# Mini-Micro Systems

A CAHNERS PUBLICATION

APRIL 19, 1985 /$15.00


## Spring Peripherals Digest

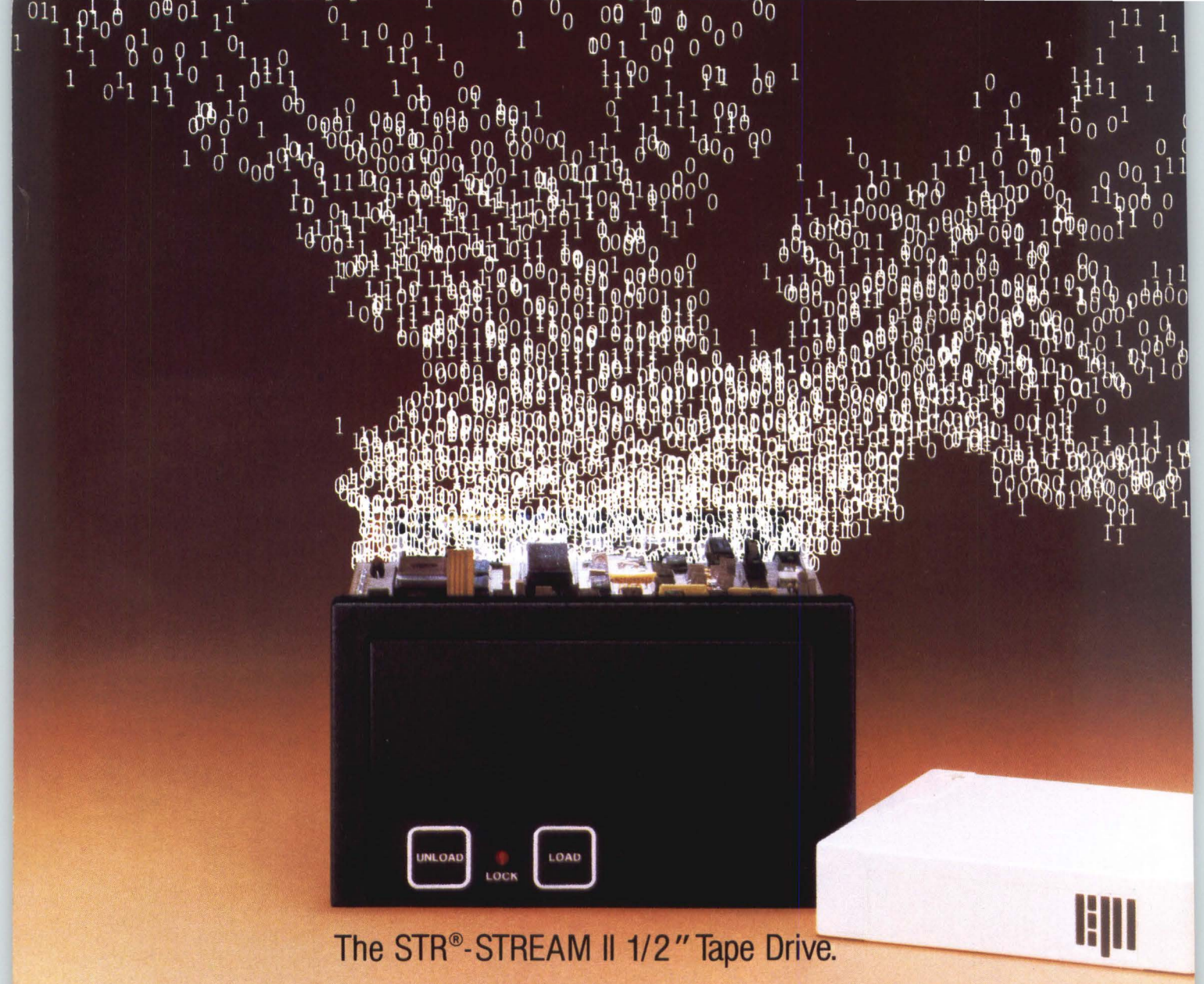
**The product guide for system integrators**

**Disk drives**

**Printers**

**Tape drives**

**Graphics terminals**




The STR®-STREAM II 1/2" Tape Drive.

# 130 million bytes can't be wrong.

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841

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CIRCLE NO. 3 ON INQUIRY CARD

# Mini-Micro Systems

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A CAHNERS PUBLICATION VOL. XVIII NO. 6 APRIL 19, 1985



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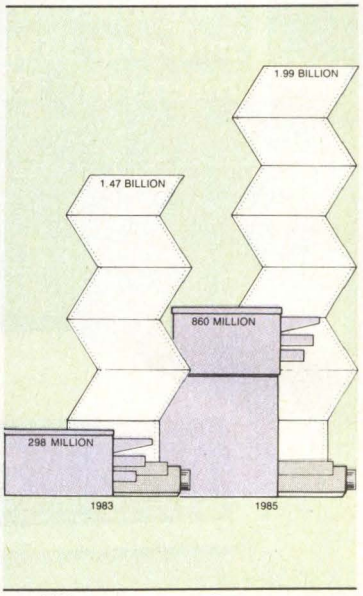


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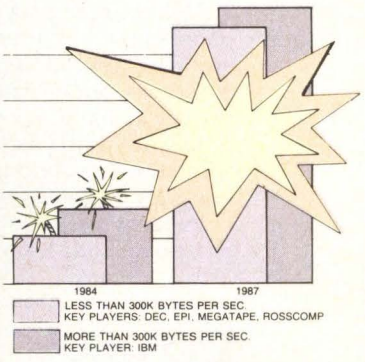


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A. Jones. *Patrick Henry Delivering His Speech at the House of Burgesses*. Courtesy The Bettmann Archive.

There's no argument that in today's business arena, 2400bps full duplex dial modems provide the lowest cost and fastest route to data communications. But of all the modem manufacturers that are promising you great dial line savings, there's only one company delivering the modem products you really need – Concord Data.

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But because AZAK successfully applies thin film technology to a hard disk, it packs much more magnetic material in a much thinner layer, forming a continuous magnetic film of high coercivity and durability.

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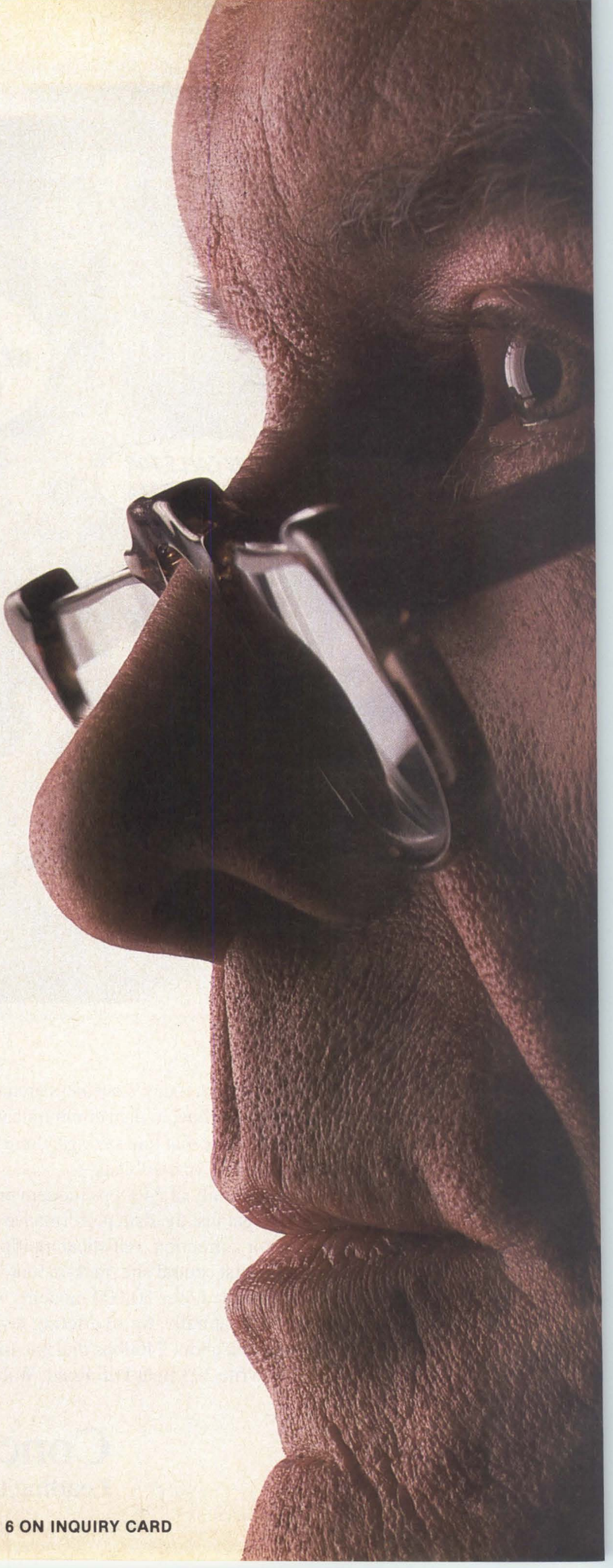

CIRCLE NO. 6 ON INQUIRY CARD

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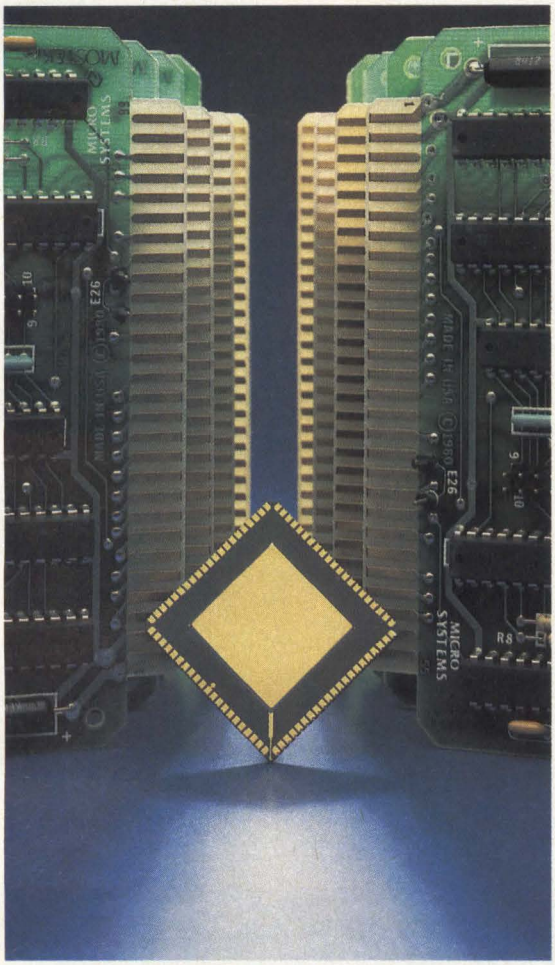

STD BUS has always been a smart choice for flexible, cost-effective Z80® systems. And now, Mostek has made it smarter still. By adding a proprietary gate array to provide more intelligence to your system.

Our family of intelligent STD boards all feature a Z80 processor, DMA controller and on-board memory. And our custom gate array, which took three man years to develop. But that's where the similarity ends. Because we've provided different features on each board to make sure you get the best possible performance from each.

For example, we've got intelligent serial boards for short (250 feet) and long (1 mile) communication distances. We have another that implements the IEEE 488 General Purpose Interface Bus standard with speeds up to 300 Kbytes/second. And an IPIO with 32-bits of parallel I/O, suitable for high-speed control and data transfer.

The point is, Mostek designed these to be the most sophisticated STD BUS boards available today. Which is one more way in which we show our continuing commitment to STD BUS.

So to give your system some extra smarts, contact Mostek Corp., 1215 W. Crosby Road, MS1051, Carrollton, Texas 75006, or call 1-800-635-0200. In Texas, 1-214-466-8801. In Europe, (32) 02/762.18.80. In Japan, 03/496-4221. In the Far East (Hong Kong), 5.681.157-9.

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# EDITORIAL

# IT'S TIME TO DEFINE THE NICHES

There was a time when system integrators addressing a "special" application would themselves customize some of the peripherals. Today that situation is becoming less likely as more and more peripheral vendors are finding that building peripherals for niche applications is the key to sustained growth and profitability.

Manufacturers of 14-inch disk drives, for example, are finding that the "general purpose," high-capacity drives are likely to be either 8-inch or the re-emerging 9-inch Winchesters. Does that mean that the 14-inch drives are no longer cost-effective solutions? Clearly not in some niche market applications. Western editor Carl Warren reports on some of the niches now being defined by 14-inch drive manufacturers, beginning on Page 17.

Finding and defining niches is also the order of the day for many graphics terminal manufacturers. As if there weren't enough competitive pressure in the graphics terminal market already, those vendors today must also compete with personal computer products with graphics capability. This has lead to an increase in the number of specialized graphics terminal products and a broader range of graphics terminal prices (see the article by senior western editor Jerry Borrell on Page 83, and the accompanying product guide, which begins on Page 90).

The growing number of peripheral vendors paying attention to niche markets is good news for system integrators. A reduction in peripheral customization means that the integrator can begin to invest his resources in other forms of added value. As noted in the editorial in the February 15, 1985 *Communications Digest*, system integrators can no longer view their products as only standalone solutions. Interconnectabilty of computer systems has risen from a desirable feature to a necessity. With peripheral integration consuming fewer resources, system integrators can now choose to shift resources to address the requirement for interconnectability.

Specialized peripherals may also allow system integrators to enter new markets. Therefore, defining new niche opportunities should be a priority item for system integrators as well as for vendors.

Remember that this year we have modified the product categories in our peripherals digests so that each category is covered once a year. Product coverage in November's *Peripherals Digest* will include flexible and rigid disk drives and subsystems with platter sizes up to 5¼ inches; matrix and solid-font character printers; ¼-inch and smaller cassette cartridge tape drives; and alphanumeric display terminals.

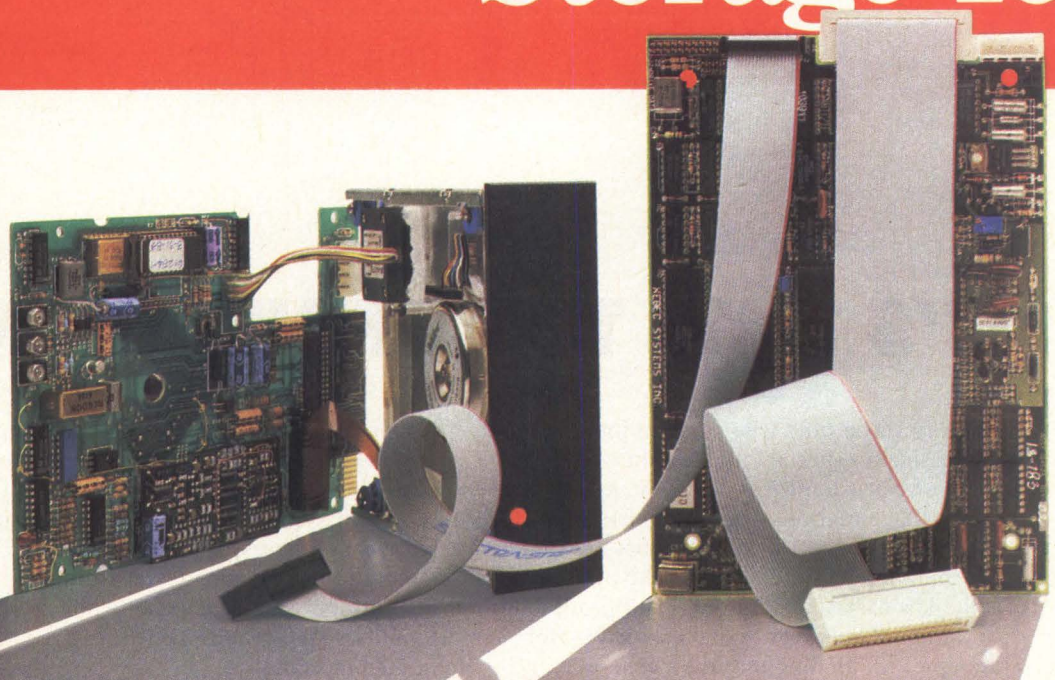
Our job is to provide timely and complete coverage of product developments in the value-added market. If you have suggestions for improving our product coverage, please send them to the Editor-in-Chief, *Mini-Micro Systems*, 221 Columbus Ave., Boston, Mass. 02116.

Rick Dalrymple

**Rick Dalrymple**
**Senior Editor**

# Xebec's New Owl Reduc Storage To

## Then.



Microcomputer storage history has progressed by a series of small "next logical steps." A replacement of a component here, a refinement of technology there. But now Xebec has taken a giant step, with its Owl intelligent disk file.

On the surface, the Owl might look like other 10-megabyte, 5¼" half-high Winchesters. Underneath, however, it's an example of superior technology. The integration of controller logic and drive electronics on a single board means not just one less PCB, but the elimination of expensive connectors and cabling, low power consumption (15 watts typical) and enhanced data integrity.

*Single-board drive and controller electronics insure higher reliability*

*Integrated data separation within disk drive delivers higher data integrity*

*Ruggedized design includes head landing zone*

*Comprehensive diagnostics eliminate "What's wrong?" guesswork*

*Compatible with industry-standard Xebec SASI bus for faster system integration*

We've put data separation in the HDA for precise control of data windowing and the elimination of background noise. We've provided a diagnostics channel to the host that delivers meaningful error messages.

Just as our superiority in minicomputer controllers led the way to a similar superiority in micro controllers, and our tested pairs solutions evolved from our considerable subsystem and testing experience, so too the Owl reflects our "top-down" engineering strategy—creating both technological and cost-of-owner-

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# es Microcomputer Disk Two Words.

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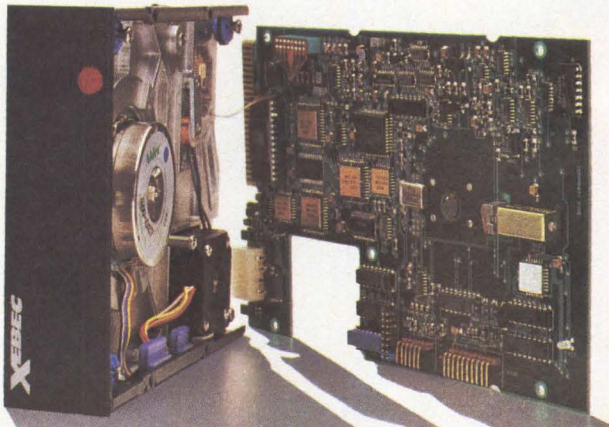


ship breakthroughs by designing sophisticated high performance, multi-user features into small-system, single-user environments.

**The System-Engineered Solution.™**

As a major user of drives, and a major testing resource for other drive manufacturers, we are concerned about drive reliability. And we've learned that it's not just a question of improving a component or consolidating some board real estate. The answer lies in careful consideration of overall system integration requirements.

The Owl epitomizes what we call the Xebec System-Engineered Solution. The focus is two-fold: on today and on tomorrow. Compatible now with industry-standard Xebec SASI, the Owl—by eliminating the ST506 interface—is upwardly compatible for future higher densities, capacities and performance.

In broader perspective, Xebec's approach to OEM satisfaction rests on our proven experience, our vertical integration strengths—which now include production of heads and plated media—and our commitment to zero defect quality, by way of computer-aided design and robotics manufacturing.

Call Xebec today. Let us tell you more about the Owl. And how we can deliver the difference between then and now. Now.

XeroD.

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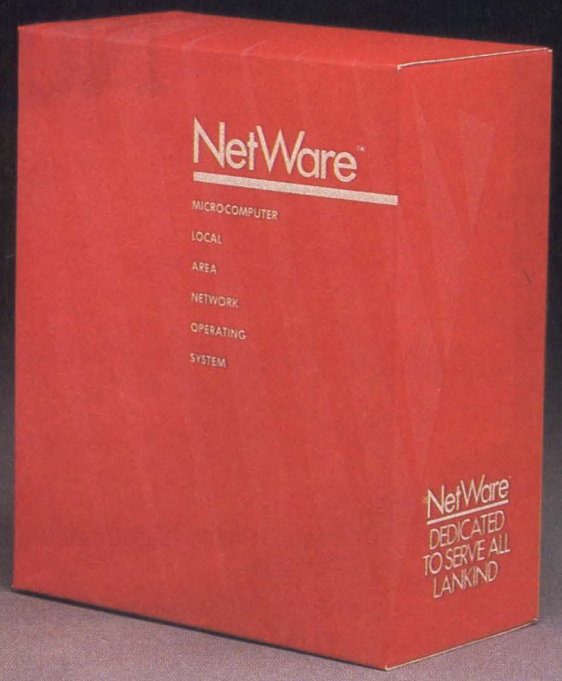
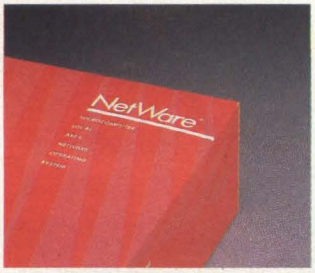
# Name-dropping just isn't enough to impress the network critics.




Now that the local area network (LAN) industry is booming, some pretty big names in the computer business are jumping on the bandwagon. Their goal is simple: get a LAN on the market and let all those who pay homage to The Name run out and buy it.

At Novell, we don't have a big name to drop when selling NetWare, our high-performance LAN operating system. So we let our technology do the talking. And the network critics are not only listening, they are taking notice.




**Performance.**

No LAN operating software outperforms NetWare. With speed, flexibility, security and hundreds of multiuser applications, NetWare sets a standard for the entire LAN industry.

**Versatility.**

NetWare is more than a LAN operating system. Currently, NetWare software is available for 24 LAN hardware systems. Plus, four complete LAN systems are sold and serviced by Novell.

**Compatibility.**

Because NetWare is compatible with DOS 3.1, it can run any application written for the IBM PC Network Program. And NetWare greatly increases IBM PC Network performance and applications software useability.

**Internetworks.**

Using bridges, NetWare can connect separate LAN systems into one large internetwork. In fact, every LAN Novell supports can be interconnected—any number, in any of the various topologies.

**Remember the name.**

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The *Peripherals Digest* is divided into six sections—five for product categories and one for a manufacturers directory of *Digest* products. Each of the five product categories begins with a staff-written article, followed by one or more product tables.

Each of the product tables contains pricing and specification information, arranged alphabetically by company name. These tables are based on mail- and telephone-survey information.

The manufacturers directory of *Digest* products, the last section of the *Digest,* is a consolidated alphabetical listing of all the vendors. Each entry provides a vendor's mailing address and telephone number, as well as a circle number for the reader-service card. The main directory is followed by a supplementary directory. This directory, also in alphabetical order, lists known vendors of peripheral products that did not respond to our survey.

To use the *Peripherals Digest* effectively, use the tabs to find the desired product category. Refer to the directory of manufacturers for company addresses and phone numbers.

To check product prices or specifications:

- Turn to the appropriate product category
- Find the product table
- Find the alphabetically listed vendor.

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The *Peripherals Digest* research and editorial staff includes Frances Michalski, associate editor; Megan Nields, assistant editor; and Pamela Gorski, assistant editor. Production assistant Carole Smith provides editorial support.

# Performance . . . i

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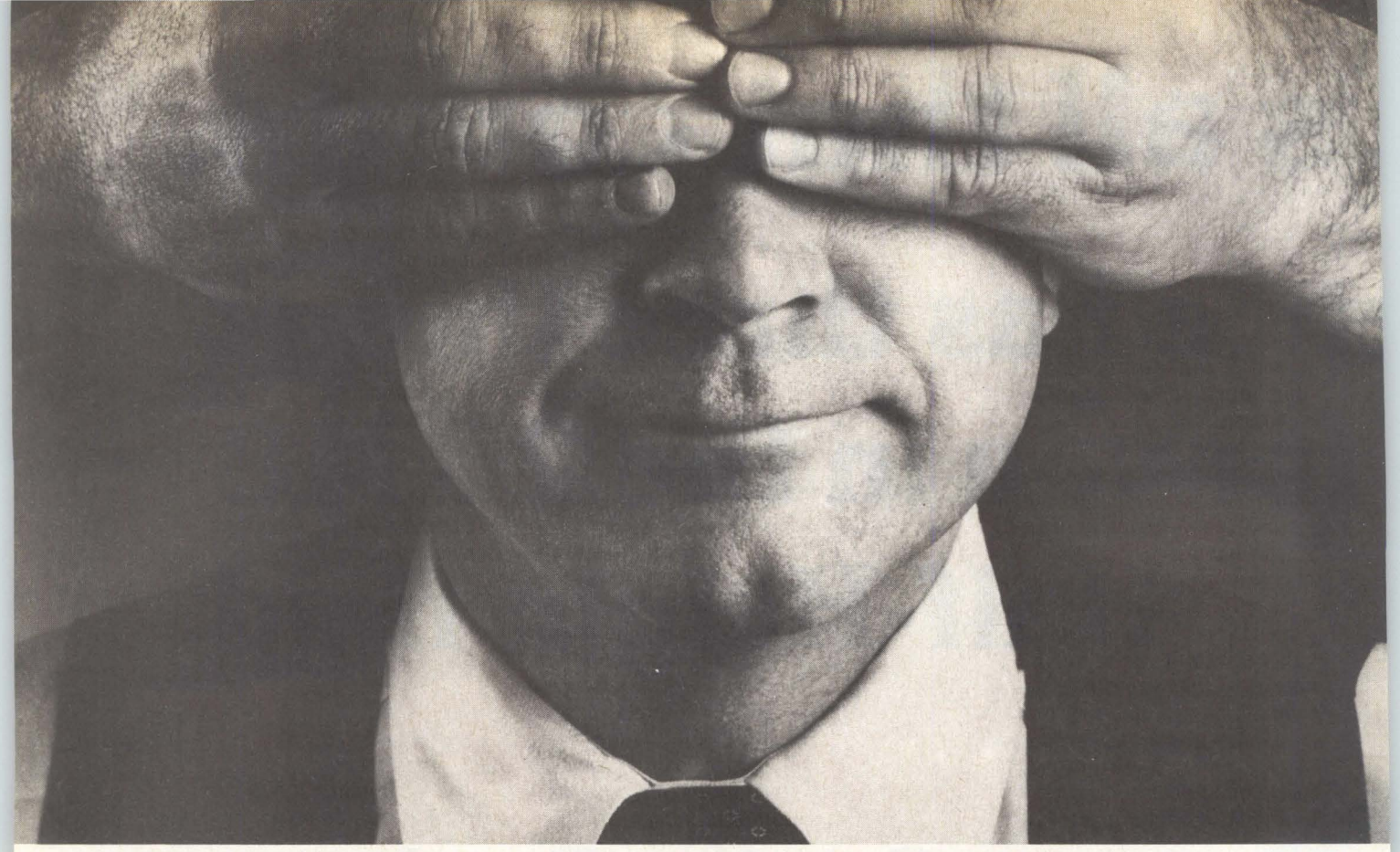
CIRCLE NO. 10 ON INQUIRY CARD



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**CIRCLE NO. 11 ON INQUIRY CARD**

# 14-INCH DISK DRIVES CARVE OUT NICHES

## Speed and cost per size allow 8-inch and re-emerging 9-inch Winchesters to attract high-capacity market and move in on 14-inch disk drive territory

**Carl Warren,** Western Editor

Although 14-inch Winchesters have historically been employed for large mass-storage applications, 8-inch and the re-emerging 9-inch Winchester drives are shrinking both the space required and cost per megabyte of disk drives over 160M bytes.

James Porter, disk-industry consultant and president of Disk/Trend Inc., Los Altos, Calif., speculates that 1986 will be the last production year for 14-inch drives. He contends that 8-inch drives will most likely replace 14-inch drives in most minicomputer applications.

However, John H. Clemens, president of Winchester Storage Inc., Campbell, Calif., expects that 9-inch as well as 8-inch drives will be used as 14-inch alternatives.

Pushed by the increasing capacity of 5¼-inch drives, 8-inch drives are breaking past the 160M-byte barrier. According to Porter, the Fujitsu Ltd. 2312 drive, which sports a 23-msec average access time, "offers manufacturers of supermicrocomputers and low-end minicomputers a viable alternative to 14-inch drives in a smaller footprint."

Although Donald Fuller, chief executive officer of Tecstor Inc., Huntington Beach, Calif., agrees that the sales of 14-inch drives will decline, he does not see 1985 as the last big year for 14-inch drives. "There is still some life left in 14-inch. But it's definitely in niche markets," says Fuller.

Because 14-inch drives can no longer compete on a price-per-megabyte basis, they are migrating toward applications that require quick access to long records. These applications include large-scale data gathering such as weather data plotting, medical and geological imaging and any application that requires real-time simulation or manipulation of stored data.

Selecting high-capacity drives is often a matter of calculating the best alternative for a given application. It's also useful for the system inte-

**Ganging together** *8-inch Winchesters for a total capacity of 1.2G bytes, the Tandem V8 transactional-processing system provides fast access to large databases by putting less data under any single actuator.*

DISK DRIVES

grator to compare the alternatives on a cost-per-megabyte vs. cost-per-cubic-inch basis (see "Cutting price down to size," below).

Then again, if space and speed of access are critical, the combining of several small drives in a cabinet may be the optimal choice. However, for specialized applications, such as imaging, that require a single direct access of large volumes of data, a 14-inch drive may prove better. The following examples illustrate how system integrators can evaluate alternatives.

### A question of speed

If medium-scale (less than 500M bytes) databases are being used and quick access is important and size is not critical, 14-inch drives can be acceptable. One company that sells access speed rather than capacity is Alpha Data Inc., Chatsworth, Calif. Its approach is conservative as far as capacity and overall implementation go, says George H. Kunstadt, company president.

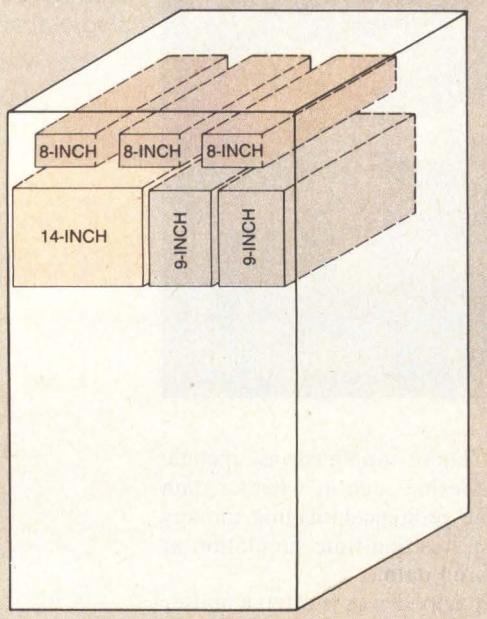
The Alpha Data Atlas 14-inch drive provides 168M bytes of unformatted storage and uses the industry-standard storage module device interface, which yields a 1.2M-byte-per-second transfer rate. "What we are selling is speed of access," says Kunstadt. "If the customer doesn't need that, he doesn't need us." The Atlas drive employs three platters with 50 read/write heads —10 per surface. "What we have done is combine the best elements of moving-head technology with a modified version of head-per-track technology," notes Kunstadt. The overall effect of having 10 heads per data surface is that at any one time there is 1M byte of data available—hence, zero access time. But Kunstadt explains that the operating system software must be tailored to avoid unnecessary seek commands when the heads are already over the desired data.

The Atlas drive, although fast, still requires the space and power needed for 14-inch drives. This can adversely affect the overall cost-performance of the system in general, says Winchester Storage's Clemens. But Woodrow Wittmayer, vice president of marketing for Aptec Computer Systems Inc., Portland, Ore., claims, "Even with power dissipation being as great as 9,000 British thermal units (Btus) per hour, some

## Cutting price down to size

A good conceptual model for determining mass-storage alternatives is to view disk drive products on a cost-per-megabyte vs. cost-per-cubic-inch basis.

Using the IBM 3380 enclosure as an example, a fair understanding of the price-per-cubic-inch differential can be seen. The 3380 cabinet measures 70½ inches high by 40 inches wide by 32 inches deep and has a volume of 90,240 cubic inches.




(3380-sized enclosure, volume = 90,240 cubic inches)

| | | | |
|---|---|---|---|
| **Platter diameter (inches)** | **14** | **9** | **8** |
| **Height (inches)** | 10.4 | 10.2 | 4.62 |
| **Width (inches)** | 18.9 | 8.5 | 8.5 |
| **Depth (inches)** | 30.1 | 23.96 | 24.25 |
| **Volume (cubic inches)** | 5,916 | 2,007 | 952 |
| **Percent of 3380 enclosure** | 6 | 2 | 0.9 |
| **Capacity (M bytes)** | 168 | 168 | 168 |
| **Price ($) (Q 100)** | 6,000 | 3,500 | 2,500 |
| **Price per megabyte ($)** | 35 | 20 | 14 |
| **Price per cubic inch (cents)** | 6 | 4 | 3 |

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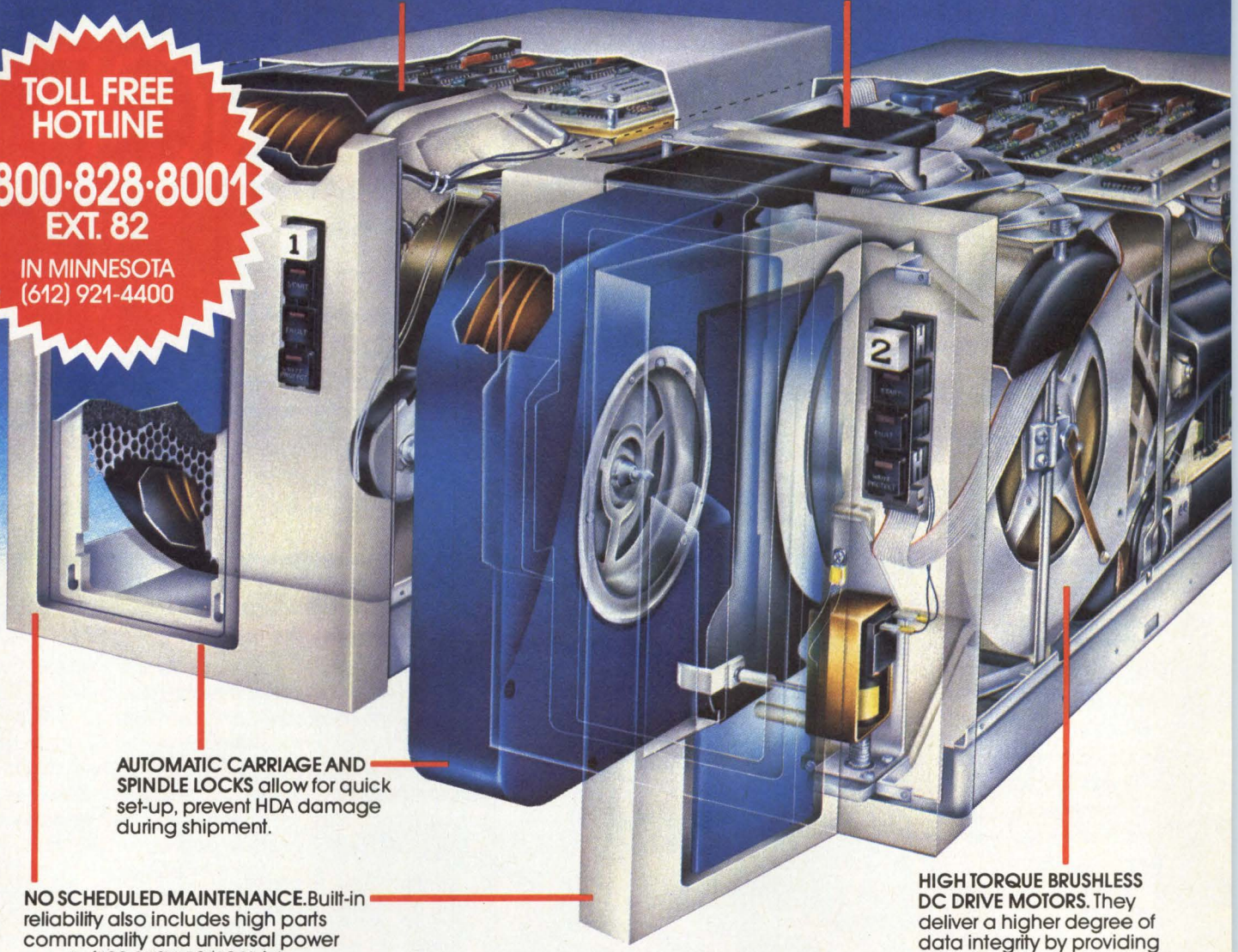


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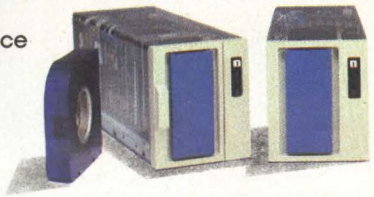

CONTROL DATA

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OEMs designing business systems face two new realities. One, data processing is becoming more distributed—more individualized work units, defined by job function and application, performed by more people in more places, demanding more independence.

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The central issue is no longer just more data. It's *more data dynamics.* And Winchesters aren't really dynamic at all. Consider "wait your turn" access, or the need for lots of user "system savvy." Consider time-consuming backup and restore. And consider the ever-present risk of expensive head crashes.

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| | IOMEGA BETA 5 | IOMEGA ALPHA 10/10H | TYPICAL WINCHESTER |
|---|---|---|---|
| Formatted Capacity | 5.0 Mbytes per cartridge | 10.0 Mbytes per cartridge | 10.0 Mbytes fixed |
| Data Transfer Rate | 5.0 Mbits/Sec | 9.0 Mbits/Sec | 5.0 Mbits/Sec |
| Average Access Time | 50 msec includes settling | 35 msec includes settling | 85 msec |
| Form Factor | 5.25" | 8"/8" Half Height | 5.25" |

The IOMEGA cartridge is the key. Now download data and software to a 5- or 10-megabyte cartridge, then manipulate, update, and upload conveniently and efficiently. The result is a total enterprise solution that can store applications, complex programs, or data sets—all of which can then be passed along to others without networking. And when you need more storage, you use more cartridges, not more hardware.

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## IOMEGA HAS REMOVED CAPACITY AS THE MASS STORAGE ISSUE.

CIRCLE NO. 13 ON INQUIRY CARD

applications demand it."

Power dissipation and size aren't concerns in making the type of system Aptec builds, according to Wittmayer. His customers want speed and the ability to handle large records. "This really flies in the face of the 'smaller-is-better' trend," says Wittmayer. He does point out, however, that of 35,000 VAX users only 5,000 need this capability and only about 3,000 will buy it. He contends that 14-inch, large-capacity drives are primarily for 20 percent of the high-end needs. "It's a performance issue. Only eight out of 10 high-end applications need this type of storage capability. But that in itself is significant."

Wittmayer's company builds the Model 2400 computer, which provides engineering computation and data-acquisition for Digital Equipment Corp. VAX Unibus systems. According to Wittmayer, the system coordinates high-speed array processors and analog-to-digital conversion. "We work in the real-time zone. So we have to have lots of data available quickly," he says.

