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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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Circle 2 on Reader Inquiry Card
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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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Dataram Corporation

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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/I 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.

Paul Snigier
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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
service quickly and significantly out-
weig 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 con­
stancy 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 inex­
pensive repair.
compatibility of inputs
Inputs to a print mechanism are analo
g 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
are installed in virtually any attitude
except for those imposed by paper
supply. After mounting, the only ad­
justment 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
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 x 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

**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
M-Core

Solid state non-volatile memory available in 1/4MB increments.
Alpha Data Inc, 20750 Marilla St. Chatsworth, CA 91311.
Circle 264

SMS-35315

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

6502 DM

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

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

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

Bubbl-Tec™

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

2065

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

B1020

Central Data Corp, 713 Edgewood Dr, Champaign, IL 61820.
Circle 233

CI-1123

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

Micro Stor-11

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

SEPTEMBER 1981 Digital Design 9
Add-In / Add-On Showcase

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 x 39, 128K x 39, 256K x 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 EXORCISR-Micromodule µP 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, 7 ½ Harris Rd, Nashua, NH 03062. Circle 239

DR-144S
1.0MB Semiconductor add-in for DEC’s PDP-11/44. The
INTRODUCING OUR NEW FAMILY OF COMPACTS

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 840 SLIP/DOCUMENT PRINTER
- Up to 40 Print Columns
- Large Clear Print
- Side or Front Form Insertion
- Top and Bottom Form Sensors
- Adjustable Slip/Document Stop

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

For full details, write or call us

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 TERAK 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:

Advanced Computer Design
A Subsidiary of Computer Services Group, Inc.
7584 Trade St., San Diego, CA 92121 / (714) 578-9620

*LSI-11 and “Q-Bus” are trademarks of Digital Equipment Corporation and UCSD Pascal trademark of the Regents of the University of California. Educational Discounts and OEM pricing available

Circle 9 on Reader Inquiry Card
Add-In/Add-On Showcase

**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).

**IMC-3**


**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.

**256 KB MOS**

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

**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.

**IM 1680**

Intelligent memory board. 16K of static RAM and sockets.
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 128K X 22 capacity. Hardware and software compatible 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

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**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

**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.

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**System 3000**

General purpose mass memory system. 1MB to 32MB of dynamic RAM with a unique error correction scheme for 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
**Add-In/Add-On Showcase**

### 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 deselected 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

### MEccVII
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

**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

---

**EYECOM II the IMAGE PROCESSING PERIPHERAL**

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.

A basic software package is provided to apply the EyeCom System to your particular problem.

**FEATURES:**
- Real Time Digitizing, 640x480x8-bits
- Add, Subtract and Convolution of images at video frame rates
- Joystick Cursor, 640x480 Resolution
- Graphic & Alphanumeric Overlay
- Color & Gray Scale Mapping Tables
- Terminal or Rack Mount Configuration

Call or write for complete information:

**Spatial Data Systems, Inc.**
P.O. Box 978, 508 So. Fairview Ave., Goleta, CA 93117 • Tel: (805) 967-2383

*Trademarks of Digital Equipment Corporation*
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


Standard Engineering Corp, 4800 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.

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

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

SEPTEMBER 1981 Digital Design 17
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 Charn/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.

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See Us at SYSTEMS '81

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
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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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Circle 15 on Reader Inquiry Card
See Us at SYSTEMS '81

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 20000 Series


Circle 15 on Reader Inquiry Card
See Us at SYSTEMS '81
The DILOG Model DQ202A is a µP based intelligent SMD I/O hard disc single board Controller for your LSI-11, 11/2, 11/23 computer. It permits up grading 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
BALL COMPUTER
BASF
CENTURY DATA
Fujitsu
Kennedy
MEMOREX
PRAIM
NPL

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.
COMPAT™ Showcase

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

The 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.

Compatible Video Display Units

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.

Power From Cigarette Lighter

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.

From MOSTEK

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, Carrolton, TX 75006.**

**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 240**

**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, Forth, 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. **Dynatemp Inc, 20881 Paseo Olma, EL Toro, CA 92630**

**Circle 214**

**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**

SEPTEMBER 1981 Digital Design 23
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, 1738 H Junction Ave, San Jose, CA 95112

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 digtal video processors incorporate a ‘hardwired computer’ as ‘arithmetic unit’ to achieve the high speed processing necessary to accomo-
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

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

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

Minicomputer Technology, 2470 Embarcadero Way, Palo Alto, CA 94303

Emulex Corporation, 2001 Deere Avenue, Santa Ana, CA 92705

Minicomputer Technology, 2470 Embarcadero Way, Palo Alto, CA 94303

ADAC Corp, 70 Tower Office Park, Woburn, MA 01801

Digital Microsystems, 1840 Embarcadero, Oakland, CA 94606
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

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.

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.

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.

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 Dataproducts’ specially designed steel band.

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

Circle 301
Circle 327
Circle 338
Circle 335

Digital Design SEPTEMBER 1981
ST506 5¼” 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.

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.

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.

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 Fullman St, Suite 120, Costa Mesa, CA 92626.

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.”

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.

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.
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.

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.

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 products 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.

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.

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 available 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 µP-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.” Teestor, Inc., 16161 Gothard St., Huntington Beach, CA, 92647

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.

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 Cit-Honeywell-Bull) 3600 West Bayshore Drive, Palo Alto CA 94303

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.
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) 698-0050, TWX (710) 833-0369 • 5000 Middle Country Road, Middle Island, NY 11953, (516) 736-3440 • 4401 Atlantic Avenue, #28, Long Beach, CA 90807, (213) 422-4445.

GIVE YOURSELF A BETTER IMAGE
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.

Emulog Inc, 3730 Yale Way, Fremont, CA 94538 Circle 342

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. 9 x 9 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

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
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.
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 MCB x 332, 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.**

**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 microprocessor 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.
RESEARCH AND DEVELOPMENT ENGINEERS

THE FUTURE OF TELECOMMUNICATIONS IS STARTING TODAY IN THE TAMPA BAY AREA

The time: Now. The place: GTE's new state-of-the-art telecommunication 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. Responsibilities include evaluating and advising product design for meeting transmission and interference requirements.

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.

COMPOSITE 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.

We're offering attractive salaries, a comprehensive benefits package and excellent opportunity for advancement. If your abilities have exceeded the potential and challenge of your present position, send your resume with salary history to:

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St. Petersburg, Florida 33702

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SEPTEMBER 1981 Digital Design 35
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


Western Peripherals, 14321 Myford Road, Tustin, CA 94680

Circle 218
The DILOG D0130 and DU130 are µP based intelligent ½" 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, the 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 ½" 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" or 10½" 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
- CIPHER
- CONTROL DATA
- DIGI-DATA
- KENNEDY
- PERTEC
- TANDBERG DATA (IDT)
- WANGCO (PERKIN ELMER)
- TDX
- EMI (SE LABS)

To ensure 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 ½" 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.
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

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

The 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

内存可扩展模块

DR-144S. 这是行业唯一的16K RAM基板PDP 11/44模块，可提供大于256KB的容量。它提供了1.0 MB！仅一个单元负载。DLC（从DEC或独立供应商）的系统容量超过了256KB。（使用16K RAM而不是64K RAM，用于更高容量系统，利用了较低的价格/位16K RAM，与64K RAM相比。）

Datam Corp, Princeton Rd, Cranbury, NJ 08512.

可靠电源供应

DU 50 and DU 250. 所有你需要的OEM电源供应。50到250瓦。可靠性保证，有一年保修。单位可选择敞开或封闭。标准或可选功能包括过压保护，短路保护，电源故障保护，过温保护，OVP用于所有输出。每个单元采用EMI滤波器和 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.

灵活控制器

MODEL 5287. 控制器接口允许任何打印机（是否RS232或Centronics）到IBM 3274 Cluster Controller或IBM 3276 Cluster Controller。
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" Winchester, 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**

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**ZZZTT. ZZZTT. ZZZTT.**

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**ZZZTT. ZZZTT. ZZZTT.**

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**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.

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

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**eia cables**

- Standard and extended length cables.
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**Circle 25 on Reader Inquiry Card**

SEPTEMBER 1981 Digital Design 39
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
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- Busy/ready handshaking supported

Call our HOTLINE...
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High-Speed MAXIRAM Storage System

Offers superior performance, throughput and reliability!

