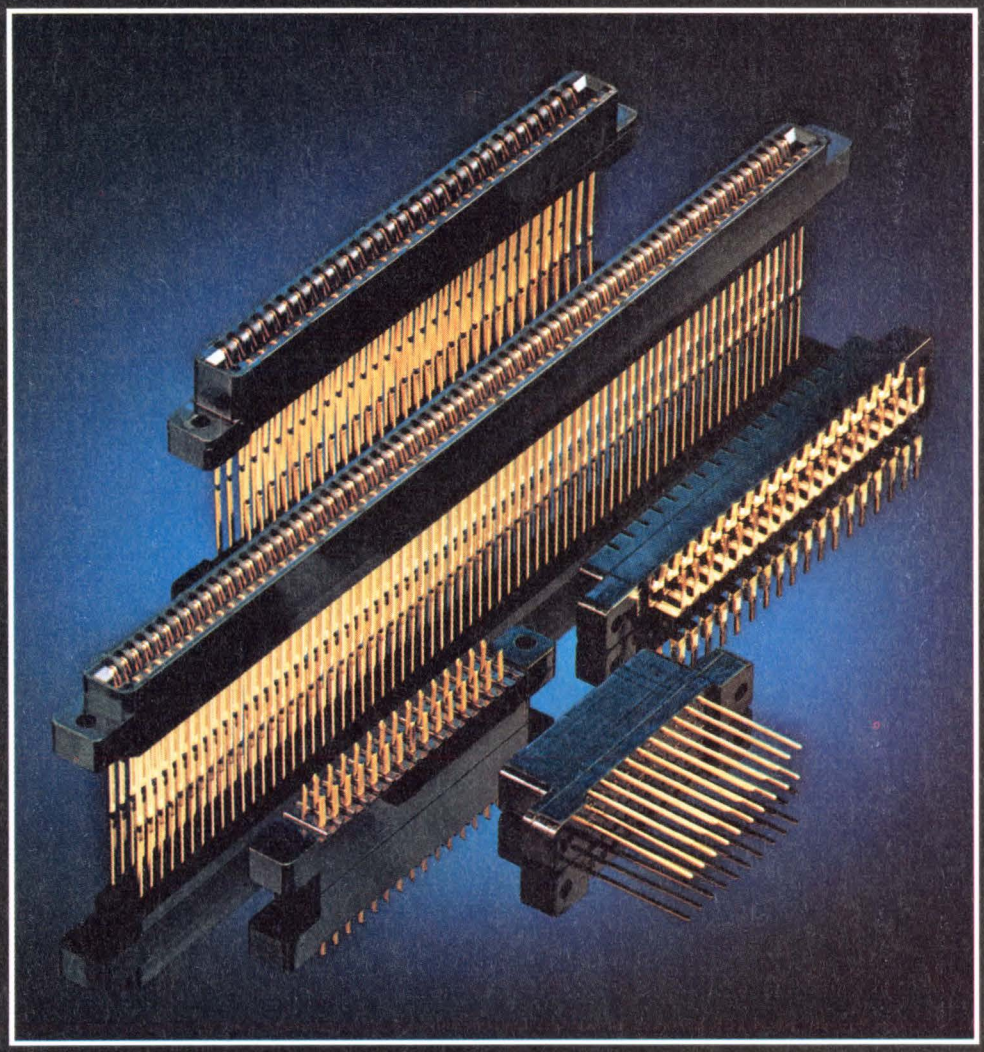
From a price/performance standpoint independent manufacturer supplied peripherals are the optimum choice for the technically-aware end user, systems house and OEM manufacturer.

In-house or contract design

Not too many CPU users consider designing on their own or contracting for a disk tape drive peripheral controller. This is always a very costly and time consuming exercise. The situations where this would be the path to follow would be where the application is of an esoteric nature and there aren't any independent or DEC standard peripheral "packages" which will do the job. In general, those would be applications where a high performance peripheral device has to be interfaced in a special manner and DEC standard software drivers, and in some cases even operating systems, can't be used. This costly exercise can be avoided in some situations with the utilization of peripheral controller offerins such as our DX200 universal mapping disk controller,

Call one of our design engineers. They're idea men—the men who helped create what is now the largest and best line of P/C connectors around. That's a lot of connectors. More important, that's a lot of experience. And it's experience that's yours for the asking. Do ask.

How to make sure you've specified absolutely the best P/C connector.



Viking
CONNECTORS

21001 Nordhoff Street/Chatsworth, CA 91311, U.S.A.
(213) 341-4330/TWX 910-494-2094

Circle 32 on Reader Inquiry Card

which allows the user to tailor the functional architecture of a high performance mass storage disk device to suit his application via a software driver.

DEC-11 peripheral interfacing

Because mC/μC architectures vary so widely, their interface design requirements cover a broad spectrum of complexities. DEC-11 machinery is at the high end of this spectrum. Communication between system components, CPU, memory and peripherals is accomplished by a single high speed bus. The architectural philosophy of this bus is somewhat unique among the mC manufacturers in that all system components communicate with each other in a similar unified manner. There are no separate I/O instructions. All instructions that are applicable to memory are also applicable to peripheral device controllers.

Communication between two devices on the bus is accomplished by a master/slave protocol. During a bus operation, one device called the "bus master" controls the bus and communicates with another device called the "slave." An example of this is the disk as master transferring data to/from the memory as slave. Master/slave relationships are dynamic and allocated by the CPU on a priority basis. This architecture produces an extremely versatile system since the main CPU does not have to get into the middle of the data transfer operations.

The device controller requests use of the bus, which is then granted on a priority basis by the CPU. Once a device is granted the bus, it controls all data transfers on the bus. A device can become bus master to enable it to transfer data or to interrupt service routine, to service the device. When the device is finished with the bus, it relinquishes control of the bus, at which time the CPU will either take the bus or allocate it to another requesting device.

Within DEC's family of machines there are, at the present time, three bus subarchitectures: the Unibus, used in the PDP-11/04 through the PDP-11/60, the Unibus/cache bus combination as used in the PDP-11/70 and the sub-Unibus, sometimes referred to as the "Q" bus used by the LSI-11 based machines.

Communication on the Unibus can be programmed I/O, interrupt driven, or direct memory access. **Figure 1** shows a simplified block diagram of the PDP-11 bus architecture.

Programmed I/O is accomplished by the CPU continually polling the device to monitor its need for servicing. This is the slowest and least efficient means of data handling, although it is the simplest from a hardware design standpoint. Slower speed devices, such as paper tape readers and punches, printers, etc., can use this method, but standard software usually augments this with the interrupt mode. The device controller will interrupt the CPU forcing the currently active program to call a device handling subroutine, which under programmed I/O accomplishes the data transfer.

The higher speed mass storage devices use the direct memory access (NPR) mode to transfer data. The programmed I/O operations are used for status and control of these devices. The interrupt mode is used to signal the completion of an operation.

The cache bus addition to the Unibus significantly increased the throughput capability of the DEC minicomputers. Controllers designed for the cache bus transfer data over this high speed 32-bit wide bus, but all control and status information is still handled by the Unibus.

The sub-Unibus or "Q"bus is a variation of the Unibus. It uses a multiplexed 18-bit bidirectional bus for both address and data transfer, whereas the Unibus has a separate 18-bit address bus and a 16-bit data bus. Because of its time multiplexed nature the throughput of the "Q" bus is less than the Unibus.

Controller architecture

Until a couple of years ago mass storage peripheral controllers were large multi PC board configurations mounted in a custom-wired system backplane that required considerable space in the CPU main frame or an external chassis with power supply. Today's mass storage controllers are on a single PCB that plugs into one standard CPU backplane slot. These μP-based controllers use bit-slice technology, making the controller versatile. By changing microcode, the controller handles different drive configurations; its characteristics are easily modified to optimize system performance.

In a μP-based controller, the original development of and modifications to the microcode require some form of a CAD system. At the least, a Writeable Control Store (to take the place of the PROMs) and a microcode assembler are required. There are commercially available Writeable Control Stores and microcode assemblers. The commercially available assemblers, because of their need to be applicable over an unlimited number of architectures, are somewhat cumbersome to use. By writing your own assembler that is customized for your specific architecture, the ease of writing and editing th microcode is greatly enhanced. Once the CAD system and peripheral controller architecture are developed, they can be used to develop a broad range of peripheral device controllers.

The major components of a mass storage microprocessor based controller are: the CPU I/O bus interface, the peripheral device interface, a data buffer or FIFO, and μP. (**Figure 3** shows a basic controller block diagram.)

In a bit-slice based controller, the μP is comprised of a number of components: the bit-slice itself (which handles the internal data busses), the PROMs (which contain the microcode), the central address processor or sequencer, and the condition code or status register. Due to the speed of the data that is encountered when interfacing a mass storage device, data to/from the peripheral device usually flows directly to/from the buffer or FIFO without the bit-slice being directly in the data path. The μP responds to CPU commands, assembles status and error information, increments the DMA address and byte count, controls the peripheral device and generally acts as an arbitrator.

The advent of the μP-based controller greatly simplified, from a hardware standpoint, the CPU I/O interface and peripheral device interface. These are now basically comprised of registers and passive components with the μP handling the dynamic requirements.

Mass storage/CPU transfer rate matching

When designing a high-speed, mass-storage device controller for a DEC 11 CPU, the device's burst mode data transfer rate and the CPU's bus bandwidth must be compared. Normally, some form of throughput rate control must be implemented so that the high speed device will not usurp an excessive amount of CPU bus bandwidth availability which can slow down the processing of interrupts and prevent other devices from communicating with memory causing what are in the DEC vernacular referred to as "data late errors". This becomes more of a factor when considering the data transfer rate for many mass storage devices is close to or exceeds the total available bandwidth of the sub-Unibus.

There are several variations or methods of implementing

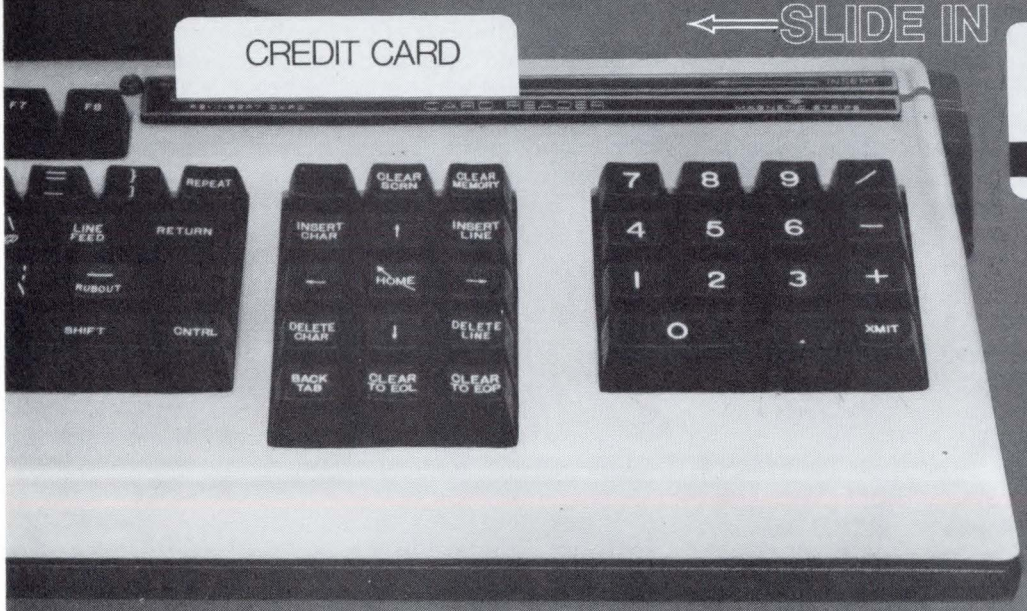
NEW!

Another TEC First

Model 70C Microprocessor Based CRT

Card Reader CRT Terminal

- Magnetic stripe card reader keyboard.
- Reads cards encoded to the international air transport association (IATA) standard.
- Up to 76 alpha/numeric characters may be recorded on one card.
- ASCII data is read from the card and sent to the CPU, and is stored in the terminal's memory but not displayed to provide security.
- Offers ability to control access to computer and data files by requiring each operator to have a card, possibly containing a user identification number and security level code.
- Read error light signals operator to reread card in the event of a card misread.
- Applications include credit card sales transactions, airline ticketing, security.



CREDIT CARD

MAGNETIC STRIP

Distributor Inquiries Welcomed

TEC®

TEC, Incorporated

2727 N. FAIRVIEW AVE., TUCSON, ARIZONA USA 85705 (602) 792-2230 TWX 910-952-1377 TELEX 16-5540

- BOSTON (617) 879-6886
- CHICAGO (312) 655-1060
- DALLAS (214) 436-3416
- LOS ANGELES (714) 848-3111
- MINNEAPOLIS (612) 941-1120
- SAN FRANCISCO (408) 374-2660
- WEST PALM BEACH (305) 684-1604

TEC International, Inc.

EUROPEAN SALES OFFICE: AVENUE LOUISE 148—BOX 6, BRUSSELS, BELGIUM (02) 649-8154 TLX 846-63553

Circle 21 on Reader Inquiry Card

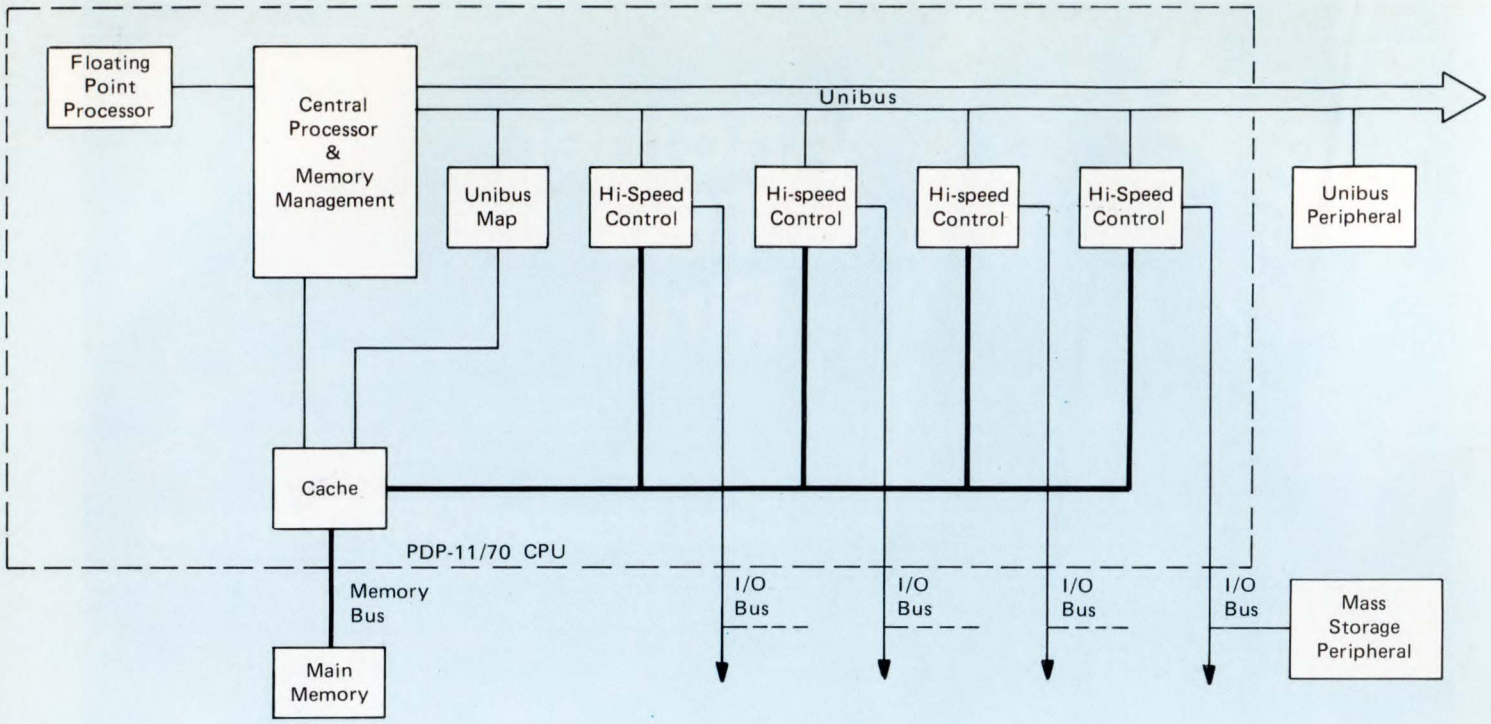


Fig 2 PDP-11/70 block diagram.

the throughput rate control function. The method used is for the most part dependent upon the characteristics of the peripheral device being controlled and the bus bandwidth characteristics of the CPU being interfaced with. Taking these two factors into consideration along with, in the case of a general purpose controller, an analysis of the majority of applications in which the controller will be used, or in the case of a *special purpose* controller, a detailed analysis of the specific application, will allow the designer to implement the proper control algorithm.

Fundamental to any throughput rate control algorithm is the buffer located on the controller in the data path between the peripheral device and the CPU I/O bus. The size of the buffer and it's method of operation can vary greatly.

For mass storage devices having data transfer rates in the order of 40% or less of the bus bandwidth, generally a simple 4 to 32 word buffer with FIFO implementation and variable length burst mode (throttle) access to the CPU bus is adequate. Typical peripheral devices where this level of throughput rate control proves sufficient would include 2315/5440/RK05 type cartridge disks and NRZI/PE ½" magnetic tape drives. When considering the interfacing of IBM 3XXX technology disk drives such as the majority of Winchester disks and higher capacity pack and cartridge type drives used with μPs today and 6250 BPI GCR formatted magnetic tape transports, FIFO organized buffers of 500 to 1,000 words or more may be required in order to avoid "data late errors." These high speed devices exhibit transfer rates as high as 2 million bytes per second. All techniques of this nature (FIFO) are implemented with a fixed length buffer which is filled to a variable capacity at any given point in time dependent upon short term transfer rate differentials between the CPU bus and the peripheral device.

Another common buffering algorithm used when tying higher speed disk drives into low end CPU's such as the LSI-11 family, is to use a fixed length buffer in the interleave mode whereby only every Nth physical sector on a specific disk track is accessible in a single revolution of the disk. In this case the buffer size would be equal to one sector's worth of information. If "N" were 3, the sequence of events in a read data transfer from disk operation would be to fill the buffer with data from the desired sector, then unload the buffer into the CPU memory over the next two physical sector times, reload the buffer with another sector's worth of information, unload into memory over the following 3-to-2 interleave. By it's very nature, it cuts the effective disk data transfer rate down by a factor of 3.

A fallout advantage of the interleaved sector buffer technique is that no "data late errors" can possibly occur. If a system is operating in a very demanding multi-device real time application, and the data throughput of the CPU bus cannot keep up with the transfer rate of the disk, the controller will allow the disk to simply take an extra revolution to acquire the data from the next sector. Although the sustained data transfer rate to and from a disk using this kind of buffering technique is certainly less than using a large FIFO, the guarantees against "data late errors" or bus overloading are absolute. When using a FIFO although the probabilities of ever exceeding the bus bandwidth are minimal, that possibility still exists since the FIFO's ability to handle bus/peripheral bandwidth differential is based on a statistical probability which will vary based upon the specific system application.

Software compatibility

One of the more difficult hurdles to overcome when designing a mass storage device controller for the DEC-11 family is in determining what level of software compatibility the device is to exhibit, and then assuring that the controller will run at that level under all DEC operating systems. This assumes, of course, that the application is not one of a special nature where software compatibility is purposely being avoided in order to fill specific needs.

Let your LSI-11* break the 28K barrier

With our Bank-Switching family

In LOCAL mode our memory is functionally just like DEC memory. But when you run out of memory space you're not lost. Add an inexpensive Bank-Switch Controller (BSC-256) and you can go to **two megabytes.** Add another and go to **four megabytes.**

So don't get boxed in with other brands of LSI-11* memory. Break free. Join the family:

RMA-032	32K by 16 bit RAM. On-board refresh	$990 (Single qty.)
RMS-016	16K by 16 bit ROM. (Intel 2716)	$300 (Single qty.)
BSC-256	The Bank-Switch Controller	$300 (Single qty.)

Substantial quantity discounts are available. The RMA-032 is also available without memory chips for $450 (single quantity). For a free copy of our Bank-Switching manual, call or write on your company letterhead.

Digital Pathways Inc.
4151 Middlefield Road
Palo Alto, CA 94306
(415) 493-5544

**Registered trademark of Digital Equipment Corporation*

DIGITAL PATHWAYS

Circle 22 on Reader Inquiry Card

In general, when considering state-of-the-art mass storage devices not currently being offered by DEC it is desirable to have compatibility with a specific set of DEC software drivers used under the various operating system configurations. However, it is not desirable from an implementation, cost, size, and time standpoint to run all diagnostics pertaining to the DEC device whose drivers will be used. This is because certain "maintenance register" functions tested by some diagnostics are never used by operating software. The maintenance register diagnostic operations are related only to the DEC hardware implementation. Since the drives being interfaced have no DEC physical counterparts, maintenance register functions are of no use in ascertaining operationality of the newly designed hardware. A great deal of circuitry can be used up in "fooling" the diagnostics into thinking that they are testing a specific DEC hardware implementation of a storage function without any benefit to the user. Therefore, compatibility with selected diagnostics of a more functional nature is the goal that should be strived for, rather than total diagnostic compatibility.

Disk mapping

Most general purpose independently manufactured disk controllers for the DEC-11 and other lines of minicomputers are designed to operate with the software set for a standard disk package offered by the main frame manufacturer. This type of controller is sometimes referred to as an emulator. Some problems must be solved when this type of controller is used with an independently manufactured disk drive which is both physically and architecturally different from the main frame manufacturer's standard disk drive, which the software set expects to be handling.

For example, the DEC RL02 cartridge disk, controller, and software combination may have up to four 10.2-MB physical cartridge disk drives. The software treats these physical drives as four 10.2-MB logical units having a specific sector, cylinder, platter and head configuration. A controller designed to run the DEC RL02 software with a Winchester disk drive of 40.8-MB formatted capacity, would have to convert the disk addressing information generated by the RL02 software drive into a format or configuration compatible with the Winchester drive. In this example it would have to make the Winchester drive look to the software as four 10.2-MB RL02 logical drives. This process of address parameter conversion would be accomplished by the controller in a manner totally transparent to the software. This conversion is commonly referred to as mapping. The mapping algorithms used by a μP-based controller are implemented in the microcode and are generally fixed for a specific physical drive configuration. That is, if another drive architecture is to be interfaced a different microcode set must be installed in the controller.

Depending upon the choice of the drive and the software driver that is to be used it may be impossible to do an exact mapping and the software driver may need to be patched. Most of the time this involves only changing the size of the logical unit which amounts to modifying a couple of constants. In other situations such as using a Winchester disk drive with a fixed head option, considerable changes may need to be made to the software driver.

In cases where an OEM customer might be considering using a number of different types of drives to handle varying applications, or in some esoteric applications where the user desires to optimize interaction with his data base device and the standard DEC software can't do the job, it may be undesirable to use a general purpose emulating controller. For

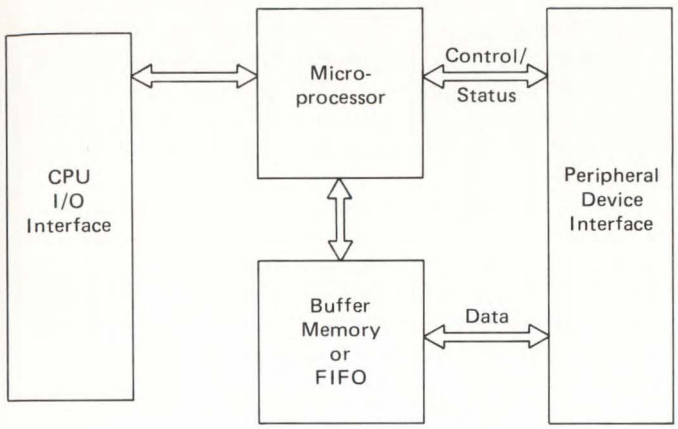


Fig 3 Mass storage device controller simplified block diagram.

these applications, a non-emulating controller which allows the user to configure a software driver in a variety of different ways from the standpoint of disk accessing, may be the optimal choice. Controller applications of this type include: those where a customer desires to use 8″ and 14″ Winchester disk drives with capacity ranges between 20 and 160 MB without changing or modifying the controller; where the fixed head option on a winchester drive is to be used; or where it is desired to make a large number of sequential or random file accesses more quickly than is allowed for by a standard DEC configuration. The DILOG Model DX200 is a "universal mapping" controller of this type and allows the user to handle all of these cases when disk drives with industry standard SMD interfaces are considered.

Maintainability and packaging

Controllers that are comprised of multiple PCBs, special backplanes or separate chassis are a poor selection from a maintainability standpoint when compared with controllers that are implemented on a single PCB. Minimizing system down time due to hardware malfunctions has always been a much sought after goal. The most logical approach to reducing down time is to use modular replacement techniques when performing system level maintenance or troubleshooting. This is especially true with the sophisticated and architecturally complex controllers of today, where to try and troubleshoot a controller in the system could mean that the system could be down for a long period of time. Single board controllers make it easy to support your user base with an extensive module replace and repair program since the boards are much easier to handle from a logistics standpoint. Common carriers such as Federal Express, UPS, and the U.S. Mail can be used to give fast and reliable replacement service.

Single PCB controllers require less power and space from the host computer than their multiple board counterparts. When considering the low end of the DEC-11 family, a single board controller can mean that the user doesn't have to add an additional chassis when expanding a system and that he won't get into power supply capacity problems. This is an especially cogent point when considering that some of the smaller DEC-11 computers may have as few as four quad slots available in the backplane for the CPU, memory and all peripheral controllers. The power supplies for these

smaller machines have only 18 amps of +5 volts available. Multiple board controllers can require as much as 7 to 9 amps of +5 volts and two or three slots. It is easy to see that when adding disk and magnetic tape to a system with two board controllers, four slots would be required and 14 to 18 A of power, thus leaving no space or power left over for the CPU and memory, which is an interesting predicament to say the least.

An often overlooked advantage of single board controllers, especially if they keep you out of an expansion chassis, is the reduction in number of connectors required in a system. If you've done any DEC-11 system troubleshooting or maintenance at all, you can certainly appreciate the problems that more interconnection can entail.

With the advent of μP-based peripheral controllers the ability to do extensive self-testing is available through microdiagnostics implemented right on the controller itself. This self testing not only helps in diagnosing systems problems but also smooths the production testing cycle.

DEC-11 eccentricities

If you've decided that because of your application, quantities involved, etc. that you must design your own controller or contract it out, the following paragraphs discuss a few DEC-11 eccentricities.

DEC-11 bus driver/receivers. The DEC-11 Unibus and sub-Unibus use a bus driver/receiver IC that is often unavailable and, in even the best of circumstances, supplied by only a few vendors. This IC has some peculiar characteristics. Its receiver, for example, must have an input threshold of about 2V with a maximum leakage of about 25 μA. Its transmitter, on the other hand, must be an open-collector device and must also exhibit a 25 μA leakage. These numbers limit the selection of IC's you can use in your interface because most standard devices have 40 and 250 μA leakages for input and output, respectively. DEC went through a long evolution of bus electrical specs before arriving at the present one. Substituted devices will most likely run for you in your test/development system, but production repeatability will be nil. To obtain the special circuits a PDP-11 interface requires, you must go to DEC or the manufacturer who initially supplied DEC. Until second sources appear for these chips, you'll be competing with DEC itself for available quantities.

Prototype testing. When testing a new design with DEC-11 computers, careful consideration should be given to use of event or transient recording techniques due to the asynchronous nature of the bus. Without using techniques of this type, when you violate a timing spec, by the time a problem is noticed the particular event that caused it will have passed and the bus will then hang up with no evidence as to what had caused the hangup. In that there is only the one common bus, any bus hangup shuts the entire system down, which means that no CPU registers or device registers can be examined to get any evidence as to the nature of the problem.

Bus latency. Due to the latency time required by the master/slave bus acquisition, much care is required in designing an interface for high speed devices. Adequate buffering must be provided to accommodate the amount of data that the peripheral device requires during the several microseconds that will elapse while the peripheral controller is acquiring the bus. Once the peripheral controller acquires the bus (becomes bus master), multiple words can be burst transferred at near memory speeds to catch up before relinquishing the bus. This catch up should be done over a

DILOG INTERFACES DEC 11*

10 intelligent hard disc and magnetic tape controllers offer LSI-11,* 11/2, 11/23, and PDP-11* single quad slot compatibility with up to 60% power saving.

Only DILOG (Distributed Logic Corporation) exclusive automated design, common proprietary architecture and sophisticated bipolar μPs give you • all single board quad size products requiring no external power or chassis . . . just a cable to connect the drive . . . *you don't need anything else* • high reliability • automated self-test including data base protect feature and indicator. And at cost savings of 50% or more.

LSI-11 MAGNETIC TAPE CONTROLLER, Model DQ 120, interfaces 4 industry standard reel-to-reel drives • emulates TM11* • handles 7 and/or 9 track NRZI drives to 112.5 ips • selectable DEC or IBM byte order formatting • data error checking • RT-11/RSX-11* compatible • extended addressing to 128K words.

LSI-11 MAGNETIC TAPE COUPLER, Model DQ 130, interfaces dual density (NRZI/PE) formatted drives • emulates TM11 • handles up to eight 9 track 800/1600 bpi industry standard drives at speeds from 12.5 to 125 ips • "streamer" mode capability • software or switch selectable density • RT-11/RSX-11 software compatibility.

LSI-11 MASS STORAGE DISC CONTROLLER, Model DQ 200, interfaces any two SMD flat cable interface compatible hard disc drives for up to 500 MB on-line storage • mix or match compatible Winchester, SMD or CMD • variable sector size • automatic media flaw compensation with bad sector flagging • optimized logical to physical unit mapping • implements Winchester fixed head option.

NEW LSI-11 SHUGART SA4000 WINCHESTER DISC CONTROLLER, Model DQ 201, emulates DEC RK* • runs drivers under RT-11 and RSX-11M* systems • compatible with 14.5 MB SA4004 or 29 MB SA4008 drives • automatic media flaw compensation.

LSI-11 DISC CONTROLLER, Model DQ 100, interfaces 2.5, 5, 10 or 20 MB cartridge and fixed platter drives in combinations to 80 MB • RKV-11/RKO5* emulator • handles front load (2315) and/or top load (5440) drives • automatic power fail/power down media protection • RT-11/RSX-11 compatible.

NEW LSI-11 EMULATING MASS STORAGE CONTROLLER, Model DQ 202. Cost effective interface of two 8 and/or 14-inch Winchesters, SMD or CMD hard disc drives without changing controller . . . 8 to 300 MB capacity • RP emulator • automatic media flaw compensation.

PDP-11 MAGNETIC TAPE CONTROLLER, Model DU 120, emulates TM-11 and has same features as Model DQ 120 (LSI unit) • software compatible with RT-11, RSX-11, RSTS, IAS and MUMPS.

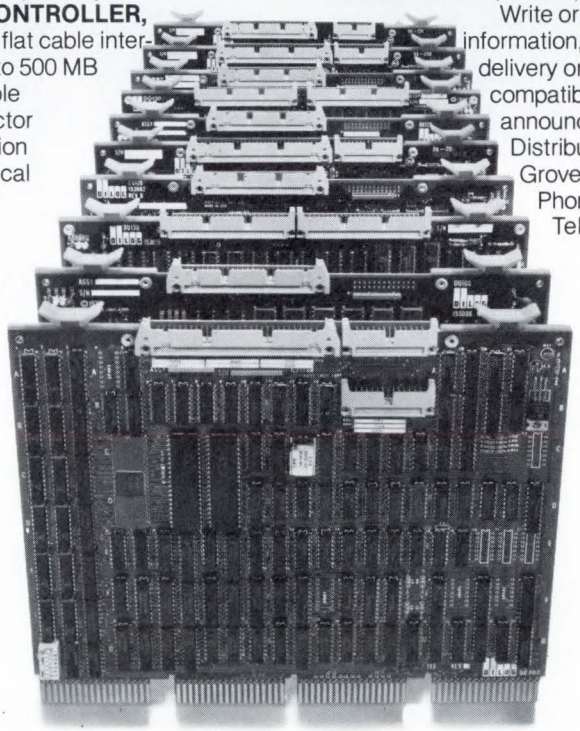
NEW PDP-11 MAGNETIC TAPE COUPLER, Model DU 130, offers features of Model DQ 130 (LSI unit) • RT-11, RSX-11, RSTS, IAS and MUMPS software compatible.

PDP-11 DISC CONTROLLER, Model DU 100 includes features of Model DQ 100 (LSI unit) • RT-11, RSX-11, RSTS, IAS and MUMPS compatible • emulates RK-11.

NEW PDP-11 EMULATING MASS STORAGE CONTROLLER, Model DU 202, offers same features as Model DQ 202 (LSI unit).

Write or call for detailed product performance information, OEM quantity pricing, stock to 30 day delivery or warranty data on these DEC 11 compatible products . . . or several soon to be announced new DILOG products.

Distributed Logic Corp., 12800-G Garden Grove Blvd., Garden Grove, CA 92643
Phone (714) 534-8950
Telex: 681399 DILOG GGVE



DISTRIBUTED LOGIC CORP.
DILOG

All DILOG μP Products are Low Power, Quad Size

*Trademark Digital Equipment Corp.

Circle 24 on Reader Inquiry Card

period of time, transferring only a few words, relinquishing the bus, and then repeating the process until the catch up has been completed. This will insure that neither the CPU nor another device will be locked out for unacceptable periods of time.

Power down. Designing interfaces for the LSI-11 presents a unique problem involving the power-down sequencing. Mass storage devices must be protected against data corruption due to a loss of power. A number of independent suppliers of LSI-11 chassis do not sequence the signals associated with power up and down as specified by DEC. This must be considered when plugging the mass storage device controllers into these independently manufactured chassis/power supplies.

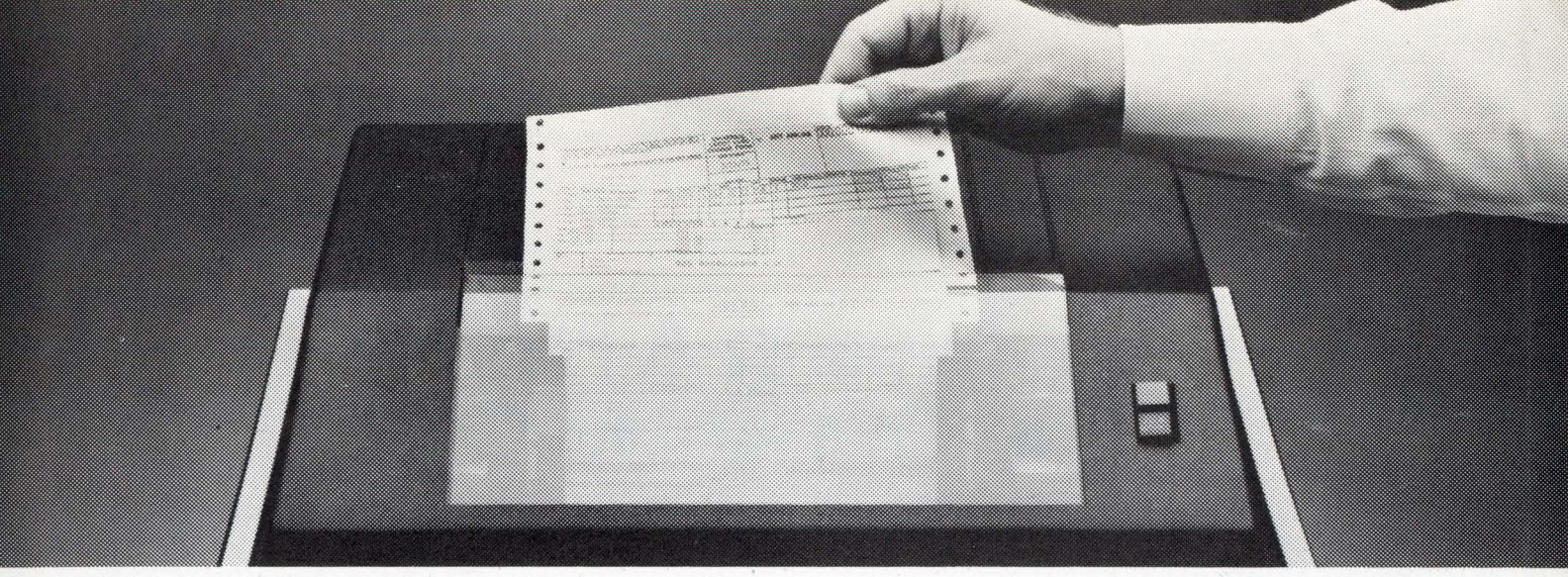
Media for software interchange. When connecting a non media compatible mass storage device to the DEC computers, a means of initially entering the software must be considered. An end user will need a DEC media compatible device on his system for this purpose. An OEM will require a DEC media compatible device on his development system and some means of down loading software to his production system.