Industry observers concede specialized applications to 14-inch drives. But some applications, such as transactional data processing used in business, have different requirements.

Unlike image processing, in which long records are used, transactional processing is made up of thousands of small records. Thus, the consensus is that it is better to put small amounts of data under the actuator than large amounts. "Software isn't optimized to quickly access records stored on large-capacity drives," says Clemens.

According to Bob Jolls, director of the database and peripherals division of Tandem Computer Inc., Cupertino, Calif., a 14-inch drive has too many megabytes per actuator for transactional processing. Because transactional processing involves accessing many short records, the idea is to speed access to a given record, and the large disks are comparatively slow, he says. Moreover, he contends that the cost-per-megabyte per cubic inch of space used is greater than desired.

To lower the number of megabytes per actuator, Tandem uses eight 168M-byte, 8-inch drives in the Model V8 transactional-processing unit to achieve a 1.2M-byte capacity. "We looked at the cost per access per second. By putting less data under an actuator and using more actuators you get a more effective device," claims Jolls. Moreover, he insists that there is the added benefit of having several paths to the data, plus a greater reliability in the system. "At the most in a failure, you can lose only 168M bytes [the capacity of one 8-inch drive]—not 1.2G bytes."

The V8 system takes the fail-safe feature further by mirroring data. Although this cuts the effective storage in half (because the data is duplicated on another drive) and therefore requires two writes for each transaction, it prevents data loss and speeds access. Should the primary drive be busy, the secondary drive can deliver the data. If the primary drive fails, the secondary drive can take over.

Drive size is also important. "Smaller drives, combined correctly, yield higher overall capacities, faster access and are less costly," maintains Clemens. Tandem's Jolls maintains that companies take a critical look at how much they get in a cabinet. "It's a new business yardstick: 'How much per cubic inch of space?'" he says.

Tandem isn't abandoning 14-inch drives. Jolls says 14-inch drives are still viable for certain applications. "It's a matter of determining the crossover point for access, power and size."

**Then again, if space and speed of access are critical, the combining of several small drives in a cabinet may be the optimal choice.**

### Nine-inch drives offer option

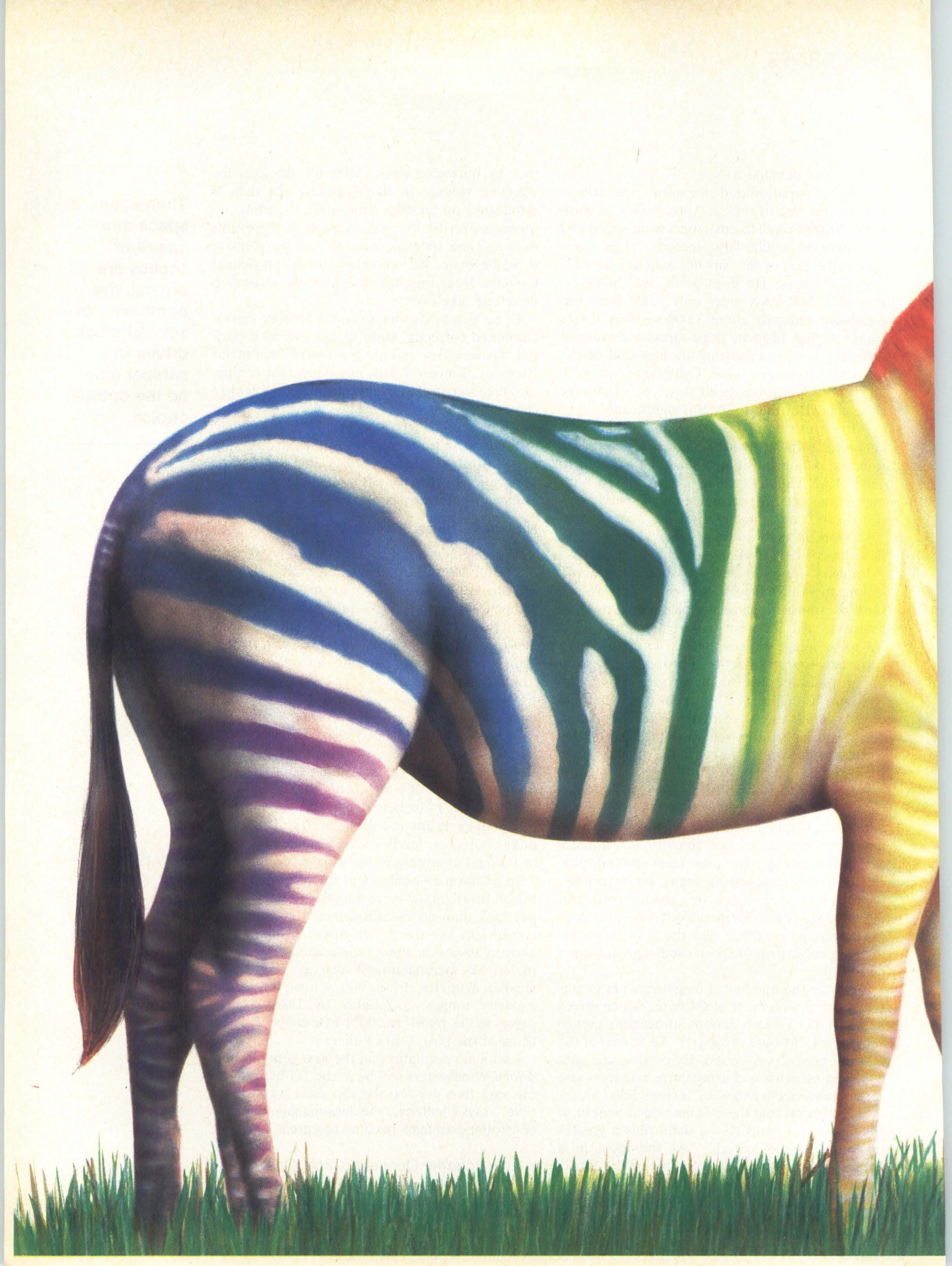
The re-emerging 9-inch-diameter Winchester offers OEMs still another choice. These drives are currently available from Control Data Corp., Minneapolis, and NEC Information Systems Inc., Boxborough, Mass. Fujitsu America Inc., San Jose, and Hitachi America Ltd., San Bruno, Calif., are also expected to introduce 9-inch drives this year.

The 9-inch disk drives, which range in unformatted capacity from 160M to 500M bytes, typically measure 10.2 inches high by 8.5 inches wide by 23.96 inches deep. A 9-inch drive, like a 14-inch drive, can be rack-mounted. A 14-inch drive measures 10.4 inches high by 18.9 inches wide by 30.1 inches deep and is typically mounted vertically in a 19-inch rack. The 9-inch drive, however, lends itself to either horizontal or vertical mounting in the same-sized rack.

In addition to being ideal for rack-mounting, 9-inch drives allow more spindles to be installed per rack than do 14-inch drives. Consequently, consultants see the 9-inch drive as supplanting 14-inch drives in many applications. Even 14-inch-drive manufacturers such as Tecstor see smaller diameter drives taking over for certain capacity ranges. "Probably by 1986, 14-inch drives in the 160M- to 500M-byte range will be a thing of the past," says Fuller.

Clemens speculates that the next generation of 9-inch Winchesters will be in the 1G-byte range. He says that may be the top end. "Above 1G byte," says Clemens, "the data-management and controller problems become too great." □

Interest Quotient (Circle One)
High 480 Medium 481 Low 482



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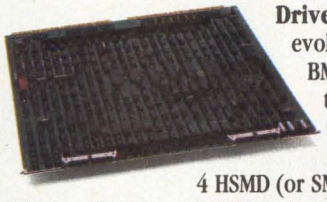

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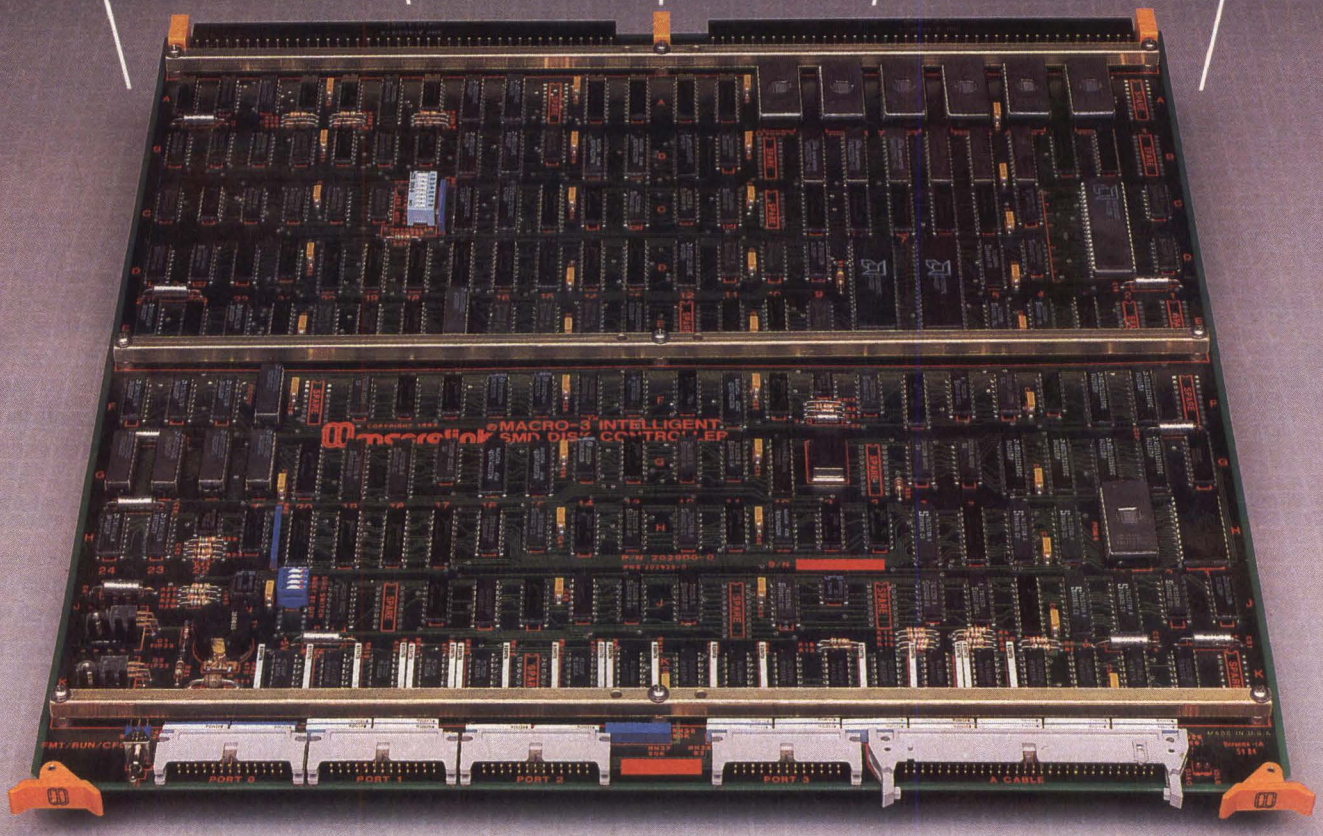


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**CIRCLE NO. 15 ON INQUIRY CARD**

# 8-INCH AND LARGER RIGID DISK DRIVES

## TABLE 1

| Company / Model | Disk size (inches) | Unformatted capacity (M bytes) | Average access time (msec) | Number of data surfaces | Number of read/write heads | Actuator type | Dimensions (H x W x D inches) | Interface | Price ($) | Notes, features, options |
|---|---|---|---|---|---|---|---|---|---|---|
| **AED INC. (ADVANCED ELECTRONIC DESIGN)** | | | | | | | | | | |
| WINC08 | 8 | 40 | 70 | | 4 | | | | | |
| **ALPHA DATA INC.** | | | | | | | | | | |
| Atlas 128 | 14 | 128 | 8–10 | 5 | 54 | rotary | 7 x 19 x 22 | SMD | 8,750(Q1); 5,750(Q500) | internal power supply 1M-byte cylinder, ruggedized for military environments |
| Atlas 160 | 14 | 160 | 8–10 | 5 | 54 | rotary | 7 x 19 x 22 | SMD | 9,450(Q1); 6,250(Q500) | internal power supply, 1M-byte cylinder, ruggedized for military environments |
| **AMCODYNE INC.** | | | | | | | | | | |
| Comanche 8160 | 8 | 165.9 | 22 | 10 | 10 | closed-loop linear voice coil | 4.9 x 8.5 x 16.75 | SMD | 4,995(Q1); 3,095(Q500) | dynamic head loading |
| Comanche 8220 | 8 | 224.7 | 25 | 10 | 10 | closed-loop linear voice coil | 4.9 x 8.5 x 16.75 | SMD | 5,375(Q1); 3,325(Q500) | dynamic head loading |
| **CENTURY DATA SYSTEMS INC.** | | | | | | | | | | |
| AMS 315 | 14 | 315, 323 | 25 | 9 | 19 | closed-loop linear voice coil | 10.5 x 18 x 28 | SMD | 10,500(Q1); 6,220(Q500) | universal power supply, DEC RM05-, CDC 9766-compatible; opt. rackmount |
| AMS 513 | 14 | 514 | 25 | 9 | 19 | closed-loop linear voice coil | 10.5 x 18 x 28 | SMD | 11,400(Q1); 6,600(Q500) | universal power supply, DEC RM05-, CDC 9766-compatible; opt. rackmount |
| AMS 571 | 14 | 615 | 19 | 9 | 19 | closed-loop linear voice coil | 10.5 x 19 x 28 | ESMD | 13,500(Q1); 8,200(Q500) | thin-film heads, universal power supply; opt. rackmount |
| Marksman M160 | 14 | 160 | 50 | 3 | 6 | closed-loop linear torque motor | | Marks-man SMD | 6,560(Q1); 3,675(Q500) | |
| **CHARLES RIVER DATA SYSTEMS** | | | | | | | | | | |
| DK-60T | 8 | 80 | 39 | 5 | 5 | | | ANSI, SASI | | |
| DK-120T | 8 | 160 | 39 | 10 | 10 | | | ANSI, SASI | | |
| DK-400 | 10.5 | 474 | 22 | 10 | 20 | | | SASI, SMD | | |
| **CONTROL DATA CORP. (OEM PRODUCT SALES)** | | | | | | | | | | |
| CDC 9715-160 FSD | 9 | 165 | 30 | 10 | 10 | rotary rack and pinion | 10.2 x 8.5 x 24 | SMD | 5,735(Q1); 4,405(Q500) | opt. power supply, dual access |
| CDC 9715-340 FSD | 9 | 344 | 20 | 12 | 24 | linear rack and pinion | 10.2 x 8.5 x 24 | SMD | 8,430(Q1); 6,475(Q500) | opt. power supply, dual access |
| CDC 9715-500 FSD | 9 | 516 | 20 | 12 | 24 | linear rack and pinion | 10.2 x 8.5 x 24 | SMD-F | 9,945(Q1); 7,510(Q500) | opt. power supply, dual access |
| CDC 9730-160 MMD | 14 | 165.9 | 30 | 5 | 10 | rotary voice coil | 10.2 x 16.5 x 30 | SMD | 7,025(Q1); 5,180(Q500) | opt. dual-channel |
| CDC 9771 XMD | 14 | 857 | 16 | 8 | 16 | linear voice coil | 10.4 x 18.9 x 30.1 | SMD-E | 12,425(Q1); 9,380(Q500) | thin-film heads; opt. dual channel |
| CDC 9775 FMD | 14 | 679 | 25 | 20 | 40 | rotary voice coil | 36.2 x 23 x 38 | SMD | 16,900(Q1); 13,700(Q500) | opt. dual channel |
| **CONTROL DATA CORP. (MINI-MICRO SYSTEMS)** | | | | | | | | | | |
| Certainty 234/241 | 14 | 63.2, 126.4 | 30 | 5 | 10 | rotary voice coil | 19.2 x 19 x 28 | IBM Series/1 | 14,500–22,600(Q1); 10,150–15,800(Q500) | includes controller, IBM 4962-compatible |
| **FUJITSU AMERICA INC.** | | | | | | | | | | |
| M2294 | 14 | 335 | 27 | 8 | 16 | closed-loop rotary voice coil | 9.84 x 16.4 x 25.6 | SMD | 11,100(Q1) | opt. dual port |
| M2298 | 14 | 671 | 27 | 8 | 16 | closed-loop rotary voice coil | 9.84 x 16.4 x 25.6 | SMD | 12,600(Q1) | RLL encoding; opt. dual port |
| M2312 | 8 | 84 | 20 | 10 | 10 | closed-loop rotary voice coil | 5 x 8.5 x 15 | SMD | 7,250(Q1) | opt. SCSI |
| M2322 | 8 | 168 | 20 | 10 | 10 | closed-loop rotary voice coil | 5 x 8.5 x 15 | SMD | 8,300(Q1) | opt. SCSI |
| M2333 | 8 | 336 | 20 | 10 | 10 | closed-loop rotary coil | 5 x 8.5 x 15 | HSMD | 9,950(Q1) | opt. SCSI |

## 8-INCH AND LARGER RIGID DISK DRIVES
## TABLE 1

| Company / Model | Disk size (inches) | Unformatted capacity (M bytes) | Average access time (msec) | Number of data surfaces | Number of read/write heads | Actuator type | Dimensions (H x W x D inches) | Interface | Price ($) | Notes, features, options |
|---|---|---|---|---|---|---|---|---|---|---|
| M2350 | 10.5 | 474 | 18 | 10 | 20 | closed-loop rotary voice coil | 10.4 x 19 x 30 | MSMD | | |
| M2351 | 10.5 | 474 | 18 | 10 | 20 | closed-loop rotary voice coil | 10.4 x 19 x 27 | MSMD | 13,000(Q1) | includes power supply |
| M2361 | 10.5 | 689 | 18 | 10 | 20 | closed-loop rotary voice coil | 10.4 x 19 x 30.3 | HSMD | 15,000(Q1) | includes power supply, RLL encoding |
| **HEWLETT-PACKARD CO. (DISC MEMORY DIV.)** | | | | | | | | | | |
| 7933H | 14 | | 24 | 13 | 13 | closed-loop linear voice coil | 32.5 x 21.7 x 32.8 | HP-IB | 25,520(Q1) | |
| **HITACHI AMERICA LTD.** | | | | | | | | | | |
| DK812S | 8 | 51, 119, 170 | 25 | 3–10 | 3–10 | closed-loop rotary voice coil | 5.1 x 8.5 x 15 | SMD | | opt. dual port, power supply |
| DK814S | 8 | 170, 238, 340 | 20 | 5–10 | 5–10 | closed-loop rotary voice coil | 5.1 x 8.5 x 15 | HP-SMD | | opt. dual port, DC power supply |
| DK815-5 | 8.8 | 525 | 18 | 14 | 14 | closed-loop rotary voice coil | 10.2 x 8.5 x 20 | ESMD | | opt. dual port, DC power supply |
| **KENNEDY CO.** | | | | | | | | | | |
| 5380 | 14 | 82 | 30 | 5 | 5 | rotary voice coil | 7 x 17 x 25 | SMD, PICO | 4,595(Q1) | internal power supply |
| 6172 | 8 | 24.58 | 40 | 3 | 3 | closed-loop linear | 5.1 x 19 x 18 | SMD, ANSI | 1,195(Q1) | |
| 6173 | 8 | 40.97 | 40 | 5 | 5 | closed-loop linear | 5.1 x 9 x 18 | SMD, ANSI | 3,195(Q1) | |
| 53210 | 14 | 165 | 30 | 5 | 10 | rotary voice coil | 7 x 17 x 25 | SMD, PICO | 5,750(Q1) | internal power supply |
| **MEGAVAULT MEMORIES** | | | | | | | | | | |
| MV 83 | 8 | 83 | 25 | 5 | 5 | rotary | 5.2 x 8.85 x 19.5 | SMD, SCSI, ANSI, ST412 | 3,919(Q1); 2,282(Q500) | |
| MV 186 | 8 | 186 | 25 | 7 | 7 | rotary | 5.2 x 8.85 x 19.5 | SMD, SCSI, ANSI, ST412 | 4,624(Q1); 2,670(Q500) | |
| MV 212 | 8 | 212 | 25 | 8 | 8 | rotary | 5.2 x 8.85 x 19.5 | SMD, SCSI, ANSI ST412 | 5,120(Q1); 2,755(Q500) | |
| MV 330 | 8 | 338 | 18 | 13 | 13 | linear | 8.55 x 5.55 x 15 | SMD, SCSI, IPI-2 | 6,200(Q1); 3,645(Q500) | opt. dual port, power supply, rackmount |
| MV 660 | 8 | 671 | 18 | 13 | 13 | | 8.55 x 5.55 x 15 | SMD, SCSI, IPI-2 | 7,500(Q1); 4,400(Q500) | opt. dual port, power supply, rackmount |
| MVP 212 | 8 | 212 | 25 | 8 | 8 | rotary | 5.2 x 8.85 x 22.65 | SMD | 11,400(Q1); 7,500(Q500) | dual port |
| **MICROPOLIS CORP.** | | | | | | | | | | |
| 1403 | 8 | 82.96 | 20 | 5, 10 | 5, 10 | closed-loop rotary voice coil | 4.62 x 8.55 x 14.32 | SMD | 2,888(Q1); 2,387(Q500) | dedicated landing zone; opt. dual port, power supply |
| 1406 | 8 | 165.92 | 20 | 5, 10 | 5, 10 | closed-loop rotary voice coil | 4.62 x 8.55 x 14.32 | SMD | 3,745(Q1); 3,013(Q500) | dedicated landing zone; opt. dual port, power supply |
| 1456 | 8 | 331.8 | 20 | 10 | 20 | closed-loop rotary voice coil | 4.62 x 8.55 x 14.32 | SMD | 3,700(Q500) | dedicated landing zone; opt. dual port, power supply |
| **MODULAR COMPUTER SYSTEMS INC. (MODCOMP)** | | | | | | | | | | |
| 4177-3 | 14 | 67.4 | 30 | 5 | | linear | | | 17,550(Q1) | opt. dual port, computer interfaces |
| **NEC INFORMATION SYSTEMS INC.** | | | | | | | | | | |
| D2246 | 8 | 85 | 25 | 6 | 6 | closed-loop rotary | 5.5 x 8.6 x 16.5 | SMD | | opt. dual port |
| D2247 | 8 | 82.9 | 18.5 | 3 | 5 | rotary voice coil | 5.5 x 8.6 x 16.5 | | | opt. dual port, power supply |
| D2247E | 8 | 104.8 | 20 | 3 | 5 | rotary voice coil | 5.5 x 8.6 x 16.5 | | | opt. dual port, power supply |
| D2257 | 8 | 167.7 | 20 | 8 | 8 | closed-loop rotary | 5.5 x 8.6 x 16.5 | SMD | | opt. dual port |
| D2300 | 9 | 520 | 15 | 9.5 | 19 | closed-loop rotary | 10.2 x 8.5 x 20.5 | ESMD | | univeral power supply, automatic carriage, spindle lock; opt. dual port |

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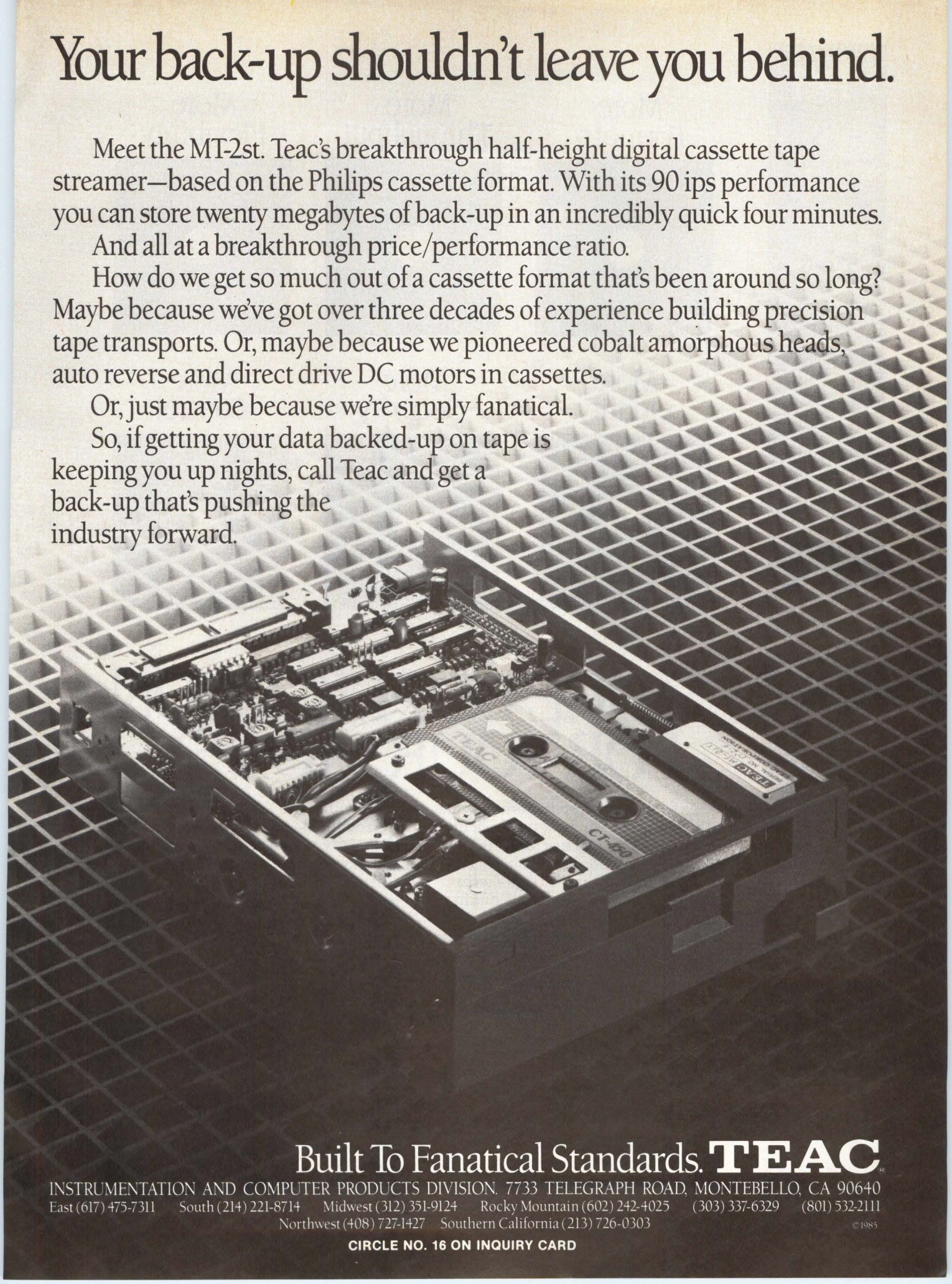


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CIRCLE NO. 16 ON INQUIRY CARD

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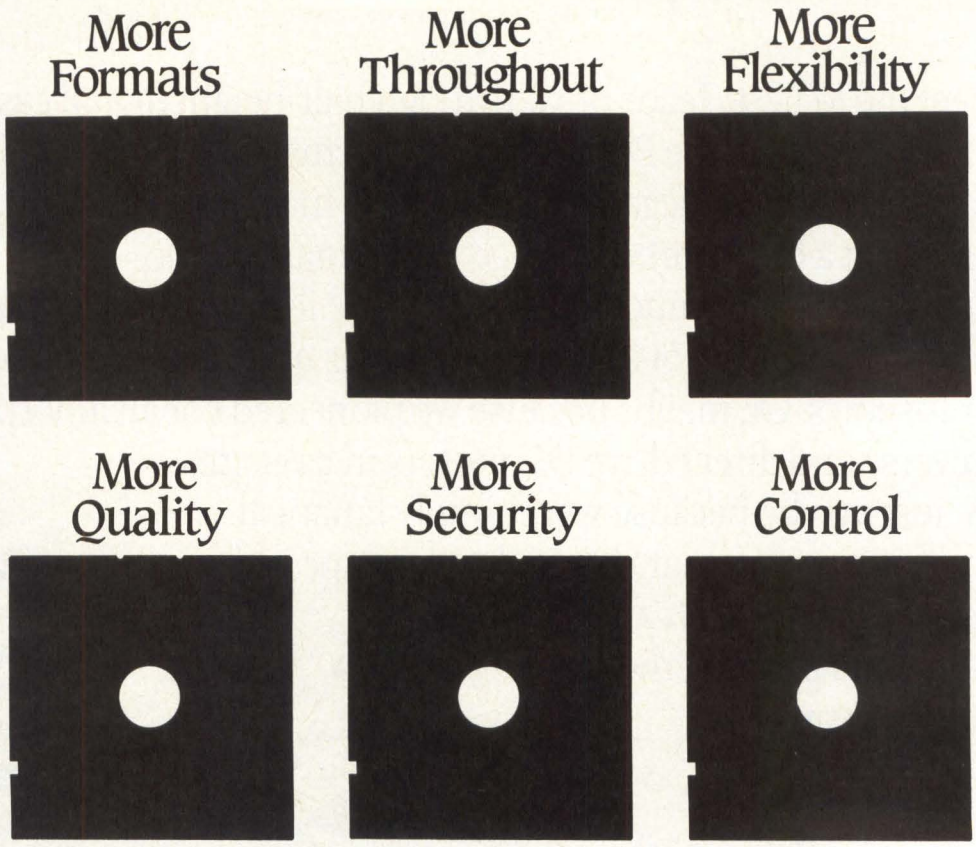


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CIRCLE NO. 17 ON INQUIRY CARD

## 8-INCH AND LARGER RIGID DISK DRIVES
## TABLE 1

| Company / Model | Disk size (inches) | Unformatted capacity (M bytes) | Average access time (msec) | Number of data surfaces | Number of read/write heads | Actuator type | Dimensions (H x W x D/inches) | Interface | Price ($) | Notes, features, options |
|---|---|---|---|---|---|---|---|---|---|---|
| **NATIONAL SEMICONDUCTOR DATACHECKER/DTS** | | | | | | | | | | |
| Dataflux 980U-4Q | 14 | 2 | 8.5, 12.5 | 2 | 128 | | 7 x 17 x 22 | | 10,000–11,000(Q1) | |
| Dataflux 990U-6Q | 14 | 3 | 8.5, 12.5 | 4 | 256 | | 9 x 17 x 22 | | 14,000–15,000(Q1) | |
| Dataflux 990U-8Q | 14 | 4 | 8.5, 12.5 | 4 | 256 | | 9 x 17 x 22 | | 15,750–16,750(Q1) | |
| **NEWBURY DATA RECORDING LTD.** | | | | | | | | | | |
| WINDSOR | 8 | 80 | 25 | 5 | 5 | closed-loop rotary voice coil | 4.65 x 8.58 x 15.18 | SMD | | |
| **NORTHERN TELECOM INC. (MEMORY SYSTEMS DIV.)** | | | | | | | | | | |
| 8204X | 8 | 93 | 23 | 4 | 4 | | | SMD, SCSI | 5,320(Q1) | embedded servo system, voltage monitoring |
| 8208X | 8 | 187 | 23 | 8 | 8 | | | SMD, SCSI | 8,400(Q1) | embedded servo system, voltage monitoring |
| 8210X | 8 | 234 | 23 | 10 | 10 | | | SMD, SCSI | 8,700(Q1) | embedded servo system, voltage monitoring |
| **PERTEC PERIPHERALS CORP.** | | | | | | | | | | |
| DX180 | 8 | 180 | 25 | 6 | 6 | rotary voice coil | 4.65 x 8.58 x 14.31 | SMD, ANSI | 4,295(Q1); 3,435(Q500) | opt. ½-inch streaming tape drive backup |
| DX240 | 8 | 240 | 25 | 8 | 8 | rotary voice coil | 4.65 x 8.58 x 14.31 | SMD, ANSI | 4,585(Q1); 3,665(Q500) | opt. ½-inch streaming tape drive backup |
| DX300 | 8 | 300 | 25 | 10 | 10 | rotary voice coil | 4.65 x 8.58 x 14.31 | SMD, ANSI | 5,000(Q1); 4,000(Q500) | opt. ½-inch streaming tape drive backup |
| **PRIAM CORP.** | | | | | | | | | | |
| 803 | 8 | 85.68 | 35 | 5 | 5 | closed-loop linear voice coil | 4.62 x 8.55 x 14.25 | SMD, ANSI, proprietary | 3,950(Q1); 2,950(Q500) | |
| 806 | 8 | 188 | 20 | 11 | 11 | closed-loop linear voice coil | 4.62 x 8.55 x 14.25 | SMD, SCSI, proprietary | 5,200(Q1); 3,450(Q500) | |
| 807 | 8 | 344 | 20 | 11 | 11 | closed-loop linear voice coil | 4.62 x 8.55 x 14.25 | SMD, SCSI, proprietary | 6,200(Q1); 4,105(Q500) | |
| 808 | 8 | 516 | 20 | 11 | 11 | closed-loop linear voice coil | 4.62 x 8.55 x 14.25 | SMD, SCSI, proprietary | 7,000(Q1); 4,630(Q500) | |
| 3450 | 8 | 35.28 | 42 | 5 | 5 | closed-loop linear voice coil | 4.62 x 8.55 x 14.25 | SMD, ANSI, proprietary | 3,500(Q1); 2,325(Q500) | |
| 7050 | 8 | 70.49 | 42 | 5 | 5 | closed-loop linear voice coil | 4.62 x 8.55 x 14.25 | SMD, ANSI, proprietary | 3,750(Q1); 2,850(Q500) | |
| **QUANTUM CORP.** | | | | | | | | | | |
| Q2020 | 8 | 16.80 | 60 | 4 | 4 | | 4.5 x 8.55 x 14.25 | SA1000 | 2,195(Q1); 1,478(Q500) | opt. power supply, automatic shipping lock |
| Q2030 | 8 | 25.20 | 60 | 6 | 6 | | 4.5 x 8.55 x 14.25 | SA1000 | 2,695(Q1); 1,775(Q500) | opt. power supply, automatic shipping lock |
| Q2040 | 8 | 33.60 | 65 | 8 | 8 | | 4.5 x 8.55 x 14.25 | SA1000 | 3,000(Q1); 2,075(Q500) | opt. power supply, automatic shipping lock |
| Q2080 | 8 | 67.41 | 40 | 7 | 7 | | 4.5 x 8.55 x 14.25 | SA1000 | 3,865(Q1); 2,450(Q500) | opt. power supply, automatic shipping lock |
| **SEAGATE TECHNOLOGY** | | | | | | | | | | |
| ST8100 | 8 | 102.1 | 30 | 5 | 10 | closed-loop linear voice coil | 2.3 x 8.5 x 12 | ST412-HP | | |

## 8-INCH AND LARGER RIGID DISK DRIVES
### TABLE 1

| Company / Model | Disk size (inches) | Unformatted capacity (M bytes) | Average access time (msec) | Number of data surfaces | Number of read write heads | Actuator type | Dimensions (H x W x D inches) | Interface | Price ($) | Notes, features, options |
|---|---|---|---|---|---|---|---|---|---|---|
| **TOSHIBA CORP.** | | | | | | | | | | |
| MK80F-10 | 8 | 15.3 | 40 | 2 | 2 | rotary voice coil | 9.4 x 15 x 5.9 | SMD | | |
| MK80F-20 | 8 | 23 | 40 | 3 | 3 | rotary voice coil | 9.4 x 15 x 5.9 | SMD | | |
| MK80F-30 | 8 | 38.3 | 40 | 5 | 5 | rotary voice coil | 9.4 x 15 x 5.9 | SMD | | |
| MK182F | 8 | 83 | 28 | 5 | 5 | rotary voice coil | 8.5 x 15 x 5.1 | SMD | | |
| MK184F | 8 | 116 | 28 | 7 | 7 | rotary voice coil | 8.5 x 15 x 5.1 | SMD | | |
| MK186F | 8 | 165.9 | 28 | 10 | 10 | rotary voice coil | 8.5 x 15 x 5.1 | SMD | | |
| **WANG LABORATORIES INC.** | | | | | | | | | | |
| 2265V-3 | 14 | | 25 | 20 | 20 | linear voice coil | 36.2 x 23 x 38 | SMD | 34,000(Q1) | |
| 2375V-1 | 9 | 516 | 20 | 12 | 24 | linear voice coil | 10.2 x 8.5 x 30 | ESMD | 25,000(Q1) | |

Information was solicited but not received from the following manufacturers:

Ampex Corp.

Cynthia Peripheral Corp

Data General Corp.

IBM Corp.

Mitsubishi Electronics America Inc.

National Memory Systems Corp.

Pertec Peripherals Corp.

For information on their products, consult the Supplementary Manufacturers' Directory of Digest Products on Page 110 .

