JUNE 1986

Computer/Software Handbook

Mini-Micro Systems
THE MAGAZINE FOR COMPUTER SYSTEMS INTEGRATION
A CAHNERS PUBLICATION

YOUR

Problem-Solving Handbook

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Software is the key to adding optical storage 156

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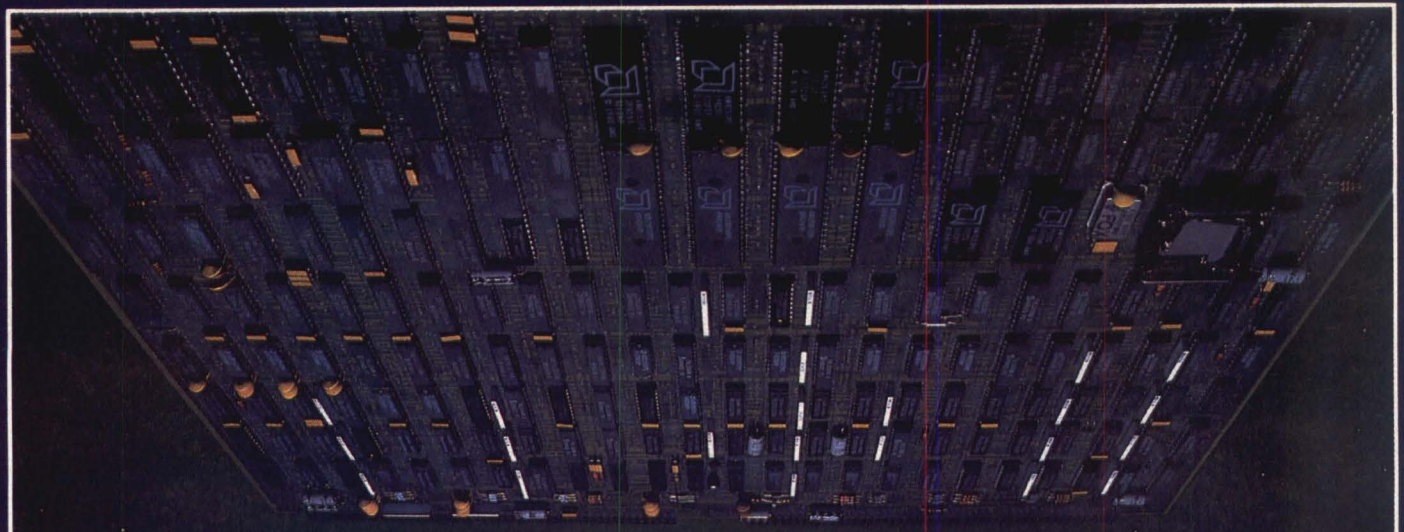

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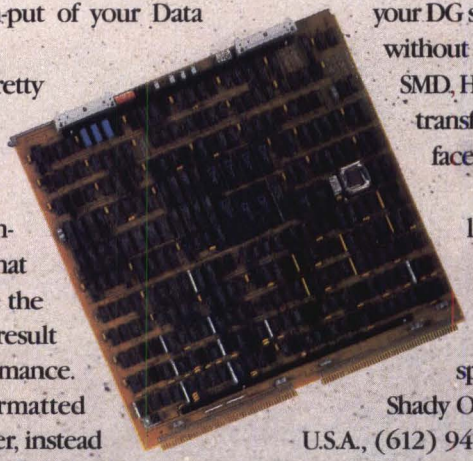

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FEATURE

SYSTEM INTEGRATION

Digital scanners build font libraries 149

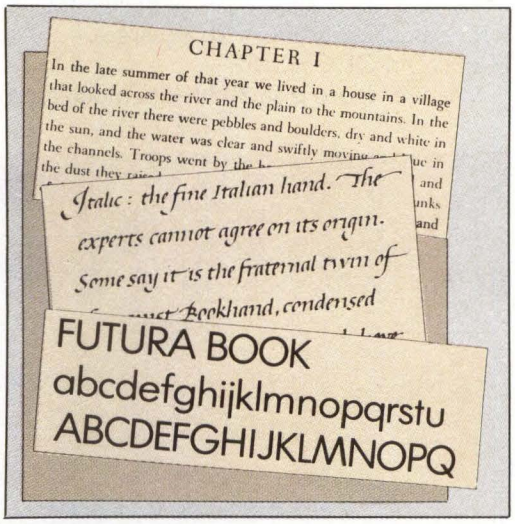
If you're a system integrator who wants to build custom libraries, digital scanners combined with laser printers are a godsend. With them you can create fonts from virtually any printed source—from calligraphy to novels. The best sources are font catalogs from typesetting houses, which present all the letters and symbols of a font in alphabetical order. Software expert Steve Bostwick tells you step-by-step how to build your own font library.

How to build a custom PC-compatible system 154

Ready-to-run PC-compatible systems don't meet the requirements of all applications. Sometimes you have to customize. System integrator Richard Steincross shows you how to work with off-the-shelf components to create custom systems for specialized applications.

Software is the key to adding optical storage 156

There's more to integrating optical read-only devices than just adding an interface card and plugging the pieces together. Western editor Carl Warren tells you what else is involved and how to deal with it.



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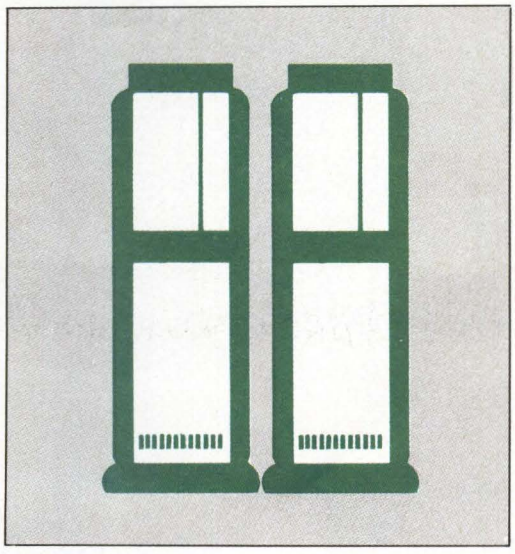

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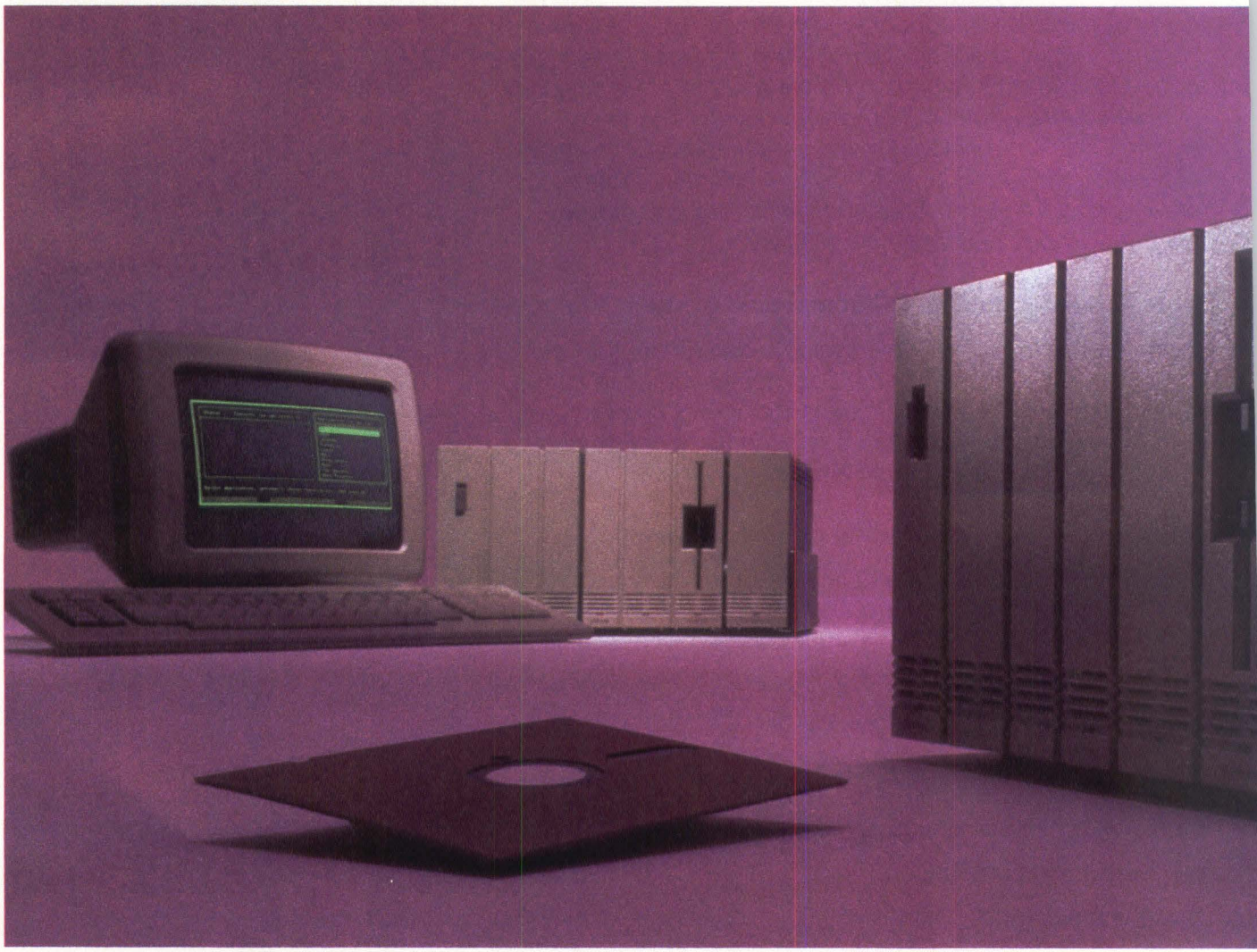

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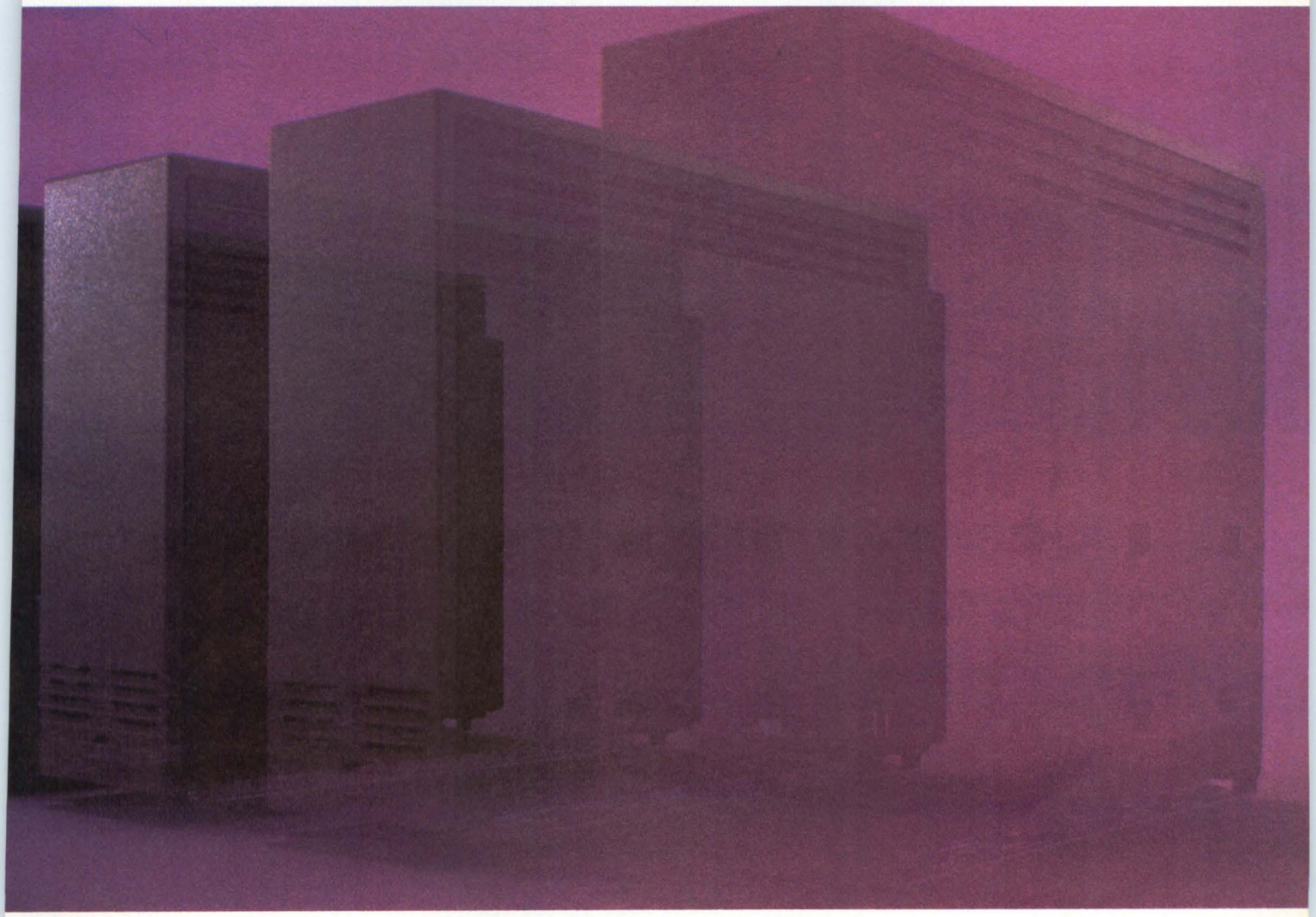

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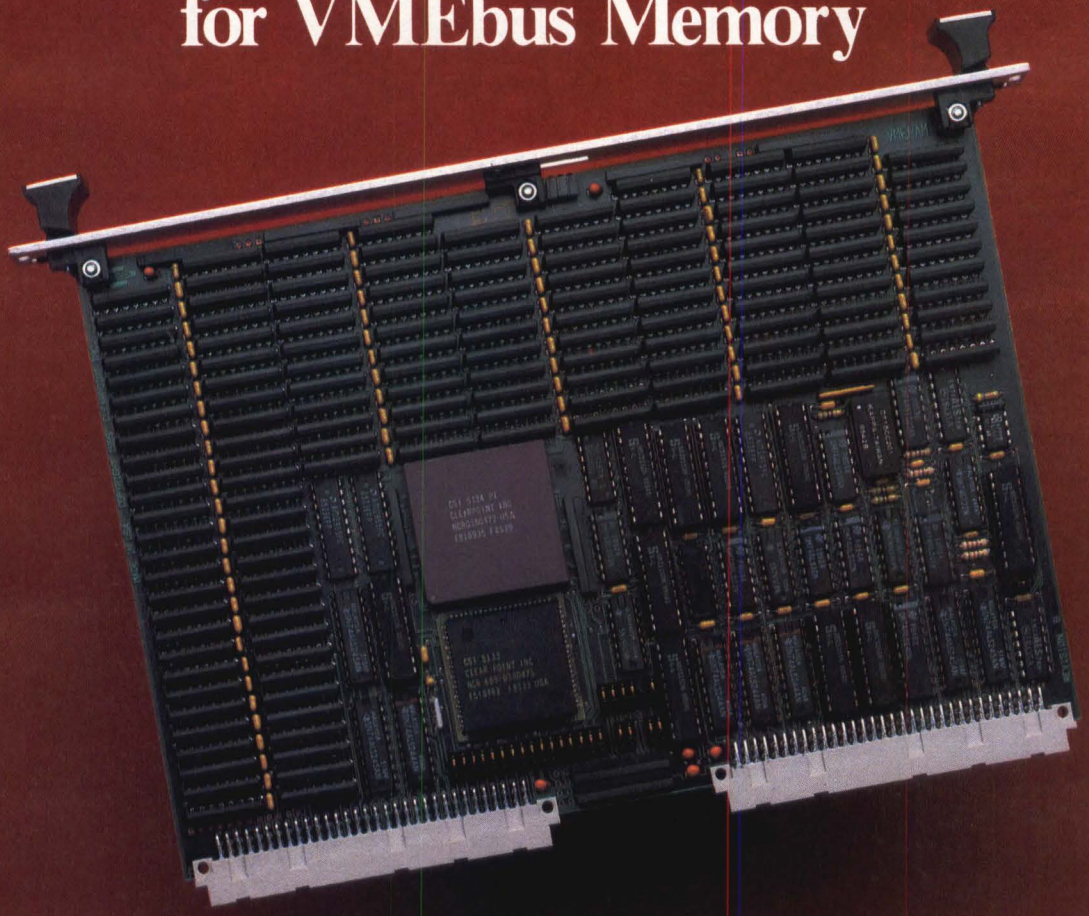

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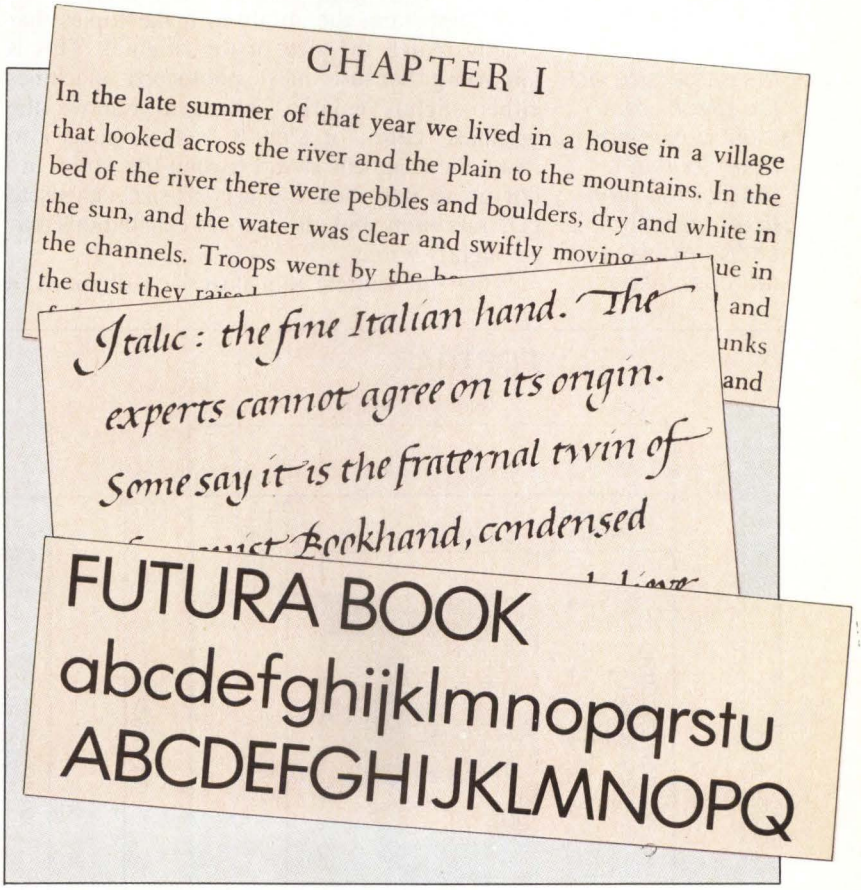
DIGITAL SCANNERS BUILD FONT LIBRARIES

Versatile and inexpensive image-capture peripherals use sources as varied as novels and calligraphy to create large font libraries for laser printers

Steve Bostwick
Query Computing Systems Inc.

If you use laser printers, digital scanners can give you increased flexibility. You can now build a library of fonts from printed material and exercise your aesthetic creativity when printing a variety of custom documents.

Or, you may need to create a font to solve a problem. For instance, few printers—laser or impact—offer Saxon runes in their font catalogs. However, English scholars who may need to print these runes could create their own fonts with a scanning digitizer, a laser printer, a personal computer and requisite software. Facing similar problems are businessmen and government agencies dealing in languages that don't use standard Roman characters, such as Arabic, Hebrew, Mandarin or Russian.



Usable fonts abound

Any printed page is a potential source of font information in that it may contain a variety of font examples. Particularly useful sources present all the letters and symbols of a font in alphabetical order and in various sizes. You can obtain font catalogs from typesetting houses, typesetting equipment manufacturers and the International Typeface Corp., New York, the leading independent creator and producer of typeface design. These catalogs usually offer complete alphabets and some actual text.