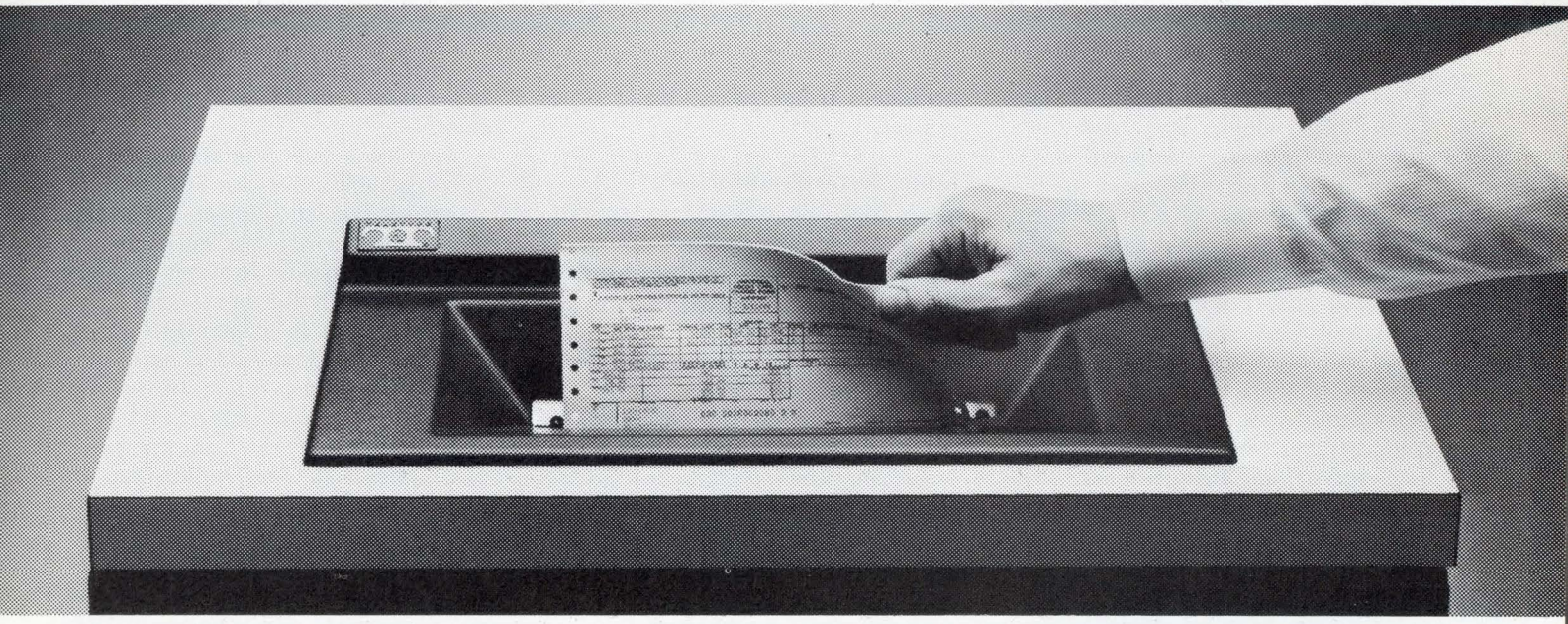
The future

Functionally, the near term future in terms of mC/μC-based systems using mass storage peripheral devices lies in the direction of distributed intelligence. That is, disk and tape drives with built in μP-based intelligent formatters/electronics. We are already seeing this in the ½" magnetic tape area with the microprocessor based formatter embedded in the magnetic tape drive rapidly becoming the industry standard. This means that the devices which tie the drives into the computers will no longer be "controllers" in the classic sense, but more adapters.

How quickly the movement towards drive embedded intelligence will affect the architecture of disk based systems is uncertain at this time. It seems obvious that the technology is certainly here now to offer highly intelligent μP-based formatting electronics mounted inside the disk drive. Indeed, there have already been a small number of disk offerings with a μP-based intelligent formatter embedded within the drive that allowed the user to program a number of functions such as automatic file searches, parallel or serial interfaces to other CPUs, exotic contention networks, etc. It is interesting to note here, however, that only that part of the formatter intelligence which pertains to the fundamental drive functions is really of any value when looking at adding the drive to a mC/μC (such as the DEC-11 line), since the standard software offered by DEC and most other manufacturers at this time has no way of taking advantage of a controller which does automatic file searches, etc. It would appear that "systems" oriented intelligence such as this will have to wait on the sidelines for major operating system architectural advances or changes to be offered by the CPU manufacturers. It is unclear how far in the future these architectural advances might be offered or whether it even makes sense from an overall system point of view to offer same. But is it definite however that "device" oriented intelligence built into the drive is rapidly moving to the forefront in mass storage peripheral technology.

Rate this article: circle 5L, 5M or 5H on Reader Inquiry Card.





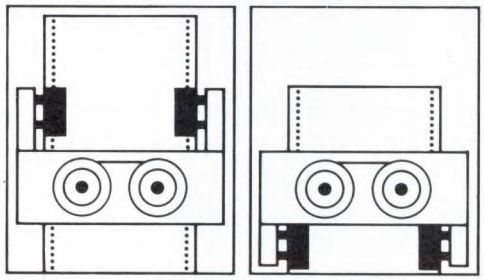
THE BOTTOM LINE ON FORMS ACCESS PRINTERS.

Why can the Teletype* model 40 printer give you the bottom line when most other printers can't?

Because with the Teletype model 40 printer, you can print from the very top to the very bottom line of any form, tear it off, and never waste or destroy the next form.

It saves paper.

We designed our Forms Access printer with the tractor feed mechanism mounted below the print line. The paper is pushed up through the printer, so you never have to feed a second form through to get at the one you just printed.



Theirs. Ours.

It makes money.

And, while your customers save paper, you make money. Teletype Corporation's low price on the remarkable model 40 makes it extremely cost efficient. Plus our proven LSI circuitry assures you of high reliability.

And it's ready to go to work now.

The model 40 unit includes everything you need to go on-line right now. There's also handsome cabinetry or modification kits available to make packaging quick and simple. Plus technical assistance if you need it.

And that's the bottom line on the Forms Access printer. No wonder we're getting a reputation as the printer people.

Teletype Corporation
5555 Touhy Avenue, Dept. 3185, Skokie, IL 60076.
Telephone (312) 982-2000.

Circle 52 on Reader Inquiry Card

*Teletype is a trademark and service mark of the Teletype Corporation.

Howard Kendall
Data Printer Corp., Malden, MA

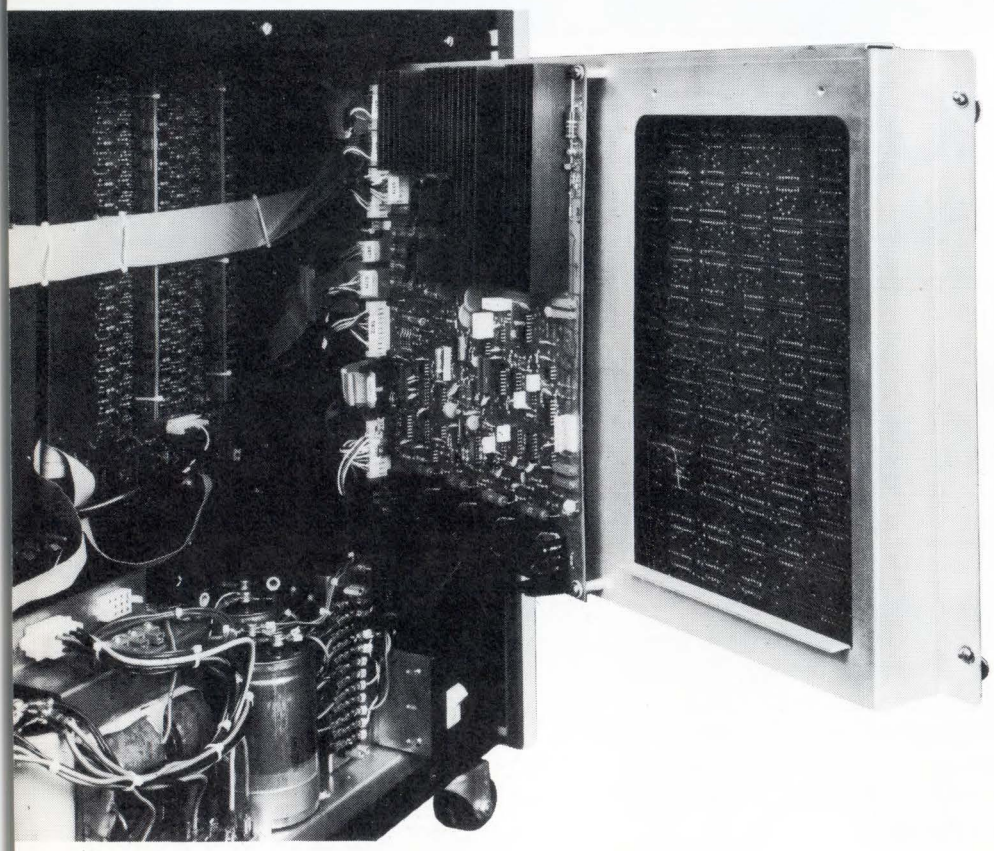
Uncovering A Printer's True Ownership Cost

In today's economy system integrators and builders, and users, must consider all costs associated with printer purchases. Paper costs over the life of the average line printer can equal three to five times the printer's initial purchase price. If overlooked, other ownership cost factors can create enormous expenses that your customers discover only after it's too late. And, end users are now starting to ask more sophisticated questions before buying computer systems. Less and less will they accept the argument that such costs are a function of uncontrollable factors, such as paper costs, ribbon replacement expenses and maintenance charges.

Some basic assumptions

Three basic areas should be carefully evaluated in determining your potential ownership cost expenses: printer life expectancy, maintenance rates and cost of consumables.

First, make an assumption about your printer's life expectancy because the period of time the device will be used will impact total costs. Total ownership cost for a printer that lasts one year is far greater on a per-output basis than a printer that survives five years. (Life expectancy also helps determine more than just cost-of-ownership.)



For most line printers, it's fairly safe to assume a five-year life cycle; it's a commonly-cited statistic. Chaintrain printers frequently last much longer, while some newer low-cost printers operate properly for three years.

Next, factor in maintenance costs. If you're an end user planning to buy a service contract, these figures are known. If you're planning to do your own maintenance, there are numerous other printer statistics you'll want to look at to roughly determine anticipated costs. MTBF, labor rates and spares costs are a few. We'll make assumptions here about maintenance and other costs, but only for illustration; adjust your own figures accordingly. For example, even though maintenance rates vary, our rates here were assumed to be between $125 a month for low-speed line printers and up to $200 for high-speed, heavy duty cycle printers.

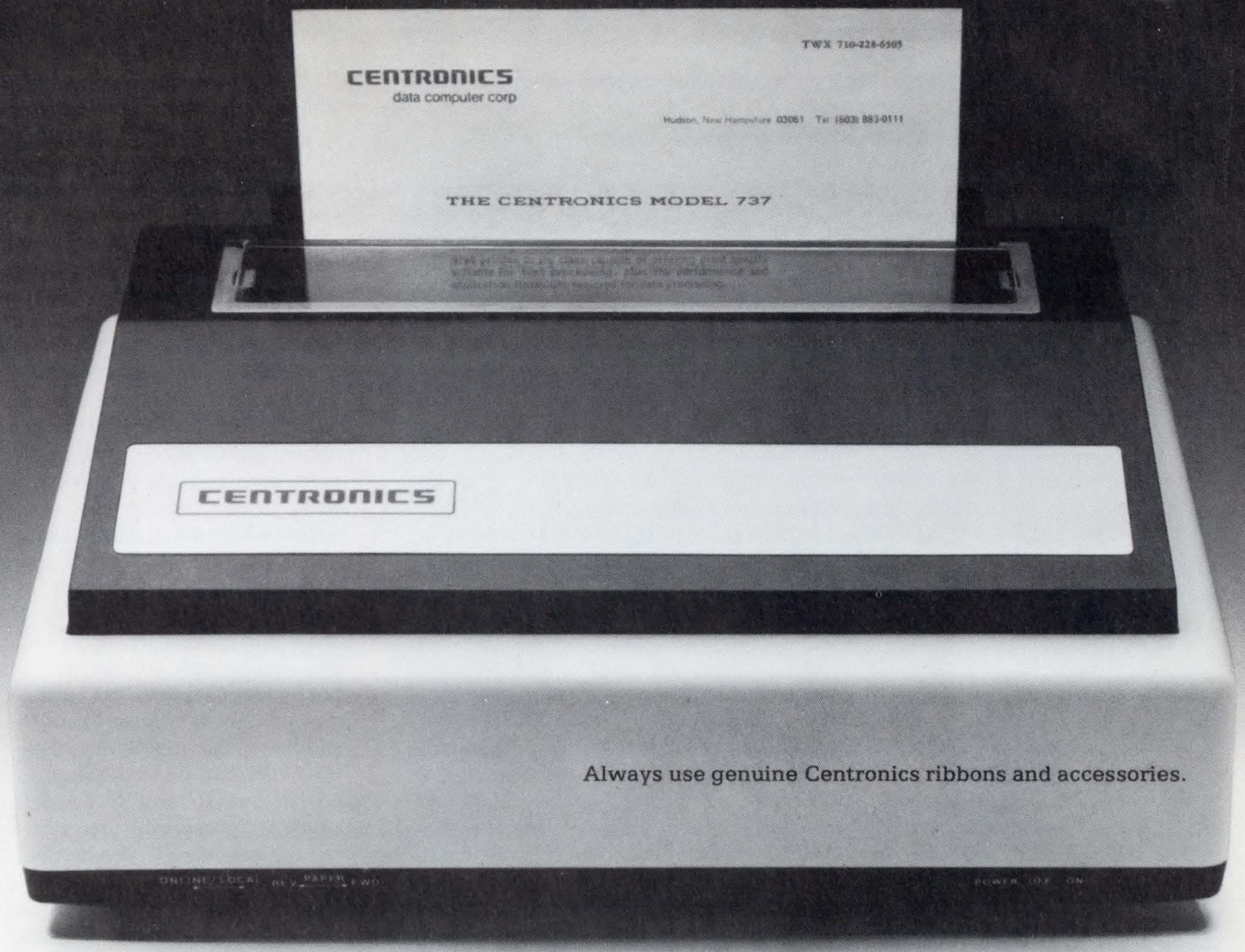
Costs of consumables

This area is most often ignored, but is no more difficult to figure than any of the other expected costs. Determine how much paper the printer will use each month and how many ribbons it'll go through, and then determine costs based on a little research with suppliers.

Let's assume that printers operate at 217 power-on hours/month (10 hours/day), 33% duty cycle, 50% line density and 50% column density.

Using these basic assumptions (which you can adjust for your application), let's determine the number of pages of paper or forms utilized monthly. Determine the time spent printing: multiply "power-on" time of 217 hours by the expected 33% duty cycle; it im-

CENTRONICS MODEL 737: The Advantage for Low Cost Word and Data Processing



Always use genuine Centronics ribbons and accessories.

The flexibility and print quality OEMs need is here now. The new Model 737 is the small business printer versatile and reliable enough to meet almost any systems requirement. It's the first low-cost printer to offer print quality suitable for text processing plus the performance and applications flexibility required for data processing and electronic mail. And this latest Centronics breakthrough is priced under $1000 in the U.S.A.

Outstanding Print Quality

Model 737 is the first small business printer to offer correspondence quality printing. 18 x 9 dot matrix provides high-quality characters with true descenders as well as underlining. Proportional spacing, the ability to justify right margins and serif typeface makes the 737 ideal for text processing applications. Standard business data processing spacing of 10 and 16.7 characters per inch are also resident in the 737, allowing for applications ranging from letters to aged accounts receivable reports. The steel platen assures crisp, clean print impression.

Unexpected Features

Leave it to Centronics to have some surprises in the new Model 737. You get the ability to print subscripts and superscripts. Especially attractive to OEMs requiring superior print appearance and/or chemical or mathematical applications. Centronics gives you its field proven 700 Series printhead, stepper motor paper drive, fewer moving parts, microprocessor electronics and high volume production to achieve reliability that you wouldn't expect in a compact, low-cost printer.

The 737 is quiet. An optional acoustic cover makes it ideal for office environments.

Pick Your Paper

Run letterhead paper for correspondence, roll paper for general information, or fan-fold paper for standard data processing (payroll, billing, inventory, etc.). You can, with the 3-way paper handling ability of the Model 737.

The Printer of the Future... Today

Never before has one printer offered such high quality, reliability, and applications flexibility at such low cost.

Another workhorse in the Centronics 700 Series is the 730, if you don't need the correspondence quality of the 737. Delivers 100 c.p.s. at even greater savings.

Why Wait?

The new Model 737 is now available for delivery. For more information: call (603) 883-0111, or contact any of our 15 U.S.A. or 9 international sales offices. Centronics Data Computer Corporation, Hudson, New Hampshire 03051.

All Centronics products are supported by the largest worldwide service network of any independent printer company.

CENTRONICS® PRINTERS
...the advantage

Circle 27 on Reader Inquiry Card

Dot-Matrix Impact Printers: Simplicity Equals Reliability

Joe Dennis
Eaton Printer Products

Most firms are making dot-matrix impact printer mechanisms simpler. For example, let's look at how using a double helix drive cam eliminates drive belts, cables and dual polarity motors.

In such a printer, a single continous helical slot runs the length of the cylinder with two primary sections displaced by 180°. Using a guide pin, the printhead runs in one direction and then the other, as the cylinder rotates, while the motor continues to run in one direction only. Thus, a single-direction dc motor can be used, without additional components required for dual-direction. Beyond simplicity, the double helix cam also affords notable constancy in speed or rate.

The drive motor is accurate enough to completely eliminate the need for clock signals (although they are included as a back-up should the motor's accuracy ever falter). Clock signals can enhance resolution by generating improved dot-to-dot accuracy, and can be brought out as a user benefit to reflect the printhead's linear travel. But it's important to note that in the move toward simplification, the need for clock signals has been reduced.

Other considerations exist. Motor and solenoid drive electronics are included, eliminating sizeable design engineering expense and time for potential purchasers, and proving helpful when packaging printer mechanisms. Also, most printer mechanisms require only convection cooling if packaged correctly; otherwise, possible overheating may stop the printer.

Construction methods and design are simplified. With added stress on a low moving-parts count, assembly requirements are significantly reduced. Manufacturers reduce components until the unit can be assembled with just two screwdrivers. For OEMs, that cuts costs and simplifies production for OEMs; for end users, it means virtually maintenance-free operation. Commercial and industrial markets consider high reliability and ease of maintenance the most important printer mechanism features. To the typical field user, the assurance of continued, uninterrupted service is especially attractive. Generally speaking, the low-priced dot-matrix printers are field-serviceable, even by the user. The trend is to providing a comprehensive service manual that enables users to handle simple maintenance without calling a factory repairman. Cleaning procedures and ribbon changing – these and other minor adjustments can be made by the unsophisticated user.

pacts the paper 72 hours/month. Next, if you format the pages at 6 lpi and use 11 in.-wide forms (66 lines/page) and you buy a 300 lpm printer, your output is 19,656 total pages printed/month.

Paper costs

Paper costs vary substantially, depending on the combination of single-part, multi-part, preprinted, top-quality, or recycled papers and the amount of paper you can purchase in volume. If you can determine ahead of time what your mix of forms will be and the amount of paper you can buy at once, your estimate can be very accurate.

Users will spend $0.025/page. The cost of printing 19,656 pages/month is $492. Multiply that by the printer's life expectancy of 5 years; paper alone costs $30,000! If you buy a printer that doesn't include excellent paper-handling and forms-positioning controls – or if they are offered, but your sensitivity to initial price is so great that you don't buy them – you're overlooking one of the key areas for enormous savings.

If your printer won't handle forms well, expect up to 10% paper wastage – wasting up to $3,000 for forms and paper that are misprinted, nonaligned and unusable (and frustration).

Faster printers use more paper. A 900-lpm printer, exercised under the same duty cycle conditions we outlined, produces 58,896 pages/month. At $0.025/page, monthly paper expenditures are $1,473. Over five years, paper costs will hit $90,000!

Ribbon costs

Ribbons are dull – until frequent jams or breakage leave nothing but empty pages stacked on the paper-out tray. A 900-lpm printer over five years uses over $4,000 on ribbons.

Ribbons, like print mechanisms and print heads, are given ratings covering the amount of full 132 column lines or character impressions they can produce. These ratings – when you can get them – are most often accurate, but are only part of the equation.

Price is a factor. Don't assume all ribbons are the same and opt for lower-price, thinking to save money in the long run. Maybe. Let's see how a small difference can hurt your ribbon costs.

First, determine how many characters produced/month. Evaluate your ribbons on the basis of character impressions, not lines. Ribbon suppliers rate their ribbons on the number of characters the ribbon will create. This is the only quantitative way to compare. A ribbon statistic listing the number of lines or pages of data the ribbon produces is useless because imprinted word density within that line varies widely with users and applications.

To find the number of characters produced/month, go back to our original assumptions relating to line and column densities. A 50% line density means that of the 66 available lines/page, only half are used. A 50% column density means that of the 132-column positions within each line, half are used; the remaining places are used for spaces between words, for example, or on documents where only certain areas need to be printed. Now, (66 lines × .5) × (132 characters per line × .5) equals 2,178 characters/average page of output. Going back to the 300 lpm printer and the 19,656 pages it is expected to print each month, you determine that it will create 42,810,768 total characters/month.

Assume you purchase ribbon cassettes priced at $15 each and that their stated life is 30 million character impressions. This means that on average you would use 1.42 ribbon cassettes/month. At $15/cassette, per-month costs for ribbons will be $21.30. Over five years, this amounts to $1,300. But, if you aren't paying attention to ribbon life – and the total number of characters you're printing each month – you could buy ribbons that provide 15 million impressions, and ribbon costs over five years would double.

With a 900-lpm printer, some 128 million characters are created each month under our assumptions. If your ribbons are really supplying you with 30 million impressions, you'll use 4.25 ribbons/month for an average monthly cost of $63.75. Over five

years, that's $3,825. If, on the other hand, your 30 million character ribbons are really providing just slightly fewer characters – say 25 million, you'll expend 5.1 ribbons per month – or $76.50/month – or $4,590 over the printer's life. That's a $750 difference.

Price and ownership costs

Let's see how ownership costs compare to the original purchase price. Because you readily see costs associated with the purchase price, they seem high. Let's assume, for example, you know that to buy a 300-lpm line printer outright will cost $6,000. A 600-lpm printer might cost $9,000 and a 900-lpm printer might average $12,000.

With a $12,000 bill for a 900-lpm printer, this price tag looks like the most important consideration. Not so. Let's compare that initial purchase price with the monthly and total five-year costs associated with maintenance, paper and ribbons combined.

Clearly, whether you rent, lease or buy, the printer's price is relatively small compared to the ownership cost over the printer's expected five-year life (used with an average duty cycle). With the 900-lpm printer, total ownership cost is almost ten times over the purchase price. That's why more OEMs and end users should spend more time determining the total ownership cost – ahead of time. Also, be sure your suppliers live up to their stated performance, such as with ribbons. Other than this, what can you do to make sure that ownership costs don't get out of hand?

Select carefully

Beyond price, you want a printer that can keep your maintenance costs to a minimum. Diagnostics, self-test, designs that allow for quick accessibility and modularity all contribute to lowering maintenance costs. Without these features, your printer's purchase price will be low; on the other hand, ownership cost will be higher.

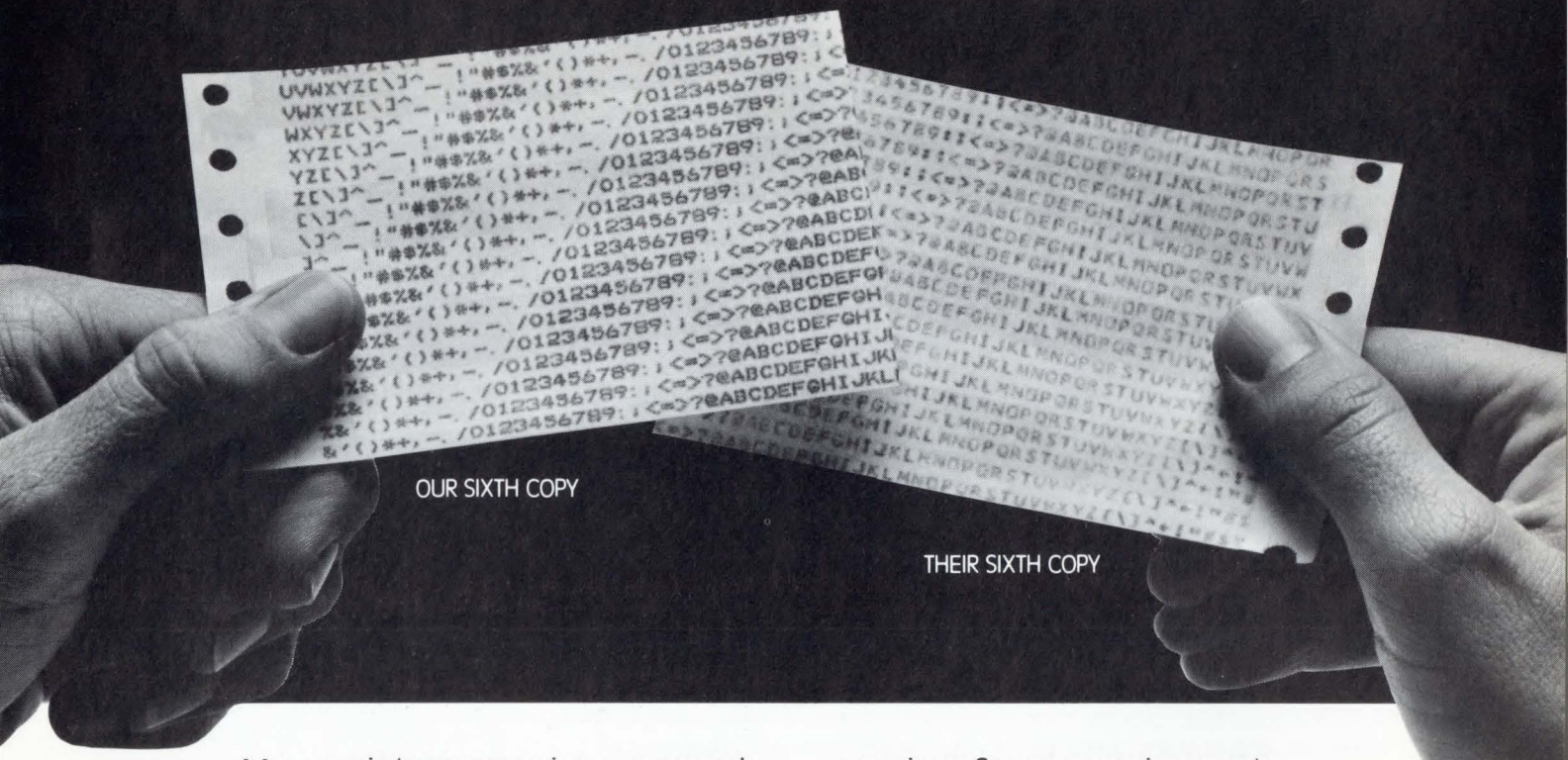
Speed	Purchase Price	Monthly Maint.	Monthly Paper	Monthly Ribbons	Total 5-Yr Costs
300	$ 6,000	$125.00	$ 492	$21.30	$ 44,298
600	9,000	150.00	983	43.00	79,560
900	12,000	200.00	1,473	63.75	116,205

You also want a printer that intelligently uses paper and forms (with little waste). Paper alarms, paper motion detectors, precision-forms set-up features, 6-pin (rather than 4-pin) tractors, top-of-form and VFUs minimize paper wastage. If paper will cost $500 to $1,500 a month, consider adding forms handling features.

Caveat emptor goes for ribbons. Don't assume you're getting everything promised. Now that you can more easily determine the number of characters you print each month, check to see that you're not being forced to change ribbons more often than you calculated. Also, keep in mind that while one ribbon may cost more initially, it may actually cost less in the long run. Finally, work with a company that will help you determine and hold down ownership cost. If the manufacturer hasn't got a good answer ready when you ask, "What is the printer's total ownership cost," then that company hasn't given much thought to your basic need for a quality output device at the lowest *overall* price.

Rate this article: circle 1L, 1M or 1H on Reader Inquiry Card.

OUR QUALITY COMES IN QUANTITY.



Many printers can give you good print quality on a first copy. The real challenge is to give you that same quality, copy after copy, on multi-part forms.

Obviously, most printers can't. The further they get from the first copy, the more their quality fades. But, as you can see here, the quality of Printronix' sixth copy continues sharp and clear.

This superior quality is achieved through a simple printing mechanism quite unlike any other. It forms characters by printing one dot row at a time, overlapping rows vertically and horizontally, while maintaining uniform hammer impact energy. The result is unequalled print quality and characters that appear solid.

This same design approach also requires fewer moving parts, eliminates most bearing surfaces, and employs simple hammer drive circuits. All of which means there's less to go wrong. And that's why Printronix can give you a full one-year warranty, not the 90-day warranty typical of most other printers.

For more information on the complete line of Printronix printers, call: (714) 549-7700. Or write:

Printronix Inc.,
17421 Derian Ave.,
P.O. Box 19559,
Irvine, CA 92713.

PRINTRONIX
It's simple, to be reliable.

REGIONAL SALES OFFICES: WESTERN; 17421 Derian, P.O. Box 19559, Irvine, CA 92713. CENTRAL; 414 Plaza Drive, Suite 106, Westmont, IL 60559. SOUTHERN; 2220 Parklake Drive, Suite 180, Atlanta, GA 30345. EASTERN; 7½ Harris Road, Nashua, NH 03060.

Circle 34 on Reader Inquiry Card

Guide To Color Hard Copy

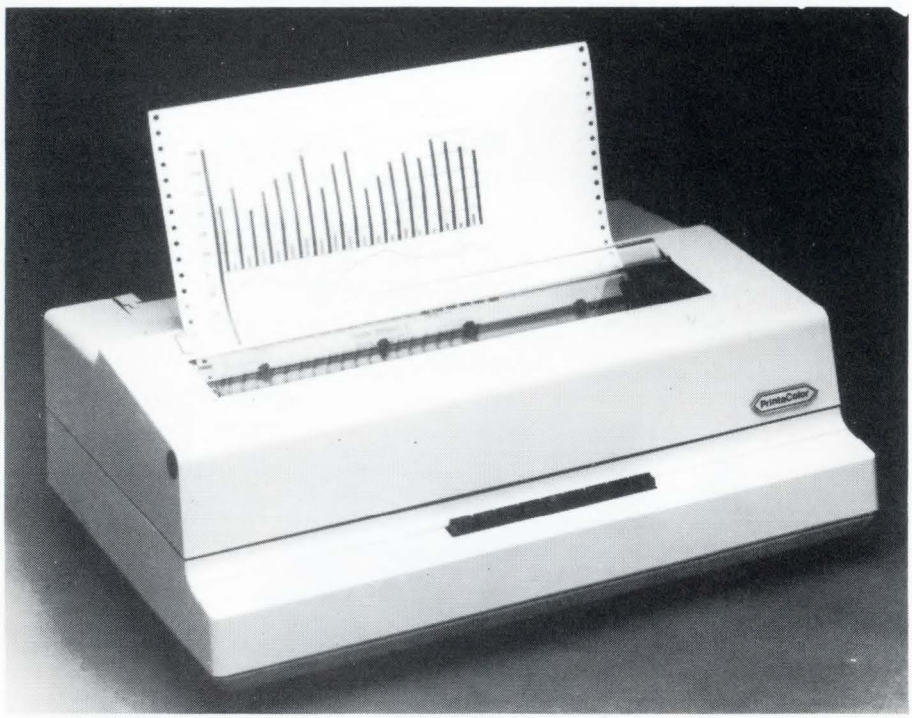
Guide To Color Hard Copy
Guide To Color Hard Copy
Guide To Color Hard Copy

Bob Hirshon
Assistant Editor

It wasn't very long ago that images from inexpensive color graphics displays were unattractive enough so that users had no difficulty parting with them. As image quality got better and better, however, the images got tougher and tougher to say goodbye to – users wanted hard copies to use in reports, a/v presentations, data analysis away from the home computer, or just for long term storage. Several new technologies, and one quite old one, emerged to meet this new market.

Vector pen plotters, although predated by Victrolas and Model Ts, are ancient in terms of modern computer technology. Since their inception over 25 years ago, they've remained relatively unchanged – and for a lot of good reasons: their simple design gives them extremely high reliability; they plot on plain paper or transparency material with ordinary felt-tip pens, resulting in low cost-per-copy; they produce draftsperson-quality graphics; they're light and compact; and, with prices starting well under $1000, there's simply no cheaper way of getting color graphics on paper. Unfortunately, their cost in terms of time is steep: typical plots take twenty minutes or more, depending on complexity. Also, multi-color plots require operator intervention to change pens on the less-expensive models. Colors are limited to available pens. And, most importantly, pen plotters are limited in their ability to color in large areas.

If you can live with these limitations, "Designers' Guide To Pen Plotters" on page 66 can help you make a selection; if you can't, a number of alternatives are available, each offering its own particular advantages.



PrintaColor's IS8001 is the first low-cost color graphic printer terminal using a color ink jet head. Unit prints with electrically-charged droplets of ink, producing seven-color copy.

Photographic methods

Color cameras. Before color hard copy became readily available, color graphics terminal owners found that the only way they could get a hard copy record of a CRT image was to take a snapshot. Unfortunately, they soon also found that the resulting photograph had poor color quality, required a long exposure time, and was distorted due to the curvature of the CRT screen. Then color cameras from Dunn Instruments, Matrix Instruments, and Image Resource came on the scene. All three companies produce devices with the same basic architecture: a light-tight box enclosing a small, monochromatic CRT facing a fixed-focus lens/film holder assembly. Between the CRT and the lens is the unit's only moving part – a red, green, and blue (RGB) color wheel separation filter.

To create a single photograph, the device accepts RGB information sequentially: first, red information inputs into the unit's monochromatic CRT, appearing on the screen as fields of white. Simultaneously, the red portion of the color wheel swings into place in front of the CRT, and the red data is photographed. The procedure is repeated for green and blue information.

Once the film is exposed, the operator must remove it from the camera back and run it through a desk-top film processor. Total time required to produce an 8″ × 10″ photo is around two minutes.

Polaroid Corp. manufactures the instant 8″ × 10″ film used in the cameras, selling it for between $5 and $6 per sheet. Color camera manufacturers are predicting that the company will soon announce an instant transparency film as well; Polaroid says such predictions are premature.

Advantages of color camera hard copy systems are:

- very high resolution
- sharp, bright colors

OLIVETTI PRINTERS
AVAILABLE NOW!

For years we have been our own biggest customer. Until now you couldn't buy an Olivetti printer unless you bought a complete Olivetti calculator. Now, for the first time, our complete line of OEM printers is available for immediate shipment in any quantity. For use in calculators, electronic scales, cash registers, mini computers, CRT hard copy output, data loggers, medical and scientific instruments, or any application where a paper tape printout is desired. Olivetti has a quality OEM printer for you.

Features:

- ☐ High Speed
- ☐ Low Cost — The Best Really Can Cost Less!
- ☐ Fewer Moving Parts
- ☐ Proven High Reliability and Long Life
- ☐ Over 3 Million In Use by Olivetti Alone
- ☐ Lightweight and Compact — Extremely Versatile
- ☐ Available with 6V or 18V Motor
- ☐ Low Power Usage
- ☐ Graphic Capabilities (PU1828 and PU1840)
- ☐ All Printers are Available With or Without Interface Boards

For Further Information Please Contact:

Alphacom, Inc.
3031 Tischway Suite 200
San Jose, California 95128
Telephone: 408/249-2152

Alphacom

Other Distributors of Alphacom:

I/O Sales
2551 Casey Avenue
Mountain View,
California 94043
Telephone: 415/968-1080

Sylex Corporation
4332 East LaPalma Avenue
Anaheim, California 92807
Telephone: 714/528-4480

Coming Soon:
80 Column Thermal, 240 L.P.M.
Dot Matrix, Plotter

PU1840—
40 Column Thermal,
240 L.P.M.
Dot Matrix,
Plotter

Optional Interface Boards

PU1800—
20 Column Thermal,
120 L.P.M.

PU1828—
28 Column Thermal
240 L.P.M.
Dot Matrix,
Plotter

PU1808—
16 Column Thermal,
120 L.P.M.

PU1100—
20 Column
Impact,
120 L.P.M.

Circle 39 on Reader Inquiry Card

- ability to make 35mm slides for presentations
- few moving parts to wear out

Disadvantages include:

- high cost per copy
- limited to photographic media
- require operator intervention

Laser scanner/writers. If you're willing to spend more money, and wait longer per picture, Optronics International offers a series of color image digitizing and recording instruments with extremely high resolution. These laser plotters are used primarily for aerial photography, radiography, geophysics or any application where image clarity and detail is of prime concern.

"Basically, the system is nothing more than a lathe," says Dr. Alan Barrett, Optronics' Director of Product Development. Instead of wood, Optronics devices use film; instead of knives, Optronics uses lasers. Film is clipped onto a spinning drum; underneath, a laser assembly moves on a lead screw. Digital RGB input from the CPU modulates the intensity of the laser beam as it slowly exposes the film. Making one pass for each of the three primary colors, the units require about thirty minutes per photo.

