VOLUME 11, NO. 8

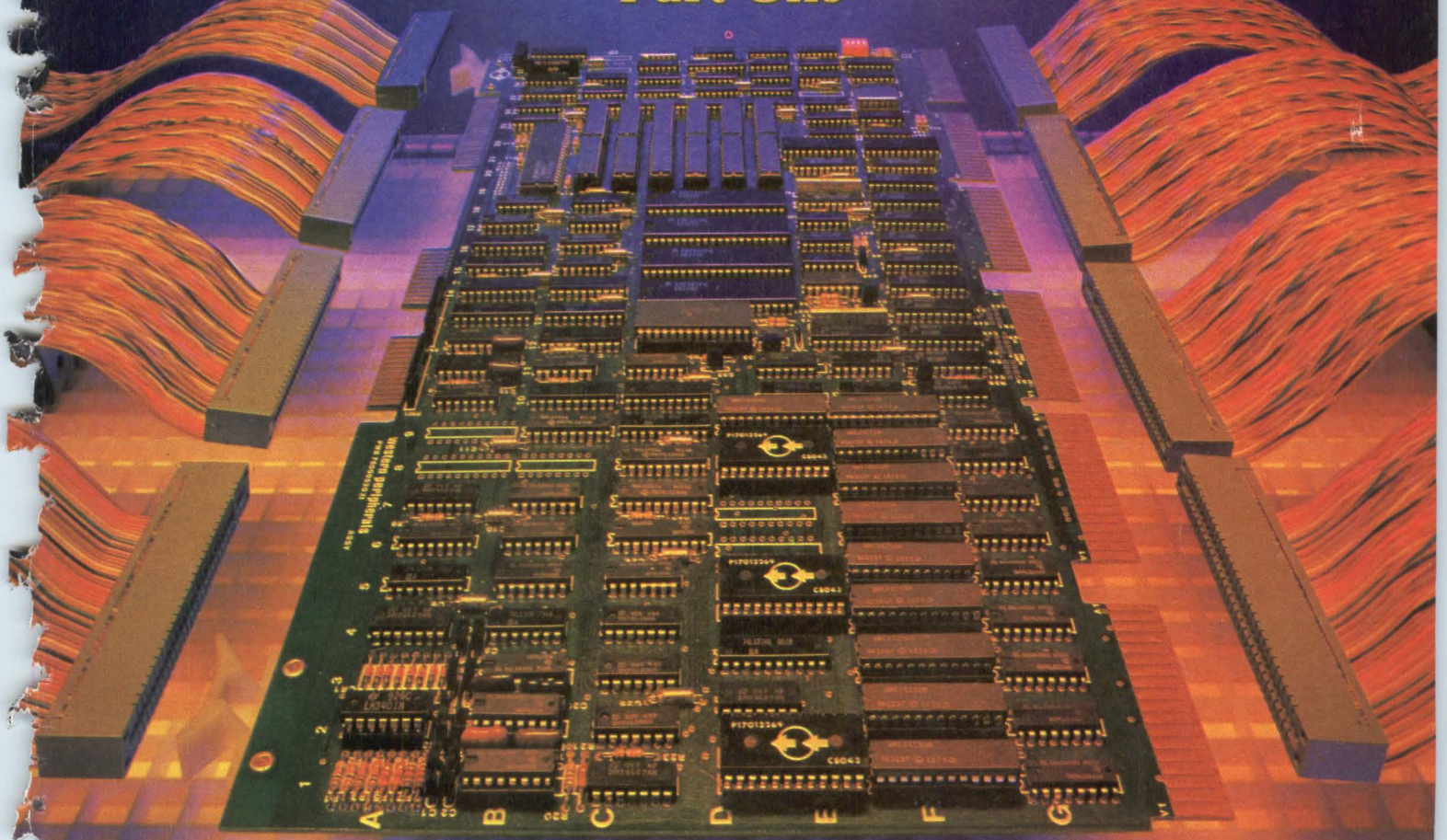
AUGUST 1981

Digital Design

Computers • Peripherals • Systems

COMPAT™ '81 Show Issue

Computer Compatible Directory Part One



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VOLUME 11, NO. 8 AUGUST 1981

Digital Design

Computers • Peripherals • Systems

Publication Number: USPS 407-010

This month's cover photo, a board's-eye view of a computer-compatible controller, comes courtesy of Wespercorp.

Features

The Computer Compatible Directory Part One

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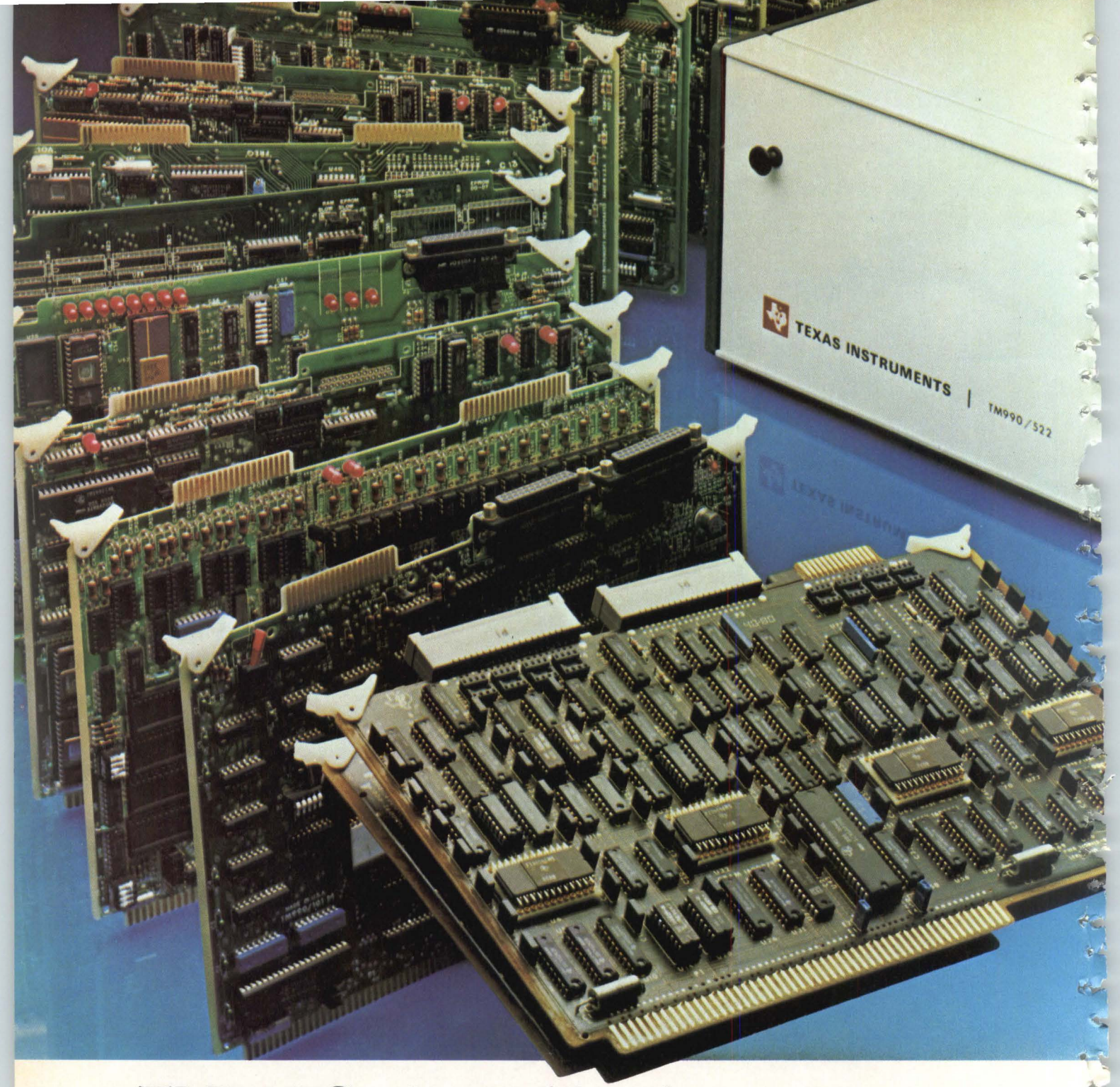

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If you need a high-performance general purpose 16-bit CPU, then the new TM990/1481 two-board CPU is your answer. With 95 distinct instructions, it has the processing power of a minicomputer.

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faster. In fact, the TM990/1481 performs double precision floating point in the same time as it takes competitive products to perform single precision.

Memories: Broader range

Your choice in TM990 memories includes a variety of directly addressable semiconductor memory modules.

There's also provision to handle floppy disks drives. The TM990/303A controls up to four standard drives or three mini diskette drives.

Exceptional I/O capability

Interfacing with the outside world is relatively easy. The TM990 Series contains a comprehensive selection of I/O modules: Digital. Analog. Industrial AC and DC. And, *a readily available speech module,* the TM990/306. It can speak 179 words and is ideal for situations where the spoken word is the most effective means of communication.

Recently added to the TM990 line are two new communication modules. The TM990/308 Industrial Communication Module permits communication with as many as 31 other compatible TM990 systems. Over distances up to 10,000 feet, using twisted-pair lines. The optically isolated interfacing built into the 308 simplifies interconnects and lowers installation costs even in electrically noisy environments.

The TM990/307 allows communication with up to four RS232 devices such as terminals or modems.

Functional integration: Slashes your software costs

Functional integration. Hardware and software units developed together. To work together. TI is first with this system concept of the 80's that can substantially cut software development time and costs.

Key element is a set of software interconnect standards that ties the system together.

The Realtime Executive implementation allows you to interface

Broad and growing series: TI's TM990

Microcomputer Modules:
TM990/100MA
TM990/101M
TM990/180M
TM990/1481

Memory Module:
TM990/201 EPROM/RAM
TM990/203 Dynamic RAM
TM990/206 Static RAM

Mass Storage Module:
TM990/303A Floppy Disk Controller

Digital I/O Modules:
TM990/305
TM990/310

Analog I/O Modules:
TM990/1240
TM990/1241
TM990/1243

Communication Modules:
TM990/307
TM990/308

Speech Module:
TM990/306

Card Cages & Enclosures:
TM990/510
TM990/520
TM990/522
TM990/530

Industrial AC and DC I/O Modules:
TM990/5MT Series

Data Entry and Display Microterminal:
TM990/301

University Module:
TM990/189M

Software Development Module:
TM990/302

TI's Component Software with the system easily and quickly. These Component Software packages provide a library of statements common to many programs. You choose what you need and combine it with the specific software required by your application. Savings can be more than two-thirds the cost of writing a typical program.

Available now: the File Manager. Coming soon: Software Data Communication packages.

The File Manager package performs such functions as library level management of diskette storage. Including install formatted volume, open/close/read/write files, random access to files.

TI's powerful AMPL hardware and software development system includes full speed emulation of 9900 microprocessors, and provides for program development in assembly language, TI Microprocessor Pascal (complete with concurrency), and Power Basic.

Complete accessories

The TM990 Series is supported by a broad selection of accessories — card cages, connectors, cables, and power supplies. Just added: the TM990/522 Enclosure containing a four-slot OEM chassis, power supply, and cooling fan in a neat, attractive, table-top unit.

For faster, simpler solutions to industrial control problems, take the shortcut. The TM990 Series of microcomputers. For more details about these time and money saving modules, see your local TI distributor, or fill out and return the coupon.

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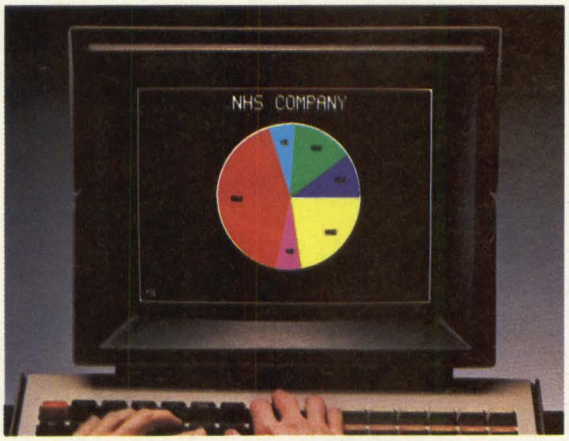
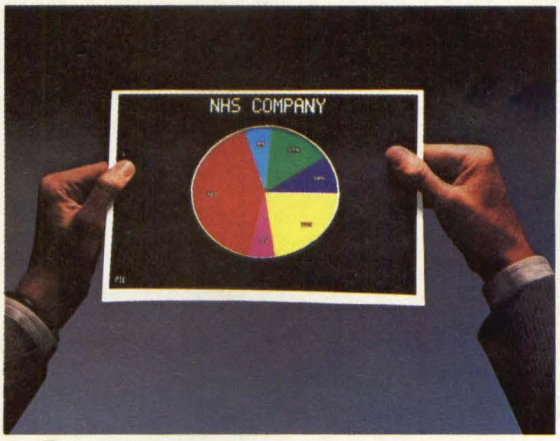
We can make a pie in twenty seconds.





When you start comparing color graphics systems, the Xerox 6500 Color Graphics Printer looks very, very good. Any way you slice it.

Not only can it produce computer-generated full-color graphics at a rate of three a minute, it can produce them at a cost of 6¢ apiece. On paper, or overhead transparency. It can even print from 35mm slides.

And you don't need to be a computer genius to operate one.

If you're thinking of taking your company to color, call the Xerox Printing Systems Division sales office nearest you. And take a long look at the Xerox 6500 Color Graphics Printer.

It could make your decision as easy as pie.

XEROX

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Letters

unaddressed problem

Dear Editor:

One problem not addressed by your other letter-writers involves philosophical differences (mores, etc.) of (mainly) non-Western foreign-born engineers (FBEs). Ethical definitions are not necessarily the same, and this can be critical when we're trying to safeguard our technology. I recently had the experience of working for an East Indian national who sought out new grads from universities catering to foreign students. He admitted that he could double his staff this way since these students would do anything for sponsorship. The personnel department did its share in working around Labor Department loopholes. This guru sidelined in real estate in order to profit from the housing of his "captive" engineers. I don't believe that this is an isolated case. An epilogue to the above has the East Indian out of work due to the poor performance of his division and 90% of his people (mainly FBEs) out of work and sponsorship.

Irwin Feerst is not all wrong!

F. D. Smith, P.E.
W. Melbourne, FL

P.S. My father and mother were foreign born, but 1900 — not 1981.

like the Mafia

Dear Editor:

I am not against anyone hiring anyone at any salary. The FBE issue is a small part of another problem: there are many U.S. employers with managers who exploit engineers by deliberately writing schedules that automatically force engineers to work unpaid overtime to accomplish unrealistic schedules, etc. These companies have a high number of FBEs, who are willing to put up with crap from these abusive companies. Hence, engineers gripe against FBEs. Since there is no watchdog over management abuses, many engineers point at the FBE problem.

The real problem is that there is no organization to which EEs can bring grievances. Even a simple organization that rated companies according to questionnaires filled out by EEs who work for those companies would be a tremendous help. Then EEs could avoid those companies with poor ratings. Those companies would be forced to change.

The AMA serves such a function. Suppose some hospital brought in large numbers of patients so doctors had to work unpaid overtime. And, suppose the hospital required the MDs to empty bed-pans during slow periods. Doctors would walk out, the AMA would tell other doctors, and the hospital would be closed down.

EEs lack such an organization; IEEE is a management tool. The FBE issue is merely a focal point for legitimate grievances because FBEs tolerate more abuses. Engineers pursue the FBE issue like the government goes after Mafia bosses for tax evasion when they can't nail them for their real crimes. Companies with numerous FBEs are usually guilty of far worse offenses, but no court or group brings them to account.

Thomas Golab
Washington, DC

at your expense

Dear Editor:

FBE (foreign-born engineering) students come here for an education — mainly at our expense. We hope they return to their own country but most do not! Industry hires them at reduced wages so they may remain here. Working with many of them, I find them clannish, speaking their own languages and associating mostly with their own kind. It's unfair competition to us and our children. If a crisis-situation develops, as it will likely within the next 2-3 years or less, where will their loyalty lie?

As for AAES, I have mixed feelings. Industry execs will dominate both organizations so the working engineer loses either way.

Name Withheld Upon Request
Milwaukee, WI

don't blame us

Dear Editor:

You can't blame foreign-born engineers for wanting out from their native environment; you CAN blame U.S. industry for subverting, (and lying)

immigration procedures, and you CAN blame the Government and your Congressman for looking the other way!

My thoughts on AAES? It is the typical IEEE subterfuge to escape responsibility. But, on the other hand, what can you expect of an organization made up primarily of dum-dumbs under the control of industry execs and university professors?

Name Withheld Upon Request
Tennessee

turning off motivation

Dear Editor:

Are aliens entering the U.S. at too high a rate to be properly assimilated? This may or may not be "real", but since EEs perceive it this way, this problem affects American views of FBEs. But companies improperly utilize EEs. Is the salary scale being depressed by the influx of aliens?

Engineers could be more effectively utilized if provided with better tools, and/or more support. Management prefers the brute force method: just hire more engineers. At current salaries and benefits, engineer vs. technician salaries may be too close to not want to hire an engineer for mostly technician work.

Once in the U.S., based on their technical skills, many FBEs migrate into management. Good technical people do not necessarily make good managers, and FBEs are at a disadvantage because of lessened communication ability and possibly different cultural backgrounds. We have some FBE managers here who are good for turning off employee motivation. However, FBE managers like to hire more people of their own background.

Name Withheld Upon Request
San Jose, CA

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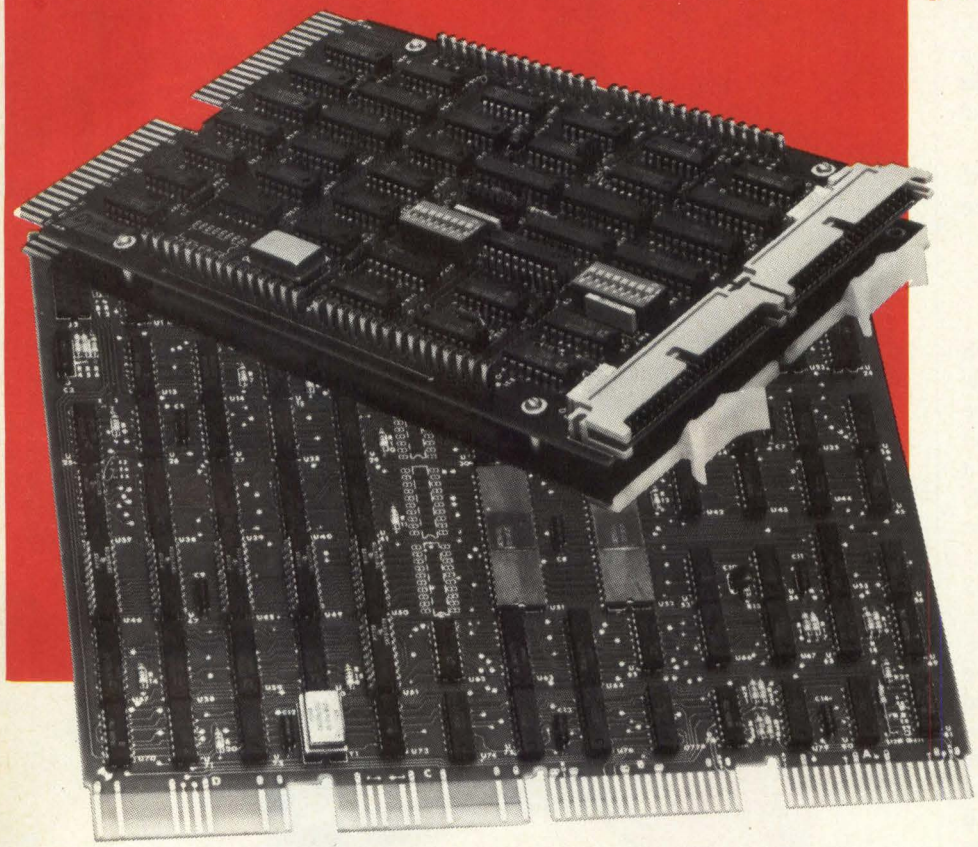
DEC®-COMPATIBLE PERIPHERAL CONTROLLERS

ALSO FROM DATARAM
JUST ANNOUNCED
PDP 11/44 MEMORY



Now, from the company that delivers the industry's widest range of DEC-compatible memory products, a family of peripheral controllers that's second to none. From comparatively simple cartridge disk controllers to complex 300MB storage module drive (SMD) controllers.

An impressive array of state-of-the-art controllers, all built around high-speed bipolar microprocessors. All software compatible with the host LSI-11® or PDP®-11 minicomputer...and all available now.

And Dataram's controllers are designed to save you money, and a lot more. Like space — our controllers typically occupy half the space required for the comparable controller from DEC. Doing it with a level of performance that makes any member of this family worth looking at.

Look at the chart of our current family of peripheral controllers, growing every day. If you don't see the controller you need, we're probably working on it right now. Call us and discuss your requirements.

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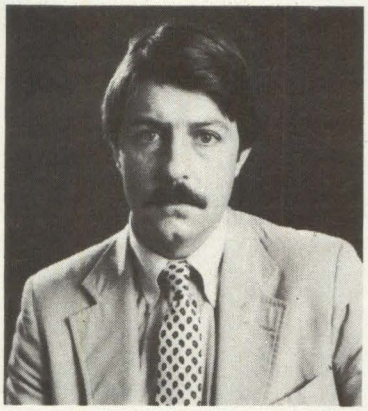
Publisher's Letter

Second Industrial Revolution



by Jeffrey C. Hoopes, *Associate Publisher*

Digital Design is rapidly approaching its ten year anniversary serving the computer industry. Needless to say, we've witnessed incredible growth in the market while, in the process, our publication has changed over the years to react to and meet the needs of designers working in this dynamic industry.

It is in that spirit of change that the COMPAT$_{TM}$'81 show and this special COMPAT '81 Directory were conceived. The response was so tremendous from Computer Compatible Equipment Manufacturers that we were forced to run the directory in two parts. After the second half of the directory appears in September, we hope to be doing much more in the areas of compatibility in upcoming issues, while helping to further define the market for computer compatible products in general. Hopefully, these efforts will persuade other computer publications to follow *Digital Design*'s lead in the future.

The key word here is *future*. Through our technology we all have the task, indeed the mission, to effect great change in our lives today, and the future of modern civilization itself. That's quite a responsibility to bear. However, it's one that I'm sure you already realize by working in this wonderful field.

As I see it, the computer industry is, in fact, the Second Industrial Revolution. New designs are coming from your offices every year. New products are being designed by the thousands to conform to size, weight, speed and efficiency characteristics. If you haven't guessed already, I happen to be a technological optimist. As our lives and society become increasingly complex, I have faith that *you*, the designer in the computer industry and your fellow designers in other industries, will continue to solve today's seemingly gargantuan problems with tomorrow's innovative solutions. As designers, you remain the world's greatest natural resource.

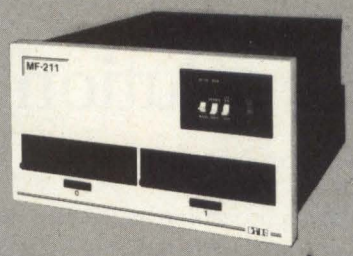
To help you meet those increasing demands, *Digital Design* will continue to provide you with practical, applications-oriented editorial that you can use today to solve your engineering problems. Your correspondence indicates that you find our directories and showcases of particular value in keeping you abreast of the current state of the art in various products and technologies. We will continue to do these showcases while providing you with new, innovative and important editorial that you need to maximize your talents. A recent reader survey conducted by the Starch Ballot Company for *Digital Design* shows a total audience of 195,000+ designers reading *Digital Design* each month. I thank you for your interest in *Digital Design* and always welcome your comments on how we can serve you better, or how you like what we've done in the past. In the meantime, I hope you'll enjoy our first COMPAT '81 show issue. We feel it's an idea whose time has arrived. D

Jeffrey C. Hoopes

Build your own DEC system with CRDS...

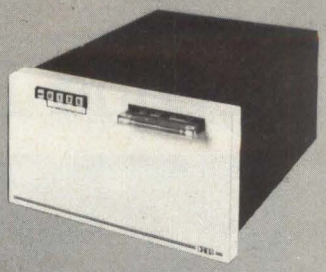
MF-211

10½" Enclosure for LSI 11/23 System with built-in RX02 equivalent floppy disk system. Available with or without processor and memory.



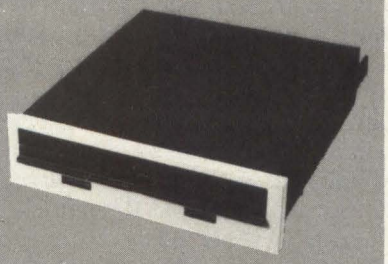
HD-11/T

20.8 Megabyte Winchester disk software equivalent to 4 RL01 units. Optional cartridge tape backup.



FD-311

RX02 equivalent dual floppy system, single or double sided. Includes bootstrap loader, self-tester, formatter and diagnostic diskette.



MB-211

5¼" enclosure with 8 quad slot backplane. Front panel console with switches for Enable/Halt, Boot/Init and Line Time Clock.

Complete software compatibility at a savings!

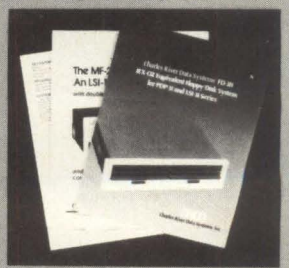
With CRDS, you can configure your own DEC system and be assured of complete software compatibility. Each of the above systems is provided with slides for rack mounting or can be used in desk top applications. All DEC LSI 11 based modules and associated software packages are available through CRDS, if desired.

Attractive Packaging
Careful attention is given the CRDS repertoire of enclosures in assuring you an attractive yet comfortable blending of product in the DEC environment.

Significant Savings
Flexibility of procurement plus attractive OEM schedules allows you to optimize dollar savings in configuring your CRDS system. Use the time tested technique. Compare.

Warranty and Maintenance
A 90 day warranty is offered with your CRDS system. In the event of malfunction, by use of provided diagnostic routines, the defective submodule is normally found within minutes. After verification with the CRDS Maintenance Department, a replacement for your defective module will be promptly forwarded.

Call or write for a comprehensive literature package and prices.



CRDS

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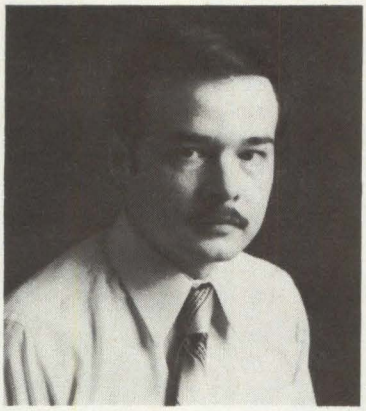
Speakout

Computer Compatible Directory



Paul Snigier, *Editor*

This two-part Computer Compatible Directory is designed to serve you. As system designers and OEM integrators, you should find it an invaluable, permanent addition to your reference library. It was a mammoth undertaking. It is the first such directory ever published.

Reader and manufacturer response to the January 1981 DEC compatible directory issue — the first of its kind in the computer industry — was overwhelming. Since this directory also was the first of its kind, we asked you for your comments, corrections, additions and updates to make this expanded directory as comprehensive and accurate as possible. In addition, we mailed out even more questionnaires, reviewed more new product releases and scanned other sources for information on firms manufacturing computer compatible equipment. From this vast array of sources, we compiled this Computer Compatible Directory — the first and most formidable ever published in the trade press. In fact, it was so overwhelming that it will run in two parts. The first half is running this month; part two will appear in September.

From your enthusiastic response and recommendations, we decided to expand the coverage to include not just DEC compatible products (as big as that field is), but also to expand this directory to include all computer compatible products. Emphasis, obviously, would center on minicomputer and microcomputer compatible products for the industrial, scientific and engineering fields. In addition, the new and expanded directory would be divided into product categories to facilitate the easy location of products. This new format will now prove easier to use: simply turn to the product category, search for the appropriate products, and note the vendors' names. If you wish to contact specific firms, simply turn to the manufacturers' listing. Addresses, phone numbers and sales contacts are included for your convenience.

Although we have tried to name every manufacturer and product that we could locate, the dynamic nature and rapid growth of this field make this impossible. If you find that your firm is not listed, return the Compat Directory questionnaire so that we can include you in the next Compat Directory. Also, if you find any inaccuracies, please write, so that we can make the changes.

This Compat Directory has been a tremendously tough job. Primary credit for this mammoth undertaking belongs to our editor Martha Hawkins, without whose tireless research and editing, this directory would not have been possible.

A second industry-first is occuring on September 16th and 17th at the San Franciscan Hotel. We are launching a series of national Compat exposition shows devoted exclusively to computer compatible products — something which has never been done before, despite the rapid growth of DEC, DG and other computer compatible products in the past several years. Subsequent Compat expositions will be held several times a year at different locations to bring computer compatible, plug compatible manufacturers together with interested OEM designers and system builders.

We want to eliminate the "fans" (those curiosity seekers cluttering up too many other conventions) and bring the "players" and plug compatible manufacturers together. We want to improve the signal-to-noise ratio by eliminating the noise and increasing the signal.

Be sure to visit Compat. You'll see new computer compatible products, attend seminars and talk to exhibitors in a vertically-structured environment of computer compatible manufacturers and products. D

Paul Snigier

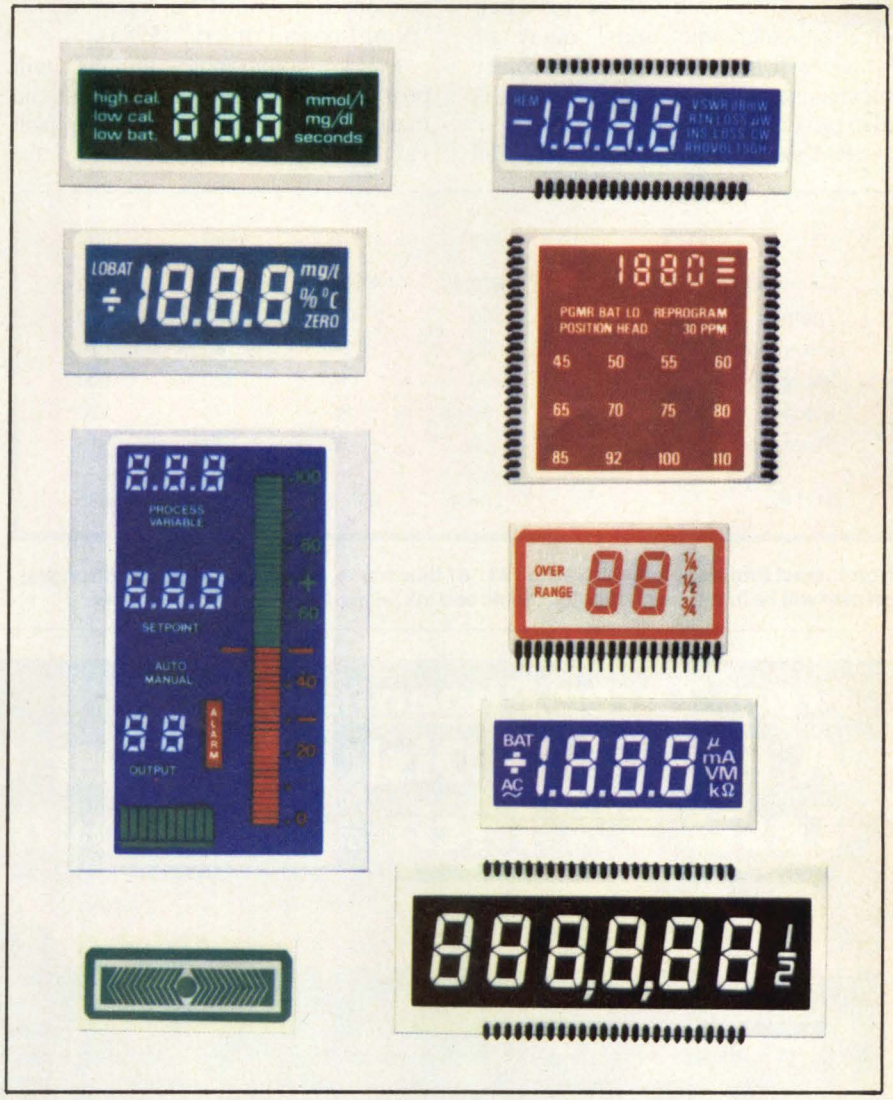
Guest Host Dichroic LDCs Add Color

LCDs continue to make advances. Designers employing LCDs for indication in instrument or industrial applications are no longer limited to displays with black segments on a light colored background. The introduction of a new line of Hamlin color LCDs offer a wide choice of color combinations for both digit segments and background. The new line offers a display with higher contrast, extremely wide viewing angle and high reliability for viewing in a wide range of lighting conditions. They are ideal for use in avionics, instrumentation, medical equipment, home appliances, pocket computers, programmable calculators, games and many other applications.

These color LCDs are of the negative "guest"/"host" type and employ a liquid crystal fluid as the "host" and a dichroic dye as the "guest". Using this advanced technology, Hamlin developed single layer displays for either transmissive or reflective viewing. The transmissive type incorporates a single polarizer and is back-lighted; the reflective type uses neither a polarizer nor backlighting but employs a reflector on the back of the display. Both types are being offered as two-color displays, with clear segments on an orange, blue, black or violet background. The additional colors of green and red should be available in the near future.

Color LCDs which employ their standard twisted nematic displays with a dichroic front polarizer are available. This offers two-color viewing — red digits on a blue backgound or blue digits on a red background, for example.

Development of guest/host color LCDs includes double layer types for viewing of information in as many as three colors. They offer the possibility of varying the segment color by applying various drive signals. The display can be viewed with clear, light blue, or orange segments on a dark violet background. The color of all segments can be individually controlled by the drive circuitry. Additional color combinations will be available in the near future.



Featuring higher contrast, wider viewing angle, and higher reliability, these new color LCDs come in a wide variety of sizes, and are suited to applications in medical equipment, avionics, appliances, calculators and games. Two-color reflective and transmissive displays are both available in sample quantities.

The new color LCDs come in many sizes, depending on type desired. The single layer transmissive mode display can be furnished in all sizes offered in the present Hamlin line — as small as 1.2″ × 0.9″ or as large as 6″ × 2″. Reflective mode displays are available in all sizes up to 2.75″ × 1.5″. All have an operating temperature range of −20°C/+90°C. They can be used with operating voltages of 3V min. to 10V max. Typical response times are under 250 Ms.

While prices of Hamlin Color LCDs exceed those of conventional field effect types, they are only 25% to 50% higher, depending on type. The new displays could eventually be priced competitively with existing types.

Want immediate samples of the single-layer transmissive-mode color LCDs? If so, contact Hamlin directly at Lake & Grove Sts., Lake Mills, WI 53551. (424) 648-2361. Single layer reflective and double layer types can be furnished as samples in 12 weeks.

Non-Impact Printer Market Grows

The market for non-impact printers will pass $1 billion this year, and will grow to more than $3 billion by 1986. The largest growth area will be for small electrophotographic units, many of which will be based on office-copier mechanisms. "Very strong" growth is also projected for ink jet printers.

IBM's 6670, announced in 1979, had "lukewarm" sales; Xerox's 5700 and Wang's Image Printer didn't do any better. "There is a great future for intelligent copier/printers, but IBM's 6670 Information Distributor was priced much too high, at $75,000, for most users' budgets, and it's been a marketing disaster," according to Kenneth G. Bosomworth, President of IRD (at 30 High St., Norwalk, CT), who participated in the study. This abstract was condensed from IRD's report #173, "Non-Impact Printers" ($985).

Electrophotographic printers will prosper until 1986; after that, high-end market saturation will bring shipment value down in the latter part of the decade. Thermal printer shipments will remain strong, doubling between 1981 and 1986, but suffering from increasing price erosion later. An increase is unexpected in electrostatic printer shipments, which should suffer from increasing availability and falling prices of copier derivative electrophotographic devices.

Although Honeywell had significant successes with its PPS electrostatic printer, many placements of Honeywell equipment were in specialized industry-specific environments (telephone companies, the Internal Revenue Service, etc.), where potential sites for new placements are limited. Electrosensitive printing will retain a strong position at the bottom of the market, but won't advance beyond the low end. However, the simplicity of electrosensitive printing suggests that vendors will still be attracted to the possibility of a winning product based on this technology, despite the long history of disappointments in the past. Magnetic printing will not develop into a major market segment.

TYPE	1981	1983	1986	1991
Electrophotographic	670.4	1,330	1,960	1,380
Thermal	300	430	650	550
Electrostatic	85	80	80	70
Ink Jet	90	140	320	500
Electrosensitive	60	80	70	70
Magnetic	3	6	11	15
TOTAL	1,208.4	2,066	3,091	2,585

Non-Impact Printer Shipments in the 1981-91 time frame, in millions of dollars. Strongest growth will be in the electrophotographic and ink jet markets.

supplier lineup

Xerox and IBM own most of the top end of the market at the present time

with the 3800 and 9700. Siemens ND-2 resembles the 3800 and is resold by Sperry Univac and others. Honeywell's electrostatic printer competes at the top-end of the market; all other top-end products are electrophotographic.

At the bottom end, with strip printers for calculators, etc., Texas Instruments, Matsushita and Olivetti are major vendors, and TI also dominates the thermal data terminal market, although strong competition in the latter sector comes from Computer Devices, Computer Transceiver Systems and others.

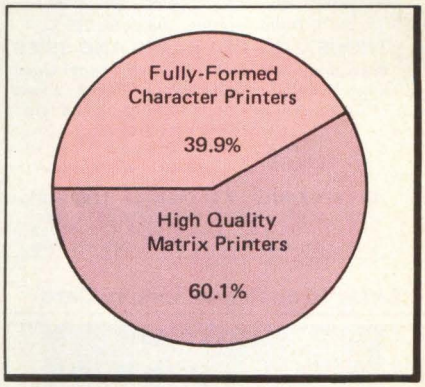
Wang Laboratories competes with IBM and Xerox in the intelligent printer segment, which is likely to number a dozen or more vendors over the next year or two. Some entrants will procure equipment on an OEM basis from Konishiroku, General Optronics, Canon, Minolta, etc.

Non-impact printer specialty paper and supplies will be a relatively small market, particularly by paper-company standards. However, according to IRD it has been a lucrative one. Although growing markets for thermal and electrostatic specialty-coated papers will increase strongly, the most spectacular growth will be in toners and other supplies for electrophotographic printers. This area does not offer great opportunities for supply vendors, because most of these printers will be based upon standard office copiers; now supplies are readily available through stationery stores and other non-specialty channels.

Will High-Resolution Printers Dominate Market?

The 1985 sales of high quality computer printers will exceed $2 billion. Manufacturers of matrix printers with a resolution higher than 180 dots/inch will account for over 60% of this market. Fully-formed character printers are not becoming obsolete: they will ship more units in 1985 than manufacturers of high quality matrix printers — but not without a good fight.

The fastest growing subsector of the high quality printer market will be the high-resolution dot-matrix segment, which will grow at a compound annual rate of 164% from its presently small base through 1985. This market was pioneered by Sanders Technology Systems; new entrants coming in the next few years will include Florida Data Corp., Centronics, Diablo, and Integral Data Systems.



Projected breakdown of 1985 printer sales, based on dollar volume, shows dominance of matrix printers.

This market is currently using two different technologies to accomplish the same end result. Sanders and Diablo are using a multipass tech-

Technology Trends

nology where the print head passes over the same spot four times, adding more dots to the character in each pass. The other is an overlapping dot technology that only uses two passes. The overlapping dot technology prints a complete character in the first pass and then shifts position slightly so that when the same character is printed over the first one, it fills in the gaps that were left the first time by overlapping the dots. This technology has a speed advantage over the multi-pass technology, which may make it the winner in the end, since speed is an important factor in the product decision.

On the other hand, quality is considered to be even more important than speed, which is why many manufacturers are entering the market with new low cost/low speed fully-formed character printers. These printers will be marketed mainly to users of personal and small business systems, the driving forces of the low cost fully-formed character market. The three leading fully-formed character manufacturers, Diablo, Qume, and NEC, all have entries in this market, but are receiving a lot of competition from foreign manufacturers, such as Triumph-Adler and C. Itoh.

Other high quality printers examined in the study include ink-jet and page printers, both having substantial growth rates. Want more information? VDC of 1 Washington St., Wellesley, MA, can provide it in a 200-pg. study: "High Quality Computer Printer Industry: A Strategic Analysis."

Color Terminals Fall Below $6K

A full-featured, desk-top terminal offering high-resolution raster scan color graphics at a limited-time price of $5,995, the RM-6211 is a compact and cost-effective system. It is suited for business, process control, scientific data analysis and government and military applications.

It communicates with any host computer via a standard RS-232C interface, offers resolution of 640 × 480 pixels operating at 30 Hz (interlace), with an option for 640 × 512 pixels operating at 60 Hz (repeat field). Its standard 13″ monitor is suited for interactive applications due to easy-to-view 64-dot-per-inch image. The standard interlaced version features built-in high-voltage regulation and long-persistence phosphors for stability and flicker-free data display. Precision in-line (PIL) tridot CRT technology eliminates the need for any dynamic convergence controls. BNC connectors are provided for daisy-chaining additional monitors for board room and similar applications.

Four refresh memory planes controlled by a user-programmable video

This full-featured, desk-top terminal offers high resolution raster scan color graphics.

look-up table permit the simultaneous display of up to 16 colors selected from a palette of 64, or eight colors plus either an alphanumeric overlay or a blink function.

The RM-6211 is compatible with the Tektronix Plot 10 graphics software, upgradable on the terminal to add color capability. It is compatible with DEC's VT-100 and other software packages, including DISSPLA, TELL-A-GRAF, DI-3000, GRAFMAKER SAS/GRAPH and PATRAN-G.

Another standard item is a Centronics-compatible parallel printer interface that supports the Ramtek 4100 Colorgraphic Printer low-cost, high-quality color hardcopy output. Color camera systems such as Ramtek's GM-300 Series are also supported. Ramtek Corp., 2211 Lawson Lane, Santa Clara, CA 95050.

Remote Terminals

CHINA: The light industrial sector of the Chinese economy is being brought into higher priority as a result of economic restructuring within the country that is taking place this year. There is less emphasis being placed on large capital investment projects, bringing them into balance with light industry . . . **ISRAEL:** Fibronics Inc., of Haifa, has begun direct sales distribution in North America of a portion of their broad product line of short haul communication fiberoptics equipment (optical fibers, fiberoptic cable, splitters, couplers, specialized data links and fiberoptic telephone) . . . **SCOTLAND:** A new Ventures Unit operating out of Glasgow has been established by the Scottish Development Agency to assist small companies which are looking to invest in Scotland for the first time, or are looking for joint venture opportunities with Scottish companies. Electronic companies with sales of less than $100 million interested in markets in Europe (and needing some assistance) should contact the Scottish Development Agency, 120 Bothwell Street, Glasgow, 627JP Scotland . . . **LONDON:** British officials are sending a delegation of computer scientists to Japan to discuss development of a fifth generation computer in a joint project . . . US Leasing has purchased a British rental company, Labhire, from Hamilton Leasing. Selling price for the British company, $3.8 million. New name for the subsidiary is Instrument Rentals (UK).

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- ☐ Floppy Disk
- ☐ Magnetic Tape
- ☐ Tape Cassette/Cartridge
- ☐ Winchester Drives

E. Printers/Plotters
- ☐ CRT Display Copiers/Printers
- ☐ Line Printers
- ☐ Plotters
- ☐ Serial Printers
- ☐ Teleprinters

F. Input/Output Units
- ☐ COM Equipment
- ☐ Digitizer/Light Pens
- ☐ Facsimile Equipment
- ☐ Magnetic Card Equipment
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- ☐ Intelligent Interface Modules/ Subsystems
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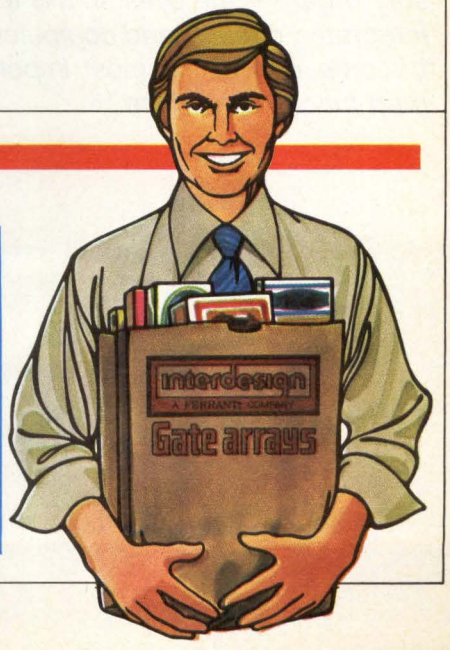

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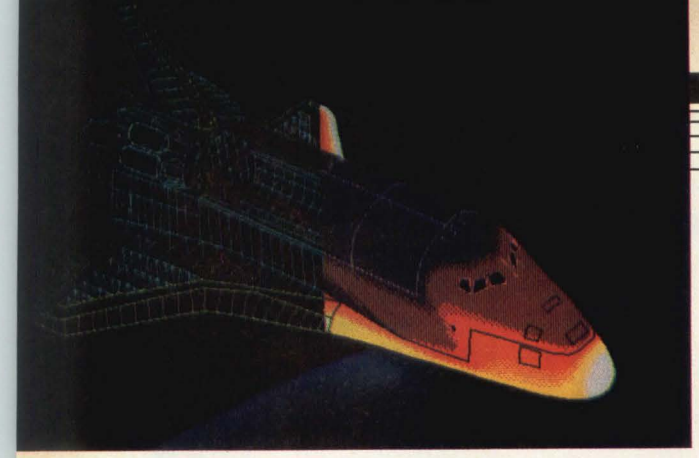

Photo courtesy of Dunn Instruments.

Advances in Display Technology

a review of the most important technologies and their recent advances

Displays are man-machine or man-information interface devices. Displays and printers are often called I/O devices which input information into man's brain through his most powerful sensory organ — the eyes. In this era of electronics, integrated circuits, and computers, displays have become one of the most important devices for man-machine interface.

by I.F. Chang

The two major classes of display technology, today, are **Active, Light-Emitting Displays** (CRTs, Plasma Display Panels, LEDs, Electroluminescent Displays); and **Passive Light-Modulating Displays** (Electrochromic Displays, LCDs).

In today's market, the CRT is the dominant technology, with its growth momentum remaining unchecked. As for the others, the LCDs are gaining their own market share and are doing it more rapidly than other technologies.

CRT technology

The CRT Display Technology can be subdivided into five categories: Direct-View Refresh CRT; Direct-View Storage CRT; Projection CRT and Light Valve; Special CRT; and Flat Panel CRT.

The most recent advance in **Direct View Refresh CRT** has been cost reduction due to improvements in its fabrication. Also contributing to cost reduction has been a decrease in cost of memory. In the display tube, the electron-gun design has also been improved to show more shock and vibration resistance and better resolution. For CRT screens, some new rare-earth phosphors which allow narrow-band filters to improve display contrast have been developed. Antireflection coatings have also been widely used in applications where high ambient and directional illumination conditions exist. In the color CRT (shadow mask type) a black guard band is used around each color phosphor dot, thus improving color contrast.

The most important display in **Direct-View Storage** is the bistable phosphor storage CRT. In operation, a writing beam establishes a charge pattern on the phosphor screen and a flood beam maintains and displays such a pattern through a secondary electron emission process and low voltage (200-300 V) cathodoluminescence. It initially was used mainly for oscilloscope application and only recently was entered into the information display market. The significant advance made is the size of the display screen. In 1963, only a 5″ diagonal screen was possible. A 25″ diagonal storage CRT display is now available with write-through feature, a writing speed of 15000 cm/sec, a resolution of 15.75 line pairs/cm and brightness of about 8.6 ml.

Another storage CRT display is the cathodochromic CRT (CCRT) which utilizes, instead of a cathodoluminescent screen, a cathodochromic screen which changes into dark color upon electron-beam excitation. The most efficient cathodochromic material developed is the alkali-halide-doped sodalite. Although a direct-viewing CCRT has been

Dr. I. F. Chang is with IBM's T. J. Watson Research Center, PO Box 218, Yorktown Heights, NY 10598.