If you're willing to hunt for examples of each letter, you can use any source—from novels to calligraphy. The only requirement is that you have at least one good example of each letter and figure needed for your font. If you are working with an incomplete set, you may have to use an image editor to fake the missing characters.

One note of caution: If you're building a font library for your own use, you can legally and morally draw on any available source. But if you intend to use the fonts for a commercial venture,

you must make sure that the font design is not copyrighted.

How to build fonts

When you have collected suitable source material for your new font, your next step is to digitize the letters with a digital scanner. Two major types are available. One, called a stationary-optics digitizer, has a flat-glass input area and suits all types of material, including bound books. With stationary-optics digitizers, copy moves past the imaging hardware. The other type, called a moving-optics digitizer, moves single sheets of paper through a series of channels and pinch rollers. It works well with source material in sheet form but requires bound material to be photocopied before digitizing (see "How image digitizers work," Page 153).

When photocopying, use a high-quality machine with sharp optics, solid black lines and, most important, the ability to make copies that exactly match the size of the original. This is important because most photocopy machines either slightly enlarge images to remove the originals' edges or slightly reduce images to make them appear sharper when the optics are not up to par. You can use off-size images to generate fonts, but all your size calculations may be slightly wrong.

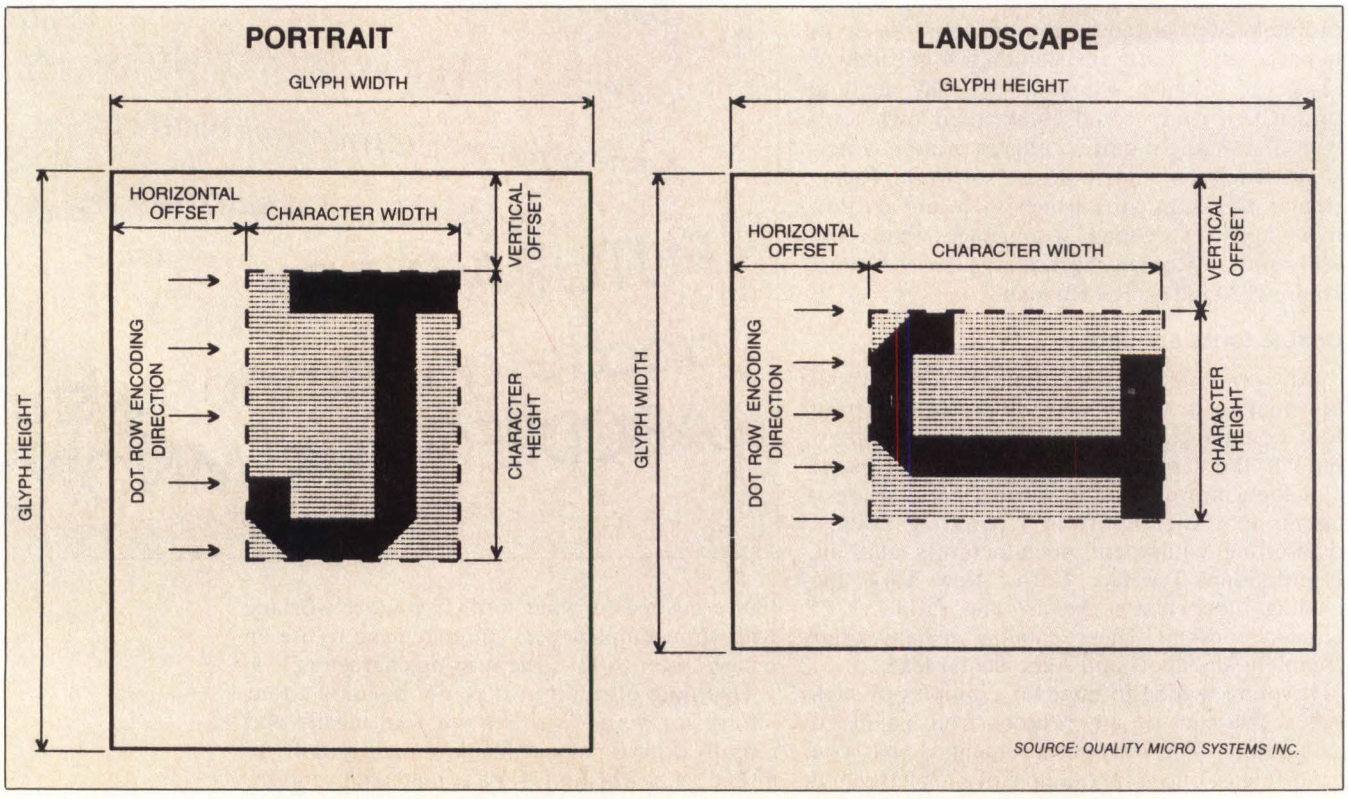
When the sample font pages are digitized, a disk file containing the image of the page is made. Image files are all the same in principle, but they vary in detail. You have to write a computer program to read this image file, but this allows you to "snip" the image of a letter from it. This excised letter image is then converted to the proper form for transmission to the laser printer. The collected letters and symbols are stored on disk so that they can be transmitted to the printer, and they must be retransmitted whenever you turn on the printer.

How to specify a font

For demonstration purposes, we used a Smart Writer printer from Quality Micro Systems Inc. (QMS). This 300-dot-per-inch (dpi) laser printer accepts downloaded characters in two downloading modes—Epson America Inc. emulation and "native" ANSI. In Epson mode, the character resolution is limited to that of impact dot-matrix-printer output—a 7-by-8 dot array. Each dot measures approximately one seventy-second of an inch across. In the ANSI mode, however, the dots measure one three-hundredths of an inch in diameter. The character area, called a glyph, can be 255 dots high and 255 dots wide. This allows you to create well-defined characters measuring almost a square inch.

Different character presentations use either of two glyph formats. The vertical format, which

Glyph diagrams *indicate the height and width of a character, referred to as the actual bit map (shaded area). The rest of the glyph represents white border around the character. The bit map may be the same size as the glyph. You must define separate fonts for the portrait (vertical) and landscape (horizontal) orientations.*



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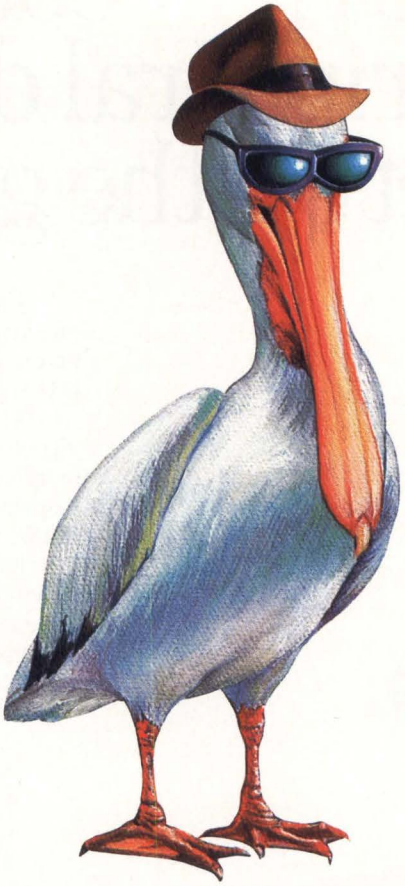

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printer manufacturers call "portrait," presents the page in the same, vertical, orientation as the page you are reading now. What printer manufacturers call the "landscape" format presents the page horizontally. These formats form characters from a bit map with rows of bits, each representing a dot. The area around the bit map represents the borders around the character. For characters that abut, the bit map may completely fill the glyph area.

When specifying a font, you must specify a font header with parameters that affect the whole font. These parameters include the following:

- Font name.
- Glyph height—the height, in dots, of the character glyph. This value includes descenders and top and bottom borders. The maximum possible height is 255 dots, but QMS recommends that characters be no more than 85 dots high. The glyph height can be the same size as the bit-map height in portrait orientation or the bit-map width in landscape orientation. The printer uses glyph-height parameters to determine the font's line spacing value.
- Baseline—the distance, in dots, from the top of the glyph cell (thus including ascenders) to the baseline of the character. Characters without

How image digitizers work

Image digitizers offer a choice of three copy-handling methods: stationary optics, moving optics and camera and copy stand. In stationary optics, the copy moves past the imaging hardware. In moving optics, the optics move past the copy, which remains stationary. In camera and copy stand, a camera mounted above a copy stand takes an image of the copy.

For the system discussed in this article, we used stationary-optics digitizers from MicroTek International Inc. and moving-optics digitizers from Datacopy Corp. We did not use camera and copy stand digitizers because they did not meet our cost requirements.

The stationary-optics scanners are mechanically simpler, more reliable and less expensive than their moving-optics counterparts. However, the pinch rollers they employ to move copy can wear, causing slippage and distortion of the image. In addition, rollers can jam, damaging copy.

With moving-optics digitizers, you place the copy on a flat glass, much as you might use a photocopier. Thus, these systems can digitize bound text as easily as they do single sheets. In addition, they are more consistently accurate. However, because they have more moving parts than do stationary machines, they also require more maintenance and cost more.

- **Model:** MS-200
- **Manufacturer:** MicroTek International Inc.
- **Resolution:** 200 pixels per inch
- **Technology:** Stationary optics
- **Document size:** As large as 8½ by 24 inches
- **Document type:** Line drawings and halftone images
- **Digitizing time:** An 8½-by-11-inch page in 20 seconds
- **Interfaces:** RS232 serial ports as fast as 19.2K bits per second, and parallel ports
- **Software-programmable features:** Scaling, brightness and contrast

- **Model:** MS-300
- **Manufacturer:** MicroTek International Inc.
- **Resolution:** 300 pixels per inch or 200 pixels per inch
- **Technology:** Stationary optics
- **Document size:** As large as 8½ inches wide, software-programmable length with 11-inch default
- **Document type:** Line drawings and continuous-tone images
- **Digitizing time:** An 8½-by-11-inch page at 300 dots per inch (dpi) in 26.4 seconds and an 8½-by-11-inch page at 300 dpi in 17.6 seconds
- **Interfaces:** RS232 serial ports at 9.6K, 19.2K or 57.6K bps, and to parallel ports
- **Software-programmable features:** Scaling, brightness and contrast

- **Model:** Model 700
- **Manufacturer:** Datacopy Corp.
- **Resolution:** 203 pixels per inch
- **Technology:** Moving optics
- **Document size:** As large as 8½ by 11 inches
- **Document type:** Line drawings and halftone images
- **Digitizing speed:** An 8½-by-11-inch page in 23 seconds
- **Interfaces:** High-speed 8-bit parallel port; includes a standard half-sized IBM Corp. PC printed circuit card with direct-memory-access capability
- **Software-programmable features:** Contrast

- **Model:** Model 730
- **Manufacturer:** Datacopy Corp.
- **Resolution:** 304 pixels per inch or 203 pixels per inch
- **Technology:** Moving optics
- **Document size:** As large as 8½ by 11 inches
- **Document type:** Line drawings and halftone images
- **Digitizing speed:** An 8½-by-11-inch page in 23 seconds
- **Interfaces:** High-speed 8-bit parallel port; includes a standard half-sized IBM PC printed circuit card with direct-memory-access capability
- **Software-programmable features:** Contrast

descenders rest upon the baseline.

- Font-fixed character spacing—the optimum character spacing for this font size. If you set this parameter at zero, the printer will use proportional character spacing.
- Underline distance—the distance in dots, ranging from 1 to 255, from the font baseline to the top of the underline stroke. The printer automatically adds underlines to text when requested. This parameter tells the printer where to place the underline for this font.
- Double-underline distance—the distance in dots, ranging from 1 to 255, from the font baseline to the top of the second underline stroke.
- Underline thickness—the thickness of the underline stroke in dots, ranging from 1 to 255.
- Horizontal bold offset—the number of horizontal dot positions the printer must move when overprinting a character to achieve boldface printing. You can use this parameter in conjunction with vertical bold offset.
- Vertical bold offset—the number of vertical dot positions the printer must move when overprinting a character to achieve boldface printing.
- Superscript distance—the distance, in dots, from the font baseline to the baseline at which the superscript is to be established.
- Subscript distance—the distance, in dots, from the font baseline to the baseline at which the subscript is to be established.

After you define the overall parameters of the

How to build a custom

Richard Steincross

Although system integrators and value-added resellers have a variety of IBM Corp. or PC-compatible systems to choose from, not all application requirements can be met with ready-to-run boxes. In such cases, system integrators can select from off-the-shelf components to create custom systems for specialized applications.

To develop the system for use with digital scanners discussed in this article, we tried both approaches. Originally, we employed a Compaq Computer Corp. DeskPro, added a 2M-byte Emulex/Persyst Corp. Stretch memory board and attached a Quality Micro Systems Inc. laser printer. Although this system worked well for general applications, it proved too restrictive for application-specific digital imaging.

To create the desired system, we started with the Faraday Electronics A-Tease motherboard. Although a variety of other boards are available, the A-Tease most closely fit our needs. For example, the Faraday motherboard is compatible with the IBM PC/AT card. Although basically identical to the IBM version, our evaluation board had two notable differences: no BASIC in ROM, and extra I/O ports. Because Faraday offers Microsoft Corp. GW BASIC on disk, the first point did not pose a problem. And the extra I/O ports increased flexibility in system design. The A-Tease comes with two serial ports, which are user-selectable between RS232 and RS422, and a parallel printer port.

A handy feature of the Faraday basic input/output system code is that it detects, each time the computer starts, both scrambled setup data in the battery-backed-up CMOS RAM and configuration changes between stored and actual conditions. In the event the CMOS has a bad checksum (possibly due to battery disconnection) the BIOS prompts the user for complete configuration information. If more or less memory, or the addition or deletion of an Intel Corp. 80287, is detected, the CMOS is automatically updated. The BIOS lets the user determine RAM size, time, date and the type of rigid disk, flexible disk, coprocessor and video adapter. With an IBM PC/AT, in contrast, all these changes require a setup disk.

In addition, three RAM memory sizes are possible: 512K, 640K or 1,024K bytes. As with most systems and boards currently available, a socket for the 80287 math coprocessor is provided.

One additional convenience, not found on most systems, is the reset port. Via a push-button switch, it is possible to restart the A-Tease without resorting to cycling the power switch, thus saving power-down and power-up time.

Be aware that the power connectors on the Faraday motherboard are not the kind you'll find on the IBM PC/AT or its clones. However, instead of changing connectors on the power supply, we chose to build an adapter cable assembly. This required two connectors to mate with the motherboard, two to plug into the power supply and an additional small connector to connect the POWER GOOD signal. We used simple flat-ribbon cables with appropriate 26-pin IDC and DB25 connectors to carry the serial channels and parallel port out to the rear panel.

Although the motherboard is the major component of the system, integrators also have to choose a case, or card-cage system; a power supply; a disk and, possibly, tape-storage system; and a keyboard and other input peripherals.

Because our goal was to create a graphics-oriented system, we also considered a variety of en-

font in the font header, you must specify the details of the characters. Each character has its own header, which should include the following fields:

- Character number—the position in the ASCII collating sequence that this bit pattern defines. The number is two digits long and is specified in ASCII-hexadecimal format.
- Glyph width—the width, in dots, of the character, including any left and right borders. This width is used if proportional spacing is requested.
- Bit-map height—the height, in dots, of the character portion of the glyph.
- Bit-map width—the width, in dots, of the character portion of the glyph. The value can range from 1 to 255.
- Vertical offset—the distance, in dots, from the upper border of the glyph to the upper edge of the bit map. You can include an optional sign with this value, but a negative number will place the bit outside the glyph. If you position characters outside the glyph, you may not be able to use subscripts, superscripts or boldface characters. In some cases, bit maps outside the glyph do not print correctly.
- Horizontal offset—the distance, in dots, from the left border of the glyph to the left edge of the bit map. As with the vertical offset, the horizontal offset's value can be negative. Characters outside the glyph may not support subscripts, superscripts or bold characters. Also,

PC-compatible system

hanced graphics adapters (EGA). Specifically, we looked at the following EGA boards:

EPIC, from NSI Logic Inc., comes standard with 256K bytes of display memory and allows full IBM EGA emulation. Of the cards we used, this is the only one that doesn't use the Chips and Technology Corp. chipset. Instead, the EPIC board has one custom integrated circuit, which replaces the four custom chips typically found on other boards. The setup program can change the card to IBM EGA-, Monochrome- or Color Graphics Adapter (CGA)-compatible emulation modes. This is the only card able to fully emulate the CGA registers, and one of a few cards able to run some CGA games. The card plugs into any slot in an AT.

The Spectra EGA Model 4800, from Genoa Systems Corp., is similar to the EPIC and comes with 256K bytes of display memory, allowing full EGA emulation. This card has the setup switches mounted internally (not accessible from outside the computer) to allow room on the mounting bracket for a printer connector. The card outline is cut to allow clearance around the extra bus connector in the IBM PC/AT, and may be used in any AT slot.

Quadram Corp's QuadEGA+ provides similar capabilities, with the addition of Hercules Computer Technology graphics emulation. The setup program and diagnostics are on disk. A software program sets the card to different emulation modes without resorting to switches. Like NSI Logic's EPIC board, QuadEGA+ supports some CGA-specific games.

The EGA PLUS from STB Systems Inc. is similar to the other boards in capability, but also supports a real-time clock and printer port, thus adding functionality to the single slot in the PC backplane.

Typical AT-class systems incorporate from 20M to 40M bytes of Winchester storage. Because of the memory-intensive nature of our imaging application, we integrated a 40M-byte disk drive from Computer Memories Inc. (CMI) and a 120M-byte drive from Maxtor Corp. into two separate configurations, although you could use any drive that meets your capacity and cost requirements. We used a Western Digital Corp. model WD-1002-WA2 disk controller for both configurations. The controller handles both flexible and rigid disk drives.

We also added RAM storage beyond the 620K bytes on the motherboard, using 2M-byte enhanced memory boards from Emulex/Persyst and STB Systems Inc. The boards, as supplied, were used primarily as RAM disks. However, by installing the proper drivers, the extra memory can also be used as cache buffers and for program and image memory.

Although the system described in this article was created specifically as an imaging system, it isn't limited to that application. For example, by adding serial ports and modems, the system can serve as a powerful on-line communication system. Similarly, the addition of networking boards turns the system into a hub network module.

Our approach allowed us to use a variety of graphics boards and to attach a variety of peripherals, including scanners, with minimum hardware-integration difficulty. Writing the software isn't that easy and frequently is the major stumbling block in most integration tasks.

Richard Steincross is president of RMS Laboratories, Long Beach, Calif. He specializes in system integration and board design.

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some characters outside the glyph do not print correctly.

After you specify the character header, you should specify the bit map in either ASCII-hexadecimal or binary format. In binary, the binary representation of each 8 pixels is sent as 1 byte. The ASCII-hex system sends the 8 pixels as three ASCII-hex representations. The disadvantage of the ASCII-hex form is that 2 bytes of data must be sent for each 8 pixels. However, ASCII-hex avoids other problems.

For example, while in font-downloading mode, the printer absorbs all carriage returns (<CR>), line feeds (<LF>) and form feeds (<FF>). QMS provides this feature because some computer systems automatically insert some or all of these form-control characters. This causes no problem when sending the bit map using ASCII-hex. This mode uses only the characters 0 through 9, A through F and a through f; it does not use—or miss—the form-control characters. But in binary mode, <CR> (0DH), <LF> (0AH) and <FF> (0CH) are all valid pixel patterns. To solve this problem, you must precede these three characters with an escape character <ESC> (1BH). However, this introduces another question: How do you send the pixel pattern 1BH? The answer: Send <ESC><ESC>. The disadvantage of the complex software needed to insert these extra characters may outweigh the advantage of having to send only half as many bytes.

Write the clipping program

You can use almost any language to write a program to extract the character images and to place the data in the appropriate form. To keep the program from being unacceptably slow, however, you should write all image handling in assembly language.

The program has four major functions: read the image file produced by the scanner, display and move the image, clip and edit the character and form the glyph for downloading.

Whichever portion of the program reads the image depends on which format the digitizer uses to store the image data. Files stored in a non-compressed manner in which 1 bit represents 1 pixel are the easiest files to process. However, this mode takes a great deal of memory. For example, an 8½-by-11-inch page could require more than 1M byte. As a result, most digitizer manufacturers allow the data to be compressed using techniques similar to those used by facsimile machines.