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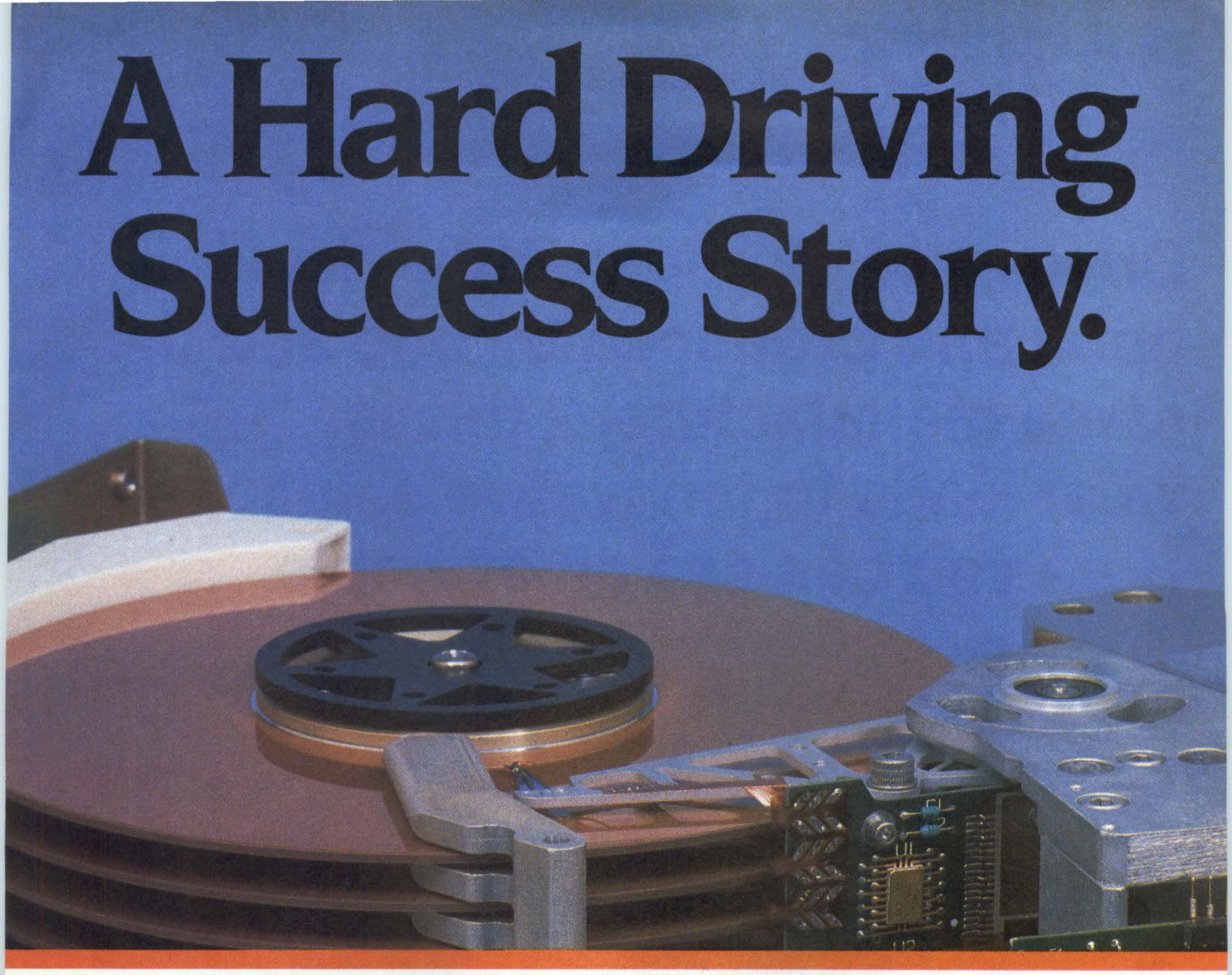

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CIRCLE NO. 18 ON INQUIRY CARD

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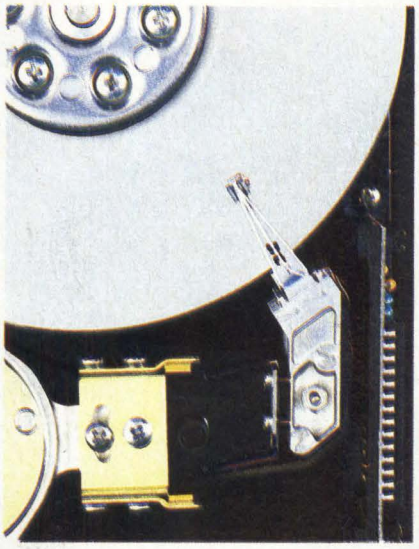

Our new 6190 fixed-disk drive can send the coolest computer pro into raptures. It is easy to see why: A thin-film metal circuit developed by BASF and mini Winchester heads combine to provide a capacity of 94 MB at highest data safety. Thanks to the rotary positioning system, also newly developed, extremely fast data access is assured, together with correspondingly high processing speed to meet severest demands in multi-user/multi-task applications.

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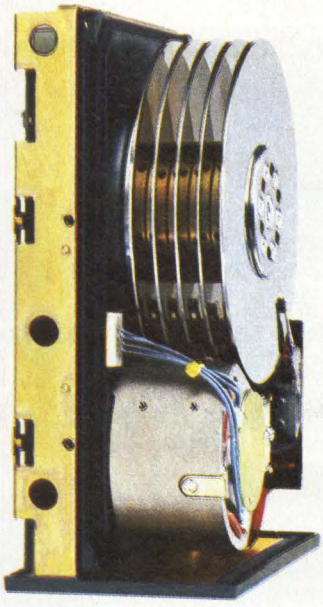

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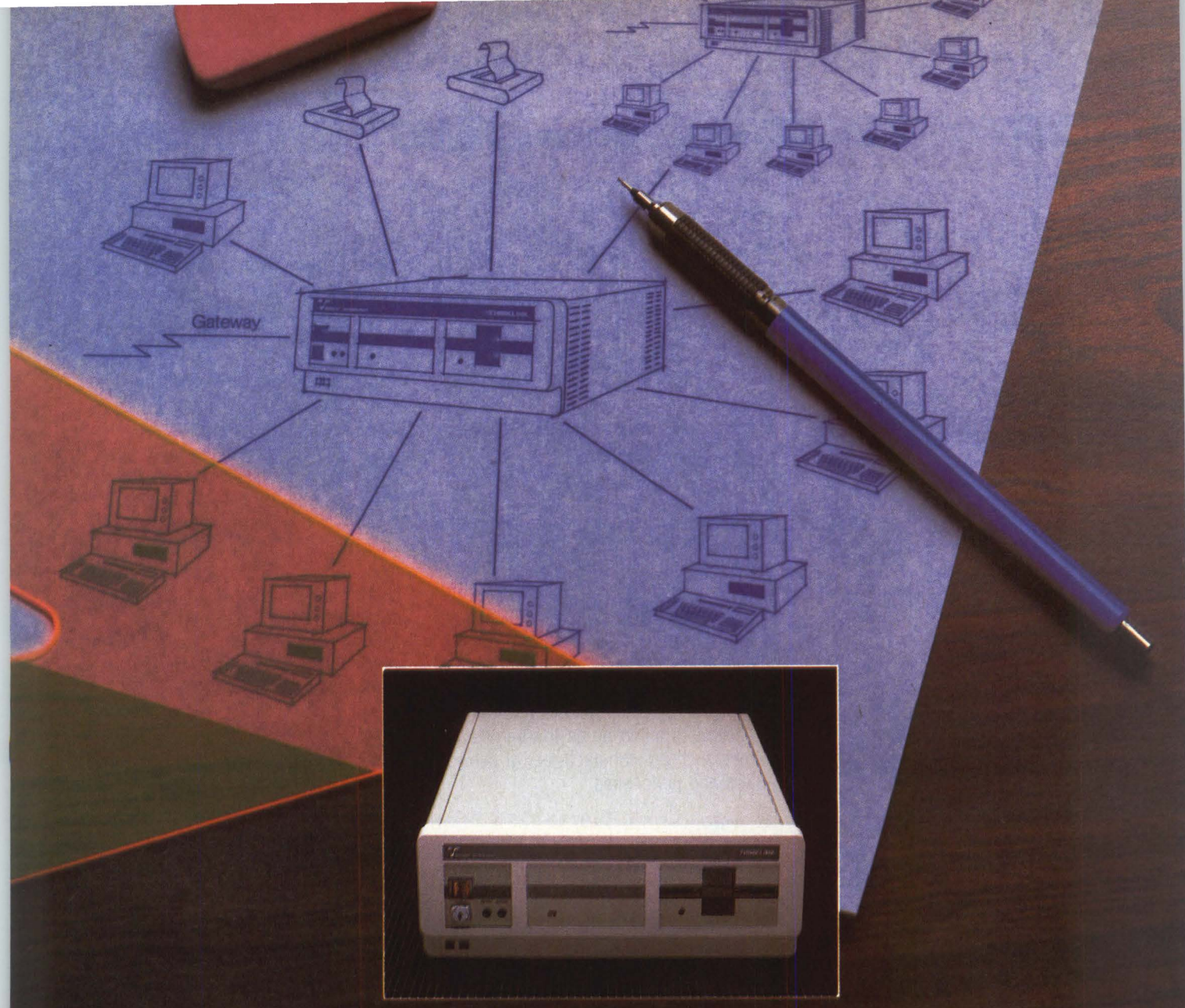
CIRCLE NO. 20 ON INQUIRY CARD

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CIRCLE NO. 21 ON INQUIRY CARD

# 8-INCH AND LARGER DISK DRIVE SUBSYSTEMS

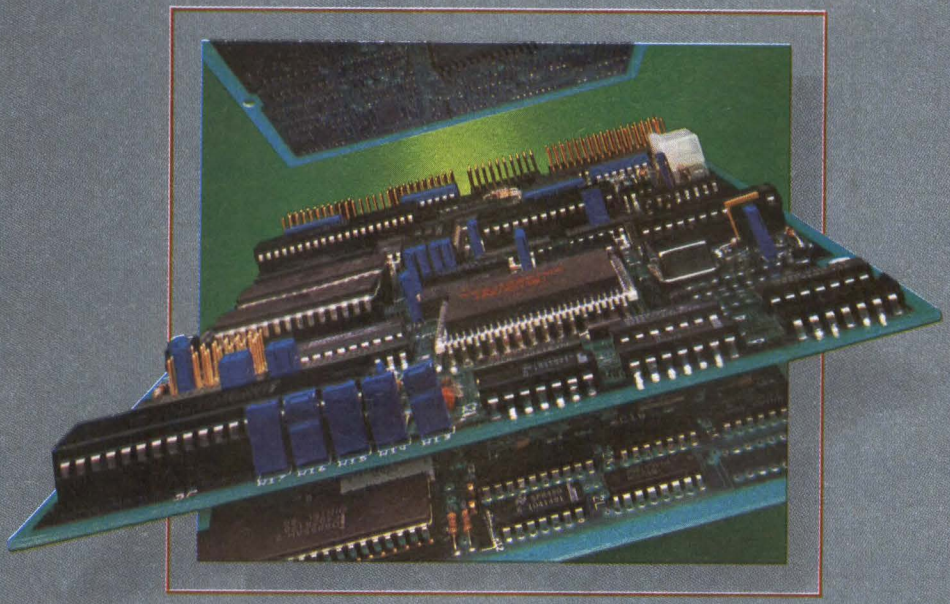
## TABLE 2

| Company / Subsystem Model | Disk drive manufacturer/ model | Capacity (M bytes) | Disk size (inches) | Computer/bus compatibility | Price ($) | Notes, features, options |
|---|---|---|---|---|---|---|
| **CENTURY DATA SYSTEMS INC.** | | | | | | |
| C2075 | Century Data Systems C2075 | 80.2 (fixed)/ 21.8 (removable) | 8 | | 4,525(Q1); 3,780(Q100) | detached power supply; SMD, LMD interface |
| C2120 | Century Data Systems C2120 | 122.9 (fixed)/ 28.5 (removable) | 8 | | 4,725(Q1); 4,110(Q100) | detached power supply; SMD, LMD interface |
| C2476 | Century Data Systems C2476 | 475.9 (fixed) | 8 | | 11,670(Q1); 6,960(Q100) | detached power supply, ESMD interface |
| **DATAPOINT CORP.** | | | | | | |
| 9325 Plus Series Disk Module | | 40 (fixed)/ 10 (removable) | 8 | | 17,750(Q1); 15,090(Q100) | |
| 9331 Dual Disk Drive | | 135 (fixed)/ 67 (removable) | 14 | | 17,000(Q1) | |
| **DIGITAL EQUIPMENT CORP.** | | | | | | |
| RA60 | Digital Equipment Corp. | 205 (removable) | 14 | Unibus, Q-bus, HSC 50 | 16,000(Q1) | includes power supply, rackmount, error correction, embedded servo positioning, DSA interface |
| RA80 | Digital Equipment Corp. | 121 (fixed) | 14 | Unibus, Q-bus, HSC 50 | 14,000(Q1) | includes power supply, rackmount, DSA interface |
| RA81 | Digital Equipment Corp. | 456 (fixed) | 14 | Unibus, Q-bus, HSC 50 | 19,000(Q1) | includes power supply, rackmount, error correction, dedicated servo surface, embedded servo positioning, DSA interface |
| RC25 | Digital Equipment Corp. | 26 (fixed)/ 26 (removable) | 8 | Unibus, Q-bus | 12,500(Q1) | includes power supply, standalone, rackmount, DSA interface |
| RL02 | Digital Equipment Corp. | 10 (removable) | 14 | Unibus, Q-bus | 3,600(Q1) | includes power supply, standalone, rackmount |
| **DISC TECH ONE INC.** | | | | | | |
| 4160 | Disc Tech One | 160 (fixed) | 14 | IBM PC, DEC, S-100, Multibus | 5,500(Q1); 4,000(Q100) | includes power supply, rackmount, controller, SMD interface |
| 4300 | Disc Tech One | 300 (fixed) | 14 | DEC RM05, S-100 Multibus | 7,000(Q1); 5,000(Q100) | includes power supply, rackmount, controller, SMD interface |
| 8070 | Disc Tech One | 60 (fixed) | 14 | DEC RK or RL emulation, Multibus | 3,500(Q1); 2,500(Q100) | includes power supply, rackmount, controller, ANSI interface |
| **GENERAL ROBOTICS CORP.** | | | | | | |
| WDD | Fujitsu America | 67 (fixed) | 8 | DEC RM02, RP02 emulation | 1,750(Q1) | SMD interface, diskette, tape backup; opt. chassis |
| **HARRIS CORP. (COMPUTER SYSTEMS DIV.)** | | | | | | |
| Harris 5120 | | 72 (fixed) | 8 | Harris super-minicomputers | 19,400(Q1) | includes integrated disk controller, SMD interface |
| Harris 5130 | | 144 (fixed) | 8 | Harris super-minicomputers | 23,200(Q1) | includes integrated disk controller, SMD interface |
| Harris 5360 | | 406 (fixed) | 10.5 | Harris super-minicomputers | 26,000(Q1) | includes integrated disk controller, SMD interface |
| Harris 5630 | | 72 (removable) | 14 | Harris super-minicomputers | 20,900(Q1) | includes integrated disk controller, SMD interface |
| Harris 5650 | | 300 (removable) | 14 | Harris super-minicomputers | 26,500(Q1) | includes integrated disk controller, SMD interface |
| Harris 5660 | | 675 (fixed) | 14 | Harris super-minicomputers | 44,500(Q1) | includes integrated disk controller, SMD interface |
| **HEWLETT-PACKARD CO. (DISC MEMORY DIV.)** | | | | | | |
| 7911P | Hewlett-Packard 7911 | 28.1 (fixed) | 14 | IEEE-488 | 13,750(Q1) | includes ¼-inch streaming tape drive |
| 7911R | Hewlett-Packard 7911 | 28.1 (fixed) | 14 | IEEE-488 | 13,750(Q1) | includes ¼-inch streaming tape drive |
| 7912P | Hewlett-Packard 7912 | 65.6 (fixed) | 14 | IEEE-488 | 14,800(Q1) | includes ¼-inch streaming tape drive |

## 8-INCH AND LARGER DISK DRIVE SUBSYSTEMS
## TABLE 2

| Company / Subsystem Model | Disk drive manufacturer/ model | Capacity (M bytes) | Disk size (inches) | Computer/bus compatibility | Price ($) | Notes, features, options |
|---|---|---|---|---|---|---|
| 7912R | Hewlett-Packard 7912 | 65.6 (fixed) | 14 | IEEE-488 | 14,800(Q1) | |
| 7914P | Hewlett-Packard 7914 | 132.1 (fixed) | 14 | IEEE-488 | 17,350(Q1) | |
| 7914R | Hewlett-Packard 7914 | 132.1 (fixed) | 14 | IEEE-488 | 17,350(Q1) | |
| **IBIS SYSTEMS INC.** | | | | | | |
| Model 1400 | Ibis Systems Inc. Model 1400 | 1250 (fixed) | 14 | custom | 65,000(Q1); 53,800(Q100) | internal power supply, custom interface |
| **IOMEGA CORP.** | | | | | | |
| Bernoulli Box A110 | Iomega Alpha 10 | 10 (fixed)/ 10 (removable) | 8 | IBM PC/XT/AT; Texas Instruments Professional | 2,695(Q1) | field upgradable, SCSI interface |
| Bernoulli Box A210 | Iomega Alpha 10 (2) | 20 (fixed)/ 20 (removable) | 8 | IBM PC/XT/AT; Texas Instruments Professional | 3,695(Q1) | two 10M-byte drives, built-in backup, SCSI interface |
| **KENNEDY CO.** | | | | | | |
| 4055 | Kennedy Co. 4055 | 40 (fixed) | 8 | | 5,800(Q1) | internal power supply, cartridge tape backup; SMD, ANSI, PICO interface |
| 7340 | Kennedy Co. 7340 | 40 (fixed) | 8 | DEC RL01/02, 606X, 6067 | 3,200(Q1) | external power supply; SMD, ANSI, PICO interface |
| 7380 | Kennedy Co. 7380 | 80 (fixed) | 8 | DEC RL01/02, 606X, 6067 | 3,995(Q1) | external power supply; SMD, ANSI, PICO interface |
| 8055 | Kennedy Co. 8055 | 80 (fixed) | 8 | | 6,600(Q1) | internal power supply, cartridge tape backup; SMD, ANSI, PICO interface |
| 73160 | Kennedy Co. 73160 | 160 (fixed) | 8 | RL01/02, 606X, 6067 | 4,695(Q1) | external power supply; SMD, ANSI, PICO interface |
| **MEGAVAULT MEMORIES** | | | | | | |
| Vault 10 1080 | MegaVault MV83 | 80 (fixed) | 8 | | | SMD, ANSI, SCSI, SA 1000 interface; opt. dual port power supply |
| Vault 10 1180 | MegaVault MV186 | 186 (fixed) | 8 | | | SMD, ANSI, SCSI interface; opt. dual port power supply |
| Vault 10 1200 | MegaVault MV212 | 212 (fixed) | 8 | | | SMD, ANSI, SCSI interface; opt. dual port power supply |
| **MEMOREX CORP.** | | | | | | |
| 3652 Disc Subsystem | Memorex | 635 (fixed) | 14 | (2) IBM 3350 | 57,745(Q1) | intelligent dual interface |
| 3680 Disc Storage Device | Memorex | 1.26G (fixed) | 14 | IBM 3380 | 40,096(Q1) | single spindle architecture |
| 3695 Disc Subsystem | Memorex | 819.7 (fixed) | 14 | IBM 3375 | 28,770(Q1) | opt. dual port |
| **MILTOPE CORP.** | | | | | | |
| RD 45 | Milltope | 35 (fixed)/ 35 (removable) | 8 | Rolm, IBM, Norden PDP Series | 20,000(Q1) | SMD interface |
| RD 160 | Miltope | 134 (fixed)/ 134 (removable) | 8 | Rolm, IBM, Norden PDP Series | 25,000(Q1) | SMD interface |
| **NCR CORP.** | | | | | | |
| 6099-1001 | | 20.4 (fixed)/ 20.4 (removable) | 8, 9 | | 12,700(Q1) | SCSI interface |
| 6099-1101 | | 40.8 (fixed)/ 40.8 (removable) | 8, 9 | | 20,700(Q1) | SCSI interface |
| 6099-2001 | | 134.8 (fixed) | 9 | | 16,500(Q1) | SCSI interface |
| 6099-2101 | | 155.2 (fixed)/ 20.8 (removable) | 8, 9 | | 23,500(Q1) | SCSI interface |
| 6099-2201 | | 134.8 (fixed)/ 67.4 (removable) | 9 | | 26,600(Q1) | SCSI interface |
| **NATIONAL SEMICONDUCTOR DATACHECKER/DTS** | | | | | | |
| Dataflux DC108 | Datachecker/DTS Dataflux 980 | 2 (fixed) | 14 | DEC PDP-8, Unibus | 3,000(Q1) | transparent to DEC software |
| Dataflux DC111C | Datachecker/DTS Dataflux 980 | 1 (fixed) | 14 | DEC PDP-11, RC11 emulation; Unibus | 4,500(Q1) | transparent to DEC software |
| Dataflux DC111K | Datachecker/DTS Dataflux 980 | 9.6 (fixed) | 14 | DEC PDP-11, RC11 emulation; Unibus | 5,000(Q1) | transparent to DEC software |

# SCSI.
# A secret weapon in the battle against obsolescence.



**It's the interface that lets you design systems people can grow with — not grow out of.**

SCSI. Small Computer Systems Interface. A major advance in systems integration — because, unlike today's less intelligent I/O architectures, it gives you the flexibility to put systems together the way *you* want. Using virtually any peripherals — in both single- *and* multiple-host systems. And at the same time, it ensures that the system you design will remain open to future peripheral expansion.

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NCR helped develop SCSI. And we've been the undisputed leader in designing and manufacturing SCSI components — and in making them smaller, better and less expensive.

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## SCSI Products from NCR

### Host Adapters

IBM PC to SCSI Adapter
Multibus to SCSI Adapter

### Disk Controllers

SCSI/ST506 Controller for 5¼" Disks
SCSI/SMD-O Controller for Large Disks
Disk Controller Module

### Tape Controllers

SCSI/PERTEC Controller for ½" Tape
SCSI/QIC-02 Controller for ¼" Tape

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NCR

OEM Products Wichita, KS 67226 1-800-325-SCSI

Find out more about SCSI at COMDEX/Spring Booth 800

CIRCLE NO. 22 ON INQUIRY CARD


# Our Low-Cost Voice Data Entry Peripheral Could Double Your Computer System's Productivity

Verbex voice data entry has improved the speed and accuracy of data entry operations for companies across the country. We're helping firms in material handling, inventory control, inspection, test and other applications save thousands of dollars in time and labor costs, often resulting in productivity gains of 100% and more. Now *you* can offer this proven technology in a new, low-cost voice data entry peripheral – the Verbex Series 4000 Voice Recognizer.

Integrating seamlessly with your own system, the Series 4000 Voice Recognizer adds simultaneous voice input to keyboard data entry for virtually any mainframe, mini, micro or personal computer. It loads voice patterns and applications vocabularies directly from your host system, or from its own reusable CMOS voice cartridges. Users simply drop their own cartridges into the Series 4000 Voice Recognizer console and it instantly responds to verbal commands despite accent, dialect, or interference from loud background noise.

### Simple software tools let you create custom vocabularies.

With our Series 4000 Voice Planner™ software, you can program vocabularies for any customer application. Voice Planner software runs on IBM® PC, PC compatible, and DEC VAX™ systems, and is readily adaptable to other computing environments.

### True continuous speech recognition: the key to your success.

With Verbex, the user inputs data in a natural voice, so there's no risk of fatigue or irritation caused by the staccato diction that other products require. And while others may claim it, only Verbex's patented continuous speech recognition achieves this natural man/machine interface without sacrificing accuracy or vocabulary size.

For details on the Series 4000 or our OEM/VAR programs, call toll-free 1-800-343-4458. In Mass., call (617) 275-5160. Or write on company letterhead and ask for a free video tape of voice applications. Verbex, Two Oak Park, Bedford, MA 01730.

**Verbex**

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**CIRCLE NO. 23 ON INQUIRY CARD**

**See us at Comdex Spring Booth #6136**

## 8-INCH AND LARGER DISK DRIVE SUBSYSTEMS
### TABLE 2

| Company / Subsystem Model | Disk drive manufacturer/ model | Capacity (M bytes) | Disk size (inches) | Computer/bus compatibility | Price ($) | Notes, features, options |
|---|---|---|---|---|---|---|
| **QUALOGY INC.** | | | | | | |
| D880 | Shugart SA1004; Quantum Q2030, Q2040 | 7.8, 20.8, 31.2 (fixed) | 8 | Q-bus, Unibus, DEC RL01/RL02 emulation | 5,495-8,495(Q1) | standalone, built-in diagnostics |
| M770 | Shugart SA1004; Quantum Q2040, 2080 | 10, 40, 80 (fixed) | 8 | Multibus | 4,195-9,470(Q1) | single controller interface, non-interleaved operation |
| **RACET COMPUTES LTD.** | | | | | | |
| PCMS-150 | Priam | 150 (fixed) | 8 | IBM PC; Tandy Model 2, 12 | 15,900(Q1); 10,900(Q100) | SMD interface, 150M-byte streaming tape drive backup, software transparent to PC or MS DOS |
| PCMS-411 | CENTURY DATA AMS-513 | 411 (fixed) | 14 | IBM PC; Tandy Model 2, 12 | 24,500(Q1); 15,900(Q100) | SMD interface, 150M-byte streaming tape drive backup, software transparent to PC or MS DOS |
| **SYSTEM INDUSTRIES** | | | | | | |
| 9722 | Fujitsu 2322 | 124 | 8 | Unibus, CMI, SBI, Cache | | SMD interface |
| 9751 | Fujitsu 2351 | 414 (fixed) | 14 | Unibus, CMI, SBI, Cache | | SMD interface |
| 9798 | Fujitsu 2398 | 532 (fixed) | 14 | Unibus, CMI, SBI, Cache | | SMD interface |
| **TECSTOR INC.** | | | | | | |
| Series 3/315 | Tecstor | 3.32 (fixed) | 14 | Control Data 9766 | 9,850(Q1); 5,600(Q100) | SMD interface |
| Series 3/316 | Tecstor | 332 (fixed) | 14 | Tandem | 11,519(Q1); 8,412(Q100) | |
| Series 3/317 | Tecstor | 332 | 14 | Honeywell | 16,000(Q1); 7,715(Q100) | |

Information was solicited but not received from the following manufacturers: Perkin-Elmer Corp. (Data Systems)

For information on their products, consult the Supplementary Manufacturers' Directory Digest Products on page 110.

# HOW LONG SHOULD A DISK DRIVE RUN BEFORE IT RUNS INTO TROUBLE?

NEC 8" Winchesters have twice the industry standard MTBF.

## Is 24,000 hours too much to ask?

We don't think so. But then we're the only disk drive producer who could dare ask this question. Because we're the only one who has a disk drive MTBF of 24,000 hours. And not just in the lab but proven in the field.

We did it on our 8" Winchester drive. Which makes our 8" Winchesters two to three times as reliable as anybody else's.

You can expect superior reliability from NEC drives in any size. And that includes our 5¼" and our new 3½" drives.

## We go to greater lengths in building and testing.

Our drives are more reliable because we take extra care. From the initial design through manufacturing and testing.

One reason is our "zero-defects" policy. The goal is nothing less than perfection. That's why every NEC drive is subjected to a 24 hour burn-in before testing. And our floppy disk drives are assembled automatically.

CIRCLE NO. 25 ON INQUIRY CARD

## Take a nice, long drive with NEC.

NEC has been designing disk drives for over 25 years. We were one of the first to develop magnetic recording devices way back in 1959. Today, we're a worldwide company with 8 billion dollars a year in sales.

Obviously we're here to stay.

And we have the resources to give you the support you need to stay competitive. Along with the drives. Not just today. But also down the road.

Isn't it time you got started with NEC? Just call 1-800-343-4418. (In Massachusetts call 617-264-8635.) Or send us the coupon.

And find out why more and more OEM's are saying, "NEC and me."


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**Floppy Drives**
- ☐ 3½"
- ☐ 5¼" half-height
- ☐ 8"

**Winchesters**
- ☐ 8"
- ☐ 5¼" half-height
- ☐ 9"

Name _____

Title _____

Company _____

Address _____

City _____

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Tel ( ) _____

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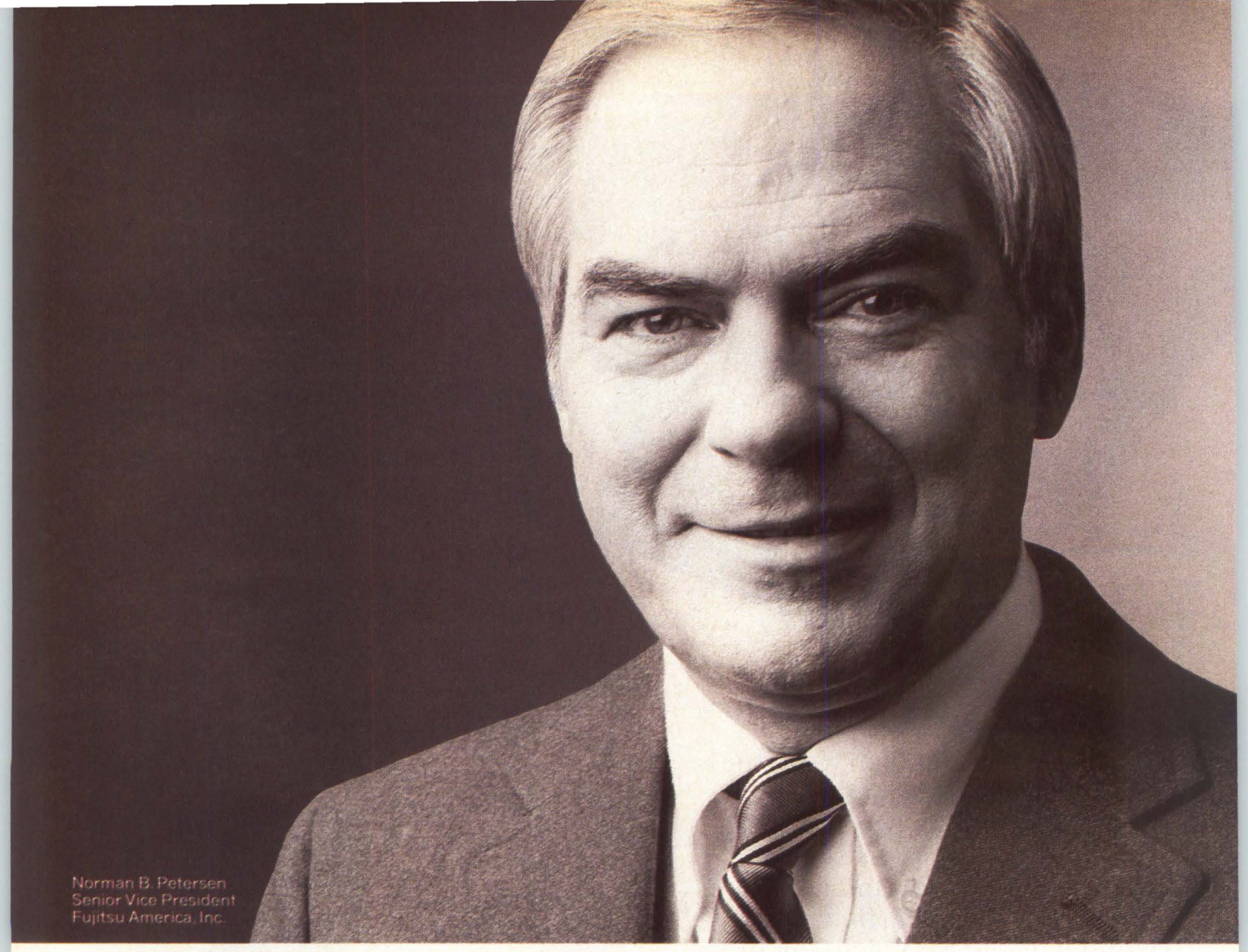
Department 1610
Boxborough, MA 01719

MMS 4/85

**NEC AND ME**




# "At last there's a high-performance 5¼" disk drive with Fujitsu quality. From Fujitsu, of course."

Finally there's a 5¼" disk drive that offers you the kind of high-performance features and quality components generally found only in larger, more expensive drives.

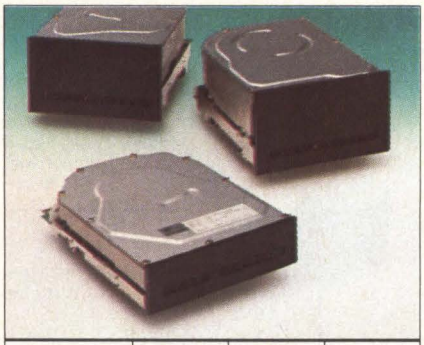
It's from Fujitsu, of course. We worked very hard to perfect this drive, so we could offer you a product that is competitive in price, yet still superior in quality.

So we designed it with proven technology, using standard ferrite heads and oxide recording media.

Then we proved it in the field. And today, based on actual operating experience, we now back all our 5¼" drives with a specified MTBF of more than 20,000 power-on hours.

So you can design them into your system with complete confidence.

You'll get a top-notch performer, too. With from 31 to 86 megabytes of capacity, 33 millisecond average positioning time, and a 625 kilobyte-per-second transfer rate!



| MODEL | M2241 | M2242 | M2243 |
|---|---|---|---|
| CAPACITY (MB) Unformatted | 31 | 55 | 86 |
| AVERAGE POSITIONING TIME (msec) | 33 | 33 | 33 |
| TRANSFER RATE (KB/sec) | 625 | 625 | 625 |
| INTERFACE | ST506/ SA4000 | ST506/ SA4000 | ST506/ SA4000 |
| POSITIONING METHOD | Rotary Voice Coil | Rotary Voice Coil | Rotary Voice Coil |

We also offer a full line of stepper-motor, standard performance 5¼" drives. With capacities from 13.3 to 26 megabytes. Plus half-high models with 6.6 and 13.3 megabyte capacities.

To assure you prompt delivery, we have just completed a new plant, adding 220,000 square feet to our 5¼" manufacturing capability.

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And we can deliver.

Fujitsu Storage Products. Maximum Performance. Maximum Quality.

**FUJITSU AMERICA, INC.**

FUJITSU



CIRCLE NO. 26 ON INQUIRY CARD

# 8-INCH AND LARGER CARTRIDGE DISK DRIVES

## TABLE 3

| Company / Model | Disk size (inches) | Unformatted capacity (M bytes) | Average access time (msec) | Number of data surfaces | Number of read/write heads | Actuator type | Dimensions (H x W x D/inches) | Interface | Price ($) | Notes, features, options |
|---|---|---|---|---|---|---|---|---|---|---|
| **AMCODYNE INC.** | | | | | | | | | | |
| Arapahoe 7110 | 8 | 26.9 (fixed)/ 26.9 (removable) | 35 | 4 | 4 | closed-loop linear voice coil | 4.6 x 8.5 x 14 | SMD | 4,695(Q1); 2,875(Q500) | dynamic head loading, embedded servo system |
| Arapahoe 7110S | 8 | 26.9 (fixed)/ 26.9 (removable) | 29 | 4 | 4 | closed-loop linear voice coil | 4.6 x 8.5 x 14 | SCSI | 5,370(Q1); 3,295(Q500) | dynamic head loading, embedded servo system |
| **CENTURY DATA SYSTEMS INC.** | | | | | | | | | | |
| Trident T306 | 14 | 315 (removable) | 30 | 20 | 19 | closed-loop linear voice coil | 36 x 19.5 x 33 | SMD | 13,900(Q1); 9,750(Q500) | |
| **CONTROL DATA CORP.** | | | | | | | | | | |
| 9448-32 | 14 | 16 (fixed)/ 16 (removable) | 30 | 2 | 2 | closed-loop linear voice coil | 10.5 x 19 x 30.5 | SMD | 6,630(Q1); 4,730(Q500) | |
| 9448-64 | 14 | 48 (fixed)/ 16 (removable) | 30 | 4 | 4 | closed-loop linear voice coil | 10.5 x 19 x 30.5 | SMD | 7,320(Q1); 5,420(Q500) | |
| 9448-96 | 14 | 80 (fixed)/ 16 (removable) | 30 | 6 | 6 | closed-loop linear voice coil | 10.5 x 19 x 30.5 | SMD | 8,010(Q1); 6,110(Q500) | |
| 9457 | 8 | 25.7 (fixed)/ 25.7 (removable) | 35 | 4 | 4 | closed-loop linear voice coil | 5.2 x 8.58 x 20.88 | SMD | 4,075(Q1); 2,800(Q500) | embedded servo system, self-test; opt. digital fault status display |
| 9458 | 8 | 26.7 (fixed)/ 26.7 (removable) | 35 | 4 | 4 | closed-loop linear voice coil | 5.2 x 8.58 x 20.88 | SMD | 4,075(Q1); 2,860(Q500) | embedded servo system, self-test, DEC RL02 disk drive emulation; opt. digital fault status display |
| **CONTROL DATA CORP. (OEM PRODUCT SALES)** | | | | | | | | | | |
| CDC 9710-80 RSD | 9 | 82.9 (removable) | 30 | 5 | 5 | linear voice coil | 10.2 x 8.5 x 24.25 | SMD | 5,680(Q1); 4,370(Q500) | opt. power supply, dual access |
| CDC 9762 SMD | 14 | 80 (removable) | 30 | 5 | 5 | linear voice coil | 10.5 x 19 x 30 | SMD | 8,035(Q1); 5,840(Q500) | opt. dual channel, rackmount |
| CDC 9766 SMD | 14 | 300 (removable) | 30 | 19 | 19 | linear voice coil | 10.5 x 19 x 30 | SMD | 13,840(Q1); 10,945(Q500) | opt. dual channel |
| LaserDrive 1200 | 12 | 1000, 2000 (removable) | 150 | 1, 2 | 1 | linear voice coil | 5.24 x 19 x 25.6 | ISI, SCSI | 6,600(Q250) | |
| **CONTROL DATA CORP. (MINI-MICRO SYSTEMS)** | | | | | | | | | | |
| Certainty 270/271 | 14 | 63 (removable) | 30 | 5, 10, 19 | 5, 10, 19 | linear voice coil | 36.2 x 23 x 36 | IBM Series/1 | 14,500–27,550(Q1); 10,150–19,285 (Q500) | includes controller |
| Certainty 280 | 14 | 64.5/129 (fixed)/ 13.3/26.6 (removable) | 30 | 6, 12 | 6, 12 | linear voice coil | 36 x 21.5 x 36 | IBM Series/1 | 17,550–29,550 (Q1); 12,285–20,685 (Q500) | includes controller |
| **DATREX INC.** | | | | | | | | | | |
| Series 6000 | 14 | 6.25 (fixed)/ 6.25 (removable) | 35 | 4 | 4 | linear voice coil | 8.75 x 19 x 28 | | 2,575(Q1); 2,100(Q500) | |
| **HEWLETT-PACKARD CO. (DISC MEMORY DIV.)** | | | | | | | | | | |
| 7906H | 14 | | 25 | 3 | 3 | closed-loop linear voice coil | 32.5 x 21.6 x 32 | HP-IB, IEEE-488 | 16,830(Q1) | |
| 7906M | 14 | | 25 | 3 | 3 | closed-loop linear voice coil | 32.5 x 21.6 x 32 | HP-IB, IEEE-488 | 18,870(Q1) | |
| 7906S | 14 | | 25 | 3 | 3 | closed-loop linear voice coil | 32.5 x 21.6 x 32 | slave drive for HP 7906M | 14,790(Q1) | |
| 7920H | 14 | | 25 | 5 | 5 | closed-loop linear voice coil | 32.5 x 21.6 x 32 | HP-IB | 19,990(Q1) | |
| 7920M | 14 | | 25 | 5 | 5 | closed-loop linear voice coil | 32.5 x 21.6 x 32 | HP-IB | 22,130(Q1) | |

## 8-INCH AND LARGER CARTRIDGE DISK DRIVES

### TABLE 3

| Company / Model | Disk size (inches) | Unformatted capacity (M bytes) | Average access time (msec) | Number of data surfaces | Number of read/write heads | Actuator type | Dimensions (H x W x D/inches) | Interface | Price ($) | Notes, features, options |
|---|---|---|---|---|---|---|---|---|---|---|
| 7920S | 14 | | 25 | 5 | 5 | closed-loop linear voice coil | 32.5 x 21.6 x 32 | slave drive for HP 7920M | 17,850(Q1) | |
| 7925H | 14 | | 25 | 9 | 9 | closed-loop linear voice coil | 28.25 x 21.78 x 31.13 | HP-IB, IEEE-488 | 20,360(Q1) | |
| 7925M | 14 | | 25 | 9 | 9 | closed-loop linear voice coil | 28.25 x 21.78 x 31.13 | HP-IB, IEEE-488 | 22,510(Q1) | |
| 7925S | 14 | | 25 | 9 | 9 | closed-loop linear voice coil | 28.25 x 21.78 x 31.13 | | 18,220(Q1) | |
| 7935H | 14 | | 24 | 13 | 13 | closed-loop linear voice coil | 32.5 x 21.7 x 32.8 | HP-IB | 28,070(Q1) | |
| **IOMEGA CORP.** | | | | | | | | | | |
| Alpha 10 | 8 | 14 (fixed)/ 14 (removable) | 35 | 1 | 1 | rotary voice coil | 4.5 x 8.54 x 14.09 | SCSI | 1,745(Q1) | includes controller |
| **MILTOPE CORP.** | | | | | | | | | | |
| RD45 | 8 | 45 (fixed)/ 35 (removable) | 42 | 6 | 6 | rotary | 12 x 6.187 x 21 | SMD | 20,000(Q1) | |
| RD160 | 8 | 160 (fixed)/ 134 (removable) | 26 | 12 | 11 | rotary | 12.187 x 6.687 x 21 | SMD | 25,000(Q1) | |
| **NEWBURY DATA RECORDING LTD.** | | | | | | | | | | |
| D9448 | 14 | 32, 64, 96 (fixed)/ 16 (removable) | 30 | 2, 4, 6 | 2, 4, 6 | closed-loop linear voice coil | 10.5 x 19 x 30.5 | SMD | | |
| D9760 | 14 | 80, 300 (removable) | 30 | 5, 19 | 5, 19 | closed-loop linear voice coil | 10.5 x 19 x 30 | SMD | | |
| **VERMONT RESEARCH CORP.** | | | | | | | | | | |
| 8010 | 8 | 11 (removable) | 55 | 2 | 2 | closed-loop linear voice coil | 7 x 8.5 x 16.6 | SASI, ANSI | | includes power supply, controller; opt. ruggedized construction |
| 8520 | 8 | 22 (fixed)/ 11 (removable) | 55 | 4 | 4 | closed-loop linear voice coil | 7 x 8.5 x 16.6 | SASI, ANSI | | includes power supply, controller; opt. ruggedized construction |
| **WANG LABORATORIES INC.** | | | | | | | | | | |
| 2265V-1 | 14 | | 30 | 5 | 5 | linear voice coil | 36 x 22 x 36 | SMD | 12,000(Q1) | |
| 2265V-2 | 14 | | 30 | 19 | 19 | linear voice coil | 36 x 23 x 36 | SMD | 18,000(Q1) | |
| 2267V-1 | 9 | 82.9 (removable) | 30 | 5 | 5 | linear voice coil | 10.2 x 8.5 x 30 | SMD | 12,000(Q1) | |
| 2280-3A | 14 | | 30 | 6 | 6 | linear voice coil | 10.5 x 19 x 31.75 | SMD | 16,500(Q1) | includes disk-processing unit |
| 2280N-3A | 14 | | 30 | 6 | 6 | linear voice coil | 10.5 x 19 x 31.75 | SMD | 13,000(Q1) | |
| 2280V-3 | 14 | | 30 | 6 | 6 | linear voice coil | 36 x 21 x 33 | SMD | 13,000(Q1) | |

Information was solicited but not received from the following manufacturers:

Ampex Corp.