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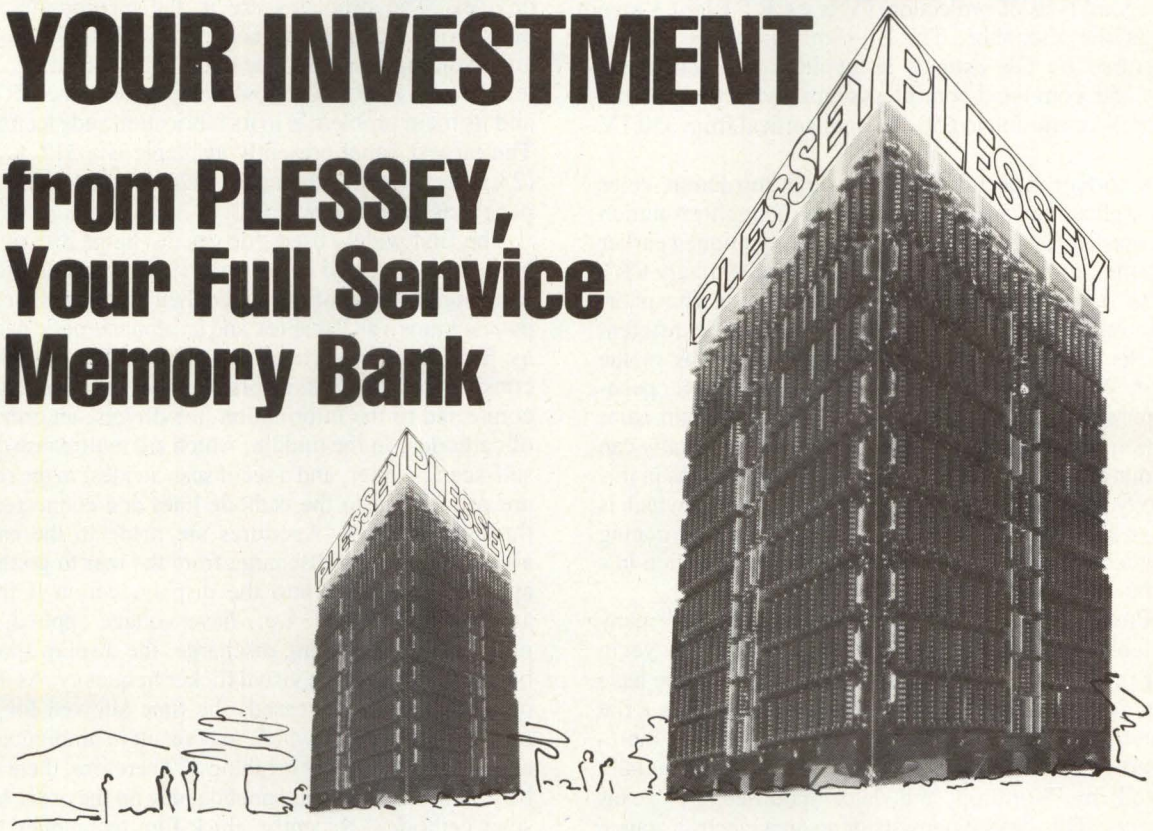

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developed, a more useful version, perhaps, is a projection system where the sodalite material is deposited on a metallic target and the image is projected onto a 1.22 × 1.83 m^2 screen through a reflection lens. The advantages of the CCRT are high resolution and freedom from flicker. Its primary drawback is that full-screen erasure is slow, typically 3 sec.

The shadow-mask **Projection CRT** can produce more than 100 fL on its faceplate because of its higher heat tolerant mask, higher transmission faceplate glass, and removal of black guard band around the color phosphor dots.

The second type of projection TV is a **CRT Light Valve** known as the Eidophor. The oil-film light-valve system manufactured by GE extends its application to simulator displays and command-control systems by improving the light valve's resolution to 650 TV lines vertical from 350 TV lines.

An important **Special CRT** for high-resolution color display applications and a competitor to the high-resolution shadow mask and beam-index color tubes mentioned earlier is the "penetration CRT." It is the same as an ordinary CRT except its screen is prepared from a penetration phosphor. The penetration CRT is based on the principle that different energy electrons have different penetration depths in the phosphor. When the CRT screen is made of multilayer penetration phosphors of different colors, one can obtain color modulation by switching the beam voltage. One usually can obtain four colors in penetration CRTs. The problems in this technology are in the high-voltage switching circuit which is expensive and in the limitations of brightness and switching speed which restricts the color information presentation in a sequential color frame mode.

Flat-Panel TV display is a long-term goal of many display technologists, although there is no technology yet in sight for replacing the shadow-mask color CRT. There have been several exploratory efforts in the past to develop a flat CRT such as Aiken & Gabor tubes. One of the more-developed e-beam flat-panel CRTs is the Digisplay initially introduced by Northrop and later modified by Texas Instruments. This device consists of an area electron source made of a number of line cathodes, a set of spatial selection grid plates which selects the beam over 512 × 512 spots to excite the phosphor anode. The modified version has made significant improvements in device fabrication and cathodes and their electron optical design. Although the performance of this device was rather good, the technology seems to have been shelved for production cost reasons.

A flat cathode-ray display device, which has really obtained a market share, especially in the small display area (several characters or digits), is the ZnO vacuum fluorescent panel (VFD). This technology is competing with the LED, PDP, and LCD in several application areas including use in the automobile.

plasma display panels (PDP)

Gas discharge is a breakdown phenomenon in which the current will continually increase unless it is limited by a load resistor (operable under both dc and ac voltages) or a capacitor (operable under ac voltage only). The latter operation exhibits a memory effect because the charge deposited on the wall during a gas discharge will aid the polarity-reversed applied voltage to break down the gas again; thus, once initiated, a gas discharge can be maintained with a lower magnitude of applied voltage in the alternating mode.

The "ac PDP" consists of a matrix of gas discharge cells defined by two sets of orthogonal insulated electrodes deposited on two glass substrates which are properly separated, filled with neon-argon gas and sealed. The device was first reported in 1964. The advances made in this technology can be divided in three groups. The first group is the exploration of new driving techniques and various functional effects such as light-pen interaction, direct electrical readout, cursor action, and the ability to achieve gray scale. The second group is the development of integrated drivers and fabrication techniques with the hope of reducing cost. The third group is the exploration of color and TV display possibilities. However, the third exploration has not yielded any practical devices. The problems are in the incorporation of color phosphors into the panel, achieving high luminous efficiency and avoiding cross talk due to UV light spreading. Nevertheless, the ac PDP is a serious competitor to the CRT display, and its main problem is in its fabrication and electronics cost. The largest panel presently available is a 512 × 512 panel (23.6 lines/cm), although a 1024 × 1024 (32.7 lines/cm) panel has been attempted.

The first widely used "dc gas discharge display" was the Nixie tube invented in the early 1950's and manufactured by Burroughs Corporation. Since then more advanced numeric panels known as Panaplex and an alphanumeric panel known as Self-Scan have been developed. The Self-Scan PDP consists of a set of display anodes, in front, which are connected to the information line drivers, an orthogonal set of cathodes, in the middle, which are multiphase driven in a self-scan manner, and a set of scan anodes, in the rear, which are orthogonal to the cathode lines and connected together through resistors. Apertures are made in the cathodes to allow the priming discharge from the rear to go through the aperture and enter into the display section if the display anodes are selected, i.e., have voltage applied. Synchronized with the priming discharge, the display anode should be scanned above the visual flicker frequency. As the number of characters is increased, the time allowed for discharge transfer is reduced, which may result in ambiguous priming and, of course, lower brightness. Therefore, there appears to be a limit for practical panel display on the order of 200-300 scan cathodes. Recently, thick-film techniques have been used in panel fabrication which, along with integrated drivers and high-voltage logic, have reduced the device cost considerably.

The dc PDPs do not have memory as do the ac PDPs. However, memory may be obtained by incorporating a thick-film resistor at each cathode or a spiral-shaped thin-film resistor at each anode or by using a graphite cathode which limits current flow without additional resistance. However, to date these developments have not given rise to commercial devices.

LED display technology

Although discovered in 1922, the LED as an electronic device did not receive serious development until the mid-sixties. The recent advances in LED display are along several technological fronts. One is the improvement of efficiency and surface brightness. Several-thousand millilamberts of surface brightness can be obtained with 100% duty cycle at a current density of 10 A/cm^2. The second area is toward achieving higher reliability in LEDs. Extrapolating the data on percent light reduction after 1000 hr of high current stress (35-40 mA), one expects that the reliability issue is entirely insignificant in today's LEDs except for extremely high-brightness applications. The third area is the availability of color choices and diode size. There are various diode sizes of four colors (red, orange, yellow, and green) available today.

Due to the cost difference of substrates(~$10/in.^{2} for GaAs and ~$100/in.^{2} for GaP), the red LEDs are much cheaper than the non-red LEDs. The fourth area is the development of monolithic processing which, due to material cost, is mainly for GaAs substrate. The monolithic technology has not only yielded the seven-segment numeric digits (at ~10¢ a digit price) but also the 5 × 7 alphanumeric dot-matrix displays fully packaged at $1/character. The fifth area is the display panel development using monolithic LED arrays and packaged into x-y addressable panels. A 5.1 × 1.3 cm LED display consisting of four 1.3 × 1.3 cm arrays of 30 × 36 LEDs was first demonstrated in 1975. The limitations on this approach are the peak current and the resistance in the row leads in the LEDs.

Large LED display panels are presently at crossroads between monolithic and discrete assemblies. The former approach is more limited by high power dissipation and uniform yield, whereas the latter is rather limited in resolution and fabrication cost. In either case, the brightness nonuniformity from diode to diode within a batch or wafer or from batch to batch is often a problem for displays requiring gray scale through current modulation. In addition, there are still problems associated with low luminous efficiency, differential aging, and flicker due to vibration that are limiting the LED's entrance into the large display domain.

electroluminescent displays (ELD)

ELDs can be divided into ac or dc types corresponding to whether they are driven by ac or dc voltage. In each type, the devices may be fabricated with powder EL or thin-film EL materials.

The "ac EL" phenomenon (electroluminescence generated by an alternating field), was first discovered in 1936 in ZnS. The early device work indicated that EL devices were short lived for both powder and thin-film devices. Attempts at making ac EL TV have not resulted in a practical device, but have come closer than almost any other flat-panel technology. In the early seventies, a development effort led by Sigmatron succeeded in fabricating ac thin-film EL devices with reasonable life and brightness. Recently, researchers at Sharp Corp. have made a significant breakthrough in achieving high brightness and long life ac thin-film EL (ACTEL) panels. The reliability of the ACTEL devices not only depends on the quality of the polycrystalline manganese-doped ZnS layer, but also on the breakdown strength of the insulating layers sandwiching the ZnS layer. The EL mechanism is believed to be due to the electron impact excitation of the manganese ion. Since the light output of the device is directly proportional to the charge flowing through the capacitative layers per pulse, the number of pulses per second and the voltage across the ZnS film, one expects to have higher efficiency if high dielectric constant and breakdown strength insulator films are used. The sharp voltage threshold, fast turn-on and turn-off response times, and high peak brightness make this device one of the attractive candidates for a refreshed matrix display.

The "dc ELD" also has a long history. The advances in dc EL have been rather slow due to the small number of man years invested in it. However, it has come a long way, with improvements both in brightness and operating life. The dc EL powder device consists of a layer (~50 μm) of fine grained (~0.5−1 μm) manganese-doped ZnS powder coated with Cu_xS. The device requires a high current forming process to establish a stable active region (~1000 Å) at the anode. The devices of today can give several hundred foot-lamberts of brightness and a 1000-hr half-life. Furthermore, the dc EL powder has also been shown to respond to fast dc pulses with a fairly steep voltage dependence, therefore making matrix address feasible. A 1250-character alphanumeric panel which can be operated at 120 V with 15-μsec pulses and a 0.5% duty cycle for 8.6 mL has been developed at the Royal Signal and Radar Establishment Laboratory. Because of these interesting properties, this technology is being considered by several auto manufacturers. The potential low cost of the dc EL device (due to ease of fabrication) and its moderate operating voltage (in the high duty cycle) are its main advantages.

LCD display technology

In 1964, workers at RCA Laboratory discovered a string of electro-optic effects in liquid crystals. The first was the guest-host effect, which is a color change due to reorientation of a pleochroic guest dye molecule along with the nematic liquid crystal host under applied field. Second was the dynamic scattering effect, which is a turbulence induced by the applied field in the transparent liquid crystal. A third effect was a phase-transition storage effect which was discovered in the cholesteric-doped nematic liquid crystal, permitting light to be transmitted through a pair of cross polarizers sandwiching the liquid crystal.

Today, the most developed LC product is based on the twist nematic (TN) field effect. In such a device, light polarization is normally rotated in the liquid crystal. On the other hand, when an electric field is applied, the twisting structure is neutralized, and light cannot be transmitted. In recent years, this device has dominated the electronic watch display.

The most significant advances in the LCD are in materials and device fabrication. A variety of high-purity LC materials has been developed with reasonable operating temperature range (0-80°C, ± 20°C). LC alignment techniques have been developed to achieve a low tilt angle (tilting of LC molecule axis with respect to the surface of substrate) for multiplex drive. The device reliability was improved significantly when a glass frit seal was employed to eliminate moisture.

Because of their low power requirement, LCDs are quite attractive for many applications; however, liquid crystals have some serious problems, such as low speed, poor threshold, viewing angle restrictions and temperature dependence. Temperature compensation circuits may cure the latter problem, but the rest are intrinsic to LC material properties.

electrochromic displays (ECD)

An electrochromic display was first reported by Deb in 1969. In 1973, the writer started a research project to investigate the feasibility of various electrochromic and electrochemichromic effects for display applications. The word "electrochromic" describes a color change effect induced by an electric field or current, whereas "electrochemichromic" (ECC) strictly applies to a color change effect induced by an electrochemical reaction, such as a redox reaction. Conclusions have been made that, due to the charge responding characteristics and slow response of both EC and ECC devices, these materials are not suitable for matrix addressing of any significant matrix size. The only practical addressing schemes are either using optical or electron-beam addressing, or using TFT or silicon transistor arrays for latching and addressing. However, to date there are no significant advances made in these areas. D

This article was extracted from a paper entitled "Recent Advances In Display Technologies" delivered by Dr. Chang at the 1980 meeting of the Society for Information Display.

Power Supply Selection Criteria

specifying a power supply? follow these selection criteria

This article examines the specification of switching and linear power supplies, the control of EMI and PC board-mountable power sources.

Today's switching or linear power supplies require that you make more than just a few preliminary system power estimates; supply technology has gone through rapid change. If you allocate less time to power supply considerations and put off specification to the final portion of your design project, you will inevitably discover that the power supply is underpowered, must fit in one-third the space originally allocated, and that the originally-specified supply cannot meet the increased power demands of the final system design. The trend is towards purchasing. But if you decide to build, you need more expertise than you did in the past.

by Paul Snigier, *Editor*

Despite slowed growth, linear power supplies still take a major portion of the OEM market simply because switching power supplies cannot equal engineering advantages of these linear supplies. Although inefficient, heavy and bulky, linear supplies do provide faster response to transients, lower cost, under 150-W units, better regulation, low RFI output, ease of adjustment, low ripple output and lower field service troubleshooting. Although growing at one-third the rate of switchers in annual sales, linears will continue to take a good share of the market. Reliability of linear power supplies is quite adequate, provided heat dissipation is properly accounted for. Since the efficiency of linears (40%) is half that of switchers (75% or better), heat dissipation is a serious problem. Larger heat sinks are necessary, particularly in more compact, smaller linears; and, in many cases, forced-air cooling is mandatory. With more than twice the efficiency, switchers need fewer cooling considerations, and more often than not, can get by with only convection cooling.

Although linear efficiencies will continue to improve beyond the 55% or better which has been reached, any significant improvement beyond this point is unlikely.

Future improvements in linear power supply efficiency and heat-handling capability will probably come with the improvement of materials and the usage of ferroresonant transformers, thus minimizing voltage drop in the linear-regulator series device. With higher-efficiency transformers, the volume and weight of modular power supplies will decrease. Improved grain-oriented steel permits smaller laminations. But it also raises transformer temperatures.

Improper heat sinking and cooling reduce linear power supply lifespan considerably. An MTBF of 100 kh at 25°C might be reduced fourfold to 25 kh at an operating temperature of 55°C. System designers have used various methods of measuring computer system power supply operating temperatures. (See "Special Report: Power Supplies", P. Snigier, **Digital Design,** February 1980, pp. 50-62.) Infrared scanning techniques have confirmed that switching power supply temperatures are more uniform over the supply, whereas linear power supplies are much less uniform. This means that orientation of a linear power supply is generally more critical than with a switcher. These hot spots can be up to 50°C above the overall background temperature! However, if oriented properly and cooled correctly, there is no reason for a linear supply to not function properly for decades without any change in its operating characteristics or destruction of its components, such as its electrolytic capacitors.

are linears still more reliable?

Despite improvements in switcher reliability, linears are superior in reliability simply because their technology is tried and proven, the units are easier to test and adjust, and are easier to troubleshoot. If a linear power supply does fail, it is

generally easy to find a replacement. Not so with a switcher. Switchers involve switching transistors, which are far more susceptible to large-voltage spikes. And loop stability problems are not exactly easy to diagnose or cure. Switching supplies are improving in efficiency, and the day will come in the mid-1980s when switching supply efficiency will equal that of the linear supply.

Is it possible that switching supplies will exceed linears in other areas? Not very likely. Output ripple under 3 mV p-p is common for linears. But try getting anything much below 25 mV p-p on switchers. Linears remain RFI-free and are not the source of EMI, unlike so many switchers. Linears are a safe bet when meeting VDE 0871/6.78 noise requirements. Even at that, many linears in the past were without line filtering. The reputation of switching supplies for not passing VDE requirements is legendary. If a computer system must pass VDE requirements in one country but not in another, then often it is not necessary to specify two different switchers to lower system and marketing cost. Of course, switchers also have slow response time to line for load transients. A typical switcher needs 10 to 50 ms. Linears could respond in 50 μs in response to a 50% unit load change.

line-voltage inputs

Encapsulated linears available for PCB mounting with line-voltage inputs (115 Vac) are known as ac-dc units. Many ac-dc unit manufacturers also offer these ac-dc linear supplies. With encapsulation, these small mountable units can resist shock and vibration, high humidity, corrosive atmospheres and other severe environmental problems. In addition, direct mounting of these encapsulated units mitigates special and costly production equipment that would otherwise be used.

Open frame linears continue finding new uses, and their sales are growing. Advantages include price, delivery, hardware features, strapping, repairability and other factors. Manufacturers of open frame linears claim higher MTBFs.

switchers improve

Although noisy, slow to respond to changing loads, complex, more difficult to design, suffering from other problems (such as expense, RFI and difficulty of adjustment), switchers do provide advantages that include much higher efficiency (75% versus 35%-40%), smaller size, lower weight and longer hold-up time. This last advantage provides for more orderly shutdown or switchover to UPS during a dropout. Switching power supplies provide double the efficiencies of linears. In this age of dwindling energy sources, switching power supplies have an edge: they use energy twice as efficiently. Sophisticated system purchasers and users take overall cost into consideration more than they did in the past. For this reason, switcher advantages more than compensate for extra cost. Switching supply manufacturers claim that supplies will become less noisy, will respond faster and will drop in price.

Lower filter inductance will speed response, and frequencies of switchers will continue to rise, although lowered filter inductance and improved response will worsen ripple current. Compensating for this increased ripple current, improved output filter capacitors with their lower ESRs will cut ripple. Semiconductor manufacturers — now that they have begun to understand power supply technology — are providing improved IC circuits that will keep noise down. As a side effect, the new ICs, although more complicated, are reducing parts count, cost and improving reliability.

Improved MOSFETs and new materials for inductors and transformer cores will boost switching frequencies, thus reducing weight and size and improving reliability. Is there a limit to the practical upper frequency the switchers will attain? Yes. But at present most switchers have a distance to go. Originally at 25 kHz, switcher frequencies are now up to 200 kHz. There is much room for improvement with commonly available switchers on the market. With higher frequencies, will switcher efficiencies improve above the 75% to 90% range that we now see? Perhaps, but it will not be that much more. On the other side, linears, now at the 35% to 45% efficiency range, will not become much more efficient with improved materials. Efficiencies are asymptotically approaching their limits.

Linears dissipate unreasonably excessive power on lighter loads; switchers, on the other hand, are less dissipative. Efficiency does not vary as much with the load, as in a linear, simply because of the power-input duty cycle. Pulse width modulation (PWM) techniques and improved IC devices mean that supply efficiency is more non-dissipative than in a linear supply.

As mentioned earlier, the greater inefficiency of linears, and the non-uniform heating of such supplies, makes thermal stress of linear components something to be reckoned with. Consequently, placement and cooling of linear supplies requires much greater consideration, and the margin for error is greater. With the switcher, however, operating temperature is in the 35°C region, unlike the linear (which is in the 50°C to 75°C range). Lower switching supply operating temperature means that components will be less thermally stressed. This offsets the higher MTBF rates resulting from such higher parts counts. Switcher reliability continues to improve as the regulator/controller circuit parts count is reduced with IC regulators. In addition, IC regulators make easier the task of designing and manufacturing. They offer more features than earlier devices. These include greater range of frequency and duty-cycle control, oscillator synchronization, adjustable dead time, symmetry correction, accurate voltage references, programmable voltage and current output, under-/over-voltage protection, soft-start circuitry and other features.

Is everyone switching to the newer ICs? You'd think so.

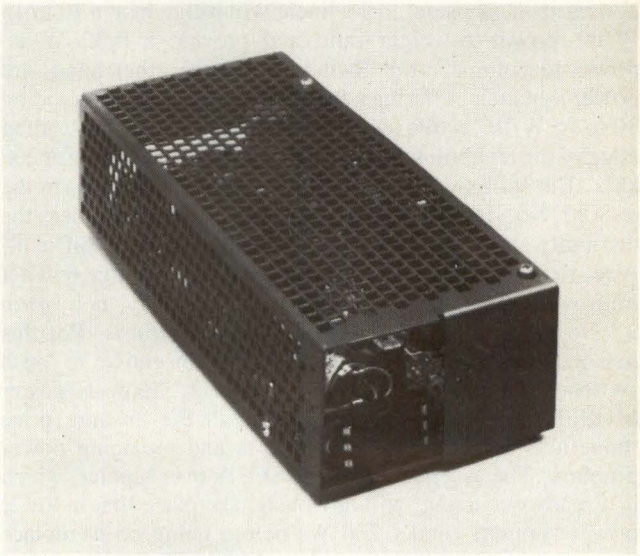

Figure 1: With 115 Vac or 230 Vac input at 47 to 440 Hz, Standard Logic's SWS 150 Series is designed for either domestic or European applications. It has good regulation on all outputs. Features include single phase input, 75% efficiency, low parts count, remote sense and remote shutdown capability.

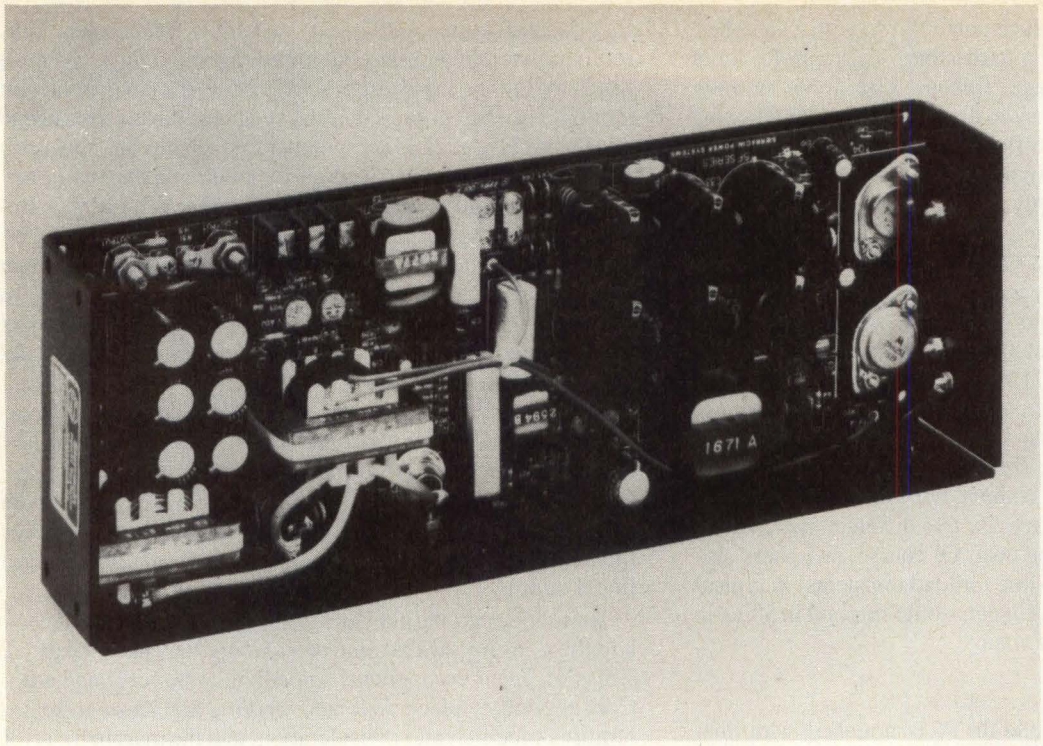

Figure 2: Single and multiple output switchers are available in different models, each with its own voltage and current ratings. To reduce cross-regulation, as with Sierracin/Power Systems' switchers, auxiliary outputs are preregulated by the switching section, then postregulated by linear regulators.

But the sad truth is otherwise. Despite the rapid introduction of controller and other ICs, too many switcher manufacturers remain with older IC devices (and sometimes, even older discrete-component regulator curcuits). Most switcher manufacturers using IC regulator devices use those that are available off-the-shelf, although proprietary regulator ICs exist. These ICs may provide improvements, such as higher operating frequencies, and incorporate more discrete devices and offer unique features not available with standard regulator ICs.

will frequencies exceed 200 kHz?

Standard switchers operate at 20 kHz to 25 kHz. This is just above the audio frequency range. Due to higher switching frequencies, the transformers, capacitors, inductors and other devices can be smaller and lighter. As a means of comparison, consider that a linear will weigh in at a 10 to 15 W/lb. power-to-weight ratio and provide a 0.32 W/in^3 power-to-volume ratio. Switchers, on the other hand, are power dynamos, offering a threefold improvement, providing 30 to 75 W/lb., while packing 1 to 3.5 W/in^3. At the leading edge of the technology, certain switchers are operating at 200 kHz. But will switchers exceed the 200 kHz barriers in the 1980s? No. It is unlikely they will go much higher; the difficulty with efficient coupling will make this difficult. And, reduction in weight and power per unit volume will not improve that much more beyond this frequency. Is it worth it? No. This is the point of diminishing returns. For this reason, there will be little economic incentive to push switcher frequencies above 200 kHz. Expect power MOSFETs to enter a price war, with the ensuing price reductions lowering switching costs and replacing power bipolars. The ascendency of MOSFETs over bipolar, which is already occurring, will obviously take place first in lower power supplies (under 200 W) before going on to replace bipolars in higher power supplies. MOSFET semiconductor technology still has far to go, but it is beginning to approach maturity. Newer devices that will be introduced in the next two years will improve MTBFs and result in lower-cost switchers that are lighter and smaller.

switchers beat those dropout blues

Utility company power, though it has not deteriorated as rapidly as it did four years ago, continues to deteriorate and, at the present rate, line-power dropouts (and even brownouts and blackouts) will become more commonplace as is now the case in many nations. This is due to several factors in the U.S. that include the slowdown in nuclear power plant construction, government red tape for utilities, oil prices, and the increasing use of transient and EMI-generating devices. Unlike the electronics industry, manufacturers of heavy industrial equipment (such as air compressors) are not bound by the same strict EMI requirements. Although this is unfair — and complaints have been voiced — not enough has been done about this problem in heavy industrial equipment. Compounding this problem, newer and more energy-efficient industrial equipment may aggravate the problem by generating EMI. Increasing use of microprocessors and computer systems in the industrial environment and by consumers and small businesses mean more systems will be subjected to these transient-generating and EMI-producing industrial units.

Power line dropouts exceeding single cycles (16.67 ms) occur more frequently than in the past. As mentioned earlier, switchers provide more carryover (typically 15 to 40 ms). This hold-up time can carry over the majority of such interruptions without going out-of-tolerance in their output. Output regulation for linears, on the other hand, is worse.

Linears are less able to tolerate low-line voltages or brownouts. Switchers tolerate about ±20% of the input voltage range (90-130 V/180-260 V), while linears can only handle ±10% (105-125 V/210-250 V). Unlike linears, switchers are commonly available to tolerate even greater tolerances of the input voltage range. Certain military switchers, although costing more, can take input frequencies from dc up to 440 Hz and voltage ranges from 10 to 260 V without a variable transformer or changing transformer taps. One such unit provides ±5% from a full load up to 10% of full load, keeping a respectable efficiency of 70%. Other manufacturers provide switchers that also operate on widely varying voltage inputs. This will vary (depending upon the supply); typically it is from 90 to 250 V and may include a dc

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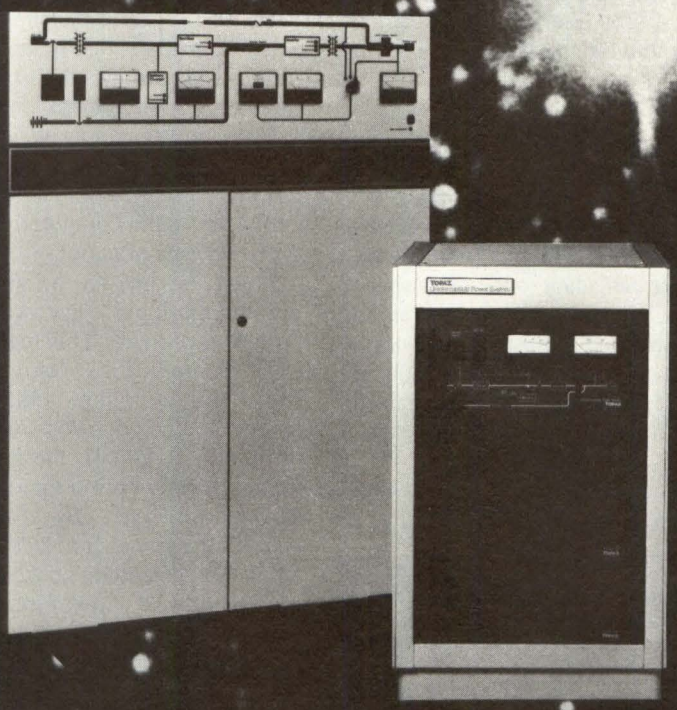

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voltage range (which may typically be lower for the same switcher). Some switchers are available in combinations of single, dual and triple outputs. Others provide LED status indicators for the status modes, softstart overvoltage and overcurrent protections, paralleling and other features. These extra features will increase. By the mid-1980s, something resembling an "intelligent power supply" could emerge.

difficulties still plague switchers

Aside from switcher problems already mentioned — noise, EMI, spikes, greater difficulty in meeting VDE requirements, higher noise output, greater ripple — the switching supply is prone to other problems. Cost is one. Meeting the noise requirements (such as those of the FCC, EMI/RFI regulations [Docket 207080] and other regulations), mandated increased filtering. Switcher manufacturers claim this will boost prices by up to 15%. Extra filtering, components, testing and markup will account for this 15% increase in price.

Home computers, which did fall upon their own problems with radiated and conducted noise, certainly don't need the extra problems that poorly-designed switchers could provide. With certain personal computers using enclosed supplies, the extra space for further filters and components, the problems of space and the cost cannot fail to add more to unit prices. Although open frame switchers can adapt to the extra space more readily, many need shielded enclosures — even if the personal computer is already shielded against radiated noise (which is more difficult to suppress than conducted noise). Aluminum-sprayed housing, plastic enclosures impregnated with metalized strands or particles, or more costly metal cabinets will not suffice.

Although more manufacturers claim that their switching supplies meet FCC and VDE specifications, enough supplies exist that do not (or are questionable). Requirements such as those covering noise suppression (VDE 0871/0875) have been met by some switching supply manufacturers in this country for some time. However, if the computer system is to sell in West Germany, the U.S. and the third world, it would be price-foolish to use the same supply in each computer system; each nation may require your system to comply with different regulations. Although supplies may meet FCC noise-suppression regulations, and though these FCC regulations are more lenient than VDE 0730 regulations, the FCC may upgrade its regulations to make them just as stringent. To meet these more stringent requirements requires built-in filters, greater component spacing, wider wiring, special capacitors, transformers and inductors with greater primary-to-secondary voltage isolation when high-potted.

Although a number of switchers now on the market meet VDE 0871, certified supplies are still uncommon. The reason for this is that reducing conducted EMI requires line filters. This reduces the isolation voltage and raises ground leakage — sometimes to unacceptable levels. For this reason, power supply manufacturers prefer not to specify EMI standards unless the application requires it. In addition, OEMs refuse to specify a switching power supply unless they know that their computer system will be required to meet such EMI specifications.

Noise suppression means little when you're specing for low-output ripple, since switchers are not uncommonly in the 50 mV p-p range. This high ripple certainly can be filtered with external filters or clocked digital circuitry. If the switcher's internal switching is synchronized to an external clock (which is done by some switchers by carrying this out through a terminal), the internal oscillator of the switcher transmits only during intervals when ripple or other noise is least harmful and affects filtering the least. This solution enables the switcher to sidestep the noisiest time period, like a boxer sidestepping punches. Since the external ripple filter on a switcher's output forms a feedback loop to the regulator input, it is difficult to adjust the output filter to reduce ripple. Instabilities due to feedback magnitude and phase problems, undershoot, overshoot, response and hold-up characteristics are so dependent on the filter that only minimal adjustments can be made to minimize the ripple. Synchronization of the internal oscillator to transmit during the best intervals (to make filtering easier) appears to be a good solution.

Quasi-regulation for multi-output switchers fully regulates the main output, with other outputs keyed to it. If the load is reasonably invariant, this is adequate. Unfortunately, if line excursions are greater with widely varying loads, this will not suffice. A ±10% regulation, which is needed for most commercial ICs, may be exceeded in thermal drift and cross regulation. Before specifying such supplies, be sure to test the supply under the worst case input and loading conditions. If this proves satisfactory, such a lower-priced unit will save in overall system costs.

specifying switchers? follow these steps.

Since switchers are more difficult to design and manufacture in-house than are linears, most OEMs specify switchers. Despite the wide variety of available switchers, many applications require modification of existing switchers or possibly custom designs. Rather than specifying a standard catalog switcher, designers specify a semi-customized unit. It is at this point that you may run into trouble. Like writing an article, writing a good specification requires that you begin with a specification outline or table of contents. And

Switching and Linear Supplies Features

Among the many different features to look for in a supply, the following form a good starting point. If writing a specification, include them. Features include:

- Number of package sizes
- Range of models
- UL, VDE, etc. listed
- Commercial contract plan (for OEM/large-quantity purchasers)
- Reliability (practical, not theoretical)
- Several levels of regulation
- Convection cooling (vs. external heat sinking or forced air)
- Efficiency
- Remote programming (on all models?)
- Mountable on 3 planes in any position
- Wide operating temperature range
- Automatic current-limiting and self-resetting protection
- Overvoltage protection
- Serviceability (all components replaceable? Easy to locate?)
- Complete electrical isolation
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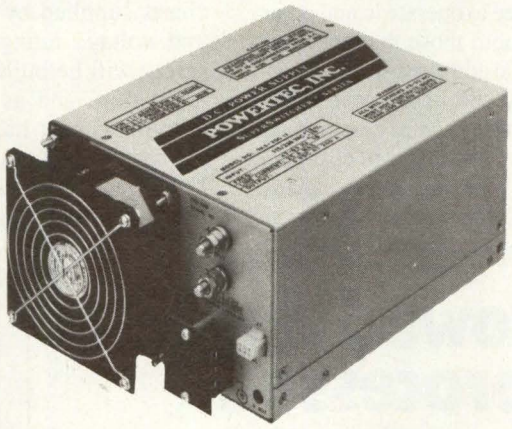

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- EMI AND SAFETY: Designed to meet UL478, CSA22.2, IEC435 and VDE0804. 165-265 VAC model meets Class B levels of FCC Docket 20780 and VDE0871.
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writing a specification for a power supply, particularly a switcher, means you must take into account the intended application. If it is a switching power supply, it must be particularly well-specified with limitations. Differences between the specification for a switcher and a linear supply would be primarily in the performance requirements (I/O specs). To prepare a specification, begin by preparing a specification outline or table of contents that includes these major categories: introduction, standards, performance (I/O specs), environmental requirements, acceptance tests, warranty and documentation. The last five are typically the same for both linears and switchers.

Sound confusing? If you've written specs before, you may think that writing specs for a semi-customized or customized supply is not that involved (and, relatively speaking, you are right). But, make one mistake, and your company will foot the bill for oodles of supplies good for boat anchors (not to mention your career). With this in mind, let's look at one set of specifications, as suggested by a supply maker. It's not something cast in concrete, so adapt it to your specific needs.

Introduction is merely a brief statement which indicates how the supply will be used in your particular application. This statement will detail the type of equipment to be powered and provide details of the computer system, including the environment it will be expected to operate in and other conditions. Standards will include both those that are legal and must be met or other standards. To add extra standards — more than is necessary — will only add to the cost of the overall system. If intended for a system used in commercial applications, obviously the supply will be lower in cost than one intended to meet government or other regulatory agency standards. Overspecification is as dangerous and costly as underspecification. This is more true today than in the past and will be even more so in the future.

As for performance requirements that must be met, it is this section that will differ most from that when specifying linear supplies. This section's performance requirements will be broken down into several categories. It will include input voltage range which will typically be around 115 V to 220 V; anything above 260 should be avoided because this is generally the switching transistors' upper ratings.

In defining the frequency ranges of the input circuit, remember that they typically fall between 45 Hz and 400 Hz. The need for lower output frequencies is not so common, which is just as well because the capacitor input filter limits the input frequency. Whenever a source or power supply is placed across an uncharged capacitor, the capacitor will act as a short circuit, thus creating a transient current surge. Obviously, limiting is needed. Generally, this can be low-cost thermistor-type or step-start limiting. Thermistor limiting, though low in cost, cannot cool between a series of dropouts and recoveries. If repeated dropouts are an anticipated problem, forbid thermistor limiting and specify one of several alternatives. Do specify maximum acceptable inrush current, which is a function of the circuit breaker's or fuse's current trip rating. This may be determined from specification charts supplied by the manufacturer. As for output current and voltage ratings, the loads will set this. Decide what safety will be built in above this maximum. As for voltage regulation, and as discussed earlier, a regulated multiple-output switcher has a primary output with secondaries. The primary voltage is obtained from a pulse-width regulator. Load regulation will be ±0.1%. Secondaries are quasi-regulated or unregulated. If unregulated, they can vary,

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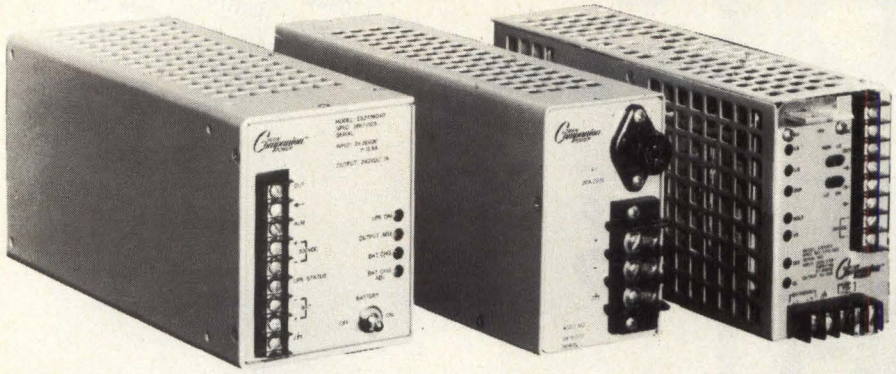

Figure 3: More manufacturers offer series of switching supplies, associated UPS and battery modules to provide built-in protection from AC line interruptions. In the case of these Lorain Products' Companion series, interruptions up to 30 minutes are handled for medium power systems.

usually up to ±10% from nominal. It may be lower in cost.

When specifying noise and ripple, the more you require a supply manufacturer to design in or semi-customize, the greater the switcher will cost. A reasonable tradeoff between noise and cost can be made if a one to two percent value is specified. Be sure to specify the test instrument bandwidth that will be used to measure this figure (typically dc to 10 MHz and 30 MHz). As for slower transient response, this is unavoidable; unity-gain frequency of the regulator must be lower than switching frequency. Do specify the magnitude of load-step change, how close the output must return to nominal in the specified time, and maximum overshoot resulting from a load-step change. As for holdup time, as mentioned earlier, this will depend primarily upon the rectifier-filter capacitor and typically may lie between 15 ms and 30 ms. If your application requires a longer holdup time, obviously, increased capacitance will be reflected in the cost.

As for ohm-per-voltage protection, this problem is not as serious with switchers as with linears, since in the case of switchers the opposite problem is more likely to happen. When a Schottky diode or switching transistor goes, it usually opens, thus either removing output voltage or greatly lowering it. If ohm-per-voltage protection is deemed necessary, pulse width modulator control circuitry may contain inherent electronic limiting to prevent this. On occasion, a switcher's control feedback loop may open, resulting in a rapid rise in ohm per voltage. In a linear supply, failure of the series-pass transistor, usually due to a short, permits unreg-

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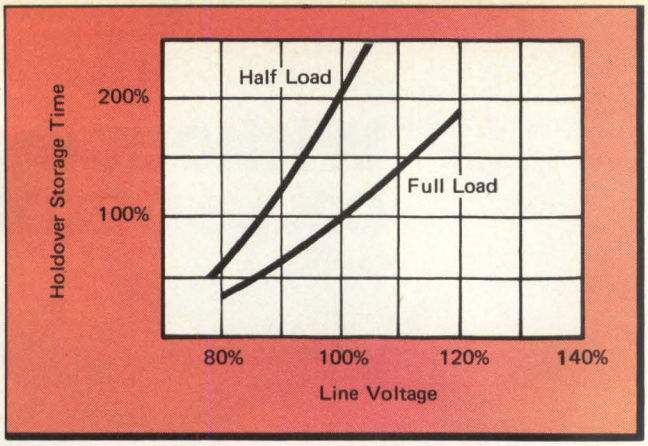

Figure 4: Holdover storage time, the length of time a switcher maintains full output after input power fails, varies: the greater the input voltage and the less load, the longer it is. The relationships are approximately linear.

ulated dc to pass through to the output. To prevent such high voltage from damaging the load, some form of low protection (such as an SCR crowbar circuit) will short the output to ground quickly enough to prevent damage.

Although these general guidelines for writing switching supply specifications may vary, why not contact several vendors to obtain sample specifications? By comparing them, and knowing your application needs, you can avoid making that one critical mistake that will fill your warehouse with useless supplies.

purchase or build? beware of pitfalls

For most uses, off-the-shelf supplies are sufficient. Unless you have in-house power supply expertise (particularly for switchers), or if the volume of systems warrants it, or if you are building up in-house expertise, it may pay to buy rather than build. With the engineering shortage, and with the growing complexity of supplies and the specialty of the field, the trend is definitely towards buying and not building your own. The cost per watt of off-the-shelf, custom and semi-custom switchers continues to improve. For a manufacturer lacking switching supply design expertise, it is unlikely that he can produce a supply in reasonable quantity that would be competitive; or, if he could, would feel comfortable doing so, knowing that the risk of failure is growing.

So did you decide to buy rather than go the "roll-your-own" route? If you think you've got it made, you're wrong. In buying a supply, the road is strewn with potholes. Confusing claims made by supply manufacturers compounded with suspiciously high values (particularly MTBFs), look-alike warranties, and other pitfalls insure that specifying a supply is not without its dangers.

Although there is no way to avoid risks, there are certain rules to follow to minimize dangers. Do not specify a power supply solely from spec sheets. If you are a programmer, or in any other way unqualified to compare computer supplies (particularly switchers), obtain the services of a knowledgeable engineer. Always visually examine and evaluate a supply. Be sure to remove cover plates, inspect for inspection dots, wiring, solder quality, connectors, PCB quality, and other visually obvious signs. When comparing MTBFs, calculated values are usually based on vendors' derating standards; therefore, they may be inadequate. If calculated against a recognizable standard, this will prove to be a baseline by which you may compare different supplies. Unfortunately, the real world doesn't work so well. Check

out the power supply manufacturer's QC, his visual inspection of mechanical components (switcher's solder joints, screw connections and so forth), full power burn-in and other procedures. Check the vendor's reputation. Contact colleagues in your firm (or its divisions), or at other firms (who will return the favor one day). And be sure to obtain a list of customers. Remember: big isn't always best; at least one major power supply manufacturer now provides less than satisfactory service.

Are those claims of immediate delivery really true? Do off-the-shelf supplies come within the three days, as claimed? Unfortunately, off-the-shelf supplies may not be available for eight or more weeks ARO. This is particularly true if a lower quantity is ordered. Other companies both small and large list supplies they do not have in stock or even in production — or sometimes not even on the drawing board! Of course, it is impractical to stock thousands of models, so it is expected that many are built on a "per order" basis. However, many off-the-shelf items are not.

If you specify a semi-custom supply and discover it must be returned, you will not receive return credit, nor credit for cancellations for supplies ordered in error. Even for off-the-shelf supplies, a restocking fee will be charged prior to return for credit.

As for terms, consider price and quantity discounts, export handling charges, financing, in-plant (source) inspection charges, anti-moisture fungus-resistant varnish coating charges and service charges. Examine serviceability of the supply. Replacement parts may not be as easy to obtain as you were led to believe, particularly for switchers.

As for warranties, warranty times do differ; and, in many cases, MTBFs may exceed the warrantied term. Warranty periods may extend from one to five years, with encapsulated supplies, which are non-serviceable, running for far less (such as one year). Determine if the manufacturer includes a retest and inspection charge. Determine service facilities available and the reps in the area. Can you reproduce the technical data manual, technical data sheets or information for inclusion in your computer system technical manuals? This is the time to ask. And does the manufacturer provide applications assistance? What is his level of expertise? Examine qualifications. And, while examining specifications, beware of specsmanship. Qualifiers like "up to" and "greater than" are more often a representation of reality than the better values that they seem to indicate. (Or, this may indicate these values are too hard to measure).

If you are specifying a custom switcher or semi-custom supply, don't over specify. A range that is specified as too broad, such as meeting transient responses under all input conditions (when the applications do not require it!), only makes it more difficult for the manufacturer to meet those specifications. So, some manufacturers will take certain shortcuts to do so. Worse, this overspecification can do nothing but lower reliabilty and unnecessarily increase costs.

In considering power supplies, particularly switchers, it is more important today to consider company reputation than in the past. Reputation alone isn't enough. Certain well-known firms may carry some categories of supplies merely as a convenience to customers, rather than specializing in those categories. Other well-known firms may semi-customize or customize power supplies for a certain category of users, such as aerospace or medical OEMs, and may find it more difficult to meet your intended application if it falls within, say, industrial or scientific fields. In any event, if you follow the above selection procedures, you will optimize your chances of selecting the best supply for your system. D

Chief Engineer

Fame and fortune — yours for the asking. Ask about Smoke Signal Broadcasting's powerful and flexible development systems with 64K RAM — called Scout - system™. Hardware and software in one complete, low-cost package.

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Video Display Terminal Showcase

terminal manufacturers offer alphanumeric and graphic terminals

This showcase presents the latest in display technology from a variety of major manufacturers. Only the most recently introduced models appear here; each company sells a number of other models as well.

For inclusion in future display terminal showcases, write to: Showcase Editor, **Digital Design,** *1050 Commonwealth Ave, Boston, MA 02215.*

Dialogue 80

Video Display Terminal. Capable of operating in either conversational or block mode. Non-glare 12″ diagonal screen. Also non-glare detachable keyboard with 20 programmable function keys. Scrolling is standard. Self test program ROM, display, data RAM and loopback of serial interface.

Ampex Corp, *(Memory Products Div), 200 N Nash Street, El Segundo, CA 90245.* **Circle 226**

AND

A liquid crystal dot matrix display. Features 40 A/N characters in a two row, 20 character per row format. Each 5×7 dot matrix character is 0.21″ high and is capable of displaying the full ASCII character set. Below each 5×7 dot matrix character, an additional row of dots has been provided for a cursor. Requires only a single 5 VDC supply. Other models have 1 to 4 display rows.

A.N.D. Co, *770 Airport Boulevard, Burlingame, CA 94010.* **Circle 300**

AJ 510

Interactive 15″ Display Terminal. TTY compatible. 80 columns. Terminal status indicator allows user to see terminal presets in 81st column. Rear panel switches may be displayed on command. Cursor key transmission permits local or remote control. Preset tabs every 8 spaces with resetting on command. Typewriter style keyboard. Two RS232C connections, 80 characters/24 lines, 7×10 dot pattern in 9×12 matrix.