Resolution is 1000 to 2000 lines per inch; in other words, Optronics images contain more information in a single square inch than images from other systems contain in an entire 8″ × 10″ plot. The price for this quality is $65K to $100K; systems vary widely according to specific applications and so, therefore, do prices.

Other benefits of Optronics systems are:

- color separation capabilities
- 256 intensity levels per color (256^3 total colors)
- rugged design; high MTBF

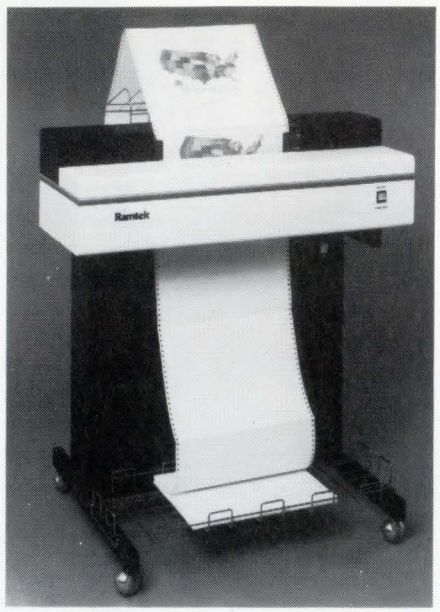
The only drawbacks are:

- high initial cost
- long time requirement for each image

Other photographic image processing systems, with price tags considerably above Optronics', are made by Itec, Perkin-Elmer, Goodyear, and RCA. These units sell for $150K to $1.5M – needless to say, only the government can afford them, and even they only buy a handful each year.

Impact printers

Dot matrix line and serial printers have long had graphics capabilities – producing color was the problem. Trilog, Inc was the first to come up with a solution: a three-color ribbon consisting of 20 yd lengths of yellow, magenta and cyan laid end-to-end, combined with a sophisticated bidirectional paper-handling mechanism. Incorporating these advances into a Printronix line printer, Trilog Colorplot interfaces directly to a CRT and prints one color at a time; first the unit prints all the yellow information, then it backs the fan-fold paper up to the start and prints all the magenta, backs the paper up again, and prints all the cyan. Overlapping any two of these primary reflective colors yields three more colors (red, green, and blue). Until recently, Trilog achieved a muddy black by overlapping all three colors; now a four-color ribbon includes black for sharper contrast. For more information on the Trilog Colorplot, see DD 7/80, Product Close-Up, pg 50.



Ramtek's 4100 is a four-color dot matrix printer/plotter featuring separate cartridge ribbons and print heads for each primary color plus black.

IBM brought out a color plotter/printer of their own; it uses a four-color ribbon, but with the four color sections running parallel. Also, IBM doesn't back up the paper, but prints all the required colors on each line before going on to the next; the print head must make as many passes per line as there are colors on the line. IBM's entry prints in only four colors (it doesn't automatically halftone off the CRT, as does the Trilog) and is intended mostly for color alphanumerics and simple business graphics.

Ramtek offers the latest entry in color impact printer/plotters. Their major innovation is separate, drop-in ribbon cartridges for each color, each with its own separate print head. This prevents contamination of one color ribbon with ink from another, and allows the user to replace each color ribbon as it wears out, without replacing all four colors.

Advantages of impact printer/plotters include:

- low media costs – plot on plain, fanfold paper
- versatility – double as printers
- high reliability – use tried-and-true impact printer heads

Disadvantages include:

- limited format – so far, these units plot only on plain paper (although research is being conducted to develop a special Mylar plastic for overhead transparencies)
- high noise – these color printer/plotters, like all impact printers, tend to be noisy
- duller colors – ribbon inks used in impact plotting can't provide the same color intensity as can other technologies.

Laser xeroxgraphy

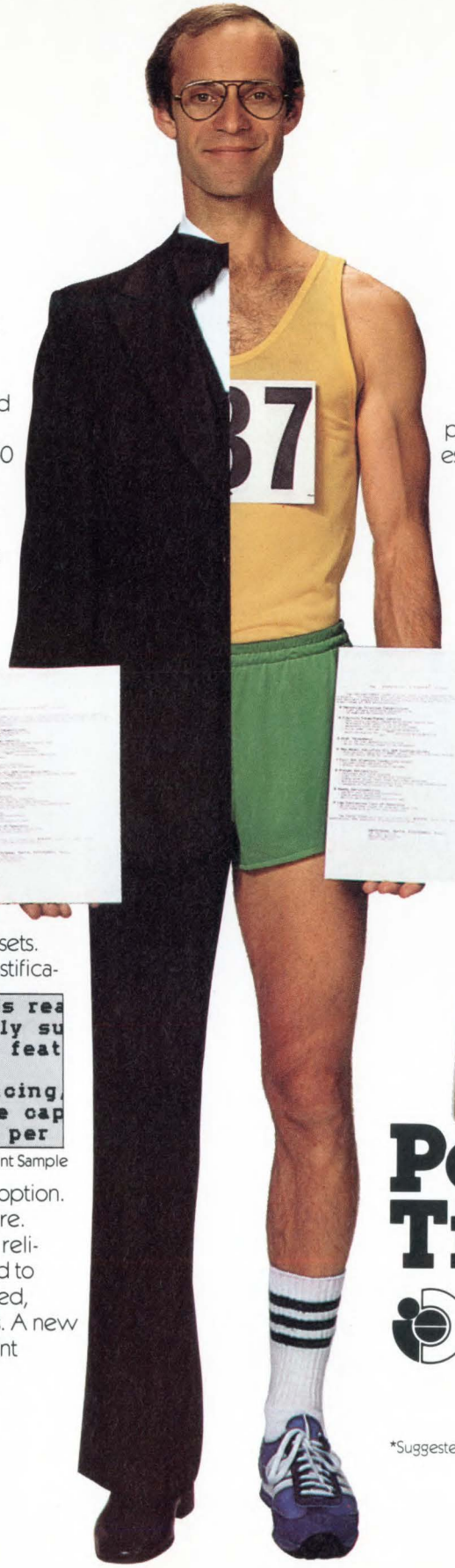
In 1978, Xerox introduced a color copier, the 6500 CGP, that could accept digital input from color graphics terminals. At that time, market analysts predicted that Xerox, with its vast financial and promotional resources, would take over the color hard copy market. This hasn't come about, largely due to two factors: initial cost of the unit was, and is, high ($28K) and interfacing is limited. Xerox doesn't supply interfaces, but leaves it up to the graphics terminal vendors. Thus far, only a few have responded (Ramtek, Tektronix and Chromatics), sharply limiting Xerox's market share.

It's likely that the 6500 CGP is Xerox's "foot in the door," so to speak: if extravagent predictions for growth in the color graphics field come about, Xerox will have the groundwork laid to jump into hard copy with both feet.

Laser xerography operates using a laser that "writes" on a photosensitive drum. Sensitized areas of the drum pick up toner, and the drum then rolls the toner onto a plain sheet of paper or transparency plastic. This process occurs three times, once for each of the primary reflective colors. As with color impact printer/plotters, overlapping pairs of primary colors results in three more colors. Unlike color impact printers, overlapping all three colors gives a sharp, high-quality black.

Consistency of the toners is so thick that the images are actually raised above the paper's surface – this is es-

Introducing quality print at matrix speed. For only $1295.*



Until now, you could pay thousands for a slow, letter-quality character printer. Or hundreds for a dot matrix printer, giving up print quality for speed and price.

But that was before Paper Tiger™ 460 offered you a better choice.

The new Paper Tiger 460 is the first matrix printer with high-density dot matrix characters plus high speed. At a low price.

The secret? A unique nine-wire, staggered matrix head provides overlapping dots in both horizontal and vertical planes. The result is dense, high-quality characters you'll be proud to show off.

What's more, Paper Tiger 460 gives you a combination of features simply not available on any other printer, at any price. Like bi-directional, logic-seeking printing at speeds in excess of 150 cps. Microprocessor electronics, with field-installable character sets. Proportional spacing. Automatic text justification. DotPlot™ high resolution graphics option. RS232 and parallel interfaces. And more.

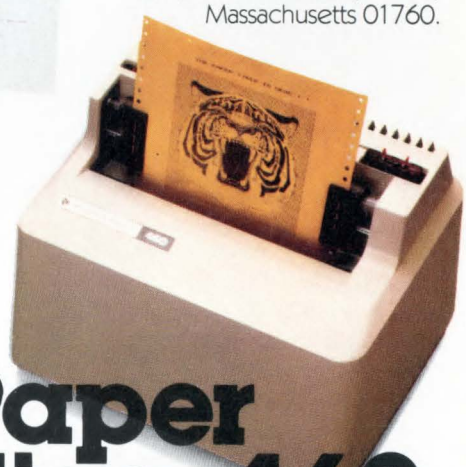
```
Integral Data Systems stands rea
performance printers ideally su
printer, the IDS 460, offers feat

Automatic proportional spacing,
processing systems, plus the cap
resolution of 84 by 84 dots per
```

Paper Tiger 460 Print Sample

But its most important feature is high reliability. The Paper Tiger 460 is designed to be tough and dependable. It has rugged, stepper-motor head and paper drives. A new 300-million-character ballistic-type print head. And its simple, chassis-mounted cartridge ribbon lasts up to four times longer than cassette or spool ribbons.

All this means that Paper Tiger 460 is perfect for word processing, data processing, or electronic mail. It's also perfect for anyone who requires the flexibility of a matrix printer but wants superior quality printing. Without trading off speed or price.

Get your paws on the Paper Tiger 460, and join the tens of thousands of satisfied Integral Data Systems users. Call us toll-free: 800-343-6412. (In Massachusetts, Alaska, and Hawaii, call (617) 237-7610.) Or, write for complete specifications. Integral Data Systems, 14 Tech Circle, Natick, Massachusetts 01760.



Paper Tiger 460

Integral Data Systems, Inc.

Circle 35 on Reader Inquiry Card

*Suggested single-unit, U.S. price. Generous OEM discounts available.

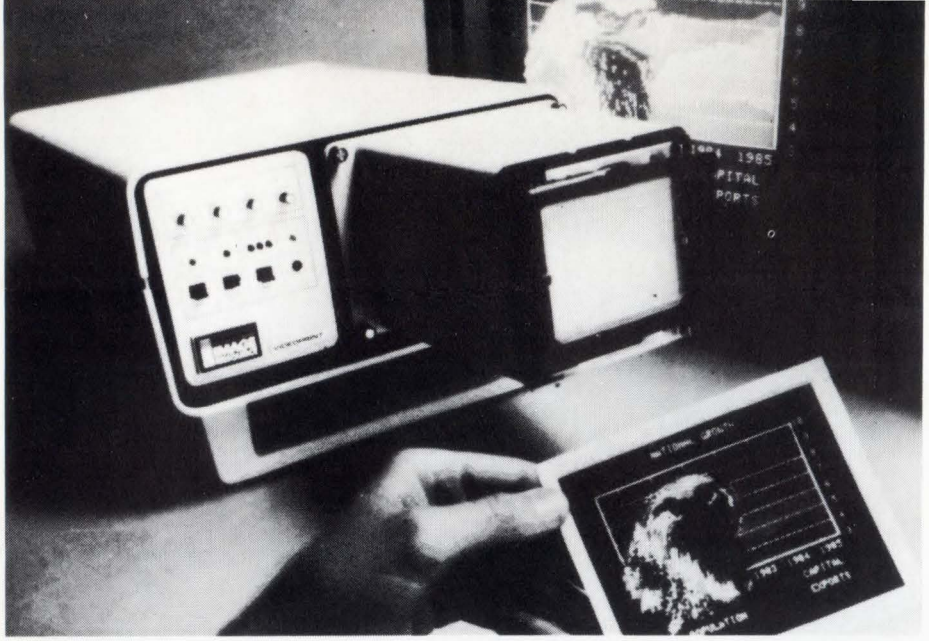


Image Resource Corp's desk-top color cameras can produce instant SX-70 photographs from color raster displays.

pecially true of black areas. However, the colors don't easily scrape off, as might be expected.

Advantages of the 6500 CGP are:

- sharp, bright colors
- color copier capability
- overhead transparency capability
- high speed (three copies/minute)
- low cost per copy, using plain paper
- accessory for copying from color slides

Disadvantages are:

- high acquisition cost
- five to six minute warm-up time
- low compatibility
- generally lower MTBF, due to more complex operating system

Ink jet

Hertz ink jet technology sounds like one of those theoretical concepts that look great on paper but would never work in reality. It involves spraying a continuous stream of electrically charged ink through a high-voltage field at a sheet of paper. Switching the electrical field on and off determines whether the ink droplets reach the paper, or are repelled electrically and sucked up by a miniature vacuum unit under the jets. Remarkably, the concept works, and the results are impressive.

Applicon's CP5586 Satellite Plotter has a plotting head consisting of three 10-micron ink jet nozzles mounted on a lead screw just above a rotating drum. A sheet of paper or clear plastic attaches to this drum via adhesive strips. As the drum spins, the ink jet head slowly moves horizontally, plotting lines of dots at a density of 127 to the inch. These dots are quite small – .008 inches square, far smaller than impact printer dots – and therefore image clarity is far higher. By interspersing these dots, the Satellite Plotter can produce over 5000 different colors.

Originally, the CP5586 operated as a stand-alone unit, accepting input only from 9-track, 800 or 1600 bpi magnetic tape. Now Applicon has introduced an 8-bit parallel on-line interface, so the unit may be attached to a raster graphics terminal.

Applicon has also spent considerable R & D on a smaller, less-expensive ink-jet for business use, but, as a press deadline, has no official statement.

Dunn Instruments' Model 632 color camera is a low-cost photographic hard copy system that may be expanded to suit growing requirements.

PrintaColor, however, a Norcross, Georgia company, does make a small color ink-jet plotter. It's a desk-top unit with far fewer colors (only seven) and lower resolution (100 dpi) than Applicon's, but with a far lower price to match. In fact, at $6K, PrintaColor's entry is the least expensive method to get color graphics on plain paper, aside from pen plotters. Other advantages of the unit include:

- quiet operation
- plotting and printing capabilities
- compact size
- low cost per copy

On the negative side:

- colors are duller than other units'
- image clarity is generally lower

Regarding Applicon's plotter, major advantages include:

- large selection of high-quality colors
- format size up to 34″ wide
- transparency/plain paper capabilities

Chief disadvantages are:

- high acquistion cost
- high space requirements

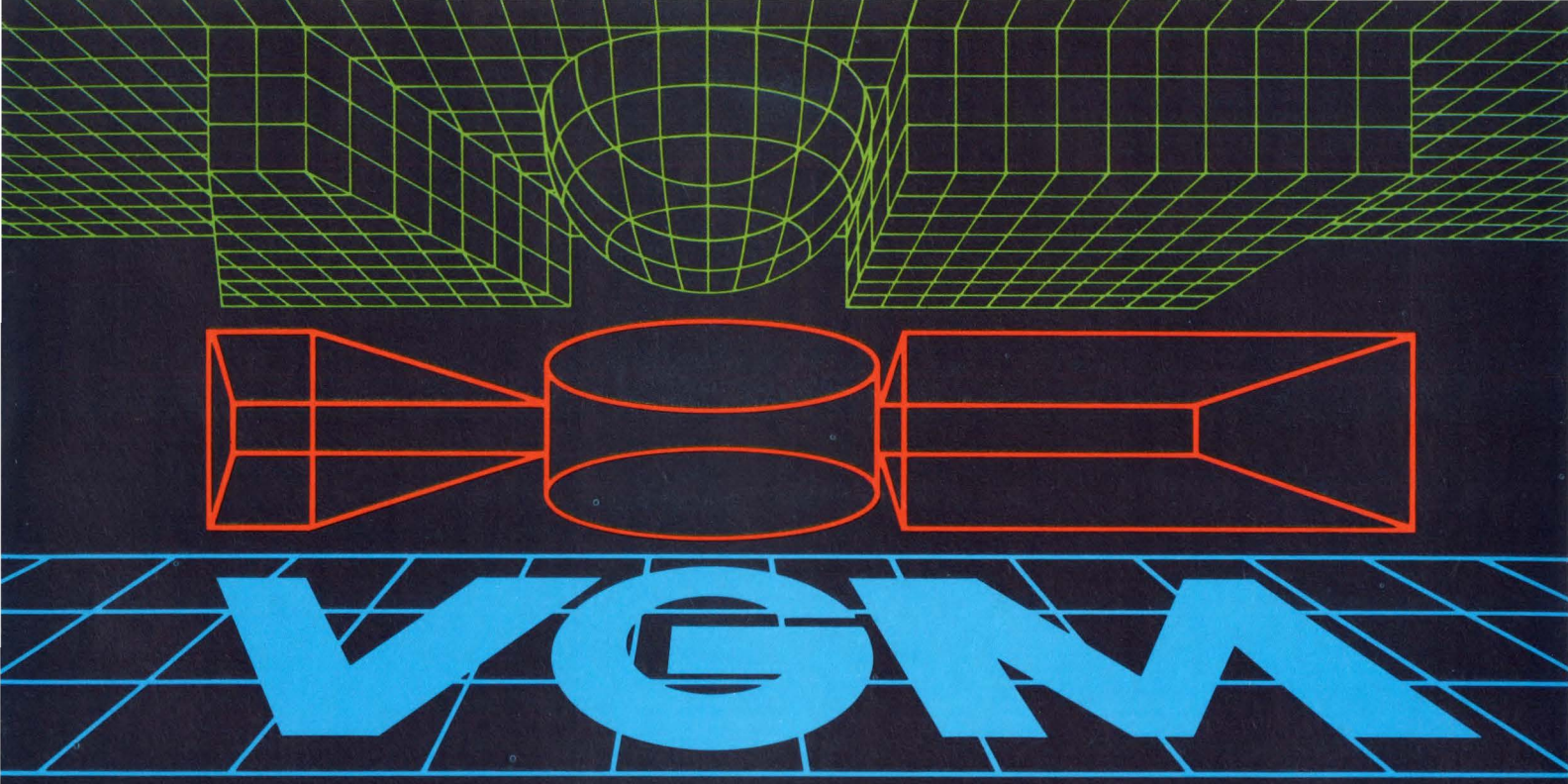
Purchase considerations

When selecting a color hard copy unit, remember to acquire one to suit your specific needs, rather than rearranging your needs to suit a particularly attractive unit. As James Dunn, President of Dunn Instruments, says: "People have never seen this color quality for the price before and they say 'Boy, we've got to have one of these.'" But, he goes on, "they typically buy capabilities far in excess of what they need, because they really haven't defined their need yet."

In making your cold, sober decision, consider not only acquisition cost, but material costs – they'll generally exceed original purchase cost in a couple of years. Also, compare actual hard copy output – resolution specs give only a general idea of true quality. If possible, check output from machines actually being used in the field, rather than demo units.

But above all, don't be dazzled into buying above your requirements; salesmen from the major manufacturers boasted that their jobs were easy, since these machines literally sell themselves. Don't let them sell themselves to you.

Rate this article: circle 7L, 7M or 7H on Reader Inquiry Card.



Great visual applications need a great graphics system

VGM® — The Virtual Graphics Machine

A truly great graphics system providing a rich set of operations, developed for flexibility and device independence. This will allow your own applications to drive any graphics device without software alteration. VGM is designed to support any output configuration based on any display technology, be it raster, vector, storage or hardcopy and any input device such as lightpen or joystick. With VGM you concentrate on what's important; the application, not the hardware.

Flexibility the Key

VGM provides a wide variety of selectable features to support a broad spectrum of graphics applications including engineering, architectural and business. Since this set of graphics functions meets and actually exceeds the 1979 ACM/SIGGRAPH Core System standards, program portability is guaranteed and significant reduction in programmer training is ensured. In addition, VGM is written in ANSI-FORTRAN and is compact enough to fit on most processors, including micros, making VGM machine independent — another key factor in VGM's flexibility!

The Basic Package

VGM lets you optimally use graphics by providing: a complete set of 2D primitives including lines, arcs, text, polygons; choice of size, colour, orientation and intensity; an extensive debugging and error handling facility which speeds up application software development; introductory and user manuals; fully documented skeleton device driver; a user requested device driver from the current VGM library; Acceptance Package for system self-test; 90-day support. These are some of the key features now available for just $5,000.

For your Future Expansion

VGM's modular design allows you to expand your system capability by using VGM options. Increase productivity through the ability to interactively build quality charts with our Business Graphics option. Using our PLOT 10® interface, existing PLOT 10 software life can be extended with minimal change. Other enhancements, starting at $500, include: additional device drivers; a 3D graphics package which resides on top of VGM, with optional hidden line removal. Extended support, on-site installation guidance and consultation are also available.

For more information on this versatile system which can provide a positive increase in performance please contact:

Olga Lapczak
Manager, Graphics Technology,
Dept. 2S14
Bell-Northern Research
P.O. Box 3511, Station C
Ottawa, Canada K1Y 4H7

VGM

Bell-Northern Research is the largest privately owned research and development organization in Canada. It is widely recognized as a world leader in electronics and digital communications. VGM and many other quality software tools help maintain its prominence.

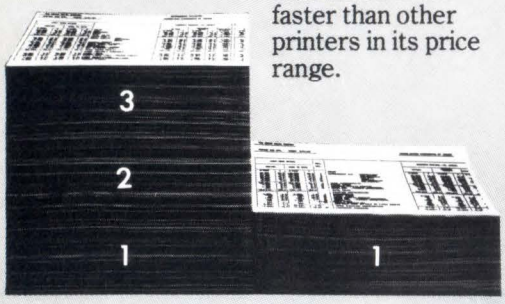
Illustration is an artist's impression.
VGM is a registered trademark of Bell Northern Research.
PLOT 10 is a registered trademark of Tektronix.

Circle 36 on Reader Inquiry Card

Output for Versatec's

A new generation of printer/plotters delivers more output for less money.

Faster printing. The new Versatec V-80 prints 1000 lines per minute, more than three times faster than other printers in its price range.

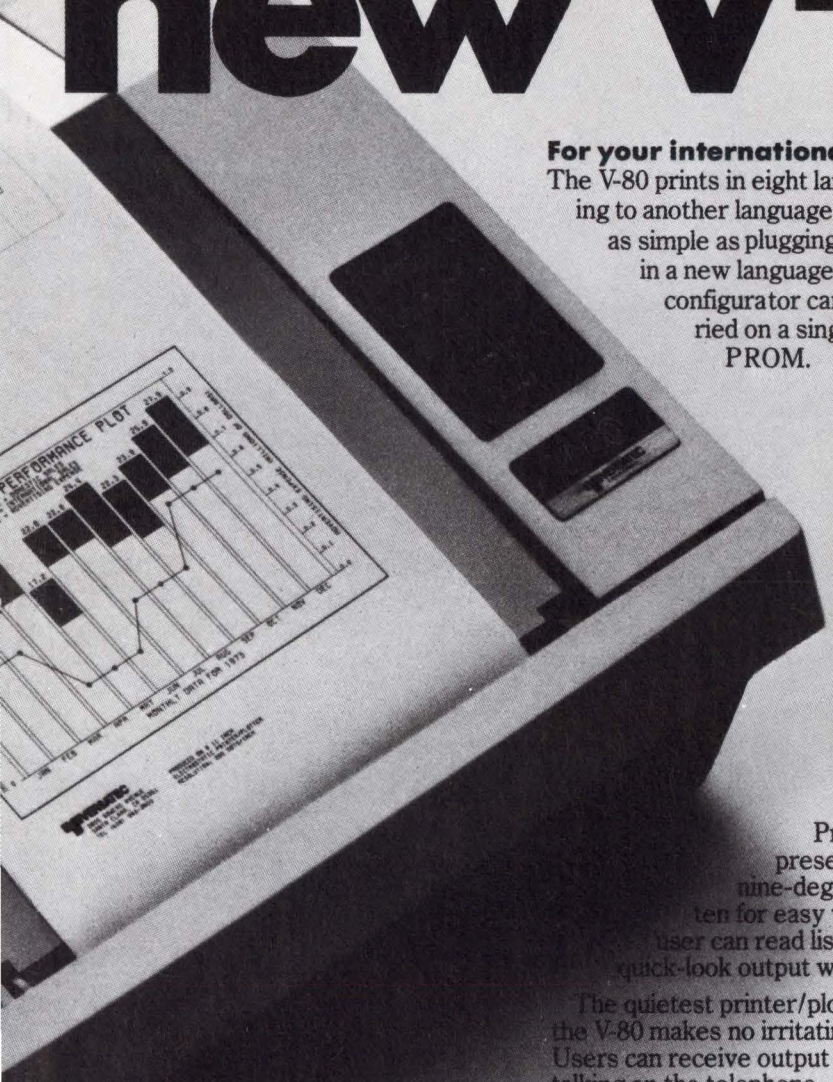


Graphics. The Versatec V-80 gives you better image quality than other printer/plotters. Get true high quality graphics with 200 dot per inch resolution. Plot an 11 by 8½-inch page in just seven seconds.

Hard copy from display. V-80, with an optional controller, makes quick, archival quality copies from storage tube displays or digital sources within twenty seconds.

Easy to integrate. Use V-80 with any popular computer. Styled to complement your computer-based system, the V-80 is suitable for any office or laboratory environment. The V-80 can be mounted directly into your system console, placed on a table, or be carried on its own optional utility stand. Weight is only 75 pounds.

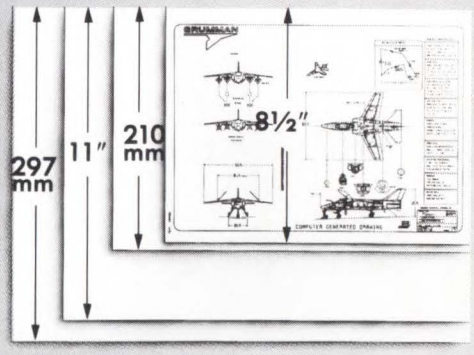
the 80's. new V-80.



For your international customers. The V-80 prints in eight languages. Changing to another language is as simple as plugging in a new language configurator carried on a single PROM.

The V-80 has been designed to meet both UL and VDE standards. Re-positioning one electrical plug adapts the printer/plotter to different voltage requirements.

Paper widths of standard 8½ and 11-inch *and* international A4 (210 millimeter "Portrait" and 297 millimeter "Landscape").



Easy to use. Printed output is presented on a nine-degree sloped platen for easy viewing. The user can read listings and other quick-look output without standing.

The quietest printer/plotter ever built, the V-80 makes no irritating clatter. Users can receive output even when talking on the telephone.

Changing toner is easier, faster and cleaner than changing typewriter ribbon. The disposable toner bottle inserts directly into the printer. No pouring. No mess. The toner is sealed away from hands and clothes.

Easy to maintain. Electrostatic writing is simple, because it's electronic rather than mechanical. Versatec has reduced mechanical part count to just 135, and that includes screws. Improvements in electronic design include microprocessor control, new LSI technology, and low power Schottky TTL logic. Fewer mechanical and electronic parts reduce spares requirements.

For more information, circle our readers' service number for the free brochure—"Output for the Eighties." To arrange a demonstration, call your local Versatec representative.

VERSATEC
A XEROX COMPANY

2805 Bowers Avenue
Santa Clara, California 95051
Telephone: (408) 988-2800
TWX: 910-338-0243

Versatec European Headquarters
27/35 London Road
Newbury, Berkshire, England
Telephone: (0635) 42421
Telex: 847259

Circle 49 on Reader Inquiry Card

See Us at SEG (Houston, TX), and CAD/CAM (Anaheim, CA)

The Color Hard Copy Spectrum: A Buyer's

COMPANY	MODEL	OUTPUT MEDIA	INPUT/INTERFACE	RESOLUTION	SPEED	COST/COPY*
Photographic Methods						
Dunn Instruments, Inc 544 Second St PO Box 77172 San Francisco, CA 94107	631 632 633	prints: 8×10, 4×5, SX-70 transparencies: 8×10, 35mm cine: 16mm, 35mm	525/60 and 625/50 RGB with composite or external sync standard	1400 lines 750 lines 1400 lines	2 min/ print 1 min/ slide	$5.50/ 8×10 $0.35/ 35mm slide
Image Resource Corp 2260 Townsgate Rd Westlake Village, CA 91361	3000 series 5000 series	prints: SX-70, 3×4, 4×5 transparencies: 35mm	NTSC composite video, RGB or monochrome, depending on model	600 lines	2 min/ print	$0.28/ 35mm slide $0.60/ SX70 print $1.55/ 4×5 print
Matrix Instruments, Inc 230 Pegasus Ave Northvale, NJ 07647	2000 4007	prints: 8×10, 4×5, SX-70 transparencies: 35mm cine: 16mm, 35mm	RS-170, RS-330 (RS-343, others optional)	1400 lines 1400 lines	1.5 min/SX-70 print	$5.50/ 8×10 print
Optronics International, Inc 7 Stuart Rd Chelmsford, MA 01824	4100 4300 4500 4100 SC	any film format up to 10×10 (14×17 for 4100)	interfaces to a variety of minicomputer systems	2000 lines per inch 1000 lpi 1000 lpi 2000 lpi	approx. 30 min/ print	varies widely with film type
Impact Printers						
IBM Corp 1133 Westchester Ave White Plains, NY 10604	3287 1C 3287 2C	plain fanfold paper	IBM 3274 control unit, models 1A, 1C, 1D or 51C	64 dots per inch	over 2 min/ 4-color plot	approx. $0.20 including ribbon cost
Ramtek Corp 2211 Lawson Ln Santa Clara, CA 95050	4100	plain fanfold paper	standard 8-bit parallel Centronics-compatible	60 dpi	3 min/ plot	approx. $0.15 including ribbon cost
Trilog, Inc 17391 Murphy Ave Irvine, CA 92714	C-60 C-100 C-144	plain fanfold paper	RS232 or Centronics-compatible	60 dpi 100 dpi 144 vert × 100 hor dpi	2 min/ plot 3 min/ plot 3.5 min/ plot	approx. $0.25 including ribbon cost
Laser Xerographic						
Xerox Corp Xerox Square Rochester, NY 14644	6500 CGP	plain paper or transparency	internal logic card interface available in Chromatics, Tektronix 4027, and Ramtek 6200A graphic terminals	100 dpi	0.3 min/ plot	$0.06 for paper and toner
Ink Jet						
Applicon, Inc 420 New Boston Park Woburn, MA 01801	CP5586	22×34 paper or transparency	operates off-line with 9-channel NRZI (800 or 1600 bpi) or on-line with optional 8-bit parallel printer-type interface	125 dpi	8.5 min/ poster-size plot	$1.75 per 22×34 plot
PrintaColor Corp. 5965 Peachtree Corners East Norcross, GA 30071	IS8001	plain fanfold paper	RS232C; so far, only interfaces to ISC terminals — general interface available in near future	100 dpi	2 min/ plot	$0.10 for paper and ink

Compiled with cooperation of *The Harvard Newsletter On Computer Graphics*

Guide

Compiled by Bob Hirshon, Assistant Editor

COST/UNIT	ACCESSORIES/ ADDED COSTS	COMMENTS
$12,000	Polaroid 8 × 10 film processor — $900; optional format film backs — $1500 to $6800	8 × 10 standard, all other formats optional
$5950		basic, stripped-down model with all camera-backs optional or will accommodate your own camera
$15,750		makes multiple images on a single sheet of film
$3000	optional format film systems — $340 to $590	these are desk-top units for lower resolution small format prints and slides
$6000		
$10,750	Polaroid 8 × 10 film processor—$900; optional format film backs—$1500-7000	basic unit, 8 × 10 format standard
$16,000		multiple image model
$65,000-100,000 depending on model and application	various software packages	—
$6430 + 2347 graphics hardware	software ranges from $60/mo to $220/mo	model 1C prints at 80 cps
$6825 +$2347 graphics hardware		model 2C prints at 120 cps
$12,000	—	—
$11,800	—	made for Chromatics terminals
$28,000	slide adapter II accessory for making enlarged color copies of 35mm slides — $2250	interface must be supplied by graphics terminal vendor
$53,000	software — $6000-20,000; on-line interface — $1500	—
$6000	optional 20mA current loop — approx. $100	desk-top size

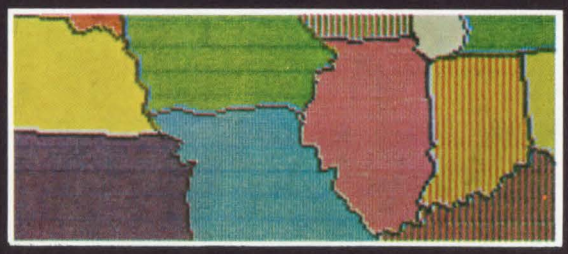
*cost/copy figures estimated by each manufacturer

†As magazine reproduction techniques alter hard copy quality, use these samples for comparison purposes only; examine actual hard copy to determine true image quality.

ACTUAL-SIZE HARD COPY REPRODUCTIONS †

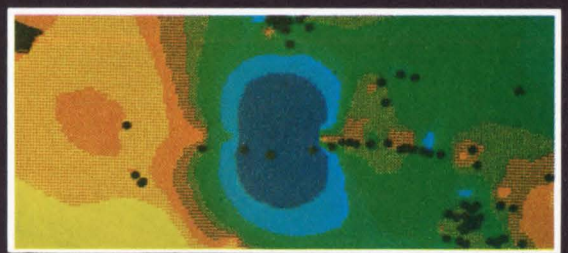
Color cameras produce high resolution photographic prints of color graphic displays. (photo courtesy of Image Resource Corporation)

Optronics International photos are suitable for showing large quantities of discrete information. (photo courtesy of Optronics International)



Impact printer/plotters make plain paper hard copy in seven colors by printing lines of colored dots with leaf spring printing hammers. (photo courtesy of Ramtek Corp)

Laser xerographic prints are made in seven colors by a photosensitive drum that delivers colored toners to plain paper or transparency plastic. (photo courtesy of Xerox Corp)



Applicon's ink jet printer/plotter produces fine dots of ink, allowing thousands of colors on poster-size paper or plastic. (photo courtesy of Applicon, Inc)

T. Ray Woodard
Texas Instruments

Thermal Printing With Semiconductor Printheads

Thermal printers apply heat at a given temperature to a specially-coated paper, and chemical changes create character images. Semiconductors produce clear character definition at up to 140 cps. Advantages include small size, light weight, low power consumption, easier acceleration and deceleration because of smaller drive motors and mechanical components.

For portable terminals and calculators, thermal printing is the logical choice. The smaller size of thermal printers is beneficial in limited workspaces that require virtually silent printing.

Thermal paper performance

The paper coating's thermal response and the printhead's thermal performance must be well matched. **Fig 1** shows a typical method of specifying paper coating characteristics: the curve shows image density plotted against temperature. Any point on the curve divided by the background density value yields the contrast ratio for that point. The point at which 90% of maximum contrast ratio occurs, referred to as 90% T, is often chosen as the reference point on which the other parameters are based. On the lower end of the curve is the 10% T, and the temperature difference between these two points, or the ΔT is the key figure of merit describing the thermal response of the paper.

For crisp character definition and contrast, the temperature must be maintained below the 10% T in background areas and must be driven to equal or exceed the 90% T in the darkened image areas.