Cynthia Peripheral Corp.

Data General Corp.

IBM Corp.

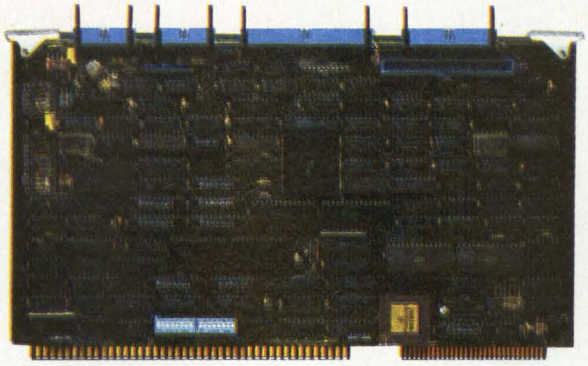
For information on their products, consult the Supplementary Manufacturers' Directory of Digest Products on Page 110 .

# "With the Interphase Storager,™ I can make a 5¼" hard disk perform like an 8" disk."

**Frank Emser**
Manager Hardware Development
Paradyne Corporation

The Interphase Storager Multibus™ controller can give a 5¼" Winchester disk capabilities never before possible. Storager not only gets more performance from existing ST506 drives, but also supports the new ESDI and ST412HP interfaces for more power and capacity than ever before. And since Storager can control two Winchester disks, four ¼" tapes (QIC-02), and two 3½", 5¼" or 8" floppies, the same controller can be used for every storage need.

Storager features 1:1 interleave, with concurrent disk and tape transfers and simultaneous disk and bus transfers for speed and high performance. And Storager's unique "virtual buffer" architecture with UNIX™-optimized intelligent caching can reduce or eliminate disk rotational latency and overcome data overrun/underrun problems of FIFO-based controllers. Plus, for the very first time on a controller, Storager has an *on-board* 68000 CPU.



The Storager controller is the latest product in Interphase's line of high-performance Multibus controllers. Interphase also offers Multibus controllers for SMD disks, local area networks and video monitors. Plus powerful disk controllers for the IBM® PC. They're all backed by a great customer support team that works full time with Interphase customers to assure that our products work the way they should — in the system.

Find out how Storager can make a 5¼" disk perform like an 8" disk. Call Interphase today at (214) 350-9000.

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UNIX is a trademark of Bell Laboratories
IBM is a registered trademark of International Business Machines

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CIRCLE NO. 27 ON INQUIRY CARD

# HITACHI ANNOUNCES OUR 39TH DISK DRIVE TRIUMPH.

Hitachi's new DK512-17 squeezes 171 MBytes of unformatted storage—the most ever—onto 5¼" coated media. It complements our full line of high-performance Winchester disk drives, which offers you increments of 36, 51, 86 and 120 MBytes.

Like all our products, the DK512-17 is tough. Our MTBF is the best in the industry: 20,000 power-on hours. We maintain this high standard by making every key component of every drive.

The past 21 years have been full of triumphs like this. It began with our 14" products in the 60's and 70's. Ten years ago, we introduced Winchester technology to our 14" drives.

In 1980, we brought out a complete line of 8" Winchester disk drives; in 1982, we introduced our 5¼" Winchester. Then in 1984, we announced 2.6 gigabytes on an optical disk.

And this promises to be our best year yet.

171 MB AND RELIABLE COATED MEDIA IN A 5¼" DRIVE.

# AND OUR 40TH.

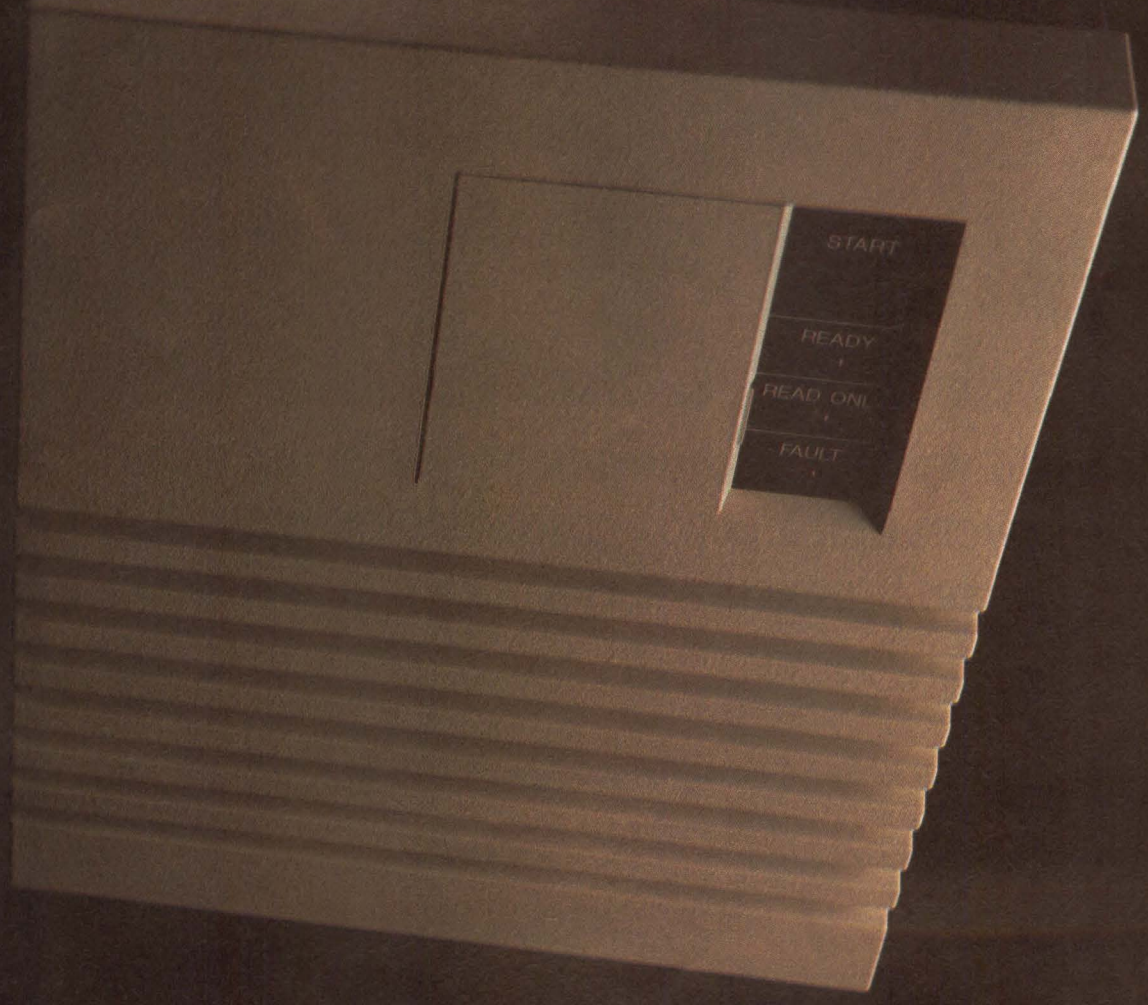
This is a triumph of rather bigger proportions. Our DK815-5 packs 525 MBytes onto an 8.8" drive. It's so compact, you can put two side-by-side in a 19" rack for more than a gigabyte of storage.

And the depth is only 20", much less than that for comparable units.

With an average access time of 18 milliseconds, this is the perfect combination for faster, larger systems.

So if you're looking for reasons why we're the largest OEM supplier of disk drives in Japan, we'll give you 40 of them.

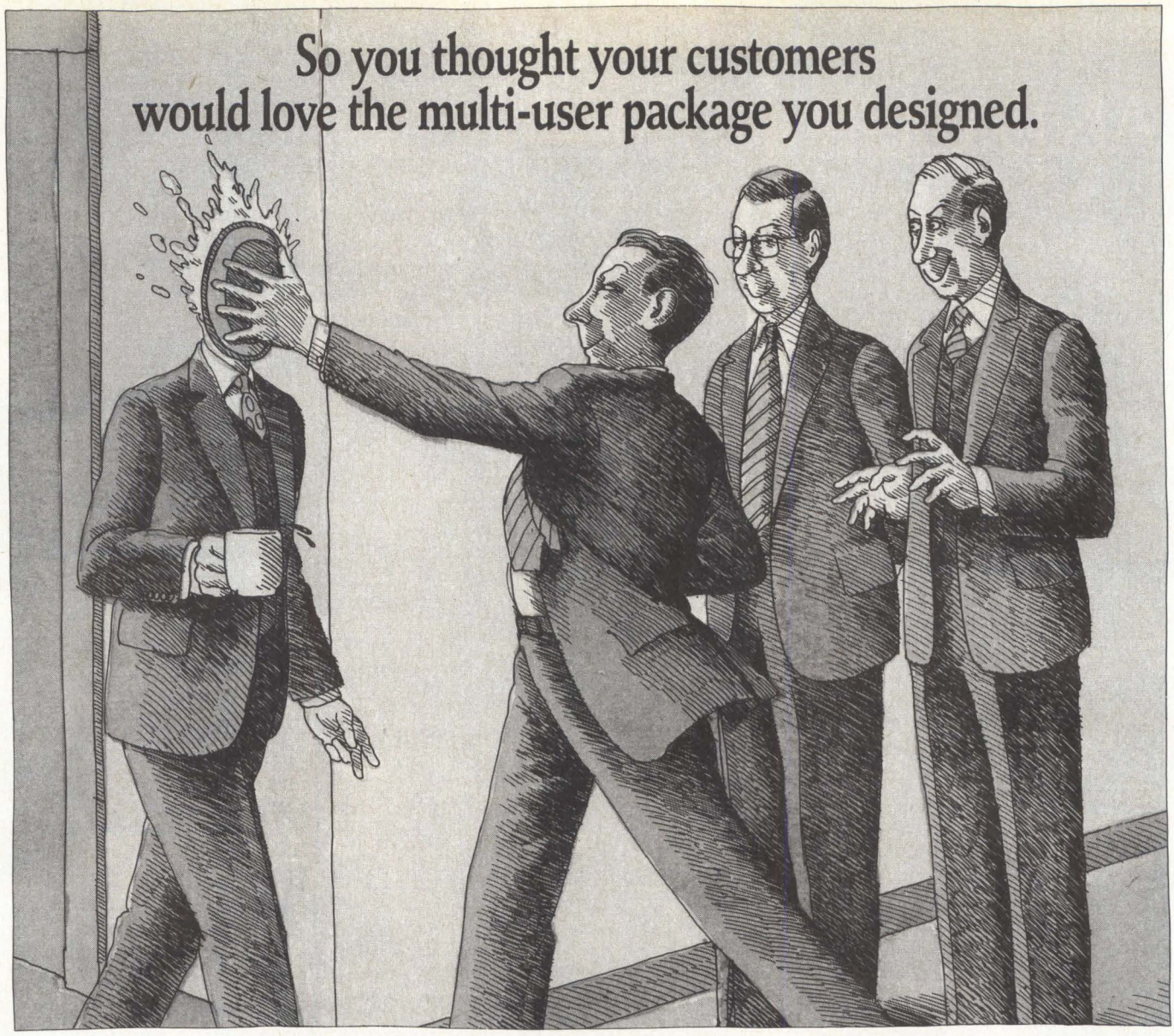
**Hitachi America, Ltd.**
950 Elm Avenue, San Bruno, CA 94066




GIGABYTE-PLUS CAPACITY
IN A 19" RACK.

HITACHI

CIRCLE NO. 28 ON INQUIRY CARD




# Too bad you didn't know about North Star's Dimension. The system that lets you customize business solutions—without compromising performance or IBM compatibility.

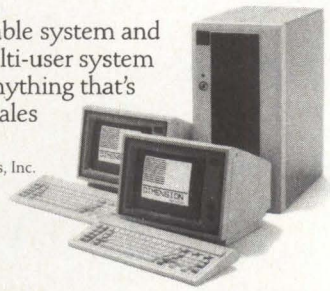
Customizing multi-user computer packages for vertical markets used to mean compromising either price or performance. But no more. Because now there's Dimension™ from North Star.

Dimension is a perfect fit for virtually any market you can name. Its architecture is designed specifically for the multi-user environment, with each individual user having his or her own 8088-2 microprocessor, plus access to a central 80186 server processor that controls the system's shared resources. As a result, up to 12 Dimension users can simultaneously share data, files, software and expensive peripherals.

And to make writing your own proprietary software applications as easy as pie, Dimension's new PC-DOS compatible operating system was designed utilizing popular multi-user standards. Plus, the operating system already runs dozens of the best selling software titles for the IBM® PC/XT including multi-user applications right off the shelf.

What's more, you don't have to worry about discount computer stores undercutting your profit margin. Because we're distributing Dimension exclusively through a network of selected resellers, and supporting them with software tools, a technical hotline, training and documentation, co-op advertising, and reliable after-the-sale service.

To find out how this remarkable system and your software will give you a multi-user system for vertical markets superior to anything that's available today, call North Star's sales department at (415) 357-8500.



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IBM is a registered trademark of International Business Machines, Inc.

NorthStar™

**The brightest alternative to PCs.™**

# 8-INCH FLEXIBLE DISK DRIVES AND SUBSYSTEMS

## TABLE 4

| Company / Model | Unformatted capacity (bytes) | Single-sided/ double-sided | Average access time (msec) | Transfer rate (K bits/sec) | Number of tracks per surface | Number of tracks per inch | Dimensions (H x W x D/inches) | Price ($) | Notes, features, options |
|---|---|---|---|---|---|---|---|---|---|
| **BASF AG** | | | | | | | | | |
| 6102 | 800K | single-sided | 152 | 500 | 77 | 48 | 4.3 x 8.5 x 14 | | interchangeable bezels |
| 6104 | 1.6M | double-sided | 76 | 500 | 77 | 48 | 4.3 x 8.5 x 14 | | interchangeable bezels |
| **BERING INDUSTRIES INC.** | | | | | | | | | |
| 2895 | 1.6M | double-sided | 174 | 62.5 | 77 | | 4.2 x 15.5 x 17.5 | 2,990(Q1) | IBM 3740-, Hewlett-Packard-compatible; multiport, automatic format, rackmount; opt. hard disk up to 60M |
| 3800 | 1.6M | double-sided | 174 | 62.5 | 77 | | 7.3 x 19 x 21.6 | 4,990(Q1) | IBM 3740-, Hewlett-Packard-compatible, rackmount |
| **CONTROL DATA CORP.** | | | | | | | | | |
| 9406-4 | 800K, 1.6M | double-sided | 91 | 250, 500 | 77 | 48 | 4.65 x 8.55 x 14 | 400(Q1) | write protect |
| **DATA COMPASS** | | | | | | | | | |
| I-8480 | 2.4M | double-sided | 3 | 500 | 77 | 48 | | 1,495(Q1) | |
| I-8481 | 1.2M | double-sided | 3 | 500 | 77 | 48 | | 995(Q1) | |
| I-8482 | 1.2M | single-sided | 3 | 500 | 77 | 48 | | 1,295(Q1) | |
| I-8483 | 600K | single-sided | 3 | 500 | 77 | | | 895(Q1) | includes power supply |
| **DIGITAL EQUIPMENT CORP.** | | | | | | | | | |
| RX02 | 512K | single-sided | 262 | 61 | 77 | 48 | 10.5 x 19 x 17 | 4,150(Q1) | includes controller, power supply |
| **GRECO SYSTEMS** | | | | | | | | | |
| FDS-800 (subsystem) | 800K, 1.6M | double-sided | 91 | 250, 500 | 154 | 48 | 5.50 x 17 x 16.75 | 4,500(Q1) | includes controller, power supply |
| FDS-800/2 (subsystem) | 1.6M, 3.2M | double-sided | 91 | 250, 500 | | | 7 x 19 x 16.75 | 5,500(Q1) | includes controller, power supply |
| **HITACHI AMERICA LTD.** | | | | | | | | | |
| FDD-412 A/B | 1.6M | double-sided | | 62.5 | 77 | 48 | 8.54 x 2.17 x 12.91 | | head loading system |
| FDD-413 A/B | 1.6M | double-sided | | 62.5 | 77 | 48 | 8.54 x 2.17 x 12.91 | | IBM interface |
| FDD-441 | 9.6M | double-sided | 140 | 187.5 | 154 | 96 | 8.54 x 2.24 x 12.99 | | ST506, SCSI interface |
| **I2 INTERFACE** | | | | | | | | | |
| TM848-1 | 500K | single-sided | 91 | 250 | 77 | 48 | 2.3 x 8.55 x 13.125 | 475(Q1); 270(Q500) | half-height drive |
| TM848-2 | 1000K | double-sided | 91 | 250 | 77 | 48 | 2.3 x 8.55 x 13.125 | 575(Q1); 320(Q500) | half-height drive |
| **IOMEGA CORP.** | | | | | | | | | |
| Alpha 10 | 14.1M | single-sided | 35 | 1.13M | 306 | 300 | 4.5 x 8.5 x 14 | 1,745(Q1); 1,295 (Q500) | includes SCSI controller |
| Alpha 10H | 14.1M | single-sided | 35 | 1.13M | 306 | 300 | 2.32 x 8.54 x 12 | 1,745(Q1); 1,295 (Q500) | includes SCSI controller |
| PC-10 (subsystem) | 14.1M | single-sided | 35 | 1.13M | 306 | 300 | 5.5 x 19.5 x 18.9 | 2,695 | includes host adapter, software |
| PC-20 (subsystem) | 28.2M | single-sided | 35 | 1.13M | 306 | 300 | 5.5 x 19.5 x 18.9 | 3,695 | includes host adapter, software |
| **MILTOPE CORP.** | | | | | | | | | |
| Alpha 10 (subsystem) | 10M (formatted) | single-sided | 35 | 1.13M | 306 | 300 | 6.125 x 10.5 x 20.75 | 12,000(Q1) | |
| DD 400 (subsystem) | 6.4M | single-sided | 6 | 250, 500 | 77 | 48 | 6 x 10 x 18 | 4,950(Q1) | |
| DD 450 (subsystem) | 1.6M (formatted) | double-sided | 5 | 250, 500 | 77 | 48 | 6 x 10 x 18 | 5,650(Q1) | |
| **NCR CORP.** | | | | | | | | | |
| 6097-6560 | 2M (formatted) | double-sided | 174 | 500 | 77 | 48 | 6 x 14 x 16 | 2,950(Q1) | includes power supply |
| 6097-6660 | 1M (formatted) | double-sided | 174 | 500 | 77 | 48 | 6 x 14 x 16 | 1,900(Q1) | includes power supply |

## 8-INCH FLEXIBLE DISK DRIVES AND SUBSYSTEMS

### TABLE 4

| Company / Model | Unformatted capacity (bytes) | Single-sided/ double-sided | Average access time (msec) | Transfer rate (K bits/sec) | Number of tracks per surface | Number of tracks per inch | Dimensions (H x W x D/inches) | Price ($) | Notes, features, options |
|---|---|---|---|---|---|---|---|---|---|
| **NEC INFORMATION SYSTEMS INC.** | | | | | | | | | |
| FD1165 | 1.6M | double-sided | | 62.5 | 77 | 48 | 2.28 x 8.55 x 12.7 | 330(Q500) | |
| **QUALOGY INC.** | | | | | | | | | |
| 430 | 1M (formatted) | single-sided | 296 | | 77 | | 5.25 x 17.6 x 21 | 2,495(Q1) | Q-bus compatible, emulates DEC RX02 |
| 440 | 1M (formatted) | single-sided | 296 | | 77 | | 5.25 x 17.6 x 21 | 3,895(Q1) | Q-bus, Unibus-compatible; emulates DEC RX02; standalone; diagnostics |
| 480 | 2M (formatted) | double-sided | 174 | | 77 | | 5.25 x 17.6 x 21 | 4,495(Q1) | Q-bus, Unibus-compatible; emulates DEC RX02; standalone; diagnostics |
| **SHUGART CORP.** | | | | | | | | | |
| 801 | 800K | single-sided | 210 | 500 | 77 | 48 | 4.62 x 8.55 x 14.25 | | |
| 851 | 1.6M | double-sided | 91 | 64 | 76 | 48 | 4.62 x 8.55 x 14.25 | | |
| **TANDON CORP.** | | | | | | | | | |
| TM848E-1 | 800K | single-sided | 91 | 500 | 77 | 48 | 2.30 x 8.55 x 12.2 | 250(Q1) | |
| TM848E-2 | 1.6M | double-sided | 91 | 500 | 77 | 48 | 2.30 x 8.55 x 12.2 | 285(Q1) | |
| **TECHTRAN INDUSTRIES INC.** | | | | | | | | | |
| TR-10 | 1.2M | double-sided | | 110–9600 | 77 | 48 | | 3,995(Q1) | transaction recorder |
| **TOSHIBA CORP.** | | | | | | | | | |
| ND-40D | 1.6M | double-sided | 76 | 500 | 77 | 48 | 2.2 x 8.5 x 12.4 | | |
| **WANG LABORATORIES INC.** | | | | | | | | | |
| 2270A-2 | 630.8K (formatted) | single-sided | 363 | 31 | 77 | | 19 x 17.5 x 16.3 | 4,700(Q1) | |
| 2270A-3 | 946.2K (formatted) | single-sided | 363 | 31 | 77 | | 19 x 17.5 x 16.3 | 6,200(Q1) | |
| **Y-E DATA INC.** | | | | | | | | | |
| YD-174 | 1.6M | double-sided | 91 | 500 | 77 | 48 | 4.5 x 8.55 x 14.57 | | |
| YD-180 | 16.4M | double-sided | 91 | 500 | 77 | 48 | 2.25 x 8.55 x 12.6 | | |

Information was solicited but not received from the following manufacturers:

Advanced Electronic Design Inc.

Alloy Computer Products Inc.

Caldisk

Datapoint Corp.

Memorex Corp. (a subsidiary of Burroughs Corp.)

Mitsubishi Electronics America Inc.

Motorola Microsystems

Qume Corp.

Remex (Div. of Ex-Cell-o Corp.)

Scientific Microsystems Inc.

For information on their products, consult the Supplementary Manufacturers' Directory of Digest Products on Page 110 .

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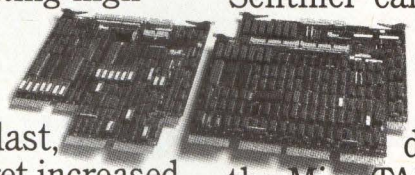
CIRCLE NO. 30 ON INQUIRY CARD

# BIG FOR YOUR

# NEWS
# LITTLE VAX.

Extra! Extra! DILOG announces the only combined hardware, software driver and diagnostic packages for integrating high-performance disk and tape backup to the MicroVAX®. At last, it's possible to get increased speed and capacity in peripheral devices, without spending more for the controller than the cost of the actual drive.



## DISK PACKAGES.

The new MicroSMD™ (MV210) includes a DILOG disk controller and software for interfacing any SMD-type Winchester or removable disk drive with capacities to 450 megabytes.

There's also a product for small Winchesters. The Micro506™ (MV610) controller and software interfaces ST506/412-type 5¼″ Winchesters.

## TAPE PACKAGES.

DILOG's new MicroTK™ (MV342) coupler and software interfaces ¼″ CDC Sentinel® cartridge tape drives to the MicroVAX.

For ½″ tape drives, there's the MicroTAPE™ (MV132). The accompanying software allows you to interface most popular ½″ streaming and start-stop drives, with densities to 6250 bpi.

If you'd like to learn more about our MicroVAX mass storage products, call (714) 937-5700. Or write DILOG, P.O. Box 6270, Anaheim, CA 92806. We'll send you a spec sheet that's hot off the press.

**DILOG**

**EMULATION IS NOT ENOUGH.**

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CIRCLE NO. 31 ON INQUIRY CARD


# Let QDRIVE help you out of a sticky situation.

**QDRIVE ™ dissolves the glue from "cut and paste".**

If you're still using scissors and glue to merge your output from various software packages, you need QDRIVE from Talaris Systems.

**QDRIVE. The missing link.**

QDRIVE is a software package designed to merge the output from your text formatting tools with the output from your graphics generating tools.

The Talaris 2400 Laser Printer

QDRIVE will merge and print your text **and** graphics on the same page. You won't need to coordinate separate printing steps, programmers and word processing operators, or a paste up artist. And with QDRIVE, every copy is an original.

**Talaris software is compatible with your software.**

With QDRIVE, you can merge your text and graphics on a page-by-page basis or for an entire document. Text files generated with TEX ™, TROFF, MASS-11 ™, SCRIBE®, RUNOFF ™, and many other word processing tools can be merged with graphics from CalComp, Versaplot ™, Tektronix ®, DISSPLA ™, TELL-A-GRAF ™, DI-3000 ®, RS/1 ™, and TEMPLATE ®.

All you need to know is the size to be allowed for the figure and the graphics file location.

QDRIVE will do the rest — scaling the graphics file to fit, and positioning it correctly on the page.

**Talaris has the one-source solution.**

Talaris Systems has the hardware to match the software.

Talaris offers a complete line of high-resolution **laser printers**.

These printers can print the full range of files that QDRIVE can create. From **8 to 24 pages** per minute and with over **600 fonts** to choose from.

Call Talaris Systems for more information about the QDRIVE solution.

Once you've tried it, we think you'll stick to it.

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*a software company*

TALARIS SYSTEMS INC.

**Headquarters:** P.O. Box 261580/San Diego, CA 92126/(619) 587-0787
**East Coast Office:** Ste. 400/67 So. Bedford St./Burlington, MA 01803/(617) 229-5820

CIRCLE NO. 32 ON INQUIRY CARD

# LEANER PAGE PRINTERS BID FOR OFFICE SPACE

## Huge high-cost page printers still do the big jobs, but under-$4,000 versions are challenging entrenched line and daisywheel units


**Today's page printers** *can print "near-typeset-quality" text and reproduce detailed graphics on the same page (characters enlarged five times). Print samples in this article were produced by the Apple LaserWriter.*

**Rick Dalrymple,** Senior Editor

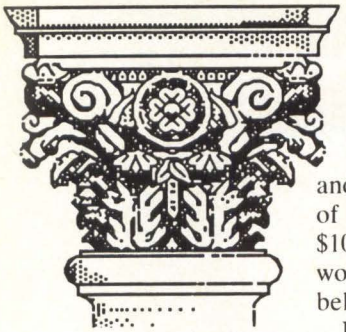
The first users of page printers were data-processing centers where today's high-performance versions still spurt out millions of pages a month at a rate of 200 pages per minute (ppm). This is a mammoth output, and the machines carry a mammoth price tag—about $300,000. The majority of printer buyers, however, have much smaller volume requirements, and for those buyers there is a growing number of scaled-down units—some priced at under $4,000. No longer limited to the data-processing center, lower-cost products are allowing today's system integrators to extend the benefits of page printers to businesses as small as a newsletter produced by one person.

C.A. Pesko Associates Inc., a Marshfield, Mass., market research company specializing in page printers, divides the market into four segments: centralized, satellite, office cluster and workstation.

The centralized and satellite segments are closely related. Page printers in these environments serve large business establishments in which printing volumes are measured in millions of pages per month. Centralized page printers typically run at speeds in excess of 100 ppm and sell for $200,000 to $300,000. Page printers in a satellite operation, however, may not have as big a workload as those in a centralized site. Therefore, a page printer running at 35 to 80 ppm, priced at $40,000 to $100,000, may suffice. The main difference between these two environments is that the satellite printer is located at a place more convenient to users. Typically, centralized and satellite printers are organizationally linked. Companies normally employ only one or two satellite printers for each major location.

### Lower prices open applications

The dramatic reduction in the size of page printers over the years has allowed the newer machines to compete in both the office-cluster



and workstation environments. End-user prices of office-cluster page printers now range from $10,000 to $20,000, while end-user prices for workstation page printers have started to drop to below $4,000.

In an office-cluster environment, a page printer serves a work force of up to 50 employees who utilize similar files and produce similar documents. Since they can be located much closer to the users, page printers in an office cluster are more convenient than are centralized or satellite page printers. In a smaller company, an office-cluster page printer may serve as the central printer. Office-cluster page printers function well in applications in which most of the printing consists of short runs of small- to moderate-sized documents. Typical volume for an office-cluster page printer is 5,000 to 20,000 pages per month and typical printing speeds are from 10 to 20 ppm.

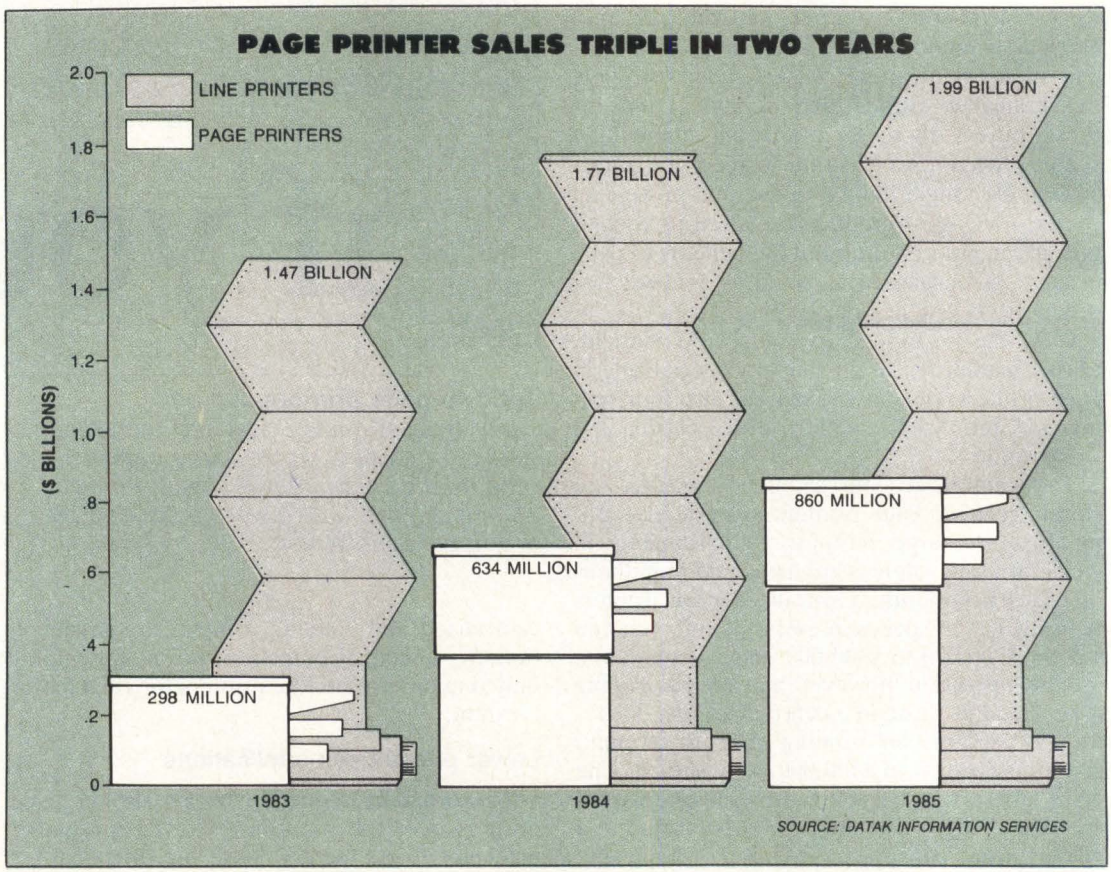
**End-user prices of office-cluster page printers now range from $10,000 to $20,000.**

The most decentralized operating environment is that of the personal workstation. In this operating environment, a user may have exclusive control over the page printer. Operating at speeds of less than 10 ppm, workstation page printers function well in applications in which most of the printing jobs are only a few pages long and the monthly printing volume is below 5,000 pages.

Most page-printer manufacturers and computer manufacturers that offer page printers under their own labels buy the print engines on an OEM basis and add their own controllers (often microcomputers), storage facilities (such as disk drives and RAM), interfaces, emulations, power supplies and enclosures. Many page printers are based on the same print engine. The characteristics that differentiate one printer from another are generally attributable to the functions performed by the controller and the software provided for emulations, graphics and type fonts (see "Controllers are the key to added value," right).

Clearly the most popular print engine for workstation page printers is the LBP-CX from Canon USA Inc. The engine of choice for many office-cluster page printers is the XP-12 from Xerox Corp. Also gaining strength for both cluster and workstation printers are print engines from the LP4000/3000 series made by Ricoh Corp.

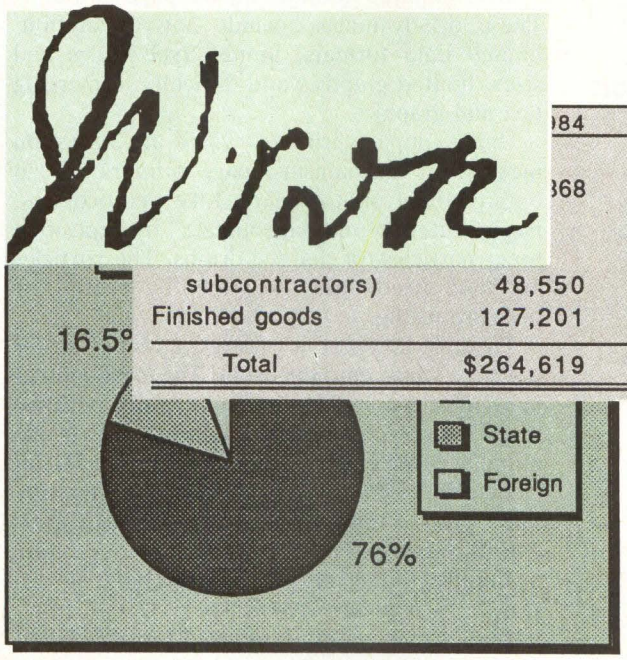
According to Edward Webster, editor of the



*Printout* newsletter published by Datek Information Services, Waltham, Mass., the Canon LBP-CX "is one of those great leaps forward in terms of concept and price/performance."

Currently, daisywheel printers are feeling the most competition from printers based on the Canon LBP-CX engine. The lowest-cost page printers now on the market are priced about the same as a daisywheel printer. These LBP-CX-based printers usually emulate the Diablo Systems Inc. 630 printer and, therefore, compete as "plug-in-and-play" replacements for daisywheel printers. Compared to daisywheel printers, however, low-cost page printers offer faster printing and boast several resident fonts, graphics and quieter operation. "Competitive laser printers have emerged a lot sooner than expected, cutting short the heyday of the daisywheel printer," says Jonathan Dower, a Datek vice president. Dower claims there are only about two more years of growth left for daisywheel printers.

"The next victim will be the fully formed-character line printer," says Dave Glidewell, of Dataquest Inc.'s electronic printer industry service, based in San Jose, Calif. Glidewell points out that, although line printers in general continue to be cost-effective solutions in high-duty-cycle applications, a requirement for either fully formed characters or text and graphics will tip the scales in favor of page printers.




Impact printing technologies such as daisywheels, thimbles, golf balls, chains, bands and drums all suffer the same disadvantages

## Controllers are the key to added value

Since many page printers are based on the same print engine, page-printer manufacturers must add value to differentiate their products. That added value is usually a combination of printer emulations, type sizes and fonts, graphics software interfaces and software that allows text and graphics to be combined in the printed document.

The device that runs all of the above software is the page-printer controller. Page-printer controllers are microcomputers in their own right, and many are based on the 68000 microprocessor from Motorola Inc. The page-printer controller may be connected to memory boards and a disk drive. Obviously, as the amount of RAM and disk drive capacity increases, so does the price of the page printer. In some of the more sophisticated page printers, the cost of the print engine may be 20 percent of the integrated printer.

A productive way to increase a page printer's versatility and market is for it to offer not only a wide selection of emulations (so that it can function as a "plug-in-and-play" replacement for another printer) but also printer drivers for popular host computers and installed application software.

For example, QMS Inc., Mobile, Ala., is one of several page-printer manufacturers that have worked with third-party software vendors so that the company's Lasergrafix printers can be used with the software packages. The printer driver is obtained from the third-party software vendor and includes packages such as: Tell-A-Graph and Disspla from ISSCO graphics, San Diego; DI-3000 from Precision Visuals Inc., Boulder, Colo.; SAS/System from the SAS Institute Inc., Cary, N.C.; CCSI-PLOT from Cerritos Computer Services Inc., Long Beach, Calif., a package that allows the page printer to be used as if it were a multipen incremental x-y pen plotter; and PostScript from Adobe Systems Inc., San Jose, Calif.