Compatible with:
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- 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 26 on Reader Inquiry Card

COMPAT Showcase

Voice-Entry Device

AURICLE-I. 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.
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 switchable 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 16.6 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 65dB(A); 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.
**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

**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

(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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**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) 396-4774
Telex: 65-2337
(BT Smedley SNM)

Circle 30 on Reader Inquiry Card

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** TRANSMAGNETICS INC.**

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

Circle 29 on Reader Inquiry Card

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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 ±20 arc seconds.

TRANSMAGNETICS INC.

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

Circle 29 on Reader Inquiry Card

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**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) 396-4774
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

Locating 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. 6 FO. Amtek 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 keybd. $1450.
**DC-COMPAT**
Dasher emulation; 24 line x 80 char display; blink, dim, underline accents; standard printer output; 20 function keys; 15" screen and detachable 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.

**Television 950 Terminal w/ACS-WANG Interface**
Emulates Wang 2236 DE, including limited graphics. Protected fields, underlining, self-tests, titlable screen, 24 lines x 80 char reverse video dual intensity, blink, blank, detached selective keyboard; w/ switch selectable key click comm to Wang MVP, IVP, VP. $2236. Automated Control Systems Inc., Bellevue, WA.

**7216, 5215, 5217, 5217CT, 8000 Series CRTS**
Graphical display terminals, RGB color video monitor. 8 FO. Aydin Controls, Fr. Washington, PA.

**Micro 4400 and DM 3270**
DM 3270 is an IBM 3276 compat. terminal. Enhanced emulation. Micro 4400 is a µP 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. Braegem 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**

**CD100/L03**
VT100/52 compat video processor; 2 mini floppy's (12kB 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-11 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; 280 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, standalone 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. Cobol 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**

**MB 80/280**
Integrated Multibus microcomputer w/; 12" CRT, keyboard, backplane, control panel, and 8805 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 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' output pixels.

**HPR**
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. 3FO. Control Concepts Corp, Arlington, VA.

**CT11000**
3767/2740 compat display with printer. CRT: $2350; printer: $1650. Vend maint. 3FO. Custom Terminals Inc., Raleigh, NC.

**132-1D Display Terminals**
132-col. emulates DEC VT-100. Uses the Character (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 24mo. 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, Hazeline 1420, ADDS Regent 21, Datamedia 1521; 12" or 14" non-glare screen, tilt monitor, detachable keyboard. All include business graphics. Vend maint. 7FO. Datamedia Corp., Pennington, NJ.
### Display Terminals

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>VP/828</td>
<td>V/3000 and ANSI compat. 32K of display memory, 80 or 132 col. buffered printer port. complete video attributes. smooth scroll.</td>
<td>$7500.</td>
</tr>
<tr>
<td>32K Option</td>
<td>VP800/B and VP800/C only. 32K display memory.</td>
<td></td>
</tr>
<tr>
<td>GT-110</td>
<td>12&quot; ASCII RS-232C w/ printer port: programmable function keys; full editing capabilities; block mode; line &amp; block graphics; video attributes; foreign char sets.</td>
<td>$2295.</td>
</tr>
<tr>
<td>GT-400</td>
<td>12&quot; 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.</td>
<td>$1150.</td>
</tr>
<tr>
<td>G-1000 Interactive</td>
<td>Low cost, high resolution, monochrome raster scan graphics terminal; user programmable; RS-232C compat. with any host computer; selective erase; 1024x1024 resolution; detachable keyboard; 60 Hz flicker-free refresh; 28001 processor.</td>
<td>$11.15.</td>
</tr>
<tr>
<td>GCT-3000 Series</td>
<td>High resolution monochrome or color for displays (512x256 to 1280x1024 pixels); flicker-free 30, 40 or 60 frames/sec refresh; modular design, user programmable; video look-up table; ultra fast data transfers.</td>
<td>$11,000 and up. Vend Maint. 5 FO. Genisso Computers. Costa Mesa. CA and Silver Spring. MD.</td>
</tr>
<tr>
<td>H-89 Microcomputer</td>
<td>Microcomputer with built-in disk drive. 12&quot; 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. $1695 for H-89; $2,895 for assembled Z-89 w/48K RAM.</td>
<td></td>
</tr>
<tr>
<td>H-19 Video Display Terminal</td>
<td>Monochrome 12&quot; 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. Lehigh Co. Benton Harbor, MI.</td>
<td></td>
</tr>
<tr>
<td>ID-100</td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td>304-D</td>
<td>Comp w/ VT 52 CRT terminal. $2295; discounts up to 40%.</td>
<td></td>
</tr>
</tbody>
</table>

### Pricing

- $7500. for VP/828
- $2295. for GT-110
- $1150. for G-1000 Interactive
- $11,000 for GCT-3000 Series
- $1695 for H-89 Microcomputer
- $695 kit for H-19 Video Display Terminal
- $3095. for ID-100
- $4895. for ID-100VA
- $2295. for 304-D
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.

Finally: LSI-11 Compatible memories with ECC.
Display Terminals

GET-100
General Terminal emulator card.
Multibus.
Matrix Electronic Systems Ltd.,
Quebec.

Ampec Dialogue 80 CRT
Terminal
Intelligent CRT terminal with
detached keyboard, numeric keypad,
full SW support for DG Business
Basic. Wholesale. $1295. OEM
discharges.

Net-Pac 105
VT100 compaq LSI 11/12 or 11-
23 Q-Bus. Complete video en-
closure, 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. Com-
plete video enclosure. 80 col. ver-
sion, built in mini-floppy, mini-
Winchester options, 8 Quad (16
dual height) backplane. $2800.

WHIZZARD 7200 family
Raster and line 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 mod-
eled). $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 ad-
dressable, 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.

Alphanumeric LED Flat Panel
Smart Terminal, LD 2600
2.3" char height X16 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. Acces-
sores: 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 compaq graphics dis-
play terminal with detached key-
board and input cursor control.
Features: Tektronix Plot 10 SW
compat. 250 X 512 resolution, selec-
tive graphic erase, white-on
black or black-on-white display.
24 lines of 80 ASCII alphanumeric
characters, block and conversa-
tional mode options, protected
fields, full editing capability, and
many communication options.
$2590.

MOI Computer Products,
Mountain View, CA.

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-height). Parity baud rate,
derunning, 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
GV-1000
Ramek Corp.
Santa Clara, CA.

PTS-100
Display terminal system.

PT-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 µPs,
up to 256K byte memory, and mon-
ochrome or color display. Parallel
interface allows compat. with
over 12 major computer lines.

Graphic 8
Raster scan graphics system,
1024 resolution, up to 256 simul-
taneous colors, and dual bit mem-
ory for dynamic updating.

Sanders Assoc. Inc.
North, 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, AP.
GREEK, RAM char. standards:
3 rotations for labels; boldface,
doublewidth type; separate graph-
ics memory; light pen option,
printer dump port to DECwriter II
with Graphics II. $1200. 1 FO.
Selanq Corp.
Santa Clara, CA.

ST-103 CRT Terminal with
VT103 Expansion
CRTC/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 and associated
device.
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 sys-
tem. 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 in-
cludes A/N, graphics, image dis-
play, color display and image digi-
tizer. Whole models of DEC
PDP-11 and LSI-11 systems.
$15,500—$40,000. Vend Maint.
Spatial Data Systems.
Galeta, CA.

TAB 132/15
ANSI/DEC compat. terminal, 15" screen
132 col., 4 pages of mem-
ory, large characters and 8 soft
keys with over 100 operator as-
signable functions. $2450. Vend
Maint. 22 FO.

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.
Beaver, OR.

100
Super VT100-compat. w/extended
user-programmable function me-
memory, advanced video plus many
other programmable features.
$1705.

10-V52
Plug-in and code-compat w/ DEC
VT52. $1290.

10-MP
Plug-in and code-compat w/ Microdata Prism. $1260.

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

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

VC2100
VT100 compat. Multi µP-based.
serial typewriter style, detached keyboard, on-glass screen.
80/132 cols. display, 2 pg. memory. 8 independent attributes, selectable audible feedback.

VC414H
Hazeline 1510 compat. µP-based buffered editing data terminal.
Block mode, char. highlighting.

VC415 APL
µP-based w/ASCII and APL.