Anderson Jacobson, Inc, *521 Charcot Ave, San Jose, CA 95131.* **Circle 227**

209001 Ambassador

15″ screen. A/N stand-alone terminal. Keyboard attached. Raster technology. Selectable A/N display formats from 18 to 60 lines via keyboard or computer. 80 characters per line. Zoom and scroll control. Interface, RS232 standard; optional, RS449, 20mA. Height of character varies with display format. Readout color, P39 green. Also available, P4 white.

Ann Arbor Terminals, Inc, *6175 Jackson Rd., Ann Arbor, MI 48103.* **Circle 228**

LPVT

Large Printer Video Terminal. TV-type monitor plus software produces high quality print of various sizes. The LPVT unit can be used with various black and white or color monitors, or can be attached to a standard TV unit. Unit can produce character sizes from 3/16″ to 3″ high. Useful for airports, loading terminals, visually impaired, etcetera.

ART Computer Products Inc, *80 Boylston St., Suite 1260, Boston, MA 02116* **Circle 229**

DC-946-30

5″ CRT Data Display. Incorporates a new frame type and ultra reliable state of the art components. Has a plug-in circuit board, minimum geometric distortion, video response to 18 MHz. 650 lines of resolution. Internal controls for brightness and vertical/horizontal size, linearity and hold. Company has a line of data displays ranging in screen size from 5″ to 15″.

Audiotronics Corp, *7428 Bellaire Ave, N Hollywood, CA 91605* **Circle 230**

Consider graphic input devices, instruction set richness, software support packages, screen resolution, picture element resolution and host interfaces.

CC80

Graphics Work Station. 19″ or 25″ high resolution graphics CRT plus 9″ A/N CRT. 240-position menu function keyboard plus record function keyboard plus standard graphics keyboard plus coordinate entry keyboard. Cursor control. A variety of digitizers. Communications processor (high speed communication multiplexer) can support up to 4 CC80 work stations.

Auto-trol Technology Corp, *12500 North Washington, Denver, CO 80233* **Circle 231**

BCX Series

CRT. Available in a frameless version. Unmounted display concept saves cost and facilitates incorporation into terminals. 12″ diagonal. Single circuit board. All electronics included plus high-voltage assembly. Each display is fully aligned, adjusted and ready for installation. Specified line rates up to 19,400 Hz. High brightness display with high video channel bandwidth.

Ball Electronics, *Display Div, PO Box 43376, St Paul, MN 55164* **Circle 232**

SM-810-002

Planar gas discharge (neon gas) display with microprocessor control. High brightness (75 foot lamberts.) Parallel ASCII input. Self test and scroll modes. 130° viewing angle. Single 5V supply. Single line, 20 characters (0.47″ × 0.28″) 5×7 dot matrix from 98 character set. A μC assembles characters and controls display. The display system can be interrogated concerning status (busy or ready).

Beckman Instruments, *350 N Hayden Rd, Scottsdale, AZ 85257* **Circle 233**

DM Series

New optional 15″ monitor. Has a bonded anti-glare face plate with high resolution. P42 green monitor offers a high degree of character legibility and larger character size to alleviate operator fatigue. Beehive's DM series terminal includes its recently introduced IBM 3276 compatible control unit with display station.

Beehive International, *4910 Amelia Earhart Drive, Box 25668, Salt Lake City, UT 84125* **Circle 234**

TM 71 A/N Microterminal

Measures 8.5″×4.5″×0.6.″ Small compact device has 16 segment LED character display. 0.16″ red LED 80 character buffer. Single line display. 80 ASCII characters, 14 function keys. Interfaces RS232C, 20 mA current

loop. This tiny terminal functions as console and control center for instruments and small systems. CPU control of flashing, scrolling or blinking.

Burr-Brown Corp, *PO Box 11400, Tucson, AZ 85734*
Circle 235

Self Scan II

Gas Plasma Display. Screen size 11″×6″×1¼″. OEM component. 60 lines/inch resolution. 75 Hz rate. Compatible with any host computer. Color readout: neon orange. Height of character 0.26″. Burroughs has, or is about to announce, a new gas plasma technology. New unit will eliminate need for refresh electronics and will offer additional benefits to terminal mfrs.

Burroughs OEM Marketing, *Burroughs Place, Detroit, MI 48232* **Circle 236**

3100

DEC-compatible video terminal. Emulates the DEC VT 100 with advanced video options. Has features which, according to company, are not available on the comparable DEC model. Costs less than the VT 100. OEM plus quantity discounts available. Has printer port, non-glare screen, four video attributes to set up prompt legends, 19,200 baud operation and screen save.

Cobar Inc, *1181 North Fountain Way, Anaheim, CA 92806* **Circle 237**

MVI-7

Color Graphic CRT Terminal. Colors include red, green, blue, white, yellow, turquoise and pink. Display has 1920 A/N characters in a 24 line × 80 column format with 720×288 graphic resolution. Graphic data can be displayed by using any position or all of 9×12 character matrix. Detached keyboard has 87 keys. Blink, highlight, foreground and background colors and underscore. Four independently addressable and scrollable split screens. Standard emulation package includes VT 100, VT 52, IBM 3101, Hazeltine 1500 and Lear Siegler ADM3.

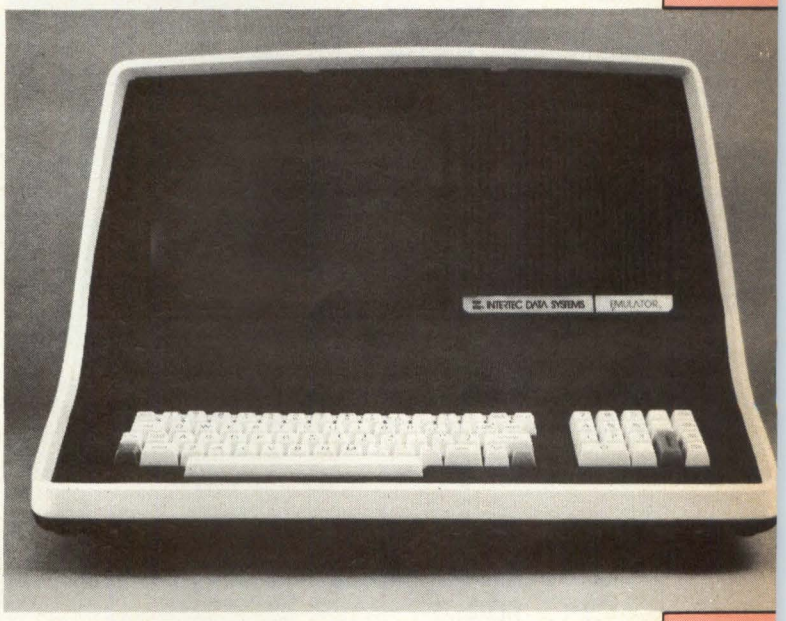
Colorgraphic Communications Corp., *2379 John Glenn Drive, Atlanta, GA 30341* **Circle 238**

MB85-12

A/N plus pixel graphics terminal with attached keyboard. Raster screen technology. Resolution 700. Scanning speed 1572 KHz; refresh rate 60 Hz. Compatibility: Intel, multibus interface. Readout 80 characters × 24 lines. Character height, 7×9 pixels. Reverse video, underline, blink, half-intensity. 88 programmable keys. N-key rollover, numeric keypad. Cursor control keypad.

Comark Corp, *257 Crescent St, Waltham, MA 02154* **Circle 239**

The display terminal market, for both high- and low-end terminals, will show greater growth than projected.



Designer M

Graphics processor with a fixed media disk and magnetic tape drive system. Has 2 "Instaview" raster scan interactive design work stations, a graphics operating system, a system console and a CAD/CAM software applications package. Three tasks (two interactive and one batch) can be supported simultaneously by system.

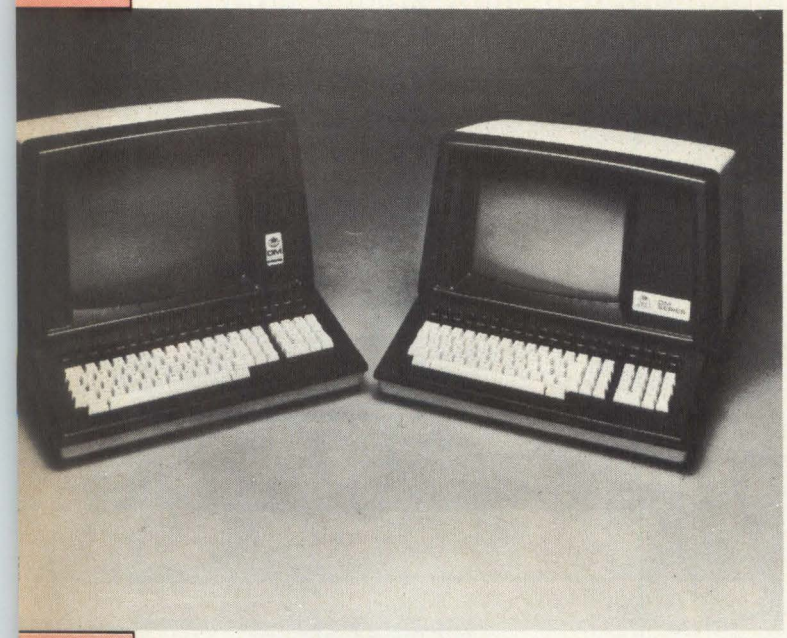
Computervision Corp, *201 Burlington Rd, Bedford, MA 01730* **Circle 240**

Model 2400

High resolution monochrome display monitor. 19″. Wideband video amplifier, pre-set calibration controls, dynamic focus, optional CRT phosphors, adjustable horizontal scan frequency. Available in cabinet, naked or rack-slide versions.

Conrac Div, *of Conrac Corporation, 600 North Rimsdale Ave, Covina, CA 91722* **Circle 241**

Color graphics provide wider ranges of options from single on-board processors to complete systems.



CPG 100

Graphics terminal operates in 11 modes to permit use for graphics memory, A/N or independent use of either without affecting the other. Compatible with the industry standard Tektronix Plot 10 software, it is also compatible with ISSCO's DISSPLA and TELLEGRAF and offers enhanced graphics input. The CPG-100 allows for full scale usage with a 640 × 480 resolution on a green-toned raster screen and a large addressable plot area of 1024×780 dots. Selection of 4 character sizes, dot-dashed lines, selective erase and A/N overlays are all standard.
Continental Resources Inc., *175 Middlesex Tpke, Bedford, MA 01730* **Circle 242**

CTI 2000

Display terminal. 12". Provides 3270-type features and application-program access to IBM 2740 and 3767-type keyboard printer terminals. A slave printer may be attached to the display to print data selectively from a screen. 24 lines, 80 characters. 25th line for operator use.
Custom Terminals Inc, *Box 19906, Raleigh, NC 27619* **Circle 221**

Dasher G300

Graphics Display Terminal. Two modes of graphic operation are selectable: abbreviated command mode; mnemonic command mode. Two user selectable scroll rates. 12" tilt and swivel screen displays. 1920 characters in 24 lines, 80 columns. Graphic images are plotted on a 640 × 240 pixel matrix. Detached keyboard has a typewriter style arrangement; 14-key numeric pad; 15 program function keys; 5 local function selection keys.
Data General, *Rte 9, Westboro, MA 01581* **Circle 243**

132-2

Stand alone, 12" diagonal screen. Green phosphor (P-31). Has an integral keyboard. A/N, no graphics. "Charactron" technology. (Dual deflection CRT. Beam deflected through stencil cutout and then to screen.) Resolution: 4000 lines, 60 Hz refresh. Compatible with all asynchronous (ASCII) computers. RS 232C, (20 mA current) 0.09" character. 115V or 230V.
Datagraphix, Inc, *10981 San Diego Mission Road, San Diego, CA 92108.* **Circle 244**

DT 80/3

12" Standard screen, 14" optional. Stand alone component. Sold with keyboard. A/N + business graphics. Raster technology. 50 or 60 Hz refresh rate. Compatible with any asynchronous computer. Interface: RS 232C. 24 display lines. 80/132 characters per line. Operating power, 100 watts. Readout: white phosphor; optional, green.
Datamedia Corp., *7401 Central Highway, Pennsauken, NJ 08109* **Circle 245**

DTH-15

CRT Data Display. Available in kit form as well as in a compact and rugged frame. Mounted on a single PC board including the HV flyback assembly. The 110° deflection CRT can be ordered in different phosphor types and with a polished, direct etched or laminated faceplate. Compatible with Motorola and Ball 110' models. Competitively priced.
Datronix Inc, *160 First St SE, New Brighton, MN 55112.* **Circle 246**

D148C

Graphics System. Creates high resolution 35mm slides. Unit creates a full range of computer-oriented business graphics and presentation quality slides quickly, easily and at a low cost.
Dicomid Corporation, *9700 Newton Ave., Minneapolis, MN 55431.* **Circle 225**

GIGI

General Imaging Generator and Interpreter. Low cost text and graphics terminal with built in features of graphics intelligence and special applications software. Aimed at educational institutions. Accesses Digital's powerful educational computers. Portable modular keyboard. Multiple color for display (8) with 8 shades of gray. Multiple character sets (24 rows of 84 characters each.)

Digital Equipment Corp, Education Computer Systems, *129 Parker Street, Maynard, MA 01754* **Circle 247**

VT100

Video Terminal. A high performance video display that provides maximum flexibility and portability. Operator-oriented features include double-width/double-size characters, 80 and 132 column lines, a detachable keyboard, smooth scrolling, a split-screen and composite video output. 7×9 dot matrix characters with 2 dot descenders in 24 lines. Character set: 94-character ASCII and 32 special graphic features. Baud rates from 50 to 19200. Options include advanced video, printer port, a 20mA interface, foreign language and special character sets.

Digital Equipment Corp. *(Terminal Product Group) One Iron Way, Marlboro, MA 01752* **Circle 223**

VT-640

Retro-Graphic enhancement for the DEC VT100 terminal (Converts the VT100 A/N terminal to a graphic capability). Display screen: 8×6. Graphics terminal with A/N ability. 640×480 resolution; vector drawing; point plotting; selective erase; A/N overlay. Interface: E1A RS-232C. 34 lines displayed, 80 characters per line. Operating power: 90-128 V, 180-256V. Switch selectable.

Digital Engineering Inc., *630 Bercut Dr, Sacramento, CA 95874* **Circle 248**

VP 828

Video Display Terminal. Customized features: bidirectional scrolling, three scroll rates, eight video intensity levels. User can also select page or line transmission, block or character transmission and the start and end of blocks. 80 or 132 columns. Split and reverse screen, blink, underscore. Non-volatile RAM, separate transmit and receive.

Direct Inc, *1279 Lawrence Station Road, Sunnyvale, CA 94086* **Circle 249**

CD-33

A new series of BARCO compact color display monitors is offered by Elector, US distributors of BARCO displays. This model offers a color-critical, high resolution PIL tube which, claims the company, lowers costs and eliminates the need for operator convergence and adjustments. Unit has a high resolution .31 mm dotted screen shadow mask in-line gun picture tube permitting sharp definition of characters or graphics. Rack mounted or desk-top display.

Elector, *5128 Calle del Sol, Santa Clara, CA 95050* **Circle 250**

4430 CRT Terminal

Ergonomically designed with green non-glare display. A/N asynchronous ASCII microcomputer based terminal. Fully compatible with the DEC VT100. Has a detached low profile keyboard, tiltable screen, a printer port, format control and smooth scrolling.

Facit, Inc., *66 Field Point Rd, Greenwich, CT 06830* **Circle 251**

Increased intelligence frees terminals from dependence upon the host computer, if the graphics display is simple.

IM-1

Graphics terminal. Has a basic interface using full RS-232C I/O port. Universally compatible. Interfaces to most minis and micros (Alpha Micro, LSI-11, etc.). Software allows interactive XY plotting, 3-D contour plotting and pie charts. High quality images.

Form and Substance, Inc, *(c/o DP Design) 3375 Vinton Ave, #3, Los Angeles, CA 90034* **Circle 252**

Vuepoint

An A/N display panel, touch sensitive scanner. Microprocessor controlled, communications interfaced. Up to 240 touch-sensitive areas. Interface: RS 232. 12 lines × 40 character flat panel display can be hung on wall, attached to an industrial control panel or pedestal mounted. Small: 12″×9″×3″ for display; 12″×9″×6″ for controller. Lightweight, portable (display can be placed 10′ from controller.) Optional keyboard and printer interface. Automatic screen refresh.

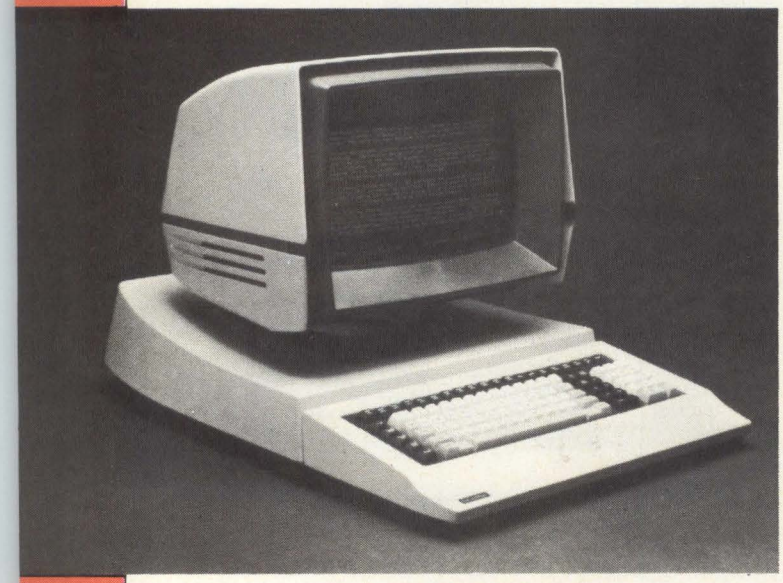
General Digital Corp, *700 Burnside Ave, E Hartford, CT 06108* **Circle 253**

GT-110

Stand alone. 12″ screen. P4 or P31 color readout. Sold with keyboard. A/N. Raster technology. 50/60 Hz refresh. 24 display lines; 80 characters per line. 0.2″ height of character. Operating power: 110/60Hz or 220/50Hz. It has a line or block graphic capability and is ASCII compatible.

General Terminal Corp, *14831 Franklin Ave, Tustin, CA 92680* **Circle 254**

Display resolution is determined mostly by dimensional mathematics.



G-1000

High resolution, low cost monochrome graphic terminal with an A/N overlay option. Z-8001 based, self contained unit. Useful as a programmable terminal in any application requiring high resolution and interactive capability. A/N data is stored in that portion of the memory plane not required by the bit-mapped 1024 × 792 graphics image. No additional memory required. AOC card is field installed by user.

Genisco Computer Corp, *3545 Cadillac Ave, Costa Mesa, CA 92626.* **Circle 255**

9278-12

CRT. Supports screen size of 1,920 characters. 15″ screen. Automatically adjusts from a 1,920 character screen to a 3,440 character screen depending on application. Uses full display area in all applications. Compatible with IBM's 3270 product line. Has detachable 75-key keyboard. Three intensity levels. 25th status line.

Harris Corporation, *Data Communications Division, 16001 Dallas Pkwy, Dallas, TX 75240* **Circle 222**

Executive 80, Models 21/30

Display terminal. 15″ stand alone. With keyboard. A/N. Raster technology. Refresh rate 60 Hz. TTY compatibility. Interface: EIA RS 232/ RS422. 25 lines displayed Characters per line: 80/132. Height of character 0.213″. Operating power: 130 W. Readout green.

Hazeltine Corp, *Commack, NY 11725* **Circle 256**

HMW 9001

Interactive Graphics Terminal. A self-contained ASCII compatible color graphics color terminal intended for process control, network management, financial analysis and computer-aided design. "This compact unit may be desk mounted and may replace most A/N terminals," says company. Dual 8085 processors. Eight foreground and background colors. 80 × 48 character format. 512×256 repeat field graphics format. Full edit and communications.

HMW Enterprises, Inc, *604 Salem Rd, Etters, PA 17319* **Circle 258**

Concept 108

Display terminal. 80/132 column display, non-volatile memory, 8 pages of display memory, and a series of user-specified functions. 5×9 dot matrix in a 7×10 dot array. The 8 pages of display memory is allocatable between display memory and function key storage. "Create screen" function transmits a complete format.

Human Designed Systems, Inc, *3700 Market St, Philadelphia, PA 19104* **Circle 259**

ED-7128

Small, solid-state flat panel E1 display made by Sharp Corp. Provides 80 characters per line and up to 12 lines of A/N information. Graphic portrayal possible on the 128×512 full field array. Display panel is 1.77″×7.1″. The entire assembly weighs approximately 0.5 pounds. The 72.5 LPI resolution is flicker free.

Hycom Inc, *16841 Armstrong Ave, Irvine, CA 92714.* **Circle 260**

ID 100

Video Color-Symbol Graphics Terminal. 12″ display. Serial Communications. ASCII terminal. Portrays 8-color (background or foreground) character and symbol graphic images. A high performance color-replacement (80 characters per line) for DEC's VT 100 B&W display terminal. High resolution. With keyboard. 24 lines displayed (80 or 132 characters) 5×7 or 7×9 ulc ASCII symbols plus special control symbols (128 total.)

ID Systems, *4789 Rings Rd, Dublin, OH 43017* **Circle 261**

RDS 3000

19″ Color display, optional keyboard. Graphics use. Raster technology. Resolution 512^2 or 1024^2 programmable. Pans and scrolls in pixel increments. Zooms in integer values. Compatible with PDP-11, VAX, Prime, Data General, DMA Interface.

Ikonas Graphics Systems Inc., *531 Pylon Drive, Raleigh, NC 27606* **Circle 263**

3600-21-020

A microprocessor controlled compact A/N vacuum fluorescent display. Can be mounted in minimum panel area. Full 96-character ASCII set plus European ECMA-7 overlay characters. 5×7 dot matrix (20 displayable characters) are bright blue-green color, filterable to blue, green, aqua or yellow. 150° viewing angle.

Industrial Electronics Engineers, Inc, *7740 Lemona Ave, Van Nuys, CA 91405* **Circle 262**

Replacement terminals offer display enhancements, more flexible printing terminals and choice of screen sizes.

Model 401

Pedestal type CRT for OEM and systems designer. Compact with a footprint of 13″×12″. Weighs 14 pounds. 9″ screen. 80 column display. Full 128 character ulc. ASCII character set. Reverse video, blinking, and underlining. Optional: a line drawing set. Format protection, security, blank fields, windowing, scrolling. Non-glare screen can be tilted and rotated. 7×9 characters displayed in green or white on black.

Informer Inc, *PO Box 91054, Los Angeles, CA 90009* **Circle 264**

High Resolution Flicker-Free Display

System features dual 19″ raster screens; one color, one monochromatic. Resolution of 1280 × 1024 pixels. Each screen can display full 2- and 3- dimensional graphics, plus operator prompts and messages with independent hardware pan, zoom and drag for both screens. 8 color from palette of 4096 usable colors.

Integraph Corp, *One Madison Industrial Park, Huntsville, AL 35807.* **Circle 265**

Color graphics terminals add a degree of interactive independence to the display station.

TK-242

Touch-sensitive add-on kit for use with Lear Siegler Model ADM-42 CRT Terminal. Provides the video display with a human interface that is easy to use. Data entry is made by touching the finger to display on the CRT screen. The touch-sensitive faceplate is placed over the CRT Monitor. The electronics board is mounted inside the CRT monitor housing. Interconnecting cables and mounting clamps are supplied with the kit. Offered for either parallel or serial interface.

Interaction Systems, Inc. *24 Munroe St., Newtonville, MA 02160* **Circle 257**

The Emulator

Video Display Terminal. 12″ diagonal screen. Stand alone with keyboard. P4 Phosphor. Non-glare screen. Memory size: 24 lines × 80 characters per line. All 128 ulc ASCII characters, 11 special character symbols, 8×10 character field; 8×8 character matrix. Light character on dark background; reversible. Interface, RS 232C operates at 15 keyboard selectable baud rates 50 to 9600 bps.

Intertec Data Systems, *2300 Broad River Road, Columbia, SC 29210* **Circle 266**

LTE-3

Video Display Screen for Lanier typewriter. Large easy-to-read characters help reduce eye fatigue. Sold with typewriter. Proofread right on the screen. Make revisions or corrections simply by typing over.

Lanier Business Products, Inc, *1700 Chantilly Drive NE, Atlanta, GA 30324* **Circle 267**

ADM 31

Intermediate Terminal Video Display. Has programmable function keys, 25th line for terminal status, smooth scroll, X-on and X-off, cursor on/off and horizontal split screen. Blink, blank, underline, reduce intensity, reverse fields and business graphics. 12″ diagonal CRT. 25 lines of 80 characters ulc.

Lear Siegler Inc, *Data Products Div, 714 N Brookhurst St, Anaheim, CA 92803* **Circle 268**

Lexiscope 4000

Video Display Controller. Graphics plus A/N capability. Emulates standard A/N display terminal and provides moderately high resolution display. Display with only A/N can have graphics capability with this board. Plugs directly into one slot in a Nova or Eclipse mainframe. Also emulates graphic commands of an HP 2648A terminal. Graphic resolution 560 × 500. 256 byte FIFO buffer. 96 ASCII ulc characters set plus 32 special pseudo-graphic symbols.

Lexicon Inc, *60 Turner St, Waltham, MA 02154* **Circle 269**

Hypergraf 2600

Interactive Graphics Terminal. Uses: CAD/CAM, mapping, mechanical design, piping. Stroke writer display. Dimensions: 52″×50″×44″. 115VAC, 60 Hz (50 Hz available.) Power description 1.6 KW. Heat 5500 BTU/hr. Recommended for those applications that place an inordinate demand on mainframe.

Lundy Electronics & Systems Inc, *One Robert Lane, Glen Head, NY 11545* **Circle 270**

Orion-60

512 × 512 Plasma Display. Standalone 96 symbol character set. A/N and graphics. Has touch panel as an option. The plasma display offers a non-refreshed storage for a bright high contrast flicker-free presentation. Selective erase for any point character or vector. Full 96 symbol ASCII character set plus a programmable character set with 128 symbols. Transparent plasma display may

be viewed in combination with projections from 35 mm projector.

Magnavox Govt and Industrial Electronics Co, *1313 Production Rd, Fort Wayne, IN 46808* **Circle 271**

CTM 300

Serially interfaced (RS-232C) ASCII terminal with an 8 color CRT display. 80 characters by 25 lines. Detachable typewriter format keyboard plus 18 user definable keys, color monitor has high color clarity and resolution (0.3 mm dot pitch.) Deliveries of new CRT and keyboard were scheduled to begin in July.

Matrox Electronic Systems Ltd, *5800 Andover Ave, TMR Quebec, H4T 1H4 Canada.* **Circle 272**

32-Character Display Module

Vacuum fluorescence features oversize characters in soft green light for improved readability and prevention of eye strain. Fully compatible with ASCII and Baudot code. Single 5 V power source. Characters are 0.21″ high by 0.12″ wide. 32 A/N per line plus an additional 8 character "wraparound" in a 40 character buffer. Switch-selectable display can move 1 to r or r to 1. Full 96 character set including all symbols and letters, all upper case.

Micon Industries East, *8 Blanchard Road, Burlington, MA 01803* **Circle 273**

V-2000

Video Display Terminal. The terminal incorporates a 12″ non-glare screen with detached keyboard for operator preference-location. Reverse video, flashing, underline and half-intensity. Has 12 control keys, a separate numeric key pad, printer interface, two pages of memory and 20 programmable functions.

Micro Five, *17791 Sky Park Circle, Irvine, CA 92714* **Circle 224**

LD 2650

Alphanumeric LED Flat Panel Smart Terminal. Displays 16 characters, 2.3″ in height in either amber or red LED. Overall dimensions of display unit are 6″H × 3′L and 2.5″D. The unit is designed for large group viewing. It has both an RS-232 and tape storage ports. UL plug-in transformer mass storage unit. Repairs facilitated by permitting PC board exchange.

MIM Co., *(Modern Information Methods), 2860 Bay Rd, Redwood City, CA 94063* **Circle 220**

ST 2019/LBW2

Black matrix with a phosphor screen of red, green and white for A/N display. Has a dot trio spacing of 0.31 mm. This series uses a combination of a superfine-pitch shadow mask and a superhigh-precision electron gun. Offers a resolution double that of color-tv CRTs. More than 6000 characters can be displayed. Has a high quality color-character and color-graphic display.

Mitsubishi Electronics America Ltd, *2200 West Artesis Blvd, Compton, CA 90220* **Circle 274**

DM 256 X 64A

A complete display panel consisting of 16,384 fluorescent 0.4mm square dots arranged in a 256 vertical-rows and 64 horizontal-rows configuration. Fills an area 166mm×41mm (approx.) Bright, high resolution, dot matrix images obtained. Size of screen is 2½ times image width previously available in continuous dot flourescent display units.

Noritake Electronics Inc, *22410 Hawthorne Blvd, Torrance, CA 90505* **Circle 275**

Alphanumeric terminal costs continue dropping while intelligence increases.

VCG-QT

Graphic Display Terminal. Provides 512 × 512 monochrome (or 512 × 640× 3 color dot resolution.) Interface included for DEC LSI-11/2 and 11/23 providing direct, high-speed access to all dot positions on the CRT screen. Monochrome version is also available with parallel character memory for combined rapid update A/N and graphics display. 13″ screen. 32 lines displayed.
Peritek Corp, *3014 Lake Shore Avenue, Oakland, CA 94610* **Circle 276**

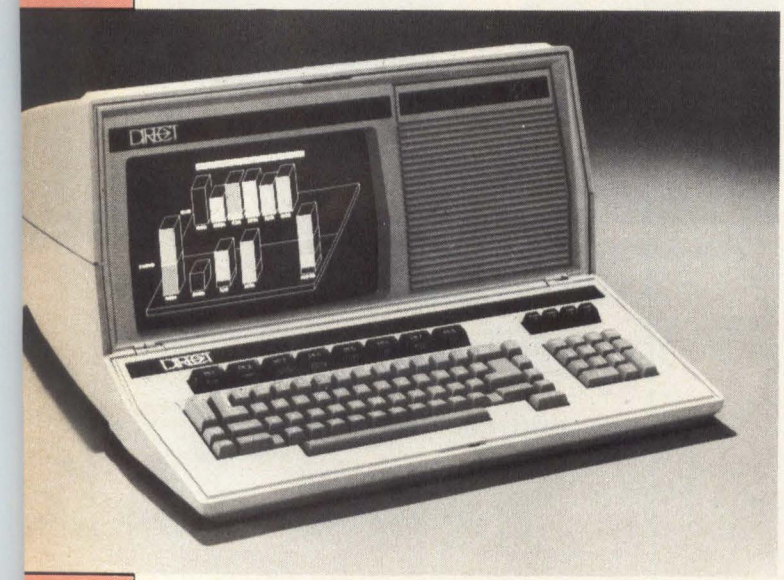
New CRT Tube

19″ high resolution (Delta type electron gun assembly). Provides high brightness levels and small sharp detail. Produces 80 easy-to-read characters per line (48 lines). Features very dense triad phosphor/dot screen and a new high density aperture mask which eliminates dot patterns visible on conventional TV tubes.
Philips ECG Inc., *100 First Ave, Waltham, MA 02154* **Circle 277**

PT-100

Data Terminal 12″ Screen with Detachable Keyboard. For A/N plus line graphics. Resolution: 240 lines at 50/60 Hz. 24 lines displayed, 80 or 132 columns. Height of character, 0.132″ × 0.078″. Readout color: white or amber. Fully compatible with DEC VT 100. RS 232 or 20 mA interface. Keyboard baud rate 50 to 19,200.
Plessey Peripheral Systems, *17466 Daimler Ave, Irvine, CA 92714* **Circle 278**

Various methods of displaying characters determine least costly approaches.



PE 7902

Single-board LCD Driver. Drives LCD 5×8 dot matrix display systems. Activates 40 column or 8 A/N graphic display. Five-voltage-level LCD multiplexing schemes are employed for optimum display performance. Voltage levels can be adjusted by input ports. Contains an on-chip 8 row × 40 column bit map. RAM for storage of display information. Only a single 9v battery is required.
Polychore Electronics, *1107 Tourmaline Drive, Newbury Park, CA 91320* **Circle 279**

4276

Stand Alone A/N Display Terminal. 15″ screen with attached keyboard. High resolution (525 lines per frame) raster display, non-glare screen. Compatible with IBM 3276. Interface RS232C. Readout green phosphor, 24 lines, 80 characters (0.125″ high) per line. 25th line for operator information.
Racal-Milgo, *Computer Products Division, 6250 NW 27th Way, Ft. Lauderdale, FL 33309* **Circle 280**

ZMS-50

Programmable CRT Display Terminal. Microcomputer-based keyboard/video display unit. Controlled by programs executed out of firmware. General purpose keyboard. 24 line × 80 character (25th line for operator message). 4K RAM (16K optional). 7×9 dot matrix in a 10×10 cell. Blinking underline cursor. 96 ASCII characters (ulc) 24 special function keys. Available for lease. Wide variety of communication capabilities.
RCA Service Co, *(Div of RCA) Bldg 204-2, Camden, NJ 08101* **Circle 281**

Rastergraf

High Resolution, Flicker-free Display. Resolution: 1000 × 1000 pixels. Screen sizes up to 25″. DMA transfer rate to the raster scan display is up to 1 MB/sec. Vector drawing time is typically 3 microsec/pixel. This speed produces almost instantaneous updating of display. Great image brightness; interactive modification response time. 64 special function keys. System: Z80A microprocessor with 176 KB RAM memory, drum plotter, plasma display, desk and software.
Sigma Design West Ltd, *7306 S Alton Way, Englewood, CO 80112.* **Circle 282**

1Q140

Sophisticated Multi-featured Video Display Terminal. Detachable keyboard, 117 keys. Baud rates of 110 to 19,200. Interfaces: RS232, 20 mA current loop. Protect mode. Addressable cursor. Tab. 16 function keys. Convenient up-front controls. Display: 24 lines. 25th line for status mode display.

Soroc Technology, *165 Freedom Ave., Anaheim CA 92801* **Circle 283**

Eyecom II 109

RM Display Teminal. 12″ diagonal screen. With or with out keyboard. Graphics and A/N capability. Raster scan. 640×480 resolution. Refresh 30 frame/sec. Pan. Zoom (2:1-8:1). Input: Serial or parallel. Compatible with PDP-11, LSI-11. Interface, Unibus, LSI Bus. 24 lines, 80 characters, 9×7 matrix. 120 V (60 Hz) or 240 V (50 Hz). Display color: White on black.

Spatial Data Systems, *PO Box 978, 508 S Fairview Ave., Goleta, CA 93017* **Circle 284**

UTS 40

Communication Terminal A/N. 12″ CRT display. Attached keyboard. Raster technology. Scanning. Horizontal frequency of 22.2 KHz. Resolution 9×14 dot matrix over 80 columns, 25 lines. Input source: keyboard, communication I/F or direct CPU connect. Interface RS232. Compatible with Sperry Univac computer. Height of characters, 3.9 mm, width 2.4 mm.

Sperry Univac, *PO Box 500, Blue Bell, PA 19424* **Circle 285**

132/15 Editing Terminal

15″ non-glare screen with green phosphor, 25 lines by 80 or 132 characters including 24 data lines, 1 blank and 2 for status and prompting. ASCII 7×11 dot matrix with true descenders in a 9×14 or 9×16 dot cell. Horizontal scroll. Bold, blink underline, reverse video, double height, double width. Selectable dark or light backgrounds. 30 graphic characters.

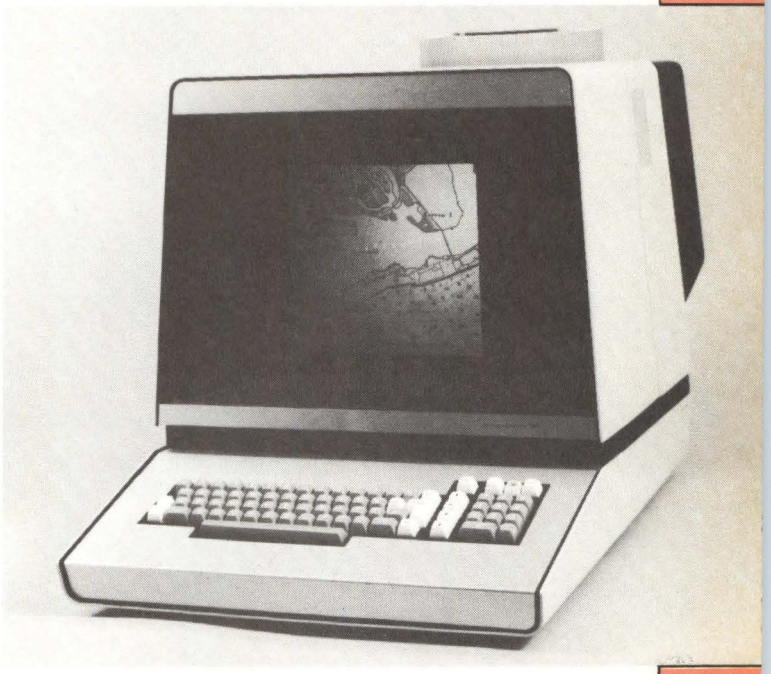
Tab Products Co, *1451 California Ave, Palo Alto, CA 94304* **Circle 286**

VMT-2000 Videomate

Computer Data Display and a high resolution video raster scan display in the same unit. Displays documents, graphics, computer generated A/N and word processing images. Data display is produced by a companion keyboard and character generator. 3.8 million bit digital memory. Image memory output is 140 megabit rate for high resolution, flicker-free image. 8½″ × 11″ screen. Display resolution 200 dots/inch.

TDC (Terminal Data Corp), *21221 Oxnard St, Woodland Hills, CA 91367* **Circle 287**

Some CRT terminal manufacturers purchase the monitor, rather than design one.



4114

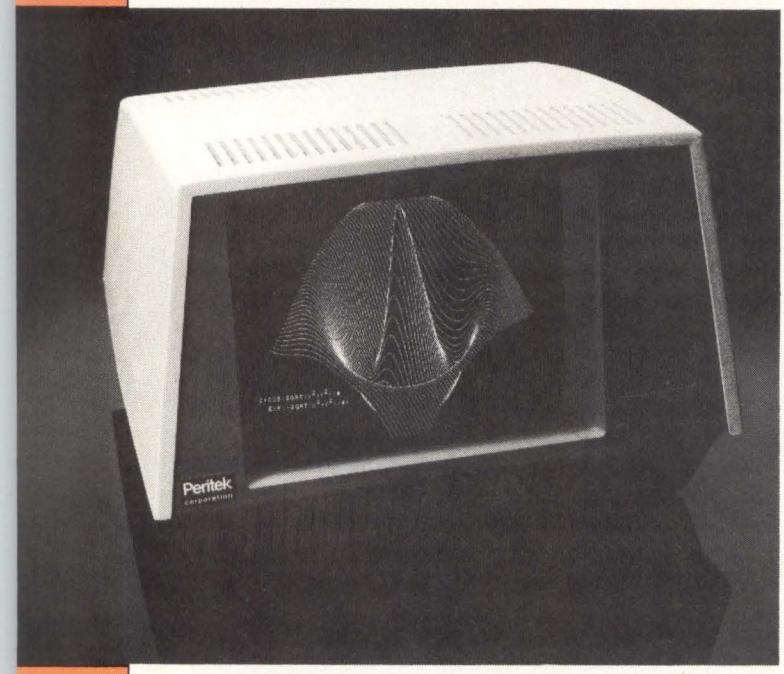
Computer Display Terminal. 19″ DVST with powerful local intelligent graphics terminals. Host-based computer has vast processing power. Has capability for locally retained picture segments. MOVE and DRAW commands can be defined then stored, recalled and manipulated locally. Has new fast repaint feature and a definable, refreshed dialog area.

Tektronix Inc, *PO Box 500, Beaverton, OR 97077* **Circle 288**

100-RO

132 column, VT100-compatible. 12″ screen (diagonal.) Stand alone component. Sold with or without keyboard. Primarily A/N. Dot Matrix. Refresh rate 50-60 HZ. 32-character graphics set. Input, ASCII. Interface RS 232/I loop, 24 display lines. Character per line: 40/66/80/132.

The "settling in" of functions and features has taken place; product differences are less of a factor today.



Double height characters and double width. 40W operating power.
Teleray, *Div. of Research Inc, Box 24064, Minneapolis, MN 55424* **Circle 289**

276/SDLC

Eight Station Display Control Unit. A/N. Functionally compatible with the IBM 3276 counterpart. Control unit serves 8 printers and display stations. Non-glare, smear resistant screen. Flicker-free. High resolution 9×14 dot matrix. Typamatic repeating keys, keyboard clicker, numeric pad, single key clear. Operates at 50° to 150° F. Heat dissipation: 502 BTU/Hr. 15″ display screen. Raster technology. 24 display lines, 80 green or white characters.
Telex Computer Products, Inc, *6422 East 41st St., Tulsa, OK 74135* **Circle 290**

940

Video Display Terminal. Has advanced editing display capabilities. Ergonomic features to reduce operator fatigue: detached keyboard with 6′ coiled cord for flexibility and operator comfort; functionally clustered keys. Double-sized characters to reduce eye strain. Display can be dimmed or brightened in multi-steps; reverse video; intensified characters.
Texas Instruments Inc, *PO Box 202145, Dallas, TX 75220* **Circle 291**

Perq

High Resolution Graphics Display. Single user workstation 15″ screen. System sold with keyboard. Raster technology: 768 × 1024. 1 bit/pixel, 60 Hz. Non-interlaced. Tablet input source 66 display lines (80 characters per line.) with white readout. Height of characters is user specified as is width.
Three Rivers Computer Corp, *720 Gross Street, Pittsburgh, PA 15224* **Circle 292**

NDC 120

CRT Display Monitor. Video bandwidth 25 MHz. High linearity. Uniform focus characteristics across entire screen. Horizontal retrace time is less than 7 microseconds. Compatible with Bell and Motorola monitors. Special designed PC board provides highest performance levels. Separated horizontal drive, vertical drive, video-size inputs. MTBF 10,000 hours. P4 phosphor is standard. Options are P31 and P39.
TSD Display Products, Inc, *35Orville Drive, Bohemia, NY 11716* **Circle 293**

Graphics-80

Intelligent Terminal. High resolution on large 21″ display. Stand alone with keyboard. Primary use: graphics, uses stroke technology. Resolution 4096 ×4096. 2D clip, rotate, translate; 3D is optional. Serial or parallel interfaces. 80 line readout, 64 characters per line. Height of letters is scalable. Readout colors, P39 green, P40, P4, white.
Vector Automation, *Village of Cross Keys, Baltimore, MD 21210* **Circle 294**

Visual 400

A/N non-glare tiltable screen. Switch selectable emulation of DEC VT52, Hazeltine 1500, ADDS 580, LSI ADM-3A. Detached keyboard. Large 7×9 dot matrix characters. Numeric keypad and cursor positioning keys. 14 user programmable functions keys. Up to 48 codes each. Remote transmit. EIA-RS232-C and 20 mA interfaces. Serial printer port, smooth scroll.
Visual Technology Inc, *Railroad Ave., Andover, MA 01810* **Circle 295**

VG 8250

Graphics Display System for CAD/CAM applications. Emulates IBM's 2250 Display. Further, includes features of IBM's 3250 system. System easy to use with reduced operator fatigue. Built in diagnostics reduce idle time. Channel speed up to 1.2 MB/sec. System designed with small number of components.

Vector General, *21300 Oxnard St, Woodland Hills, CA 91367*

Circle 296

VC 404

TTY Compatible Data Terminals. Low cost. Detachable keyboard. 1920 characters. Quiet and fast. Keyboard reliability, auto repeat, switch selectable, ulc characters, complete cursor control key cluster. Optional numeric pad and function keys, APL character set, bidirectional serial peripheral interface. 12″ non-glare screen. Green or amber display screen.

Volker-Craig Inc., *333 Metro Park, Rochester, NY 14623*

Circle 297

1955

OEM Display Scope. Open frame 9″ CRT. Magnetic deflection for improved point-by-point image construction. Used for displays in automobile testing, real-time spectrum analyzers, NC systems, flow monitors and medical electronics. Vertical bandwidth DC to 15 KHz.

Wavetek Indiana, *5808 Churchman, PO Box 190, Beech Grove, IN 46107*

Circle 298

4815

Sealed Industrial Terminal. Non-ventilated display terminal with keyboard for interaction with remote electronic devices. Self test on power up, 12″ display. Full ASCII character set. Addressable cursor. Available with RS 232C as well as optional fibre optics. Baud rates, 110 to 9600. Display format: 80 characters/line × 24 lines (25 for status comments.) For use in hostile environments.

Xycom Inc, *PO Box 984, Ann Arbor, MI 48106*

Circle 299

D

What's Coming Up

Articles in the September issue of ***Digital Design*** will cover. . .

Computer Compatible Add-In/Add-On Memory

This focus on memory boards and boxes for system builders and integrators will examine how the changing market will affect the OEM in terms of shorter lead times, costs and access times as well as supposedly compatible boards and other pitfalls that system designers must be aware of when specifying such memory systems.

Here, in a nutshell, is a preview of things that we will cover. Independents are out of the vise that IBM's aggressive price-cutting put them in starting in late 1979. A few folded, others survived, and some finally prospered. Semiconductor makers, however, have grown more than expected, emerging as a dominant force in this market. Competition is fierce, and margins are small. The partials debate has subsided, and should be non-existent as we reach the mass markets with the 64-K RAMs. Much delayed, partly because of problems in going to a single 5V-source, 64-K RAMs stumbled on the way to market; and, it looks like the Japanese will take this round. They should establish a share of market, maintain it, and will emerge as a more potent force in the add-in/add-on memory market.

Designing Answer/Originate Modems With Off-The-Shelf Components

This article will describe how to build a sophisticated modem with standard components with little or no adjustment. Designers building their own modems can find it's a trying experience, particularly if they lack communications experience. It need not be so: here is how to design answer/originate modems by using standard, off-the-shelf components. Electronic engineers proficient at designing with microprocessors, PLAs, digital logic ICs and the like generally lack understanding of the analog side. This works against them in certain design situations, such as designing an answer/originate to connect a multiplexer from a remote outlet to the interface device.

Designing With Dot Matrix Printers

Low-cost computers, CRTs and communications demand low-cost hard-copy output for numerous applications. This article discusses some of the basic specification concerns of engineers encountering such application needs. Although slanted a bit to the low-cost printers used in portable terminals, desktop computers and the like, much of the selection criteria are valid for larger printers.

At the moment, the Japanese are attacking this low-end of the printer market, although Centronics, for one, should have the volume to persevere in this low-profit-margin, high-volume market — once it assimilates its on-going organizational changes and successfully challenges the Daisywheel with its upcoming printers. Daisywheels will continue to drop.

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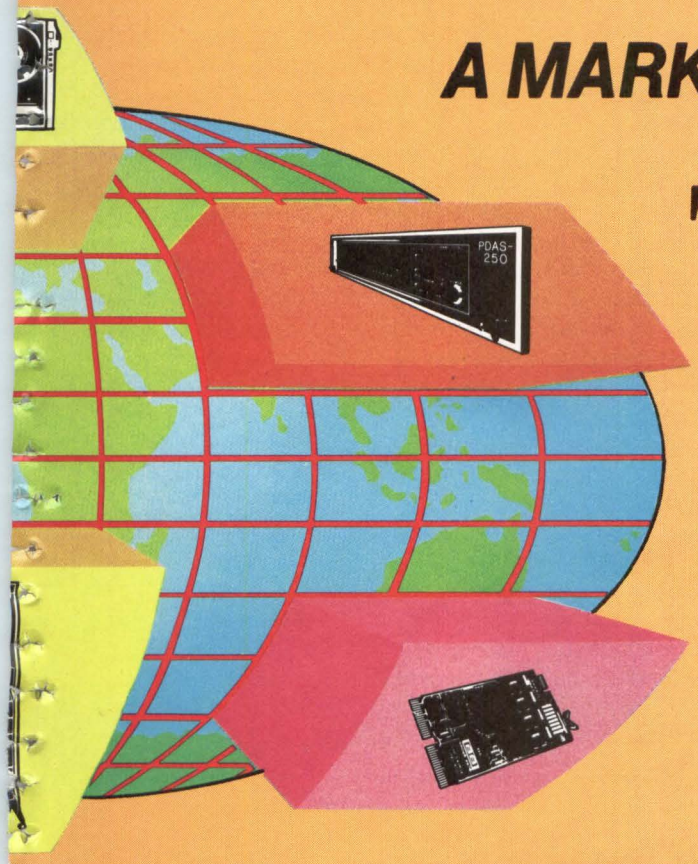

A MARKETING FORUM for CEMs

This exposition is dedicated to the proposition that the unprecedented growth and expansion in the use of computers for all kinds of applications will continue at an exponential rate. No one company can solve everyone's applications problems; no one company can supply everyone's needs for complete systems, add-ons, peripherals and software.