The image-reading routine delivers, on de-

Software is the key to adding optical storage

Integrating an optical read-only device, such as the North American Philips Corp. Compact Disc ROM, involves more than just adding an interface card and plugging the pieces together.

In its current configuration, the Philips drive uses a serial interface that conforms to the RS422A standard. The commands are thus transmitted serially and asynchronously, and yield a transfer rate of 1.41M bits per second.

This CDROM uses a spiral track that is divided into sectors that are individually addressable; each sector comprises 98 CD frames, each of which contains 24 bytes. Therefore, a sector equals 2,352 bytes. Each sector begins with a 12-byte synchronization pattern followed by 3 bytes of address information and a 1-byte mode indication, leaving 2,336 bytes free for data.

Addressing is easy because data is organized along a spiral linear track. Thus each sector can be addressed with an absolute—as opposed to logical—sequence number from the start of the track. The algorithm used to find data can be expressed in units of time because the device rotates at a constant linear velocity.

Linking the drive requires a device driver. In the case of the IBM Corp. PC, you link the device in the CONFIG.SYS file that tells the system about any special devices in the system. Essentially, the device driver establishes the port, physical location of the drive in the memory and interrupt map of the system. It also handles the bit-serial transfer of data from the device. The only information going to the drive represents commands to tell it when to turn on or off and when to move to a new sector location.

Part of the device driver's duty is to hand data from the disk to the operating system and application program. The application program then converts this data into user-understandable data.

A special index helps locate data on the CDROM disk. The index uses key words associated with specific sector addresses. Thus a request from an application for a specific word causes a lookup in the index and then a translation to the proper location. Depending on the sophistication of the application program, the system either indicates that the word was found or queues up several possible data locations for viewing.

—Carl Warren, Western Editor

mand, one screen pixel line of uncompressed data. The demand, which comes from the editor routine, includes the pixel-line number, the starting pixel column, the pixel-line length and the line-buffer location. The pixel-line and column numbers refer to locations in the image file, not to the data displayed on the screen. The routine returns an uncompressed buffer of pixels, which is

(LINE LENGTH + 7)/8

bytes long. Any unused bits in the last byte of the buffer are returned as 0.

The routine that displays the digitized image uses the line-reading routine. Initially, the display of the digitized data starts at the upper left corner of the stored image. Enough of the first pixel line is read to fill the first line of the display. Our system has a graphics card from Hercules Computer Technology that requires 720 pixels to fill one line. Because this card has an aspect ratio of 2-to-3, we adjusted the image by making each pixel 3 screen dots wide and 2 dots high. This means that each dot must be repeated three times and each pixel line must be repeated twice. This yields images with the correct aspect ratio. The screen, which is 720 by 348 dots, can contain a piece of the digitized image that is 240 by 174 digitizer dots.

How to clip characters

The clipping routine superimposes a frame showing the glyph outline and major parts of the glyph. You set the size of the outline and the placement of the baselines when you specify the font-header information. The outline is in the middle of the screen. You use the arrow keys to move the image under the outline. The image is properly placed when the letter is on the baseline and at the left margin of the bit-map area. To move the right side of the bit map, use the shifted left and right arrows to adjust the width of the character.

When the character is correctly placed in the glyph, you press the Enter key, which causes the image in the bit-map area to be extracted, or clipped, and prepared for downloading. You'll then receive a prompt for the ASCII value that this character will replace. That value provides an index into a direct-access file that holds the new font. The record written to the disk provides the character-header and bit-map data. This process is repeated until all the new characters in the font have been written to the file.

Although the font file has been written randomly, it can be read sequentially whenever the font needs to be downloaded to the printer. The data written to the file has been formatted into the proper form for downloading. The font-header information, along with the proper command string, is written to the front of the file. Because the file was initialized to all blank letters, any unused characters are printed as blanks. Setting up the file like this allows the file to be read sequentially and written to the printer. The DOS copy command can be used by entering:

C:>copy xxxx.fnt,lpt1:

This will copy the font named xxxx to the line printer.

Using the downloaded font requires that you embed the proper control codes or dot commands in the document. In some cases, the codes are a combination such as ^P^B, with ^ denoting use of the Control key. This could mean, for example, use of a Helvetica, 24-point boldface font. Other combinations of codes cause the printer to make various choices from the downloaded font table. □

Companies mentioned in the articles

Compaq Computer Corp.
20333 FM 149
Houston, Texas 77070
(713) 370-7040
Circle 573

Datacopy Corp.
1215 Terra Bella Ave.
Mountain View, Calif. 94043
(415) 965-7900
Circle 569

Emulex/Persyst Corp.
3545 Harbor Blvd.
Costa Mesa, Calif. 92626
(714) 662-5600
Circle 574

Faraday Electronics
749 N. Mary Ave.
Sunnyvale, Calif. 94086
(408) 749-1900
Circle 575

Genoa Systems Corp.
73 E. Trimble Road
San Jose, Calif. 95131
(408) 942-1700
Circle 576

Maxtor Corp.
150 River Oaks Parkway
San Jose, Calif. 95134
(408) 945-9720
Circle 577

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16011 N.E. 36th Way
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Marlboro, Mass. 01752
(617) 460-0717
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1 Quad Way
Norcross, Ga. 30093-2919
(404) 923-6666
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(205) 633-4300
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Query Computing Systems Inc.
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Suite 125
Richardson, Texas 75081
(714) 557-3550
Circle 584

Western Digital Corp.
2445 McCabe Way
Irvine, Calif. 92714
(714) 557-3550
Circle 585

Steve Bostwick is president of Query Computing Systems Inc., a software company specializing in applications that interface microcomputers to specialized hardware. He received a bachelor's degree in physics from UCLA, where he is an instructor for the Extension Department of Engineering and Science.

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High 745 Medium 746 Low 747

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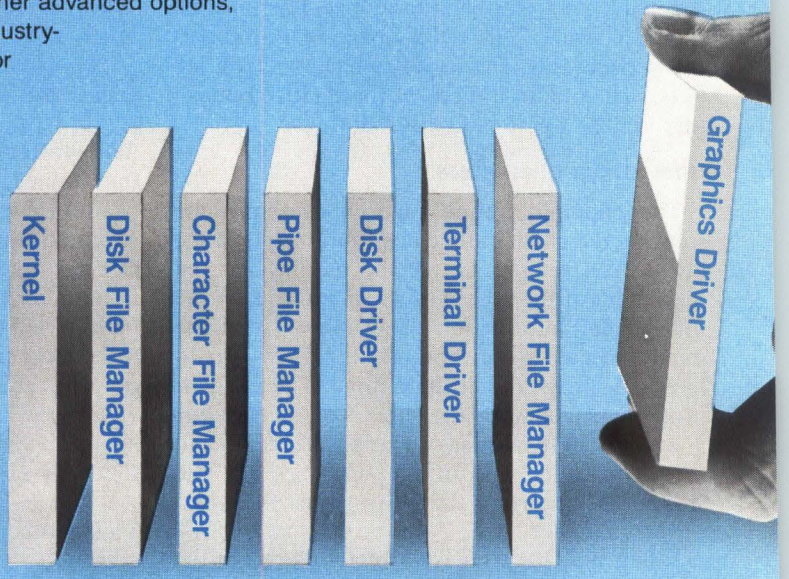

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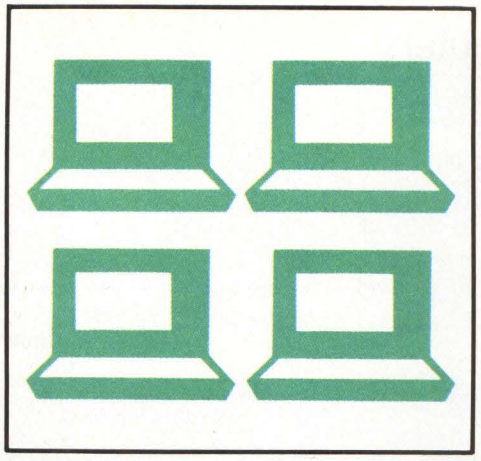


Single-user microcomputers

Company / Model	Display size, color, Screen format (col. × lines)	CPU type	Main memory min.-max. (bytes)	Operating systems available	Programming languages supported	Unit price $	Configuration
AC JACQUARD — Circle 586 3534 Atlantic Ave., Long Beach, CA 90807, (213) 424-2986							
J5000	12-inch, green (80×24)	proprietary	128K-512K	proprietary	BASIC	6,500	two 5¼-inch flexible drives
AMPRO COMPUTERS INC. — Circle 587 67 E. Evelyn Ave., Mountain View, CA 94041, (415) 962-0230							
Series 100		Z80A	64K	CP/M 2.2, Turbo-DOS, ZRDOS	CP/M 2.2 compatible	995-1,645	one or two, 5¼-inch, 400K-, 800K-byte flexible and one 5¼-inch, 10M-byte rigid drive(s)
Series 200		80186	512K-1M	Concurrent DOS, PC-DOS, Turbo-DOS	MS-DOS	1,295-1,945	one or two, 5¼-inch, 360K-, 720K-byte flexible and one 5¼-inch, 10M-byte rigid drive(s)
ANDROMEDA SYSTEMS INC. — Circle 588 9000 Eton Ave., Canoga Park, CA 91304, (818) 709-7600							
11/B73-W20		LSI-11/73	256K-4M	RT-11, TSX Plus	BASIC, FORTRAN, Pascal	8,895	one 8-inch, 512K-byte flexible and one 5¼-inch, 76M-byte rigid drive
11/M12-W20		LSI-11	256K-4M	RT-11, TSX Plus	BASIC, FORTRAN, Pascal	6,995	one 5¼-inch, 800K-byte flexible and one 5¼-inch, 20M-byte rigid drive
11/73-W20		LSI-11/73	256K-4M	RT-11, TSX Plus	BASIC, FORTRAN, Pascal	7,250	one 5¼-inch, 800K-byte flexible and one 5¼-inch, 20M-byte rigid drive
APPLE COMPUTER INC. — Circle 589 20525 Mariani Ave., Cupertino, CA 95014, (408) 996-1010							
Apple IIc		65C02	128K	Apple DOS 3.3, ProDOS	BASIC, FORTRAN, Logo, Pascal, Pilot	940	one 5¼-inch, 140K-byte flexible drive
Apple IIe		65C02	64K-128K	Apple DOS 3.3, ProDOS	BASIC, FORTRAN, Logo, Pascal, Pilot	945	
Macintosh 512K/ Macintosh Plus	9-inch, b&w	68000	512K/1M	Macintosh	BASIC, C, Pascal	1,999/ 2,599	512K includes MacWrite, MacPaint software and one 3½-inch, 400K-byte flexible drive; Plus has one 3½-inch, 800K-byte flexible drive
BEEHIVE INTERNATIONAL — Circle 590 4910 Amelia Earhart Dr., Salt Lake City, UT 84116-2837, (801) 355-6000							
Topper	12-inch, green (80×24)	Z80A	64K	CP/M 2.2	CBASIC, MBASIC, COBOL, Turbo-Pascal	2,795	two 5¼-inch, 400K-byte flexible drives
Topper II	12-inch, green (80×24)	Z80A	64K	CP/M 2.2	CBASIC, MBASIC, COBOL, Turbo-Pascal	3,595	two 5¼-inch, 386K-byte flexible drives
CANON USA INC. — Circle 591 One Canon Plaza, Lake Success, NY 11042, (516) 488-6700							
A-200	12-inch; monochrome or 16-color (80×25)	8086	256K-512K	MS-DOS	GW BASIC	2,195-2,695	two 5¼-inch, 360K-byte flexible drives
A-200HD	12-inch; monochrome or 16-color (80×25)	8086	256K-512K	MS-DOS	GW BASIC	3,795-4,295	one 5¼-inch, 360K-byte flexible and one 10M-byte rigid drive

Single-user microcomputers

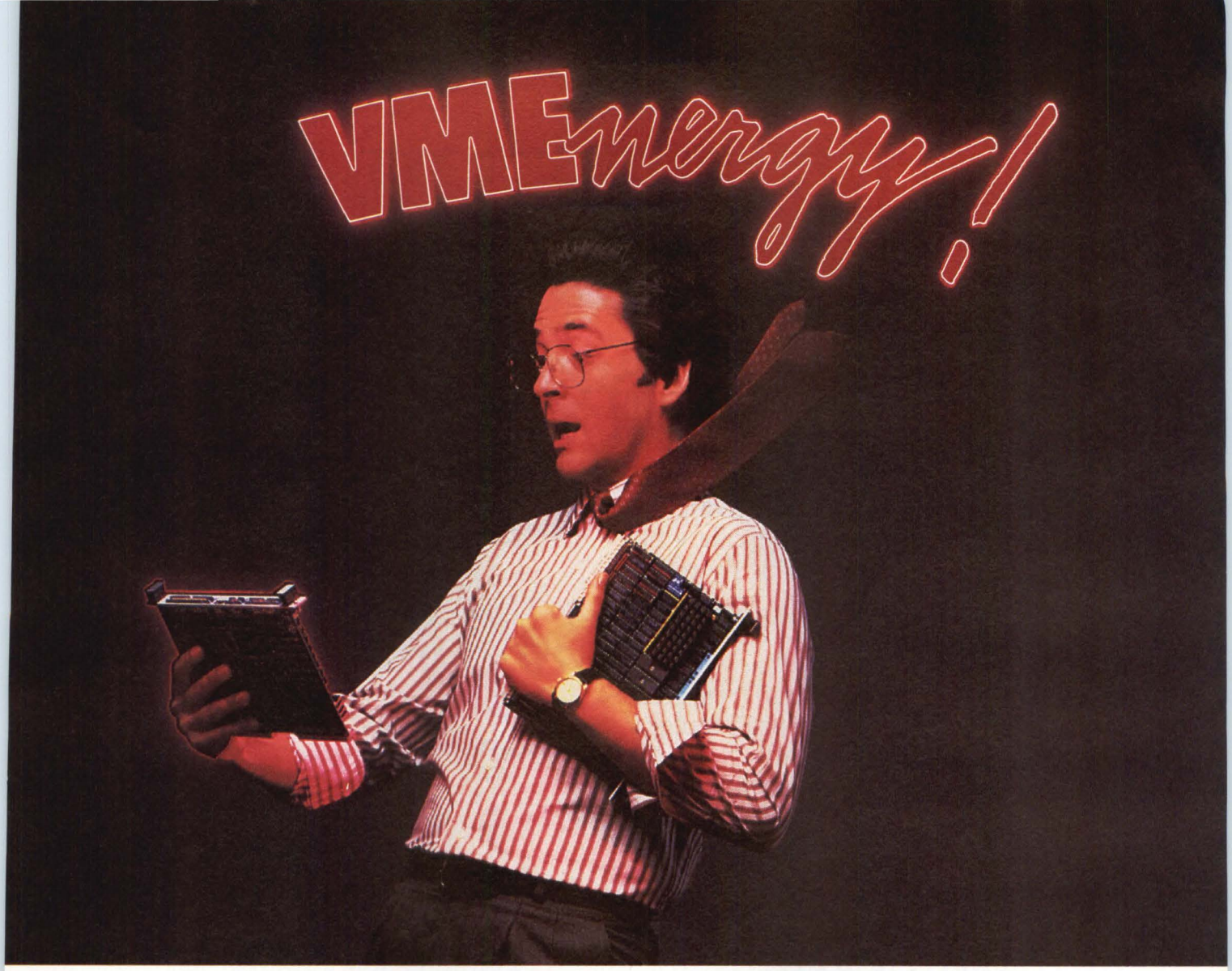
Company / Model	Display size, color, Screen format (col. × lines)	CPU type	Main memory min.-max. (bytes)	Operating systems available	Programming languages supported	Unit price $	Configuration
A-200TP	12-inch, LCD (80×25)	8086	512K-640K	MS-DOS	GW BASIC	2,295	transportable; two 5¼-inch, 360K-byte flexible drives
COMARK CORP. P.O. Box 474, Medfield, MA 02052, (617) 359-8161							**Circle 592**
DISKSTOR M-3		8085	64K	CP/M	BASIC, C, FORTRAN, Pascal	7,995	one 8-inch flexible and one 20M-byte rigid drive
MB85I	12-inch (80×24)	8085	64K	CP/M-80	BASIC, C, FORTRAN, Pascal	3,995	one 5¼-inch, 20M-byte Winchester drive
MB86I	12-inch (80×24)	8086	512K	Concurrent CP/M	BASIC, C, FORTRAN, Pascal	5,495	one 5¼-inch, 20M-byte Winchester drive
CORDATA (FORMERLY CORONA DATA SYSTEMS) 275 E. Hillcrest Dr., Thousand Oaks, CA 91360, (805) 495-5800							**Circle 593**
ATD-Q20	14-inch; green, up to 64-color (80×25)	80286	640K	MS-DOS	PC	5,495	one 5¼-inch, 1.2M-byte flexible and one 5¼-inch, 20M-byte rigid drive
ATD-8-Q	9-inch, green (80×25)	80286	512K	MS-DOS	PC	4,286	one 5¼-inch, 1.2M-byte flexible drive
PC-400-HD2	14-inch, green (80×25)	8088	256K-512K	MS-DOS	PC	2,295	one 5¼-inch, 360K-byte flexible and one 5¼-inch, 10M-byte rigid drive
DATA GENERAL CORP. 4400 Computer Dr., Westboro, MA 01580, (617) 366-8911							**Circle 594**
DASHER/One Model 1	12-inch, green	8088	256K-640K	MS-DOS	BASIC, C, COBOL, FORTRAN, Pascal, PL/1	2,100	one 3½-inch, 720K-byte flexible drive
DASHER/One Model 2	12-inch, green	8088-2	256K-640K	MS-DOS	BASIC, C, COBOL, FORTRAN, Pascal, PL/1	2,415	one 3½-inch, 720K-byte flexible drive
DIGITAL EQUIPMENT CORP. 146 Main St., Maynard, MA 01754, (617) 897-5111							**Circle 595**
Professional 350	12-inch; amber, green, white (132×24)	J-11	256K-896K	P/OS, RT-11			two 5¼-inch, 400K-byte flexible and one 5¼-inch, 10M- or 31M-byte rigid drive(s)
Professional 380	12-inch; amber, green, white (132×24)	F-11	256K-896K	P/OS, RT-11			two 5¼-inch, 400K-byte flexible and one 5¼-inch, 10M- or 31M-byte rigid drive(s)
Rainbow	12-inch, amber, green, white (132×24)	8086, Z80	64K	CP/M-80, CP/M-86, MS-DOS			two 5¼-inch, 400K-byte flexible and one 5¼-inch, 10M- or 20M-byte rigid drive(s)
EPSON AMERICA INC. 2780 Lomita Blvd., Torrance, CA 90505, (213) 539-9140							**Circle 596**
Equity I	12-inch, green; 13-inch, 16-color (80×25)	8088	256K-640K	MS-DOS 2.11	GW BASIC	1,273-1,693	one 5¼-inch, 360K-byte flexible drive
Equity II	12-inch, green; 13-inch, 16 color (80×25)	8086	640K	MS-DOS 3.1	GW BASIC	1,973-2,393	one 5¼-inch, 360K-byte flexible drive
Equity III	12-inch, green; 13-inch, 16-color (80×25)	80286	640K-15.5M	MS-DOS 3.1	GW BASIC	3,773-4,193	one 5¼-inch, 1.2M-byte flexible drive
FUJITSU MICROSYSTEMS OF AMERICA INC. 3025 Orchard Parkway, San Jose, CA 95134-2017, (408) 434-1160							**Circle 597**
Micro 16s	12-inch; white, black, cyan, red, green, blue, yellow, magenta (80×25)	8086, Z80A	128K-1M	MS-DOS, CP/M-86, Concurrent CP/M-86	CBASIC Compiler, C Compiler, Level II COBOL, Pascal MT, Personal BASIC, PL/1		two 5¼-inch, 360K-byte flexible drives
Micro 16sx	12-inch; white, black, cyan, red, green, blue, yellow, magenta (80×25)	8086, Z80A	384K-1M	MS-DOS, CP/M-86, Concurrent CP/M-86	CBASIC Compiler, C Compiler, Level II COBOL, Pascal MT, Personal BASIC, PL/1		one 5¼-inch, 360K-byte flexible and one 5¼-inch, 13M-, 26M-byte rigid drive