VC4404 (The Chat)
Conversational data terminal compat. w/Lear Siegler ADM-3A.
µP-based circuitry, modular design, char highlighting. 10 program function keys, detached keyboard, 14 key numeric pad.

Z-99 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. $2955 w/o drive.

Z-19 Video Display Terminal
Monochrome 12" display, 25 lines, 20 char per line: ASCII. DEC VT-52 compat.; 84-key keyboard including 12 numeric, 8 special function; RS-232 interface.

Zenith Data Systems.
Glenview, IL.

DM-9300 AQ Removable Media
Replacement for CDC 9766 disk drive, plug, media, and data commands.
Available for CDC 9883-91 type 20-lb. disk packs, 15,637 data tracks, 823 cylinders per track, inline heads. Vend Maint.

Model 900
10 I/O 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.

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 19.2 kbps.

Fedex Systems.
Ontario, 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, full screen mode, auto repeat. U/L case.

VC410
µP-based teletype compat w/buffered line editing and split screen.

VC4140 (The Chat)
Conversational data terminal compat. w/Lear Siegler ADM-3A.
µP-based circuitry, modular design, char highlighting. 10 program function keys, detached keyboard, 14 key numeric pad.

Volker-Craig, ltd.
Ontario, CA.

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. $2955 w/o drive.

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.

BASE Systems Corp.
Bedford, MA.

MD122 Mini Disk Drive Plus
Multibus Adaptor
6MB storage capability on 2 flexible Multibus adapters. Multibus drive adapters all supported. 2 ports of MD122 or MD210 series fixed drive. $4700.

Burroughs Corp. OEM Div.
Detroit, MI.

4600 Series 8" Floppy Disk Module
Single-sided, double-density; and, single-sided, double-sided, single- and dual-density. 4 FO.

California Computer Systems Inc.
Sunnyvale, CA.

DEC RX01, RX02
Floppy disk drives. Vend Maint. 1 FO.

California Datalase Systems & Financial Corp.
Anaheim, CA.

A506 & S500
8MB cartridge mini floppy. Qty 500 — $850. 1 FO.
Amlin 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.

California Computer Systems Inc.
Sunnyvale, CA.

DEC RX01, RX02
Floppy disk drives. Vend Maint. 1 FO.

California Datalase 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.

OF11
DEC Q-Bus compat. dual Shugart drives, RX01 or RX02 compat., write protect and unit selection switches, up to 4 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. P.L. 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.

Compart 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

DSD 470
Low-cost single-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

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 HyperDiagnoses built-in for stand-alone self-testing. DSD880D/8, $6995: 880/S/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 512 kB. RS-232 interface. $1200.

DUALDRIVE 800/00-800
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 MB formatted removable storage. DLV11 serial async 1/0 interface or the QLV11 quad serial 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 MB memory. DLV11 serial async I/O interface or the QLV11 quad serial async interface; and 2 5-1/4" double-sided, double-density mini floppy 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 MB—256 MB memory; DLV11 serial async 1/0 interface or the QLV11 quad serial async interface; and 2 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 MB — 256 MB memory; DLV11 serial async 1/0 interface or the QLV11 quad serial async interface; and 3 8" double-sided double-density floppy drives; 2.5MB mass storage. $10000-$14000. Vend Maint. General Robotics Corp., Hartford, WI.

H-27 8" Drive
Compant with DEC RX01 (PDP-11/033) and RXV7 (PDP 11/033) HW/SW. Storage to 500 GB. Compant 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. Iomega Corp., Ogden, UT.

950
Dual drive system consisting of Seagate Technology ST506 with Shugart SA440 700 KB floppy introduce controller and appropriate system interface.

LDOS
Lobo disk operating system for use with TRS-80. When used with LX30 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 (3.2MBBJ.

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.

3101 Shugart SA 390

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

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 system; LSI-11, RX01/RX02/RX03 compat. w/ controller (Qume Data Trak 8 Drives). $1745.

MD3003
Double-sided 8" floppy subsystem; 1.6 MB unformatted, Shugart SA801 Drives. $1995.

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
Dual 8" floppy 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. $7750.

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.

LSI-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. Periphere Computer System GmbH. Munich, Germany.

FD 650
8" double-headed flexible disk, $675 OEM qty 100.

FD 200/250
Packaging, Hardware, Backplanes, Enclosures

PM XS31
2 MB, rack-mount, dual floppy subsystem: 2 MB double-density, double-sided drives, µP-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 head, 96 tpi, 3 mb track-to-track, $625. qty: 100-249. Vend Maint, 10 FO.

PM-21
1 MB, rackmountable, dual floppy subsystem has two 512 KB double density floppy disk drives, µP-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

FWTO122, FWTO127
RX02-compat floppy storage w/ Winchester add-on capability. Low profile 5 1/4" enclosure allows direct connection to 14" WIN1400 24.6 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 mb 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, 48 tpi, 20 ms track-to-track. $360, 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, 10 FO.

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. $300 (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 RIM03, removable media, single or dual channel. $14000-$33000. Vend Maint, 14 FO.

Dec Systems 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 9 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
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.

Techtron Industries Inc., Rochester, NY.

ZBX-218A Floppy Disk Module
Small add-on module compat with SBC specifications. Allows SBC to directly address 4 MB of private, removable media. $480. Zendex Corp., Dublin, CA.

DEC

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. $115.

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 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 a 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 with larger CPU's.
8100 Multibus Chassis
16 gauge steel, 30AMP power supply, accommodates 9 boards, 19" rack mountable, 2 disk drives, switched AC outlet. $1280 in 50 piece.

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. $90-$208.

RTFM. 

Forethought Products.

Eugene, OR.

BA/X3 LSI-11 Base System Chassis
Includes: BP84 backplane and card cage with 8 quad (16 dual) high Q-Bus slots, power supply, and TBC Terminator/Bootstrap/Clock. $1650. $1072, qty 100.

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 async interface. $4250-$7250; OEM discounts.

Vend Main.

General Robotics Corp.

Hartford, WI.

High Frequency Series/Model 4-DE612-VHF
Compatible 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; DEET2; DEET4; DEET6
Models for popular 8 bit card cabs, gold-plated TPs allow TPs to hang at any angle, staggered contact points 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 compatible 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, compatible with DEC HW. Extended frequency range to 500MHz for high-speed logic, continuous ground plane, low noise cross-talk failures. $55-$139.

Low-Profile Series/2-DE6-SS, 3-DE6-SS
Compatible with DEC low-profile boards, mounted on ½" centers, handles all sizes of DIPs. Single-sided board permits stacking on ½" centers. Comes pinned or loaded with 16-pin DIP sockets, tantalum caps. $175-$453.

Socket Pinned Boards/4-8010A-TG and 4-801OB-TG
Intel Multibus comput 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
Useable 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.

Hybric Corp.

Littleton, MA.

Clear Signal Cables & Connectors
Interface virtually any HW with any peripheral. Innuc.
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 30 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.

W950 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.

W950 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
AC Coupler/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
AC Coupler/Cable Assembly
Use between 2nd and 3rd chassis in multiple chassis configuration. Not terminated on either end. Cable length 4'. LSI-11. $230.

MLSI-BCG
LSI-11 bus grant continuity card. LSI-11. $15.

MLSI-WWB-1 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.

W950 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 sockets: 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-11/3 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.

MLH-H964 Roll-Around System Cabinet

MLH-H961-A High-Boy System Cabinet
60" panel height. Removable side and back panels. Top mounted cooling fan and filter. Internally mounted A/C 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 backlight 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 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 size boards 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-TU58 System
Includes LSI-11/2 CPU, 2 async serial ports, line time clock, boot strap, 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-TU58 System
Similar to above, but contains BPA84 backplane. $4800.

MLSI-11-03-581X LSI-11/2-TU58 System
All features of MLSI-BA11-581X 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 of computer chassis. DG Nova & Eclipse. $248.

MDB-1022 Same as MDB-1021 except includes wirewrap pins 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
Contains 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 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 50 pin connector for flat ribbon cable connection. Board uses one 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 expanded chassis: +5 VDC ±5%, 18 A; -5 VDC ±5%, 1.2 A; +12 VDC ±5%, 2.4 A; -12 VDC ±5%, 1 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, ±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 point bus 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 connection with Intel 8010, 8020, 8030 boards. Also I/O modules directly compat with ICS-80. $100, PB24; $10.50 per module.