Building around the central processing unit, the OEMs, the systems integrators, the turn-key houses and the sophisticated large volume end users will continue to use compatible computer equipment to devise special systems to solve applications problems with greater versatility and flexibility.

IF YOU ARE a buyer and specifier of plug-in electronics and appropriate software, you have a need to know about currently available products you can design into your systems as well as future trends in the state-of-the-art **THIS EXPOSITION GIVES IT TO YOU.**

PRODUCED BY:

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ENDEE'S REGISTRATION FORM
IBITOR'S APPLICATION FORM

COMPAT '81™
COMPATIBLE COMPUTER PRODUCTS EXPOSITION

San Francisco Show Preview

first ever computer compatible conference debuts in september

COMPAT '81 Fills Information Vacuum

Why a Compat show at this point in time? To answer this question, we must go back a few years, back to 1970 and the introduction of the now-famous PDP-11 minicomputer by Digital Equipment Corporation — almost singlehandedly responsible for today's burgeoning independent peripheral industry. To be sure, independent peripheral suppliers did exist prior to the debut of the PDP-11; however, these manufacturers were concentrated solely in the large mainframe area supplying equipment for the IBMs and Univacs. This was a tough nut to crack for new entrepreneurs without the megabucks behind them so necessary to launch a new product. Not so in the minicomputer area.

A resourceful entrepreneur could break into the independent mini-peripheral market with a minimum of capital, and many did just that. To systems designers and end users, this was like opening a door to a whole new world. They were no longer locked into one manufacturer, but were free to seek other alternatives in the marketplace.

For a time, it seemed like everyone and his brother was starting up a company to offer independent equipment compatible with DEC CPUs. DEC, for its part, gave the industry an even further push by concentrating so hard on the production of the CPUs, that it all but ignored the peripheral area. Before too long, the market was inundated with peripherals and add-ons; but with the respectable suppliers also came the rip-offs, the fly-by-nights, and the mom and pop garage operations. The result of all this activity: confusion on the part of the systems designer — confusion that still exists to this day.

Clearly, the process of systems design — choosing a CPU from one vendor, terminals from another, disk drivers from yet another, etc. — has one overriding problem: How can a systems designer or large volume end user make an informed decision concerning product selection when he may not be aware of everything available to him? To make a choice without knowing all the facts, all the options open, and all the possibilities, is obviously unwise. To not be aware of potential problems, such as product reliability and failure to deliver on time, is equally foolhardy.

It came to the attention of the magazine's staff that there was a growing need for a central source to which designers could refer when considering memories, peripherals, add-ons, etc. Many of our readers reported that they relied on the ads in our magazine as a major source of information on compatible computer products and services. Some said that they saved every back issue, while others indicated that they had started a crude filing system comprised of ads torn from the magazine.

To help alleviate this information void, **Digital Design** published its DEC Compatible Directory (See **DD** January '81). The response to this directory was greater than ever anticipated, and led the directors of the Benwill Conference Group to believe that the time was now ripe for a trade show and seminar program geared to the needs of the buyer/specifier of compatible computer products (both mini and micro). Thus, ***COMPAT '81*** was launched . . . some ten-plus years after the introduction of the PDP-11 . . . the first national trade show to ever exclusively address this segment of the computer industry.

Vendors Show Plug-Compatible Products

The list of exhibitors planning to show their wares at Compat is an impressive one, and covers every area in the realm of compatible computer products and services. Buyers and specifiers of these products — including OEMS, systems integrators, turnkey houses, large volume end users, and software houses — will find company representatives eager to help Compat attendees assess their current design needs, and to evaluate the equipment now available for integration into their computer systems.

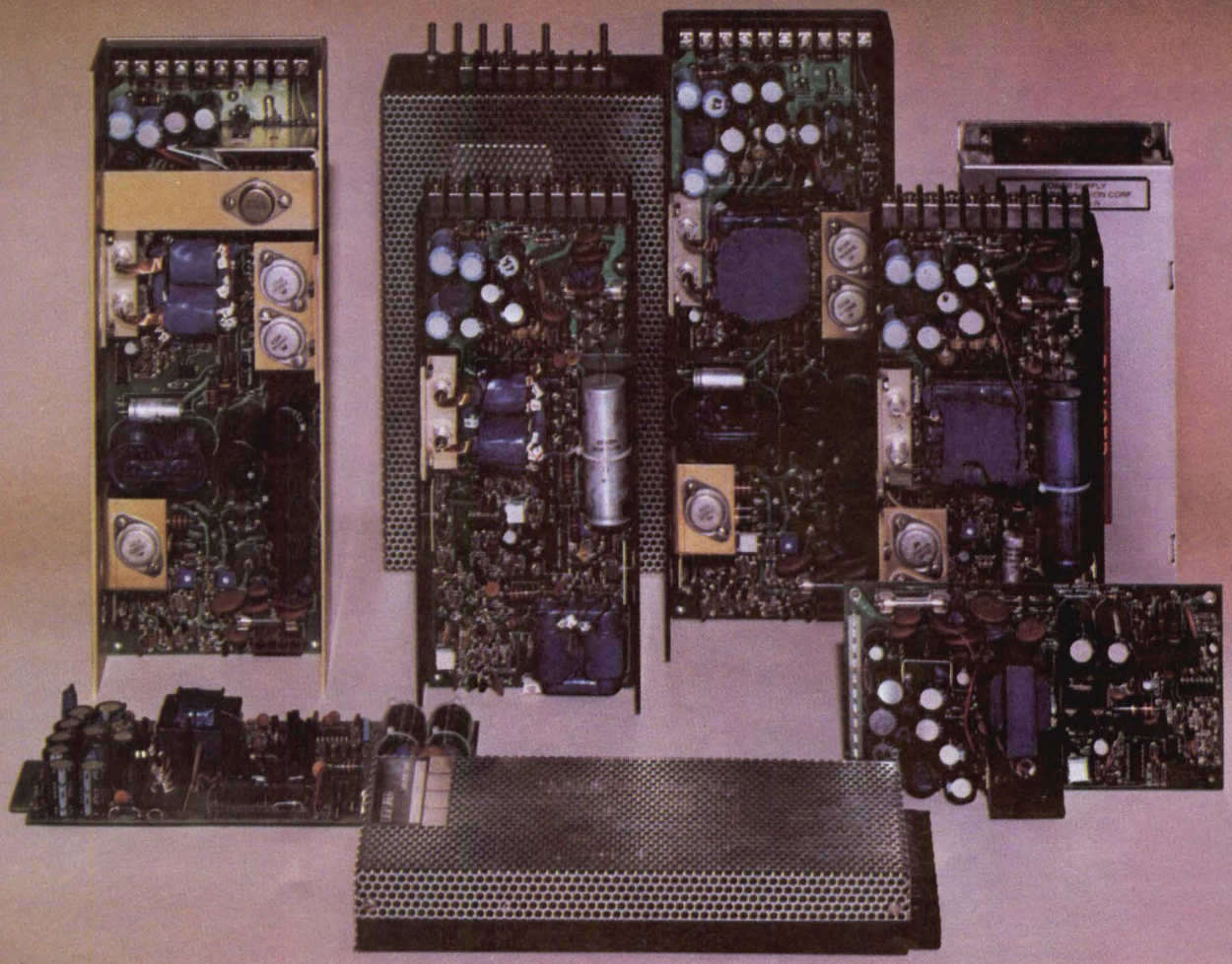
Compat will be a one-stop shopping center for compatible computer products: Attendees will be able to see what's out there in the marketplace; to learn how existing products may be implemented to solve specific computer application problems; to compare price and performance figures; and, to

Digi-power has all the power you'll ever need in OEM power supplies.

Select from a complete line of compact power supplies, 50 to 250 watts. Each unit is burned-in for a full 12 hours at 100% rated load before final testing and packaging for shipment. Reliability is assured with a one year warranty. Digi-power has the size you need for your microprocessor, minicomputer Winchester-type modules or peripheral equipment.

Units are available open-frame or enclosed to meet your specific requirements. Standard or optional features include brown-out protection, short circuit protection, power-fail option, overtemperature protection, and OVP for all outputs. Each Digi-power component is EMI filtered and constructed of tested and proven quality materials. All units deliver up to 80% efficiency. UL approval expected in the immediate future.

The 50 watt DU50 unit is 4.25″ x 7.75″ x 2″ height; the 250 watt DU250 Series is 4.7″ x 12.25 x 2.45″ height. Custom designs are available for OEM customers requiring special electrical, mechanical or physical parameters. A staff of service personnel and off-the-shelf replacement parts can be readily accessed should the need arise. Call or write for informative booklet and specification sheets.



digi-power 686 E. Gish Road / San Jose, CA 95112 / (408) 288-5600 / TWX 910-338-0579

Circle 39 on Reader Inquiry Card

"talk shop" with people attuned to their needs and interests. Armed with this knowledge, Compat attendees will be able to make their buying decisions easily and with confidence.

Many of the products to be on display are unique; others will be getting their first public exposure prior to national marketing in the Fall. Here's just a brief rundown on the type of hardware and software to be seen on exhibit:

- Controllers that provide compatibility between peripherals and CPUs marketed by major manufacturers. Also, networking controllers for data communications applications.
- Peripherals including printers, plotters, alphanumeric and graphic terminals, Winchester drives, floppies, cartridge drives, mag tape, backup storage, speech I/O devices, telecommunications devices, and add-on memories suitable for operation with major manufacturers' CPUs.
- Accessories such as data links, backplanes, PROM boards, cabinets, A/D and D/A converters, communications panels, cables, modems, and power supplies.
- Software packages that can run on major manufacturers' CPUs.

COMPAT '81 Exhibitors

The following is our list of ***COMPAT '81*** exhibitors as of press time; more are joining every day.

ABLE COMPUTER
Products: Bus links, multiplexers, extender boards.

ADAC
Products: Model 1816 CMOS 16K memory boards, featuring on-board battery back-up complete with charging circuitry.

ADVANCED ELECTRONICS DESIGN, INC.
Products: Winc-08 Winchester disk drives, AED 512 full color graphics display terminals.

AMLYN CORPORATION
Products: Models 5850 and A506 mini floppy disk drives, compatible with Shugart SA 850 floppy drive and Seagate ST 506 Winchester disk drive.

AUGAT
Product: Computer interface wirewrap panels. Compatible with DEC, multibus, Prolog, Exercisor, TI, Versabus, Nova. New bondex multibus panel offers flexibility of wirewrap, but profile of multi-layer.

AUTOMATED CONTROL SYSTEMS
Products: Wang compatible printers, memory, terminals.

Cii HONEYWELL BULL
Product: DSS-L100 — a new line of high-reliability, low maintenance cartridge disk drive systems.

CODATA
Product: UNIX-like operating system.

COMPOWER
Products: High reliability, switching power supplies. Model OL 25/50, a new design, is compatible with Boschert OL 25, yet offers twice the power (50 watts). Compact, high efficiency, and including protection circuitry. Other models: QL 50/65, OL 65/100, OL 130/150.

CRAIG DATA CABLE CO.
Products: Interface cable assemblies.

CUSTOM SYSTEMS, INC
Products: Model 420 16 channel programmable terminal interface. Additional offerings: controllers and peripheral interfaces for DG minis, including line printers, Qty. muxes, tape and disk controllers, memory control.

DATACUBE
Products: Color video graphics, alphanumeric character controllers, video processors for image processing and pattern recognition applications, memory products. Also produces multibus and Q bus compatible products.

DATAFLUX CORPORATION
Product: Winchester disk drive system.

DATA SYSTEMS SERVICES
Product: Disk systems.

DIGITAL ASSOCIATES
Products: Indp. value-added supplier of line printers for minicomputers. On display: GE TermiNet 510, CDC Band Printer, 9380 Series.

DIGITAL MICROSYSTEMS, INC.
Products: HiNet microcomputer network offering high speed local processing and shared disk storage in mulit-user systems. Currently supports up to 32 users and is designed to address 255. Single-board system means improved reliability and easier maintenance.

DIGITAL PATHWAYS, INC.
Products: Controllers, voice synthesizers.

DIRECT, INC.
Product: Models VP825, VP828, and VP800 series terminals to be featured. All units offer fold-up, detachable keyboard, and up to 32K of display memory. VP828 and VP825 are compatible with H-P VIEW/3000 screen management system.

DISTRIBUTED COMPUTER SYSTEMS
Products: Models DCS/80 and DCS/86 Industrial Development and Control Systems. Based on either 8080 or 8086 CPU, and including disk controller, two 8" disk drives, 64K RAM, and 9 slot multibus backplane in a high-quality industrial case.

EMULEX CORPORATION
Product: Controllers.

EMULOG, INC
Products: Log-53 terminals, compatible with DG 6053/6052, D200, D100.

INTERNATIONAL DATA SERVICES (IDS)
Products: New system to be compatible with all DEC PDP-11 and VAX systems. Also: PDP-11/44 and VAX 750 with UNIX operating system.

INTERPHASE CORPORATION
Products: Multibus peripheral controllers for disk drives, including hard disk, cartridge, SMD, and ANSI interfaces. Also: video boards and subsystems.

INTERSIL, INC
Products: Memory for minicomputers, std bus products.

MAGNETIC RECOVERY TECHNOLOGISTS
Products: Tridensity 6250 BPI mag tape head and tape head drives. Tridensity 6250 compatible with IBM 3420, Pertec 1600/6250, STC 1600/6250, Telex 1600/6250.

Modgraph introduces
"Smart Graphics"

Smart because one low cost terminal provides easy to use graphics and a completely independent alphanumerics overlay.

GRAPHICS FEATURES: 512 x 480 Resolution • RS-170 Video Output • Plot 10® Compatible • Selective Erase • Separate Graphics Cursor • Addressable Cursor • Cursor Pad — Slow and Fast Motion • Special Graphics Function Keys • Absolute and Relative Vectors • Dot, Dash, Solid Vector Styles • Hardware Graphic Characters

ALPHANUMERIC FEATURES: Independent Alphanumeric Plane • 7 x 9 Character Font With Attributes: Blink, Reverse Character, Underline • 96 Displayable Characters • 80 Character x 35 Lines • 3 Pages Scrollable Memory • 2nd Character Set Available • Status Line • Separate Alphanumeric Cursor • Tab, Backspace, Etc. • Special Alphanumeric Function Keys

GENERAL FEATURES: 15" P-39 Green Phosphor Screen • High Resolution CRT • Special Function Keys • Detachable Keyboard • RS-232C Interface • Set-Up Mode from Keyboard • Many Options Available

BOX 349
235 BEAR HILL ROAD
WALTHAM, MA 02154
(617) 890-5764

Modgraph

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MINICOMPUTER TECHNOLOGY
Products: Model EDC21 disk controller which emulates DEC RH11 controller interfaced to multiple RM02/03/05 disk drives. Also: Turbo 21 single board add-on disk cache which eliminates up to 80% of all disk access time. Both products just introduced.

MOSTEK CORPORATION
Product: Memory.

NATIONAL INSTRUMENTS
Products: GPIB 11V-2 high speed DMA interface between DEC Q-bus micros and the IEEE Std. 48 bus. Increases data throughput up to 100 times.

NATIONAL SEMICONDUCTOR, Memory Division
Products: Hex 1000 single board controller, capable of controlling three I/O devices simultaneously. Other offerings include DEC-compatible add-in and auxiliary memories.

NETCOM PRODUCTS, INC.
Products: LSI-11 system building

Technical Seminar Chairmen and Topics

Software

Chairing the panel on software will be **Douglas I. Michels,** Vice President and co-founder of The Santa Cruz Operation, Inc., a management and consulting firm specializing in the application and support of UNIX systems. Michels, as well as other noted authorities, will focus on operating systems and applications programs. Panel members will explain their views on the current direction of software and the latest in languages, such as UNIX and ADA. Mr. Michels, in particular, is a leading expert in UNIX, an operating system at Bell Labs.

Panel members:

Gary Kildall, Digital Research
Paul O'Grady, Microfocus
Mike Saccamano, Ryan McFarland
Mark Ursino, Microsoft
Time: Wednesday, September 16, 10:00 A.M.

Memory Systems

Heading up the talks on memory systems will be **Gerald H. Kiltz,** Product Marketing Manager, Fixed Disk Drives, for BASF Systems Corp. Kiltz and his panel members will aim their talks at the OEM systems designer, furnishing useful data not only on floppy, hard disk (Winchesters), and tape drives, but on semiconductor board level memory as well.

Panel members:

Thomas Knight, National Semiconductor
Gail R. James, Qume
Kim Kelly, Pertec
Robert Oakley, Data Electronics, Inc.
Time: Thursday, September 17, 9:00 A.M.

Controllers

The topic of controllers will be addressed by **Jack Olson,** Vice President of Marketing for Western Peripherals, a division of Wespercorp. Mr. Olson, who formerly held various positions at Datum, Inc., will cover what's happening to the technology because of changes in hardware and software. He'll also brief attendees on what to expect a few years down the line. Other panel members will zero in on specific types of controllers on which each is an expert.

Panel members:

Drew Krycerick, Wespercorp
Bill LeDuc, National Semiconductor
Doug Kolb, Signetics
Dave Vedner, Macrolink
Nick Horn, Minicomputer Technology
Time: Wednesday, September 16, 9:00 A.M.

Input/Output Peripherals

Tackling the subject of I/O peripherals will be **Ian Turner,** Director of Printer Engineering at Data Products' Serial Printer Division. Mr. Turner has been associated with some of the leading hardware manufacturers, and has a broad background in designing computers and printers of all types. The panel will speak to the systems engineers, informing them of the latest industry developments and the changes they foresee in the future.

Panel members:

Ken Freund, Dataproducts
Hiram French, Megatek
Mike Watt, Calcomp
Wayne Smith, Lear Siegler
Time: Thursday, September 17, 9:00 A.M.

modules including video work station, line printer, interface guide, and box enclosure. Video unit to be displayed for first time.

NEW WORLD COMPUTER COMPANY
Products: Mikro-disc V — a 5 1/4" disk drive with removable cartridge. High performance, compatible with S-100. Available in five models and two interface configurations.

PIICEON, INC.
Products: Model PM 2010 smart terminals. Also: S-100 based memory controller, Cromemco "Cromix" compatible boards.

QANTEX (Div. of North Atlantic Industries)
Products: Winchester disk back up high-capacity drives, high-speed dot matrix printers, OEM cartridge tape drives, and tape storage for small systems.

QUALEX TECHNOLOGY, INC.
Products: Model 1000 high performance, triple density tape system for HP 1000 users, SMASH (Shared Mass Archive Storage Host).

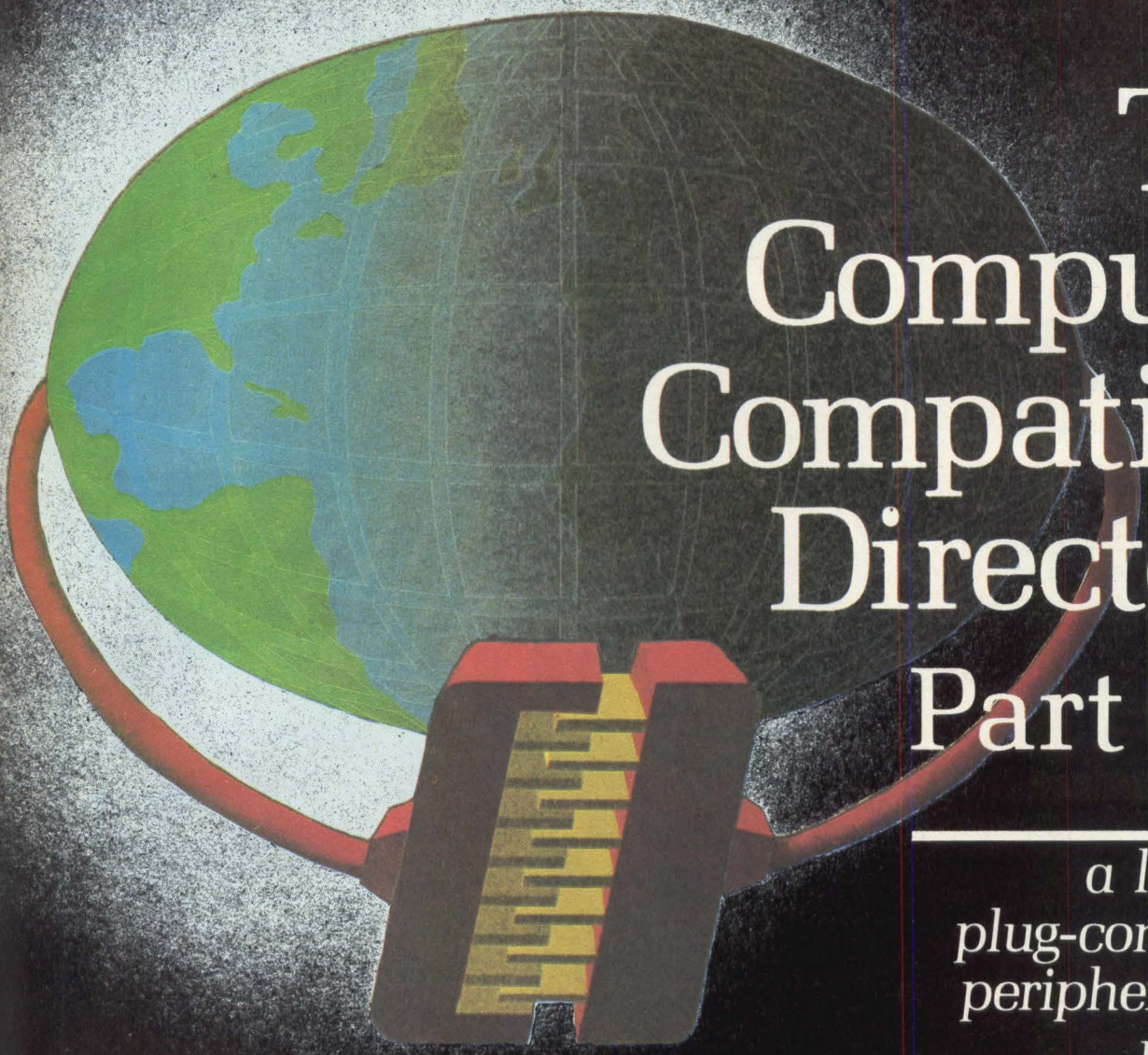
QUENTIN RESEARCH, INC.
Products: Models 4107, 4111, and 4118 ULM transparent multiplexers. Also: Models 4307, 4311, and 4318 ALM/ATM software transparent multiplexers, and the 4808 8-port DMA multiplexer. First public showing of these models.

SPECTRA LOGIC CORP
Products: Emulating disk and tape controllers for DEC, DG Nova and Eclipse, and Perkin-Elmer mini- and microcomputers. Featured: DG-compatible Spectra 10; single function DEC-compatible Spectra 11; and several other models.

TECHTRAN
Products: Porta 210 — includes the 800 series portable Philips-type cassette recorder data entry system, and the 900 series 5 1/4" disk line. 800 series available in two sizes with dual RS232 ports. 5 1/4" disk hosts same interface and features double bit density.

TECSTOR, INC.
Products: Sapphire 160 14" Winchester disk drive. Replaces CDC 9730, DEC RM80, and others.

WESTERN PERIPHERALS, Div. of Wespercorp
Products: Disk and tape controllers for DEC PDP-11, including model DC-231, a DEC-emulating RM02 disk subsystem.



The Computer Compatible Directory Part One

a listing of plug-compatible peripherals and products

Two-Part Directory

Due to the overwhelming volume of responses, the Computer Compatible Directory has been extended into two issues. This issue covers the following product categories: AC/DC Power Supplies, UPS, Line Conditioners, Add-In/Add-On Memories, Array Processors, Communications, Controllers, Disk Emulators. The second half of this directory will run in September and will cover: Display Terminals, Flexible Disk Drives, Packaging/Hardware/Backplanes/Enclosures, Printers/Plotters, Rigid Disk Drives, Services, Software, Special I/O's, Tape Systems, Test Equipment/Instrumentation, Other. The complete manufacturer's listing from all categories is listed in both issues.

COVER FEATURE

by Paul Snigier, *Editor,* **and Martha Hawkins,** *Directory Editor*

This two-part directory is the industry's first computer compatible directory, meeting the needs of both OEM integrators and system designers. Locating compatible memory and peripherals for DEC, DG, P-E, HP and other computers for integration into systems intended for use in the scientific, engineering and industrial fields can be a problem; many system designers must scan through our magazine looking for relevant advertisements and new product announcements, either marking up and saving the issues, or clipping and filing the listings. The editors of **Digital Design** were sure that our readers had better ways to occupy their time.

You no longer need to read **Digital Design** with scissors in one hand; here is the industry at a glance. Due to the tremendous response, we extended the directory to two issues. This month's directory covers the following product categories: AC/DC Power Supplies, UPS, Line Conditioners, Add-In/Add-On Memories, Array Processors, Communications, Controllers, Disk Emulators. The second half of this directory will run in September and will cover: Display Terminals, Flexible Disk Drives, Packaging/Hardware/Backplanes/ Enclosures, Printers/Plotters, Rigid Disk Drives, Services, Software, Special I/O's, Tape Systems, Test Equipment/Instrumentation, Other.

Although our staff used scientific and orderly data gathering techniques in collecting information to provide the most comprehensive and accurate listings, some bits of information may have escaped us. If so, please call any errors or omissions to our attention.

What surprised us most was the number of categories of computer compatible products; and, since many manufacturers checked "other" on the questionnaire, we listed most of them as such. When possible, we tried to create new categories; but for the most part, this was not possible: many categories had just a few products, making it difficult or impossible to create separate categories for them.

A word about acronyms and nomenclature: Product models/numbers are boldfaced with heavy type. Each new product starts a new line. To prevent redundancy, only company names are listed after their products; a separate listing includes company names, sales contacts, addresses and phone numbers.

Following the product name/number is a brief description. Vendor maintenance and number of field offices (FO) and/or third party service is listed. The acronym "RTFM" means return to factory for maintenance. "Compat" is "compatible". "HW/SW" is "hardware/software".

We will expand this directory in future issues. Our next computer compatible issue will contain descriptions of new products introduced between now and then, as well as any manufacturers who missed last April's questionnaire. If you were left out and want to be listed in our next directory, please fill out the questionnaire at the end of this directory. Use photocopied forms for each product. Please, don't take the easy way out and write, "See spec sheet"; we cannot reprint spec sheets. Include in your mail-back such material as press releases, photos, manuals, literature, articles, etc.

If your firm manufactures computer compatible products, and you don't see them listed here or next month (or if you are introducing new products), this will prove an excellent opportunity to be listed free in a directory that will be read by 67,000 direct (198,000 total) readers — leading computer system integrators throughout the industry. We're sure system integrators and designers will save this directory and actively refer to it over the next 12 months.

Illustration by Josh Randall

The Computer Compatible Directory Part One

AC/DC Power/UPS/ Line Conditioners

Power Conditioners/Uninterruptible Power Systems
Operates as a Power Conditioner to eliminate transients, voltages and surges, lightning, single phasing, dirty off/surge on, and as a Uninterruptible Power System to bridge light flickers and utility outages of up to 500 ms. $14,000 and up. Vend Maint, 5 FO.
Atlas Energy Systems,
S. El Monte, CA.

AC Power Conversion Equip.
Invertron solid-state voltage or current sources, frequency and phase converters, and AC line regulators; RTFM.
California Instruments, Div of Norlin Industries,
San Diego, CA.

Uninterruptible Power Systems
Provide steady clean power to sensitive computer systems; protects the power against brown outs, black outs, power surges, etc., available from 750 VA to 30 KVA; Vent Maint.
Clary Corp-Precision Instruments Div,
San Gabriel, CA.

OL25/50
50W on board 5.92″ × 3.82″ × 1.65″. Drops in same socket as Boschert OL25 (25W). 75% min. efficiency, 110/220V strappable std., short circuit and overload protection.
Compower Corp,
Campbell, CA.

Power Conditioning
Sells and services full line of power supplies and conditioners; isolation transformers, motor/generator sets, UPSs, and power-line conditioners; $500 — $50,000; Vend Maint.
Computer Power Solutions,
Placentia, CA.

Uninterruptible Power Systems
Models UPS-501-1 through UPS-453-3; single and three-phase systems available from 500VA to 45KVA; several models are seismically-qualified units; $3340. to $49,490; Vend Maint, 3 FO
Elgar Corp, an Onan Power Systems Co,
San Diego, CA.

UPS — 2 Series
DSU & 5000A Series; DSU Series, 700 VA to 1800 VA; 5000A Series, 3 KVA to 37.5 KVA; Vend Maint, 2 FO.
Gould-Deltec,
San Diego, CA.

Load Ramp Control
Provides gradual and stepless application of voltage when turning computer on, reducing in-rushing current. $1750 and up.

Overvoltage Panel
Designed to sense line voltage conditions, removing voltage from computer if voltage exceeds prescribed limits for a selected length of time; $1750 and up.
Donald C. Harder Co,
San Diego, CA.

MPD 208
Power controller DEC VAX Compatible; 3 Phase 120/208 VAC at 90 amps; 6 switched outlets & 3 unswitched outlets; interchangeable with DEC VAX 869 series power controller; $1650.

MPD 416
Power controller is DEC VAX compatible; 3 Phase 240/416VAC at 45 amps; 6 switched outlets & 3 unswitched outlets; interchangeable with DEC VAX 869 series power controller; $1375.

MPD 7100
Switching power supply; DEC VAX Compatible; 120/240 VAC input 47-63 Hz; 5.1V output at 100 amps; mechanically and electrically interchangeable with DEC VAX 11/780 power supplies; $2,475.

MPD 115
Power controller; DEC compatible; controls 30 amps at 115VAC; has 8 switched and 4 unswitched outlets; this unit is compatible with DEC 861 series; high performance EMI filter, remote control & optional delay; $325.

MPD 115A
Power controller, DEC compatible; controls 30 amps 230 VAC (4 wire) input, 115VAC output; 8 switched and 4 unswitched outlets; high performance EMI filter; remote control & optional delay; DEC 861 compatible; $375.

MPD 110
Power controller controls 15 amps at 115VAC; has 10 unswitched outlets on the standard unit; has 8 switched and 2 unswitched outlets with remote option; standard high performance EMI filter; special FCC filter available as option; $149.

MPD 220
Power controller controls 15 amps at 230VAC; has 10 unswitched outlets on standard unit; has 8 switched and 2 unswitched outlets with remote option; standard high performance filter; special FCC filter optional; $214.

MPD 230
Power controller is DEC compatible; controls 20 amps at 230VAC; has 8 switched and 4 unswitched outlets; this unit is compatible with DEC 861 series power controllers; high performance EMI filter, remote control and delay option; $425.

MPD 2010
Power controller controls 15 amps at 230VAC input (4 wire) 115VAC output; has 10 unswitched outlets standard; has 8 switched & 2 unswitched outlets with remote option; standard high performance filter; special FCC filter optional; $176.

MPD 117
Power controller; line filter & power distribution for home and office computer; handles 10 amps at 115VAC with 6 switched & 2 unswitched outlets; high performance EMI filter; $89.
Marway Products Inc,
Santa Ana, CA.

1000 Watt Switching Power Supply
165-265 VAC input, or 115/230 VAC strappable; meets stringent FCC class B and VDE 0871 class B EMI requirements; 40 mS hold-up time; 80% efficient; fully self protected; fail safe remote sensing; meets all of the latest requirements for EMI; $795 (qty 1).
Powertec,
Chatsworth, CA.

OmniBus Power Distribution Center
Workstation model, free-standing rollabout models, and 19-inch rack-mount model; UL listed, 57-63 Hz; output power is 10 kVA, 15 kVA, 22.5 kVA, 30 kVA, 37.5 kVA; input voltage 208V, 240V or 480 V, three-phase; $4685 to $6950. Contact DPP Div. of Topaz.

PI Power Conditioner
With Distribution PI with 5.0 kVA to 10.0 kVA; 50 Hz and 60 Hz; nominal output voltage 117/220/234 VAC; efficiency is 94% minimum; regulation band± 7%; $2060 - 3250. Contact Electronics Div. of Topaz.

Series 82000 UPS
0.5 kVA to 1.2 kVA; 50 Hz and 60 Hz, Single-Phase; UL Listed, 115 VAC Output/Input; $4990 - $9590. Contact Electronics Div. of Topaz.

Series L6 AC Voltage Regulators
Output voltage regulation bands: Type 1 ± 10% of nominal; Type 2, +5%, -10% of nominal; Type 3, ± 5% of nominal; 96% efficiency minimum; operating frequency of 47 to 63 Hz; 1 KVA & 2 KVA; $938 - $1313; Contact Powermark Div. RTFM.
Topaz Inc,
San Diego, CA.

Add-In/Add-On Memories

SCAT/45 Add-In Parity Memory
PDP-11/45, -11/50, -11/55. Enables all 256 kB of memory to reside on Fastbus. Dualport, and can be used with either DEC bipolar or MOS already on Fastbus. Model 10019-0, 64 kB, $13,500; 10019-1, 128 kB, $23,500; 256 kB, $44,650.

CACHE/45
2 kB high speed cache memory that resides on Fastbus of PDP-11/45, -11/50, -11/55. Installed in place of M9200 interconnect module. Contains 2048 bytes of Schottky bipolar RAMs. 10006-2, $4500.

CACHE/435, CACHE/440
8 kB cache memory. Replaces M9202 interconnect module in PDP-11/34, -11/34A and replaces M981 interconnect module in PDP-11/35, -11/40. 10031, $3500. Vend Maint, 1 FO.
Able Computer,
Irvine, CA.

1816 CMOS
16K word CMOS RAM with battery backup for LSI-11, -11/2, -11/23. $1995. Vend Maint, 47 FO.
ADAC Corp,
Woburn, MA.

Mostek MK8000 Series
32kB to 2MB, add-in, add-on, cache, fast parity, and upgrade memory for Q-Bus, Unibus, and Massbus systems. Vend Maint, 4 FO.
Advanced Digital Products,
San Diego, CA.

Floppy Mem
To replace Nc machine tool's tape reader and tape with high speed, reliable floppy memory. Vend Maint.
Alden Computer Systems,
Natick, MA.

M-Core
Solid state non volitile memory in 1/4 MB increments. $20,000/MB. 45 FO.
Alpha Data Inc,
Chatsworth, CA.

ARM-10XD
DEC comp. 256K, 512K, 768K, or 1024K word capacity, 4 to 8 ports, 2 or 4 way interleaving, SW transparent.

MCM-8086 Multibus
64kB capacity, random access R/W memory, write protect or access inhibit in 4kB increments.

MCM-8080 Multibus
Fully compatible with SBC 80/MDS 800 systems. 16 kB R/W capacity; occupies single card slot; TTL compatible data, address and command signal interface; expands memory through direct bus interface; switch selectable starting address for 16K contiguous addresses; SW transparent.

ARM-2
DG comp. 16K words on a single board; 800 ns cycle time; complete HW/SW compatibility; single or multiple nonsequential address fields; plugs into any memory slot; operates in any address field; frees CPU slots for other functions.

ARM-3
DG comp. 16K or 32K words on a single board; 800 ns cycle time; totally transparent; operates in any address field; plugs into any memory slot.

ARM-20S Mainframe Memory
DEC comp. 256K to 2048K word capacity (in 256K increments); 2- or 4-way internal interleaving; no CPU modifications; extensive diagnostic capabilities; ECC capability.

ARM-20 Mainframe Memory
DEC comp. 128K word increments; 4-way interleaving; no CPU modifications; non-volatile storage; extensive diagnostic capabilities.

ARM-1100P
DEC comp. 32K to 128K word memory expansion; provides parity generation and error detection; Unibus compatible.

ARM-1170 Mainframe Memory
DEC comp. 345 ns effective cycle time; totally transparent; expansion to 2 million processor words; 128K word increments; enhanced throughput with 2- or 4-way interleaving.

ARM-1280
DG comp. 16K or 32K words on a single board; switch selectable cycle speed to match CPU model; totally transparent; plugs into any memory slot; operates in any address field including extensions beyond 32K.

Megastore 11
DEC comp. 259 ms block access and transfer time; 3 ms access; 512K to 1024KB/sec transfer rate; 512K to 4096KB capacity; 512KB expansion increments; Unibus compatible; totally transparent.

Megastore 1223
DG comp. 1.8 ms block access and transfer time; 200,000 wps transfer rate; 256K to 2048K word capacity; totally transparent; dual port option . Vend Maint.
Ampex Corp, Memory
Products Div,
El Segundo, CA.

MEM 11
LSI-11 Q-Bus. Dual width module provides from 16 kB to 256 kB of dynamic memory. Parity also available. $700-$3240.
Andromeda Systems,
Canoga Park, CA.

ACS/Motorola 128K
Self-diagnostic 128K memory compatible w/Wang MVP, LVP and VP. Detects parity errors on incoming & outgoing data indicated on card edge LEDs. Manufactured & Warranteed for 1 year by Motorola. $5333.
Automated Control Systems Inc,
Bellevue, WA.

5000 Series
High performance, PDP-11 Compat. Offers a wide selection of memory capacities up to 256kB × 18 in 32kB increments. Unibus and modified Unibus compat. Requires only one Unibus load.

6256-D
PDP-11/70 compat. Flexible expansion capacity available in 64kB increments to 256kB max. Includes on line/off line switch for troubleshooting or configuration procedures.

7512-D
Compat. with VAX-11/780 HW, SW, standard peripherals & system options. 64k × 72 (512kB) NMOS random access card. Easy to install. Vend Maint, 55 FO.
Braegen Minicomputer,
Peripherals Div.,
Anaheim, CA.

2116 16K Static Memory Board
2114 type static memory. Available in 450 or 200 ns access, address at 4K boundaries, configurable to 4, 8 or 12K w/o removal of RAM, phantom enable, bank port/bank byte select to any one of 8 banks. $349.95

2032 32K Static Memory Board
2114 type static memory. Available in 450 or 200 ns access, address at 8K boundaries, configurable to 8, 16 or 24K w/o removing RAM, phantom enable, bank port/bank byte select to any one of 8 banks. $660.

2065 64K Dynamic Memory Board
4116 type dynamic memory, 200 ns access, 16K bank independent, configurable to 16, 32 or 48K w/o removing RAM, on board refresh and wait state jumper enable, phantom enable jumper. S100 Bus compatible. $720. RTFM, 15 FO.
California Computer Systems Inc,
Sunnyvale, CA.

National Semiconductor 11/34, 11/70, 11/750, 11/780
Retail, system integrater. Vend Maint, 1 FO.
California Datalease Systems &
Financial Corp,
Anaheim, CA.

MicroSTOR-11
Compatible with CSI-11 2/03/23, Q-bus. Storage capacity — 16K, 32K, 48K or 64K words. On board parity, refresh options. Dual ht. board.

SuperSTOR-11
Compatible with PDP-11 Family (11/04, 11/05, 11/34, 11/40, 11/45 and 11/60). Fits any HEX slot modified Unibus or std. Unibus. Storage capacity — 16KW to 128KW × 18 bits.

VA-780
Compatible with VAX-11/780. Full ECC compatibility. Direct replacement for DECs M8210 main memory board. Storage capacity — 256kB. Expands main memory to 4 MB.
Cambex Corp,
Waltham, MA.

CIS10 0
64K × 8 memory for S100 based systems. Access time 225 ns. Bank select option for addressing to 512kB. $575.

CI-1123
256K × 9 memory for LSI 11/23. Has parity, access time 240 ns, addressable to 4MB. 256K $1925, Qty 100 $1475, 128K $1550.

CI-8086
128K × 9 to 512K × 9 memory for Multibus compatible systems, has parity. Access time 270 ns. Addressable to 16MB. 128K $1350, 512K $2995.

CI 6800-2
For Motorola Exercisor systems. 64K × 9. Has parity, access time 225 ns. Addressable on VXA or VUA. $575.
Chrislin Ind Inc.,
Westlake, CA.

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. From $450. 3 FO.
Comark Corp,
Waltham, MA.

NS-23L
Q-Bus (LSI-11) memory modules 64kB, dual height module. $585-64K; $1200- 128K; $2000-256K.

NS-11L
Unibus memory module, 256kB, single module. $2250. RTFM.
Compumart Corp,
Cambridge, MA.

94144 Semiconductor Memory
PDP-11/44. Includes ECC. 64K × 39, 128K × 39, 256K × 39. 525 ns read cycle time, 900 ns write cycle time; battery back-up. OEM qty, 128K × 39 (512kB) - $5050.

94123 Semiconductor Memory
LSI-11/2 to LSI-11/23. Up to 64K × 16/18 capacity. Full cycle time — 500 ns; full access time — 240 ns. OEM qty, 32K × 18 — $590.

94134 Semiconductor Memory
DEC 11/04 to 11/34. Up to 128K × 18 capacity. Full cycle time — 500 ns; full access time — 350 ns. 32K × 18 up to 128K × 18. OEM qty, 64K × 18 — $1130.

94134P Semiconductor Memory
DEC 11/04 to 11/55. Includes Parity. Up to 256K × 18 capacity by using double density (32K) chips. Full cycle time — 500 ns; access time — 350 ns; 16K × 18 up to 256K × 18 capacity. OEM qty, 64K × 18 — $1210.

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Add-In/Add-On Memories

94170 Semiconductor Memory
DEC 11/70. Up to 4MB capacity. Full cycle time — 600 ns; access cycle time — 460 ns. 256kB to 4MB capacity. OEM qty, 512kB system — $6670.

94178 Semiconductor Memory
DEC VAX. Full cycle time — 400 ns; full access time — 250 ns. OEM qty, 256kB — $1535. Vend Maint, 12 FO.
Control Data Corp, Computer Memory Div,
Bloomington, MN.

CCS-1220 EPROM Programmer
LSI-11 8K EPROM module and Intel 2716 type EPROM programmer. R/W switch, disable programming in RO mode. $475. Vend Maint.
Bob Sonnabend
Control Logic Inc,
Natick, MA.

720/Memory Expansion Unit
Memory expansion, memory parity, memory protect, multiple/divide options available. $3600 full configuration. Vend Maint.
Custom Systems Inc,
Eden Prairie, MN.

RM-117 Dual Port RAM
Intel Multibus. Complete memory management with 16kB on board RAM. Support dual processor with common RAM resources. $1200 (1-9).

CM-126 Universal RAM/ROM
Intel Multibus. Complete memory resource on one board. Accept 32 different RAM/ROM/PROM/EPROM, user selectable access time. Up to 128kB per card. $695 (1-9).

EM-115 Dual Port RAM Expansion
Intel Multibus. Efficient add on to RM-117. Contain additional 16kB RAM and 8kB PROM/ROM. $650 (1-5).

PM-116 PROM Memory
Intel Multibus. Total PROM-ROM memory module for Multibus, can hold over 1 megabit of standard PROM-ROM memory. $265 (1-9).

RM-119 64kB Dynamic RAM
Intel Multibus. High density RAM storage. Low power consumption, support 20 bit addressing. $960 (1-9).
Datacube Inc,
Reading, MA.

DR-181 16K × 8
16kB core memory for Intel's 8010/8020 computers. $930.

BC-801 Memory System
256kB to 2MB of core memory for the Multibus. $10,100.

BS-801 Memory System
512kB to 8MB MOS/ECC Multibus memory. $9530.

DR-70 16K × 18
Core memory for use with Sperry-Univac V71, 72, 73, 74, 75 and 76 computers. $3345.

V70S 256K × 23
512kB MOS/ECC memory board for Sperry-Univac V77-600. $9860.

DR-477 Memory System
32kB to 512kB core memory expansion for Sperry-Univac's V77-400 computer. $5355.

DR-1200 16K x 16
Core memory for use in DG's 1200, 1210, 1220 and 1230 computers. $1760.

DR-124 16K × 16
Core memory for use in DG's NOVA 2 series computers. $1760.

DR-123 16K × 16
Core memory for use in DG's NOVA 3 series computers. $1760.

DR-123S 128K × 17
MOS memory for use in DG's NOVA 3 series. $2970.

DR-125S 128K × 21
MOS/ECC memory for use in DG's ECLIPSE. $3520.

DR-118 16K × 12
Single quad core add-in memory for DEC's PDP-8/E, F, or M computers. $2120.

DR-118A 32K × 12
Single hex add-in memory board for DEC's PDP-8/A. A 16K × 12 version is also available. $2800.

DR-118S 128K × 12
Single board MOS memory for DEC's PDP-8/A computer. $6110.

DR-716 16K × 17
32kB core memory for P-E's 50, 55, 70, 74, 7/16, 7/32 and 8/32 computers. $2000.

DR-717 32K × 17
64kB core memory for P-E's 50, 55, 70, 74, 7/16, 7/32, 8/32, 6/16 and 8/16 computers. $3570.

DR-320S 512kB Memory Module
Single board MOS memory for P-E's 3220 and 3240. $6630.

BS-417 Memory System
512kB to 4MB MOS/ECC memory expansion for DEC's PDP-11/70. Includes chassis, power supply and cables. $5000.

DR-178S 64K × 72
A 512kB version of DEC's M8210 semiconductor array for the VAX-11/780. $3060.

DR-175S 64K × 39
A 256kB equivalent to DEC's M8728 semiconductor array for the VAX-11/750. $2400.

DR-120S 64K × 43
MOS memory for use in DEC's DECSYSTEM 2020. Equivalent to DEC's M8629. $5040.

DR-114 32K × 18
Single board core memory for use with DEC's PDP-11 Unibus computers. MM11-DR equivalent. $2745.

DR-114S 128K × 18
256kB single board MOS memory operates with DEC's M7850, for use in the PDP-11 Unibus computers. MS11-JS equivalent. $2125.

DR-114SP 128K × 18
256kB single board MOS memory with on-board parity control for use with DEC's PDP-11 Unibus computers. MS11-LD equivalent. $2205.

DR-144S 1024kB Memory Module
1MB MOS/ECC memory plugs directly into the PDP-11/44 backplane. Operates all current DEC diagnostics and operating systems for the PDP-11/44. $9000.

DR-115 16K × 16
Core memory for use with DEC's LSI-11 series computers. $1540.

DR-115S 32K × 16
MOS memory for use with DEC's LSI-11 series computers. Parity version also available. $610.

DR-113S 128K × 18
Single board 256kB MOS memory for use with DEC's LSI-11/23 computer. Non-parity version also available. $1950. RTFM.
Dataram Corp,
Cranbury, NJ.

PDP-11 Unibus Memory
DMS 11 LB, D is HW, SW compat with PDP-11 series. 128kB × 18 bit to 256kB × 18 bit. 500 ns full-cycle time; 375 ns access time.

PDP-11 Memory
DMK 11 is HW, SW compat with PDP-11/70. 600 ns read cycle time; 800 ns write cycle time; 460 ns access time. Stores up to 4MB.

VAX Memory
DMS 780. 32K × 72 bit, 256kB card. 400 ns cycle time; 250 ns access time; 800 ns write cycle time; 400 ns refresh cycle time. Vend Maint, 4 FO.
Data Systems Services,
El Toro, CA.

Core and Semiconductor Memories
Complete line of boards compatible with DEC, NOVA, HARRIS. 100% compat, 1 yr guarantee. Custom designs available. Vend Maint, 3 FO.
Digital Data Systems Inc,
Plantation, FL.

RMA-032.
32KW RAM board for LSI-11. Supports bank-switching to 2MB in LSI-11/2. Dual-width board. 450 ns access time. Up to 32 RMA-032s controlled by single BSC-256 bank switch controller. $750; $450 w/o memory chip.

BSC-256
Bank-switch-controller. Controls up to 2MB of RAM or ROM using the RMA-032 and RMS-016 memory boards. Vastly expands LSI-11/2 memory space. Dual width board appears as registers in peripheral space. Contains 32 word prom bootstrap. $300.

RMP-116
EPROM Programmer/Memory Board. DEC PDP-11 Unibus. Holds 16K words of Intel 2716 or TI 2516 EPROMs. Programs and executes from any socket. $650.
Digital Pathways Inc,
Mountain View, CA.

ECC128 Intel Multibus
Dynamic RAM with error correction. $2200/up.

SM/32
Intel Multibus compatible static RAM. $450.
Distributed Computer Systems,
Waltham, MA.

MSV11
General purpose LSI-11 64kB memory board. $1,000; $650-100 qty.
General Robotics Corp,
Hartford, WI.

MAXIRAM-S70
Main memory for PDP-11/70. Up to 4MB, interleaved operation,

600 ns cycle time, modular field expansion.
Imperial Technology Inc, El Segundo, CA.

