

If your label is printed in red, please see page 86 for details.

# Digital Design

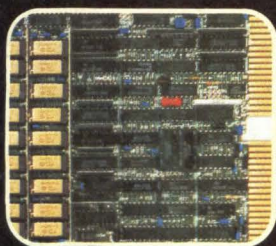
Computers • Peripherals • Systems

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Memory boards and boxes comprise one of the fastest changing segments of the computer industry. This showcase will help designers keep abreast of the latest entries from most major manufacturers.



## COMPAT™ Showcase 22

This "showcase" displays some of the products that are on exhibition at the September COMPAT™ show.



## The Computer Compatible Directory 44

Part Two: DEC, DG, IBM, P-E, HP, etc., compatible products are described. Categories include Display Terminals, Flexible Disk Drives, Packaging/Hardware/Backplanes/Enclosures, Printers & Plotters, Rigid Disk Drives, Services, Special I/O's, Tape Systems, Test Equipment/Instrumentation, Other, List of Manufacturers.

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Cover designed by Josh Randall

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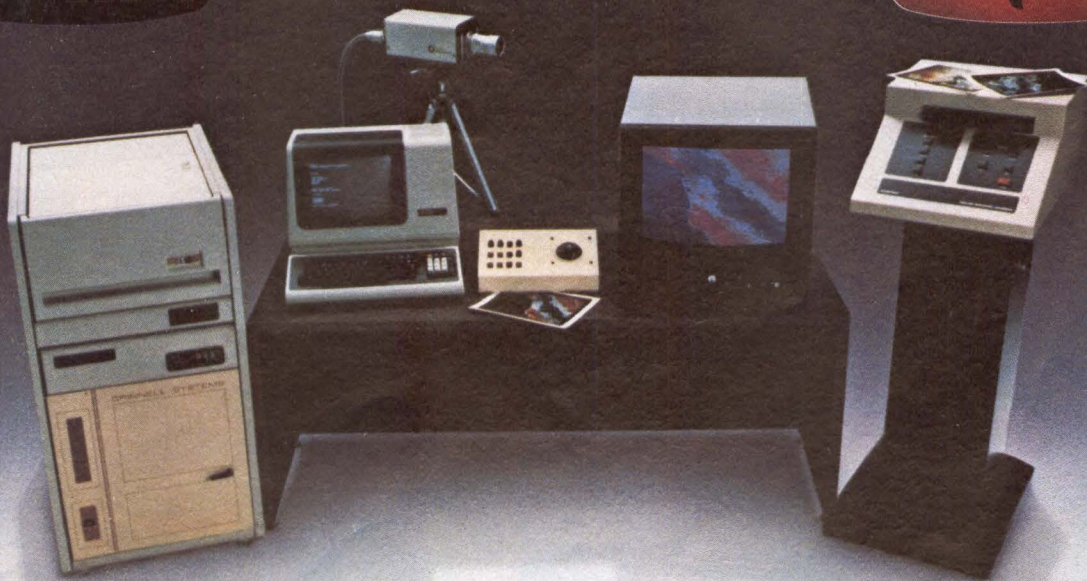
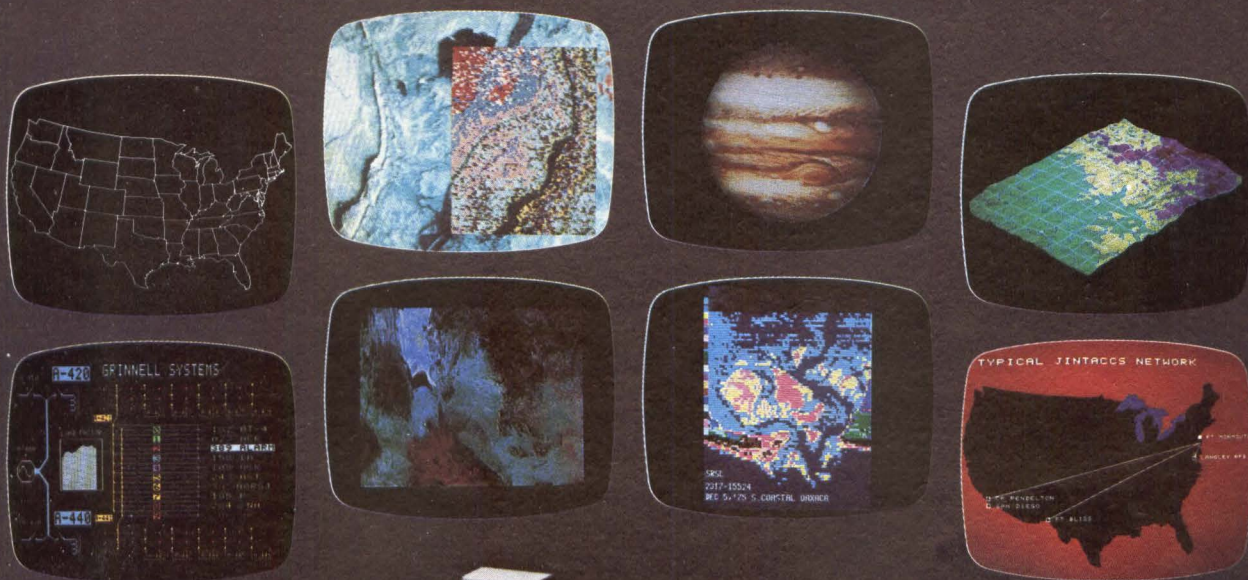
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**10½" B05 CHASSIS  
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NOW AVAILABLE.**



Another industry first from Dataram: The B04 chassis that lets you add TU58 capability to your LSI-11<sup>®</sup> configuration without buying two DEC<sup>®</sup> chassis (the 5¼" PDP<sup>®</sup>-11/03 and 5¼" TU58 subsystem). Now, with a single 7" B04 chassis, you can accomplish the same thing, saving space and money at the same time.

The B04 saves time and trouble, too, with its unique front-loading feature that gives you fast, easy access to the eight-quad-slot backplane through a

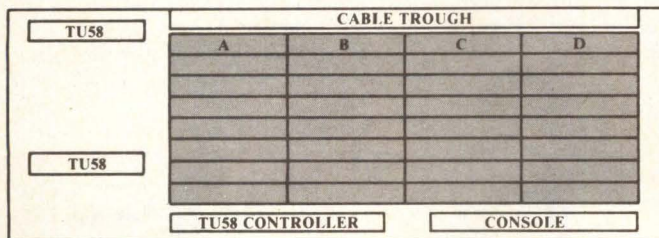
simple snap-off front panel. And when you use DEC's LSI-11/23 along with Dataram's 256KB single-board DR-113S in the B04 chassis, there's still a lot of 5.0VDC power remaining — 20 amps — to configure the rest of your system.

There's also a lot of innovative thinking in our B04 chassis — practical engineering that makes the LSI-11 Bus available on the A and B, and C and D connectors; an Operator's Console Unit that doesn't take up a valuable

backplane slot; and a trough that provides space for routing cables to the rear of the B04 chassis.

If you don't need TU58 capability, our B03 chassis provides these same features (less the TU58s) in a 5¼" alternative.

In addition to the B03 and B04 chassis, Dataram also provides LSI-11/2 and LSI-11/23 microcomputers; memory; cartridge disk, tape, and SMD controllers; and a wide range of accessories. Give us a call.



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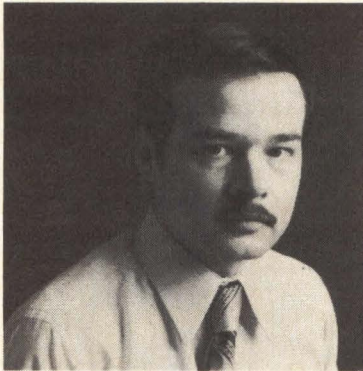
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## Requiem For The Programmable Calculator



by Paul Snigier, *Editor*

A powerful new engineering tool, the pocket computer, promises to more than merely displace the programmable calculator. Pocket computers, such as those sold by Sharp and Tandy, are only the beginning; in two years, we will look back on them as the initial and primitive forerunners of a new executive and engineering tool: the microworkstation.

Future pocket computers will evolve into "microworkstations" by adding such extra functions as calendars, tickler files, messaging, speech synthesizers (or tone generators), up-to-date product "manuals", algorithms to aid specific users or customers, humanized and interactive tutorial devices, language translators, limited speech inputting and ability to remotely access large data bases. These multifunction microworkstations — with mass memory and microprinter, modem and LCD displays (capable of limited graphics) — will easily fit into any briefcase with room to

spare. With lowered costs, microworkstations will quickly establish a phenomenal market when they begin to arrive in the mid 1980's.

They'll even challenge the post office by delivering text and limited graphics electronically via modem. With limited fax capability, microworkstations (together with intelligent copiers with high-end fax capability) will begin to compete with fax. By 1986, limited voice entry will program these units, thus circumventing inadequate keyboards.

By now you've seen ads for Sharp's PC-1211 pocket computer, which resembles Tandy's unit. The PC-1211 contains 1.9K of RAM, is programmed in Basic to run 40-line programs, and displays or enters 24 alphanumeric characters on its LCD matrix display and keyboard. It hooks up to a printer and loads and unloads programs with most cassette recorders. The display scrolls left or right and displays instructions asking for data or other user-prompting. It has 22 statements and 12 commands. Commonly-used commands and mathematical functions can be assigned to reservable keys, thus saving keying-in time.

Though I'd like to see more RAM and a few other features, these pocket computers are a quantum jump over programmable calculators. When in a program or learn mode, a programmable's sequence of keystrokes (instructions) creates the program. The instructions are limited, and memory is used up faster than expected. Many programmables are also limited in a single-step key sequence to portraying code digits that identify instructions.

For the pocket computer, Basic's advantage will clearly give it a competitive edge. It has no formatting worries, and writing in it is trivial (relative to writing, say, a PL/1 compiler). It is user-friendly and touts high learnability, since any software-ignorant MD, lawyer, high-school student, architect or non-electronics engineer can pick it up in a week or two.

What about Basic's inherent unstructurability, which is due to limited control structure set and lack of local variables? This is a problem for applications systems — not pocket computers. Basic's easy patching feature tempts programmers to add code and jump around bad code rather than edit — producing lucid (but sometimes strange) code that's incomprehensible three months later. Patching may be difficult with upcoming units.

Since scientists and engineers will be using pocket computers first, Basic's letter and alphanumeric identifiers lend themselves more to formulas than do existing programmables. There is a lack of user-defined external procedures. Altering a file, data item or procedure affects every program in that system. If all variable names are accessible by the main program and its subroutines (global variables), then keeping track of control flow increases oversights. But, in a pocket computer, there is no problem.

Basic is streamlined; its minimal control or data structure (array), short identifiers, easy typability, interactivity and problem-solving nature make it well-suited to the pocket computer. It's also a market environment suited to pocket computers writing 80-line Basic programs. These small and infrequently-run programs will never be intended for larger systems with their shared data. And, slowness is no disadvantage. Despite the need for main storage, upcoming mass memory devices (such as 256-K RAMs) make the pocket computer and the microworkstation a sure bet. Whatever direction pocket computer evolution takes, one thing is certain: a large market is about to open. D

*Paul Snigier*



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SEPTEMBER 1981 Digital Design 5

## Designing With A Dot-Matrix Printer

Low cost computers, CRTs and communications have opened vast new market opportunities. New applications now demand hard copy output for uses such as customer receipts, permanent records for IRS or product quality assurance and other "convenience" requirements. For this reason, printer mechanisms are becoming integral parts of most electronic data processing and communications equipment.

Besides the large-format document printers utilized by the manufacturers of data processing equipment, the major markets for printer mechanisms are the manufacturers of POS terminals, electronic cash registers, medical instruments, data logging equipment, banking terminals, lottery systems, weighing systems, personal computers and various test and "special purpose" instrumentation.

In most of these and similar applications, the small integral printer mechanism is incorporated into the data terminal or instrument. In this area of small printers, 20-40 columns, product designers must consider a variety of printing technologies, electronic interface, physical size, serviceability.

Four types of printing technology are available to the designer requiring a small printer: fully formed character impact (drum), impact dot-matrix, thermal dot-matrix and electrosensitive dot-matrix. The advantages of the impact-type printers, the fully formed character and the dot-matrix, are that they can produce multiple copies and use ordinary paper (far less costly than electrosensitive and thermal papers). The advantages of the dot-matrix printers are the flexibilities of character set, character font and character size. Only impact dot-matrix printers possess all the above advantages.

Dot-matrix impact printers have achieved popularity among designers and end users. This popularity is due to greater versatility and use of standard paper rolls, ticket forms, and multiple paper. Unlike electrostatic and thermal printing methods, impact-printed documents produce readable copies that do not fade or darken with age.

Printing speed — frequently a design concern — of dot-matrix impact printers is up to 200 cps, which is sufficient for most terminal applications.

### operating principles

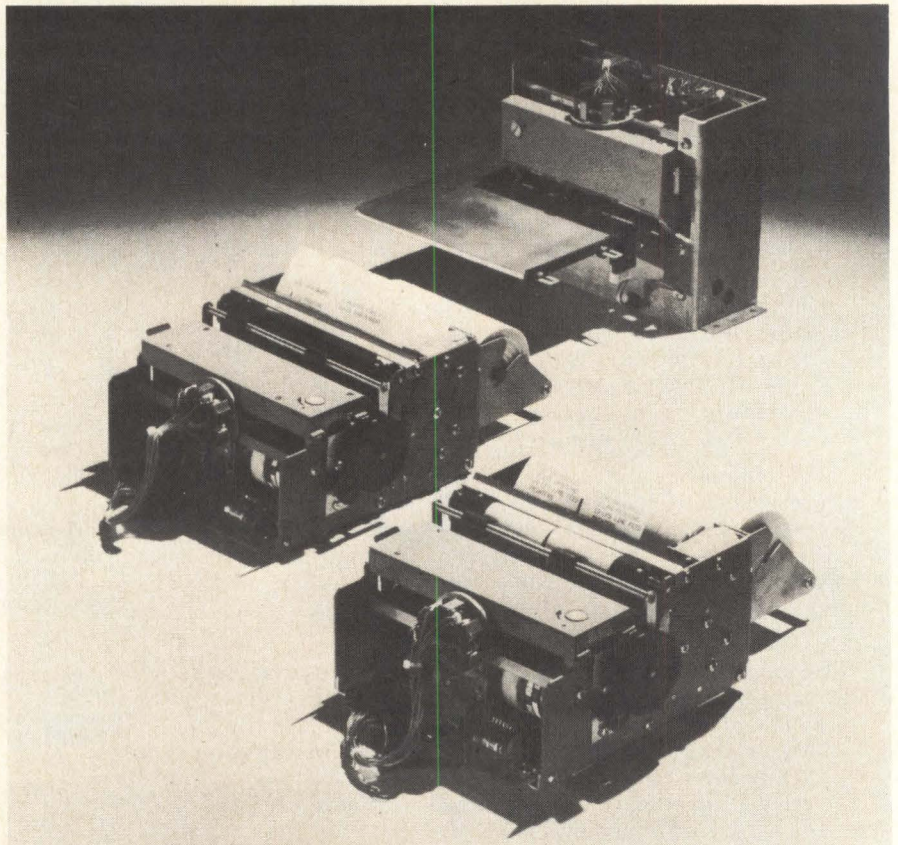
Dot-matrix impact printer operation is based on the activation of print wires or needles in a printhead to create characters on a medium — paper rolls, form or ticket. Generally, the characters are formed serially as solenoids and activate the wires in accordance with information provided by a host computer or microprocessor. Actual impressions are rendered by an ink ribbon onto paper. Unlike drum, chain, belt, or other fixed font printers, there is no limit to the number and font variations of characters that can be formed in this manner at high speeds. With appropriate input, a dot-matrix

printer can now combine different fonts, sizes, and even graphics on a single line.

Field-replaceable printheads now have a life exceeding 100 million characters, and the overall printer-mechanism MTBF is 10 million cycles. Printer mechanisms combine speed, reliability and cost effectiveness.

### design considerations

When including a dot-matrix impact printer mechanism in a data terminal or similar piece of OEM equipment, a few simple, yet critical, product features should be kept in mind. Certainly, physical dimensions and cost must be considered. More serious, long-term consequences are reliability and ease of service. Once equipment is installed in geographically dispersed and remote locations, costs of maintenance and



The Eaton M-4 family of dot-matrix impact printer mechanisms includes a document printer, a 40-column, single roll unit, and a split paper feed printer. The small integral mechanism is incorporated into the data terminal.



service quickly and significantly outweigh any variances in the initial product costs of printer mechanisms. To this end, many designers look for operational simplicity of print mechanisms.

Simplicity can be seen in many print mechanisms. Rather than drive belts, cables, bi-directional motor drives, and complicated ribbon mechanisms and paper advance systems, Eaton, for example, introduced a unidirectional, double helix drive cam and simple, independent ribbon cartridge and paper system which involves a minimum number of moving parts (and potential failure points).

A single continuous helical slot runs the length of the cylinder with two primary sections displaced by 180°. Using a guide pin, the printhead runs first in one direction and then the other. As the cylinder rotates, the motor continues to run in one direction only. Thus, a single-direction d.c. motor drive can be used without additional components required for bi-directional drive. Beyond simplicity, the double helix cam also affords notable constancy in speed.

Furthermore, drive motor speed is controlled to eliminate need for clock signals (although they are included as Eaton's alternate means of character generation or graphics). Clock signals enhance resolution by generating improved dot-to-dot accuracy. It is important, however, to note that in the move toward simplification, the need for clock signals has been eliminated for most applications.

Printers that feature integral motor drive and speed control electronics eliminate sizable design engineering expense and time for the OEM designer and equipment cost. Simplicity of design and construction methods also are important to OEM designers. List of components should be ideally reduced so the whole device can be assembled with just two screwdrivers. That suggests a sizable advantage for the manufacturer in terms of cost factor and production ease, but it is also an end user plus in terms of virtually maintenance-free operation and inexpensive repair.

### compatibility of inputs

Inputs to a print mechanism are analog in nature; i.e., solenoid drivers, motor drivers, etc. and are usually unique to a given vendor and model. Eaton adopted a family approach to print mechanisms, allowing designers to accommodate a customer's need for a variety of printer

types in the same terminal. For example, the same POS terminal could be fitted with a ticket, single-roll or split-paper feed printer with no change in the electronic input from terminal to printer. This feature saves the OEM time and money and allows him to accommodate special customer needs without excessive special changes.

### installation

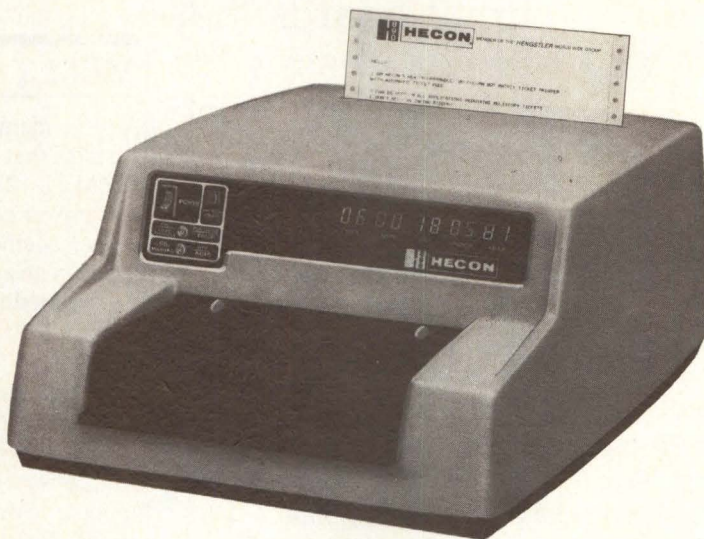
One of the real strengths of quality dot-matrix print mechanisms is that they can be installed in virtually any attitude

except for those imposed by paper supply. After mounting, the only adjustment required is the head-to-platen gap on the Eaton M400 ticket printer. Maintenance is limited to periodic cleaning and lubrication. Normally such maintenance can be accomplished by relatively unskilled customer personnel.

by Joe Dennis

Eaton Corp., Count Control/  
Systems Div., Riverton Printer  
Products Plant, Watertown, WI

## The Hecon with the Hopper.



The Hecon A0542 impact dot matrix ticket printer with hopper feed. Load up to 75 tickets in the easily accessible hopper. When you are ready to print, the A0542 automatically feeds, prints and transports the ticket for removal. You can even reinsert a ticket for additional printing thru the unique reprint feed slot.

The highly visible Time and Date feature is standard and can be printed with a single command.

The A0542 can print the 96 character ASCII set bidirectionally at 120 characters per second. The standard print head is rated at 200 Million characters minimum for long, dependable service.

It's got to be good. It's a Hecon.



Hecon Corporation, 31 Park Road, Tinton Falls, NJ 07724  
• (201) 542-9200

## Add-In/Add-On Showcase

circuit boards that  
slip into the chassis (or  
into expansion cabinets).

*All manufacturers of board memories who were contacted have not responded by publication date and some did not send complete product descriptions. They will be included in a more comprehensive listing in the next MEMORY SHOWCASE we run. Meanwhile, if you are a manufacturer of add-in board memories and have not been listed, please send us a description of your product for our files.*

*Shown here are only one new or most popular product for each company. Every manufacturer has a catalog of many other products they make. Information on those other products can be obtained by writing to them.*

### 1816 CMOS

8 or 16K words storage memory with on-board battery. Compatible with LSI-11/2 and LSI-11/23. Battery allows user to turn off power for long periods of time — up to a full 168-hour week (at normal temperatures), and still maintain the data in the memory. Uses only one slot due to its standard component height. Configuration switches are accessible even when board is plugged into the rack.

**Adac Corp**, 70 Tower Office Park, Woburn, MA 01801.

Circle 274

### 32 kB to 2 MB Add-In Cache Memory

Fast parity and upgrade memory for Q-bus, Unibus and Mass Bus systems.

**Advanced Digital Products**, 7584 Trade St, San Diego, CA 92121.

Circle 270

### MEM 11-128

Add-in memory board (256 KB). For use in LSI-11/23 systems that can utilize memory in excess of 64 KB. The MEM 11-128 offers more compactness (1 card); less cost; less power consumption. Plugs directly into Q-bus backplane. Memory chip is 64K×1 dynamic RAM. Entire memory array socketed for easy maintenance and upgrade.

**Andromeda Systems, Inc**, 9000 Eton Ave, Canoga Park, CA 91304.

Circle 226

### MCM-8080

Multibus compatible add-in non-volatile RAM memory module. For 8080 computers. Storage capacity: 16,384 Bytes. Read access: 325 ns; read restore cycle: 780 ns; clear write cycle: 1240 ns. TTL compatible. 86 pin double-sided printed circuit edge connector. 0.156" contact center. Alternative of SBC's -016, -046, -416, NDS-016. Interfaces directly with System 80 computers.

**Ampex Corp**, Memory Products Div, 200 N. Nash St, El Segundo, CA 90245.

Circle 227

### The Cache

8 KB Cache/434 (and 440). Industry's first 8 KB cache memories for the PDP 11/34, -11/34A and PDP-11/35 and -11/40. Requires no additional backplane space. Easy to install. Contains 8192 Bytes high speed memory. Implemented on a pair of dual-width modules. Monitors both address and data parity. Two activity indicators give visual display of cache operation. A green LED indicates hit rate (the more reads from cache, the brighter the light). A red LED indicates cache error.

**Able Computer Co.**, 1751 Langley Ave, Irvine, CA 92714.

Circle 228

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## M-Core

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Solid state non-volatile memory available in 1/4MB increments.

**Alpha Data Inc, 20750 Marilla St, Chatsworth, CA 91311.**

**Circle 264**

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## SMS-35315

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128K 9-bit words. Memory modules completely compatible with WANG MVP, VP and LVP memory boards. Detects parity errors on incoming and outgoing data. Parity errors are stored in memory array and are indicated by card edge LED indicators which can be manually reset. Read access time: 400 ns; write access time: 470 ns; R/W cycle time: 660 ns. Data input 18 lines; output, 18 lines.

**Automated Control Systems, Inc, 1801 130th NE Suite 4, Bellevue, WA 98005.**

**Circle 229**

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## 6502 DM

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32K RAM. Compatible with a 6502 CPU-based processor (KIM, PET, AIM, or SYM) which operates at 1.2 MHz. Memory sizes available: 32K, 16K or 8K organized in 4K blocks. Inputs buffered with ILS TTL load. Interface to memory board requires only +5 VDC power. Power dissipation is 4 watts, maximum.

**Beta Computer Devices, 1230 W Collins Ave, Orange, CA 92668.**

**Circle 302**

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## MAC-111

---

ROM/RAM CPU memory boards. Handles up to 16 KB of RAM 8-bit word size. 450 ns access time. +5 V, 1.8 A.

**BK & Associates, 11891 Martha Ann Dr, Los Alamitos, CA 90720.**

**Circle 231**

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## 6256-D

---

Add-in memory. Compatible with DEC PDP-11/40. Offers flexible expansion. Available in 64 KB increments to 256 KB. For troubleshooting or configuration procedures.

**Braegen Minicomputer Peripherals Div, PO Box 3320, Anaheim, CA 92803.**

**Circle 263**

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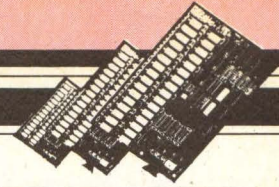
## Bubbl-Tec™

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A non-volatile solid-state magnetic bubble memory. Ideal for mass storage applications. Entirely contained on one or two PC boards that plug into present systems — no extra chassis required. Uniquely ideal for harsh conditions. Low power requirements (around 20 watts). Very fast access time; less than 7.5 ms to first byte. Wide range of compatibilities.

**Bubbl-tec, Div of PC/M Inc, 6800 Sierra Court, Dublin, CA 94566.**

**Circle 285**



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## 2065

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Dynamic RAM board. 64K. Supports memory expansion to 512K through its bank-selection system. Berg jumpers allow selection of the board's bank and the bank port's address. Any 16K block can be made bank-independent or be disabled while all 64K can be set to come up bank-enabled on reset and power-on.

**California Computer Systems, Inc, 250 Caribbean Dr, Sunnyvale, CA 94086.**

**Circle 305**

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## B1020

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Multibus dynamic RAM board. Sizes: from 32K to 128K. Parity checking standard. Full 24 bit address bus. Full Multibus compatibility. 330 ns access time; 430 ns cycle time. Physical size: 6 3/4" x 12".

**Central Data Corp, 713 Edgebrook Dr, Champaign, IL 61820.**

**Circle 233**

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## CI-1123

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Dynamic memory system. For DEC 11/23. First and only memory, says company, to place the full complement of memory, 256 Bytes (128K words by 18 bits) on a single dual width board. Replaces the need of the standard 4 dual width board requirements necessary for populating a PDP 11/23 with its full complement of memory. Frees critical backplane space and reduces substantially the system power requirements. 4 MB address field (22 address lines). "No need to worry about obsolescence when PDP 11/23 is upgraded in near future to address this amount of memory. Generates a check parity. Access time of 240 ns; cycle time of 400 ns. Single 5 V power requirement; battery backup."

**Chrislin Industries, Inc, Computer Products Div Inc, 31352 Via Colinas #102, Westlake Village, CA 91362.**

**Circle 319**

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## Micro Stor-11

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Add-in memory for DEC LSI 11/02-03-23 systems. Expands main memory. "First dual sized" LSI-11 compatible memory card to feature highly reliable 16K Dynamic RAM construction and achieve 64K word density. (Double the density of standard DEC memory.) Storage capacity 16K, 32K, 48K or 64K words. On board parity. Refresh options, provision for halting backup. I/O page select — 2 KW or 4 KW. Write access time: 100 ns; read access time: 145 ns.

**Cambex Corp, 360 Second Ave, Waltham, MA 02154**

**Circle 235**

**MR80**

NMOS version, 16K or 32K. CMOS version, 8K, 16K or 32K. Multibus memory static RAM, power fail interrupt, logic battery backup for CMOS versions, 8 or 16-bit operation. 86-pin edge connector.

**Comark Corp.**, 257 Crescent St, Waltham, MA 02154.

Circle 269

**VRL 11**

Up to 16 KB or 2716 type EPROM or pin compatible RAM in any combination on a dual width board. On-board programming directly from file or keyboard with no software wait loops required. The unit operates with standard +5 VDC and +12 VDC power available on LSI-11 bus. Addressing and bank enabling is done via on-board DIP. Switches in 2K word increments to 128K. The VRL 11 is software and hardware compatible to LSI-11, -11/2, -11/23, and PDP-11/03.

**Computer Extension Systems, Inc.**, 17511 El Camino Real, Houston, TX 77058.

Circle 236

**94144**

Semiconductor memory. Add-in memory board for DEC's PDP-11/44. Includes ECC, 64K×39, 128K×39, 256K×39. Read cycle time: 525 ns; write cycle time: 900 ns. Battery backup.

**Control Data Corp.**, Computer Memory Div., 8001 E Bloomington Freeway, Bloomington, MN 55420.

Circle 275

**CCS-1120**

8K words EPROM Module. A R/W switch is provided to set the card in program mode and disable programming when set in Read-Only mode. Allows programming of any memory location, individually, sequentially or randomly under software control.

**Control Logic Inc.**, 9 Tech Circle, Natick, MA 01170.

Circle 266

**9637**

16 KB static RAM. Non volatile. Module designed for compatibility with the EXORCISOR-Micromodule  $\mu$ P bus. Utilizes byte-wide CMOS static memory devices that are supported by batteries for data retention during power transitions. Devices can be removed from system and transported without loss of data. Batteries will last for 3 years and so will data retention.

**Creative Micro Systems**, 11642-8 Knott St, Garden Grove, CA 92641.

Circle 237

**720**

Memory expansion unit. Memory parity. Memory protect. Multiply/divide options available. Fully compatible with DG operating system software. Easy installation in new or existing systems. Memory management option is required to support memory sizes above 32K words.

**Custom Systems, Inc.**, 6850 Shady Oak Rd, Eden Prairie, MN 55344.

Circle 278

**CDM-77/03R**

A high density memory board for the DEC LSI-11/03-/23. The device features up to 256K bytes on a dual height card. Addressing to 22 bits allows the use of up to 4MB of main memory with an LSI-11/23 CPU. Standard features include on-board transparent refresh, delay line timing for optimum reliability, switch selectability for starting and ending addresses, extended boundary for an additional 4 KB in the I/O page and 75% less power dissipation.

**Cyberchron Corp.**, PO Box 164, Garrison, NY 10524.

Circle 281

**RM-117**

Dual port memory. 1MB virtual spaces — 65K Map per port. 16K R/W on board memory. 16 or 20-bit port address bus. Automatic 20-bit address. Translation for 16-bit memory address. Dual processor ports — complete control and contention logic. Allows two independent Multibus ports to share access to a common memory area.

**Datacube SMK Inc.**, 670 Main St, Reading, MA 01867.

Circle 279

**8688 / 8689**

RAM/EPROM memories. Extends PROM-able capabilities to the microNOVA MP/200 computer. No. 8316 provides the capabilities of a portable memory.

**Data General Corp.**, Rt 9, Westborough, MA 01581.

Circle 238

**Diagnostic Module**

A set of PROMs that provides power-up diagnostics and bootstrap code for DEC LSI-11/2 and -11/23 processors. Previously the alternatives have been to purchase the DEC bootstrap/diagnostic module, BDV-11, or to exclude power-up diagnostics. For users who have chosen not to use BDV-11, Dice has introduced a set (2) of 512 Byte PROMs which replaces the present bootstrap PROMs on the MX V11-A Multipurpose module.

**Dice Systems, Inc.**, 7½ Harris Rd, Nashua, NH 03062.

Circle 239

**DR-144S**

1.0MB Semiconductor add-in for DEC's PDP-11/44. The

# WESTREX

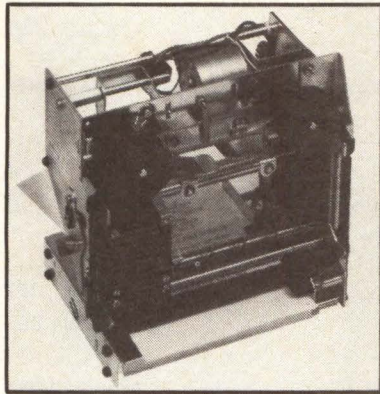
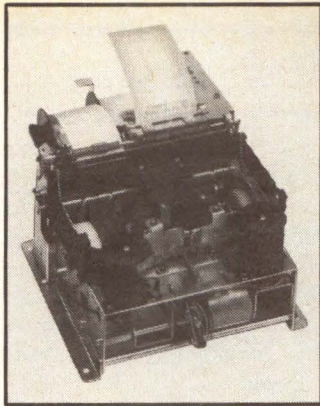
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INTRODUCING  
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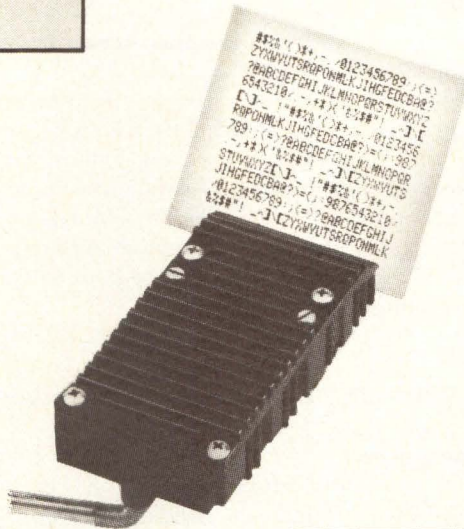
### MODEL 820 SPLIT PLATEN PRINTER

- Various Platen Splits
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- Paper-Supply and Take Up
- Logo Printing
- Automatic Receipt Cutter



### MODEL 840 SLIP/DOCUMENT PRINTER

- Up to 40 Print Columns
- Large Clear Print
- Side or Front Form Insertion
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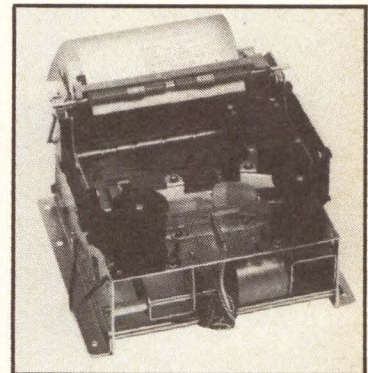
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### MODEL 801 LOW PROFILE, LOW WEIGHT, PRINT HEAD:

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- Low Power Consumption
- 100% Duty Cycle
- 100 Million Character Life

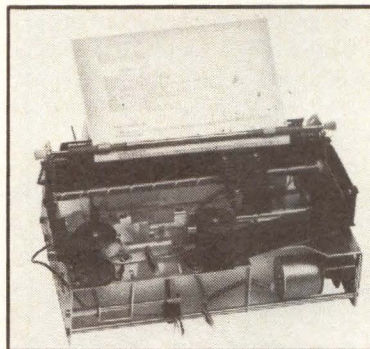
WESTREX 800 Series of alphanumeric bi-directional printers include split platen printers, flat bed slip/document printers and 51 to 96 column journal printers in a variety of standard models to suit a wide spectrum of OEM applications. All WESTREX 800 Series printers utilize the same simple, reliable drive system, head position sensors, ribbon transport mechanism and other quality tested components for maximum cost effectiveness.

*Basic models illustrated on this page are obtainable with various options to suit your application needs. Data sheets with technical specifications for each of these products are available upon request.*



### MODEL 850 JOURNAL PRINTER

- 51 Print Columns
- Integral Paper Supply Holder
- Easy Top Paper Insertion
- Document Validation Capability



### MODEL 880 JOURNAL PRINTER

- Up to 96 Characters Per Line @ 12 CPI
- Bi-Directional Printing
- Standard & Graphic Feed
- 576 Print Dots Per Line



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## WESTREX OEM PRODUCTS

1140 Bloomfield Ave., West Caldwell, N.J. 07006 (201) 227-7290  
IN FRANCE — WESTREX OEM PRODUCTS, 103-107 Rue de Tocqueville, 75017, Paris, France 01-766-32-70  
IN SWEDEN — WESTREX OEM PRODUCTS, Box 3503, S-17203 Sundbyberg, Sweden 46/8+981100

Circle 8 on Reader Inquiry Card

only PDP-11/44 add-in on the market which exceeds 1/4MB with 16K RAMs. Other capacities available: 256 KB, 512 KB and 768 KB. Company's design boasts a unique mechanical package. Mother board (only board which interfaces to the Unibus) contains the overhead electronics. Therefore, maximum capacity of 1.0MB is cost effective. With two DR-144S modules, maximum capacity of PDP-11/44 is 2.0MB as opposed to the 1.0 MB limitation using DEC-supplied modules.

**Dataram Corp**, Princeton Rd, Cranbury, NJ 08512.

Circle 314

## Memory Board

Complete line of memory boards compatible with DEC and DG.

**Digital Data Systems, Inc**, 1551 NW 65th Ave, Plantation, FL 33313.

Circle 271

## MSV11-LF

128 KB module is Digital's first product using 64 KB RAM memory technology. Another module in the series is the MSV11-LK, which is 256 KB. Both products (for the LSI-11/23) feature byte parity. The new memories offer on-board refresh capability and either 18 or 22-bit address decoding. The modules include a control and status register that permits isolation of memory faults and provides software compatibility with DEC's OS's. Both modules are claimed to offer a combination of compactness and high data integrity for the LSI-11/23.

**Digital Equipment Corp**, Maynard, MA 01754.

Circle 283

## RVM-128

Memory expansion module. Plugs into peripheral slot of any model PDP-11 (from 11/04 to 11/70). "A restoration kit for rejuvenating tired, old PDP-11s or LSI-11s," says company. Operates on standard +5 V levels. A parity option is available. Requires no special power supply. Provides PDP-11 users with low-cost memory expansion.

**Digital Pathways Inc**, 1260 L'Avenida, Mountain View, CA 94043.

Circle 322

## MB 8167

A high-speed +5 V only 16K static RAM. Pin compatible with Intel's 2167. Has an access time of 70 ns and is fully static operational. Maximum power consumption is 180 mA. Separate data input and output. TTL compatibility. Three-state output with OR-tie capability. Chip select for simplified memory expansion and automatic power down.

**Fujitsu Microelectronics Inc**, 2945 Oakmead Village Ct, Santa Clara, CA 95051.

Circle 326

## GMS6505

65K×9 dynamic memory module. It is addressable in segments, offers parity generation and check and has on-board refresh. Also features write protect, over voltage and reverse polarity protection. Allows users to address multiple 65K memory banks. Selectable speeds, extremely low power consumption and direct compatibility with 6500/6800 families. Four 16K arrays addressable in 4K increments. Each array can be write protected. A 9th bit in each byte stores data for on-board parity generator and parity check.

**General Micro Systems Inc**, 1320 Chaffey Ct, Ontario, CA 91762.

Circle 308

## MSV11

64 KB Memory Board. General purpose memory card for LSI-11, 800 ns access time, 500 ns cycle time. 32,768×16 bit capacity. 18 address lines. Switch selectable configurations. Uses one dual height Q-bus module slot.

**General Robotics Corp**, 57 N Main St, Hartford, WI 53027.

Circle 332

## 8112

8K RAM. 24-pin device. Standard or low power versions. Pin to pin compatible with GTE's 2716 EPROM. 8112 can be used in software development to improve turn-around time "by eliminating the time-consuming steps of erasing or reprogramming." A detached write function unit allows data-in to be controlled by the write enable function.

**GTE**, 2000 W 14th St, Tempe, AZ 85281.

Circle 316

## HM6116

CMOS RAM, 2K×8. Pin compatible with byte organized industry standard EPROMs. NMOS high bit densities and CMOS low power dissipation. Device has an address access time of 120 ns. Power dissipation during operation is 180 mW; 100 mW during complete standby.

**Hitachi America Ltd**, 1800 Bering Dr, San Jose, CA 95112.

Circle 246

## AM Series

A complete line of add-in memory products for the entire line of Hewlett Packard's 9800 series desk top computers. All the memories in the series are warranted for one full year. Both the dimensions and color coding are similar to HP so installation is identical as well as simple. More than 1,000 systems owners have already installed Infotek memories in their HP 9800 series desk-top computers. Easy to follow detailed instructions are included and the only required tool, a Phillips screwdriver, is included.

**Infotek Systems**, 1400 N Baxter St, Anaheim, CA 92806.

Circle 286

# You should hear what **PASCAL PDQ-3™** users are telling us!

## "FAST, EXPANDABLE, ECONOMICAL!"

- One happy user rated the PDQ-3 up to 6 times faster than a LSI-11\* based system in the development of the LISP Compiler.
- Another user rated the PDQ-3, up to 20 times faster than the APPLE, while running a Financial Planning Software Package he is marketing.
- A third user reported that the PDQ-3 required only one and one-half hours to reformat the text of a 200 page manual. He estimated a savings of three and one-half hours over another popular microcomputer.
- In a Recursive Quicksort comparison, for example, the PDQ-3 was matched against the TERA version of the LSI-11 and the INTEL 8080. This benchmark generates a list of 10,000 random numbers, which it sorts using a process of array indexing, integer arithmetic, comparisons and procedure calls. The INTEL 8080 took 316 seconds; the TERAK required 198 seconds; but the PDQ-3 took only 44 seconds to sort the entire list.
- The PDQ-3 benchmark comparisons are available in print on request. They include tests for Transitive Relations, Floating Point Add/Subtract and Multiply/Divide, Transcendental Functions, Task Switching and many more.



## EXPANDABLE

Options available:

- Backplane expandable to 8 Slot Quad size
- Expandable to 128KB Memory
- Double sided, double density floppy disc drives
- Hard disc drives up to 300MB
- Mag Tape Drives up to 75 IPS
- Printers up to 300LPM
- Abundant communication capability
- Unlimited LSI-11 "Q-Bus" Options

## ECONOMICAL

The PDQ-3 Computer Systems consist of:

- A Processor card containing a 16 Bit Stack Oriented Processor
- Real Time Clock
- Fully Interrupt Driven Interval Timer
- DMA Floppy Disc Controller that can be ordered with Single or Double Density
- Multiplexed CRT and Printer Interface
- Two 8" Floppy Disc Drives
- 4 Slot Quad size LSI-11 "Q-Bus" Backplane
- Complete UCSD Pascal Software Operating System Complete System for under \$7900 (includes Z-19 terminal). Call or write now to:



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Educational Discounts and OEM pricing available

Circle 9 on Reader Inquiry Card

### IMS 1400

16K Static RAM. Fastest available (45 ns) high speed device. Maximum power dissipation of 600 mW. Housed in a standard 20-pin 300-mil-wide package. Requires only a single 5 V power supply. All inputs and the output have direct TTL compatibility. Memory has equal access and cycle time (40 ns max).

**INMOS Corp.**, PO Box 16000, Colorado Springs, CO 80935. **Circle 347**

### IMC-3

Add-in memory for DG Nova 3 computer. Up to 128K words on a single card. Boards available for other computers.

**Intersil Systems Div.**, 1275 Hammerwood St, Sunnyvale, CA 94086. **Circle 273**

### MU-5780

Add-in memory for the VAX-11/780. Plug in memory card comes in either 512 KB or 1024 KB versions. Module is organized as 64K or 128K words of 72 bits each. Typical

READ cycle and access times are 530 and 250 ns. Can be used to expand basic VAX 11/780 memories up to 4MB.  
**Intel Corp.**, 1302 N Mathilda Ave, Sunnyvale, CA 95086. **Circle 248**

### 256 KB MOS

Low power, single board 256 KB MOS memory for Perkin-Elmer 7/32 computer. Contains error correction and logging.

**Macrolink.**, 1150 E Stanford Ct, Anaheim, CA 92805. **Circle 276**

### MM1103/2

A 16,384 word, 16-bit per word core memory system. Designed and developed as an enhancement or replacement memory for DEC's LSI-11. Cycle time: 1.2 ms; access time: 400 ns. Expandable in 4K memory blocks up to 128K. Input is TTL compatible.

**Micro Memory, Inc.**, 9436 Irondale Ave, Chatsworth, CA 91311. **Circle 272**

### IM 1680

Intelligent memory board. 16K of static RAM and sockets

# Quality Costs Less . . . with the Eaton 7000+ Printer

#### Costs less to buy.

Purchase price of the Eaton 7000+ Dot Matrix Impact Printer is less than most industrial stand-alone printers — but the built-in quality and reliability are what really make it a value investment.

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Prints on any regular roll paper with widths of .750 to 3.875 inches. No expense of special treated paper to buy and stock

#### Costs less to maintain.

Designed with a minimum of moving parts, the 7000+ requires little maintenance. Unique long life printhead boasts 100 million character life for dependable operation.

Designed for application in a wide variety of industrial and commercial fields — wherever hard copy information is needed. Ideal for printout of manufactur-



ing records, quality control test events, mailing lists, time-cost-quality information, or other data from a micro-processor or mini computer sources. Optional interface cables for serial RS 232, IEEE interface, current loop, or parallel interface. Capable of receiving

data at 110, 150, 300, 600 or 1200 BAUD.

High speed operation of 1.25 lines per second provided by unidirectional printing. Also available with a fast paper feed option for increased throughput.

#### Print versatility.

Single width font of 40 columns at 12 characters per inch or 20 columns at 6 characters per inch with a double wide font are standard, 64 columns at 19.2 characters per inch and 32 columns at 12 characters per inch optionally available.

For additional technical information, call or write: Eaton Corporation, Printer Products Operation, Riverton, WY 82501. Phone: 307/856-4821

**EATON** Printer Products

Circle 10 on Reader Inquiry Card



for 8, 2716 EPROMs interfaced to Intel's Multibus. Intelligence derived from on board Z80 processor. Devices can be used as regular memory or on board Z80 can process data in parallel with the Multibus Master. Several boards can be used in a system to increase memory capacity.

**Microsignal Co.**, 3704 State St, Santa Barbara, CA 93105. **Circle 349**

### MSC 4804

A 256 KB dual-height memory system. Fully compatible with LSI-11 processors. 22-bit addressing capability (up to 4 MB). Configured for DEC compatible battery backup operation. 256 KB on a single dual-height module. Parity generation, checking and storage standard.

**Monolithic Systems Corp.**, 84 Inverness Circle East, Englewood, CO 80112. **Circle 328**

### MK 8024

Add-in memory board. Offers low power dissipation. Has 128Kx22 capacity. Hardware and software compat with DG Eclipse. Three error correction options and on-board LEDs allow analysis at RAM level while running the diagnostics.

**Mostek Corp.**, 1215 W Crosby Rd, Carrollton, TX 75006. **Circle 315**

### System 3000

General purpose mass memory system. 1MB to 32MB of dynamic RAM with a unique error correction scheme for a single bit error correct and double bit error correct. Block transfer rate of 64MB per sec. is achieved through an efficient bus architecture. Three interface slots are available to adapt the System 3000 to any application. By including an MC 68000 intelligent user card the memory system can handle those data formatting routines which normally interface with the host's main task.

**Motorola Inc.**, MOS IC Div, 3501 Ed Bluestein Blvd, Austin, TX 78721. **Circle 252**

### NURAM

An inexpensive large RAM memory for DEC Unibus systems. Built-in self diagnostics and self-maintenance. 2, 4 or 8MB of auxiliary memory. Emulates DEC's RS 04 fixed-head-disk subsystem. High field reliability. 16 spare RAMs per MB can substitute a good RAM for a failing RAM "on the fly." Access time 2ms. Transfer rate 500 KB/second.

**National Semiconductor Corp.**, 2900 Semiconductor Dr, Santa Clara, CA 95051. **Circle 253**

## LSI-11 SERIAL INTERFACES

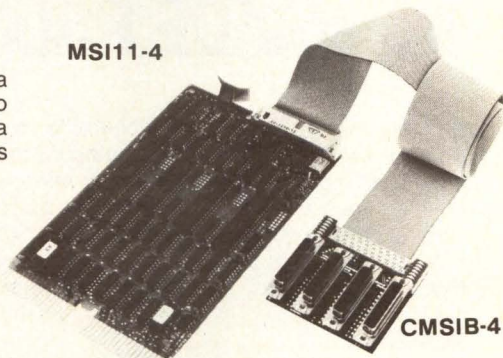
THE MSI11 SERIES - AN ALTERNATIVE TO THE DLV11-J

The MSI11 series of Multiple Serial Interfaces from Andromeda offers the Q-Bus user a variety of ways to connect serial devices to an LSI-11 system. These include 1, 2, or 4 serial channels on a dual-width card; and the MSI11-P series has 2 or 3 serial channels combined with a parallel printer interface, also dual width.

### COMPARE THE FEATURES:

- Low Cost: the MSI11-4 is only \$500, quantity 1
- 16 Data Rates: 50 baud to 19,200 baud including 110 bd. and 134.5 bd.
- Data rates are selectable on the board by jumper plug or remotely by DIP-switch, without wire-wrapping
- RS232 and 20ma current loop interfaces are provided for all channels, without external hardware
- Q-Bus address and interrupt vector selection are by plug-in PROMS, more flexible and independent
- Hardware handshake for serial printers is an option
- Cable cost is low too: a 4-channel cable assembly, like the CMSIB-4, is only \$115

MSI11-4



CMSIB-4

Andromeda provides a large selection of LSI-11 related products; contact us for details

LSI-11 is a trademark of the Digital Equipment Corp. Wire-Wrap is a trademark of the Gardner-Denver Corp.