PB16P 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 points, 3 FO. Opto 22. Huntington Beach, CA.

ZIF-TENDER PDX-2, 4, 6
HPD-11 and LSI-11 compact 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 $19.50 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.
Periphery Computer Systems 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
1 slot aluminum card cage with wire wrapable 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. -1/2, -11/23 CPUS/associated devices. +2 mix/match floppy/8 Winchester/Cartridge tape 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.

PDG/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.

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-tri-ribbon. $10 & up. Vend Maint, 1 FO. TeleCom Products Inc. Westmont, IL.

WP-909
General purpose expansion chassis for PDQ-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 latch. Vend Maint. 8 FO.

Printronix P-300
300 lpm dot matrix printer, controller. Static eliminator. pedestal and paper latch. Vend Maint. 8 FO.

Centronics 704
150 CPS bidirectional dot matrix printer. Vend Maint. 4 FO. Advanced Digital Products, San Diego, CA.

Sprintex 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 to 1.75 to 150 - 200 lps. From $175 - $595. Also OEM printer mechanisms, controller boards and interface cables avail.

Alphacom, Campbell, CA.

DP 9500/950
150 CPS 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.
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 Exerciser® operating system, allowing MDOS to be booted and run on a Smoke Signal computer. Exerciser® 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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31336 Via Colinas, Westlake Village, CA 91362
(213) 889-9340

Circle 33 on Reader Inquiry Card
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-Interface W/ 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 — $2428.

**Diablo 630 RO Printer**
W/ ACS-Interface W/ printer. Metal or plastic wheel, 40 cps, 120 print wheel styles, internal diagnostics. Compatible w/ Wang 2200 MVP. LVP. VP and T computers. $3480.

**TI 820 RO Printer**
W/ ACS-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-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 available. $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 µP controlled chain printer and a single board embedded controller with interface cables. Produces hard copy output of 1000 lpm. Vend Maint. 55 FO.

**Bruegen 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 lpm). $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-coupl w/ 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 µP electronics. Choice of 48, 64. 96 and 128 col. set print bands. Vend Maint.

Centronics Data Computer Corp., Hudson, NH.

**Miniter 2101 Thermal Matrix**
160 cps, 80/132 col, 10 or 18.4 cpz 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, asynch up to 1200 lpm. 80 char/line, 64 char ASCII. Built-in test, optional plotting.

**DMC-4680**

**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 9×9 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 7×7 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 7×7 using 14-wire printhead: operator replaceable printhead: full year warranty on complete unit including printhead. $2650 OEM.

**M-2250**
Vend Maint. 20 FO.

**Data Products Corp., Woodland Hills, CA.**

**DLP11 Band Printer**
48, 64, 96 and 128 char set sizes: operator-changeable char sets. Self-adjusting char size and 10 or 15 cpi. Vend Maint. 4 FO. Data Systems Services, El Toro, CA.

**APP-20A2**

**APP-48**

**Series 2510 Printing Terminal**
150-200 cps; for 3-15 wide forms in up to 6 parts: 7×9 dot matrix: 110-190 baud: RS-232 serial 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 controllers/ interfaces and comm buffers. Supplier. 3 types of service. over 200 FO.

**Digital Associates Corp.**
Stanford, CT.

**MDP-125**

**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**

**Infoscribe Inc., Santa Ana, CA.**

**Dual-Mode 200**

**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 graphics up to 400 x 400. Qualifies 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. Standard interface is serial by char and parallel by bit, including full line buffer. Unit includes off-line built-in test capability. 9.5 in. x 14 in. x 191/2 in. Controllers: PDP-11/40L Hrm 1620/NTDS/RS232C- MIL-Std-188C. $14,500.

LP3036 Line Printer
Lightweight (12 lbs.), multifunction. µPen 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 in. wide, single or multi-part fanfold paper. 64 ASCII char set is std. 96 or 128 char optional. $5000.

TP2000 Thermal Line Printer

KPV-1100 Line Printer Interface

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 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". $3900-$32,900.

Zeta 5400
4-pen, 54" intelligent drum plotter with proprietary servo-motor drive system with linear actuator pen system. Zeta 21004 High speed electrostatic printer/plotter. Printing speed is 1000 lpm, plotting speed 120 in/min. with a resolution of 100 dots/in. $8500.

Zeta C63
On-line/off-line plotter work-station 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 Printer
7x9 dot matrix, 80 cpi, 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

Wiper Printer
150 Matrix Impact Line Printer
150-lpm 96-char ASCII sets, expandable to 160 char, unlimited font versatility, and full plotting and graphics capability.

CDC 9762
80MB storage module drive with removable media.

CDC 9766
300MB storage module drive with removable media.

CDC 9730-68
80MB mini-module drive with floor unit or rack mount option.

C200 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. FU. 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 electrophotographic 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. 33 FO. Tektronix Information Display Div., Beaverton, OR.

WX4675
6-pen plotter, flat bed, 5 cm/axis/ sec speed. $7800, 2 FO. Watanabe Instruments Corp., Costa Mesa, CA.

ZBX-349 Printer Interface
Small board module, plugs onto SBX connector of various Intel and ZenXed baseboards. Included cable is 8' long and connects at each 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. ZenXed Corp., Dublin, CA.
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 P1iam 3350 14", 33MB Winchester and 6400 bpi cartridge for backup. $695 Controler with SW. Warranty: RTFM.

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-diagnosics.
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.

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. Braeunin 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/$6500. Burroughs, Detroit, MI.

4610 and 4620
Winchester disk subsystems and expansion subsystems. 4610 is 10MB. 4620 is 20MB. Intelligent controller w/DMAX 800 mb transfer rates. Up to 4 drives any mix per controller. S100 Bus system compat. Uses real-time HW vectoring interrupt control. RTFM. 15 FO. California Computer Systems Inc, Sunnyvale, CA.

DEC Drives
RL01, RL02, RK05, RK06, RK07, RP04, RP05, RP06.

CDC Drives

HD 11/7
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 compact hard disk 14", 5440 top loader/200 tpi. 5MB fixed. 5 MB removable. Emulates DEC RKV1, $7995.

MD 80
Multibus compact 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.

QRMO3/QRMO5/URMO3/ URMO5

880-D/8L-11
Winchester/floppy subsystem for LSI-11. 7.8MB Winchester with 1MB floppy. Built in diagnostics, formatter. bootstrap. $6895.

880-D/30L-11

CM 5616
5¼" disk drive. 16MB unformatted. $2140. Computer Memories Inc., Chatsworth, CA.

20L, 11L, 5L
Comp 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 DRMO2/3
80MB for PDP-11. 6000 bpi. DEC SW transparent.

SMD DRMO4
300MB for Unibus-based PDP-11.

Fixed Media Drive DRMO7
600MB for PDP-11. SMD interface protocol. 25 ms access time. Optional head per track—1.92MB.

Mini Module DRMM BM-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
μP-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 hanging 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.

CDC 9766/CDC 9762
300 and 800MB disk drives are available for subsystem needs. Vend Maint. 2 FO.

Datam Inc.
Anaheim, CA.

Dicom 604
14" Winchester disk system to 130MB. Interfaces HP 21xk/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 9821A and 9833A. Capacity is 3MB. Operating temp. 0°C to 60°C. Shock and vibration resistant. $5000-$10,000.

Model 601-17
Intelligent bit-slicer 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-slicer 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-slicer 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. Capacities 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 NRZI serial data interface. Plug compat with HPT drives from DDC. Data Flux. Ancompc and Librascope. Capacity 5MB. 0°C to 60°C. Shock and vibration resistant. $5000-$10,000.

Model 601-10
Intel Multibus comp sys supports 8080/8085/8086 µP. 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. Complete ly 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. Complete ly sealed disk drive. 0°C to 60°C. Shock and vibration resistant. $5000-$10,000.

DCS/80-W
Complete Multibus system with 24MB Winchester disk and SW (8086 based). $12,500

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 async interface; and 1.85MB/min-Winchester drive and 1 2.5MB 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 async interface; and 1.85MB/min-Winchester drive and 1.25MB double-sided double-density floppy drive. $15,000 to $18,000. OEM discounts avail. Vend Maint.