MU-5780-256, MU-5780-1MB
VAX 11/780 add-in memory board available in 1/4, 1/2, and full MB sizes. Fully compatible with DEC. 1 year warranty. $2000, 1/4MB; $3000, 1/2MB; $5500, full MB.

MU-5750-256, MU-5750-512
VAX 11/750 and PDP-11/70 add-in memory board available in 1/4 and 1/2MB sizes. Fully compatible with DEC. 1 year warranty. Manual supplied. $2000, 1/4MB; $3800, 1/2MB.

CM-5044-256, CM-5044-512, CM-5044-1MB
Unibus compatible memory board for PDP-11/44, PDP-11/34, and other DEC CPU's. Available in parity and ECC versions and sizes of 1/4, 1/2 and full MB. Full DEC compatibility, 1 year warranty, manual. $3000, 1/4MB; $6000, 1/2MB; $12,000, full MB.

CM-5034-864
PDP-11/34 add-in memory board with parity, 128kB capacity, and HW error logging and display on board. Fully compatible with DEC. 1 year warranty. Manual supplied. $1100.

IN-1671/SY-1671
256, 512, 768, 1MB, 1.2MB, 1.5MB, 1.7MB, 2MB. PDP-11/70 add-on memory system in capacities from 1/4 to 2MB. System contains ECC memory, HW error logger and display, power supply and cooling. UL recognized, 1 year warranty; manual supplied. $15,000, 1MB; $25,000, 2MB.

CM-5151-256, CM-5151-512, CM-5151-1MB
Eclipse add-in memory board with ECC and HW error logging on board. Fully DG compatible including BMC and DCU options. Available in 1/4, 1/2 and full MB sizes. Features include 200 ns cycle time and both on-board and between board interleaving. 1 year warranty, manual. $5400, 1/4MB; $9000, 1/2MB; $15,000, full MB.

CM-5160
NOVA 3 add-in memory card avail. in 4 configurations and 2 capacities (128kB and 256kB). Configurations with on-board memory management and protect unit (MMPU) are unique in industry. Fully DG compatible, one year warranty, manual supplied. From $2400 for 128kB with parity to $4794 for 256kB with ECC, log, and MMPU. Vend Maint, 40 FO.
Intel, Memory Systems Operation, Sunnyvale, CA.

IMC-3
Add-in memory for DG Nova 3. Up to 128K word on a single card. $2380 (128K × 17; 1-9).

MCB-332
Non volatile CMOS add-in memory for Intel Multibus with battery back-up. Up to 32kB on a single card. $1436 (32kB; 1-9).

IMC-11
Add-in memory for DEC PDP-11. Up to 128K words on a single card. $1574 (128K × 18; 1-9).

IMC-11/780
Add-in memory for DEC VAX-11/780. 256kB (32K words × 64 data bits and 8 ECC bits). $1454 (1-9).
Intersil Systems Div, Sunnyvale, CA.

256kB MOS
For P-E 7/32 computers. Low power, single board, error correction and logging. $7700 qty 7-9.
Macrolink, Anaheim, CA.

MEGA-1
128K dynamic RAM board. Multibus. $650-$1470.

MEGA-4
512kB dynamic RAM, 8202 MMU. Multibus. $680-$5775. Vend Maint.
Matrox Electronic Systems Ltd, TMR Quebec, Canada.

MR-004 General Purpose PDP-11 PROM Module
On-board PROM programmer. Accommodates 2716, 2732 and 2758 type devices. Sockets for 8 device positions. PROMS not included. Programmer and memory area allocation are both switch and program selectable. Capacity from 1024 to 16K 16-bit words. Expansion in 1K, 2K or 4K increments. On-board +25VDC supply. $995.

MR-005 General Purpose PDP-11 PROM/RAM Module
Provides for mixture of PROM and RAM modules. Accommodates 2704, 2708, 2716, 2732 and 2758 type PROMS and 4118, and 4016 type RAM devices. Sockets for 16 devices. PROM/RAMS not included. Capacity from 1K to 4K words for 4118; 2716 gives up to 8K in 2K increments; 2758 provides 8K in 1K increments and 2732 gives up to 16K in 4K increments. $575.

MLSI-MRV-000 LSI-11 PROM Module
8 sockets accommodating commercially available 2704, 2708 or 3624 PROMS or equivalent. Switch selectable memory area allocation. Capacity from 512 to 4K 16-bit words. On board regulated −5VDC supply. $195.

MLSI-MRV-001 LSI-11 PROM Module
8 sockets accommodating 1702 PROMS or equivalent. Switch selectable memory area allocation. Capacity from 256 to 1K 16-bit words. On board regulated −9VDC supply. $195.

MLSI-MRV-002 LSI-11 PROM Module
32 sockets accommodating commercially available 5623, 5624 or equivalent PROMS. Switch selectable memory area allocation. Capacity from 256 to 4K 16-bit words. $195.

MLSI-MRV-003 LSI-11 PROM Module
32 sockets accommodating commercially available 3625 or equivalent PROMS. Switch selectable memory area allocation. Capacity from 256 to 4K 16-bit words. $195.

MLSI-MRV-004 LSI-11 PROM Module
8 sockets with on-board programmer. Accommodates commercially available 2716, 2732 and 2758 or equivalent PROMS. Programmer and memory area allocation are both switch selectable. Capacity from 1024 to 16K 16-bit words. Expansion in 1K, 2K or 4K increments. On-board +25VDC supply. $550.

MLSI-MRV-005 LSI-11 PROM/RAM
Combination module with 8 sockets. Accommodates 2716, 2732, 2758 or equivalent type PROMS as well as 4118 RAMS. (Chip addressing must match). Capacity from 1K to 4K words for 4118; 2716 gives up to 8K in 2K increments; 2758 provides 8K in 1K increments and 2732 gives up to 16K in 4K increments. $350. RTFM, 1 yr warranty.
MDB Systems Inc, Orange, CA.

MM-1103/2
32kB of non-volatile core memory for LSI-11. $1350.

MM-1103
16kB of non-volatile core memory for LSI-11. $990.

MM—6800S
32kB plus parity static RAM memory for Motorola microcomputer and Rockwell System 65. $850.

MM-8086
32kB of non-volatile memory for Intel 8 or 16 bit μP's. $1275.

MM-8086/16
16kB of non-volatile memory for Intel 8 or 16 bit μP's. $875.

MM-8080/16
16kB of non-volatile core memory for Intel Multibus. $849.

MM-8080B
8kB of non-volatile core memory and 16kB of ROM/PROM compatible with Intel Multibus. $790.

MM-6800D
64 bytes plus parity dynamic RAM memory for Motorola microcomputer and Rockwell System 65. $600.

MM-6800/16
16kB of non-volatile core memory for Motorola microcomputer. $849.

MM-6800
8kB of non-volatile core memory for Motorola microcomputer. $725.

MM-6800 S1
32kB plus parity static RAM memory for Motorola microcomputer and Rockwell System 65. $650.

MM-S-100
8kB of non-volatile core memory for S-100 Bus. $650. Vend Maint.
Micro Memory Inc, Chatsworth, CA.

Intelligent Memory — IM-1680
Multibus compatible, 16K static RAM/16K EPROM and on-board Z-80 processor that allows operating on on-board data. $344 any qty, Vend Maint.
Microsignal, Santa Barbara, CA.

MSC 3602
PDP-11/70 memory system. Expandable in 256kB increments, provides up to 2MB of ECC memory in 10½" of rackmount space.

MSC 3605
PDP-11/04 through 60 parity memory module. Provides a standard on-board parity control status register (CSR), parity generation and checking for the whole backplane. Selectable between standard and modified Unibus configurations, expandable in 32kB increments to 128kB.

MSC 3606
PDP-11/04, 34, 60 parity memory module. Expandable in 64kB increments to a full 256kB on a single board. On board parity generation, checking and CSR for the whole backplane.

MSC 3607
Single port extended memory unit (EMU). Emulates the RF-11/RS-11 disk system. 512kB to 2MB capacity. ECC to correct single bit errors and detect double bit errors. Error logging and battery backup optional.

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Add-In/Add-On Memories

MSC 3608
Dual-port extended memory unit (EMU). Allows high speed communication between two PDP-11's. Either port, via I/O register manipulation, can interrupt the other processor.

MSC 3610
VAX-11/780 memory module. 256kB plug-compatible expansion memory. Plugs directly into the MS 780 memory system and is a direct replacement for the M 8210 Memory Array.

MSC 3611
PDP-11/70 Memory Module. 256kB increments and is completely compatible with DEC's diagnostic and ECC systems.

MSC 3612
PDP-11/750 memory module. Direct replacement for the M 8728 memory system. Capacity of 256kB and plugs directly into the VAX 11/750 memory system.

MSC 4604
LSI-11, /2, /23 memory module. Expansion memory requiring only one Q-Bus slot for 64kB of memory with or without parity.

MSC 4804
LSI-11/2, /23 memory module. 128kB or 256kB of parity memory, occupies a single Q-bus slot. 22 bit address capability for applications up to 4 MB. Byte parity generation, checking and storage are standard.

MSC 4602/4802 Memory Expansion
16K to 64kB RAM for 4602: 64K to 256kB RAM for 4802. 4 sockets for 24 or 28 pin EPROMS. Full 20 line address decode, byte or word transfer mode, switch selected address map.

MSC 4605/4805 Memory Expansion with ECC
32K to 128kB RAM for 4605: 128K to 512kB RAM for 4805. ECC with double bit error detection, single bit error correction. FIFO buffer for up to 16 error messages.

MSC 8901 Memory Management
Allows 1 to 8 microcomputers to address 1MB of memory. Parallel bus arbitration logic for multiprocessor applications. 20 bit address generation for processors with only 16 bit address capability.
Monolithic Systems, Englewood, CO.

MK8023
LSI 11/23, 256K X 18 capacity on single quad card, on-line/off-line switch, battery backup, access LED on-board parity generation & checking, internally distributed refresh access time = 205ns, cycle time = 440ns.

MK8000
General purpose add-in board, on-board refresh, battery backup, 128K × (up to 24 bits), ECC parity or interleave optional, hex wide board, cycle time = 275 to 450, access time = 175-250.

MK8005
LSI-11 computers dual card with 32K × 18 capacity, 375ns cycle time, dynamic NMOS technology, battery backup, on-board refresh.

MK8003
DG's Nova-3 computer, 128 × 17 capacity, dynamic NMOS technology, battery backup, parity bits present but parity not generated on-board, on-board refresh 500ns cycle time, 350ns access time.

MK8001
PDP-11 line of computers, 64K × 18 capacity dynamic NMOS memory, battery backup, on-board refresh available. Parity bits present but generation does not occur on-board. Access time 350ns, cycle time 650ns.

MK8015
PDP-11 line plus PDP-11/44. 128 × 18, on-board parity generation, on-board refresh, battery backup, 100ns access time, 450ns cycle time, dynamic NMOS technology.

MK8009
PDP-8 computers. 64K × 12 capacity, battery backup, dynamic NMOS technology, on-board refresh.

MK8016
VAX 11/780. 64K × 72 capacity (512 kB) on one card, dynamic NMOS technology, battery backup, 8 bits ECC, on-board refresh.

MK8022
LSI 11/23. 256 × 18 capacity on a single dual card, internally distributed refresh, on board parity generation & checking, battery backup.

MK8601
PDP-11/70. Capacity of up to 2MB/chassis ECC, switch, on/off line switch, maintenance switch to allow easy trouble shooting, battery backup.

MK8032
P-E's 3220 or 3240. 128K × 39 (1/2 MB) capacity, battery backup, 7 bits ECC, access LED.

MK8070
PDP-11/70 or VAX 11/750. 64K × 39 (256kB) capacity per card, on-off/line switch, access, power and on-line LEDs indicating status, 7 bits ECC, battery backup, dynamic NMOS technology.

MK8075
PDP 11/70 and VAX 11/750. 64K × 39 (256kB) capacity on a single card, switch selectable for operation in the PDP 11/70 on VAX 11/750, status LEDs, 7 bits ECC, battery backup, on/off-line switch.

MK8024
DG's Eclipse line (except S/140). 128K × 22 capacity, on-board ECC, on-board error log, battery backup, interleave, 200ns access time, 600ns cycle time, dynamic NMOS technology.

MK8018
DG's Nova 4 and Eclipse S/140. 128K × 21 (5 bits ECC). On-board ECC allows error correction in Nova-4. On board error log makes self maintenance simple. Battery back, on-board refresh, 4-way on-board interleave.

MK8600
General purpose add-on's using the MK8000 card 2048K × 24 capacity, customer timing options available, interleave within the chassis; bidirectional address & data bus, byte control, inverting or non-inverting data.

MK8608
General purpose add-on memory. 1024K × 40 capacity, ECC separate data-in & data-out bus structure, error logging for single-bit errors, external refresh control, 2-way interleave 4 user I/O slots: uses MK8000 card.

MK8607
General purpose add-on memory. 768K × 72 capacity; 4 user I/O slots, ECC, external refresh control, separate data in/data out bus structure, error logging for single bit errors, 2-way interleaving uses MK8000 card.
Mostek Subsidiary of UTC, Carrollton, TX.

DEC-11/VAX Semiconductor Memory
Add-in memory boards for PDP-11, LSI-11, VAX.
Motorola Inc, Austin, TX.

NURAM Bulk Storage System
2MB, 4MB or 8MB self-diagnosing/maintaining RAM memory in 12 1/2" chassis emulating DEC's RS04 FHD. $9500 for 2MB.

NS780
VAX 11/780 compatible, 512kB, 225ns access/425ns cycle. Two year warranty.

NS70/75
VAX 11/750 and PDP 11/70 compatible. 256 kB.

NS23L
LSI 11, LSI 11/02, LSI 11/23 compatible. 64kB, 22 bit addressing, dual width, 190ns read access, 90ns write access, 490ns cycle. One year warranty.

NS23Q
LSI 11/23 compatible 256kB quad width, 22 bit addressing. 80ns read access, 180ns write access, 490ns cycle, 22 bit addressing. One year warranty.

NS11L
PDP 11 compatible, 256kB, on board parity controller, on board CSR. 100ns write access, 300ns read access, 450ns access, 22 bit addressing. One year warranty.

NS11E
PDP 11 compatible, 128kB ECC, on-board CSR; 400ns read access, 100ns write access, 450ns cycle.

NS44F
PDP 11/44 compatible, 512kB ECC. Vend Maint.
National Semiconductor, Memory Systems, Santa Clara, CA.

NM3602
256kB-2048kB add-on, ECC MOS memory for DEC.$11,000-$36,000. Vend Maint, 8 FO.
Nordata, Seattle, WA.

MEcc V11
Error correcting memory system for Q-Bus. LSI-11 compatible. Vend maint.
PEBX Inc, Campbell, CA.

PM-S11E
Compact system has 2 boards of 256kB of memory. ECC.

PM-S8A
High density add-in memory for PDP-8/A. Addresses located anywhere from 0-128K words in 4K increments using a DIP switch module located on memory card. Operates with KT8A memory management unit for addresses above 32K.

PM-1132W/JE & PM-1132W/J
128 kB parity core memory provides nonvolatile R/W storage for PDP-11/70.Is a 64-kB add-in memory for MJ11 memory chassis. Single unit space for PM-1132W/JE.

PM-S11E/64
128kB MOS board ECC.

PM-S11L & PM-S11L/F
Memory board replaces MS11L & provides 256 kB of MOS memory and on-board parity controller. SW transparent to DEC's OS & diagnostics. 256 kB MOS memory for PDP-11. Single hex-board compatible with DEC's OS/ diagnostics. HW, voltage, signal, pin-to-pin compatible with Unibus backplanes. Refresh cycling. Supported by battery backup. Variable switch settings permit starting/stopping on any 8 kB boundary within extended addressing range of 0 to 4 MB.

PM-SJ11
High speed memory system for the PDP-11/70 has 256 kB storage to 1.5 MB.
Plessey Peripheral Systems, 17466 Daimler, Irvine, CA.

PM-KK 11A
High-speed, 2 kB cache memory for PDP-11/34A central processor. Cache memory has required data for 85% of data requests that occur during typ. program operation.

PM-8A16
16,384-word by 12-bit random access core memory module for PDP-8A. Plug-in replacement for MM8-AB core memory. Operates with (or in place of) MM8-AA (8K) — or MM8-AB (16K) core memories.

PM-1132
64-kB core memory module operates on Unibus of PDP-11.

PM1132A
64 kB core memory module operates on Unibus of PDP-11.
Plessey Peripheral Systems, 1691 Browning, Irvine, CA.

3010 MEMORY
32 K word MOS memory for DG Nova 1200 and 800 computers. $2100. Vend Maint, 15FO.
Quentin Research Inc, Northridge, CA.

MEM 16K-BES Static RAM
Multibus (IEEE P-796), 8 and 16 bit mode, 16K (Byte Exchange). $745.

MEM 64K-BE Dynamic RAM
Multibus, Byte Exchange, traditional three power supply. $995.

MEM 64K-D Dynamic RAM
Multibus, 8 or 16 Bit mode jumper selectable. $995.
Relational Memory Systems/ relms, San Jose, CA.

Dual Ported Memory/ SKYMEM-Q
A dual ported Q-bus memory with 2 channels of A/D data operating at 1 MHz, 128kB. Ability to control 2 Reticon line scan or Matrix cameras for image processing. $5000. Vend Maint.
Sky Computers Inc, Lowell, MA.

Dual-Port LSI-11 Memory/ LS-060
4K, 16-bit static RAM for interface with Q-bus or Unibus. Handles single-cycle DMA. Supports 18-bit addressing. Software transparent from both ports. $1495.

Semiconductor Memory/ LS-040
16K or 32K, or dynamic RAM with 256-word on-board PROM for systems bootstrapping and diagnostics. 450-ns cycle time. $495 for 16K. Vend Maint, 2FO.
Standard Engineering Corp, Fremont, CA.

LEC-16 and MAC-16
4K increments. Vend Maint, 17FO.
Telefile Computer Products Inc, Irvine, CA.

PINCOMM 44S
MOS add-in memory for use in DEC PDP 11/44 and other extended Unibus applications. 256KB-$3995; 512KB-$7795; 1024KB-$13,440.

PINCOMM 780S
MOS add-in memory for use in VAX 11/780. $2200.

PINCOMM 750S
MOS add-in memory for use in VAX 11/750. $2300.

PINCOMM 70S
MOS add-in memory for use in DEC PDP 11/70 with MK-11 memory system. $2300.

PINCOMM 24S
MOS add-in memory for use in PDP 11/24 and other extended Unibus applications. $2650-256KB; $10,600-1024KB.

PINCOMM PS
MOS add-in memory for use in PDP-11 Unibus family. $1690 (128KB).

PINCOMM HPS
MOS add-in memory for use in HP 1000 (high and std performance versions). $1200 (64KB); $1680(128KB); $3360 (256KB); $6720 (512KB).

PINCOMM PE16S
MOS add-in memory for use in P-E series 16 (ECC and parity versions). $590.

PINCOMM H6
MOS add-in memory for use in Honeywell series 60, level 6. $1350.

PINCOMM N
Core add-in memory for use in DG Nova 2, Nova 3, Nova 1200. $1758.

PINCOMM I
Core add-in memory for use in P-E (Interdata) 7/32, 8/32. $2034.

PINCOMM AS
MOS add-in memory for use in General Automation 220/110 series. $1835 (128KB).

PINCOMM A
Core add-in for use in General Automation SPC-16, 18/30, 330/ 440. $1983.

PINCOMM CS
MOS add-in memory for use in Computer Automation LSI/2 and LSI/4. $1200 (64KB) w/ battery backup. Qty discounts available on all. Vend Maint, 24FO.
Trendata Corp/Standard Memories, Santa Ana, CA.

Head-per-Track Drum 4016/4401
High-reliability, high-performance add-on memory for PDP-11, 1 to 4 MB, 8.5 ms avg. access, 16-word buffer controller interfaces PDP-11 via Unibus (OEM). MTBF exceeds 25,000 hrs. Others: head-per-track drum with controller. Storage capacity 4.7 MB unformatted; storage capacity 4.194 MB formatted. Avg. transfer rate 541K bytes/sec.

Head-per-Track Drum 4016/4402
High-reliability, high-performance add-on memory for PDP-8. MTBF exceeds 25,000 hrs. Storage capacity 2.35 megawords unformatted. 2.20 formatted. Avg. access 8.5 ms. Avg. transfer rate 235K words/sec.
Vermont Research Corp, N. Springfield, VT.

ZX-028B 128KB RAM Card
Intel MULTIBUS compatible. Interfaces directly to any SBC-80 or SBC-86 Computer. Unpopulated or populated with 128KB. R/W buffers on each board buffer all data written into or read from the memory array. $1280.
Zendex Corp, Dublin, CA.

Array Processors

MARS-232
Modular system which allows designers to configure multiple processor systems. Performance: 1K complex FFT 1.05 ms for a single processor. $20K to 40K OEM; $40K for full development systems. Vend Maint.
CNR Inc, Computer Products Div, Needham, MA.

MSP-2X
DG single board 24-bit block floating point data format. Library of Fortran callable signal processing routines. 1K point real FFT in 14.3 ms. $5950.

MSP-3000 Floating Point
Programmable thru Fortran calls of library subroutines or in mini- or macro-language. DEC 32-bit single precision data format. 1K real FFT in 7ms. $19,500/in expansion chassis; w/ 1/4 MB — $29,200.
Computer Design and Applications Inc, Newton, MA.

MAP 200
32-bit floating point, 7.5MFLOPS, full operational and development software provided. Complete systems from $30,500.

MAP 6400
64-bit floating point, 3MFLOPS, full operational and development software provided. From $89,000.

MAP 300
32-bit, floating point, 15MFLOPS, full operational and development software provided. From $40,000. Vend Maint, 60 FO.
CSPI, Billerica, MA.

IP8500
DEC Unibus compatible, with digital video processor, video output controller. Image array processing using up to 20 512 × 512 × 8 bit image memories. Color or monochrome. A true state-of-the-art product. Up to 4 simultaneous users. From $40,000 to $200,000. Vend Maint, 2 FO.
De Anza Systems Inc, San Jose, CA.

AP-180V
Fully-programmable, 38-bit, attaches to VAX DR780 high-speed interface. 12-million floating point operations/sec. $90,000-$160,000.

AP-190L
38-bit, interfaces to IBM 370 series, DEC 10 computers, and UNIVAC 1106, -08, -10. Programmable with Fortran Compiler, chainer, or assembly language. Library with 250 routines. Channel interface. 12-million floating point operations/sec. $150,000-$250,000.

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Array Processors

AP-120B
38-bit, programmable with Fortran compiler, chainer, or assembly language. Application library of 250 routines. 12-million floating-point operations/sec. Interfaces to PDP 11 series, VAX 11 series, HP 21 MX, PE 3200 series, Sel 32 series, Harris series. $48,000-$155,000.

FPS-100 Arithmetic
Compact, fully programmable 38-bit array processor offered on an OEM basis. Special provisions for multitasking and real-time operations. Interfaces to PDP 11 series and DG Nova series. Providing 8-million floating-point operations/sec. $24,000-$85,000.

FPS-164 Attached
Large memory, fully programmable 64-bit array processor that interfaces to: VAX-11 series Unibus and IBM 370/303X/43XX series selector or block multiplexor channel. Main memory to 1.5 million words. 12-million floating point operations/sec. $159,500-$589,800. Vend Maint, 13 FO.
Floating Point Systems, Portland, OR.

Micro Number Kruncher SKYMNK-Q
LSI 11, LSI 11/23 Q-Bus compatible. Does floating point in 32-bit single precision, 48-bit extended precision. Provides full digital signal processing at Megaflop speeds. On 2 quad modules. $5990 single unit; under $4000 qty over 100 units.

Micro Number Kruncher SKYMNK-M
Multibus compatible array processor for 16-bit micros — Intel 8086, Z8000. Does floating point (IEEE STD) in 32-bit single precision and 48-bit extended precision 20-bit bus address. 1 Megaflop processing on 2 SBC modules. $5990 single unit, under $4000 qty over 100 units.

Micro Number Kruncher SKYMNK-V
Versabus/M-68000 based array processor. Does 32-bit single precision, 48-bit extended precision in IEEE floating point format. 1 Megaflop speed on Versabus module format. $5990 single unit, under $4000 qty over 100 units.

Micro Number Kruncher SKYMNK-02
Floating point array processor. 32-bit single precision, 48-bit extended precision. Does digital buffering, FFT, Vector operations . . .programmable from host processor currently supported under RT-11 and RSX11. Whole processor system or two modules. Driver software, Vector library software and software simulator for SKYMNK-02 free with system. $5990 single unit, $4000 in qty 100. Vend Maint.
Sky Computer Inc, N. Chelmsford, MA.

Communications

DMAX/16
μP based controller connecting a PDP-11 to 16 asynch comm lines with DMA output capabilities. Replaces DEC DH11. 10048-1, EIA version without modem control, $4500. 10048-2, EIA version with modem control, $5300. 10048-3, current loop version $4500.

Quadracall (10045)
Interface between PDP-11 and up to 4 Bell 810 Automatic Calling Units. Replaces 4 DEC DN11's. $1400.

DV/16
Communications multiplexer that interfaces up to 32 lines to a PDP-11 with DMA transfer & dataset control. Synch/asynch switch selectable in groups of 4 channels. ABLE DV/16 Replaces DEC DV11 series. Up to 32 lines sync/async. 10070-1, 8 line DMA multiplexer with modem control & panel, $8000. 10071-0, 16 line DMA multiplexer with modem control & panel $11000.

Quadrasync/B (EIA/CCI7); Quadrasync/C (current loop)
Communication link between PDP-11 and 4 asynch comm channels — full or half duplex. Replaces 4 DEC DH11s. $1000.

DZ16 10090-1
μP controller connecting PDP-11 to 16 async comm lines. Replaces 2 DEC DZ11 controllers. $3200.

Quadrasync/E 10028
Interface between Unibus and 4 async comm. channels with data set control. Replaces 4 DEC DL11-E's. $1500.

DH/DM 10100-1
DEC DH11 and DM11-B Replacement. A microprogram controller with modem control, connecting the Unibus to 16 sync comm lines. $4100. Vend Maint, 1 FO.
Able Computer, Irvine, CA.

Able Interprocessor Links
DMA Interface, Bus Converter, Memory Modules, 5 V regulators, Backplanes, Terminators and Bus Repeaters. Manufacture, wholesale, service. Vend Maint, 4 FO.
Advanced Digital Products, San Diego, CA.

Cables
EIA RS-232C, extended data cable, twin or coaxial cable. Also port to port switch boxes, connectors and piece parts. RS-449 cable also available. Distributor. 1 FO.
American National Supply, Ansco, Gardena, CA.

IF-11/3270
Communication package allows IBM 370 user to remotely attach 8 terminals and a PDP-11 to an IBM controller. Emulates IBM 3271 remote cluster control unit with IBM 3277 display terminals attached. X/3270 units may be added to increase capacity up to 31 terminals. $11,400.

IF-11/3780
Package which emulates IBM 3780 (or 2780 or 2770) control unit for IBM 370. Allows PDP-11 to connect, by either of 2 channels, to the IBM 3705 or any 3780 protocol host. $8,000.

IF-11/HASP
Allows RSX-11M based PDP-11 system to emulate a HASP Remote Work Station. Provides Multi-leaving service for Remote Job Entry and File Transfer to Host Processor. $8,000.

IF-11/U200
μP-based package allows Univac 1100 users to attach multiple terminals and a PDP-11. Emulates a multiplexer cluster control unit with multiple U200 display terminals attached. Supports 8 terminals; add-on X/U200 units increase capacity to 31 terminals. $11,400.

IF-11/DCT1000
μP-based package allows Univac 1100 users to attach multiple terminals and a PDP-11. Emulates a multiplexer cluster control unit with multiple DCT1000 display terminals attached. Supports 8 terminals; add-on X/DCT1000 units increase capacity to 32 terminals. $11,400.

IF-11/UNTR
μP-based unit which emulates a Univac 9000 Remote Batch Emulator. Connects to PDP-11. Up to 2 remote Univac mainframes may be linked to the unit. Requires 1 hex SPC slot. $8,000.

IF-11/X.25
μP-based network package supports X.25 protocol levels 1, 2, and 3. Establishes calls to remote sites via Telenet, Tynmet or appropriate private X.25 network. Allows up to 32 simultaneous virtual calls. $10,000.

IF-11/1822
Programmable attachment for PDP-11. Allows operation with an ARPANET IMP (1822 protocol). The number of 1822 connections can be increased by adding optional X/1822 boards. $7,900.

IF-11Q/1822
Full-duplex DMA controller used to attach an LSI-11 to an ARPANET IMP. If more than one IMP connection is required, optional XQ/1822 boards can be added. $3,500.

LH-DH/11
Full-duplex DMA controller used to attach a PDP-11 to an ARPANET IMP. Operates in Local or Distant Host mode. $6,500.

IF-11/ECU
μP-based attachment for PDP-11. Contains 1822 interface controller and ECU-11 Logic Module. Format is a version of SDLC. Transmission rates can exceed 1 MB/s. Requires a companion ECU/11 at the remote terminus. $12,500.

VDH/11
Full-duplex DMA error-checking communications unit connects a PDP-11 to an ARPANET IMP. Sends and receives bisync mode. Provides dual-buffered DMA on input and real time clock. For use on ARPA-style networks using 24-bit or 16-bit CRC. $6,500. Vend Maint, 2 FO.
Associated Computer Consultants, Santa Barbara, CA.

1022 Intelligent Modem
Auto-dial, auto-answer modem, direct connect FCC registered. Remote-controlled output line for remote maintenance/diagnostics. Signalling= dial pulse and touch tones. RS232 interface. $595.

1030/1031 Intelligent Modems
Auto-dial, auto-answer, direct connect, FCC registered, RS232 interface. User friendly features, terminal modems. $395/$495. Vend Maint from factory.
Bizcomp Corp,
Menlo Park, CA.

B-DH11 Communications Multiplexer
Provide a buffered DMA-capable interface between a PDP-11 and multiple local or remote terminals. The B-DH11 is fully SW/HW compatible with the DEC DH-11. It occupies a single slot in the Unibus, requires only 1 bus load and interfaces upto 64 devices.

B-DZ11 Asynchronous Multiplexer
PDP-11 and VAX-11/780 compatible and SW compatible with DEC's DZ11. Provides a buffered program-controlled interface between a PDP-11 and multiple local or remote async terminals. Vend Maint, 55 FO.
Braegen Minicomputer Peripherals Div,
Anaheim, CA.

11-0080 Multibus Megalink
Multibus compatible interface w/ intelligent networking controller. Enables party line transmission between iSBC/System 80/86 μP. Communicates in DMA mode at 1 megabaud rate over coaxial cable up to 32,000′ long. Compatible w/other Megalink models for networking up to 255 processors. $2000, qty discounts.

11-0011 Q-Bus Megalink
Plugs into LSI-11 family & provides DMA transfers at 1 megabaud rate to up to 255 LSI-11's on one coaxial cable network, up to 32,000′ long. Compatible on same network w/PDP-11 processors using 11-0016 Megalink. $2235.

11-0016 Unibus Megalink
Interfaces to PDP-11 family & provides DMA transfers at 1 megabaud rate to up to 255 PDP-11's or LSI-11's on one coaxial cable network, up to 32,000′ long. Compatible on same network w/LSI-11 μP's using 11-0011 Megalinks. $5,375.

80-0025 RT-11 Device Handler
For Model 11-0011 Q-Bus & Model 11-0016 Unibus Megalinks. Version I handles point-to-point communications link between two processors. Version II handles multi-drop party-line communication. $1000. — Version I; $1500 — Version II. RTFM, 11 FO.
Computrol Corp,
Ridgefield, CT.

DCA System 355 Network Processor
Master network processor for medium to large private networks. Used as stand alone network, multipoint multiplexing network, multilink network. Newest release ×.25 gateway interface.

DCA System 205 Unibus Interface Statistical Multiplexor
DEC-Unibus-based computers. Designed to provide cost-effective growth in applications using terminals at a remote site. Compatible with DEC PDP-11, VAX-11/780 and DEC System-20 computers. Used in point-to-point or multipoint configurations.

DCA System 115 Statistical Multiplexor/Network Processor
Network processor provides same features as 105 but supports up to 32 ports. Ideal for time-sharing vendors whose host computer site located long distance from group of customers. Eliminates need for expensive wats lines or long-distance service.

DCA System 105 Statistical Multiplexor
μP based stat. mux. used in point-to-point configuration or as a slave unit in full function network. Serves both terminals & host computers at either end of network. Used in single phone line networks connecting 2-8 terminals to a host computer site. Vend Maint, 36 FO. Sales reps located US, Canada, Europe.
Digital Communications Associates (DCA),
Norcross, GA.

DCS/M1200
Multibus compatible modem for direct connection to telephone (FCC certified). $950.
Distributed Computer Systems,
Waltham, MA.

CS11/H Communications Multiplexer
One hex-size board, occupying a single Unibus slot, handles up to 64 async lines on PDP-11 or VAX-11 system. Qty 1-4: $4950 for 16 lines. 1 yr warranty, 3 FO.
Emulex Corp,
Santa Ana, CA.

4261 RS232 Daughter Board
4 line RS232C compatible interface module for use with DG ALM16 or ATI16. $115. Vend Maint, 1 FO.
Interface Electronics,
Southfield, MI.

8-Line Com-mux
RS-232 for P-E computers. $1900.

PADLA
2 RS-232 channels for P-E computers. $600.

QALTA
4 channel local terminal adapter for P-E computers. $675.
Macrolink,
Anaheim, CA.

Z9600
0 - 9600 bps async short haul modem. Self test feature, data indicators, and 2 year warranty. Carrier detect, lightning protection and rack mount options available. $167 single unit, $117 in qty.
Madzar Corp,
Fremont, CA.

MIOB-A Teletype/RS232 Serial Async Interface
SW compatible to DG 4010 or 4077 interface. Switch selectable device address, 20 mA current loop/RS232, baud rate and character format. 16 selectable baud rates from 50Hz to 19.2KHz. $358.

MIOB-B Optional
Second teletype/RS232 serial async interface. Same features as MIOB-A. Installed on MIOB-A, first serial interface. $248.

MIOB-C Optional Real Time Clock
Generates interrupts at programmed controlled rates of 60Hz, 10Hz, 100Hz or 1KHz. Compatible with DG operating system and diagnostic SW. Installed on MIOB-A. $275.

MIOB-A(B)-03 Optional Modem Control
First or second serial interface. Compatible with DG 4029 option to 4010 board. Add -03 after -A or -B or both to designate which interface requires modem control option. $83.

8063-04
4 channel async communication multiplexor. SW compatible with 4063 multiplexor. Provides interface to 4 async data sets or local terminals with RS232-C interface. Switch selectable device address, baud rate and character format (controls all channels). $1045.

8063-08
8 channel async communication multiplexor. Identical to 8063-04 with 4 additional channels. Optional comm. panel with eight 25 pin connectors also available. $1595.

MDL-11 Async Serial Interface Module
PDP-11 compatible. Combined EIA RS-232-C, 20mA current loop and RS-422 interface circuitry on a single board. Switch selectable operating modes of DEC DL11-A, B, C, D or E modules. 16 switch slectable rates from 50 to 19.2K baud. DIP switch selectable device addressing and interrupt vectors, as well as all UART parameters. Capability for different transmit and receive data rates. $825.

MDL11-W Async Serial Interface
PDP-11 line frequency clock and combined EIA RS-232-C, 20mA current loop and RS-422 interface circuitry on a single board. Combines all functions of the DEC DL11-W, DL11-WA and DL11-WB modules onto one board. Switch selectable baud rates from 50 to 19.2K as well as all UART parameters. $795.

DUP11 High Speed Synchronous Serial Interface
Single quad board. Complete modem control for full or half duplex operation. Provides all features of DEC Unibus DUP11-DA, including on board hardware CRC or LRC checking and generation for Bit Oriented Protocols SDLC, ADCCP and HDLC. $1350.

DZ11-A Async 8-line EIA Multiplexor
Provides all features of DEC Unibus DZ-11-A plus each line has programmable character formats and data rates from 50 to 19.2K baud. Contains a 64 character buffer with 16 character SILO counter. Upgradable to 16 line multiplexor with DZ11-B. $1950.

DZ11-AC
Async 8-line multiplexor with combined EIA/20mA capability on a per line basis (provides operational features of DEC Unibus DZ11-A and DZ11-C within a single board). Each line is programmable from 50 to 19.2K baud. $2100.

DZ11-B
Async 8-Line EIA multiplexor module. Provides all features of DEC UnibusDZ11-B plus each line has programmable character formats and data rates from 50 to 19.2K baud.$1500.

DZ11-E
Async 16-line multiplexor provides all features of DEC Unibus DZ11-E plus individually programmable character formats and data rates for each EIA line from 50 to 19.2K baud. $3110.

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Communications

H317-E EIA 16 Channel Distribution Panel
RETMA rack mountable. Used with one or two MDB or DEC DZ11-B multiplexor boards to provide DZ11-A or DZ11-E capabilities. $750.

H317-AC
EIA/20 mA Current loop 8 channel distribution panel. RETMA rack mountable. Used with MDB or DEC DZ11-8 multiplexor boards to allow choice of 8 channels of EIA-RS-232-C or 20 mA current loop circuitry on a per line basis. When used with DZ11-B, provide combination of DEC DZ11-A and DZ11-C without the requirement for separate RS-232 or Current Loop modules and communications panels. $875.

DLV11
LSI-11 single line EIA RS-232-C/20 mA Current Loop serial interface. Switch selectable: device addressing, interrupt vectors. UART parameters and baud rates from 50 to 19.2K baud. Generates Reader-Run for ASR type terminals. $475.

DLV11-E
Single line EIA RS-232-C serial interface with modem control. Switch selectable device addressing interrupt vectors, UART parameters and baud rates from 50 to 19.2K baud. EIA RS-232-C drivers and receivers for complete dataset control. Split transmit and receive baud rate capability. $370.

DLV11-F
Single line EIA RS-232-C/20 mA Current Loop serial interface with programmable and switch selectable baud rates from 50 to 19.2K baud. 4 level interrupt. Switch selectable device addressing, interrupt vectors and UART parameters. Generates Reader-Run for ASR type terminals.$350.

MLSI-DLV11-FX
Single line serial interface with combined EIA RS-232-C/20 mA Current Loop and RS-422 circuitry on a single board. Switch and programmable baud rates from 50 to 19.2K baud. Switch selectable device addressing, interrupt vectors and UART parameters. Generates Reader-Run signal. Also includes Buffer Ready/Printer Busy user strap selectable circuitry. $350.

MLSI-DUV11
Single line sync serial interface. Complete modem control. Sync Or Isochronous comm. modes, either half or full duplex. Transmitter and receiver double buffered logic permits a full character time for handling of interrupts. Provides level conversion between on-board TTL levels and EIA RS-232 or appropriate dataset levels and accommodates transmission rates up to 40K baud. $700.

MLSI-DUPV11
Single line sync serial interface. Complete modem control for full or half duplex operation. Provides all features of DEC Unibus DUP11-DA, including on board hardware CRC or LRC checking and generation for Bit Oriented Protocols SDLC, ADCCP and HDLC. Also Byte Protocols BY-SYNC and DDCMP. ×.25 capability. $950.

MLSI-DZ11A
Async 8-line EIA multiplexor. Provides all features of the DEC Unibus DZ-11-A plus each line has programmable character formats and data rates from 50 to 19.2K baud. Switch selectable device addressing and interrupt vectors. Includes dataset control. 4 level interrupt. Contains a 64 character buffer with a 16 character SILO counter. $1750.

MLSI-DZ11-AC
Async 8-line multiplexor with combined EIA/20 mA capability on a per line basis (provides operational features of DEC Unibus DZ11-A and DZ11-C within a single board). $1900.

MLSI-DZ11-B
Async 8-line EIA multiplexor module. Provides all features of the DEC Unibus DZ11-B plus each line has programmable character formats and data rates from 50 to 19.2K baud. $1350.

MLSI-DZ11-E
Async 16-line multiplexor. Provides all features of DEC Unibus DZ11-E plus individually programmable character formats and data rates for each EIA line from 50 to 19.2K baud. $2800.

47-102 Programmable Async Single Line Adapter (PASLA)
For use with P-E async data sets or local RS232-C terminals. Switch selectable functions include device address, high and low baud rates and half/full duplex operation. 16 selectable, crystal controlled, rates from 50 to 19.2K baud. $450.

47-102D
Dual programmable async single line adapter (dual PASLA) for use with async data sets or local RS232-C terminals. Each channel has independent switch selectable functions. Either channel may be strapped for 20mA current loop operation. $625.

47-102DLL
RS422 long line option contained on Dual PASLA. Strap selectable RS422 differential driver/receiver to drive local terminals up to 4,000′. Includes strapping for both channels. Requires MDB-47-102D. $50.

48-024
Current loop/RS232-C interface for local TTY or terminals. Switch selectable functions include device address, baud rate, character format and 20 mA/RS232-C operation. 16 selectable, crystal controlled, rates from 50 to 19.2K baud. $350.

48-000
Universal clock module to provide a precision interval clock interrupt that is program selectable from one μs to 4.095 sec. $650.

48-012
Line frequency clock module to provide interrupts at a 120 Hz rate that is derived from the 60 Hz AC power line frequency. $225.

MBI-49-TTY/RS232 Async Serial Interface Module.
IBM Series/1 Compatible. Combined EIA RS-232-C, 20 mA current loop, TTL and RS-422 interface circuitry on a single board. Switch selectable: device address, baud rates from 50 to 19.2K, and character format. Printer BUSY monitor circuit allows use with low cost printers with RS-232-C or 20 mA interface circuitry. $595.

MBI-TTY-25-A 25′ Cable
Operates with most devices with a serial 20 mA current loop interface. Device end of cable has transmit and receive leads. Board end of cable is pre-configured to allow data transmission/reception between the device and the TTY/RS232 Adapter. $52.

MBI-TTY-25-B
Similar to cable above, but preconfigured to allow BUSY monitor circuit to operate with devices that signify BUSY by the absence of current in their transmit circuit. $52.

MBI-EIA-25
25′ general purpose RS-232 cable has a male DB-25P EIA type connector on the device end. Interlock circuitry allows monitoring of BUSY signal on pin 20 (Data Terminal Ready) of device. $70.

MBI-EIA-25-A
25′ RS-232 cable for TI 810 printers that have the DNB option enabled and have an RS-232 interface installed. $70.

MBI-EIA-25-B
Similar to cable MBI-EIA-25-A, but designed for Centronics printers that have an EIA interface installed. $70.

MBI-EIA-25-C
Similar to cable MBI-EIA-25-B, but used with Teletype Model 40 printer with simplified EIA-like interface. $70. All above RTFM, 1 yr warranty.
MDB Systems Inc, Orange, CA.

Microconnection
Auto-dial, autoanswer direct connect modems. RS-232 serial I/O compat. Vend Maint.
Micro Peripheral Corp, Redmond, WA.

GPIB11V-2 DEC Q-bus to IEEE-488 Highspeed DMA Interface
Implements talker, listener and controller functions. Dual height board. Data transfer rates up to 250 KB/sec. Allows use of the IEEE-488 as an interprocessor communication link. SW is provided which may be installed as a handler in RT-11, RSX-11 or UNIX operating systems.

GPIB11-2/VX
Interfaces DEC VAX computer to IEEE-488 Bus via DMA channel. Same as GPIB 11-2 except comes with SW driver package compat. with VAX/VMS operating system. $2495.

GPIB11V-1
Interfaces DEC Q-bus computers to the IEEE-488 Bus. $695.

GPIB11-1
Interfaces DEC Unibus computers to the IEEE-488 bus. $1295.

GPIB11-2
Interfaces DEC Unibus computers to IEEE-488 via DMA channel. 6 high board. Data transfer rates of up to 500 kB/sec allow use of IEEE-488 as an interprocessor communication link. SW provided which may be installed as a handler in RT-11, RSX-11, UNIX and VAX/VMS operating systems. $1995.

GPIB-100 IEEE-488 Bus Extender

Extends the IEEE-488 bus beyond the specification's distance limitations. Bus may be extended up to 300 meters per pair of GPIB-100s. Full handshake protocol is maintained across the entire comm link. $995 (1-9). Vend Maint from factory.
National Instruments, Austin, TX.

NDLV-11 Serial Line Unit

Compat with DLV-11, switch selected address & speed lines, async serial line unit. $265.

NDLV11 J/2

2 port serial line unit. SW compat. w/DLV11 J, 2 independent serial line ports, baud rates to 19,200. $295.

NDLV11-E

Serial line unit with modem control. SW compat with DLV11-E. Full modem control, switch selectable address and line speeds. $275. Vend Maint.
Netcom Products Inc, Sunnyvale, CA.

T-Comm 80 Communications Processor

The system supports terminals and hosts from any number of manufacturers, and mix any number of data and voice comm. lines. True network control. $50,000 to $150,000. Vend Maint, 7 FO.
Periphonics Corp, Bohemia, NY.

RayNet Network Processing Systems

Single host/single protocol; multihost/single protocol; multiple host/multiple protocol systems. Turnkey multiprocessing, multitasking systems for interactive terminal network control, independent of terminal or host manufacturer. Vend Maint.
Raytheon Data Systems, Norwood, MA.

NTDS Interface Model Nos. 14190-501 & 14192-501

Rockwell's NTDS interfaces provide the communications link between PDP-11/VAX computers and U.S. Navy std. tactical computers or NTDS peripherals with fast, slow or Anew channels. Sell, service. $6000-$8000.
Rockwell International, Autonetics Marine Systems Div, Anaheim, CA.

Archinet

Medium speed (150,000 baud) local network interface for interconnecting up to 16 P-E 16- and 32-bit minicomputers or Tektronix 4081's. Half-card Z-80 based interface handles all protocol. $1500, OEM discounts avail.
Scientific Enterprises Inc, Wilsonville, OR.

SCD-DZ11 Async Multiplexers

Programmed interface between PDP-11 & multiple local or remote async terminals. 8 or 16 line, EIA, 20mA or mixed 8 line each EIA/20mA. Programmable speeds. $1615,8-channel. Vend Maint. 7 FO.
Sigma Sales Inc, Anaheim, CA.

Local Net System 40/55 Tswitch

Provides automatic switchover to a redundant Tverter. $1485.

Local Net System 40/50 Tverter

Central retransmission unit for cable head end. Supports up to 10 Mbps aggregate transmission in two 30 MHz bands. $3500.

Local Net System 40/PDP Interface

Adds a DEC Unibus interface to the system 40/100 network adapter unit. $1500.

Local Net System 40/IBM Interface

Adds an IBM channel interface to the system 40/100 network adapter unit. $3000.

Local Net System 40/100 Network Adapter Unit

High speed network adapter. Sustained throughput to 1.5 Mbps. Includes Intel Multibus interface. Aggregate data transmission to 10 Mbps. $8515.

Local Net System 40

High-speed networking system operating on CATV-compatible coaxial cable. Up to 1 Mbps per adapter. Interfaces compat. with IBM channels and DEC Unibus. 10 Mbps aggregate data transmission. $10,000 per network adapter (configuration dependent).

Local Net System 50/300 Tbridge

Gateway interconnection between channels. Handles up to 4 System 20 channels and/or system 40 channels. $5800.

Local Net System 20/55 Tverter Switch

Provides automatic switchover to a redundant Tverter. $1495.

Local Net System 20/50 Tverter

Central retransmission unit for cable head end. Supports up to 15.4 Mbps aggregate transmission in two 36 MHz bands.

Local Net System 20/200 Tmux

Terminal/computer network adapter. 8 RS232C ports. Each operates at up to 19.2K bps. $4200.

Local Net System 20/100D Tbox

Dual port terminal network adapter (RS232C). $1175.

Local Net System 20/100 Tbox

Terminal network adapter. Single RS232C port. $995.

Local Net System 20

Low-cost, coaxial cable local network compat. with CATV standards. RS232C interface at up to 19.2 Kbps. Local Net can support up to 20,000 terminals on a single cable. $600 per terminal connection (configuration dependent). Vend Maint, multiple plans, 4 FO.
Sytek Inc, Sunnyvale, CA.

8800 Series Micom Concentrators

A family of modem multiplexers in a single unit. $1950 for a 4 channel mux w/a 2400 bps modem.

Codex 664 & 668 Multiplexers

To hook remote multiple terminals through a single Bell telephone line to a central computer. $1900-$3300. Vend Maint. Retailer.
Tel Com Products Inc, Westmont, IL.

Controllers

TC11

Tape Drive Controller For UNIBUS Systems.

TC01

Tape Drive Controller For Q-BUS Systems.

SC11/BX

SMD hard disk drive controller for UNIBUS systems.

SC01

Disk drive SMD controller for Q-BUS systems; Vend maint, 4 FO.
Advanced Digital Products, San Diego, CA.