PostScript is available with the LaserWriter from Apple Computer Inc., Cupertino, Calif. QMS is now offering an Adobe PostScript-based controller for its Lasergrafix page printers, and Apple Macintosh users can use a Lasergrafix printer instead of the Apple LaserWriter. QMS' controller allows users to treat text, graphics and scanned images in an integrated manner. This allows users to format complex pages and to scale, rotate and transform character shapes. The resulting output, claims QMS, is suitable for business or scientific publishing applications.

**'The next victim will be the fully formed character line printer.'**

when compared to non-impact page printers. These disadvantages include noisy operation, limited data formats, limited type styles and sizes, limited graphics and difficulty in merging text and graphics.

Unlike impact printers, which are based on mechanical mechanisms, page printers are an outgrowth of photocopiers. Like photocopiers, page printers print "page images" by depositing toner particles on charged drums. The particles are then fixed onto the paper by heating or pressure fusing.

There is, however, a variety a ways to transfer the page image onto the drum. The most popular method is to use a laser beam to write a negative image by erasing portions of an image that was initially completely black. Other methods include a liquid crystal shutter technology incorporated into Epson America Inc.'s GQ 3000 (MMS, January, Page 54) and an ion-deposition technique found in Delphax System's S6000 (MMS, September 1984, Page 35). Two other technologies recently introduced for page printers are the binary-deflection/multiple-array technique, a variation on the continous-stream ink-jet employed by Diconix Inc., and the technique used in a magnetic printer from Ferix Corp. that uses a magnetic drum with thin-film magnetic recording heads (MMS, October 1984, Page 59).

Even manufacturers of laser-beam page printers don't agree on what is the best technology. General Optronics Corp. uses a diode laser instead of a gas laser and a holographic-defraction grating instead of the more typical spinning polygon mirror. In theory, holographic scanners should deliver a cleaner scan than a spinning mirror. To date, however, the General Optronics Holoscan 28 stands alone as the only diode-laser, holographic-scanner printer.

No one technology is emerging as the best for page printers. With so many alternatives available, a variety of technologies will probably find sucess in different segments of the page-printer market. One trend, however, is clear. As soon as a page printer product reaches a price competitive with other printers, users will switch. □

Interest Quotient (Circle One)
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# THE LEADER IN LASERS PRESENTS THE 28-PAGE-PER MINUTE HOLOSCAN PRINTER.

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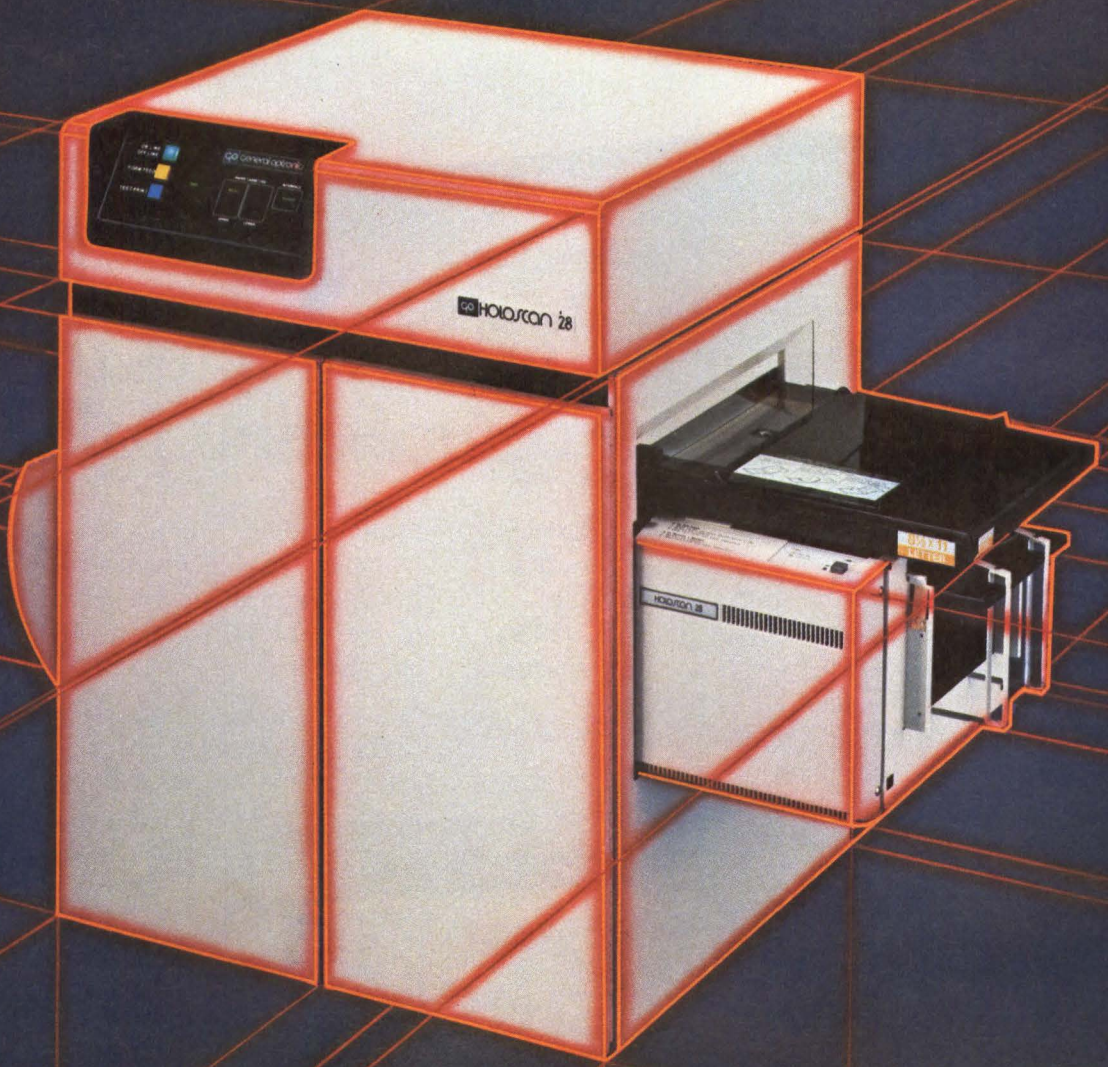
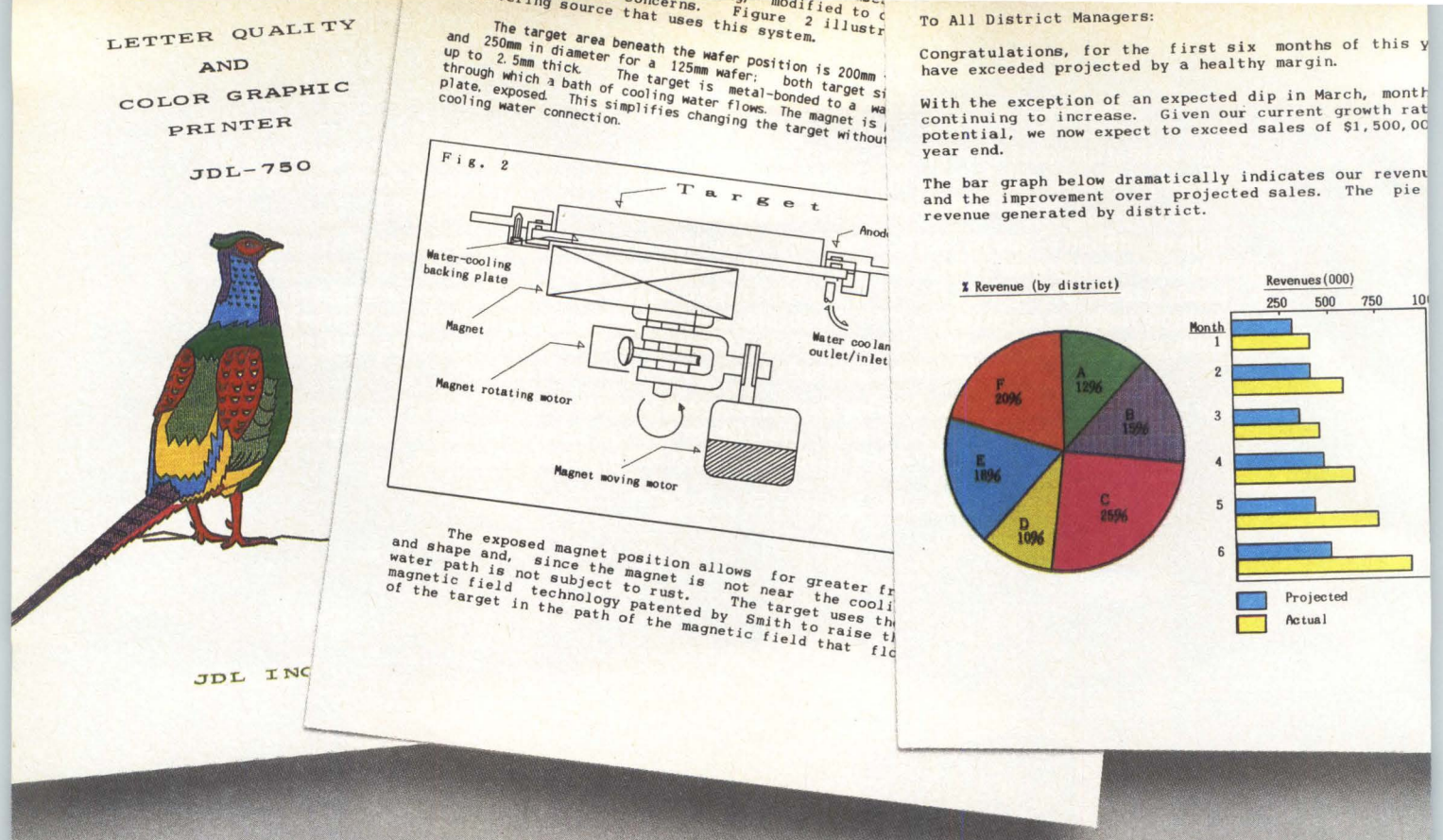
**For information, call or write Charles Kaplan, National Sales Manager, General Optronics Corp., Optical Information Products Division, Two Olsen Avenue, Edison, NJ 08820. 201-549-9000. TWX 710-997-9556. Distributor and OEM inquiries welcomed.**

HOLOSCAN 28 LASER PRINTER




general optronics corp.

CIRCLE NO. 35 ON INQUIRY CARD

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# LINE AND PAGE PRINTERS

## TABLE 5

| Company Model | Print method | Print speed | Characters per line | Simultaneous copies | Forms width (inches) | Interfaces (protocols) | Price ($) | Notes, features, options |
|---|---|---|---|---|---|---|---|---|
| **AMERICAN COMPUTER HARDWARE CORP.** | | | | | | | | |
| 2230 | drum (line printer) | 300 lpm | 132–136 | 1–6 | 4–16.75 | RS232C, Centronics, Dataproducts (300–19.2K bps) | | |
| 2260 | drum (line printer) | 600 lpm | 132–136 | 1–6 | 4–16.75 | RS232C, Centronics, Dataproducts (300–19.2K bps) | | |
| 2290 | drum (line printer) | 900 lpm | 132–136 | 1–6 | 4–16.75 | RS232C, Centronics, Dataproducts (300–19.2K bps) | | |
| 2410 | drum (line printer) | 300–1500 lpm | 132–136 | 1–6 | 5.125–19 | RS232C, Centronics, Dataproducts (300–19.2K bps) | | |
| 2470 | drum (line printer) | 1800 lpm | 132–136 | 1–6 | 5.125–19 | RS232C, Centronics, Dataproducts (300–19.2K bps) | | |
| B300 | band (line printer) | 300 lpm | 132–136 | 6 | 3–16 | RS232C, Centronics, Dataproducts (300–19.2K bps) | | |
| B600 | band (line printer) | 650 lpm | 132–136 | 6 | 3–16 | RS232C, Centronics, Dataproducts (300–19.2K bps) | | |
| B1000 | band (line printer) | 1025 lpm | 132–136 | 6 | | RS232C, Centronics, Dataproducts (300–19.2K bps) | | |
| BP1500 | band (line printer) | 1200 lpm | 132–136 | 1–6 | 3.5–18.75 | RS232C, Centronics, Dataproducts (300–19.2K bps) | | |
| BP2000 | band (line printer) | 1650 lpm | 132–136 | 1–6 | 3.5–18.75 | RS232C, Centronics, Dataproducts (300–19.2K bps) | | |
| Fast 5000 Series Model 5100 | ion deposition (page printer) | 5000 lpm, 60 ppm | 80 | | 8.5 | Dataproducts (100K bps) | | dot-mapped, assembled graphics; multiple fonts |
| Fast 5000 Series Model 5200 | ion deposition (page printer) | 5000 lpm, 60 ppm | 80 | | 8.5 | Dataproducts (100K bps) | 65,000(Q1) | dot-mapped, assembled graphics; multiple fonts |
| Fast 5000 Series Model 5600 | ion deposition (page printer) | 7500 lpm, 90 ppm | 80 | | 9.87 | Dataproducts (100K bps) | | dot-mapped, assembled graphics |
| **APPLE COMPUTER INC.** | | | | | | | | |
| Laser Writer | laser (page printer) | 8 ppm | | | 8.5–12 | RS232C, AppleTalk Personal Network | 6,995(Q1) | includes PostScript language for printers and typesetters |
| **AT&T TELETYPE CORP.** | | | | | | | | |
| 4500 | belt (line printer) | 300 lpm | 80, 132 | 6 | 2.75–15 | RS232C | | diagnostics, variable width tractor |
| Model 40 | belt (line printer) | 300 lpm | 80, 132 | 6 | 2.75–15 | RS232C | | forms access, diagnostics, variable width tractor |
| T-300 | belt (line printer) | 300 lpm | 132 | 6 | 4–15 | RS232C, Centronics | | variable width tractor |
| **CENTRONICS DATA COMPUTER CORP.** | | | | | | | | |
| E-Series Model-I | band (line printer) | 900 lpm | 132 | 6 | 4–16.25 | Dataproducts | 14,090(Q1); 9,820(Q100) | towel ribbon, universal power supply, statistical band capability; opt. power paper stacker |
| E-Series Model-II | band (line printer) | 1200 lpm | 132 | 6 | 4–16.25 | Dataproducts | 15,600(Q1); 10,180(Q100) | towel ribbon, universal power supply, statistical band capability; opt. power paper stacker |
| E-Series Model-III | band (line printer) | 1800 lpm | 132 | 6 | 4–16.25 | Dataproducts | 16,800(Q1); 10,800(Q100) | towel ribbon, universal power supply, statistical band capability; opt. power paper stacker |

## LINE AND PAGE PRINTERS
## TABLE 5

| Company / Model | Print method | Print speed | Characters per line | Simultaneous copies | Forms width (inches) | Interfaces (protocols) | Price ($) | Notes, features, options |
|---|---|---|---|---|---|---|---|---|
| **CIE TERMINALS** | | | | | | | | |
| CI-300 | impact matrix (line printer) | 85, 300 lpm | 220 | | 3.5–16 | RS232C, Dataproducts (synch, asynch) | 4,495(Q1) | bar codes, dual microprocessor |
| CI-600 | impact matrix (line printer) | 85, 300 lpm | 220 | | 3.5–16 | RS232C, Dataproducts (synch, asynch) | 5,995(Q1) | bar codes, dual microprocessor |
| **CYNTHIA PERIPHERAL CORP.** | | | | | | | | |
| MP6050 | magnetic (page printer) | 3000 lpm, 50 ppm | 132, programmable | 1–99 | 8.5–9.5 | Dataproducts, video | 30,000(Q1); 16,700(Q100) | |
| MP6090 | magnetic (page printer) | 6000 lpm, 90 ppm | 132, programmable | 1–99 | 6.5–15.75 | Dataproducts, video | 50,000(Q1); 26,000(Q100) | paper tape VFU |
| **DATA GENERAL CORP.** | | | | | | | | |
| 4327, 3228 | band (line printer) | 300 lpm | 64, 96 | 5 | 3–16 | Data General Data Channel Controller | 8,900(Q1); 8,010(Q100) | international character sets |
| 4364, 4363 | band (line printer) | 600 lpm | 64, 96 | 5 | 3–16 | Data General | 12,500(Q1); 11,250(Q100) | |
| 4374, 4373, 5968L | band (line printer) | 1200 lpm | 48, 64, 96 | 6 | 5–18.75 | Data General | 27,000(Q1); 24,300(Q100) | |
| **DATAPOINT CORP.** | | | | | | | | |
| 9257 | band (line printer) | 300 lpm | 132 | | 4–16 | serial, parallel | 6,800(Q1); 6,120(Q100) | |
| 9258 | band (line printer) | 600 lpm | 132 | | 4–16 | serial, parallel | 11,950(Q1); 10,150(Q100) | |
| 9660 Laser Printer | laser (page printer) | 1300 lpm, 20 ppm | | | 8.5 | ARC/RMS coax connector | 65,000(Q1); 55,250(Q100) | |
| **DATAPRODUCTS CORP.** | | | | | | | | |
| B-300 | band (line printer) | 300 lpm | 132, 136 | 6 | 3–16 | RS232C, Centronics, Dataproducts (19.2K bps, X-on/X-off, ETX/ACK, ACK/NAK, DTR) | 3,823(Q100) | self-test, diagnostic status display, static eliminator; opt. 60 dB(a) acoustic cabinet, universal power supply |
| B-600 | band (line printer) | 600 lpm | 132, 136 | 6 | 3–16 | RS232C, Centronics, Dataproducts (19.2K bps, X-on/X-off, ETX/ACK, ACK/NAK, DTR) | 5,122(Q100) | self-test, diagnostic status display, static eliminator; opt. 60 dB(a) acoustic cabinet, universal power supply |
| B-1000 | band (line printer) | 1000 lpm | 132, 136 | 6 | 3–16 | RS232C, Centronics, Dataproducts (19.2K bps, X-on/X-off, ETX/ACK, ACK/NAK, DTR) | 7,987(Q100) | 60 dB(a) acoustic cabinet, self-test; opt. universal power supply |
| BP-1500 | band (line printer) | 1500 lpm | 132, 136 | 6 | 3.5–18.75 | RS232C, current loop, Dataproducts (19.2K bps) | 22,500(Q1); 10,700(Q100) | universal power supply, 4 forms tractors, self-test, diagnostic status display |
| BP-2000 | band (line printer) | 2000 lpm | 132, 136 | 6 | 3.5–18.75 | RS232C, current loop, Dataproducts (19.2K bps) | 30,000(Q1); 13,375(Q100) | universal power supply, 4 forms tractors, self-test, diagnostic status display |
| LSR-2600 | laser (page printer) | 26 ppm | | | | | 12,900(Q1) | |
| **DELPHAX SYSTEMS** | | | | | | | | |
| S6000 | ion deposition (page printer) | 60 ppm | 80, 105, 120, 132, programmable | | | IBM channel interface, Dataproducts (IBM 3211 emulation) | | |
| **DIABLO SYSTEMS INC. (XEROX CO.)** | | | | | | | | |
| EPM/API | thermal matrix (page printer) | 300 lpm, 6 ppm | 120, programmable | | 4–8.5 | RS232C, Centronics (19.6K bps, X-on/X-off, ETX/ACK, ACK/NAK, DTR) | 3,995(Q1); 2,995(Q100) | self-test, page counter, noise level less than 55 dB(a) |
| **DICONIX INC.** | | | | | | | | |
| Dijit 1 Office Printer | ink-jet (page printer) | 18 ppm | | | 8–14.5 | RS232C (Xerox 2700) | | opt. RS422 serial, Centronics, Dataproducts interfaces; Diablo 630 emulation |
| **DIGITAL EQUIPMENT CORP.** | | | | | | | | |
| LN01 | laser (page printer) | 12 ppm | up to 150 | 1 | 8.5–14 | RS232C, Dataproducts (up to 19.2K bps, X-on/X-off) | 19,995(Q1) | uses PLOT-LN software for graphics; page counter |
| LN03 | laser (page printer) | 8 ppm | | | | RS232C, CCITT V.24, serial (up to 19.2K bps, X-on/X-off) | 4,195(Q1) | portrait, landscape printing, noise level less than 55 dB(a) |
| LN01S | laser (page printer) | 12 ppm | unlimited | 1 | 8.5–14 | RS232C, Dataproducts (up to 19.2K bps, X-on/X-off) | 29,995(Q1) | bit-mapped graphics, 12 fonts, page counter |

## LINE AND PAGE PRINTERS
## TABLE 5

| Company / Model | Print method | Print speed | Characters per line | Simultaneous copies | Forms width (inches) | Interfaces (protocols) | Price ($) | Notes, features, options |
|---|---|---|---|---|---|---|---|---|
| **EPSON AMERICA INC.** | | | | | | | | |
| LCS/GQ-3000 Printer | electrophotographic (page printer) | 7 ppm | | | | RS232C, Centronics, parallel (19.2K bps, X-on/X-off) | 4,000(Q1) | bit-mapped graphics |
| **EXXON OFFICE SYSTEMS CO.** | | | | | | | | |
| Exxon 965 | ink-jet (page printer) | 2 ppm | 132, 158, 198 | | up to 16.54 | RS232C, serial (1200–19.2K bps, X-on/X-off, DTR) | 2,995(Q1) | bit-mapped graphics, dual sheet feeder, multi-language print fonts |
| **FUJITSU AMERICA INC.** | | | | | | | | |
| M3040 | band (line printer) | 300 lpm | 132, 136 | 6 | 3–17 | RS232C, Centronics, Dataproducts (up to 19.2K bps) | 4,950(Q1); 3,600(Q100) | noise level under 55 dB(a) |
| M3041 | band (line printer) | 600 lpm | 132, 136 | 6 | 3–17 | RS232C, Centronics, Dataproducts (up to 19.2K bps) | 5,950(Q1); 4,250(Q100) | noise level under 55 dB(a) |
| M3042 | band (line printer) | 900 lpm | 132, 136 | 6 | 3–17 | RS232C, Centronics, Dataproducts (up to 19.2K bps) | 8,950(Q1); 6,750(Q100) | noise level under 55 dB(a) |
| M3043 | band (line printer) | 1200 lpm | 132, 136 | 6 | 3–17 | RS232C, Centronics, Dataproducts (up to 19.2K bps) | 10,950(Q1); 8,100(Q100) | noise level under 55 dB(a) |
| **GENERAL BUSINESS TECHNOLOGY INC.** | | | | | | | | |
| 3220 LP | band (line printer) | 720 lpm | 132, 198 | 6 | 4–16.75 | IBM S/34, S/36, S/38 (twin-ax) | 11,500(Q1) | changeable bands, acoustic enclosure |
| 3230 LP | band (line printer) | 1130 lpm | 132 | 6 | 4–16.75 | IBM S/34, S/36, S/38 (twin-ax) | 16,995(Q1) | changeable bands, acoustic enclosure |
| 3240 LP | band (line printer) | 1440 lpm | 132 | 6 | 4–16.75 | IBM S/34, S/36, S/38 (twin-ax) | 19,995(Q1) | changeable bands, acoustic enclosure |
| 5201 FA | chain (line printer) | 400 lpm | 80 | 6 | 4.125–9.125 | IBM S/34, S/36, S/38 (twin-ax) | 7,200(Q1) | acoustic enclosure |
| 5202 LP | chain (line printer) | 400 lpm | 132 | 6 | 4.125–15 | IBM S/34, S/36, S/38 (twin-ax) | 8,000(Q1) | tractor feed line, acoustic enclosure |
| 6600 XP | laser (page printer) | 12 ppm | 185 | | | IBM S/34, S/36, S/38, PC, 3270 (twin-ax) | 22,500(Q1) | |
| 6620 XP | laser (page printer) | 12 ppm | 132 | | | IBM S/34, S/36, S/38, PC, 3270 (twin-ax) | 11,995(Q1) | noise level under 53 dB(a); portrait, landscape mode graphics |
| 6630 XP | laser (page printer) | 8 ppm | 198 | | | IBM S/34, S/36, S/38, PC, 3270 (twin-ax) | 5,995(Q1) | raster graphics |
| **GENERAL OPTRONICS CORP. (PRINTER DIV.)** | | | | | | | | |
| Holoscan 28 DP 100 | laser (page printer) | 28 ppm | 80, 105, 132, 216, programmable | | 5.5–17 | RS232C, Centronics, Dataproducts (19.2K bps, X-on/X-off, DTR, ETX/ACK) | 17,000(Q1) | diagnostics, cellular graphics, 4-font capacity |
| Holoscan 28 WP 200 | laser (page printer) | 28 ppm | 80, 105, 132, 216, programmable | | 5.5–17 | RS232C, Centronics, Dataproducts (19.2K bps, X-on/X-off, DTR, ETX/ACK, Diablo 630) | 19,000(Q1) | diagnostics, cellular graphics, 16-font capacity |
| **GENICOM CORP.** | | | | | | | | |
| 310 | belt (line printer) | 240, 340, 425 lpm | 132 | 6 | 3–15 | Centronics (9600 bps, X-on/X-off, ENQ/ACK/NAK, RTS, DTR) | 4,170(Q1); 3,336(Q100) | 2-channel VFU; opt. RS232C interface |
| 340 | belt (line printer) | 240, 340, 425 lpm | 132 | 6 | 3–15 | Centronics (9600 bps, X-on/X-off, ENQ/ACK/NAK, RTS, DTR) | 4,835(Q1); 3,868(Q100) | 2-channel VFU; opt. RS232C interface |
| 4410 | impact matrix (line printer) | 300 lpm | 132, 158, 175, programmable | 6 | 3–16.54 | RS232C, Centronics, Dataproducts (19.2K bps, ANSI X3.64, Printronix p-Series, X-on/X-off, ETX/ACK, RTS, DTR) | 5,500(Q1); 4,400(Q100) | IBM PC graphics, 12-channel EVFU, dual tractors, 2K buffer; opt. bar codes |
| 4440 | impact matrix (line printer) | 600 lpm | 132, 158, 175, programmable | 6 | 3–16.5 | RS232C, Centronics, Dataproducts (19.2K bps, ANSI X3.64, Printronix p-Series, X-on/X-off, ETX/ACK, RTS, DTR) | 7,200(Q1); 5,760(Q100) | IBM PC graphics, 12-channel EVFU, dual tractors, 2K buffer; opt. bar codes |

## LINE AND PAGE PRINTERS
## TABLE 5

| Company / Model | Print method | Print speed | Characters per line | Simultaneous copies | Forms width (inches) | Interfaces (protocols) | Price ($) | Notes, features, options |
|---|---|---|---|---|---|---|---|---|
| **HARRIS CORP. (COMPUTER SYSTEMS DIV.)** | | | | | | | | |
| Harris 4240 | chain (line printer) | 1000 lpm | 64 | | 3.5–19.5 | RS232C | 29,900(Q1) | includes electronic paper-width adjustment, EVFU, controller |
| Harris 4260 | chain (line printer) | 1200 lpm | 64 | | 3.5–19.5 | RS232C | 39,900(Q1) | includes electronic paper-width adjustment, EVFU, controller |
| Harris 4270 | chain (line printer) | 900 lpm | 96 | | 3.5–19.5 | RS232C | 40,900(Q1) | includes electronic paper-width adjustment, EVFU, controller |
| Harris 4336 | band (line printer) | 450, 600 lpm | 64, 96 | | 3–16 | RS232C | 16,900(Q1) | includes electronic paper-width adjustment, EVFU |
| Harris 4356 | band (line printer) | 900, 1200 lpm | 64, 96 | | 3–16 | RS232C | 28,900(Q1) | includes electronic paper-width adjustment, EVFU, controller |
| **HETRA COMPUTER AND COMMUNICATIONS INDUSTRIES INC.** | | | | | | | | |
| 3100 | band (line printer) | 300, 600 lpm | 132, 136 | 1 | 3.5–18 | RS232C, Dataproducts (up to 19.2K bps, X-on/X-off, ACK/NAK, bisynch, SNA) | | diagnostics, acoustic cabinet |
| 3300 | band (line printer) | 600, 1200 lpm | 132, 136 | 1 | 3.5–19 | RS232C, Dataproducts (up to 19.2K bps, X-on/X-off, ACK/NAK, bisynch, SNA) | | diagnostics |
| 3500 | band (line printer) | 1000, 2000 lpm | 132, 156 | 1 | 3.5–20 | RS232C, Dataproducts (up to 19.2K bps, X-on/X-off, ACK/NAK, bisynch, SNA) | | |
| 3608 (8 PPM Laser) | laser (page printer) | 8 ppm | 132, 156 | | | RS232C, Dataproducts (up to 19.2K bps, X-on/X-off, ACK/NAK, bisynch, SNA) | | |
| 3624 (24 PPM Laser) | laser (page printer) | 24 ppm | 132, 156 | | | RS232C, Dataproducts (up to 19.2K bps, X-on/X-off, ACK/NAK, bisynch, SNA) | | |
| **HEWLETT-PACKARD CO. (BOISE DIV.)** | | | | | | | | |
| HP 2563A | impact matrix (line printer) | 300 lpm | 66, 132, 220, programmable | 6 | 3–16.7 | RS232C, RS422A, Centronics, Dataproducts, HP-IB, HP Multipoint (300–19.2K bps, X-on/X-off, ETX/ACK, ENQ/ACK) | 5,700(Q1); 3,876(Q100) | raster graphics, programmable 16-channel VFC, self-test; opt. cabinet, stand, sound cover, passive paper stacker |
| HP 2565A | impact matrix (line printer) | 600 lpm | 66, 132, 220, programmable | 6 | 3–18 | RS232C, RS422A, Centronics, Dataproducts, HP-IB (300–19.2K bps, X-on/X-off, ETX/ACK, ENQ/ACK) | 18,500(Q1); 12,025(Q100) | raster graphics, programmable 16-channel VFC, self-test; opt. passive paper stacker, character set |
| HP 2566A | impact matrix (line printer) | 900 lpm | 66, 132, 220, programmable | 6 | 3–18 | RS232C, RS422A, Centronics, Dataproducts, HP-IB (300–19.2K bps, X-on/X-off, ETX/ACK, ENQ/ACK) | 21,500(Q1); 13,975(Q100) | raster graphics, programmable 16-channel VFC, self-test; opt. passive paper stacker, character set |
| HP 2680A | laser (page printer) | 45 ppm | 66, 132, 255 | | 3–17 | HP-IB (700K bps) | 69,950(Q1); 44,000(Q100) | raster graphics, diagnostics, power paper stacker, fold paper |
| HP 2686A Laser Jet | laser (page printer) | 8 ppm | 80, 96, 132, 176, 226 | | 6.7–8, 9.7–13.6 | RS232C, RS422 (300–19.2K bps, X-on/X-off, DTR) | 3,495(Q1); 2,516(Q100) | raster graphics, self-test, noise level less than 55 dB(a) |
| HP 2687A | laser (page printer) | 12 ppm | 66, 132 | | 8.5 | RS232C, RS422 (300–19.2K bps, X-on/X-off) | 12,800(Q1); 8,500(Q100) | self-test, cut sheet paper |
| HP 2688A | laser (page printer) | 12 ppm | 66, 132, 255 | | 3–17 | HP-IB (700K bps) | 29,950(Q1); 19,000(Q100) | raster graphics, self-test, cut sheet paper |
| **IMAGEN CORP.** | | | | | | | | |
| 8/300 | laser (page printer) | 8 ppm | | | | RS232C, Centronics, Dataproducts, Ethernet (9600 bps, X-on/X-off) | 9,950(Q1) | noise level less than 55 dB(a), graphics |
| 12/300 | laser (page printer) | 12 ppm | | | | RS232C, Centronics, Dataproducts, Ethernet (9600 bps, X-on/X-off) | 19,950(Q1) | noise level less than 55 dB(a), graphics |
| **KAYE INSTRUMENTS INC.** | | | | | | | | |
| Digistrip Printer LP-1 | impact matrix (line printer) | 60 lpm | 137 | 1 | | RS232C, current loop (X-on/X-off) | 2,990(Q1) | rackmount; internal 3000 character buffer |

## LINE AND PAGE PRINTERS
## TABLE 5



| Company Model | Print method | Print speed | Characters per line | Simultaneous copies | Forms width (inches) | Interfaces (protocols) | Price ($) | Notes, features, options |
|---|---|---|---|---|---|---|---|---|
| **MANNESMANN TALLY CORP.** | | | | | | | | |
| MT660 | impact matrix (line printer) | 600 lpm | 132, 198 | 6 | 4–16 | Centronics, Dataproducts (up to 19.2K bps, X-on/X-off, ETX/ACK, ENQ/ACK, ACK/NAK, READY, BUSY) | 7,995(Q1); 5,356(Q100) | noise level less than 60 dB(a); opt. serial, RS232C, RS422, current loop interfaces; static eliminator |
| **MILTOPE CORP.** | | | | | | | | |
| 3801 Line Printer | ion deposition (line printer) | 60 ppm | programmable | | 7.75–10.75 | RS232C (19.2K–56.2K bps, HASP) | | prints continuous business forms |
| HSP3609-212A | impact matrix (line printer) | 400 lpm | 80, 132 | 4 | 8–12 | RS232C, Centronics, Dataproducts, MIL-STD-188C, Rolm, Norden, NTDS (9600 bps) | 20,000(Q1) | dot-addressable graphics, meets military specs |
| LP3036 | impact matrix (line printer) | 240 lpm | 36 | 1 | 4.25 | RS232C, Centronics, Dataproducts, MIL-STD-188C, Rolm, Norden, NTDS (9600 bps) | 7,800(Q1) | dot-addressable graphics, meets military specs |
| TP2000 | thermal matrix (line printer) | 240 lpm | 40, 66, 80 | | 4.25 | RS232C, Centronics, Dataproducts, MIL-STD-188C, Rolm, Norden, NTDS (9600 bps) | 7,800(Q1) | dot-addressable graphics, meets military specs |
| TP3000 | thermal matrix (line printer) | 1000 lpm | 80, 132 | | 8–12 | RS232C, Centronics, Dataproducts, MIL-STD-188C, Rolm, Norden, NTDS (9600 bps) | 15,800(Q1) | dot-addressable graphics, meets military specs |
| **MODULAR COMPUTER SYSTEMS INC. (MODCOMP)** | | | | | | | | |
| 4240-X | impact matrix (line printer) | 300 lpm | 132 | | 3–16 | | 8,100–12,000(Q1) | self-test, diagnostics, 12-channel VFU; opt. acoustic cabinet |
| 4241-X | impact matrix (line printer) | 600 lpm | 132 | | 3–16 | | 10,250–14,500(Q1) | self-test, diagnostics, 12-channel VFU; opt. acoustic cabinet |
| 4242-X | impact matrix (line printer) | 1000 lpm | 132 | | 3–16 | | 15,875–19,600(Q1) | self-test, acoustic cabinet, diagnostics, 12-channel VFU |
| **NCR CORP.** | | | | | | | | |
| NCR 6411-1550 | impact matrix (line printer) | 45 lpm | 5–230, programmable | 4 | 4.25–15 | RS232C, Centronics (up to 9600 bps, X-on/X-off, DTR) | 1,095(Q1) | character, dot-addressable graphics; EVFU; 2K buffer; foreign character sets |
| NCR 6411-1551 | impact matrix (line printer) | 45 lpm | 5–230, programmable | 4 | 4.25–15 | RS232C, Centronics (up to 9600 bps, X-on/X-off, DTR) | 1,195(Q1) | character, dot-addressable graphics; EVFU; 2K buffer; foreign character sets |
| NCR 6411-1552 | impact matrix (line printer) | 45 lpm | 5–218, programmable | 4 | 4.25–15 | parallel (Epson) | 1,095(Q1) | character, dot-addressable graphics; EVFU; 2K buffer; foreign character sets |
| NCR 6411-8510 | impact matrix (line printer) | 70 lpm | 5–136, programmable | 4 | 4.25–10 | RS232C, Centronics (up to 9600 bps, X-on/X-off, DTR, ETX/ACK) | 795-895(Q1) | character, dot-addressable graphics; EVFU; 2K buffer; foreign character sets |
| NCR 6411-8511 | impact matrix (line printer) | 70 lpm | 5–132, programmable | 4 | 4.25–10 | RS232C, Centronics (up to 9600 bps, X-on/X-off, DTR, ETX/ACK) | 795–895(Q1) | character, dot-addressable graphics; EVFU; 2K buffer; foreign character sets |
| NCR 6411-8512 | impact matrix (line printer) | 70 lpm | 5–132, programmable | 4 | 4.25–10 | parallel (Epson) | 795(Q1) | character, dot-addressable graphics; EVFU; 2K buffer; foreign character sets |
| NCR 6430-0101 | impact matrix (line printer) | 360 lpm | 132 | 6 | 4–17.5 | RS232C, Centronics, Dataproducts (up to 19.2K bps, X-on/X-off) | 8,750(Q1) | |
| NCR 6430-0201 | impact matrix (line printer) | 720 lpm | 132 | 6 | 4–17.5 | RS232C, Centronics, Dataproducts (up to 19.2K bps, X-on/X-off) | 13,695(Q1) | |
| **NEWBURY DATA RECORDING LTD.** | | | | | | | | |
| 8850 | impact matrix (line printer) | 300 lpm | 132–226 | 6 | 4–15.31 | RS232C, current loop, Centronics (9600 bps, X-on/X-off, ETX/ACK, DTR, BUSY) | | character downline load, noise level less than 53 dB(a) |