Ampex DFR-996
DG emulating drive and controller; 67MB fixed, 12MB 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.

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 HP95 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.

Milestone Corp., Plainview, NY.

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.

NIMWS
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/off, boot, AC on/off. Accepts up to 12 Winchester 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 adapter interface between LSI-11 and Priam Winchester disk.

WIN-Q
Bus adapter 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 disk drive. $1980. OEM Qty 100. Vend Maint. 9 FO.


PM-RF11

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-DAS11/300
256MB disk pack subsystem for PDP-11.

PM-FS11G
14" Winchester disk subsystem for PDP-11s. Has single hex-wide PM DCI100 controller board, FD11G fixed-disk drive w/253MB formatted capacity. Compact with RP 11/C controller & SW.

Diskos 3350

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. 14.5/29.0580 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.
Mini Winchester Disk Drive/ 
   TM 600 
2 & 3 platter Models: 254 tpi: un- 
   formatted 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. 
   Tectron Inc., 
   Huntington Beach, CA.

Series 9000 Cartridge Disk 
   Drive 
20MB capacity, 10MB fixed + 
   10MB removable. Top loading. 
   digital controls servo electronics. 
   µP controlled, brushless DC 
   motor crystal controlled sectoring 
   with switch selectable sector op- 
   tion 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 as- 
   sociated power supplies. The 
   completely self-contained XD1000 
   uses Xylogics $30, 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 MICROS Basic to DG Busi- 
   ness 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 compact with DEC, etc. for 
   terminals, add-in/add-on mem- 
   ory, 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 con- 
   trollers — 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.

LXI 11/2 or LXI 11/23 
Systems 
Configured to customer specifica- 
   tions, completely tested; quick 
   delivery, low cost. 
   Indec Computer Systems. 
   Sunnyvale, CA.

DEC Service 
Terminals, CRTs, printers. 
   David Lee. 
   Van Nux, CA.

Magnetic Tape Heads 
Reconditions, rebuilds, or other- 
   wise 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 replace- 
   ment; 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 program- 
   ming 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 develop- 
   ment, 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 de- 
   veloped 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.

RPQ3, RP04, RP05, RP06, 
   RM02, RM03 
Critical component recondition- 
   ing. Disk heads, spindles and 
   motor reconditioning available. 
   All service backed with warran- 
   ties and guaranteed turnaround 
   within 45 days. 
   Trans Datacorp. 
   Belmont, CA.

RPQ3, RP04, RP05, RP06 
Disk Drives 
Third party repair facility, printed 
   circuit assemblies, electronic sub- 
   assemblies. Phone for quotations. 
   UniTrance Inc. 
   Santa Clara, CA.
Special I/Os

Dual I/O 10039
General purpose interface between PDP-11 and 2 user peripherals. Replaces 2 DEC DR11-C unit, $950. Vend Maint, 1 FO.
Able Computer, Irvine, CA.

1616/OL, 1616/OIO
16 lines of optically isolated inputs and outputs. 1616/OLF: $345; 1616/OIO: $275.

1632TTL, 1664TTL, 1664ATT
32 or 64 lines of programmable TTL compat I/O lines. 1632TTL: $275, 1664TTL: $350, 1664ATT: $350.

1750
Dual port serial I/O: RS232 and current loop. $395. Vend Maint, 47 FO.
ADAC Corp, Woburn, MA.

8911 Programmable IBM Interface Module
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 output, 4-20mA, 4-output channels; 1-bit resol: ±0.0256% acc: 0.0 μA resolution; $1550.

MP1216
Analog input for LSI-11. 16 DIG/32 SE input channels: 1-bit resol: ±0.025% acc: 0.0 μA; ±10V to ±10mV range. $550.

MP1216-PGA
Analog input for LSI-11. 16 DIG/32 SE input channels: 1-bit resol: ±0.025% acc: 0.0 μA; ±10V to ±10mV range. $675.
Burr Brown Industrial Systems Products, Tucson, AZ.

2830
6 channel serial I/O module. Asyn RS 232C channels with programmable control for each channel. $100 Bus system compat. Uses real time vectored interrupt control. Includes 6, 30" internal cables. $600.

2710
4 channel serial I/O board. Asyn channel with independent program control. Fully buffered I/O, ROM option with phantom enable capability. $100 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. $100 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 handshaking using jumpers, 7-bit status register, fully buffered, provision for 2K ROM with phantom enable. $100 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 × 128 pixels by 8 bits of intensity resolution/frame. $1500.

MIP-3/A Data Spooler
Input processor includes 16-channel, 1-bit, 100K Hz ADC, integral 16-bit bid slice minicomputer, and 20K word dual port, dual buffer memory. $2000.

MDP-3 Display Processor
Programmable image processor drives color RGB monitor: 64K word image memory plus separate graphic/alphabetic 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.

DT 1711 Series
DEC Unibus. Analog I/O systems for Unibus processors.

DT 1715 Series
Multibus. Analog I/O systems for Intel SBC-80 and National BLC-80 Multibus.

DT 3362 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. $500 — $2000. RTFM, 1 FO.

ST warranty.
Data Translation Inc., Marlboro, MA.

ST-711/ST-732
Intel Multibus compat. 32SE (16 Dit) A/D channels with 12-bit resolution: IBM X1, 2, 4, 8, 10, 12, or 16-bit start trigger interrupts; pacer clock, DC-DC converter; systems manual & diagnostis included. $732: all above plus 2 A/D channels (12-bit) with bit clock loop outputs; 23,000 samples/sec. ST-711 pin-for-pin replacement for ISBC-711; ST-732 pin-for-pin for ISBC-712. ST-711, $625; ST-732, $788.

ST-800, ST-800-ADX
Intel Multibus compat. ST-800: 12SE or 16 Dit A/D channels; 12 bit resolution: 20,000 samples/sec; optional DMA (3600 samples/sec with DMA); scan clock. ST-800-ADX: expander board. 32SE, 32 Dit, 48 SE or 48 Dit channels available: 256 A/D channels max including ST-800. Manual & diagnostis included with ST-800 & ST-800-ADX. ST-800-16S (16 SE A/D channels), $687; ST-800-ADX32S (32 A/D channels, expander), $1300.

ST-800-DAB, ST-800-DAX8
Intel Multibus compat. ST-800-DAB: 8 SE or 4 Dit A/D channels; 12-bit resolution: scan clock. ST800-DAX8: 8 SE or 4 Dit A/D channels, expander card. ST-800-DAX8, $860; ST-800-DAX8, $825.

ST-6800DA
Comapt with Motorola M-6800 Series EXORciser. 4 or 8 Dit A/D channels, 12-bit resolution; 12-bit output; optional DC-DC convert- er: manual and diagnostics included. From $546.

ST-6800 & ST-6800ADX

ST-LS1-DA
Compapt with DEC LSI-11. Halfquad 4-channel D/A board; 12-bit output; optional DC-DC convert- er. ST-LS1-DA, $524 (w/o DC- DC), $590 (w/DC-DC).

ST-LS12, ST-LS12-ADX, ST-LS12-DMA

16-bit words; EOC & end of cycle interrupts, 2 vectors, 50 kHz transfer rate. ST-LSI2, $825; ST-LSI2-ADX, $376; ST-LSI2-DMA, $368.

ST-LS1, ST-LS1-ADX
Compapt with DEC LSI-11. ST-LS1: full quad: 32S/16D A/D channnels, 2 D/A channels, pacer clock: 12 bit resolution, A/D and D/A sections; current loop out- puts; optional PGA or instrumentation Amp. ST-LS1-ADX: half quad slave A/D expander: 32S or 16D channels. ST-LS1, from $734; ST-LSI-ADX, $326.

ST-LSI-RLY
Compapt with ST-LSI and ST-LS12. 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 start trigger interrupts; DC-DC convert- er: includes manual and diagnostic. $695.

PDAS-250/PDS-32
Computer data acquisition/distribution syst. Up to 256S (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 convertor; voltage or 4-20 mA current outputs selectable can be used with RMX-80 SW. Includes systems manual and diagnostic. $995.

ST-711RLYD and ST-711RLY16D
Intel Multibus compat. 8 or 16 relay-isolated differential A/D channels; 126 dB CMRR, 250V RMS isolation: 12-bit resolution; PGA (X1, 2, 5, 10); EOC, EOI, ext start trigger interrupts; pacer clock: systems manual; diagnostic included. 30 samples/sec. ST-711RLYD, $683; ST-711RLY16D, $1045.