**ANDROMEDA SYSTEMS INC.**

9000 Eton Ave.  
Canoga Park, Calif. 91304  
Phone: (213) 709-7600  
TWX: (910) 494-1248

Prices are domestic U.S.A. only.

Circle 11 on Reader Inquiry Card

### BP 0200

CMOS RAM Board. Maintains data during power outages. Has 16 KB R/W memory, on board batteries and battery charger, 7 days continuous battery backup, memory deselect in 2K byte blocks. A memory inhibit allows paging of 2 or more boards to the same address block. Supports both 16 bit and 20 bit addressing with data retention for 168 hours after removal of +5 V bus power.  
**NEC Microcomputers, 173 Worcester St, Wellesley, MA 02181.**

Circle 254

### NM 3602

256 KB ECC MOS Memory for DEC equipment.  
**Nordata Corp, 4433 27th Ave, Seattle, WA 98199.**

Circle 265

### MEcc VII

Error correcting memory system for Q-bus. LSI-11 compatible.  
**PEBX, Inc, 501 Vandell St, Campbell, CA 95008.**

Circle 268

### M48DSS

Dynamic RAM Board Module. 5 1/2" high × 9 3/4" wide. Signal voltages are TTL compatible. Average input power is 5 watts maximum. Operating temperature range is 0° to 70°C. Available with 16, 32 or 48K RAM. Expansion kits available. Interface: System 50 (SS-50) Bus.

**Percom Data Co, 211 N Kirby St, Garland, TX 75042.**

Circle 255

### PM-SIIE/2

Add-in memory with on board ECC for PDP-11 processors. Single hex card (8.875 × 15.688). Capacities 256 KB and 512 KB available. Access time: 550 ns; cycle time: 700 ns. Interface: unibus, modified unibus and extended unibus. Depopulated capability options available.

**Plessey Peripheral Systems, 1691 Browning Ave, Irvine, CA 92714.**

Circle 256

### 3010

32K word MOS memory for Data General Nova 1200 and 800 computers. Reliable static SC memory — no refresh circuitry. Single power supply operation — 5 V only. Low power consumption, 5 W total. Available in four memory

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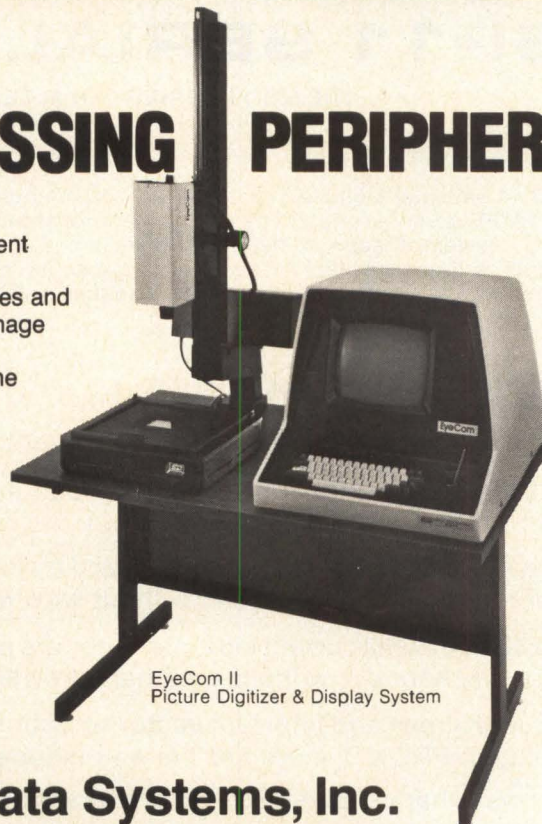
Add this image processing peripheral to your present PDP-11\* or LSI-11\* to measure variations in image brightness, separate image features, enhance edges and contrast, measure areas of interest, do real time image integration, and real time image differencing.

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#### FEATURES:

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- Graphic & Alphanumeric Overlay
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**The Image Processing Company**

\*Trademarks of Digital Equipment Corporation

Circle 12 on Reader Inquiry Card

configurations of 8K, 16K, 24K and 32K words.

**Quentin Research Inc.**, 19355 Business Center Dr, Northridge, CA 91324.  
Circle 277

## 64K-D

A high speed Multibus compatible memory board. Offers 1 MB and 1 megaword of addressability. Has page switching option, on-board refresh, and sequential refresh. Single memory card is dedicated in 8-bit mode when strapped (jumper is set) for 8 bit processor use. The board can also be used in 16-bit mode with 16-bit bus when strapped for 16-bit processor use.

**Relational Memory Systems, Inc.**, Box 6719, San Jose, CA 95150.  
Circle 262

## SKY-MEM Q

Dual-ported memory for Q-bus. Has 2 channels of A/D data operating at 1 MHz, 128 KB. Can control two Reticon live scan or Matrix cameras for image processing.

**Sky Computers, Inc.**, Foot of John St, Lowell, MA 01852.  
Circle 267

## LS-060

4K×16 bit static RAM shared by two processors. Q-bus and Unibus compatible. Single cycle interprocessor DMA. Supports 18-bit memory addressing. Manual Enable/Disable switches. Optional read only access from remote port.  
**Standard Engineering Corp.**, 44800 Industrial Dr, Fremont, CA 94538.  
Circle 280

## Dynamic RAM Boards

With hidden refresh are available in 16K, 32K, 34K, 48K and 64K memories in either 1 or 2 MHz versions. Memory refresh is performed on board during Phase 1 when the processor is not accessing memory. The memory array can be deselected in 4986 byte blocks to meet any system requirement. These boards are directly compatible with Motorola, EXORcisor/Micromodule bus.

**Synertek Systems**, PO Box 552, Santa Clara, CA 95052.  
Circle 284

DEC-11 OEMS: use **RTFILE**<sup>TM</sup> for efficient software development!  
Sell your customers **RTFILE** for on-line applications without programming!

### What is it?

- **Relational DBMS with**
  - Access Control/Logging
  - Integrated Data Dictionary
  - Data Definition Language
  - Data Manipulation Language
  - Utility Libraries
- **Interactive Utilities for**
  - Directory Management
  - File Management
  - Index Management
  - CRT Display Generation
  - Transaction Processing
  - Data Management
  - File Listing
  - Report Generation
  - Sorting and Selection
  - Operating System Interface
  - Applications Interface
- **No SYSGEN Required**
- **Adapts to Operating System**
- **Uses Standard File Formats**
- **CRT Screen "Forms" Oriented vs. "Language" Oriented**
- **Shares Resources With Any Other Programs and Data**

### Who uses it?

- Research Organizations
- Educational Institutions
- Government Agencies
- Manufacturing Firms
- Commercial Enterprises
- Professional Offices
- Systems Houses
- OEMs

### For what?

On-line, interactive applications requiring data entry, update, and retrieval with varied reporting demands.

### Like what (installed)?

- Inventory Management
- Property Management
- Survey Analysis
- Production Planning
- Contract/Project Management
- Communications Accounting
- Scheduling and Billing
- Personnel Management
- List Processing

### What does it work with?

- **Operating Systems:**
  - RT-11\* } Single-User
  - CTS-300\* }
  - STAR-eleven\*: Multiprocessor Networking Distributed Data Processing System
  - TSX-Plus\*: Multiuser Timesharing
  - DYNIX\* (UNIX\* V7.0)
- **Hardware:**
  - Any DEC PDP-11\* or LSI-11\* CPU
  - Minimal Memory (64 KB)
  - Any Random Access Mass Storage Devices (Microflops to SMDs)
  - Any CRTs or Printers

### What about support?

- **Full Documentation Provided**
- **Hot-Line Telephone Support**
- **OEM Training Is Available**

### How do I get it?

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\* **REGISTERED TRADEMARKS OF:**  
Digital Equipment Corp.  
HAMMOND software  
SGH Computer Systems  
Santa Cruz Operation  
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**International Computing Company**  
ATTN: Robert C. Natale, Product Manager  
4330 East West Highway, Bethesda, Maryland 20014  
(301) 654-9120, TWX: 710-824-0414

Circle 13 on Reader Inquiry Card

# WHAT DO YOU WANT IN A DIGITAL DATA ACQUISITION SYSTEM?

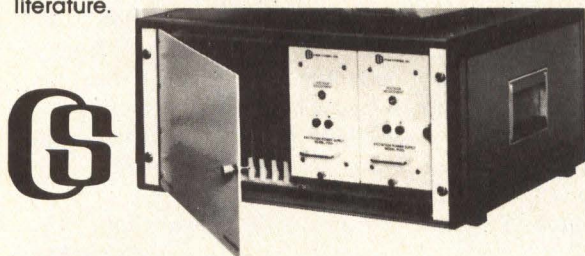
The CYBER I is more than just another front-end... It offers you a flexible, open-ended design that is readily expandable to meet a variety of requirements.

## CYBER I HAS IT ALL!

- Compatible with: IEEE-488 NOVA\*, MICRO-NOVA\*, LSI-11
- Automatic Strain Gauge Measurement
- Serial Remote Operation
- Optically Isolated Data Trans.
- Automatic Calibration
- 50,000 Chan/sec Sampling Rate
- Automatic Bridge Balancing

\*NOVA is a registered trademark of the Data General Corporation.

For the whole story on CYBER I, send for FREE descriptive literature.



## CYBER SYSTEMS, INC.

2031 E. Cerritos Ave. • Anaheim, CA 92806 / (714) 772-2051

Circle 14 on Reader Inquiry Card  
See Us at SYSTEMS '81

Modified or extended Unibus, I/O page size, error status register.

Texas Instruments Inc, Semiconductors Group, PO Box 1443, MS 6958, Houston, TX 77001. **Circle 258**

## PINCOMM 750S

Semiconductor add-in memory. For DEC VAX-11/750 minicomputers. Memory organization on the device is 39 bits wide (32-bit data word + 7 error check bits). The check bits provide single error correction and double or multiple error detection. An on-line/off-line switch allows memory to be switched off line as an aid in trouble shooting or when configuring a system.

Trendata Corp, 3400 W Segerstrom Ave, Santa Ana, CA 92704. **Circle 259**

## ZX-028B

128K RAM. Dynamic RAM for Multibus systems. 450 ns access. 1 ms cycle (Byte swapping). Power requirements: +5 V at 0.6 Amps; +12 V at 0.1 Amp; -12 V at 0.001 Amp. Also available, a 5 V only operation. Switch locatable on any 32K boundary. R/W data buffers. On-board hardware. Refresh controller (8202A). All signals are TTL compatible.

Zendex Corp, 6680 Sierra Lane, Dublin, CA 94566.

**Circle 260**  
D

## Add-In/Add-On Showcase

### DMB 6400

Bank select 64 KB expandable memory board. Four independent 16K software selectable banks. Switch selectable bank sizes — from 16K to 64K in 16K increments. Eight banks (512K) per I/O port for each of the 256 ports. Z-80, 4 MHz operation with no wait states. Low power-8 watts maximum. Reliable, tested and burned-in memory. 1 year guarantees. IEEE S-100 compatibility.

Systems Group, 1601 Orangewood Ave, Orange, CA 92668. **Circle 257**

### LEC-16

Add-in memory boards in 4K increments.

Telefile Computer Products Inc, 1713 Daimler St, Irvine, CA 92711. **Circle 261**

### TMM 2000 Series

Add-in memory systems. 256K word/128K word high-density versions. Error detection/correction enhances system reliability. Fully compatible with PDP-11/34 and PDP-11/44. Unibus computers. Addressing capability to two megawords. Low power. Programming options.

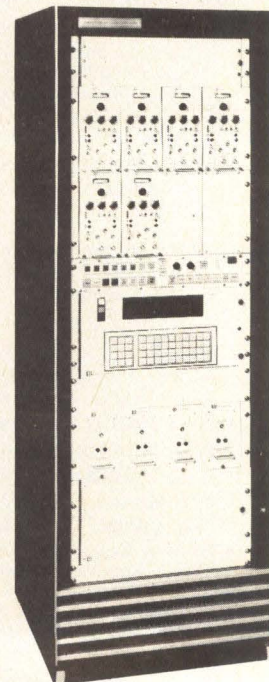
# INTRODUCING THE CYBER II LOAD CONTROL SYSTEM

ALL YOU REALLY NEED  
FOR DYNAMIC AND  
STATIC STRUCTURAL  
TESTING

## LOOK AT THESE SELECTED FEATURES:

- Computer-controlled testing.
- Easy test definition and setup—no computer programming required.
- Automatic self-checking and calibration.
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- Integral data acquisition automatically synchronized with loading.
- Failure history storage eliminates analog tape or o-graph recording.

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# DILOG DISC CONTROLLER... MIXES WINCHESTERS, SMDs, CMDS COMPATIBLY FOR DEC LSI-11\*

The DILOG Model DQ202A is a  $\mu$ P based intelligent SMD I/O hard disc single board Controller for your LSI-11, 11/2, 11/23 computer. It permits upgrading or expanding your data base without changing components. (The first true SMD I/O controller that does not retain disc drive parameters in on-board components.)

If you start with one (or two drives) and later wish to increase capacity, change to another manufacturer, etc., simply plug in the new drive (or drives). That's it. The Controller's universal firmware set saves you changing anything but the drive.

You can mix drives, or match them... use one or two 8"- or 14"- Winchester/SMDpack or CMD cartridge drives... mix different transfer rates, number of heads, data surfaces, capacities from 8-300 Mbytes each, etc. And you can add or change drives at anytime.

The Controller offers full DEC software compatibility with either RT-11, RSX-11 or RSTS operating systems. Versatility is further enhanced with switch

selectable emulations.

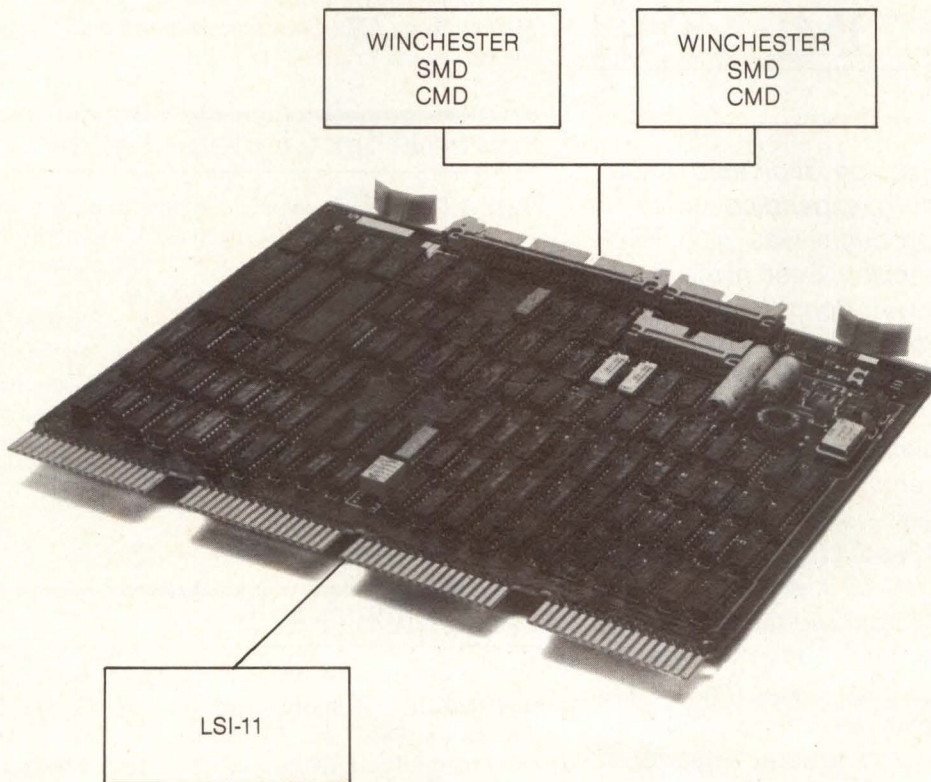
As for disc compatibility, the DQ202A interfaces drives from the following manufacturers.

AMPEX	CONTROL DATA	MITSUBISHI
BALL COMPUTER	FUJITSU	NPL
BASF	KENNEDY	PRIAM
CENTURY DATA	MEMOREX	

Of course the Controller has automatic self-test with built-in microdiagnostics and LED status indicator, along with numerous other important features you'll find invaluable.

Call or write for complete details on the Controller that lets you mix or match drives and expand your data base... without changing components. Distributed Logic Corp., 12800 Garden Grove Blvd., Garden Grove, California 92643, Phone: (714) 534-8950, Telex: 681-399 DILOG GGVE • EASTERN REGIONAL SALES OFFICE, 64-A White Street, Red Bank, New Jersey 07701, Phone: (201) 530-0044.

\*Trademark Digital Equipment Corp.



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AT SYSTEMS '81'  
BOOTH 57  
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**DILOG**  
DISTRIBUTED  
LOGIC CORP.  
**DILOG**  
NUMBER 1 FOR DEC-11

Circle 16 on Reader Inquiry Card

## COMPAT™ Showcase

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this showcase highlights  
the wares of 47  
computer compatible  
product manufacturers  
exhibiting at  
COMPAT 81

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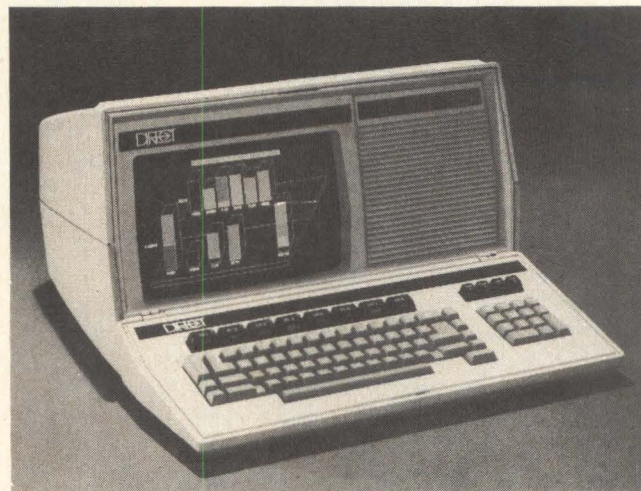
**T**he first national exhibition dedicated exclusively to the constantly expanding world of computer compatible products was held September 16-17 in San Francisco. Seen at the show, sponsored by the Benwill Conference Group, were peripherals, controllers, accessories, functional boards, software packages, etc., all designed to interface to the most popular computers (DEC, Data General, Hewlett Packard, IBM, etc.) This first show was eagerly received by an audience consisting of qualified buyers and specifiers of compatible computer products. The next show, scheduled for February 16-17 in Anaheim, promises to be bigger and better. The manufacturers who exhibited their products in San Francisco are listed in the following pages. If you missed the show you can stroll down the magazine aisles at your own pace and stop to look at some of the offerings.

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### Compatible Video Display Units

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**VP 828.** (One of the VP 800 Series.) Video display terminal tailored to be functionally equivalent to the HP 2645A and DEC VT 100. Has a low profile design. The system is fully supported. 32K RAM memory. "Memory manager" allows storage of up to 40 pages of data. High resolution 132-column display. Detachable, fold-up keyboard. Flexible



character size allows for selection of double high and/or double width characters. Other products and compatibility: VP 825 (HP2645), VP 800/A (VT100/VT52), VP 800/B (VT100/VT52).

**Direct, Inc.**, 1279 Lawrence Station Road, Sunnyvale, CA 94086. **Circle 313**

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### Power From Cigarette Lighter

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**THE FINDEX.** A complete system in a compact package that weighs only 31 lbs. Can be carried easily from place to place. System includes an 80K RAM memory, expanded keyboard, a gas-plasma display, disk drive and a printer. This microcomputer can be purchased as a patient-accounting turnkey system for a medical office (one application for the system from an extensive library of Findex supported applications software packages). Battery backup allows machine to operate for up to 30 minutes without outside power. Can be operated in automobile through cigarette lighter.

**Findex**, 20775 South Western Ave, Torrance, CA 90501. **Circle 331**

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### From MOSTEK

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**ADD-IN/ADD-ON.** Memory for DEC and Data General. Included are 3 memory boards for Data General, 5 memory boards for DEC and 1 memory board for Perkin Elmer equipment. The DEC boards have been on the marketplace for a period of time ranging from new introduction to four years. What is unique about the newly introduced DEC board is that it is on a 64K chip. The Perkin Elmer memory board is just coming off the production line. It was designed for the

3220 and the 3240 (PE). The brand new units for Perkin Elmer and for DEC have on-board diagnostics which find failing memory chips by LEDs on the memory board.

**MOSTEK**, Memory Systems Div, 1215 W. Crosby Rd, Carrollton, TX 75006. **Circle 240**

## New Life for Old Heads

**HEAD RECOVERY SERVICE.** Company reconditions 6250 bpi high-density tape heads. State-of-the-art techniques have been developed through seven years of dedication to finding methods of recovering and extending tape head life. "After recovery, each head meets or exceeds the original manufacturers specifications for new heads," says the company. Complete test and data packages are delivered with each reconditioned head providing quality records and traceability. Basic recovery service has been available on lower density heads since 1974.

**Magnetic Recovery Technologists, Inc**, 25431 Rye Canyon Rd, Valencia, CA 91355. **Circle 214**

## Micro With Unlimited Expansion

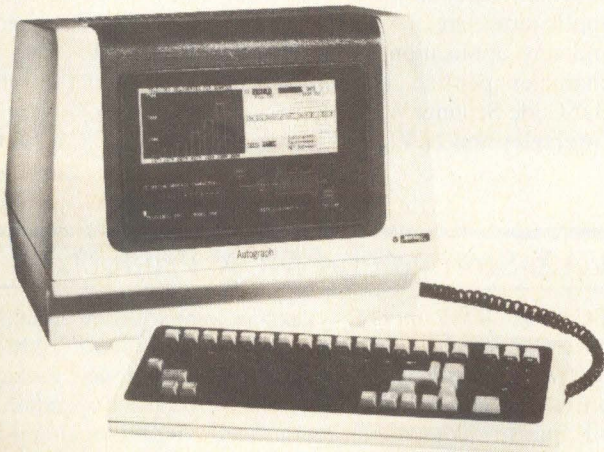
**AME 1000.** A complete system based on Rockwell's AIM 65, with disk operating software, add-on memory, CRT for 6502 development or as an industrial controller. Application software can be written in Assembler, Fort, Basic, PL 65. The System is designed for portability. A complete AME 1000 with 20 character printers and alphanumeric display including CRT and floppy disk controllers and 32 KB of RAM weighs less than 15 pounds (excluding the monitor and floppy disk drive). It is a low cost, portable microcomputer system with essentially unlimited expansion options for industrial control applications.

**Dynatem Inc**, 20881 Paseo Olma, EL Toro, CA 92630

**Circle 209**

## Two New Products

**AUTOGRAPH 150.** Complete point-to-point control of graphic input is now available on this versatile, low-cost, Tektronix-compatible, graphic display terminal. Detached



keyboard, 250×512 resolution, selective graphic erase, white-on-black or black-on-white display, 24 lines or 80 ASCII A/N characters, block and conversational modes as options, protected fields, and full editing capability.



**INFOSCRIBE 1000** is a new serial matrix impact printer. It is aimed at designers of small business and minicomputer systems who require up to 180 cps print speed and up to 136 column output. This new printer has only a few, easily understood external controls and can be successfully operated with a minimum of training.

**MQI Computer Products**, 2815 Miller Ave, Mountain View, CA 94041

**Circle 210**

## Text to Speech

**SPEECH-1000.** Electronic Speech Synthesizer. Company specializes in limited vocabulary stored-speech system, and unlimited vocabulary text-to-speech system. Utilizes such speech technology as compressed waveform encoding, linear predictive coding and formant. The unit has superior voice quality with natural life-like speech using linear predictive coding. Interfaces: Multibus, parallel I/O, serial output (RS 232C). Large vocabulary storage of up to 458 kilobits (typically 200-300 sec. of speech). Low-cost vocabulary generation service in all languages using customers' speakers or company's. Also showing a variety of other speech synthesizing products.

**Telesensory Speech Systems**, 3408 Hillview Ave., Palo Alto, CA 94304.

**Circle 312**

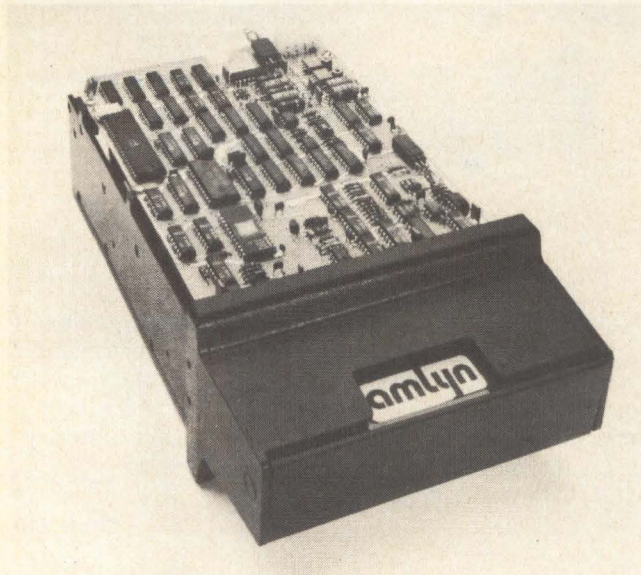
## Video Processing System

**MODEL VG-120.** A total video acquisition and display system for the Intel Multibus. Provides binary storage and regeneration of a full screen of video information. It has quality resolution of black-and-white or pseudo-color images. True EIA-compatible inputs and outputs. Full computer access of binary screen memory. Has high pixel resolution. Unit can acquire a full screen of display information from any EIA-standard video source. The data with 3 or 6 bit resolution, are then available in an on-board memory for computer access. Choose between 320 or 640 screen display location (pixels) per line and 240 or 256 lines. Both black and white and pseudo color display versions are available. And your computer can transmit the same memory information to a remote site for analysis or display

**Datacube Inc**, 670 Main St, Reading, MA 01867. **Circle 333**

## An Ideal Data Back-up Device

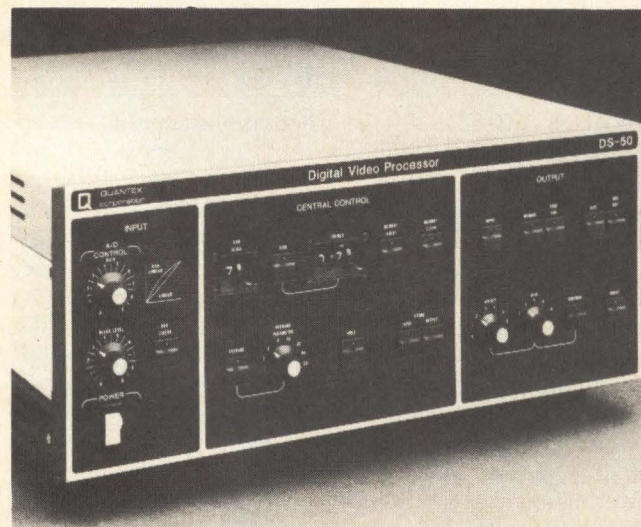
**MODEL 5750 and Model A506.** Disk Drives which are functionally compatible with the Shugart SA 850 floppy disk drive and the Seagate Winchester disk drive respectively (or their equivalents.) May be employed as a stand alone on a



line storage device or as a data back up drive with Winchester disk drive. The unit offers an unformatted capacity of 8 MB. "It is ideally suited as a data backup device," says Jim Snow, Marketing Director. **Amlyn Corp., 1758 H Junction Ave, San Jose, CA 95112** **Circle 224**

## High Speed Video Processing

**DIGITAL VIDEO PROCESSOR.** These video processors are designed to convert video pictures into digital data in real-time and on-line. As "processors" they provide further extensive pre-processing of the digital data to achieve noise reduction, contrast, enhancement, on-line mask subtraction, etc. The company says: "The Quantex digital video processors incorporate a 'hardwired computer' as 'arithmetic unit'



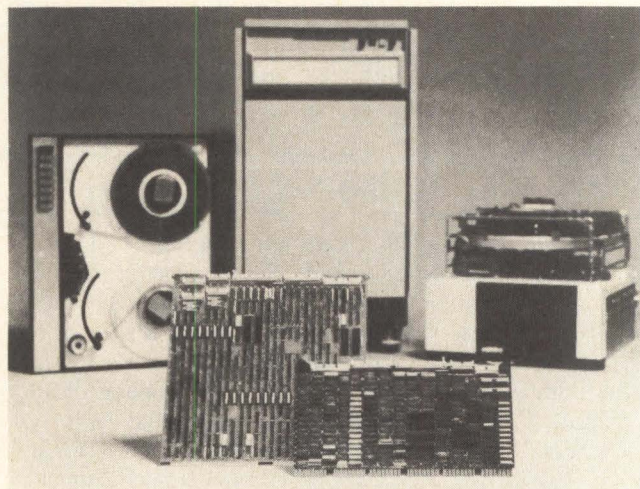
to achieve the high speed processing necessary to accommodate the 1/4 MB, resulting from the digitizing of just one full video frame."

**Quantex Corporation, 252N Wolfe Road, Sunnyvale, CA 94086** **Circle 330**

## New Back-ups Coming

### MULTIFUNCTION DISK TAPE CONTROLLERS.

Compatible with PDP-11, Data General and Perkin Elmer. These multifunction single board controllers attach any 4 SMD disk and 8 formatted tape drives. Full emulation of DEC and DG disk and tape subsystems is standard. "We are also about ready to announce Spectra Stream — streaming software for streaming tape drives and disk back up," says the company. Other products: Spectra 10, emulating DG



compatible disk controllers; Spectra 11, emulating DEC compatible disk controllers; Spectra 14, emulating Perkin Elmer compatible disk controllers. **Spectra Logic Corp., 1227 Insbruck Drive, Sunnyvale, CA 94086.** **Circle 222**

## Five Moving Parts

**NIP 18.** Non impact dot matrix printer mechanism. It prints a 5x7 matrix on metallized, electrosensitive paper which provides a permanent impression. It can print any A/N character or symbol by control logic. It has only five moving parts. The applications are for data loggers, instruments, calculators and any application requiring a printed record. Prints 25 characters per line. The company also exhibited its versatile Bar Code Scanner Wand.

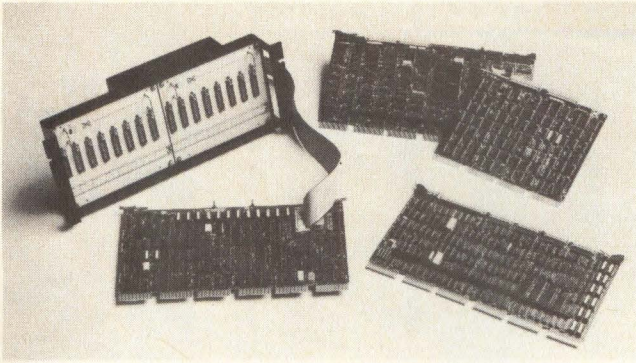
**Intertelephon N.V., 1200 Levin Ave, Mt View, CA 94040.**

**Circle 317**

## VAX Storage and MUX Products

**TC11/V.** This model is a hardware/software package designed to add economical tape storage to the VAX-11 system. Hardware is the standard TC11 controller. Package provides complete capability for installation and operation of all industry-compatible reel-to-reel NRZ/PE/dual-density tape transports on the VAX-11 series computers. "This con-



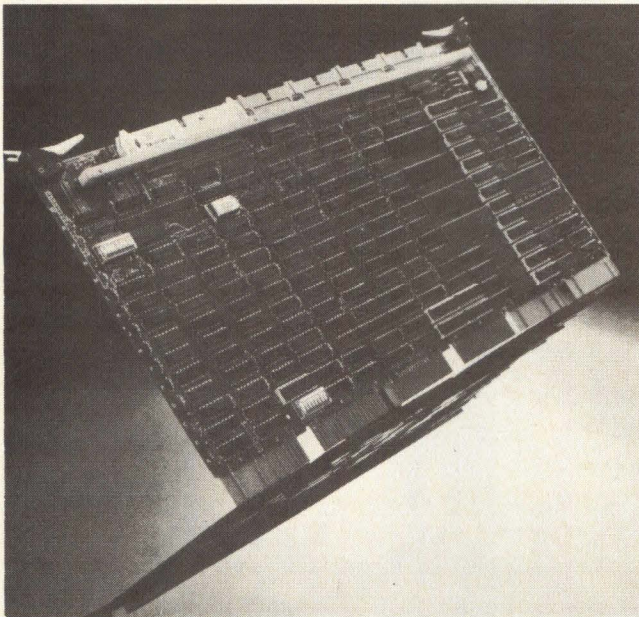


figuration provides the same storage capability as 800/1600 bpi DEC Massbus installations at a fraction of the cost," says the company. Other units: **CS11/HV** VAX/VMS Communications multiplexer; **SC21/V**, a hardware/software package designed to add economical big disk storage to a VAX system. Company also has a complete line of disk, tape and communications controllers for use with LSI-11, PDP-11 and VAX-11 Series computers.

**Emulex Corporation**, 2001 Deere Avenue, Santa Ana, CA 92705  
**Circle 213**

### Eliminates 80% of Disk Access Time

**EDC 21.** An emulating disk controller which emulates the DEC RH11 controller interfaced to multiple RM02/03/05 disk drives. Turbo 21 is a single board add-on disk cache

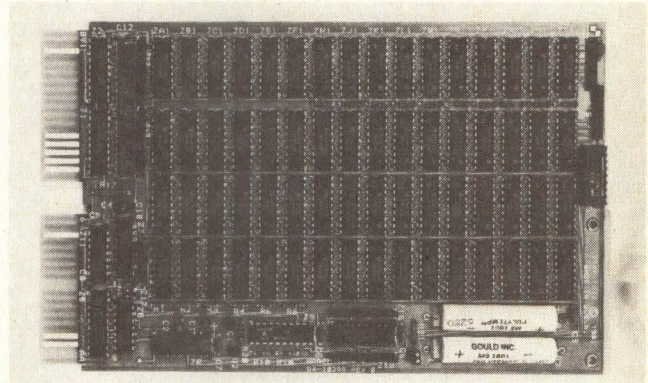


which eliminates up to 80% of all disk access time. Both feature 32-bit ECC. Each is contained on a single hex-wide board; both run with unmodified DEC operating systems, including RSTS/E, RSX-11M, RT-11, VMS and with Unix. Both are transparent to host software. Other products: **ED 22** for Data General, **EDC 23** for Perkin Elmer; **EDC 24** for LSI-11. Storage module controllers are available for DEC, DG and PE; Trident controllers for Data General and Perkin Elmer.

**Minicomputer Technology**, 2470 Embarcadero Way, Palo Alto, CA 94303  
**Circle 341**

### Data Protected for up to One Week

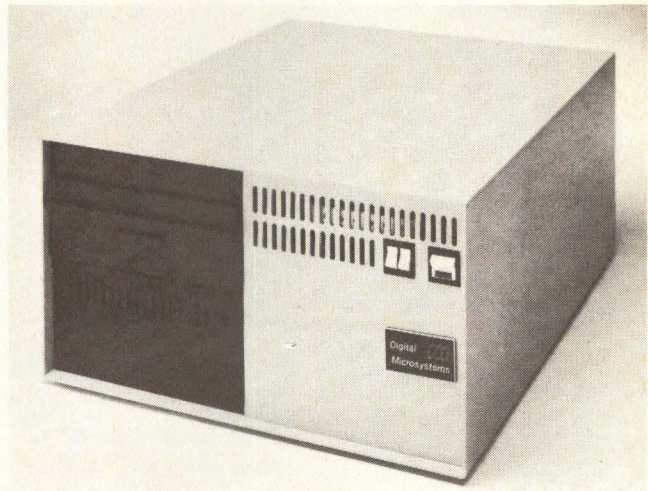
**1816.** A 16K word, non-volatile CMOS memory board. Plugs directly into a single slot of the LSI-11 backplane. This unit consumes 1/6 the power, occupies 1/4 the space, and is 2/3 the price of competing core memory. Retains data during temporary power-outages or equipment shut-down periods for up to one week. On-board 18 bit address-decoding circuitry and write-protect dip switches (accessible while the



board is positioned in backplane) permit memory access to start at any 4K work boundary and write protect either 4K, 8K, 12K or 16K word segments. **ADAC Corp**, 70 Tower Office Park, Woburn, MA 01801  
**Circle 215**

### Powerful, Single-User Computer

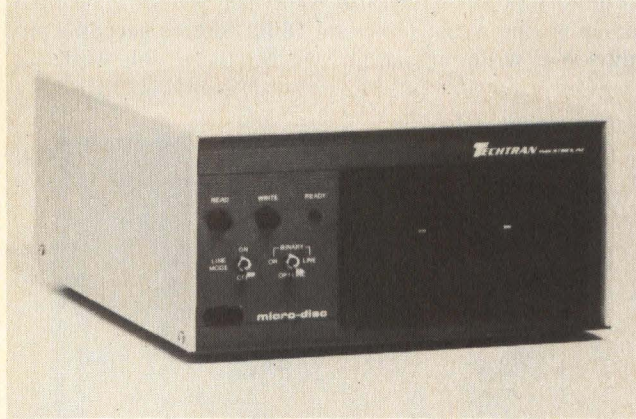
**DSC-3/102.** "The speed, reliability and data storage capacity of these systems," says the company, "makes them excellent, extremely powerful single user computers." Within a single cabinet the unit includes a ZSBC-3 SBC, a single 8" floppy disk drive (dual density, single sided) the DMS intelligent disk controller and a Winchester drive in either 10 or 23 MBytes. System is HiNet™ compatible and may be



expanded to network operation (HiNet) at any time. Other products include: Streamer Tape Drive, Serial Port Expander, Controllers, Disk Drives, etc. **Digital Microsystems**, 1840 Embarcadero, Oakland, CA 94606  
**Circle 323**

## Highly Reliable 5 1/4 Micro Disk

**MODEL 951.** A perfect RS-232 addition for sophisticated but simple operation at remarkable cost savings. These micro-disks are microprocessor-intelligent, minidiskette systems featuring over 200,000 useable character storage.



Contains easy file oriented mass data storage. File names are automatically recorded on a directory as you enter data in either file or batch modes. It is a powerful disk editor and high speed string searcher. Can add, delete or replace data with one command. 5 1/4" minidiskettes. Mfr's statement: "Nobody does it better than us."

**Techtran Industries, Inc, 200 Commerce Drive, Rochester, NY, 14623**

**Circle 301**

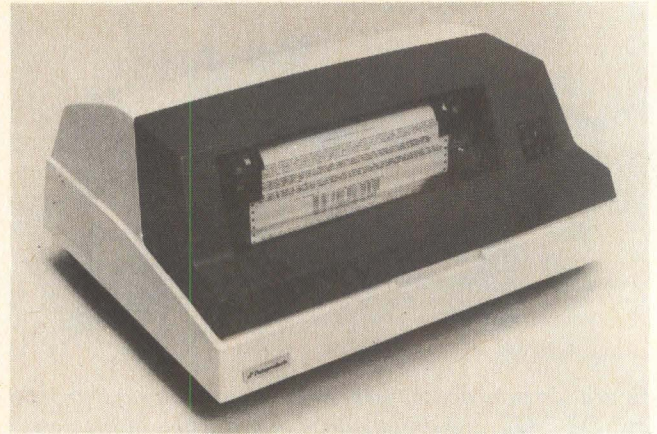
## Arrow Exhibits Six Clients' Products

**MODEL 950 by TELEVIDEO SYSTEMS.** Smart CRT. (Compatible with RS232). Has four pages memory, detachable keyboard, smooth scrolling, 15 graphics characters, 22 function keys, wraparound.

**Circle 304**



**MODEL B-600 by DATAPRODUCTS COMPANY.** Unique combination of simple design and field proven technology. Built for dependable operation, the B-series Printers incorporates today's state-of-the-art band technology. Friction-free hammers, microprocessor-based electronics, high-



energy magnets, custom IC hammer drivers, and Data-products' specially designed steel band.

**Circle 327**

**FINCH™ MODEL 9410 8" FIXED DRIVE by CONTROL DATA** An 8" rigid disk drive that provides 8 or 24 MB of unformatted storage on fixed, lubricated media in a sealed



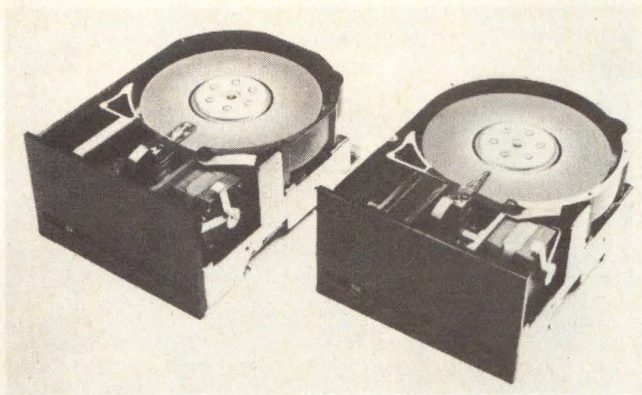
recording environment. The Finch digital interface is intended to be attached to a single controller capable of controlling both a 9410 and a flexible disk drive.

**Circle 338**

**VIEWPOINT by APPLIED DIGITAL SYSTEMS** A new low-cost CRT with detachable keyboard and visual attributes. A unique feature is that it has only 11 LSI chips in circuit.

**Circle 335**





**ST506 5 1/4" WINCHESTER DRIVE** by **SEAGATE TECHNOLOGY** Low cost and unit reliability for this RAM storage device are achieved through the use of a band actuator and open loop stepper head positioning mechanism.

**Circle 346**

**DTC-510 DISK DRIVE CONTROLLER** by **DATA TECHNOLOGY CORP.** The DTC-510 microprocessor-based, intelligent controller provides all the functions necessary for the systems implementation of up to 2 Seagate Technology ST 506 drives.

**Circle 343**

Above six products shown at Compat by **ARROW ELECTRONICS** (Headquartered in Farmingdale, LI, NY) 521 Weddell Drive, Sunnyvale, CA 94086.

## New Systems on Market

**CD 100L.** A new configuration presented for the first time at the show. It is the only integrated DEC compatible (VT 100) system featuring an intelligent terminal, an integrated card cage, and a disk memory system, all desk-top. Basic memory system includes a 5 MB 5 1/4" Winchester Drive emulating RL 01. It also has a 0.5 MB Floppy back-up emulating RX 02. **Callan Data Systems.** 2637 Townsgate Rd, Westlake Village, CA 91361.

**Circle 337**

## Multi Head 5 1/2 Disk Drive

**MICRO-DISK V.** A family of Winchester disk drives (5 1/4"). Units offer the performance of bubble memory, the reliability of a Winchester drive and the convenience of a removable disk cartridge within the size of a standard mini floppy. Its capacity is 8 MB (unformatted). Average access time is 8.3 ms; cylinder to cylinder access time, 5 ms. Its



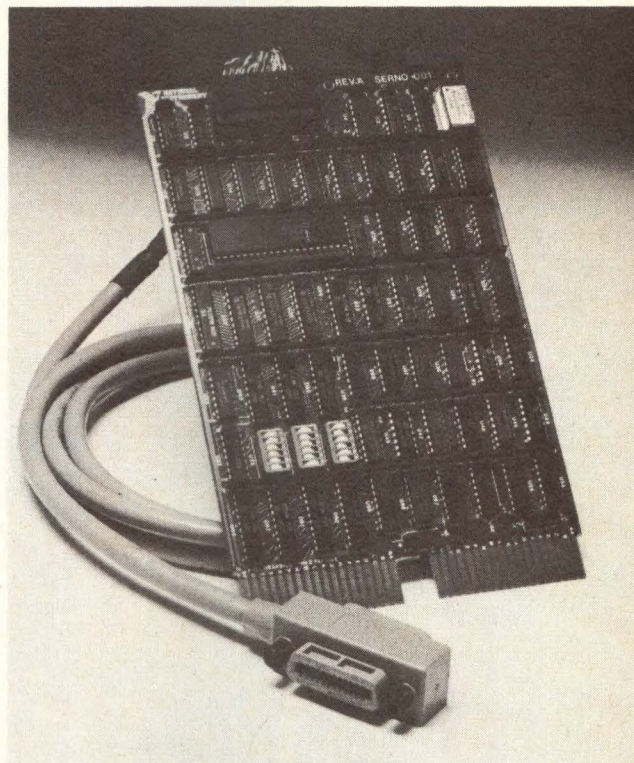
track density is 250 tpi; its bit density is 9,000 bpi. It has up to 32 read/write heads in the system plus total back-up capability.

**New World Computer Company, Inc.** 3176 Pullman St, Suite 120, Costa Mesa, CA 92626.

**Circle 311**

## Increases Data Throughput 100 Times

**GPIB11V-2.** High-speed DMA interface between the DEC Q-Bus microcomputer and the IEEE Std 488 Bus. With the use of this device the DEC Q-Bus user can now make high speed data transfers between the computer and the IEEE Std 488 Bus. "This is the first high speed interface between the DEC computers and the IEEE-488 (GPIB) Bus," says



National. "It has increased data throughput capability up to 100 times more than what was previously available." **National Instruments**, 8900 Shoal Creek, Bldg. A117, Austin, TX 78758.

**Circle 334**

## It Talks to Everybody

**SLC-II.** A sophisticated monitor that intercepts messages from a computer and takes specific actions. Hooks up between the CPU and terminal with its standard RS-232 or 20 mA serial loop interface. It automatically dials a pre-set telephone number and delivers any given message in an electronically synthesized voice. So, if trouble comes, the SLC-II can make the necessary phone calls to have it fixed. "The SLC-II is a microprocessor that talks to everybody," says the company. "Its vocabulary runs well over 300 words. And what it can't say, it will spell for you in English." **Digital Pathways**, 1060 East Meadow Circle, Palo Alto, CA 94303.

**Circle 339**

## Hot Off The Press

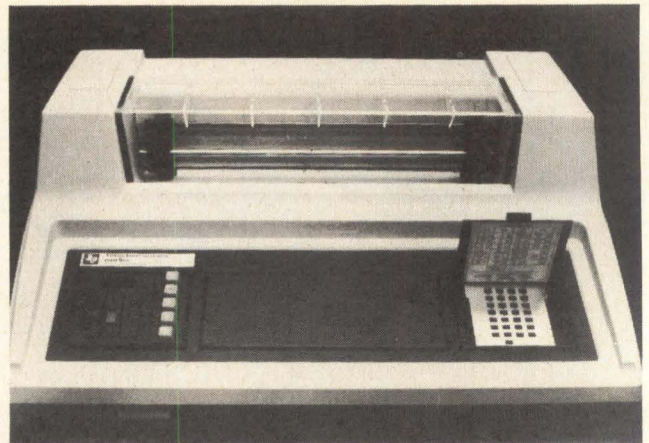
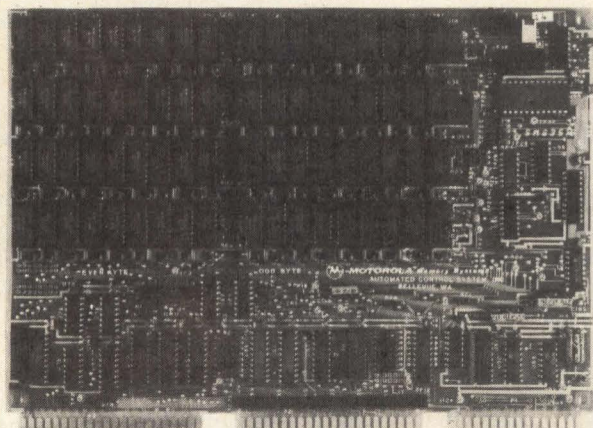
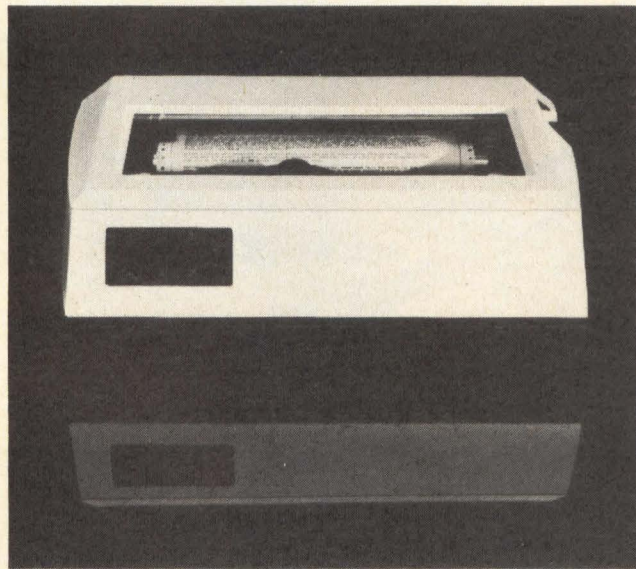
**THE SIZZLE SHEET.** This lively communications sheet offers COMPAT attendees a special 12-month subscription price of only \$24. This is the only marketing communications guide for marketers of computer, electronics, communications and information products, systems and services. Every issue features important data and analyses to aid marketers and marketing communications professionals in buying and applying advertising, trade shows, public relations, sales promotions, research and marketing support services.