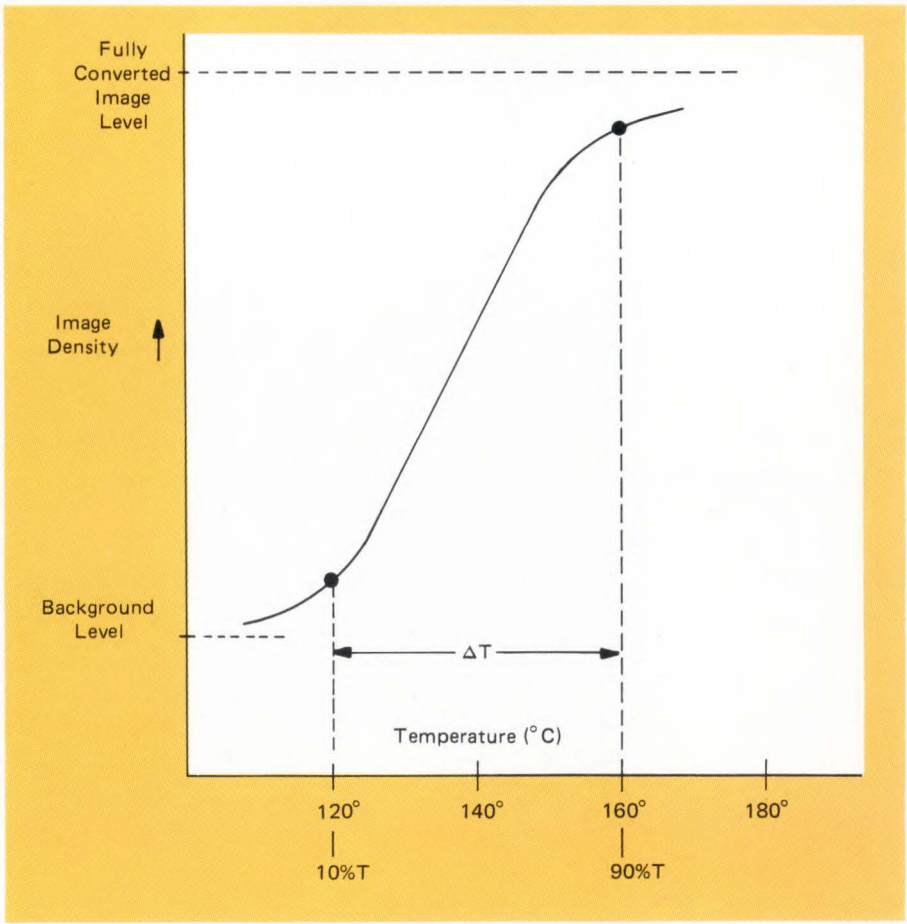


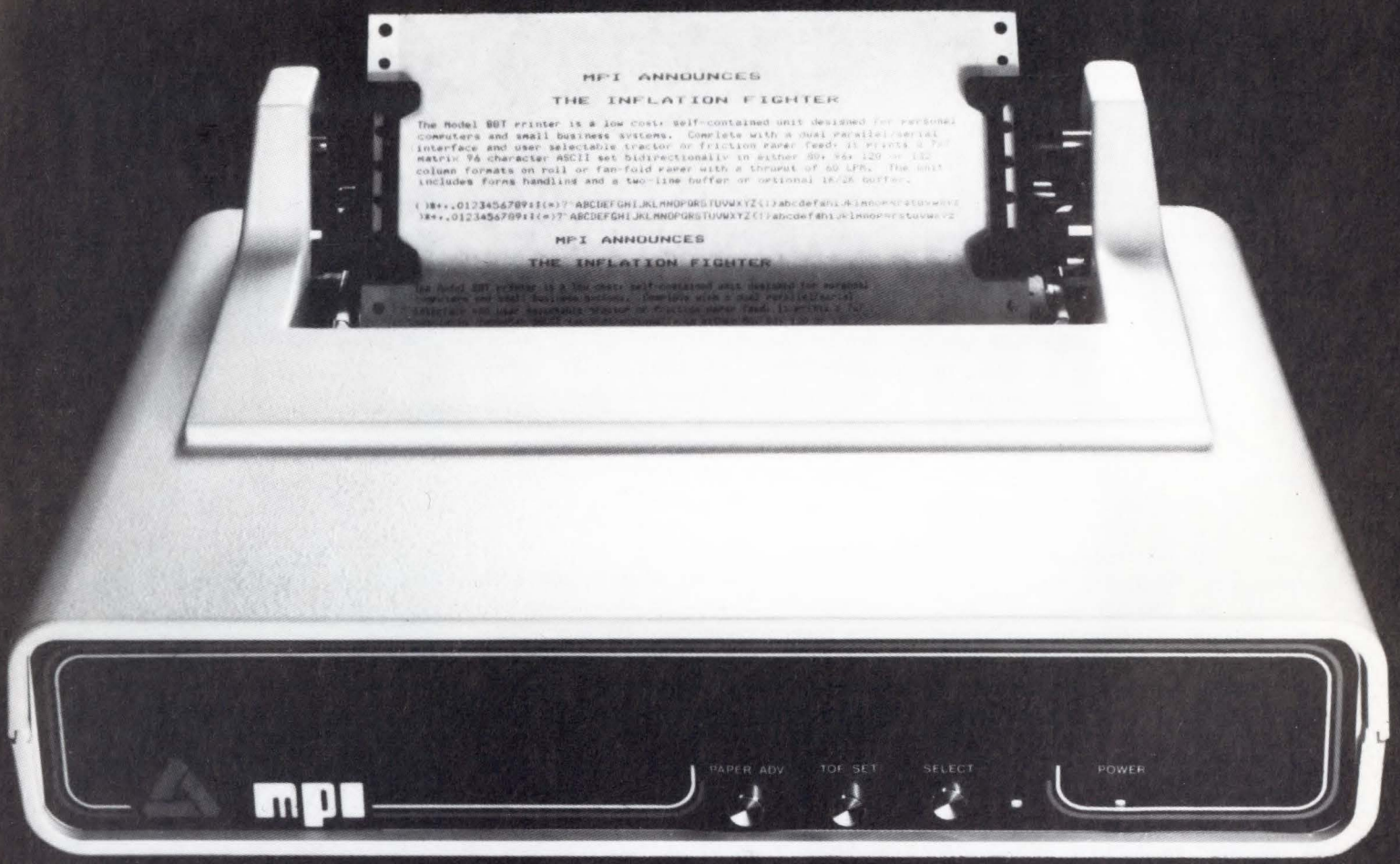
Fig 1 A typical response curve for thermal paper.

Printhead performance

Semiconductor printheads generally use silicon-controlled-rectifiers (SCR) as their heating elements. The addressing and triggering of SCR's can be done with small currents and conductors. Unlike the early transistor/resistor matrix printheads, the anode and cathode leads can be connected in parallel and controlled with fewer conductors in the connecting cable.

Each converted dot on the paper is the result of heating one SCR. As shown in **Fig 2**, distinct dots are created by SCRs in multiple dot or matrix printheads which are separated by moats. The time required to create an image on the paper is determined by the time it takes the paper under one dot to reach 90% T.

THE NATIONS LEADER IN AFFORDABLE PRINTERS



$749

*Suggested retail price, substantial OEM and dealer discounts available.

The first in series of new printers designed specifically for the general use computer market, the MODEL 88T DOT MATRIX PRINTER combines quality construction and attractive styling with capabilities generally associated only with more expensive printers. The Model 88T comes standard with a dual tractor/pressure-roll paper feed system and a serial/parallel interface. The tractor paper feed system provides the precision required to handle multi copy fanfold forms, ranging in width from 1 inch to 9.5 inches. The pressure-roll paper feed can be used with 8.5 inch roll paper. An optional sheet feeder is available for feeding single sheets. A long life ribbon cartridge gives crisp, clean print without messy ribbon changing. The microprocessor based controller has 80, 96, 120 or 132 column formating capability while printing upper and lower case characters bi-directionally at 100 characters per second. Write for complete specifications, pricing and distributor list.

mpi

MICRO PERIPHERALS, INC./2099 WEST 2200 SOUTH/SALT LAKE CITY, UTAH 84119/(801) 973-6053

Circle 38 on Reader Inquiry Card

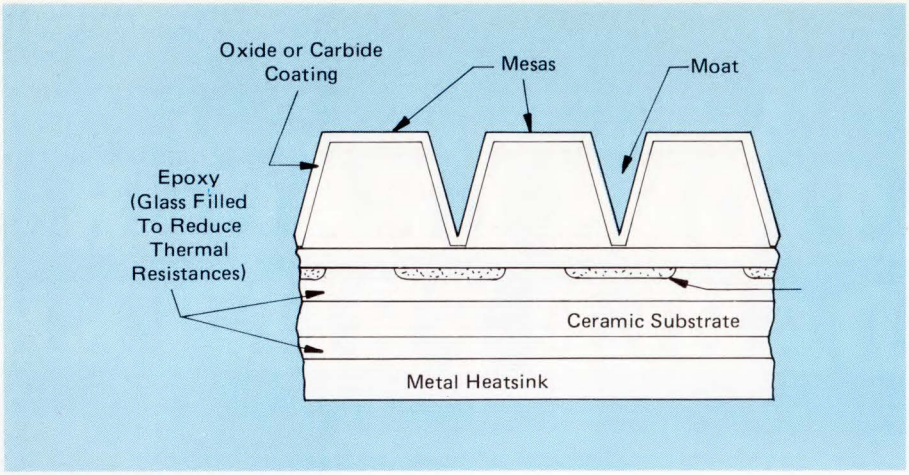


Fig 2 Physical construction of a semiconductor printhead.

Heating the dots is only half of the problem, though, because characters will smear if the mesa temperature is not below the 10% T before the paper or printhead can be moved. Printhead performance can be measured in part by the speed which the mesas can be heated and cooled.

A model of a thermal SCR printhead is shown in **Fig 3**. When the SCRs are triggered and conducting current, the power is being dissipated not only in the mesas but also in the substrate and in the heatsink. Therefore, the total energy being supplied to the printhead must be considerably greater than that required to convert the paper. When the current is removed, the thermal capacitances of $\Theta_{P\text{-}S}$ and $\Theta_{S\text{-}HS}$ must be discharged. This thermal time constant determines the printhead cooling time. Thermal resistances must be kept as low as possible to increase thermal conductivity. This is typically achieved by adding thermally conductive fillers to the mounting epoxy.

A limit on printing speed is defined by the thermal response of a printhead to specific paper characteristics. Maximum printing speed is reciprocal to minimum printing time. Printing time is the sum of heating and cooling time and the time required to move the printhead or paper to the next printing position.

Paper categories

Two essential elements are missing from **Fig 1**: time and pressure. The time that the heating element remains in contact with the paper and the pressure applied are usually constant for the printer mechanism. Therefore, the resulting image density is plotted against the temperature curve.

It is not always practical to use the printhead as a vehicle for characterizing a paper's performance; more accurate results can be obtained by using a heating element with a linear temperature gradient. A solid steel bar heated at one end yields excellent results. A resistance heating element brings one end of the bar up to a temperature that ensures 100% conversion of the paper. The temperature gradient along the bar is predictably based on the material and dimensions. The length is selected so that the temperature of the unheated end will be well below that required for a 10% conversion of the paper.

As shown in **Fig 4**, the heated bar is brought down onto the surface of the paper mechanically and a pressure impulse is applied. This action originated the term "slapper bar," a name often used to describe the apparatus. Since the slapper bar embodies a linear temperature gradient, the pressure impulse produces a linear conversion gradient on the paper. A densitometer optically examines the converted strip, determining the 90% and 10% contrast points. Linear measurements of these points along the gradient then directly correspond to temperatures on the bar.

Therefore, the characteristic curve for a paper coating is plotted as image density versus temperature for a specified time and pressure profile. The slapper bar test is used both for characterization and lot acceptance testing of thermal paper. The results of a slapper bar test can be compared experimentally with a particular printhead and the pressure and pulse widths applied in a specific printer mechanism.

Printhead categories

The heating of a practical printhead occurs much faster than cooling. Ideally, a constant voltage source is applied across the SCRs. To achieve minimum heating time, the voltage source should be as high as possible without risking breakdown. The SCRs will reach a maximum temperature determined by the voltage source and remain at that temperature as long as the source is applied. The pulse width of the voltage source determines the total energy applied to the printhead and the thermal resistances of the system determines how much of that energy actually reaches the paper to affect the conversion.

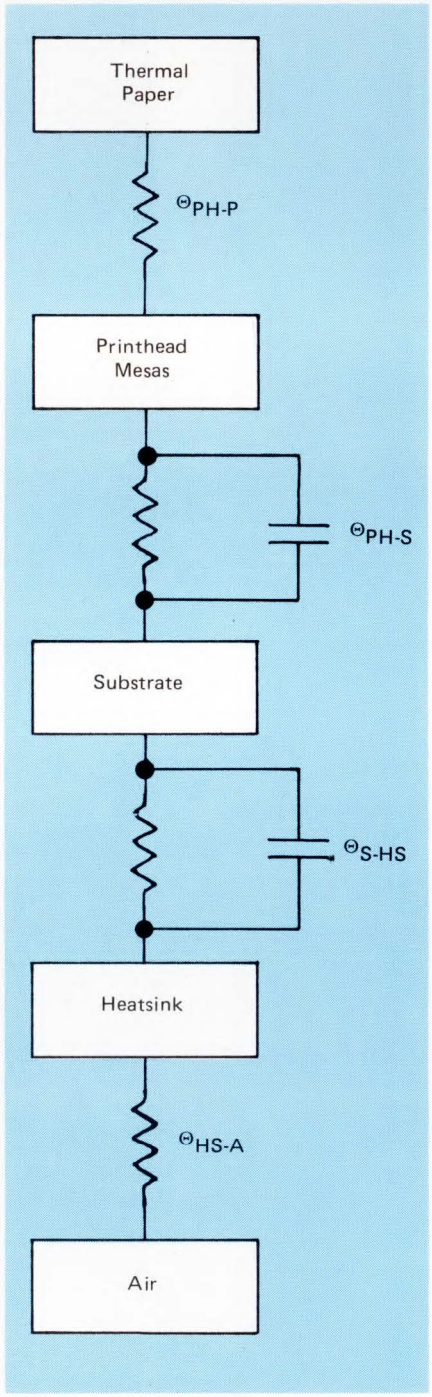
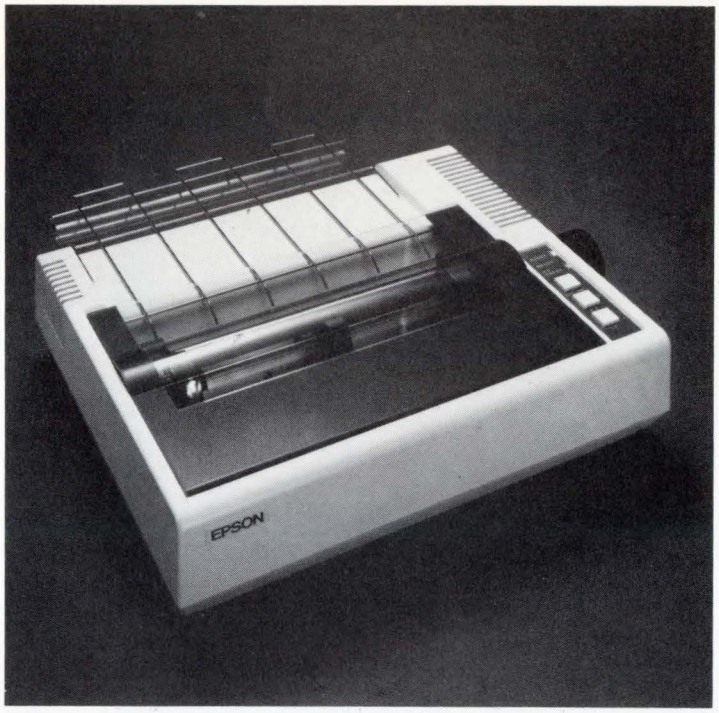


Fig 3 Thermal model of a semiconductor printhead.

The MX-80. It not only does everything, it does everything well.



Epson.

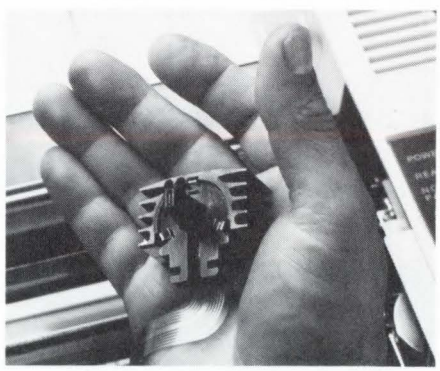
This is the new Epson MX-80 dot matrix printer. It does just about everything you could ask a printer to do. Quickly. Quietly. Reliably. In fact, for OEM installations, the MX-80 may be the single best, all-round printer you can buy. But that's not the best reason to buy it.

The MX-80 prints bidirectionally at 80 CPS in a user-defined choice of 40, 80, 66 or 132 columns. And if that's not fast enough, its logical seeking function minimizes print head travel time. The MX-80 prints 96 ASCII, 64 graphic and eight international characters with a tack-sharp 9x9 matrix. For a long time. Epson printers are known for reliability and the MX-80 is no exception. But that's not the best reason to buy it either.

The print head has a life expectancy of up to 100×10^6 characters, and when it wears out, just throw it away. A new one costs less than $30 and the only tool you need to change it is attached to the end of your arm. The MX-80 is compact, weighs only 12 lbs., and the whole unit, including the two stepper motors controlling carriage and paper feeding functions, is precisely controlled by an internal microprocessor. But even that isn't why you should specify the MX-80.

The best reason is this: because Epson makes more printers than anyone else in the world, we can afford to sell each one for a little less. So you can get one Epson MX-80 Printer for less than $650. And more than one for even less than that.

That's what we call a small price to pay for a printer that does everything well.



The world's first disposable print head. When it wears out, just throw it away. A new one costs less than $30, yet it's so simple, you can change it with one hand.

EPSON
EPSON AMERICA, INC.

Western: 23844 Hawthorne Boulevard, Torrance, California 90505 • (213) 378-2220 TWX: 910-344-7390
Eastern: 98 Cutter Mill Road, Rm. 350, Great Neck, New York 11021 • (516) 487-0660

Circle 31 on Reader Inquiry Card

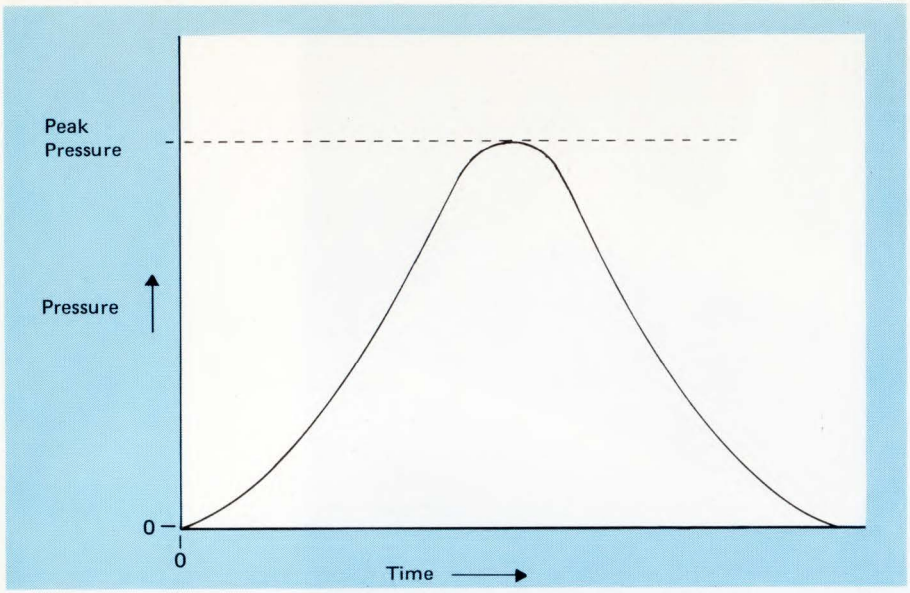


Fig 4 Pressure/time profile of slapper bar contact with thermal paper.

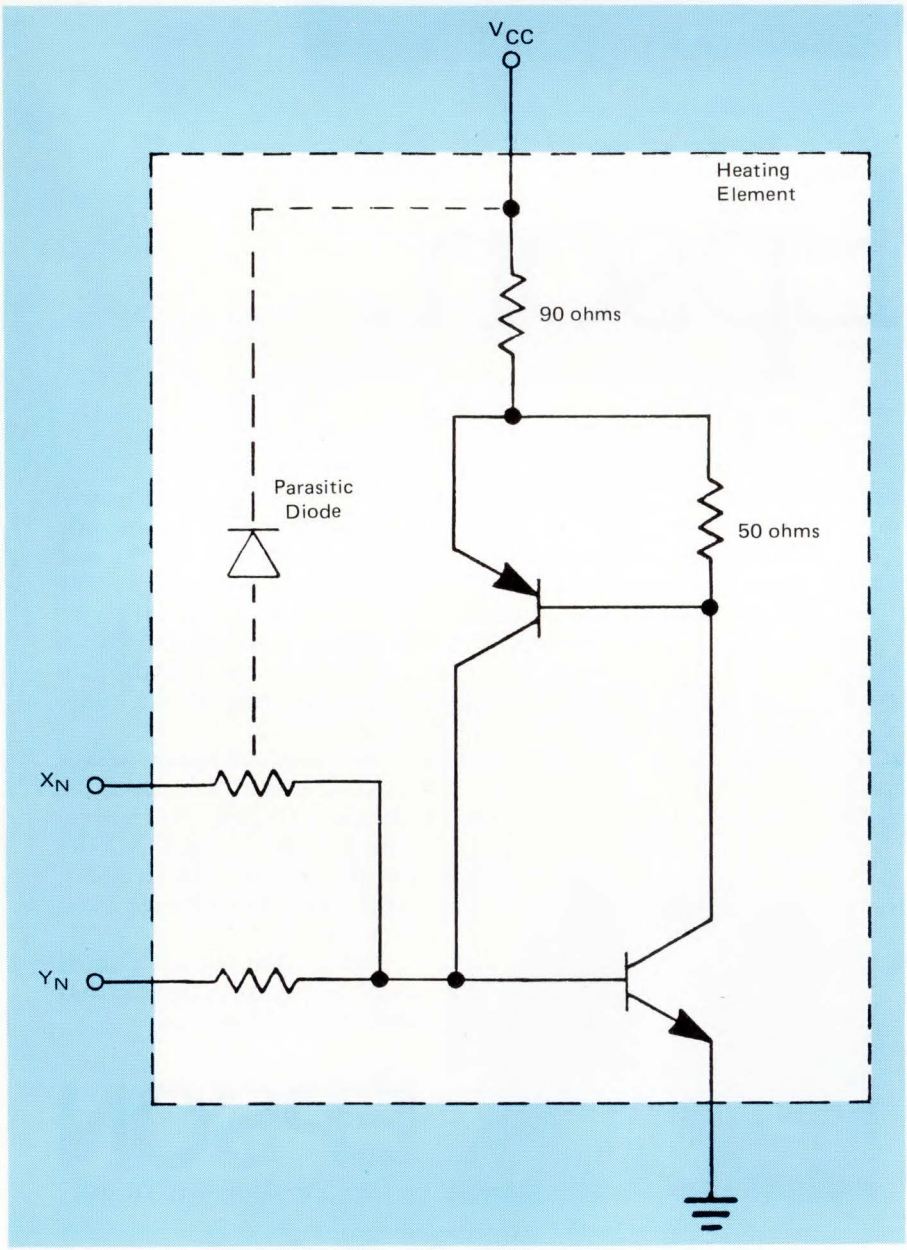


Fig 5 Heating element schematic showing parasitic diode.

To characterize a printhead, first determine what pulse width produces 90% contrast at the maximum safe voltage. Do this by applying successive pulses of increasing width until 90% contrast is achieved, while at the same time allowing a sufficient interval for the printhead to cool after each pulse before it progresses on the paper. Printhead heating characteristics can be related to the 90% T of the slapper bar when the 90% pulse width is determined.

After the minimum 90% pulse width is applied to the printhead and paper conversion is complete, some cooling time must be allowed to avoid blurring the printed dots. The printhead temperature must fall below the 10% T point of the characteristic curve of the paper. Therefore, the cooling time for the printhead, t_c, is directly related to the ΔT obtained in the slapper bar test for the paper. A minimum ΔT is an essential element in the paper specification.

By limiting the ΔT, the cooling characteristics of the printhead determine the maximum printing speed. The most satisfactory way of measuring the cooling characteristics of SCR printheads is to use the parasitic diodes found between the gate resistor diffusion and the substrate as shown in **Fig 5**. The minimum 90% pulse width is applied to the printhead as in normal printing. The falling edge of the print pulse enables a constant current source connected across the parasitic diode. The voltage drop across this diode is monitored on an oscilloscope.

The diode forward voltage is found to decrease with increasing temperature: $V_F = V_{F2} - V_{F1} = -k(T_2 - T_1)$, where $k = 2.0$ mV/°C and T is expressed in °C.

The oscilloscope display can be calibrated directly in degrees Celsius. **Fig 6** shows a typical cooling characteristic for an SCR printhead mounted with thermally conductively filled epoxy.

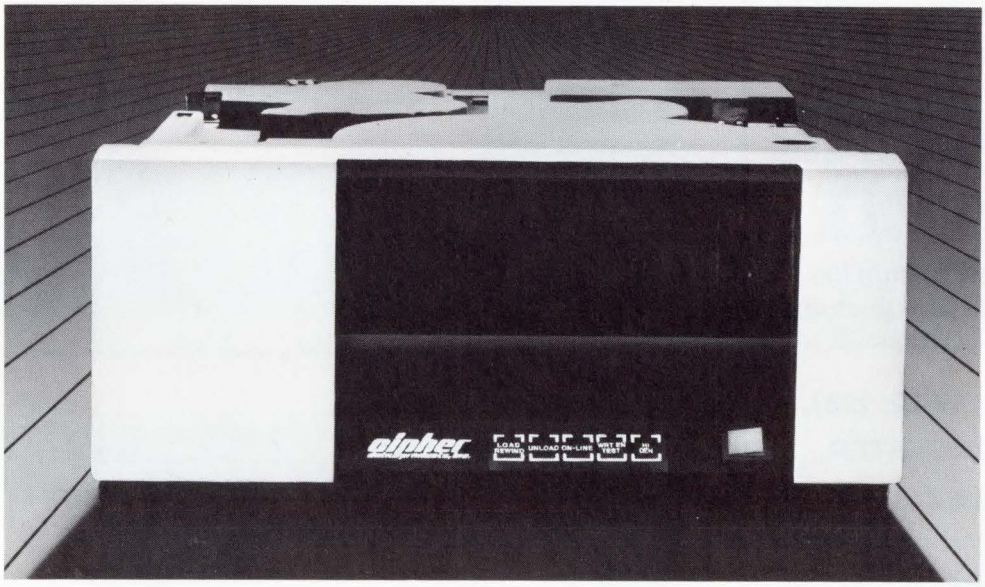
Once the cooling time, t_c, is determined, the printhead/paper interface system has been thermally characterized for a given pressure. The electronic system for driving the printhead can then be designed to operate within the limits established. Thermal specs may be written for paper and printheads.

Thermal feedback

Dot patterns and character patterns received by a thermal printhead are not normally regular or predictable. As a result, power dissipation in the substrate and heatsink is irregular:

The Tape technology of the future is here...

...and it costs less than what you're paying for standard 1/2 tape drives.



It's the Microstreamer™ from Cipher Data Products and it's designed with advanced tape motion techniques for applications such as data acquisition, computer output microfilm, computer graphics, mass storage for sequential files. And more.

Performs like a conventional IBM compatible tape drive but has unique new features...

and still costs less.

For most of these applications, the Microstreamer is a perfect replacement for standard start/stop drives and you get auto load, internal diagnostics, advanced packaging, dual speed, plus 100 ips for high speed **disk backup—FREE.**

And anyone can use it,

NOW.

Controllers are available for interfacing the Microstreamer to just about anyone's minicomputer or microcomputer. From PDP-11's, LSI-11's and Novas to CPU's that use Multibus, S100 or IEEE-488 interfacing. The kind of system you configure is limited only by your imagination. And using dual purpose Microstreamers can simplify your system design.

Want to know "HOW CAN THAT BE?" Give us a call.

Ask for Ralph. (714) 578-9100

cipher data products, inc.

10225 Willow Creek Road, San Diego, CA 92131

Circle 26 on Reader Inquiry Card

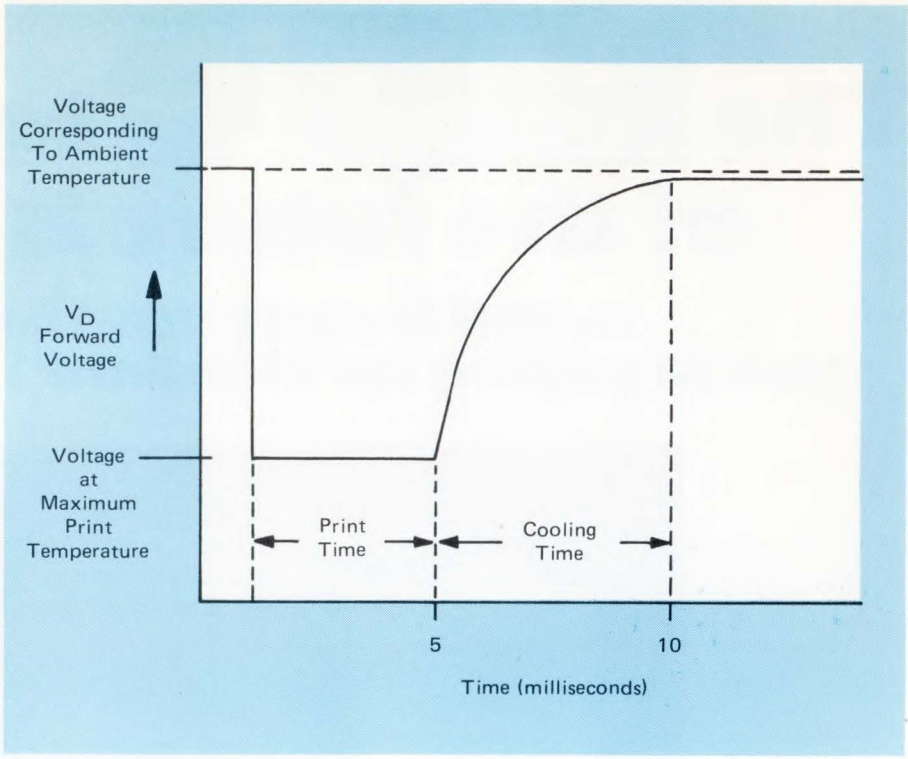


Fig 6 Forward voltage drop across parasitic diode showing printhead cooling characteristic.

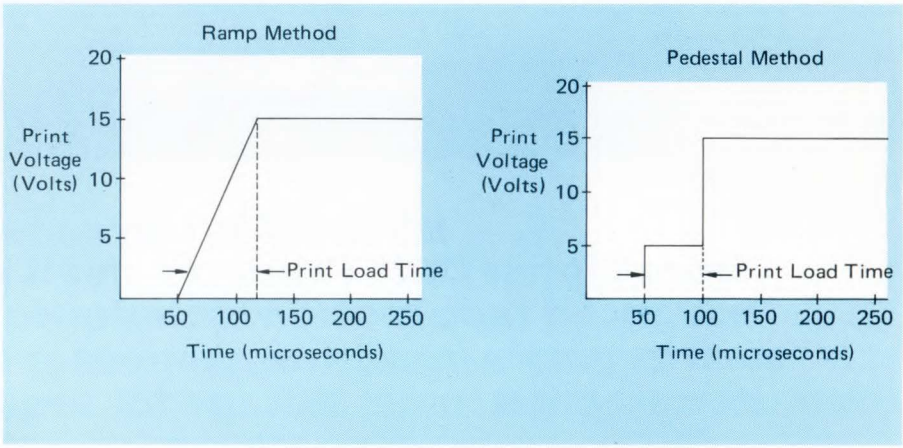


Fig 7 Print voltage pulses showing methods for loading data before paper conversion begins.

its temperature varies, depending on the data being printed. The voltage required to heat the mesas to the 90% T may also vary according to recent print history. A fixed voltage source is not adequate because it would cause contrast to vary as the printhead and heatsink temperature varies.

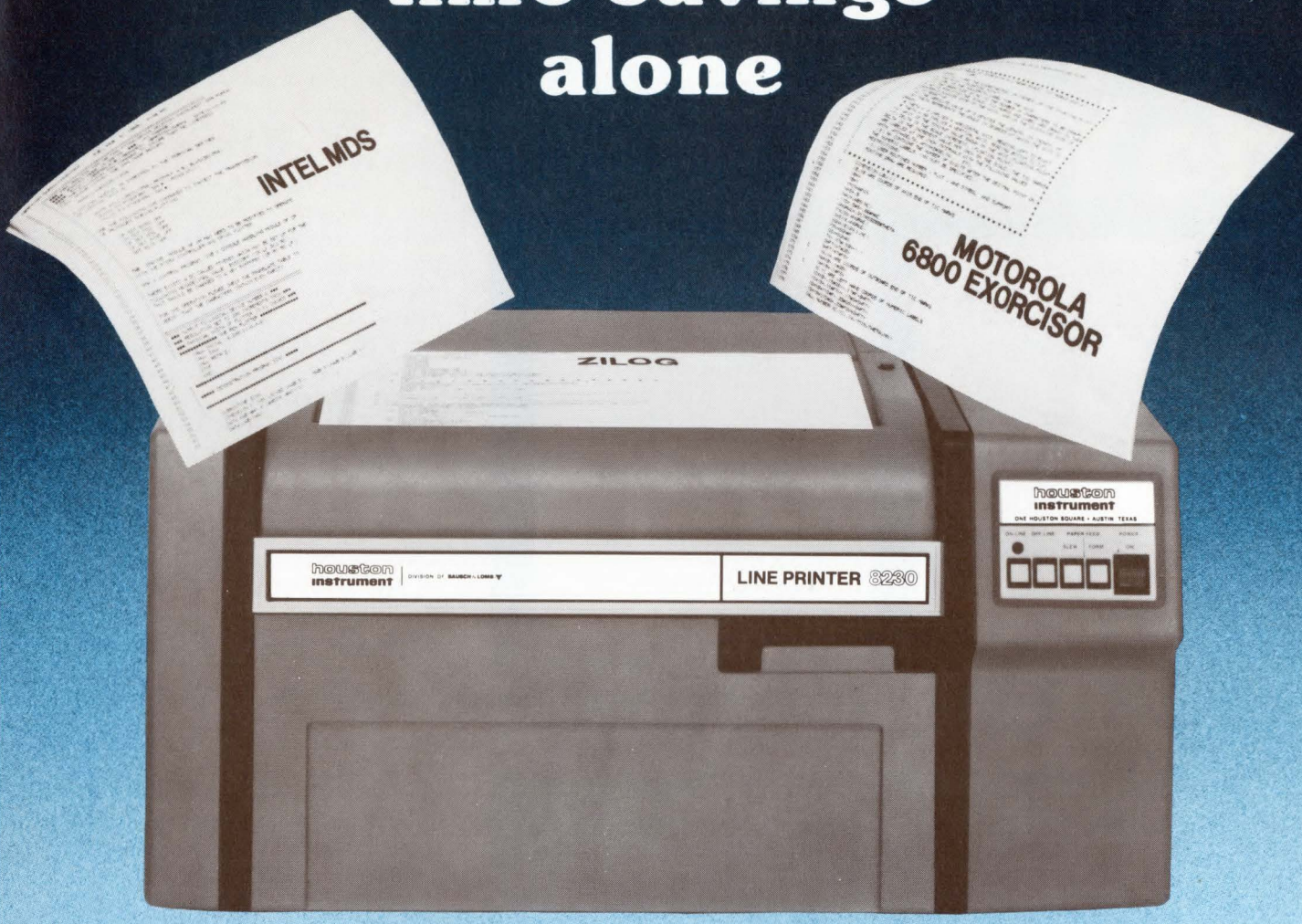
This problem is solved by closing the loop with a thermal feedback element. A diffused junction independent of printing mesas is used to provide thermal information to the print voltage control circuit.

The junction is forward biased and driven with a constant current. The forward voltage is directly proportional to the printhead temperature. This voltage is used as the error signal in the loop which controls the printing voltage level to achieve uniform contrast regardless of data print pattern.

Addressing printheads

In semiconductor thermal printheads using SCRs as the heating elements, the anode and cathode leads of the SCRs are connected in parallel and the individual SCRs are triggered by pulses on their respective gate leads. The gate leads typically are connected in a matrix AND-configuration so that data on the Y leads are changed according to the desired dot pattern just before each X lead is strobed.

One good printer for software development can justify itself in time savings alone



And the best software development printer available today comes from Houston Instrument

Model 8210 $3,950.* 2400 LPM 80 col.

Model 8220 $4,750.* 1000 LPM 132 col.

Model 8230 $4,250.* 1400 LPM 132 col.

Watch your programs fly off this machine . . .quietly, accurately and above all quickly.

Why wait for the printer . . .it could be waiting for you. Others are benefiting from this desktop printer in software development. Why not you?

For complete information contact Houston Instrument, One Houston Square, Austin, Texas 78753 (512) 837-2820. Outside Texas call operator #5 toll free 1-800-531-5205. In Europe contact Houston Instrument, Rochesterlaan 6 8240 Gistel, Belgium. Telephone 059/277445.

houston instrument | DIVISION OF BAUSCH & LOMB

"the graphics - recorder company"

*U.S. Domestic Price Only

Visit Us at Wescon, Booths 2330, 2332 & 2336

Circle 41 for Information Only; Circle 43 for Demonstration Only.

Therefore, the SCRs are triggered in columns from left to right. If the printer system is controlled by a μP with a clock at 2MHz, the total time required to load the data into five columns of dots could be a significant portion of the total print time. Retrieving the dot patterns from memory could take up to 50 μs, while print times are currently in the range of 4 to 50 ms. The dots triggered in the first column could be up to 50 μs longer than those in the last column. This could cause a noticeable difference in contrast from the left to the right side of the printed character.

To avoid this problem, a print load time is required: there must be enough voltage to trigger the SCRs into conduction without converting the paper. After all data is loaded, voltage is increased to the maximum safe printing level and held for the required printing time. Two methods of maintaining the print load time are shown in **Fig 7**. The ramp method and pedestal method both yield acceptable results.