System 256/DDS-32
Computer data acquisition/distribution system. Up to 256S (128D) A/D, 32 D/A channels; A/D section 12 bits: 250,000 samples/sec; D/A section — 8, 10, 12, or 14 bit; 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 comput digital-to-sync and sync-to-digital interface.

DCS488
Multibus interface for IEEE 488 (GPIB).

Distributed Computer Systems, Waltham, MA.
**Special I/Os**

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<tr>
<th>Model</th>
<th>Description</th>
<th>Price</th>
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<tbody>
<tr>
<td>MDB-TA528</td>
<td>General purpose digital I/O interface with external bus control for PDP-11. Includes bus-to-bus interface up to 100' on 16-bit device and receivers and buffered input and output. Consisting of input buffer (16-bit RO), output buffer (16-bit RW), and control status register (16-bit RW).</td>
<td>$615.</td>
</tr>
<tr>
<td>MDB-KW11-P</td>
<td>Programmable real-time clock for PDP-11. Provides 4 clock rates, program selectable (external, 50 Hz, 10kHz, 1kHz). Includes bi-directional 16-bit bus interface and watchdog timer.</td>
<td>$795.</td>
</tr>
<tr>
<td>MDB-DR11B</td>
<td>Direct memory access module for PDP-11. Completes with DEC DR11-B on a single quad module and includes connector for independent quad module and connector for independent external bootstrap control and watchdog timer.</td>
<td>$1195.</td>
</tr>
<tr>
<td>MDB-11B</td>
<td>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 80 connectors each for cable to peripheral devices or to wire-wrap modules for expansion of user logic.</td>
<td>$1195.</td>
</tr>
<tr>
<td>MDB-11C</td>
<td>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 configuration.</td>
<td>$1195.</td>
</tr>
<tr>
<td>MDB-1710</td>
<td>General purpose parallel bus foundation module for PDP-11 with all logic for bus interface and interrupt service. Provides bi-directional exchange of 16-bit data from PDP-11 end external device.</td>
<td>$550.</td>
</tr>
<tr>
<td>MDB-1710-01</td>
<td>General purpose parallel bus foundation module as 1710 but with sockets inserted in 40 positions.</td>
<td>$445.</td>
</tr>
<tr>
<td>MLSI-DRV11-P</td>
<td>General purpose bus foundation module for PDP-11. Provides buffered I/O ports for serial and parallel I/O. Also available for serial I/O port, 48 parallel I/O lines.</td>
<td>$1450.</td>
</tr>
<tr>
<td>MDB-48-013-01-01-WW1</td>
<td>Universal logic module for P-E has a basic 16-bit I/O module which includes device addressing and handshake logic: 8 status lines, interrupt control including standard interrupt arm/disarm and enable/disable control.</td>
<td>$500.</td>
</tr>
<tr>
<td>MDB-48-013H-01</td>
<td>Universal logic half module for P-E provides basic bus interface and handshake logic.</td>
<td>$495.</td>
</tr>
<tr>
<td>MDB-48-013H-02</td>
<td>Universal logic half module for P-E provides basic bus interface and handshake logic.</td>
<td>$495.</td>
</tr>
</tbody>
</table>

**Power I/O**

<table>
<thead>
<tr>
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<tr>
<td>PB-24</td>
<td>PB 24 mounting rack for Opto 22 I/O modules. Direct connect with Intel 8600.</td>
<td>$50.</td>
</tr>
<tr>
<td>PB-16P1</td>
<td>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.</td>
<td>$275.</td>
</tr>
</tbody>
</table>

**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.
NOW . . .
THE BEST OF BOTH WORLDS

First...
think of me as a MEMORY SYSTEM
because I'm the first and only 5½" Mikro Winchester Disk System with up to 32 heads that provide 8 millisecond access times (Bubble Memory Performance).
- Entire capacity of minifloppy under the heads at all times (400,000 byte cylinders)
- Up to 20 cylinders available, 5 ms cylinder/cylinder
- 2 inch overall height (min.)
- Up to 6.25 megabit transfer rate

Now...
think of me as a DISK SYSTEM
because I have the convenience of a removable cartridge and fit in the space of a 5½" floppy:
- Up to 8 megabyte capacity
- 5 models with 2, 4, 6, or 8 megabyte capacity
- Shugart/Seagate compatible interface (optional)
  - Light Weight / Low Power / Small Size

It's a New World in Disk Technology
**Interface SA4008**

All manufacturers emulate the Michigan City, IN. TEAC Inc., Ohio Woburn, 256 kbytes per drive:

**Hardware and Software**

Z80 processor: $750 Controller with DP-8000 Module/S3D Interface. $2900 systems.

Controller to integrate systems:

RT-11 compatible, intelligible male voice.

**Software**

Module/S3D Software, $2900

**Controller**

Controller only.

**Software**

Available for 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.

**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 Magnetics, Valencia, CA.

**Rigid Disk Cartridges**

Available for DEC RL01, RK01, RK02, RK03, R005, RK08E, RK05A; also for Data General 6045, 6046, 6047, 6048, 6095. Diablo 41, 43, 44, 6070, 4047A, B, D420, 27, 400. Call for current prices.

American National Supply Co. ANSCO, Gardena, CA.

**Magnetic Tape System TFS 712**

45, 75, or 125 ips dual density tape drive plus TFC 712 controller.

**Magnetic Tape System TFS 812**

45, 75, or 125 ips dual density tape drive plus TFC 812 controller.

**Magnetic Tape System TFS 822**

45, 75, or 125 ips dual density tape drive plus TFC 822 controller.

**GCR Mag Tape System TFS 706**

6280 GCR/1600 PE/800 NRZI bpi mag tape system. Compat with DG's Nova/Eclipse computers.

**DTU 77/100/125**

100/125 ips tape drive. Dual PE/NRZI format. dual GCR/PE format. PDP-11 comp. 75.

**DTU 45**

45 ips tape drive. Full PDP-11 compat. std interfaces, rack mountable. dual mode PE/NRZI. Vend Maint from CDC/GE & DEC. CPO.

**Data Systems Services, El Toro, CA.**

**D451**

1/2" mag tape transport. 800/1600 45, 85. $4550 end user dual density. Vend Maint. 2 FO.

**Datam Intc.**

Anaheim, CA.

**DICOM 374**

Cassette system — micro controlled. Interfaces most mins 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; $1255, $1980, $1565; RTFM.

**Series 40 Mag Tape Systems**

Transports with embedded formatters and simple board plug-in interfaces for PDP-11. NOVA/Eclipse and HP1200/21MX computers. Transport reel sizes 7", 8-1/2" and 10-1/2" speeds 12-1/2 to 75 ips; formats NRZI, PE, NRZI/PE; densities 800, 1600 bpi for 9-track and 200, 556 and 800 for 7-track. 4870-$775, RTFM 1 FO. Digi-Data Corp. Jessup, MD.

**DCS/3 MCCR-1**

Multibus based system for 3M cartridge tape drive.

**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
density, IBM, ECMA and ANSI compat. Up to 24 kB of I/O memory. Transfer rate to 100 k/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. Compats HP 3000 series. Requires no SW. Dual density. 45 to 125 ips. Up to 200 k/sec transfer rate.

**Series Eight**
IEEE-488 microstreamer recording system. 100 ips. 1600 bpi. Disk backup. I/O buffer storage up to 24 k. Transfer rate over 150 k/sec.

**Series Ten**
HP-IB mag tape recording system. Compats with HP 1000L. Requires no SW. Single and dual density. 25 to 125 ips. Dylon Corp. San Diego, CA.

**STR-Link II**
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 minicassette 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 II**
Self contained, µP-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, San Diego, CA.

**Mark III, Mark V Cartridges**
2.5-10MB cartridges suitable for use on virtually all drives in this range — special sectoring and subformatting 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") digital cartridge data cassette recorder. 30-ips tape speed with 90-ips recording/rewind. 1600 bpi data transfer rate. CR300 utilizes a completely sealed, interchangeable SUPER PAC cartridge.