FLEX02

RX02 Compatible Floppy Disk Controller/System. FLEX02 controller is single, dual width card for DEC LSI-11, providing up to 2.05 MB of storage. $1220-3510.

WINC 08

Winchester disk controller/system for the DEC LSI-11 and PDP-11. Features emulation of the RL02, providing software compatibility with a total storage capacity of 41.6 MB. $3310-$7075.

STORM 25

Single board controller provides emulation of DEC's RM02/05. Hex board compatible with standard PDP-11 SPC slot allowing attachment of up to 4 industry standard 80/300 MB SMD Drives: $4925; Vend maint, 2 FO.
Advanced Electronics Design, Sunnyvale, CA.

5287 Printer Controller

Allows any RS232C or parallel printer to be attached to IBM 3274/6 cluster controllers (BSC, SDLC or SNA/SDLC); Vend maint.
Agile Corp, Sunnyvale, CA.

TS-100 Tape Controller

IBM-compatible 9-track magnetic tape controller for S-100 based processors including software. $600 controller with software, $4200 complete subsystem.

TZ-80

IBM-compatible 9-track magnetic tape controller for Z80 single board processor by means of piggy-back connection: $600, controller with software: $4200 complete subsystem.

OSTU-C

IBM-compatible 9-track magnetic tape controller with software for Ohio Scientific processors: $4500 complete subsystem; Vend maint and RTFM.
Alloy Engineering Co, Inc, Natick, MA.

ADC-01 PDP-11 Controller

Intelligent disk storage module controller for PDP-11s.

ADC-10 Constellation

Emulating storage module disk controller for DG Nova and Eclipse.

ADC-11 Constellation

Emulating storage module disk controller for DEC PDP-11.

ADC-20 Constellation

Dual-function emulating disk and tape controller for DG Nova and Eclipse.

ADC-21 Constellation

Dual function emulating disk and tape controller for PDP-11; Vend Maint.
Ampex Corp, Memory Products Div, El Segundo, CA.

Winchester Disk Controller

Dual-Width, DEC LSI-11 Q-Bus module controls combination of 8" and 5 1/4" Winchester + Floppy devices; bootstrap ROM, total potential storage capacity of 160 MB. $2000.

Double Density Floppy Disk Controller/DFDC11

For DEC LSI-11 Q-Bus; dual width module provides RX01 compatibility, performance and storage advantage over RX02; controls 8" and 5 1/4" drives, single or double-headed; built-in bootstrap ROM. $1200.

COMPAT '81 ™ COMPATIBLE COMPUTER PRODUCTS EXPOSITION

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Controllers

Video Display Controller for DEC LSI-11 Q-Bus, VDC11

Dual width module appears to be 2 serial channels, but 2nd channel provides logic for video controller; TEK 4010 graphics incl.; emulation of QLY video terminal possible; $1200-$1400; RTFM.
Andromeda Systems Inc, Canoga Park, CA.

1001 Magnetic Tape Controller for DG

Allows interfacing of Nova type systems to 800 bpi tape consoles; $2000.

1001 Card Reader Controller for DG

Allows interfacing between Nova system users and Documation-type card readers; $1300.

2803 DMA Multiplexor

Multiport device useable for Nova type software system users. Micro-programmable to meet individual OEM needs; $3900.

2803 Multiplexors for DG

4 and 8 channel muxs with on-board printer controller, master port with up to 8 different baud rates; from $950.

2301 Line Printer Controller for DEC

Allows interfacing between PDP 11, 8 and Centronics/Printronix type devices; $360 (OEM qty).

2301 Line Printer Controller for DG

Allows interfacing between Nova systems and Centronics/Printronix type devices; $360 (OEM qty).

2601 Disk Controller for DG

Allows interfacing between Nova systems and Diablo/Hawk/W. Dynex/Pertec/Perkin Elmer cartridge type drives; $950 (OEM qty).

3000 Disk Controller for DG

Allows interfacing of Nova-driven systems to CMD/SMD type disk drives; on-board error correction; hi-speed data handling; $1790 (OEM qty).

2320 IBM Series 1 Printer Controller

Allows interfacing of Series 1 to Centronics/Printronix-type printers using standard IBM protocol; $1500; RTFM.
Ardent Computer Products, Doobs Ferry, NY.

IF-11/9700

μP-driven controller which front ends a PDP-11 and emulates an IBM System/370 Selector or Byte Multiplexer Channel. Principal use is operation of Xerox 9700 high-volume multi-font printer from the PDP-11. $15,000.

IF-11/9100

IBM-compat. mag tape unit for local use in conjunction with a PDP-11 computer. This μP-based system includes a Kennedy tape formatter type 9219 with Kennedy 9100 tape transport. $26,000. Vend maint, 2 FO.
Associated Computer Consultants, Santa Barbara, CA.

Magnetic Tape Controller Model TFC 912

800 NRZI/1600 PE bpi imbedded controller takes one dual-height slot in backplane. Interfaces to LSI-11, 11/2, and 11/23 computers. Compatible with all industry standard tape drives; $2730 (OEM qty).

Magnetic Tape Controller

Model TFC 712 is dual-density 800 NRZI/1600 PE, single board plug-in controller. Compatible with DG Nova/Eclipse computers; $2500 (OEM qty).

Tape Controller Model TFC 822

800 NRZI/1600 PE bpi single hex card controller, μP-controlled on-board test. Compatible with all industry standard tape drives. Interfaces to all PDP-11 and VAX-11 computers; $2695 (OEM qty).

Tape Controller Model TFC 812

800 NRZI/1600 PE bpi imbedded controller with system unit. Compatible with DEC's PDP-11 and VAX-11 computers. TM-11 Compatible; $3400; Vend Maint, 25 FO.
AVIV Corp, Woburn, MA.

3170 Disk Controller

Compatible with all Nova minicomputers; handles up to 4 drives; features automatic formatting, multiple sector transfer, overlapped seek and comprehensive error detection.

3120 Tape Controller

Compatible with Nova minicomputers, 7-track NRZI format is fully IBM compatible; 9-track NRZI meets ANSI standards; features dual-density, data rate selection, and 2 and 3 character mode.

3180 Tape Controller

Nova-compatible controller with IBM-compatible format; features data rule selection, Read-after-Write check, optional dual-density and full core transfer.

3255 Disk Controller

Single board handles up to 4 disk drives; features multiple record length format, full 4 sector buffering, proprietary ECC, offset and strobe.
Ball Computer Products, Boulder, CO.

DEC System Controller

LPC-20 plug-compatible controller/printer. Handles printers (300, 600, 900, 1200, 1500, or 1800 lpm). SW comp. w/TOPS-10, TOPS-20 OSs. Quad-board (10.5" H by 9" W by 0.875" T). Hex-board (5.062" H by 9" W by 0.875" T). Power (+5Vdc @ 4.5A). Printer systems (w/LPC-20), from $10,550 (300 lpm) to $33,500 (1800 lpm).
BDS Computer Corp, Menlo Park, CA.

FLOP 02

RXV21-compatible floppy disk controller. Bootstrap for LSI-11, dual slot PCB.

900-220

Printer controller for LSI-11 Centronics compatible, dual slot PCB.

Communication Processor CP

Bit slice co-processor for LSI-11 Q-Bus; also stand alone usable; own I/O-Bus; Applications include Comm-Controller BSC, HDLC, SDLC, X.25, FFT-processor; Vend maint, 2 FO.
Bereich Mini-Computer-Systeme, Periphere Computer Systeme GmbH, Munich, W. Germany.

2422 Floppy Disk Controller

S100 Bus compatible; up to 4 8", 5 1/4" or mix; single or double density diskette read; auto diskette format detect, single and double side disk drives, soft sectored; fast seek for voice coil drives; optional wait states; CP/M 2.2 operating system w/DOC included; $425; RTFM, 15 FO.
California Computer Systems Inc, Sunnyvale, CA.

Emulex Controllers

Carries a variety of Emulex tape and disk controller for systems integration.
California Datalease Systems & Financial Corp, Anaheim, CA.

RIMFIRE 38

Intel Multibus compatible single-board disk and tape controller for the Priam Winchester disks and formatted 1/2 inch tape drives; streaming and start/stop; $2295.

Tape Master

Intel Multibus compatible tape controller for formatted 1/2 inch streaming and start/stop tape drives; $1895; RTFM.
Computer Products Corp, Plymouth, MN.

480/Slot Saver II

4-channel, single board contains interface and communications controllers for low speed and peripheral devices used with DG and DG-emulating computers; replaces 4 DG boards; $1650.

290 SMD Controller

Fully emulates DG Series 606x series of drives, permits mix of differing capacity drives; $3860.

DG Cartridge Disk Controller

10 MB cartridge disk controller for DG minis; $1690.

120 Magnetic Tape Controller

NRZI magnetic tape formatter/controller with Pertec industry standard interface for DG minis. $1,690.

260 Multiplexer

Asynchronous multiplexer with 8 channels individually switchable for RS232 or 20 mA and speeds to 19,200 bps; $1800.

400 Multi-Function I/O

2 consoles; real time clock; parallel line printer; 8 channels of programmable Mux; $2100.

220 Slot Saver 1

Options available include: 2 consoles; real time clock; paper tape reader and punch; line printer; controls devices used with DG and DG-emulating computers; $2200, full configuration.

280 Cartridge Disk Controller

20 MB cartridge disk controller features full emulation of DG 6070 series subsystems; 256 word buffer eliminates data late conditions; $1850.

130 Magnetic Tape Coupler

Supports formatted NRZI and PE drives in conventional start/stop or streaming mode; $1490.

370 DMA Line Printer

Line printer controller with direct memory access, for Nova or Eclipse minis; optional internal timer and long line driver; $1200. Vend Maint.
Custom Systems, Inc, Eden Prairie, MN.

CD-6 Cartridge Tape Controller
Nova series interface for 3M HCD-75, 67 MB/ cartridge drive; one slot; DMA data transfer; $1100 (OEM qty).

CQ-6 Cartridge Tape Controller
Q-Bus interface for 3M HCD-75, 67 MB per cartridge drive; dual card; $1000, (OEM qty).

CU6-Cartridge Tape Controller
Unibus interface for 3M HCD-75, 67MB per cartridge drive; Quad card-one SPC slot; DMA data transfer; RSX-11 driver sources available to users at no cost; $1000 (OEM qty); RTFM.
Cybergraphic Systems,
Victoria, Australia.

VR-110 Video RAM-Intel Multibus
64 character by 16 line A/N video controller; mixed pseudo graphic and text; features blinking, video, underline; $450 (QTY 1-10).

VG-120 Video Digitizer — Intel Multibus
Video Digitizer and frame store, with spatial resolution: 320 × 256 × 6; generates 64 grey level or color; conforms to RS-170 video specs; $2995 (QTY 1-9).

VT-103 Video Terminal — Intel Multibus
64 character by 16 line video terminal on one card; Interpret ASCII command from key board port; features reverse video and blink; $495. (QTY 1-5).

QVG-120/QAF-120, Video Digitizer System for DEC Q-Bus
Video digitizer and frame store, with spatial resolution of 320 × 256 × 8; generates 256 grey or 256 color; $4999 (QTY 1-9); RTFM.
Datacube,
Reading, MA.

S33/C SMD Controller
Storage module drive controller for DEC's PDP-11 series computers; RP06 and extended RP06 emulation; $4410 (qty 1).

S33/D SMD controller
Storage module drive Controller for DEC's PDP-11 series computers; RK06 emulation; $4410 (qty 1).

C33 Disk Controller
Movinghead cartridge disk controller for DEC's PDP-11 series computers; when interfaced with one to four disk drives, it emulates DEC's RK11/RK05 disk subsystem; $1860 (qty 1).

T34/D Tape Controller
Dual density tape controller for the PDP-11 and industry standard drives, emulates TU10/TM11 subsystem; accommodates drives up to 100 bpi, 125 ips; NRZI only version also available; $3300 (qty 1).

T36 Tape Controller
Single card dual-density tape controller for the PDP-11 and industry standard drives; emulates TU10/TM11 subsystem; can accommodate drives up to 1600 bpi and 125 ips; $3300 (qty 1).

S03/A SMD Controller
Storage module drive controller for DEC's LSI-11 series computers; RM02/RM05 emulation; $4410 (qty 1).

S03/B SMD Controller
Storage Module Drive controller for DEC's LSI-11 series computers; RK07 emulation; $4900 (qty 1).

S03/C SMD Controller
Storage module drive controller for DEC's LSI-11 series computers; RP06 and extended RP06 emulation; $4900 (qty 1).

S03/D SMD Controller
Storage module drive controller for DEC's LSI-11 series computers; RK06 emulation; $4900 (qty 1).

C03 Disk Controller
Moving head cartridge disk controller for DEC's LSI-11 series computers; when interfaced with one to four disk drives, it emulates DEC's RK-11/RK05 Disk System. $1860 (qty 1).

T03 Tape Controller
NRZI tape controller for DEC's LSI-11 series computer; when interfaced with one to four industry standard 1/2″ reel-to-reel tape transports, emulates DEC's TU10/TM11 subsystem; $1950 (qty 1).

T04/D Tape Controller
Dual-density tape controller for the LSI-11 and industry standard drives; emulates TU10/TM11 subsystem; can accommodate drives up to 1600 bpi, 125 ips; NRZI only version also available; $3300 (qty 1).

S33/B SMD Controller
Storage module drive controller for DEC's PDP-11 series computers; RK07 emulation; $4410 (qty 1).

S33/A SMD Controller
Storage module drive controller for DEC's PDP-11 series computers; RM02/RM05 emulation; $3970 (qty 1); RTFM.
Dataram Corp,
Cranbury, NJ.

DSD 4140 Flexible Disk Controller
Controller/interface board for DEC LSI-11 computers; enables OEMs who have unique requirements of space or configuration to design their own package; fully compatible with RX02 hardware; $1250 (qty 1); Vend Maint, 2 FO.
Data Systems DesignInc,
San Jose, CA.

DLP-3300 Line Printer Controller
DMA controller that connects IBM Series/1 models 4952, 4953, or 4955, or a 4959 I/O expansion unit to any Centronics or Dataproducts interface printer. Specs: 7″ × 11″ board; printer speed: over 2,000 lines per minute; power requirements: 5 volts at 3.0 amperes; logic type: MOS and TTL/MSI; Device Code — switch selectable: 2116 standard. $1825 plus cable.

DLP-2200 Line Printer Controller
DMA controller that connects Data General Nova or Eclipse computers to any Centronics or Dataproducts interface printer. Size: 15″ × 15″ board; parallel data transfer rate: 125,000 Bytes per second max; power requirements: 5 volts at 2550 ma; logic type: TTL/MSI; device code — switch selectable: 178 standard; $ 1300 plus cable (OEM discounts).

DLP-1200 Line Printer Controller
Connects Nova or Eclipse to any Centronics or Dataproducts interface printer; 15″ × 15″ board; parallel transfer rate: 400,000 Bytes per second maximum; power requirements: 5 volts at 1050 ma; logic type: TTL/MSI; device code — switch selectable: 178 standard; $650 plus cable (OEM discounts).

DLP-11 Line Printer Controller
Connects DEC Unibus to any Centronics or Dataproducts interface printer. Size: one quad size module (10 3/8″ × 8 7/16″); parallel data transfer rate: 300,000 Bytes per second maximum. power requirements: 5 volts at 950 ma; logic type; LSTTL/MSI. $625

DLP-1100 Line Printer Controller
Connects DEC Q-Bus to any Centronics or Dataproducts interface printer. Size: double module (5 3/16″ × 8 7/16″); parallel data transfer rate: 300,000 Bytes per second maximum; power requirements: 5 volts at 825 ma; logic type: LS TTL/MSI; $375 plus cable (OEM discounts).
Datasystems, a Wespercorp Subsidiary,
San Diego, CA.

IBM Series 1 Tape Controller
Model 1050 external controller which will operate up to 4 tape drives at all speeds and densities, including 125 ips; tape system starts at $9000 (qty 1).

Embedded Cartridge Disk Controller
Model 45112 single board occupies one I/O slot of a DG computer and controls up to 4 cartridge disk drives; $1895 (qty 1).

1521 Dual-Density Tape Controller
Embedded DEC LSI-11 compatible tape controller; 800/1600 bpi; 12.5-75 ips; $3000 (qty 1), dual density.

Univac MCC Chassis Series 99060
Other Univac controllers include line printer controller, card reader controller, tape reader controller, duplexers, mag tape controller and cartridge disk controller.

Model 1520AV Dual-Density Tape Controller
Embedded DEC VAX 11/780-11/750 compatible controller; 800/1600 bpi; 12.5 to 125 ips; $3900 (qty 1) dual-density.

Model 6520 SMD Disk Controller
Embedded Single Board DEC PDP-11/04 through 11/60 compatible controller; $4900 (qty 1).

Model 6521 SMD Disk Controller
Embedded DEC LSI-11 Compatible Disk Controller; $4950 (qty 1).

Model 6527 SMD Disk Controller
Embedded DEC PDP 11/70 Compatible Disk Controller.

Model 6520V SMD Disk Controller
Embedded DEC VAX 11/750-11/780 Compatible Disk Controller.

Model 1542 Dual Density Tape Controller
Embedded Interdata Compatible Tape Controller; 800/1600 bpi; 12.5 to 125 ips; $3600 (qty 1), dual density.

HP Compatible Tape Controller
Model 1041 allows the user to interface up to 4 drives to HP 1000 M,E, or F computer; this external controller includes chassis, duplexer cards, I/O cables, documentation and diagnostics; $5200 (qty 1).

Model 1520A Dual Density Tape Controller
Embedded DEC PDP-11 Compatible Tape Controller; 800/1600 bpi; 12.5 to 125 ips; $3400 (qty 1), dual density.

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Controllers

DG SMD Disk Controller
Model 6512 will accommodate one or two drives to provide up to 600 MB of storage capacity; $3595 (qty 1).

DG Mag Tape Controller
Model 1512 is an embedded controller which will control up to 8 tape drives with any density configuration; transparent to existing DG software operating systems; $3400 (qty 1); Vend Maint, 2 FO.
Datum Inc,
Anaheim, CA.

Megacore
Add-on memory systems with custom controller added; interfaces to any computer; Vend Maint, 3 FO.
Digital Data Systems, Inc,
Plantation, FL.

Shugart SA4000 Interface Compatible Disk Controllers
Single quad size controller interfaces up to two compatible drives to LSI-11, 11/2, 11/23; Emulations: Model DQ401 (RK05) DQ403 (RP02/RP03) DQ404 (RL01/RL02); Runs under RT-11 and RSX-11 software w/DEC drivers; $2050.

Mag Tape Coupler/DILOG Model DU130
Interfaces up to 2 industry std. formatted tape drives with 3 slave drives each to PDP-11 Unibus. 12.5 to 125 ips; drives either single or dual density; software-compatible with RT-11, RSX-11, RSTS, IAS, Mumps via std. tape drivers; $1695.

LSI-11 Disk Controller/ DILOG DQ100
Single board, quad size; emulates RK05 Disk Controller. RT-11, RSX-11 software-compatible. LSI-11, 11/2, 11/23; addressing capability to 128K words, RK05 software & media compatibility; handles to 80MB total capacity. $1520.

LSI-11 Mass Storage Disk Controller/DILOG DQ200
Interfaces LSI-11 to disk drives w/ flat cable SMD interface; handles to 500MB of on-line storage; has modified DEC RK Software Driver. DEC LSI-11, 11/2, 11/23; single board, quad size; addresses to 128KW memory, R/W in block sizes to 64KW. $2950.

LSI-11 Tape Controller/ DILOG DQ120
0.5″ tape controller; single board, quad size. Emulates TM-11 tape controller. RT-11 RSX-11 software-compatible; handle to 4 ind. std. tape drives to 112.5 ips. DEC or IBM media compatible. $2295.

LSI-11 Tape Coupler/DILOG DQ130
DQ130 interfaces to 2 ind. std. single or dual density formatted tape drives to LSI-11. 12.5 to 125 ips; emulates TM-11 controller, software-compatible w/RT 11 and RSX-11. LSI-11, 11/2, 11/23. Single board, quad size; $1695.

Mass Storage Disk Controller/ DILOG Model DQ202
For interfacing 8″ & 14″ Winchester or similar drives with flat ribbon cable (SMD) interface; emulates DEC RP02 device drivers used in RT-11 & RSX-11 software systems. LSI-11, 11/2, 11/23. Single card, quad size; $2450.

PDP-11 Compatible Disk Controller/DILOG DU100
Single-board, quad-size board occupying 1SPC slot; controller software-compatible to RT-11, RSX-11, RSTS & IAS via FK05 software drivers. PDP-11 Unibus. RK05 media compatible (when using properly aligned 2315 disk drive), handles to 80 MB capacity. $1520.

PDP-11 Tape Controller/ DILOG DU120
0.5″ tape controller on single, quad size board, software-transparent to RT-11, RSX-11, RSTS, IAS and Mumps software systems via TM-11 tape driver. TM-11 software-compatible, handles to 4 ind. std. tape drives; to 112.5 ips; card draws under 3.5A from 5V; occupies 1 SPC slot. $2295.

Mass Storage Disk Controller/DILOG DU202
For interfacing 8″ & 14″ Winchester or similar disk drives w/ flat ribbon cable (SMD) interface; runs RP02 software driver in DEC software systems; single card, quad size board, uses under 3.5A at 5V; 500 mA at −15V. Controller comes std. w/ on-board bootstrap loader, diagnostics & auto media-flaw compensation. $2450.

Universal I/O Winchester Disk Controllers
For LSI-11, 11/2, 11/23; interfaces up to two drives having proprietary I/O architecture such as BASF, IMI, PRIAM; emulations: Model DQ411 (RK05) DQ413 (RP02/RP03), DQ414 (RL01/RL02); Runs RT-11 and RSX-11 software with DEC drivers; $2050.

ANSI Interface Compatible Winchester Disk Controllers
Interfaces up to two drives to LSI-11, 11/2, 11/23; emulations: Model DQ421 (RK05), DQ423 (RP02/RP03), DQ424 (RL01/RL02); runs RT-11 and RSX-11 operating software systems using standard DEC drivers; $2050.

Shugart SA1000 Interface Compatible Winchester Disk Controllers
Interfaces up to two SA1000-compatible drives to LSI-11, 11/2, 11/23; emulations: Model DQ431 (RK05), DQ433 (RP02/RP03), DQ434 (RL01/RL02); runs under RT-11 and RSX-11 software systems using standard DEC drivers; $2050.

Seagate ST506 Interface Compatible Winchester Disk Controllers
Interfaces up to two ST506 compatible drives to LSI-11, 11/2, 11/23; emulations: Model DQ601 (RK05), DQ604 (RL01/RL02); Controllers run under RT-11 and RSX-11 operating software systems using standard DEC drivers; $2050.

Model DQ330 ¼″ 3M Cartridge Magnetic Tape Coupler
Interfaces up to two Kennedy Model 6450 tape drives to the Q-Bus of the LSI-11, 11/2, 11/23; emulates DEC TM-11, TS-03 software driver supported in the DEC RT-11 and RSX-11 operating systems; $1795.

Model DQ320 ¼″ 3M
Cartridge magnetic tape controller interfaces up to eight DC300A-type cartridge drives to Q-bus of LSI-11, 11/2, 11/23; switch selectable Serpentine or non-Serpentine read/write; emulates DEC TM-11 and TS-03; runs standard DEC RT-11 and RSX-11 software; $1995.

Model DQ409 Floppy Disk
Dual-wide controller interfaces up to two Shugart SA800 or 850 equivalent drives to Q-bus LSI-11, 11/2, 11/23; compatible with RX02 (DY) software drivers in RT-11 and RSX-11; RX01, RX02 media compatible: IBM 3740 format: $1195.

Model DQ202A SMD Interface Compatible Disk Controller
Interfaces one or two (mix or match) SMD compatible drives with 8-300 MB capacity to LSI-11, 11/2, 11/23; handles different transfer rates, number of heads, data surfaces, capacities, etc; RP02/RP03 software; runs RT-11 RSX-11; $2775.

Model DQ212 Mass Storage Disk Controller
For LSI-11, 11/2, 11/23, interfaces up to two SMD interface compatible 8″ or 14″ Winchesters/ SMD pack/CMD cartridge drives without changing controllers; capacities 8-160 MB; runs RP02/ RP03; supports soft and hard sectored disks; bootstrap for RP-11 & TM-11; automatic media flaw compensation, write protect, ECC & automatic read retry; $2950.

SMD Interface Compatible Disk Controllers
For LSI-11, 11/2, 11/23, interfaces two drives (mix or match); compatible with RP02/RP03 software drivers RT-11 and RSX-11; switch-selectable RK06/RK07 emulation; Model DQ205; bad-sector mapping or automatic media flaw compensation; DQ215; ECC; $2950; Vend Maint, 2 FO.
DILOG, Distributed Logic Corp, Garden Grove, CA.

FD/80
Single/double density floppy disk controller; 8″ or 5¼″; Multibus compatible.

DCS/STEP 2
Multibus stepper motor interface.
Distributed Computer Systems, Waltham, MA.

SC01 Disk Controller
For DEC's Q-Bus, enables you to integrate one or two SMD or Winchester disks, from 12 to 600 MB, providing every big disk subsystem feature contained on Emulex Unibus and Cache bus controllers to the LSI-11 series computers; $3950 (qty 1).

SC21 Large Disk Controller
For DEC's PDP-11 and VAX-11; single-board, microprocessor-based large disk controller; same basic architecture and microcode, with all the features and better performance as Emulex SC11; $5000 (qty 1); SC 21/V (for VAX): $6000.

SC02 Disk Controller
For DEC's LSI-11 μC; designed to match the packaging and economy of SMD small and medium capacity 8″ and 14″ hard disk drives; $2500-$2800 (qty 1).

SC70/71 Large Disk Controller

For DEC's PDP-11/70; designed for the DEC Cache Bus for maximum performance and complete software transparency; $7950 (qty 1).

TC01 Tape Controller

For DEC's LSI-11 Q-Bus; industry's only fully imbedded dual-density controller for use with the LSI-11, 11/2, and 11/23 CPU's; $3000 (qty 1).

TC11 Tape Controller

For DEC's PDP-11 Series Unibus; dual-density controller that puts virtually any tape transport on the PDP-11 Unibus; $3600 (qty 1). Vend Maint, 3 FO.

Emulex Corp,
Santa Ana, CA.

2023 High Speed Paper Tape Punch Controller

These units are similar to DEC's PA611-series "Typeset-11" paper tape punch controllers used with BRPE Punch Models 11, 18 and 21 at speeds up to 110 cps; they are supplied as a complete system unit and are available with or without power supplies and punches; $1350 and up.

2024 Line Printer Controller

The controllers are compatible with DEC LP11, LA11 and LS11 line printers and the LXY11 printer/plotters; the controller, operating with standard DEC software, interfaces to dot matrix, impact, and electrostatic line printers operating at up to 1000 lpm; $575 and up.

2025 Card Reader Controller

This card reader controller is hardware and software compatible with DEC CR11/CM11/CMS11 systems; operates with DEC, Documation, Cardamation, PDI, GDI and similar card readers; punched or marksense cards can be read at speeds up to 600 cpm; $700.

2031 Asynchronous Serial Line Interface

The 2031 series are single line asynchronous serial data interfaces that provide full or half-duplex communication between a PDP-11 computer and a serial data communication device; these modules incorporate on a single quad board all of the features of the DL11-A through E and the DL11-WA and B if the Line-Time Clock feature is not needed; units are compatible with teletypewriters, Bell-series 103, 113 and 202-type modems, and other asynchronous serial data devices; $550 and up.

2033 Asynchronous Multiplexer

This is a program-controlled asynchronous multiplexer that connects a PDP-11 processor to 8 or 16 asynchronous serial lines; units offer improvements over the DEC DZ11 models while retaining all of the standard hardware features and software compatibility; features include automatic configuration for RS232 or current-loop operation, split transmit/receive baud rates, RS423/RS232 drivers and 19.2 KB capability, and built-in test mode connectors; $1450 and up.

2040 Hi-Density Universal Wire-Wrap Module

These modules offer great flexibility in the choice of the number and size of ICs used; low-profile sockets with component side Wire-Wrap pins permit standard 0.5 in. slot spacing; mounting-holes for additional I/O connectors and trimpots are provided on the top edge of some modules; $63 and up.

2041 General Device Interface

This is a general purpose parallel interface used between a PDP-11 Unibus and a peripheral device; unit is compatible with the DR11-C operating system and diagnostic software, providing parallel transfers of 8- or 16-bit out, 16-bit data in, and 6 bits of control and status information; $425.

2081 Parallel Communications Link

The Parallel Communications Link is a multiprocessor communications device with the capability of interconnecting multiple PDP-11 computers operating under RSX-11M or DECNET in a distributed processing environment; the unit provides the same features as the DEC PCL-11B high performance computer link, including a maximum bus bandwidth or one MB/sec and error-free data communication with hardware parity and CRCC error detection at a substantial reduction in space and power requirements; $4200 and up.

2140 Hi-Density Universal Wire-Wrap Modules

These modules offer great flexibility in the choice of the number and size of ICs used; low-profile sockets with component side Wire-Wrap pins permit standard 0.5 in. slot spacing; mounting-holes for additional I/O connectors and trimpots are provided on the top edge of some modules; $63 and up.

2153 Disk Cartridge Controller

The disk controller provides hardware and software compatibility with DEC RKV11/RK05 systems; operates with drives having capacities of 2.5 to 20 MB; either 2315 front load or 5440 top load removable cartridge disk drives may be interfaced; operates with the full 18-bit extended address of the LSI-11/23; standard features include selectable address and interrupt vector, Bus priority level, and 1500 or 2400 RPM disk drives; $1750 and up.

3021 Multi-Function Peripheral Control

The DG-compatible 3021 Series is a single board that will replace up to four I/O circuit boards; it provides a line printer control, card reader control, paper tape reader control, paper tape punch control, a real-time clock and two independent terminal interfaces; the interfaces are compatible with teletypewriters, CRT terminals and all others using standard serial data protocol, and the real-time clock is crystal controlled; $500 and up.

3040 Hi-Density Universal Wire-Wrap Module

This DG-compatible module offers complete flexibility in the choice of the number and size of ICs used, accommodating a maximum of 228 14-pin ICs; there is also a provision for two on-board 50-pin flat cable connectors for additional I/O connections; $345.

3042 Universal Logic Interface

Designed for applications where the DG processor is interfaced to special purpose front ends, one-half of this module provides computer interface logic, and the other half provides universal flexibility in the choice and the number and size of ICs used; a maximum of 114 14-pin ICs may be inserted on this standard size DG module; $522 and up.

3052 Disk Cartridge/Diskette Control

This control is software, hardware, and media-compatible with DG Models 4046, 4234 and 6045 cartridge units and the Model 6030 diskette; the control module interfaces to 100 and 200 tpi and 2200 bpi 2315/5440 disk cartridge drives having capacities up to 40 MB with standard software; up to 80 MB can be used if software compatibility is not a requirement; $1200; RTFM.

GEN/COMP Inc,
Canton, MA.

Printer Controller Model 9341

Interfaces Perkin-Elmer computers to most Data Products printers; 1/2 slot configuration; available with 1/2 board extender and cable; $925 each; $555 in quantity (75 up); RTFM.

Instrumentation Technology Systems,
Northridge, CA.

LPT/CRT Interface

One board with a line printer and a serial I/O interface; interface is for Centronics or Data Products printers; serial I/O is asynchronous, selectable baud rate & device code, 20 mA current loop or RS232, optional modem control signals; $800 line printer; $300 additional for serial; $150 additional for modem; vend maint, 1 FO.

Interface Electronics,
Southfield, MI.

5046 Disk Controller

Connects 3350 type disk drive to Univac 1100 Series computers.

6804 Magnetic Tape Controller

Connects Univac 1100 series computer.

V3830

Connects 3330 type disk drive to Univac 1100 series computers. Vend Maint, 3 FO.

Interscience Systems,
Canoga Park, CA.

GCR Tape Adapter

Interfaces STC 1900 GCR tape system to Perkin-Elmer computer; software compatible, OS and diagnostics; $2835 (qty 3-5).

Line Printer Controller

Line printer controller interfaces Perkin-Elmer computers to Centronics, DataProducts or Data Printer type printers; $550; RTFM.

Macrolink,
Anaheim, CA.

UFG-01

High-speed video frame grabber for PDP-11 bus; factory maintenance; companion to URGB-256; American/European std; three-version 4/6/8 bits per pixel; conversion rate at 30 MHz, ext. sync to video source; full SW control. $795 (1-4).

URGB-Alpha

Color Alphanumeric Video Controller for PDP-11 bus; programmable character density; blinking/Inverse/double height; from 10-128 characters per line; hardware scroll & light pen; up to 60 lines; ext/int sync; American/European std. $845 (1-4).

QRGB-Alpha

Color Alphanumeric Video Controller for LSI-11 bus; programmable character density; blinking/inverse/double height; from 10-128 char./line; hardware scroll & light pen; up to 60 lines; ext/int sync; American/European std. $885 (1-4).

QRGB-GRAPH

Variable Resolution Color graphic controller for LSI-11 bus; support zoom, pan & scroll; ext/int sync; variable resolution 256 × 256 × 4; American/European standard; 512 × 512 × 4, 1024 × 1024; single command erase. $2520 (1-4).

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URGB-GRAPH
Variable resolution color graphic controller for PDP-11 bus; support zoom, pan & scroll; ext/int sync; variable resolution 256 × 256 × 4, 512 × 512 × 4; American/European standard; 1024 × 1024, plus more; single command erase. $1500 (1-4).

URGB-256
256 × 256 Color Graphic Video Controller for PDP-11 bus; 256 × 256 × 4 resolution; optional companion frame grabber; 16-level color grey scale; ext/int sync; two boards for 256 level color; American/European std. $1675 (1-4).

QFG-01
High-speed Video Frame Grabber for LSI-11 Bus; companion to QRGB-256; American/European Std; three version 4/6/8 bits per pixel; conversion rate at 30 MHz; ext. sync to video source; full SW control. $795 (1-4).

QRGB-256
256 × 256 color graphic video controller for LSI-11 bus; 256 × 256 ×4 resolution; optional companion frame grabber; 16 level color grey scale; ext/int sync; two boards for 256 level color; American/European std. $1675 (1-4).

MDC-512
Variable resolution graphics controller for PDP-11 bus; variable resolution; ext/int sync; 256 × 256, 512 × 256, 512 × 512, 1024 × 256, American/European std; single command erase; vertical scroll. $1295 (1-4).

MDC-2480
24 × 80 alphanumeric video controller for PDP-11 bus; U & L graphic character set; access time 500 ns; support blink/inverse video; American/European std; transparent memory; ext/int sync. $495 (1-4).

MLSI-2480.
24 × 80 alphanumeric video controller for LSI-11 bus; support blinking/inverse video; access time 500 ns; upper/lower/graphic character set; American/European std; transparent memory, ext/int sync. $495 (1-4).

MLSI-512
Variable-resolution graphic controller for LSI-11 bus; variable resolution; ext/int sync; 256 × 256, 512 × 256, 512 × 512, 1024 × 256; American/European std; single command erase; support vert. scroll. $1295 (1-4).

FFD-1
Quad floppy disk controller; 32K RAM on board; 1/2-sided, 1/2 density; multibus: $625

STD-256
256 × 256 × 1 graphics control ler; multiple boards can be used for color; STD-bus; $370.

STD-2480
24 row × 80 column alpha numerics; STD-bus; $310

STD-ALPHA
Variable format alphnumeric controller; STD-bus; $415.

EXO-2480.
24 row × 80 column alpha numerics; Motorola Exorcisor bus; $520

EXO-512
512 × 256 ×1 graphics controller; Motorola Exorcisor bus; $730

ALTR-2480
24 row × 80 column alpha numerics; S-100 bus; $310.

ALT-256
256 × 256 × 1 graphics controller; S-100 bus; $415. (qty 1-4)

ALT-512
512 × 256 × 1 graphics controller; S-100 bus; $625. (qty 1-4).

MLSI-512
512 × 512 × 1 graphics controller; DEC Q-bus; $1360. (qty 1-4).

MAC-512
512 × 512 × 1 graphics board; DEC U-bus; $1360. (qty 1-4).

FG-01
Real time video frame grabber/ digitizer; 4/6/8 bit models avail.; multibus.

RGB-256
256 × 256 × 4 color graphics; multibus; $1675. (qty 1-4).

RGB-GRAPH
512 × 512 pixel × 4 bit color graphics display controller; multibus; $2520. (qty 1-4).

RGB-ALPHA
Variable format color alpha-numeric video controller; Multibus; $885. (qty 1-4). Vend Maint.
Matrox Electronic Systems Ltd. Quebec, Canada

MDB-4016 Card Reader Controller
For all models of Documation, Truedata and other popular card readers; compatible with DG operating system and diagnostic software; jumper selectable for device address and positive or negative true card reader interface; unless otherwise specified, board will be jumpered for negative true interface; 15 foot (4.57m) cable included; $963.

MDB-4034 Programmed I/O Line Printer Controller
For all models of Dataproducts, Data Printer, Centronics, Printronix, G.E. TermiNet and other manufacturers whose interface emulates any of the above printers; compatible with DG operating system and diagnostic software; has MDB exclusive PrinTest (TM) and Loopback features, plus LEDs to give visual indication of data lines; PrinTest feature has the capability of being operated remotely from the printer if a low-going signal is entered on a prescribed pin of the printer interface connector; DIP switch selectable addressing; furnished with 15-foot cable which contains the proper interface connector for the printer; $750.

MDB-4034-A
Programmed I/O line printer controller designed to operate most models of Data Printer line printers; compatible with DG operating system and diagnostic software; furnished with 15 foot cable; $995.

MDB-42XXData Channel (DMA) Line Printer Controller
For all models of Dataproducts, Data Printer, Centronics, Printronix, G.E. Terminet and all other manufacturers whose interface emulates any of the above printers; compatible with DG operating system and diagnostic software; has PrinTest (TM) and Loopback features, plus LEDs to give visual indication of data lines; $1500.

MDB-4217
Optional Programmable Interval Timer (PIT)/Real Time Clock; this option is switch selectable to operate as a PIT or RTC. PIT operates with switch selectable frequencies of 60, 10, 100, 1K, 10K, 100K or 1 MHz; with program loaded 16 bit counter, provides interrupts at time intervals from 1 μsec to 6.5K sec. RTC provides interrupts at programmed control rates of 60Hz, 10Hz, 100Hz or 1KHz; compatible with DG operating system or diagnostic software. Option to MDB-42XX data channel line printer controller and MDB 4034 Programmed I/O line printer controller; $750.

MDB-DA11-BJ High Speed Parallel DMA Interprocessor Link
Between two PDP-11 Unibus or VAX computers with differential drivers and receivers, will operate up to 3,000 feet (914.4m); allows data transfers across 32K boundaries in blocks of up to 32K words; data transfer speeds up to 500K words per second. Selectable address, interrupt vector and bus levels provided, preset to DEC standard assignment 77241X. Compatible with DEC DR11-B and DA11-B operating and diagnostic software; $4875.

MDB-DA11-BOI
High speed parallel DMA interprocessor link between two PDP-11 Unibus or VAX computers with differential drivers and optically isolated receivers, operates up to 1,000 feet (304.8m); allows data transfers across 32K boundaries in blocks of up to 32K words; data transfer speeds up to 500K words per second; selectable address, interrupt vector and bus levels provided, preset to DEC standard assignment 77241X; compatible with DEC DR11-B and DA11-B operating and diagnostic software; $5275.

MDB/MLSI-DA11-BOI
High speed parallel DMA interprocessor link for use with PDP-11 Unibus and LSI-11/2 or 11/23 Q-bus computers with differential drivers and optically isolated receivers; allows data transfers across 32K boundaries in blocks of up to 32K words; data transfer speeds up to 500K words per second; selectable address, interrupt vector and bus levels provided, preset to DEC standard assignment 77241X; compatible with DEC DR11-B and DA11-B operating and diagnostic software; $4050.

MDB-DA528
Parallel buffered program controlled interprocessor link for use with PDP-11 Unibus computers; provides programmed control of 16-bit parallel data transfer between two PDP-11 computers; line drivers and Schmidt receivers for noise immunity; selectable address, interrupt vector and bus level, preset to DEC standard DR11C assignment 76777X; compatible with DEC DR11C operating and diagnostic software; $2495.

MDB-LP/LSII
Line printer controller for all popular line printers; interfaces include Centronics, Dataproducts, LA 180, G.E. TermiNet, and Houston Instrument; also operates printers emulating Centronics or Dataproducts interfaces such as Printronix, Mannesmann/Tally, Okidata, CDC, etc; compatible

with DEC LP11 or LS11 diagnostics and printer driver routines; PrinTest and Loopback features, plus LEDs to give visual indication of data lines; $750.

MDB-LP11-A
Line printer controller with Data Printer interface; contains all features of LP11 described above; however, interface is designed to operate exclusively with most models of printers manufactured by Data Printer; the printer must have the standard interface, not the first character interface; $1250.

MDB-LV11
High speed electrostatic printer/plotter controller for Versatec or similar emulating device; compatible with DEC LV11 operating and diagnostic software; not compatible with Versatec supplied software; $1450.

MDB-CR11 Card Reader Controller
For all speed versions of Documation, Truedata and other popular card readers; multiple card reader address selection standard; compatible with DEC CR11 operating and diagnostic software; $875.

MDB-PC11 High Speed Paper Tape Reader/Punch Controller
For popular paper tape reader/punch devices; interfaces for Remex, Digitronics, EECO, Facit and other popular makes; not compatible with DEC manufactured paper tape Reader/Punches; compatible with DEC PC-11 operating and diagnostic software; $750.

MDB-XY11 Parallel Incremental Plotter Controller
For Houston Instrument or CalComp 500 Series XY plotters or equivalent; multiple plotter address selection and differential drivers standard; compatible with DEC XY-11 operating and diagnostic software; $1250.

MDB-IB11A IEEE/488 Instrumentation Bus Controller
Provides interface between PDP-11 computer and programmable instruments that conform to ANSI std. MC 1.1-1975/IEEE std. 488-1975; operating and programming considerations are exactly as described as for DEC's IB11 and IBV11A; $1425.

MLSI-DA11BOI Optically Isolated Parallel DMA Interprocessor Link
For any two LSI-11 computers; high speed differential drivers coupled with optically isolated receivers maximize circuit isolation and provide ground loop current elimination for bidirectional data transfer rates up to 500K words per second; data rate adjustments provided for optimum system operation over distances up to 1,000 feet; selectable feature allows data transfers across 32K boundaries in blocks of up to 32K words; switch selectable address and interrupt vector; adjustable data transfer rates for regulating DMA load on each computer; compatible with DEC DR11-B and DA11-B operating and diagnostic software; $3295.

MDB/MLSI-DA11BOI
Optically isolated parallel DMA interprocessor link between any LSI-11 computer and any Unibus computer (PDP-11 or VAX); all features are identical to the MLSI-DA11BOI; $4050.

MLSI-LP11 Line Printer Controller
For all popular line printers, interfaces include Centronics, Dataproducts, LA 180, G.E. TermiNet, and Houston Instrument; also operates printers emulating Centronics or Dataproducts interfaces such as Printronix, Mannesmann/Tally, Okidata, CDC, etc; four level interrupt; compatible with DEC LP11 or LS11 diagnostics and printer driver routines; has PrinTest and Loopback features, plus LEDs to give visual indication of data lines; $475.

MLSI-LP11A
Line printer controller with Data Printer interface; contains all features of LP11 described above; however, interface is designed to operate exclusively with most models of printers manufactured by Data Printer; the printer must have the standard interface, not the first character interface; $650.

MLSI-LV11
High speed electrostatic printer/plotter controller for Versatec or similar emulating device; compatible with DEC LV11 operating and diagnostic software; not compatible with Versatec supplied software; for LSI-11 computers; $975.

MLSI-XYV11 Parallel Incremental Plotter Controller
For Houston Instrument or CalComp XY plotters or equivalent; multiple plotter address selection and differential drivers standard; compatible with DEC XY-11 operating and diagnostic software; for LSI-11 computers; $700.

MLSI-CR11 Card Reader Controller
For all speed versions of Documation, Truedata and other popular card readers; multiple card reader address selection standard; compatible with DEC CR11 operating and diagnostic software; for LSI-11 computers; $850.

MLSI-PC11 High Speed Paper Tape Reader/Punch Controller
For popular paper tape reader punch devices; interfaces for Remex, Digitronics, EECO and other popular makes; not compatible with DEC manufactured paper tape Reader/Punches; compatible with DEC PC-11 operating and diagnostic software; for use with LSI-11 computers; $750.

MLSI-IBV11 IEEE/488 Instrumentation Bus Controller
Provides interface between LSI-11 computer and programmable instruments that conform to ANSI/IEEE std. 488-1975; four level interrupt; operating and programming considerations are exactly as described for DEC's IBV11—A; for use with LSI-11s; $725.

MDB-46-206 P-E Line Printer Controller
For all models of Dataproducts, Data Printer, Centronics, Printronix, G.E. Terminet and other manufacturers whose interfaces emulate any of the above line printers; $875.

MDB-46-235 P-E Card Reader Controller
For all models of Documation, Tru Data and other popular card readers; compatible with Perkin Elmer operating system and diagnostic software; $875.

MDB-46-234
Optional Hollerith to ASCII converter contained on the MDB-46-235 card reader controller; compatible with Perkin Elmer operating system and diagnostic software; requires MDB-46-235; $305.

MDB-48-488
IEEE Instrumentation Bus Controller (and talker/listener) includes IEEE standard receptacle on board, switch selectable device address, IEEE bus address, and IEEE bus configuration; this item is a special product that is not supported with operating system software drivers or diagnostics; $1250.

MBI-49-LPC IBM Line Printer Controller
For all models Centronics, Dataproducts, Data Printer, G.E. TermiNet, Houston Instrument and other manufacturers whose interface emulates any of the above printers, such as Printronix Documation, CDC, Tally, Trilog, Okidata, etc; compatible with IBM operating systems EDX, RPS and CPS, by emulating 4973 printer controller; switch selectable device address; can be supplied with special PROMS to allow block character printing, bar codes, plotting and other graphics when used in conjunction with printers that provide these capabilities; includes PrinTest feature; $1995.

MDB-HP-LPC Line Printer
For all popular line and dot matrix printers; interfaces include Centronics, Dataproducts, LA 180, GE TermiNet, and Houston Instrument; also operates printers emulating Centronics or Dataproducts interfaces, such as Printronix, Mannesmann/Tally, Okidata, CDC, Documation, etc; operates under HP operating systems RTEII, III & IV; can provide graphics capability to Printronix printers; $850. RTFM.
MDB Systems Inc,
Orange, CA

MCV-1023-Multichannel Video Controller
Board for Intel Multibus; alphanumerics and graphics capability; $695.

Multiple RS422 Communications Board
With modem DAA board; for Multibus;
Metacomp, Inc.
San Diego, CA

TURBO-21
Intelligent disk cache for DEC PDP-11 and VAX-11 Unibus series computers; singleboard add-on to the MCT EDC21 emulating disk controller increases disk subsystem throughput by eliminating up to 80% of all seek time and rotational latency; $6750 (1), $5335 (25).

EDC23
Singleboard emulating disk controller interfaces Perkin-Elmer 16- and 32-bit computers to four SMD-compatible disk drives; emulates the P-E MSM (mass storage module) disk controller; $4700 (1), $3600 (25).

EDC21
Singleboard emulating disk controller interfaces DEC PDP-11 and VAX-11 Unibus computers to four SMD-compatible disk drives; emulates the DEC RH11 controller interfaced to multiple RM02/03/05 disk drives; $3900 (1), $3082 (25).

SMV15
Singleboard disk controller interfaces DEC Vax-11 and PDP-11 series Unibus computers to two SMD-compatible disk drives; supports VMS, UNIX, RT-11, RSX-11M and RSTS/E operating systems; $3500 (1), $2766 (25).

SMC903
Singleboard disk controller interfaces Perkin-Elmer 16- and 32-bit computers to two SMD-compatible disk drives; supports OS/16 and OS/32; $3100 (1), $2400 (25).

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SMC11
Singleboard disk controller interfaces DEC PDP-11 Unibus series computers to two SMD-compatible disk drives; supports RT-11, RSX-11M and RSTS/E operating systems; features automatic DMA throttle, 32-bit ECC; $3500 (1), $2766 (25).

TDC803
Singleboard disk controller interfaces Perkin-Elmer 16- and 32-bit computers to two Trident-compatible disk drives; runs with OS/16 and OS/32; $2900 (1), $2200 (25).