Single-user microcomputers

Company / Model	Display size, color, Screen format (col. × lines)	CPU type	Main memory min.-max. (bytes)	Operating systems available	Programming languages supported	Unit price $	Configuration
System 2000	12-inch; white, black, cyan, red, green, blue, yellow, magenta (80×25)	8086, Z80A	384K-1M	Pick	Data BASIC, Pick Assembler		one 5¼-inch, 360K-byte flexible and one 5¼-inch, 26M-byte rigid drive
HONEYWELL INFORMATION SYSTEMS INC. Honeywell Plaza, Minneapolis, MN 55408, (612) 870-5200							**Circle 598**
AP Series	12-, 13-inch; amber, monochrome or 16-color (80×25)	80286	256K-4M	MS-DOS 3.1	MS-DOS	3,565+	bundled software; two 5¼-inch, 360K-byte flexible and one 5¼-inch, 10M-byte rigid drive(s)
EP Series	12-, 13-inch; amber, monochrome or 16-color (80×25)	8088-2	256K-640K	MS-DOS 3.1	MS-DOS	1,450+	bundled software; two 5¼-inch, 360K-byte flexible and one 5¼-inch, 10K-byte rigid drive(s)
XP Series	12-, 13-inch; amber, monochrome or 16-color (80×25)	8088-2	256K-640K	MS-DOS 3.1	MS-DOS	2,300+	bundled software; three 5¼-inch, 360K-byte flexible and two 5¼-inch, 20M-byte rigid drives
ITT INFORMATION SYSTEMS 2350 Qume Dr., San Jose, CA 95131, (408) 945-8950							**Circle 599**
ITT XTRA Model II, III, V	14-inch; amber, green; 16-color (80×25)	8088	256K-640K	ITT DOS 3.1, MS-DOS	BASIC, COBOL, FORTRAN, Pascal	1,595-3,195	up to two, 5¼-inch, 360K-byte flexible and one 10M-, 20M-byte rigid drive(s)
ITT EXTRA XP Model II, V	14-inch; amber, green, 16-color (80×25)	80286	512K-1.64M	ITT DOS 3.1, MS-DOS	BASIC, COBOL, FORTRAN, Pascal	3,995-4,595	one 5¼-inch, 360K-byte flexible and one 10M-, 20M-byte rigid drive
LOMAS DATA PRODUCTS INC. 182 Cedar Hill St., Marlboro, MA 01752, (617) 460-0333							**Circle 600**
S100PC		8086	512K-1M	MS-DOS, Concurrent DOS 4.1	BASIC, C, COBOL, Pascal	2,995	two 5¼-inch, 360K-byte flexible and one 5¼-inch, 85M-byte rigid drive(s)
MAD INTELLIGENT SYSTEMS INC. 2950 Zanker Rd., San Jose, CA 95134, (408) 943-1711							**Circle 601**
D1000	12-inch, monochrome (80×25)	80286	512K-1M	MS-DOS		4,895	one 5¼-inch, 1.2M-byte flexible and one 5¼-inch, 20M-byte rigid drive
NCR CORP. (PERSONAL COMPUTER DIV.) 1601 S. Main St., PCD-1, Dayton, OH 45479, (513) 445-7478							**Circle 602**
PC4i	12-inch, monochrome (80×25)	8088	256K-640K	NCR DOS	GW BASIC	3,285-4,658	bundled software; up to two, 5¼-inch, 360K-byte flexible and one 5¼-inch, 10M-byte rigid drive(s)
PC6		8088-2	256K-640K	NCR DOS	GW BASIC	2,585-5,154	bundled software; up to two, 5¼-inch, 360K-byte flexible and one 5¼-inch, 20M-byte rigid drive(s)
NEC HOME ELECTRONICS (USA) INC. 1401 Estes Ave., Elk Grove Village, IL 60007, (312) 228-5900							**Circle 603**
PC-8201A	LCD (40×8)	80C85	16K-64K	proprietary			portable
PC-8401A-LS	LCD (80×16)	Z80A	64K-96K	CP/M			
NEW GENERATION SYSTEMS INC. 1800 Michael Faraday Dr., Suite 206, Reston, VA 22090, (703) 471-5598							**Circle 604**
Maker II		Z80B	64K-256K	CP/M, MS-DOS	ASM, C	5,995	four 5¼-inch, 8-inch, 780K-, 1.2M-byte flexible drives
NIXDORF COMPUTER CORP. 300 Third Ave., Waltham, MA 02154, (617) 890-3600							**Circle 605**
8810/25	9-inch, amber (80×25)	8088	256K-640K	MS-DOS 2.11	all major languages	2,500-3,900	transportable; two 5¼-inch, 360K-byte flexible and one 10M-byte rigid drive(s)
8810/65	12-, 15-inch; amber, green (132×27)	80186	256K-768K	Concurrent DOS	all major languages	4,800-8,600	two 5¼-inch, 512K-, 1M-byte flexible and one 10M-byte rigid drive(s)

Single-user microcomputers

Company / Model	Display size, color, Screen format (col. × lines)	CPU type	Main memory min.-max. (bytes)	Operating systems available	Programming languages supported	Unit price $	Configuration
OMNIBYTE CORP. 245 W. Roosevelt Rd., West Chicago, IL 60185, (312) 231-6880							**Circle 606**
OB68K/SYSII		68000	512K-16M	IDRIS, polyFORTH	BASIC, C, FORTH, FORTRAN, Pascal	9,995-27,595	up to two, 8-inch, 1.6M-byte flexible and up to two, 5¼-, 8-inch, 32M-, 500M-byte rigid drive(s)
OSBORNE COMPUTER CORP. 42680 Christy St., Fremont, CA 94538, (415) 490-6885							**Circle 607**
Osborne AT		80286	512K-1M	MS-DOS	MS-DOS	1,995	one 5¼-inch, 360K-byte flexible and one 5¼-inch, 10M- to 30M-byte rigid drive
Vixen	7-inch, amber (80×24)	Z80A	64K	CP/M 2.2	Pascal	1,298	bundled software; two 5¼-inch, 390K-byte flexible drives
2100		8088	128K-640K	MS-DOS	MS-DOS	1,695	built-in serial, parallel ports; two 5¼-inch, 360K-byte flexible drives
PERFORMANCE TECHNOLOGIES INC. 300 Main St., East Rochester, NY 14445, (716) 586-6727							**Circle 570**
SYS100		68010	1M-16M	UNIX System V	Ada, BASIC, C, COBOL, FORTRAN, Pascal	12,900	one 5¼-inch, 120M-byte rigid drive
SYS102		68010	512K-16M	P-DOS (2)	BASIC, C, FORTRAN, Pascal	7,950	one 5¼-inch, 1M-byte flexible and one 5¼-inch, 20M-byte rigid drive
PERSONAL MICRO COMPUTERS INC. 275 Santa Ana Court, Sunnyvale, CA 94086, (408) 737-8444							**Circle 608**
PMC-101		Z80A	128K	CP/M 3.0	CBASIC	795-1,295	bundled software; one 5¼-inch, 400K-byte flexible drive
PMC-102		Z80A	128K	CP/M 3.0	CBASIC	995-1,595	bundled software; two 5¼-inch, 400K-byte flexible drives
PMC-121		Z80A	128K	CP/M 3.0	CBASIC	1,495-2,395	bundled software; one 5¼-inch, 400K-byte flexible and one 5¼-inch, 20M-byte rigid drive
PRO-LOG CORP. 2560 Garden Rd., Monterey, CA 93940, (408) 372-4593							**Circle 609**
ABL-2		Z80	64K-128K	CP/M-80	CP/M-80 compatible	4,495	two 8-inch, 1M-byte flexible drives
STD DOS		8088	640K-1M	MS-DOS 3.1	MS-DOS 3.1 compatible	1,680	
QDP COMPUTER SYSTEMS 10330 Brecksville Rd., Cleveland, OH 44141, (216) 526-0838							**Circle 610**
16	12-inch, monochrome	8088	128K-640K	MS-DOS, XENIX, UNIX	Assembly, BASIC, C, COBOL, FORTRAN	1,995-4,000	two 5¼-inch, 360K-byte flexible and two 10M- to 40M-byte rigid drives
REGENCY SYSTEMS INC. 3200 Farber Dr., P.O. Box 3578, Champaign, IL 61821, (217) 398-8067							**Circle 611**
R2-C Family	12-inch, 256-color (512×512)	Z80B	64K-1M	USE	USE		bundled software; up to two, 5¼-inch, 1M-byte flexible and two 5¼-inch, 10M- to 1.8G-byte rigid drives
SANYO BUSINESS SYSTEMS CORP. 51 Joseph St., Moonachie, NJ 07074, (201) 440-9300							**Circle 612**
MBC-555-2	8-color (80×25)	8088	128K-256K	MS-DOS	Sanyo BASIC	849	two 5¼-inch, 360K-byte flexible drives
MBC-675/ MBC-775e	7-inch, b&w; 9-inch, 16-color (80×25)	8088/ 8088-2	256K-640K	MS-DOS	MS-DOS	1,599-2,499	portable; two 5¼-inch, 360K-byte flexible drives
MBC-885/ MBC-885HD20	16-color (80×25)	8088-2	256K-640K	MS-DOS		1,499-2,599	two 5¼-inch, 360K-byte flexible drives; HD20 has one 5¼-inch, 20M-byte rigid drive
SHARP ELECTRONICS CORP. Sharp Plaza, Mahwah, NJ 07430, (201) 599-8571							**Circle 613**
PC-2500	LCD (24×4)	8-bit CMOS	5K-21K		BASIC	397	built-in, 4-color printer/plotter; removable RAM data card
PC-7000	10½-inch, white (80×25)	8086	320K-704K	MS-DOS 2.11	GW BASIC	1,795	two 5¼-inch, 360K-byte flexible and one 3½-inch, 10M-byte rigid drive
SPERRY CORP. P.O. Box 500, Blue Bell, PA 19424, (215) 542-4011							**Circle 614**
PC HT	12-, 14-inch; monochrome or color (80×25)	8088-2	256K-640K	MS-DOS, XENIX	all		up to two, 5¼-inch, 360K-byte flexible and one 5¼-inch, 20M-byte rigid drive

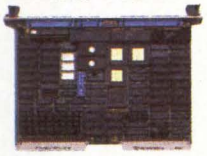


CHARGED WITH THE POWER TO DRIVE YOUR APPLICATIONS

For those who expect more from VME, Heurikon proudly presents the HK68/V™ Family of 16 and 32-bit microcomputers.

Heurikon delivers the right processor for your application. The HK68/V Family presents a choice of board designs ideally suited for UNIX™ as well as real-time systems. Whether your application demands basic Motorola 68010 processing power or top-of-the-line 68020 performance, the HK68/V Family meets the challenge.

HK68/V10



Features include:
- No wait-state 12.5 MHz 68010 CPU
- Up to 1 MB on-card DRAM
- Optional MMU, DMA and Floating Point Processor
- 2 Serial Ports
- SCSI Interface.

HK68/V20

Features include:
- 68020 CPU at up to 24 MHz
- Optional PMMU and Floating Point Coprocessor
- Up to 4 MB on-card DRAM
- One Serial Port
- VSB/MVMX32 Memory Expansion Bus.

And with powerful tools like UNIX and Heurikon's UNIX/VRTX® multiprocessor development system, Heurikon makes light work of your real-time and other software tasks.

Whether boards or complete systems, Heurikon manufactures quality. To learn more about Heurikon's HK68/V Family of VME products, **call Heurikon at 1-800-356-9602 (ext. 399).**
3201 Latham Drive, Madison, WI 53713.

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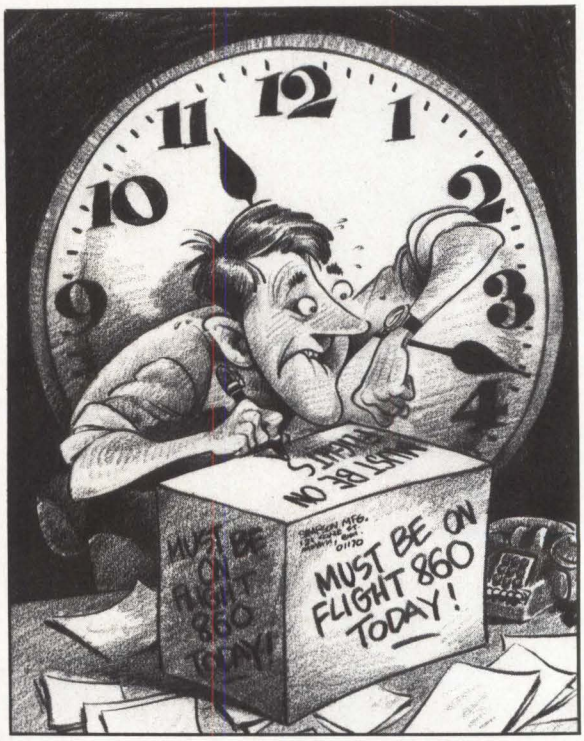

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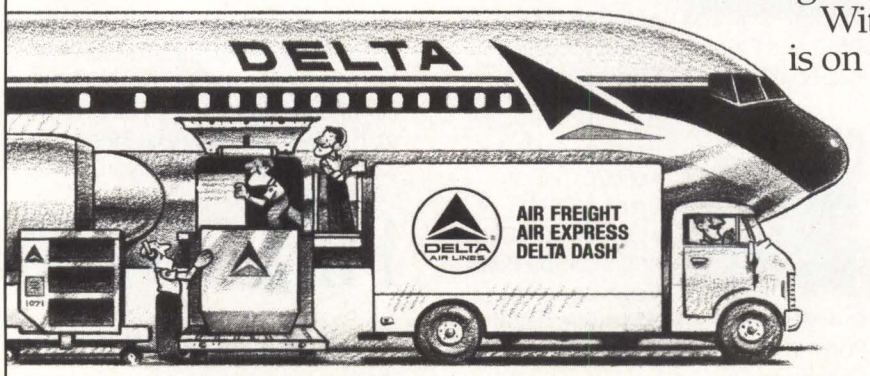

AIR EXPRESS. DELTA TAKES IT THERE.®

Single-user microcomputers

Company / Model	Display size, color / Screen format (col. × lines)	CPU type	Main memory min.-max. (bytes)	Operating systems available	Programming languages supported	Unit price $	Configuration
PC IT	12-, 14-inch; monochrome or color (80×25)	80286	512K-5M	MS-DOS, XENIX	all		one 5¼-inch, 360K-, 1M-byte flexible and two 5¼-inch, 44.6M-byte rigid drive(s)
TANDY CORP. 1800 One Tandy Center, Fort Worth, TX 76102, (817) 390-3011							**Circle 615**
Tandy 1000/2000	12-inch, 16-color (80×25)	8088	128K-640K/ 256K-640K	MS-DOS	BASIC, C, COBOL, RM FORTRAN, Pascal	999/ 1,499	up to two, 5¼-inch, 360K-byte flexible drive(s)
Tandy 2000	12-inch, monochrome; 14-inch, color (80×25)	80186	256K-768K	MS-DOS	BASIC, C, COBOL, RM FORTRAN, Pascal	1,599-2,499	two 5¼-inch, 720K-byte flexible and one 10M-byte rigid drive(s)
Tandy 3000	monochrome, 16-color (80×24)	80286	512K-1.2M	TRS-DOS	BASIC, C, COBOL, RM FORTRAN, Pascal	2,599	one 5¼-inch, 1.2M-byte flexible drive
TELEVIDEO SYSTEMS INC. 1170 Morse Ave., Sunnyvale, CA 94086, (408) 745-7760							**Circle 616**
TeleVideo AT		80286	256K-15M	MS-DOS 3.1	GW BASIC 3.1	3,395-5,795	one 5¼-inch, 1.2M-byte flexible and one 44.5M-byte rigid drive
TeleColor XT	12-inch, color (80×25)	8088	256K-640K	TeleDOS	GW BASIC	4,595	bundled software; one 5¼-inch, 360K-byte flexible and one 20M-byte rigid drive
TPC-IID	9-inch, yellow (80×25)	8088	256K-640K	MS-DOS	GW BASIC	2,395	bundled software; two 5¼-inch, 360K-byte flexible drives
TEXAS INSTRUMENTS INC. P.O. Box 809063, Dallas, TX 75380-9063, (214) 995-6611							**Circle 617**
Business Pro	green (80×25)	80286	512K-3M	MS-DOS 3.0	MS BASIC, MS COBOL, MS FORTRAN, MS Pascal, RM COBOL	3,995-5,795	512K-, 1.2M-byte flexible and 21M-byte Winchester drive
Portable/Professional Computer	13-inch/9-inch (80×25)	8088	128K-768K	MS-DOS	BASIC, CBASIC, COBOL, FORTRAN, Pascal	2,295-2,395	one flexible drive
Pro-Lite	LCD (80×25)	80C88, 8087	256K-768K	MS-DOS 2.1	MS BASIC, RM COBOL, MS Pascal	2,995	one 3½-inch, 720K-byte flexible drive
TOSHIBA AMERICA INC. 2441 Michelle Dr., Tustin, CA 92680, (714) 730-5000							**Circle 618**
T1100	LCD (80×25)	80C88	512K	MS-DOS	IBM PC compatible	1,999	one 3½-inch, 720K-byte flexible drive
WANG LABORATORIES INC. One Industrial Ave., Lowell, MA 01851, (617) 459-5000							**Circle 619**
Professional Computer	12-inch, green (80×25)	8086	256K-768K	MS-DOS	BASIC, COBOL, FORTRAN, Pascal	2,445	one 5¼-inch, 360K-byte flexible drive
XEROX CORP. 006 Xerox Square, Rochester, NY 14644, (716) 423-3539							**Circle 572**
6064	12-inch; monochrome or color (80×24)	8086	256K-640K	MS-DOS	Assembly, BASIC, C	2,885	two 5¼-inch, 360K-byte flexible drives
6065	12-inch; monochrome or color (80×24)	8086	256K-640K	MS-DOS	Assembly, BASIC, C	4,485	one 5¼-inch, 360K-byte flexible and one 5¼-inch, 10M-byte rigid drive
6068	12-inch; monochrome or color (80×24)	8086	512K-640K	MS-DOS		5,645	one 5¼-inch, 360K-byte flexible and one 5¼-inch, 10M-byte rigid drive
ZENITH DATA SYSTEMS 1000 Milwaukee Ave., Glenview, IL 60025, (312) 391-8860							**Circle 620**
Z-148 PC		8088	128K-640K	MS-DOS 2.11		1,499-1,799	up to two, 5¼-inch, 360K-byte flexible drive(s)
Z-158 PC		8088	256K-640K	MS-DOS 2.11		2,199-3,699	up to two, 5¼-inch, 360K-byte flexible and one 5¼-inch, 10M-byte rigid drive(s)
Z-200 Advanced		80286	512K-15M	MS-DOS 2.11, XENIX		3,999-5,599	one 5¼-inch, 1.2M-byte flexible and one 5¼-inch, 20M-byte rigid drive

Information was solicited but not received from the following manufacturers:

Alcyon Corp.
San Diego, CA 92121

Applied Micro Technology
Tucson, AZ 85702

AT&T Information Systems
Morristown, NJ 07960

Casio Inc.
Fairfield, NJ 07006

Cifer Plc
Melksham, Wiltshire
SN12 6TP, England

Compaq Computer Corp.
Houston, TX 77070

Computer Automation Inc.
Irvine, CA 92713

Computer Systems
St. Clair Shores, MI 48081

Fortune Systems Corp.
Redwood City, CA 94065

Hewlett-Packard Co.
Cupertino, CA 95014

IBM Corp.
Boca Raton, FL 33432

Intel Corp.
Phoenix, AZ 85027

ISI International
Sunnyvale, CA 94086

Kaypro Corp.
Del Mar, CA 92014

Lobo Systems Inc.
Santa Barbara, CA 93101

Masscomp
Westford, MA 01886

MDB Systems
Orange, CA 92613

Micro-Link Corp.
Carmel, IN 46032

Monroe Systems For Business
Morris Plains, NJ 07950

Phaze Information Machines Corp.
Scottsdale, AZ 85260

Quay Corp.
Eatontown, NJ 07724

Sony Corp.
Park Ridge, NJ 07656

Sumitronics Inc.
Tustin, CA 92680

Visual Technology Inc.
Lowell, MA 01851

Wave Mate Inc.
Hawthorne, CA 90250

Zendex Corp.
Dublin, CA 94568

One Million Samples/Second
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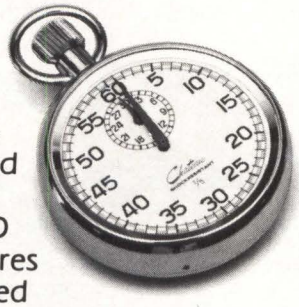
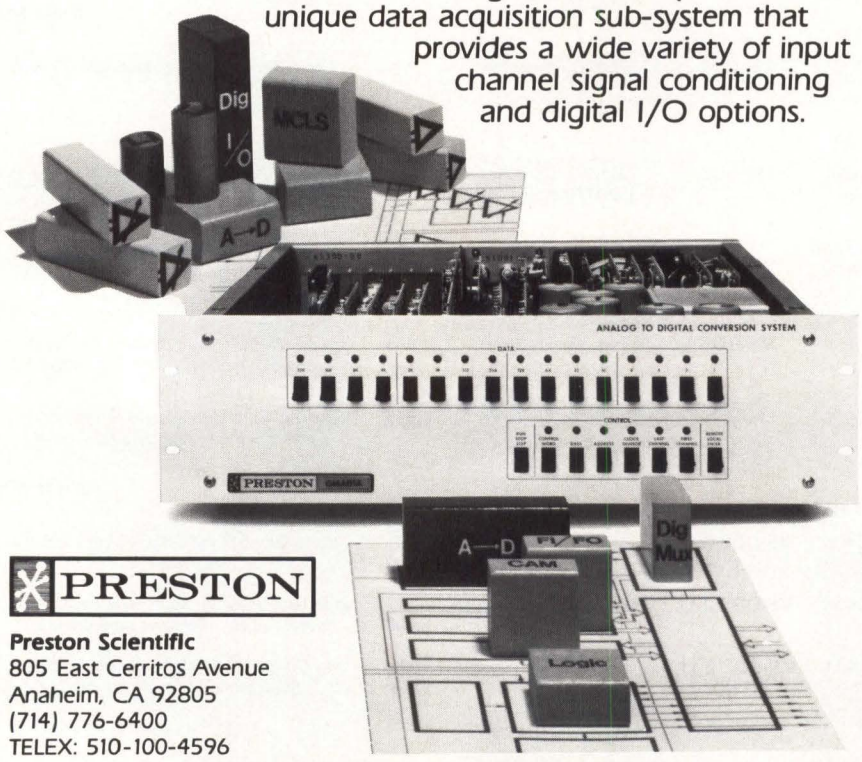


Preston Scientific's GMAD1A A to D Conversion Systems provide 1MHz conversion, 15-Bit resolution, and multiplexed inputs with up to 512 channels.
All of Preston's GM & EM Series A to D Conversion Systems include these features and more . . . such as software supported interfaces to DEC, Micro Vax, HP 1000, IBM PC and others.
Preston's building block concept results in a unique data acquisition sub-system that provides a wide variety of input channel signal conditioning and digital I/O options.