**The Sizzle Sheet, PO Box 801, Framingham, MA 01701.**

**Circle 340**

## Compatible Units For Wang

**ACS INTELLIGENT PRINTER INTERFACE.** Mates the Texas Instruments 820 RO, the Tally 1612 RO, the Diablo 1640, 1650 and 630 printers all with the WANG 2200 MVP, LVP and T computers. Also mates with Televideo Terminal. The **SMS3515** 128K custom memory system modules are completely compatible with, and meet or exceed all specifications for WANG MVP, VP and LVP memory boards and are available at a cost effective price. These



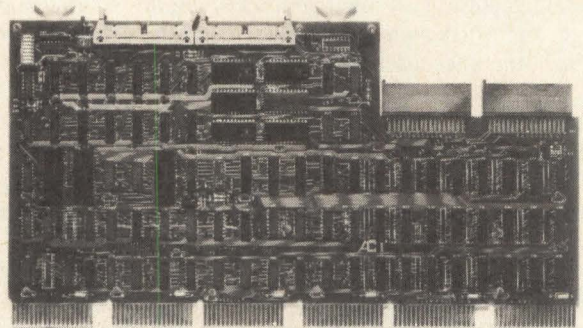
unique boards (with many exclusive features) were designed by ERG of Kent, WA, and are manufactured and warranted for one year by Motorola Memory Systems.

**Automated Control Systems Inc, 1801-130th NE Suite 4, Bellevue, WA 98005.**

**Circle 300**

## Able's Multi Products

**ENABLE/34.** Supports expansion of existing PDP-11/34 RSTS/E systems by up to 4 MB of main memory. Includes ENABLE CONTROL and Bus Isolater. Bus Isolater supports use of existing 18-bit memory and additional non-DMA I/O devices at user's options. Among the many other prod-



ucts made by Able are: multiplexers, bus converters, bus repeaters, DMA interprocessor links, cache memory for the PDP-11/34 and 34A; Cache memory for the PDP11/35 and 40, modem controls, fastbus memory modules, etc.

**Able Computer, 1751 Langley Ave, Irvine, CA 92714.**

**Circle 344**

## Wirewrap Panels

**COMPUTER INTERFACE WIREWRAP PANELS.** Compatible with DEC, Multibus, Prolog, Exercisor, TI, Versabus, Nova. New bondex Multibus panel offers flexibility of wirewrap, but profile of multilayer.

**Augat, 33 Perry Ave, Attleborough, MA 02703. Circle 303**



Barney Stevenson just spent two years programming and de-bugging a process control system in assembly code.

Now Barney thinks he deserves some congratulations for his efforts.

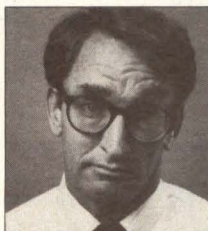
Sorry Barney,

# NO CIGAR.

Barney Stevenson thought he deserved a pat on the back. As project manager at Smart Widgets, Inc., he had taken on the biggest real-time process control headache of his life. And after 24 months he'd finally succeeded in programming and de-bugging Smart's newest product.

We think Barney missed the boat.

Barney figured the choice was simple. High level languages like Pascal and Fortran could program quickly,



but would run too slowly and take up too much memory. Assembly code would take longer to program and de-bug, but was

the only answer for real-time applications.

Wrong.

Real wrong.

Barney didn't know about FORTH: a language that runs nearly as fast as assembly, is just as compact (if not more so), yet can cut

development time by a factor of 10 over assembly language.

He also didn't know about FORTH, Inc.

They're the people who invented this remarkable tool, evolved it, and for 10 years have seen it used in thousands of applications... from running an observatory to sorting baggage, from video games to industrial robotics. Virtually every real-time application imaginable.

The latest evolution of FORTH is called polyFORTH:™ An incredible programming environment avail-

able for just about any mini or micro processor.

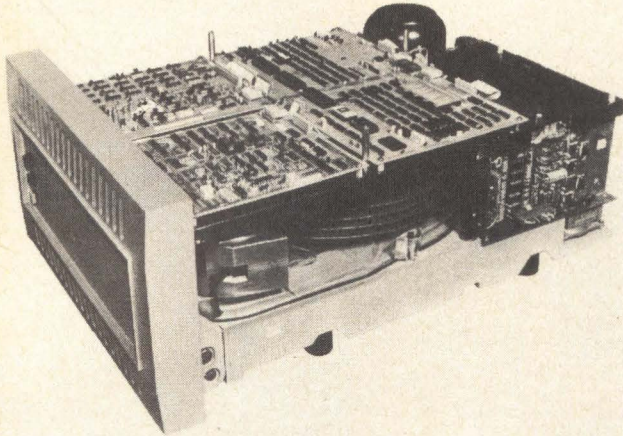
For Barney? Still no cigar. But for you, FORTH offers a software tool that in speed, compactness and extensibility, simply has no match.

So call us at (213) 372-8493. Or write FORTH, Inc., 2309 Pacific Coast Highway, Hermosa Beach, California 90254. We'll rush you the latest on polyFORTH,™ and tell you where you can see it in action.

**FORTH, Inc.**  
...the real-time saver.

## Our Unit Sets a New Standard

**SAPPHIRE 160.** A 14" Winchester Disk Drive. This unit replaces Control Data's 9730, DEC's RM80 and other high-density Winchester drives. Has an SMD-compatible interface with execution of instructions performed by  $\mu$ P-controlled electronics. Uses four fixed-drives in density of

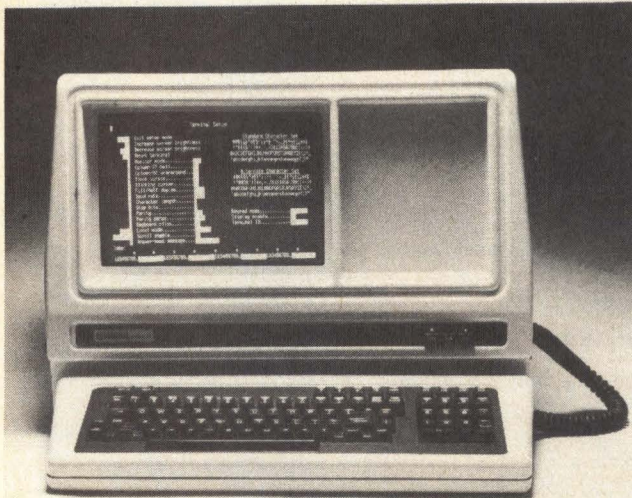


6400 bits/inch and 600 tracks/inch. Air conditioning not required. "The Sapphire 160 is a mature product, is in production, and is available now," says the company. "Our unit sets a new standard in 160MB capacity." **Tecstor, Inc.**, 16161 Gothard St., Huntington Beach, CA, 92647

**Circle 309**

## A New Video Display Enclosure

**NET PAC 95.** This company, which specializes in LSI-11 compatible products, revealed at the COMPAT show a new Video enclosure, the NET PAC 95. This unit provides a video building block for complete LSI 11/2 and LSI 11/23 system configurations in a single desk top package. Features of the unit are total video enclosure: 8 quad, 16 dual height

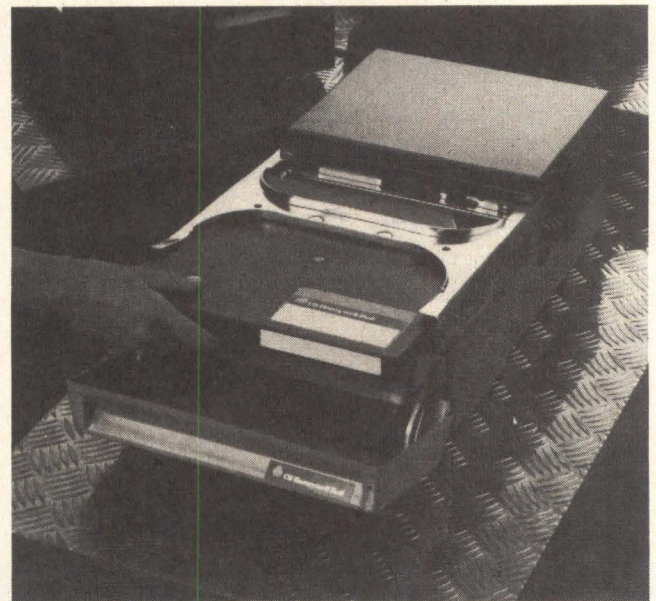


slots; +5 and +12V internal power supplies; optional mass storage; easy board accessibility; high reliability; modular design for ease of maintenance; low cost. The company also supplies a complete series of LSI-11 processors, memory modules, interface modules and mass storage options which can be installed in the backplane of NET PAC 95.

**Netcom Products Inc.**, 430 Toyama Drive, Sunnyvale, CA 94086. **Circle 318**

## Low-Maintenance Disk Drives

**DSS 1100.** This first series of a new line called the "Cynthia DSS 1100" family features full compatibility with DEC's LSI-11 Q-Bus family of processors, as well as full compatibility with DEC RT 11 and RSX 11M operating systems. Available in three configurations packaged in 19" rack-mountable drawers: DSS 1111 (2 D 120S disk drives) total 20



MB storage: DS 1120, (1 D 140 disk drive) with 20 MB of storage — 10 MB fixed, 10 MB removable; DS 1122 (2 D 140S Disk drives). The DS 1122 has the storage capacity of four DEC RL 02 drives in a package the size of one RL 02. "These units in OEM quantities," says the company, "will be offered at prices 40% to 50% below DEC list."

**Cynthia Peripherals Corporation** (Div. of Cii-Honeywell-Bull) 3600 West Bayshore Drive, Palo Alto CA 94303 **Circle 321**

## A New Terminal

**TS-1.** Brilliant terminal. Permits user selection of terminal emulation including TS-1 native mode, ADM-31, VT-52, VT-100 (optional). User selectable from set-up screen. Features include detachable keyboard with programmable function keys, sculptured key caps, typewriter or data-entry style keyboard. Other features: split screen, dual intensity, four character sizes, cursor control, standard or smooth scrolling selectable, 12 or 24 hours clock, freeze mode, etc.

**Falco Data Products, Inc.**, 1286 Lawrence Station Rd, Sunnyvale, CA 94086. **Circle 306**

# VISACOM/23 GRAPHIC/IMAGE SYSTEM. SUPER CAPABILITIES, SUPER FAST, SUPER PRICE.



DeAnza's VISACOM/23 now offers you features and capabilities previously only found in large-scale systems. Features like proven and superior image and graphic display software, advanced computing capabilities and proven operating systems software.

All at a very reasonable price.

The VISACOM/23 and the DeAnza Library of Image Processing Software (LIPS) allows you to perform work you only thought possible on the large, expensive systems.

Graphic and display efforts like convolutions, rotations, classification, amplifications, addition, subtraction, image and graphic zoom and scroll as well as much more.

And, the VISACOM/23 incorporates the powerful LSI-11/23 computer so you perform graphic and

image processing more easily and much faster.

It allows you to do more work in less time.

VISACOM/23 has a full 512K byte memory for dedicated computer operation or image display as well as 128K bytes of dedicated memory outside of the image memory, four independent graphic overlay channels, alphanumeric character generators, color and monochrome transformation units and cursor overlays.

If your graphic and imaging application calls for a system that provides quality, flexibility and added capabilities all in an economical package, find out more about the VISACOM/23 today.

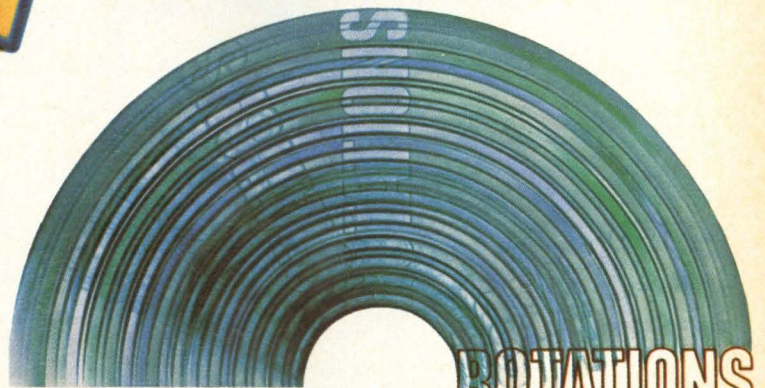
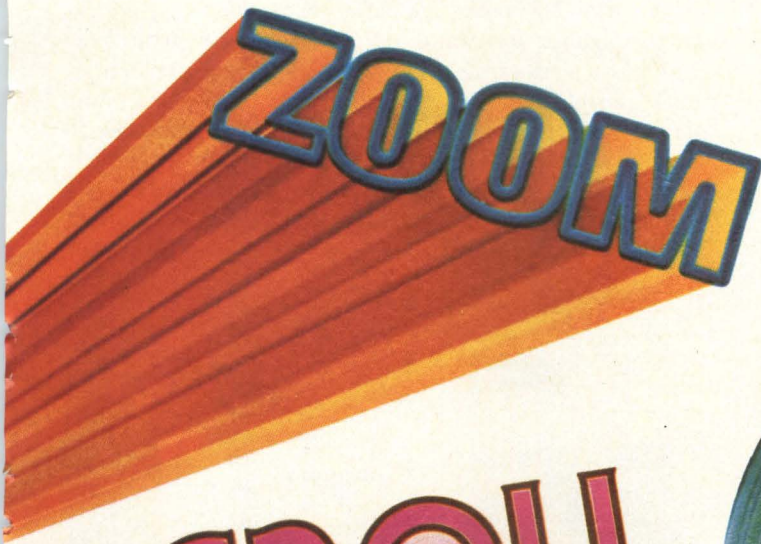
Call or write:

## DeAnza Systems Incorporated

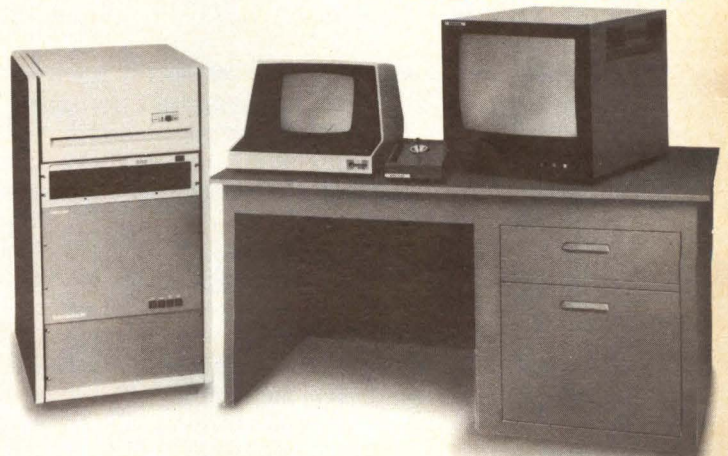
*Corporate Headquarters:* 118 Charcot Avenue • San Jose, California 95131 • (408) 263-7155 • TWX (910) 338-7656

*Regional Offices:* 100 First Avenue N.E., Suite 114F, Cedar Rapids, IA 52401, (319) 354-1366, TWX (910) 525-1306 • 3918 Prosperity Avenue, Suite 204, Fairfax, VA 22031, (703) 698-0600, TWX (710) 833-0369 • 500K Middle Country Road, Middle Island, NY 11953, (516) 736-3440 • 4401 Atlantic Avenue, #28, Long Beach, CA 90807, (213) 422-4445.

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ROTATIONS



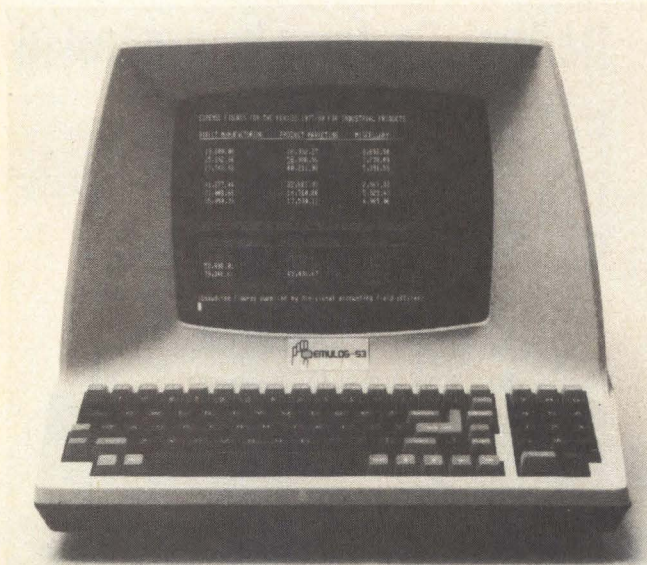
## Daughter Boards Are Unnecessary

**MODEL 420.** 16-channel Programmable Terminal Interface (PTI). It is fully compatible with Nova 3, Nova 4, Eclipse and Data General's ALM/ATI programming format. It supports Clear-To-Send and can be switched by line to operate RS232 or 20mA terminals. The PTI mounts in the CPU chassis and comes complete with 16-port, prewired distribution panel. "With the Model 420, daughter boards are unnecessary," says the company. "The cost and rack space usage associated with a communications chassis is eliminated."

**Custom Systems Inc, 6850 Shady Oak Rd, Eden Prairie, MN 55344.** **Circle 216**

## Terminal With Operator Comfort

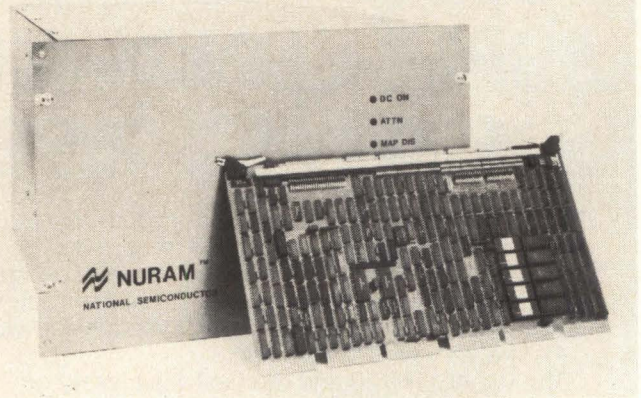
**LOG 53.** Alternative to Data General's 6053 CRT display terminal. "The 'Log 53 gives you complete emulation of the model 6053 functions," says the company, "with more operator comfort and less operator fatigue." 12" screen size.



80 x 24 character display. Data rate 75-19,200 Baud; interface, EIA-RS-232-C, 20mA C/L. Character set, 96 displayable ASCII; character matrix, 7 x 12 in 10 x 14. **Emulog Inc, 3730 Yale Way, Fremont, CA 94538** **Circle 342**

## Eliminates Costly Expansion Chassis

**HEX 1000™ CONTROLLER.** A single hex-wide card which simultaneously controls I/O operation by 3 peripheral subsystems: disk, tape and a fixed-disk emulator. The HEXACON controller installs on any DEC Unibus system and is fully compatible with operating systems providing transparent emulation of the RM02 disk TM11/TU10 tape subsystem and RS04 FHD, which is emulated by National's NURAM™ system. "One (1) hex wide card controls simultaneous I/O operations," says the company, "by all three high-speed peripheral subsystems. This not only provides slot-saving advantages but many users will also be able to

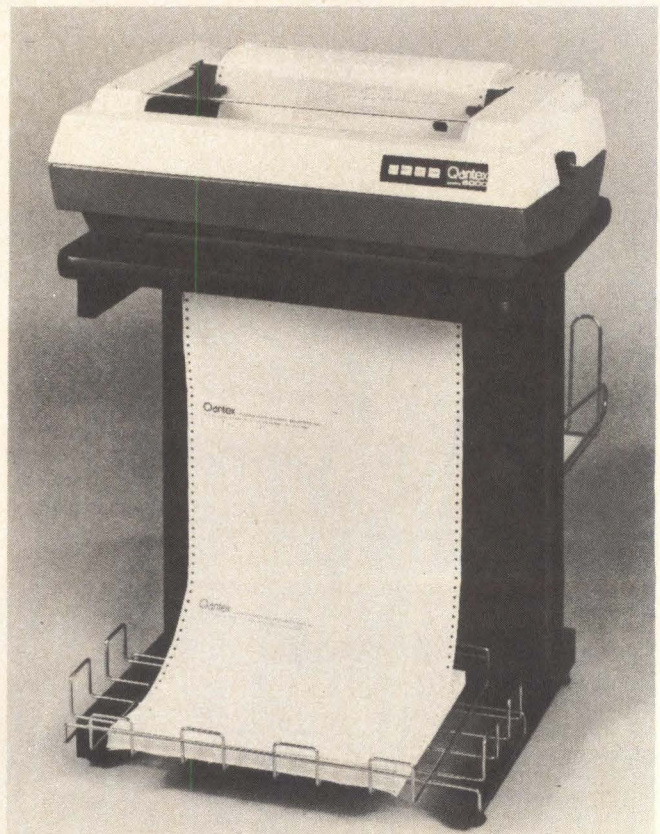


eliminate costly expansion chassis." **National Semiconductor Corp, 2900 Semiconductor Drive, M/S 7C-265, Santa Clara, CA, 95051** **Circle 220**

## A Printer with Message Buffer

**SERIES 6010.** A high-performance, low cost dot matrix printer. Has 2 KB message buffer (expandable to 4 KB) to protect against loss of data. Microprocessor controlled. Operates at a print speed of 150 CPS. 9x9 dot matrix for high quality printing. Unit is available with a Centronics compatible parallel on an RS-232 serial interface operating at maximum baud rates up to 19,200 baud. A rear-panel switch permits choice of active or passive 20MA current loop.

**Qantex Division, North Atlantic Industries Inc, 60 Plant Avenue, Hauppauge, NY 11787.** **Circle 211**





# Give your Q-BUS the UNIBUS award.

There's a definite place for the Q-BUS. Some applications are right on target, but if yours has even a slight chance of expanding upward, we want you back on the UNIBUS. That's where the action is, and that's where you belong. We can get you there, too. Quick and easy, with two highly effective add-ins.

QNIVERTER™, our exclusive Q-BUS to UNIBUS or UNIBUS to Q-BUS converter, opens the wonders of the UNIBUS world to PDP-11/23 and LSI-11 users. Completely contained on a single quad-width board, QNIVERTER™ plugs into the LSI-11, LSI-11/23, PDP-11/03 or PDP-11/23 and allows UNIBUS compatible controllers to be used with LSI computer systems or LSI based peripherals to be used with PDP-11 systems.

Our companion add-in, the ABLE BUSLINK, installs in any LSI-11 or PDP-11 and provides UNIBUS to UNIBUS, UNIBUS to Q-BUS or Q-BUS to Q-BUS link. ABLE BUSLINKS deliver in pairs of hex-width, hex/quad-width or quad-width boards. They provide full DA11-B compatibility, operate at DA11-B transfer rates up to fifty feet and are software compatible with the existing and proven DA11 driver.

QNIVERTER™ and the ABLE BUSLINK are designed exclusively for use in LSI-11 and PDP-11 computers. Just like the rest of our line, they cost less but do more than the products they are intended to replace. To find out more about them, call or write for details. We'll include information on our complete line of UNIBUS compatible general-purpose, special-memory and data-communications products as well as the MAGNUM™ Series of computer systems.

DEC, UNIBUS, Q-BUS, PDP and LSI are trademarks of Digital Equipment Corporation.



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ABLE COMPUTER, 1732 Reynolds Avenue, Irvine, California 92714. (714) 979-7030. TWX 910-595-1729 ACT IRIN.  
ABLE COMPUTER-EUROPE, 74/76 Northbrook Street, Newbury, Berkshire, England RG13 1AE. (0635) 32125.  
TELEX 848507 HJULPHG.

Circle 17 on Reader Inquiry Card

See ABLE products, COMPAT '81, San Francisco

## Enlarging Memory

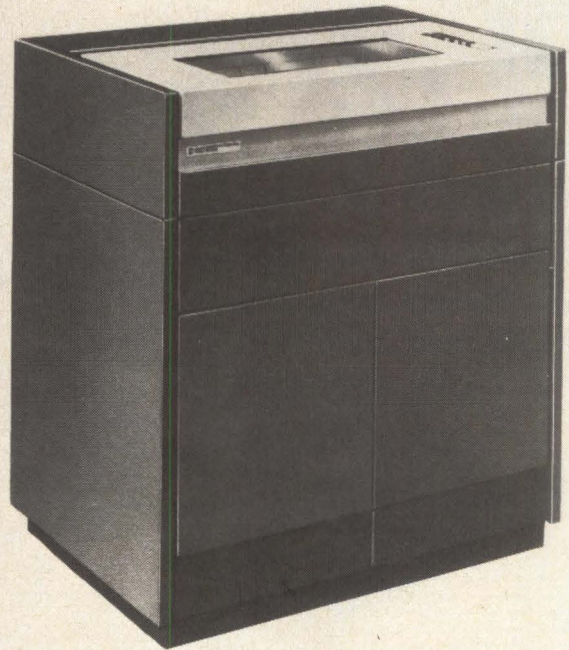
**IMC-8000.** 128Kx24 bit multi-purpose memory board. Compatible with various minicomputers. The board is available in word lengths of 16, 18, 20, 22 or 24 bits. It has on-board refresh/timing/control logic plus versatile interface options all available in a single card. Two or more boards may be operated in parallel to provide larger word lengths than those listed. For example, three cards may be used together to provide 128K x 72 bits or one megabyte (with ECC bits) memory system. Among other company products are MCBx332, 32K Byte CMOS nonvolatile memory module for Multibus; IMC-11/780, VAX-11/780 Add-in Memory; IMC-3 Series, Nova 3 Add-in Memory; and others.

**Intersil Inc., Systems Div., 1275 Hammerwood Ave., Sunnyvale, CA 94086.**

**Circle 324**

## Bring Your Printer Problems to Us

**1200 Series Chaintrain Printer.** Top-of-the-line heavy duty Chain Train models offer high speed, superior print quality and durability seldom available from minicomputer vendors. These printers feature two sets of motorized



tractors, 95% parts commonality, compact size and micro-processor electronics make them perfect for a variety of "work horse" applications. The company also makes band printers, drum printers, belt printers and matrix printers. "Bring your minicomputer printer problems to Digital Associates," says the company. "Our printer specialists are anxious to be of service to you."

**Digital Associates Corp., 1039 East Main St., Stamford CT 06902.**

**Circle 320**

# 64K RAM S-100.

# \$350\*

\*OEM quantity 500 Model 2065.

IEEE S-100 64K dynamic RAM board supports Cromemco-type bank port/bank byte bank select; 16K block addressing (can be bank independent); configurable as 16, 32, or 48K board without removing devices. Supports DMA, and includes fail-safe refresh circuitry (processor transparent for Z80A or 8080 CPUs). 4116 RAMs; no wait states at 4MHz.

Part of the CCS industrial quality S-100 product line. Call or write for a free catalog.



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Computer  
Systems**

250 Caribbean Drive  
Sunnyvale, California 94086  
(408) 734-5811  
Telex 171959 CCS SUVL

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RESEARCH AND  
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# THE FUTURE OF TELECOMMUNICATIONS IS STARTING TODAY IN THE TAMPA BAY AREA

The time: Now. The place: GTE's new state-of-the-art telecommunications facility in St. Petersburg, Florida. The focus: Tomorrow. Our facility represents a new plateau in the progress GTE has made in developing computer based telecommunications systems with expanded capabilities. In merging advanced communications and electronics technologies we've introduced new systems with remarkable voice and data services that meet the needs of an increasingly sophisticated market.

We're looking for a start-up team of creative hardware design professionals who will enjoy working in an environment without precedent. We have the following positions available to ambitious candidates:

## **MICROPROCESSOR SYSTEM DESIGN ENGINEER**

Approximately 15 years experience in microprocessors, memory and peripheral components required. Responsibilities include evaluating, selecting and recommending state-of-the-art components for telecommunications products.

## **TRANSMISSION AND PROTECTION ENGINEER**

Specify transmission requirements for PABX and key systems.

## **TRANSMISSION ENGINEER**

Responsibilities include evaluating and advising product design for meeting transmission and interference requirements.

## **LINE AND TRUNK CIRCUIT DESIGN**

Approximately 15 years of design experience in line/trunk circuit design. Responsibilities include designing the line circuits and trunk circuits for the key system and next generation voice/data switches.

## **POWER SUPPLY DESIGN ENGINEER**

Design and develop power supplies and distribution techniques for use in terminals and small switch units. Requires 10 or more years of experience.

## **LOGIC CIRCUIT DESIGNER**

Approximately 12 years relevant experience in the design of computers, digital systems, logic circuits and LSI circuit development for computers and communication systems.

## **COMPONENT ENGINEERS**

Assist in the evaluation and qualification of new technology components for use in advanced telecommunications products. Requires 4 or more years of experience.

You'll find yourself in surroundings that promote accomplishment. In addition to our new building, the growing Tampa Bay area offers its own special advantages. Housing is affordable. Assumable mortgages are available. The Gulf Coast beaches provide enjoyable recreation. There is a diverse spectrum of cultural and educational activities. And our "flex-time" working schedules allow you the time you want to participate.

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**Performance** - Relms' Mega-Memory™ Series P-796 Multibus™ memory products offer unsurpassed performance and quality.

**Expandability** - Relms' Mega-Memory™ Series boards address up to 16 megabytes for expandable memory systems.

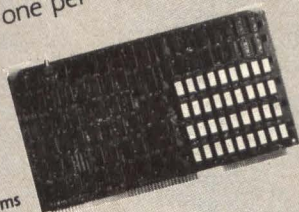
**Availability** - Relms' Mega-Memory™ Series are immediately available with full documentation to ease your production problems.

**Remember** - Relms would like to be considered as your OEM supplier. To encourage you to evaluate our hi-performance line, we are making this limited offer:

**Relms' 256 Kilobyte IEEE 796 board \$1790<sup>00</sup>** — Limit one per purchaser.

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**(408) 732-5520**

**relms**  
Relational Memory Systems  
1180 Miraloma Way  
Sunnyvale, CA 94086  
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 Yes, Relms, your 256K Mega-Memory™ offer is unforgettable. Please contact me immediately.  
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| <input type="checkbox"/> 64K Dynamic RAM   | <input type="checkbox"/> GPIB                      |
| <input type="checkbox"/> Memory Protection | <input type="checkbox"/> Z80 Single Board Computer |
| <input type="checkbox"/> 64K ROM           | <input type="checkbox"/> CP/M Board Set            |
| <input type="checkbox"/> P796 Display      |  |

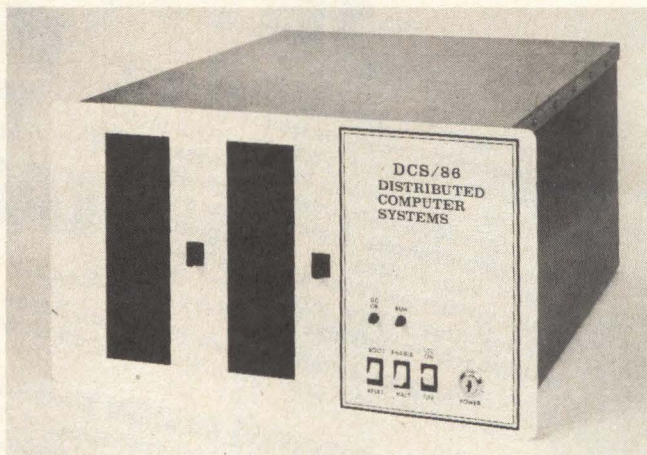
Name \_\_\_\_\_  
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 Address \_\_\_\_\_  
 City \_\_\_\_\_  
 Phone No. (\_\_\_\_) \_\_\_\_\_  
 1180 Miraloma Way, Sunnyvale, CA 94086

Byte Exchange & Mega-Memory are trademarks of Relational Memory Systems, Inc. Multibus™ is a trademark of Intel Corp.

Circle 20 on Reader Inquiry Card

## New Development System

**DCS/86.** A 16-bit microcomputer development system which uses Intel's 8086 16-bit processor plus the CPM/86 operating system. The DCS/86 can be used for most industrial applications where minicomputer performance is required. Applications include data communications,

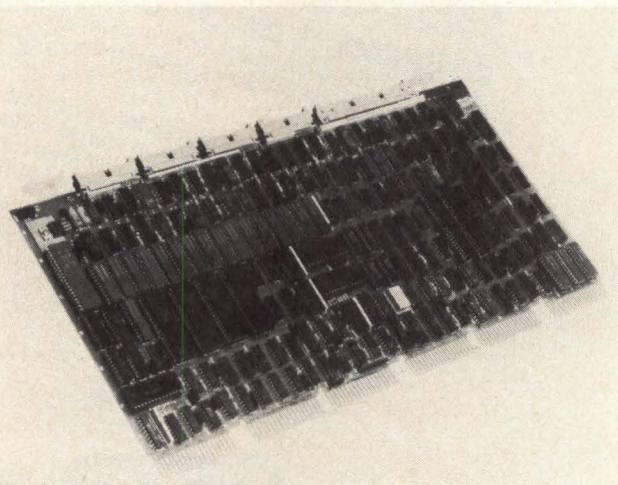


graphics, industrial control, process control, etc. "This unit," says the company, "is a 16-bit microcomputer system with the performance of a minicomputer."

**Distributed Computer Systems, 223 Crescent Street, Waltham, MA 02154**  
**Circle 212**

## Highest Performance Subsystem

**DS-231.** A DEC emulating RM02 disk subsystem. Compatible with PDP-11. Storage capacity: 67MB formatted. Five disks (14"); five sides; six heads. Recording density: 6038 BPI. Track density: 384 TPI. Avg. access time: 35 ms. Track to track access: 6 ms. Latency: 8.33 ms. Data transfer rate: 1200 KB/sec. "This subsystem has the highest per-



formance/dollar ratio of any subsystem presently offered," claims the company. "Its average data through-put is limited only by the disk drive transfer rate." **Western Peripherals, 14321 Myford Road, Tustin, CA 94680**  
**Circle 218**

# DILOG TAPE COUPLERS FOR STREAMING OR FORMATTED DRIVES FOR DEC 11\*

The DILOG DQ130 and DU130 are  $\mu$ P based intelligent 1/2" Tape Couplers for your LSI-11, 11/2, 11/23 or PDP-11 computers respectively. They're the only Couplers • for standard start-stop or streaming mode operation • capable of handling 8 drives • proven reliability and performance with an installed base *in excess of 1,000 units* • all on a single quad board that plugs into your CPU.

If you intend using your streaming tape drive in a standard start-stop mode and later wish to employ streaming mode for Winchester back-up, DILOG Couplers will handle both. You don't need to change a thing. The Dilog 'Backup/Restore' stand-alone driver software will implement and support streaming operation.

The '130' Series can also accommodate two standard 1/2" formatted tape drives with three slaves each, or two stand-alone formatters that handle four drives each... 9-track 800 bpi NRZI, 9-track 1600 bpi PE, or 800-1600 bpi dual density... with 7", 8 1/2" or 10 1/2" reels and read/write speeds from 12.5 to 125 ips and data transfer rates to 200,000 bytes per second.

The Couplers emulate the DEC TM-11/TS-03 and you'll get full software compatibility with RT-11, RSX-11, RSTS, IAS and MUMPS.

As for tape drive compatibility, both the DQ130 and DU130 interface drives from the following manufacturers:

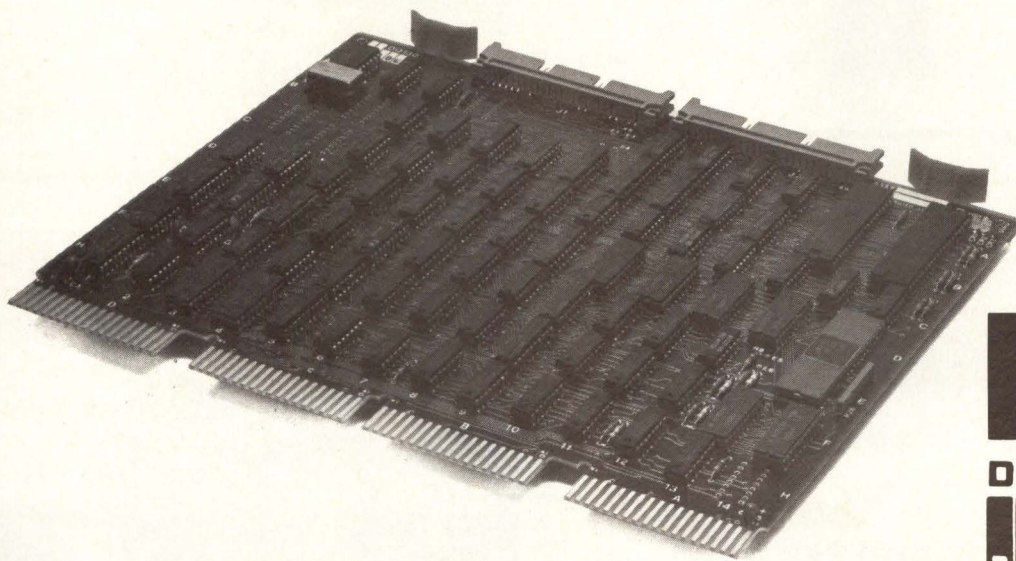
AMPEX	PERTEC
CIPHER	TANDBERG DATA (IDT)
CONTROL DATA	WANGCO (PERKIN ELMER)
DIGI-DATA	TDX
KENNEDY	EMI (SE LABS)

To insure ease of maintainability & data integrity the Couplers incorporate an automatic self-test feature, with card-edge LED status indicator, and data protect feature.


Write or call for complete details on the Coupler that lets you mix or match up to eight 1/2" tape drives for standard or "streaming" operation.

Distributed Logic Corp., 12800 Garden Grove Blvd., Garden Grove, California 92643 Phone: (714) 534-8950  
Telex: 681 399 DILOG GGVE • EASTERN REGIONAL SALES OFFICE, 64-A White Street, Red Bank, New Jersey 07701, Phone: (201) 530-0044.

\*Trademark Digital Equipment Corp.

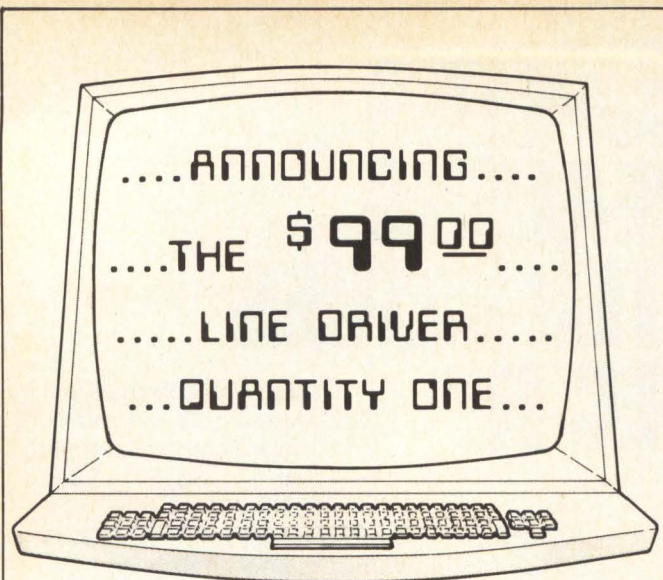


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DILOG 

**NUMBER 1 FOR DEC-11**

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The bo-sherrel M-3 Asynchronous Line Driver provides full duplex data transmission over regular 4-wire lines. It is end-to-end compatible with bo-sherrel's M-1 Short Haul Modem, but requires power from the attached terminal.

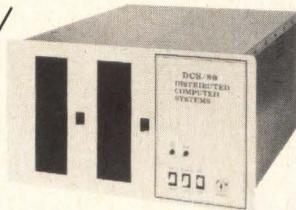
### bo-sherrel co.

6101 Jarvis Avenue  
Newark, CA 94560  
415 + 792-0354

Quantity:	Price:
10 - 99	\$83.00
100 - 999	\$67.00
1000 - UP	\$51.00

Circle 22 on Reader Inquiry Card

## DCS/86 (16 bit) Multibus® Development/ Control System \$6500



The DCS/86 is an industrial quality rack mountable Multibus\* system based on the Intel 8086 16 bit microprocessor. A DCS/86 system includes dual 8" floppy disks with controller, DCS 86/16 CPU, 9-slot backplane, and heavy duty power supply. A 64K byte system with CPM/86\*\* software is \$6500.00.

**MULTIBUS HARDWARE** - DCS designs and manufactures a complete line of Multibus compatible modules which includes the DCS 86/16 that contains an 8086, 3 serial ports (two of which are capable of high-level protocols including HDLC and SDLC), vectored interrupt, counter/timer, RAM/PROM, 24 bits of parallel I/O and full multimaster capability.

**SOFTWARE** - The DCS/86 utilizes CPM/86\*\*, a complete disk operating system with assembler, editor and utilities. 8080, 8085, Z80 to 8086 translation software is also available. High level languages include Basic, Pascal, Fortran, PL/I (Subset G) and Cobol.

**DCS/80** - 8080 based system prices begin at \$3995.

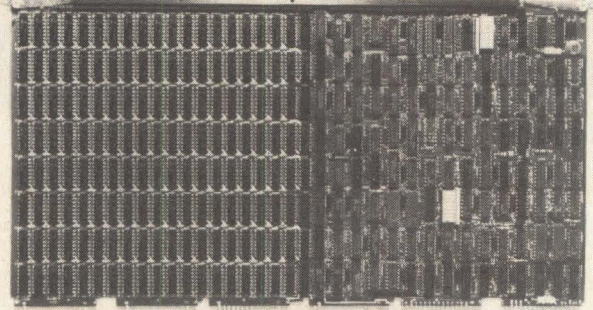
\*Multibus TM of Intel, \*\*CPM/86 TM of Digital Research

**Distributed Computer Systems** 617 899-6619  
223 Crescent Street, Waltham, Ma. 02154 Toll Free 1-800-225-4589

Circle 23 on Reader Inquiry Card

## Memory Expandable Module

**DR-144S.** This is the industry's only 16K RAM-based PDP 11/44 module to provide more than 256KB capacity. It provides 1.0 MB! Only one unit load. Lower power. The DR-144S is the only PDP 11/44 semiconductor ADD-IN



(from either DEC or the independents) to exceed 256KB in capacity while utilizing 16K RAMS. (Using 16K RAMS rather than 64K RAMS, for higher capacity systems, takes advantage of the lower price/bit of 16K RAMS, compared to 64K RAMS).

**Dataram Corp,** Princeton Rd, Cranbury, NJ 08512.

Circle 245

## Dependable Power Supplies

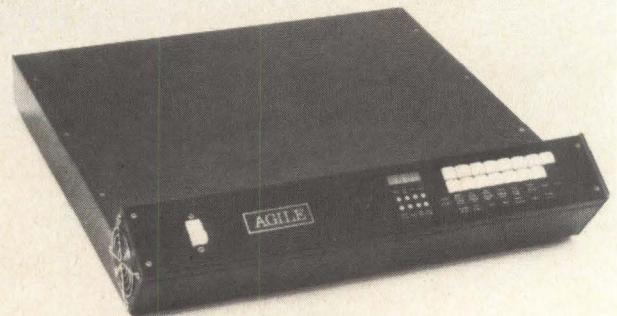
**DU 50 and DU 250.** All the power you'll ever need in OEM power supplies. 50 to 250 Watts. Reliability is assured with a one-year warranty. Units are available open-frame or enclosed. Standard or optional features include brown-out protection, short-circuit protection, power-fail option, over-temperature protection, and OVP for all outputs. Each unit is EMI filtered and constructed of proven quality materials. All units deliver up to 80% efficiency. Custom designs are available for special needs.

**Digital-Power,** 686 E. Gish Road, San Jose, CA 95112.

Circle 250

## A Flexible Controller

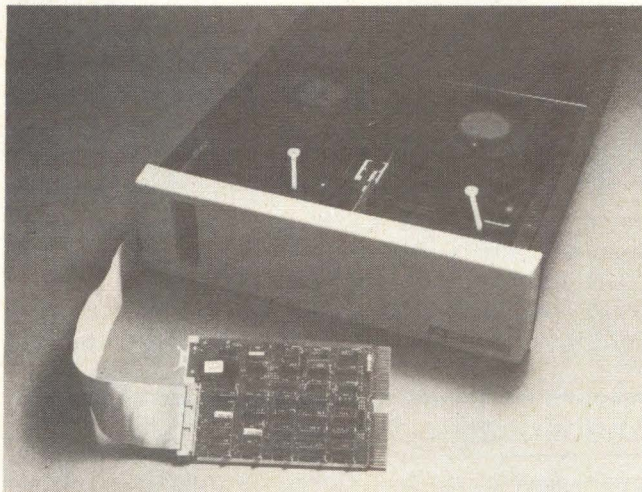
**MODEL 5287.** Controller interface allows attachment of any printer (whether RS232 or Centronics) to IBM 3274 Cluster Controller or IBM 3276 Cluster Controller. The unit



will support both BSC or SNA/SDLC applications.  
**Agile Corporation**, 1050 Stewart Dr, Sunnyvale, CA 94086.  
**Circle 234**

### Increase Storage Capacity Four Times

**WINC 08.** Utilizes Fujitsu 8" Winchester drives which allows the system to operate in a standard industrial environment. By providing two 8" Winchesters, a total usable storage of 41.6MB is usable. System is provided in a 5 1/4" high, rack-mountable or table top chassis. Winc-08 will operate under DEC's PDP-11 or LSI-11 CPU series. The unit is available in varying system configurations to allow the user the most cost efficient system. The device is completely software transparent to DEC's RL02 system and provides up



to 41.6MB of data storage. "And that," says the company, "is four times as much storage capacity as DEC's RL202 gives you in just half the space." **Advanced Electronics Design Inc**, 440 Potrero Ave, Sunnyvale, CA 94086

**Circle 223**

### Scratch Resistant Disks

**MODEL 5800C.** Dual 5 1/2" Micro-Winchester Disk System. Compatible with LSI-11. Provides 10.4 MB of formatted storage emulating the equivalent of two RL01s. The disk drive utilizes plated disks to improve data reliability and is 1000 times more resistant to scratches and damage than traditional oxide-coated disks. Other products: **MODEL 980/990 (2/4 MBs)** fixed hard disk memory; **MODEL 9800R 8" Winchester** for hostile environments.

**Dataflux Corp**, 1050 Stewart Drive, Sunnyvale, CA, 94086.

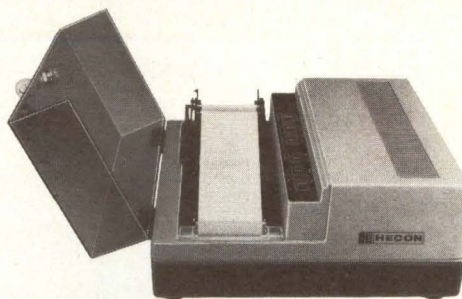
**Circle 242**

### Second Sourcing

This company offers a second source hardware integration and UNIX operating systems support for the PDP-11 and VAX minicomputer systems. IDS's product has been on the market for approximately five years. **International Data Services**, 1020 Stewart Dr, Sunnyvale, CA 94086.

**Circle 241**

**ZZZTT. ZZZTT. ZZZTT.**



**The sound of Hecon's G0687 Electrosensitive Tape Printer.**

**Reliable.**

The only moving part is the paper feed. A unique, fixed 100 wire printhead produces a full 20 characters per line. No shuttle mechanism to fail. No ink cartridges or ribbons to replace. Lots of dependable printing.

**Legible.**

The 64 character ASCII set is produced in a unique 5 x 14 matrix pattern. Crisp, clear characters line after line at 5 lines per second.

**Versatile.**

Available versions are desktop, wallmount, and rackmount complete units or OEM mechanisms. A model for every application.

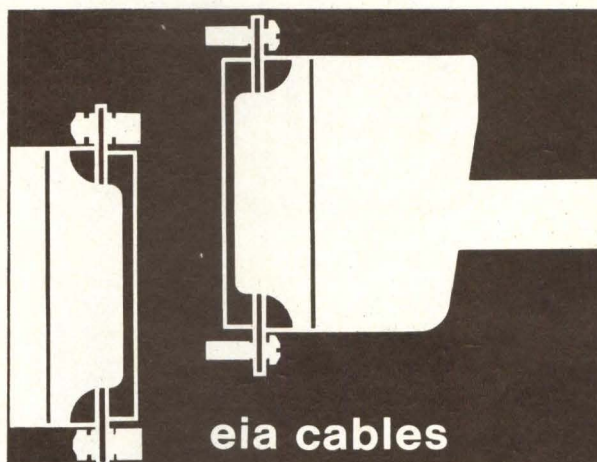
Reliability, legibility, versatility—all you ever needed in a Tape printer. Available now in the G0687.

**It's got to be good. It's a Hecon.**



Hecon Corporation, 31 Park Road, Tinton Falls, NJ 07724  
 • (201) 542-9200

**Circle 24 on Reader Inquiry Card**



- Standard and extended length cables.
- Highest quality materials.
- Stringent quality control.
- Stocked lengths for immediate delivery.
- Custom lengths to order.
- Coax/twinaxial cables also available.
- Quantity pricing and fast delivery.

**wireworks**

WIREWORKS CORPORATION  
 Data Communications Division  
 380 Hillside Avenue, PO Box 3600  
 Hillside, New Jersey 07205  
 Tel: (201) 686-7400  
 Twx: 710-985-4675

**Circle 25 on Reader Inquiry Card**

## EXATRON'S RS-232C STRINGY/FLOPPY MASS STORAGE SYSTEM.



**Mini-disk speed, capacity and reliability for only \$399.50.**

- Standard RS-232C communications link
- Built-in operating system
- Two file management structures: ASCII and binary
- Three baud rates available: 300, 1200 and 9600
- Busy/ready handshaking supported

Call our HOTLINE...