SMC12
Singleboard disk controller interfaces DG Nova or Eclipse computers to four SMD-compatible disk drives; supports RDOS, IRIS and BLIS/COBOL; features hardware ECC; dual full-sector buffering, dual-access; $3500 (1), $2766 (25).

SMC902
Singleboard disk controller interfaces DG Nova and Eclipse computers to two SMD-compatible disk drives; supports RDOS, IRIS and BLIS/COBOL; features onboard RAM buffering, APL support; $3000 (1), $2371 (25).

TDC802
Singleoard disk controller interfaces DG Nova and Eclipse computers to four Trident-compatible disk drives; runs with RDOS, IRIS and BLIS/COBOL; features onboard RAM buffering, APL support; $2900 (1), $2200 (25).

EDC24
Singleboard emulating disk controller interfaces DEC LSI-11 Qbus computers to two SMD-compatible disk drives; emulates several DEC disk subsystems including RK06 and RM02/03/05; $3900 (1), $3082 (25).

EDC22
Singleboard emulating disk controller interfaces DG Nova and Eclipse computers to four SMD-compatible disk drives; emulates the DG 6060 series (Zebra) disk subsystems; $3900 (1), $3082 (25); RTFM;
MiniComputer Technology
Palo Alto, CA

MSC 8102 Video Graphics Controller
Directly drives monitor; on-board processor for alphanumeric and graphics generation independent of the Multibus; self-contained memory; RS-170 standard composite and separate video output.

MSC 8001 Industrial Controller
Includes Z80A CPU, 4KB/8KB RAM, 1 KB-16 KB EPROM capacity, 1 RS-232C port, 48 parallel I/O lines
Monolithic Systems
Englewood, CO

Hexacon Multi-Device Controller
Simultaneously controls 4 67MB disks, 4 1/2" streaming tapes and up to 8MB RAM bulk memory emulating Fixed-Head-Disk on DEC's Unibus; $6500 (qty 1).
National Semiconductor/Memory Systems
Santa Clara, CA

PM-DC 11A
Controller board replaces RK11D controller for RK05; transparent to DEC OS diagnostics; support std 2.5; 5; 10 MB drives for max. formatted capacity of 20 MB storage.

PM-DC 1100
Completely transparent to DEC OS & diagnostics that support RP series controllers; for realistic expansion of RP02/03 series subsystem data base to over 538/2000 MB hard disk storage; supports up to 8 drives; disk controller interfaces PDP-11 and wide range of SMD drives — including latest Winchester minimodule drives; single hex-wide board pin-to-pin, signal and power compatible with DEC backplanes; transparent to OS and diagnostics that support RP Series controllers; transfer rate of 1.2 μs/word, transparent ECC and multi-word DMA transfer; with selected drives, cables, DEC-compatible SW as complete disk storage subsystem.

PM-DC 1102
Disk controller for use w/ high performance CDC 9762 (or equiv.) storage module drives; PM-DC 1102 emulates; totally SW and media comp. w/ RH11/RM02 disk subsystem; 4 drives can be connected directly to DC 1102 controller.
Plessey Peripheral Systems,
17466 Daimler, Irvine, CA.

Lotus 700 Disk Controller
Point 4 and Nova-type computer I/O bus-compatible; interfaces up to 4 storage module drives; data transfer of 1.209 MB/sec.

Lotus 701 Disk Controller

Mighty Mux
DMA Multiplexor supports mixed line speeds and code levels; line speeds up to 56,000 baud; 4 or 8 multiplexor ports.

Mark V CPU Board
Vend Maint, 2 FO.
POINT 4 Data Corp,
Irvine, CA.

8200 Disk/Tape Controller Combination
Single board disk and tape controller for Nova & Eclipse computers; software transparent to RDOS and AOS operating systems; $2900.

8100 Disk Controller/ Multiplexor Combination
Single board disk controller and multiplexor for Nova & Eclipse computers; software transparent to RDOS & AOS operating systems; $3100.

7100 Mag Tape Adapter
Magnetic tape adapter for DG Nova & Eclipse computers; software transparent to RDOS & AOS operating systems; $1200.

4318 ALM Multiplexor
18 port multiplexor for DG Nova & Eclipse computers; software transparent to RDOS & AOS operating system; $3200.

4311 ALM Multiplexor
11 port multiplexor for DG Nova & Eclipse computers; software transparent to RDOS & AOS operating system; $2500.

4118 ULM Multiplexor
18 port multiplexor for DG Nova & Eclipse computers; software transparent to RDOS & AOS operating systems; $3200.

4111 ULM Multiplexor
11 port multiplexor for DG Nova & Eclipse computers; software transparent to RDOS & AOS operating systems; $2500.

4808 DMA Multiplexor
8 port DMA multiplexor for DG Nova and Point 4 computers; software transparent to Point 4's Iris operating system; $2100.

4604 Asynchronous Multiplexor
Four port communication multiplexor for DG Nova & Eclipse computers; software transparent to RDOS & AOS; $1200.

6100 Disk Controller
Disk controller for fixed & removable and Winchester drives; DG Nova & Eclipse compatible; software transparent RDOS & AOS; $2000.

6700 Disk Controller
High speed disk controller for DG Nova and Point 4 computers; software transparent to Point 4's Iris operating system; $2600.

6010 Disk Controller
High speed disk controller for DG Nova & Eclipse computers; software transparent to RDOS & AOS operating systems; $2900; Vend Maint, 15 FO.
Quentin Research, Inc,
Northridge, CA.

Line Printer Controller Model 1200
120X line printer controller connects a Data Products or Centronics (or equiv.) line printer to Unibus of PDP-11; add-in/add-on memory, hard disk drive, controllers, also tape drives. $800.

Mag Tape Adapter, Model 1300
13XX mag tape adapter interfaces industry std. formatted tape transports to PDP-11/04 thru PDP-11/70; adapter logic completely contained on one quad board that plugs into one SPC slot of CPU. $1600.

Mag Tape Adapter, Model 3300
33XX mag tape adapter interfaces ind. std. formatted tape transports to LSI-11s. Adapter logic on 2 dual boards. $1600.

Cartridge Disk Controller Model 1400
Provides PDP-11 users the ability to control cartridge class disk drives from manufacturers other than DEC while retaining compatibility with DEC OS SW. $2500.
Rianda Electronics, Ltd,
Anaheim, CA.

SA1400 Series Intelligent Controller
Controls up to 4 disk drives and floppy disk drives or 1/4-inch streaming tape cartridge; Vend Maint, 10 FO, 3 service centers.
Shugart Associates,
Sunnyvale, CA.

SDC-RXV21 Floppy Disk Controller
For LSI-11, -11/2, -11/23; compatible with RX01/RX02 media, IBM 3740 format and Shugart interface; single dual-wide board; diskette formatting capability; $872 (qty 1).

SDC-RKV11 — LSI—11 Cartridge Disk Controller
Single quad controller board for RK05; supports combinations of industry standard 2.5MB, 5MB and 10MB drives with max formatted capacity of 20MB; completely compatible with DEC operating systems & diagnostics for RKV11; $1198 (qty 1); Vend Maint, 7 FO.
Sigma Sales, Inc,
Anaheim, CA

SPECTRA 20
Multifunction Data General compatible disk/tape controller; 6060 series disk emulation, 6021 tape emulation, and hardware ECC on a single PCB; RDOS, AOS, IRIS, BLIS/COBOL; $3200 (OEM qty).

SPECTRA 10
Single function Data General compatible disk controller; RDOS, AOS, IRIS, BLIS/COBOL emulation with hardware ECC on a single PWB; $2600 (OEM qty).

SPECTRA 11
Single function DEC compatible disk controller (Emulator); $2300 (OEM qty).

SPECTRA 12
Single function DEC compatible disk controller (Emulator); $2900 (OEM qty).

SPECTRA 14
Single function Perkin Elmer compatible disk controller (Emulator); $3100 (OEM qty).

SPECTRA 21
Multifunction DEC compatible disk/tape controller; RM02, RM05, RK06/7 disk emulation and T11-10, TM-11, TS-11 tape emulation with hardware ECC on a single PWB; $3600 (OEM qty).
Spectra Logic Corp,
Sunnyvale, CA.

DC-16-C Disk Controller and Computer Interface
Flexible unit that connects 1-4 3330-type or 300MB-600MB Winchester disks to Interdata 5, 6, & 8/16 & 32 computers, or DEC PDP-10, 11, 15 and VAX computers, or Relm computers, or Microdata 1600, 3200 Reality computers, or Keronix computers, or Lockheed LEC-16 and MAC-16 computers, or DG Nova and Eclipse computers, Varian/Univac V-70 series computers, Honeywell Series 60 Level 6 computers, HP 2100, 21MX and 21MXE computers, or HP 3000 computers; includes computer interface, connector cables, software driver and diagnostic tapes; $4000-$8000, Vend Maint, 17 FO.
Telefile Computer Products, Inc,
Irvine, CA.

uiC-11TD
LSI-11 Q-Bus compatible DMA dual controller; 32 kB RAM buffer; for both IMI-7700 series Winchester disk and DEI-3400 cartridge tape; $2995 (qty 1).

uiC-11T
LSI-11 Q-Bus compatible DMA controller; 16 kB RAM buffer; for DEI-3400 17.25MB random access 1/4 inch cartridge tape; $1995 (qty 1).

uiC-11D
LSI-11 Q-Bus compatible DMA controller; 16 kB RAM buffer; for IMI-7700 series Winchester fixed disk drive (8", 10, 20, or 40MB); $1995 (qty 1); RTFM.
U.S. Design Corp,
Crofton, MD.

LSI-11 Printing/Plotting.
Model 125 single-board interface allows LSI—11s to use any Versatec electrostatic plotter or printer/plotter, I/O MUXer, hard copy controller, vector-to-raster converter; electrically/mechanically comp. w/ PDP-11/03, -11/23, LSI-11/2, -11/23, LP-11 line printer driver; operates under DEC Direct Program Control (DPC) or DMA. $1600.
Versatec
Santa Clara, CA.

VIP-201 Multiprinter Controller
DG compatible controller for three independent line printers, which can be any mix of industry-standard interfaces or the Teletype Model 40. Uses only one slot; $2400 (qty 1).
Vetra Systems Corp,
Melville, NY.

TC-151/TS-151
Software compatible single board embedded tape controllers and tape subsystems for DEC LSI-11 computers; $2450 to $11,815 (qty 1).

TC-160/TS-160
Software compatible embedded cartridge tape drive controller and subsystems for DEC LSI-11 computers; $2750 to $7400 (qty 1).

TC-170/TS-170
Software compatible embedded cartridge tape drive controller and subsystems for DG and DG-emulating computers; $2200 to $6800 (qty 1).

TC-180/TS-180
Software compatible embedded cartridge tape drive controller and subsystems for DEC PDP-11 computers; $2500 to $7200 (qty 1).

DC-220/DS-220
Software compatible single board embedded cartridge disk controller and disk subsystems for DG and DG emulating computers; $1240 to $8840 (qty 1).

DC-231/DS-231
Software compatible RM02 emulating single board embedded disk controller and subsystems for DEC PDP-11 computers; $3350 to $20,170 (qty 1).

TC-140/TS-140
Software compatible single board embedded dual density tape controller and tape subsystems for Perkin Elmer computers; $2820 to $12,185 (qty 1).

TC-131/TS-131
Software compatible single board embedded dual density tape controller for DEC PDP-11 and VAX computers and tape subsystems; $2680 to $11,965 (qty 1).

TC-120/TS-120
Software compatible single board embedded tape controllers and tape subsystems for DG and DG emulating computers; $3410 to $12,185 (qty 1); Vend Maint, 4 FO.
Western Peripherals Div of
Wespercorp,
Tustin, CA.

211 Peripheral Processor
For Unibus/SMD disk drives; provides up to 1.2 billion bytes of disk storage capacity for DEC Unibus family of processors; connects up to four SMD interface drives; $6673 (qty 1).

410 Peripheral Processor
For multibus/cartridge disk; provides up to 40 MB of online disk storage for any Multibus-based system; single board multibus-based system will support four 10MB drives with Diablo 44B interface; Xylogics supplies the 410 and CDC Hawk drives; $1925 (qty 1); $1435 (25-49).

440 Peripheral Processor
For multibus/SMD disk drives; provides up to 1.2 gigabytes of on-line disk storage for any Multibus based system; two board set that can support up to 4 SMD interface drives; Xylogics supplies complete disk subsystems; $3960 (qty 1); $2950 (25-49).

510 Emulating Peripheral Processor
For Q-Bus/Cartridge disk; interfaces DEC LSI-11 Q-Bus computers to a maximum of 4 drives that range in size from 2.5, 5 or 10MB; total capacity supported is 20 MB; Xylogics supplies CDC disk subsystems; $1635 (qty 1); $1215 (25-49).

530 Emulating Peripheral Processor
For Q-Bus/Winchester disk; Q-bus compatible with DEC LSI-11 computers and supports up to 4 Winchesters allowing an on-line capacity of 41.6 MB; emulates the DEC RLV11/RL01 or the RLV21/RL02; Xylogics supplies Winchester disk subsystems; $2065 (qty 1); $1540 (25-49).

537 Peripheral Processor
For Q-Bus/Cynthia D100 Disk Drives; provides 38.4 MB of Cii Honeywell Bull Cynthia D100 series disk storage on any DEC LSI-11 Q-Bus based system; the 537 supports any combination of two D120 or D140 disk drives; $2365 (qty 1).

550 Emulating Peripheral Processor
For SMD disk subsystems; supports up to 4.8 billion bytes of on-line SMD interface disk storage on DEC LSI—11/2 and LSI—11/23 Q-bus expandable to eight drives; $4950 (qty 1); $3200 (25-49).

570 Emulating Peripheral Processor
For Q-Bus cartridge tape subsystems; on-line cartridge tape storage for DEC LSI-11 based computers; the 570 runs up to two 17MB tape drives and uses all current LSI-11 operating systems and diagnostics; $1980 (qty 1); $1475 (25-49).

610 Emulating Peripheral Processor
For cartridge disk subsystems; provides up to 20MB of cartridge disk storage capacity for the DEC Unibus family of computers; the 610 supports all RK11/RK05 features, or 2.5, 5 or 10 MB fixed/removable media with optional 100% verification; $2475; $1845 (25-49).

650 Emulating Peripheral Processor
For SMD disk subsystems; up to 4.8 billion bytes of on-line disk storage for Unibus based DEC PDP-11 or VAX-11 computers; the 650 runs up to four SMD-interface disk drives on all current PDP-11 operating systems and diagnostics; $4950 (qty 1); $3200 (25-49).

675 Emulating Peripheral Processor
Runs up to four TM11/TU10 compatible 1/2 inch industry standard tape drives (including mixed densities) on DEC PDP-11 or VAX-11 computers; the 675 runs 800 bpi (NRZ) and 1600 bpi (PE) in DEC or IBM standard packing modes using DEC operating systems and diagnostics; $3495 (qty 1); $2995 (25-49).

810 Peripheral Processor
For cartridge disk subsystems; supports up to 40MB of on-line cartridge disk storage for Nova, Eclipse, and Nova "lookalike" computers, and runs DG software and diagnostics; Xylogics can supply CDC 9427H Hawk disk drives; $1870 (qty 1); $1395 (25-49).

850 Emulating Peripheral Processor
For SMD subsystems; provides up to 1.2 billion bytes of on-line disk storage capacity for DG Nova and Eclipse computers; the 850 supports up to four SMD interface disk drives on RDOS, AOS, IRIS and BLIS/COBOL; $3575 (qty 1); $2665 (25-49); RTFM.
Xylogics, Inc.
Burlington, MA.

COMPAT'81™
COMPATIBLE COMPUTER PRODUCTS EXPOSITION

The Computer Compatible Directory
Part One

Disk Emulators

Expanda STOR-11
Semiconductor replacement for DEC's RK05 disk. SW compatible to RK11-D/RK05 system. Available as add-in or 19" rack mountable add-on. Capacity-.25 MB to 4.0MB. Expandable in 256 kB increments. (Ideal as a snapping disk.) From under $5,000 0.25MB — $38,050 4.0MB. RTFM.
Cambex Corporation, Waltham, MA.

BC-701 Memory System
256 kB to 4MB core disk emulator replacing Perkin-Elmer's M46 movinghead disk system. Off-line tester inc; 256 kB incremental memory size. $11,200.

BS-701 Memory System
512 kB to 8MB MOS/ECC disk emulator replacing Perkin-Elmer's M46 movinghead disk. 512 kB incremental memory size, off-line tester inc. $11,300.

BC-301 Memory System
256 kB to 4MB core disk emulator replacing Data General's NOVA-DISC. Off-line tester inc; 256 kB incremental memory size. Dual port option avail. $10,200.

BS-301 Memory System
512 kB to 4MB MOS/ECC disk emulator replacing Data General's NOVADISC. Off-line tester inc. 512 kB incremental memory size. Dual port option avail. $9730.

BC-303 Memory System
1MB to 8MB core disk emulator replacing Data General's 6063/6065 disk system. Off-line tester inc; 1MB incremental memory size. Dual port option avail. $30,000.

BS-303 Memory System
1MB to 8 MB MOS/ECC disk emulator replacing Data General's 6063/6065 disk system. Off-line tester inc; 1MB incremental memory size. Dual port option avail. $15,960.

BC-301R Memory System
256 kB to 2MB core disk emulator for use with ROLM's 1602 computer. Emulates ROLM's 3340 disk system. $12,300.

BS-301R Memory System
512 kB to 4MB MOS/ECC disk emulator for use with ROLM's 1602 computer. Emulates ROLM's 3340 disk system. $12,930.

BC-316 Memory System
256 kB to 2MB core disk emulator for use with Honeywell's 316 computer. Emulates X16-931X drum storage. $11,400.

BC-316 Memory System
512 kB to 4MB of MOS/ECC disk emulator for use with Honeywell's 316 computer. Emulates X16-931X drum storage. $12,030.

BC-901 Memory System
256 kB to 2MB core storage module drive emulation for use with any controller with SMD interface. $9,900.

BS-901 Memory System
512 kB to 8MB of MOS/ECC storage module drive emulation for use with any controller with SMD interface. $9730.

BC-212 Memory System
256 kB to 4MB core RF-11 disk emulator for DEC's LSI-11 series computer. 256 kB incremental memory size; off-line tester inc. $10,900.

BC-214 Memory System
512 kB to 8MB core RJS03/04 disk emulator for DEC's LSI-11 series computer. 512 kB incremental memory size, inc. $16,900.

BS-212 Memory System
512 kB to 4MB MOS/ECC RF-11 disk emulator for DEC's LSI-11 series computers. 512 kB incremental memory size; off-line tester, error log for ECC inc. $10,330.

BS-214 Memory System
512 kB to 8MB MOS/ECC RJS-03/04 disk emulator for DEC's LSI-11 series computers. 512 kB incremental memory size; off-line tester, error log for ECC inc. $10,330.

BC-202 Memory System
256 kB to 4MB core RF-11 disk emulator for DEC's PDP-11 series computer. 256 kB incremental memory size; off-line tester inc. $10,100.

BC-204 Memory System
512 kB to 8MB core RJS03/04 disk emulator for DEC's PDP-11 series computer. 512 kB incremental memory size; off-line tester inc. $16,000.

BS-202 Memory System
512 kB to 4MB MOS/ECC RF-11 disk emulator for DEC's PDP-11 series computer. 512 kB incremental memory size; off-line tester, error log for ECC inc. $9,530.

BS-204 Memory System
512 kB to 8MB MOS/ECC RJS03/04 disk emulator for DEC's PDP-11 series computers. 512 kB incremental memory size; off-line tester, error log for ECC inc. $9,530.

BS-200DP Memory System
512 kB to 8MB of dual port MOS/ECC disk emulation for DEC's LSI-11, PDP-11 and custom I/O for data acquisition, array processors, etc; off-line tester, error log for ECC inc. $13,830.

BC-200DP Memory System
256 kB to 8MB of dual port core disk emulation for DEC's LSI-11, PDP-11 and custom I/O's for data acquisition, array processors, etc; off-line tester inc. $17,500.

BC-205 Memory System
512 kB to 2.0MB core RF-15 disk emulator for DEC's PDP-15 computer. 512 kB incremental memory size; off-line tester inc. $20,000.

BS-205 Memory System
512 kB to 4.0MB MOS/ECC RF-15 disk emulator for DEC's PDP-15 computer. 512 kB incremental memory size; off-line tester, error log for ECC inc. $13,830. RTFM.
Dataram Corp, Cranbury, NJ.

SDV11
LSI-11 semiconductor disk emulator. Direct access storage device 256 kB to 2MB of storage in 256 kB increments. $3,750 in single quantities: $2,437.50 in quantities of 100. Vend maint.
General Robotics Corp, Hartford, WI.

MaxiRAM-11/70HS
Attaches to high speed cache bus of PDP-11/70 computer emulates fixed-head disk. Avail. with core or semiconductor memory modules. Solid State.

MaxiRAM-V77
Attaches to direct data channel of Sperry Univac (Varian) V70 series of minicomputers. Avail. with core or semiconductor memory modules. Solid State.

MaxiRAM-20, MaxiRAM-S20
Attaches to I/O bus of Data General Nova and Eclipse computers, emulates fixed-head disc. Avail. with either core or semiconductor memory modules. Solid State.

MaxiRAM-11, MaxiRAM-S11
Attaches to Unibus of any PDP-11 computer, emulates a fixed-head disk. Avail. with core or semiconductor memory modules. Solid State.

MaxiRAM-25, MaxiRAM-S25
Attaches to I/O bus of a Westinghouse W2500 computer, emulates fixed-head disk. Avail. with either core or semiconductor memory modules.
Imperial Technology Inc, El Segundo, CA.

PM-RFV11
Fixed-head disk emulator, for fast swapping on TSX OS or RSX-11M. 500 kBs, transfer rate w/ 4 ms access time; quad-wide controller board w/ 256 kB memory board can interface with max. 7 PM-RMV11 memory modules for 2MB capacity.

PM-RF11
Fixed head disk emulator provides high-speed bulk storage (to 1.5 MB); 16K MOS RAMs; ECC; no moving parts; for interactive applications, use as a swapping file (increases throughput); data transfer speed: 1 to 2 μS/word; access time, under 1 μS. 1 FO.
Plessey Peripheral System, Irvine, CA.

D

Next Month . . .

Part II of this directory will cover:

Display Terminals, Flexible Disk Drives, Packaging/Hardware/ Backplanes/Enclosures, Printers & Plotters, Rigid Disk Drives, Services, Software, Special I/O's, Tape Systems, Test Equipment/ Instrumentation, and Other.

List of Manufacturers

suppliers of computer compatible products

This alphabetical listing of computer compatible product manufacturers includes names, addresses, phone numbers and sales contacts. All companies cited in the Compat Directory Part I, as well as those that will be included in September's Compat Directory Part II, are listed here for your convenience.

A

Ray Ball
Able Computer
1751 Langley Ave.
Irvine, CA 92714
(714) 979-7030

Allen L. Pollens
ADAC Corp.
70 Tower Office Park
Woburn, MA 01801
(617) 935-6668

John H. Meyn
Adams Russell
Digital Processing Div.
1370 Main St.
Waltham, MA 02154
(617) 891-4700

Tamisie Honey
Advanced Business Technology Inc.
12333 Saratoga-Sunnyvale Rd.
Saratoga, CA 95070
(408) 446-2013

K.J. Scannell, Vince Maturo
Advanced Digital Products
7584 Trade St.
San Diego, CA 92121
(714) 578-9595

Gary Wilson
Advanced Electronics Design Inc.
440 Potrero Ave.
Sunnyvale, CA 94086
(408) 733-3555

John Rademaker
Agile Corp.
1050 Stewart Dr.
Sunnyvale, CA 94086
(800) 538-1634

William Alden
Alden Computer Systems
23 Strathmore Rd.
Natick, MA 01760
(617) 655-6610

Nigel R. Spicer
Alloy Engineering Co.Inc.,
Computer Products Div.
12 Mercer Rd.
Natick, MA 01760
(617) 655-3900

Barbara Currall
Alphacom Inc.
2323 So. Bascom Ave.
Campbell, CA 95008
(408) 559-8000

D. Curtiss Johnson
Alpha Data Inc.
20750 Marilla St.
Chatsworth, CA 91311
(213) 882-6500

Richard F. Rohrev
Alphamatrix Inc.
1021 Millcreek Dr.
Langhorne, PA 19047
(215) 355-3297

Robert Sillers
Darrell Sprague
Alternatives in Magnetics
25431 Rye Canyon Rd.
Valencia, CA 91355
(805) 257-2262

Linda Taylor
American National Supply Corp. (ANSCO)
Box 2259
Gardena, CA 90247
(800) 421-1270

Jim Snow
Amlyn Corp.
1758-H Junction Ave.
San Jose, CA 95112
(408) 275-8616

John Jory
Ampex Corp.,
Memory Products Div.
200 N. Nash
El Segundo, CA 90245
(213) 640-0150

John Kim
Amtek Business Machines Inc.
2255-H Martin Ave.
Santa Clara, CA 95050
(408) 727-1510

Rich McMahon
AMT Software Systems
183 Guggins
Boxboro, MA 01719
(617) 263-3030

John Knox
Anadex Inc.
9825 DeSoto Ave.
Chatsworth, CA 91311
(213) 998-8010

Les Silvern
Analog Devices Inc., Systems Div.
Box 280
Norwood, MA 02062
(617) 329-4700

Jim Lawrence
Analog Technology Corp.
15859 E. Edna Place
Irwindale, CA 91706
(213) 960-4004

Linda Rioux
Analogic Corp., Data Acquisition & Conversion Products
Audubon Rd.
Wakefield, MA 01880
(617) 246-0300

Will Alger
Andromeda Systems Inc.
9000 Eton Ave.
Canoga Park, CA 91304
(213) 709-7600

Sarah Freeman
Ann Arbor Terminals Inc.
6175 Jackson Rd.
Ann Arbor, MI 48103
(313) 663-8000

Elizabeth Ferebee
Applied Information Systems Inc.
500 Eastowne Dr., Suite 207
Chapel Hill, NC 27514
(919) 942-7801

Art Garofalo
Ardent Computer Products
145 Palisades St.
Dobbs Ferry, NY 10522
(914) 693-6900

Sheldon Hess
Associated Computer Consultants
228 E. Cota St.
Santa Barbara CA 93101
(805) 963-8801

COMPAT'81™ COMPATIBLE COMPUTER PRODUCTS EXPOSITION

List of Manufacturers

Don Raymond
Atlas Energy Systems
9457 Rush St.
So. El Monte, CA 91733
(213) 575-0755

Augat Inc.
33 Perry Ave.
Attleboro MA 02703
(617) 222-2202

David A. Huss
Auscom Inc.
2007 Kramer Lane
Austin, TX 78758
(512) 836-8080

Natalie J. Riehl
Automated Control Systems Inc.
Box 748
Bellevue, WA 98009
(206) 881-0177

Allan Hughes
AVA Instrumentation Inc.
9672 Manzanita Ave.
Ben Lomond, CA 95005
(408) 336-5048

John S. Connolly
Aviv Corp.
6 Cummings Park
Woburn, MA 01801
(617) 933-1165

J. Taylor
Aydin Controls
414 Commerce Dr.
Fort Washington, PA 19034
(215) 542-7800

B

William Backus
Backus Data Systems Inc.
1440 Koll Circle, Suite 110
San Jose, CA 95112
(408) 279-8711

Prentiss Smith
Ball Computer Products
P.O. Drawer K
Boulder, CO 80306
(303) 441-4646

David F. Pippin
BASF Systems Corp.
Crosby Dr.
Bedford, MA 01730
(617) 271-4000

Robert Harvey
BBN Information Management Corp.
68 Moulton St.
Cambridge, MA 02238
(617) 497-2929

BDS Computer Corp.,
Line Printer Systems
1120 Crane St.
Menlo Park, CA 94025
(415) 326-2115

John McPhail, Ron Hardy
Beehive International
4910 Amelia Earhart Dr.
Salt Lake City, UT 84125
(801) 355-6000

D. Bellin
Bellin Computer Systems Inc.
206 Terminal Dr.
Plainview, NY 11803
(516) 349-9714

Stephen F. Grande
Best & Midcom Data Systems
1940 N. Tustin, Suite 117
Orange, CA 92665
(714) 998-6041

Bill White
Bill White Printed Circuit Design
1106 S. Ambridge St.
Anaheim, CA 92806
(714) 778-1477

Laurel Lea
Bizcomp Corp.
Box 7498
Menlo Park, CA 94025
(415) 966-1545

Steve Lipsey
Bolt Beranek and Newman Inc. (BBN),
Computer Systems Div.
10 Moulton Street
Cambridge, MA 02238
(617) 491-8488

Boston Systems Office (BSO)
469 Moody St.
Waltham, MA 02154
(617) 894-7800

Roger Nadow
Braegen, Minicomputer Peripherals Div.
3320 E. La Palma Ave.
Anaheim, CA 92806
(714) 520-9200

C.A. Williams, Jr.
BST Consultants Inc.
BST Data Systems Inc.
Box 23425
Tampa, FL 33623
(813) 961-3902

R. L. Nelson
Bubbl-Tec Div.
6800 Sierra Court
Dublin, CA 94566
(415) 829-8705

J. Doronsky
Bud Industries Inc.
4605 E. 355th St.
Willoughby, OH 44094
(216) 946-3200

C. R. Teeple
Burr Brown Industrial Systems Products
3631 E. 44 th St.
Tucson, AZ 85713
(602) 747-0711

D. Barry Donahue
Burroughs Corp. OEM Div.
Burroughs Place
Detroit, MI 48232
(313) 972-8031

C

Roger O' Hollander
Cableshare Ltd.
20 Enterprise Dr.
London, Ontario N6A4L5
Canada
(519) 686-2900

Brett Benson
Tammy Benson
California Communications
8405 Pershing Dr. #401
Playa del Rey, CA 90291
(213) 306-2377

Zeer Rote
California Computer Group
3303 Harbor Blvd, #K-11
Costa Mesa, CA 92626
(714) 966-1661

Dave Hall
California Computer Products Inc.
2411 W. La Palma Ave.
Anaheim, CA 92801
(714) 821-2541

Sales Dept.
California Computer Systems
250 Caribbean Dr.
Sunnyvale, CA 94086
(408) 734-5811

Matthew Goldback
California Datalease
2770 E. Regal Park Dr.
Anaheim, CA 92806
(714) 632-6986
(800) 854-0350

L. E. Thompson
California Instruments, Division of Norlin Industries
5150 Convoy St.
San Diego, CA 92111
(714) 279-8620

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Callan Data Systems
2637 Townsgate Rd.
Westlake Village, CA 91361
(805) 497-6837

John Robinson
Cambex Corp.
360 Second Ave.
Waltham, MA 02154
(617) 890-6000

Walter Hodge
Chris Patton
Cambridge Computer Assoc. Inc.
222 Alewife Brook Pkwy.
Cambridge, MA 02138
(617) 868-1111

Mr. John Garrity
Centronics Data Computer Corp.
One Wall St.
Hudson, NH 03051
(603) 883-0111

William Nimee
Charles River Data Systems Inc.
4 Tech Circle
Natick, MA 01760
(617) 655-1800

John Ross
Chrislin Ind. Inc.
31352 Via Colinas
Westlake, CA 91362
(213) 991-2254

Lowell Coulson
Chromatics Inc.
2558 Mountain Industrial Blvd.
Tucker, GA 30084
(800) 241-9467

Cii-Honeywell-Bull (Bull Corp. of America)
200 Smith St.
Waltham, MA 03154
(617) 895-6020

Ed Kramer
Clary Corp.,
Precision Instruments Div.
320 W. Clary
San Gabriel, CA 91776
(213) 287-6111

Allan R. Clyde
Clyde Digital Systems, Div. of Clyde Enterprises
Box 348
Bedford, MA 01730
(617) 275-6642

Peter Alexander
CNR Inc.,
Computer Products Div.
220 Reservoir St.
Needham, MA 02194
(617) 449-4906

Phylis Comaroto
Cobar Inc.
1181 N. Fountain Way
Anaheim, CA 92806
(714) 630-0970

A. J. Armstrong
Comarco Inc.
Sterling Engineering Div.
150 Cerritos
Anaheim, CA 92805
(714) 535-2464

Ross Chapman
Heshil Kagen
Comark Corp.
257 Crescent St.
Waltham, MA 02154
(617) 894-7000

Kenneth Guy
Com Design Inc.
751 S. Kellogg Ave.
Goleta, CA 93117
(805) 964-9852

Compiler Systems Inc.
Box 145
Sierra Madre, CA 91024
(213) 355-1063

Compower Corp.
548 Division St.
Campbell, CA 95008
(408) 866-8141

John Marcus
Compumart Corp.
65 Bent St. Box 568
Cambridge, MA 02139
(617) 491-2700

Computer Covenant
790 Farmington Ave.
Farmington, CT 06032
(203) 677-6563

Dennis Fennelly
Computer Design and Applications Inc.
377 Elliot St.
Newton Upper Falls, MA 02164
(617) 964-3770

Donald Cadieux
Computer Devices Inc.
25 North Ave.
Burlington, MA 01803
(617) 273-1550

David Kalstrom
Computer Memories Inc.
9233 Eton Ave.
Chatsworth, CA 91311

Ed Muxo
Computer Power Solutions
Box 974
Placentia, CA 92670
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2415 Annapolis Lane
Plymouth, MN 55441
(612) 559-2034

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2002 Ford Cr.
Milford, OH 45150
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K1G 3M9 Canada
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3198-G Airport Loop Dr.
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(714) 557-1811

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Control Concepts Corp.
2361 S. Jefferson Davis Hwy.
Arlington, VA 22202
(703) 521-8866

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San Diego, CA 92101
(714) 235-6721

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Control Data Corp.,
Computer Memory Div.
8001 E. Bloomington Freeway
Bloomington, MN 55420
(612) 830-6135

Bob Sonnabend
Chuck Stires
Control Logic Inc.
9 Tech Circle
Natick, MA 01170
(617) 655-1170

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Corvus Systems Inc.
2029 O'Toole Ave.
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(408) 946-7700

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652 Glenbrook Rd.
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(203) 356-9315

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Eugene, OR 97405
(503) 485-4254

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CSPI
40 Linnell Circle
Billerica, MA 01821
(617) 272-6020

Paris J. Campbell
Custom Systems Inc.
6850 Shady Oak Rd.
Eden Prairie, MN 55344
(612) 941-9480

J. David Hil
Custom Terminals Inc.
5249 North Blvd.
Raleigh, NC 27604
(919) 876-8731

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Cyberdata
2611 Garden Rd.
Monterey, CA 93940

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Cybergraphic Systems
181 Barkly St.
Stkilda, Victoria 3182
Australia
(3) 534-4347

D

Robert Wang
Datacube Inc.
670 Main St.
Reading, MA 01867
(617) 944-4600

Bill Dilfer
Datafusion Corp.
5115 Douglas Fir Rd.
Calabasas, CA 91302
(213) 887-9523

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Display Products Dept.
Box 82449
San Diego, CA 92138
(714) 291-9960

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Pennsauken, NJ 08109
(609) 665-5400

Mr. Jim Foti
Datametrics Corp.
7630 Gloria
Van Nuys, CA 91406
(213) 989-3840

Eric Moothart
Data Processing Design Inc.
181 W. Orangethorpe, Suite F
Placentia, CA 92670
(714) 993-4160

Joan Naidish
Dataproducts Corp.
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Woodland Hills, CA 91365
(213) 887-8451

Pete Yeatman
Dataram Corp.
Princeton Rd.
Cranbury, NJ 08512
(609) 799-0071

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Datasystems,
Subsidiary of Wespercorp
8716 Production Ave.
San Diego, CA 92121
(714) 566-5500

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Data Systems Design Inc.
2241 Lundy Ave.
San Jose, CA 95131
(408) 946-5800

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23901 Remme Ridge
El Toro, CA 92705
(714) 770-8024

Data Translation
100 Locke Dr.
Marlboro, MA 01752
(617) 481-3700

Ted Petit
Datel-Intersil Inc.
11 Cabot Blvd.
Mansfield, MA 02048
(617) 339-9341

David Riley
Gary Gonnella
Datum Inc.
1363 S. State College Blvd.
Anaheim, CA 92806
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Phil Cleveland
De Anza Systems Inc.
118 Charcot Ave
San Jose, CA 95131
(408) 263-7155

Nancy Savinelli
Design Aids Inc.
27822 El Lazo Rd.
Laguna Niguel, CA 92677
(714) 831-5611

G. Readman
Di-An Data Systems Ltd.
Mersey House, Heaton Mersey
Stockport, Cheshire
England
(061) 442-9768

Thomas Moriarty
Dice Systems Inc.
7½ Harris Rd.
Nashua, NH 03062
(603) 888-6700

R. N. Tingley
Dicom Industries Inc.
715 N. Pastoria Ave.
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(408) 732-1060

COMPAT'81™
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Digital Associates Corp.
1039 E. Main
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(203) 327-9210

James B. Lee
Digital Communications Associates (DCA)
303 Technology Park
Norcross, GA 30092
(404) 448-1400

Alfred Gomez
Digital Data Systems Inc.
1551 N. W. 65th Ave.
Plantation, FL 33313
(305) 792-3290

Lee Ambrosini
Digital Engineering
630 Bercut Dr.
Sacramento, CA 95814
(916) 447-7600

Roy Bettenhausen
Digital Microsystems Inc.
1840 Embarcadero
Oakland, CA 94606
(415) 532-3686

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

Direct Inc.
1279 Lawrence Station Rd.
Sunnyvale, CA 94086
(408) 734-5504

Adrienne Webb
DISC
6247 Fair Oaks Blvd.
Carmichael, CA 95608
(916) 485-4849

Dennis Setera
Disk Memory Technology Inc.
Box 19814
Portland, OR 97219
(503) 643-1887

Gerry Nadler
Distributed Computer Systems
223 Crescent St.
Waltham, MA 02154
(617) 899-6619
(800) 225-4589

Les Alberts (Domestic)
Steve Arnaudoff (International)
Distributed Logic Corp. (DILOG)
12800-G Garden Grove Blvd.
Garden Grove, CA 92643
(714) 534-8950

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DY-4 Systems Inc.
1573 Laperriere Ave.
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Dylon Corp.
10130 Sorrento Valley Rd.
San Diego, CA 92121
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E

Eden Engineering
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EEC Systems
315 Goodman's Hill Rd.
Sudbury, MA 01776
(617) 443-6376

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Electronic Processors Inc.
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Englewood, CO 80110
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Electronic Solutions
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San Diego, CA 92123
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(800) 854-7086

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Elgar Corp.,
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8225 Mercury Ct.
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EMM SESCO
20630 Plummer St.
Chatsworth, CA 91311
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Santa Ana, CA 92705
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Emulog Inc.
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Fremont, CA 94538
(415) 490-1290

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Enterprise Technology Corp.,
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NYC, NY 10028
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Alan R. Daniels
ETI Micro
6918 Sierra Ct.
Dublin, CA 94566
(415) 829-6600

F

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Floating Point Systems
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Portland, OR 97223
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Foonly Inc.
160 S. Whisman Rd.
Mountain View, CA 94041
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Forethought Products
87070 Dukhobar Rd.
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756 Lakefield Rd., Suite B
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(805) 497-8529

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General Digital Ind. Inc.
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(205) 837-8305

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General Eclectics
2604 8th St.
Berkeley, CA 94710
(415) 540-0504

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General Robotics Corp.
57 North Main St.
Hartford, WI 53027
(800) 558-7832

Al Guzzetti
General Terminal Corp.
14831 Franklin
Tustin, CA 92680
(714) 730-0123

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Donald C. Harder Co. Inc.
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101 Tremont St.
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C. Michael Hayward, Backplanes
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Darrell Sprague
Magnetic Recovery Technologists Inc.
25431 Rye Canyon Rd.
Valencia, CA 91355
(805) 257-2262

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Malibu Electronics Corp.
2301 Townsgate Rd.
Westlake Village, CA 91361
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Marway Products Inc.
2421 S. Birch St.
Santa Ana, CA 92707
(714) 549-0623

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San Tomas at Central Expwy.
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Harry Comerchero
Mennen Medical Inc.
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7290 Engineer Rd.
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Microbar Systems Inc.
1120 San Antonio Rd.
Palo Alto, CA 94303
(415) 964-2862

Hank Vlcek
Microcomputer Systems Corp.
432 Lakeside
Sunnyvale, CA 94086
(408) 733-4200

Bob Lepore
Micro Memory Inc.
9436 Irondale Ave.
Chatsworth, CA 91311
(213) 998-0070

Susane Matlock
Micro Peripherals Inc.
4426 S. Century
Salt Lake City, UT 84119
(801) 263-3081

Don Venable
Microperipheral Corp.
2643 151st Pl.
Redmond, WA 98052
(206) 881-7544

Dennis Resnik
Micropolis Corp.
21329 Nordhoff St.
Chatsworth, CA 91311
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Microsignal
3704 State St., Suite 214A
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Oscar Rosenbloom
Microtech Exports
467 Hamilton Ave.
Palo Alto, CA 94301
(415) 324-9114

W.A. Williamson
Micro Technology Inc.
2192 Martin, Suite 230
Irvine, CA 92715
(714) 851-2120

Charles A. Sereno
Mikros Systems Corp.
3828 Quaker Bridge Rd.
Mercerville, NJ 08619
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Miltope Corp.
9 Fairchild Ave.
Plainview, NY 11803
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Carrollton, TX 75006
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(800) 527-7410

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1451 E. Irvine Blvd.,
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Austin, TX 78758
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(800) 531-5066

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Don Johnson
National Semiconductor/ Memory Systems
2900 Semiconductor Dr.
M/S 7C265
Santa Clara, CA 95051
(408) 736-6994

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Netcom Products Inc.
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Seattle, WA 98199
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60 Plant Ave.
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(516) 582-6500

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O

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Pfalzer-Wald-Strasse 36
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90 W. Germany
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Irvine, CA 92714
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R

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D

Computer Compatible Questionnaire

If your firm manufactures compatible memories, peripherals or equipment for DEC, Data General and other computers, then let our 67,000 direct (198,000 total) readers know. Send us all the product literature you've got. Please place one product per page (make photocopies as desired). Give brief description and important specs. Please do not write, "See Spec Sheet," we cannot reprint spec sheets.

Category (for this product)

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- ☐ Communications
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- ☐ Software

Product Name/Model No. _____

Description/specs _____

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This product is compatible with? ____DEC, ____DG, ____P-E, ____HP, ____Intel, ____Other

Price(s) _____

Do you ☐ manufacture? ☐ wholesale? ☐ service? ☐ other? describe _____

Check type(s) of maintenance available:

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Number of your field offices: ____FO.

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Company Name/Division _____

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City _____ State/Zip _____ Phone ( ) _____

Whom should our editors contact? _____

Mail this form to Directory Editor, *Digital Design,* 1050 Commonwealth Ave., Boston, MA 02215 (617) 232-5470

Flywheel UPS Produces 60 Hz At Any Speed

Usually, technology developed as a result of the computer industry trickles down to augment established, existing technologies. Rarely, however, this course reverses, and an established, existing technology is rediscovered that is uniquely suited to computer applications.

John Roesel's variable-speed, constant-frequency (VSCF) generator, developed in the early '70s, provides continuous 60-Hz power, whether the input comes from the utility company or a lawn mower engine. This precisely controlled power is just what today's computer systems require, and Continental, "an international packaging, forest products, insurance and energy company," recently acquired the license for the technology and added "manufacturer of uninterruptible power supplies" to their title.

100% output isolation

Continental calls their line of uninterruptible power supplies (UPS) "PoweRotor," and claims the units have a number of advantages over existing UPSs. First of all, their power input is 100% isolated from their power output, thereby eliminating power spikes, dips, and transient noise caused by lightning, utility switching, large load changes and utility equipment malfunctions. Second, PoweRotor provides from 10 to 30 seconds of ride-through power in the event of a power outage. In the case of an outage longer than this, PoweRotor generates the power necessary to effect an orderly shutdown of computer systems or start-up of a stand-by source. Third, Continental claims five times the MTBF of static inverter/battery systems, crediting low power electronics and simple construction for PoweRotor's long life and low maintenance.

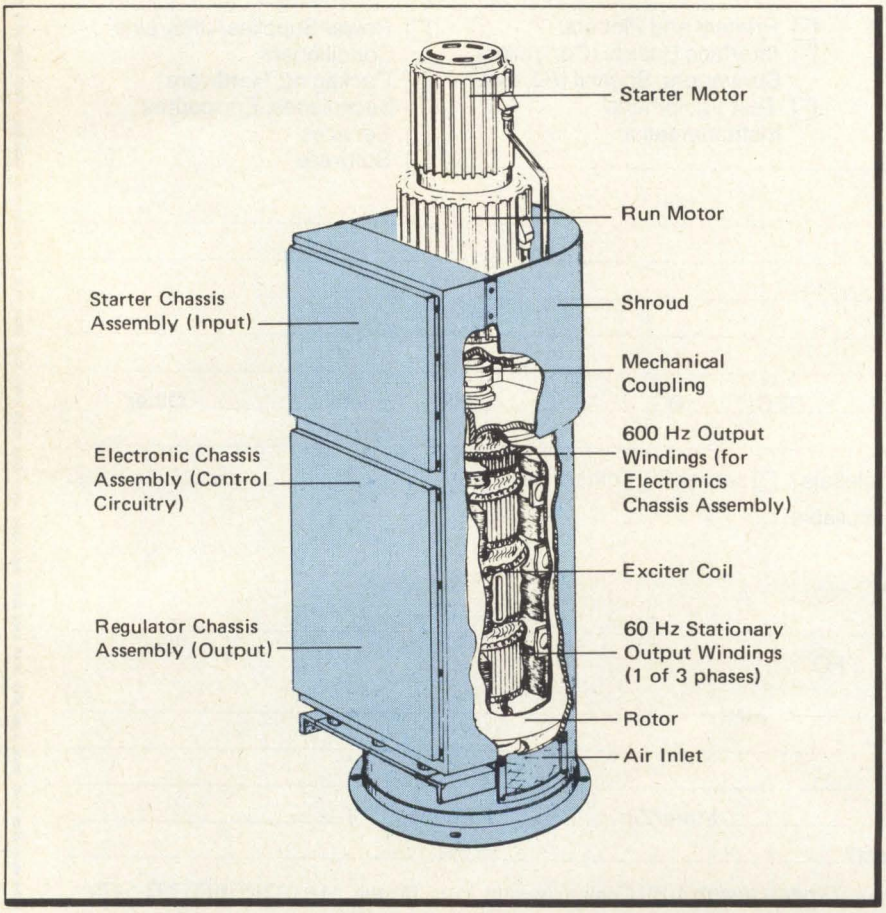

Figure 1: This variable-speed, constant-frequency (VSCF) generator uses an exciter coil that prints magnetic poles on a magnetic rotor fly wheel, producing even-frequency power, despite input power spikes, dips, and outages of 10 secs or more.

exciter prints poles

Central to the PoweRoter VSCF generator is the exciter head coil **(Figure 2)**, which is "essentially like a big tape recorder write head," according to Bradley Walter, Continental Vice President of Marketing. Revolving around it is the rotor drum, a high density flywheeel "lined with material generically similar to the oxide on tape recorder recording tape."

As the inductance part of a tuned inductance/capacitance resonant circuit, the exciter head "prints" north and south poles on the 800-1b, revolving barium-ferrite drum. A crystal oscillator insures that these poles are printed at precisely 120 poles per second. Therefore, if the rotor spins at 1800 rpm, it's a four-pole magnet, each pole occupying one-fourth of its circumference **(Figure 3).** At 3600 rpm (PoweRotor's standard rate), the exciter head prints two poles per revolution, each extending halfway around the rotor's surface.

Generator coils occupy the periphery of the "stator," which is the stationary center of the generator. Regardless of rotor speed, these coils "see" the same number of poles per second, thanks to the constant printing rate of the exciter head. Frequency (Hz) equals the number of poles times rpm over 120; with PoweRotor, the number of poles increases as rpm decreases, and vice versa, so frequency remains constant.

blackout protection

During a power outage, PoweRotor's magnetic flywheel provides smooth power for 10 to 30 seconds, depending on load. "Most power problems are of short-term duration," says Walter. "Ten seconds of ride-through time will solve 98% or 99% of all the power problems that are outside a computer

Family pride.

Now there's an advanced technology family of single board controllers for DEC* computers from Western Peripherals—the number one name in controllers.

The TC-131 (for PDP-11s*) is the first TM-11 emulating controller to combine PE and NRZ on one standard hex board. It lets you mix 9-track, PE, NRZ or dual density tape units in any combination up to 125 ips. A 64 byte data buffer allows installation at any point on the unibus without consideration of NPR priority.