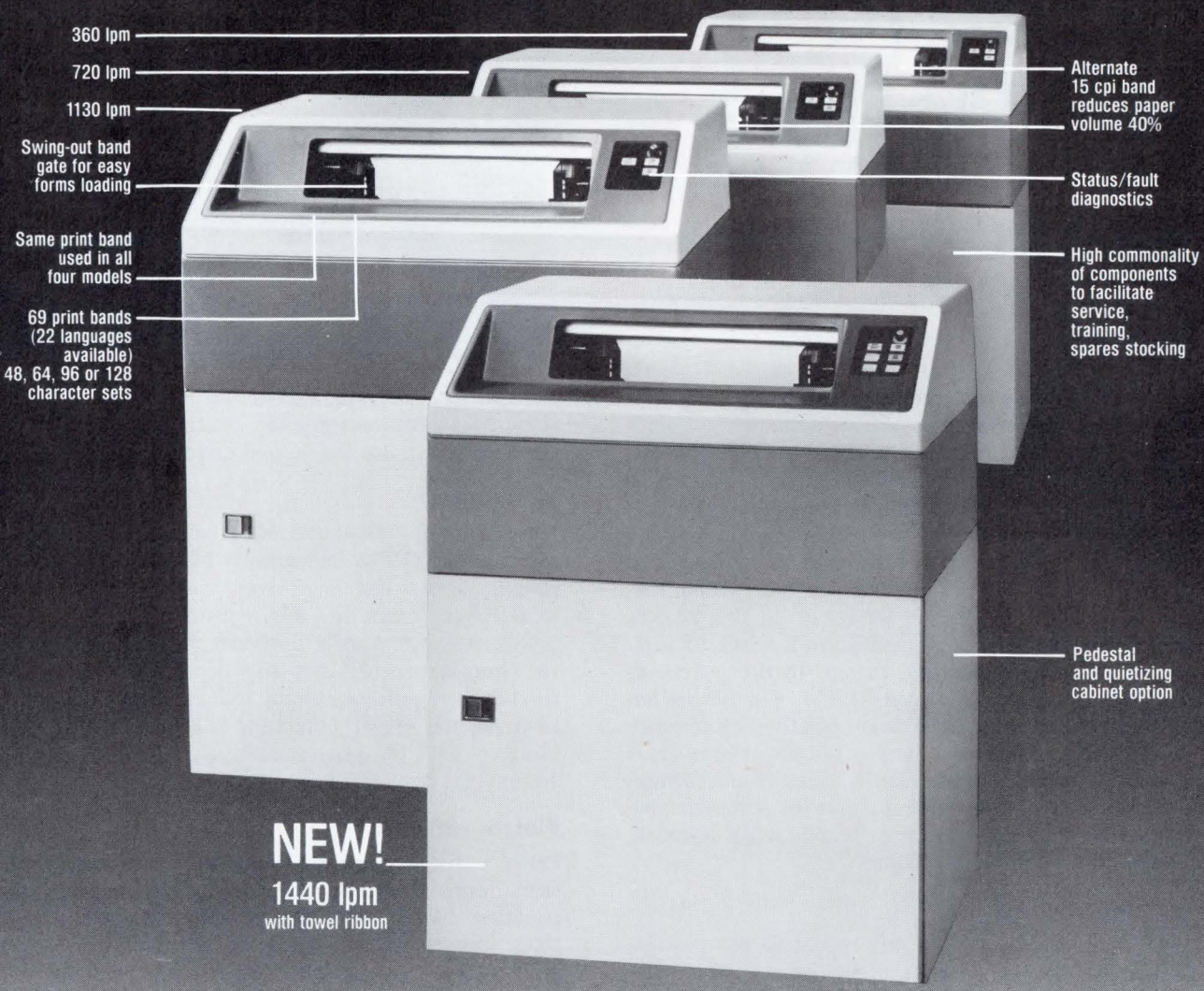
Technology forecast

New print fonts and higher speeds are on the horizon for thermal printing. Printing speeds for portable data terminals with 5 × 7 character matrix font have already passed the 120 cps barrier. Throughput capabilities of portable terminals must keep up with speed capabilities of modems. Printers containing a direct-connect internal modem allow operators to interface directly into a standard telephone line; combined with the size and power advantages of thermal printheads, these higher speeds will allow thermal printers to enter realms previously dominated by impact printing technology.

New applications will require additional fonts. Presently, several market segments are demanding a font which can underscore and print characters with full ascenders and descenders. In addition, the innovation of smaller dot sizes will provide increased clarity of slanted and curved segments of the character being printed. Thermal printers are improving rapidly and will prove well-suited for new applications. In the meantime, they are well-suited for a variety of applications requiring small size and almost-silent operation.

Rate this article: circle 3L, 3M or 3H on Reader Inquiry Card.

Make quality impressions with OEM band printers from Control Data



If you're an OEM, you already know what Control Data has done for disk technology. Now we're determined to earn the same reputation for excellence in band printer technology. By giving *you* versatility and maintainability. By giving *your customer* reliability, superior print quality and economical operation.

Engineered for component commonality

All four members of our 9380 family of band printers look pretty much alike. Inside and outside. So your servicing, training and inventory requirements are simplified. Yet you can choose from four print speeds, 69 print bands and lots of other options.

Built with the features and economy to attract end-users

Our 360/720 lpm models offer a compressed pitch option. That saves your customer paper. And gives him the capability to print 132 columns on standard 8½ by 11 inch paper. Bands switch in seconds. Paper loading is easier. Operator controls and adjustments are minimal. And your customer will like the clean, crisp impressions delivered by our proven hammer technology.

Put quality behind your nameplate. Let us send you data sheets and print samples. Call us at 313/651-8810 or if in Europe, contact one of our European representatives. Or write OEM Product Sales Manager, Control Data Corporation, 1480 N. Rochester Road, Rochester, MI 48063.

CONTROL DATA CORPORATION

Addressing society's major unmet needs

Circle 42 on Reader Inquiry Card

Designers' Guide to Pen Plotters

Maurie D. Wagner
Houston Instruments

Reading some of the tests on interactive computer graphics, you get the feeling that a large number of graphics professionals have a lackadaisical attitude towards plotters, and pen plotters in particular. There are several factors that create this attitude. Use of a plotter in interactive systems is as a hardcopy device; however, interactive graphics is still a small and sophisticated portion of the graphics industry. Pen plotters are not interactive in the inherent sense of the term – they typically belong to the family of graphic devices known as passive graphic devices. Despite the lack of textual interest in passive graphics, current market estimates place the plotter market between $200M and $300M annually – certainly not an insignificant position. Plotters are used in systems where interactivity is not required, such as production of plots that are similar in structure and format, and done repeatedly. Some common uses for noninteractive plotting are contour mapping, structural drawing, scientific test data results and business graphics.

Plotter fundamentals

Although there are myriads of different style pen plotters on the market, they all operate in the same fundamental manner. Primary differences are in maximum speed, paper size, resolution and cost. Plots are generated by operation of three independent axes; in a drum plotter the chart paper (X) and pen carriage (Y) are positioned by motors, and the pen is either raised or lowered by a solenoid.

Lines are generated by using a series of straightline segments, usually equal to the plotter resolution, each of which is one of the eight prime plotting vectors. Basic segment length, at an angle of 45° (also 13°, 225°, and 315°) is the vector sum of the simultaneous motion of the X and Y axes – or simply the basic segment multiplied by 1.414. The incremental path generated for a typical analytic function shows the curve is an approximation to the slope at any point. The most basic task of the utility plotting software is generating the correct incremental, straight-line approximation between any two points Programmers are thus relieved of having to deal with vector generation and can instead concentrate on graphics problems using (X,Y) coordinate data. Alphanumeric characters and special symbols are also generated, leaving only the location, size angle, name of the character array, and number of characters to be determined by the programmer. By merely inserting calls to standard subroutines into an existing program, it is often possible to produce the desired graphic output.

Resolution

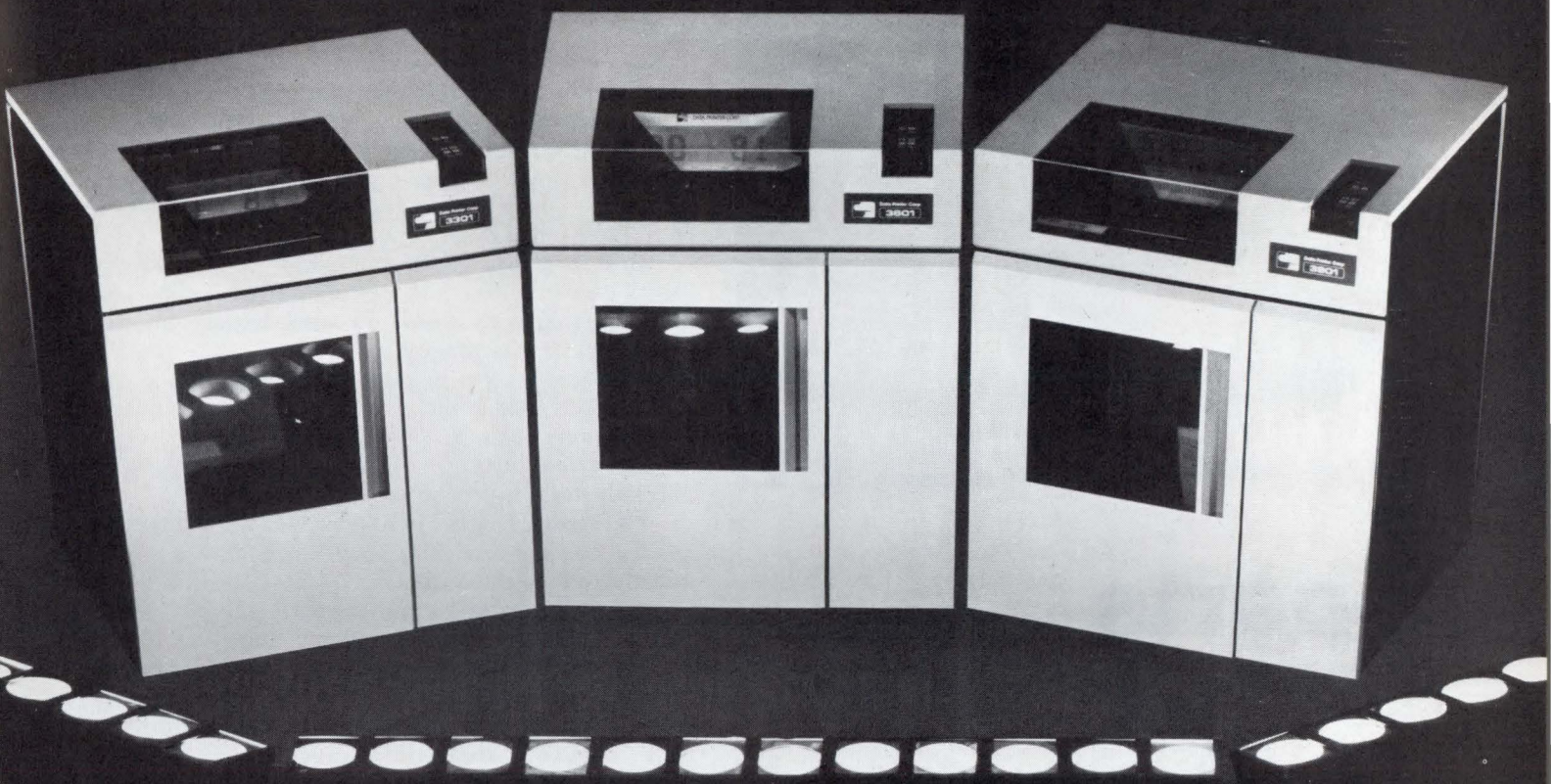
Because many line slopes must be approximated, there is often some visible indication of the path taken by the plotter. Several increment size options ranging from 0.001″ to 0.01″ are often available – generally, at a resolution of 0.002″ it is not visually bothersome. However, the penalty for choosing a small step size is usually increased burden for the host processor. Most software has a feature for initializing the vector generating routine for any resolution plotter; thus, the programmer can still think in terms of actural plot size regardless of the particular resolution used.

Plotter software

Plotter packages typically consist of user-callable subroutines normally written in Fortran. Users write Fortran application programs containing calls to the desired subroutines. These calls will move the plotter pen to a specified point, draw symbols and numbers, raise or lower the pen, draw with labels, provide the necessary scaling, and plot a series of points when an array of X and Y coordinates is supplied.

Here are some typical plotter subroutines: INITIAL sets up certain constants and the plot buffer area from which the plotter commands are written; PLOT drives the pen from its present position with the pen raised or lowered. It is also used to redefine the present position of the pen or to locate the present position of the pen; SCALE sets and stores scaling information for AXIS and LINE routines; AXIS draws an axis with "Tick" marks at one-inch intervals and an identification label. Numerals representing the magnitude of the plotted data are drawn at each "Tick" mark; LINE drives the pen through an array of points for point-to-point plotting; SYMBOL positions the pen and forms the characters to be plotted. Available characters are 0-9, A-Z, and various special markers; NUMBER positions the pen and forms the numerals that define the magnitude of an internal floating point number; MARKER draws event marker at present pen position; NEWPN selects a specific pen on a multi-pen plotter; FACTOR scales all subsequent plotting subroutine

Audition Our Band.



"Our 3001 Band Printers Will Perform, or Your Money Back."

Paul Kwasnick, President

Another overnight success story? Hardly. We've been working on this act for over twelve years as the leading manufacturer of horizontal font line printers of exceptional quality, craftsmanship and reliability. Now, we're ready with our second generation of band line printers—the 3001. Combining what we've learned about heavy-duty cycle designs with the efficiencies and economies inherent in band technology, the 3001 outperforms any other band printer available today. And, we're prepared to prove it.

How? With the industry's first-ever money-back guarantee. Why? Because we're confident. Confident that you'll like the performance of this printer's unique chaintrain-type hammer and actuator system, fine horizontal *and* vertical paper adjustments, standard quietized cabinetry and operator self-test. You'll applaud the wide range of speeds—from 150 to 1100 lines per minute, all within a single family.

Operator changeable fonts, clean-hands ribbon cassettes, a touch-control operator's panel, 95% spares commonality, and a mean time to repair that has yet to be bested by any other band printer available today are just a few of the other high performance features of the 3001.

Therefore, to qualified OEMs and systems integrators who plan to buy 20 or more printers a year, Data Printer is extending an invitation to audition our 3001 band printer for 30 days. If the printer's performance and quality don't live up to its billing, return it for your money back.

The 3001. We say it's the best. Now you make us prove it. Data Printer Corp., 99 Middlesex Street, Malden, MA 02148, Telephone (617) 321-2400, TWX: 710-348-0794.

All Right, Data Printer, Prove It.

☐ Please have a sales representative call on me immediately to arrange a 30-day audition of your new 3001 Band Printer.

☐ I need to know more first. Please send me additional information.

Name_____

Title_____

Company_____

Address_____

City_____

State_____ Zip_____

Telephone_____ Ext._____

Number of Printers you expect to buy this year_____

Data Printer
The Craftsmen.

Circle 40 on Reader Inquiry Card.

calls; WHERE returns the current pen-position coordinates and scaling factor to the user-written program; PENUP raises the pen; PENDN lowers the pen; RSTR restores plotter to a new page and positions the pen at the bottom of page. A call to RSTR is required for the dumping of the output buffer in time-shared and off-line software.

Why a pen plotter?

Considering the age of the pen plotter, it's natural to assume that other technologies such as ink jet, electrostatic, thermal, etc., would come along to supercede the pen plotter as a hard copy graphics device. This has not occurred because the inherent characteristics of the pen plotter are difficult to parallel when viewed as a whole.

Host processor requirement. Pen plotters place a very small burden on the host computer. Quite useful plots can be generated with a host processor having only 16 K of RAM and no mass storage.

Plot quality. Pen plotters produce graphs and drawings that look as good as those drawn by a human draftsperson.

Hardware costs. For any given size plotter, a pen plotter will cost less than any other plotter type. This is true for both the total system or just the plotter.

Plot media. The ability to draw on a wide range of media such as plain paper, view graph material, and polyester is unique to the pen plotter.

Color. Pen plotters can support multiple colors with both multiple or single pen units.

Vector operation. Pen plotters are vector devices and are similar to the calligraphic or stroke type CRT, whereas, most other plotters are raster devices similar to the digital T.V. type CRT display. This difference is the key to the advantages and disadvantages of pen plotters.

Drawbacks. The two biggest drawbacks pen plotters have are their relative lack of speed and their limited ability to produce shaded graphs.

Pen plotter family

The pen plotter family can be arbitrarily divided into several sub-divisions.

Divisions	Drum	Flatbed
Small	10″ – 24″ Wide	A & B Size
Medium	24″ – 34″ Wide	C Size
Large	34″ – 42″ Wide	D Size
Very large	42″ – UP″ Wide	E Size

The principal choice a potential user has to make initially, is whether to use a drum or flatbed plotter. The issues between the two are relatively simple. These include the inherent ability to put a plot back on a flatbed at a later date to add more lines; relative costs – a small flatbed is less expensive than a small drum, but a large flatbed is more expensive than a large drum; and the higher level of operator intervention required by a flatbed because of the necessity of changing paper.

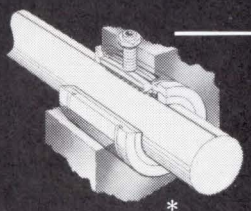
After deciding whether to use a flatbed or a drum, the selection of a specific plotter tends to reduce itself to one of plot size, performance, and cost. One rather simple-minded comment is appropriate at this point. A user should never get so enthralled with specifications that he forgets that the desired end result is a useable plot.

Rate this article: circle 4L, 4M or 4H on Reader Inquiry Card.

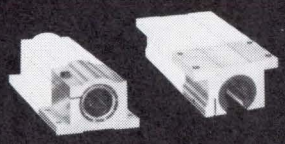
THOMSON Linear Motion

Self-Aligning Super Ball Bushings®*
Simplify Installation, Improve Performance, Reduce Costs!

- *Lower First Cost*
- *Lower Cost Installation*
- *SMOOTHER Lower Friction*
- *3-Times Greater Load Capacity OR*
- *27-Times-Longer Travel Life*
- *Adjustable Diameter*
- *Lightest Weight*
- *Silent Operation*



NEW THOMSON SUPER Ball Bushing with a * Single BALL-GROOVE™ 60 Case Shaft provides Torque Resistance, Torque Drive, Rotary Positioning.



Single and NEW Twin Pillow Blocks

- LITERATURE: Complete technical and application information with prices and name of your local distributor mailed promptly on request.

Progressive Manufacturers use Thomson Ball Bushings . . . A Major Improvement at a Minor Cost.

OVER 35 YEARS
PROVEN DEPENDABILITY
1. CONSISTENT HIGH QUALITY
2. RELIABLE DELIVERY
3. QUALIFIED FACTORY ENGINEERING SERVICE
Guaranteed by the World's Largest Manufacturer of Linear Bearings and Shafts.

THOMSON INDUSTRIES, INC.
Tel. 516 883-8000

Dept. AAS
MANHASSET
N.Y. 11030

Manufacturers of ROUNDWAY Bearings (for heavier loads), 60 Case Shafting, BRONZE Case Shafting, Shaft Supports, NYLINED Bearings, MILL-DRILL Tables

 * Patented.

Circle 45 on Reader Inquiry Card

SINGLE OUTPUT IC REGULATED OEM SERIES EAPS U

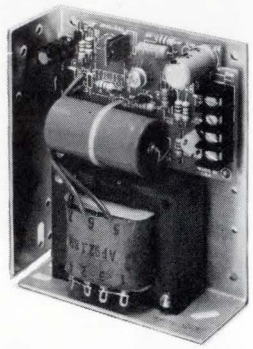
MEETS U L AND C S A REQUIREMENTS

Not available through distributors contact the engineering sales office near you. Minimum sales order 50 units.

FEATURES

- 3 way barrier block output terminals screw, solder connection or fast on tabs
- Higher efficiency cooler operation 45% efficiency at 5VDC, 60% at 15VDC
- Better noise immunity dual input electro-statically shielded transformer
- High reliability over 100,000 hr MTBF (5V 6A per MIL-HDBK-217B at 40°C ambient, full load, nominal line)
- Metal Cased Hermetically Sealed Pass Transistors used on all units over 25 watts
- 85°C 10 yr life computer Grade capacitors
- Meets UL and CSA requirements
- Full 5 yr warranty
- Metal Cased Hermetically Sealed IC regulator
- Fully enclosed, dustproof, insulated Potentiometers
- Wider input line voltage range 103-130V/206-260V 47-63Hz
- Thinner profile 3 plane mounting

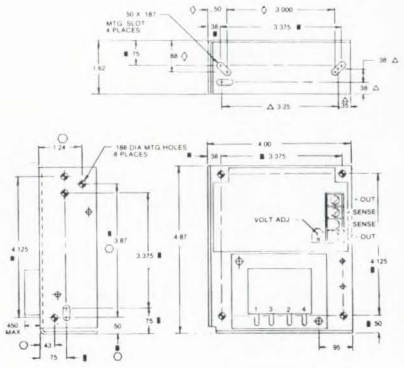
$22.25



10-15 Watts

HB Case Series
Meets U.L. and C.S.A. Requirements
5 Vdc @ 1.2 Amps to 24 Vdc @ 0.6 Amps
Optional OVP available for 5V to 24V units

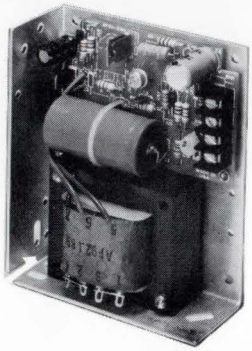
MODEL NUMBER	RATING		REGULATION		RIPPLE
	Vdc	Amps	Line	Load	(Pk/Pk)
EAPS 5-1.2U	5	1.2	±0.05%	±0.10%	3mV
EAPS 12-0.5U	12	0.5	±0.05%	±0.10%	3mV
EAPS 15-0.5U	15	0.5	±0.05%	±0.10%	3mV
EAPS 24-0.6U	24	0.6	±0.05%	±0.10%	5mV



Weight: 2 lbs

115V INPUT 1-4 JUMPER 1-3 & 2-4
230V INPUT 1-4 JUMPER 3-2 ONLY
NOTE: UNLESS OTHERWISE SPECIFIED

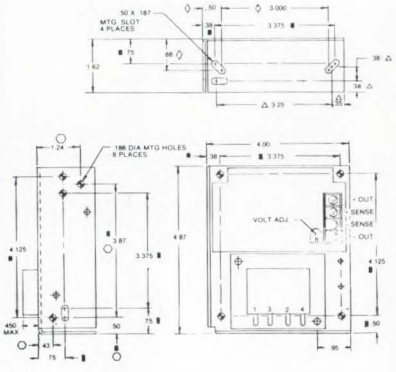
$23.25



15-24 Watts

HB Case Series
Meets UL and CSA Requirements
5VDC @ 3 Amps to 24VDC @ 1.0 Amps
Optional OVP available for 5V to 24V units.

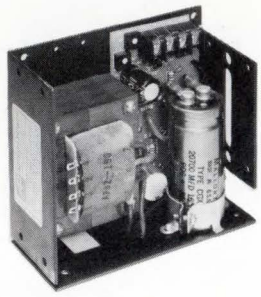
MODEL NUMBER	RATING		REGULATION		RIPPLE
	Vdc	Amps	Line	Load	(Pk/Pk)
EAPS 5-3.0U	5	3.0	±0.05%	±0.10%	5mV
EAPS 12-1.6U	12	1.6	±0.05%	±0.10%	5mV
EAPS 15-1.5U	15	1.5	±0.05%	±0.10%	5mV
EAPS 24-1.0U	24	1.0	±0.05%	±0.10%	5mV



Weight: 2 lbs

115V INPUT 1-4 JUMPER 1-3 & 2-4
230V INPUT 1-4 JUMPER 3-2 ONLY
NOTE: UNLESS OTHERWISE SPECIFIED

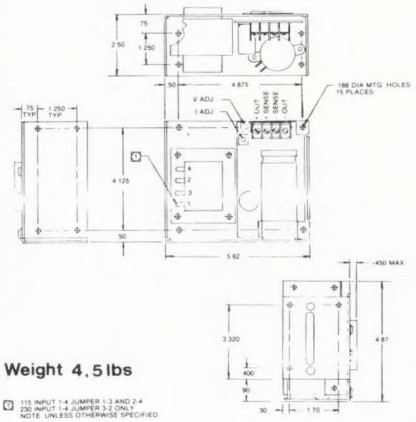
$44.95



30-50 Watts

HC Case Series
Meets UL and CSA requirements
5VDC @ 6 Amps to 24VDC @2.4 Amps
Optional OVP Available for 5V to 24V units

MODEL NUMBER	RATING		REGULATION		RIPPLE
	Vdc	Amps	Line	Load	(Pk/Pk)
EAPS 5-6.0U	5	6.0	±0.05%	±0.10%	5mV
EAPS 12-3.4U	12	3.4	±0.05%	±0.10%	5mV
EAPS 15-3.0U	15	3.0	±0.05%	±0.10%	5mV
EAPS 24-2.4U	24	2.4	±0.05%	±0.10%	5mV



Weight 4.5 lbs

115 INPUT 1-4 JUMPER 1-3 AND 2-4
230 INPUT 1-4 JUMPER 3-2 ONLY
NOTE: UNLESS OTHERWISE SPECIFIED

NOW! Call Toll Free (800) 854-8288)

See Page 73 for List of Local ADTECH Field Offices . . .

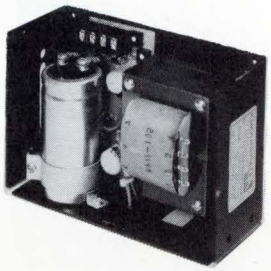
Specifications:

AC Input: 103-130V/206-260V AC 47/63Hz
Derate 10% at 50Hz
DC Output: See tabulation of models
Line Regulation: ±0.05% for ±10% line change
Load Regulation: ±0.1% for ±50% load change
Ripple: Less than 5Mv peak to peak
Transient Response: Less than 50 microseconds
Short Circuit and
Overload Protection: Automatic recovery foldback current limiting
Reverse Polarity Protection: Standard
Remote Sensing: Standard with open sense lead protection
Output Adjustment: ±5% minimum

Operating Temperature Range: 0°C to +50°C at full power rating. Derate linearly to 40% at 70°C or -20°C
Storage Temperature: -30°C to +85°C
Stability: ±0.1% for 24 hours after warm up
Temperature Coefficient: ±0.01% typical ±0.03% maximum
Vibration: Per MIL-STD-810B method 514, procedure 1, curve AB (to 50Hz)
Shock: Per MIL-STD-810B method 516 procedure
Overvoltage Protection: Optional
Efficiency: 5V units 45%; 12V units 55%; 15V units 60%; 24V units 62%
Line Noise Suppression: Electrostatically shielded transformer

ALL MODELS WARRANTED FOR 5 YEARS

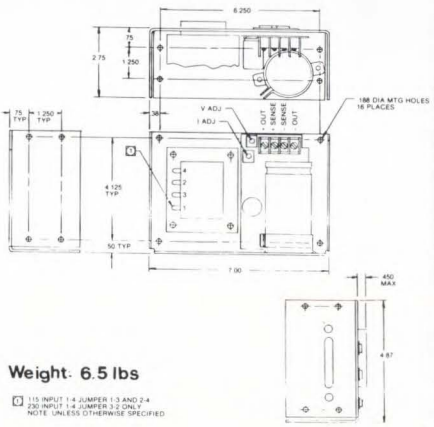
$59.45



50-84 Watts

HN Case Series
Meets UL and CSA Requirements
5 Vdc @ 9 Amps to 24 Vdc @ 3.6 Amps
Optional OVP available for 5V to 24V units

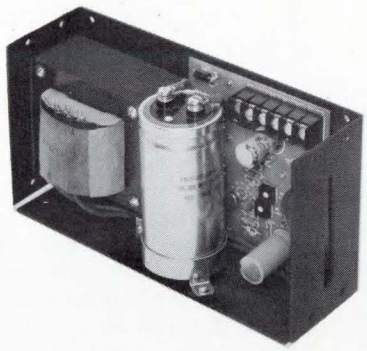
MODEL NUMBER	RATING		REGULATION		RIPPLE
	Vdc	Amps	Line	Load	(Pk/Pk)
EAPS 5-9.0U	5	9.0	±0.05%	±0.10%	5mV
EAPS 12-5.0U	12	5.0	±0.05%	±0.10%	5mV
EAPS 15-4.5U	15	4.5	±0.05%	±0.10%	5mV
EAPS 24-3.6U	24	3.6	±0.05%	±0.10%	5mV



Weight: 6.5 lbs

115 INPUT 1-4 JUMPER 1-3 AND 2-4
230 INPUT 1-4 JUMPER 3-2 ONLY
NOTE: UNLESS OTHERWISE SPECIFIED

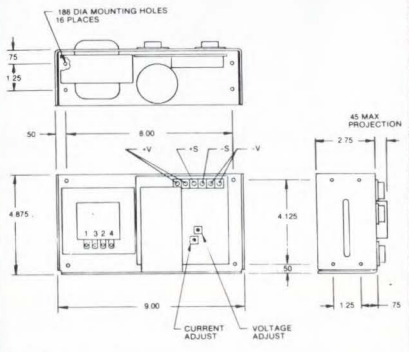
$71.05



60-100 Watts

HD Case Series
Meets UL and CSA Requirements
5 Vdc @ 12 Amps to 24 Vdc @ 4.5 Amps
Optional OVP available for 5V to 24V units

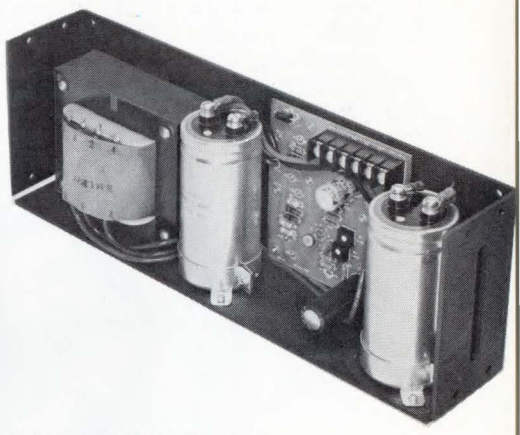
MODEL NUMBER	RATING		REGULATION		RIPPLE
	Vdc	Amps	Line	Load	(Pk/Pk)
EAPS 5-12.0U	5	12.0	±0.05%	±0.10%	5mV
EAPS 12-6.8U	12	6.8	±0.05%	±0.10%	5mV
EAPS 15-6.0U	15	6.0	±0.05%	±0.10%	5mV
EAPS 24-4.5U	24	4.5	±0.05%	±0.10%	5mV



Weight: 7 lbs

115 V INPUT 1-4, JUMPER 1-3 & 2-4
230 V INPUT 1-4, JUMPER 3-2 ONLY

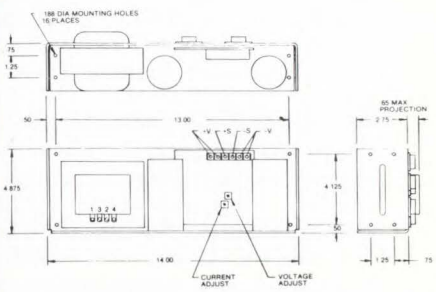
$98.85



90-168 Watts

HE Case Series
Meets UL and CSA Requirements
5 Vdc @ 18 Amps to 24 Vdc @ 7.0 Amps
Optional OVP available for 5V to 24V units

MODEL NUMBER	RATING		REGULATION		RIPPLE
	Vdc	Amps	Line	Load	(Pk/Pk)
EAPS 5-18.0U	5	18.0	±0.05%	±0.10%	5mV
EAPS 12-10.0U	12	10.0	±0.05%	±0.10%	5mV
EAPS 15- 9.0U	15	9.0	±0.05%	±0.10%	5mV
EAPS 24- 7.0U	24	7.0	±0.05%	±0.10%	5mV



Weight: 9.5 lbs

115 V INPUT 1-4, JUMPER 1-3 & 2-4
230 V INPUT 1-4, JUMPER 3-2 ONLY

ADTECH POWER SUPPLIES

ADTECH POWER

1621 S. Sinclair St., Anaheim, CA 92806 (714) 634-9211 • Telex: 68-1498 • Outside Calif. (800) 854-8288

Circle 37 on Reader Inquiry Card

New Products

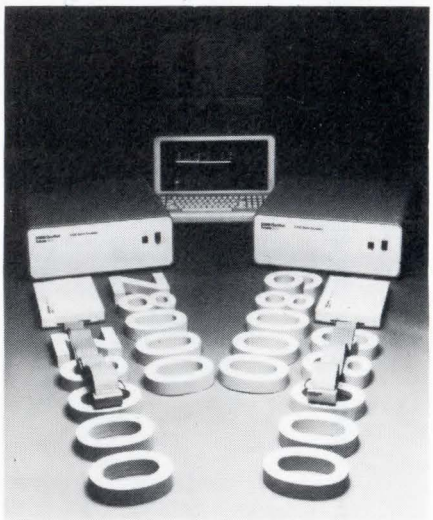
LOW-COST DAISY WHEEL. This letter-quality daisy wheel printer has five built-in μPs, providing complete text formatting including right-justification, proportional spacing, and a variety of other features. Unit also functions as a sophisticated electronic typewriter, with an alphanumeric display showing the current line, column position, and lines remaining to the end of the page. Printer is compatible with all micro, mini and mainframe computers and utilizes a parallel Centronics interface, with RS-232C and IEEE-488 interfaces also available. A

novel feature is the printer's ability to print in reverse – white characters on a black background – to highlight critical information. **Howard Industries, Inc**, 2031 E Cerritos Ave, Bldg 7K, Anaheim, CA 92806. **Circle 179**

BIDIRECTIONAL TIMER/CONTROLLER combines functional capabilities not available in any other single instrument, says the manufacturer. User-programmable operating modes include: time up to preset number, time down from preset number, external start and external reset, external start and automatic reset. The unit can be programmed for one industrial application requirement, then easily reprogrammed to perform in a different operation. Has full 6-decade thumbwheel for preset and a full 6-decade LED display. NMOS/LSI design and an internal crystal-controlled clock for accurate timing even in harsh, electrical noise environments. Also provides all inputs and outputs required for systems interfacing. DigiTec Model 8230, $446; immediate delivery. **United Systems Corp**, 918 Woodley Rd, Dayton, OH 45403. **Circle 175**

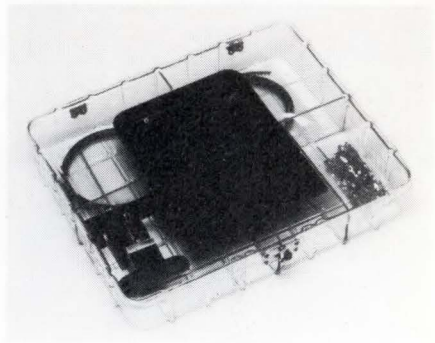
16-BIT INTELLIGENT EMULATOR. A self-contained analyzer/emulator, called ZSCAN 8000, is a mid-range device that can be used either standalone or as a front-end peripheral interfaced to a development system based on a wide range of computer system hosts. Features include: dual RS232C ports allowing placement in the serial path between the host computer and CRT console; mappable memory, permitting designers to map 4K words of high-speed static RAM, with no wait states, on 4K boundaries anywhere in the Z8000 address space; and a trace feature permitting retrieval of address/segment, data, and CPU resource information to the CRT console for detailed analysis. Model ZSCAN 8000, approximately $4500. **Zilog**, 10340 Bubb Rd, Cupertino, CA 95014. **Circle 176**

SUPPORT FOR 68000 & Z-8002 μPs. Full in-circuit emulation support is available for use with both the 2300 Series single user and the 2301 development network configurations, with either floppy or hard disk mass storage. Program execution and emulation for the two 16-bit processors is accomplished through the 2302 Slave Emulator, which eliminates the need to use the resources of the user's μP for debugging purposes. The emulator fully supports all features of the 68000 and Z-8002 including execution speed, control lines, interrupts and address space. The emulator executes programs at



full processor speed using either an internal or a prototype clock without wait states or other timing constraints. Control lines and interrupts can be selectively activated in the prototype system. Up to 512 KB of slave emulator memory may be mapped anywhere within the prototype address space. The slave emulator supports simultaneous, multiple emulation for up to 8 different μPs. Price for either the 68000 or Z-8000 personality module and support software is $2,950 each; complete systems from $23,200; 8 wks ARO. **GenRad/futuredata**, 5730 Buckingham Pkwy, Culver City, CA 90230. **Circle 170**

BUS BAR SYSTEM AND CONNECTORS. New from 3M is a 50-position insulation displacement delta ribbon connector designed for mass termination of flat cable with conductors on



.05″ centers. Compatible with standard miniature ribbon connectors, numbers 3564 (male) and 3565 (female) are designed to terminate 26, 28, and 30AWG solid and stranded cables. Number 3564 available in either bail or screw mounting. Also from 3M is a clip-on bus bar system for efficient prototyping, custom and large-production assembly of backplane power and signal buses; the kit will lower termination costs at least 60% by lessening time spent in assembly and installation, according to the manufacturer. **3M**, PO Box 33600, St. Paul, MN 55133. **Circle 180**

STD BUS-COMPATIBLE BREADBOARDS. Series includes 16-pin DIP breadboards, LSI as well as wire-wrappable panels, and a bus extender card. All boards are made of FR-4 glass epoxy with solder traces and gold connector fingers. Immediate shipment. **Douglas Electronics**, 718 Marina Blvd, San Leandro, CA 94577. **Circle 169**