(800)-538-8559

In California,

Call (408)-737-7111



Exatron, Inc.

181 Commercial Street  
Sunnyvale, California 94086  
(408)-737-7111

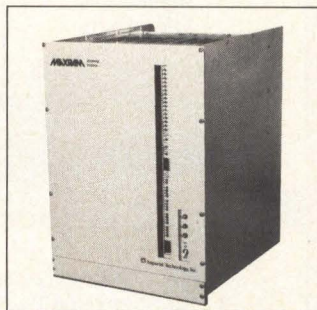
Circle 26 on Reader Inquiry Card

## High-Speed MAXiRAM Storage System

Offers superior performance, throughput and reliability!

Compatible with:

- D.E.C.
- Data General
- Westinghouse



The non-rotating MaxiRam is a solid-state disc replacement storage system that operates at the speed of main memory. It is ideal for the following:

- ...if your processor is disc I/O bound.
- ...if your CPU spends too much time in the 'wait' state.
- ...if your present disc gives you reliability headaches.

Write or call to find out how *your* memory performance and reliability can be dramatically improved. Units available in both core and semiconductor.



Imperial Technology, Inc.

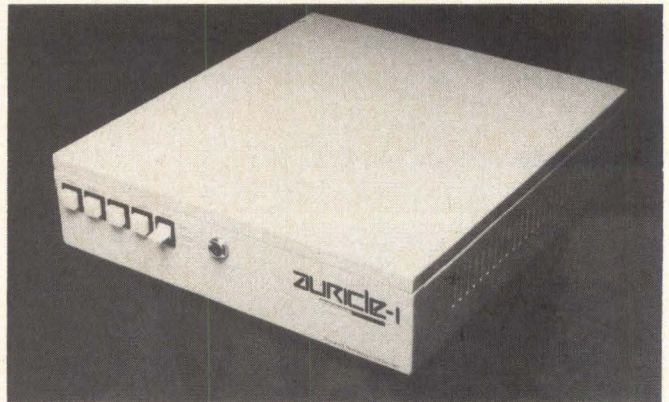
831 S. Douglas Street • El Segundo,  
California 90245 • Telephone: (213) 679-9501

Circle 27 on Reader Inquiry Card

## COMPAT Showcase

### Voice-Entry Device

**AURICLE-1.** Stand alone development system intended to familiarize OEM's of computer based systems with user trainable speech recognition. The OEM will find it easy to integrate a low-cost modular speech recognition subsystem into his product. Device has a vocabulary of 80 words or short phrases. Voice data entry capability enables an OEM to

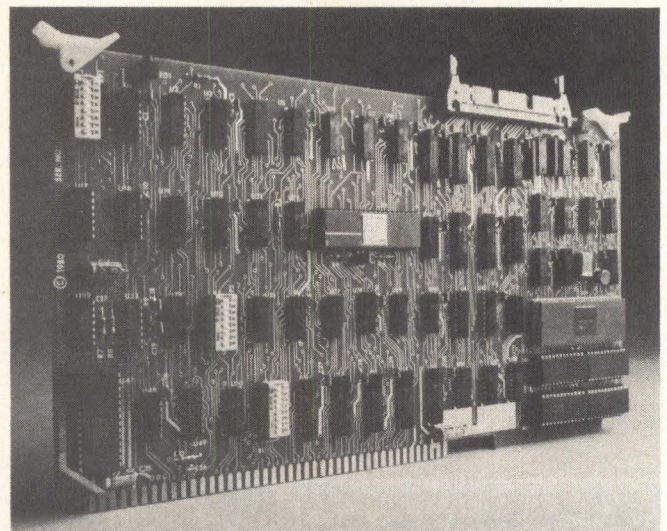


add significant value to his product. It is a natural man/machine interface that permits hands-free interaction with a system. It eliminates need for skilled key operators.

**Auricle Inc.**, A Subsidiary of Threshold Technology Inc., 20823 Stevens Creek Blvd, Cupertino, CA 95014. **Circle 243**

### Announcing a Wedding

**WDC 2880.** Winchester Disk Controller. Compatible with Intel Multibus, it can control up to eight rigid disk drives from any manufacturer complying with the new ANSI X3T9.3 interface specifications (which are expected to be the accepted industry standard for new 8" Winchester drives and



possibly for new 5 1/4" Winchester drives.) "Our WDC 2880," says the company, "marks the marriage of two great standards, the ANSI X3T9.3 Winchester Disk interface standard and the powerful MULTIBUS."

**Interphase Corporation**, 32667 Floyd Circle, Dallas TX 75243.

**Circle 249**





# Superior!

## The Superior 5¼ inch Winchester Disk Drive

We're starting out ahead of the industry. Our new CM 5000 5¼ inch Winchester disk drive is already superior to any drive available. It delivers more capacity at the lowest cost per megabyte. An incredible 16 megabytes in a minifloppy-sized unit that fits into most floppy systems without requiring system structural changes. It's a result of our no-compromise design philosophy that improves upon proven Winchester technology.

### No Equal

Our CM 5000 has no equal. We've designed features into a 5¼ inch Winchester disk drive that no one else has. For example, there are our high resolution, high output heads.

There's a unique no hysteresis positioning feature. Added to that are such exceptional features as 345 TPI recording, an internal microprocessor and a high torque stepper motor. With capacities of 5.3, 10.7, and 16 megabytes in one, two or three platter versions. All built around proven Winchester technology.

### The Leading Edge

We're not stopping here. Our concept, philosophy and commitment is to keep ahead. To stay at the leading edge of Winchester technology. You'll see us lead the rest in innovations and features that translate into an even lower cost per megabyte.

To find out how you can have the superior Winchester drive in your system, call us at (213) 709-6445 today for complete specifications, prices and for immediate delivery of an evaluation unit.

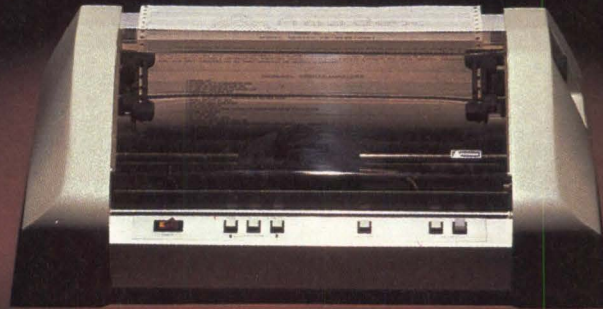


**Computer Memories, Incorporated**  
9233 Eton Ave. Chatsworth, California 91311  
(213) 709-6445 TWX 910 494-4834

Circle 28 on Reader Inquiry Card

The important plus in matrix printers:

# grafixPLUS.™



Since their introduction in mid-1980, the Anadex high-resolution DP-9500 Series matrix printers have set new standards for printer quality and performance. All models feature the rugged Anadex 9-wire print head that combines long life with resolutions of 72 dots/inch vertical and up to 75 dots/inch horizontal. With this kind of resolution, fineline graphics (under data source control) and razor sharp characters are pluses built into every printer.

#### Performance Plus

The full standard ASCII 96 character set, with descenders and underlining of all upper and lower case letters, is printed bi-directionally, with up to 5 crisp copies, at speeds up to 200 CPS. Models DP-9500 and DP-9501 offer 132/158/176 and 132/165/198/220 columns respectively. Print densities are switch- or data-source selectable from 10 to 16.7 characters/inch. All characters can be printed double-width under communications command.

#### Interface Plus

Standard in all models are the three ASCII compatible interfaces (Parallel, RS-232-C, and Current Loop). Also standard is a sophisticated communications interface to control Vertical Spacing, Form Length and Width, Skip-Over Perforation, Auto Line Feed, X-On/Off, and full point-to-point communications.

#### Features Plus

As standard, each model features forms width adjustment from 1.75 to 15.6 inches, shortest-distance sensing, full self-test, 700 character FIFO buffer (with an additional 2048 characters, optional), and a quick-change, 6 million character life ribbon.

#### Quality Plus

Beyond the built-in performance of the grafixPLUS series printers, the engineered-in quality and support are equally important. The result? Approval of both UL and FCC, Class A; operating noise levels under 65dbA; and a nationwide service organization second to none.

To see for yourself why the grafixPLUS printers offer more pluses for your printing dollar, contact us today.

 **Anadex**  
the plus in printers

Made in  
**U.S.A.**  
for the World

ANADEx, INC. • 9825 DeSoto Avenue • Chatsworth, California 91311, U.S.A. • Telephone: (213) 998-8010 • TWX 910-494-2761  
U.S. SALES OFFICES: San Jose, CA (408) 247-3933 • Irvine, CA (714) 557-0457 • Wakefield, MA (617) 245-9160 • Austin, TX (512) 327-5250  
ANADEx, LTD. • Weaver House, Station Road • Hook, Basingstoke, Hants RG27 9JY, England • Tel: Hook (025672) 3401 • Telex: 858762 ANADEx G

Circle 35 on Reader Inquiry Card

## Triple Density Tape System

**GROUP 3000.** Triple density 125 ips Tape System. Until recently, 6250 technology was only available on very large mainframe CPUs. "Now," says Qualex, "our Group 3000 is a plug-compatible compact upgrade that brings 6250 bpi, 125 ips performance to your HP 3000 computer." Transfer rate is 781 KB ("20-fold boost over HP's 800 bpi drive"). Other specs: rewind speed, 500 ips; density, 800-6250 bpi; dual density; triple density; rewind time, 1 minute; auto load; automatic reel latch.

**Qualex Technology Inc.**, 6925 Canby Ave, Building 109, Reseda, CA 91335 **Circle 230**

## New Multiplexers

**MODELS 4107, 4111, AND 4118.** ULM transparent multiplexers. Also models 4307, 4311, and 4318 ALM/ATM software transparent multiplexers, and the 4808 8-port DMA multiplexer. First public showing of these models.

**Quentin Research Inc.**, 19355 Business Center Dr, Northridge, CA 91325 **Circle 247**

D

(If you missed seeing the products in the designated booth areas, then use circle numbers to get all pertinent information by mail from the manufacturer.)

## Itching . . . for a Thermal Printer?



### Don't Scratch Your Head!

Don't scratch your printhead, that is. Only the Hecon A0550 Thermal Printers lift the printhead away from the paper during paper advance. This unique feature reduces unnecessary wear and extends printhead life to a minimum of 4 million lines at 2 lines per second.

Designed for long term reliability, the A0550 uses cast parts for consistent and dependable operation. Even the rubber roller uses an exclusive compound to ensure accurate paper position and superior print quality.

Available in 20 or 40 column versions, you can specify desktop complete units or OEM mechanisms. Two copy thermal paper is also available.

If thermal is the way you go, don't scratch your head—make Hecon your destination!

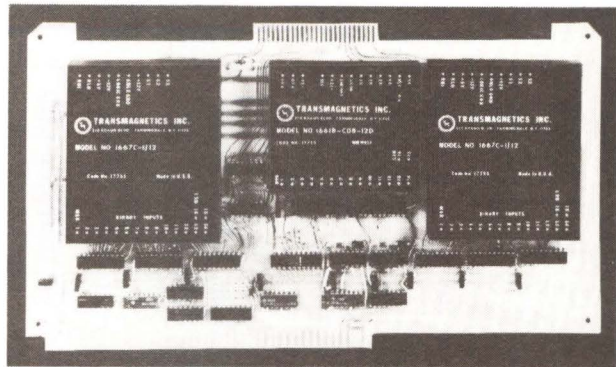
It's got to be good. It's a Hecon.



Hecon Corporation, 31 Park Road, Tinton Falls, NJ 07724  
• (201) 542-9200

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## INTEL MULTIBUS COMPATIBLE SYNCHRO-TO-DIGITAL AND DIGITAL-TO-SYNCHRO CONVERTERS



The Model 5401 is a versatile interface that consists of a standard Intel size PC incorporating all the required interface logic. This board can be configured with either a multi-purpose two-speed (36:1/18:1) Synchro/Resolver-to-Digital converter, or any combination of three 16 bit Synchro/Resolver-to-Digital or Digital-to-Synchro/Resolver converters.

Accuracy to  $\pm 20$  arc seconds.



**TRANSMAGNETICS INC.**

210 ADAMS BLVD. • FARMINGDALE, N.Y. 11735

Circle 29 on Reader Inquiry Card

## POCKET PROGRAMMER POCKET CONTROLLER POCKET DIAGNOSTIC POCKET TERMINAL

If you're building, servicing or using industrial micro systems, the Pocket Terminal could save you time, money and frustration. It gives full ASCII I/O facilities with 16 segment display, 30 character memory and a wide range of signalling options in a low cost, hand-held package weighing approx. 1/2 lb.

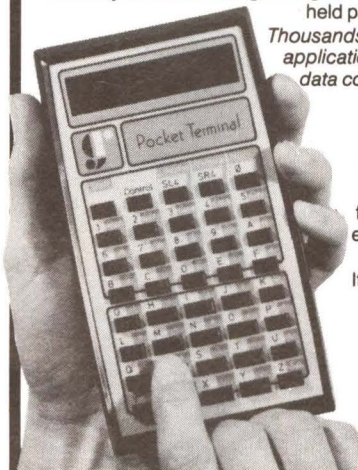
Thousands of units are now in service in applications including instrumentation, data collection, telecommunications, radar, process control, traffic regulation, analytical and medical systems.

The Pocket Terminal is a real, cost-effective alternative to fixed control panels and bulky, expensive terminal equipment.

Try one. It could solve a lot of problems.

Further information from:  
**G. R. ELECTRONICS**

1640 Fifth Street,  
Santa Monica, CA 90401.  
Telephone: (213) 395-4774  
Telex: 65-2337  
(BT Smedley SNM).



Circle 31 on Reader Inquiry Card

# The Computer Compatible Directory

## Part Two

a listing of plug-compatible  
peripherals and products

**L**ocating compatible peripherals for DEC, DG, P-E, HP and other computers has been a problem — until now. This directory of computer compatible products gives you model names, descriptions, prices and company contacts right at your fingertips so that you, the OEM integrators and system designers, may evaluate and make comparisons without spending valuable time searching through many different sources. Here is the industry at a glance.

Part Two contains listings of: Display Terminals, Flexible Disk Drives, Packaging/Hardware/Backplanes/Enclosures, Printers and Plotters, Rigid Disk Drives, Services, Special I/O's, Tape Systems, Test Equipment/Instrumentation, Other. For more information on AC/DC Power/UPS/Line Conditioners, Add-In/Add-On Memories, Array Processors, Communications, Controllers and Disk Emulators, see Part One of the directory in the August 1981 issue of **Digital Design**. The complete listing of manufacturers, including addresses and phone numbers, is given following both parts.

This directory will continue to be expanded as new companies come into this growing market and as new products are introduced. If you were left out and want to be listed in our next directory, fill out the questionnaire that follows the Manufacturer's Listing and return to Directory Editor, **Digital Design**, 1050 Commonwealth Ave, Boston, MA 02215.

### Display Terminals

#### VT100 Terminal Emulator

ABT VT100 is a PASCAL program that uses the Videx 80 column board and the Apple comm. card to emulate a DEC VT-100 and VT-52 terminal. It enables dial-up access to any established RSTS/E operating system or data base. \$495 w/ Videxboard; \$250 w/ SW only. Vend maint. ABT and Apple.  
*Advanced Business Technology Inc, Saratoga, CA.*

#### Zenith Data Systems Z-19

Video terminal. Manufacture. service. 4FO.  
*Advanced Digital Products, San Diego, CA.*

#### AED 512

256 colors, 512 x 483 resolution. Intelligent based controller provides scroll, pan, zoom plus exclusive Superroam feature. External comm. via RS-232 serial interface or parallel DMA interactive capability via keyboard and

joystick. \$8875 — \$16,500. Vend Maint, 2 FO.

*Advanced Electronics Design Inc, (AED), Sunnyvale, CA.*

#### ABM 85 Video Terminal

Smart terminal, high resolution green screen, full video attributes, line graphics, advanced editing. \$700 — \$900. Vend maint, 6FO.  
*Amtex Business Machines Inc, Santa Clara, CA.*

#### 190-T Tektronix

Plug-in conversion board for the TI 810 RO printer. Emulates the Tektronix 4611 and 4631 hard-copy units while serving as 150

cps serial RS-232 printer at rates to 9600 baud. \$995.

*Analog Technology Corp, Irwindale, CA.*

#### AMBASSADOR 100

Supports DEC VT100 private use modes and controls. \$1095 qty 100 OEM.

#### VT52-COMPAT

DEC VT52 emulation; 24 line x 80 char display; test mode for system debugging; erase to end-of-line/page; U/L case display; blink accent std (dim and reverse-video opt.); 15" screen & detached keyboard. \$1450.

**DG-COMPAT**

Dasher emulation; 24 line x 80 char display; blink, dim, underline accents; standard printer output; 20 function keys; 15" screen and detached keybd. \$1600.

**AMBASSADOR**

ANSI X3.64 compat. CRT terminal; standard with editing, formatting, block or char transmission, printer output; displays up to 60 lines of 80 chars; 64 downloadable strings for function keys. \$995-1100 qty 100 OEM. RTFM. *Ann Arbor Terminals Inc, Ann Arbor, MI.*

**Televideo 950 Terminal w/ACS-WANG Interface**

Emulates Wang 2236 DE, including limited graphics. Protected fields, underlining, self-tests, tilt-able screen, 24 lines x 80 char reverse video dual intensity, blink, blank, detached selectric keyboard w/ switch selectable key click compat to Wang MVP, LVP, VP. \$2236.

*Automated Control Systems Inc, Bellevue, WA.*

**5216, 5215, 5217, 5217CT, 8000 Series CRTS**

Graphic display terminals, RGB color video monitor. 8 FO.

*Aydin Controls, Ft. Washington, PA.*

**Micro 4400 and DM 3270**

DM 3270 is an IBM 3276 compat. terminal. Enhanced emulation. Micro 4400 is a  $\mu$ P based data comm. terminal. Emulates Burroughs TD 700/800. Can support special protocols.

*Beehive Int'l, Salt Lake City, UT.*

**BT-100 + Video Display Terminal**

Plug-compat with DEC VT-100. Features a 15" diagonal non-glare screen and detached keyboard. Includes advanced video, printer port, 20mA current loop and auxiliary AC outlet.

**BT-314**

Emulates Lier Siegler ADM-3A. 12" high data display monitor. User-controlled brightness, standard control functions and cursor positioning.

**BT-100**

Plug-compat with DEC VT-100. 12" diagonal screen and advanced video. 20mA current loop, and printer port.

**BT-2A**

Emulates DEC VT-52. 12" diagonal, non-glare screen and displays 1920 characters, 80 char/line by 24 lines. Cursor control, 32 char graphics mode. Vend maint. 55FO. *Braeger Minicomputer Peripherals Div, Anaheim, CA.*

**CAL-COM 920-H/CAL-COM 78A/CAL-COM 78SP**

Honeywell emulation. Sync or async models. Enhanced features, cost savings. From \$1595-\$2895. Vend maint.

*California Communications, Playadel Rey, CA.*

**4650 and 4651 Video Display Terminals**

12" CRT, 80 char x 24 line, 25th command/status line, detached keyboard, to 19200 baud, 96 char ASCII, 4650 char mode only, 4651 char/block mode, 20 user programmable function keys. Both have full cursor control and number keypad. Furnished with shielded cable. 4650, \$995; 4651, \$1245. RTFM. 15FO.

*California Computer Systems Inc, Sunnyvale, CA.*

**DEC VT100**

Retail, systems integrator, vend maint.

*California Datalease Systems & Financial Corp, Anaheim, CA.*

**CD100/L03**

VT100/52 compat video processor; 2 mini floppies (512kB each) RX02 compat; 6 slot LSI-11 Q-Bus compat card cage. All integrated in desk top work station.

**CD100/L04**

VT100/52 compat video processor; one 5 MB mini-Winchester, RL01 compat and one 512kB mini floppy RX02 compat 6 slot LSI-II Q-Bus compat card cage. All integrated in desk top work station.

**CD100/M01**

Advanced video processor ANSI compat. One 5MB mini-Winchester and one 1MB mini-floppy; Z80 CPU with 64K RAM and 2 serial ports; CPM operating system; 6 slot Intel Multibus card cage. Vend Maint. 15 FO.

*Callan Data Systems, Westlake Village, CA.*

**CGC 7900 Color Graphic Computer**

Driven by MC68000 chip, stand-alone mode or as an intelligent terminal, 19" tube with 1024 by 768 screen resolution, up to 256 colors displayable simultaneously, a menu of 16 million color shades, graphic and alphanumeric overlays that are independent of the underlying bit map screen, up to 8 windows. Compat. with DEC's DRVII-B. \$19,995.

*Chromatics, Tucker, GA.*

**3100 VT100 Emulator**

Advanced video option, printer port, non-glare screen, 4 video attributes, set up prompt legends, 19,200 baud operation and screen save. \$1595.

**3132 VT100 Emulator**

Smart scroll, non-glare screen, blink/non-blink cursor, detachable keyboard with operator selectable configuration, advanced video attributes and serial printer port. \$1795. RTFM.

*Cobar Inc, Anaheim, CA.*

**QBII**

Completely integrated Q-Bus terminal w/ 11/2 or 11/23 CPU, display, keyboard, and Q-Bus backplane. Rugged enclosure. Console emulates VT52. \$3295 w/out CPU.

**MB 851**

Industrial Multibus Microcomputer. Fully integrated terminal constructed for durability. Environmentally sealed for protection, unique thermal heat exchanger, thermostatic protection.

**MB 80/280**

Integrated Multibus microcomputer w/ 12" CRT, keyboard, backplane, control panel, and 8085 CPU. Vast array of SW available. \$3495. 3FO.

*Comark Corp, Waltham, MA.*

**Vision One/20**

Digital image exploitation system. Self-contained with multi-purpose programmable processors and large data bases. Stand-alone or coupled processor to numerous hosts. Field upgradable to 4096<sup>2</sup> data bases.

**8000-R**

Solid state RAM memory LSI peripheral processor. Semi-autonomous device. Pipeline processing capability and color or monochrome image enhancement, storage, and display.

**DVIP**

Digital Video Input Processor. Multiple frame integration TV image digitizer. Max frames integrated of 64, 128, or 256.

**MAPPER**

A digital 6 degree of freedom spatial warping HW option for mapping digital imagery in approximately 1/5 of a second time frames for 512<sup>2</sup> output pixels.

**COZO**

Continuous zoom processor, provides real-time HW magnification of factors ranging from 1 x up to 512 x.

**Twin Display**

Version of the Vision One/20, designed for the graphic arts community, provides for various combinations of black and white and color page make-up, color previewing, color correction, and job control generation.

**HRP**

High Resolution Processor. High speed special purpose HW to accept a job control to produce high spatial and color brightness resolution output required for printing operations.

**2000**

Stores digital color imagery in digital NTSC form in a single 8 bit 512 x 512 monochrome refresh memory.

*Comtal Corp, a Subsidiary of 3M, Altadena, CA.*

**Em3275/6**

Plug-compat IBM 3270 information display systems. \$2350, qty. discounts avail. Vend maint. 7FO.

*Control Concepts Corp, Arlington, VA.*

**CTI1000**

3767/2740 compat display with printer. CRT: \$2350; printer: \$1650. Vend maint. 3FO.

*Custom Terminals Inc, Raleigh, NC.*

**132-1D Display Terminal**

132-col, emulates DEC VT-100. Uses the Charactron (R) CRT which displays fully-formed (rather than dot matrix) characters. Has VT52 operating mode. Set-up from keyboard via English-language menu. Range of data rates from 300 to 19.2 K. \$1695, lease for \$96/month incl. maint. for 24-mo. lease. 100 + FO.

*DatagraphiX Inc, Display Products Dept, San Diego, CA.*

**EXCEL 12, EXCEL 14**

VT-100 emulator with 12" or 14" non-glare screen, tilt screen; detachable keyboard; advanced video option and enhanced printer port standard.

**EXCEL 22, 24**

VT-100 emulator, 12" or 14" tilt screen, detachable keyboard.

**EXCEL 52, EXCEL 54**

Provides VT-100-like capabilities with APL as a second language, 12" or 14" screen, non-glare tilt monitor; detachable keyboard.

**Color Scan 10**

VT-100 emulator display, 8 colors, 12" non-glare screen, tilt monitor, detachable keyboard.

**EXCEL 32, EXCEL 34**

Keyboard selectable emulation of Lear Siegler ADM 3A, Hazeltine 1420, ADDS Regent 2J, Datamedia 1521; 12" or 14" non-glare screen, tilt monitor, detachable keyboard. All include business graphics. Vend maint. 7FO.

*Datamedia Corp, Pennsauken, NJ.*



### Display Terminals

#### IPG4002 Image Processing System

DEC Unibus compat. with digital video processor, video output control, up to four 512x512x8 bit image memories plus overlay memory. Color or monochrome. From \$20,000 — \$60,000.

#### ID2000 Image Display System

256 x 256 pixel. DEC unibus compat. for display of color or monochrome images. From \$7500.

#### ID5000

512 x 512 pixel. DEC Unibus compat. for display of monochrome or color images. From \$12,500.

#### Visacom/23 Visual Computer System

Stand alone image processing system, incorporates DEC LSI-11/23. Optional interface to larger DEC host system. 512 kB image memory. From \$25,000. Vend Maint, 2 FO.

*DeAnza Systems Inc., San Jose, CA.*

#### Hazeltine, Lear Siegler, Diablo, Cltoh

Wholesale, discounted prices. vend maint, 3 FO. *Digital Data Systems Inc., Plantation, FL.*

#### Retro-Graphics Enhancement RG-512

Retro-Graphics PC card upgrades LSI ADM3A, 3A+ dumb terminal into graphics terminal. \$1150. Vend Maint, 1 FO. *Digital Engineering Sacramento, CA.*

#### VP800/A ANSI Compliant Display Terminals

Interactive display. VT100 compat. 8K display memory, buffered printer port, load font.

#### VP800/B

16K display memory, block mode, buffered editing, buffered printer port, load font.

#### VP800/C

Interactive Programmable Display Station. 16K display memory, buffered editing, full format capability, buffered printer port, download program capability.

#### VP825

Display station. V/3000 compat. 16K display memory, 80 or 132 col, complete video attributes and smooth scroll.

#### VP828

V/3000 and ANSI compat. 32K of display memory, 80 or 132 col, buffered printer port, complete video attributes, smooth scroll.

#### 32K Option

VP800/B and VP800/C only. 32K display memory.

#### Cables

Color coordinated RS-232C cable. H-P Paddleboard Connector. *Direct Inc., Sunnyvale, CA.*

#### VGT-100

VT-100 emulation with Plot 10 graphics capability. \$3154. Vend maint, 1FO.

*DY-4 Systems Inc., Ottawa, Ontario.*

#### LOG-53

Emulation of DG 6053/6052, D200/D100 or Dasher display terminals. Complete SW and keyboard compat, non-glare, high contrast screen, 1920 char display, serial printer port. \$1600; \$995 (OEM 100).

*Emulog Inc., Fremont, CA.*

#### IM-1

512 x 484 V resolution, text in 39 lines by 85 char, light pen interface, 20 MHz monitor, keyboard, RS232 interface, on-board  $\mu$ P, primitive SW, \$3000 for CRT, \$1000 operating SW, \$1500 dot matrix printer. Vend Maint, 1 FO.

*Form & Substance, Inc., Westlake Vge, CA.*

#### VuePoint/0190-0010

Complete terminal. 120 line by 40 char display, optical grid (LED) touch screen with up to 120 sensitive locations.  $\mu$ P controller with up to 51 pages of display memory. RS232 interface and keyboard and printer ports. \$3500, 3 page memory. RTFM.

*General Digital Corp., E. Hartford, CT.*

#### GT-100A

12" ASCII RS-232C w/ printer port; programmable function keys; full editing capabilities; block mode; line graphics; smooth scroll; XY cursor addressing.

#### GT-100D

6053 emulator, printer port; programmable function keys; line drawing graphics; XY cursor addressing; smooth scroll; half/full intensity.

#### GT-101

12" ASCII RS-232C w/ printer port; programmable function keys; full editing capabilities; block/char mode; line graphics; half/full intensity; smooth scroll.

#### GT-110

12" ASCII RS-232C w/ printer port; programmable function keys; full editing capabilities; block mode; line & block graphics; video attributes; foreign char sets.

#### GT-400

12" ASCII; detach kybd; 24 function keys; block/char/line transmission; video attributes; additional pages of memory; buffered printer port; foreign char sets.

*General Terminal Corp., Tustin, CA.*

#### G-1000 Interactive

Low cost, high resolution, monochrome raster scan graphics terminal; user programmable; RS-232C compat. with any host computer; selective erase; 1024 x 1024 resolution; detachable keyboard; 60 Hz flicker-free refresh; Z8001 processor. \$11,150.

#### GCT-3000 Series

High resolution monochrome or full color displays (512 x 256 to 1280 x 1024 pixels); flicker-free 30, 40 or 60 frames/sec refresh; modular design, user programmable; video look-up table; ultra fast data transfers. \$11,000 and up. Vend Maint, 5 FO. *Genisco Computers, Costa Mesa, CA and Silver Spring, MD.*

#### H-89 Microcomputer

Microcomputer with built-in disk drive. 12" video display, keyboard built-in; ASCII, DEC VT-52 compat terminal; Z-80 based with choice of CP/M; HDOS or UCSD Pascal operating systems. \$1,695 for H-89; \$2,895 for assembled Z-89 w/ 48K RAM.

#### H-19 Video Display Terminal

Monochrome 12" terminal, available as kit or assembled. ASCII. DEC VT-52 compat; 84-key keyboard includes 12 numeric, 8 special function keys; RS-232 interface. \$695 kit; Z-19 (fully assembled) is \$995. Vend maint, 57 FO.

*Heath Co., Benton Harbor, MI.*

#### ID-100

VT-100 modified for 8 color display, all features of VT-100. Added capability of full graphics-3 levels of resolution. Foreground/background color/blink. Standard \$3095; Full Graphics ID-100VA \$4895. Vend Maint.

*ID Systems, Inc., Dublin, OH.*

#### 304-D

Compat w/ VT 52 CRT terminal. \$2295; discounts up to 40%.

#### 304-DP

Datapoint 3601 compat. \$2295.

#### 304-DG

Compat with DG Dasher 6053, D200 Terminals. \$2295.

#### 304-M

Microdata compat. \$2295. Vend maint, 2FO.

*Informer Inc., Los Angeles, CA.*

#### 4424 Graphic Video Generator

Multi-channel, multi-resolution, graphic display for HP 2100/MX/XE/XF computers. User switch selectable among 8 densities ranging from 256 x 240 thru 512 x 512. Each channel has an enable, data & polarity control for complete flexibility in monochrome or color applications. \$3,550.

#### 4600 Graphics Display System

Hi-res, color graphics for HP 2100/MX/XE/XF computers. Resides in host computer. Display channel format 768 x 512 dot matrix w/ 2 to 8 channels per system. Std fnctns: vectors, areas, perimeters, characters, points & image readback. \$5500-\$13,000. Vend Maint, 1 yr. warranty, 1 FO. *Intermedia Systems, Cupertino, CA.*

#### System 3400 Display Processor

Image and graphics processor that provides state-of-the-art refreshed raster-scan display technology. From \$10,000. Vend maint, 2FO.

#### System 8000 Display Processor

With dual processor architecture, combines the performance of Lexidata's high speed raster display processor with a powerful 16/32 bit Motorola MC 68000. From \$26,200. Vend Maint, 2FO. *Lexidata Corp., Billerica, MA.*

#### HyperGraf 2600 — UltraGraf

Interactive intelligent systems using stroke writer technology. \$45,000 to \$60,000. Vend Maint, 25 FO. *Lundy Electronic Systems Inc., Glen Head, NY.*

#### CTM-300

Color alphanumeric/character graphics smart terminal, RS232, extended character set, light pen, printer interface.

#### GT-600

Full intelligent graphics add-on to VT 100/103. Printer interface, high level commands incl arcs, ellipses.

# Add in Reliability. Then Relax.

Our LSI-11\* compatible memory systems come with built-in ECC (Error Checking and Correction) circuitry. So you don't have to worry about expensive service calls, or strained relations with customers. Our 2,500 ECC systems in the field have a proven MTBF *in excess of 15 years*.

PEBX is the first to protect your LSI-11 system from failing RAMs and those random alpha particle crashes. We've also made protection from power outages as easy as hooking up a battery.

We'll give you from 32 to 256K bytes of error-correcting memory that takes care of

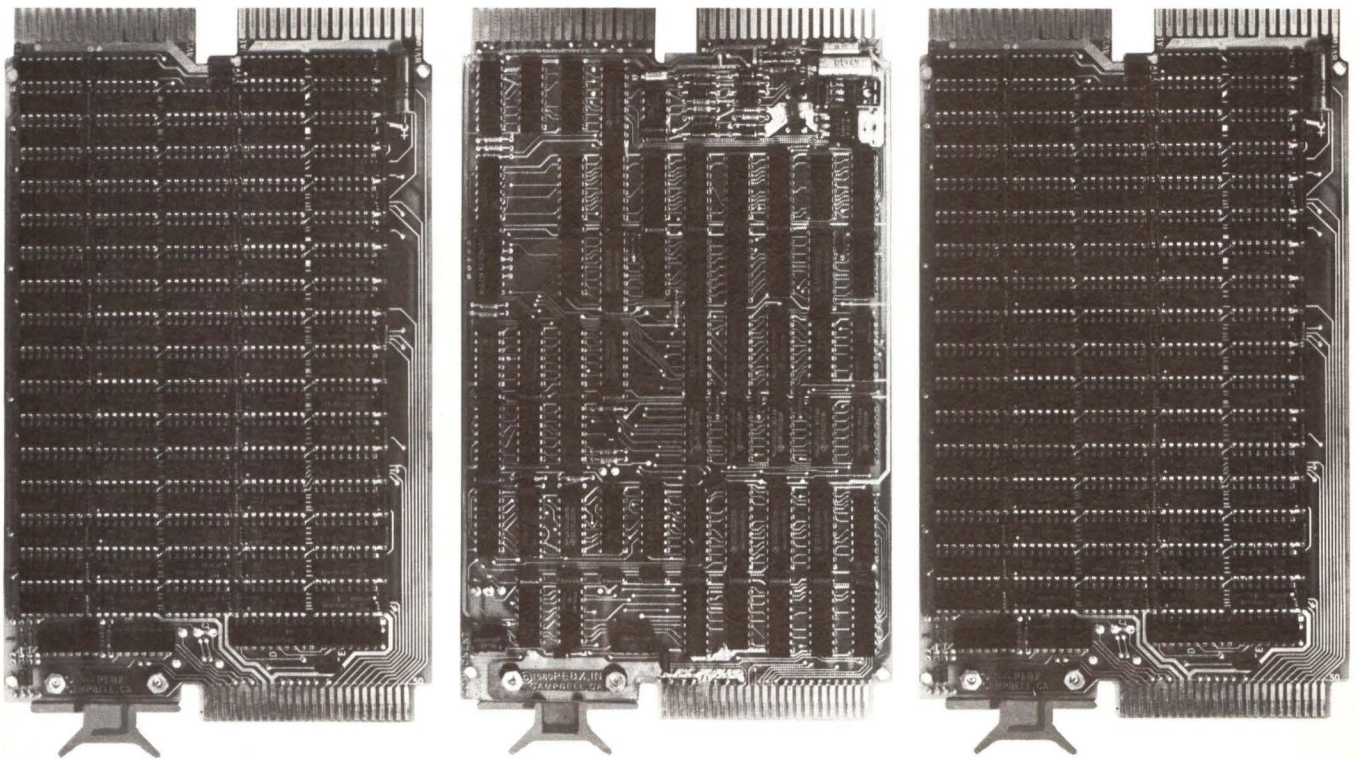
all single-bit errors. Plus a display that points to any erring RAM, allowing *preventive* maintenance rather than finger-pointing after a system crash.

So if you're an OEM and you don't want to worry about costly service calls, find out about our add-in reliability and relax. Contact *PEBX* toll-free today at (800) 538-3112, (in California (408) 866-7838), for full information on how you can get the best LSI-11 compatible memories available today.



501 Vandell Way  
Campbell, CA 95008  
(408) 866-7838

## Finally: LSI-11 Compatible memories with ECC.



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

Circle 32 on Reader Inquiry Card



Display Terminals

**GET-100**

General Terminal emulator card. Multibus. *Matrox Electronic Systems Ltd. Quebec.*

**Ampex Dialogue 80 CRT Terminal**

Intelligent CRT terminal with detached keyboard, numeric keypad, full SW support for DG Business Basic. Wholesale. \$1295. OEM discounts.

*MBS Inc. Madison, WI.*

**WHIZZARD 7200 family**

Raster and stroke refresh color or monochrome graphics terminals. 7210-stroke: 7250-raster: 7290 stroke & raster. \$20-50K.

**WHIZZARD 6200 family**

512 or 1024 color or monochrome raster graphics terminals (4 models). \$17-35K. Vend Maint. 7 FO. *Megatek Corp. San Diego, CA.*

**VMD-04 Graphics Video Generator**

Quad-size board for LSI-11, 11-2, 11-23. One channel of 256X256 resolution. Drives 2 separate video displays. Output composite video for American or European TV sync. Full graphics, point addressable, partial and full screen operation. SW support available for characters & graphics. Runs under RT-11 or RSX-11. \$995 (1-4). Vend Maint. 1 FO. *Mennen Medical, Inc. Clarence, NY.*

**AlphanumericLED Flat Panel Smart Terminal, LD 2650**

2.3" char height x 16 char long. Overall: 6" H x 3' L x 2.5" D. RS-232 port and tape storage port. UL Class 2 plug-in transformer included as power supply. Accessories: detached keyboard, cassette tape mass storage unit. Designed for large group viewing. \$1200 (1-4). Vend maint by board exchange.

*MIM (Modern Information Methods), Redwood City, CA.*

**Autograph 150**

Tektronix compat graphics display terminal with detached keyboard and input cursor control. Features: Tektronix Plot 10 SW compat. 250 x 512 resolution, selective graphic erase, white-on-black or black-on-white display, 24 lines of 80 ASCII alphanumeric characters, block and conversational mode options, protected fields, full editing capability, and

many communication options. \$2590.

*MQI Computer Products, Mountain View, CA.*

**Net-Pac 105**

VT100 compat LSI 11/12 or 11/23 Q-Bus. Complete video enclosure, 80 or 132 col., graphics optional. Built in mini-floppy, mini-Winchester options. 8 Quad (16 dual height) backplane. \$3400.

**Net-Pac 95**

LSI 11/2 or 11/23 Q-Bus. Complete video enclosure, 80 col. version, built in mini-floppy, mini-Winchester options. 8 Quad (16 dual height) backplane. \$2800. Vend maint.

*Netcom Products Inc, Sunnyvale, CA.*

**DSG 101**

Compat to VT100 including current loop and advanced video.

*Periphere Computer Systeme GmbH, Munich.*

**VRC-Q, VRC-U**

High-speed color alphanumeric CRT interface for LSI-11, PDP-11.

**VRG-Q**

22-bit graphics CRT interface for LSI-11, 512x512 resolution.

**VCG-Q**

22-bit color raster-scan graphics interface for LSI-11.

**VRA-Q, VRA-U**

High-speed alpha CRT display interface for LSI-11, PDP-11.

*Peritek, Oakland, CA.*

**PM 2010**

Complete set of ANSI std. terminal control functions. 66 x 80 char. display, 16-bit  $\mu$ P. 32K RAM expandable to 256K, and 8kB EPROM. \$2500 (OEM qty. 500).

*Piiceon Inc, San Jose, CA.*

**Zenith Z19 Video Terminal**

24 x 80, 12" diag. ASCII 128 char. U/L case, VT52 graphics, keypad, 12 function keys, EIA/RS232 SW/HW/keyboard programmable, VT52 or ANSI. \$795. *PK Systems Inc, Bloomington IL.*

**PT-100 VT-100 Alternative**

80 or 132 col. by 24 lines, reverse video/blink fields on per-char. basis, variable intensity (bold to half-bright). Parity baud rate, underlining, tabs KB-selectable. Detached KB. Switch-selectable 20mA/EIA interface, printer port (RS-232 interface).

*Plessey Peripheral Systems, 17466 Daimler, Irvine, CA.*

**6211 Colorgraphic Terminal**

**6212 Colorgraphic Terminal**

**4100 Colorgraphic Printer**

15 FO. *Ramtek Corp, Santa Clara, CA.*

**PTS-100**

Display terminal system.

**PTS-2000**

Information display terminal.

*Raytheon Data Systems, Norwood, MA.*

**VT-100-Compatible Video Display Generator**

LSI-11 bus resident. Comes as board set or w/ KB and monitor as console or workstation

*RDA Inc, Beltsville, MD.*

**Graphic 7**

Refresh stroke graphics system, two 16-bit programmable  $\mu$ P's, up to 256kB memory, and monochrome or color display. Parallel interface allows compat. with over 12 major computer lines.

**Graphic 8**

Raster scan graphics system, 1024<sup>2</sup> resolution, up to 256 simultaneous colors, and dual bit memory for dynamic updating.

*Sanders Assoc. Inc, Nashua, NH.*

**Graphics 100**

Add-in printed circuit card gives VT-100 full graphics capability. Has light pen, hardcopy, support SW options. 1220 x 240 dot screen resolution: ASCII, APL, GREEK, RAM char sets standard: 3 rotations for labels; boldface, doublewidth type; separate graphics memory; light pen option, printer dump port to DECwriter II with Graphics II. \$1200. 1 FO. *Selanar Corp, Santa Clara, CA.*

**ST-103 CRT Terminal with VT103 Expansion**

CRT/keyboard with mounting for LSI-11 Series. Video terminal with detached keyboard. Power supply and 4-row quad backplane provides mounting for LSI-11, -11/2, -11/23 CPUs + associated devices.

*Sigma Sales Inc, Anaheim, CA.*

**GT-100E**

Emulates DEC VT-52. Factory upgradable to any other GTC 100 series. \$995.

**GT-100D**

Plug-in replacement (aside from no underscore and no individual blinking char). Line graphics, smooth scroll, programmable function keys. \$1580. Wholesale. Vend Maint.

*Small Business Systems Group Inc, Westford, MA.*

**EyeCom III**

Real time picture processing system. B&W and color with A/N, graphics, joystick. All models of DEC PDP-11 and LSI-11 systems. From \$60,000.

**EyeCom 109PT**

Image processing terminal includes A/N, graphics, image display, color display and image digitizer. All models of DEC PDP-11 and LSI-11 systems. \$15,500 — \$40,000. Vend Maint. *Spatal Data Systems, Goleta, CA.*

**TAB 132/15**

ANSI/DEC compat. terminal. 15" screen 132 col., 4 pages of memory, large characters and 8 soft keys with over 100 operator assignable functions. \$2450. Vend Maint. 22FO.

*TAB Products Co, Palo Alto, CA.*

**630 Data Screen Terminal**

Detached keyboard, 6 function keys, 12" screen, separate cursor control, transfer rates from 110-9600 baud. \$1100.

*TEC Inc, Tucson, AZ.*

**4020 Series**

Raster scan graphic terminals including monochrome and color models: standard 525 line scan with 476 lines displayed. \$3,700 — \$9,000. Vend Maint, 53 FO.

*Tektronix Information Display Div, Beaverton, OR.*

**100**

Super VT100-compat. w/extended user-programmable function memory, advanced video plus many other programmable features. \$1705.

**10-V52**

Plug-to-plugin and code-compat w/ DEC VT52. \$1290.

**10-MP**

Plug-to-plugin and code-compat w/ Microdata Prism. \$ 1260.

**10-DG**

Single-page editor, complete DG Dasher-compat. \$1260. Vend Maint. 46FO.

*Teleray, Div. of Research Inc, Minneapolis, MN.*



**Model 910 Display Terminal**  
Lear Siegler ADM-3A/ADM-5. Hazeltine 1410. ADDS 25 compat. 10 preprogrammed function codes, typewriter tabs, monitor mode, erase to end of line/page. 4 strappable languages, gated printer port, 5 screen attributes, 15 baud rates from 50B to 19.2 kB, self test.

**Model 912/920**

Editing keys (char insert/delete; line insert/delete), 22 special function keys, true block mode, 5 visual attributes, 7 × 10 char resolution, protected fields, nonglare screen, 9 baud rates from 75B to 9.6 kB.

**Model 950**

Programs 22 special functions using 256-bytes on-board RAM, advanced editing with wrap-around, split screen with line lock and smooth scrolling, 25th status line, 15 special graphics char, tiltable nonglare screen, 15 baud rates from 50B to 19.2 kB, protected fields, self test, buffered auxiliary port, 14 × 10 char resolution.

*TeleVideo Inc,  
San Jose, CA.*

**3300-3400**

Interactive graphic systems, Vend Maint, 4 FO.

*Vector General,  
Woodland Hills, CA.*

**VC404**

Teletype compat, data terminal. Detached keyboard, 1920 char, auto repeat, U/L case, numeric keypad, 12 program function keys.

**VC4152**

VT52 compat, detached keyboard, char. highlighting, hold screen mode, auto repeat, U&L case.

**VC2100**

VT100 compat. Multi  $\mu$ P-based, serial typewriter style, detached keyboard, non-glare screen, 80/132 col. display, 2 pg. memory, 8 independent attributes, selectable audible feedback.

**VC414H**

Hazeltine 1510 compat,  $\mu$ P-based buffered editing data terminal. Block mode, char. highlighting.

**VC415 APL**

$\mu$ P-based w/ASCII and APL overstrike.

**VC410**

$\mu$ P-based teletype compat w/ buffered line editing and split screen.

**VC4404 (The Chat)**

Conversational data terminal, compat w/Lear Siegler ADM-3A.  $\mu$ P-based circuitry, modular design char highlighting, 10 program function keys, detached keyboard, 14 key numeric pad.

*Volker-Craig Ltd,  
Waterloo, Ontario.*

**Z-89 Microcomputer**

Green glare-free display, disk drive, keyboard, microcomputer in one housing; ASCII, DEC VT-52 compat., Z-80 based, expandable to 64K internal memory (48K std), \$2895 w/built-in drive; \$2595 w/o drive.

**Z-19 Video Display Terminal**

Monochrome 12" display, 25 lines, 80 char per line; ASCII, DEC VT-52 compat; 84-key keyboard including 12 numeric, 8 special function; RS-232 interface. \$995. Vend Maint, 200FO. *Zenith Data Systems,  
Glenview, IL.*

**DM-9300 AQ Removable Media**

Replacement for CDC 9766 disk drive, plug, media, and data compatible. Utilizes CDC 9883-91 type 20-surface disk packs, 15,637 data tracks, 823 cylinders per track, in-line heads. Vend Maint.

*Ampex Corp, Memory Products Div,  
El Segundo, CA.*

**Dual Mini-Disk System (DMDS)**

For DEC LSI-11, packaged 5-1/4" system, 205 kB-1.5MB; avail. with or without controller which provides bootstrap ROM, ability to control up to 4 drives. From \$1429 w/o controller — \$2454 w/ controller, 2-head, double-density, RTFM.

*Andromeda Systems Inc,  
Canoga Pk, CA.*

**Digidisk I & II**

Floppy add-on; video forms display. \$1095-\$1295.

**Digilink**

Protocol converter, electronic mail, text editor. \$775-\$1050 (depending on RAM configuration). Vend Maint, 1 FO.

*Backus Data Systems, Inc,  
San Jose, CA.*

**Model 6106/8**

5.25" single or double-headed floppy disk drive.

**FlexyDisk**

8" and 5.25" floppy disks, single-sided, double-sided, single- and dual-density. 4 FO.

*BASF Systems Corp,  
Bedford, MA.*

**MD122 Mini Disk Drive Plus Multibus Adaptor**

6MB storage capability on 2 flexible media. Multibus adaptor drives 2 ports of MD122 or FD210 series fixed drive. \$4700.

*Burroughs Corp, OEM Div,  
Detroit, MI.*

**4600 Series 8" Floppy Disk Module**

Single-sided, double-density; and, double-sided, double-density subsystems and expansion subsystems. Subsystems include controller for up to 4 drives any mix. S100 Bus system compat. using DMA data transfer. Real time HW vectored interrupt control. \$995+. RTFM.

*California Computer Systems Inc,  
Sunnyvale, CA.*

**DEC RX01, RX02**

Floppy disks. Vend Maint, 1 FO.

*California Datalease Systems & Financial Corp,  
Anaheim, CA.*

**MF211**

10 1/2" enclosure housing LSI 11/23, memory and associated DEC interface cards, 8 quad backplane and RX02 equivalent dual floppy system; optional double-sided drives. \$4450-\$8755.

**FD311**

Dual floppy disk system completely SW and media compat. with RX02 system. For LSI 11/23, LSI 11/2 and all PDP 11 processors; optional double-sided drives. \$3250. Vend Maint.

*Charles River Data Systems Inc,  
Natick, MA.*

**QF11**

DEC Q-Bus compat. dual Shugart drives, RX01 or RX02 compat., write protect and unit select switches, up to four 8" drives. \$3450.