PRESTON

Preston Scientific
805 East Cerritos Avenue
Anaheim, CA 92805
(714) 776-6400
TELEX: 510-100-4596

NEXT MONTH IN MMS

Graphics gets the feature spotlight in the July issue of Mini-Micro Systems.
Features will include:

- A detailed look at enhanced graphics adaptors (EGAs) which inhance graphics capabilities in systems such as CAD/CAE.
- Part II of MMS's study of OSI standards. The article will cover the upper level of OSI protocols.

LOOKING AHEAD IN MMS

Be sure to watch for these editorial highlights in coming issues of Mini-Micro Systems.

- The August issue will cover single-board computers and microprocessors.
- Data communications and local area networks will be profiled in the September issue.
- Add-in/add-on subsystems will be studied in the October issue.

A STUDY COMPARING DEC® PYRAMID, SUN, AND SEQUENT LED TO THE FOLLOWING CONCLUSIONS...

CIRCLE NO. 90 ON INQUIRY CARD

CLEA

There's only one thing bigger than DEC's VAX® when it comes to UNIX® timesharing.

DEC's cost.

Well, now you can go ahead and bulldoze that DEC.

THE PRACTICAL PARALLEL® BREAKS NEW GROUND.

Sequent's family of parallel computers lets you run two to three times as many users as a VAX. For the same money.

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R THE DECS.®

The Practical Parallel never runs slow because it's based on parallel technology.

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It's like getting an entire DEC product line in one box.

The Practical Parallel supports UNIX 4.2 bsd and System V concurrently. So it runs a ton of software for database applications, software development, office automation, or any other UNIX application.

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The Practical Parallel has a proven MTBF of over 11,000 hours. That's more than a year without a failure.

And thanks to our parallel architecture and automatic reconfiguration, even if your system does fail you should be able to bring it right back up again.

Okay, we know all this sounds almost too good to believe.

But Texas Instruments and Hughes Aircraft and General Electric and dozens of other major companies already have Sequent systems up and running at over 80 sites around the country.

For your copy of our 1986 multiuser benchmark report, call 800/854-0428. Or write to us at 15450 S.W. Koll Pkwy., Beaverton, Oregon 97006-6063.

We'll show you how to get a high performance UNIX system without digging yourself into a hole.

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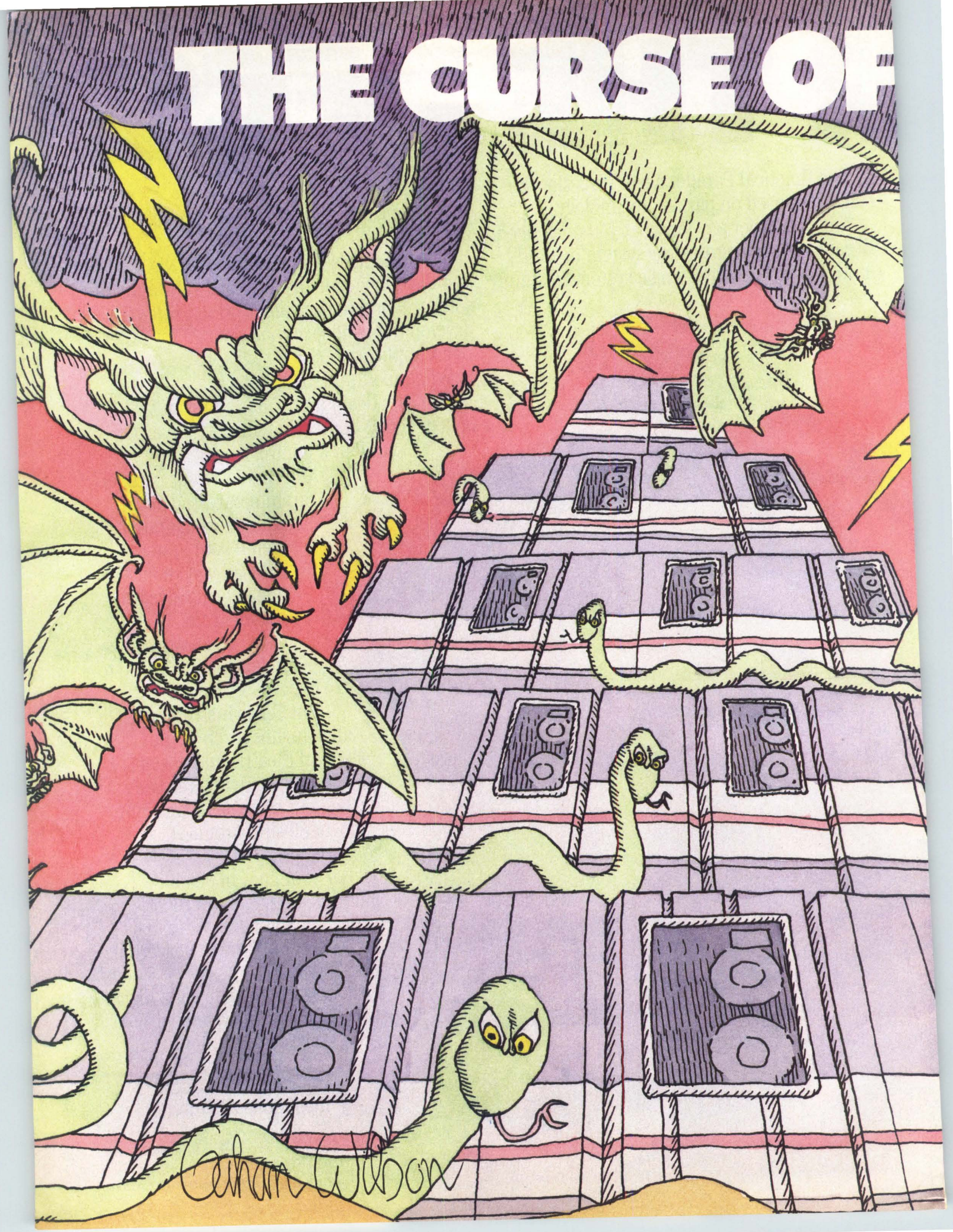
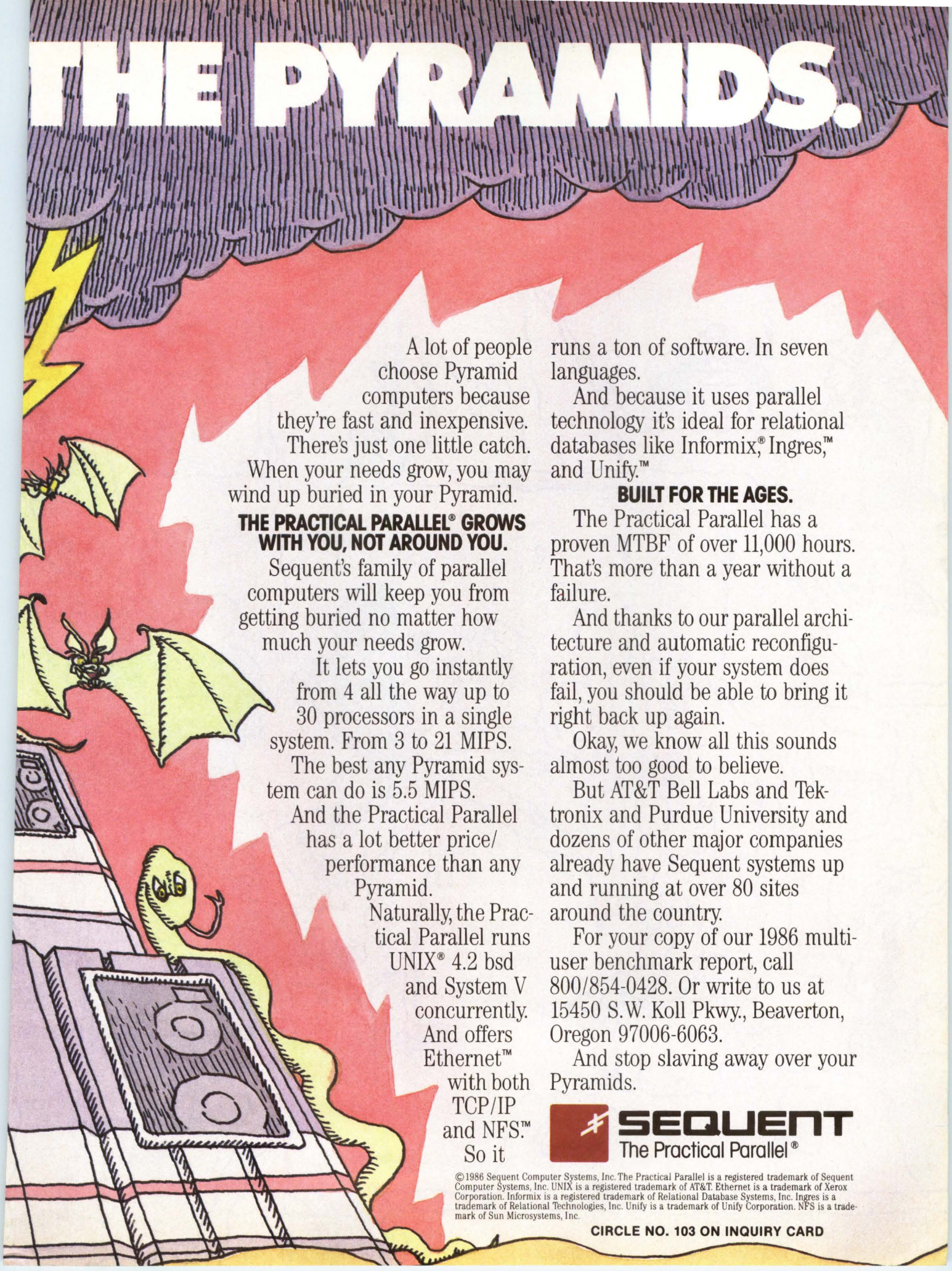

THE CURSE OF

THE PYRAMIDS.



A lot of people choose Pyramid computers because they're fast and inexpensive. There's just one little catch. When your needs grow, you may wind up buried in your Pyramid.

THE PRACTICAL PARALLEL® GROWS WITH YOU, NOT AROUND YOU.

Sequent's family of parallel computers will keep you from getting buried no matter how much your needs grow.

It lets you go instantly from 4 all the way up to 30 processors in a single system. From 3 to 21 MIPS. The best any Pyramid system can do is 5.5 MIPS.

And the Practical Parallel has a lot better price/performance than any Pyramid.

Naturally, the Practical Parallel runs UNIX® 4.2 bsd and System V concurrently. And offers Ethernet™ with both TCP/IP and NFS.™ So it runs a ton of software. In seven languages.

And because it uses parallel technology it's ideal for relational databases like Informix,® Ingres,™ and Unify.™

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The Practical Parallel has a proven MTBF of over 11,000 hours. That's more than a year without a failure.

And thanks to our parallel architecture and automatic reconfiguration, even if your system does fail, you should be able to bring it right back up again.

Okay, we know all this sounds almost too good to believe.

But AT&T Bell Labs and Tektronix and Purdue University and dozens of other major companies already have Sequent systems up and running at over 80 sites around the country.

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And stop slaving away over your Pyramids.

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CIRCLE NO. 103 ON INQUIRY CARD

THE S

THIS IS WHERE UN DON'T SHINE.

Sun is one of the hottest names in workstations.

But there are times when even a network of the best workstations can't take the heat. Not Sun. Not Apollo. Not PC/AT.

Like when your network is jammed with users sharing a single data base. Or when a single workstation gets overloaded with work. Or when you have so many users, multiple workstations are just too expensive and too hard to handle.

THE PRACTICAL PARALLEL® WILL MAKE YOUR SUN SHINE AGAIN.

Sequent's family of parallel computers lets you offload some of the users or data intensive applications that are causing network congestion.

With up to 21 MIPS in a single box and dynamic load balancing, your system never slows down. Even during peak hours.

And it's easy to add more users because you can instantly add more power. In whatever increments your workload demands.

Naturally, the Practical Parallel runs UNIX® 4.2 bsd and System V concurrently. So it runs a ton of software for any UNIX application.

And Sequent gives you all the software you need to talk to your favorite workstation. Ethernet™ with TCP/IP. NFS™ distributed file system. Even software that lets you turn your PC into a windowed UNIX workstation.

The Practical Parallel has a proven MTBF of over 11,000 hours. That's more than a year without failure.

And thanks to our parallel architecture and automatic reconfiguration, even if your system does fail, you should be able to bring it right back up again.

Okay, we know all this is hard to believe.

But Siemens and MCC and Argonne National Laboratories and the University of Texas and dozens of other major companies already have Sequent systems up and running at over 80 sites around the country.

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And let your workstations shine again.

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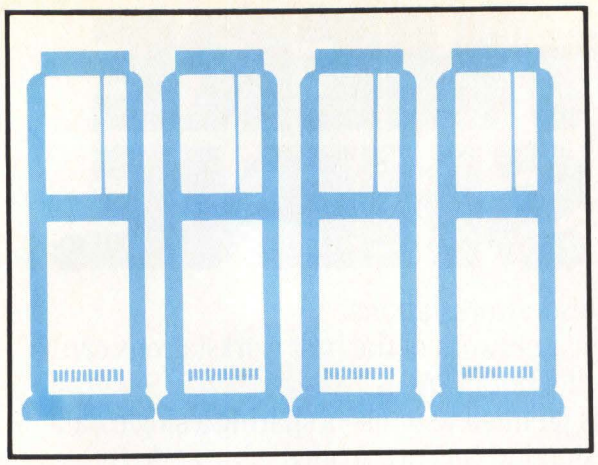
CIRCLE NO. 104 ON INQUIRY CARD



Multiuser microcomputers

Company Model	CPU word size (bits)	CPU type	Main memory min.-max. (bytes)	Operating systems available	Programming languages supported	Base price $	Base configuration
ACTION COMPUTER ENTERPRISE INC. 430 N. Halstead, Pasadena, CA 91107, (818) 351-5451							**Circle 649**
X-3 Desk Top	16	80186	512K-7M	Concurrent DOS, CP/M, CP/M Plus, dpc/OS, MS-DOS, PC-DOS		11,500	one 5¼-inch, 620K-byte flexible and one 5¼-inch, 85M-byte rigid drive; up to seven terminals
Tower X-3	16	80186	512K-16M	Concurrent DOS, CP/M, CP/M Plus, dpc/OS, MS-DOS, PC-DOS		18,900	two 5¼-inch, 620K-byte flexible and one 5¼-inch, 85M-byte rigid drive(s); up to 16 terminals
ALTOS COMPUTER SYSTEMS 2641 Orchard Pkwy., San Jose, CA 95134, (408) 946-6700							**Circle 650**
486	16	80186	512K-896K	XENIX	BASIC, COBOL, FORTRAN, Pascal	6,490	one 5¼-inch, 1M-byte flexible and one 5¼-inch, 25M-byte rigid drive; up to four terminals
886/986-T	16	80286/8086	1M	XENIX/Concurrent CP/M, XENIX	BASIC, COBOL, FORTRAN, Pascal	7,990/13,490	one 5¼-inch, 1.6M-byte flexible and one 5¼-inch, 25M-byte rigid drive/one 5¼-inch, 1M-byte flexible and one 5¼-inch, 40M-byte rigid drive
1086/2086	16	80286	1M/1M-4M	XENIX	BASIC, COBOL, FORTRAN, Pascal	14,990/19,990	one 5¼-inch, 1.6M-byte flexible and one 5¼-inch, 50M-byte rigid drive/one 5¼-inch, 1.6M-byte flexible and one 5¼-inch, 80M-byte rigid drive
ALPHA MICROSYSTEMS P.O. Box 25059, Santa Ana, CA 92799, (714) 957-8500							**Circle 651**
AM-1000 Series	16	68000	1M-16M	AMOS, UNIX	BASIC, C, COBOL, FORTRAN, Pascal	6,500-21,000	one 5¼-inch, up to 70M-byte rigid drive
AM-1500 Series	16	68010	2M-16M	AMOS, UNIX	BASIC, C, COBOL, FORTRAN, Pascal	20,000-75,000	one 5¼-inch, 400M-byte rigid drive; can be upgraded to 68020
AM-2000 Series	32	68020	2M-28M	AMOS, UNIX	BASIC, C, COBOL, FORTRAN, Pascal	22,000-80,000	one 5¼-inch, 400M-byte rigid drive; runs all AMOS software
AMPRO COMPUTERS INC. 67 E. Evelyn Ave., Mountain View, CA 94041, (415) 962-0230							**Circle 652**
Series 200	16	80186	512K-1M	Concurrent DOS, Turbo-DOS	any MS-DOS generic	1,295	two 5¼-inch, 400K-byte flexible drives
BURROUGHS CORP. One Burroughs Place, Detroit, MI 48232, (313) 972-7000							**Circle 653**
B26	16	80186	256K-1M	BTOS, MS-DOS	BASIC, COBOL, FORTRAN, Pascal	3,195	one 1M-byte flexible drive; includes power supply; ¼-inch tape drive available
B28	16	80286, 80287	1M-4M	BTOS, MS-DOS	BASIC, COBOL, FORTRAN, Pascal	5,130-6,130	one 1M-byte flexible drive; includes power supply; ¼-inch tape drive available