DEC-COMPATIBLE FLOPPY. This double-sided, double-density DEC RX02-compatible flexible disk memory system reads and writes on both sides of industry-standard 8″ diskettes for a formatted capacity of 1MB per diskette, or 2MB of on-line storage. Features include onboard diagnostics, diskette formatting, and a built-in hardware bootstrap. DSD-470, $4295. OEM discounts available. Delivery 30-45 days ARO. **Data Systems Design, Inc**, 3130 Coronado Dr, Santa Clara, CA 95051. **Circle 128**

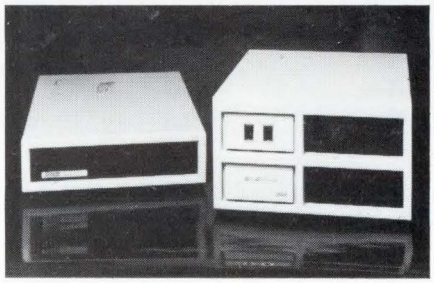
NEW VIDEO DISPLAY PROCESSOR for the System 3400 is capable of producing and manipulating raster-scan graphics and images with resolutions of up to 1280 X 1024 pixels. The new hardware interface is one standard quad-width dual-height DEC PCB, which plugs into the VAX Unibus. DMA supports transfers up to the full bandwidth of the Unibus. Also available is software in FORTRAN callable subroutines, and cross-assembler to generate code for the System 3400's Writable Control Store. The System 3400 is priced from $7510, the VAX hardware interface for $1200, VAX driver software for $750, and the VAX cross-assembler to Writable Control Store for $250. **Lexidata Corp.**, 37 North Ave., Burlington, MA 01803. **Circle 138**

μP DEVELOPMENT SUPPORT for the 8086 and Z8000 SBC's includes Assemblers for the 8086/8088 and Z8002 μP's and Prototype Debug packages for the Intel iSBC 86/12A and Zilog Z8000 Development Module. These products offer software development tools for designers who utilize SBC circuit cards instead of designing μP circuit cards and enable products to be developed before in circuit emulation is available. Each Assembler converts source code into executable object code, using a source file that has been created through the 8002A's editing software. The address space for the assemblers is 0 to 64K bytes, equal to or greater than the RAM memory on the supported SBC for the 8086 and Z8000. Included with the Assembler are a powerful set of macro features which allow the expansion of in-line code. The Prototype Debug package allows absolute object code or a linked load file to be transferred from the 8002A to the SBC, and then executed under the control of the debug software. Assembler packages are priced at $850 each, Prototype Debug support at $1,650 each. **Tektronix, Inc.**, P.O. Box 1700, Beaverton, OR 97075. **Circle 139**

DISK DRIVE. The addition of the 8360 to STC's family of direct acces storage devices is a high capacity fixed media disk device for attachment to CPUs compatible with the IBM System 370/135 or with IBM's 3350 disk drive. Model A2 is a 2 spindle disk storage unit with 317.5 MB of storage per spindle and with associated control. The A2 attaches to the STC 8000-2, 8000-4, or 8880 disk control units. Model B2 attaches to an A2 and is also a 2 spindle disk unit with 317.5 MB per spindle. Up to 3 B2s can be attached to an A2. Both models of the drive have an average access time of 18 ms, a data transfer rate of 1.198 MB/sec and an average latency time of 8.3 ms. Two-year leases on the STC 8360 begin at $1,200 per month for an A2 and $941 per month for a B2. **Storage Technology Corp.**, 2270 S. 88th St., Louisville, CO 80027. **Circle 137**

EXTREME ENVIRONMENT FLOPPY. The single-sided Optima Series XE disk operates in temperatures from 50°F to 160°F. Shipping and storage environments from −40°F to 160°F will not damage the disk. The product's material and design helps eliminate warpage and subsequent data loss associated with high temperatures. Optima Series XE disks may be used wherever high reliability systems and components are employed. The disks have a maximum storage density of 6537 fcpi and are priced at $20 per unit. **Verbatim Corp.**, 323 Soquel Way, Sunnyvale, CA 94086. **Circle 166**

LSI-11/23 supports floppy and Winchester storage. The DEC-compatible LSI-11/23 computer system. The Disk System 11x includes LSI-11/23 CPU, 128K bytes of RAM, (4) RS-232C serial ports, and up to 2M bytes of

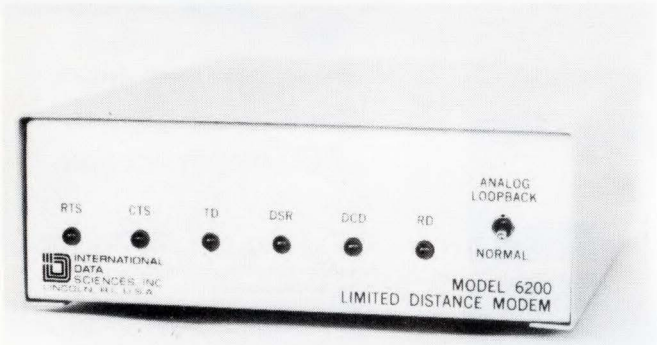


floppy disk storage in a single 10 1/2″ table top enclosure. Storage can be expanded by addition of a 26.4M byte 14″ Winchester drive option in a matching 5 1/4″ enclosure. Disk System 11x is compatible with standard DEC operating systems RT-11 and RSX-11M. The addition of dual head floppies doubles the storage normally available when running the RT-11 operating system available on DEC RX02 floppy diskettes. Additional performance is achieved due to 40% faster disk access compared to DEC single head floppy disk drives. Either 13.2Mb or 26.4Mb of formatted Winchester disk storage may be added to any Disk System 11x computer. Using 14″ Shugart SA4000 disk drives, the add-on storage is easily connected via flat ribbon cable to the SMS "Flinchester" controller resident in Disk System 11x. Included with each Disk System 11x are 4 rear panel mounted RS-232C connectors and 8-quad slot LSI-11 Q-bus backplane with additional power for customer furnished LSI-11 modules. DSX0122/2 (with LSI-11/2 CPU) from $7400; DSX0122/23 (with LSI-11 CPU) from $9995. Add-on Winchester storage, **Scientific Micro Systems**, 777 E. Middlefield Rd., Mountain View, CA 94043. **Circle 293**

New Products

NEW PARALLEL I/O PORT, for use in DEC LSI-11 QBUS applications. The device address and vector interrupt address are switch selectable by the user which allows flexibility and time saving during installation and set-up. Individual 16 bit I/O connectors with appropriate handshaking logic for ease of interface are standard. All inputs and outputs are TTL or DTL compatible. The GRC DRV11 permits program-controlled data transfers at rates up to 40K wps. All input lines are diode clamped and the output lines are latched. 16 bit word or 8 bit byte transfers are allowed. The GRC DRV11 is priced at $250/unit and $162.50/100, 30 to 90 days delivery. **General Robotics Corp**, 57 N. Main St., Hartford, WI 53027. **Circle 147**

LIMITED DISTANCE MODEM is designed for asynchronous operation over private 2- and 4-wire non-loaded metallic (twisted-pair) conductors at speeds up to 19,200 bps. It can be used in both point-to-point and multidrop network configurations for local data distribution up to 9 miles. Model 6200 provides internal strap selections for receiver impedance and receiver equalizer. The modem employs a baseband modulation scheme that varies the voltages of the transmit signal on a balanced line, requiring DC continuity. Its data terminal equipment interface meets EIA RS-232 and CCITT V.24 specifications. A 20 mA TTY Current Loop interface is also available. Priced at $225. **International Data Sciences, Inc.**, 7 Wellington Rd, Lincoln, RI 02865. **Circle 146**



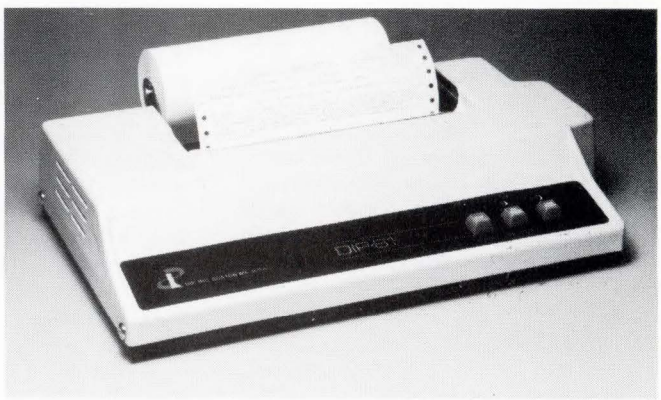
SOFTWARE/COMPILER PACKAGE, a design tool for Intel's 2920 signal processor, permits circuit designers to develop both analog and digital filters using interactive computing techniques on the standard Intellec development system. SPAS-20 makes it easy for the designer to specify, alter and review design parameters for any signal processing application, as well as to automate the writing of all the detailed steps required to implement the design functions in assembly language code. The 2920 signal processor is a single-chip, real-time analog I/O μC. It converts analog input signals to digital information, processes this information in its high-speed digital processor and produces analog outputs in a real-time mode. The device and the design software enable thousands of different complex analog systems to be formulated from one standard integrated circuit. The SPAS-20 system is composed of 3 basic segments: A filter design section, which assists designers in the definition of their filter designs and provides interactive feedback in the form of response displays for manipulation of design parameters. Both digital and analog filter may be specified. A 2920 compiler section, which will generate 2920 assembly code to implement the digital filter specified; it will also translate algebraic equations into 2920 assembly code; and a macro capability, which functions as an applications software section because it permits users to execute multiple functions with just one instruction. The 3-part software package for the 2920 including SPAS-20, the assembler and software simulator is $4,200. SPAS-20 as an add-on product for $1,300. **Intel Corp.**, 3065 Bowers Ave., Santa Clara, CA 95051. **Circle 151**

μC BOOK. Many of us learned μPs from the 1st edition of Adam Osborne's classic paperback, "An Introduction to Microcomputers: Volume 1 – Basic Concepts" (1976). The 2nd edition covers recent developments such as the 8086, Z8000, 68000 and I/O processors. This new edition discusses and makes use of the IEEE std. assembly language mnemonics which are still in development. An expanded discussion of μP programming technique and style (not the main focus) is treated comprehensively. The larger print is a relief, as is its "well-groomed" appearance and larger size (9.25" X 7.375"). Must reading for EEs desiring a thorough grounding in μPs. 480 pgg. $12.50. **Osborne/McGraw-Hill**, 630 Bancroft Way, Berkeley, CA 94710. **Circle 152**

MAGNETIC TAPE CONTROL UNIT. Model 7800 Magnetic Tape Controller (MTCU) supports Group Code Recording (GCR, 6250 BPI), Phase Encoded (PE, 1600 BPI), and Non-Return to Zero Inverted (NRZI, 800 BPI) tape densities. This system is fully compatible with PDP-11 UNIBUS and VAX 11/780 UNIBUS Adaptor (UBA). Model 7800 supports a superset of command and status functions similar to the DEC TE-16 or TU-10 magnetic tape subsystem command and status registers. Unit also allows attachment of the higher performance magnetic tape systems now available. **Information Products System, Inc**, 6567 Rookin, Houston, TX 77074. **Circle 158**

FIBER OPTICS BULLETIN. "The Fiber Optic Difference" outlines EMI/RFI/EMP immunity, low loss, elimination of ground loops, increased data speed and data security, all advantages, 3M claims, of fiber optics systems. In addition, they claim that Scotchflex Fiber Optic Data Link Systems represent the "only complete production-ready duplex system with transmitter/receiver in one compact P.C. mountable package." Brochure contains detailed specs. **3M**, Dept EP9-50, Box 33600, St. Paul, MN 55133. **Circle 153**

DATA IMPACT PRINTER. Features include 7 X 7 or expanded 14 X 7 matrix printing, upper/lower case character set, 100 cps bidirectional print-out, "finger clean" ribbon cartridge loading, and a low profile. It uses ordinary bond paper in sheets, roll or fanfold form. Complete with μC electronics, DIP-81 is designed to interface directly with mini and micro computers. It is suited for small business, educational, professional data processing, as well as industrial, laboratory and personal computing applications. Model DIP-81, $499. OEM quantity discounts available. **DIP Inc**, 121 Beach St., Boston, MA 02111. **Circle 157**



The AED 512... graphics, imaging, Superoam™ and integer zoom in one desktop terminal!

At the Siggraph '79 Show, it was acclaimed as 'The Incredible Graphics Machine!' Since then, the AED512 full-color graphics and imaging terminal has more than lived up to its reputation among sophisticated users. Its ability to display 256 simultaneous colors (from a total palette of 16.8 million) on a 512 x 483 pixel screen; zoom at integer increments to x16; pan continuously via joystick; perform full-screen DMA transfer in 0.5 second; emulate Tektronix 4014 software; allow overlaying TV images with computerized graphics; permit animation by using read/write masks and colorblink make its under $20,000 price tag seem small. Add to this its unique ability to Superoam an expanded image of 1024 x 1024 pixels and you'll see why the '512 is way ahead of the competition. For information call Advanced Electronics Design, 440 Potrero Ave., Sunnyvale, CA 94086. Tel: 408-733-3555. Boston: 617-275-6400. LA: 213-705-0379.

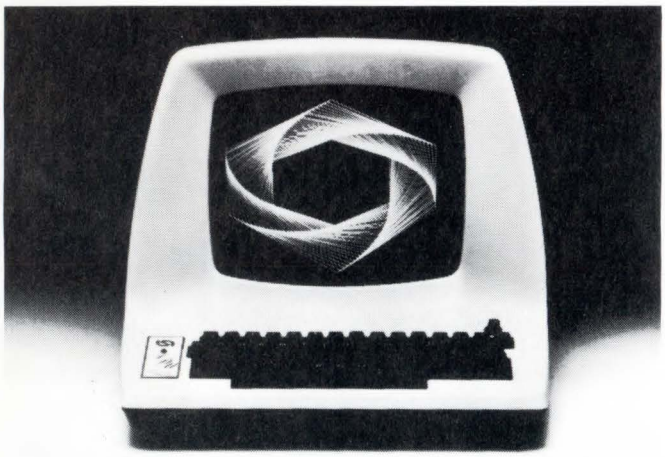
TM Trademark of Advanced Electronics Design

Circle 46 on Reader Inquiry Card

New Products

THREE NEW POWER SUPPLY FAMILIES from Powertec are being shown at Wescon/80. The Open Frame Series 19 ValuSwitchers, are quad output power supplies in power ranges of 50, 100, 150, 200, 300 and 400 watts. D.C. output configurations are: primary outputs +5 VDC, outputs #2 and #3 of either ±12 VDC or ±15 VDC and output #4 with either − 5 VDC or +24 VDC. They feature strappable AC input of 90-132 or 180-264 VAC, 47-440 Hz with brownout set at 85 VAC or 170 VAC. Load regulation for regulated outputs is ±0.2% for a 10-100% load change and +3% for a 40-100% load change on unregulated outputs. OEM XII Seres, linear D.C. power supplies, feature 5 VDC, 12 VDC, 15 VDC and 24 VDC outputs at current ranges of 1.0 to 12.0 amperes. They provide strappable A.C. inputs of 105-125/210-250 VAC, 47-63 Hz. An improved version of the 9N SuperSwitcher, model 9N Rev. C, has D.C. outputs of 2, 5 and 12 VDC at currents of 50-200 amperes. It offers newly extended wide range strappable AC inputs of 90-132/180-264 VAC or 165-230 VAC only, 47-440 Hz with brownout set at 85 VAC or 160 VAC. **Powertec**, 20550 Nordhoff St., Chatsworth, CA 91311. **Circle 150**

Z-80 BASED GRAPHICS TERMINAL. Operating in four modes to permit alphanumerics, graphics, or both, this terminal is compatible with Tektronix Plot 10 software. Incorporating a Z-80 μP, the Continental CPG-4010 operates



in the ADM-3A Alpha, 4010 Alpha, vector, and point modes. Allowing full screen usage, the Plot 10 graphic grid is automatically scaled to the CPG-4010 grid (512 hor X 250 ver). Options include phosphorous green screen, hairline cursor control module, and plotter output. $1,995. Delivered from stock. **Continental Resources, Inc**, 175 Middlesex Tpke, Bedford, MA 01730. **Circle 156**

MATRIX PRINTER FOR SMALL BUSINESS COMPUTERS. With a speed of 150 cps, bi-directional logic seeking, this unit is a 100% duty cycle printer. Minimum head life is 200 million characters. User may select 80, 132 or 136 columns; 6 or 8 lines per inch. Matrix is 9 X 9, upper and lower case with descenders. The MQI 150 will accommodate multi-part forms up to original-plus-five copies, from 2″ to 15″ in width. Options include a head with life expectancy of 600 million characters, multiple font selection, and IEEE-488 interface. The MQI 150 is 23″ N expectancy of 600 million characters, multiple font selection, and IEEE-488 interface. The MQI 150 is 23″ X 8″ X 14″ and operates on 110, 120, 220 or 240 volts, ±10% 50 or 60Hz. **MQI Computer Products**, 18381 Bandilier Circle, Fountain Valley, CA 92708. **Circle 148**

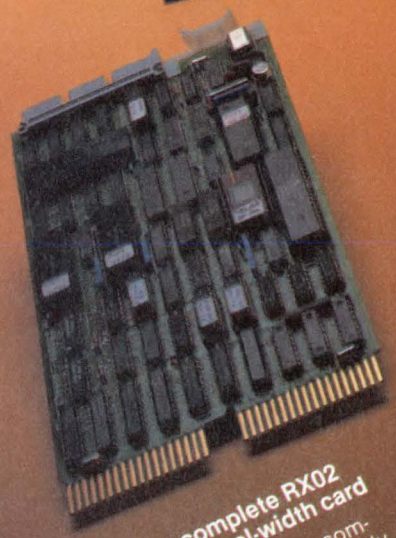
CARTRIDGE DRIVE BACKUP FOR WINCHESTER DISK New recording technology quadruples the density of information on 1/4″-tape from a previous 1,600 bpi, to a new high of 6,400 bpi. This high density recording technology, (which depends on new heads, new electronics, and a new recording code,) has been incorporated into the QUANTEX Division's Model 400 tape transport. Consequently, this drive now provides a fourfold gain in memory from the firm's previous maximum of 5.4 MB to 22 MB. Among new features of Model 400 are a digital speed control tachometer; a hard-mounted drive motor with spring-loaded idles; a mechanical interlock to hold tape cartridge in place. $1,585, down to $1,075 in quantities of 100. Delivery, 12 weeks. **Quantex Div,** North Atlantic Industries, 60 Plant Ave, Hauppauge, NY 11787 **Circle 127**

FORTRAN PLOTTING SOFTWARE. The new software allows Fortran users to "call" such functions as XYAXIS, LINE, GRID, CIRCLE, FRAME, etc, for execution on DECwriters equipped with Selanar's GRAPHICS II feature. The package contains 24 standard routines for higher level graphics, and four specialized labelling routines which use GRAPHICS II's unique printing capability. The GRAPHICS II PC card gives an LA36 DECwriter II most of DEC's options plus vector plotting. In addition to all standard features the options provide APL, Math, and RAM based character sets plus two additional type fonts and three rotations. In graphics mode, user specifies line end points and the built-in vector generator creates the line anywhere on the 1320 X 792 dot page. PL II software, $400; GRAPHICS II costs $995. **Selanar Corp**, 2403 De La Cruz Blvd, Santa Ana, CA 95050. **Circle 160**

SINGLE BOARD COMPUTER unit generates all standard S-100 bus signals, including emulation of an 8080 CPU, and contains a Z80-A operating at 4MHz, 1K of high-speed static RAM memory, 3 sockets for up to 12K of PROM, one serial port, and three 8-bit programmable parallel ports. Circuitry is provided to support static or dynamic memories. Use of 2708, 2716, or 2732 PROMs is jumper selectable and addressing of the PROM and RAM is completely variable. Use of wait states on bus cycle and/or instruction fetch cycle is also jumper selected. The serial port makes use of the Intel 8251 USART, which enables software to control the format of the transmitted data and to vary the mode of transmission. Model ZCB, $395 (OEM discounts). **Vector Graphics, Inc.** 31364 Via Colinas, Westlake Village, CA 91361. **Circle 155**

WINCHESTER DRIVES Two new drives have been added to the MIKRO-DISC family: the MINIMIKRP-DISC V Series of 5 1/4″ fixed disk drives; and an enhanced double density system. The MINIMIKRO-DISC V-1TF has the entire capacity of a standard mini floppy under its multiple head assembly, and can access this data in 8 ms. This quick access disk drive features a single 5 1/4″ diameter hard disk and a proprietary low-mass, multiple head assembly that takes 5 ms to shift heads from one cylinder to the next, provides 8 Read/Write heads, 128 tracks per surface, and places the storage capacity of a 5 1/4″ floppy disk drive immediately beneath the heads at all times, accessible within one disk rotation. $700. The MIKRO-DISC 211, has been renamed the MIKRO-DISC VIII-1TF, a high performance 8″ drive with double the original storage capacity. This new drive features an 8″ diameter hard disk and a proprietary, low-mass multiple head assembly. It provides 20 Read/Write heads and 160 tracks per surface. Average access time to the entire capacity of the drive is only 18.825 ms. $1100. Both systems are available 30 days ARO. **New World Computer Co., Inc.**, 3176 Pullman St., Suite 120, Costa Mesa, CA 92626. **Circle 149**

DEC COMPATIBILITY

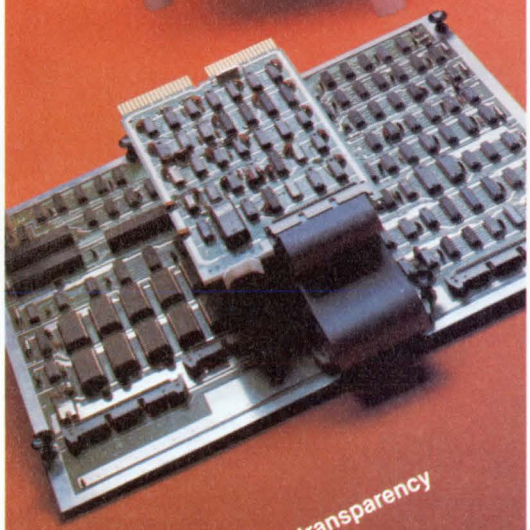


FLEX 02 offers complete RX02 emulation on one dual-width card

Media compatible and software compatible, the FLEX 02 card plugs directly into your LSI-11, 11/2 or 11/23. This low-priced controller has built-in bootstrap; handles single or dual-head floppy disk drives. Order now for 30-day delivery!

Circle 76

DEC COMPATIBILITY



WINC 01 offers RL01 transparency for Winchester-type drives

Software transparent to RL01 driver, WINC 01 maps the data of three RL01 cartridges (15.6 MBs) on one Winchester. Dual-width interface card plugs into LSI-11, 11/2 or 11/23; low-cost controller mounts onto Marksman drive. Call today, they're going fast!

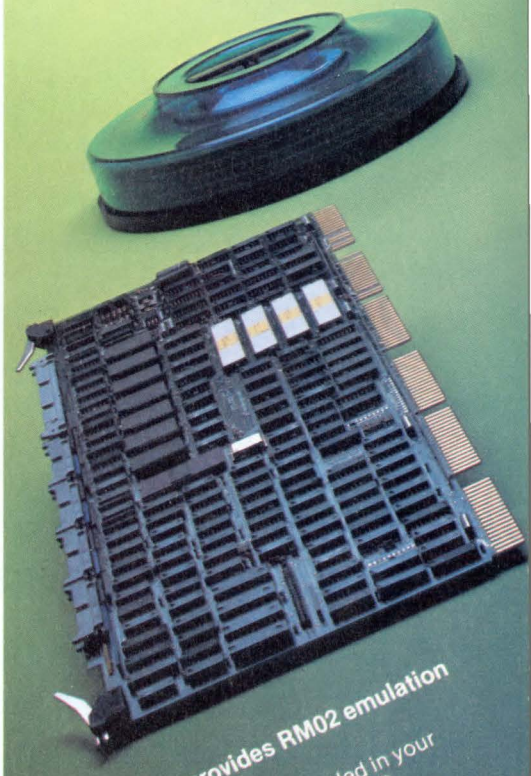
Advanced Electronics Design
440 Potrero Ave., Sunnyvale
CA 94086, 408-733-3555

Boston 617-275-6400
Los Angeles 213-705-0379
U.K. 44 256 61551
France (1)724 19 54
W. Germany 040-310824
Holland (070)46 95 09
Switzerland (022)32 97 20
India 79281
Japan 03-437-5471
Australia (02)438 2444
New Zealand 499 197

FROM AED

Circle 77

DEC COMPATIBILITY

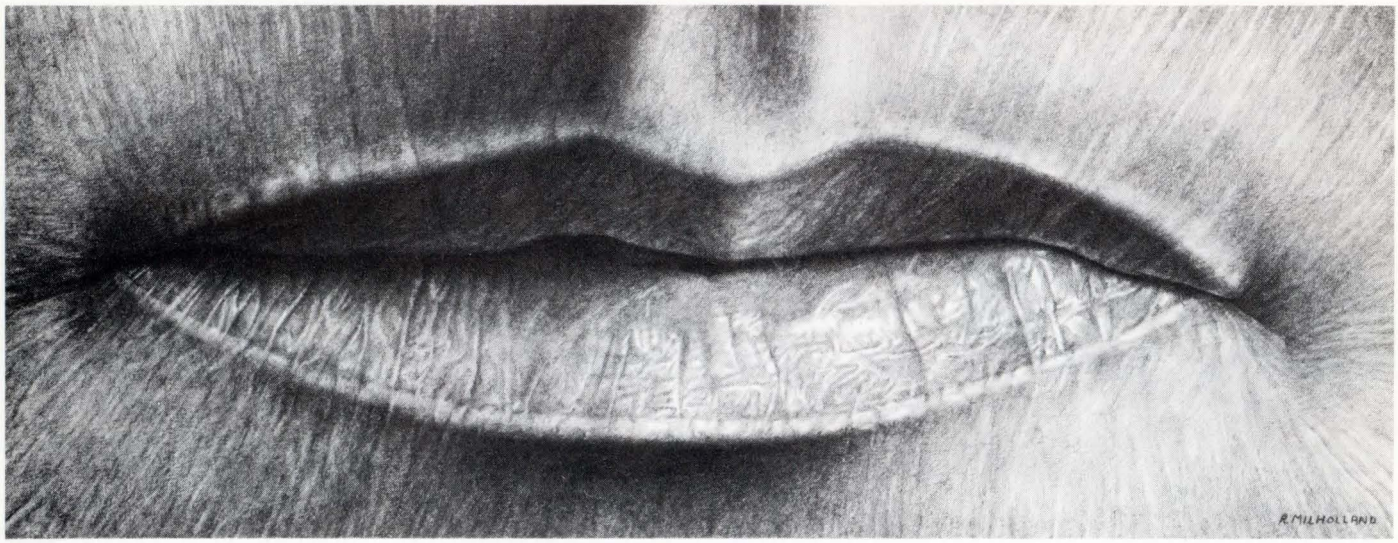


STORM 02 provides RM02 emulation for PDP-11 users

This single hex card, embedded in your PDP-11, runs under standard RM02 drivers. STORM 02 accommodates up to four 80 MB storage module drives and provides disk pack interchangeability with DEC. 30-day delivery and quantity discounts!

Circle 78

Promises, promises, promises.



We've made over 80,000 promises. And we've delivered every one of them.

Pertec® has shipped more tape drives into the minicomputer market than any other independent manufacturer in the world. Tension arm models. Vacuum column models. Microformatters and mini-size drives. Tape drives that set the industry standards. Available in thousands of final feature and specification configurations.

With Pertec, there's less down time and lower maintenance costs. In fact, some of our models have been in service a dozen years and are still producing at top speed.

Thanks to our sophisticated, high-volume production facilities, we're geared to meet your most demanding time schedules. But then, that's what our promises are all about.

Write for our new full-line peripherals brochure. Pertec Computer Corporation, Peripherals Division, 21111 Erwin Street, Woodland Hills, California 91367. Or call (213) 996-1333 (Western Region); (603) 883-2100 (Northern Region); or (305) 784-5220 (Southern Region).

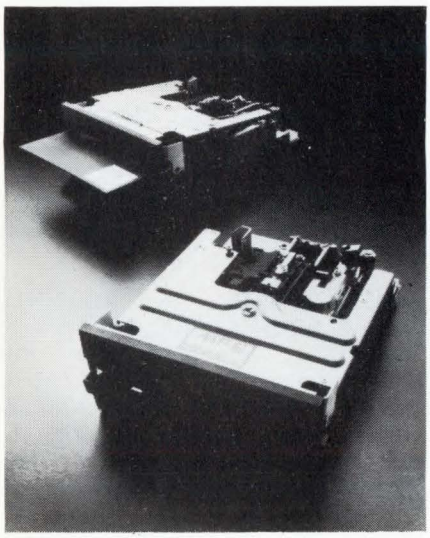
You don't get lip service... you get delivery.

PERTEC
PERIPHERALS

Circle 47 on Reader Inquiry Card

New Products

TWO NEW PRODUCTS FROM MFE. New μP-based digital cassette data terminals are designed to serve as data storage and transfer subsystems for data loggers and EDP systems. Models 2500, 5000 and 5450 can hook locally to CRTs and or terminal devices, or on-line into a computer system via modem or direct link. They will load programs or prerecorded diagnostics directly into CPUs. Since these terminals have interchangeable tapes, cassettes can be read at any location equipped with an MFE data terminal.

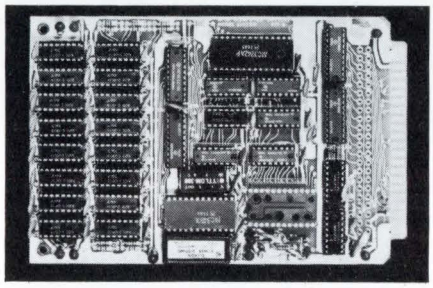


Features include formatted capacities up to 720KB; 2 I/O ports for either RS-232C interface or a 20 mA loop; 15,000-hour MTBF transport ratings, and TI tape compatibility. Models 5000 and 5450 have search/edit modes, optional NCR/SWEDA tape reading, and line formats of 86 and 138 characters. Model 2500, $1190; Model 5450, $2245 (OEM discounts available). The second product is the 500 Series flexible disc drives which give double-sided technology in single-sided units and enable OEM users to design a new EDP system with, or to upgrade an existing system to, the features of MFE double-sided flexible disc drives. They weigh less than 10 pounds which allows OEM designers to reduce the overall size and weight of the drive component in their systems. MFE's head positioning system guarantees a 3 ms track-to-track access time. **MFE Corp**, Keewaydin Dr, Salem, NH 03079. **Circle 191**

MODULES ADAPT GRAPHICS PLOTTER TO RS-23-C. The RS-232-C/CCITT V.24 compatible I/O card, HP Model 17604A "Personality Module," adapts the 7225A plotter for use in either a direct hardwired or remote data communications computer or μP-based environment. Internal arc and circle generation capability is included. The 7225A/17604A is programmed by Hewlett-Packard Graphics Language which is made up of two-letter English language abbreviations for over 40 plotting commands. Model 17604A is $900, delivery in 10 weeks. Model 7225A is $2050, delivery in 8 weeks. **Hewlett-Packard**, 1507 Page Mill Rd, Palo Alto, CA 94304. **Circle 193**

M68000 CROSS-ASSEMBLER AND LINKER has been developed to run on DECs PDP-11 series. Standard features include: Motorola-compatible mnemonics and instruction formats; full expressions with add, subtract, multiply, divide, and shift operators; macros with argument substitution; external and public symbols; relocatable object code; local symbols; and, cross-reference listing. The cross-linker combines programs that were assembled separately and resolves references to public symbols. Available as a single package for $2,500. **Ruben Engineering Corp**, 60 Aberdeen Ave, Cambridge, MA 02138. **Circle 192**

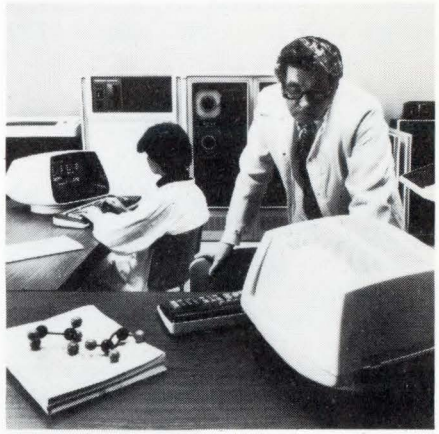
NEW 32K RAM MEMORY is compatible with a 6502 CPU-based processor such as the AIM, KIM, SYM or PET, that operates at maximum clock rates of 1.2 MHz. Memory sizes are 32K, 16K or 8K, organized in 4K blocks, each independently addressable on any 4K address within the 64K address space. All inputs are buffered with 1LS TTL load. The interface to the memory board requires only +5VDC power (obtained from the host computer), addresses, data, clock and the read/write signal. Power dissi-



pation is 4 watts, maximum. Model 6502DM is $395 (32K); $339 (16K); $279 (8K). Delivery, 2 weeks ARO. **Beta Computer Devices**, 1230 W. Collins Ave, Orange, CA 92668. **Circle 190**

TTL CATALOG. A 56-pg. free booklet, "Texas Instruments 74 Series TTL Digital ICs" has been produced with TTL circuit designers' requirements in mind and comprises two main sections. The first section is a comprehensive listing of all the pin diagrams with logic diagrams where appropriate and type numbers and descriptions of the 74 standard, H, L, LS and S families stocked by Quarndon Electronics. The second section is entitled Functional Descriptions and gives switching speeds, loading, power consumption, etc. of the 74 series under their functional headings. **Quarndon Electronics Ltd**, Slack Lane, Derby, DE3 3ED, England. **Circle 162**

32-BIT COMPUTER SYSTEM. The unit has a user program address space totaling 512 million characters of information, a main memory bandwidth of 36.4 million characters, and a virtual memory capacity of more than 4 billion

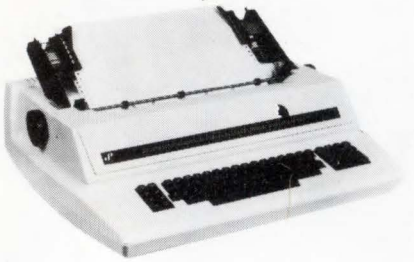


characters. It also includes an integrated μP-based diagnostic capability for comprehensive system control and error diagnosis. The Eclipse MV/8000 is designed around a software support capability, the Advanced Operating System/Virtual Storage (AOS/VS) which takes advantage of the MV/8000's hardware architecture to manage system resources for up to 128 users each accessing up to 512 MB of logical address space. AOS/VS also supports simultaneous execution of 16- and 32-bit programs and can run 16-bit programs developed under the AOS without modification and at faster speeds. Support software includes 3 new 32-bit languages that conform to ANSI standards for added user benefits including AOS/VS Fortran 77, PL/I, and BASIC. **Data General Corp**, Rt. 9, Westboro, MA 01581. **Circle 184**

SHORT FORM CATALOG. This free catalog (# 679) describes LDJ's complete line of standard equipment. New instruments include Model 101B Portable Digital Readout Gaussmeter, Automatic Hysteresigraph Model 5200, and Core Loss Tester Model 7200 for flat rolled steel. The LDJ line of permanent magnet magnetizers and calibrators has also been increased and new options offered. Other equipment with new features includes the Series 5000 BH Meters which provides energy product curves of hard materials, and soft materials and digital readout of significant points (Br, Hci) on the BH curve. **LDJ Electronics, Inc.**, 1064 Naughton, Troy, MI 48084. **Circle 187**

New Products

NEW BIDIRECTIONAL PAPER TRACTOR. Providing forward and reverse paper motion for Dataproducts' daisy wheel printer line, this unit accommodates paper from 2″ to 15″ wide and to .025″ thick. Paper can be positioned and tensioned both vertically and horizontally by a graduated scale, 2 independently adjustable and lockable tractors, and a tensioning mechanism. The bidirectional paper tractor is controlled and driven automatically by the printer. Price is $250



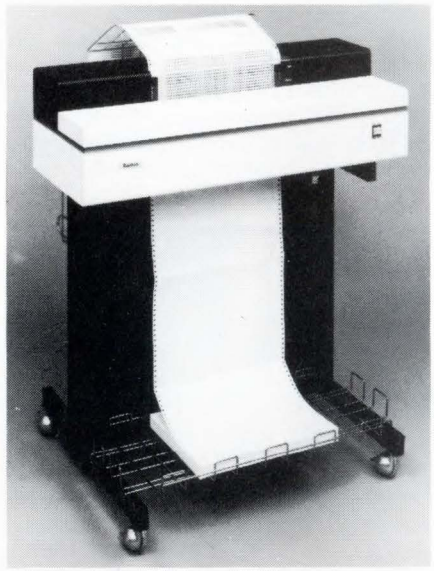
each or $200 each for quantity 100. Delivery is 30 days ARO. **Dataproducts Corp**, 6200 Canoga Ave, Woodland Hills, CA 91365. **Circle 172**

ENHANCED DATATRIEVE SOFTWARE. Designed to work with RMS-11 records management files, this new version is available on RSTS/E, RSX-11M PLUS and IAS operating systems for the PDP-11 and (in compatibility mode) for the VAX-11/80. DATATRIEVE enables users to locate, sort and update information in RMS-11 files and to generate reports from files. Designed for inexperienced users as well as those with extensive knowledge, the new DATATRIEVE version has been extended through variable length record support, crossfile "views,' and a revised and expanded documentation set. DATATRIEVE software version 2.0, $4500. **Digital Equipment Corp**, Maynard, MA 01754. **Circle 159**

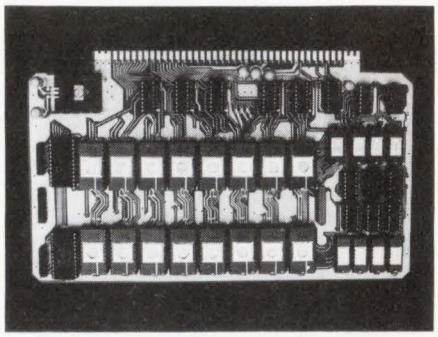
Z8000 TEXT. This paperback by Richard Mateosian introduces machine language concepts to advanced programming techniques. It describes both architecture and instructions. The instructions are arranged logically – not simply alphabetically by mnemonic name. This enables readers to gain insight into the Z8000's overall capabilities. It covers I/O techniques, Z8000 peripheral components, utility programming examples, Z8000 addressing modes and Z8000 hardware organization. Don't let the smaller size of the text (298 ppg) fool you; it is representative of the newer texts – better written, more concise and possessing a "maturity" lacking in the first- and second-generation μP texts. $15.95. **Sybex**, 2344 Sixth St, Berkeley, CA 94710. **Circle 174**

VIDEO DISPLAY SYSTEMS. Supporting a variety of ultra-high resolution image display requirements, the ID 1100 Video Display is compatible with the DEC PDP-11 UNIBUS. The system offers full true color, or up to 4 multi-image monochrome or pseudo color displays with 1K×1K×8, 16, 24 or 32 bit resolution. Other features include up to 4 1024×1024×8 overlay memories on each image channel; independent zoom of 2:1, 4:1 and 8:1 on up to 4 channels; and independent pan (scroll) for each channel. Optional interactive devices include cursor controlling joystick, trackball and light pen. From $26,000. **DeAnza Systems**, 118 Charcot Ave., San Jose, CA 95131. **Circle 167**

FOUR-COLOR PRINTER/PLOTTER. New from Ramtek is a four-color process digital dot matrix printer/plotter utilizing separate cartridge ribbons and print heads for each primary color plus black. Controlled by a Z-80 μP, unit prints from a raster refresh graphics system at a resolution of 60 dots per linear inch. Plotting speed in the full color graphics mode averages three minutes a page for 11″ forms. Characters are printed in a 5 × 7 dot matrix at 60 lpm. The μP incorporates self-diagnostic routines to facilitate maintenance. Optional format control is available, using electrically alterable ROM. Model 4100, $12,000 (OEM discounts); production quantities available in November. **Ramtek Corp**, 2211 Lawson Ln, Santa Clara, CA 95050. **Circle 178**



NEW MEMORY CARD. EPROM/RAM board accommodates full 32K or 64K of EPROM. Allows a mix of triple or single supply devices throughout the 64K memory map. Each device is independently addressable on 2K or 4K boundaries. The board also accommodates 4K of Static 2114 RAM, likewise randomly addressable. Adapted for



Motorola's EXORCISOR bus μC systems. Price of a fully socketed TAK EPROM/RAM board (memory chips not included) is $325 in quantities of 1 to 9. Ten to 99 quantity is $295. Delivery, stock to 3 weeks ARO in small quantities. **Tak Components**, 1307 N Carolan Ave, Burlingame, CA 94010. **Circle 181**

SINGLE-BOARD, 16 CHANNEL DZ11-E EQUIVALENT. For use with any PDP-11 computer system, this new multiplexer is a μP based controller which controls 16 asynchronous communication lines by emulating the functions of 2 full hex-width DEC DZ11 8-line boards. Although the DZ/16 replaces two DZ11s, it occupies half the space and presents only one load to the Unibus. Features include on-board self test with LED display, on-board switches for address and vector selection, a data format which is program selectable for each channel and compatibility with DEC diagnostic and operating system software. The DZ/16 supports all DZ11 baud rates and costs $3500. OEM quantity discounts are offered. **Able Computer**, 1751 Langley Ave., Irvine, CA 92714. **Circle 171**

SYSTEM SOFTWARE LANGUAGE. MS-Pascal is a true compiler, including a global optimizer and modular code generators for 8080, Z80, 8086, Z8000 and a pseudo-machine. Enhancements include expanded string support, UNITS and USES interfaces, a machine-oriented WORD type, dynamic and conformant arrays, and attributes for variables and procedures. Many low-level escapes are also provided, such as direct access to memory locations, call to assembly language subroutines and a RETYPE function. MS-Pascal is divided into four levels: the metalanguage, Standard Pascal, Extended Pascal and Systems Pascal. Custom implementations of MS-Pascal are available to OEMs. **Microsoft**, 10800 NE Eighth, Suite 819, Bellevue, WA 98004. **Circle 177**

Announcing...