**MF80**

Dual Shugart drives 8", Intel compat (201/202), write protect and unit selection switches. \$3295.

**MF85 IBM Format Floppy Disk**

Multibus compat. Shugart 8" drives, single- or double-density and sided, 9511A or 9512 math subsystem option, PLL data separator. \$2995. Vend Maint w/in 50 mi., 3 FO.

*Comark Corp,  
Waltham, MA.*

**430-L11-2A/470-L11-2A**

1MB (2MB-470) floppy subsystem for LSI-11. RX01/RX02 compat. Built in bootstrap, formatter, diagnostics. 430-\$3395, 470-\$4295. RTFM.

*Compumart Corp,  
Cambridge, MA.*

**DSD 430**

Low-cost single-sided, double-density floppy disk storage system for LSI-11 computer. FLPEXR (Floppy Exerciser), bootable mini-operating system on a diskette shipped with every system. \$3395.

**DSD 440**

Single-sided, double-density memory system, 1MB capacity. Available with PDP-11 or LSI-11 interface. Exclusive HyperDiagnostics perform self-tests independent of host computer. \$3695.

**DSD 470**

Low-cost double-sided, double-density memory system, 2MB of on-line storage for LSI-11. FLPEXR (Floppy Exerciser), bootable mini-operating system, exercises the system, diagnoses problems. \$4295.

**DSD 480**

2 MB double-sided, double-density memory system for on-line storage for LSI-11 or PDP-11. Contains HyperDiagnostics for stand-alone testing. \$4495.

## Flexible Disk Drives

**Model 840**

Dual-drive system, 512 kB storage per disk. \$3875. Vend Maint, 47 FO.

*ADAC Corp,  
Woburn, MA.*

**Shugart SA800/SA850**

8" single- or double-density soft sectored floppy disk drives. Vend Maint, 4 FO.

*Advanced Digital Products,  
San Diego, CA.*

**Flexible Diskettes**

Single/double density. Single or double sided 8" or 5-1/4". Shugart, Memorex, Burroughs & IBM compat. 1 FO.

*American National  
Supply Corp, ANSCO,  
Gardena, CA.*

**A506 & 5850**

8MB cartridge mini floppy. Qty 500 — \$850. 1 FO.

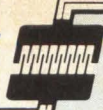
*Amlyn Corp,  
San Jose, CA.*

**DM-980 Removable Media**

82.9MB pack capacity, CDC 9877 or equivalent pack, 823 cylinders per pack, 4115 data tracks, 384 tracks per in.

**DM-9160 Removable Media**

165.8MB per pack, 5-high SMD pack per Ampex specification 3309806, 1645 cylinders per pack, 8225 data tracks, 768 tracks per in.



Flexible Disk Drives

**DSD 880 Combination Winchester & Floppy Disk Memory Systems**

Double-density floppy, single- or double-sided for .5 or 1.0MB of formatted removable storage. Winchester system drives for 7.8 or 31.2MB formatted capacity. All with HyperDiagnostics built-in intelligence for stand-alone self-testing. DSD880D/8: \$6895; 880S/8: \$6525. Vend Maint, 2 FO. *Data Systems Design Inc., San Jose, CA.*

**Dicom 422 Floppy Disk System**

1, 2, or 3 drive hard-sectored. Interfaces HP 21xx/1000. FDOS or RTE. Starts at \$3825. Vend Maint, 12 FO.

*Dicom Industries Inc., Sunnyvale, CA.*

**DUALTAPE DT-58**

Dual cassette drive and controller. Factory maintenance. 256 kB/cassette; 2 drives; 9.5-sec av. access time to any block of 512B. RS-232 interface. \$1200.

**DUALDRIVE 800/DD-800**

Dual Shugart 801 or 850 floppy drives + chassis + supply + controller for Q-Bus. \$2995. *General Digital Ind, Inc., Huntsville, AL.*

**FDV11**

LSI-11 floppy disk controller, controls 5 1/4" and 8" floppy disk drives, single-sided or double-sided, double-density. \$1500; \$975 (qty 100).

**Gemini**

Includes: 8 quad slot (16 dual slot) Q-bus backplane; LSI-11/2 or LSI-11/23 CPU; 64 kB to 256 kB memory; DLV11 serial async I/O interface or the QLV11 quad serial sync/async interface; and 2 8" double-sided, double-density floppy drives, 2.5MB mass storage. \$9500 to \$12500.

**Scorpio Microsystem**

Includes: 4 quad slot (8 dual slot) Q-bus backplane; LSI-11/2 or LSI-11/23 CPU; 64 — 128 kB memory. DLV11 serial async I/O interface or the QLV11 quad serial sync/async I/O interface; and 2 5-1/4" double-sided, double-density minifloppy drives, 1.8 MB mass storage. \$7000-\$10000.

**Super Pegasus**

Includes: 8 quad slot (16 dual slot) Q-bus backplane; LSI-11/2 or LSI-11/23 CPU; 64 kB—256 kB memory; DLV11 serial async I/O interface or the QLV11 quad serial sync/async interface; and 1 90 MB storage module. \$22500-\$25500.

**Tristar**

Includes: 8 quad slot (16 dual slot) Q-bus backplane; LSI-11/2 or LSI-11/23 CPU; 64 kB — 256 kB memory; DLV11 serial async I/O interface or the QLV11 quad serial sync/async interface; and 3 8" double-sided double-density floppy drives; 3.75MB mass storage. \$11000-\$14000. Vend Maint. *General Robotics Corp., Hartford, WI.*

**H-27 8" Drive**

Compat with DEC RX01 (PDP-11/03) and RXVII (PDP 11V03) HW/SW. Storage to 500 kB. Compat with IBM 3740 format. Vend Maint., 57 FO. \$2195 kit; \$2595 assembled.

*Heath Co., Benton Harbor, MI.*

**ISG 11/80**

Dual floppy disc w/ optional hard disc upgrade. Vend Maint. *Intermountain Systems Group Inc., Orem, UT.*

**Alpha 10**

10 MB storage subsystem. Alpha 10 drive uses 10 MB removable cartridge that contains an 8" floppy. \$2300 for drive and controller in OEM qty. *Omega Corp., Ogden, UT.*

**950**

Dual drive system consisting of Seagate Technology ST506 with Shugart SA450 700 kB floppy to include controller and appropriate system interface.

**LDOS**

Lobo disk operating system for use with TRS-80. When used with LX80 expansion interface, allows for double-sided, double density drives.

**5202CA w/ LCA22**

Dual Shugart SA850/851 8" double-sided double-density disk drive for the Apple (3.2MB).

**1850**

Dual drive system consisting of Shugart SA1000 10MB hard disk drive with SA850 1.6MB floppy to include controller and appropriate system interface.

**4401C**

5-1/4" 40 track floppy disk drive (250 kB).

**8202C**

Dual SA800/801 Shugart 8" single-sided, single or dual density disk drive (1.6MB).

**8202CA w/ LCA22 Controller**

Dual Shugart SA800/801 8" single-sided, dual density drives with dual density controller for the Apple II.

**5202C**

Dual Shugart SA850/851 8" double-sided, single or dual density disk drive.

**31011 Shugart SA 390**

5-1/4" floppy disk drive with controller for Apple II. (120 kB). Vend Maint Opt.

*Lobo Drives International, Goleta, CA.*

**DF-28S**

Dual floppy disk drive. \$2310. Vend Maint.

*Matrox Electronic Systems Ltd., Quebec, Canada.*

**550**

Compact, direct access disk storage unit. Capacity 243 kB in IBM 3740 format or up to 800 kB unformatted. Vend Maint, 5 FO.

*Memorex, OEM Div., Santa Clara, CA.*

**1015 MegaFloppy**

5-1/4" 1MB floppy disk drive. From \$467. Vend Maint.

*Micropolis Corp., Chatsworth, CA.*

**MD3101**

Dual single-sided 8" floppy system; LSI-11, RX01/RX02 compat, w/ controller (Shugart SA801 Drives). \$3250.

**MD3103**

Dual double-sided 8" floppy system; LSI-11, RX01/RX02/RX03 compat, w/controller (Qume Data Trak 8 Drives). \$4145.

**MD3001**

Dual single-sided 8" floppy subsystem; 1.6 MB unformatted, Shugart SA801 Drives. \$1995.

**MD3003**

Dual double-sided 8" floppy subsystem; 3.2 MB unformatted, Qume Data Trak 8 drives. \$2850.

**MD3006**

Double-sided 8" floppy drive & 8" Winchester single disk drive subsystem; 6.9 MB unformatted, Shugart SA1002 & Qume Data Trak 8 drives. \$4595.

**MD3012**

Double-sided 8" floppy drive & 8" Winchester disk drive subsystem; 12.3 MB unformatted; Shugart SA1004 & Qume Data Trak 8 drives. \$5295.

**MD3020**

Dual 8" Winchester 2 disk drive subsystem; 21.4 MB unformatted, Shugart SA1004 drives. \$7730.

**Disk Controller: MXV21**

LSI-11, Q-Bus, RX01/RX02/RX03, Shugart interface compat. \$1140.

**Mini-Floppy Disk Controller: MXV21M**

LSI-11 Q-Bus, RX02, Shugart interface compat. \$1260.

**Controller: MX21**

PDP-11 Unibus, RX01/RX02/RX03, Shugart interface compat. \$1495. Vend Maint, 1 FO.

*Micro Technology Inc., Irvine, CA.*

**DD400 Flexible Disk Drive**

Over 3 million bits of 'on line' storage on interchangeable floppy disk media (over 6 million bits with optional double density). Media compatibility with IBM3740; each diskette provides 77 data tracks with 3200 bits/inch data packing (6400 bpi double density). Any addressable position on the diskette can be accessed in random sequence. Data transferred at a peak rate of 250 KC (500 KC double density). Track-to-track access within 6 ms. Slave \$4700; Master \$8850.

*Miltope Corp., Plainview, NY.*

**MSC 8206 Floppy Disk Power Supply**

+5 VDC ±5%, 2.5A; +24 VDC ±5%, 2.6A; -12 VDC ±5%, 0.8A; short circuit protected.

*Monolithic, Englewood, CO.*

**LSII-FD-DDDS**

RX02 compat. subsystem for LSI 11, 2 x 1MB.

**YD-174**

Floppy drive 8" double sided, 1.6 MB unformatted. Shugart compat. Vend Maint, 2 FO.

*Peripher Computer Systeme GmbH, Munich, Germany.*

**FD 650**

8" double-headed flexible disk. \$675 OEM qty 100.

**FD 200/250**

FD200 5 1/4" single-head flexible disk drive, FD250 5-1/4" double-headed flexible disk drive. FD200 - \$260, FD250 - \$340, OEM qty 100. Vend Maint, 9 FO.

*Pertec Computer Corp., Peripherals Div., Chatsworth, CA.*

**PM XS31**

2 MB, rack-mount, dual floppy subsystem: 2 1MB double-density, double-sided drives,  $\mu$ P-based controller uses single-density encoding (IBM 3740 FM) or double density (DEC Modified MFM) RX11 and RX211 compat.

**PM XSV 31**

Double-density floppy subsystem w/ double-sided drive, PM-XCV31 controller. Write precompensation, transparent firmware, bootstrap, 4 level interrupt priority. 1MB w/ single drive or 2MB w/ two drives.

**PM XS 21**

1MB, rackmountable, dual floppy subsystem has two 512 kB double density floppy disk drives,  $\mu$ P-based controller. Single density encoding (IBM 3740 FM) or double density (DEC-modified MFM) RX11, RX211 compat SW, diagnostics.

**PM-XSV-21**

Dual density floppy subsystem for LSI-11/2, LSI-11/23.

**PM-TS11**

TM11/TU10 equivalent mag tape subsystem for PDP-11.  
*Plessey Peripheral Systems,*  
1691 Browning,  
Irvine, CA.

**FWT0122, FWT0127**

RX02-compat floppy storage w/ Winchester add-on capability. Low profile 5 1/4" enclosure allows direct connection to 14" WIN1400 26.4 MB Winchester disk option. Includes self-test, resident diagnostics, IBM double density format support, dual-head drive option. LSI-11 or PDP-11 interface. Factory warranty/service. \$3900 (1); \$2650 (50).  
*Scientific Micro Systems,*  
Mountain View, CA.

**SA400 Single-Sided Minifloppy**

Single/double density, (5.25") 125/250 kB, 48 tpi, 20 ms track-to-track. \$235. Qty: 100-249.

**SA450 Double-Sided Minifloppy**

Single/double density, 5.25" 250/500 kB, 48 tpi, 20 ms track-to-track. \$360, qty: 100-249.

**SA410 Single-Sided Minifloppy**

Single/double density, 5.25" 250/500 kB, 96 tpi, 6 ms track-to-track. \$325, qty: 100-249.

**SA460 Double-Sided Minifloppy**

Single/double density, 5.25" 0.5/1.0 MB, 96 tpi, 6 ms track-to-track. \$400, qty: 100-249.

**SA801 Single-Sided 8" Floppy**

Single/double density, 400/800 kB, 48 tpi, 8 ms track-to-track. \$440, qty: 100-249.

**SA851 Double-Sided 8" Floppy**

Single/double density, 0.8/1.6 MB, 48 tpi, 3 ms track-to-track. \$625, qty: 100-249. Vend Maint, 10FO.

*Shugart Assoc.,*  
Sunnyvale, CA.

**FDD 100-5**

5 1/4" flexible disk drive, single head, 48 tpi, industry compat. \$350 (1-9).

**FDD 200-8**

8" flexible disk drive, double head, industry compat. \$700 (1-9).

**FDD 100-8**

8" flexible disk drive, single head, industry compat. \$500 (1-9).

**FDD 296-5**

5 1/4" flexible disk drive, double head, 96 tpi, industry compat. \$550 (1-9).

**FDD 200-5**

5 1/4" flexible disk drive, double head, 48 tpi, industry compat. \$450 (1-9).

**FDD 196-5**

5 1/4" flexible disk drive, single head, 96 tpi, industry compat. \$450 (1-9). RTFM.

*Siemens Corp.,*  
Anaheim, CA.

**9400-62 Disk Storage System**

DEC-compat, 80 MB disk drive and controller, replaces RM03, removable media, single or dual channel. \$14000-\$33000. Vend Maint, 14 FO.  
*System Industries,*  
Sunnyvale, CA.

**Mini-Floppy Disk Drive/TM100 Series**

Single and double-sided, 48 and 96/100 tpi, 250 - 1000 kB unformatted. Access time: track-to-track is 5 ms for 48 tpi; 3 ms for 96 tpi. Average: 75 ms for 48 tpi; 90 ms for 96 tpi. \$350-\$500.

**8" Thinline Disk Drive**

Single-sided TM 848-1; double-sided TM848-2. Exactly half the height of any other 8" model, DC operation, track-to-track access time is 3 ms, average (including head settle) is 91 ms. Unformatted recording capacity for TM 848-1 is 0.8MB single density. TM 848-2, 1.2MB double density. \$530-\$635. Vend Maint, 4 FO.

*Tandon Corp.,*  
Chatsworth, CA.

**FD-50A 5 1/4" Floppy**

48 tpi, 40 track, single sided, single or double density. \$298. Vend Maint, 2 FO.

*TEAC,*  
Montebello, CA.

**950/951 Micro-Disks**

$\mu$ P intelligent minidiskette system. Half/full duplex; async transmission. Selectable 110 to 9600 baud. Unrestricted file lengths; automatic file directory; add. delete. replace data on disk using single command; high speed string search.  
*Techtran Industries Inc.,*  
Rochester, NY.

**ZBX-218A Floppy Disk Module**

Small add-on module compat with SBX specifications. Allows SBC to directly address 4 MB of private, removable media. \$480.  
*Zendex Corp.,*  
Dublin, CA.

## Packaging, Hardware, Backplanes, Enclosures

**System 1000**

22 slot backplane with 5V @ 25A power supply. LSI-11 compat. \$1700.

**System 2000**

13 slot backplane with 5V @ 15A power supply. LSI-11/2, 11/23 compat. \$1095. Vend Maint, 47 FO.

*ADAC Corp.,*  
Woburn, MA.

**DEC DD11-DK**

DEC 9 slot backplane.

**DEC DD11-CK**

DEC 4 slot backplane. Vend Maint, 4 FO.

*Advanced Digital Products,*  
San Diego, CA.

**8x4 Q-Bus Card Cage/8LCC**

Q-Bus compat card cage and backplane; holds up to 16 dual-width cards, or 8 quad-width cards. Can be used as primary or secondary card cage; BCV compat connectors; choice of 3 diff. input connector types. \$340-\$350.  
*Andromeda Systems Inc.,*  
Canoga Pk, CA.

**Deskware for DG**

Housings and computer furniture for DG systems and peripherals.

**Deskware for DEC**

Computer furniture and work stations for DEC systems and peripherals.

*Ardent Computer Products,*  
Dobbs Ferry, NY.

**Computer Interface W/W Panels**

DEC, Multibus, TI, Nova, etc. compat. Bondex Multibus Panel. Flexibility of W/W, but profile of multilayer.

*Augat Inc.,*  
Attleboro, MA.

**Enclosures And Accessories**

Packaging, components, HW. 46 FO.  
*Bud Industries Inc.,*  
Willoughby, OH.

**DEC**

Cabinets, expansion boxes, backplanes. Retail, systems integrator.  
*California Datalease Systems & Financial Corp.,*  
Anaheim, CA.

**CC 11 Card Cage**

Q-Bus card cage, aluminum construction, 9 quad card capacity, reversible mounting ears for flexibility in mounting, .5" card spacing, 1 or 2 fans for ventilation. \$450.

**PC 11A**

Same specs as CC 11 but includes a 200 W switcher power supply. \$1195.

**CC 80/280**

Multibus card cage, 9 or 18 slot versions, rugged Anodized aluminum construction, 1 or 2 fans for cooling, terminated backplane, .6" card space, closed plenum design. \$400.

**PC 80A/280**

Same as CC 80/280 but includes 200 W switcher power supply (400 W w/PC 280). 3 FO.

*Comark Corp.,*  
Waltham, MA.

**HV 1123 Enclosure**

4 x 8 enclosure for LSI-11 compat modules. \$1300-1500.

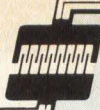
*Compumart Corp.,*  
Cambridge, MA.

**240/Wirewrap Development Board**

Includes basic board and printed circuit wiring and 2 sets of logic. Programmed I/O only. \$480. Vend Maint.  
*Custom Systems Inc.,*  
Eden Prairie, MN.

**BM-2 Computer System**

Bulk-Mini is a combination of an LSI-11 micro computer and a MOS/ECC disk emulator, packaged in a single 15-3/4" chassis. Available in a dual port version for interfacing w/ larger CPU's.



### Packaging, Hardware, Backplanes, Enclosures

#### **BM-1 Computer System**

Combination of an LSI-11 micro computer and a core disk emulator, packaged in a single 15-3/4" chassis. Ideal for applications not suited for mechanical devices.

#### **BO5 Chassis Assembly**

10 1/2" LSI-11 system chassis with power supply and mounting rails. Will support two 9 x 6 LSI system units to obtain 54 dual slots. \$2500.

#### **BO3 Chassis Assembly**

5 1/4" LSI-11 system chassis with 8 quad slot backplane and power supply. \$1250.

#### **DR-414 Expansion Chassis**

5 1/4" expansion chassis containing DD11-D type backplane and power supply. \$1685.

#### **DR-832 Chassis Assembly**

14" P-E 8/32 expansion chassis. \$2900.

#### **MBI Chassis Assembly**

14" expansion chassis for use in place of P-E's Local Memory Bank Interface Chassis. \$2400. RTFM.

*Dataram Corp., Cranbury, NJ.*

#### **ICM/80**

Industrial Multibus chassis for rack mounting or NEMA enclosure. \$1400. Vend Maint. *Distributed Computer Systems, Waltham, MA.*

#### **Micro Power/23**

Based on PDP-11/23, turnkey system. 256 kB MOS memory, 32 or 96MB disk drive, VT 100 terminal, letter quality printer. Wholesale.

*EEC Systems, Sudbury, MA.*

#### **SBC 604-SBC 6026 Card Cages**

4-26 slots. The Multi-Cage with motherboard backplane is 100% compat with Intel's iSBC 80 cards and card cages. Also comes with rack mountable application. .75" card spacing avail. \$195-\$1200.

#### **Prototyping Boards PR80H, PR80A**

Board with holes only; and prototyping board with interface area. \$75-\$355.

#### **80 EX-2**

Extender card for Multibus. \$75. Vend Maint. *Electronic Solutions, San Diego, CA.*

#### **8100 Multibus Chassis**

16 gauge steel, 30AMP power supply, accommodates 9 boards, 19" rack mountable, 2 hush fans, switched AC outlet. \$1280 in 50 piece price.

*ETI Micro, Dublin, CA.*

#### **AIM-Mate Case**

Completely supports an AIM 65 computer plus add-ons. Including internal power supply, memory expansion, video display interface, floppy disk interface and other special I/O. \$99-\$208. RTFM.

*Forethought Products, Eugene, OR.*

#### **BA/X3 LSI-11 Base System Chassis**

Includes: BP84 backplane and cardcage with 8 quad (16 dual) height Q-Bus slots, power supply, and TBC Terminator/Bootstrap/Clock. \$1650; \$1072, qty100.

#### **Nebula Computer System**

Includes: 8 quad slot (16 dual slot) Q-Bus backplane; LSI-11/2 or LSI-11/23 CPU; 64 kB-256 kB memory; DLV11 serial async I/O interface or the QLV11 quad serial sync/async interface. \$4250- \$7250; OEM discounts. Vend Maint.

*General Robotics Corp., Hartford, WI.*

#### **High Frequency Series/ Model 4-DE6/12-VHF**

Compat with DEC VAX System HW. Negligible series inductance in bypass path. 3 isolated sections of equal area, or can be joined with jumpers. Extended version of HEX. \$582.50.

#### **Universal Extender Card/ 8010ET; Z80ET; 6800ET; DE2ET; DE4ET; DE6ET**

Models for popular  $\mu$ P card cages, gold-plated TPs allow TPs to hang at any angle, staggered test contact pts eliminate test probe cluttering, side strips for positive-ground clip retention. Intel, Zilog, Motorola. \$65-\$165.

#### **Socket Pinned Boards Model 4-DE2-VHF; 4-DE6-VHF; 4-DE4-VHF**

Dual, quad and hex-type boards; compat with DEC HW. 2-format boards loaded with screw-machined socket pins, factory installed. Pin level can be low profile (1.5), 2-level or 3-level. \$87-\$395.

#### **High Frequency Series, Model 2-DE2-VHF; 2-DE4-VHF; 2-DE6-VHF**

Dual, quad and hex type bds, compat with DEC HW. Extended frequency range to 500MHz for high-speed logic, continuous ground plane, low noise crosstalk disappears. \$55-139.

#### **Low-Profile Series/2-DE6-SS, 3-DE6-SS**

Compat with DEC low-profile, mounts on 1/2" centers, handles all sizes of DIPs. Single-sided board permits stacking on 1/2" centers. Comes pinned or loaded with 16-pin DIP sockets, tantalum caps. \$175-\$453.

#### **Socket Pinned Boards/ 4-8010A-TG and 4-8010B-TG**

Intel Multibus compat board, pre-pinned with screw machined socket pins. Allows complete design flexibility in circuit layout and interfacing of custom designed memory or I/O circuitry. Documentation Kit available for this series. \$284-\$294.

#### **Controlled Impedance Extender Cards/DE2ET/ 4ET/6ET/ML**

Usable with DEC HW, signal lines simulate a transmission line roughly matching bus impedance; connectors are offset to prevent interference with adjacent card handles. \$275. RTFM.

*Hybricon Corp., Littleton, MA.*

#### **Clear Signal Cables & Connectors**

Interface virtually any HW with any peripheral. *Inmac, Santa Clara, CA.*

#### **11WWB Quad Wire Wrap Module**

For PDP-11, PDP-8 and LSI-11. Accommodates up to 70 DIP sockets or ICs. Includes 4 connector positions of up to 50 conductors each for cable to peripheral devices or to wire wrap modules for expansion of user logic. \$150.

#### **11WWB-01 Quad Wire Wrap Module**

Same as 11WWB but with sockets inserted for 70 IC positions. For PDP-11. \$220.

#### **W9501 Universal Quad Wirewrap Module**

PDP-11 or LSI-11. Accommodates IC sockets from 14 to 40 pins, in any combination and location. Power and ground decoupling pads provided. Wirewrap pins

mounted on component side of module. Two I/O connector positions provided. \$175.

#### **W9500 Universal Hex Wire Wrap Module**

Pins inserted for almost any combination of up to 96 sockets or ICs from 14 to 40 pins. Two I/O buses are provided. For PDP-11. \$195.

#### **M91WW Dual I/O Coupler Wire Wrap Module**

Accommodates any combination up to 28 sockets or ICs from 14 to 40 pins. Two I/O positions are provided, 120 pins each on both sides to accommodate any configuration edge connector. For PDP-11. \$75.

#### **MLSI-BCV-000 Backplane Jumper/Cable Assembly**

For use between 1st and 2nd chassis in multiple chassis configuration. 250 ohm termination in first system; second should be terminated separately. Cable length 6'. LSI-11. \$310.

#### **MLSI-BCV-001 Backplane Jumper/Cable Assembly**

Used between 2nd and 3rd chassis in multiple chassis configuration. Not terminated on either end. Cable length 4'. LSI-11. \$230.

#### **MLSI-BGC**

LSI-11 bus grant continuity card. LSI-11. \$15.

#### **MLSI-WWB1 Universal Dual Wirewrap Module**

Wirewrap pins provided for 36 IC positions on component side of module. Has multiple external I/O provisions. Will accommodate any .300", .400" or .600" center DIP packages. Provisions for 4 cable connector positions, up to 50 pins each. LSI-11. \$75.

#### **W9501 Universal Quad Wirewrap Module**

Accommodates IC sockets from 14 to 40 pins, in any combination and location. Power and ground decoupling pads provided. Provision for wide variety of cable connector positions in two different locations. \$175.

#### **MLSI-BPA82 Backplane/ Card Guide Assembly**

Provides 8 standard LSI-11 Q-Bus dual slots; accepts one LSI-11/2 or LSI-11/23 processor and 7 dual modules. \$275.

**MLSI-BPA84 Backplane/  
Card Guide Assembly**

Provides 8 quad or 16 dual standard LSI-11 Q-Bus slots. Compact assembly fits into 5 1/4" RETMA chassis. Standard LSI-11 bus accepts one LSI-11/2 or LSI-11/23 processor and 15 dual modules. \$425.

**MLSI-BPA84-A Backplane/  
Card Guide Assembly**

Identical to BPA84 except for 2 dual slots, 6 C-D and 7 C-D. Wired to accept DEC's RLV11 or RLV21 disk controller. All other slots are wired for Q-Bus. \$565.

**MLSI-H984 Roll-Around  
System Cabinet**

Rear panel with cable cut-out. Louvered side and rear panels. Internally mounted A/C power strip. External on/off circuit breaker. Two sets of vertical mounting rails, RETMA spacing. \$675.

**MLSI-H961-A High-Boy  
System Cabinet**

60" panel height. Removable side and back panels. Top mounted cooling fan and filter. Internally mounted AC power strip. \$1490.

**MLSI-BA11-20X System  
Chassis Assembly For  
LSI-11 Processors**

Includes front panel, front loading BPA84 backplane/card guide assembly and triple output regulated switching power supply. Two cooling fans for 200 cfm air circulation. Includes bus terminator, power on/off failure sequencing and Line Time Clock. Front panel switches and indicators for user selected DEC LTC or KW11-L compatibility. \$1990.

**MLSI-BA11-21X System  
Chassis Assembly**

Same as MLSI-BA11-20X except includes the BPA84-A backplane/card guide assembly for use with RL01 or RL02 disk controllers. Last dual slot in backplane is occupied by bus terminator and LTC module functions. \$2130.

**MLSI-BA11-30X Expansion  
Chassis Assembly**

Blank front panel. BPA84 backplane/card guide assembly. Triple output regulated switching power supply with +5V @ 25A, +12V @ 5A and -12V @ 1A. Front loading chassis holds 8 quad or 16 dual size modules. Two cooling fans. \$1550.

**MLSI-BA11-31X Expansion  
Chassis Assembly**

Same as MLSI-30X, but contains BPA84-A backplane/card guide assembly for use with RL01 or RL02 disk controllers. \$1690.

**MLSI-BA11-58X TU-58  
Chassis Assembly**

Includes rear loading BPA82 eight slot dual width backplane/card guide assembly with removable 120 ohm termination. Triple output regulated switching power supply with +5V @ 18A, +12V @ 4A and -12V @ 1A. Two cooling fans. Unit includes dual front loading TU-58 cartridge tape drives and controller with a combined storage capacity of 500 kB. \$3050.

**MLSI-BA11-580X TU-58  
Chassis Assembly**

Includes rear loading BPA84 backplane to hold 16 dual or 8 quad size boards. Triple output regulated switching power supply. Includes dual front loading TU-58 cartridge tape drives and controller with combined storage capacity to 500 kB. \$3330.

**MLSI-BA11-581X TU-58  
Chassis Assembly**

Includes BPA84-A quad width backplane to hold 16 dual or 8 quad boards. Backplane can accommodate DEC RL01 or RL02 disk controller. All other features are the same as the MLSI-BA11-580X. \$3440.

**MLSI-11/03-58X  
LSI-11/2-TU-58 System**

Includes LSI-11/2 CPU, 2 async serial ports, line time clock, bootstrap, 32 kB of RAM plus dual TU-58 cartridge tape units with combined storage capacity of 500 kB. \$4650.

**MLSI-11/03-580X  
LSI-11/2-TU-58 System**

Similar to above, but contains BPA84 backplane. \$4800.

**MLSI-11/03-581X  
LSI-11/2-TU-58 System**

BPA84-A backplane. All features of MLSI-BA11-58X but with a quad size backplane that will accommodate DEC's RL01 or RL02 disk controller. \$5040.

**MDB-1021 All Wirewrap  
Interface Board**

Contains 198 socket positions for 14 or 16 pin ICs. Can accommodate larger ICs on .3, .4 or .6" centers. Provisions for up to four 50 pin connectors for flat ribbon cable connection. Board uses one slot position of computer chassis. DG Nova & Eclipse. \$248.

**MDB-1022**

Same as MDB-1021 except includes wirewrap pins installed in 198 IC positions. DG. \$495.

**MDB-1023**

Same as MDB-1021 except includes wirewrap pins and lo-profile sockets installed in 198 IC positions. DG Nova & Eclipse. \$660.

**MDB-NEC-01 Expansion  
Chassis**

For interface controllers. Front loading chassis contains 6 I/O slots on 3/4" slot spacing. Includes dual fans. 5' interconnecting cable to computer chassis included. Optional bus terminator module and power supplies. DG. \$963.

**NTM-01 Bus Terminator  
Module**

Used to terminate the I/O bus at the expansion chassis. DG. \$138.

**MDB-CPNL-01  
Communication Panel**

Four 25 pin connectors and 6' cable to attach to computer backplane. DG. \$248.

**MDB-CPNL-02  
Communication Panel**

Eight 25 pin connectors and 6' cable to attach to computer backplane. DG. \$330.

**MNTL-WWB Universal Wire  
Wrap Board**

For Intel 8 and 16-bit single board computers. Combinations of up to 60 lo-profile sockets or ICs in any DIP configuration can be accommodated. Wire-wrap posts on component side of the board permits half inch spacing. Provides 3 positions for edge connectors for up to 50 conductor ribbon cable assemblies. \$145.

**MBI-49-WW64**

All Wire Wrap Interface Board. Contains provision for 64 sixteen-pin, 66 fourteen-pin, or 14 twenty-pin, plus 48 sixteen-pin IC positions. Will accommodate any .300, .400, .500 or .600 center dual-in-line packages. IBM Series/1. \$495.

**MBI-49-WW72 Wire Wrap  
Module**

Has provision for up to 72 twenty-pin, 90 sixteen-pin, or 99 fourteen-pin IC positions. Both boards are double sided with plated thru holes, with power and ground pre-wired for each standard socket position. IBM Series/1. \$495.

**MDB-48-002-01 General  
Purpose Wirewrap Module**

Provides wirewrap pins installed for 197 14 or 16 pin ICs or sockets. Can accommodate larger ICs on .3, .4, .5 and .6" centers. Provisions for up to four 50 pin connectors for flat ribbon cable connection. Board uses one slot in computer chassis P-E. \$495.

**MDB-48-002-02**

Same as MDB-002-01 except includes lo-profile sockets for 197 IC positions. P-E. \$695.

**MDB-48-002H-01 General  
Purpose Wirewrap Half Board**

Provides wirewrap pins installed for 91, 14 or 16 pin ICs or sockets. Can accommodate larger ICs on .3, .4, .5 and .6" centers. Provisions for up to one 40 pin and one 50 pin connector for flat ribbon cable connection. Board uses one half slot in computer chassis. P-E. \$275.

**MDB-48-002H-02**

Same as MDB-48-002H-01 except includes lo-profile sockets for 91 IC positions. P-E. \$375. RTFM, 1 yr. warranty.

*MDB Systems Inc,  
Orange, CA.*

**MSC 8202 Microcomputer  
Power Supply**

Cables provided for basic or expansion chassis; +5 VDC  $\pm 5\%$ , 1.8 A; -5 VDC  $\pm 5\%$ , 1.2 A; +12 VDC  $\pm 5\%$ , 2.4 A; -12 VDC  $\pm 5\%$ , 1.0 A; power fail detection, short circuit and over voltage protected, sequencing of supplies upon power up or power down.

**MSC 8203 Extender Board**

Use with any Multibus boards, ground plane reduces noise, supports and protects board under test, rail for test cable strain relief.

**MSC 8204 Universal Board**

Full Multibus interface and bus arbitration logic on-board, selectable memory or I/O addressing, integral power and ground planes, standard serial and parallel card edge connector.

**MSC 8201 Chassis &  
Expansion Chassis**

*Monolithic,  
Englewood, CO.*

**Net-PAC 95**

LSI 11/2 or LSI 11/23 Q-Bus complete video enclosure, 80 col version, built-in mini-floppy, mini Winchester options, 8 quad (16 dual height) backplane. \$2800.

**Net-PAC 105**

VT100 compat, LSI 11/2 or LSI 11/23 complete Q-Bus video enclosure, 80 or 132 col, graphics optional, built-in mini-floppy, mini Winchester options, 8 quad (16 dual height) backplane. \$3400.

**HV-1123 Enclosure  
Assembly**

Q-Bus enclosure for LSI 11/2 and LSI 11/23 systems, 8-slot quad backplane, front panel switch group, internal power supplies +5 V @ 25 A,  $\pm 12$  V, rotatable or front load access backplane. \$1425.



**Packaging, Hardware, Backplanes, Enclosures**

**HV 1148 Backplane**

Compat with LSI 11/2 or LSI 11/23 and associated Q-Bus options, space for 8 quad or 16 dual height modules, mountable in customers' custom enclosure. Full 22-bit addressing, RL options, \$380. Vend Maint.  
*Netcom Products Inc., Sunnyvale, CA.*

**Power I/O**

PB32 DEC quad Pak, rack & quad Pak I/O modules. Direct connection to LSI 11/2 thru DRV11J board. Optical isolation, 3 A power switching. High density I/O. PB32 DEC mounting rack \$150, quad Paks \$40.

**Industrial Power I/O**

PB24 mounting rack for Opto 22 I/O modules. Direct compat with Intel 8010, 8020, 8030 boards. Also I/O modules directly compat with ICS-80, \$100, PB24; \$10.50 per module.

**PB16PI Addressable Multiplexer**

Provides I/O expansion to 1024 points from 19 bits of any host parallel I/O port. Building block design allows cost effective design by adding boards in 16 point I/O increments to achieve required number of points. \$275/16 point board, 3 FO.  
*Opto 22, Huntington Beach, CA.*

**ZIF-TENDER PDX-2, 4, 6**

PDP-11 and LSI-11 compat extender cards with either a standard PC connector or a zero insertion force ZIF connector. Pin numbers for each pin provided for ease of location. ZIF conn 1-49 \$90 for Dual, \$120 for Quad, \$160 for Hex.  
*Pacific Digital Systems, Sunnyvale, CA.*

**921-002**

LSI-11 enclosure incl power 5V125A 16 dual — 8 quad slots. Vend Maint, 2 FO.  
*Periphere Computer Systeme GmbH, Munich.*

**System 1261 Industrial Control Unit — SYS1261**

19" rack mount or stand-alone chassis with 11 slot aluminum card cage and 4 output switching regulator power supply interfaced to a keylock or push/push front panel. Intel SBC 80 compat. \$1750.

**Series 126 Card Cage, CWA-126P and CWF-126P**

11 slot aluminum card cage with wire wrappable or bussed backplane compat with Intel SBC 80 series. From \$215.

**Series 126 Extender Card, ECA-126 & ECA-126R**

Extender cards compat with Intel SBC 80 series. From \$85.

**Universal Wire Wrap Card, WWA-126 and WWB-126**

Universal 3 level wire wrap card. Intel SBC 80 compat. From \$110.  
*Prototek Inc, Cincinnati, OH.*

**Flexible Circuits**

Designed for rotating memory systems. Permit error-free assembly and eliminate as many as 28 individual wire connections. Series CK11Z and CK12Z, \$11.90 (100-499).  
*Rogers Corp, Chandler, AZ.*

**SA-H103 CPU/Drive Mounting Chassis for LSI-11**

10.5" high chassis provides mounting for LSI-11, -11/2, -11/23 CPUs/associated devices +2 mix/match floppy/8" Winchester/Cartridge tape drives. Q-Bus compat power supply, front control panel, 8-row quad or 9-row hex backplane, fans.

**SA-H104 CPU/Floppy Drive Mounting for LSI-11**

10.5" high chassis provides mounting for LSI-11, -11/2, -11/23 CPUs & associated devices, plus 1 or 2 vertically mounted floppy drives. Includes 8-row quad-wide backplane, power supply, fans, & front control panel.

**SA-BA11N-1 LSI-11 Processor Chassis**

5.25" high chassis provides mounting for LSI-11, -11/2, -11/23 CPUs and associated devices. Contains Q-Bus power supply, fans, 8-row quad-wide backplane & front control panel. Front loading, \$1092.

**SA-H100 Backplane/Cardframe Assembly for LSI-11**

8-row quad-wide backplane/cardframe assembly supports all LSI-11, -11/2, -11/23 CPUs and associated devices. 16 dual slots with 2 optional slots dedicated to RL01/RL02 controller. Full length guides provide positive module alignment. Optional cooling fan available. \$324.

**SA-H101 Floppy Disk Drive(s) Mounting Chassis**

Provides mounting for 1 or 2 Shugart SA800/850 compat drives side-by-side horizontally in 19" rack. 5.25" high chassis includes power supply, fan, AC switch & installation sleeve. Power outputs are regulated & adjustable. Access holes for drive strapping. 115 or 230 VAC.

**SA-H102 CPU/Drive Mounting Chassis for LSI-11**

10.5" high chassis provides mounting for LSI-11, -11/2, -11/23 CPUs/associated devices +2 mix/match floppy/8" Winchester/cartridge drives. Q-Bus power supply, front control panel, 8-row quad backplane, fans. Vend Maint, 7 FO.  
*Sigma Sales Inc, Anaheim, CA.*

**Accessories for Dataroyal Printers**

Various accessories for Dataroyal printer stands, ribbons.  
*Small Business Systems Group Inc, Westford, MA.*

**PDQ/DSC Backpanel**

Compat to CK and DK DD11 Series, built to an F-style length.

**DEC-Compat Backpanels**

PDQ backpanel packaging system offers PC board/edgecard circuit connector integration in single, double-sided, true multi-layer

assemblies. Complete wire-wrap services, full testing, total in-house backpanel construction. DEC-compat backplanes PDQ/DSC offers prewired, pretested unit in 4- and 9-slot systems & custom configs. Pin grid patterns in .125 x .125 and .125 x .250. Connectors can be assembled to any length.

**DEC-Compat DSC-DD11-CK, DSC-DD11-DK, DSC-DD11-PK**

4 x 6 and 9 x 6 units, pre-wired and tested. Vend Maint, 88 FO.  
*Stanford Applied Engineering/Engineered Products, Santa Clara, CA.*

**Interface Cables for All Manufacturers**

Large selection of DEC compat cables outside of DEC direct. Thousands of custom cables for most major manufacturers. Multi-conductor-coax-triax-ribbon. \$10 & up. Vend Maint, 1 FO.  
*Tel Com Products Inc, Westmont, IL.*

**WP-909**

General purpose expansion chassis for PDP-11 or LSI-11 systems. \$750.

**WP-921**

System housing for LSI-11 computers. 5-1/4" high, with 25 A, 5V power and a 9 x 4 backplane. \$1750. Vend Maint, 4 FO.  
*Wesperline Division of Wespercorp, Tustin, CA.*

**Printers/Plotters**

**Printronix P-600**

600 lpm dot matrix printer, controller. Static eliminator, pedestal and paper latcher.

**Printronix P-300**

300 lpm dot matrix printer, controller. Static eliminator, pedestal and paper latcher.

**Centronics 704**

150 cps bidirectional dot matrix printer.

**Centronics 737**

Dot matrix printer for 8 1/2" x 11" paper. Vend Maint, 4 FO.  
*Advanced Digital Products, San Diego, CA.*

**Sprinter Series Printers**

High speed thermal plotter/printers for small business and personal computers. 20, 40 and 80 char models. User selectable parallel or RS232 serial interface. 8 user selectable baud rates, user selectable char or graphics mode. SW controllable print speeds from 2-4 lps. From \$175 - \$595. Also OEM printer mechanisms, controller boards and interface cables avail.  
*Alphacom, Campbell, CA.*

**DP 9500/950**

150 cps printer with dot addressable graphics. 132-220 char/line. 150-200 cps, all forms controls. 1.75 to 16.8" paper width. 3 char fonts std. \$1650. Vend Maint, 4 FO.  
*Anadex Inc, Chatsworth, CA.*

# Clearly, the Chief Development System

Smoke Signal's 6809-based PATHFINDER™ — the Engineer's turn-key computer. It offers advanced hard disks, multi-tasking and in-circuit emulator at significantly lower cost.

The Pathfinder's heritage lies in the demonstrably superior architecture of 6809-based microprocessors. It's the same blood line that produced today's state-of-the-art 68000 series. The Pathfinder Development System is the culmination of an intensive Smoke Signal design effort that commenced in 1976.

## A Few Reasons Why Pathfinder Provides Faster Application Design and Implementation

- **MDOS CONVERSION** puts patches in a user-supplied version of MDOS, the Exorciser® operating system, allowing MDOS to be booted and run on a Smoke Signal computer.  
Exorciser® is a registered trademark of Motorola.
- **SYMBOLIC DEBUGGER** permits inspection and change of memory, registers and stack contents. And facilitates setting of breakpoints in either RAM or ROM, with traces set before or after breakpoints.
- **MOTOROLA-COMPATIBLE MACROASSEMBLER** uses standard Motorola assembler directives. Relocatable code eliminates reassembly of modules when changes are made.
- **IN-CIRCUIT EMULATOR** uses Pathfinder, target system or emulator memory. Replaces 6800, 6802 or 6809 CPU and interfaces with standard 40-pin socket and cable.
- **WINCHESTER HARD DISK**, plus multi-user and multi-tasking options provide system expansion for growing requirements.
- **EPROM PROGRAMMER** handles 1k, 2k or 4k single voltage EPROMS in only one 30-pin slot.
- **PLUS** 8080, 8085, Z-80 Cross Assembler, Text Editor, Text Processor, Outstanding Support and a spectrum of other features.  
At prices up to 60 percent below comparable 6800/6809 Development Systems.



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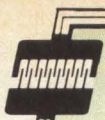
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### Printers/Plotters

#### Model 180 Graphics Conversion Board

For TI 810 RO printer. Provides raster graphics plotting capability in 2 modes plus user-defined SW font of 75 char in addition to all printer functions. \$695.  
*Analog Technology Corp., Irwindale, CA.*

#### Diablo 1640-1650 RO Printer

W/ ACS-Wang interface WP printer. 45 cps. host control through escape sequences. internal diagnostics. 1640 has plastic print wheel and 40 type styles. 1650 has metal print wheel and 80 type styles. 1640 — \$3880; 1650 — \$4248.

#### Diablo 630 RO Printer

W/ ACS-Wang interface WP printer. Metal or plastic wheel. 40 cps. 120 print wheel styles. internal diagnostics. Compat w/ Wang 2200 MVP. LVP. VP and T computers. \$3480.

#### TI 820 RO Printer

W/ ACS-Wang interface. 150 cps. logic seeking. expanded/compressed print. 6-8 lpi. device forms control. LED status control panel. 1280 FIFO buffer. \$2990.

#### Tally 1612 RO Printer

W/ ACS-Wang interface. 160 cps; logic seeking; 6 or 8 lpi; 10, 12 or 16.5 print; expanded 5, 6 or 8.25 print; 132, 158 or 218 col; forms control programmable; bottom feed; 9-wire print head; U/L case; dual color option avail. \$2990; w/ dual color \$3395. Vend Maint.

*Automated Control Systems Inc., Bellevue, WA.*

#### LPD 300 and 600 LPM Matrix Printers

Compat with DEC PDP-11. Use standard 96-char ASCII code set and print 132 char/line; 10 char/in. horizontal; 6 or 8 char/in. vertical.

#### LPD 1000 Impact Line Printer System

DEC-compat. Consists of  $\mu$ P controlled chain train printer and a single board embedded controller with interface cables. Produces hard copy output of 1000 lpm. Vend Maint. 55 FO.

*Braegen Minicomputer Peripherals Div., Anaheim, CA.*

#### Printer/VAX Interface

Installed on VAX-11/750. 11/780 Unibus. this word-buffered interface permits access to Calcomp's 5000 series of 7 electrostatic printer/plotters (11"/22"/36" wide. 0.72-3.25 ips). \$2380.

*California Computer Products, Anaheim, CA.*

#### 4671 Dot Matrix Printer

180 cps. 132 col. impact. 6 part forms. front panel programmable and SW override. RS232 and Centronics parallel interface standard. Furnished with shielded cable. True logic seeking bidirectional printing. \$1725.

#### 4672 Full Character Printer

60 cps. 132 col. impact daisy wheel. furnished with shielded cable. \$2475. RTFM. 15 FO.

*California Computer Systems Inc., Sunnyvale, CA.*

#### Band and Drum Printers

300, 600, 900 lpm. DEC and Data Products. Retail. systems integrator. Vend Maint. 1 FO.

*California Datalease Systems and Financial Corp., Anaheim, CA.*

#### LP Series 600 LPM

Plug-compat with DEC. DG and IBM systems. 2 versions: standard pedestal-mounted unit with open paper path (LPS); and a totally enclosed office quiet version with noise level less than 60 dbA (LPQ). Operator activated self-test. built-in  $\mu$ P electronics. Choice of 48, 64, 96 and 128 char set print bands. Vend Maint. 21 FO.

*Centronics Data Computer Corp., Hudson, NH.*

#### Miniterm 2101 Thermal Matrix

160 cps. 80/132 col. 10 or 18.4 cpi horiz spacing. 6 lpi vertical spacing. 96 ASCII. APL. custom char sets. RS232. 20 mA. Self test. \$1385. Vend Maint. 11 FO.

*Computer Devices Inc., Burlington, MA.*

#### DmC-1500

Medium-speed. non-impact military page printer. Dry electro-sensitive printing. async up to 1200 lpm. 80 char/line. 64 char ASCII. built-in test. optional plotting.

#### DmC-2001

Alphanumeric. high-speed. non-impact military half-page printer. 32 col. 2000 lpm. small and light-weight. quiet. 64 char ASCII. 32 char/line.

#### DmC-4003

Alphanumeric. high-speed. non-impact military half-page printer. 33 col. 2000 lpm. small size and light-weight. Dry electro-sensitive printing. 20,000 hr. MTBF.

#### DmC-4680

Airborne half-page thermal printer/plotter. 160/240 lpm. OCR B1 char. 64 ASCII coded char. 150/200 dots/in. silent operation. Selectable 40, 53, 66, 80 col. 1920 char buffer. Vend Maint. 2 FO.

*Datametrics Corp., Van Nuys, CA.*

#### D-50 Daisy Wheel Printer/Terminal

50 cps in bidirectional mode; provides graphics capability with resolution of 11.520 points/sq.in.; high capacity ribbon system (multistrike-120 yds. fabric-50 yds); avail as RO printer. RO and KSR terminals. RO printer \$2047; RO terminal \$2667; KSR terminal \$3056 OEM.

#### M-100

140 cps in bidirectional logic-seeking mode; char structure is 9x9 using 14-wire printhead; prints true subscripts, superscripts and underlining; avail with options to print block letters, bar codes, graphics, programmable char generator. full year warranty on complete unit including replaceable printhead. \$2705 OEM.

#### M-120

180 cps in bidirectional logic-seeking mode; matrix char structure is 7x7 using 7-wire printhead; operator replaceable printhead; full year warranty on complete unit including printhead. \$2250 OEM.

#### M-200

340 cps in bidirectional logic-seeking mode; matrix char structure is 7x7 using 14-wire printhead; operator replaceable printhead; full year warranty on complete unit including printhead. \$2650 OEM.