Multiuser microcomputers

Company / Model	CPU word size (bits)	CPU type	Main memory min.-max. (bytes)	Operating systems available	Programming languages supported	Base price $	Base configuration
CHRISLIN INDUSTRIES INC. 31352 Via Colinas, Suite 101, Westlake Village, CA 91362, (818) 991-2254							**Circle 654**
Micro-11A/ Micro-11B	16	LSI-11/23+	256K-4M	RSX-11M, RT-11, TSX Plus, ULTRIX		6,095/ 7,295	two 5¼-inch, 800K-byte flexible and one 5¼-inch, 10M-, 30M-, or 60M-byte rigid drive(s)/two 8-inch, 2M-byte flexible and one 5¼-inch, 20M-, 40M-, or 100M-byte rigid drive(s)
Micro-11C	16	LSI-11/73	256K-4M	RSX-11M, RT-11, TSX Plus, ULTRIX		11,995	two 8-inch, 2M-byte flexible and one 5¼-inch, 20M-, 40M-, or 100M-byte rigid drive(s); 70M-byte streaming tape drive
COMARK CORP. 93 West St., P.O. Box 474, Medfield, MA 02052, (617) 359-8161							**Circle 655**
Diskstor M-6	16	8086	1K	Concurrent CP/M	Ada, BASIC, C, FORTRAN, Pascal	11,995	one 8-inch, 512K-byte flexible and one 5¼-inch, 20M-byte rigid drive; 16 terminals; parallel printer
COMPUPRO/VIASYN CORP. 26538 Danti Ct., Hayward, CA 94545, (415) 786-0909							**Circle 656**
10 Plus	8, 16	Z80B, 8088	1M	Concurrent DOS 816	C, BASIC, FORTRAN, Pascal	6,195	one 5¼-inch, 800K-byte flexible and one 5¼-inch, 20M-byte rigid drive
286 Series	16	80286	512K-16M	Concurrent DOS 816	C, BASIC, FORTRAN, Pascal	7,895	one 5¼-inch, 800K-byte flexible and one 5¼-inch, 20M-byte rigid drive
816/C2	8, 16	Z80H, 80286	256K-16M	Concurrent DOS 816	C, BASIC, FORTRAN, Pascal	8,895	one 5¼-inch, 800K-byte flexible and one 5¼-inch, 20M-byte rigid drive
COMPUTER AUTOMATION INC. 2181 Dupont Dr., Irvine, CA 92713, (714) 833-8830							**Circle 657**
OMNIX III	16	Scout	128K-2M	OMNIX, OPUS, OS4	Assembly, FORTRAN, Pascal, TRANS BASIC	6,795	one 5¼-inch, 1M-byte flexible and one 5¼-inch, 20M-byte rigid drive; Cipher 32M-byte streaming tape drive
NM 4/08	16	NM 4	128K-2M	OS4, RTX4/IOS4	Assembly, BCPL, CORAL, FORTRAN, Pascal	3,060	
CONCURRENT COMPUTER CORP. (FORMERLY PERKIN-ELMER) Two Crescent Place, Oceanport, NJ 07757, (201) 876-4500							**Circle 658**
XF/200, XF/300	16		1M-4M	MicroXELOS	Assembly, BASIC, C, FORTRAN, RM COBOL, UNIBOL	13,325/ 14,000	one 5¼-inch, 320K-byte flexible and one 5¼-inch, 51M-byte rigid drive; XF/300: 17.2M-byte tape drive backup
CORDATA INC. (FORMERLY CORONA DATA SYSTEMS INC.) 275 E. Hillcrest Dr., Thousand Oaks, CA 91360, (805) 495-5800							**Circle 659**
Mega PC	16	8088	512K	MS-DOS 3.10, MS-NET 1.0		6,640	one 5¼-inch, 360K-byte flexible and one 5¼-inch, 10M-byte rigid drive; one terminal
DATA GENERAL CORP. 4400 Computer Dr., Westboro, MA 01580, (617) 366-8911							**Circle 660**
DESKTOP GENERATION Model 10/10SP	16	micro-ECLIPSE, 8086	128K	AOS/WS, CP/M-86, MS-DOS, MP-AOS, RDOS	Business BASIC, Extended BASIC, FORTRAN, Interactive COBOL, PL/1	3,310	one 5¼-inch, 368K-byte flexible drive; one terminal
DESKTOP GENERATION Model 20	16	microECLIPSE	256K	AOS/WS, RDOS	Business BASIC, Extended BASIC, FORTRAN, Interactive COBOL, PL/1	7,725	one 5¼-inch, 368K-byte flexible and one 15M-byte rigid drive
DESKTOP GENERATION Model 30	16	microECLIPSE	256K-2M	ASO/WS, RDOS	Business BASIC, Extended BASIC, FORTRAN, Interactive COBOL, PL/1	10,040	one 5¼-inch, 368K-byte flexible and one 15M-byte rigid drive
DATAMEDIA CORP. 11 Trafalgar Sq., Nashua, NH 03063, (603) 886-1570							**Circle 661**
20P/30P	32	68000	1M-2M/ 512K-2M	Pick			one 5¼-inch, 52M-byte rigid drive; six terminal ports
1620P/1624P	32	68010	1M-12M	Pick			one 5¼-inch, 52M-byte rigid drive; six terminal ports/one 5¼-inch, 143M-byte rigid drive; 16 terminal ports

Multiuser microcomputers

Company / Model	CPU word size (bits)	CPU type	Main memory min.-max. (bytes)	Operating systems available	Programming languages supported	Base price $	Base configuration
1620X/1640X	32	68010/68010, 68000(2)	1M-12M/ 2M-12M	UNIX System V	CBASIC, MBASIC, SML BASIC, RM COBOL, Philon FAST	13,500/ 18,500	one 5¼-inch, 52M-byte rigid drive; 1620X: one ¼-inch, 20M-byte streaming tape drive; 1640X: one ¼-inch, 80M-byte streaming tape drive
DATAPOINT CORP. 9725 Datapoint Dr., San Antonio, TX 78284, (512) 699-7000							**Circle 662**
3200	32	68000	1M-8M	UNOS, RMS	DATABUS, RM COBOL	18,500	one 1M-byte flexible and one 32M-byte rigid drive
DIGITAL EQUIPMENT CORP. 146 Main St., Maynard, MA 01754, (617) 897-5111							**Circle 663**
Micro PDP-11/83	16	proprietary (J-11)	256K-4M	RSX-11M, RSX-11M Plus, RSTS/E, RT-11	BASIC, COBOL, FORTRAN, MUMPS-11, Pascal	34,360	dual 5¼-inch, 800K-byte flexible drives; one terminal
Micro VAX II	32	proprietary (J-11)	1M-4M	Micro VMS, ULTRIX 32-M		20,000	dual 5¼-inch, 800K-byte flexible drives; one terminal
DUAL SYSTEMS CORP. 2530 San Pablo Ave., Berkeley, CA 94702, (415) 549-3854							**Circle 664**
Chaparral III/IV	32	68020/68881	1M-17M	UNIX System V 2.2	BASIC, C, COBOL, FORTRAN, LISP	21,900/ 26,900	one 5¼-inch, 1.6M-byte flexible drive; Chaparral III: one 5¼-inch, 171M-byte rigid drive; eight terminals; Chaparral IV: one 8-inch, 337M-byte rigid drive; eight terminals
FIRST COMPUTER CORP. 645 Blackhawk Dr., Westmont, IL 60559, (312) 920-1050							**Circle 665**
Gemini 23/ Gemini 73	16	LSI-11/23/ LSI-11/73	256K-2M	RSTS, RSX-11, RT-11, TSX Plus, UNIX	BASIC, C, COBOL, FORTRAN	23,550/ 23,850	one 10-inch, 80M-, 160M-byte rigid drive
Spirit 23/ Spirit 73	16	LSI-11/23/ LSI-11/73	256K-1M	RSTS, RSX-11, RT-11, TSX Plus	BASIC, COBOL, FORTRAN	14,750/ 16,650	two 8-inch, 20M-byte rigid drives; Spirit 23: six terminals; Spirit 73: 18 terminals
Taurus 73	16	LSI-11/73	256K-2M	RSTS, RSX-11, RT-11, TSX Plus, UNIX	BASIC, C, COBOL, FORTRAN	21,950	one 10-inch, 160M-byte rigid drive; ½-inch tape drive
FUJITSU MICROSYSTEMS OF AMERICA INC. 3025 Orchard Pkwy., San Jose, CA 95134, (408) 434-1160							**Circle 666**
Micro 16sx	16	8086	384K-1M	Concurrent CP/M-86	CBASIC Compiler, C Compiler, Level II COBOL, Pascal MT, P BASIC, PL/1		one 5¼-inch, 360K-byte flexible and one 5¼-inch, 54M-, 85M-byte rigid drive; eight terminals
System 2000/ System 2020	16	8086/80286	384K-1M	Pick	Assembly, DATA BASIC		one 5¼-inch, 360K-byte flexible and one 5¼-inch, 13M-, 26M-, rigid drive; eight terminals; ¼-inch tape drive backup
GENERAL MICRO SYSTEMS INC. 4740 Brooks St., Montclair, CA 91789, (714) 625-5475							**Circle 667**
68KV-EN 3/ 68KV-EN 5	16	68010	512K-2M	P-DOS	BASIC, C, Pascal	7,295/ 5,995	one 3½-inch, 1M-byte flexible and one 3½-inch, 10M-byte rigid drive/one 5¼-inch, 1M-byte flexible and one 5¼-inch, 10M-byte rigid drive
HEURIKON CORP. 3201 Latham Dr., Madison, WI 53713, (800) 356-9602							**Circle 668**
Minibox/MLZ-814	16	68010	512K-16M	UNIX System V 2.2, VRTX	Ada, BASIC, C, COBOL, FORTRAN, Pascal	9,000/ 11,000	one 5¼-inch, 1M-byte flexible and one 5¼-inch, 30M-byte rigid drive
HEWLETT-PACKARD CO, 3404 E. Harmony Rd., Fort Collins, CO 80525, (303) 226-3800							**Circle 669**
550	32	proprietary	2M-10M	HP-UX	BASIC, C, FORTRAN 77, Pascal	19,425	
INTEGRATED BUSINESS COMPUTERS (IBC) 21621 Nordhoff St., Chatsworth, CA 91311, (818) 882-9007							**Circle 670**
Ensign/System-68	16	68010	2M-8M	UNIX System V, THEOS-68K	BASIC, C, COBOL, FORTRAN, Pascal	23,995/ 13,995	one 8-inch, 1.6M-byte flexible drive; 16 terminals; serial, parallel printer; Ensign: one 8-inch, 85M-byte rigid drive; System-68: one 5¼-inch, 86M-byte rigid drive

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Multiuser microcomputers

Company / Model	CPU word size (bits)	CPU type	Main memory min.-max. (bytes)	Operating systems available	Programming languages supported	Base price $	Base configuration
Multistar/ Megastar	8	Z80H	512K/ 512K-1M	THEOS 8	BASIC, COBOL	4,495/ 6,995	one 5¼-inch, 1M-, 1.6M-byte flexible drive; Multistar: one 5¼-inch,12M-byte rigid drive, five terminals; Megastar: one 5¼-inch, 27M-byte rigid drive; 15 terminals
Super Cadet	8	Z80H	640K	THEOS 8	BASIC, COBOL	12,395	one 8-inch, 1.6M-byte flexible and one 8-inch, 85M-byte rigid drive; 15 terminals; serial, parallel printer
INTEL CORP. 2402 W. Beardsley Rd., Phoenix, AZ 85027, (602) 869-3805							**Circle 700**
SYSTEM 310 AP Model 142	16	80286	2M-9M	XENIX 3.0	Assembly, BASIC, C, COBOL, FORTRAN	19,250 (OEM)	one 5¼-inch, 360K-byte flexible and one 5¼-inch, 140M-byte rigid drive; ¼-inch, 60M-byte tape cartridge backup; supports up to eight users
SYSTEM 310 AP Model 146	16	80286	2M-9M	XENIX 3.0	Assembly, BASIC, C, COBOL, FORTRAN	19,950 (OEM)	one 5¼-inch, 360K-byte flexible and one 5¼- inch, 140M-byte rigid drive; ¼-inch, 60M-byte tape cartridge backup; supports up to 16 users
SYSTEM 310 APEX2	16	80286 (2)	2M-16M	XENIX 3.0	Assembly, BASIC, C, COBOL, FORTRAN	17,950 (OEM)	one 5¼-inch, 360K-byte flexible and one 5¼-inch, 40M-byte Winchester drive; ¼-inch, 60M-byte tape cartridge backup; supports up to eight users
INTELLIMAC INC. 6001 Montrose Rd., Sixth Floor, Rockville, MD 20852, (301) 984-8000							**Circle 671**
IN/7000 M	16, 32	68000	4M-16M	UNIX System V	Ada, C, FORTRAN 77	39,390	one 5¼-inch, 53M-byte rigid drive; 9-track tape drive
IN/7000 AT/R	16, 32	68000	4M-16M	UNIX System V	Ada, C, FORTRAN 77	39,950	ruggedized
IRONICS INC. 798 Cascadilla St., Ithaca, NY 14850, (607) 277-4060							**Circle 672**
Performer 16	16	68010	1M-16M	UNIX	Ada, AS. ASM-68, BASIC, C, COBOL, FORTRAN, Pascal	11,795	one 5¼-inch, 640K-byte flexible and one 5¼-inch, 30M-byte rigid drive
Performer 32	32	68010, 68020	1M-16M	UNIX System V	C, FORTRAN, Pascal	15,500	one 5¼-inch, 640K-byte flexible and one 5¼-inch, 80M-byte rigid drive
ISOTRON INC. 140 Sherman St., Fairfield, CT 06430, (203) 255-7443							**Circle 673**
OSI 712	32	68010	2M-4M	RTIX System V, XENIX 5	APL, COBOL, C, FORTRAN, Pascal, OSI BASIC	9,990	one 5¼-inch, 1.2M-byte flexible and one 5¼-inch, 25M-byte rigid drive
ITT INFORMATION SYSTEMS 2350 Qume Dr., San Jose, CA 95131, (408) 945-8950							**Circle 674**
EXTRA XL Model III, IV	16	8086	1.6M-16M	ITT DOS 3.1	BASIC, FORTRAN, Pascal	10,299	one 5¼-inch, 1.2M-byte flexible and one 5¼-inch, 40M-byte rigid drive; 60M-byte tape drive backup
J.C. INFORMATION SYSTEMS 161 Whitney Place, Fremont, CA 94539, (415) 659-8440							**Circle 675**
4X-1H36	8	Z80H	256K-1M	Turbo-DOS 1.42	BASIC, C, LISP, DATAFLEX, DBASE, Modula, Pascal	6,795	one 5¼-inch, 770K-byte flexible and one 5¼-inch, 36M-byte rigid drive; four terminals
5071H36	8, 16	Z80H, 80186	128K-1M	Turbo-DOS 1.42	BASIC, C, LISP, DATAFLEX, DBASE, Modula, Pascal	8,995	one 5¼-inch, 770K-byte flexible and one 5¼-inch, 36M-byte rigid drive; four terminals
5102H85	16	80186	1M-6M	Turbo-DOS 1.42	BASIC, C, LISP, DATAFLEX, DBASE, Modula, Pascal	19,670	two 5[/14]-inch, 1.4M-byte flexible and one 5¼-inch, 85M-byte rigid drive; four terminals
L/F TECHNOLOGIES (FORMERLY IMS INTERNATIONAL) 2800 Lockheed Way, Carson City, NV 89701, (702) 883-7611							**Circle 676**
1620	16	80186	256K-9M	Concurrent DOS, Turbo-DOS	CBASIC, CBASIC-80, CBASIC-86, DATAFLEX	16,000	two 5¼-inch, 820K-byte flexible and two 5¼-inch, 280M-byte rigid drives

Multiuser microcomputers

Company / Model	CPU word size (bits)	CPU type	Main memory min.-max. (bytes)	Operating systems available	Programming languages supported	Base price $	Base configuration
1630	16	80186	256K-9.2M	Concurrent DOS, Turbo-DOS	CBASIC, CBASIC-80, CBASIC-86, DATAFLEX	10,000	two 8-inch, 1.2M-byte flexible and one 5¼-inch, 140M-byte rigid drive(s)
1650	16	80186	256K-31M	Concurrent DOS, Turbo-DOS	C BASIC, C BASIC-80, C BASIC-86, DATAFLEX	22,000	two 5¼-inch, 800K-byte or two 8-inch, 1.2M-byte flexible and three 5¼-inch, 420M-byte rigid drives
LITTLE MACHINES INC. 4241 Jutland Dr., Suite 103, San Diego, CA 92117, (619) 483-3606							**Circle 677**
DN-16	16	80286, 80186	1M-1.6M	RMX 286, VRTX 86, XENIX	ASM 86, ASM 286, C, PLM	5,000	three to 11 terminals; Centronics printer
SA-16	16	80286, 80186	1M-1.6M	RMX 286, VRTX 86, XENIX	ASM 86, ASM 286, C, PLM	9,000	one 5¼-inch, 1.6M-byte flexible and one 5¼-inch, 40M-byte rigid drive; three to 19 terminals; Centronics printer
WN-16	16	80286, 80186	1M-1.6M	RMX 286, VRTX 86, XENIX	ASM 86, ASM 286, C, PLM	6,500	one 3½-inch, 20M-byte rigid drive; Centronics printer
LOMAS DATA PRODUCTS INC. 182 Cedar Hill St., Marlboro, MA 01752, (617) 460-0333							**Circle 678**
S100PC-TM	16	80186	512K-1M	Concurrent DOS 4.1	BASIC, C, COBOL, Pascal	6,095	two 5¼-inch, 360K-byte flexible and one 5¼-inch, 40M-byte rigid drive
MAI BASIC FOUR 14101 Myford Rd., Tustin, CA 92680, (714) 731-1500							**Circle 679**
MAI 2000	16	68010	768K-1.5M	BOSS/IX	Business BASIC, COBOL, C	18,395	one 5¼-inch, 44M-byte rigid drive; one terminal; character printer; controller
MICRO FIVE CORP. 3560 Hyland Ave., Costa Mesa, CA 92626, (714) 957-1517							**Circle 680**
Series 5000	16	80286	512K-16M	MS-DOS, XENIX	C, GW BASIC	5,440	one 5¼-inch, 1.2M-byte flexible and one 5¼-inch, 45M-byte rigid drive
MIZAR INC. 20 Yorkton Ct., St. Paul, MN 55117, (612) 224-8941							**Circle 681**
VME 9000/ VME 9100	16	68000, 68010	512K-2M	CP/M-68K, P-DOS, polyFORTH, OS9-68K	BASIC, BASIC 09, C, FORTRAN 77, Pascal	3,495/ 4,795	two 5¼-inch, 1M-byte flexible drives; Centronics-compatible printer; VME 9100: one 5¼-inch, 20M-byte rigid drive
VME 9200	16	68000, 68010	512K-2M	CP/M-68K, P-DOS, polyFORTH, OS9-68K	BASIC, BASIC 09, C, FORTRAN 77, Pascal	6,495	one 5¼-inch, 1M-byte flexible and one 5¼-inch, 20M-byte rigid drive; 17 VME expansion slots; Centronics-compatible printer
VME 9400	16	68000, 68010	512K-2M	CP/M-68K, P-DOS, polyFORTH, OS9-68K	BASIC, BASIC 09, C, FORTRAN 77, Pascal	5,295	one 5¼-inch, 1M-byte flexible and one 5¼-inch, 20M-byte rigid drive; Centronics-compatible printer; controller; three expansion slots
MOTOROLA COMPUTER SYSTEMS (FORMERLY MOTOROLA/FOUR-PHASE) 10700 N. De Anza Blvd., Cupertino, CA 95014, (408) 255-0900							**Circle 682**
6200	16	6809E	384K		MUMPS	25,660	one 5¼-inch, 67M-byte rigid drive; six terminals; character printer; 60M-byte streaming tape drive
6300/6350	16, 32	68010	512K-2M/1M-2M	UNIX-derived	BASIC, C, COBOL, RM COBOL, Pascal, SIBOL	20,500/ 28,100	one 5¼-inch, 655K-byte flexible and one 5¼-inch, 37M-byte rigid drive; 6300: six terminals; 6350: eight terminals; 60M-byte streaming tape drive
6400/6600	16, 32	6809E, 68010/ 68010	1M-2M/ 1M-4M	UNIX-derived	BASIC, C, COBOL, RM COBOL, FORMS, Pascal, SIBOL	35,400/ 76,800	6400: one 5¼-inch, 67M-byte rigid drive; ten terminals; controller; 60M-byte streaming tape drive; 6600: three 5¼-inch, 37M-byte rigid drives; 14 terminals; 60M-byte streaming tape drive
NABU NETWORK 1719 St. Laurent Blvd., Ottawa, Ontario, K1G 3V4, Canada (613) 526-1426							**Circle 683**
NPC	8	Z80A	64K	CP/M	Assembly, BASIC, LOGO	150	two 5¼-inch, 200K-byte flexible drives
NATIONAL SEMICONDUCTOR DATACHECKER/DTS 800 Central Expwy., Santa Clara, CA 95050, (408) 986-0860							**Circle 684**
610/620	8	8088	256K	MS-DOS 2.1			