**CR 600 Mag Tape Cartridge Recorder**
Reel-to-reel cartridge recorder offers cartridge operation and reel interchangeability with IBM compat tape transports. Utilizing 7" reels of 600' of storage, supply reel within cartridge ready removed for loading & processing on any IBM compag mag tape unit. Processes data at 25-ips tape speed in IBM compag 556/800-bpi NRZI format. Rewind at 50-ips. $11,300.

**AT-1161 Tape Transport**

**T1000**
Vacuum col tape drive. 75-125 ips. $7565 OEM qty 100.

**T7000**
Tape transport. 7" tape. 12.5-18.75 ips. $25,050 OEM qty 100.

**T8000**
Tape transport. 10" tape. 12.5-25 ips. $35,250 OEM qty 100.

**T9000**
Vacuum col tape drive. 37.5-75 ips. $42,425 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. Compats w/all DEC SW diagnostics.

**SYST-13V**
Line of disc cartridge micro systems: 128 kB MOS memory.

**PM-DSA 11/32**
Cartridge disk subsystem contains DC1100 controller with PMMD 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.

**Dynamax Peripherals System.**
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 and IBM and SW. $1425. RTFM.

**Remtech Inc.**
Huntsville, AL.

**Architect**
14 MB cartridge tape backup for all Perkin-Elmer 16- and 32-bit minicomputers, and Tektronix 4081 graphics systems; half-card size. 1/4" cartridge tape drive. $950. $1395 with formatter. Vend Maint. 2 FO. System Industries, Sunnyvale, CA.

**M720 1/4"**
Cartridge tape drive. $950. $1395 with formatter. Vend Maint. 2 FO. System Industries, Sunnyvale, CA.

**DEC Memory Tester Model T-119**
Semicontroller/circuit memory board tester. Stand-alone, bench-top tester. Features avail for LSI-11 and PDP-11 series memories. $13,400. RTFM.

**Concept Development Inc.**
Rochester, NY.

**5017/8401**
Rugged high-performance moving head drive 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**

<table>
<thead>
<tr>
<th>Equipment Type</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Floppy drive</td>
<td>$200. Vend Maint.</td>
<td></td>
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<tr>
<td>Memory testing</td>
<td>$1425. RTFM.</td>
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<td>Processor test</td>
<td>$36.600</td>
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<td>Disk cartridge drive</td>
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<td>Magnetic tape drive</td>
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<tr>
<td>Magnetic tape reader</td>
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<tr>
<td>Magnetic tape writer</td>
<td>$1400</td>
<td></td>
</tr>
<tr>
<td>Magnetic tape controller</td>
<td>$1500</td>
<td></td>
</tr>
</tbody>
</table>

**Alloy Engineering Co., Inc.**
New York, NY.

**Unibus Cable Tester OST11-A**
Unibus cable tester allows convenient verification of continuity of all Unibus lines simultaneously. $195. 30 day warranty. RTFM.

**Digital Design**
SEPTEMBER 1981
**Test Equipment/Instrumentation**

- **µM**
  - In-circuit emulation for 8080, 8085, Z-80 and 6800 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, 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 compats. $12,000 - $17,000. Vend Maint. 10 PO.

- **Intech Instruments Div.,**
  - Santa Clara, CA.

- **DGEB-01**
  - Extender board for DG. Used to extend interface board from computer chassis for trouble shooting. $193.

- **MIB-49-EB**
  - 18" extender board for IBM Series 1 that allows easy debugging of circuitry developed on MBD wire wrap boards, or can be used for trouble shooting of Series/1 boards. $395. RTFM. 1 yr. warranty. MBD Systems Inc, Orange, CA.

- **IEEE-488 Bus Tester (GPUB=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 device and interrupt vector addresses. Word or byte transfers. $240.

- **NDRV11-B Parallel DMA Interface**
  - SW compacts 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**

- **Pacific Digital Systems,**
  - Sunnyvale, CA.

- **GM Series Systems — GMP/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 comp. $1200.

- **F8/3870/72 ASM**

- **8051 ASM**
  - Cross-assembler, relocatable. macro. 8051. ISIS-11 comp. $1200.

- **ASM 1802**
  - Cross-assembler, relocatable. macro. 1802. ISIS-11 comp. $995.

- **ASMSZ8000/ASMSZ8K**

- **ASMS6500/01/02**
  - Cross-assembler, relocatable. macro. 6500/01/02. ISIS-11 comp. $995.

- **6805 ASM**
  - Cross-assembler, relocatable. macro. 6805. ISIS-11 comp. $1200.

- **800ASM**
  - Cross-assembler, relocatable. macro. NSC 800. ISIS-11 comp. $995.

- **Z8ASM**

- **Z80 Spice (In-circuit Emulator)**
  - Z80 microcomputer emulator for Intel's development system. Includes Spice operating system and ISIS-11 comp. Z80 assembly.

- **Z80A8**
  - $4800: Z80AMB $5590 (includes 64K memory).

- **Z80ASM**
  - Cross-assembler, relocatable. macro. Z80. ISIS-11 comp. $950. RTFM.

- **Relational Memory Systems/RELSAM,**
  - 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. Spectrogram Corp, 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.

- **Step Engineering,**
  - Sunnyvale, CA.

- **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 PO.

- **NDRV-11-B**
  - Performs ANSI specified tests. µP controlled. Adjustable thresholds. 3 operating modes. Used for production or evaluation.

- **DX-1000 Disk Drive Tester**
  - Portable designed to evaluate and exercise IBM type 2315-5440 disk drives manufactured by many companies.

- **FX-500 Floppy Disk Drive Tester**
  - Programmable to serve all standard drives including GSI-110, Shugart 800/801/900/301, Wangco 760/765, Calcomp 142M/143M, Pertec FDX5/FD400, Memorex 550/552 and similar drives.

- **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 Kenyon, Datum, Cipher, Pertec, P-E and other dual-mode formatters. $1795. RTFM.

- **Wilson Laboratories Inc**, Orange, CA.
Emuloder (10047) ODT/Bootstrap Loader
Provides fixed console emulator (ODT) + bootstrap loaders replacing DEC BM873, M9301, M9312 boot, terminator, console emulator. $750.

Qvarter (10067) Bus Converter
Permits LSI-11, LSI-11/23 or PDP 11/03 to access Unibus comp. controllers + memories, OR permits PDP-11 Unibus systems to access LSI-11 comp. controllers + memories. $825.

Interlink/LSI (10049) Buslink Q-Bus version of DEC DR11-B DMA interface for LSI's. $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 leads 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, -11/3 comp. $1195.

1616/MIC
16-line multiple interrupt encoder LSI-11, -11/2, -11/3 comp. $495.

1616 CCI & 1632 HCO

1604/OP & 1604/POC
4-channel pulse counter. 4-channel pulse generator. LSI-11/2, -11/3 comp. 1604/OP: $395; 1604/POC: $520.

1023AD
16-channel MUX. 12-bit ADC with LSI-11/23 comp. interrupt. $495.

1025AD
16-channel MUX. 12-bit ADC with LSI-11/23 comp. interrupt. $495.

1025K
16-channel MUX. 12-bit ADC with LSI-11/23 comp. interrupt. $495.

ZT7002
Reed relay cards for STD Bus. 8 dry or mercury-wetted relays. $195 - $360. Vend Maint. ZiaTech Corp. San Luis Obispo, CA.

ZT7502
Reed relay cards for STD Bus. 8 dry or mercury-wetted relays. $195 - $360. Vend Maint. ZiaTech Corp. San Luis Obispo, CA.

### Other

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**1604/OP & 1604/POC**
4-channel pulse counter. 4-channel pulse generator. LSI-11/2, -11/3 comp. 1604/OP: $395; 1604/POC: $520.

**1023AD**
16-channel MUX. 12-bit ADC with LSI-11/23 comp. interrupt. $495.
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 available. 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. DLVIIJ 4-channel port. 75 ips tape drive. Housed in a 5' cabinet. 80MB SMD disk drive on pedestal. Vend Maint, 55 FO.

Turnkey Distributors

PPS 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 Bubbli-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. Bubbli-Tec Div., Dublin, CA.

Processors, Concentrators

LSI-X.25 front end processor. LSI-X.25 intelligent host port concentrator. IC-$6750 to $13,950. F.E.P $16,000. Sell, Service, 3 FO.