*Vend Maint. 20 FO. Dataproducts Corp., Woodland Hills, CA.*

#### DLP11 Band Printer

48, 64, 96 and 128 char set sizes; operator-changeable char sets. Self-adjusting char set size and 10 or 15 cpi. Vend Maint. 4 FO.

*Data Systems Services, El Toro, CA.*

#### APP-20A2

20 col thermal printer: 96-char ASCII alphanumerics. RS-232-C serial interface: up to 72 lpm. \$795.

#### APP-48

48-col thermal printer: 96-char ASCII alphanumerics; RS-232-C serial data interface: up to 72 lpm. \$1095.

*Datel-Intersil Inc., Mansfield, MA.*

#### Series 2510 Printing Terminal

150-200 cps; for 3"-15" wide forms in up to 6 parts; 7x9 dot matrix; 110-19,200 baud; RS-232 interface. Height 8.5". width 22". depth 18.5" (keyboard) or 16" (RO). \$1880 (RO); \$2150 (KSR). RTFM. 1 FO.

*Digi-Data Corp., Jessup, MD.*

#### Line Printer Systems

Full product line including Chain Train, Band, Drum, Belt and Matrix. Up to 40% off list prices. Complete line of printer controller/interfaces and comm buffers. Supplier. 3 types of service. over 200 FO.

*Digital Associates Corp., Stamford, CT.*

#### MDP-125

Hard copy printer for Intel Development Systems. Original plus 5 copies. Prints 125 cps. 9x9 dot matrix. U/L case plus underlining. 96 ASCII char. 80 or 136 col. optional control panel/self test. From \$1355.

*EMC Corp., Newton, MA.*

#### LPV11

LSI-11 line printer controller. Parallel interface for most Centronics compat commercial line printers. \$250; \$130 Qty 100. Vend Maint. 3rd P.

*General Robotics Corp., Hartford, WI.*

#### Infoscribe 500 and 1000

150 and 180 cps printers; 10, 12, 16.5 cpi; correspondence quality print; graphics. downloadable char sets. low noise. 500, \$1595; 1000, \$1825. Vend Maint.

*Infoscribe Inc., Santa Ana, CA.*

#### Dual-Mode 200

DP speed. letter quality WP and dot control graphics; daisywheel control code compatibility; RS-232C serial/Centronics parallel interface; tractor feed and friction feed standard. \$2995; \$1745. Qty 500+. Factory and Distributor Service.

*Malibu Electronics Corp., Westlake Village, CA.*

#### 88G

80 col printer. \$749.

#### TP40

40 col ticket printer. \$885. Vend Maint. 27 FO.

*Micro Peripherals Inc., Salt Lake City, UT.*



**HSP3609-212A**

Weighs less than 65 lbs. & provides 64-char ASCII alphanumeric subset plus graphs up to 400 lpm. Qualified to MIL-E-5400, MIL-E-4158 & MIL-E-16400. Switch selectable 80 col & 132 col printout on multiple copy — up to 4 part — fanfold paper. Std interface is serial by char and parallel by bit including full line buffer. Unit includes off-line built-in test capability. 9.5"H x 14"W x 19"D. Controllers: PDP-11M/Rolm 1602/NTDS/RS-232C/MIL-Std-188C. \$14,500.

**LP3036 Line Printer**

Lightweight (12 lbs.), multifunction.  $\mu$ P controlled line printer provides 36 or 42 col. printout to 240 lpm. Meets MIL-T-21200, MIL-E-16400, MIL-E-5400, NAC-SEM 5100. Internally stores to 150 sheets of 4.25" wide, single or multi-part fanfold paper. 64 ASCII char set is std. 96 or 128 char optional. \$5000.

**TP2000 Thermal Line Printer**

Meets environmental requirements of MIL-T-21200, MIL-E-16400, MIL-E-5400. 7 lbs. Internal storage for a 150' roll of 4.25" wide thermal paper. Automatic paper take up optional. 10 cpi. 40 col printer. operates at 160 lpm. For greater page density, a 66-col (17 cpi) version available. \$5000. *Miltope Corp., Plainview, NY.*

**KPV-1180 Line Printer Interface**

Q-Bus compat parallel interface to most popular printers. Switch selectable device and interrupt vector address. low cost. totally SW compat w/LAV11. \$295. Vend Maint. *Netcom Products Inc., Sunnyvale, CA.*

**Zeta 1553 Digital Drum Plotter**

One-pen. 12" drum plotter for use with continuous feed paper for unattended multiple-plot operation. Speeds: 10 ips on axis. 14.14 ips diagonally. Resolution of 0.0025". \$5950.

**Zeta 1453B**

4-pen. 12" drum plotter with continuous feed paper for unattended multiple-plot operation. Speeds: 10 ips on axis. 14.14 ips diagonally. Resolution of 0.0025" and absolute repeatability. \$8950.

**Zeta 1453SX**

4-pen. 12" drum plotter with continuous feed paper for unattended multiple-plot operation. Speeds up to 15 ips on axis. 21 ips diagonally. Resolution of 0.001" with absolute repeatability. \$10,950.

**Zeta 3653SX**

4-pen. 36" drum plotter with full plotting area of 34" by 120" for all pens. Speeds up to 15 ips on axis. 21 ips diagonally. Resolution of 0.001" and absolute repeatability. \$21,900.

**Zeta 3620**

4-pen. 36" intelligent drum plotter with proprietary servo-motor drive system and linear actuator pen system. Axial speed 35 ips. diagonal speed 50 ips with 4g acceleration. resolution of 0.00049". \$30,900-\$32,900.

**Zeta 5400**

4-pen. 54" intelligent drum plotter with proprietary servo-motor drive system with linear actuator pen system.

**Zeta Z1004**

High speed electrostatic printer/plotter. Printing speed is 1,000 lpm. plotting speed 120 in/min. with a resolution of 100 dots/in. \$8500.

**Zeta C63**

On-line/off-line plotter workstation consisting of a plotter controller, tape drive, CRT and keyboard in one compact unit. \$19,900. Vend Maint. 30+ FO. *Nicolet Zeta Corp., Concord, CA.*

**P 80 Serial Matrix**

7x9 dot matrix. 80 cps. bidirectional logic seeking. 96 char ASCII. U/L case. Optional APL. International and graphic char sets. \$635. OEM 100 Qty.

**P250 High Speed Matrix Printer**

7x9 matrix. 250 cps. 96 char ASCII. U/L case. Optional APL. International and graphic. Up to 19,200 baud. optional 2K char buffer. Serial RS-232C. optional Centronics interface. \$1740. OEM Qty 100.

**Stylist 360 Daisywheel**

Letter quality. 100 char ASCII. U/L case, symbols, proportional and OCR type. 17 cps. bidirectional logic seeking. \$820. OEM qty 100. Vend Maint. 9 FO. *Pertec Computer Corp., Peripherals Div., Chatsworth, CA.*

**Dataproducts and Tally Printers**

Full line of printer systems. Band. Daisywheel. Matrix. Drum. Thermal. Wholesale. Vend Maint. *Printer Systems Corp., Gaithersburg, MD.*

**P150 Matrix Impact Line Printer**

150-lpm 96-char ASCII sets, expandable to 160 char. unlimited font versatility, and full plotting and graphics capability.

**P300**

300-lpm model. Same features as P150.

**P600**

600-lpm model. Same features as P150. Vend Maint. 100 Locations. Various 3rd P. 40 FO. *Printronic Inc., Irvine, CA.*

**Dataroyal IPS-5000**

150 lps; selectable print styles; 9 x 9 impact; up to 5 multipart forms. \$1495. Vend Maint. *Small Business Systems Group Inc., Westford, MA.*

**2290 Line Printer System**

900 lpm. 132 col. 64 char 6/8 lpi. form length select switch, static eliminator, self test, active ribbon control, paper motion detect. I/O cable assembly. DEC, DG, HP, TI, Burroughs, P-E. Controllers: included with line printer. \$18,000.

**B-300 Line Printer System**

300 lpm band printer. 64 or 96 char. 132 col. 6/8 lpi. form length select switch, pedestal, diagnostic display, with computer interface. I/O cable. DEC, DG, P-E, HP, Burroughs TI and most other processors. \$6000.

**2260 Line Printer System**

600 lpm. 136 col. 64 char. 6/8 lpi. form length select switch, static eliminator, self test, paper receptacle, controller. I/O cable assembly. \$12,000.

**B-600 Line Printer System**

600 lpm band printer. 64 or 96 char. 132 col. 6/8 lpi. form length select switch, pedestal, diagnostic display, with computer interface. I/O cable assembly. \$8000.

**B-900**

900 lpm line printer system with 64 or 96 char. 132 col. 6/8 lpi. form length select switch, quietized cabinet, paper puller, diagnostic display, with computer interface. I/O cable assembly. \$12,000.

**M200 Line Printer System**

200 lpm matrix line printer with 128 char. 132 col. form length select switch, diagnostic display, 10 & 16.7 cpi, self test with computer interface (parallel or serial). I/O cable. \$2995.

**2550 Line Printer System**

1500 lpm charaband line printer system with 64 and 96 char set. 132 col. 12 ch. VFU, self test, static eliminator, paper puller, active ribbon control. 6/8 lpi. with controller. I/O cable assembly. \$33,000.

**Model 2230**

300 lpm line printer system, with 64 char. 136 col. 6/8 lpi. form length select switch, static eliminator, paper receptacle, self test, controller. I/O cable. \$9000. *Southern Systems Inc., Ft. Lauderdale, FL.*

**4611, 4632, Video Hard Copy Units**

Produce B&W or grey scale copies from most video signals. The 4611 is an electrostatic copier, the 4632 uses electro-photographic technique. \$4400-\$5350.

**4662 Interactive Digital Plotter**

B size plotter which creates graphic images on paper, mylar, or overhead transparency film with fiber-typed or wet-ink pens. \$4600. Vend Maint. 53 FO. *Tektronix Information Display Div., Beaverton, OR.*

**WX4675**

6-pen plotter, flat bed. 5 cm/axis/sec speed. \$1700. 2 FO. *Watanabe Instruments Corp., Costa Mesa, CA.*

**ZBX-349 Printer Interface**

Small board module, plugs onto SBX connector of various Intel and Zendex baseboards. Included cable is 8' long and connects at one end to a 50-pin edge on the ZBX-349, the other end plugs directly into the parallel connector on a Centronics line printer. \$190. *Zendex Corp., Dublin, CA.*

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## Rigid Disk Drives

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**CDC 9762**

80MB storage module drive with removable media.

**CDC 9766**

300MB storage module drive with removable media.

**CDC 9730-80**

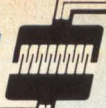
80MB mini-module drive with floor unit or rack mount option.

**CDC 9448-32**

32MB cartridge module drive with 16MB fixed/16MB removable media.

**CDC 9448-64**

64MB cartridge module drive with 48MB fixed/16MB removable media.



### Rigid Disk Drives

#### CDC 9448-96

96MB cartridge module drive with 80MB removable media. Vend Maint. 4 FO. *Advanced Digital Products, San Diego, CA.*

#### PDS-100

Single board S-100 Bus controller for Priam 3350 14". 33MB Winchester and 6400 bpi cartridge for backup. \$695 Controller with SW. Warranty; RTFM. *Alloy Engineering Co. Inc, Computer Products Div, Natick, MA.*

#### Disk/Atlas 80

80MB hard 14" disk. 8 ms access time per single MB of access. 35 ms for random 1MB access. \$8000.

#### Disk/Model 80

8 ms access time. 14" hard disk. 1, 2, 4 and 8MB increments. Can be daisy-chained up to 8 units/controller. Between \$8000-\$22,000. Limited Maint. 45 FO. *Alpha Data Inc, Chatsworth, CA.*

#### BD 50, BD 80, BD 100, BD 160

50, 80, 100 and 160MB capacities. Rack or console mount. easy maintenance, protective features, self-diagnostics. *Ball Computer Products, Boulder, CO.*

#### Model 6171

8" fixed disk drive. 8MB.

#### Model 6172

8" fixed disk drive. 24MB.

#### Model 6173

8" fixed disk drive. 40MB. *BASF Systems Corp, Memory Div, Los Gatos, CA.*

#### Disk Systems-Mass Bus

Utilize SMD and Winchester technologies in formatted capacity ranges from 67.4 to 551.8MB, with state-of-the-art controllers included.

#### VAX Disk Systems

Utilize SMD technology in formatted capacity ranges from 67.4 to 256.2MB, with state-of-the-art controllers included.

#### Disk Systems-Q-Bus

Wide variety of Q-Bus disk subsystems utilizing SMD, fixed/removable and Winchester technologies in formatted capacity ranges from 10.4 to 551.8MB, with state-of-the-art controllers included.

#### Disk Systems-Unibus

Wide variety of Unibus disk subsystems utilizing SMD, fixed/removable, and Winchester technologies in formatted capacity ranges from 10.4 to 551.8MB, with state-of-the-art controllers included. Vend Maint. 55 FO. *Braegen Minicomputer Peripherals Div, Anaheim, CA.*

#### FD211/214

20/80MB storage capability on 14" rigid media. Multibus adaptor drives 2 ports of FD211/214 or MD122 flexible disk drive. \$5100/\$6300. *Burroughs, Detroit, MI.*

#### 4610 and 4620

Winchester disk subsystems and expansion subsystems. 4610 is 10MB, 4620 is 20MB. Intelligent controller w/DMA 800 kB transfer rates. Up to 4 drives any mix per controller. S100 Bus system compat. Uses real-time HW vectored interrupt control. RTFM. 15 FO. *California Computer Systems Inc, Sunnyvale, CA.*

#### DEC Drives

RL01, RL02, RK05, RK06, RK07, RP04, RP05, RP06.

#### CDC Drives

80MB, 300MB. Retail, systems integrator. *California Datalease Systems & Financial Corp, Anaheim, CA.*

#### HD 11/T

20.8MB Winchester drive system. SW equivalent to 4 RL01s. Optional cartridge tape backup. \$8700 with tape option; \$6500 w/o tape option. *Charles River Data Systems Inc, Natick, MA.*

#### Cynthia DSS 1100 Family

Cartridge disk drives and subsystems. LSI-11 Q-Bus and RT 11, RSX 11M compat. Includes disk drives, power supply and controller. 3 configurations. *Cii-Honeywell-Bull, Waltham, MA.*

#### QD 11

DEC compat hard disk 14". 5440 top loader/200 tpi. 5MB fixed, 5MB removable. Emulates DEC RKV11. \$7995.

#### MD 80

Multibus compat hard disk 14", intelligent controller. DMA operation. 5440 top loader, 200 tpi. 5MB fixed, 5MB removable. \$7995. Vend Maint. 3 FO. *Comark Corp, Waltham, MA.*

#### QRM03/QRM05/URM03/URM05

67-256MB subsystem for LSI-11/PDP-11/VAX-11. 100% DEC compat with RM disk family. \$9000-\$24,000.

#### 880-D/8-L11

Winchester/floppy subsystem for LSI-11. 7.8MB Winchester with 1MB floppy. Built in diagnostics, formatter, bootstrap. \$6895.

#### 880-D/30L11

Winchester/floppy subsystem for LSI-11/PDP-11. 31MB Winchester emulating 3-RL02 with 1MB floppy. Built-in diagnostics, formatter, bootstrap. Under \$9000. *Compumart Corp, Cambridge, MA.*

#### CM 5616

5 1/4" disk drive. 16MB unformatted. \$2140. *Computer Memories Inc, Chatsworth, CA.*

#### 20L, 11L, 5L

Compat w/LSI-11, provides 5.2, 10.4, or 19.6MB of formatted storage. Supports all DEC compat operating systems. \$4250, \$5850, \$6950. *Corvus Systems Inc, San Jose, CA.*

#### Wave 80

Intelligent 8" Winchester disk drives. Model 11 is an 11MB drive. Model 22 is a 22MB drive. *Cyberdata, Monterey, CA.*

#### SMD DRM02/3

80MB for PDP-11, 6000 bpi. DEC SW transparent.

#### SMD DRM04

300MB for Unibus-based PDP-11.

#### Fixed Media Drive DRM07

600MB for PDP-11, SMD interface protocol. 25 ms access time. Optional head per track — 1.92MB.

#### Mini Module DRMM 80-160

80 or 160MB for PDP-11. SMD interface protocol. Sealed module. Vend Maint from CDC. GE & DEC. 4 FO. *Data Systems Services, El Toro, CA.*

#### DTC-510 Intelligent Disk Drive Controller

$\mu$ P-based provides all the functions for implementation of up to 2 Seagate Technology ST506 disk drives. Features: overlapped seek, automatic seek and verify, ECC, fault detection sector buffer.

#### DTC-520 Intelligent Disk Drive Controller

Capable of handling up to 4 disk drives, any combination of ST506 disk drives and IBM-compat single or double-density, single or double-sided flexible mini-disk drives. IBM format compat. *Data Technology Corp, Santa Clara, CA.*

#### CDC 9766/CDC 9762

300 and 80MB disk drives are available for subsystem needs. Vend Maint. 2 FO. *Datum Inc, Anaheim, CA.*

#### Dicom 604

14" Winchester disk system to 130MB. Interfaces HP 21xx/1000 and DEC LSIs. From \$9875. Vend Maint. 12 FO. *Dicom Industries Inc, Sunnyvale, CA.*

#### Model 601-17A Disk Drive Subsystem

Computer Automation LSI-2 and NMI-4 compat disk drive. Supports cartridge disk D05 and file manager system. Capacity is 2.5MB. Operating temp. 0°C to 60°C. Shock and vibration resistant. \$5000-\$10,000.

#### Model 601-17B

H-P 9825/35/45 compat. Supports file manager ROMs for H-P 98217A and 98331A. Capacity is 3MB. Operating temp. 0°C to 60°C. Shock and vibration resistant. \$5000-\$10,000.

#### Model 601-17

Intelligent bit-slice controller drives general purpose 16-bit bidirectional data bus for special interface applications. 0°C to 60°C. Shock and vibration resistant. \$5000-\$10,000.

#### Model 601-16

Intelligent bit-slice controller drives general purpose 8-bit bidirectional data bus for special interface applications. 0°C to 60°C. Shock and vibration resistant. \$5000-\$10,000.

#### Model 601-15

Intelligent bit-slice controller drives RS232/422 serial data port. Data rates to 500 K baud. 0°C to 60°C. Shock and vibration resistant. \$5000-\$10,000.

#### Model 601-14

Emulates ANSI std Winchester interface for plug compat. Capacity 5MB. \$5000-\$10,000.

**Model 601-13**

IEEE 488 GPIB compat. Uses intelligent bit-slice controller under firmware control. 5MB. 0°C to 60°C. Shock & vibration resistant. \$5000-\$10,000.

**Model 601-12**

Emulates Shugart 850/851 floppy disk drives or equivalent. Plug compat with floppy disk controller HW & SW. Can be daisy-chained to existing floppy. 0°C to 60°C. Shock & vibration resistant. \$5000-\$10,000.

**Model 601-11**

Emulates head-per-track NRZ serial data interface. Plug compat with HPT drives from DDC. Data Flux. Amcomp and Librascope. Capacity 5MB. 0°C to 60°C. Shock and vibration resistant. \$5000-\$10,000.

**Model 601-10C**

Intel Multibus compat system supports 8080/8085/8086  $\mu$ P. Capacity is 2.5MB. 0°C to 60°C. Shock and vibration resistant. \$5000-\$10,000.

**Model 601-10B**

DEC LSI-11 Q-Bus and RK11/RK05 compat. 2.5MB. Completely sealed disk drive. 0°C to 60°C. Shock and vibration resistant. \$5000-\$10,000.

**Model 601-10A**

DEC PDP-11 Unibus and RK11/RK05 compat. 2.5MB. Completely sealed disk drive. 0°C to 60°C. Shock and vibration resistant. \$5000-\$10,000. Vend Maint. 5 FO.

*Disk Memory Technology, Portland, OR.*

**DCS/80-W**

Complete Multibus system with 24MB Winchester disk and SW (8080 based).

**DCS/86-W**

Complete Multibus system with 24MB Winchester disk (8086 based) and SW. \$12,500

*Distributed Computer Systems, Waltham, MA.*

**Super Gemini**

Includes: 8 quad slot (16 dual slot) Q-Bus backplane; LSI-11/2 or LSI-11/23 CPU; 64 kB to 256 kB memory; DLV11 serial async I/O interface or the QLV11 quad serial sync/async interface; and 1 8.5MB/mini-Winchester drive and 1 1.25MB double-sided double-density floppy drive. \$13,500 to \$16,500; OEM discounts avail.

**Super Tristar**

Includes: 8 quad slot (16 dual slot) Q-Bus backplane; LSI-11/2 or LSI-11/23 CPU; 64 kB to 256 kB memory; DLV11 serial async I/O interface or the QLV11 quad serial sync/async interface; and 1 8.5MB/mini-Winchester drive and 2 1.25MB double-sided, double-density floppy drives. \$15,000 to \$18,000; OEM discounts avail. Vend Maint. *General Robotics Corp, Hartford, WI.*

**Amplex DFR-996**

DG emulating disk drive and controller; 67MB fixed, 13MB removable; full RDOS and AOS SW support. \$11,950; OEM discounts. Vend Maint. *MBS Inc, Madison, WI.*

**101-8"**

Product family offering 8" Winchester disk drive, 11.7MB capacity, low power requirements, sealed media, integral data separation.

**677 — Removable Media**

200/300MB capacity. Off-line tester avail.

**601/612**

14" Winchester disk drive. Capacities from 50 to 84MB, sealed environment, broad range of applications.

**659**

14" Winchester disk drive 680MB storage, direct access, SMD interface, 1.2MB transfer rate. Vend Maint. 5 FO. *Memorex OEM Div, Santa Clara, CA.*

**1200 Series**

8" Winchester rigid disk drives, 9, 27, 45MB capacity. Offered with or without controller. Vend Maint.

*Micropolis Corp, Chatsworth, CA.*

**MSC 9800H**

5MB subsystem which combines a 5-1/4" Winchester drive, power-supply and GPIB controller. Designed to work with the HP85 small business computer. Under \$4000. Vend Maint. 2 FO. *Microcomputer Systems Corp, Sunnyvale, CA.*

**RD45**

45MB capacity rigid disk drive. Winchester technology. \$23,000; with controller \$38,000. Vend Maint. 3 FO. *Miltope Corp, Plainview, NY.*

**Mikro-Disk VIII-I**

8" Winchester disk drive that gives the user the performance of bubble memory. \$1150. (Qty 500).

**Mikro-Disk V Family**

From 2MB-8MB. 5 1/4" Winchester disk drive with removable cartridge giving 8MB of storage. 4 fixed and 4 removable. \$1196. (Qty 500). RTFM. *New World Computer Co. Inc, Costa Mesa, CA.*

**NWMOS**

300MB. SMD disk drive with Massbus controller for DEC. \$20,500. Vend Maint. 8 FO. *Nordata, Seattle, WA.*

**WCF-1 Mini-Winchester/Floppy System**

Compact rack mountable 19" enclosure housing a 5MB Winchester, 1MB floppy drive (both 5-1/4"). Choice of LSI/11-2 or 23 with up to 256K RAM. The WCF-1 includes a controller, and 4 port RS232 I/O. Included are all power supplies and control electronics for clock/enable, run/halt, DC on/boot, AC on-off. Accepts up to 12 Q-Bus dual height slots and includes top mounted fans for efficient cooling.

**WCF-3 8" Winchester/Floppy System**

19" rack mountable system. Includes 8" Winchester (for up to 70MB) and 8" 1MB floppy. Choice of LSI/11-2 or 23 with up to 256K RAM and 4 port RS232 I/O. Can house combinations of dual or quad cards. *North Atlantic Industries, Hauppauge, NY.*

**PRM-Q**

Bus adaptor interface between LSI-11 and Priam Winchester disk.

**WIN-Q**

Bus adaptor interface between Micropolis Winchester and LSI-11. *Peritek, Oakland, CA.*

**D3000 Extension**

Rigid disk drive. 24MB. \$4680. OEM Qty 100.

**D3000**

Rigid disk drive. 12MB. \$3900. OEM Qty 100.

**MiniWini/D8000**

8" Winchester drive. \$1980. OEM Qty 100. Vend Maint. 9 FO. *Pertec Computer Corp, Peripheral Div, Chatsworth, CA.*

**PM-RF11**

Replaces RF-11A. High-performance, disk emulator. Utilizes 16K MOS memory in place of mag disk Unibus systems.

**PM-DSW 11/E**

254MB disk storage system for PDP-11/70. PM-DCW11 controller interfaces direct to RH70. Emulates RH70 w/RP06 drive.

**PM-DS11/300 C**

DEC RH11 replacement. Complete mass storage disk system. Expandable to 8 drives.

**PM-DSA11/300**

256MB disk pack subsystem for PDP-11.

**PM-FS11G**

14" Winchester disk subsystem for PDP-11s. Has single hex-wide PM DC1100 controller board, FD11G fixed-disk drive w/25.3MB formatted capacity. Compat with RP 11/C controller & SW. *Plessey Peripheral Systems, 1691 Browning, Irvine, CA.*

**Diskos 3350**

Winchester disk drive. DEC, DG, Intel, TI-990, Interdata. Hard disk drive, controllers. Capacity: 10-160MB; access: 45 ms; 8" & 14". \$2195 to \$6600. *Priam, San Jose, CA.*

**ST 506**

5-1/4" micro Winchester. 6.38MB unformatted, 5MB formatted. 5 Mbit/sec transfer rate, 170 ms random average access.

**ST 512**

12.76MB unformatted, 10MB formatted, on 2 disks. Thin film head technology, 100 ms average access. *Seagate Technology, Scotts Valley, CA.*

**SA1000**

8" Winchester 5.3/10.7MB. \$1140 (SA1002); \$1400 (SA1004).

**SA 4000/4100**

14" Winchester. 14.5/29.0/58.0 MB. \$1600 (SA4004); \$2000 (SA4008); \$2650 (SA4104); Qty 100-249.

**SA600**

5.25" Winchester 3.3/6.6/10.0MB. \$870 (SA602); \$1125 (SA604); \$1380 (SA606); Qty 100-249. 3 Reg Svc Cntrs. 10 FO. *Shugart Assoc, Sunnyvale, CA.*



**Rigid Disk Drives**

**Cheyenne**

8" Winchester disk drive. From 7.3MB to 52MB. SMD. ANSI or floppy-type interfaces. From \$1815 (OEM Qty).  
*SLI Industries, Woodland Hills, CA.*

**9400-75 Disk Storage System**

DEC-compat. 600MB disk drive + controller. fixed media. single or dual channel. \$36,900-\$61,400 depending on CPU interface.

**9400-84**

DEC-compat. 160MB disk drive + controller. fixed media. single or dual channel. \$14,000-\$21,500.

**3100-66**

DG compat. 300MB disk drive + controller. removable media. \$20,500 single channel; \$25,000 dual channel.

**3100-75**

DG compat. 600MB disk drive + controller. fixed media. \$34,200 single channel; \$37,500 dual channel.

**3100-84**

DG compat. 160MB disk drive + controller. fixed media. \$15,000 single channel; \$19,500 dual channel.

**3100-62**

DG compat. 80MB disk drive + controller. removable media. \$13,000 single channel; \$16,450 dual channel.

**9400-66**

DEC-compat. 300MB disk drive + controller. replaces RP06. Removable media. single or dual channel. \$23,900-\$47,500. Vend Maint. 14 FO.  
*System Industries, Sunnyvale, CA.*

**Mini Winchester Disk Drive/ TM 600**

2 & 3 platter Models; 254 tpi; unformatted recording capacity: TM 602-6.4MB; TM 602E-7.8MB; TM 603-9.5MB; TM 603E-11.6 MB. Access times: track-to-track-3 ms. average-153 ms & 210 ms. \$1220-\$1485. Vend Maint. 4 FO.  
*Tandon Corp, Chatsworth, CA.*

**Sapphire 160**

14" Winchester disk drive. 168MB with SMD interface and internal power supply. \$4950. OEM Qty. RTFM. 2 FO.  
*Tecstor Inc, Huntington Beach, CA.*

**Series 8000 Cartridge Disk Drive**

20MB capacity. 10MB fixed + 10MB removable. Top loading. digital controls servo electronics.  $\mu$ P controlled. brushless DC motor crystal controlled sectoring with switch selectable sector option on fixed disk. \$2300.

**Series 6000**

Cartridge disk drive. 10MB capacity. 5MB fixed + 5MB removable. Front or top loading. \$2100.

**Series 4000**

Fixed disk drive. 10MB capacity with 2 fixed disks. \$1650. Vend Maint.  
*Western Dynex Corp, Phoenix, AZ.*

**XD1000 Winchester Disk Module**

For Q-Bus. Unibus. Multibus and DG I/O Bus. Xylogics XD1000 Winchester disk module provides up to 48MB of on-line storage using up to 2 disk units with associated power supplies. The completely self-contained XD1000 uses Xylogics 530. 550. 650. 440 or 850 Peripheral Processors to support: Q-Bus/BASF disk bus; or Q-Bus, Unibus, Multibus, or DG I/O Bus with SMD interfaces.  
*Xylogics Inc, Burlington, MA.*

**The Converter**

Semi-automated aid to conversion from MICOS Basic to DG Business Basic. May also be adapted for other Basic versions (Binary, etc) to DG.

*Bellin Computer Systems Inc, Plainview, NY.*

**PC Design**

Design and documentation of PCBs compat with DEC, etc. for terminals, add-in/add-on memory, floppy disk drive, hard disk drive, controllers, I/O analog boards, processors. Price quoted, based on complexity/density.

*Bill White Printed Circuit Design, Anaheim, CA.*

**Product Design Services**

Disk controllers — SMD, ANSI, cartridge, Winchester. Tape controllers — NRZI, PE, GCR. Memories — 16 bit through ECC capabilities.

*Concept Development Inc, Costa Mesa, CA.*

**Computer Repairs**

DEC, NOVA, CPU's, memory & power supplies, all manufacturers. \$90 to \$300. 3 FO.

*Digital Data Systems Inc, Plantation, FL.*

**System Integration**

HW/SW interfacing for 8 bit microcomputers and 16 bit mini-computers.

*Form & Substance Inc, Westlake Vge, CA.*

**LSI 11/2 or LSI 11/23 Systems**

Configured to customer specifications, completely tested, quick delivery, low cost.

*Indec Computer Systems, Sunnyvale, CA.*

**DEC Service**

Terminals, CRTs, printers.  
*David Lee, Van Nuys, CA.*

**Magnetic Tape Heads**

Reconditions, rebuilds, or otherwise restores worn or worn out heads to like-new condition at less than 1/2 the cost of a new head. All models. Maint at vendor's facility.

*Magnetic Recovery Technologists Inc, Valencia, CA.*

**Disk Drive Service**

Most companies/models. Disk drive motor repair: spare parts: absolute & pre-filters replacement: spindle repair: circuit board replacement and/or repair. Maint at site. Quote after evaluation.  
*NOW Enterprises, Valencia, CA.*

**Consulting and Programming Services**

Consulting and contract programming for PDP-11/03 and 11/23. Specialize in RT-11, DIBOL, BASIC. Certified.

*PK Systems Inc, Bloomington, IL.*

**UNIX Management and Technical Services**

Services dedicated to the development, support and application of UNIX based systems and products. Consultants.

*The Santa Cruz Operation Inc, Santa Cruz, CA.*

**Software Consulting Services**

Provides a broad array of high-powered DEC SW expertise on every level from applications design to driver development using RSTS/E, DECNET, and BASIC+2.

*Software Techniques Inc, Los Alamitos, CA.*

**Custom SW & HW**

As an OEM for DEC, has developed an extensive library of scientific SW and expertise in FORTRAN, MACRO & BASIC.

*Spectrogram Corp, No. Haven, CT.*

**Maintenance Service**

Spare parts repair service for Lockheed LEC-16 and MAC-16 computers. 17 FO. Contract \$250-\$400 per month or T & M.  
*Telefile Computer Products Inc, Irvine, CA.*

**RP03, RP04, RP05, RP06, RM02, RM03**

Critical component reconditioning. Disk heads, spindles and motor reconditioning available. All service backed with warranties and guaranteed turnaround within 45 days.

*Trans Datacorp, Belmont, CA.*

**RP03, RP04, RP05, RP06 Disk Drives**

Third party repair facility, printed circuit assemblies, electronic sub-assemblies. Phone for quotations.

*Unitrace Inc, Santa Clara, CA.*

**Services**

**Custom MIS Packages**

Generate turnkey SW packages to fit needs. Build spec, & deliver quotes.

*AMT Software Systems, Boxboro, MA.*

**Software Maintenance Service**

Similar to HW service, SMS offers preventative examination/correction to SW as well as priority on-site response in emergencies. \$200/up.

# Special I/Os

## Dual I/O 10039

General purpose interface between PDP-11 and 2 user peripherals. Replaces 2 DEC DR11-C units. \$950. Vend Maint, 1 FO. *Able Computer, Irvine, CA.*

## 1616/OII, 1616/OIO

16 lines of optically isolated inputs and outputs. 1616/OII: \$345; 1616/OIO: \$275.

## 1632TTL, 1664TTL, 1664ATTL

32 or 64 lines of programmable TTL compat I/O lines. 1632TTL: \$275; 1664TTL: \$350; 1664ATTL: \$350.

## 1750

Dual port serial I/O: RS232 and current loop. \$395. Vend Maint, 47 FO. *ADAC Corp, Woburn, MA.*

## 8911 Programmable IBM Channel Interface

Stand-alone IBM channel-speed interface for attaching non-IBM DP equipment and peripherals to an IBM 360/370, 303X, and 4300 channel. \$12,995.

## 8900 IBM Channel Interface Module

Programmable IBM-to-DEC LSI-11 interface module. Attaches to all IBM 360/370, 303X, 4300 system channels, operates at channel speed. \$4995; \$2995 (50 or more). *Auscom Inc, Austin, TX.*

## MP1104

Analog output for LSI-11. Specialized terminals. I/O analog boards. 4-output channels: 12-bit resol:  $\pm 0.025\%$  acc; 10  $\mu$ s conversion. \$550.

## MP1216

Analog input for LSI-11. 16 DIF/32 SE input channels: 12-bit resol;  $\pm 0.025\%$  acc; 40  $\mu$ s conversion;  $\pm 10$ V to  $\pm 10$ mV range. \$550.

## MP1216-PGA

Analog input for LSI-11. 16 DIF/32 SE input channels: 12-bit resol;  $\pm 0.025\%$  acc; 350  $\mu$ s conversion;  $\pm 10$ V to  $\pm 10$ mV range. \$675.

*Burr Brown Industrial Systems Products, Tucson, AZ.*

## 2830

6 channel serial I/O module. Async RS 232C channels with programmable control for each channel. S100 Bus system compat. Uses real time vectored interrupt control. Includes 6, 30' internal cables. \$600.

## 2710

4 channel serial I/O board. Async channel with independent program

control. Fully buffered I/O, ROM option with phantom enable capability. S100 Bus compat. \$340.

## 2718

Serial/parallel I/O board. 2 serial async channels (RS232C) 75-19.2K baud, one channel may be used in sync mode; 2, 8-bit parallel channels with full buffering and invertible handshaking using jumpers. S100 Bus compat. \$360.

## 2720

4-channel parallel I/O. 3, 8-bit I/O ports and 1 output only port, full handshake control with invertible handshake using jumpers. 7-bit status register, fully buffered, provision for 2K ROM with phantom enable. S100 Bus compat; \$250. RTFM, 15 FO. *California Computer Systems Inc, Sunnyvale, CA.*

## MIP-3/V Video Input Processor

Solid state video camera and input processor. Samples up to 30 frames/sec. 128  $\times$  128 pixels by 8 bits of intensity resolution/frame. Grab single frame or process image data on the fly. \$7950.

## MIP-3/A Data Spooler

Input processor includes 16-channel, 12-bit, 100 KHz ADC, integral 16-bit bit slice minicomputer, and 20K word dual port, dual buffer memory. Transfers data continuously to system disk. \$7320.

## MDP-3 Display Processor

Programmable image processor drives color RGB monitor; 64K word image data memory plus separate graphic/alphanumeric overlay memories; \$12,000. *Computer Design and Applications Inc, Newton, MA.*

## DT 2762 Series

DEC Q-Bus. Analog I/O systems for DEC Q-Bus processors.

## DT1711 Series

DEC Unibus. Analog I/O systems for Unibus processors.

## DT1751 Series

Multibus. Analog I/O systems for Intel SBC-80 and National BLC-80 Multibus.

## DT3362 Series

DEC Q-Bus. High performance, dual ported, advanced architecture analog I/O systems for Q-Bus processors.

## DT 3752 Series

Intelligent analog peripherals (Multibus). Analog input and output, digital input and output, CPU, RAM, EPROM, all in one family of Multibus compat boards. \$600 — \$2000. RTFM; 1

yr. warranty.

*Data Translation Inc, Marlboro, MA.*

## ST-711/ST-732

Intel Multibus compat. 32SE (16 Dif) A/D channels with 12-bit resolution; PGA (X1, 2, 4, 8 gains); EOC, EOS, Ext start trigger interrupts; pacer clock, DC-DC converter; systems manual & diagnostics included. ST-732: all above plus 2 D/A channels (12-bit) with current loop outputs; 23,000 samples/sec. ST-711 pin-for-pin replacement for iSBC-711; ST-732 pin-for-pin for iSBC-732. ST-711, \$625; ST-732, \$788.

## ST-800, ST-800-ADX

Intel Multibus compat. ST-800: 32SE or 16 Dif A/D channels; 12 bit resolution; 20,000 samples/sec; optional DMA (36,000 samples/sec with DMA); scan clock. ST-800-ADX: expander board: 32 SE, 32 Dif, 48 SE or 48 Dif channels avail; 256 A/D chans max including ST-800. Manual & diagnostics included with ST-800 & ST-800-ADX. ST-800-16S (16 SE A/D chans), \$687; ST-800-ADX32S (32SE A/D chans, expander), \$330.

## ST-800-DA8; ST-800-DAX8

Intel Multibus compat. ST-800-DA8: 8 SE (4 Dif). D/A channels; 12-bit resolution; scan clock. ST-800-DAX8: 8 SE (4 Dif). D/A channels, expander card. ST-800-DA8, \$860; ST-800-DAX8, \$825.

## ST-6800DA

Compat with Motorola M-6800 Series EXORciser. 4 or 8 D/A channels, 12-bit resolution; 12-bit output; optional DC-DC converter; manual and diagnostics included. From \$546.

## ST-6800 & ST-6800ADX

Compat with Motorola M-6800 EXORciser. ST-6800: 32S or 16D A/D chans, 2 D/A chans; 12 bits of resolution; DC-DC power converter; current or voltage inputs; 12-bit digital output; manual and diagnostics included. ST-6800ADX: 32S/D or 48 S/D channel A/D slave expander. ST-6800, from \$485; ST-6800ADX, from \$226.

## ST-LSI-DA

Compat with DEC LSI-11. Half-quad 4-channel D/A board; 12-bit output; optional DC-DC converter. ST-LSI-DA, \$524 (w/o DC-DC); \$590 (w/DC-DC).

## ST-LSI2, ST-LSI2-ADX, ST-LSI-DMA

Compat w/DEC LSI-11 & LSI-11/2. ST-LSI2: half quad A/D brd; 16S/8D A/D chans; pacer clock, PGA, DC-DC conv. ST-LSI2-ADX: half-quad A/D expander; 48S or 24D chans. ST-LSI2-DMA: half-quad DMA A/D block transfer controller. 32,768

16-bit words; EOC & end of cycle interrupts, 2 vectors, 50 kHz transfer rate. ST-LSI2, \$625; ST-LSI2-ADX, \$376; ST-LSI2-DMA, \$368.

## ST-LSI, ST-LSI-ADX

Compat with DEC LSI-11. ST-LSI: full quad; 32S/16D A/D channels, 2 D/A channels; pacer clock; 12 bit resolution, A/D and D/A sections; current loop outputs; optional PGA or instrumentation Amp. ST-LSI-ADX: half quad slave A/D expander; 32S or 16D channels. ST-LSI, from \$734; ST-LSI-ADX, \$326.

## ST-LSI-RLY

Compat with ST-LSI and ST-LSI2. Half-quad, 8-channel differential A/D board; relay MUX permits 126 dB CMRR and 250V RMS isolation. PGA (X1,2,5,10); EOC interrupt; ext trigger start; DC-DC converter; includes manual and diagnostic. \$695.

## PDAS-250/PDS-32

Computer data acquisition/distribution syst. Up to 2565 (128D) A/D, 32 D/A channels; A/D section — 12 bits; 250,000 samples/sec; D/A section — 8, 10, 12, or 14 bits; SS&H optional; used with any computer parallel I/O port. System shipped with systems manual. From \$2845.

## ST-724

Intel Multibus compat 4 channel D/A board; 12 bits; selectable XACK delay; DC-DC converter; voltage or 4-20 mA current outputs selectable can be used with RMX-80 SW. Includes systems manual and diagnostic. \$595.

## ST-711RLY8D and ST-711RLY16D

Intel Multibus compat. 8 or 16 relay-isolated differential A/D channels; 126 dB CMRR, 250 VRMS isolation; 12-bit resolution; PGA (X1, 2, 5, 10 gains); EOC, EOS, ext start trigger interrupts; pacer clock; systems manual, diagnostic included. 30 samples/sec. ST-711RLY8D, \$683; ST-711RLY16D, \$1045.

## System 256/DDS-32

Computer data acquisition/distribution system. Up to 2565 (128D) A/D, 32 D/A channels; SS&H available; A/D — 12-bit resolution; 50K or 100K samples/sec; D/A — 8-, 10-, 12-, or 14-bit resolution. Systems manual included with each unit. From \$1675. *Datel-Intersil Inc, Mansfield, MA.*

## DIGSYN

Multibus compat digital-to-sync and sync-to-digital interface.

## DCS488

Multibus interface for IEEE 488 (GPIB).

*Distributed Computer Systems, Waltham, MA.*



*Special I/Os*

**STD-VI08 I/O Timer Counter Board**

8 programmable I/O ports; four 16-bit programmable timers; four 16-bit event counters; 4 programmable shift registers; programmable interrupts from all devices; fully decoded address space; switch selectable addressing; reliable output connectors; 65/6800 STD Bus compat; single 5V supply operation. \$199. RTFM. *Forethought Products, Eugene, OR.*

**STC-100**

Serial (RS-232) magnetic tape coupler. RS-232 serial port controller for IBM format compat. 1/2" magnetic tape drives. \$2320 to \$5025. Vend Maint. 5 FO. *IBEX Computer Corp, Tarzana, CA.*

**Graphic CRT Interface**

DG compat interface to Tektronix GMA 102A graphic CRT. Direct memory access controller. \$3850.

**Custom Design**

Custom interfaces to the customers' printers, machinery, testers, etc. *Interface Electronics, Southfield, MI.*

**MDB-4040**

General purpose interface board for DG contains basic logic for device addressing, BUSY and DONE status and interrupt logic. Provisions for 105 14- or 16-pin ICs for user-designed logic. \$424.

**MDB-DR11B**

Direct memory access module for PDP-11 completely compat with DEC DR11-B on a single quad module instead of the complete systems unit required by the DEC equivalent. Provides interrupt request and bus master control for bi-directional exchange of 16-bit data from the Unibus to an external device. \$1450.

**MDB-DR11-BLL**

Direct memory access module for PDP-11 with RS-422 long line differential circuitry which occupies a hex size slot. Allows placement of peripheral devices or other computers up to 3,000' from the PDP-11 or VAX. \$1995.

**MDB-BLL11**

RS-422 long line extension module for MDB and DEC DR11-B modules. The dual size module can be used to provide long-line signal capabilities to previously purchased MDB DR11-B modules. \$795.

**MDB-DR11-C**

General purpose parallel interface for PDP-11. Direct replacement for DEC DR11-C. Provides bi-directional exchange of 16-bit data from PDP-11 end external device. \$550.

**MDB-TA528**

General purpose digital I/O interface with external bus control for PDP-11. Provides bus-to-bus interface up to 100'. Includes line drivers and receivers and buffered input and output. Consisting of input buffer (16-bit RO), output buffer (16-bit R/W), and control status register (16-bit R/W). \$615.

**MDB-KW11-P**

Programmable real-time clock for PDP-11. Provides 4 clock rates, program selectable (external, 60 Hz, 10KHz, 100KHz). Has own 60Hz crystal controlled oscillator. \$810.

**MDB-MR11A**

Bootstrap loader/restart module for PDP-11. Incorporates all features of DEC 873, 793 and MR 11 on a single quad module. Includes connector for independent quad module and connector for independent external bootstrap control and watchdog timer. \$795.

**MDB-11B**

General purpose DMA interface for PDP-11 on a single quad board with provision for 12 IC positions of user logic. Includes two connector positions of up to 50 conductors each for cable-to-peripheral devices or to wire-wrap modules for expansion of user logic. \$1195.

**MDB-11C**

General purpose parallel bus foundation module for PDP-11 with all logic for bus interface, interrupt service, address selection plus 16-bit input and 16-bit output registers. A universal wire-wrap portion is provided for up to 20 sockets or devices of any DIP configurations. \$570.

**MDB-1710**

General purpose parallel bus foundation module for PDP-11 with all logic for bus interface and interrupt service. In addition provides universal wire-wrap portion for user logic of up to 40 sockets of devices of any DIP configuration. \$425.

**MDB-1710-01**

General purpose parallel bus foundation module as 1710 but with sockets inserted in 40 positions. PDP-11 compat. \$445.

**MLSI-1710**

General purpose bus foundation

module for LSI-11. Basic Q-Bus programmed I/O interface. Address decode circuitry and multiple interrupt vector priority selection. Multiple external I/O provisions on module. Pinned for 20 wire-wrap IC positions for user designed logic. \$225.

**MLSI-DRV11-P**

General purpose bus foundation module for LSI-11. Same as MLSI-1710 but has available up to 56 IC positions for user designed logic. Provision for wide variety of cable connector positions. \$325.

**MLSI-11B**

General purpose direct memory access bus foundation module for LSI-11. Contains basic Q-Bus programmed I/O interface with address decode circuitry, interrupt vector priority selection, plus address word count, data registers and bus master control and timing logic. Includes 26 IC positions for user designed logic and multiple external I/O provisions. \$650.

**MDB-48-013-01-WWI**

Universal logic module for P-E has a basic 16-bit I/O which includes: device addressing and handshake logic; 8 status lines; interrupt control including standard interrupt arm/disarm and enable/disable control. \$500.

**MDB-48-013-01-WW2**

Universal logic module same as MDB-48-013-01-WW1 except includes lo-profile sockets for 92 IC positions. \$600.

**MDB-48-013H-01**

Universal logic half module for P-E provides basic 16-bit I/O with device addressing and handshake logic; 8 status lines; interrupt control with standard arm/disarm and enable/disable logic; 16-bit input and 16-bit output register. \$495.

**MDB-48-013H-02**

Universal logic half module for P-E same as MDB-48-013H-01 except includes lo-profile sockets for 42 IC positions. \$550

**MNLT-GP-8**

General purpose bus foundation module for use with Intel 8-Bit single-board computers. Contains address selection logic which includes receivers and a decoder to provide 8 sequential addresses. The interrupt logic provides a request latch and a status latch for the non-bus vectored interrupts. All eight interrupt request lines are selectable. \$245.

**MNLT-GP-16**

General purpose Bus foundation module for use with Intel 16-bit single-board computers. Contains

address selection logic which includes receivers and a decoder to provide 8 sequential addresses. \$295. RTFM, 1 yr warranty. *MDB Systems Inc, Orange, CA.*

**MSC 8103 I/O & Memory Expansion**

4K/8 kB RAM, 4 EPROM sockets, 1K to 16 kB capacity, 1 RS-232C serial I/O port, 48 parallel I/O lines.

**MSC 8104**

9511A or 9512 APU optional, 16K/32 kB RAM, 4 EPROM sockets, 1K to 32 kB capacity, 1 RS-232C serial I/O port, 48 parallel I/O lines.

**MSC 8050**

Z80A, 16 kB/32 kB RAM, 1K-32K EPROM capacity, 1 RS-232C port, on-board DMA controller.

**MSC 8107**

9511A or 9512 APU optional, 16k/32kB RAM, 4 EPROM sockets, 1K to 32 kB capacity, 3 RS-232C serial I/O ports, 24 parallel I/O lines. *Monolithic, Englewood, CO.*

**Power I/O**

PB 32 DEC Quad PAK Rack and Quad PAK I/O Modules. Direct connection to DEC LSI 11-2 thru DRV11J board. Optical isolation — 3A power switching. High density I/O. PB 32DEC mounting rack \$150. Quad PAKS \$40.

**Industrial Power I/O**

PB 24 mounting rack for Opto 22 I/O modules. Direct compat with Intel 8010, 8020, 8030 boards; also I/O modules directly compat with ICS-80. \$100-PB24.

**PB16P1 Addressable Multiplexer**

Provides I/O expansion to 1024 points from 19 bits of any host parallel I/O port. Building block design allows cost effective design by adding boards in 16-point I/O increments to achieve required number of points. \$275 per 16-point board.