Multiuser microcomputers

Company / Model	CPU word size (bits)	CPU type	Main memory min.-max. (bytes)	Operating systems available	Programming languages supported	Base price $	Base configuration
NCR CORP. (PERSONAL COMPUTER DIV.) 1601 S. Main St., Dayton, OH 45479, (513) 445-7478							**Circle 685**
3279-0101	16	80286-8	256K-16M	NCR-DOS, XENIX System V	GW BASIC	3,795	one 5¼-inch, 1.2M-byte flexible drive; bundled software; eight expansion slots
3279-0202	16	80286-8	512K-16M	NCR-DOS, XENIX System V	GW BASIC	5,505	one 5¼-inch, 1.2M-byte flexible and one 5¼-inch, 20M-byte rigid drive; bundled software; eight expansion slots
NEC INFORMATION SYSTEMS INC. 1414 Massachusetts Ave., Boxboro, MA 01719, (617) 264-8000							**Circle 686**
APC	16	8086	128K-512K	CP/M-86, MS-DOS 2.11		2,748	one 8-inch, 1M-byte flexible drive
APC III	16	8086-2	128K-640K	MS-DOS 2.11, PC-UX (UNIX III)		1,595	one 5¼-inch, 360K-byte flexible drive; one terminal
NIXDORF COMPUTER CORP. 300 Third Ave., Waltham, MA 02154, (617) 890-3600							**Circle 687**
8850 Micro 5	16		128K	DPEX		9,950	one 1.2M-byte flexible and one 10M-byte rigid drive; one terminal
8890	32	proprietary	1M-8M	DOS/VSE, DOS/VS, NIDOS/VSE, SSX/SP, VM/SP	COBOL	83,385	two 200M-byte rigid drives; four terminals; 600-lpm printer; controller; 20K-, 160K-byte streaming tape drive
M7	16		256K-512K	NIROS	BASIC	12,795	one 800K-byte flexible and one 10M-byte rigid drive; one or two terminals; character printer
NORTH STAR COMPUTERS INC. 14440 Catalina St., San Leandro, CA 94577, (415) 357-8500							**Circle 688**
Dimension 300	16	80186, 8888-2	512K-2.5M	North Star DOS		12,900	one 5¼-inch, 360K-byte flexible and one 30M-byte rigid drive; one ¼-inch streaming tape drive backup
Dimension 1200	16	80186	512K-2.5M	North Star NetWare		19,900	one 5¼-inch, 360K-byte flexible drive; one ¼-inch streaming tape drive backup
OMNIBYTE CORP. 245 W. Roosevelt Rd., W. Chicago, IL 60185, (312) 231-6880							**Circle 689**
OB68K/SYSII	16, 32	68000	512K-1.6M	IDRIS, polyFORTH 32	BASIC, C, FORTH, FORTRAN, Pascal	10,995	one 8-inch, 1.6M-byte flexible and one 5¼-inch, 32M-byte rigid drive
PERTEC COMPUTER CO. 17032 Armstrong Ave., Irvine, CA 92714, (714) 863-7580							**Circle 690**
3215	16	68000	512K-1.5M	M BOS, OS/3200, Pick	BASIC, RM COBOL	7,530	one 5¼-inch, 1M-byte flexible and one 5¼-inch, 26M-byte rigid drive
3235	32	68000, 68020	1M-10M	M BOS, OS/3200, Pick	BASIC, RM COBOL	22,500	one 5¼-inch, 1M-byte flexible and one 5¼-inch, 85M-byte rigid drive; tape cartridge drive
3280	32	68000, 68020	1M-15M	M BOS, OS/3200, Pick	BASIC, RM COBOL	39,990	one 8-inch, 1M-byte flexible and one 8-inch, 330M-byte rigid drive; ½-inch tape cartridge drive
SENTINEL COMPUTER CORP. 8800 Governor's Hill Dr., Cincinnati, OH 45249, (513) 677-2400							**Circle 691**
PCX Base XT System	16	8088	256K-640K	DBOS, PC-DOS	BASIC, COBOL, Pascal	13,995	one 5¼-inch, 360K-byte flexible and one 5¼-inch, 30M-byte rigid drive; five terminals; matrix, line printer; tape cartridge drive
SHARP ELECTRONICS CORP. Sharp Plaza, Mahwah, NJ 07430, (201) 599-8971							**Circle 692**
OA-95		68000	512K-1.3M	UNIX System III	BASIC, C, COBOL, FORTRAN, SCHPOL, Pascal		one 1M-byte flexible and one 10M- to 60M-byte rigid drive; controller
SORD COMPUTER OF AMERICA INC. Olympic Tower, 6th Floor, 645 Fifth Ave., New York, NY 10022, (212) 759-10140							**Circle 693**
M680UX (UNIBOX)	16	68010	1M-4M	Sord System V	C, FORTRAN	4,695	one 5¼-inch, 1.2M-byte flexible and one 5¼-inch, 20M-byte rigid drive; two terminals

Multiuser microcomputers

Company / Model	CPU word size (bits)	CPU type	Main memory min.-max. (bytes)	Operating systems available	Programming languages supported	Base price $	Base configuration
SPERRY CORP. P.O. Box 500, Bluebell, PA 19424, (215) 542-4011							**Circle 694**
5000/20, 5000/40	16	68010	1M-2M/ 1M-8M	UNIX System V	BASIC, C, COBOL, FORTRAN, RPG		45M-byte tape cartridge drive; battery backup; 5000/20: eight terminals; 5000/40: 16 terminals
5000/60, 5000/80	16	68000	1M-16M	UNIX System V	BASIC, C, COBOL, FORTRAN, RPG		45M-byte tape cartridge drive; battery backup; 5000/60: 32 terminals; 5000/80: 64 terminals
7000/40	32	proprietary	4M-32M	Berkeley UNIX Version 4.2, UNIX System V	BASIC, C, COBOL, FORTRAN, RPG		battery backup; 240 terminals
TANDY CORP. 1800 One Tandy Center, Fort Worth, TX 76102, (817) 390-3011							**Circle 695**
3000	16	80286	512K-12M	MS-DOS, XENIX	BASIC	2,599	one 5¼-inch, 1.2M-byte flexible drive; one terminal
6000	8, 16, 32	68000, Z80A	512K-1M	XENIX, TRS-DOS	BASIC	4,499	two 8-inch, 1.2M-byte flexible drives
WANG LABORATORIES INC. One Industrial Ave., Lowell, MA 01851, (617) 459-5000							**Circle 696**
Advanced Professional Computer	16	80286	256K-768K	IN/ix, MS-DOS, XENIX	Assembly, Advanced BASIC, COBOL, FORTRAN, Level II COBOL, Pascal	3,465	one 5¼-inch, 360K-byte flexible drive
WAVE MATE INC. 14009 S. Crenshaw Blvd., Hawthorne, CA 90250, (213) 978-8600							**Circle 697**
Bullet 286/4, Bullet 286/8	16	80286-8	256K-1M	Concurrent CP/M, PC-DOS, Pick, SMC, THEOS, UNIX	BASIC, C, COBOL, Pascal	4,995/ 5,995	one 5¼-inch, 360K-byte flexible and one 5¼-inch, 20M-byte rigid drive; four terminals; two printers
Bullet 286/T	16	80286-10	1M-4M	Concurrent CP/M, PC-DOS, Pick, SMC, THEOS, UNIX	BASIC, C, COBOL, Pascal	9,950	one 5¼-inch, 360K-byte flexible and one 5¼-inch, 50M-byte rigid drive; 16 terminals; two printers; battery backup
WICAT SYSTEMS INC. 1835 S. State, Orem, UT 84058, (801) 224-6400							**Circle 698**
1250/1255	16	68000	1M-5M	Pick, UNIX, WMCS	BASIC, C, COBOL, FORTRAN 77, Pascal	14,738/ 17,695	one 5¼-inch, 616K-byte flexible and one 5¼-inch, 28M-byte rigid drive; eight to 16 terminals; 1255: eight to 24 terminals
1260	16	68000	1M-7M	Pick, UNIX, WMCS	BASIC, C, COBOL, FORTRAN 77, Pascal	25,661	one 8-inch, 80M-byte rigid drive; eight to 32 terminals
2220	16	68000	4M-12.2M	Pick, UNIX, WMCS	BASIC, C, COBOL, FORTRAN 77, Pascal	43,418	one 8-inch, 80M-byte rigid drive; 16 to 64 terminals
XEPIX INC. (FORMERLY PIXEL SYSTEMS INC.) 51 Lake St., Nashua, NH 03060, (603) 881-8791							**Circle 699**
Gator S/ Gator L	32	68020	1M-13M/ 1M-24M	UNIX System V	COBOL, FORTRAN, Franz LISP, INFORMIX, UNIFY	6,995/ 15,900	Gator S: one 5¼-inch, 1M-byte flexible and one 5¼-inch, 20M-byte rigid drive; Gator L: one 5¼-inch, 42M-byte rigid drive; cassette backup
P80/20	32	68020	1M-16M	UNIX System V	COBOL, FORTRAN, Franz LISP, INFORMIX, UNIFY	16,000	one 5¼-inch, 1M-byte flexible and one 5¼-inch, 42M-byte rigid drive
System 4/P80	16, 32	68000	512K-6M	UNIX System V	COBOL, FORTRAN, Franz LISP, INFORMIX, UNIFY	5,975/ 12,000	System 4: one 8-inch, 6.2M-byte flexible and one 8-inch, 40M-byte rigid drive; two terminals; P80: one 5¼-inch, 1M-byte flexible and one 5¼-inch, 42M-byte rigid drive

Information was solicited but not received from the following manufacturers:

AT&T Information Systems
Morristown, NJ 07960

Cadmus Computer Systems
Lowell, MA 01854

California Computer Systems
Milpitas, CA 95035

Charles River Data Systems
Framingham, MA 01701

CIE Systems Inc.
Irvine, CA 92713

Cifer Plc
Melksham, Wiltshire
SN12 6TP, England

Codata Systems Corp.
Sunnyvale, CA 94086

Computer Systems
St. Clair Shores, MI 48081

Convergent Technologies Inc.
Santa Clara, CA 95050

Dynabyte Business Computers
Santa Clara, CA 95054

Esprit Computer Products Inc.
Montgomeryville, PA 18936

Flexible Computer Corp.
Dallas, TX 75229

General Automation Inc.
Anaheim, CA 92803

Gifford Computer Systems Inc.
San Leandro, CA 94577

Harris Corp.
Fort Lauderdale, FL 33309

IBM Corp.
Boca Raton, FL 33432

Independent Business Systems
Livermore, CA 94550

Inforex Inc.
Burlington, MA 01803

Lanier Business Products
Atlanta, GA 30324

M/A Com Information Systems
Rockville, MD 20852

Masscomp
Westford, MA 01886

MDB Systems Inc.
Orange, CA 92667

Megadata Corp.
Bohemia, NY 11716

Micro-Link Corp.
Carmel, IN 46032

Molecular Computer
San Jose, CA 95134

Onyx Systems Inc.
San Jose, CA 95131

OSM Computer Corp.
Mountain View, CA 94043

Pacific Microcomputers Inc.
Cardiff, CA 92007

Paradyne Corp.
Largo, FL 33540

Parallel Computers Inc.
Santa Cruz, CA 95060

Plexus Computers Inc.
San Jose, CA 95134

Polymorphic Systems
Santa Barbara, CA 93111

QDP Computer Systems
Cleveland, OH 44141

Quay Corp.
Eatontown, NJ 07724

Qubix Graphics Systems Inc.
San Jose, CA 95126

Rexon Business Machines Corp.
Culver City, CA 90230

SBE Inc.
Concord, CA 94520

SCI Systems
Huntsville, AL 35807

STM Electronics Corp.
Menlo Park, CA 94025

Stride Micro
Reno, NV 89502

Sykes Datatronics Inc.
Rochester, NY 14604

Systime Computers Ltd.
Leeds, LS11 OAL, England

Universal Data Research Inc.
Buffalo, NY 14221

XYZtek Corp.
Englewood, CO 80111

Zendex Corp.
Dublin, CA 94568

Zentec Corp.
Santa Clara, CA 95051

Zilog Inc.
Campbell, CA 95008

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	LA210 Letter Printer	1,299	125	70	47
	LA120 DECwriter III KSR	2,195	211	117	79
	VT220 Video Terminal	849	83	46	31
	VT240 Graphics Terminal	1,850	178	99	67
	VT241 Color Graphics Terminal	2,650	255	142	95
	LN03 Laser Printer	3,295	316	176	119
TI	TI707 Portable Data Terminal	$ 550	$ 53	$ 30	$ 20
	TI820 Data Terminal PKG KSR	1,995	192	107	72
	TI855 Dual Mode Printer	649	63	35	23
	TI865 Dual Mode Microprinter	810	78	43	29
WYSE	WY50 Video Terminal	$ 459	$ 44	$ 25	$ 17
	WY75 Video Terminal	559	54	30	20
	WY85 Video Terminal	459	44	25	17
PANASONIC	FT70 Executive Partner PC with 640K RAM	$2,395	$230	$128	$ 87
NORTHERN TELECOM	NT6K90 Displayphone Plus	$ 995	$ 96	$ 53	$ 36
CITOH & CIE	CIT-220+ Video Terminal	$ 775	$ 75	$ 42	$ 28
	CI-300 Matrix Line Printer	4,045	388	216	146
	CI-3500 Serial Printer	1,550	149	83	56

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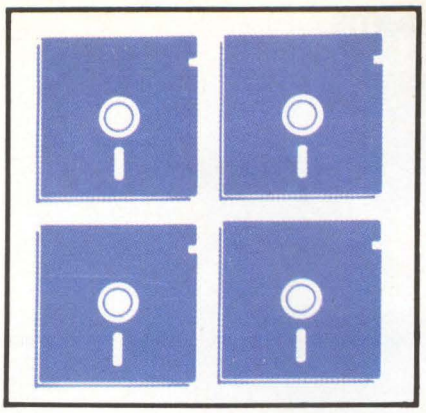

Operating systems

Company / System name	CPU	Min. memory (bytes)	Languages supported	Applications/ Features	Memory management	File management	Price $	UNIX/DOS compatible
ALCYON CORP. 5010 Shoreham Place, San Diego, CA 92122, (619) 587-1155								**Circle 621**
REGULUS	68000, 68010, 68020	164K	C, FORTRAN, Pascal	development, real-time/ multiuser, multitasking, multiprocessing		named files, contiguous, directory		UNIX
ALPHA MICROSYSTEMS P.O. Box 25059, Santa Ana, CA 92799, (714) 957-8500								**Circle 622**
AMOS	68000, 68010, 68020		Alpha BASIC, SMC BASIC, C, RM COBOL, FORTRAN 77, Pascal	development/network support, multiuser, multitasking, multiprocessing		sequential, random, directory, security	1,500-2,000	
APPLE COMPUTER INC. 20525 Mariani Ave., Cupertino, CA 95014, (408) 996-1010								**Circle 623**
ProDOS	Apple II	64K	Applesoft BASIC, Assembly	development/network support		random, directory		
BOS NATIONAL INC. 2607 Walnut Hill Lane, Suite 200, Dallas, TX 75229, (214) 965-7722								**Circle 624**
BOS/5	68000, 8086, PDP-11, Z80	64K	BOS/MicroCOBOL	general overlays, development	overlays, chaining	named files, sequential, contiguous, random, directory, security	450	
MBOS/5	68000, 8086, PDP-11, Z80	128K	BOS/MicroCOBOL	general overlays, development/multiuser, multitasking	overlays, swapping, chaining	named files, sequential, contiguous, random, directory, security	1,050	
BOS/NET	68000, 8086, PDP-11, Z80	128K	BOS/MicroCOBOL	general overlays, development/multiuser, multitasking, multiprocessing	overlays, swapping, chaining	named files, sequential, contiguous, random, directory, security	1,050	
BOSTON SYSTEMS OFFICE 128 Technology Center, Waltham, MA 02254-9164, (617) 894-7800								**Circle 625**
BSO/RTOS	68000, 8086, 6809, Z80	4K	C, Pascal	development, real-time				
CONVERGENT TECHNOLOGIES INC. 2700 N. First St., P.O. Box 6685, San Jose, CA 95150-6684, (408) 434-2848								**Circle 626**
CTOS	80286, 80126, 8086	512K	Assembly, BASIC, C, COBOL, FORTRAN, Pascal	development, real-time/ network support, multiuser, multitasking, multiprocessing	overlays, swapping, chaining, segmentation, relocation	named files, sequential, random, security		
DATA GENERAL CORP. 4400 Computer Dr., Westboro, MA 01580, (617) 366-8911								**Circle 627**
AOS/DVS	ECLIPSE MV/ Family, DS/ Family	2M	BASIC, C, FORTRAN 77, Pascal, PL/1	development, real-time/ network support, multiuser, multitasking	swapping, chaining	named files, sequential, contiguous, random, directory, security		
AOS/VS	ECLIPSE MV/ Family	2M	BASIC, C, COBOL, FORTRAN, Pascal, PL/1	development/network support, multiuser, multitasking, multiprocessing		named files, sequential, contiguous, random, directory, security		

Operating systems

Company / System name	CPU	Min. memory (bytes)	Languages supported	Applications/ Features	Memory management	File management	Price $	UNIX/DOS compatible
DIGITAL EQUIPMENT CORP. 146 Main St., Maynard, MA 01754, (617) 897-5111								**Circle 628**
RSX	F-11, J-11		most major languages	general overlays, development, real-time/ network support, multiuser, multitasking	overlays, swapping, chaining, segmentation	named files, sequential, contiguous, random		
ULTRIX-32/ 32M	VAX, MicroVAX		C	general overlays, development/network support, multiuser, multitasking	overlays, swapping, segmentation			
VMS	VAX		all major languages	general overlays, development, real-time/ network support, multiuser, multitasking, multiprocessing	overlays, swapping, chaining, segmentation, relocation	named files, sequential, contiguous, random, directory, security		
MicroVMS	MicroVAX I, MicroVAX II		all major languages	general overlays, development, real-time/ network support, multiuser, multitasking	overlays, swapping, chaining, segmentation, relocation	named files, sequential, contiguous, random, directory, security		
DIGITAL RESEARCH INC. 60 Garden Court, P.O. Box DRI, Monterey, CA 93942, (408) 649-3896								**Circle 629**
Concurrent DOS-68K	68000, 68010, 68020	512K	BASIC, C, COBOL, FORTRAN	development, real-time/ multiuser, multitasking, multiprocessing	overlays, relocation	named files, sequential, random, directory, security	750	
Concurrent DOS-286	80286	512K	BASIC, C, COBOL, FORTRAN	development, real-time/ network support, multiuser, multitasking, multiprocessing	overlays, segmentation, relocation	named files, sequential, random, directory, security	750	
Concurrent DOS-XM	8086, 8088, 80286	256K	CBASIC, C, COBOL, FORTRAN 77, Pascal, PL/1	general overlays, development, real-time/ network support, multiuser, multitasking, multiprocessing	overlays, swapping, relocation	named files, sequential, random, directory	395	PC-DOS 2.1
FORTH INC. 111 N. Sepulveda Blvd., Manhattan Beach, CA 90266, (213) 372-8493								**Circle 630**
polyFORTH II	8080, 8085, 8086, 8088, 6809, 68000, PDP-11, LSI-11, Z80	64K-128K	FORTH	development, real-time/ multiuser, multitasking	overlays	named files, sequential, contiguous, random	600-3,200	
HCR (HUMAN COMPUTING RESOURCES) 10 St. Mary St., Toronto, Ontario, M4Y 1P9, Canada, (416) 922-1937								**Circle 631**
RT/EMT	PDP-11	256K		general overlays/multiuser, multitasking	overlays	named files, sequential, directory, security		UNIX
PDP Unity	PDP-11	256K	BASIC, C, FORTRAN, Pascal	general overlays/multiuser, multitasking	overlays, swapping, segmentation	named files, sequential, directory, security		
VMS Unity	VAX-11, MicroVAX	256K	BASIC, C, FORTRAN, Pascal	general overlays, development/multiuser, multitasking	overlays, swapping, segmentation	named files, directory, security		
HEWLETT-PACKARD CO. 11000 Wolfe Rd., Cupertino, CA 95014, (408) 257-7000								**Circle 632**
RTE-A	HP 1000	512K	BASIC, C Compiler, FORTRAN, MACRO, Pascal	general overlays, development, real-time/ network support, multiuser, multitasking	overlays, swapping, chaining, segmentation	named files, sequential, contiguous, random, directory, security	2,000-7,000	