DEQ DEC Products

D2-11 async MUX, DH11 async, MUX, DC-11 interface, DH11 backplanes. MS-11 memory, MK11 memory, RM05 disk drive controllers, TW77 tape drives. Wholesale, Vend Maint, 2 FO.

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.

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 and complete transparency. TC-3 local: $3200; TC-3 4-line remote: $1950; TC-3 8-line remote: $2650.

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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 and complete transparency. TC-3 local: $3200; TC-3 4-line remote: $1950; TC-3 8-line remote: $2650.

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 uses. Buses 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 OSR11-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 lines. $350.

R04 Chassis Assembly
7" LSI-11 system chassis with 8 quad-slot backplane, power supply, dual TUSBs 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 x 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


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/RK bootstrap PROMs for LSI-11 systems. Direct insertion into MXVII-A compat module. $90/set. Direct mail replacement of failing components, 1 FO.

DICE Systems Inc. Nashua, NH.

401 Multi Processor

Dicom Industries Inc., Sunnyvale, CA.

DSC-4 Microcomputer System
An Intel Multibus compat multi-user Z80A-based µP 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. $640.

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
Batter-supported calendar clock for LSI-I Q-Bus. Dual-width board maintains hour, minute, second, month, day, year, day of week. $250. Vend Maint.

Digital Pathways Inc. Culver City, CA.

DCS 86/16 SBC
16-bit using Intel 8086 µP.

DCS 8010A SBC
Compat with Intel 8010A. $425. Vend Maint.

Distributed Computer Systems Waltham, MA.

Orion µP 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 floppy 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.

Compal Products
Complete DEC/DG PC supplier. Vend Maint, 12 FO.

EMC*, Newton, MA.

SECS 2

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 volt operation. 80 char x 25 line version — $265; 64 char x 28 line version — $249.

Memory Mate

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 break point 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" x 10" x 21/2" tall; powers entire AIM-Mate system including AIM 65; provides 5V @ 3.5A; 12V @ 0.40A, 24V @ 0.4A 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

Forward Technologies Inc., San Jose, CA.

QLV11
LSI-11 quad serial sync/async I/O interface. Furnishes 4 DVL11-E compat serial ports with full modem control. $800; $320 qty 300.

BP94
LSI-11 Q-Bus backplane and cardcage, accommodates 8 quad height or 16 dual height modules. $350; $227 qty 100.

TBC
LSI-11 terminator/boost/clock. $350; $227 qty 100.

DRV11
LSI-11 general purpose parallel I/O interface, HW/SW compat with DEC DRV11. $250; $162 qty 100.

DVL11
LSI-11 serial async I/O interface. HW/SW compat with DEC DVL11. $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.

GBNCS-58 Terminal Switchers
Compat with WANG, H/P, IBM and DEC. Will switch one terminal between 3 or more CPUs or modems. The GBNCS-58RC can be operated via remote control. $139 for GBNCS-58; $298 for GBNCS-58RC. 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 µP 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.

Peripicon Series 500 Image Digitizer System
Includes controller up to 6 image digitizing cameras. (Peripicon 521, 32 x 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.
COMPAT '81
The Computer Compatible Directory
Part Two

Other

Videoprint 3000/Videoprint 5000
Photographic hard-copy device. Prints, slides or transparencies. Accepts RGB or NTSC signals. Approx $60/hardy copy. $4000-5000.
Image Resource, Westlake Village, CA.

Series 1000 Phototypesetter Interface

Compal

72 Digital Design SEPTEMBER 1981

MBC-86/12 CPU
16-bit Multibus CPU, 8086 based up to 128K on-board dual-port RAM. $1995.
Matrix Electronic Systems Ltd, TM, Quebec.

MDB-MDU11
High speed sync programmed controlled data serial interface for PDP-11. Complete modem control, sync or asynchronous communications modes, either half or full duplex. Provides all features of DEC DU-11 plus speeds up to 650 bytes/sec. $1775.

MLSL-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.

MLSL-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.

MLSL-DRL1-B DMA System Module
Compaq 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.

MLSL-DRV11-B DMA System Module
Compaq with DEC 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. $670.

MLSI-TEV-003 Bus Terminator
Module with 120-ohm termination. $110.

MLSI-11/03-LHXB 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-LHXB except slots 6 and 7 in columns C and D are wired to accept the RL01 or RL02 disk controller. $3580.

MLSI-11/03-LKXB LSI-11/2 system same as MLSI-11/03-LHXB except includes 64 kB RAM and 4 async serial ports. $3680.

MLSI-11/03-LKXB LSI-11/2 system same as MLSI-11/03-LHXB 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 K of RAM, 4 async serial ports, bootstrap, line time clock and bus termination. $6080.

MM6 16-Bit SBC
Memory management module for Microbor 8086 SBC for running XENIX operating system or other memory management requirements. $495. Vend Maint.

Microbor 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.

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MSC 8004/8007 SBC
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Miomolithic Systems, Englewood, CO.

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PBV-102 Multifunction Module
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4400 Font Digitizing Module Automatic front 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.


PCM-12 Omega Complete TTL µC system. Runs all PDP-8 SW. Typical system $2500.

PPS-12 Complete all-CMOS µC PDP-8 SW comp. Runs all PDP-8 SW. For battery and solar-power applications. Typically $950. Pacific Cyber Metrics (PCM), 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. Plesey’s Micro 1 & Micro II.

SYST-34 Line of mini systems offers sophisticated computing applications.


Plessey Peripheral Systems, 1691 Browning, Irvine, CA.

SYST-1V LSI-11/2 systems.

SYST-2VX General purpose µC 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 comp. 200MB per system when extended to full capacity of 8 drives.

PM-DQA 11/80 Disk subsystem consists of DC100 controller board (fully SW transparent to DEC SW) & DD 11/80 disk drive. Single-board controller 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 O’s on the Unibus, a more probable failure than all 1’s. Insures memory integrity. Plessey Peripheral Systems, 17466 Daimier, 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. Compact with any computer via DMA interface and any IEEE-488/GPIB std interface. Quantex Corp., Sunnyvale, CA.

90MP-SBC Z80A CPU, 4MHZ with floppy disk controller interface under DMA control to support up to four 51/4" or 8" single/double density drives. Avail with 16 kB dynamic RAM to 64kB 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.

PCL 2200 Series Pseudo Color Image 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, alphanumeric, 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.


RDS-VT 23 Microcomputer System General purposes µC 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 compatible.

RSI 16 Multiple-process system features multi-user capability. Uses DEC Q-Bus std DEC comp peripherals. Up to 16 independent processors. Mix a variety of CPUs in same system. Supports any DEC LSI-11 or 68000.
## 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.

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<td>Able Computer</td>
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<td>Advanced Business</td>
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<td>Advanced Computer Systems</td>
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<td>American National Supply Corp.</td>
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<td>Ampex Corp.</td>
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<td>Ampex Corporation</td>
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<td>Amtek Business Machines Inc.</td>
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<td>AMC Software Systems</td>
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<td>Analogon Corp.</td>
<td>Data Acquisition &amp; Conversion Products Aluburn Rd. Wakefield, MA 01800</td>
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**Description/specs**

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Whom should our editors contact?

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first, some basics

One of the very few methods of exchanging data (files, source code, object code, etc.) between diverse µPs 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 µCs. Data transmission over phone lines can be independent of both the µPs 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 µC 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 DAs: 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.

Originating/Answering: Two modes of operation for a modem. In the originating mode, the modem will utilize one set of frequencies to transmit data and another set of frequencies to receive data. In the answering 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 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 bandpass 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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Circle 36 on Reader Inquiry Card

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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 CHI 262 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 by the line side by a 74123 one shot and 7447 D-latch.

The RC network on the line side by a 74123 one shot 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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Designers' Notebook

Dealers

New DEC-compatible processor link improves system efficiency.

The PPL-1 Peripheral Processor Link is a unique shared memory interface between any two Q-bus (LSI-11) and/or Unibus (PDP-11)-based DEC CPU's. Two quad boards and a connecting cable link the peripheral unit with the host. Up to 32KB of memory may be accessed by the peripheral processor at any location within the host. 16 vectored interrupts (8 from each direction) provide necessary hardware for protocol implementation. Multiple PPL-1's provide capability for parallel processing.

Digital Design SEPTEMBER 1981

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 elec-

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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.

by the Engineering Staff

Amp. Inc., Harrisburg, PA 17105.
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