**SAMUX Remote I/O System**

Provides serial data communication to any host serial I/O port, handles up to 8000 points of digital and analog I/O at up to 64 locations which can be located to 5000' from host. \$25-\$55 per point depending on mix of digital and analog points. *Opto 22, Huntington Beach, CA.*

**DMA-Q**

22-bit DMA interface for LSI-11

**HEX-Q**

Multi-processor linking system for the LSI-11. *Peritek, Oakland, CA.*

# NOW . . .

## THE BEST OF BOTH WORLDS

**First...**

**think of me as a MEMORY SYSTEM**

because I'm the first and only 5¼" Mikro Winchester Disk System with up to 32 heads that provide 8 milli-second access times (Bubble Memory Performance).

- Entire capacity of minifloppy under the heads at all times (400,000 byte cylinders)
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**Special I/Os**

**CD23-4 OSI to SA4008 Interface Board**

Hard disk interface which allows users to interface from 1 to 4 Shugart SA4008 drives to one Ohio Scientific C3-C computer thru the existing controller board. \$845.

**CD-74 Interface Modification**

HW and SW modification to an Ohio Scientific C3-B computer which allows multiple (up to 4) Ohio Scientific Memory Products (formerly Okidata) series 3300 drives to one computer. \$200.

TEACO Inc,  
Michigan City, IN.

**Series III Speech Synthesizer Module/S3D**

Interfaces directly to 8080, 8085, Z80 system bus, includes 119 Basic vocabulary with extra socket to expand. Single +5V supply, uses standard ROMs and EPROMs. Intelligible male voice.

**Text-to-Speech System/Model TTS-X**

Unlimited vocabulary, speech peripheral device. ASCII coded text input via RS232C, unrestricted English language output. Speech rate: 50-200 words/minute. Speaking modes: Lexical, prosodic, spell.

**Series II Mini Speech Board/S2A, S2B, S2C, S2S**

Economical stored speech board. Variety of standard vocabularies to chose from. Requires external filter and amplifier.

**SPEECH 1000 Synthesizer Board/SP1000**

Stored speech system using linear predictive coding (LPC). High speech fidelity almost as natural sounding as a tape recording. 200 seconds of speech storage on board. Multibus compat, TTL parallel, RS232C. RTFM

Telesensory Speech Systems,  
Palo Alto, CA.

**TFS 804**

6250 GCR/1600 PE/800 bpi mag tape system for PDP-11/VAX-11 systems. TM-11 compat. For operation with VAX system TM-11 handler furnished.

**TFS 805**

6250 GCR/1600 PE/800 NRZI bpi mag tape system. TM-11 compat. For operation with VAX system TM-11 handler furnished.

**TFS 806**

6250 GCR/1600 PE/800 NRZI bpi mag tape system. TM-11 compat. For operation with VAX system TM-11 handler furnished. End-user and OEM qty price avail. Vend Maint. 25 FO.

AVIV Corp,  
Woburn, MA.

**Single Disk Cartridges**

100/130/Phoenix 671, 681 top and front load single disk cartridges. BASF Systems Corporation, Bedford, MA.

**TSQ 75 Mag Tape System**

Compat with DEC LSI-11. Operates at 75 ips and has both NRZI 800 bpi and PE 1600 bpi mode capability. The basic system consists of a vacuum column tape drive with cabinet and a 2-board controller with cables.

**TSQ 75 and 125 Tape Systems**

Operates at 75 and 125 ips, respectively. Both are DEC Unibus compat. SW compat with RT-11, RSX-11, RSTS/E, and IAS operating systems. Vend Maint. 55 FO.

Braegen Minicomputer  
Peripherals Div,  
Anaheim, CA.

**Streaming Tape Drives**

DEC TE16, TU45, TU77, Cipher 45, 75, 125 ips. Retail, systems integrator. California Datalease Systems & Financial Corp, Anaheim, CA.

**MT 80 Mag Tape Subsystem**

Multibus compat 1/2" mag tape system. NRZI (800 bpi) or PE (1600 bpi) operation, tape speeds up to 125 ips. 10-1/2", 8-1/2" or 7" reel sizes. SW drivers avail.

**QT 11**

DEC Q-Bus compat mag tape subsystem. Emulates DEC TM11. 45, 75 or 125 ips. tension arm tape drives. 10-1/2", 8-1/2" or 7" reel sizes. From \$5250. Vend Maint w/in 50 mi. 3 FO.

Comark Corp,  
Waltham, MA.

**Cartridge Module Drive**

Combines removable cartridge fixed disk for PDP-11s; Vend Maint from CDC/GE & DEC.

**DTU 77/100/125**

100/125 ips tape drive. Dual PE/NRZI format, dual GCR/PE format. PDP-11 compat.

**DTU 45**

45 ips tape drive. Full PDP-11 compat, std interfaces, rack mountable, dual mode PE/NRZI. Vend Maint from CDC/GE & DEC. 4 FO.

Data Systems Services,  
El Toro, CA.

**D451**

1/2" mag tape transport, 800/1600 bpi, 45 ips. \$4550 end user dual density. Vend Maint. 2 FO.

Datum Inc,  
Anaheim, CA.

**DICOM 374**

Cassette system — micro controlled. Interfaces most minis and micros, 1, 2, or 3 drives. ANSI or DIPHASE. Starts at \$3280. Vend maint, 12 FO.

Dicom Industries Inc,  
Sunnyvale, CA.

**Model 6400 1/4" Cartridge Drive**

Reads and writes MFM or other high density codes at 6400 bpi, for transfers at 192 Kbits/second, in both "blocking" and "streaming" modes at 30 ips. High speed search operations are performed at 90 ips. Three levels of industry-standard interfacing are offered: basic drive; drive with control electronics and drive with control and MFM formatting electronics; \$1265, \$1390, \$1565: RTFM.

**Series 40 Mag Tape Systems**

Transports with embedded formatters and single board plug-in interfaces for PDP-11, NOVA/Eclipse, and HP2100/21MX computers. Transport reel sizes 7", 8-1/2" and 10-1/2"; speeds 12-1/2 to 75 ips; formats NRZ, PE, NRZI/PE; densities 800, 1600 bpi for 9-track and 200, 556 and 800 for 7-track. \$4850-\$7775. RTFM. 1 FO.

Digi-Data Corp,  
Jessup, MD.

**DCS/3 MCAR-1**

Multibus based system for 3M cartridge tape.

**DCS/HD**

CDC Hawk drive with 10 MB; Intel Multibus compatible with CP/M software; \$8000.

**DCS/MT**

Multibus interface for Cipher 1/2" mag tape with SW. Distributed Computer Systems, Waltham, MA.

**Series Two**

9 IEEE-488 mag tape recording system. 7" to 10-1/2" reel sizes. 12.5 to 75 ips. Single and dual

**Tape Systems**

**Model 2000TV**

Dual-Drive Cartridge System; 256 kbytes per drive; RS 232 interface; RT-11 compatible, \$1395. Vend Maint, 47 FO.

ADAC Corporation,  
Woburn, MA.

**LSI-30**

Controller to integrate DEI 30 ips streaming cartridge to LSI-11 under standard SW, emulating TM-11. \$875 controller with SW.

**DP-8000**

6400 bpi cartridge tape backup to emulate the Pertec FT7000/FT8000 formatted 9-track drive; \$900 — Controller only.

**DMB-1**

6400 bpi cartridge tape backup with software for multibus based processor; \$750 Controller with Software, \$2900 complete Subsystems.

**DS-100**

6400 bpi cartridge tape backup with software for S-100 based processor; \$500 Controller with Software, \$2650 complete Subsystem.

**DRS-232**

6400 bpi cartridge tape backup for RS-232 connection; \$900 Controller only, \$3300 complete Subsystem. Alloy Engineering Co. Inc, Computer Products Div, Natick, MA.

**Magnetic Tape Heads**

New direct replacement magnetic tape heads for the OEM. Most models available. From 20% to 50% less. On Site Maint.

Alternatives In Magentics,  
Valencia, CA.

**Rigid Disk Cartridges**

Available for DEC RL01, RK01, RK02, RK03, RK05, RK08E, RK05A; also for Data General 6045, 6046, 6047, 6048, 6095; Diablo 41, 43, 44; 6070; 4047A, B; Diablo 4237, 8, 9. Call for current prices.

American National  
Supply Co, ANSCO,  
Gardena, CA.

**Mag Tape System TFS 712**

45, 75, or 125 ips dual density tape drive plus TFC 712 controller.

**TFS 812**

45, 75, or 125 ips dual density tape drive plus TFC 812 controller.

**TFS 822**

45, 75, or 125 ips dual density tape drive plus TFC 822 controller.

**TFS 912**

45, 75 or 125 ips dual density tape drive plus TFC 912 controller.

**GCR Mag Tape System**

**TFS 706**

6250 GCR/1600 PE/800 NRZI bpi mag tape system. Compat with DG's Nova/Eclipse computers.



density. IBM, ECMA and ANSI compat. Up to 24 kB of I/O memory. Transfer rate to 100 kB/sec.

#### Series Four

IEEE-488 digital cartridge recording system. Single and dual density. 12MB formatted storage. 1600 and 6400 bpi. Transfer rate of 30kB/sec. Up to 24 kB of I/O memory.

#### Series Five

HP-IB mag tape recording system. Compat with HP 3000 series. Requires no SW. Dual density. 45 to 125 ips. Up to 200 kB/sec transfer rate.

#### Series Eight

IEEE-488 microstreamer recording system. 100 ips. 1600 bpi. Disk backup. I/O buffer storage up to 24 kB. Transfer rate over 150 kB/sec.

#### Series Ten

HP-IB mag tape recording system. Compat with HP 1000L, 1000XL. Requires no SW. Single and dual density. 25 to 125 ips.

*Dylon Corp.*  
*Santa Diego, CA.*

#### STR-Link IIA

Digital cassette recorder, completely self-contained unit, collects and transmits serial data between various data processing devices. Manual or remotely controllable program loader can be used with computers, controllers, and other devices which require temporary or permanent storage of digital data.

#### EPI STR-Stream

1/4" cartridge magnetic tape drive designed for Winchester disk backup, large scale data and file storage systems, or any unique save and restore application.

#### EPI STR-610

Digital cartridge recorder utilizing the 3M DC-100A minicartridge serves in a broad range of applications including remote data logging, word processing, point-of-sale terminals, and IEEE 488 or standard Mini/Micro computer interfaced peripherals.

#### EPI STR-810

Utilizes the 3M DC-300 quarter-inch cartridge; features include high speed search and optional format facilities.

#### STR-LINK III

Self contained,  $\mu$ P-based, magnetic tape storage device for use with computers, controllers or other devices requiring temporary or permanent storage of digital information.

*Electronic Processors, Inc.*  
*Englewood, CO.*

#### TD 1050 Series/TC 3000 Series

1/2" IBM compat. industry standard reel-to-reel tape drives. 1/4" ANSI/ECMA compat cartridge

recorders. \$3000-\$11,000. Vend Maint. 2 FO.

*Innovative Data Technology.*  
*Santa Diego, CA.*

#### Mark III, Mark V Cartridges

2.5-10MB cartridges suitable for use on virtually all drives in this range — special sectoring and formatting available Vend Maint. 15 FO.

*Memorex — Rigid Media & Components Div.*  
*Santa Clara, CA.*

#### CR300 Compact Cartridge Recorder

The compact CR300 (5.5" x 8.5" x 8.5") provides record/playback of digital data on DC300A (1/4") data cartridge. 30-ips tape speed with 90-ips search/rewind. 1600-bpi PE recording the CR300 utilizes a completely sealed, interchangeable SUPER PAC cartridge. Reliable in severe military environments and operator-proof data security. \$5000.

#### CR 600 Mag Tape Cartridge Recorder

Reel-to-reel cartridge recorder offers cartridge operation and reel interchangeability with IBM compat transports. Utilizing 7" reels with 600' of storage, supply reel within cartridge readily removed for loading & processing on any IBM compat mag tape unit. Processes data at 25-ips tape speed in IBM compat 556/800-bpi NRZI format or optional 1600-bpi PE format. Rewind at 50-ips. \$11,300.

#### AT-1161 Tape Transport

(Auto Threading) operates to 130 ips with 200/556/800 bpi NRZI format. Optional 1600 bpi PE. Complies with MIL-E-16400/MIL-T-21200. Built-in test equipment. Unit is interfaced to NORDEN (DEC) and ROLM (DG). Litton 3050. CDC 560124A  $\mu$ P (ANEW interface). Varian 620. Honeywell RL-6. others. \$23,500.

*Miltope Corp.*  
*Plainview, NY.*

#### T1000

Vacuum col tape drive. 75-125 ips. \$7565 OEM qty 100.

#### T7000

Tape transport. 7" tape. 12.5-18.75 ips. \$2505 OEM qty 100.

#### T8000

Tape transport. 10" tape. 12.5-25 ips. \$3525 OEM qty 100.

#### T9000

Vacuum col tape drive. 37.5-75 ips. \$4245 OEM qty 100. Vend Maint. 9 FO.

*Pertec Computer Corp.*  
*Chatsworth, CA.*

#### PM TS11

Mag tape subsystem for PDP-11 is direct replacement for TM 11/TV

10 tape system. Compat w/all DEC SW diagnostics.

#### SYST-13V

Line of disk cartridge micro systems: 128 kB MOS memory.

#### PM-DSA 11/32

Cartridge disk subsystem contains DC1100 controller with PMDD 11/32 CMD Disk Drive: one 13.4-MB fixed; one 13.4 MB front-loading cartridge.

#### PM-DSA11

5 & 10-MB cartridge disk subsystem for PDP-11.

#### PM-CSV11

Minicartridge tape backup subsystem for LSI-11.

#### PM-DSV-21L

RL02 equiv. disk cartridge subsystem for LSI-11.

#### PM-DCV11A

Cartridge disk controller for LSI-11 based systems.

*Plessey Peripheral Systems.*  
*1691 Browning, Irvine, CA.*

#### Group 3000 Tape System

Triple density 125 ips system for HP3000. Combines 800, 1600 and 6250 bpi recording densities in one system. 781 kB transfer rate. ANSI/IBM compat.

*Qualex Technology Inc.*  
*Reseda, CA.*

#### RDS-58 Mass Storage Unit

Version of DEC's TU-58 dual drive tape cartridge unit. Completely compatible with DEC/LSI HW and SW. \$1425. RTFM.

*Remtech Inc.*  
*Huntsville, AL.*

#### Architape

14 MB cartridge tape backup for all Perkin-Elmer 16- and 32-bit minicomputers, and Tektronix 4081 graphics systems; half-card

Z-80 based "Smart" interface. \$4800 in single qty. (OEM discount): RTFM.

*Scientific Enterprises, Inc.*  
*Wilsonville, OR.*

#### 9700-53 Mag Tape System

DEC-compat. tri-density (800/1600/6250 bpi) tape drive & controller. 75/125 ips. \$32,100-\$36,600 depending on CPU interface.

#### 9700-20 Mag Tape System

DEC-compat. dual density (1600/6250 bpi) tape drive & controller. 75 ips. \$26,100-\$30,600 depending on CPU interface. Vend Maint. 14 FO.

*System Industries.*  
*Sunnyvale, CA.*

#### 800 Series Datacassette

$\mu$ P intelligence and RS-232 plug compat. On-line/off-line with remote control. Optional ANSI/ECMA recording format. File skip, binary mode. 2400 baud, editing. Half/full duplex. async transmission. 20 ips R/W. 120 ips rewind.

*Techtran Industries Inc.*  
*Rochester, NY.*

#### MT20 1/4"

Cartridge tape drive. \$950; \$1395 with formatter. Vend Maint. 2 FO.

*TEAC.*  
*Montebello, CA.*

#### 5017/8401

Rugged high-performance moving head drive with controller for PDP-11; has interspersed servo track following system; 52 MB top load cartridge with 1 fixed disk. Avg. access time, 5.5 ms; transfer rate — 763.8 bytes/sec.

*Vermont Research Corp.*  
*N. Springfield, VT.*

## Test Equipment/ Instrumentation

#### clone-A-prom

2716/2732 5V EPROM copier. \$299. Warranty and RTFM.

*Alloy Engineering Co, Inc.*  
*Computer Products Div.*  
*Natick, MA.*

#### MACSYM 20

Intelligent measurement & control front end. RS232 compat. 16 I/O card slots (512 channel max). 3400 channels/sec sampling rate to RAM. data storage for 18000 readings. \$4980 base. Vend Maint. 9 FO.

*Analog Devices Inc, Systems Div.*  
*Norwood, MA.*

#### MODEL 103B

Floppy disk drive exerciser for any 5-1/4" or 8" Shugart compat

floppy disk drive. \$520. Vend Maint.

*AVA Instrumentation Inc.*  
*Ben Lomond, CA.*

#### DEC Memory Tester Model T-119

Semiconductor/core memory board tester. Stand-alone. bench-top tester. Fixtures avail for LSI-11 and PDP-11 series memories. \$13,400. RTFM.

*Concept Development Inc.*  
*Costa Mesa, CA.*

#### Unibus Cable Tester OST11-A

Unibus cable tester allows convenient verification of continuity of all Unibus lines simultaneously. \$195. 30 day warranty. RTFM.

*Datafusion Corp.*  
*Calabasas, CA.*



Test Equipment/  
Instrumentation

**μM**

In-circuit emulation for 8080, 8085, Z-80 and 68xx type μP's. *Distributed Computer System, Waltham, MA.*

**EP-710 Personality Board**

Personality board plugs into Intel's Universal PROM programmer and allows user to program the 2508, 2758, 2716, 2732, 2732A and 2532 EPROM types. \$625. Factory 1 yr warranty and service. *Eden Engineering, San Jose, CA.*

**Video Reader Model 9763**

Combines frame store and reader functions in single unit to allow operator to accurately measure points of interest within both real time and frozen frame TV video interfaces to HP 9800 Series via HPIB. \$9500. RTFM. *Instrumentation Technology Systems, Northridge, CA.*

**D132 Logic Analyzer**

32 to 64 channel logic analyzer. To 400 MHz (2.5 ns) sampling rate. IEEE-488 and RS232 compat. \$12,000 — \$17,000. Vend Maint. 10 FO. *Intech Instruments Div, Santa Clara, CA.*

**DGEB-01**

Extender board for DG. Used to extend interface board from computer chassis for trouble shooting. \$193.

**MBI-49-EB**

18" extender board for IBM Series 1 that allows easy debugging of circuitry developed on MDB wire wrap boards, or can be used for trouble shooting of Series/1 boards. \$395. RTFM. 1 yr. warranty. *MDB Systems Inc, Orange, CA.*

**IEEE-488 Bus Tester ( GPIB-400)**

Will test/analyze IEEE-488 based systems. Will operate as a single-step controller or monitor. By use of an external RS-232 port, a standard terminal may be used to implement fast troubleshooting via the 400's automatic source or acceptor handshake modes. \$995 (1-9). RTFM. *National Instruments, Austin, TX.*

**NDRV-11 Parallel Line Interface**

SW compat with Digital's DRV-11, switch selected register and vector addresses, word or byte transfers. \$240.

**NDRV11-B Parallel DMA Interface**

SW compat with Digital's DRV11-B, switch selected device and interrupt vector addresses. Data transfer rate up to 500K, 16-bit words/sec. \$570. Vend Maint. *Netcom Products Inc, Sunnyvale, CA.*

**Unibus Status Monitor PDM-U1**

Dual wide status monitor that provides the capability of monitoring all 56 Unibus signals simultaneously. Each signal is displayed by a LED and can be stored in an onboard latch. 1-9, \$350; 10-24, \$315; 25-49, \$300; 50-99, \$275. *Pacific Digital Systems, Sunnyvale, CA.*

**GM Series Systems — GM/PL I/O**

Data acquisition sub-systems; A/D conversion systems; D/A conversion systems. \$10,000 to \$80,000.

**GM Series System — ADC11 I/O**

Data acquisition sub-systems; A/D conversion systems; D/A conversion systems. \$10,000 to \$80,000. *Preston Scientific Inc, Anaheim, CA.*

**6809 ASM**

Cross-assembler, relocatable, macro. 6809, ISIS-11 compat. \$1200.

**F8/3870/72 ASM**

Cross-assembler, relocatable, macro. F8/3870/3872, ISIS-11 compat. \$995.

**8051 ASM**

Cross-assembler, relocatable, macro. 8051, ISIS-11 compat. \$1200.

**ASM 1802**

Cross-assembler, relocatable, macro. 1802, ISIS-11 compat. \$995.

**ASMZ8000/ASMZ8K**

Cross-assembler, relocatable, macro. Z800, ISIS-11 compat. \$1950.

**ASM6500/01/02**

Cross-assembler, relocatable, macro. 6500/01/02, ISIS-11 compat. \$995.

**6805 ASM**

Cross-assembler, relocatable, macro. 6805, ISIS-11 compat. \$1200.

**800ASM**

Cross-assembler, relocatable, macro. NSC 800, ISIS-11 compat. \$995.

**Z8ASM**

Cross-assembler, relocatable, macro. Z8 ISIS-11 compat. \$1200.

**Z80 Spice (In-circuit Emulator)**

Z80 microcomputer emulator for Intel development system. Includes Spice operating system and ISIS-11 compat Z80 assembler. Z80A — \$4800; Z80AMB — \$5590 (includes 64K memory).

**Z80ASM**

Cross-assembler, relocatable, macro. Z80, ISIS-11 compat. \$995. RTFM.

*Relational Memory Systems/RELMS, San Jose, CA.*

**EYECOM PMS**

Automatic non-contact dimensional measurement system for incoming inspection of part or in process inspection of parts for LSI-11/2. \$40,000 — \$90,000. *Spatial Data Systems, Goleta, CA.*

**VERS — I/O**

For PDP, LSI 11/2, 11/23 series. Provides the user with a convenient, flexible means of interfacing PDP-11, LSI to external equipment for control and monitoring functions. SW can be readily developed in MACRO, BASIC or FORTRAN. \$1875. Vend Maint. *Spectrogram Corp, No. Haven, CT.*

**STEP-3**

Development instrument compat with DEC, DG, HP, P-E, IBM, Intel, and all computer systems with an RS 232 port for interface. Includes ROM simulator with built in logic analyzer with process controls for debug. 7 FO. *Step Engineering, Sunnyvale, CA.*

**TE001 Interface Monitor Continuity Tester**

Has 2 functions: tests continuity on cables for proper loading and works as a break out box to monitor signals. \$249. Vend Maint. 1 FO. *Tel Com Products Inc, Westmont, IL.*

**3PX 140**

5" single-sided flexible disk certifier. Performs ANSI tests. μP-controlled, adjustable threshold. 3 operating modes, used for production or evaluation.

**3PX 148**

8", 4-drive, dual-sided flexible disk production certifier. Performs ANSI specified tests, adjustable thresholds, μP controlled. Includes sort assist for disk classification.

**3PX 158**

5" and 8" dual-sided flexible disk certifier. 2 drives in one unit. μP controlled with adjustable thresholds. Economical production and evaluation tool.

**3PX 133**

8" single sided flexible disk certifier. Performs ANSI specified tests. μP controlled. Adjustable thresholds. 3 operating modes. Used for production or evaluation.

**3PX 134**

8" dual-sided flexible disk certifier. Performs ANSI specified tests. μP controlled. Adjustable thresholds. 3 operating modes. Used for production or evaluation. Vend Maint. 3 FO. *Three Phoenix Co, Phoenix, AZ.*

**SX-530 Storage Module Tester**

Drive variations accommodated by plug-in interface cards include CDC SMD, CMD & MMD; the Kennedy 5300; Trident T25-T300, Ampex SMD compat. Pertec, Priam, BASF, SLI, IMI, ANSI standard and other 8" and 14" Winchester devices. \$2250.

**DX-1000 Disk Drive Tester**

Portable designed to evaluate and exercise IBM type 2315-5440, disk drives manufactured by many companies. \$2250.

**FX-500 Floppy Disk Drive Tester**

Programmable to serve all standard drives including GSI-110, Shugart 800/801/900/901, Wangco 76/76S, Calcomp 142M/143M, Pertec FD5xx/FD400, Memorex 550/552 and similar drives. \$1495.

**CX-500 Communications Exerciser**

Provides all testing capabilities to detect and isolate problems that occur in RS-232-C or current loop data communications interfaces. \$1295.

**TX-1200 Tape Drive Tester**

Portable tester used on any digital tape transport and will handle NRZI or PE at speeds from 12.5 to 75 ips. Also customer specified interface and tape speeds of up to 250 ips avail. \$2250.

**TFX-500 Formatted Tape Drive Tester**

Tests formatters for Cipher Microstreamer type drives. Substitution of cable end adapters allows testing of Kennedy, Datum, Cipher, Pertec, P-E and other dual-mode formatters. \$1795. RTFM. *Wilson Laboratories Inc, Orange, CA.*

**ZT80 IEEE-488 (GPIB)**

Bus interface/processor. Multibus intelligent slave processor. \$995.

**ZT7399**

Dual 4 digit BCD counter/timer for STD Bus. 2 MHz count rate. optional human-readable display. \$275.

**ZT7502**

Reed relay cards for STD Bus. 8 dry or mercury-wetted relays. \$195 — \$360. Vend Maint. *Ziatech Corp., San Luis Obispo, CA.*

## Other

**Emuloader (10047) ODT/Bootstrap Loader**

Provides fixed console emulator (ODT) + bootstrap loaders replacing DEC BM873, M9301, M9312 boot, terminator, console emulator. \$750.

**Qniverter (10067) Bus Converter**

Permits LSI-11, LSI-11/23 or PDP 11/03 to access Unibus compat controllers + memories. OR permits PDP-11 Unibus systems to access LSI-11 compat controllers + memories. \$825.

**Interlink/LSI (10049) Buslink**  
Q-Bus version of DEC DR11-B DMA interface for LSIs. \$950.

**Interlink/UNI (10046) Buslink**  
Replaces DEC DR11-B DMA interface and 1/2 of DA11-B Unibus Link. \$1600.

**Rebus (10014) Bus Repeater**  
Allows physical + electrical extension of DEC Unibus (19 extra bus loads and 50' extension in bus length). \$1500.

**Buslink/UNI/LSI/U-Q**

High-speed, parallel, half-duplex DMA channel between 2 DEC computers (Unibus to Unibus, Q-Bus to Unibus, Q-Bus to Q-Bus. From \$2100-\$3600. Vend Maint, 1 FO.

*Able Computer, Irvine, CA.*

**1014 Data Acquisition**

16-channel MUX, 14-bit ADC. LSI-11, -11/2, -11/23 compat. \$1195.

**1616/MIC**

16-line multiple interrupt encoder LSI-11, -11/2, -11/23 compat. Optically isolated input, priority encoding. \$495.

**1616 CCI & 1632 HCO**

16-line contact closure detector. 32-line high current driver. LSI-11, -11/2, -11/23 compat. 1616 CCI: \$275; 1632 HCO: \$395.

**1604/OPI & 1604/POC**

4-channel pulse counter. 4-channel pulse generator. LSI-11' -11/2, -11/23 compat. 1604/OPI: \$395; 1604/POC: \$520.

**1023AD**

16-channel MUX. 12-bit ADC with LSI-11/23 compat interrupt

structure. 35/100 KHz throughput. \$695.

**1012**

16-channel MUX, 12-bit ADC, 35 KHz throughput, 100 KHz optional. \$630.

**735/DAC**

4-channel 12-bit DACs. All Multibus CPUs. Third wire sense for ground noise rejection. \$520.

**710-RL Low Level Data Acquisition**

16-channel thermocouple digitizer. All Multibus CPUs. Input full scale ranges from 10 mv to 500 mv. Programmable gain amplifier with 6 gain settings. \$1145.

**735/SBC**

64-channel MUX 12-bit ADC with 2 DACs. All Multibus CPUs. Single-ended or differential inputs, voltage/current loop inputs. \$520 to \$1070.

**600/11DA Multi-Channel DAC**

4 channels of 12-bit DAC. PDP-11 series compat. \$1075.

**1620 DMA, 1620 TTL**

Controller used to allow DMA transfers. LSI-11, -11/2, -11/23 compat. 1620 DMA: \$450; 1620 TTL: \$350.

**1900 & 1950 Bus Interface Cards**

1900: Unibus to LSI-11 bus translator. 1950: Bus repeater. LSI-11, -11/2, -11/23 compat. 1900: \$650; 1950: \$450.

**500/DGC, 535/DGC**

64-channel input, 12-bit ADC with DMA. DG Nova and Eclipse compat. High-speed sample and hold. 35/100 KHz throughput. \$1545 to \$3000.

**600/11AD, 635/11AD**

64-channel MUX, 12-bit, 4 channels of DAC. PDP-11 series compat. \$1795 to \$3000.

**600/8EDA**

4-channel, 12-bit DAC. PDP-8E, F, M + A compat. \$1050.

**600/8EAD, 635/8EDA**

64-channel MUX, 12-bit ADC. PDP-8E, F, M + A compat. \$1545 to \$2400.

**1601 GPT**

General purpose timer. LSI-11, -11/2, -11/23 compat. 16-bit

counter, SW programmable clock. \$595.

**1412DA**

4-channel 12-bit DAC. LSI-11, -11/2, -11/23 compat. \$545.

**1113AD**

Low-level ADC with up to 128 input channels. Can directly digitize thermocouples. LSI-11, -11/2, -11/23 compat. \$495.

**1030 Series**

64-channel MUX, 12-bit ADC, 2-channel 12 bit DAC. \$630 to \$1400. Vend Maint, 47 FO. *ADAC Corp., Woburn, MA.*

**AR-Z100 High Speed Digitizer**

15 MHz sampling of real-time signals with storage for up to 4MB. Local editing and time-tagging plus many other features/options. Typically \$100,000 up.

**AR-40 Microcomputer/Signal Processor**

An attached or independent signal processing system for data reduction, array processing, data interpretation and control. \$10,000 up.

**AR-10 Signal Processor**

An attached signal processing peripheral for programmable array processing, data interpretation and control. From \$45,000 to \$155,000. Vend Maint, 2 FO.

*Adams-Russell,*

*Digital Processing Div., Waltham, MA.*

**LC-36 Protocol Translator**

Allows any RS232C peripheral to be compat with Burroughs Poll Select Protocol. \$995.

**LC-3000 Protocol Translator**

Allows any RS232C peripheral to be compat with H-P's MTS3000 multipoint terminal SW. \$1595. Vend Maint. *Agile Corp., Sunnyvale, CA.*

**ANDS5400 Data Acquisition**

The System will acquire, condition, measure, translate and output a wide variety of signal types, enabling direct connection to real world environment. SW controllable throughput rates up to 100KHz, specifiable resolution up to 16 bits for analog I/O. Vend Maint, 35 FO.

*Analogue Corp., Wakefield, MA.*

**Compat Products**

Distributor for Applied Digital Data Systems, Control Data Corp. Data Products, Data Technology Corp. Seagate Technology and Televideo Systems. CRTs, disk drives, printers, interface boards, etc.

*Arrow Electronics, Sunnyvale, CA.*

**IF-11/1100 Mainframe Interfaces**

Allows interconnection of PDP-11 to I/O channels of a Univac 494 or 1100 series processor. Provides mapping of Univac word into PDP-11 16-bit word. Word mapping can be varied under program control and is defined using replaceable PROM devices within the controller. \$19,000.

**IF-11/6600**

Provides interface for the PDP-11 on a Control Data CDC 6600 Processor. Word mapping can be specified. \$19,000.

**IF-11/7600**

Provides interface for the PDP-11 on a Control Data CDC 7600 Processor. Word mapping can be specified. \$19,000.

**IF-11/B6700**

Allows PDP-11 to attach to a Burroughs B6700 Processor. Allows parallel data transfer with I/O multiplexer in excess of 300 kB/sec when attached to the Burroughs SPC-16A. \$19,000.

**IF-11/B7700**

Allows PDP-11 to attach to a Burroughs B7700 Processor. Allows parallel data transfer with I/O multiplexer in excess of 300 kB/sec when attached to the Burroughs SPC-16A. \$19,000.

**IF-11/370**

Interface for PDP-11 Unibus to IBM 370 Byte Multiplexer, Block Multiplexer, or Selector Channel. \$19,000.

**IF-11/NTDS**

Provides means of connecting a PDP-11 with processors or peripherals adhering to US Navy NTDS interface standards. Full-duplex DMA capabilities to and from PDP-11 memory. \$15,000.

**IF-11Q/NTDS**

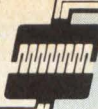
Allows connections of LSI-11 (PDP-11/23) to 32-bit wide NTDS system. Full-duplex parallel transfer takes place on a DMA basis. Requires 1 dual slot and 2 quad slots in LSI-11 backplane. \$9100.

**IF-11/H6000**

Provides interface between PDP-11 and Honeywell 6000 Processor. Mapping if dissimilar word sizes between the two machines can be specified. \$15,000.

**UA/11**

Unibus adaptor for LSI-11, PDP-11/03 and PDP-23 systems. Allows Unibus devices to be connected to these systems.



**Other**

**FCSR**

Function Control Switch Register front panel contains 16 switches and indicators accessed as a single definable address in PDP-11 peripheral address space. Connects to the Unibus for use as a function switch and display register on 11/04 and 11/34 Processors. \$1000.

**DG/11-A**

High-speed data transform unit provides a means for moving blocks of data (messages) from one area of PDP-11 memory to another. Operates on DMA basis and can expand, compress, justify, and generally manipulate characters as information is moved. Operates on bit boundaries. \$4000. Vend Maint, 2 FO. *Associated Computer Consultants, Santa Barbara, CA.*

**ACS/Wang Compat Interface**

External box for Televideo 950 terminal, built-in power supply and cables. Compat w/Wang MVP, LVP + VP computers. \$1400.

**ACS/Wang Compat Interfaces**

External box for Tally 1612 RO TI820 RO + Diablo 1640, 1650 + 630 RO printers. Built-in power supply + cables. Compat w/Wang MVP, LVP, VP and T computers. \$1100. Vend Maint. *Automated Control Systems Inc, Bellevue, WA.*

**Magnetic Media**

1258 Trident disk pack/1268 storage module. 80MB storage capacity disk packs.

**2000 A.D.**

Premium grade computer tape.

**Endura Tape**

Computer tape. 4 FO. *BASF Systems Corp, Bedford, MA.*

**DH-11 VAX/VMS Terminal Driver**

A versatile terminal driver that offers advanced DH-11 VAX Terminal/Driver capabilities for VAX systems. Features include: programmable line parameters, DMA output to 19.2K baud per line, split speed, full modem control for RS232, support of VT-100, VT-52 and intelligent terminals, normal VAX user interface. Supports DEC and ABLE DH-11 type products. \$1450. *Best & Midcom Data Systems, Orange, CA.*

**BC223 System**

Provides max performance based on the DEC LSI-11/23 processor. Utilizes state-of-the-art Winchester and tape cartridge technology. Wide range of options avail. Up to 256 kB of MOS memory. SW compat with RT-11 and RSX-11M.

**BC 323 Computer System**

LSI-11/23 processor. Up to 256 kB memory. DLV11J 4-channel port. 7.5 ips tape drive. Housed in a 5' cabinet. 80MB SMD disk drive on pedestal. Vend Maint, 55 FO.

*Braegen Minicomputer Peripherals Div, Anaheim, CA.*

**Turnkey Distributors**

PDP-11 family. Professional market target. *BST Data Systems Inc, Tampa, FL.*

**MBC-11, MBB-11**

LSI-11 compat bubble memory system. Up to 655 kB non-volatile mass storage in 40 kB increments.

**MBB-80 Bubbl-Board**

Intel (and other) SBC-80 Multibus compat bubble-memory system. 92 kB non-volatile memory and all required control logic and page buffering. Typically \$2000. *Bubbl-Tec Div, Dublin, CA.*

**Processors, Concentrators**

LSI-X.25 front end processor. LSI-X.25 intelligent host port concentrator. IIC-\$6750 to \$13,950; F.E.P \$16,000. Sell, Service, 3 FO. *Cableshare Limited, London, Ontario.*

**DEC Compat Products**

D2-11 async MUX, DH11 async, MUX. DC-11 interface, DD11 backplanes. MS-11 memory, MK11 memory. RM05 disk drive controllers. TU77 tape drives. Wholesale. Vend Maint, 2 FO. *California Computer Group, Costa Mesa, CA.*

**MC85 SBC**

8085A-Z-based SBC, 5 MHz operation. Multibus compat (8 bits), 12 interrupt levels, 3 16-bit counters. Complete display controller. 4K RAM, 48 I/O ports. 80/20 structure, keyboard input, RS232 port, I/O monitor included. \$1295. Vend Maint w/in 50 mi, 3 FO. *COMARK Corp, Waltham, MA.*

**TC-3 Terminal Concentrator**

Plugs on Unibus and communicates with 8 remote terminals over

one phone line. The local TC-3 board combines DZ11-A functions with statistical multiplexing in one hex slot. The remote TC-3 unit connects to 4 or 8 async terminal devices. Features up to 40% cost savings, high performance, auto SW downloading, powerful diagnostic panel and complete transparency. TC-3 local: \$3200; TC-3 4-line remote: \$1950; TC-3 8-line remote: \$2650.

**TC-5**

Statistically multiplexes 4 to 16 ports and is compat with all systems using async terminals. Features up to 400% throughput improvement, easy front panel programming, powerful diagnostic and status monitoring capabilities, complete transparency, Autobaud, ECHOPLEX, Alarm Messages, statistical readouts, data viewing and dial-up capabilities. 4-Port: \$1625; 8-Port: \$2450; 12-Port: \$3300; 16-Port: \$4150. Vend Maint, next day replacement. *ComDesign Goleta, CA.*

**QUIC Module**

Q-Bus to Unibus bus converter, line clock, 2 RS-232 serial lines, 16K x 16 bits RAM. \$2495/QUIC backplane-\$850. *Computer Design and Applications Inc, Newton, MA.*

**NTDS to PDP-11 Unibus IF/NPF 1-1**

This interface allows data transfers between devices with a NATO std I/O port (such as AN/UYSK-20, AN/USH-26, etc) and DEC Unibus. Data transfers are DMA and can be 16- or 32-bit parallel words. *Computing Devices Co, Div of Control Data Canada, Nepean, Ontario.*

**Interface Cables**

DEC, IBM, TI, DG, Wang, H-P, compat cables.

**RS232C Null Modem Cable**

Wiring configuration negates need for a modem when direct communication is required but system is configured to operate only with an interfacing modem.

**RS232C Interface Cables**

25 position 'D' connectors and 25 conductor, 22AWG wire, shielded or unshielded for interfacing computer equipment of the major manufacturers. *Craig Data Cable Co, Inc, Stamford, CT.*

**SD50 Line Distribution Rack**

Current loop, RS232C or RS449 line interface cards for DEC DH11 MUX. Rack-mount 16 or 32 cards in 10-1/2". LEDs show data movement. Select 20mA or EIA on line-by-line basis. Plug-connectable with DH11-AA, SD150, SD250 and SD450. SD 50/16-\$4700; SD50/32-\$8800.

**SD150 Multiplexor Trunk Switch**

Electronic fallback switch for DEC DH11 type MUXes. The SD150 can switch up to 256 terminals between 2 CPUs in groups of 32. Rack-mount, pushbutton control panel, also has 8-bit port for SW control. \$2900-\$7800.

**SD250 Terminal Line Switch**

Electronic fallback switch for DEC DH11 type MUXes. Switches 32 serial lines between 2 CPUs. Individual line control or group control. Rack mount, pushbutton control panel, 8-bit port for SW control. \$2100.

**SD450 Electronic Matrix Switch**

Electronic switch array for multiple DEC DH11 type MUXes. Any port to any terminal up to 128 x 256. Port expansion — more lines than ports, port contention-user controlled switching, preset pattern switching for fast reconfiguring. \$6000-\$100,000. RTFM or on-site spares. *Crosspoint Systems Inc, Eugene, OR.*

**Unibus Router OSR11-A**

Allows reconfiguration of Unibus with the push of a button. Many CPUs can share many buses. Uses include backup and reduction of expensive peripherals. \$2900, 2 CPUs, 1 bus.

**Associate File Processor, AXP**

An efficient HW approach to text retrieval in large unformatted textual data bases. \$39,000.

**Bus Repeater OSB11-A**

Repeats Unibus signals an additional 50' and allows 19 additional loads. Ultra fast, only 40 ns delay through repeater. Plugs into 2 adjacent SUs in place of an M920 jumper. \$1250. RTFM, 30 day to 1 yr warranty. *Datafusion Corp, Calabasas, CA.*

**510/Micro Mutt**

Remote diagnostic tool that allows the CPU to be assessed from a remote terminal to provide HW diagnostic or SW debugging and updating. \$895.

#### **420/Programmable Terminal Interface**

16 channel of MUX. Each line individually switchable for RS232 or 20 mA. Operates in CPU chassis of NOVA 3, NOVA 4 and Eclipse. \$2200 includes distribution panel. Vend Maint.

*Custom Systems Inc,  
Eden Prairie, MN.*

#### **MBI Board**

512 kB memory bank interface for use in place of P-E's local memory bank interface module. \$3300.

#### **R03 Bus Repeater**

LSI-11 bus repeater allows the extension of the Q-Bus beyond 20 loads. \$350.

#### **B04 Chassis Assembly**

7" LSI-11 system chassis with 8 quad-slot backplane, power supply, dual TU58s and controller. \$2700.

#### **P03 Parity Control Card**

This dual-wide card provides the control circuitry to allow LSI-11 parity memory to operate with the LSI-11/23 processor. \$300. RTFM.

*Dataram Corp,  
Cranbury, NJ.*

#### **ID1100 Image Display System**

1024 × 1024 pixel image display system. DEC Unibus compat, high resolution display of monochrome or color images. From \$25,000. Vend Maint, 2 FO.

*De Anza Systems Inc,  
San Jose, CA.*

#### **RTP Series Measurement And Control**

Analog and digital I/O interface equipment compat with PDP-11, LSI-11, DG, H-P, Intel, Texas, Modcomp, Computer Automation, IBM and P-E. \$2000 +. Vend Maint, 1 FO.

*Di-An Data Systems Ltd,  
Stockport, England.*

#### **Diagnostic Engineering Services**

Diagnostic products for DEC/DG compat products. OS drivers for DEC compat products (RSX-11M, RT-11 and VMS).

#### **LSI-11 Diagnostic and Bootstrap PROMS**

1 kB power-up diagnostics and RX/RL bootstrap PROMs for LSI-11 systems. Direct insertion into MXV11-A compat modules. \$90/set. Direct mail replacement of failing components, 1 FO.

*Dice Systems Inc,  
Nashua, NH.*

#### **401 Multi Processor**

General purpose multi-processing computing system. Uses LSI 11/23 with 8085A front end. Cassette subsystem, and 5-1/4" Winchester

standard. Full range of printers, CRTs, communications avail. Starts at \$16,500. Vend Maint, 12 FO.

*Dicom Industries Inc,  
Sunnyvale, CA.*

#### **DSC-4 Microcomputer System**

An Intel Multibus compat multi-user Z80A-based  $\mu$ P system. Will address up to 512K RAM and interfaces to HiNet local computer network. Basic system with 128K RAM, 2 floppy disks — \$6950. Vend Maint, 1 FO.

*Digital Microsystems Inc,  
Oakland, CA.*

#### **TCU-150 Calendar Clock**

Battery-supported calendar clock for PDP-11 Unibus. Continuously maintains year, month, day, hour, min, sec. Batteries support for 3 mo, but recharge automatically when computer power restored. \$460.

#### **TCU-100**

Time-of-day calendar clock, battery-supported. PDP-11 Unibus. Continuously maintains month, day, hour, min, sec. Batteries good for 3 mo, recharge automatically when power restored. Programmable interrupts. \$495.

#### **TCU-50D**

Battery-supported time-of-day calendar clock for LSI-11 Q-Bus. Dual-width board maintains hour, min, sec, mo, day. Battery supported (self-recharging) time is continuously avail. \$325.

*Digital Pathways Inc,  
Mountain View, CA.*

#### **DCS 86/16 SBC**

16-bit using Intel 8086  $\mu$ P.

#### **DCS 8010A SBC**

Compat with Intel 8010A. \$425. Vend Maint.

*Distributed Computer Systems,  
Waltham, MA.*

#### **Orion $\mu$ P Systems**

STD Bus-based. CP/M based dual 8" floppy disk. Vend Maint, 1 FO.

*DY-4 System Inc,  
Ottawa, Ontario.*

#### **AME 1000 Microcomputer System**

Unlimited expansion options for industrial control applications. Allows up to 10 modules to be added to a Rockwell AIM 65 microcomputer, within a single enclosure. Drives floppies and mini-floppies, cassettes, D to A and A to D modules, solid state relays, CRTs and printers. A disk operating system. SW and application engineering are also offered.

*Dynatem Inc,  
El Toro, CA.*

#### **Compat Products**

Complete DEC/DG PC supplier. Vend Maint, 12 FO.

*EMC<sup>2</sup>,  
Newton, MA.*

#### **SECS 2**

Ruggedized 16-bit mini I/O & SW compat to PDP-11. Floppy drive: ruggedized floppy disk SEDS-1. Controllers: tape system controller, 1553 bus controller. I/O analog boards: serial I/O for RS-232/422. Also: supply, extenders, half, full ATR chassis. MIL E5400, MIL E16400, MIL E4158B.

*EMM, Severe Environment  
Systems Co,  
Chatsworth, CA.*

#### **Video-Mate Video Board**

3 programmable character sizes; programmable screen format; programmable reverse video characters, 2716 compat character generator RAM. Includes graphic character set; 64 or 80 character/line versions; 2K on-board RAM; STD Bus compat; composite & non-composite video outputs; 5 V only operation. 80 char × 25 line version — \$265; 64 char × 28 line version — \$249.

#### **Memory Mate**

16K to 48K RAM expansion; parity check circuitry; programmable tone output; PROM sockets on-board; compat mounting under AIM; programmable write protect; I/O ports with handshaking; STD Bus interface (opt). w/16K RAM-\$440; w/32K RAM-\$495; w/48K RAM-\$550.

#### **STD-Mate**

STD Bus interface card to the memory-mate board. Direct interface to STD Bus card cage from AIM 65 development system. Substitutes for a 6502 processor card in STD Bus card cage. Allows single step trace breakpoint and other debugging/development facilities with actual system I/O in place. With 50-pin 3' cable-\$140; without cable-\$120.

#### **AIM-Mate Power Supply (A.M.P.S.)**

4" × 10"; 2-1/4" tall; powers entire AIM-Mate system — including AIM 65; provides 5V @ 3.5A; 12V @ 200mA, 24V @ .5A avg; accommodates either 115 or 230 VAC input, and includes short circuit & over voltage protection. \$79. RTFM.

*Forethought Products,  
Eugene, OR.*

#### **Gateway Series 16-Bit SBC**

FT-86C, FT-86/FP, FT-86M, FT-86M/FP and FT-68M. With Intel's 8086, 8087 and Motorola 68000. Multibus compat, multi-master capability. From \$1250 to \$2950. Vend Maint.

*Forward Technology Inc,  
San Jose, CA.*

#### **QLV11**

LSI-11 quad serial sync/async I/O interface. Furnishes 4 DLV11-E compat serial ports with full modem control. \$800; \$520 qty 100.

#### **BP84**

LSI-11 Q-Bus backplane and cardcage, accommodates 8 quad height or 16 dual height modules. \$350; \$227 qty 100.

#### **TBC**

LSI-11 terminator/bootstrap/clock. \$350; \$227 qty 100.

#### **DRV11**

LSI-11 general purpose parallel I/O interface. HW/SW compat with DEC DRV11. \$250; \$162 qty 100.

#### **DLV11**

LSI-11 serial async I/O interface. HW/SW compat with DEC DLV11. \$250; \$162 qty 100. Vend Maint.

*General Robotics Corp,  
Hartford, WI.*

#### **GRS 232-S8RC Switching Unit**

Remote connection of up to 3 peripheral devices to a CPU or modem. Switching of all basic EIA interface signals. Communication speeds up to 1MB/sec. \$289; \$198 in OEM qty.

#### **GBNC-S8 Terminal Switchers**

Compat with WANG, H/P, IBM and DEC. Will switch one terminal between 3 or more CPUs or modems. The GBNC-S8RC can be operated via remote control. \$139 for GBNC-S8; \$298 for GBNC-S8RC. OEM qty discounts avail.

*Giltronix Inc,  
Palo Alto, CA.*

#### **Industrial Distributor**

Flexible/rigid disk drives, I/O, memory, terminals, printers, etc. *Hamilton/Avnet Electronics,  
Culver City, CA.*

#### **H-11A Computer System**

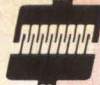
Uses same  $\mu$ P memory, interfacing and operating system as DEC LSI-11, runs SW designed for PDP-11/03. \$1395 for kit; \$1995 for assembled. Vend Maint, 57 FO.

*Heath Co,  
Benton Harbor, MI*

#### **Periphcon Series 500 Image Digitizer System**

Includes controller @ up to 6 image digitizing cameras. (Periphcon 521, 32 × 32 pixels). Controller interfaces the camera(s) to DEC LSI-11 and PDP-11 architecture using Q-Bus or Unibus. From \$2500 to \$8450.