Secret Weapon for System Builders

The key to successful computer systems is successful software — tailored to the customers' needs, bug-free, structured, well documented, easy to maintain and to extend.

FORCE, POINT 4's Automated Programming technique is a powerful new tool for creating just such software.

- ★ *You interactively define menus, screens, data elements, synonyms, files and reports.*
- ★ *FORCE enters them into a data dictionary.*
- ★ *You write a sequence of high level macros that define the logic of your program.*
- ★ *FORCE generates structured, debugged, fully commented programs in Business BASIC. It validates all data, handles all error conditions, presents a uniform interface to the user.*

- ★ Documentation? FORCE provides it.
- ★ Changes? Modify any of the formats or the logic, and FORCE changes the programs.
- ★ Run-time efficiency? Faster code than you can write by hand.
- ★ Programmer productivity? Up by 500% to 1000%.
- ★ Want to convert your programs to run on the 400 nanosecond POINT 4 computer? FORCE is the answer.

Should you be without FORCE?

POINT 4 DATA CORPORATION

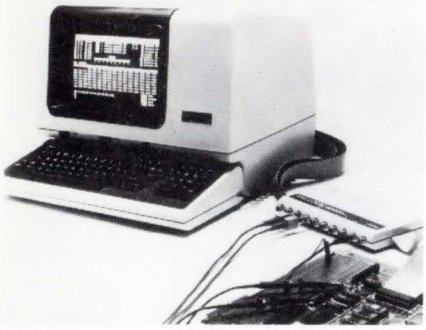
2569 McCabe Way
Irvine, Calif. 92714
(714) 754-4114

May the Secret Weapon Be With You.

Circle 57 on Reader Inquiry Card

New Products

UNIVERSAL μP DEVELOPMENT SYSTEM can emulate any μP, from 4-to 32-bits, in real time. The ECL-3211 provides in-circuit emulation of chips at up to 30 MHz. Available for stand-alone or down-loaded applications, the system utilizes a software-driven approach so that new emulator hardware does not have to be installed every time a new chip is introduced. Up to 64 stations may be tied together in any combination of software development and in-circuit emulation stations. Users may also tie ECL-3211 systems into time-sharing networks



or in-house computer systems. The basic system includes an LSI 11/2 CPU, 64K bytes of 210 ns RAM (expandable to 256K bytes), 1MB double density dual floppy disk, a 512 X 64-bit trace buffer, a VT103 terminal with full screen display and keypad editor, DEC RT-11 operating system and software, full hardware/software emulation support for any one chip family, and is priced at $23,990. Full emulation support for each additional chip family, including assembler and linker, is $1500. Assembler/linkers may be purchased separately for $750 each. **Emulogic Inc.**, 362 University Ave., Westwood, MA 02090.

Circle 141

DISC CARTRIDGES. The "Guardian" series of disc cartridges incorporating Memorex's unique "Shockwatch" impact detector which detects and alerts the user to potentially damaging shock to the media. It has a capillary tubing containing a thread of liquid which is disrupted by shock or acceleration exceeding predetermined levels. A rapid color change signals the user to check for possible damage to the media before it is loaded into the disc file, or before the cartridge is stored. **Memorex Corp.**, San Tomas at Central Expy., Santa Clara, CA 95052.

Circle 132

LOW-COST CONTROLLERS FOR WINCHESTER DISK STORAGE contains all of the essential common functions of a universal controller in reduced space. Design of "Micromodule 9000" reduces the number of chips in a complete Winchester disk controller system from about 200 to typically less than 25. This results in far greater reliability, saves valuable space in system design, and leads to manufacturing efficiencies and significantly lower prices for OEM customers, says the company. Features such as error correction, data buffering, overlap seek, automatic position verification, and alternate tracks are standard. The company is presently able to integrate the MICROMODULE for OEM customers requiring 1000 controllers within 18 months. Priced under $600 each. **Microcomputer Systems Corp.**, 432 Lakeside Dr., Sunnyvale, CA 94086.

Circle 129

NEW OPTIONS FOR 300 LPM PRINTER. In addition to the standard character set permanently stored in this printer, another 128 user defined character set can be stored without sacrificing printer speed. The Asynchronous Communications Adapter of Model T-3000 allows "on-line" printing of transmitted data. The buffered unit can achieve full speed 300 LPM printer operation at 4800 Baud. A horizontal tab feature removes contiguous spaces from the transmitted data to reduce transmission time. The unit is available in 3 different data communication proto-

cols to provide compatibility with the more popular computer systems. Data transfer speeds are 1200, 2400, 4800, 9600, or 19,200 Baud. A 1K buffer is standard, a 4K buffer is optional. **Tally**, 8301 S. 180th Kent, WA 98031.

Circle 133

NEW COMMUNICATIONS TERMINAL PRODUCTS from Sperry. The UTS 4020 Cluster Controller, can support 12 UTS 20 workstations has 256KB of memory in 64K increments, an integrated 1 MB diskette which serves as the load device, and control for up to 16 peripherals. $61,280 with supports. The UTS 10 with a 12″ diagonal CRT display and

a detached keyboard, operates as an unbuffered ($1360) or buffered ($1560) TTY. The UTS 20 Editing CRT is compatible with currently installed UNISCOPE 100/200 and UTS 400 terminals. It is designed for extensive data editing without user programmability of the terminal. Available in the single station UTS 20 and the cluster workstation UTS 20W. $3200. The UTS 40 Programmable CRT with 64KB of user memory, consists of a 12″ CRT display and a selection of 4 pluggable keyboards. $4160. Also available are UTS 4000 Program Cartridges which provide the stations with different functional capabilities, and UTS 4000 Software which includes the System Control Program, UTS COBOL, Interactive Program Generator (IPG) and Edit Processor. Quantity discounts and lease rates are available. **Sperry Univac**, PO Box 500, Blue Bell, PA 19424.

Circle 142

M980 PROM PROGRAMMER REPLACES M900B in Pro-Log's STD BUS prototyping systems for 8085A and Z80 μP's. The M980 has a 4K, 8K or 16K CMOS RAM buffer with battery back-up. Its built-in software and expanded 8 digit hexadecimal display accommodates devices up to 64K X 16 bits. Operations include Checksum, Blank Check, Duplicate, Verify, Read, and Program. It can program more than 450 different programmable devices, including PROMs and PALs. Both the 8085 STD BUS and the Z80 prototyping system with the M980 control unit are $5800. **Pro-Log Corp.**, 2411 Garden Rd, Monterey, CA 93940. **Circle 144**

Another Able First

Paydirt for VAX and PDP-11 users

One blue-chip card delivers 16 DZ lines per slot.

Key Features

1 SELF TEST
(ON-BOARD LED DISPLAY)

Self test feature is unique. No other DZ has it.

Executes – at every power on.

Identifies – any malfunction and directs attention to the specific area of the DZ board affected. No lights, no problem.

Controls – fault isolation/repair by means of related options.

2 CONFIGURATION CONTROL
(ON-BOARD ADDRESS/VECTOR PENCIL SWITCHES)

Complete configuration control – not matched by other DZ's.

Compatibility – assured with all DEC address/vector/interrupt level disciplines.

Easy Integration – no etch-cuts, no jumpers.

Priority Selection – plug provided just like with DEC.

Automatic Assignment – one setting establishes base address & vector for both logical controllers.

3 STAGGERED LOOP-AROUND
(BUILT-IN MAINTENANCE AID)

Another Able exclusive found only on the DZ/16

Complete Checking – provides the only way to effect total parity/framing error check. Uses one UART to drive another for fault isolation. Alternative internal loop-around gives partial check only.

Diagnostics – support loop-around capability which is built-in to DZ/16 panel. Connectors are built-in. Guess where the other kind are anytime you need them.

Now you can add twice as many DZ lines to your PDP-11 in half the space and at a lower cost than ever before. Our new DZ/16 is a microprocessor-based controller which fits 16 asynchronous communications channels into a single board but sells for much less than the two-board DZ11-E it replaces. There's no waiting either. You'll probably have your card plugged in and running less than 30 days after we get your order.

The unique multiplexer installs in any standard hex-width slot and presents only one load to the Unibus. It supports all DZ11 baud rates, provides modem control on all lines and is compatible with DEC diagnostic and operating system software. The data format is program-selectable for each channel.

This isn't the first time we've been first. It won't be the last. The advantages we've sent your way again and again will keep coming. Get the most out of your VAX or PDP-11. Write today for details on our remarkable line of memory, communications and general-purpose cards for use in the PDP-11 family.

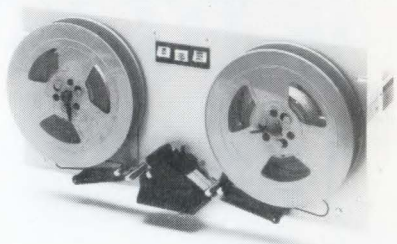
Able, the computer experts

ABLE COMPUTER, 1751 Langley Avenue, Irvine, California 92714. (714) 979-7030. TWX 910-595-1729.

ABLE COMPUTER-EUROPE, 74/76 Northbrook Street, Newbury, Berkshire, England RG13 1AE. (0635) 32125. TELEX 848507 HJULPHG.

New Products

PAPER TAPE READER has a 200 cps asynchronous or synchronous read speed and a 400 cps tape positioning mode for rewinding on program cueing. The reader has only one moving part with "stop-on-character" capability at all speeds. The RR7155 is 5-1/2″ high and mounts in a 19″ rack with an optional add-on fanfold tank assembly. It



has an MTBF of 16,000 to 20,000 hours. Operating life is extended by an LED phototransistor read head and will operate from 47 to 63 Hz at 115V, 1.0 AMPS and 230V, 0.5 AMP. $657 in OEM quantities, 60 - 90 days ARO. **Remex Div, Ex-Cell-O Corp,** 1733 E. Alton St, P.O. Box C-19533, Irvine, CA 92713. **Circle 183**

μP-BASED DISK CONTROLLER with on-board data separator logic capable of controlling up to 4 disk drives in any combination of Winchester fixed or floppy units is available. The controller incorporates a significant amount of functional "intelligence" on-board to relieve host computers of many standard disk control functions. Features of the SA1400 are automatic copy, sector interleaving, error correction code autonomous to the CPU and optional microdiagnostics. Copying from one disk to another is carried out by the controller logic with no need for CPU involvement. A full sector of data can be stored in the controller, rather than in the CPU, while a read/write operation is taking place on the disk. The SA1400 works with any combination of Shugart SA1000 8″ or SA4000 14″ Winchester drives and SA800/850 8″ floppy disk drives. It is based on a high performance bit-slice μP and uses firmware design concepts to provide onboard controller functions that optimize CPU operation. Functions include overlapped seek operations, integral data separators, automatic switching of head and cylinder, and optional track formats. The entire controller is on a single 8.25″ by 13.70″ circuit board. Power supply is +5 volts at 4.6 amps, −5 volts at 500 mA and +24 volts at 100 mA. The SA1400 to control up to 4 disks is just $1125 in OEM quantities. **Shugart,** 435 Oakmead Pkwy, Sunnyvale, CA 94086. **Circle 185**

weed out bad products

Wilson exercisers

Manufacturers and Systems Houses alike know that heading off defective products is the surest way to cut down on cost, capital, frustration, and delay.

Wilson Exercisers check out every operating function that can go wrong and stop defective products cold. Even products with intermittent problems reveal their faults when connected to an Exerciser for automatic cycling operation.

Inspection stations equipped with Wilson Exercisers are much faster and more efficient than conventional scope-and-probe inspectors...cost less than computer terminal set-ups...and are convenient to emplace because every Exerciser is portable and self-contained.

Find out how easy it is to turn back bad products.

Send For Complete Information

WILSON Laboratories, Inc.
2237 N. Batavia Street, Orange, Calif. 92665
Telephone (714) 998-1980 Telex 181 598

FULL LINE OF QUALITY ASSURANCE TESTERS

Floppy Disk Exerciser	Disk Drive Exerciser	Tape Drive Exerciser	Communications Exerciser	Storage Module Exerciser	Disk Drive Exerciser	Tape Drive Exerciser

Circle 11 on Reader Inquiry Card

New Products

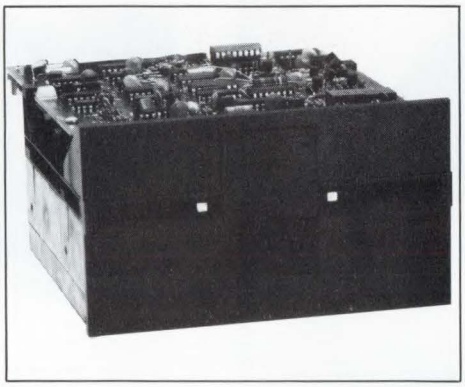
S-100 COMPATIBLE 64K RAM MEMORY. The modules contain a dynamic memory array, bus interface/control logic, on-board crystal timing, refresh oscillators, and voltage regulators. The on-board refresh timer and 25 MHz crystal oscillator generate internal timing signals for read/write and refresh functions to assure proper operation with minimum reliance on bus timing. This provides all the necessary signals to refresh the memory array without interfering with or cycle stealing from a bus memory user. The memory board is deselectable in 4K increments and has a power dissipation of 8 watts. All DM6400 boards are 100% burned-in, guaranteed for one year. Delivery from stock, Dealer/OEM discounts available. **Measurement Systems & Controls,** 867 North Main St, Orange, CA 92668. **Circle 189**

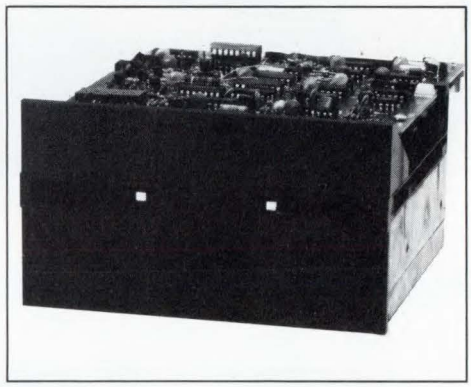
EIGHT-INCH DISK DRIVE combines fixed and removable data storage for use with mini and micro-computer systems. It offers an alternative to the problem of memory "back-up" that confronts users of fixed, 8″ disk drives. The first in a planned family of 8″ disk drives, it provides 8 MB of data storage on a fixed disk and another 8 MB on a removable disk cartridge. Features of the CDC 9455 Lark include μP-based control logic, and a design that allows it to be mounted 2 horizontally or 3 vertically in a standard 19″ rack. $2700 including power supply and SMD compatible I/O. A CDC 91208 cartridge, for use with the Lark, has a data transfer rate of 9.67 million bps. $100 in OEM quantities. Evaluation units available in November. **Control Data Corp.,** Box O, Minneapolis, MN 55440. **Circle 188**

DEC/BURROUGHS COMMUNICATION SYSTEM. The system allows a DEC PDP-11 to communicate with Burroughs computers using synchronous communication techniques, and PDP-11 computers to communicate with each other. Using either dial-up or leased telephone lines, it supports the Burroughs point-to-point conversational protocol to give high throughput data transmission with low operating system overhead. Error detection and record retransmission are handled automatically. BURCOM-11 provides user-callable subroutines for sending and receiving messages, establishing a transmission link (including dialing of numbers), terminating a link, and reviewing the line status and error counts. A single machine perpetual license, $4400. **Applied Information Systems, Inc,** 500 Eastowne Dr, Suite 207, Chapel Hill, NC 27514. **Circle 196**

GO FIRST CLASS

½ MByte
TM-100-3 (Single-sided)
Capacity (unformatted):
500K bytes
TPI: 96 or 100
Tracks per side:
80 maximum
Recording density:
5535 BPI
Access time:
• Track to track: 3ms
• Average: 90 ms





1 MByte
TM-100-4 (Double-sided)
Capacity (unformatted):
1,000K bytes
TPI: 96 or 100
Tracks per side:
160 maximum
Recording density:
5877 BPI
Access time:
• Track to track: 3 ms
• Average: 90 ms

At an economy Price

It doesn't cost anymore to go first class when it's a Tandon 5¼" flexible disk drive. The reason is simple. We're the recognized leader in mini-floppy read/write head technology. In fact, our patented, double-sided head design is used by all the other major mini-floppy suppliers. And, it makes no difference if you buy one or one-thousand drives, you'll always get the first class price/performance that's made Tandon first choice among OEMs of word processing, small business systems, and personal computers. Tandon is rapidly becoming the first name in mini-floppies because we offer up to *one megabyte* of storage capacity, the fastest access time, a choice of single or double-sided recording, and 96 or 100 tracks per inch. All with proven reliability at an unbeatable price. Because we are the leaders in head technology, Tandon mini-floppies are designed beginning with the head to assure dependability throughout each drive. With Tandon, going first class is both sensible and economical.

Tandon

9333 Oso Ave.
Chatsworth, California 91311
(213) 993-6644

Heads Above The Rest in Disk Technology

Circle 59 on Reader Inquiry Card

New Products

S-100 BUS' This 258-pg. 8.5″ by 11″ paperback, "The S-100 Bus Handbook," by D. Bursky starts with three chapters of basics, then settles down to discuss the S-100 bus, I/O interfaces, peripheral storage, 8080 instruction set, and troubleshooting for the first 148 ppg. The appendices list reference books, S-100 related components and suppliers, and 98 ppg. of 31 S-100 bus board schematics. At times it gives an overview of material the EE had better know by now (such as 8080 instruction set in ch. 8) and lacks some of the material found in Howard Sams S-100 book (and vice versa). Both are recommended for S-100 bus users. $12.95. **Hayden Book Co, Inc,** 50 Essex St, Rochelle Park, NJ 07662.
Circle 173

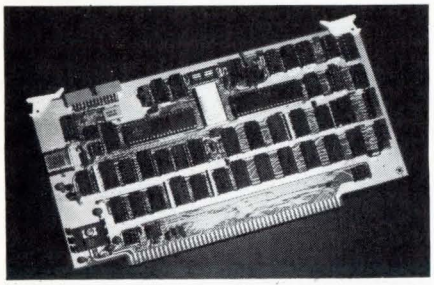
NEW IC SOCKET CATALOG. The "IC SOCKET CATALOG AND DESIGN ENGINEERING GUIDE." contains information on Cambion's family of dual-in-line IC Sockets plus data on the new, Solder-tab LOW PROFILE (.159″) Series 703-42XX. The low-profile series are available in 8-pin to 40-pin position sizes with inverted contacts for excellent lead-in. The new series also offer Kapton® antiwicking sealing strips, reinforced polyester bodies for automatic IC insertion. Also featured is the new Series 703-43XX LOW-PROFILE (.093″) IC SOCKETRY in both Solder-tab and Wrapost® configurations. **Cambion,** 445 Concord Ave., Cambridge, MA 02238.
Circle 143

NEW PRODUCTS FROM ZENDEX: A **ZX-028A RAM** Board fits the Multibus and decodes all 20 address lines. The byte high enable line provides either 64K 16-bit words or 128K 8-bit bytes. The "A" in the model number represents a revision of an earlier offering. This revision has two push-on jumpers that allow the board to accept either 64 5-Volt only RAM's or 64 three-supply RAM's. Available depopulated

without RAM chips for $534. 4 week delivery. **ZX-740WF Disk System** includes 10 M Byte SA1004 Winchester Drive, SA801R Floppy Disk, SA1403 Controller, and a Power One CP-384 Supply all in a standard 19″ Rack Mountable Chassis. The drives are wired to controller and includes all cables and connectors. 1-4 weeks delivery. $7,000. **ZX-85/88 PROCESSOR** is a two card development system that combines Zendex's ZX-85 Processor Board and ZX-204 Diskette Controller. The ZX-85 board is fully capable of running unmodified ISIS-II software from an appropriate controller, or CP/M with the ZX-204. (Licenses to run Intel software on Zendex products must be obtained from Intel Corp.) The ZX-85 offers a standard Boot/Monitor program that will load and run ISIS-II or CP/M for the MDS-230. The ZX-85 features 64K BYTES of RAM. A 4K BYTE EPROM provides storage for the Boot/Monitor program. An optional Piggy-Back Card (ZX-32) can expand EPROM memory to 32K BYTES. The CPU socket is double rowed to allow replacement of the 8085A-2 with an 8088 CPU. This change will allow the board to execute 8086 code over the 8-bit Data Bus. A kit of parts (Kit-88) allows a ZX-85 board to be converted by the user to the ZX-88 version. The ZX-85 is

$1799; 4-6 week delivery. ZX-660 Chassis is $1250; 2 week delivery. Kit-88 is $500 from stock. **Zendex Corp.,** 6394 Dougherty Rd., MS32, Dublin, CA 94566. **Circle 131**

LOW-PRICED Z-80 CPU BOARD supports front panel operations and is fully compatible with the Altair



and Imsai computers, as well as the majority of S-100 systems without front panels. Options include an RS-232C serial I/O port for a console interface. The number of bits per word, parity, number of stop bits, and baud rate are all software-selectable. Other options include I/O address mirroring, a power-on jump to any location in 64K, and M1 wait states with optional wait state generation. Standard features for the 2810 include a jumper-enabled 2K ROM containing monitor firmware. The monitor features an auto-baud select allowing the serial port to match any baud rate from 2 to 56K baud set at the console. A switch allows the user to select a clock rate of 2 or 4 MHz. $300. **California Computer Systems,** 250 Caribbean Dr., Sunnyvale, CA 94086. **Circle 186**

ASYNCHRONOUS LINE DRIVERS ALD-I and ALD-II, provide data transmission over twisted pair wire for terminal to computer, terminal to terminal, or computer to computer communications. These asynchronous devices are completely transparent to data codes and rates up to 56 Kbps. The ALD-II can operate in a multipoint environment, which significantly reduces cable runs and computer ports. The units are available in either stand-alone or rack mount configurations. Up to 16 line drivers may be accommodated in a single common rack mount. $185.00 for the ALD-I, $215.00 for the ALD-II. Quantity discounts available. Delivery, 30 days ARO. **Tri-Communications Industries, Inc.,** 20 Fitch St., E. Norwalk, CT 06855. **Circle 130**

UNLIMITED VOCABULARY TALKING CHIP. This 22-pin CMOS silicon chip can be used in low-powered toys, games, calculators etc. The voice chip can generate an unlimited vocabulary at the low data rate of 70-100 bps. With the VOTRAX SC-01 chip, words and phrases are generated by a series of electronic commands that produce the various phonemes which comprise human speech. It is also possible to control degrees of inflection. Because less memory is required, end products that incorporate the SC-01 chip can be less costly, lighter and more compact. The SC-01 chip also does not require any μP controller. SC-01 chip is available in OEM quantities at $12.00/unit. **VOTRAX,** 500 Stephenson Hwy., Troy, MI 48084. **Circle 136**

NEW CMOS RAM BOARD maintains data during power outages or shortages. The BP-0200 has 16K bytes of read/write memory utilizing NEC's μPD444 CMOS RAM for both 8-bit bytes and 16-bit data words, on-board batteries and battery charger with short circuit and overcharge protection, a minimum of 7 days continuous battery back-up, memory deselect in 2K byte blocks, and a memory Inhibit allowing paging of 2 or more boards to the same address block. The board supports both 16-bit and 20-bit addressing, with data retention for 168 hours following removal of +5V bus power. **NEC Microcomputers,** 173 Worcester St., Wellesley, MA 02181. **Circle 135**

New Products

FOUR NEW PRINTERS FROM C. ITOH. The Starwriter and Starwriter II, daisy-wheel impact printers, have print speeds of 25 cps and 45 cps. Both with a 96-character print wheel, with either 136 columns in pica or 163 columns in elite, and can print forms up to 15″ wide. Two 9 X 7 dot matrix printers, the Comet, an 80-column printer with 4 character sizes; and Comet II, a 136-column printer with 2 character sizes are also available. The Comet has switch-selectable single- or bi-directional printing on forms from 4½″ to 10″ wide. Print speed is 125 cps and throughput is 63 lpm in the bi-directional mode. Character sizes are normal width (10 cpi), double width (5 cpi), compressed font (16.5 cpi) and compressed font double width (8.25 cpi). The Comet II prints at 125 cps and 40 lpm, bi-directional on forms up to 15½″ wide. Character spacing is either 10 cpi or 5 cpi. All 4 printers are multilingual, have self-test capability, and programmable vertical format unit. **C. Itoh Electronics,** 5301 Beethoven St, Los Angeles, CA 90066. **Circle 182**

ENTRY LEVEL COMPUTER SYSTEM. The unit provides the ability to perform data processing, word processing, rapid key entry, electronic mail and telecommunications, all from the same workstation. Basic configuration consists of a CPU with 128KB memory, an internal fixed disk drive with 28KB storage capacity, a workstation and an internal 1.2MB dual-sided, double-density diskette. Deliveries begin 11/80. **Wang Labs, Inc,** One Industrial Ave, Lowell, MA 01581. **Circle 194**

DISPLAY SYSTEMS. The 8395A display generator has a programmable radar processor and full graphics capability while concurrently generating radar data. It performs scaling and offsetting, and interfaces with a variety of 16-bit host computers. Interfaces include ANEW, AN/UYK-7 and ROLM. Additional peripherals and attachments, such as CRTs, auxiliary alphanumeric displays, and PPI situation displays can also interface with the system. Model 8067, a full-color large screen display, offers an alternative to the use of a penetron tube display system, but without the drawbacks. It eliminates the long distance between projector and screen, displays visibility in normal ambient lighting at a distance of up to 20′ and has high contrast (10:1) display. Screen sizes are 18″ X 18″ square and 23″ diam. Options: rear projection of 35mm slides or TV inputs of 525 or 900 lines. **Aydin Control,** 414 Commerce Dr, Fort Washington, PA 19034. **Circle 195**

introducing the MSP-3000

FLOATING POINT ARRAY PROCESSOR

LOW COST

HIGH-PERFORMANCE SCIENTIFIC COMPUTING

FOR APPLICATIONS IN
SEISMIC / MEDICAL / VIBRATION / MODELING / SIMULATION / SIGNAL ANALYSIS / IMAGE PROCESSING

MSP-3000 FEATURES

- **Large Fortran-Callable scientific, matrix and signal analysis library**
- **Unique Memory Structure**
- **PDP-11* Compatible Floating Point Format (32 - bit)**
- **5¼" rack mountable chassis or board set configuration**

**PDP-11 is a registered trademark of Digital Equipment Corporation.*

From Computer Design & Applications . . . a recognized leader in multiprocessing. Call or Write today for details on our complete family of analog and digital products and systems.

COMPUTER DESIGN & APPLICATIONS, INC.
377 Elliot Street / Newton, MA 02164 (617) 964-4320
Telex 922521 CDANEW

Circle 73 on Reader Inquiry Card

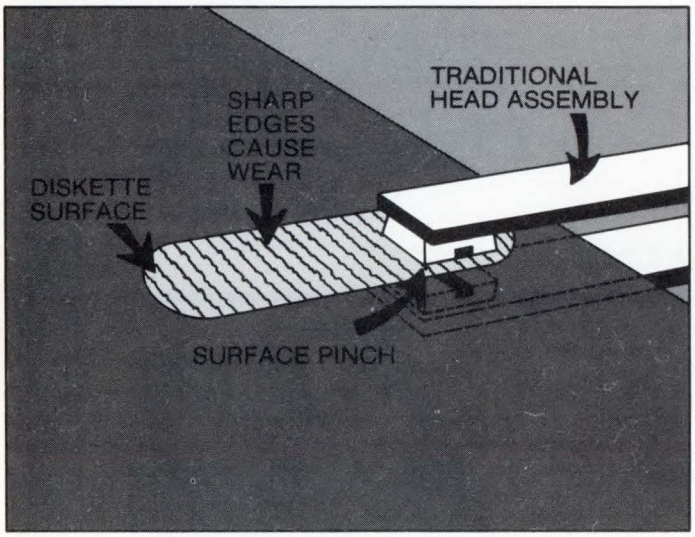
Product Index

To obtain detailed information on ads appearing in this issue use the Reader Inquiry Card. Circle appropriate numbers (as many as you desire), detach the card from binding and mail to *Digital Design*.

This index is provided as an additional service: the publisher assumes no liability for errors or omissions.

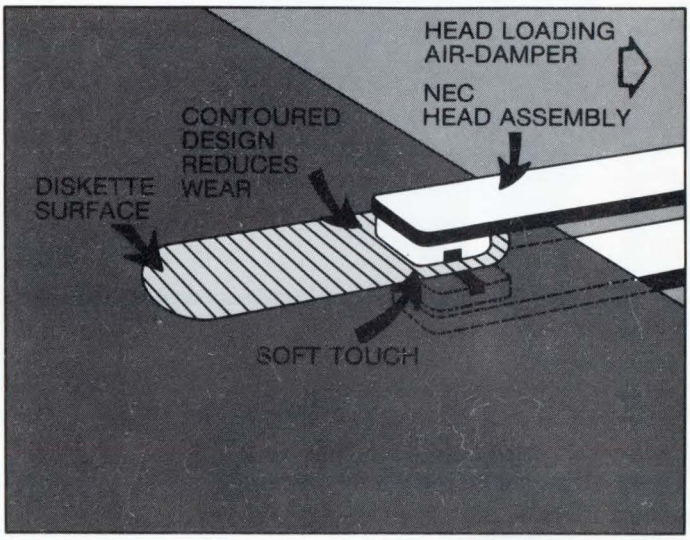
Introducing the NEC Soft-Touch.™

Other diskette drives



Dual-sided diskette drives require contact of both heads with the media to read or write. This causes head wear and a pinching action that deforms, mars and scratches the media surface, shortening head and media life.

NEC diskette drive



The NEC "Soft-Touch" drive uses advance-contour head design and a unique air-damper to load heads. These features smooth and cushion the contact of head with media surface, nearly doubling the life of both the heads and the recording media.

The industry's newest 1.6MB diskette drive. With twice the MTBF. Twice the media life.

NEC product superiority is now available in dual-sided double-density eight-inch diskette drives. Our new Model FD 1160 "Soft-Touch" flexible disk drive offers reliability and cost-of-ownership advantages that far exceed industry standards.

Media life. The "Soft-Touch" drive uses a unique air-damped head-loading system that virtually eliminates pinching, scoring and scratching of the diskette media. The result: media life of more than 6 million passes, nearly double that offered by other suppliers.

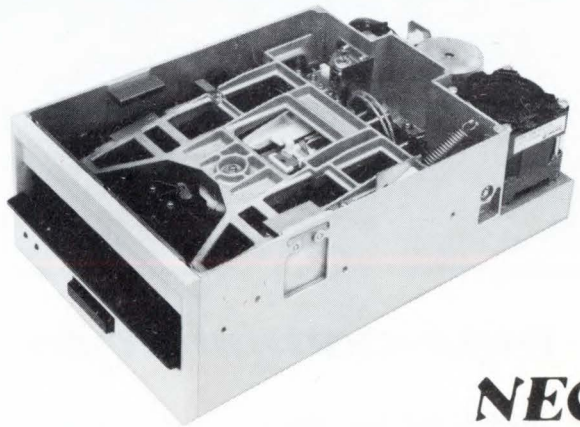
Head wear. An advanced design ceramic read/write head assures maximum signal transfer efficiency while drastically reducing head wear and media chafing.

Reliability. Most diskette drives average about 8,000 hours MTBF, with perhaps a component or two rated higher. The NEC "Soft-Touch" drive has a 15,000-hour MTBF *on the entire drive.*

Compatibility. The FD 1160 model is data compatible, electronically compatible and dimensionally compatible with industry-standard single- and dual-density drives. You can use it immediately in place of the older drives you use now.

Availability. The NEC "Soft-Touch" drive is available right now. Not as a prototype, but as a field-proven drive with over 20,000 installations worldwide.

Find out for yourself. Call Jack Flynn today on the NEC "Soft-Touch" action phone at 617-862-3120 to order your evaluation unit.



NEC

NEC Information Systems, Inc.