## LINE AND PAGE PRINTERS
## TABLE 5

| Company / Model | Print method | Print speed | Characters per line | Simultaneous copies | Forms width (inches) | Interfaces (protocols) | Price ($) | Notes, features, options |
|---|---|---|---|---|---|---|---|---|
| **PARADYNE CORP.** | | | | | | | | |
| 8360 Page Printer | ion deposition (page printer) | 60 ppm | | | 8.5 | IBM channel interface (IBM 3203-5 emulation) | 79,000(Q1) | character graphics |
| **PHILIPS PERIPHERALS INC.** | | | | | | | | |
| ELPHO 20 | drum (page printer) | 20 ppm | up to 119 | | | RS232C, CCITT V.24, Centronics, Dataproducts | 19,800(Q1) | bit-mapped graphics |
| **PRINTER SYSTEMS CORP.** | | | | | | | | |
| PSC 6404 | band (line printer) | 400 lpm | 132 | 6 | 4–18 | IBM S/34, S/36, S/38 | 8,459(Q1) | diagnostics, acoustic cabinet |
| PSC 6408 | band (line printer) | 800 lpm | 132 | 6 | 4–18 | IBM S/34, S/36, S/38 | 11,095(Q1) | diagnostics, power paper stacker, acoustic cabinet |
| PSC 6418 | band (line printer) | 1800 lpm | 132 | 6 | 4–16.25 | IBM S/34, S/36, S/38 | 23,500(Q1) | diagnostics, power paper stacker, line counter, acoustic cabinet |
| PSC 7404 | band (line printer) | 400 lpm | 132 | 6 | 4–18 | IBM 3270A | 8,495(Q1) | diagnostics, acoustic cabinet |
| PSC 7408 | band (line printer) | 800 lpm | 132 | 6 | 4–18 | IBM 3270A | 11,095(Q1) | diagnostics, power paper puller, acoustic cabinet |
| PSC LW400 | band (line printer) | 400 lpm | 132 | 6 | 4–18 | RS232C, RS422, RS423, RS449, Centronics, Dataproducts (up to 9600 bps, X-on/X-off, DTR, ETX/ACK) | 5,818(Q1) | diagnostics, quietized cabinet |
| PSC LW800 | band (line printer) | 800 lpm | 132 | 6 | 4–18 | RS232C, RS422, RS423, RS449, Centronics, Dataproducts (up to 9600 bps, X-on/X-off, DTR, ETX/ACK) | 8,110(Q1) | diagnostics, quietized cabinet |
| PSC MOD III | band (line printer) | 1800 lpm | 132 | 6 | 4–16.25 | Dataproducts | 20,950(Q1) | diagnostics, power paper stacker, line counter, acoustic cabinet |
| **PRINTACOLOR CORP.** | | | | | | | | |
| TC1040 | ink-jet (line printer) | 70 lpm | 144 | | 8.5–14.85 | RS232C, Centronics (19.2K bps, X-on/X-off, DTR, RTS) | 5,995(Q1) | 4913-color printing, 6 character sets |
| **PRINTRONIX INC.** | | | | | | | | |
| 4160 | impact matrix (line printer) | 130 lpm | 132 | 5 | | Centronics | 5,380(Q1) | bit-mapped graphics; opt. IGP-30 (Intelligent Graphics Processor) |
| DP 600 | band (line printer) | 600 lpm | 10 | 6 | 3.5–17.5 | RS232C, Centronics, Dataproducts | 9,400(Q1) | |
| DP 750 | band (line printer) | 750 lpm | 10 | 6 | 3.5–17.5 | RS232C, Centronics, Dataproducts | 10,400(Q1) | |
| DP 1000 | band (line printer) | 1000 lpm | 10 | 6 | 3.5–17.5 | RS232C, Centronics, Dataproducts | 11,800(Q1) | |
| DP 1200 | band (line printer) | 1200 lpm | 10 | 6 | 3.5–17.5 | RS232C, Centronics, Dataproducts | 12,800(Q1) | |
| L150 | impact matrix (line printer) | 80–200 lpm | 132 | 6 | 3–16 | Centronics-compatible | 3,995(Q1) | bar code label specs; opt. IGP-20 (Intelligent Graphics Processor) |
| Laserprint 20 | laser (page printer) | 20 ppm | 132 | | | RS232C, Centronics, Dataproducts | 15,900(Q1) | |
| MVP 150 | impact matrix (line printer) | 80–200 lpm | 132 | 6 | 3–16 | RS232C, Centronics, Dataproducts | 3,745(Q1) | multimode printing |
| MVP 150B | impact matrix (line printer) | 80-200 lpm | 132 | 6 | 3–16 | Centronics-compatible | 3,745(Q1) | business graphics, multimode printing |
| MVP 150C | impact matrix (line printer) | 80–200 lpm | 132 | 6 | 3–16 | Centronics-compatible | 3,545(Q1) | bit-image graphics, multimode printing |
| P300/P300XQ | impact matrix (line printer) | 300–400 lpm | 132, 176, 220 | 6 | 3–16 | RS232C, Centronics, Dataproducts | 5,400–6,400(Q1) | business graphics, bar codes; opt. multimode printing |
| P600/P600XQ | impact matrix (line printer) | 600–800 lpm | 132, 198 | 6 | 3–16 | RS232C, Centronics, Dataproducts | 7,500–8,550(Q1) | business graphics, opt. multimode printing |

## LINE AND PAGE PRINTERS
## TABLE 5

| Company / Model | Print method | Print speed | Characters per line | Simultaneous copies | Forms width (inches) | Interfaces (protocols) | Price ($) | Notes, features, options |
|---|---|---|---|---|---|---|---|---|
| **QMS INC.** | | | | | | | | |
| LASERGRAFIX 800 | laser (page printer) | 8 ppm | programmable | | 4–8.5 | RS232C; current loop; Centronics; Dataproducts; IBM 3271, 3272, 3274 A&B, 3276, System 34/36/38, synch 2780, 3780; Burroughs; Sperry Univac DCT-1000 (up to 19.2K, X-on/X-off, ETX/ACK, DTR, BUSY, ACK, SNA SDLC, BSC, Qume, Diablo, Epson) | 9,995(Q1) | bit-mapped, vector, business, plot/pixel graphics; opt. Tektronix 4010, 4014 emulation |
| LASERGRAFIX 1200 | laser (page printer) | 12 ppm | programmable | | 8.5 | RS232C; current loop; Centronics; Dataproducts; IBM 3271, 3272, 3274 A&B, 3276, System 34/36/38, synch 2780, 3780; Burroughs; Sperry Univac DCT-1000 (up to 19.2K, X-on/X-off, ETX/ACK, DTR, BUSY, ACK, SNA SDLC, BSC, Qume, Diablo, Epson) | 24,995(Q1) | bit-mapped, vector, business, plot/pixel graphics; opt. Tektronix 4010, 4014 emulation |
| LASERGRAFIX 2400 | laser (page printer) | 24 ppm | programmable | | 8.5 | RS232C; current loop; Centronics; Dataproducts; IBM 3271, 3272, 3274 A&B, 3276, System 34/36/38, synch 2780, 3780; Burroughs; Sperry Univac DCT-1000 (up to 19.2K, X-on/X-off, ETX/ACK, SNA SDLC, BSC, Qume, Diablo, Epson) | 34,995(Q1) | vector, business, plot/pixel graphics; opt. bit-mapped graphics, Tektronix 4010, 4014 emulation |
| **RICOH CORP.** | | | | | | | | |
| LP4120 | laser (page printer) | 12 ppm | 2 | | | RS232C, RS422 | 9,950(Q1); 6,170(Q100) | |
| **SIEMENS COMMUNICATION SYSTEMS INC.** | | | | | | | | |
| ND2 | laser (page printer) | 206 ppm | 136, 163, 204, 272 | | 16–65 | IBM 360/370, Siemens 7000 (24M bps, IBM 3800, Siemens BS2000, OLDS) | 300,000(Q1) | bit-mapped graphics, forms overlay |
| ND3 | laser (page printer) | 103 ppm | 136, 163, 204, 272 | | | IBM 360/370, Siemens 7000 (24M bps, IBM 3800, Siemens BS2000, OLDS) | 195,000(Q1) | bit-mapped graphics, forms overlay |
| **TALARIS SYSTEMS INC.** | | | | | | | | |
| Talaris 800 | laser (page printer) | 8 ppm | programmable | | | RS232C, Centronics, Dataproducts, IBM synch (110–3.48K bps, RTS/DTR, ACK/NAK, ENG/ACK) | 9,990(Q1) | |
| Talaris 1200 | laser (page printer) | 12 ppm | programmable | | | RS232C, Centronics, Dataproducts, IBM synch (110–3.48K bps, RTS/DTR, ACK/NAK, ENG/ACK) | 24,990 (Q1) | |
| Talaris 2400 | laser (page printer) | 24 ppm | programmable | | | RS232C, Centronics, Dataproducts, IBM synch (110–3.48K bps, RTS/DTR, ACK/NAK, ENG/ACK) | 34,990 (Q1) | |
| **TOSHIBA AMERICA INC.** | | | | | | | | |
| TN-5400 | thermal matrix (line printer) | 1.3 ppm | | | | video signal (raster scan interface) | | 4-color, graphics capability; opt. Centronics interface |
| TN-5310 | thermal matrix (line printer) | 1.3 ppm | | | | video signal | | 7-color, graphics capability; opt. buffer memory |
| **WANG LABORATORIES INC.** | | | | | | | | |
| 2273 | band (line printer) | 250 lpm | 132 | 6 | 16 | proprietary | 9,500(Q1) | full-line buffering, operator-changeable bands |
| 5573 | band (line printer) | 250 lpm | 132 | 6 | 16 | proprietary | 9,500(Q1) | full-line buffering, operator-changeable bands |
| 5574 | band (line printer) | 600 lpm | 132 | 6 | 16 | proprietary | 13,250(Q1) | full-line buffering, operator-changeable bands, foreign language support |

## LINE AND PAGE PRINTERS
## TABLE 5

| Company Model | Print method | Print speed | Characters per line | Simultaneous copies | Forms width (inches) | Interfaces (protocols) | Price ($) | Notes, features, options |
|---|---|---|---|---|---|---|---|---|
| 5575 | band (line printer) | 1100 lpm | 136 | 6 | 18.75 | proprietary | 29,500(Q1) | full-line buffering, operator-changeable bands, foreign language support |
| LIS-12 | laser (page printer) | 12 ppm | 80–158 | | 8–14 | proprietary | 26,000(Q1) | |
| LPS-12 | laser (page printer) | 12 ppm | 80–158 | | 8–14 | proprietary | 20,000(Q1) | |
| **XEROX CORP. (PRINTING SYSTEMS DIV.)** | | | | | | | | |
| 2700 II | laser (page printer) | 12 ppm | 240 | | | Centronics, Dataproducts 2260 (up to 19.2K, bps, X-on/X-off, DTR, ETX/ACK) | 19,995(Q1); 16,045(Q10–29) | |
| 5700 Electronic Printing System | laser (page printer) | 43 ppm | 200 | | 8–14 | RS232C, Ethernet (1200–9600 bps, IBM 3780, BSC) | 55,880(Q1) | diagnostics |

Information was solicited but not received from the following manufacturers:

Alphacom Inc.

Burroughs Corp.

Canon USA Inc.

Decision Data Computer Corp.

Digital Associates Corp.

Docutel/Olivetti

Ferix Corp.

IBM Corp.

Minolta Corp.

OPE Printers Inc.

Sharp Electronics

Southern Systems Inc.

Storage Technology (Documentation)

TEC America

Trilog Inc.

For information on their products, consult the Supplementary Manufacturers' Directory of Digest Products on Page 110 .

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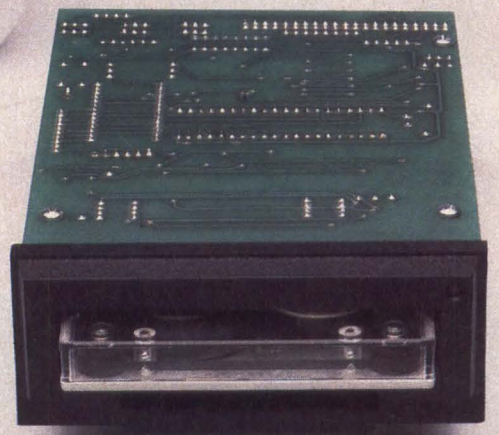

When Irwin came out with the Irwin 110 and 210 tape drives, both of which fit 10 megabytes of formatted capacity in a DC-1000™ cartridge, a lot of people said we bit off more than we could chew.

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CIRCLE NO. 38 ON INQUIRY CARD

# IBM SHUFFLES ½-INCH TAPE-CARTRIDGE DECK

## IBM's 3480 is a solid bet for an industry standard, but DEC, EPI, MegaTape, Rosscomp and members of the HI/TC group aren't about to fold



**David Simpson,** Senior Associate Editor

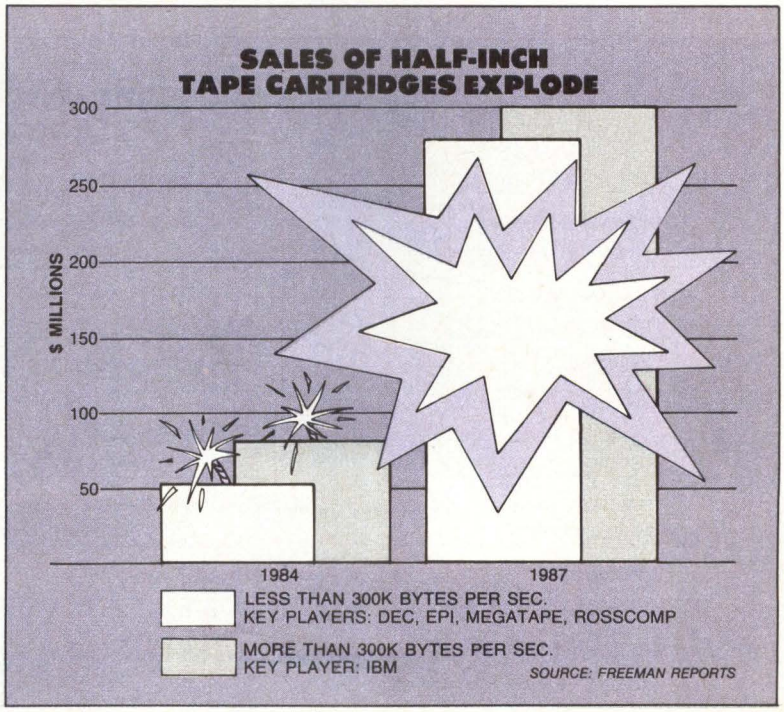
When we last took a close look at the ½-inch tape-cartridge market (MMS, May 1984, Page 41), we included the caveat "The biggest unknown...is IBM's long-awaited 'Ocotillo' drive." Before the issue reached the post office, IBM Corp. announced the drive. Within months, major manufacturers such as Tandon Corp. put plans for ½-inch tape-cartridge products on the back burner, and the industry waited to see what effect IBM's product would have on the ill-defined ½-inch tape-cartridge arena.

The field is now down to five key players, with the big question revolving around the issue of standardization. IBM appears to have succeeded in setting a standard for high-end ½-inch tape-cartridge drives, as well as for ½-inch tape-cartridge media; Digital Equipment Corp. has set a standard for the DEC world; and a recently formed group called HI/TC (Half-Inch/Tape Cartridge, pronounced "high tech") is trying to establish a standard for the rest of the industry.

Formal members of the HI/TC group include Archive Corp., Computer Peripherals Inc. (a subsidiary of Control Data Corp.), Kennedy Co., Pertec Peripherals Corp., Tallgrass Technologies Corp. and Wangtek Inc. To date, 34 companies have participated as members or observers.

Meanwhile, manufacturers like MegaTape Corp. and Rosscomp Corp. are carving secure niches with deliverable products, and heavyweights Cipher Data Products Inc., Control

**The ½-inch tape-cartridge market** *currently comprises only five manufacturers. IBM is the only company with a drive that has a transfer rate of more than 300K bytes per second. (Its 3480 operates at 3M bytes per second.)*



Data and Wangtek may be poised for action. Tandon declines to say whether it will enter the market.

For those not concerned with standards, there's a more fundamental question: "Why ½-inch tape cartridges?" The ¼-inch tape-cartridge market is streaming along, and larger, 10½-inch reel-to-reel units have served us well for three decades. The answers are size, ease of use and price/performance.

*"**Cartridge** has to be the way of the future for tape drives," says MegaTape president John Jori.*

The primary function of all types of tape drives is Winchester disk backup. In the over-300M-byte range, that job has traditionally been handled by ½-inch reel-to-reel units. The major advantage of ½-inch tape-cartridge drives is size. Half-inch cartridge-based units, such as those from DEC, Electronic Processors Inc. (EPI) and Rosscomp, fit the compact 5¼-inch form factor, an increasingly important issue for system integration. In addition, ½-inch cartridge drives can match the capacities of most reel-to-reel units, serving the 100M- to 500M-byte range.

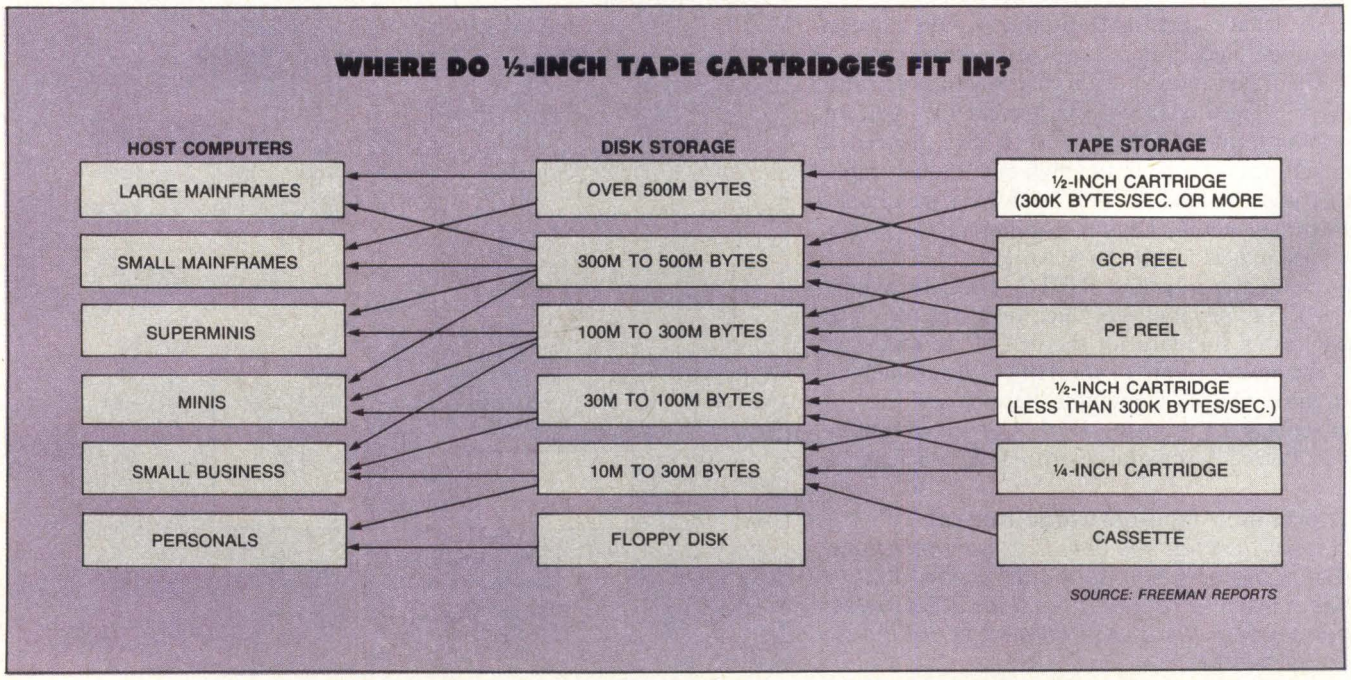
Other advantages of ½-inch cartridge drives include higher reliability and ease of operation. "Cartridge has to be the way of the future for tape drives," says MegaTape president John Jori, "because companies want to [be able to] use operators with less and less training." EPI product manager Vince Stinton claims that the higher reliability of EPI's drives, relative to reel-to-reel units, is due to the lack of belts and capstans. This gives the drive better control of tape tension, which in turn leads to better reliability and higher bit densities.

Nevertheless, ½-inch reel-to-reel units are legitimate competition until ½-inch cartridge-based drives establish themselves as a class, as opposed to a group of incompatible products. Phase-encoded (PE) streamers such as Cipher's Microstreamer and Control Data's Keystone series are less complex, more reliable, more compact and less expensive than older tension-arm units. And manufacturers of low-cost, group-code-recording (GCR) tape drives are enjoying booming growth. Both of these product classes offer competitive price/performance to the emerging ½-inch tape-cartridge drives.

At the low end (e.g., 60M to 100M bytes), ½-inch cartridges must contend with competition from their ¼-inch cousins, particularly streaming drives, which are expected to grow at an 84 percent rate over the next three years, according to Freeman Associates, Santa Barbara, Calif. However, ¼-inch tape drives are only beginning to push the 100M-byte mark, and most ½-inch tape-cartridge drives are well beyond that capacity range.

### Market lacks standards

Currently, the ½-inch tape-cartridge market is characterized by a potpourri of incompatible



products. Different form factors, cartridge designs, transfer rates, densities and recording formats mean non-interchangeability of data between the various manufacturers' drives. But three major forces are determined to clear the dust and establish, if not one, at least some standards: IBM, DEC and the HI/TC group.

For years, manufacturers steered clear of the ½-inch tape-cartridge market, waiting for the expected standard from IBM. The company introduced the 3480 in March 1984. The drive was originally code-named Ocotillo and, more recently, Saguaro. The technology, which represents a new level of technical sophistication in mass storage, is referred to as Del Oro, and supposedly spans an entire family of high-capacity storage systems.

The Saguaro moniker, derived from a variety of cactus found in the Southwest, may be fitting. As one industry observer notes, "It may prove to be a thorn in many manufacturers' sides."

The announcement characteristically lacked full specifications, but the vital statistics are available. The 3480 records at 38K bits per inch (bpi) on 18 tracks, uses parallel recording, has a fast transfer rate of 3M bytes per second, uses chromium dioxide tape and 18-channel, thin-film heads and has a capacity of at least 200M bytes. The twin-drive 3480 is primarily designed to back up 3780-class disk subsystems.

According to IBM, the 3-foot-by-2-foot-by-39-inch subsystem represents a 60 percent reduction in size and a 20-fold improvement in data reliability over its predecessor, the 3420. Pricing is speculative, but the 3480 is expected to sell for well over $100,000. The drive was scheduled for shipments in the first quarter of this year.

### 3480 cartridge is key

The important aspect of the 3480 announcement is not the drive itself, but the media cartridge, prosaically dubbed the IBM Tape Cartridge. Measuring 1 by 4 by 5 inches, the single-reel cartridge—not the drive—is an odds-on favorite for an industry-wide standard.

Industry analysts and participants agree with EPI's Stinton's assessment of the drive: "The 3480 is aimed for the very-high-capacity market because of its configuration and transfer rate. It's meant to replace big reel-to-reel units on IBM mainframes." Analysts also agree that it will be at least 18 months before any other manufacturer will be able to tool up and produce a 3480-like drive because of its complexity. Storage Technology Corp. is expected to be one of the first plug-compatible manufacturers to offer a 3480 look-alike:

The IBM introduction gains greater significance in view of a joint-development agreement entered into early last year with tape giant Cipher. The deal is believed to involve a series of products that Cipher will develop for IBM, including a scaled-down 3480-type drive, but neither IBM nor Cipher officials will comment on the deal.

**"Why try to develop a standard** *around the 3480 cartridge when IBM and Cipher are going to dictate that standard anyway?" asks Rosscomp president Rod Hosilyk.*

"I'm convinced that IBM has a strong desire to have a family of products that will provide an interchange standard for the industry," says Cipher's chairman and chief executive officer, Don Muller. Cipher, along with Archive, is a leader in the ¼-inch tape-drive market and also claims 80 percent of the ½-inch streaming reel-to-reel market. "We would proceed on a ½-inch tape-cartridge-based product only if it were based on a strong standard of interchange, and we think that requires an IBM involvement," says Muller.

The HI/TC group has adopted the IBM Tape Cartridge form factor as an industry standard. The proposed standard will use chromium dioxide tape but will record on 26 tracks, serially, two at a time, rather than in parallel, a method sometimes referred to as "dual-track serial recording." (Serial recording usually refers to a method that records one track at a time.)

Another potential de facto standard is DEC's TK50, weighing in at 131M bytes (unformatted), with a 6,667-bpi density and a low 45K-byte-per-second transfer rate. Manufacturers of ½-inch tape-cartridge drives don't see the TK50 as a threat because the drive is intended, at least initially, for in-house use and DEC's installed bases. "Within the DEC systems world," says Ray Freeman, president of Freeman Associates, "the TK50 may be an important product, but there's still some question [about] whether it can penetrate the outside OEM world."

Major drawbacks to DEC's drive include low capacity and a low transfer rate. "They don't bother us," says EPI's Stinton. "Our drive has more capacity, and some system houses will take our drive, put a DEC interface on it and sell it to the DEC world."

The important aspect of DEC's approach is that, unlike IBM, the company is opening up the technology by offering OEM licenses for the cartridge and recording format. Wangtek, an aggressive player in the 25M- to 120M-byte, ¼-inch tape-drive market, was the first licensee of the DEC product. In addition, DEC submitted its cartridge design to ANSI for considera-

**"I'm convinced that IBM** *has a strong desire to have a family of products that will provide an interchange standard for the industry," says Cipher chairman and chief executive officer Don Muller.*



tion as an industry standard.

The ½-inch tape-cartridge market also includes a few dissenters—manufacturers that, although they've submitted their products as proposed standards, are pursuing designs independent of the critical-mass movements toward standardization. These include EPI, MegaTape and Rosscomp. The latter two companies are the only manufacturers shipping ½-inch tape-cartridge drives in quantity. However, few analysts expect them to gather a significant-enough following to establish an industry-wide standard.

Countering that claim, EPI cites second-source agreements with Memorex Corp. and Fujitsu Ltd. The EPI drive was originally a joint project with Memorex, but the tape-media leader recently elected not to exercise its option to build the drive. However, the media division of Memorex will continue to manufacture the cartridge. Fujitsu is a legitimate second source, but is about eight to 12 months behind EPI in the production process. EPI's first production run is scheduled for next month.

Stinton believes that IBM's 3480 is in a different ballpark from the EPI STR-Stream II. "We're headed more for the professional workstation market," he says. "We're hitting the top 10 computer companies, excluding IBM and DEC." EPI lists the STR-Stream II's advantages, relative to competing products, as dual-mode operation (start/stop and streaming), a 5¼-inch form factor, a fast transfer rate (225K bytes per second) and reel-to-reel technology in a cartridge format.

MegaTape is another manufacturer with a unique design. There is one major advantage and one disadvantage to MegaTape's ½-inch tape-cartridge drives: They pack the highest capacity (up to 500M bytes) but at 8.75 by 19 by 17.5 inches or 10.2 by 8.4 by 29 inches, they're big compared to 5¼-inch tape drives.

MegaTape's Jori says that his company doesn't compete with ¼-inch tape-cartridge drives but, rather, with low-end GCR 10½-inch units. The MegaTape drives incorporate Pertec or Cipher interfaces, making them compatible with larger tape drives. "You can take a MegaTape drive and add it to a system that already has a 1,600-bpi Pertec drive," says Jori. "Thus, you get data interchangeability with larger drives." However, Jori downplays the importance of interchangeability in favor of user convenience. "Users aren't so concerned with data interchangeability. They just don't want to hire another man to hang tapes," which the larger reel-to-reel units sometimes require.

Rosscomp's president, Rod Hosilyk, defends his company's ½-inch tape-cartridge offerings by citing availability, second-source agreements and the unique advantages of the drives. The company recently went public, has been shipping its 190M-byte, 5¼-inch drives since last fall and had "about" $1 million in revenue during 1984, according to Hosilyk. Second-source agreements include Nippon Columbia in Japan, which supplies drives for both Rosscomp and the Japanese market, and Microlab S.A. in Brazil. Microlab is one of the largest peripheral manufacturers in South America, but it hasn't started production of the Rosscomp drives yet, having only recently inked the deal.

Hosilyk says his drives offer two major advantages: low cost and low power consumption, both of which are due in large part to the fact that the drives have only one motor. Hosilyk maintains that the IBM cartridge dictates a drive with two motors and 40W to 60W consumption, compared with 18W for Rosscomp drives.

### HI/TC group eyes standard

The HI/TC group was formed to promote widespread use of ½-inch tape-cartridge drives by establishing standards that will lead to industry-wide compatibility. The group consists of drive, media, recording head and controller manufacturers. Their current goal is to establish a recording-format standard to ensure data interchangeability between various manufacturers' drives.

In its initial meetings, the HI/TC group settled on a cartridge that is compatible with the IBM Tape Cartridge, a 240M-byte capacity, a 200K-byte-per-second transfer rate and the dual-track, serial-recording scheme on 26 tracks. Follow-on proposals will shoot for doubled capacity and transfer rates.

According to group facilitator Freeman, the HI/TC committee will probably agree on a specific recording format and device interface by this year's National Computer Conference in July. Freeman says the group has no intention of defining a new intelligent interface, and is looking closely at the small computer systems interface (SCSI) and the intelligent peripheral interface (IPI).

At its second working meeting this January, the HI/TC group formed a subcommittee to establish a recording-head standard. The subcommittee consists of 12 companies and meets on the day preceding HI/TC meetings. The next scheduled meeting is July 17. (For more information on the HI/TC group, contact Freeman Associates, 311 E. Carrillo St., Santa Barbara, Calif. 93101.)

Despite its 34 participants, not everybody

thinks that the HI/TC group is on the right track. For example, Rosscomp's Hosilyk, echoing whisperings in the industry, thinks that, because of IBM's agreement with Cipher, the activities of the HI/TC group may be somewhat futile. "Why try to develop a standard around the 3480 cartridge when IBM and Cipher are going to dictate that standard anyway?" he asks.

In addition, Hosilyk believes that any drive based on the 3480 cartridge would have to sell in the $2,000 to $4,000 range, in part because the drive would require two motors. Hosilyk's company is aiming for the $1,000 to $1,200 range (in OEM quantities).

While Hosilyk thinks that the best-laid plans of the HI/TC group will go awry, Cipher's Muller merely thinks the group is jumping the gun. "We consider it premature to develop a recording format on that cartridge [the IBM Tape Cartridge] without knowing what kind of format might be consistent with what IBM would do, if they had a downgraded version of the 3480," he says, sidestepping the issue of whether it will be IBM or his company that will develop the downgraded version.

MegaTape's Jori focuses on the capacity factor. "We believe that their [the HI/TC group's] product will be limited in capacity. No matter what they do, we can always have twice as much." Although not active members, Cipher, MegaTape and Rosscomp send observers to the HI/TC meetings.

The most likely scenario for the ½-inch tape-cartridge industry is the eventual acceptance of a variety of standards. IBM and a few plug-compatible manufacturers will control the high end of the market; a Cipher-manufactured, downgraded version of the IBM 3480 will address lower capacity ranges; the HI/TC group will agree on a standard based on the IBM Tape Cartridge form factor and attack the same capacity range as the Cipher product; DEC will serve the DEC world; and those manufacturers with unique designs will ignore the mainstream push for standards. □

**Currently, the ½-inch tape-cartridge market is characterized by a potpourri of incompatible products.**

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Spring loaded and ball bearing tape guides.

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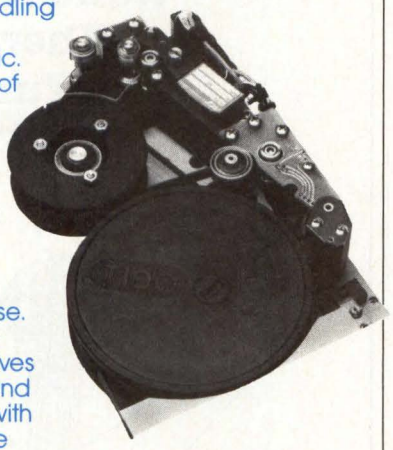

Simple, dependable automatic tape threading.

So you experience very little ISV. As well as lower power dissipation. The motor uses less than 15W.

Single capstan motor.

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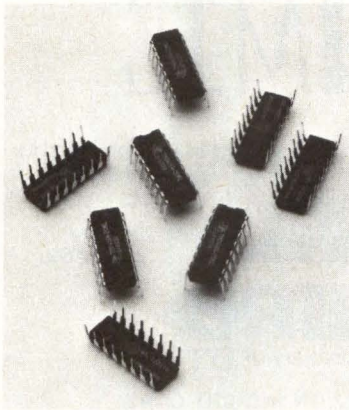

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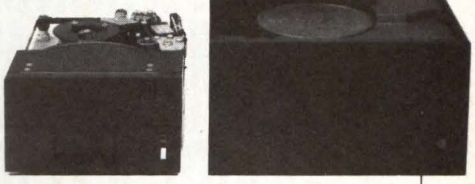

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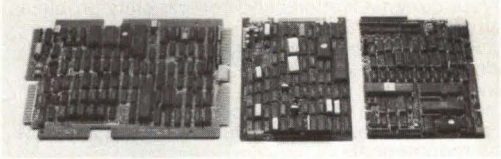

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## TABLE 6

| Company / Model | Operating mode | Storage capacity (M bytes) | Number of tracks | Recording density (bpi) | Tape speed (ips) | Data transfer rate (K bytes/sec.) | Interfaces | Dimensions (H x W x D/inches) | Price ($) | Notes, features, options |
|---|---|---|---|---|---|---|---|---|---|---|
| **DIGITAL EQUIPMENT CORP.** | | | | | | | | | | |
| TK50 | streaming | 131 (unformatted)/ 100 (formatted) | 22 | 6667 | 75 | 45 | Q-bus and Unibus for DEC PDP-11, VAX | 3.25 x 5.75 x 8.44 | | separate controller, uses a 1- x 4- x 6-inch dual-reel cartridge |
| **ELECTRONIC PROCESSORS INC.** | | | | | | | | | | |
| STR-Stream II | start/stop, streaming | 162 (unformatted)/ 151 (formatted) | 20 | 12,000 | 50, 75, 150 | 225 | ESDI | 3.25 x 5.75 x 8 | 1,500(Q1); 1,240(Q500) | opt. controller, uses a 1- x 4.1- x 4.2-inch single-reel cartridge |
| **IBM CORP.** | | | | | | | | | | |
| 3480 | streaming | 200 or more | 18 | 38,000 | | 3M bytes/ sec. | | 36 x 24 x 39 | | delivery scheduled for 1st quarter of 1985 |
| **MEGATAPE CORP.** | | | | | | | | | | |
| MT-300/300H | start/stop, streaming | 330 (unformatted) | 24 | 9600 | 50, 200 | 240 | Pertec, Cipher | 8.75 x 19 x 17.5/ 10.2 x 8.4 x 29 | 6,950/ 7,300(Q1) | track select, microprocessor-controlled formatter; opt. cache |
| MT-500/500H | start/stop, streaming | 500 (unformatted) | 24 | 10,660 | 45, 180 | 240 | Pertec, Cipher | 8.75 x 19 x 17.5/ 10.2 x 8.4 x 29 | 7,650/ 7,950(Q1) | microprocessor-controlled formatter |
| **ROSSCOMP CORP.** | | | | | | | | | | |
| 160 | start/stop, streaming | 190 (unformatted) | 24 | 8000 | 90 | 90 | BSTI, QIC-36, QIC-02, SCSI, 9-track | 4.62 x 8.55 x 11 | 1,410(Q1); <900(OEM) | opt. formatter |
| 5160 | start/stop, streaming | 190 (unformatted) | 24 | 8000 | 90 | 90 | BSTI, QIC-36, QIC-02, SCSI, 9-track | 3.25 x 5.75 x 8 | 1,300(Q1); <800(OEM) | opt. formatter |

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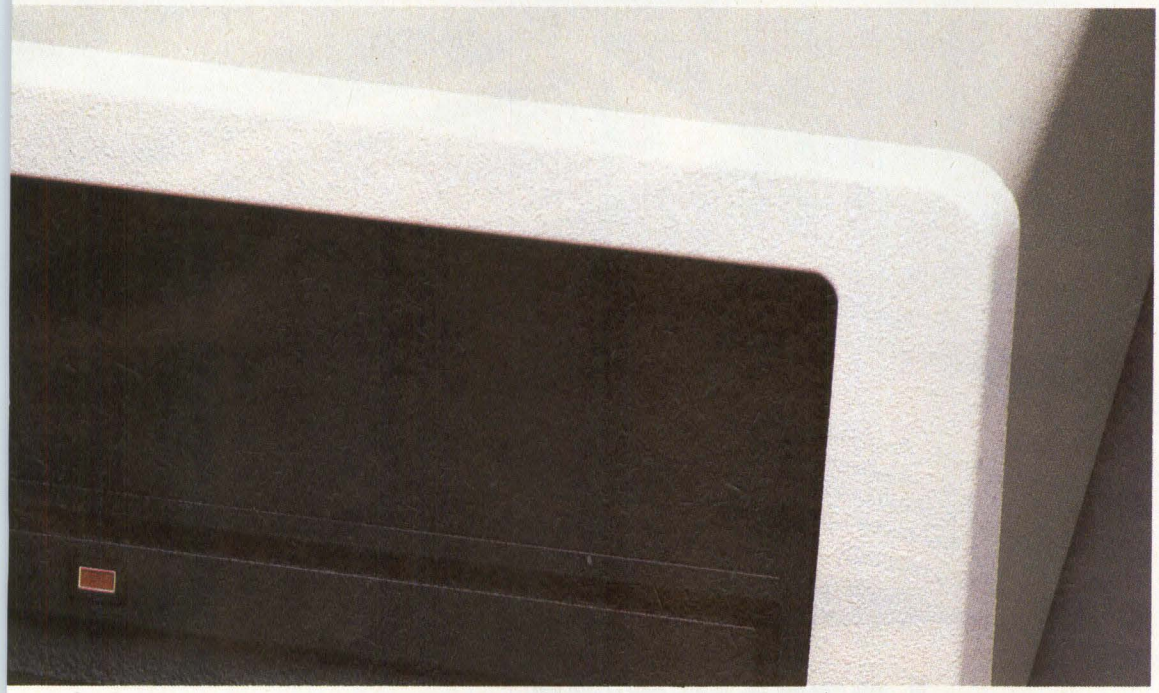

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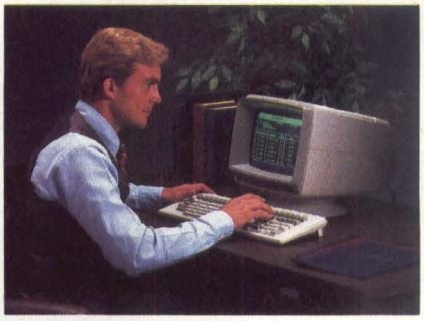

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**CIRCLE NO. 48 ON INQUIRY CARD**

# GRAPHICS USERS GAIN FROM VENDORS' RIVALRY

## Pressured by personal computer and ASCII terminal vendors, graphics terminal manufacturers fight back with lower prices and improved performance

**Jerry Borrell,** Senior Western Editor

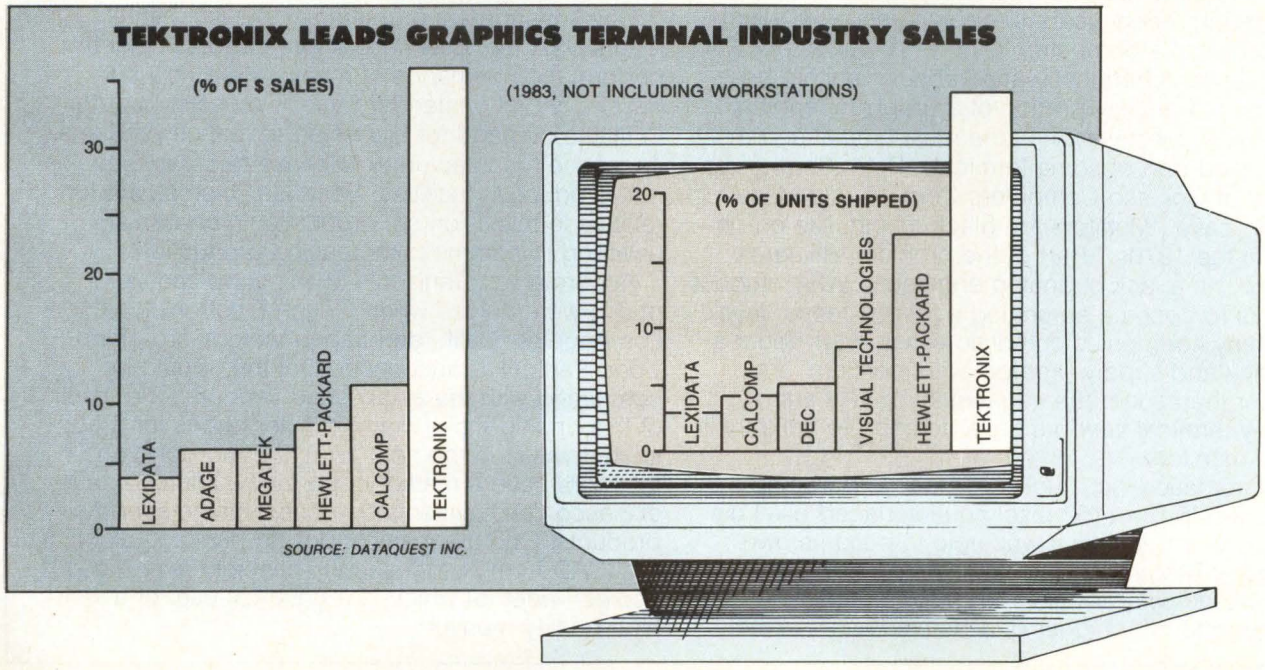
Graphics terminal buyers are finding quality products at bargain prices. They see price erosion forced by ASCII terminal manufacturers entering the graphics terminal market, by personal computer products threatening to replace graphics terminals and by VLSI component technologies, allowing some graphics terminal vendors to slash prices of their high-performance products.