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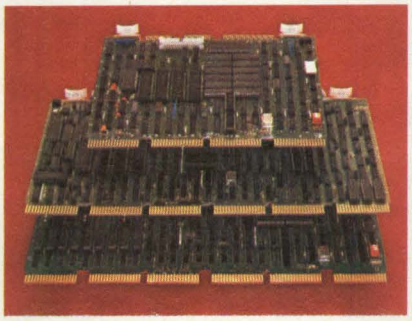
The DC-231 accommodates up to four SMD disc drives of 40 to 600 mb each with RMO2 emulation. Its four sector (2048 bytes) data buffer makes "data-late" errors a thing of the past. The advanced technology "micro-engine" allows a complete track to be written on a single drive revolution. A measurable performance advantage for your PDP-11.



All three controllers are software compatible. All have self test. All are backed by one of the best factory service organizations in the business. And all can be delivered in 30 days.

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Circle 10 on Reader Inquiry Card

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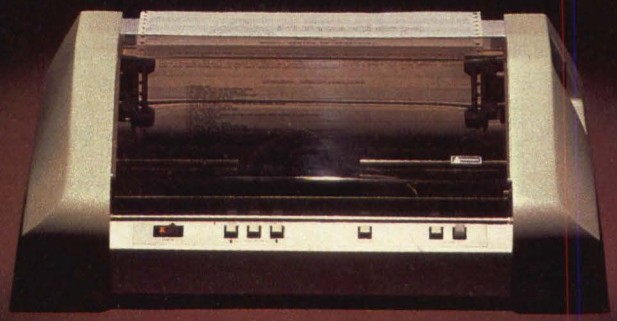

Since their introduction in mid-1980, the Anadex high-resolution DP-9500 Series matrix printers have set new standards for printer quality and performance. All models feature the rugged Anadex 9-wire print head that combines long life with resolutions of 72 dots/inch vertical and up to 75 dots/inch horizontal.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

Performance Plus

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

Interface Plus

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

Features Plus

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

Quality Plus

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

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system. Plus we get rid of all frequency deviations — in this country that's not too much of a problem, but in other countries it's a very bad problem."

But is ten seconds enough time to prepare for an unexpected, long-term blackout? "Ten seconds," answers Walter, "on the size computer we're aimed at . . . is a lifetime. They can get themselves stopped in an orderly manner so that when the power comes up they can essentially start up in a couple of seconds, and start processing from the next instruction from where they left off."

For computer systems that must never go down, even during long-term blackouts, PoweRotor still provides a solution. "When we designed PoweRotor," explains Walter, "we chose ten seconds of ride-through because you can couple this with one of the fast-start diesels that will be up and can supply load to our PoweRotor machine in less than ten seconds. Now you wouldn't have that diesel up and supplying load directly to your computer, because the frequency might not be stabilized in ten seconds. (With PoweRotor) we don't care if the frequency is stabilized — that thing can be wobbling all over the place, as long as it's putting out kilowatts."

MTBF improved

Continental estimates their unit's MTBF at over 100K hours. Competing static inverter/battery systems, according to Walter, provide under 20K hours. This is lower than battery system company specs, but Walter claims that "they get higher MTBF figures because they use a static switch . . .that switches you back to a regular power line. They don't count that as a failure, but now I'm running barefoot, because they're not providing the service I want them to provide. I call it a failure when it ceases to provide conditioned power. That's a failure — it isn't operating the way it's supposed to be operating."

Other problems Walter cites for static inverter/battery systems are sensitivity to high temperatures and tighter government regulations on installation in major urban areas, requiring separate ventilation systems and fire extinguishers.

Regarding other motor generator sets, Walter claims that during a power outage, they can't provide enough ride-through time to stop computer operations in an orderly manner, or to start a standby source. Even units with flywheels, he says, can provide only about one second of ride-through power.

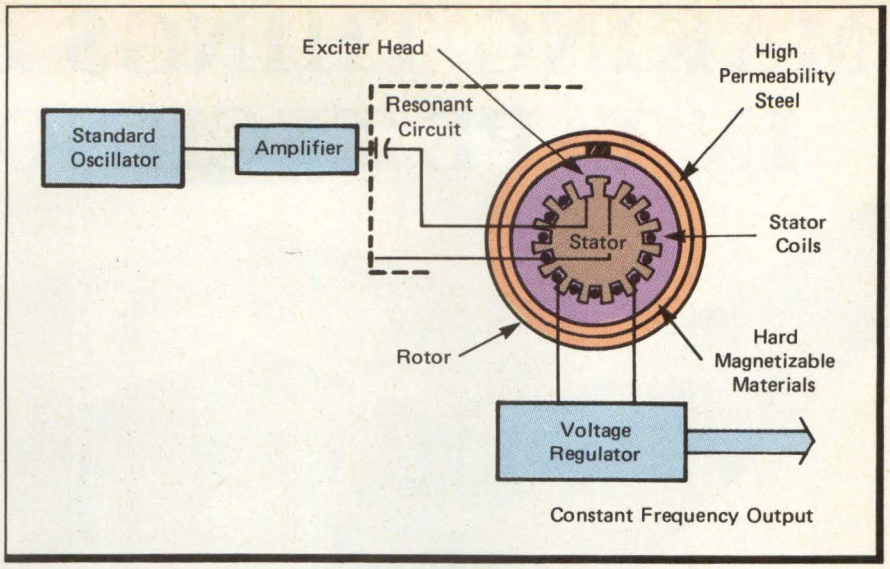

Figure 2: A standard oscillator regulates PoweRotor's exciter head, so that it prints poles on the spinning magnetic rotor drum at a constant rate. The 800-lb rotor, which may run on any power source, can speed up or slow down, but the stator coils will still see the same number of poles per second, keeping frequency accurate to 0.025%.

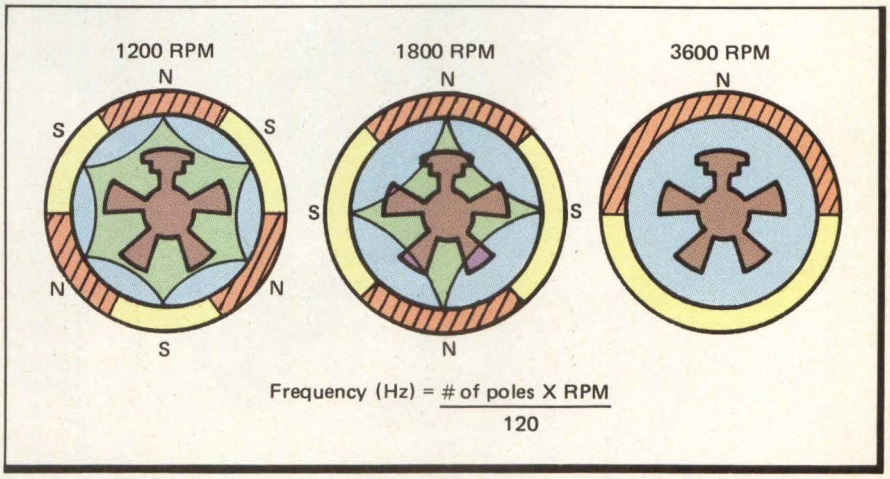

Figure 3: Rotor RPMs vary according to power source fluctuations, but exciter head pole-printing speed remains constant. Therefore, even if utility power surges tremendously, jumping rotor speed from 1200 RPM to 1800 RPM, the generator responds by dropping from 6-poles to 4-poles, and output frequency remains 60 Hz.

other applications

According to John Roesel, President of Precise Power Corp (Bradenton, FL) and inventor of the VSCF generator, computer system UPSs are merely the latest application of a multi-functional technology. "We began development in the early '70s and brought the initial products out in 1976," explains Roesel. "These were primarily motor generator sets for military applications, using the generator's constant frequency, variable speed capability." The latest twist in the technology is, according to Roesel, "the application of this same technology in the variable speed motor market, which is essentially the reverse of the same phenomenon, to have a variable speed motor working from a constant frequency source."

Continental's interest is currently limited to UPSs, and they now offer two models: Model A7-603 is rated at 7.5 KVA; output is 120/208 VAC, 3-phase, 60 Hz. Single-quantity cost is $19,950. Model A3-601 is 4.5 KVA, 120 VAC, single-phase, 60 Hz, and is priced at $9,975. Both produce frequency accuracy of 0.025%.

According to Roesel, "there are plans for a whole family of sizes, single-phase and three-phase output; they're planning sizes now up to at least 35 KVA."

— by Bob Hirshon

Continental Power Systems, Inc, One Landmark Sq, Stamford, CT 06091. **Circle 201**

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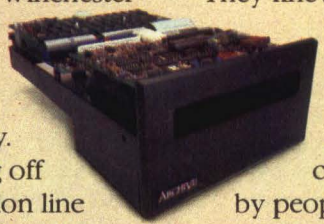

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Archive has come a long way, fast. And there's a reason. Archive was formed by an experienced, management group of OEM professionals whose backgrounds encompass the entire spectrum of engineering, manufacturing, and marketing of reliable, high volume, state-of-the-art peripherals. They knew what they wanted to do. They knew what had to be done. They have the money to do it.

Interestingly, Archive is financed primarily by computer people—by people who fully understand such things as R&D costs, start-up time, and meticulous quality control.

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Circle 36 on Reader Inquiry Card

Retro-Graphics Enhances VDTs

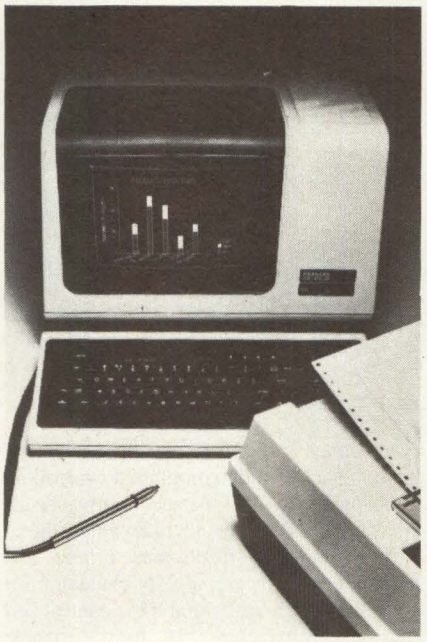
What started only three years ago as an idea to convert alphanumerics terminals into versatile graphics displays has proliferated into a million-dollar technology called Retro-Graphics. First introduced by Digital Engineering for the Lear Siegler ADM Dumb Terminal Display Series, the Retro-Graphics enhancement was expanded in September of 1980 to include the DEC VT-100 Video Display Terminal.

The idea is simple. By plugging a generically designed discrete/IC/RAM PC card into your much-used, but limited, alphanumerics terminal, you transform it into a graphics workhorse capable of creating the most complicated concepts — point plots, vector drawings, pie and bar charts, and even complex mappings and curves. Retro-Graphics allows you to continue to generate the same text you did before.

With Retro-Graphics you can now have an emulation of Tektronix's popular 4010 Series of graphics terminals. Not only does this new capability include such features as standard-to-medium resolution, flicker-free imagery, selective erase, high light output, and alphanumeric overlay, but Retro-Graphics provides compatibility with such standard graphics software as ISSCO's Displa and Tellagraf, and Tektronix's PLOT 10. Price is approximately half of what it costs for a comparably equipped terminal.

light-pen option

To further enhance Retro-Graphics-equipped terminals, Digital Engineering is now offering a light-pen as an efficient "pointing" device for interactive graphics applications. Like the Retro-Graphics standard cross-hair cursor, the light-pen allows the terminal to emulate the widely used Tektronix 4010 Graphic Input Mode. As a result, a Retro-Graphics-enhanced VT-100 terminal with light-pen is compatible with existing software written for this mode. Easily connected to a Retro-Graphics-updated DEC VT-100 terminal by means of a rear-panel assembly, the light-pen option allows



Digital Engineering's newest additions to the computer user's graphics capability — the VT-20-LPN light-pen and VT-5X-PI series printer interface — are now available as optional items for the Retro-Graphics-enhanced DEC VT-100 terminal.

an operator to point at a CRT raster screen and transmit X-Y coordinates directly into computer memory. In contrast to other types of interactive devices (thumb wheels and bit pads, for example), the pen is both rapid, convenient, and easy to use.

To operate the light-pen, the front tip containing a sensor is lightly touched by the user or pressed against the CRT display. When the phosphor directly behind the point to be recorded is illuminated by the raster scan of the CRT's electron gun, the sensor is triggered and a signal containing the X-Y coordinates of the point is recorded.

With both the Retro-Graphics enhancement and the newly introduced light-pen, DEC VT-100 terminal owners now have the means of executing almost any interactive graphics application. A typical example would be a series of programs that offer possibilities for a "menu" selection, each subject of which is positioned on the screen by the terminal operator.

printer interface

Digital Engineering is also introducing a printer-interface option which, like the light-pen, is easily attached to a DEC VT-100 terminal through a rear-panel assembly. This interface supports a number of graphics and non-graphics printers now on the market.

Basically, the printer interface operates in two modes — Alpha and Graphics. In the Alpha mode (for on-line alphanumerics printing), the interface is transparent to transmission from the terminal to the printer, with all characters received by the terminal sent directly to the printer. In the event the host computer is transmitting faster than the printer can accept data, the user can enable a special protocol to eliminate data loss and maintain maximum throughput.

If the printer being used has a graphics capability, the interface allows the Graphics portion of the terminal display to be "dumped" directly into the printer by either depressing a special function key, or when a coded signal is received by the terminal.

The printer interface will also support non-graphics printers. As such, the Alpha mode will operate as described, but no Graphics "dump" will occur. To attach the light-pen and/or the printer interface to a Retro-Graphics-enhanced DEC VT-100 terminal, a connector assembly is required. Since the connector assembly replaces the VT-100 terminal back-shell, which may contain DEC's current-loop option, an assembly can be ordered that contains an equivalent current loop.

The light-pen, Model VT20-LPN, is priced at $360. The printer interface, Model VT5X-PI Series, which consists of a six-foot cable and ROMs, is priced at $140. The connector assembly, Model VT1X-CA Series, without current loop is $135, and with current loop is $185.

by Digital Engineering Staff

Digital Engineering, Inc,
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New Products

GRAPHICS VIDEO GENERATOR

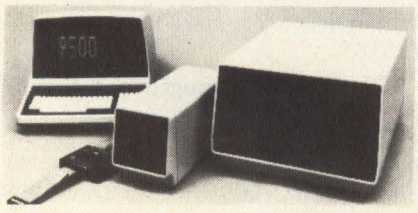
Three Selectable Resolution Options

The VMD-05 for the LSI-11, 11/2 and 11/23 has resolution options of one or two channels of 256×256 or 512×256, or one channel of 512×512. Output is a composite video for either U.S. (60Hz) or European (50Hz) TV sync. Each channel has two outputs, allowing the dual channel version to drive up to 4 video displays or hardcopy devices. Provides a full graphics display capability, with each display stored in on-board MOS RAM and each point independently addressable. The PICPAC software package for RT-11 and RSX-11 operation systems provides a full set of routines for both characters and graphics. The VMD-05 is $1495 (1-4). **Mennen Medical,** 10123 Main St, Clarence, NY 14031. **Circle 138**

DEVELOPMENT SYSTEM AND EMULATOR

Provides Universal Multi-Processor, Multi-Vendor Support

The 9520, designed to be expanded to a two-user system, provides high-level languages and a total μP software development system in a single enclosure. It has 64K of memory (all memory includes parity), 4 serial ports (3 RS 232, one RS 422) and an IEEE 488 parallel port. It is also provided with 2 dual-density floppy disk drives for total working storage of 1MB. DMA access is provided for overlapped processor and disk activity. Operating under MP/M, the 9520 uses a screen-oriented text editor to speed program preparation and changes, and can perform two or more functions simultaneously. The basic 9520 software development system is $7,495. The 9508 is a free-standing hardware debug station, providing the user with an efficient means for developing hardware, debugging software and integrating hardware and software into a working system. It provides full-speed emulation of the same 8-bit μP served by the 9520. The 9508 is provided with high-speed 16K static RAM (8K standard, 8K optional) emulation memory which is mappable into target system memory spaces on 1K boundaries. Emulation memory can be mapped anywhere in the address space of the μP being developed. The 9508 is $4995. **Millennium Systems Inc,** 19050 Pruneridge Ave, Cupertino, CA 95014. **Circle 171**



COLOR ALPHANUMERIC TERMINAL

Performance of an Intelligent Terminal with Advantages of Color Display

The CTM-300 is a serial RS-232C ASCII terminal with an 8 color CRT display. Its firmware executes intelligent commands and conforms to ANSI × 3.64 standard.

Users may customize terminal functions from the host through program downloading into the 2K RAM for execution by the Z-80A CPU. Features include an array of editing features, Centronics printer and light-pen interfaces, a 256 character set including U&L case, graphics, control and European characters, 18 user definable function keys and a numeric keypad. The color monitor (optional), the detachable keyboard and CRT display stand allow operator flexibility. Speeds up to 19.2K Baud can be user set. The CTM-300 is $2940 for a complete terminal including monitor. **Matrox Electronic Systems,** 5800 Andover Ave, Montreal, Quebec H4T 1H4. **Circle 168**

LOW COST μC NETWORK

Offers Power And Versatility of Mainframe Networks

OMNINET is an efficient one megabaud network that allows interconnection of up to 64 microcomputers and peripherals in a 4,000′ serial link. The intelligence is centered around the OMNINET transporter consisting of a Motorola 6801 μP, a custom gate array, and associated support components. The transporter interfaces directly to the microcomputer or peripheral. No software intervention required. Initial product release is available for the Apple II, Onyx C8000 and the LSI-11. It also connects to any Corvus 5, 10 and 20MB Winchesters, the Mirror or the Constellation. Future transporters will include the Apple III, Tandy TRS-80, any S-100 Bus computer and others. Plans are to provide gateways to Ethernet, SNA and other available networking in 1982. From $495 to $750. **Corvus Systems Inc,** 2029 O'Toole Ave, San Jose, CA 95131. **Circle 140**

LONG LIFE BATTERY

Up to Ten-Year Service

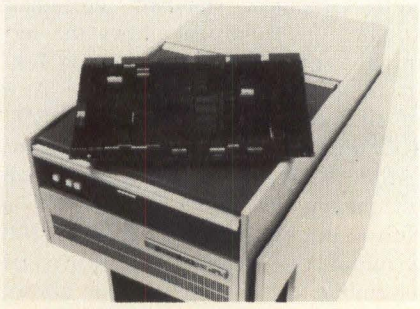
This cell provides rechargeable standby power for volatile memory devices in microelectronic systems. The 1.2 V battery operates from −40° to +85°C, and discharges at a rate of less than 1%/day at 30°C. Available in a standard 1/3 AA size, weighs 5.9 grams, and is available individually tabbed and in special configurations. Also available is a line of lithium manganese dioxide ($LiMnO_2$) batteries which are wave-solderable and polarity-keyed for efficient installation. These PC board-mountable batteries are available in capacities of 160, 170, 200 and 1000 mAh. The line also includes 15 sizes of button and cylindrical shaped cells. The $LiMnO_2$ batteries provide shelf life up to 10 years at 23°C, flat voltage profiles and operation from −20° to +50°C in CMOS RAM backup. **General Electric Co,** Batteries Business Dept, Box 861, Gainesville, FL 32602.

Circle 130

RMOX CONTROLLER

Disk System Solution for PDP-11

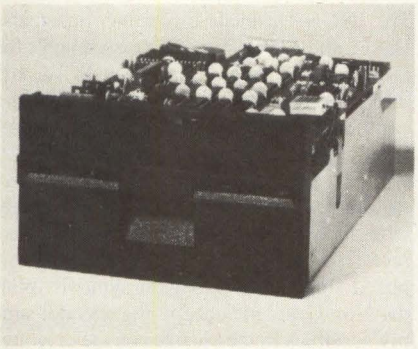
This low-cost disk system based on a single-board controller emulates the PDP-11 RM02/03/05 controller including RMOX media compatibility, and is software transparent to all standard DEC operating systems. The RMOX/6100 has a high speed bipolar μP design and operates with a variety of industry standard Storage Module Drives. It uses the AMD Z8065 burst error processor (BEP) to examine on a read operation the data and 32-bit ECC field. The BEP detects all errors and permits an 11-bit error correction. It includes a 4-sector static RAM data buffer (2048 bytes) to compensate for the speed differences between the disk and the computer interface, thus eliminating data late conditions. The RMOX/6100 supports dual port drives as well as contiguous sector data transfers — up to 64k words for a single drive command. In multiple units, a 160MB Winchester system with the RMOX/6100 controller is under $10,000. **System Industries,** 525 Oakmead Pkwy, Sunnyvale, CA 94086. **Circle 147**



5¼" FLOPPY DRIVE

Breaks 2 MB Barrier

The Megafloppy 1117 family includes two single and two double sided drives using 96 or 100 tpi double track recording technologies. Increased storage capacity was achieved by increasing data recording density from 6,000 bpi to 12,000 bpi using MFM recording techniques. Model 1117 provides 6 ms track-to-track positioning speed with 600,000 bps data transfer rates, and also provides full compatibility with industry standard interfaces. Double sided models provide 2.175 and 2.025 MB of formatted storage at 100 and 96 tpi respectively; single



sided versions offer 1.2 and 1.1125 MB. Volume deliveries in January 1982, limited quantities available earlier for system integration and evaluation. **Micropolis Corp,** 21329 Nordhoff St, Chatsworth, CA 91311. **Circle 169**

OEM DEVELOPMENT SYSTEM

To Familiarize OEMs with Voice Data Input

This speech recognition system is a standalone OEM development system with vocabularies up to 128 words or phrases. It allows the manufacturer of computer-based systems to experiment with user-trainable speech recognition. A custom design and manufacturing service is also available. The 9000 consists of a CRT terminal, a voice processor, a floppy disk drive to store vocabularies, a noise-cancelling microphone, plus complete documentation. The system is completely self-contained, no host programming is required. All system commands can be generated by voice, allowing complete hands-free operation. The 9000 Series is from $3525 to $4995. **Heuristics,** 1285 Hammerwood Ave, Sunnyvale, CA 94086. **Circle 132**

ECLIPSE ADD-IN MEMORY

Contains On-Board ECC

The MK8018 for DG's Nova 4S and 4× processors, is also compatible with the Eclipse S-140. It contains ECC on the memory board and has an on-board maintenance feature which allows a user to trace a MOS component failure to a specific RAM using an on-board LED. The 128 kB version is $3780, the 256 kB board is $5700. **Mostek Corp,** 1215 W. Crosby Rd, Carrollton, TX 75006. **Circle 142**

μP-BASED DEVELOPMENT SYSTEM

High Level Language Support

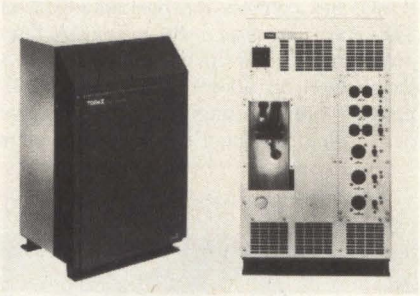
The system is targeted to meet the requirements of microcomputer system designers using high level languages and requiring the support of future 16-bit μPs. It employs two Z80A μPs in a master/slave configuration. The master processor has access to 64 kB of RAM and controls the operating system. The slave procesor, which controls user programs, also has its own 64 kB RAM. A spooled printer allows printing and simultaneous editing, compiling, assembling or performing any other development system work. A programmed-function keyboard offers 8 upper-and 8 lower-case function keys which may be programmed to provide access to a total of 16 functions. A system resident debugger does not occupy any user space in memory. FORTRAN and BASIC can be used on STARPLEX II with optional high level language support of PL/M and Pascal. Code generators for 8080/8085 and Z80/NSC800 8-bit procesors are available as well as CP/M interface. The STARPLEX II, SPX-90/51 is $15,950 for a standard configuration. **National Semiconductor,** 2900 Semiconductor Dr, Santa Clara, CA 95051. **Circle 187**

New Products

POWER CONDITIONERS

For Plug-In Compatibility

These single-phase conditioners have a choice of 5 Output Receptacle Panels to



provide users of 5 kVA to 10 kVA Line 2 Power Conditioners with plug-in compatibility to most computer systems. They protect against 99.5% of all power line disturbances. Each Output Receptacle Panel has between 7 and 11 output receptacles that distribute power to an equal number of equipment loads. Circuit breakers provide overload protection to all receptacles which are rated at either 120V, 240V or 120/240V. From $2360 for a Power Conditioner with an Output Receptacle Panel and from $2060 for a standard terminal block configuration. **Topaz Inc,** 3855 Ruffin Rd, San Diego, CA 92123. **Circle 149**

PERIPHERAL PROCESSOR

Provides 38.4MB of On-Line Storage for Q-Bus Based Systems

The 537 consists of a quad width board that supports a mix of two Cii Honeywell Bull (Cynthia) D120, two D140 disk drives or one D120 and one D140. The board can be plugged into any Q-Bus SPC slot. It utilizes a 16-bit 2901 bi-polar bit slice μP to provide operating and diagnostic commands. This dedicated approach eliminates the necessity of custom configuration required by disk subsystems with multiple drive type options. Installation time is reduced and system availability is increased. **Xylogics Inc,** 42 Third Ave, Burlington, MA 01803. **Circle 136**

UNIVERSAL PERIPHERAL

For Bit-Slice/Bipolar Test and Debug on Any System

Over the CCI's serial links, a target processor's programs can be automatically loaded, and the processor's operation monitored, and controlled. The system is easily customized to a particular architecture and instruction set. The CCI contains reconfigurable (8 to 96 bits or greater) high speed (to 36ns) memory to hold the target processor program; high speed logic analyzer, 32 or 80 bits wide, with sequential triggering, multiple trigger equations and 5 trigger sources to enable real time monitoring of the target processor; control circuitry to half target processor execution in real time, run multistep, multicycle, execute single instruction and R/W registers; and dual independent RS232 ports with programmable baud rate (110-9600), stops bits, parity, echo, line protocol and function. A full set of high level control commands and status queries simplify the task of writing CCI routines. From $6,950 to $40,000. **Step Engineering,** 757 Pastoria Ave, Sunnyvale, CA 94088. **Circle 175**

DATA CAPTURE PROGRAM

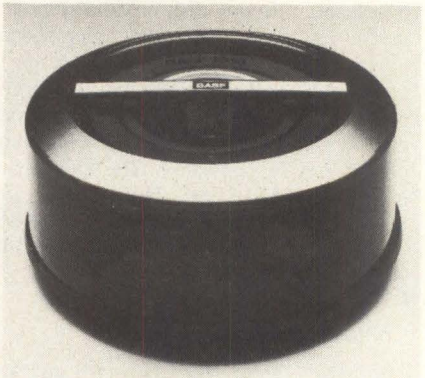
Digitize Directly From a Free-Hand Electronic Sketch

The NON-Gridded Electronic Schematic Data Capture Program, DS1, is available for DEC's VAX 11/780, and the SCI-Cards interface for SCI users. DS1 allows the computer operator to digitize directly from a free-hand electronic sketch to computer. A typical "D" size drawing takes 1 hour max to digitize. The computer automatically straightens the crooked lines, inputs the correct size symbols, as well as entering imposed alignments among the symbols. With the Non-Gridded concept, the operator simply scribbles in the changes on the drawing, performs the edit in minutes and outputs the final drawing. It is also operational on the DG Nova 4X and Eclipse, Univac, IBM and Harris Computers. **Design Aids Inc,** 27822 El Lazo Road, Laguna Niguel, CA 92677. **Circle 133**

CDC-COMPATIBLE DISKS

Phoenix-Type Cartridge and 300MB Disk Pack

The 681 is a 16MB Phoenix disk cartridge compatible with Control Data Corporation's Model 9448 disk drive or equivalents. It contains one 75-mil platter with one servo surface and one formatted surface. Storage density is 384 tpi and 6,038 bpi. $275. The 1263 is a 12-high, 300MB storage module compatible with CDC's 9766 or equivalent

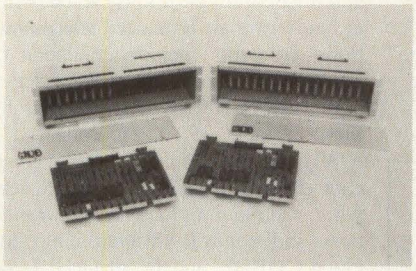


drives. It has 10 recording disks, 19 recording surfaces, plus top and bottom protective disks. A servo surface is prerecorded to provide precise control data for seeking, position sensing, and clocking. Track density is 384 tpi; bit density is 6,038 bpi. $1,100. **BASF Systems Corp,** Crosby Drive, Bedford, MA 01730. **Circle 137**

DZ11 COMPATIBLE MULTIPLEXORS

For LSI-11 Q-Bus Systems

These Unibus software compatible DZ11 multiplexors enable a user to employ an LSI-11/23 processor in a communications environment generally requiring a PDP-11/34. The MLSI-DZ11 series includes units which provide all of the features of the



Unibus DZ11-A/DZ11-B (EIA) 8-line multiplexors and the DZ11-E (EIA) 16-line unit. Another model combines the characteristics of the DZ11-A and the DZ11-C (EIA and 20 mA current loop). They offer programmable character formats and data rates from 50 to 19.2K baud. The MLSI multiplexor modules contain a 64 character buffer with a 16-bit SILO counter which allows minimal processor intervention. From $1350 to $2800. **MDB Systems Inc,** 1995 N. Batavia St, Orange, CA 92665.

Circle 135

PASCAL COMPILER SYSTEMS

Ensures μP Software Portability

This series of compiler-based software development systems is designed to speed both the development of Pascal programs and their movement from one μP to the next. The PAS-86 series includes compilers for 8-bit and 16-bit applications, plus an optional 8-bit interpreter package to support 8080 and 8085 μP applications. The first packages run on VAX and PDP computers and on IBM System 370 computers as hosts. They support development maintenance and upgrading of programs for Intel's 8086/8087/8088 μP family. Additional packages for other hosts and target μP's will also be available. **Language Resources Inc,** 4885 Riverbend Rd, Boulder, CO 80301.

Circle 134

PDP-11 READER-PUNCH

Off-Line Keypunch Capability Included

For PDP-11 and LSI-11 computers, Model RP8211 can read 80 column punched cards at 200 cards/minute and punch (with printing) at 45 to 75 cards/minute. It can also be used as a freestanding 80 column key punch, verifier, reproducer and interpreter. Editing of a selected column is possible thru punch suppressing and print editing features. For batch applications, it is a complete data entry unit when documents are transcribed and verified. The RP8211 is $8,500, Qty. discounts as well as lease and maintenance rates available. **Cardamation Co,** Box 746, Frazer, PA 19355. **Circle 127**

New Products

R/W RECORDER

Utilizes a Plug-In Bubble Memory Cassette

The BMR8 withstands harsh environmental conditions and delivers reliable data on a removable, non-volatile, solid state medium that may be reused without degradation of performance. Input and output of data may be via an RS232C mode or a 20 mA current loop or a parallel TTL 8-bit mode. Features recording speeds of up to 19,200 Baud or 2000 bps, capacity of each bubble cassette — 64,000 bits, error rate of 1 bit in 10^{10}, memory that remains undisturbed when power is turned off or when the cassette is removed, and CMOS logic throughout. $1495. **Memodyne Corp,** 220 Reservoir St, Needham Heights, MA 02194. **Circle 183**

DISTRIBUTED PROCESSING SYSTEM

Enhanced 2200 Series

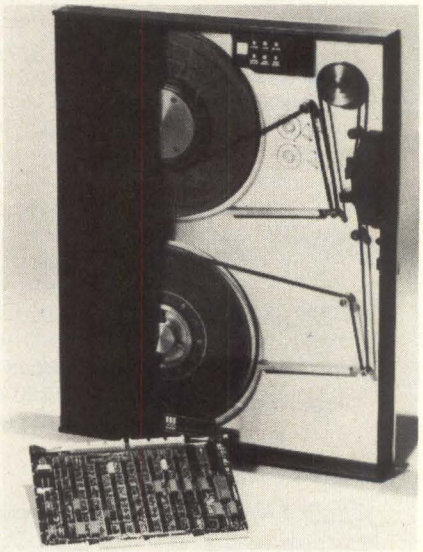
With the 2200 Series integrated workstation, data processing, word processing and host communications can be performed at one terminal. Enhanced telecommunications protocols include emulation of the IBM 3274 Cluster providing access into both a bisync and SNA/SDLC environment. Support of X.25, X.21, enhanced 2780/3780 and Teletex enables users to communicate directly into SNA or X.25 networks while maintaining local system responsiveness and control. Programming tools include COBOL, and an enhanced version of Wang BASIC. The Remote Control and Maintenance System (RCMS) provides central control and monitoring of all remote 2200 systems. **Wang Laboratories,** 1 Industrial Ave, Lowell, MA 01851.

Circle 193

LSI-11 CONTROLLER

For Magnetic Tape Drives

The QCI connects any of Digi-Data's 192 reel-to-reel tape drive models with self-contained formatters to a DEC LSI-11 via the Q-bus. It is compatible with LSI-11, 11/2 or 11/23 computer systems, emulating the TM-11 controller and compatible with RT-11/RSX-11. The QCI supports up to 2 tape formatters, each capable of handling 4



tape drives. Packaged on a single quad circuit board using 60% less power than comparable multiboard configurations. $1300 (qty. 100). **Digi-Data Corp,** 8580 Dorsey Run Rd, Jessup, MD 20794 **Circle 157**

GRAPHICS OPTION

Tektronix Compatibility for VT-100

The 4010 emulation option to Selanar's Graphics 100 allows VT-100 users to display high quality graphics data. The Graphics 100 feature will fit any VT-100

series CRT and does not require a CRT tube change. A light pen option reduces the need for keyboard interaction. Graphics 100 is $1200; Tektronix option is $250; light pen is $450. **Selanar Corp,** 2403 De La Cruz Blvd, Santa Clara, CA 95050. **Circle 143**

SPEECH VOCALIZER

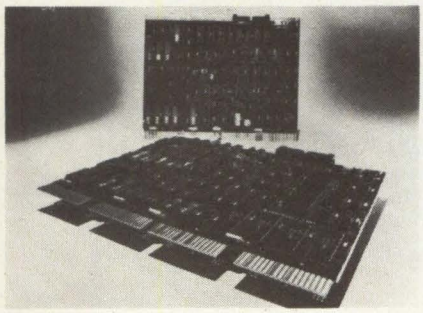
Converts Serial ASCII Data Into Speech

This unit can be used as a stand-alone peripheral for paging, instructions, vocal reminders or any automatic speech output. It can also be added to an existing terminal to vocalize portions of the display such as error conditions, operator messages or prompts. Vocabulary can be up to 800 words. The VOCALIZER contains an internal amplifier, loudspeaker and an RS-232C communications interface that operates from 110 to 19,200 baud. The unit responds to commands to set ouput loudness levels and to flush the internal buffer for emergency messages. Custom vocabularies available. The basic unit is $1395. **Micro Communications Inc,** 1509 Government St, Suite 214, Mobile, AL 36604. **Circle184**

ARRAY PROCESSOR

Transforms an LSI-11 Into a Fast Number Krunching System

SKYMNK provides high-speed (up to one megaflop), floating point processing on two quad PCBs that plug into any LSI-11 or 11/23 quad Q-bus backplane. It operates under RT-11 or RSX-11M for FORTRAN



or Macro programs, and can compute vector math, Fast Fourier Transforms, digital filtering, format conversions, and image processing at speeds 50 to 100 times faster than microcomputer stand-alone time. It shares the host's memory, up to 1 MB addressable. The SKYMNK extends the LSI-11's instruction set to include vector, matrix and compound mathematical instructions computed in real and complex arithmetic. $5990; OEM qty. under $4K. **SKY Computers Inc,** Box 8008, Lowell, MA 01852.

Circle 146

DEVELOPMENT/CONTROL SYSTEM

Based on the Intel 8086 16-Bit μP

The system consists of dual 8″ IBM compatible floppy disks, 9-slot Multibus card cage with integral fan and heavy duty power supply. The 8086 CPU card (DCS 86/16) is Multibus compatible and contains 3 serial

ports, 2 of which are capable of high level bit protocols such as HDLC and SDLC. One of the protocol ports is RS-232 and the other is RS 422/423 for network communications. The CPU also contains 24bits of parallel I/O for printer interfaces, etc. The CPU has vectored interrupt, counter/timers, PROM/RAM sockets and full multimaster capability in a multiprocessor environment. The DCS/86 is $6500 for a 64kB system with CPM/86 disk operating system. Also available is the ICM/80, a Multibus compatible chassis designed for 19″ rack mounting or NEMA sealed enclosure. It contains a 9-slot Multibus card cage with integral fan assembly and can accommodate up to 4 signal conditioning I/O panels providing up to 64 opto-isolated channels for control applications. **Distributed Computer Systems,** 223 Crescent St, Waltham, MA 02154. **Circle 128**

New Products

INTERFACE EVALUATION PACKAGE

Attach Non-IBM Equipment to IBM Mainframes at a Lower Cost

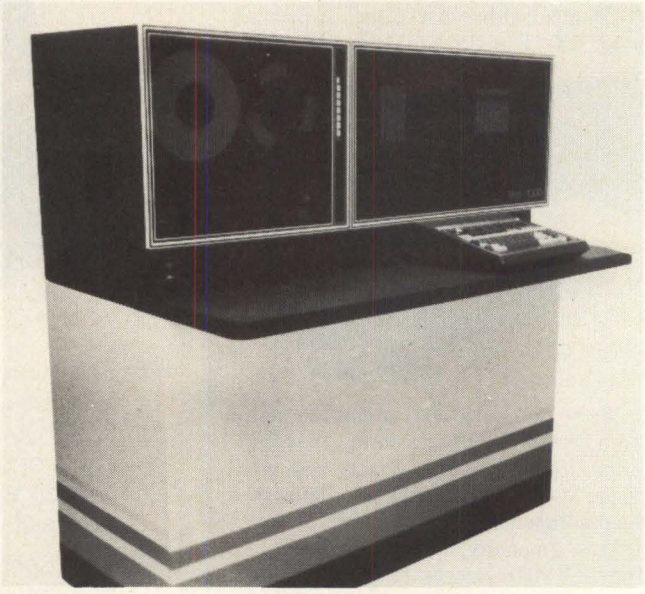
By providing both hardware and software, the user can now interface almost any non-IBM device directly to the channel. The 8900 Programmable Channel Interface Module consists of 3 quad-width PCBs that appear as a single module to the LSI-11 Bus. It provides channel-speed communication between any IBM (or IBM plug-compatible) Selector, Byte MUX or Block MUX channel and the LSI-11 Bus. It can respond to any subset of the 256 possible sub-channel addresses. The 8010 Driver/Receiver Module is a single PCB that converts IBM channel signals to/from TTL levels for use by the 8900. Off-line and Select priority functions are incorporated. The ARIES Software Library provides high-speed data transfer in a variety of interface configurations. The Channel Interface evaluation package includes the 8900, 8010, ARIES source, all interconnection cables and switches and is $6995. **Auscom Inc,** 2007 Kramer Lane, Suite 102, Austin, TX 78758.

Circle 153

DISTRIBUTED PLOTTING SYSTEM

Reduces Plot Turnaround Time

A disk based system, PMS 7000 manages up to 8 Gerber pen plotters or photoplotters in a distributed plotting network. Plot queuing, data conversion, job accounting, and data transmission enable more efficient distribution of plotting resources. From a single command post PMS 7000 users collect and convert data, allocate workload, prioritize plotting requirements, transmit information to remote



plotting systems, and control and monitor the entire plotting operation. The plot queuing feature assigns priorities for up to 32 plotting jobs and automatically transmits the data to the next appropriate plotter. Basic configuration includes two Interactive Video Display Stations with a shared ASCII keyboard, mini-computer (256K), 19.6 MB disk-drive, dual density magnetic tape unit and one plotter interface. **Gerber Scientific Instrument Co,** Box 305, Hartford, CT 06101.

Circle 131

UNIVERSAL DEVELOPMENT SYSTEM

For Bit-Slice or Fixed-Word-Length Processor Support

The EZ-PRO incorporates μP architecture and modular design to meet each user's exact application requirements. In Bit-Slice Systems, the EZ-PRO supports all of the TTL and ECL bit-slice

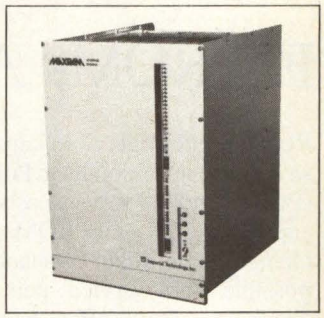
products. It can accommodate microprogram word lengths to 128 bits and depths to 2K words. With a shorter microprogram word, up to 8K words can be accommodated. Both ECL and TTL PROM Programmer Modules are available for programming or reading up to 8 PROMs at a time. From $11,335 to $26,800 including all required software, a video terminal and printer. In Fixed-Word-Length Systems, In-Circuit Emulators are available for the 2650, 6502, 6800, 6802, 6808, 6809, 8080, 8085 A/A-2 Z80 and the 3870 family. Programs supplied with each emulator include a Macro-assembler, Linking Editor, Debugging Routine and Demonstration Program. $8485 with 32 kB of static memory, one In-Circuit Emulator, a printer, dual floppy disk unit, video terminal and operating software. **American Automation,** 14731 Franklin Ave, Tustin, CA 92680

Circle 154

High-Speed MAXIRAM Storage System

Offers superior performance, throughput and reliability!

Compatible with:
- D.E.C.
- Data General
- Westinghouse



The non-rotating MaxiRam is a solid-state disc replacement storage system that operates at the speed of main memory. It is ideal for the following:
...if your processor is disc I/O bound.
...if your CPU spends too much time in the 'wait' state.
...if your present disc gives you reliability headaches.

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

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

Circle 40 on Reader Inquiry Card

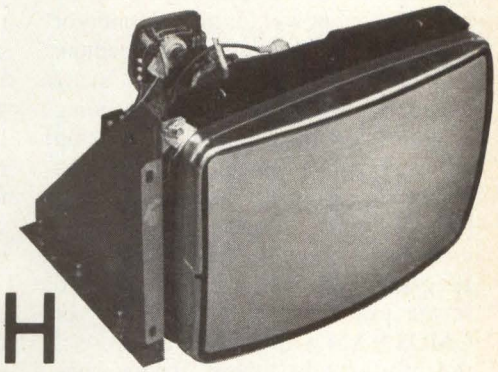
The Norm De Nardi Computer Shows give you the opportunity for hands-on demonstrations and personal dialogue direct with the manufacturer. All in one day, within minutes of your office.

In one afternoon you can see the latest in OEM and sophisticated end-user computer graphics, disc drives, minicomputers, terminals, printers and other peripheral products our industry has to offer. You'll have an opportunity to exchange ideas with such manufacturers as Tektronix, Ampex, CDC, Shugart, Centronics, IBM, Data General, DEC, Dataproducts, Perkin-Elmer, Xerox, Versatec, Intersil, Hewlett-Packard.

SHOW SCHEDULE:

Sept. 9, 1981	**Marriott Hotel, Newton, MA**
Dec. 3, 1981	**Hyatt Hotel, Palo Alto, CA**
Mar. 11, 1982	**Inn-at-the-Park, Anaheim, CA**
Apr. 22, 1982	**Hyatt Hotel, Palo Alto, CA**

Call or write for your invitation or exhibitor information to:
Norm De Nardi Enterprises,
289 S. San Antonio Rd., Suite 204,
Los Altos, CA 94022 415/941-8440.



HIGH RESOLUTION CRTs

Screen sizes from 5 to 14 in. Color plus P4, P31 and P39 phosphors. Extremely bright and sharp image due to 25 MHz video bandwidth and 1200 line resolution.

TTL logic levels for video input, and power requirements are 110V AC 60 cycle or 220V AC 50 or 60 cycle; please specify.

High performance and low prices. Call and try us!

P.S.

Switching Power Supplies

open frame, outputs +5V/4A, -5V/0.5A, +12V/1A Input 110V AC 60 cycle — others on request

Handwell corp.
257 Castro Street, Suite 2G
Mountain View, California 94041
Tel: (415) 962-9265 Tlx: 171947 HANDWELL MNTV

Circle 42 on Reader Inquiry Card

Designers' Notebook

EEPROMs Aid POS Terminals

Remote reconfiguration capability can save millions of dollars in Point Of Sale (POS) Terminal service costs. With the capability of EEPROMs, remote changes in terminal constants are now possible; no service personnel are necessary. How often have product codes and pricing information needed changes? In today's economy, one might answer "too frequently". With service costs today of over $100 per hour, those changes can be very expensive. The EEPROM benefits users of POS Terminals by completely eliminating service costs.

POS Terminals typically use look-up tables to contain product descriptions and pricing information. These tables require several different characteristics to operate optimally in a POS environment. The first storage attribute is non-volatility; look-up table data must be held without power for many months or years. Second, a dense storage medium is required because typically many products with complex encoding schemes are loaded into the look-up tables. Finally, a medium that can be changed easily is needed because pricing and product information changes frequently. All of these necessary features have been satisfied in the past with EPROM memory or CMOS RAM with battery backup.

Unfortunately, these media have drawbacks. EPROMs, while low cost, dense and non-volatile, cannot be changed in the field without a service technician. CMOS and battery backup offer more flexibility at lower density, but can suffer reliability problems if the battery and backup system aren't properly designed. The EEPROM offers users all the characteristics of EPROM with the flexible advantages of battery backed up RAMs. Look-up table data can be stored non-volatily, but can be changed while in system. **Figure 1** shows the block diagram for such a system. The terminal is composed of a high-performance μC, such as the 8051. In addition, memory is used as data and as look-up table storage. The typical I/O device structure for a terminal also exists in the system as shown. The most important interface indicated on the block diagram is the serial I/O link. The datacom or telecom link provides the system with remote reconfiguration capability. The contents of the EEPROM, a 2816, can be changed from a central location, without need for costly human service.

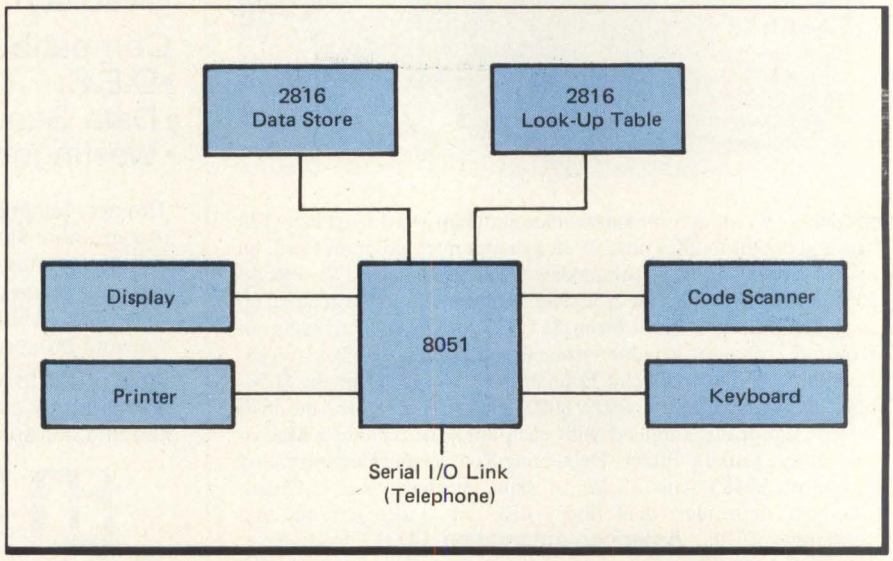


Figure 1: Point Of Sale (POS) terminal with EEPROMs, permits remote changes of terminal constants.

The look-up table contains product description and pricing information. Once the table is written, the CPU can read from it as necessary to translate product entry codes to price information. If for some reason the table data needs to be changed for pricing or product updates, then the central computer simply sends update commands and new data to the remote POS processor. Since all remote terminals are linked together at a central location and are in periodic communication with each other, such an update can occur as a part of normal inter-processor communication.

The in-system erase capability of a 2816 memory allows the table data to be changed remotely, while preserving the stand alone nature of the terminals. Without EE capability, a service technician would be required to change the table data.

In addition to containing product description and pricing data, the EEPROM can store special data unique to a particular location. If a set of locations within the memory is set aside for reorder codes, then as a location runs short of a particular item, the computer can automatically restock it. If particular information is sensitive, the 2816 can store encryption codes and software lockout mechanisms.

Another capability gained from the use of EEPROM is that daily totals in sales volume and product quantities can be stored in it. This information can be accessed by the local users as well as by the central data bank.

In such EEPROM-based POS terminals, flexibility and greatly reduced service costs are the key. The EEPROM contains product information that can now be changed from a central location without the use of very costly service personnel. It yields an ideal solution to data table storage problems in frequently altered POS systems.

by John F. Rizzo

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