*Hinds International Inc,  
Portland, OR.*



### Other

#### Videoprint 3000/Videoprint 5000

Photographic hard-copy device. Prints, slides or transparencies. Accepts RGB or NTSC signals. Approx \$ .60/hard copy. \$4000-8000. *Image Resource, Westlake Village, CA.*

#### Series 1000 Phototypesetter Interface

RS-232C to AM International comp/set or comp/edit phototypesetter. Internal buffering, 110-9600 baud, XON/XOFF handshaking, modem compat. \$1495. Factory board exchange. *Information Design, Hillsboro, OR.*

#### Compat Products

Distributors of terminals, printers and data communication equipment. Vend Maint, 3 FO. *Inland Associates Inc, Olathe, KS.*

#### UNIX Operating Systems

SW support on PDP-11 and VAX systems. Custom integration of mixed vendor PDP-11 and VAX minicomputer systems. Design of custom interfaces for foreign peripherals. *International Data Services (IDS), Sunnyvale, CA.*

#### PR77E

EPROM programming system for LSI-11. \$695. *Interplex Inc, Mountain View, CA.*

#### Port and Intelligent Data Concentrators

KR-870 for IBM protocol; KR-871 for UTS-400 protocol. Converts any dumb async ASCII terminal to IBM 327X, does protocol code conversion, and handles 32 nodes — 8 drops per node — onto a single host port. RTFM. *Kaufman Research Manufacturing Inc, Los Altos Hills, CA.*

#### LX80 Expansion Interface

For TRS-80 Model I allow use of 5-1/4", 8", and hard disk for up to 40+MB of on-line storage.

#### Lobo Pack Multiplexer

Hard disk multiplexer to allow use of multiple mix and match terminals for up to 8 computers of the same or different type. *Lobo Drives International, Goleta, CA.*

#### ZBC-80 CPU

8-bit Multibus Z-80 based CPU card. 16K/32K/64K RAM options. \$1045.

#### MBC-86/12 CPU

16-bit Multibus CPU, 8086 based up to 128K on-board dual-port RAM. \$1995. *Matrox Electronic Systems Ltd, TMR, Quebec.*

#### MDB-MDU11

High speed sync programmed controlled data serial interface for PDP-11. Complete modem control. Sync or isochronous communications modes, either half or full duplex. Provides all features of DEC DU-11 plus speeds up to 650 bytes/sec. \$1775.

#### MLSI-DRV11-C System Module

Parallel line interface module for LSI-11 with multiple address selection and multiple interrupt vectors. Provides 16-bit word programmed data transfers with 4 control lines to peripheral units. Up to 90K words/sec transfer rate. \$275.

#### MLSI-KW11-P System Module

Programmable real time clock for LSI-11. Provides 4 clock rates, program selectable (external, 60 Hz, 10KHz, 100KHz). Has own 60Hz crystal controlled oscillator. \$725.

#### MLSI-DR11-B DMA System Module

Compat with DEC Unibus operating and diagnostic SW. Provides interrupt request and bus master control for bi-directional exchange of 16-bit data from the LSI-11 bus to an external device. \$650.

#### MLSI-DRV11-B DMA System Module

Compat with DEC operating and diagnostic SW. Provides interrupt request and bus master control for bi-directional exchange of 16-bit data from LSI-11 bus to an external device. \$670.

#### MLSI-TEV-003 Bus Terminator

Module with 120-ohm termination. \$110.

#### MLSI-11/03-LHBX

LSI-11/2 system which includes LSI-11/2 CPU, 2 async serial ports, line time clock, bootstrap. 32 kB of RAM plus EIS/FIS instruction set. \$3440.

#### MLSI-11/03-LHX

LSI-11/2 system same as MLSI-11/03-LHBX except slots 6 and 7 in columns C and D are wired to accept the RL01 or RL02 disk controller. \$3580.

#### MLSI-11/03-LKBX

LSI-11/2 system same as MLSI-11/03-LHBX except includes 64

kB RAM and 4 async serial ports. \$3680.

#### MLSI-11/03-LKX

LSI-11/2 system same as MLSI-11/03-LHX except includes 64 kB RAM and 4 async serial ports. \$3820.

#### MLSI-11/23-AAOX

LSI-11/23 system which includes 11/23 CPU with memory management, 128 kB of RAM, 4 async serial ports, bootstrap, line time clock and bus termination. \$6080.

#### MLSI-11/23-AA1X

LSI-11/23 system which includes LSI-11/23 CPU with memory management, 128 kB of RAM, 4 async serial ports, bootstrap, line time clock and bus termination. \$6220.

#### MLSI-11/23-581X

LSI-11/23-TU-58 system which includes LSI-11/23 CPU with memory management, 128 kB of RAM, 4 async serial ports, bootstrap, line time clock and bus terminator, plus dual TU-58 cartridge tape units with combined storage capacity of 500 kB. \$7530. RTFM, 1 yr warranty. *MDB Systems Inc, Orange, CA.*

#### MMX-01 Multi-Function Board

Multi-function, Q-Bus compat, dual-size board. Time and date functions with on-board battery backup, 1 sec resolution. Crystal-controlled line time clock, 50 or 60Hz. Universal Bootstrap PROMS for RL01, RL02, RX01, RX02, TV58. Up to 16 kB of EPROM. Q-Bus termination. LSI-11 processor switch indicator panel control. Qty 1-9: \$550.

#### VMD05 Graphics Video Generator

Dual-size board for LSI-11, 11-2, 11-23. Dual channel, multi-resolution. 3 selectable resolutions: 2 channels 256 × 256 or 512 × 256, or one channel 512 × 512. Each channel has 2 outputs. Output composite video for American or European TV sync. Full graphics, point addressable, partial & full screen operation. Multiple cards stackable for color/gray scale applications. SW avail for char and graphics. RT-11 or RSX-11. Qty 1-4: \$1495. Vend Maint, 1 FO. *Mennen Medical Inc, Clarence, NY.*

#### Custom 86, 16-Bit SBC

8086-based SBC on 796 bus (formerly Intel's Multibus), serial port, optional 8087, prototype

area for customizing CPU board, 5 or 8 MHz CPU, up to 32 kB PROM/ROM or 4 kB of RAM. \$995-\$1395.

#### GPC 86, 16-Bit SBC

8086-based SBC on 796 Bus (formerly Intel's Multibus). Serial port, 24 programmable parallel I/O lines, optional 8087, 5 or 8 MHz CPU, up to 32 kB PROM/ROM, up to 128 kB RAM, 2 general purpose timers and an interrupt controller. \$1495-\$2925.

#### MM 86, 16-Bit SBC

Memory management module for Microbar 8086 SBC for running XENIX operating system or other memory management requirements. \$495. Vend Maint. *Microbar Systems Inc, Palo Alto, CA.*

#### MSC 9800 H Subsystem

Comb 5-1/4" Winchester drive plus IEEE 488 controller plus power supply compat with HP 80 Series 5MB storage. OEM 10-50 units-\$2995; 51-100-\$2795. *Microcomputer Systems Corp, Sunnyvale, CA.*

#### MSC 8009

Z80A, 32 kB RAM, 1 kB-32 kB EPROM capacity, 2 RS-232C ports, floppy disk on-board controller.

#### MSC 8004/8007 SBC

Z80A CPU, 16 kB/32 kB RAM, 1-3 RS-232C ports, 48 or 24 parallel I/O lines. *Monolithic Systems, Englewood, CO.*

#### NET/80 and EXP/80 Slave Processor

Z80 based, compat with any S-100 bus computer system. Has 64 kB of RAM, 1 or 2 serial ports, optional parallel port, interrupt controller, EPROM, and bus master capability. \$1395 for NET/80; \$295 for EXP/80. *MuSYS Corp, Tustin, CA.*

#### C-XX Overtemperature Protection System

All DEC computers. Provides an operator warning at the lower of 2 high temperature limits (77°F) and an automatic total system power shutoff at the upper limit of 83°F. \$749.



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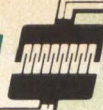
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## Let It Shine.



**Other**

**B-11**

DEC PDP11/70 CPU speedup systems & services. Simple modification and test of timing generator in PDP11/70 CPU allows 10-15% speedup in CPU instruction processing rate and a significant improvement in overall system throughput. Conversion of customer owned timing module: \$749; complete unit: \$2989. RTFM, 1 yr warranty, 2 FO. *Nassau Systems, Cincinnati, OH.*

**PBV-102 Multifunction Module**

Power up/down sequence, LTC with programmable control, on-board console switch, 2 sockets for associated logic. Also supplied with terminator as an option. \$285. Vend Maint. *Netcom Products, Sunnyvale, CA.*

**New/Used DEC & DG Equipment**

PDP11, PDP8, VAX, ECLIPSE, NOVA systems, processors, peripherals. Buy, sell. Warranty service only. 90-day warranty; most items eligible for manufacturer maintenance. Discounts to 50% off list on late-model equipment. *Newman Computer Exchange, Ann Arbor, MI.*

**MCC-2 Portable MicroChassis**

Portable, table-top package for up to 4 dual-height DEC-type  $\mu$ C modules. 5V @ 8A, 12V @ 1.5A supply w/ front-panel controls, fan, prewired Q-Bus backplane. Terminals, add-in/add-on memory, floppy drive, hard disk drive, controllers, I/O analog boards, others. \$690.

**SBC-1 Shoe-Box Computer**

Portable desk-top computer w/ front panel controls & indicators, supply, fan. LSI/11-2CPU w/ multi-function module, 8K RAM, 60Hz crystal clock, 2 RS-232 I/O ports, 2 Q-Bus slots for expansion. \$1980.

**MCC-3 System MicroChassis**

19" rack-mount chassis for up to 16 quad-height or 32 dual-height DEC-type micro modules. +5V @ 12A & 12V @ 2.5A supply w/ front-panel controls. Modules are front-mounted vertically for easy access & cabling. Includes 2 cooling fans. \$1395 w/ Q-Bus backplane for 8 double-height or 4 quad-height cards.

**MCC-1 System MicroChassis**

19" rack-mountable chassis for up to 20 dual-height DEC-type micro modules. +5V @ 12A & +12V @ 2.5A supply w/ front panel controls. Modules are front-mounted vert for easy access & cabling. Includes 2 fans. \$1195 w/12-slot Q-Bus backplane, supply, 2 fans. 20 slots add \$200. *North Atlantic Industries/ACS Div, Hauppauge, NY.*

**4400 Font Digitizing Module**

Automatic font creation for CRT terminals, dot matrix printers & word processors. \$16,000 (includes SW).

**4200 Robot Vision Module**

Machine vision system for DG computers. Counts objects, holes; measures size, location, orientation, etc. \$5148 (100); \$9900 (1).

**2000 Image Analyzer**

Video digitizer, video display, image processor for DG. 2 video inputs, 4 video outputs, 16 grey-levels, 320 x 240 x 16. \$4900 (100); \$9400 (1). Vend Maint, 1 FO. *Octek Inc, Burlington, MA.*

**PP-Series**

EPROM programmers. \$325 to \$350. Vend Maint. *Oliver Advanced Eng Inc, Glendale, CA.*

**PCM-12 Omega**

Complete TTL  $\mu$ C system. Runs all PDP-8 SW. Typical system \$2500.

**PPS-12**

Complete all-CMOS  $\mu$ C. PDP-8 SW compat. Runs all PDP-8 SW. For battery and solar-power applications. Typically \$950. *Pacific Cyber Matrix (PC/M), Dublin, CA.*

**BT-II**

Voice response front-end supporting 4 to 32 telephone lines. \$15,000 to \$50,000. *Perception Technology Corp, Winchester, MA.*

**PM-Rev 11/2**

Dual-height console bootstrap ROM loader compat with LSI-11. Plessey's Micro I & Micro II.

**SYST-34**

Line of mini systems offers sophisticated computing applications.

**SYST-23VX**

Micro systems for sophisticated computing applications in small systems environment. LSI-11/23-based system has 10MB dual-platter cartridge disk subsystem,

dual floppy disk subsystem. Expansion to large data base. Protects HW/SW. Integral memory management for max of 256 kB of addressable memory, four-level interrupt protocol, parity check, optional floating point.

*Plessey Peripheral Systems, 1691 Browning, Irvine, CA.*

**SYST-1V**

LSI-11/2 systems.

**SYST-2VX**

General purpose  $\mu$ C systems for small system applications. Terminals: PT-100.

**PM-KG11A**

Communications arithmetic option is programmable polynomial calculator providing error detection capabilities for data communications.

**PM-DC 11/300C**

Mass disk storage control unit consists of PM-DC 11/300 disk controller, supply, fans. Replaces RH11-based systems. DEC SW compat. 200MB per system when expanded to full capacity of 8 drives.

**PM-DSA 11/80**

Disk subsystem consists of DC1100 controller board (fully SW transparent to DEC SW) & DD 11/80 disk drive. Single-board controller directly supports 2 drives; 8 drives can be added to upgrade the subsystem to a maximum formatted capacity of 538.4MB.

**PM-7850**

Dual-wide parity controller for PDP-11 contains parity memory. Odd parity checking detects memory failures of all 0's on the Unibus, a more probable failure than all 1's. Insures memory integrity.

*Plessey Peripheral Systems, 17466 Daimler, Irvine, CA.*

**Digital Video Processors**

Convert video pictures into digital data in real-time and on-line. As processors they provide extensive pre-processing of digital data to achieve noise reduction, contrast enhancement, on-line mask subtraction, etc. Compat with any computer via DMA interface and any IEEE-488/GPIB std interface.

*Quintyx Corp, Sunnyvale, CA.*

**90MPS/SBC**

Z80/A CPU, 4.0MHz without floppy disk controller avail with 4 kB dynamic RAM to 65 kB dynamic RAM.

**94F/MPS**

Z80/A CPU, 4MHz. with floppy disk interface under DMA control to support up to four 5 1/4" or 8" single/double density drives. Avail with 16 kB dynamic RAM to 65 kB dynamic RAM.

*Quay Corp, Eatontown, NJ.*

**PTS/1200 Data Processing Systems**

Variety of configurations and communication options, memory sizes and peripherals. Stand-alone or part of larger system.

*Raytheon Data Systems, Norwood, MA.*

**PCI 2200 Series Pseudo Color Imager**

256 x 256 x 8 bit planes of image memory, 256 x 256 x 4 bit planes of graphic overlay, X-Y scroll, integer magnification with HW interpolation, cursor, alpha-numerics, joystick options. Expands to 32-bit planes of image memory. \$9300 to \$17,840.

**RIP-260**

Up to 4 channels of 256 x 256 x 8 bits of image memory. Processes images at video rates, real-time integer magnification with HW interpolation, X-Y scroll of all channels, monochrome, pseudo-color or pure color. \$8500 to \$21,000. Vend Maint, 1 FO.

*Recognition Concepts Inc, Lakeport, CA.*

**Z80A SAM**

$\mu$ C CPU card. Z80 A, Z80 AMB for Intel MDS-800. Includes powerful Z80 relocatable macro-assembler. Z80A-\$2195; Z80 AMB-\$2985. RTFM.

*Relational Memory Systems, San Jose, CA.*

**RDS-VT 23 Microcomputer System**

General purposes  $\mu$ C system with LSI 11/23 CPU and 10MB of hard disk storage. \$16,500. RTFM

*Remtech Inc, Huntsville, AL.*

**The Banker**

Memory bank switch allows any LSI-11 to use up to 256 kB. Usable with any memory that is DEC compat.

**RSI 16**

Multiple-processor system features multi-user capability. Uses DEC Q-Bus std DEC compat peripherals. Up to 16 independent processors. Mix a variety of CPUs in same system. Supports any DEC LSI-11 or 68000.



**RSI 68K**

68000 systems use DEC Q-Bus and std DEC compat peripherals. Renaissance Systems Inc, San Diego, CA.

**Multiplexer Model 1116/1116A.**

16 channel async MUXer. 1116, 1116A, w/modem control. PDP-11. 1116-\$5100; 1116A-\$6000.

**GCR (6250 bpi) Tape Systems, Model 1939**

Provides an ind std Pertec NRZI/PE formatter plug-compat interface to CPU interface port so existing CPU adapter designs can have high performance 50 to 125-ips dual density PE (1600 CIP/GCR 6250 cpi) mag tape subsystems easily added. DG, DEC, SEL, etc. Pertec NRZI/PE formatter compat. \$35,000.

Rianda Electronics Ltd, Anaheim, CA.

**DU-11 Trigger Trace Diagnostic Memory**

Special quad-height trigger trace diagnostic memory card. Senses trigger conditions entered by ODT or program control/locks latest stored bus transaction info for readout thru console ODT. Uses include SW debugging, development, system diagnostics. PDP-11/34 etc. (Unibus). Diagnostic memories. Size quad; trace memory 240 words; trigger/command memory 16 words; trigger levels 3; selective trace. \$975.

**DQ-11/23 Trigger Diagnostic Memory**

Special dual-height trigger trace diagnostic memory card. Senses trigger conditions entered by ODT or program control/locks latest stored bus transaction info for readout thru console ODT. Uses include SW debugging, development, system diagnostics. LSI-11, -11/2, -11/23, -11/03. Size dual; trace memory 240 words; trigger/command memory 16 words; trigger levels 3; selective trace. \$890.

**DM-11 Diagnostic Memory**

Special dual-height Flight Recorder memory card. Buffer stores latest bus transaction info until locked by computer's spurious or programmed halt. Data read-out thru system console ODT. LSI-11, -11/2, PDP-11/03. Dual size; trace memory 256 words; bus transactions computed, DATI, DATO, DATIO, Interrupt. \$650. Scanoptik Inc, Rockville, MD.

**Disk System 11X DSX0122, DSX0127, DSX01172**

Complete LSI-11 computer system w/ choice of 2 floppy disk drives or one 8.9MB 8" Winchester and one floppy disk. Includes power, 8-quad slot Q-Bus backplane, disk drives, enclosure in attractive

10-1/2" table top package. LSI-11/2 or LSI-11/23 optional. DSX0122-\$5600; with computer-\$7400.

Scientific Micro Systems, Mountain View, CA.

**Bus Control Unit Model BCU-11LA**

MIL-STD-1553A interface is plug compat with LSI-11 Q-Bus minis. \$6,000 (4).

SCI Systems Inc, Huntsville, AL.

**Multiplex Data Bus Emulators**

Full MIL-STD-1553 system capability; supports F-16, 1553A, and 1553B formats; commercial minicomputer interfaces; SW controlled; microprogrammed for flexibility; operates as controller, multiple remote terminal, and bus monitor; programmable error injection capability.

Simulation Technology Inc, Dayton, OH.

**Q-Bus to Unibus Converter QS-070**

Converts LSI-11 bus to Unibus. Drives 19 Unibus loads and drives over 50'. Handles program transfers, interrupts, and DMA. \$695. Vend Maint.

Standard Engineering Corp, Fremont, CA.

**LASERSCAN 100**

Gun-type bar-code laser scanner. Hand-held laser gun for supermarket price file verification, inventory control, direct store delivery, POS Scanning. Manufacturer programmable to read most commercially available bar codes (UPC, EAN, Code 39, Codabar, Code 2 of 5). Aggressive decoding of printed symbol on all substrates. DEC, DG, Intel, Univac, Motorola, IBM. RS232C Communications Interface.

**LASERSCAN 410**

Blood product identification scanner — desktop laser scanner for fast, accurate identification, processing of blood bags/tubes via scanning linear bar code symbols.

**LASERSCAN 550/500**

High-speed laser scanning data terminal. Unit is a Scan-Above portable work station designed for unsold returns processing applications for UPC and EAN. For the processing of magazines, paperbacks, newspapers, etc. RS232C communications interface.

Symbol Technologies Inc, Hauppauge, NY.

**T68KQ Processor Board**

Motorola 68,000 CPU on a quad width board. Also contains 4 kB of EPROM with bootstraps, diagnostics, and debugging utility. Addresses 4MB and supports

interrupts. \$2295, OEM discounts avail.

Tele Soft, San Diego, CA.

**LSI-11/23 96-KWord Modules TM10000 Series**

64KW or 96 KW, optional parity, Std dual DEC board; 5V MOS dyn RAMs.

**PDP-11/34, -11/44 256 KW/128 KW Modules TMM20000 Series**

Error-det, error-corr transparent to OS, compat w/ PDP-11/34, -11/44, addressing 2MW. Programming options: modified or extended Unibus, I/O page size, control status ref reg address location/error status reg; 5V MOS dyn RAMs.

Texas Instruments Inc, Semiconductor Group, Houston, TX.

**TEC 8770/20 IMU**

Intelligent multi-device interface unit. Provides RS232 interface using VIP 7700 protocol in a Honeywell Level 6/62/64/66, DPS-4, or DPS-8 host, for up to 32 VIP-compat terminals. \$6195 including floppy disk and 4 terminal adapter ports and SW.

**TEC 8770/20 IMU**

Intelligent multi-device interface unit. Provides RS232 interface using bi-synch protocol in an IBM host, for up to 8 3270-compat terminals. \$6195 including floppy disk and 4 terminal adapter ports and SW.

Thomas Engineering Co, Concord, CA.

**CSS-11 Storage System**

Fully integrated sub-system including IMI-7700 series Winchester 8" disk (10, 20 or 40 MB), DEI-3400 cartridge tape (17.25MB unformatted). Dual intelligent controller, power supply; packaged for desk-top use or 19" rack mount; also sold without cartridge tape. \$11,788 (20 MB). RTFM.

U. S. Design Corp, Crofton, MD.

**Compat Products**

Purchase, sell, lease and exchange minicomputer equipment. Systems integrator, subsystem supplier, manufacturer of DEC interfaces, distributor.

West Coast Computer Exchange Inc, Sunnyvale, CA.

**XL2300 — LSI-11/23 Computer**

Contains from 96 kB to 4MB of main memory — 20.8MB Winchester disk and 17MB cartridge tape drive — 8 communication ports. Runs DEC operating systems RSTS/E, RSX11M and RT11 and any DEC LSI-11 compat application program. 256 kB-\$26,900 (1-4); \$22,900 (25-99).

RTFM and dealer, 1 FO.

Xylogics Inc, Burlington, MA.

**ZX-85/88 Processor**

2 versions with different CPUs, support various standard DOS. ZX-85 uses the 8085A-2 CPU for execution of 8-bit code; the ZX-88 uses the 8088 CPU for execution of 8086 code over the 8-bit system Multibus. On-board complement of 64 kB dynamic RAM. ZX-85-\$2660; ZX-88-\$2750.

**ZX-80-05 SBC**

6.75" x 12" Multibus compat SBC. SW transparent to code written for the Intel SBC-80/05. 4 times the capacity for EPROM (32K) and double the RAM (1K). \$550.

**ZBX-324 Analog I/O Module**

Baseboard expansion module to fit the Intel SBX-Module interface specification. Comes with two 8-bit monolithic DACs with buffered output and two 8-bit CMOS ADC units with a common precision voltage reference. \$442.

**ZBX-350 Parallel I/O Expansion Module**

Increase the capabilities of any SBC  $\mu$ C that contains a Multi-module connector. Contains an 8255A programmable peripheral interface that may be set to: basic I/O, strobed I/O, bidirectional bus interface. \$141.

**ZX-200A Single Board Diskette Controller**

One board solution to running Intel's single- and double-density media on an Intellec MDS or SBC system. \$1500.

**ZX-906A Multibus Display**

Aid to programmers and HW designers in debug of systems SW and HW for SBC and other Multibus compat systems. \$480.

**ZX-908A EPROM Programmer**

Programs up to 16 kB of Intel type 2716, 2732, or 2732A. Can operate in either the Multibus chassis with simple SW drivers or stand-alone cabled to an MDS development system and run under ISIS UPM SW. \$720.

Zendex Corp, Dublin, CA.

**ZT85/38 IEEE 488 Controller**

High-speed GPIB interface for Multibus. 250 kB/sec data rate. \$1200.

**ZT7488/28 IEEE 488 Controller**

For STD Bus. Up to 250 kB/sec w/external DMA. \$488.

**ZT7488/08 IEEE 488 Interface**

Talker/listener for STD Bus. Up to 250 kB/sec with external DMA. \$298.

Ziatech Corp, San Luis Obispo, CA.



# List of Manufacturers

## suppliers of computer compatible products

This alphabetical listing of computer compatible product manufacturers includes company names, addresses, phone numbers and sales contacts. All companies cited in the Computer Compatible Directory, Part One and Two, are listed here for your convenience.

### A

Ray Ball  
**Able Computer**  
1751 Langley Ave.  
Irvine, CA 92714  
(714) 979-7030

Allen L. Pollens  
**ADAC Corp.**  
70 Tower Office Park  
Woburn, MA 01801  
(617) 935-6668

John H. Meyn  
**Adams Russell**  
Digital Processing Div.  
1370 Main St.  
Waltham, MA 02154  
(617) 891-4700

Tamisie Honey  
**Advanced Business  
Technology Inc.**  
12333 Saratoga-  
Sunnyvale Rd.  
Saratoga, CA 95070  
(408) 446-2013

K. J. Scannell, Vince Maturo  
**Advanced Digital Products**  
7584 Trade St.  
San Diego, CA 92121  
(714) 578-9595

Gary Wilson  
**Advanced Electronics  
Design Inc.**  
440 Potrero Ave.  
Sunnyvale, CA 94086  
(408) 733-3555

John Rademaker  
**Agile Corp.**  
1050 Stewart Dr.  
Sunnyvale, CA 94086  
(800) 538-1634

William Alden  
**Alden Computer Systems**  
23 Strathmore Rd.  
Natick, MA 01760  
(617) 655-6610

Nigel R. Spieer  
**Alloy Engineering  
Co. Inc.**  
Computer Products Div.  
12 Mercer Rd.  
Natick, MA 01760  
(617) 655-3900

Barbara Currall  
**Alphacom Inc.**  
2323 So. Bascom Ave.  
Campbell, CA 95008  
(408) 559-8000

D. Curtiss Johnson  
**Alpha Data Inc.**  
20750 Marilla St.  
Chatsworth, CA 91311  
(213) 882-6500

Richard F. Rohrev  
**Alphamatrix Inc.**  
1021 Millcreek Dr.  
Langhorne, PA 19047  
(215) 355-3297

Robert Sillers  
Darrell Sprague  
**Alternatives in Magnetics**  
25431 Rye Canyon Rd.  
Valencia, CA 91355  
(805) 257-2262

Linda Taylor  
**American National  
Supply Corp. (ANSCO)**  
Box 2259  
Gardena, CA 90247  
(800) 421-1270

Jim Snow  
**Amyln Corp.**  
1758-H Junction Ave.  
San Jose, CA 95112  
(408) 275-8616

John Jory  
**Ampex Corp.**  
Memory Products Div.  
200 N. Nash  
El Segundo, CA 90245  
(213) 640-0150

John Kim  
**Amtek Business Machines Inc.**  
2255-H Martin Ave.  
Santa Clara, CA 95050  
(408) 727-1510

Rich McMahon  
**AMT Software Systems**  
183 Guggins  
Boxboro, MA 01719  
(617) 263-3030

John Knox  
**Anadex Inc.**  
9825 DeSoto Ave.  
Chatsworth, CA 91311  
(213) 998-8010

Les Silvern  
**Analog Devices Inc., Systems Div.**  
Box 280  
Norwood, MA 02062  
(617) 329-4700

Jim Lawrence  
**Analog Technology Corp.**  
15859 E. Edna Place  
Irwindale, CA 91706  
(213) 960-4004

Linda Rioux  
**Analogic Corp., Data Acquisition  
& Conversion Products**  
Audubon Rd.  
Wakefield, MA 01880  
(617) 246-0300

Will Alger  
**Andromeda Systems Inc.**  
9000 Eton Ave.  
Canoga Park, CA 91304  
(213) 709-7600

Sarah Freeman  
**Ann Arbor Terminals Inc.**  
6175 Jackson Rd.  
Ann Arbor, MI 48103  
(313) 663-8000

Elizabeth Ferebee  
**Applied Information Systems Inc.**  
500 Eastowne Dr., Suite 207  
Chapel Hill, NC 27514  
(919) 942-7801

Art Garofalo  
**Ardent Computer Products**  
145 Palisades St.  
Dobbs Ferry, NY 10522  
(914) 693-6900

**Arrow Electronics**  
521 Weddell Dr.  
Sunnyvale, CA 94086  
(408) 745-6600

Sheldon Hess  
**Associated Computer  
Consultants**  
228 E. Cota St.  
Santa Barbara CA 93101  
(805) 963-8801

Don Raymond  
**Atlas Energy Systems**  
9457 Rush St.  
So. El Monte, CA 91733  
(213) 575-0755

**Augat Inc.**  
33 Perry Ave.  
Attleboro MA 02703  
(617) 222-2202

David A. Huss  
**Auscom Inc.**  
2007 Kramer Lane  
Austin, TX 78758  
(512) 836-8080

Natalie J. Riehl  
**Automated Control  
Systems Inc.**  
Box 748  
Bellevue, WA 98009  
(206) 881-0177

Allan Hughes  
**AVA Instrumentation Inc.**  
9672 Manzanita Ave.  
Ben Lomond, CA 95005  
(408) 336-5048

John S. Connolly  
**Aviv Corp.**  
6 Cummings Park  
Woburn, MA 01801  
(617) 933-1165

J. Taylor  
**Aydin Controls**  
414 Commerce Dr.  
Fort Washington, PA 19034  
(215) 542-7800

### B

William Backus  
**Backus Data Systems Inc.**  
1440 Koll Circle, Suite 110  
San Jose, CA 95112  
(408) 279-8711

Prentiss Smith  
**Ball Computer Products**  
P.O. Drawer K  
Boulder, CO 80306  
(303) 441-4646

David F. Pippin  
**BASF Systems Corp.**  
Crosby Dr.  
Bedford, MA 01730  
(617) 271-4000

Robert Harvey  
**BBN Information  
Management Corp.**  
68 Moulton St.  
Cambridge, MA 02238  
(617) 497-2929

**BDS Computer Corp.,**  
Line Printer Systems

1120 Crane St.  
Menlo Park, CA 94025  
(415) 326-2115

John McPhail, Ron Hardy  
**Beehive International**  
4910 Amelia Earhart Dr.  
Salt Lake City, UT 84125  
(801) 355-6000

D. Bellin  
**Bellin Computer Systems Inc.**  
206 Terminal Dr.  
Plainview, NY 11803  
(516) 349-9714

Stephen F. Grande  
**Best & Midcom Data  
Systems**  
1940 N. Tustin, Suite 117  
Orange, CA 92665  
(714) 998-6041

Bill White  
**Bill White Printed  
Circuit Design**  
1106 S. Ambridge St.  
Anaheim, CA 92806  
(714) 778-1477

Laurel Lea  
**Bizcomp Corp.**  
Box 7498  
Menlo Park, CA 94025  
(415) 966-1545

Steve Lipsey  
**Bolt Beranek and  
Newman Inc. (BBN),**  
Computer Systems Div.  
10 Moulton Street  
Cambridge, MA 02238  
(617) 491-8488

**Boston Systems Office  
(BSO)**  
469 Moody St.  
Waltham, MA 02154  
(617) 894-7800

Roger Nadow  
**Braegen, Minicomputer  
Peripherals Div.**  
3320 E. La Palma Ave.  
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| <input type="checkbox"/> Array Processor        |   | <input type="checkbox"/> Software                                    |
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| <input type="checkbox"/> Other (describe) _____ |   |  |

Product Name/Model No. \_\_\_\_\_

Description/specs \_\_\_\_\_  
\_\_\_\_\_  
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This product is compatible with? \_\_\_\_\_ DEC, \_\_\_\_\_ DG, \_\_\_\_\_ P-E, \_\_\_\_\_ HP, \_\_\_\_\_ Intel, \_\_\_\_\_ Other

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Check type(s) of maintenance available:

\_\_\_\_\_ Return to factory (RTF)

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\_\_\_\_\_ Other? describe \_\_\_\_\_

Number of your field offices: \_\_\_\_\_ FO.

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# Designers' Notebook

## Use Off-The-Shelf Components To Design 300-Baud Answer/Originate Modem

### first, some basics

One of the very few methods of exchanging data (files, source code, object code, etc.) between diverse  $\mu$ Ps without having to combat the problems of differing mass storage media is by means of data transmission over switched or leased telephone facilities. Most other means of data exchange such as floppy diskettes or cassette tapes are specific to one or a few  $\mu$ Cs. Data transmission over phone lines can be independent both of the  $\mu$ Ps involved and of the method or speed of the mass data storage used by either processor.

In order to transmit data at reasonable speeds over a telephone line, a modem (a contraction of the words modulator and demodulator) is used to convert digital signals into analog form for transmission over the telephone network. This is necessary because the telephone network was designed for analog voice transmission and not for digital data. The telephone network has an audio bandwidth of about 3000 Hz, so the modem must condition the signals to fit within this bandwidth.

Since communication usually involves data transmission in both directions, a convention has been established so the data traveling in each direction does so without interference. In the Bell 103 type of modem certain designated audio frequencies are used for binary zero and one. One of the pair of communicating entities is arbitrarily designated as the originating end and the other as the answering end. As the words imply, the originating end answers, but this is not necessary. All that is necessary is to designate one of the pair the "answerer" and the other the "originator." The originating end transmits a binary zero (also known as a space) as a tone of 1070 Hz and a binary one (also known as a mark) as a tone of 1270 Hz. The originating end receives space and mark as tones of 2025 Hz and 2225 Hz, respectively. The answering end obviously has the transmit and receive frequencies interchanged. The Bell 103 modem

translates serial data from voltage levels to these audio tones which are capable of being transmitted over standard telephone lines at a data rate from 0 to 300 bits per second (bps).

A data bit is usually first translated by a terminal or  $\mu$ C to standard voltage levels defined by an EIA standard known as RS-232C. This standard defines a space as a voltage level between +5 and +15 V and a mark as a voltage level between -5 and -15 V. Voltages between -5 and +5 V have undefined meaning. These signals are capable of

being transmitted over wire cable for distances of several hundred feet at speeds up to several thousand bps.

The 103 type 300 baud modem described in this article uses RS-232C levels between the processors or terminals and connects to the telephone line through a device called a Direct Access Arrangement (DAA). There are two common DAAs: the CBS data coupler which uses RS-232C levels to interface with the modem and the simpler CBT data coupler which uses contact closures (switches or relays) for

### Mini-Glossary

**Amplitude modulation (AM):** A method of transferring data via a modem in which the amplitude of a carrier signal is altered to represent zeros or ones.

**Asynchronous transmission:** Data transmission in which each character has its own start and stop bits and there is no control over time between characters.

**Baud:** A unit of measuring data transmission speed. Baud and bits per second (bps) are often used interchangeably.

**Bell compatible modem:** A modem whose line audio signals meet Bell telephone standards.

**Carrier signal:** A signal that contains no information by itself but whose characteristics can be altered to carry data.

**Frequency modulation (FM):** The most common method of transmission in which a carrier signal's frequency shifts back and forth between two distinct frequencies to designate zeros and ones.

**Full duplex:** Pertains to the simultaneous independent transmission of data in both directions over a communications line.

**Half duplex:** Pertains to the operation of a communications link

in either direction over a single channel, but not in both directions simultaneously.

**Modem:** An acronym for modulator-demodulator, a device used at each end of a telephone line to convert binary data to audio tones suitable for transmission over the line and vice versa.

**Originate/Answer:** Two modes of operation for a modem. In the originate mode, the modem will utilize one set of frequencies to transmit data and another set of frequencies to receive data. In the answer mode these frequency sets are reversed. For two modems to communicate, one modem must be in the originate mode and the other in the answer mode.

**Serial interface:** Circuitry that transforms digital data from a parallel mode to a sequential mode.

**Start/stop bits:** Bits transmitted immediately before and after a block of data (or character, in the case of asynchronous transmission). The start bits alert the receiving system to expect incoming data while the stop bits signal the end of the transmission of that block or character.



the modem interface. The CBT type DAA is used in this design for simplicity. An FCC-registered DAA is needed when connecting into the public switched network. The simple DAA design described here can be used with either leased or private lines.

### building the modem

Functionally, a frequency modulated modem of the 103 type consists of just a few basic building blocks. Data to be transmitted first enters a low pass filter which removes the high frequency components of the rectangular pulse shaped data input. The shaped pulses control the frequency of the FM oscillator. The transmit bandpass filter limits the frequency spectrum to the bandwidth of the transmission facility. At the other end the receive bandpass filter removes the noise and interference outside the band of interest. Frequency variations at zero amplitude are converted by a limiter into a rectangular wave so that residual amplitude modulation is eliminated. The original signal is then recovered in a discriminator process of the FM demodulator. The low pass filter removes out of band modulation products and noise. The output of the low pass filter is fed into the slicer which performs a slicing function to produce rectangular pulses again.

The number of components required to implement these functions is relatively modest. Only two filters are required: a switchable dual channel transmit filter and line hybrid (CH1262) and dual channel receive filter and limiter (CH1267). It is necessary to be able to switch the center frequencies of the filters (1170 and 2125 Hz) so the modem can be used either as an originate or answer mode. This is done by changing the DC voltage (+12 V) on the channel select pins. On the CH1262 channel, select pins 1 and 16 set the channel frequency to 1170 Hz when connected to V - and to 2125 Hz when connected to V +. On the CH1267, channel select pins 11, 17 and 19 will set the channel frequency to 1170 when connected to V - and to 2125 Hz when connected to V +.

The most troublesome and complicated parts of a modem are the filters used to separate and purify the transmit and receive audio tones. It is not uncommon that filters for the receive and transmit frequencies to each contain many op amps and tens of precision resistors and capacitors. The Cermetek miniModem building block filters used in this design, however, require no adjustments and few external components.

The CH1262 is a two channel band-pass filter which passes the modulated signal with extremely low distortion within the selected bandwidth. It band-limits the oscillator output to attenuate those modulation components which would interfere with the adjacent channel. Filter bandwidth is relatively large, about 500 Hz, and adjacent channel attenuation is -13 dB for the originate mode and -19 dB for the answer mode. This thick film hybrid device also contains a line hybrid to couple the receiver to the line, while isolating the modulator

from the receiver. Minimum isolation of modulation is a function of line mismatch from a nominal 600 ohm line. For 30% mismatch, the line hybrid provides complete isolation of 10 dB. With the line at 600 ohms impedance, the line hybrid will provide 6 dB of gain to the receive filter for the received signal and a 50 dB attenuation for the transmitted signal.

The CH1267 receive filter also acts in a two channel bandpass configuration which passes the signals with extremely low group envelope delay distortion.



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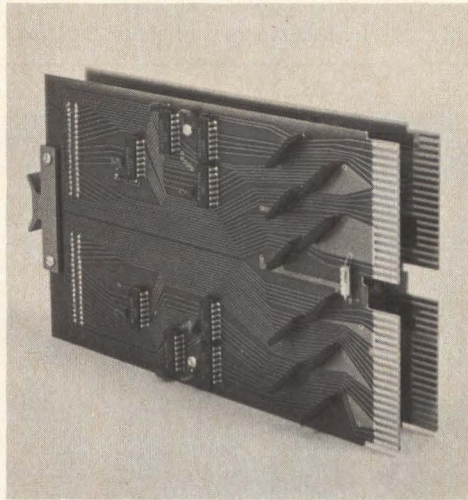
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## Designers' Notebook

The adjacent channel attenuation for the answer mode is -38 dB and for the originate mode is -42 dB. Inclusion of the line hybrid provides 10 dB of additional isolation at 30% line mismatch and 50 dB if lines are matched. The CH1267 also contains a soft limiter to amplify the signal from the filter in order to supply the demodulator with sufficient signal level for error-free operation. The soft limiter provides 38 dB of additional linear gain for threshold level and clips on larger inputs. When used with the limiter, a two stage progressive limiting function is provided for operation over a 50 dB receiver dynamic range.

The only other major component in this modem is the Motorola MC6860 MOS/LSI modem chip. It provides all the circuitry required to perform the functions of modulation and demodulation as well as several important supervisory control functions. The presence of a ring indication or the closing of the switch hook caused by taking the telephone receiver off its cradle is detected and the 6860 puts the modem in the answer or originate mode.

Of course, a variety of external devices is required in addition to these three devices for the modem to operate in an adequate fashion and to interface in the proper manner to the outside world.

Conversion of signals from RS-232C levels to TTL levels and back again is provided by the inclusion of two special interface circuits, the MC1488 and MC1489A. A 1458 dual op amp is used to convert the TTL-level mode signal from the MC6860 (as perhaps modified by the Test/Normal switch) to a +12 or -12 V signal to switch the filters between originate and answer. A 301A op amp is used to limit the received signal. A 3.9 volt zener diode causes the output of the op amp to be TTL compatible. A TTL gate helped square up the limited signal as required by the 6860. A 200K ohm variable resistor on the CH1262 is used to set the transmit level to 0 dBm (1 mW at 600 ohms or 0.7 V RMS).

Five LEDs have been incorporated into this design to be used by the operator to monitor the operation of the modem. The functions displayed are power-on, clear-to-send, mode (with the LED on in the answer mode), off-hook, and one spare for a function of the designer's choice.

The DAA used in this particular configuration is designed to have a very

clean interface between it and the modem itself. This was done so the modem could easily be used both on public switched lines with an external DAA or on private leased lines with the internal DAA.

The DAA couples the modem to the phone line through a 1:1 600-ohm transformer. Ring detection is done by a capacitively coupled diode bridge through an opto-isolator. The switch labeled "ring" simulates a ring on the telephone line for testing purposes.

There are two relays placed on the phone line. The one on the modem side closes about one second after the line side relay closes to place the telephone line off-hook. The delay is governed on the line side by a 74123 one shot and 7474 D-latch.

The RC network on the clear inputs to this delay circuitry provides power-on sequencing.

A power supply provides +5, +12 and -12 Volts regulated to the modem. These voltages, of course, can be obtained from the terminal or computer, if available. However, a self-contained power supply makes the modem an independent device. The entire modem can be wirewrapped on a small perfboard and enclosed in a cabinet.

### the modem in operation

After conversion from RS-232C to TTL levels by the MC1488 and MC1489A interface circuits, the MC6860's modulator section converts serial digital data into analog frequencies. A sine wave is digitally synthesized in one-of-four frequencies required for 300-baud modem operation. One frequency pair (Mark and Space) is for one direction and one frequency pair is for the other direction. These are: Mark: 1270 Hz (pair #1), 2225 Hz (pair #2); Space: 1070 Hz (#1), 2025 Hz (#2). This signal is filtered and amplified by the transmit CH1262 transmit filter. The demodulator section of the 6860 detects the presence of a Mark or Space frequency at its input and presents a digital zero or one output to the terminal or computer after conversion to RS-232 levels by the interface circuits. The receive signal input to the 6860 must be a 50% duty cycle TTL signal, filtered and limited (amplified and clipped) and with very clean and sharp edges.

If the data terminal is ready, ring detection creates an answer phone signal to the DAA. A 6860 mode signal output controls the switchable filters so that the correct set of signal pairs is used. A Clear-To-Send (CTS) signal is

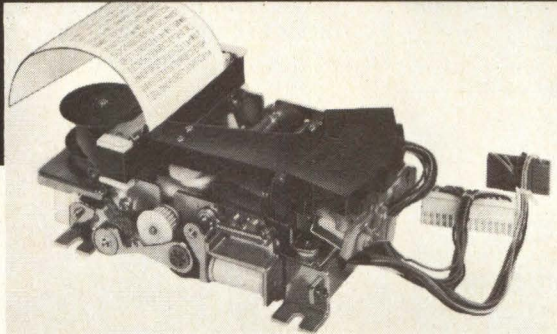
also created to indicate to the terminal or computer the establishment of a communication link.

The Request-To-Send (RTS) signal is not used by the 6860. It is normally used to indicate to the modem that it is about to begin or resume sending of data and the modem responds with a CTS signal to indicate that the modem is ready to function. However, in this design, RTS is used by the support circuitry to control pulse dialing and setting the answer/originate mode of the modem.

If the modem is powered up with RTS on (+5 to +12 V), the modem is placed in the originate mode and the Answer Phone signal from the 6860 commands the DAA to take the phone line off-hook. The telephone may then be dialed by pulsing the RTS line off and on under software control. A CP/M program for an 8080 can do automatic dialing.

If the modem is powered up and RTS is off (-5 to -12 V), the modem will wait for a ring indication from the DAA. On receipt of the ring, the 6860 will bring the Answer Phone line high and begin sending the transmit carrier (2225 Hz). If the modem on the other end of the line responds with its carrier (1270 Hz), the 6860 will turn CTS on about

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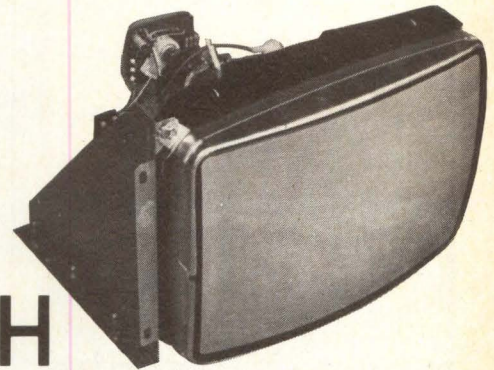
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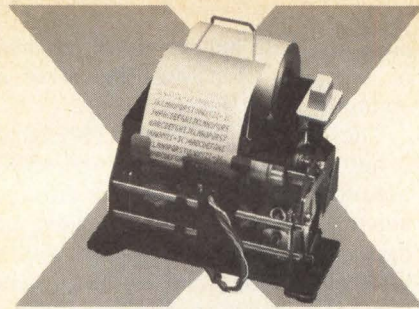
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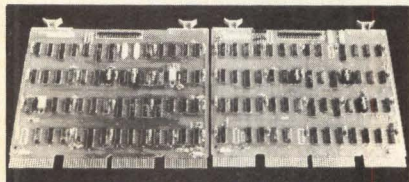
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## Designers' Notebook

half a second later. The terminal or computer can detect this and initiate whatever procedure is necessary to communicate with the originator.

### software to control the modem

A CP/M program for an 8080-type processor to perform automatic dialing to an answer modem and to initiate communication has the CP/M syntax: DIAL phone number, or DIAL phone number: logon character. The phone number may contain blanks and hyphens; these are ignored. If an invalid character is found in the phone number, the program hangs up the telephone and reboots CP/M. If a colon follows the phone number, the next character is sent to the answering modem after CTS is asserted by the modem. Such a logon character is often required by time sharing services.

Another CP/M program will configure the operating system to act as a remotely accessible computer. The program, after starting, will wait for the telephone to ring and the modem to answer. If the caller is an originating modem, the program will configure CP/M to use the terminal on the other end of the serial line as the CP/M display and console. All output to the remote terminal and input to CP/M from the remote terminal is echoed to the local display.

by **Stephen J. Durham**

*Cermetek, Inc., Sunnyvale, CA*

## Fiber Optic Selection Criteria

Struthers-Dunn of Bettendorf, IA, looked at some of the applications their Director 4001 controller would face before deciding that communications with certain types of I/O devices were best accomplished by a fiber optic link. Although most connections to their unit use conventional wire, they purchased AMP (Harrisburg, PA) fiber optic links for use near the unit, as well as a remote interface for use near remote I/O, for certain applications.

The main reason for providing a fiber optic link was noise immunity. The second most important reason was intrinsic safety. Since fiber optic cable isn't influenced by external electro-

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magnetic fields, it is inherently immune to electrical noise. In addition, because it carries energy in the form of low level light, it cannot generate a spark, resulting in high intrinsic safety.

If you're considering fiber optic links, be certain to consider field repair. It is a major requirement. Be sure that connectors come in a wide variety of types, sizes and styles to fit different fiber optic cables, including plastic, plastic clad silica, and glass, in variations such as single fiber, multifiber and bundles.

A fiber optic link that connects two or more units to each other is useful in complex manufacturing operations, such as in a transfer line in automobile manufacturing. Also, be sure use of the connector is a straightforward application of the manufacturer's products.

While a fiber optic link provides advantages of noise immunity, intrinsic safety and no ground loops, it is expensive and the cost is still not really competitive with running wire. At this time, you need some kind of justification for going to fiber optics. The cable is what adds to the cost. The fiber optic hardware — the transmitter and receiver and associated circuits — are really a one-to-one trade-off with wire.

For field repairs or if you need to cut and terminate fiber optic cable on a regular basis, consider fiber optic terminating equipment available in kit form. The equipment can be used with various types of fiber optic cable, and a skilled operator can make a complete termination — exclusive of adhesive set up time — in less than five minutes. A fiber optic designers kit can be used to design transmitter and receiver circuits. A lot of OEM designers are making transmitter and receiver modules that are typically optimized for one circumstance. As a result, available modules may not fit a new application.

In addition to fiber optic connectors, examine the rest of that manufacturer's product line. Does it include many types of connectors for conventional wire? What about wire terminals and many types of wire terminating tools and machinery? Check out tools. These range from simple hand operated devices to complex automatic machines capable of mass terminating many wires at one time. Although you may not need such diversity in this application, and though you may not anticipate the need for a broad product line, things tend to change. It's better to plan for it today than to risk being sorry tomorrow.

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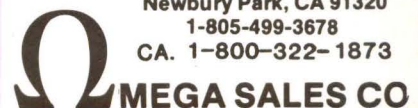
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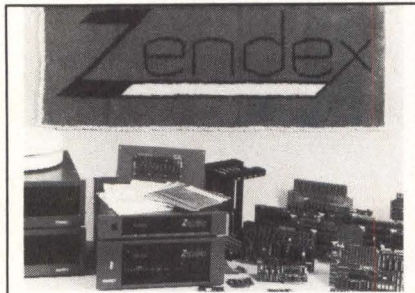


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