Many vendors have increased performance or created specialized application terminals. Michael Long, chief executive officer of AED Inc., Sunnyvale, Calif., believes, "Smaller companies must seek out vertical markets with less competition." Other terminal manufacturers have opted for the workstation marketplace. All of these approaches seem difficult to execute as price erosion has decreased the research and development funds available for new products.

### ASCII manufacturers crowd in

ASCII terminal vendors, whose markets have become increasingly competitive, view graphics as an avenue to higher profits. They released a flood of retrofitted monochrome terminals that produce graphics by adding graphics boards to

**Dollar volumes** *and unit shipments vary because the unit prices of the terminals of the different vendors vary.*



ASCII terminals. But Walt Keller, president of graphics terminal maker GraphOn Corp., Campbell, Calif., contends, "Retrofit terminals offer relatively poor graphics and have a limited life." Keller says that retrofit terminals are plagued by limited cooling or insufficient power supplies.

Like ASCII terminals, monochrome terminals with add-in graphics boards must contend with price erosion, commodity manufacturing, distributor-oriented sales and offshore manufacturing. Dan Johnson, director of graphics products at CIE Terminals, Irvine, Calif., remains positive about the market, saying, "Graphics terminal sales will never be as competitive as ASCII because of the need for more manufacturer interaction in the sale." Keith Rapp, general manager of the Terminals Division for Qume Corp. in San Jose, Calif., concurs: "The markets and products are not the same. You have different development cycles for the product, different user environments, a longer selling cycle and a need for more customer support."

An indication of the intensity of the upcoming competition is demonstrated by the number of board vendors leaving the retrofit board market to sell graphics terminals. Keith J. Sutton, vice president of marketing at Digital Engineering Inc., Sacramento, Calif., recalls, "Over the last six years, we have shipped over 35,000 boards, primarily for the retrofit of Lear Siegler [Inc.]

## Monitors: a visible issue

If the terminal industry can be said to suffer from a lack of standards, then monitors are almost anarchic. Peter Portoulis, vice president of Conrac Corp., Covina, Calif., notes, "A majority of our products are built to a unique customer specification." Mitsubishi Electronics America Inc., on the other hand, "addresses the terminal marketplace by producing a wide selection of products—over 50 different models," says Don Aarons, national sales manager for display products.

The term "monitor" refers to a CRT-based display device that has been modified to allow the red, green and blue color signals to be directed as either a composite video signal or as a red-green-blue signal. The word "monitor" has been extended in recent years to apply to any CRT display attached to a computer.

Questions frequently arise about monitors because the display portion of a graphics terminal is judged subjectively. It is the most crucial and most criticized part of some terminals. Peter Shaw, president of Genisco Computers Corp., Costa Mesa, Calif., says, "Monitors are black magic, like graphics in the 1970s." Part of the problem, declares Shaw, "is a lack of analog engineers. What student wants to become an analog engineer these days?"

Many companies complain vehemently about a quality and supply problem with monitors and, rather than suffer the vagaries of market supply, many terminal vendors have decided to build their own monitors.

Chromatics Inc., Tucker, Ga., says it was able to offer 1,536-by-1,152-pixel non-interlaced pixel displays only because it was able to build its own display. Megatek Corp., San Diego, developed its patented "pixel-phasing" displays because it needed to offer higher quality than was commercially available. Company president Paul Huber concedes, "Initially, we had some problems, but they've been solved." Ken Dozier, president of IMI Inc., Westlake Village, Calif., recalls his company's three-year effort to build its own monitor. "We wanted a display with the equivalent of 4,096-by-4,096[-pixel] resolution and found nothing available." Dozier's company handles exotic applications for military and film industry customers where high resolution and performance are required.

Opinions about quality and supply vary with system integrators. The majority of color tubes originate in Japan. There are exceptions: Barco Industries, Conrac, RCA Data Communications Products and Motorola Inc.

One key industry problem says Seiko Instruments USA Inc. president Andrew Wei, "is that the performance demands of monitors are now surpassing those of standard television sets. In order to fill the demand for higher performance products, Japanese manufacturers will have to create separate production facilities. Because volumes are low, relative to television set production, vendors are unwilling to commit to increasing production."

According to Genisco's Shaw, some monitor prices were halved when C. Itoh Electronics Inc., Los Angeles, Calif., and Japan Victor Corp., Elmwood Park, N.J., announced that they would be competing with the established vendors. The result of this pricing move may be lower prices for graphics terminals. In the near term, the monitor manufacturers have a market opportunity. Microcomputer-based CAD systems open new markets for their products. One mechanical design package alone, AutoCAD from Autodesk Inc., has sold over 13,000 copies—each of which is a potential user of a high-quality monitor.

and Digital Equipment [Corp.] products. While we continue to build retrofit cards, we now build the HiScan graphics terminal as well."

Ken Bethuel, national sales manager of Falco Data Products Inc., Sunnyvale, Calif., claims that, "The retrofit market is dying because users want faster turnaround and easier service for their graphics terminals." Bethuel points out that key retrofit manufacturers such as Digital Engineering, Selanar Corp., and ID Systems Corp. have introduced graphics terminals.

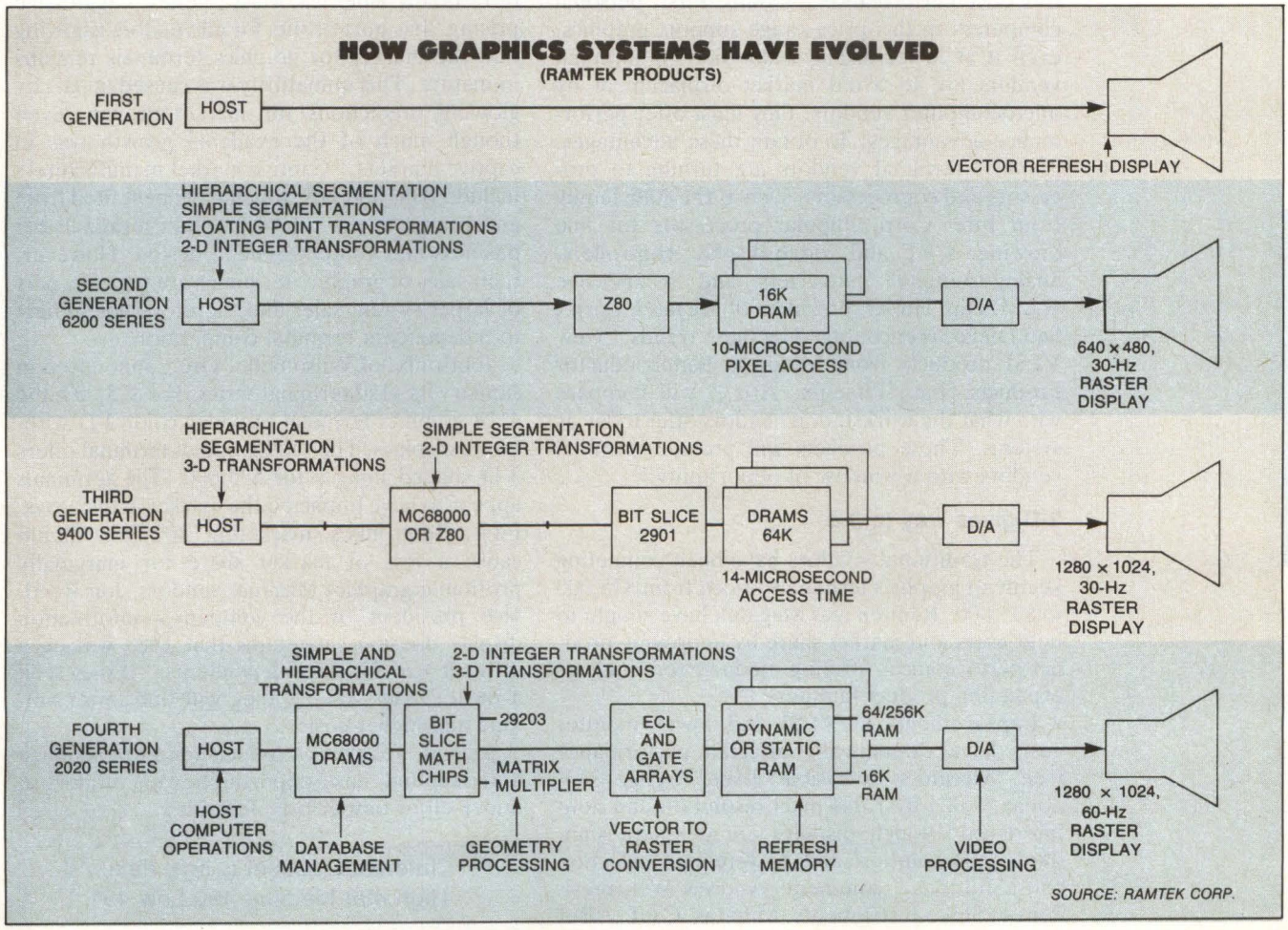
The crucial elements for success in the low-cost monochrome/graphics terminal market are marketing strength and compatibility with available software. Hardware performance will not be a marketing advantage unless, as one manufacturer notes, "someone introduces a 1,024-by-1,024-[pixel] resolution monochrome terminal during 1985 for under $2,000. That will return performance to the forefront."

As the graphics terminal market has grown, so has its dependence upon software. Because each manufacturer has unique ways of incorporating display functions, software developers must write individual device drivers for graphics terminals, in the view of Dan Jorgenson, product marketing manager at the terminal division of Hewlett-Packard Co. Developers find little incentive for this task because of the varied graphics terminals available and low profit margins.

David Deans, president of Intecolor Corp., Norcross, Ga., says this emulation "confirms that terminal trends are established by a market leader. It's unlikely that any one of 40 vendors will establish standards that depart from the Tektronix-installed base. In fact, Tektronix is bigger in graphics than IBM [Corp.]" Within associated areas, other manufacturers have achieved similar recognition.

Because DEC's 240 and 241 video terminal sales have taken off, emulation of these products has begun. New products from CIE Terminals, Qume and Digital Engineering all contain DEC emulation. Emulation of the 240 and 241 allows Regis, DEC's graphics instruction set, to be used for basic functions. "At least part of the success of the DEC 240 and 241," contends Pan Kamal, senior marketing specialist at DEC, Maynard,

**Many vendors have increased performance or created specialized application terminals.**



**As the graphics terminal market has grown, so has its dependence upon software.**

Mass., "was our incorporation of Tektronix 4010 and 4014 terminal emulation into the product line, [which indicates] the extent to which emulation plays a role in the market."

The features most important in the graphics marketplace are color, resolution (the number of picture elements, or pixels, displayed) and cost. In 1982, Ramtek Corp. and Chromatics Inc. were among the first to offer color terminals with a resolution in the 500-by-500-pixel area for about $5,000. In 1983 and 1984, there was a flurry of announcements of low-cost color terminals with emphasis on performance and resolution. For example, Seiko Instruments USA Inc.'s, GR-1104 graphics terminal offers 1,180-by-740-pixel resolution at just under $5,000. Digital Engineering's HiScan terminal offers 800-by-300-pixel resolution and a faster writing speed (1 million pixels per second) but is priced under $3,000. To outsell these products, independent vendors must introduce products with 1,024-by-1,024-pixel resolution for roughly $2,500.

Two forces are driving manufacturers toward this price/performance standard. First, personal computers in this price range support graphics, even if at lower display resolution. If terminal vendors are to avoid market displacement by microcomputer vendors, they must offer performance advantages. To obtain these advantages, graphics terminal vendors are turning to processors and coprocessors, such as the 8086 family from Intel Corp., bipolar processors for line drawing, CRT and video-display controllers, analog-to-digital converters and inexpensive RAM. Paul Huber, president of Megatek Corp., San Diego, is encouraged by these trends, "New VLSI products from Motorola Semiconductor Products [Inc., Phoenix, Ariz.], will compare with what the workstation vendors offer today as systems. These products will provide terminal vendors with a window of opportunity."

### 2-D gives way to 3-D

The traditional vendors have been competing keenly in graphics terminals priced from $15,000 to $35,000. Ramtek and Megatek have sought to hold users and market share by improving product performance, offering modular terminals or expanding product families.

Improvements in VLSI and lower monitor costs have dramatically affected performance (see "Monitors: a visible issue," Page 84). Today, 1,024-by-1,024-pixel resolution and noninterlaced 19-inch displays are de facto standards. "Resolution and cost remain selection considerations," comments Andrew Wei, president of Seiko Instruments, Milpitas, Calif., "But other factors are more important, such as how fast [terminals] can manipulate data for rotation and translation, or the amount of color depth." The use of four, 24, or 48 planes is important because of memory cost and because applications such as solids modeling require many colors. "Another criterion," continues Wei, "is the display list that determines how complex an object can be stored within the terminal."

User-acceptence of 3-D applications boosted 1984 sales of long-standing graphics companies offering 3-D products, such as Adage Inc., Evans and Sutherland, Genisco Computers Corp., Lexidata Corp., Megatek and Ramtek. New vendors that have incorporated 3-D capability include Cubicomp Inc., Jupiter Systems Inc,. Spectragraphics Corp., New GEA Corp., CGX Corp. and Silicon Graphics Corp.

All these companies are competitive in the under-$50,000 class. But the intense nature of the competition for 3-D terminals became evident in mid-1984 when Evans and Sutherland dropped its 3-D color display systems price from over $90,000 to $48,000. Ross Belson, president of Lexidata, Billerica, Mass., believes aggressive pricing "has hurt profits for all vendors, showing that the market for graphics terminals remains immature. This immaturity was caused in part by glowing predictions for market growth, even though much of the available growth was in captive markets." Captive market manufacturers include IBM and HP, which have benefited from an upsurge in the use of graphics terminals for business and computer-aided design. However, their sales of graphics terminals are typically part of larger system sales and therefore not subject to independent terminal competition.

Tektronix, of Wilsonville, Ore., announced in January its 4120 terminal series. For $25,000, the 4128 graphics terminal provides color 3-D wireframe displays. The 4129 graphics terminal offers 3-D shaded images for $35,000. The terminals appear to have impacted the market in two ways. First, Tektronix's marketing strength should cause a loss of market share for marginally profitable graphics terminal vendors. Jon Reed, vice president of the company's information display division, maintains that 1985 will be a difficult year for the independents. "If they seek a niche," says Reed, "they will find lower volume and higher costs."

Second, Tektronix products tend to legitimize a market and make opportunities for vendors to undersell or outperform Tektronix. □

Interest Quotient (Circle One)
High 489 Medium 490 Low 491

# The first smart terminal under $400.

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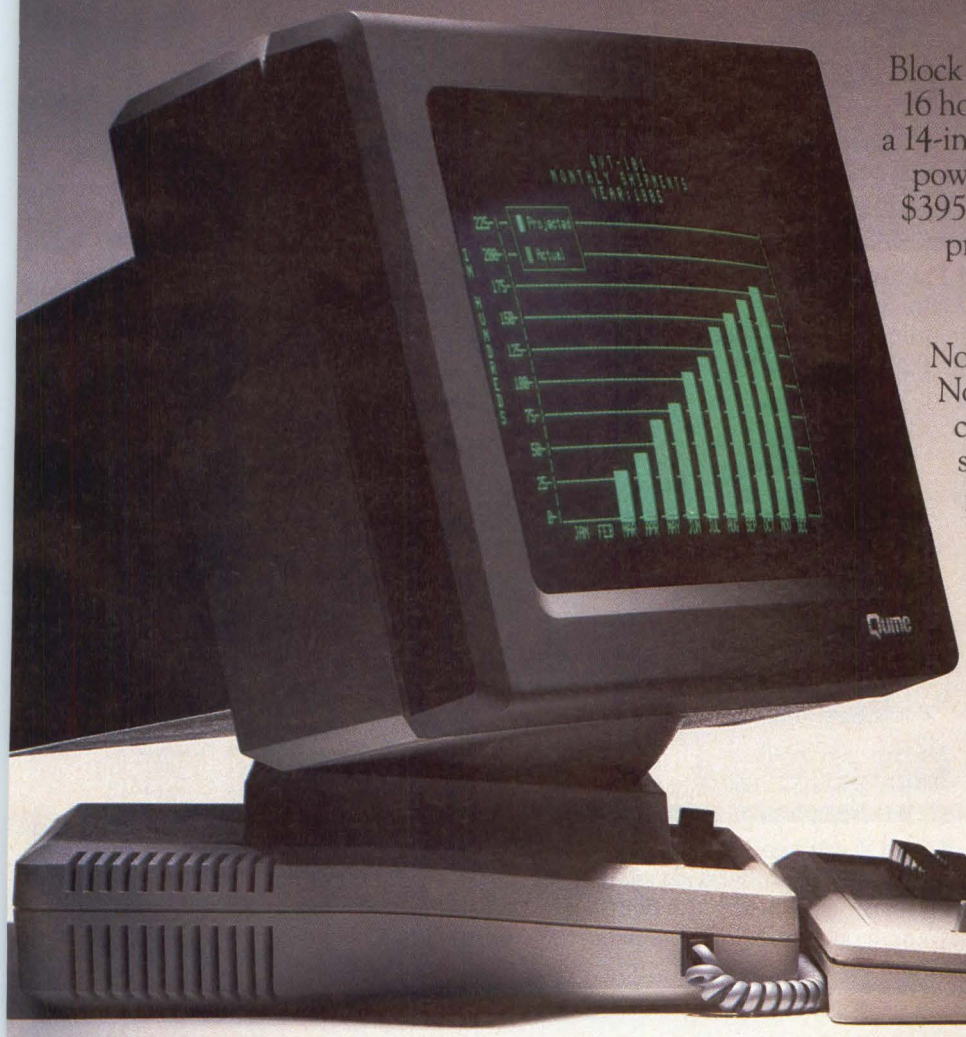

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1 There's our position on the bottom line. Simply put: No one can match our emulations, editing and ergonomics for $549.

Can anyone better this price?

2 Only at the expense of features. Often it's obvious where they've cut corners:

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7 As well as the local editing and block mode transfer capacities you need to speed work flow.

8 Plus 16 resident emulations you can switch at the touch of a key. Including the TeleVideo 910, 910+, 912, 920 or 925*...

9 The Lear Siegler ADM 3, ADM 3A, 3A+ or ADM 5*...

13 What's more, we'll add more. In OEM quantities, we'll customize our 210's appearance, personality and programming so it's perfectly suited to your needs.

14 And if you need a more powerful terminal with even more features, consider the next step up in our family of terminals: the Ampex 230.

15 We back every Ampex terminal with a six month warranty and a worldwide service network.

*TeleVideo, Lear Siegler, Esprit and Qume are trademarks of TeleVideo Systems Inc; Lear Siegler Inc; Esprit Systems Inc; and Qume Corporation respectively.

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4 We also equipped it with a low-profile, Selectric-style, adjustable-slope keyboard for easy typing.

5 And with a soothing, flicker-free amber screen for easy reading. (If you prefer, you can have the option of green at no extra cost.)

6 But ergonomics are just the beginning. The Ampex 210 is as beautifully engineered inside as outside. With line graphics and a bidirectional printer port as standard features.

10 The Esprit (Hazeltine) 1400, 1410 or 1500.*..

11 ADDS Regent 20, 25 and Viewpoint.†..

12 And Qume's QVT 102.*

16 How can we pack all that into the Ampex 210 for just $549? We're in a position to be competitive. We can take advantage of over 25 years of video, computer peripheral and offshore manufacturing experience.

17 So if you need a well-designed, full-featured terminal, call us at 800 621-0292. Or 800 821-9473 in California. We'll show you how you can be very comfortably situated for just $549.

**AMPEX**

18 The Ampex 210 is from the Computer Products Division of Ampex Corporation. One of The Signal Companies

†ADDS, Regent and Viewpoint are trademarks of Applied Digital Data Systems Inc.

# GRAPHICS DISPLAY TERMINALS

## TABLE 7

| Company Model | Display size (diagonal), color | Display resolution (in pixels) | Alpha mode screen format columns x lines (matrix character size) | Interfaces (protocols) | Emulations | Unit price ($) | Notes, features, options |
|---|---|---|---|---|---|---|---|
| **ADDS (APPLIED DIGITAL DATA SYSTEM INC.)** | | | | | | | |
| X5A | 14-inch; black, white, red, green, blue, cyan, magenta, yellow; 16-color; 4096-color palette | 512 x 390 | | | | | |
| XK-1 | 15-inch, monochrome | 1024 x 780 | 80 x 25, 132 x 25 (10 x 13) | RS232C (X-on/X-off, DTR) | DEC VT100; TeleVideo 925; Tektronix 4010, 4014 | | pan, zoom, arc, circle generation, eclipse, polygon fill, multiple patterns, rubber banding, 1 bit plane, 4 character sizes, composite video |
| XK-19 | 19-inch, monochrome | 1024 x 780 | 80x 25, 132 x 25 (10 x 13) | RS232C (X-on/X-off, DTR) | DEC VT100; TeleVideo 925; Tektronix 4010, 4014 | | pan, zoom, arc, circle generation, eclipse, polygon fill, multiple patterns, rubber banding, 1 bit plane, 4 character sizes, composite video |
| **ADAGE INC.** | | | | | | | |
| Adage 6080 | 19-inch; 256-color, 4096-color palette | 1024 x 1024 | | | | | tilt, swivel, 32 programmable function keys |
| **AED INC. (ADVANCED ELECTRONIC DESIGN)** | | | | | | | |
| Colorware 512 | 19-inch, 256-color, 16.7-million-color palette | 512 x 483 | 85 x 69 (5 x 7, 7 x 9) | RS232C, parallel, Centronics (X-on/X-off) | Tektronix 4000 series | 5,745 | zoom; pan; polygon fill; anti-aliasing; 113 protocol commands; 8 bit planes; Q-bus-, Unibus-compatible; rackmount; RGB video output |
| Colorware 767 | 19-inch, 256-color, 16.7-million-color palette | 767 x 575 | 85 x 69 (5 x 7, 7 x 9) | RS232C, parallel, Centronics (X-on/X-off) | Tektronix 4000 series | 7,795 | zoom; pan; close-curve polygon fill; anti-aliasing; 113 protocol commands; 8 bit planes; Q-bus-, Unibus-compatible; rackmount; RGB video output |
| Colorware 1024 | 19-inch, 256-color, 16.7-million-color palette | 1024 x 768 | 85 x 69 (5 x 6, 7 x 9, 10 x 12, 14 x 18) | RS232C, parallel, Centronics (X-on/X-off) | Tektronix 4000 series | 9,995 | zoom; pan; close-curve polygon fill; anti-aliasing; 113 protocol commands; 8 bit planes; Q-bus-, Unibus-compatible; rackmount; RGB video output |
| **ANN ARBOR TERMINALS INC.** | | | | | | | |
| Ambassador GXL | 15-inch, green | 768 x 600 | 60 x 80 (7 x 9) | RS232C (X-on/X-off) | ANSI X3.64 | 3,090 | polygon fill, window generation, point plot mode, 1 bit plane, diagnostics, alpha-graphics characters |
| Ambassador GXL + Plus | 15-inch, green | 768 x 600 | 60 x 80 (7 x 9) | RS232C (X-on/X-off) | ANSI X3.64 | 3,590 | polygon fill; window generation; point plot mode; 1 bit plane; Greek, math and user-defined character set; diagnostics |
| **ASEA INDUSTRIAL SYSTEMS INC. (PROCESS AUTOMATION DIV.)** | | | | | | | |
| Tesselator 520 | 13-, 16-, 19-, 25-inch; 8-color; 64-color palette | 720 x 336 | 80 x 24 (9 x 12) | RS232C, current loop (X-on/X-off) | | | 1 bit plane, built-in modem, RGB video output |
| Tesselator 8000 | 13-, 16-, 19-, 25-inch: 16-color; 64-color palette | 720 x 336 | 120 x 56 (user-definable) | RS232C, RS422, current loop (ADLP-10, X.25 level 2) | | | zoom, pan, 3 bit planes, rackmount, built-in modem, foreign language version, RGB video output |
| **AYDIN CONTROLS** | | | | | | | |
| Aycon 5215 | 13-, 19-, 25-inch; 16-color; 16-color palette | 512 x 256 | 80 x 48 (5 x 5, 7 x 9) | RS232C, parallel (bisynch) | | 10,000 | Unibus-, Q-bus-compatible; RGB video output |
| Tribune 2010 | 13-, 19-, 25-inch; 256-color; 4096-color palette | 512 x 512, 640 x 480, 768 x 576, 1024 x 768, 1024 x 1024 | | RS232C, RS422 | | 9,300 | zoom, pan, 8 bit planes |

## GRAPHICS DISPLAY TERMINALS

### TABLE 7

| Company Model | Display size (diagonal), color | Display resolution (in pixels) | Alpha mode screen format columns x lines (matrix character size) | Interfaces (protocols) | Emulations | Unit price ($) | Notes, features, options |
|---|---|---|---|---|---|---|---|
| 2300 Series | 13-, 19-, 25-inch; 16-color; 256-color palette | 512 x 512, 648 x 480, 640 x 512 | | RS232C (HDLC, X.25) | DEC VT100 | 19,000 | 5 bit planes |
| 5219 | 19-inch, 16-color | 560 x 336 | 80 x 48 (8 x 8, 8 x 16) | RS232C (X-on/X-off) | | 3,100 | RGB video output, printer output |
| **BURROUGHS CORP.** | | | | | | | |
| ET2000 Series | 14-inch, 8-color, 256-color palette | 640 x 480 | 80 x 24, 40 x 12 (8 x 18) | RS232C; TDI; BDAA; CCITT V.24, V.28 (X-on/X-off, bisynch, asynch) | DEC VT52, VT100, VT101; Tektronix 4010; IBM 3101, 3270, 3780 | 3,000–8,000 | split-screen, arc, circle/rectangle generation, mosaic, 3 bit planes, proprietary bus-compatible, foreign language version |
| GP2000 RGP | 19-inch; 8-color; 262, 144-color palette | 1024 x 768 | 80 x 32 (5 x 7) | RS232C | | 70,000–150,000 | |
| **CALCOMP** | | | | | | | |
| Vistagraphic 4500 | 19-inch, 256-color, 4096-color palette | 1280 x 1024 | | RS232C, parallel | DEC PDP-11, VAX; SEL | | circles, ellipses, vectors; rectangle, pattern, polygon fill; 4, 8 bit planes; rackmount |
| **CIE TERMINALS** | | | | | | | |
| CIT-414A | 12-inch, green | 640 x 480 | 80 x 24 (7 x 14) | RS232C, current loop (X-on/X-off, RTS/CTS, asynch) | Tektronix 4010, 4014; DEC editors | 1,495 | simulated pan and zoom; split-screen; vector plotting; 4 character sizes; DEC LA100-, Epson MX-80-, C. Itoh 8510-compatible |
| CIT-467 | 12-inch, 8-color | 570 x 480 | 132 x 24 (7 x 9, 9 x 9) | RS232C, current loop (X-on/X-off, RTS/CTS) | Tektronix 4010, 4014; DEC VT100 | 2,995 | simulated pan and zoom, split-screen |
| **CIFER PLC** | | | | | | | |
| 3842 | 15-inch; green, amber | 1056 x 300 | 80 x 24, 132 x 25 (13 x 12, 8 x 12) | RS232C, RS423 (X-on/X-off, CTS, DTR) | DEC VT100, Tektronix 4010 | | 2 bit planes, 2 bidirectional RS232C ports |
| T4 | 12-inch; green, amber | 1056 x 300 | 80 x 24, 132 x 25 (13 x 12, 8 x 12) | RS232C (X-on/X-off, CTS, DTR) | DEC VT52, VT100; Tektronix 4010 | | 2 bit planes |
| T5 | 12-inch; green, amber | 1056 x 300 | 80 x 24, 132 x 25 (13 x 12, 8 x 12) | RS232C (X-on/X-off, CTS, DTR) | DEC VT52, VT100, VT200; Tektronix 4014 | | 2 bit planes |
| **COLORGRAPHIC COMMUNICATIONS CORP.** | | | | | | | |
| MVI-100 Model 100/113/119 | 13-, 19-inch; 8-color | 640 x 480 | 80 x 24, 80 x 48 (8 x 10) | RS232C (X-on/X-off) | DEC VT52, VT100; IBM 3101; Lear Siegler ADM-3; ADDS Regent 40; Hazeltine 1510 | 2,750/2,750/3,250 | split-screen, arc, circle/rectangle generation, polygon fill, diagnostics, rackmount; opt. light pen |
| MVI-100 Model 489 | 19-inch, 8-color | 640 x 480 | 80 x 24, 80 x 48 (8 x 10) | RS232C (X-on/X-off) | DEC VT52, VT100 | 5,500 | zoom, pan, scroll, vectors, arc, circle generation, geometric, complete fill, 4 bit planes, diagnostics, rackmount, macro memory |
| MVI-100 Model 813/819 | 13-, 19-inch; 8-color | 640 x 384 | 80 x 24, 80 x 48 (8 x 8) | RS232C (X-on/X-off) | ISC 8001G; DEC VT52, VT100 | 3,000/3,500 | split-screen, arc, circle/rectangle generation, polygon fill, diagnostics, rackmount; opt. light pen |
| MVI-100 Model 820 | 13-, 19-inch; 8-color | 640 x 480 | 80 x 24, 80 x 48 (8 x 10) | RS232C (X-on/X-off) | ISC 80016; DEC VT52, VT100 | 3,250 | zoom, pan, split-screen, arc, circle/rectangle generation, polygon fill, diagnostics, rackmount |
| MVI-100 Model 820XL | 13-, 19-inch; 8-color | 640 x 480 | 80 x 24, 80 x 48 (8 x 10) | RS232C (X-on/X-off) | ISC 8001G; DEC VT52, VT100 | 5,500 | zoom, pan, scroll, vectors, arc, circle generation, geometric, complete fill, 4 bit planes, diagnostics, rackmount, macro memory |
| **DACOLL LTD.** | | | | | | | |
| | 12-inch, green | 1024 x 1024 | 80 x 25 | RS232C, Centronics, parallel (DTR, X-on/X-off, ICL C03) | Tektronix 4010, PLOT 10; DEC VT52 | | view hidden memory, trail |
| **DATAMEDIA CORP.** | | | | | | | |
| ColorScan 10 Retro-Graphics | 12-inch, 64-color | 640 x 480 | 132 x 24 (7 x 9) | RS232C, current loop (X-on/X-off) | DEC VT100; Tektronix 4027, 4010 | | point plotting, vector drawing, arc, circle generation, polygon drawing, fill formats; opt. RGB video output, light pen |

## GRAPHICS DISPLAY TERMINALS
## TABLE 7

| Company Model | Display size (diagonal), color | Display resolution (in pixels) | Alpha mode screen format columns x lines (matrix character size) | Interfaces (protocols) | Emulations | Unit price ($) | Notes, features, options |
|---|---|---|---|---|---|---|---|
| ColorScan 30 Retro-Graphics | 12-inch, 64-color | 640 x 480 | 132 x 24 (7 x 9) | RS232C, current loop (X-on/X-off) | ADDS 25; Lear Siegler ADM-3A; Tektronix 4027, 4010 | | point plotting, vector drawing, arc, circle generation, polygon drawing, fill formats; opt. RGB video output, light pen |
| **DIGITAL ENGINEERING INC.** | | | | | | | |
| HiSCAN 4205 | 14-inch, 16-color, 64-color palette | 800 x 300 | (10 x 10) | RS232C | DEC ReGIS, VT220; Tektronix 4010, 4014, 4027, 4105 | | light pen, mouse; opt. current loop |
| HiSCAN 4210 | 12-inch; white, amber, green | 800 x 600 | (10 x 20) | RS232C | DEC ReGIS, VT220; Tektronix4105, 4010, 4014, 4027 | | light pen, mouse; opt. current loop |
| **DIGITAL EQUIPMENT CORP.** | | | | | | | |
| VT240 | 12-inch; green, amber, white | 800 x 240 | 132 x 24 (8 x 10) | RS232C, RS423, current loop (X-on/X-off) | DEC VT52, VT100; Tektronix 4010, 4014 | 2,195 | polygon fill, all ReGIS commands, 2 bit planes, RS170 video output, multinational character set, printer port, DEC VT220 functionality |
| VT241 | 13-inch, 4-color, 64-color palette | 800 x 240 | 132 x 24 (8 x 10) | RS232C, RS423, current loop (X-on/X-off) | DEC VT52, VT100; Tektronix 4010, 4014 | 3,195 | polygon fill, all ReGIS commands, RGB, RS170 video output, multinational character set, printer port, DEC VT220 functionality |
| **EVANS & SUTHERLAND** | | | | | | | |
| PS 330 | 19-inch, 1801-color | | | RS232C, RS422, DEC parallel (X-on/X-off) | DEC VT100 | | |
| **GENISCO COMPUTERS CORP.** | | | | | | | |
| G-1000 | 19-inch, b&w | 1024 x 792 | 146 x 66 (7 x 12) | RS232C (X-on/X-off) | DEC VT100, Tektronix 4014 | | alphanumeric overlay, selective erase, write through mode, 5 vector formats, 1 bit plane |
| G-2000 | 19-inch, 16-color, 4096-color palette | 1024 x 792 | 146 x 66 (7 x 12) | RS232C (X-on/X-off) | DEC VT100, Tektronix 4014 | | alphanumeric overlay, selective erase, zoom, write through mode, 5 vector formats, 4 bit planes; opt. ergonomic terminal, rackmount controller |
| G-6000 | 19-inch, 16-million-color, 16-million-color palette | 512 x 256, 1280 x 1024 | 182 x 85 (7 x 12) | DMA interface for DEC VAX (DMA interface for DEC VAX) | | | character, vector circle/rectangle generation, polygon fill, word and bit scroll, up to 32 bit planes |
| G-8000 | 19-inch, 4096-color, 16-million-color palette | 1280 x 1024 | 198 x 85 (7 x 12) | RS232C, RS422, DMA interface for DEC VAX (X-on/X-off) | DEC VT100, Tektronix | | up to 12 bit planes |
| **GRAPHON CORP.** | | | | | | | |
| GO-140 | 12-inch; green, amber, b&w | 512 x 390 | 80 x 24, 132 x 24 (7 x 12, 5 x 12) | RS232C (X-on/X-off) | DEC VT52, VT100, VT102; Tektronix 4010, 4012, 4013 | 1,995 | split-screen, rectangle fill, 1 bit plane, diagnostics, bidirectional printer port |
| GO-160 | 12-inch; green, amber, b&w | 1024 x 390 | 132 x 25 | RS232C, RS422 (X-on/X-off, DTR) | DEC VT52, VT100, VT102; Tektronix 4010, 4013, 4014, 4015 | | split-screen, rectangle fill, 2 bit planes, gray scale, alpha overlay on graphics, printer and mouse ports |
| **HMW ENTERPRISES INC.** | | | | | | | |
| 9081 | 19-inch, 8-color | 480 x 384 | 80 x 48 (5 x 7) | RS232C, current loop (X-on/X-off, ASCII asynch) | ADDS 980; DEC VT100; ISC 8001G, 8001R | 5,000 | opt. RS170 video output, rackmount, line and printer ports |
| 9083-S | 13-inch, 8-color | 480 x 384 | 80 x 48 (5 x 7) | RS232C, current loop (X-on/X-off, ASCII asynch) | ADDS 980; DEC VT100; ISC 8001G, 8001R | 3,995 | opt. 16-page display |
| 9203 | 13-inch, 8-color | 480 x 384 | 80 x 48 (5 x 7) | RS232C, current loop (X-on/X-off, ASCII asynch) | ADDS 980; DEC VT100; ISC 8001G, 8001R | 5,500 | |
| 9204 | 13-inch, 8-color | 480 x 384 | 80 x 48 (5 x 7) | RS232C, current loop (X-on/X-off, ASCII asynch) | ADDS 980; DEC VT100; ISC 8001G, 8001R | 12,000–15,000 | special graphics characters |