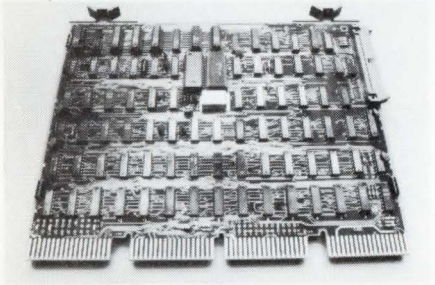
Home Office: 5 Militia Drive, Lexington, MA 02173, (617) 862-3120
Eastern Office: 36 Washington Street, Wellesley, MA 02181, (617) 431-1140
Central Office: 3400 South Dixie Drive, Dayton, OH 45439, (513) 294-6254
West Coast Office: 8939 S. Sepulveda Blvd., Los Angeles, CA 90045 (213) 670-7346
Southern Office: 2945 Flowers Road South, Atlanta, GA 30341 (404) 458-7014

Circle 60 on Reader Inquiry Card

New Products

DIGITAL CARTRIDGE TAPE DRIVE which provides connector-to-connector replacement for existing 10-1/2″ reel-to-reel computer peripheral tape drives is described in a new 2-page, data sheet entitled "Microtape® Ruggedized Cartridge Magnetic Tape System." Suitable for military and rugged industrial applications, the drive provides 34 MB of data storage. This software transparent drive looks like a 10-1/2″ reel-to-reel drive, with 9-track interface, operating at 25 ips with 800 bpi data density and NRZ format. $10,400. Availability is 120 days. **Data Electronics, Inc.** 10150 Sorrento Valley Rd, San Diego, CA 92121.
Circle 145

BYTE ORIENTED DMA CONTROLLER for Unibus computers which performs DMA data transfers to and from byte oriented peripherals. The MDB PDI-11 is mounted on a quad board to simplify system installation. On a PI/O basis, the unit allows a peripheral device to appear to the computer like a DEC DL serial line unit. Therefore, the user



can integrate the PDI-11 into his system and run a peripheral with existing software while DMA software is being developed and integrated. It functions in parallel using RS422 receivers and drivers and will operate at distances to 3,000 feet at full speed. The MDB PDI-11 is half duplex bidirectional DMA and full duplex PI/O, with transfer rates of 80,000-100,000 bps. $2,150 in single units, delivery in 60 days. **MDB Systems, Inc.,** 1995 N. Batavia St., Orange, CA 92665. **Circle 134**

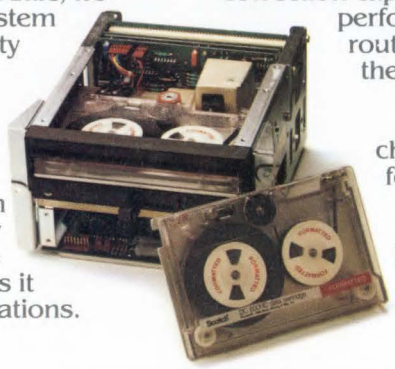
DEC LOOK-ALIKE CABINETS. The Wesperline 973 and 974 Cabinets are designed as replacements for DEC's H960 and H967 racks. They have knock-down construction that allows shipping in a small package size. Features include: AC power control-distribution, 575 CFM exhaust fans, adjustable stabilizer feet, filler panels, custom logos, casters, custom colors available, and bolt hole patterns that allow mounting to and expansion of existing DEC systems. **Wesperline,** 14321 Myford Rd, Tustin, CA 92680.
Circle 140

NEVER BEFORE HAS SOMETHING SO SMALL BEEN ABLE TO HOLD SO MUCH AT SUCH A LOW COST.

This is 3M's DC-600 HC Data Cartridge for disk back-up. It's just 4" x 6" x ½". Yet it holds a full 67 megabytes of formatted user information (144 megabytes unformatted). And most surprisingly, it only costs about thirty dollars.

The marvel that makes it work is our HCD-75 Data Cartridge Drive. At 4.6" x 7" x 8.6" (19" deep with controller/formatter module) it's the smallest full-capability back-up system available today. And its storage capacity makes it the most economical, too.

You see, the HCD-75 drive unit eliminates the need for costly multi-track heads. Instead, it uses a new tape head which features automatic positioning to any of the tape's sixteen tracks. The result is a storage capacity much larger than ever before possible with data cartridges. Which also makes it suitable for other mass storage applications.



Extensive use of microprocessors in the HCD-75 make it the world's first truly intelligent cartridge drive system. Other than initial commands, all tape drive functions are controlled locally. So the host computer system can remain free for other functions. What's more, the HCD-75 features sophisticated error detection and correction capabilities. And to insure system performance, self-test diagnostic routines run continuously. Even when the system is not in use.

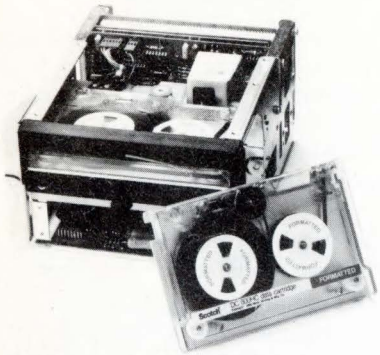
Will wonders never cease?

For more information, check the listing on the next page for the representative nearest you. Or write: Data Products Division/3M, Bldg. 223-5E/3M Center, St. Paul, MN 55144.

THE DISK BACK-UP SYSTEM THAT'S SUDDENLY WAY OUT FRONT.

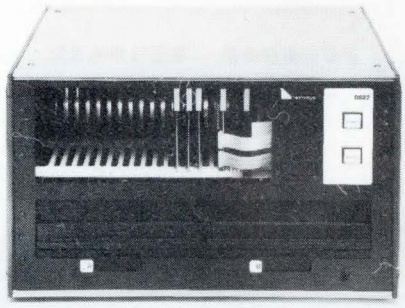
Circle 71 on Reader Inquiry Card

3M



New Products

STD BUS BASED DEVELOPMENT SYSTEM. For developing μcomputer hardware, software, and systems, the DS22 is a dual floppy disk system with full assembly language programming capabilities, including editor, assembler, utilities, and dynamic debugger. Optional software includes MACRO assemblers, BASIC, FORTRAN, PASCAL, C and PL/1. The DS22 allows software development, hardware debug, and system integration to be performed on the target hardware system with all of the advantages of having a development system's CRT, printer, and mass storage. The basic assembly language DS22 with 32K of memory and dual disk drives is $6150. Delivery is 4 weeks. **Micro/sys,** 1353 Foothill Blvd, La Canada-Flintridge, CA 91011.



Circle 165

16-BIT INTELLIGENT EMULATOR. A self-contained analyzer/emulator, called tZSCAN 8000, is a mid-range device that can be used either standalone or as a front-end peripheral interfaced to a development system based on a wide range of computer system hosts. Features include: dual RS232C ports allowing placement in the serial path between the host computer and CRT console; mappable memory, permitting designers to map 4K words of high-speed static RAM, with no wait states, on 4K boundaries anywhere in the Z8000 address space; and a trace feature permitting retrieval of address/segment, data, and CPU resource information to the CRT console for detailed analysis. Model ZSCAN 8000, approximately $4500. **Zilog,** 10340 Bubb Rd, Cupertino, CA 95014.

Circle 217

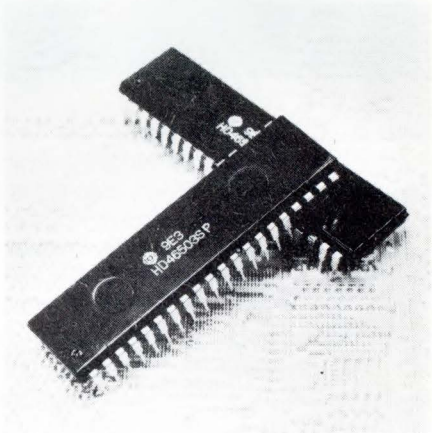
INTELLIGENT MEMORY BOARD. This memory has 16 KB of static RAM and sockets for eight 2716 EPROMs, interfaced to Intel's MULTIBUS. Intelligence is derived from an on-board Z-Z-80 μprocessor CPU. A minimum number of components is used to interface the Z-80 CPU to memory, so the addition of the CPU does not appreciably increase board cost. The Intelligent Memory can be used as regular memory or the on-board Z-80 can be activated under program control to process data in parallel with the Multibus Master. Several IM-1680 boards can be used in a system to increase memory capacity and/or processing capability. Model IM-1680, $595 each; delivery 60 days. **Microsignal,** 3704 State St, Santa Barbara, CA 93105.

Circle 161

NEW EMULATING DISK CONTROLLER FOR DEC SYSTEMS. This PDP-11 compatible emulating disk controller offers advanced architecture. A unique dual bipolar microprocessor design, provides dedicated and simultaneous control of both the CPU and the disk interfaces. Spectra 11 resides on a single hex-wide board and comes in four firmware versions, each providing emulation of various DEC disk subsystems. 2048 byte (four sector) RAM buffering eliminates "data late" errors; 32 bit ECC, generates correcting error bursts of up to 11 bits; automatic position verification eliminates sector, head, and cylinder addressing errors; and on-board LED error status display offers convenient diagnosis by the user. Single board Spectra 11 is $3300 in OEM quantities. **Spectra Logic Corp,** 2316 Walsh Ave, Santa Clara, CA 95051

Circle 126

FLOPPY DISK CONTROLLER. This IBM 3740 compatible controller provides the interface between a μP system and a floppy disk transport. The unit's flexible hardware design enables it to be used in any μP environment, and is adaptable to a variety of disk drives. Controller uses 10 macro-commands to control all head movements and R/W functions. Featured are programmable seek and settling times, R/W operation of consecutive sectors by a single command, and both program-controlled and DMA data transfer modes. Model HD46503/MC6843 FDC, $11.85 (100) **Hitachi America, Ltd,** 707 W. Algonquin Rd, Arlington Heights, IL 60005.



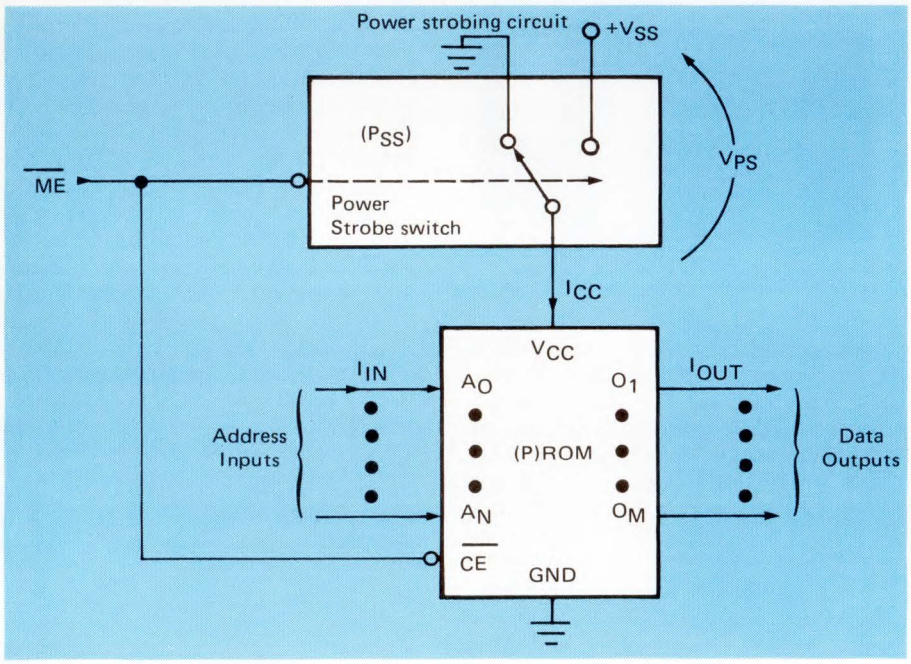
Circle 168

Designers' Notebook

PROM/ROM Power-Strobing Reduces Power Consumption

Engineering Staff
Signetics, Los Angeles, CA

The design of dense memory arrays, required in many of today's memory intensive systems, often poses critical trade offs in power economy and speed which can become of key concern to the designer. Often they can be resolved by power strobing – a technique which significantly reduces power consumption of non-volatile memories, at a small sacrifice in speed.



Power strobing provides power economy by removing the V_{CC} supply from the memory when access is not required. Bipolar PROMs are suited to this technique since they are non-volatile and have fast access times and high power consumption.

Power strobe PROM parameters

A general power strobing circuit for ROMs and PROMs switches V_{CC} to GND and deselects the Chip Enable input at the PROM in the power-down state. In this state, PROMs present no additional loading to the address and Chip Enable inputs or Data Outputs, as I_{IN}, I_{OUT}, and C_{OUT} have the same rating in either a powered-up (V_{CC} = 5.0V) or power-down (V_{CC} = 0) environment. The advantage to the designer, is that in a power strobed array, there are not additional input or output loading factors to be concerned with.

The primary parameters that require attention in the power strobed environment are I_{CC}, V_{CC}, and the power strobed access time of the PROM, T_{AA}, measured from address to data output. The worst case access is observed when the address changes just as V_{CC} supplied by the Power Strobe Switch (PSS) reaches 4.5V. By deselecting the PROM with the power strobe enable signal, the normal chip disable time, T_{CD}, specified data sheet is achieved.

The PSS must be able to supply the PROM with the required I_{CC}, while maintaining at least V_{CC} (min) in the powered up state. In the process of powering up, however, an additional parameter, C_{VCC}, must be considered. This is the capacitance from the PROM's V_{CC} pin-to-ground which the PSS must charge to V_{CC} (min). The time required to charge C_{VCC} is T_{PS}. For Signetics commercial range PROMs, V_{CC} (min) is 4.75V over the temperature range of 0° C to 75° C. If a small speed penalty (approx. 10-20ns) can be tolerated, however, V_{CC} (min) can be reduced to 4.5V, without affecting other parameters.

Switch considerations

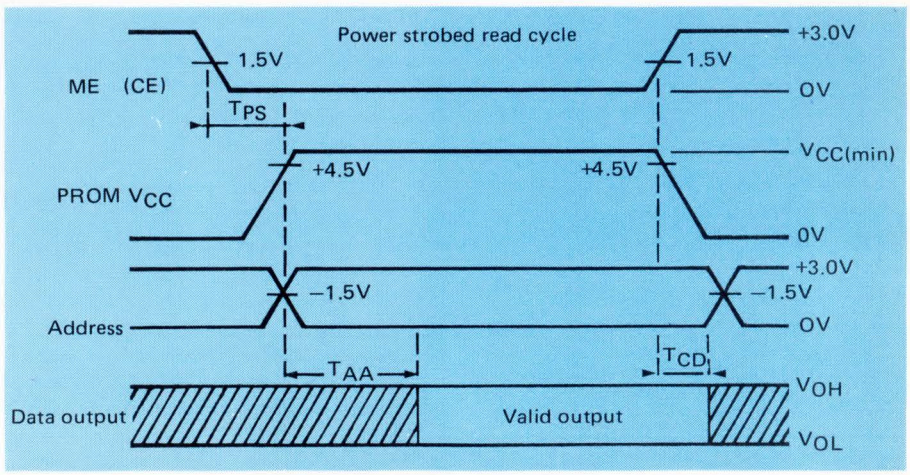
The major concerns in implementing a Power Strobe Switch are the following:

1) T_{PS}, power strobe high transition time
2) V_{PS}, voltage across the power strobe
3) I_{CC} (max)

Since T_{PS} adds to the PROM access time, the time taken by the PSS to charge C_{VCC} to 4.5V is of key concern. And, since T_{PS} is a function of V_{CC}, the voltage drop V_{PS} across the PSS is a critical parameter. Since the PROM must have a V_{CC} (min) of 4.5V, if the memory supply, $+V_{SS}$, is 5.0V, then $V_{PS} \leq 0.5V$.

The circuit is one method of implementing a PSS for a single PROM whose I_{CC} = 150mA. In some applications multiple PROM power strobing is required from a single switch.

Q1 supplies the PROM's power up current, and R1 and R2 provide Q1's



Personal Computing

For Your Home and Business

can help you . . .

- Forecast trends
- Retrieve records quickly
- Learn a language
- Figure your taxes
- Monitor your health
- Teach your children
- Improve your investments
- Have fun with games and
- do many other useful projects

If you're not afraid to do it yourself with a personal computer, this is the magazine for you. We show you how to use a computer to solve all the above problems quickly and have fun doing it, not how to build or repair a computer.

Each month, our informative, easy-to-read articles bring you ready-to-use application programs; just type them in and tell your computer to run. In addition, we feature tutorial articles showing you how to plan and write your own programs, using professional methods and the latest programming techniques.

Save 42% on home delivery of Personal Computing and get The Best of Personal Computing, Vol. 1 ($7.50 value) for one dollar. Introductory Combination Offer $15 for both.

☐ 12 months of **Personal Computing** $14.00
☐ **Best of Personal Computing, Vol. 1** $7.50
☐ Combination offer of 12 months of **Personal Computing** and **The Best of Personal Computing, Vol. 1** $15.00

(Please print or type)

Name _____

Address _____

City _____ State _____ Zip _____

Check enclosed or charge my: **DD** 9

☐ Master Charge ☐ Visa

Account #

Signature _____

Card Expiration date _____

Master Charge only:
last four digits above date

Mail to: PERSONAL COMPUTING, 1050 Commonwealth Ave., Boston, MA 02215

base drive current. The 75451 driver discharges C_{VCC} to ground rapidly during power down transitions to minimize data bus conflicts in multi-PROM systems. The 47 ohm resistor has been added to protect the switch from transient current conditions due to driver delay causing Q1 and the 75451 to be simultaneous on during power up switching.

I_{EN} is the sink current required by the ME line driver. An I_{EN} of 16mA can be supplied by a standard 7400 series gate but for higher I_{EN} current levels, a 74140 or 74S140 may be used. The 74140 will sink 48mA and the 74S140 will sink 60mA.

Calculate power savings

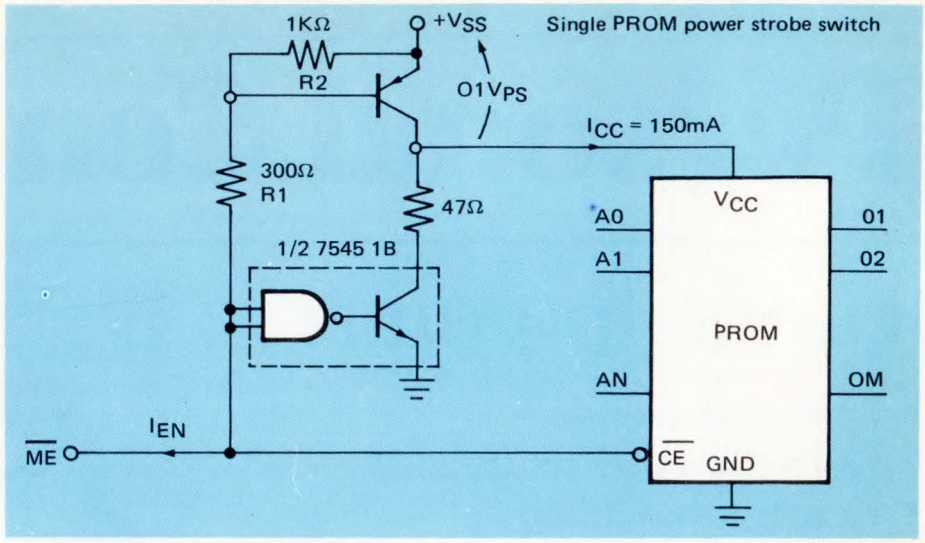
A fair estimate of the relative power savings that power strobing can provide is given by the following formula:

$$\% \text{ Power Savings} = [(P_C - P_{STR})/P_C] \times 100\%$$

$$P_{STR} = P_M M_E + M_E P_{SE}/M_S + M_D P_{SD}/M_S$$

Hence: $\% \text{ P.S.} = P_M M_D - (M_E P_{SE} + M_D P_{SD})100\%/(M_S R_M M_A)$

Where:
- M_E = the number of memory elements powered up in any memory access
- M_D = the number of memory elements powered down in any memory access
- M_S = the number of memory elements per PSS
- P_M = the power the memory element takes when powered-up
- P_{SE} = the power of the PSS when the memory element is powered-up
- P_{SD} = the power of the PSS when the memory element is powered-down



The future

The use of ROM/PROM power strobing will continue to find applications for system designers. Although system integrators and builders won't be designing memory boards, they won't be specializing on the details of memory board design, PCB, layout and fabrication. On the other hand, an understanding of the basics of PROM/ROM power strobing, as detailed in this article, is a must. With memory power consumption a growing factor in computer systems, the trend to power strobing will continue.

Rate this design: circle 10L, 10M or 10H on Reader Inquiry Card

Advertisers' Index

Sales Offices

NEW ENGLAND and UPSTATE NEW YORK:
John A. Garland **(617) 934-6464**
Box 314 SHS, Duxbury, MA 02332

MID-ATLANTIC and SOUTHEASTERN STATES:
Ed Shaud **(215) 688-7233**
P.O. Box 187, Radnor, PA 19087

MIDWEST and TEXAS:
Hank Bean **(312) 475-7173**
2633 Hillside Lane, Evanston, IL 60201

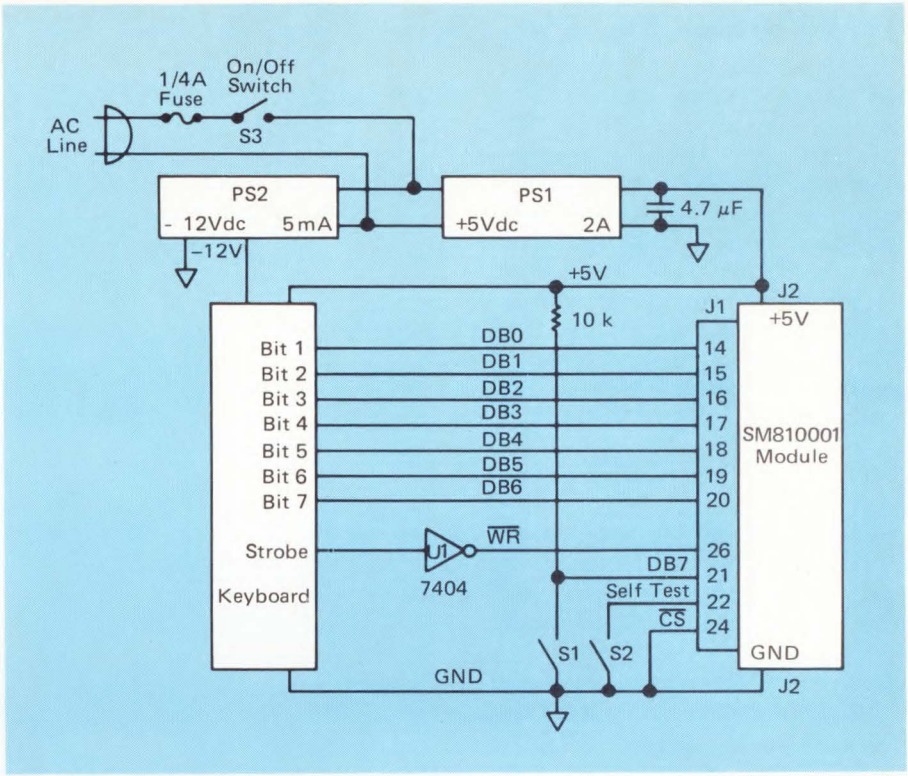
WESTERN STATES:
Lindy Dolan **(213) 478-3017**
924 Westwood Blvd., Suite 610,
Los Angeles, CA 90024

JAPAN:
K. Yanagihara **(03) 350-0272**
International Business Corp.,
10-10 Shinjuku 3-chome, Shinjuku-ku,
Tokyo 160 Cable Address: Yanacour Tokyo

Keyboard Interface Boasts Simplicity

This is the simplest interface. It uses the SM810-001 Display system. In addition to a standard parallel keyboard, the only other parts required are the power supplies, an interface cable, and in some cases, a simple signal conditioning circuit for the strobe signal. If the keyboard output strobe signal and the SM810-001 write strobe input signal are compatible, then no signal conditioning is necessary. The figure illustrates an interface to a Micro Switch keyboard. In this case, the output strobe is active HIGH. It has to be inverted to active LOW to be compatible with the SM810-001. Also data bit 8, DB7, from the keyboard is a parity bit, not compatible with the display system. Therefore, DB7 from the SM810-001 must be connected to either logic "0" (S1 Close) for ASCII character data input, or to logic "1" (S1 Open) for character position location input. S2 is normally open and closes for Self Test.

Wayne Wong, Beckman Instruments, Inc (Display Systems Div), 350 N. Hayden Rd, Scottsdale, AZ.



PS1 is a Semiconductor Circuits SP5941; PS2, an SQ1.12.100 (or equivalent). S1-3 are SPST. The keyboard is a Micro Switch 61SW12-2 (or equivalent).

1802 Power-On Reset/Run Circuits

Here are several circuits which offer a power-on reset/run capability for COS MAC CDP 1802 systems. The power-on reset/run facility is useful in systems which periodically incorporate a power-down phase during system operation. During this power-down phase, care should be taken to prevent signals from reaching any of the 1802 inputs or outputs, because these signals could be coupled through the substrate protection diodes to the V_{DD} line and repower the system.

There are clock input considerations. The waveforms **(Fig 1)** show lines and CLEAR line for resetting the 1802 using two different modes of clock inputs, the on-chip crystal oscillator and an external clock source. The required reset pulse phasing is determined by the type of clock used in the system. When the on-chip oscillator is used, the delay in oscillator start-up depends on the loading on the CLOCK input. With 5 pF decoupling capacitors on the CLOCK and XTAL lines, a delay of 10ms is typical for oscillator start up to 25°C. To assure proper operation the reset pulse should be active until the oscillator has stabilized.

When an external clock is used, it should be gated with the power-on signal. The reset pulse should allow for the V_{DD}, V_{CC} time constant, and can be terminated when the clock is in a valid state or, typically, 20ms following power-on. If the reset pulse terminates before the clock is running, internal registers I and N and the Q output will reset. Registers X, P, and R(0) will not reset, however, under the initialization cycle is completed.

Here are some typical reset circuits **(Fig 2)**. The basic one-shot circuit is shown in **Fig 2a**. The circuit in **Fig. 2b** permits manual reset and allows access to the LOAD mode. The circuits in **Fig. 2c** and **2d** eliminate feedback resistors by using the CD4093 quad 2-input NAND Schmitt triggers. Other variations of these circuits are possible following the above constraints.

W. F. Clark, RCA Solid State Div.

Rate this design: circle 14L, 14M or 14H on Reader Inquiry Card

Fig 1.

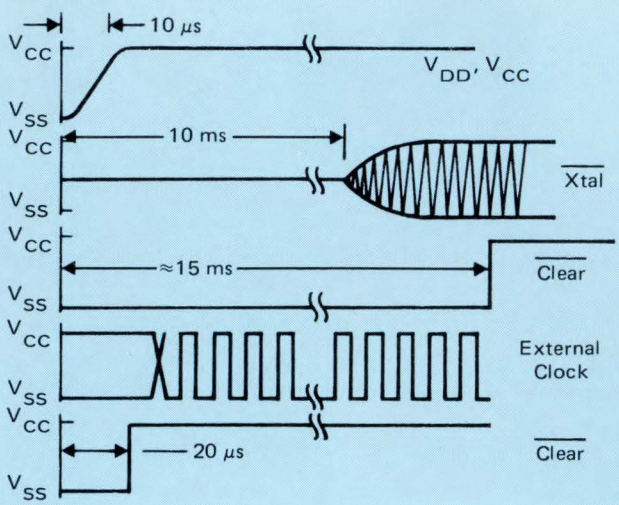
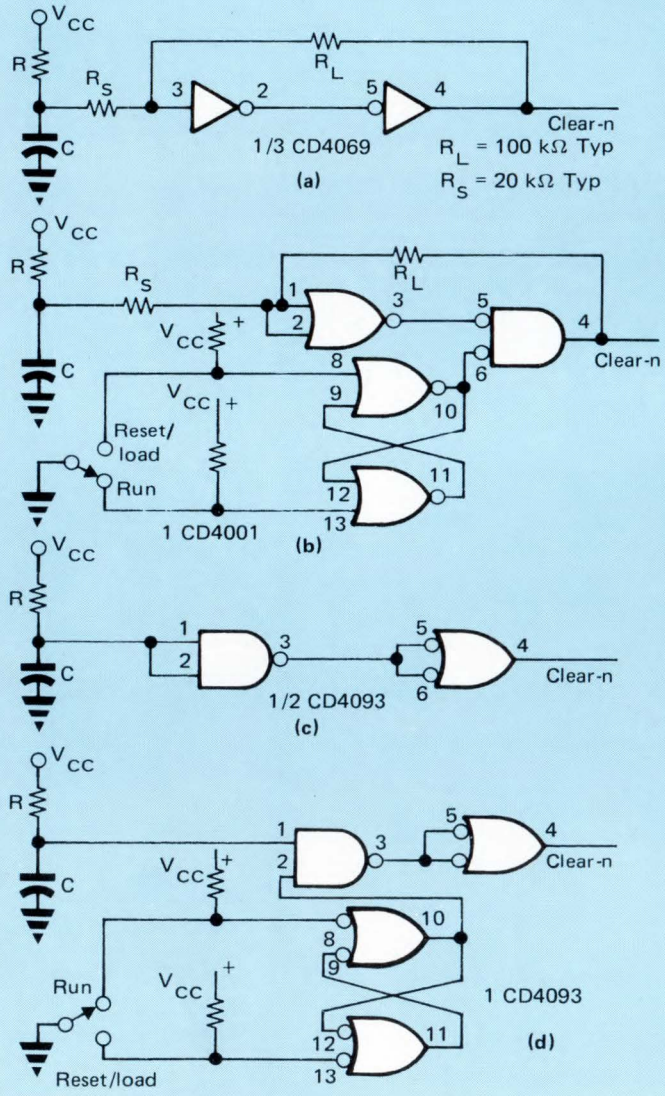
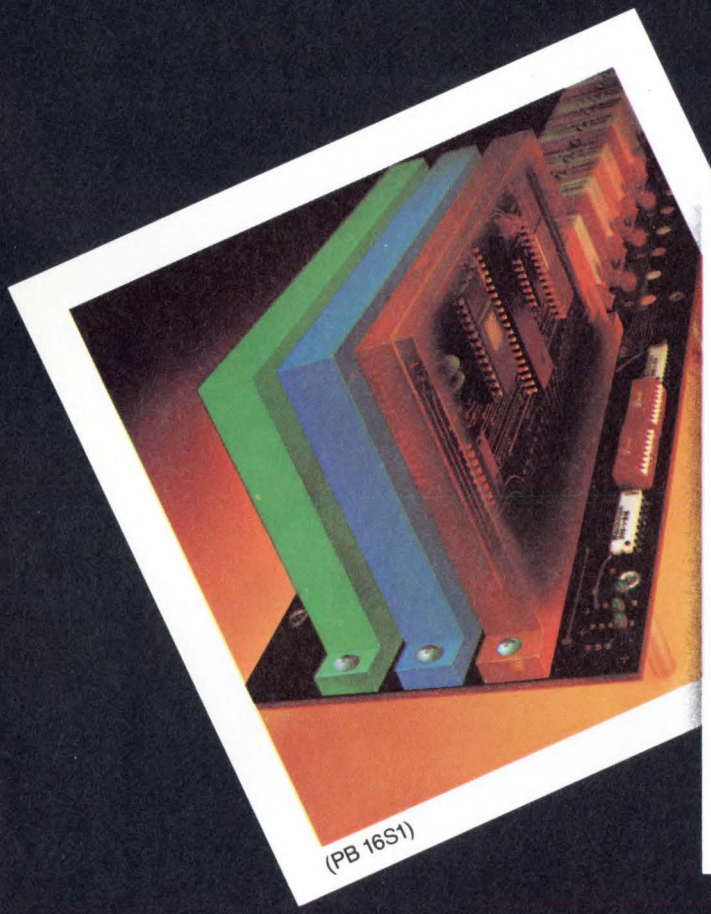


Fig 2



ADDRESSABLE I/O SYSTEMS FROM OPTO 22



(PB 16S1)

(PB 16P1)

Huntington Beach, California . . . Opto 22, originators of the industry standard I/O system, announces the second generation in I/O Systems in both serial and parallel configurations.

SERIAL ADDRESSABLE RACK (PB 16S1)

Communication with multiple input/output stations.
32 station address capability per serial loop.
Up to 16 power I/O modules per station.
Switch selectable baud rate.
Opto 22 provided firmware includes message protocol, event counter, self test, watch dog timer and more.
Plug in modules provide choice of:
1. 20 Ma Current Loop.
2. RS 422 Balanced Differential Drivers and Receivers.
3. Optically Coupled Drivers and Receivers.
4. RS 232

PARALLEL ADDRESSABLE RACK (PB 16P1)

Bidirectional Communication with input or output modules.
64 station address capability.
Up to 16 Power Input/Output modules per station.
50 Conductor Daisy-Chain cable connects all racks to host controller.
On-board station address select switch.

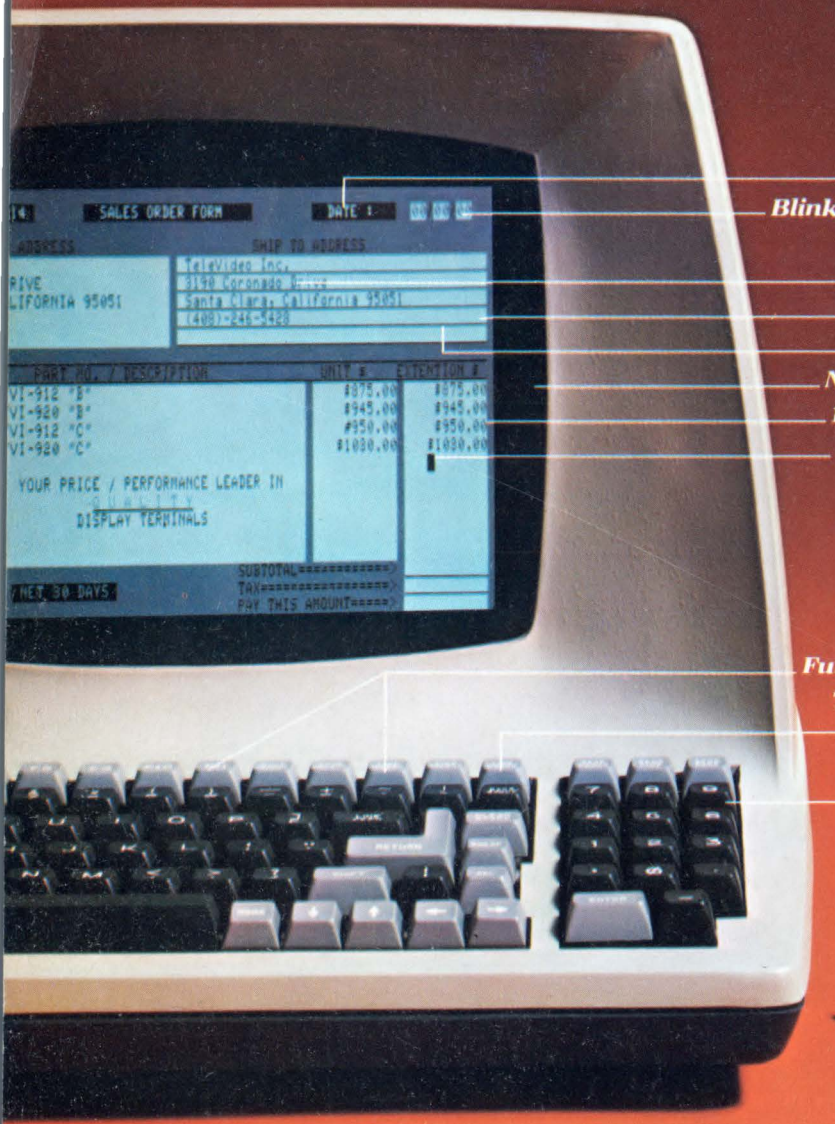
15272 Relay Circle, Huntington Beach, CA 92649
(714) 892-3313

opto 22

Another Opto 22 product available for immediate shipment.

Circle 80 on Reader Inquiry Card

COMPARE SMARTS.



Reverse video
Blinking/blank fields
Upper/lower case char.
Protected fields
Underlining
Non-glare screen
12 x 10 char. res.
Blinking cursor

- *9 Baud rates (75-9600 Baud)*
- *Self test*
- *Auxiliary port*

Function/edit keys
Typewriter/TTY keyboards
Numeric pad

Model 920C shown.

Feature-for-feature our smart CRT terminals cost less than *their* dumb ones. Much less. Compare smarts. Then compare price. You'll pick TeleVideo.

Four different models to choose from. Each with features you'd expect to pay extra for. But with TeleVideo, they're standard.

We put a lot of engineering savvy into our CRTs. Their modular design means high reliability. It also lets us build in high volume. And sell to you at low prices.

Find out how you can make your next CRT buy a smart one. Contact TeleVideo today for information.

Nationwide Field Service is available from General Electric Co., Instrumentation and Communication Equipment Service shops.

TeleVideo™

TeleVideo, Inc., 2149 Paragon Dr.
San Jose, California 95131
Phone (408) 946-8500

COMPARE PRICE.

CALIFORNIA Costa Mesa (714) 557-6095 • San Jose (408) 946-8500 • ILLINOIS Oak Grove Village (312) 981-1706
MASSACHUSETTS Boston (617) 668-6891 • NEW YORK/NEW JERSEY Paramus (201) 265-1321 • TEXAS Dallas (214) 980-9978
Circle 33 on Reader Inquiry Card