Operating systems

System name	CPU	Min. memory (bytes)	Languages supported	Applications/ Features	Memory management	File management	Price $	UNIX/DOS compatible
HUNTER & READY INC. 449 Sherman Ave., P.O. Box 61029, Palo Alto, CA 94306, (415) 326-2950								**Circle 633**
VRTX Kernel	1750A	5K	Jovial	real-time/multitasking, multiprocessing			25,000	
VRTX/OS	68000, 68020, 8086, 80286	60K	C, Pascal	real-time/multitasking, multiprocessing		named files, sequential, contiguous, random, directory	9,975	PC-DOS
INDUSTRIAL PROGRAMMING INC. 100 Jericho Quadrangle, Jericho, NY 11753, (516) 938-6600								**Circle 634**
MTOS-68K	68000	9K	C, Pascal	real-time/network support, multitasking, multiprocessing		named files, sequential, contiguous, random, directory	11,000-22,000	
MTOS-UX/68K	68000	16K	C	real-time/multitasking, multiprocessing	overlays	named files, sequential, contiguous, random, directory	5,000+ copy charges	
MTOS-86	8086, 8088, 80186, 80188	8K	C, PL/M-86	real-time/multitasking, multiprocessing	overlays	named files, sequential, contiguous, random, directory	7,000-22,000	
INTEL CORP. 2402 W. Beardsley Rd., Phoenix, AZ 85027, (602) 869-3805								**Circle 648**
iRMX86 iRMX286	8086, 80186, 8088, 80188, 80286	25K	Assembly, BASIC, C, COBOL, FORTRAN, Pascal	real-time/network support, multiuser, multitasking	segmentation, relocation	named files, sequential, random, directory, security		
XENIX 3.0	80286	512K	BASIC, C, COBOL, FORTRAN, Pascal, PL/M	development/network support, multiuser, multitasking, multiprocessing	swapping, segmentation, relocation	named files, sequential, random, directory, security	1,100	UNIX
MARK WILLIAMS CO. 1430 W. Wrightwood Ave., Chicago, IL 60614, (312) 472-6659								**Circle 635**
COHERENT	8086	256K	Assembly, C	development/multiuser, multitasking	swapping, segmentation	named files, sequential, random, directory, security	500	UNIX
MICROWARE SYSTEMS CORP. 1866 N.W. 114th St., Des Moines, IA 50322, (515) 224-1929								**Circle 636**
OS-9	6809	56K	Assembly, BASIC, FORTRAN, Pascal	development, real-time/ multiuser, multitasking	chaining	named files, sequential, contiguous, random, directory, security	250	
OS-9/68000	68000	128K	Assembly, BASIC, C, Pascal	development, real-time/ network support, multiuser, multitasking	chaining	named files, sequential, contiguous, random, directory, security	300	
MOTOROLA MICROSYSTEMS (MICROPROCESSOR PRODUCTS GROUP) 2900 South Diablo Way, Tempe, AZ 85282, (602) 438-3500								**Circle 637**
RMS68K	68000, 68010, 68020	25K	FORTRAN, Pascal	real-time/multiuser, multitasking	segmentation		499	
SYSTEM V/68	68000, 68010, 68020	500K	C, FORTRAN, Pascal	development/network support, multiuser	swapping, segmentation	named files, random, directory, security	1,600-2,500	UNIX
VERSAdos	68000, 68010, 68020	150K	BASIC, C, FORTRAN, Pascal	development, real-time/ multiuser, multitasking	segmentation	named files, sequential, contiguous, random, directory, security	2,000	MS-DOS
MULTI SOLUTIONS INC. 123 Franklin Corner Rd., Lawrenceville, NJ 08648, (609) 896-4100								**Circle 638**
S1	68000, 68010, 8086, 80186, 80286	30K-200K	BASIC, C, COBOL, FORTRAN, Pascal	general overlays, development, real-time/ network support, multiuser, multitasking	overlays, segmentation, relocation	named files, sequential, contiguous, random, directory, security	400-1,050	

Operating systems

Company / System name	CPU	Min. memory (bytes)	Languages supported	Applications/ Features	Memory management	File management	Price $	UNIX/DOS compatible
PICK SYSTEMS Circle 639 1691 Browning, Irvine, CA 92714, (714) 261-7425								
Pick			Pick/BASIC	real-time/multiuser, multitasking	overlays, swapping, chaining, segmentation	named files, random, directory, security		
RYAN-MCFARLAND CORP. Circle 640 609 Deep Valley Dr., Rolling Hills Estates, CA 90274, (213) 541-4828								
RM/COS	68000	150K	COBOL	development/network support, multiuser, multitasking, multiprocessing	segmentation	named files, sequential, contiguous, random, directory, security	1,700	
S&H COMPUTER SYSTEMS INC. Circle 641 1027 17th Ave. South, Nashville, TN 37212, (615) 327-3670								
TSX-PLUS, PRO/TSX-PLUS	PDP-11, MicroPDP-11, LSI-11, Professional 300 Series	256K	BASIC, C, COBOL, COBOL-PLUS, FORTRAN, FORTRAN 77, MACRO-11, Pascal	general overlays, development, real-time/ network support, multiuser, multitasking, multiprocessing	overlays, swapping, chaining, relocation	named files, sequential, contiguous, random, directory, security	900-2,000	RT-11
TECHNICAL SYSTEMS CONSULTANTS INC. Circle 642 111 Providence Rd., Chapel Hill, NC 27514, (919) 493-1451								
UNIFLEX	68010, 68020	512K	BASIC, C, COBOL, FORTRAN	general overlays, development, real-time/ multiuser, multitasking, multiprocessing	swapping	named files, sequential, contiguous, random, directory, security	600	
THE SANTA CRUZ OPERATION Circle 643 500 Chestnut St., Santa Cruz, CA 95061, (408) 425-7222								
XENIX System V	8086, 80286	512K	BASIC, C, COBOL, FORTRAN, Pascal	development/network support, multiuser, multitasking, multiprocessing	swapping, segmentation	named files, directory, security	495-1,085	UNIX
THE ULTIMATE CORP. Circle 644 717 Ridgedale Ave., East Hanover, NJ 07936, (201) 887-9222								
ULTIMATE			Extended BASIC, RECALL, UPDATE	general business/network support, multiuser, multiprocessing	swapping	named files, random, sequential, security		Pick
UNISOFT SYSTEMS CORP. Circle 571 739 Allston Way, Berkeley, CA 94710, (415) 644-1230								
UniPlus +	68000, 68010, 68020	1M-2M	Ada, BASIC, FORTRAN, Informix, Pascal	development, real-time/ network support, multiuser, multitasking, multiprocessing	swapping, segmentation	named files, sequential, directory, security		UNIX
UNITED STATES SOFTWARE CORP. Circle 645 5470 N.W. Innisbrook Place, Portland, OR 97229, (503) 645-5043								
MTK-II	68000, 8088, 8086, 8085, 6502, 6800, 6809, Z80	100	Assembly	real-time/multitasking			250	
USX	8051, 8086, 8096, 68000	3K	Assembly	general overlays, development, real-time/ multitasking	segmentation	sequential, random	1,950	
WATERLOO MICROSYSTEMS INC. Circle 646 175 Columbia St., West, Waterloo, Ontario, N2L 5Z5, Canada, (519) 884-3141								
Waterloo Port	8086, 8088, 80286	284K	C, Port	development, real-time/ network support, multitasking	relocation	named files, sequential, random, directory, security	1,695	PC-DOS
WHITESMITHS LTD. Circle 647 97 Lowell Rd., Concord, MA 01742, (617) 369-8499								
IDRIS	68000, 8086, PDP-11, VAX	256K	C, Pascal	development, real-time/ multiuser, multitasking	swapping, segmentation	named files, sequential, contiguous, random, directory, security	1,000-3,500	UNIX

Information was solicited but not received from the following manufacturers:

Applied Intelligence Inc.
Mountain View, CA 94043

Applied Systems Corp.
St. Clair Shores, MI 48081

Central Data Corp.
Champaign, IL 61821

Charles River Data Systems
Framingham, MA 01701

Creative Solutions Inc.
Rockville, MD 20852

Destek Group
Sunnyvale, CA 94086

Electronic Information Systems Inc.
Stamford, CT 06902

Eyring Research Institute
Provo, UT 84601

Hemenway Corp.
San Diego, CA 92101

IBM Corp.
Rye Brook, NY 10573

Infosphere Inc.
Portland, OR 97201

Microsoft Corp.
Redmond, WA 98073-9717

Mostek Corp.
Carollton, TX 75006

NV Philips Gloeilampenfabrieken
5600 AM, Eindhoven
The Netherlands

P Con Software Systems
Brooklyn, NY 11218

RCA Data Communications Products
Lancaster, PA 17101

Real-Time Computer Science Corp.
Camarillo, CA 93011

SGS Semiconductor Corp.
Phoenix, AZ 85022

Smoke Signal
Westlake Village, CA 91326

Software Components Group
Santa Clara, CA 95054

Software Dynamics
Anaheim, CA 92801

Systems & Software
Costa Mesa, CA 92626

Tandy Corp.
Fort Worth, TX 76102

TDI Software
Dallas, TX 75243

Theoss Software Corp.
Lafayette, CA 94549

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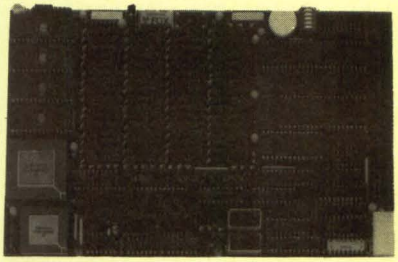

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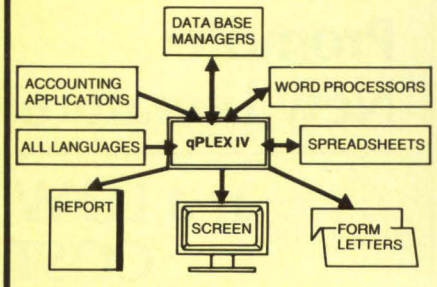

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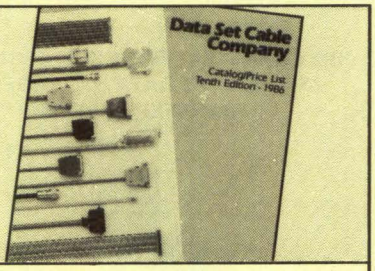

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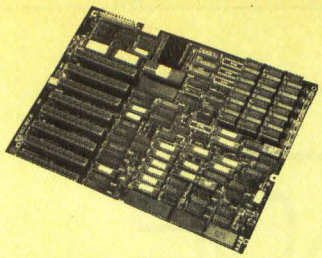

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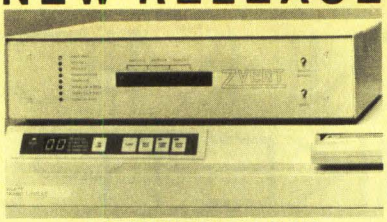

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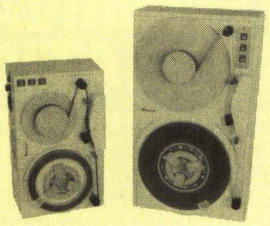

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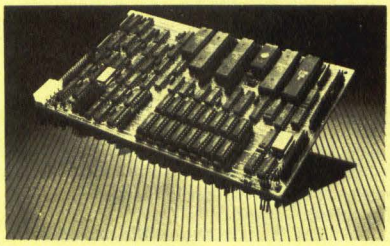

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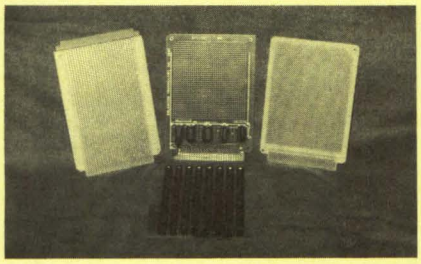

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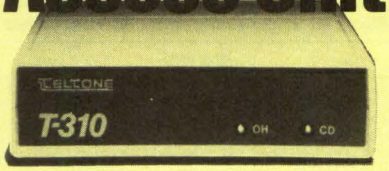

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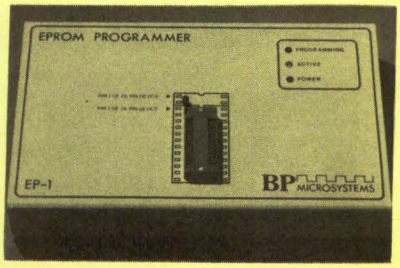

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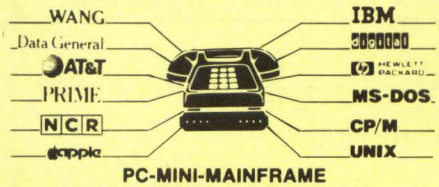

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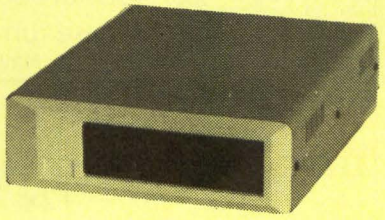

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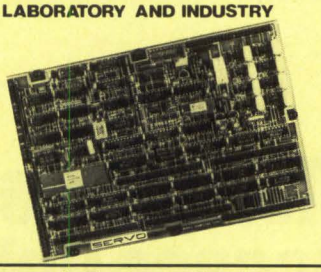

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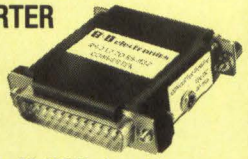

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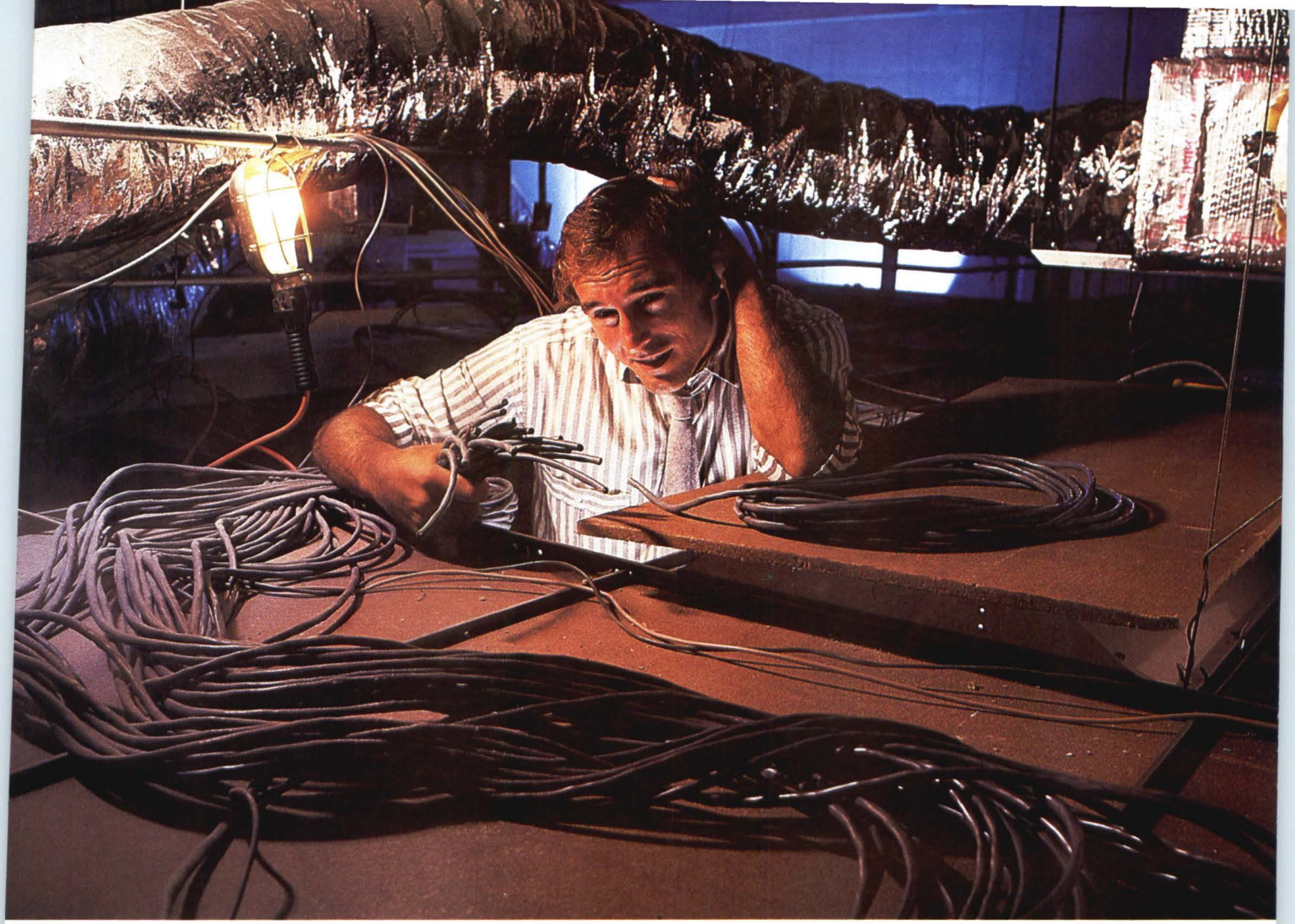

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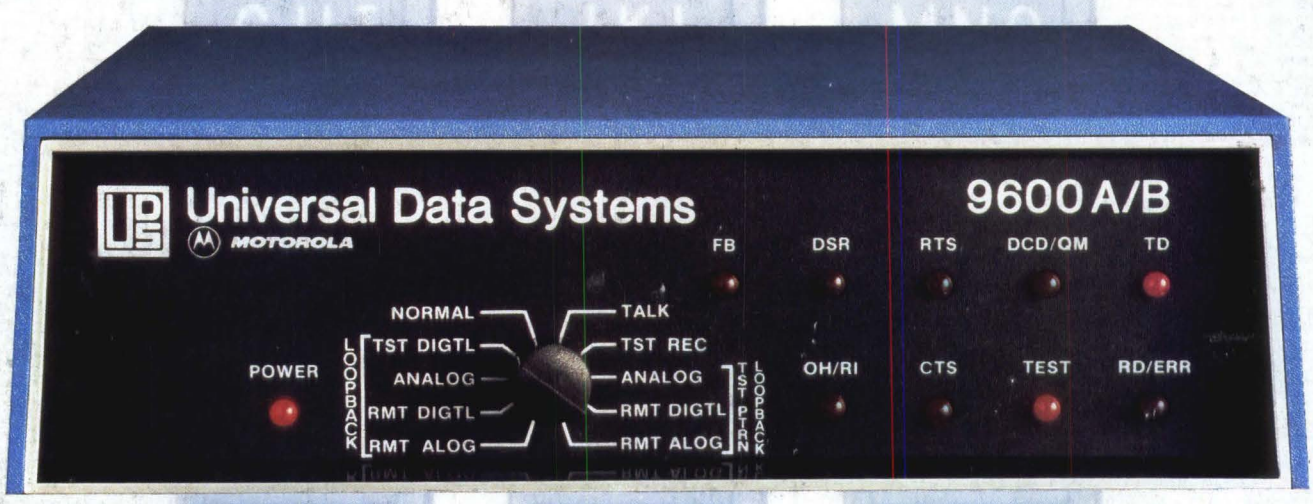

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