## GRAPHICS DISPLAY TERMINALS
## TABLE 7

| Company Model | Display size (diagonal), color | Display resolution (in pixels) | Alpha mode screen format columns x lines (matrix character size) | Interfaces (protocols) | Emulations | Unit price ($) | Notes, features, options |
|---|---|---|---|---|---|---|---|
| **HEWLETT-PACKARD CORP.** | | | | | | | |
| HP2623A | 12-inch; white, green, amber | 512 x 390 | 80 x 24 (7 x 11) | RS232C, RS422, current loop (ENQ/ACK, X-on/X-off) | DEC VT52, ANSI X3.64, Tektronix 4010 | | line, text, rubberband line, rectangular area fill, 1 bit plane, 8 foreign languages; opt. integral printer, composite video |
| HP2627A | 12-inch, 8-color, 8-color palette | 512 x 390 | 80 x 24 (7 x 11) | RS232C, RS422, current loop (ENQ/ACK, X-on/X-off) | DEC VT52, ANSI X3.64, Tektronix 4010 | | line, text, rubberband line, rectangular area fill, 3 bit planes, 8 foreign languages; opt. RGP video output |
| **HUMAN DESIGNED SYSTEMS INC.** | | | | | | | |
| Concept GVT + | 12-inch; amber, green, white | 250 x 512 | 80 x 24, 132 x 24 (7 x 11, 5 x 9) | RS232C, current loop (X-on/X-off, CTS/RTS) | DEC VT52, VT100; Tektronix 4010, 4014 | 1,695 | block fill, point plot, multiple line types, graphics memory dump/load, selective erasure, 1 bit plane, 46 programmable key functions; opt. joystick |
| Concept GVT-APL + | 12-inch; amber, green, white | 250 x 512 | 80 x 24, 132 x 24 (7 x 11, 5 x 9) | RS232C, current loop (X-on/X-off, CTS/RTS) | DEC VT52, VT100; Tektronix 4013, 4014, 4015 | 1,995 | block fill, point plot, multiple line types, graphics memory dump/load, selective erasure, 1 bit plane, 46 programmable key functions, APL; opt. joystick |
| **ID SYSTEMS CORP.** | | | | | | | |
| ID-100 | 12-inch, 8-color | 512 x 256, 512 x 512 | 8 x 24, 132 x 24 (8 x 10) | RS232C, current loop (X-on/X-off) | Tektronix 4010 | | color fill, arcs, bars, circle generation, windowing, 4 bit planes; opt. 16-color |
| ID-200 | 12-, 14-, 19-inch; green, gray | 1280 x 780 | 80 x 24, 132 x 24 (8 x 10, 10 x 10, 7 x 9) | RS232C, current loop (X-on/X-off) | DEC VT100; Tektronix 4010, 4014, 4027 | | zoom, pan, split-screen, arc, circle/rectangle generation, polygon fill, windowing, 3 bit planes, rackmount, RGB video output, joystick, mouse, blink, touch screen |
| ID-1024 | 14-, 19-inch | 1024 x 1024 | 80 x 24, 132 x 24 (8 x 10, 10 x 10, 7 x 9) | RS232C, current loop RS170 (X-on/X-off) | DEC VT100; Tektronix 4010, 4014, 4027 | | zoom, pan, split-screen, arc, circle/rectangle generation, polygon fill, windowing, 3 bit planes, rackmount, RGB video output, joystick, mouse, blink, touch screen |
| **IMLAC CORP.** | | | | | | | |
| 8000 | 19-inch, green | 2048 x 2048 | 80 x 50 | RS232C (X-on/X-off) | Tektronix 4014 | 1,735 | calligraphic, bit pad; opt. light pen, Multibus-compatible |
| **IMS INTERNATIONAL** | | | | | | | |
| ULTIMA IV | 12-inch, green, 2-color | 720 x 300 | 132 x 24 (9 x 12) | RS232C, RS422 (CTS, X-on/X-off) | TeleVideo 920, 950; ANSI, DEC VT52 | 1,945 | split-screen; circle/rectangle generation; polygon fill; Q-bus-Multibus-, VME-, S-100-compatible |
| **INTEGRAPH CORP.** | | | | | | | |
| DSP 046-Interpro | 19-inch, 256-color, 16-million-color palette | 1280 x 1024 | 80 x 40, 160 x 80 (16 x 24, 8 x 12) | (X-on/X-off, RTS/CTS) | DEC VT100, Tektronix 4014 | 42,000 | zoom, pan, rotate, arc, circle, ellipse, curve generation |
| DSP 055-Interact | 19-inch, 256-color, 16-million-color palette | 1280 x 1024 | 80 x 40, 160 x 80 (16 x 24, 8 x 12) | RS232C, RS432 (X-on/X-off, RTS/CTS) | DEC VT100, Tektronix 4014 | 48,000 | zoom, pan, rotate, arc, circle, ellipse, curve generation |
| **ITHACA INTERSYSTEMS INC.** | | | | | | | |
| GRAPHOS II | 13-inch, 16-color, 16-color palette | 640 x 480 | 80 x 30 (8 x 16) | RS232C, Centronics (X-on/X-off, DTR) | DEC VT100, Tektronix 4010 | | zoom, pan, circle generation, 4 bit planes, rackmount, 16 independent display windows |
| GRAPHOS III | 13-, 19-inch; 16-color; 32, 768-color palette | 640 x 480 | 80 x 30 (8 x 16) | RS232C, Centronics (X-on/X-off, DTR) | DEC VT100, Tektronix 4010 | | zoom, pan, circle generation, 4 bit planes, rackmount, 16 independent display windows |
| **JAPAN COMPUTER CORP.** | | | | | | | |
| JCC-2068M | 19-inch, 8-color, 16-million-color palette | 1024 x 780 | 80 x 30 (9 x 19) | RS232C, current loop, Centronics (X-on/X-off, bisynch) | DEC VT100, Tektronix PLOT 10, Data General 200K | | zoom, pan, arc, circle/rectangle generation, polygon fill, 24 bit planes, Versabus-compatible, light pen, diagnostics |
| JCC-C1421 | 14-inch, 16-color, 27-color palette | 1024 x 780 | 84 x 30 (9 x 15) | RS232C, current loop, Centronics (X-on/X-off, bisynch) | DEC VT100; Tektronix 4010, 4014; Data General 200K | | zoom, pan, arc, circle/rectangle generation, polygon fill, 4 bit planes, diagnostics |

## GRAPHICS DISPLAY TERMINALS

### TABLE 7

| Company Model | Display size (diagonal), color | Display resolution (in pixels) | Alpha mode screen format columns x lines (matrix character size) | Interfaces (protocols) | Emulations | Unit price ($) | Notes, features, options |
|---|---|---|---|---|---|---|---|
| JCC-C1431 | 14-inch, 16-color, 27-color palette | 1024 x 780 | 84 x 30 (9 x 15) | RS232C, current loop, Centronics (X-on/X-off, bisynch) | DEC VT100; Tektronix 4010, 4014; Data General 200K | | zoom, pan, arc, circle/ rectangle generation, polygon fill, 4 bit planes, diagnostics |
| JCC-C1441 | 14-inch, 8-color, 27-color palette | 1024 x 780 | 84 x 30 (9 x 15) | RS232C, current loop, Centronics (X-on/X-off, bisynch) | DEC VT100; Tektronix 4010, 4014; Data General 200K | | zoom, pan, arc, circle/ rectangle generation, polygon fill, 3 bit planes, diagnostics |
| JCC-C1468M | 14-inch, 8-color, 16-million-color palette | 1024 x 780 | 80 x 30 (9 x 19) | RS232C, current loop, Centronics (X-on/X-off, bisynch) | DEC VT100; Tektronix 4010, 4014; Data General 200K | | zoom, pan, arc, circle/ rectangle generation, 24 bit planes, Versabus-compatible, light pen |
| JCC-C2022 | 19-inch, 16-color, 27-color palette | 1024 x 780 | 84 x 30 (9 x 15) | RS232C, current loop, Centronics (X-on/X-off, bisynch) | DEC VT100; Tektronix 4010, 4014; Data General 200K | | zoom, pan, arc, circle/ rectangle generation, 4 bit planes, diagnostics, light pen |
| JCC-M1000 | 12-inch; green, monochrome | 640 x 486 | 80 x 27 (7 x 9) | RS232C, current loop, Centronics (X-on/X-off, bisynch) | DEC VT100; Tektronix 4010, 4014; Data General 200K | | zoom, pan, split-screen, arc, circle/rectangle generation, polygon fill, 1 bit plane, printer buffer, Japanese version |
| JCC-M1401 III | 14-inch; green, amber, monochrome | 1024 x 780 | 86 x 30 (12 x 24) | RS232C, current loop, Centronics (X-on/X-off, bisynch) | DEC VT100; Tektronix 4010, 4014; Data General 200K | | zoom, pan, split-screen, arc, circle/rectangle generation, polygon fill, 1 bit plane, printer buffer, Japanese version |
| JCC-V1471 | 14-inch, 256-color, 4096-color palette | 640 x 480 | 80 x 27 (9 x 15) | RS232, current loop adapter, Centronics (X-on/X-off, bisynch) | DEC VT100; Tektronix 4010, 4014; Data General 200K | | 8 bit planes, diagnostics, light pen, tablet |
| **KEL INC.** | | | | | | | |
| J1014 | 14-inch; green, monochrome | 1024 x 780 | 146 x 64 (5 x 7, 5 x 14, 10 x 14) | RS232C (X-on/X-off) | DEC VT52, VT100; Tektronix 4010, 4014 | 2,980 | pan, circle/rectangle generation, reverse, 1 bit plane, user-programmable function keys, built-in diagnostics, selective erasure |
| J1014C | 14-inch, 8-color, 8-color palette | 1024 x 780 | 146 x 64 (5 x 7, 5 x 14, 10 x 14) | RS232C (X-on/X-off) | DEC VT52, VT100; Tektronix 4010, 4014 | 4,950 | pan, circle/rectangle generation, rectangle erase, reverse, 1 bit plane, user-programmable function keys, built-in diagnostics, selective erasure |
| J1019 | 19-inch; green, monochrome | 1024 x 780 | 146 x 64 (5 x 7, 5 x 14, 10 x 14) | RS232C (X-on/X-off) | DEC VT52, VT100; Tektronix 4010, 4014 | 4,860 | pan, circle/rectangle generation, fill, 1 bit plane, user-programmable function keys, built-in diagnostics, selective erasure |
| J1019C | 19-inch, 8-color, 8-color palette | 1024 x 780 | 146 x 64 (5 x 7, 5 x 14, 10 x 14) | RS232C (X-on/X-off) | DEC VT52, VT100; Tektronix 4010, 4014 | 7,820 | pan, circle/rectangle generation, fill, 1 bit plane, user-programmable function keys, built-in diagnostics, selective erasure |
| **KEYNOTE COMPUTER PRODUCTS INC.** | | | | | | | |
| KD 500G | 12-inch; green, amber | 512 x 240 | 80 x 24 (6 x 9) | RS232C, RS422, current loop (X-on/X-off, DTR, RTS) | DEC VT100, Tektronix 4010 | | split screen, arc, circle/ rectangle generation, printer port, international character sets, tilt and swivel |
| **KIMTRON CORP.** | | | | | | | |
| KGT-100 | 12-, 14-inch; green, amber | 800 x 390 | 132 x 25 (7 x 11) | RS232C (DTR, X-on/X-off) | DEC VT220, Tektronix 4010, 4012 , 4014 | | arc, circle/rectangle generation, polygon fill, 1 bit plane |
| **LANPAR TECHNOLOGIES INC.** | | | | | | | |
| VISION 1000/ 2000 + / 2200 + | 12-inch; green, amber, monochrome | 780 x 250 | 132 x 25 (7 x 9) | RS232C (X-on/X-off) | DEC VT100, 220; Tektronix 4010, 4014 | | arc, fill, box, circle generation, printer and plotter output |
| **LEENSHIRE LTD.** | | | | | | | |
| VCT 6925 | 14-, 20-inch; 8-color | 512 x 256 | 80 x 32 | RS232C, RS422, current loop (X-on/X-off) | DEC VT52, VT100; Tektronix 4010 | | circle/rectangle area fill, 3 bit planes, rackmount monitor, RGB video output, diagnostics |
| VCT 6926 | 14-, 20-inch; 8-color | 512 x 515 | 80 x 32 | RS232C, RS422, current loop (X-on/X-off) | DEC VT52, VT100; Tektronix 4010 | | circle/rectangle area fill, 3 bit planes, rackmount monitor, RGB video output, diagnostics |

## GRAPHICS DISPLAY TERMINALS
## TABLE 7

| Company Model | Display size (diagonal), color | Display resolution (in pixels) | Alpha mode screen format columns x lines (matrix character size) | Interfaces (protocols) | Emulations | Unit price ($) | Notes, features, options |
|---|---|---|---|---|---|---|---|
| VCT 6927 | 14-, 20-inch; 64-color | 960 x 384 | 80 x 48 (12 x 8) | RS232C, RS422, current loop (X-on/X-off) | DEC VT52, VT100; Tektronix 4010 | | zoom, pan, circle/rectangle area fill, 6 bit planes, rackmount monitor, RGB video output, diagnostics |
| VCT 6928 | 14-, 20-inch; 64-color | 1024 x 768 | 80 x 48 (12 x 8) | RS232C, RS422, current loop (X-on/X-off) | DEC VT52, VT100; Tektronix 4010 | | zoom, pan, circle/rectangle area fill, 6 bit planes, rackmount monitor, RGB video output, diagnostics |
| **LEXIDATA CORP.** | | | | | | | |
| 2400 System | 19-inch, monochrome | 1280 x 1024 | 160 x 85 (7 x 9, 14 x 18, 21 x 27, 28 x 36) | RS232C (proprietary) | | | pan, zoom, 12 programmable function keys, 4 variable-sized workspaces |
| 2410 System | 19-inch, 16-color, 4096-color palette | 1280 x 1024 | 160 x 85 (7 x 9, 14 x 18, 21 x 27, 28 x 36) | RS232C (proprietary) | | | pan, zoom, 12 programmable function keys, 4 variable-sized workspaces |
| **LIBERTY ELECTRONICS** | | | | | | | |
| Freedom 210 Graphics/ASCII | 14-inch, green | 655 x 290 | 80 x 25, 132 x 25 (7 x 9) | RS232C (X-on/X-off) | Tektronix 4010, 4014; Lear Siegler ADM-31; Tektronix 4010, 4014 | 1,295 | arc, circle/rectangle generation, polygon fill, 3 write modes, 1 bit plane, DEC VT series-compatible; opt. amber color |
| Freedom 240 Graphics/ANSI | 14-inch, green | 655 x 290 | 80 x 25, 132 x 25 (7 x 9) | RS232C (X-on/X-off) | DEC VT52, VT100, VT220; Tektronix 4010, 4014 | 1,395 | arc, circle/rectangle generation, polygon fill, 3 write modes, 1 bit plane, DEC VT series-compatible; opt. amber color |
| **LUNDY ELECTRONICS & SYSTEMS INC.** | | | | | | | |
| 5400 Series | 19-inch, 16-color, 4096-color palette | 1536 x 1024 | 80 x 32 (5 x 7, 7 x 9) | RS232C, RS422, current loop | Tektronix 4014 | | arc, circle/rectangle generation, polygon fill, up to 4 bit planes, 14 programmable function keys |
| 5600 Series | 19-inch, 256-color, 16.7-million-color palette | 768 x 512 | 80 x 32 (5 x 7, 7 x 9) | RS232C, RS422, current loop | Tektronix 4010 | | arc, circle/rectangle generation, polygon fill, up to 8 bit planes, 14 programmable function keys |
| Raster UltraGraf | 20-inch, 256-color, 16.7-million-color palette | 1024 x 1024 | | 16-bit parallel, RS232C | | | 16-bit planes, segmentation |
| UltraGraf 3-D Graphics Design Workstation | 20-inch, green | | | 16-bit parallel | | | zoom, 3-D, rubberbanding |
| **MATROX ELECTRONIC SYSTEMS LTD.** | | | | | | | |
| GXT-1000 | 19-inch, 16-color, 4096-color palette | 1024 x 768 | 48 x 80 (5 x 7) | RS232C (X-on/X-off) | | 13,010 | zoom, pan, 4 bit planes; opt. rackmount, 8 bit planes |
| **MEGADATA CORP.** | | | | | | | |
| 8188-8G | 15-inch; green, amber, red | 1024 x 800 | 132 x 30 (16 x 14) | RS232C (3), Centronics (asynch, bisynch) | IBM 3271, 3275, 3277, 328C; Regent 40 | | 1 bit plane, built-in diagnostics, 128 soft character set; opt. 256 or 512 character set |
| 8188-8GH | 15-inch; green, amber, red | 1360 x 98 | 132 x 43 (16 x 32) | RS232C (3), Centronics (asynch, bisynch) | IBM 3271, 3275, 3277, 3286; Regent 40 | | windowing, 2 bit planes, built-in diagnostics, 128 soft character set; opt. 256 or 512 character set |
| **MEGATEK CORP.** | | | | | | | |
| WHIZZARD 1645 | 19-inch, green | 960 x 1280 | 132 x 72 (16 x 33) | RS232C (X-on/X-off) | DEC VT52, VT100; Tektronix 4014 | 8,900 | zoom, pan, windowing, fill, 1 bit plane, 16 programmable function keys, diagnostics |
| WHIZZARD 1650 | 19-inch, 16-color, 4096-palette | 640 x 480 | 132 x 32 (8 x 15) | RS232C (X-on/X-off) | | 9,900 | zoom, pan, windowing, fill, 4 bit planes, 16 programmable function keys, diagnostics |
| WHIZZARD 3355 | 19-inch, 16-color, 4096-color palette | 1024 x 1024 | 132 x 24 (12 x 18) | RS232C, IEEE 488 (X-on/X-off) | DEC VT100, Tektronix 4014 | 22,500 | zoom, pan, windowing, surface fill, 4 bit planes, rackmount |
| WHIZZARD 3375 | 19-inch, 16-color, 4096-color palette | 1024 x 1024 | 132 x 24 (12 x 18) | DEC Unibus (X-on/X-off) | | 26,500 | zoom, pan, windowing, surface fill, 4 bit planes, rackmount, Unibus-compatible |
| WHIZZARD 7210 | 21-inch, white | 4096 x 4096 | | RS232C; IEEE-488; DEC Unibus, PDP-11; Harris; Data General (X-on/X-off) | | 25,150 | zoom, pan, windowing, fill, Unibus-compatible |

## GRAPHICS DISPLAY TERMINALS
## TABLE 7

| Company Model | Display size (diagonal), color | Display resolution (in pixels) | Alpha mode screen format columns x lines (matrix character size) | Interfaces (protocols) | Emulations | Unit price ($) | Notes, features, options |
|---|---|---|---|---|---|---|---|
| WHIZZARD 7250 | 19-inch, 16-color, 4096-color palette | 512 x 512 | | RS232C; IEEE-488; DEC Unibus, PDP-11; Harris; Data General (X-on/X-off) | Tektronix 4014 | 23,000 | zoom, pan, windowing, 4 bit planes, rackmount, Unibus-compatible |
| WHIZZARD 7255 | 19-inch, 16-color, 4096-color palette | 1024 x 1024 | | RS232C; IEEE-488; DEC Unibus, PDP-11; Harris, Data General (X-on/X-off) | Tektronix 4014 | 36,500 | zoom, pan, windowing, 4 bit planes, rackmount, Unibus-compatible |
| **MICRO-TERM INC.** | | | | | | | |
| ERGO-201 | 12-inch; green, amber | 768 x 240 | 80 x 25 (7 x 11) | RS232C, current loop (X-on/X-off, DTR) | DEC VT52, TeleVideo 925, Lear Siegler, ADM-3A, ADDS, Hazeltine 1410, Tektronix 4010 | 1,395 | arc, circle/rectangle generation, fill, diagnostics, printer |
| ERGO 301 | 12-inch; green, amber | 768 x 240 | 132 x 25 (7 x 11) | RS232C, current loop (X-on/X-off, DTR) | DEC VT52, VT100, ReGIS; Tektronix 4010, ANSI X3.64 | 745 | zoom, pan, split-screen, arc, shading, diagnostics, printer |
| **NEW GEA CORP.** | | | | | | | |
| NWX230 | 19-inch, 16-color, 4096-color palette | 1024 x 1024 | user definable | RS232C, RS422, DEC VAX (X-on/X-off, RTS/CTS, ACK/ENQ, bisynch) | Tektronix 4014, IBM 3270 | 14,000 | zoom; pan; split-screen; arc; polygon fill; 4 bit planes; DEC VAX-, Unibus-compatible; rackmount; RGB video output; diagnostics; foreign language version |
| NWX235 | 19-inch, 16-color, 4096-color palette | 1024 x 1024 | user definable | RS232C, RS422, DEC VAX (X-on/X-off, RTS/CTS, ACK/ENQ, bisynch) | Tektronix 4014, DEC VT100, IBM 3270 | 19,950 | zoom; pan; split-screen; arc; polygon fill; 4 bit planes; DEC VAX-, Unibus-compatible; rackmount; RGB video output; diagnostics; foreign language version |
| NWX237 | 19-inch, 4096-color, 16.7-million-color palette | 1280 x 1024 | user definable | RS232C, RS422, DEC VAX (X-on/X-off, RTS/CTS, ACK/ENQ, bisynch) | DEC VT100, Tektronix 4014 | 29,950 | zoom; pan; split-screen; arc; circle generation; polygon fill; rubberbanding, 16 bit planes, DEC VAX-, Unibus compatible; rackmount; RGB video output; diagnostics; foreign language version |
| **NEWBURY DATA RECORDING LTD.** | | | | | | | |
| 9510 | 12-inch; green, amber | 1024 x 260 | 80 x 26 (7 x 11) | RS232C, current loop (X-on/X-off, DTR) | TeleVideo 925, 950; Tektronix 4010, 4014 | | 11 programmable function keys, non-volatile setup mode |
| **PSITECH INC.** | | | | | | | |
| GTC314 | 14-inch, 8-color, 4096-color palette | 512 x 480 | 85 x 48 (programmable) | RS232C (X-on/X-off, RTS/CTS) | DEC VT52, VT100; Lear Siegler ADM-3; Tektronix 4010 | 2,895 | arc, circle generation, fan, pie, box, polyline, polygon, 3 bit planes; opt. rackmount, mouse, digitizer, color printer |
| GTC327 | 14-inch, 8-color, 4096-color palette | 640 x 480 | 80 x 34 (8 x 14) | RS232C (X-on/X-off, RTS/CTS) | Tektronix 4027 | 4,100 | arc, circle generation, fan, pie, box, polyline, polygon, 3 bit planes; opt. rackmount, mouse, digitizer, color printer |
| GTC329A | 19-inch, 16-color, 4096-color palette | 512 x 480 | 85 x 48 (programmable) | RS232C (X-on/X-off, RTS/CTS) | DEC VT52, VT100; Lear Siegler ADM-3; Tektronix 4010 | 5,300 | arc, circle generation, fan, pie, box, polyline, 4 bit planes; opt. rackmount, mouse, digitizer, color printer |
| GTC419 | 19-inch, 8-color | 512 x 480 | 85 x 48 (programmable) | RS232C (X-on/X-off, RTS/CTS) | Lear Siegler ADM-3, Tektronix 4010 | 8,995 | arc, circle generation, fan, pie, box, polyline, 3 bit planes, local storage for 160 graphic pages |
| SIBYL | 19-inch, 2.7-million-color, 16.7-million-color palette | 2730 x 1024 | 240 x 100 (10 x 10) | RS232C (X-on/X-off) | | 24,500 | zoom; pan; split-screen; vectors; markers; polygon fill; multiple pages; 24 bit planes; VME-compatible; RGB, HS, VS video output; opt. mouse, digitizer |
| **QUME CORP. (SUBSIDIARY OF ITT)** | | | | | | | |
| QVT-311GX | 14-inch; monochrome, 4 shades of gray | 640 x 480 | 80 x 32 (7 x 9) | RS232C (X-on/X-off, DTR) | DEC VT52, VT100, VT125; Tektronix 4010, 4014 | 1,995 | zoom; pan; arc; circle generation; polygon fill; 2 bit planes; Q-bus-, Unibus-, Multibus-, S-100-compatible |

## GRAPHICS DISPLAY TERMINALS

### TABLE 7

| Company Model | Display size (diagonal), color | Display resolution (in pixels) | Alpha mode screen format columns x lines (matrix character size) | Interfaces (protocols) | Emulations | Unit price ($) | Notes, features, options |
|---|---|---|---|---|---|---|---|
| QVT-511GX | 14-inch, 8-color, 64-color palette | 480 x 360 | 80 x 30 (5 x 7) | RS232C, Centronics (X-on/X-off, DTR) | DEC VT52, VT100; Tektronix 4105, 4010, 4014 | 2,895 | circle/rectangle generation; polygon fill; 3 bit planes; Q-bus-, Unibus-, Multibus-, S-100-compatible; foreign language version |
| **RCA DATA COMMUNICATIONS PRODUCTS** | | | | | | | |
| VP4801 | 12-inch, green | | 80 x 25 (6 x 8) | RS232C, Centronics, RJ11C (X-on/X-off, asynch) | Texas Instruments, ADDS Viewpoint | | |
| VP5801 | 12-inch, green | | 80 x 25 (6 x 8) | RS232C, Centronics, RJ11C (X-on/X-off, asynch) | Texas Instruments, ADDS Viewpoint | | |
| **SAI TECHNOLOGY CO.** | | | | | | | |
| Series 5000 | 11-inch, orange | 512 x 512 | 80 x 50 (5 x 7, 7 x 9) | | | | split-screen, scrolling, reverse video, blinking, graphics, mil-spec display system for severe environment applications |
| Series 7000 | 8.5-inch, orange | 512 x 256 | 80 x 50 (5 x 7, 7 x 9) | RS422, RS423 | | | split-screen, scrolling, reverse video, blinking, graphics, mil-spec display system for severe environment applications |
| Series 8000 | 13.5-inch, neon orange | 576 x 640 | 85 x 57 (7 x 9) | serial, parallel | | | reverse video, blinking, graphics, mil-spec display system for severe environment applications |
| Series 9000 | 24-inch, neon orange | 1024 x 1024 | 160 x 102 (7 x 9) | serial, parallel | | | polylines, polygons, polymarkers, circle generation, arcs, ellipses, conforms with PHIGS mil-spec display system for severe environment applications |
| **SEIKO INSTRUMENTS USA INC.** | | | | | | | |
| GR-1104 | 14-inch, 8-color, 512-color palette | 1024 x 780 | 80 x 48 (11 x 13) | RS232C, Centronics (X-on/X-off, ENQ/ACK, DTR) | Tektronix 401X, ANSI X3.64 | 4,350 | line, arc, circle/rectangle generation, pan, zoom, fan, mark, pixel, scale |
| GR-2414 | 20-inch, 1024-color, 32,768-color palette | 1280 x 1024 | 132 x 64 (7 x 9, 10 x 13) | RS232C (X-on/X-off, ENQ/ACK, DTR) | Tektronix 401X | 15,950 | line, arc, circle/rectangle generation, polygon fill, zoom, pan, 10 bit planes, diagnostics, hardware anti-aliasing, console mode overlay, multiple logical surfaces |
| **SPECTRAGRAPHICS CORP.** | | | | | | | |
| 1500 | 19-inch, 4096-color, 16.7-million-color palette | 1024 x 1024 | | RS232C, Centronics, DEC Unibus (bisynch, asynch, SDLC, IBM channel, DEC Unibus, Harris channel) | DEC VT100; IBM 3250, 3278, 5080 | 22,000–26,000 | zoom, polygon fill, circle generation, local color hardcopy, up to 12 bit planes, Unibus-compatible |
| **SPERRY CORP. (COMPUTER SYSTEMS DIV.)** | | | | | | | |
| UTS 30 | 12-inch; green, monochrome | 375 x 512 | 80 x 24 (10 x 16) | RS232C (Sperry Uniscope) | TTY, KSR/ASR via CP/M | 3,235–4,565 | business graphics, pie, bar, line, scatter and text charts, polygon fill, hatch fill, 8 foreign character sets |
| UTS 60 | 14.5-inch, 16-color, 16-color palette | 375 x 512 | 80 x 24 (9 x 15) | RS232C (Sperry Uniscope) | TTY, KSR/ASR via CP/M | 6,218 | business graphics, pie, bar, line, scatter and text charts, polygon fill, screen fill, 8 foreign character sets |
| **SUMMIT CAD CORP.** | | | | | | | |
| CAD Upgrade Package 1.0 | 12-inch, 16-color | 640 x 400 | | RS232C, Centronics | | | RGB video output |
| CAD Upgrade Package 1.1 | 12-inch, 16-color | 640 x 400 | | RS232C, Centronics | | | RGB video output |
| **TECHEX LTD.** | | | | | | | |
| OMNICOMP | 19-, 20-inch; 256-color, 4096-color palette | 1024 x 1024 | | RS232C, RS422, RS343, parallel (X-on/X-off) | | | 8 bit planes; Q-bus-, Unibus-, Multibus-compatible; rack-mount; RGB video output |

## GRAPHICS DISPLAY TERMINALS

### TABLE 7

| Company Model | Display size (diagonal), color | Display resolution (in pixels) | Alpha mode screen format columns x lines (matrix character size) | Interfaces (protocols) | Emulations | Unit price ($) | Notes, features, options |
|---|---|---|---|---|---|---|---|
| VHR19-6100 SERIES | 8-, 64-color; 4096-color palette | 1024 x 768 | 132 x 32 | RS232C, RS170, RS343A, current loop (X-on/X-off) | DEC VT100; Tektronix 4010, 4014 | | zoom; pan; split-screen; 3, 6 bit planes; RGB; synch video output |
| **TEKTRONIX INC.** | | | | | | | |
| 4105 | 13-inch, 8-color 64-color palette | 480 x 360 | 80 x 30, 132 x 30 (5 x 4) | RS232C, Centronics (X-on/X-off, DTR/CTR) | DEC VT52, VT100; Tektronix 4010, 4100, 4110 | | polygon fill, split-screen, zoom, pan, rubberbanding, 3 bit planes, 5 foreign languages, local segments |
| 4106 | 13-inch, 8-color, 64-color palette | 640 x 480 | 80 x 32, 132 x 32 (7 x 11) | RS232C, Centronics (X-on/X-off, DTR/CTR) | DEC VT52, VT100; Tektronix 4010, 4100, 4110 | | polygon fill, split-screen, zoom, pan, rubberbanding, 4 bit planes, 5 foreign languages, local segments |
| 4107 | 13-inch, 8-color, 64-color palette | 640 x 480 | 80 x 32, 132 x 32 (7 x 11) | RS232C, Centronics (X-on/X-off, DTR/CTR) | DEC VT52, VT100; Tektronix 4010, 4100, 4110 | | polygon fill, zoom, pan, rubberbanding, split-screen, 4 bit planes, 5 foreign languages, local segments, separate dialog/graphics areas |
| 4109 | 19-inch, 8-color, 4096-color palette | 640 x 480 | 80 x 32, 132 x 32 (7 x 11) | RS232C, Centronics (X-on/X-off, DTR/CTR) | DEC VT52, VT100; Tektronix 4010, 4100, 4110 | | 4 bit planes, RGB video output |
| CX 4106/ CX 4107 | 13-inch, 8-color, 64-color palette | 640 x 480 | 80 x 32, 132 x 32 (7 x 11) | RS232C, Centronics (X-on/X-off) | DEC VT52, VT100; IBM 3278, 3279; Tektronix 4010, 4100, 4110 | | zoom, pan, split-screen, 4 bit planes, RGB video output, separate graphics/dialog areas |
| CX 4109 | 19-inch, 8-color, 4096-color palette | 640 x 480 | 80 x 32, 132 x 32 (7 x 11) | RS232C, Centronics (X-on/X-off) | DEC VT52, VT100; IBM 3278, 3279; Tektronix 4010, 4100 | | 4 bit planes |
| 4115B/M4115B | 19-inch; red, green, blue; 256-color; 16-million-color palette | 1280 x 1024 | 160 x 64 (7 x 9) | RS232C, DMA interface for DEC VAX | Tektronix 4014 | | zoom, pan, standard 4 bit planes, dialog area overlay, block mode; opt. curve generation, segment subroutine |
| **TELEX COMPUTER PRODUCTS INC.** | | | | | | | |
| 078 | 12-inch; green, amber | | 80 x 24 (9 x 12) | RS232C (bisynch, SNA, SDLC) | | | |
| 079 | 12-inch, 7-color | | 80 x 24 (9 x 12) | RS232C (bisynch, SNA, SDLC) | | | |
| 080 | 15-inch; green, amber | | 132 x 27 (7 x 9) | RS232C (bisynch, SNA, SDLC) | | | |
| 178 | 12-inch, green | | 80 x 24 (7 x 12) | RS232C (bisynch, SNA, SDLC) | | | |
| 179 | 14-inch, 7-color | | 80 x 43 (7 x 9) | RS232C (bisynch, SNA, SDLC) | | | |
| 276 | 15-inch; green, white | | 132 x 44 (9 x 14) | RS232C (bisynch, SNA, SDLC) | | | |
| 278 | 15-inch, green | | 132 x 27 (9 x 12) | RS232C (bisynch, SNA, SDLC) | | | |
| 1186 | 12-inch; green, amber; 16-color | | 80 x 25 (7 x 9) | RS232C (bisynch, SNA, SDLC) | | | |
| **THOMAS ENGINEERING CO.** | | | | | | | |
| TE-780x S | 14-inch, green | | 80 x 24 (7 x 9) | RS232C, current loop (Honeywell VIP) | Honeywell VIP-7814 | 1,895 | |
| TE-780x V | 14-inch, green | | 80 x 24 (7 x 9) | RS232C, current loop (X-on/X-off) | DEC VT100, Honeywell VIP-7801 | 1,895 | |
| **TRANSIAC CORP.** | | | | | | | |
| TR1024 | 15-inch, green | 1024 x 780 | 128 x 52 | RS232C (X-on/X-off) | DEC VT100, Tektronix 4010, ANSI X3.64 | 3,750–6,750 | scroll, zoom, multiple plotting modes, 4 bit planes, CAMAC-compatible; user-definable character set, rackmount |
| **VG SYSTEMS INC.** | | | | | | | |
| VG 9250 | 19-inch; green, amber, orange; 16-color; 4096-color palette | 1024 x 1024 | 102 x 68 | RS232C, RS449, CCITT V.35 (proprietary) | IBM 3250 | 26,000 | wide line fill, 8 bit planes, supports Japanese Katakana |
| VG 8250 | 21-inch; green, amber, orange; 16-color; 4096-color palette | 1024 x 1024 | 102 x 68 | RS232C, RS449, CCITT V.35 (proprietary) | IBM 3250 | 22,000 | zoom, pan, digitizer, supports Japanese Katakana, local screen copy |

## GRAPHICS DISPLAY TERMINALS
## TABLE 7

| Company Model | Display size (diagonal), color | Display resolution (in pixels) | Alpha mode screen format columns x lines (matrix character size) | Interfaces (protocols) | Emulations | Unit price ($) | Notes, features, options |
|---|---|---|---|---|---|---|---|
| **VECTOR AUTOMATION INC.** | | | | | | | |
| Graphicus-80 | 21-inch, green | 4096 x 4096 | | RS232C, IEEE-488 (asynch, ASCII) | DEC VT100, Tektronix 4014 | 18,000–29,000 | 5,000 characters, Unibus DR11W-compatible; opt. 4096-color |
| **VISUAL TECHNOLOGY INC.** | | | | | | | |
| Visual 102G | 14-inch, green | 768 x 293 | 132 x 24 (7 x 9) | RS232C; opt. current loop (X-on/X-off, DTR Busy) | DEC VT52, VT102; Tektronix 4010, 4014; ANSI | 1,395 | arc, circle/rectangle generation, 1 bit plane |
| VISUAL 240 | 14-inch, green, 4-color, 64-color palette | 800 x 290 | 132 x 24 (8 x 10) | RS232C; opt. current loop (X-on/X-off) | DEC VT52, VT100, VT220, VT240; Tektronix 4010, 4014; DEC ReGIS | 1,695 | arc, circle generation, 2 bit planes |
| VISUAL 241 | 13-inch; red, green, blue; 4-color; 64-color palette | 800 x 290 | 132 x 24 (8 x 10) | RS232C; opt. current loop (X-on/X-off) | DEC VT52, VT100, VT220, VT240; Tektronix 4010, 4014; DEC ReGIS | 2,195 | arc, circle generation, 2 bit planes |
| Visual 500 | 14-inch, green | 768 x 585 | 80 x 33 (7 x 11) | RS232C, current loop (X-on/X-off, DTR Busy) | DEC VT52; Data General D200; Lear Siegler ADM-3A; Hazeltine 1500; Tektronix 4010, 4014 | 1,595 | arc, circle/rectangle generation, 1 bit plane |
| Visual 550 | 14-inch, green | 768 x 585 | 80 x 33 (7 x 11) | RS232C, current loop (X-on/X-off, DTR Busy) | ANSI X3.64; Tektronix 4010, 4014 | 1,595 | arc, circle, rectangle generation, polygon fill, 1 bit plane |

Information was solicited but not received from the following manufacturers:

Chromatics Inc.

Control Data Corp.

Data General Corp.

Datavue Corp.

Falco Data Products Inc.

Grinnell Systems Corp.

GIXI Inc.

IBM Corp.

Industrial Data Terminals Corp.

Intecolor Corp.

Jupiter Systems Inc.

Lear Siegler Inc. (Data Products Div.)

Memorex Corp.

Modgraph

PDS Technologies Inc.

Phoenix Computer Graphics Inc.

Ramtek Corp.

Raster Technologies Inc.

Scion Corp.

Soroc Corp.

Tab Products Co.

TEC Inc.

Teleray

Verticom

Wicat Systems

For information on their products, consult the Supplementary Manufacturers' Directory of Digest products on Page 110 .

# MONITORS
## TABLE 8

| Company Model | Display size (diagonal), color | Phosphor number | Display resolution (pixels) | Input signals | Vertical refresh (Hz) | Price ($) | Notes, features, options |
|---|---|---|---|---|---|---|---|
| **AMTRON CORP.** | | | | | | | |
| CD1900 | 19-inch, infinite colors | standard, long persistence | 1280 x 1024 | RGB, TTL | 60 Hz, non-interlaced | 4,000(Q1); 2,900(Q100) | 100-MHz bandwidth; cabinet; FCC-, CSA-, UL-approved; opt. anti-glare treatment |
| **AUDIOTRONICS CORP.** | | | | | | | |
| 3DD975 | 3-inch, white | P4, P45; standard | 700 x 450 | NTSC | 60 Hz, interlaced | | 25-MHz bandwidth, kit form, power 12 VDC |
| 5DD946 | 5-inch; white, green | P4, P31; standard | 650 x 425 | NTSC, TTL | 60 Hz, interlaced | | 18-MHz bandwidth, kit/chassis form, power 12 VDC |
| 7DD959 | 7-inch; white, green | P4, P31; standard | 900 x 600 | NTSC, TTL | 60 Hz, interlaced | | 20-MHz bandwidth, kit/chassis form, flat-face tube, direct etch, power 12 VDC |
| 7DD969 | 7-inch, amber | P134, standard | 950 x 625 | TTL | 60 Hz, interlaced | | 20-MHz bandwidth, flat-face tube, direct etch, power 12 VDC |
| 9DD938 | 9-inch, white | P4, standard | 950 x 625 | NTSC, TTL | 60 Hz, interlaced | | 20-MHz bandwidth, kit/chassis form, power 12 VDC; opt. DC restoration |
| 9DD960 | 5-, 9-inch; amber | P134, standard | 700 x 600 | TTL | 60 Hz, interlaced | | 25-MHz bandwidth, kit form, power 12 VDC |
| 9DD961 | 9-inch, white | P4, standard | 1000 x 650 | TTL | 60 Hz, interlaced | | 20-MHz bandwidth, kit/chassis form, power 12 VDC, P31 available |
| 9DD964 | 9-inch, green | P31, standard | 1000 x 650 | TTL | 60 Hz, interlaced | | 20-MHz bandwidth, power 12 VDC, direct etch |
| 12DD955 | 12-inch; amber, green | P134, P39 | 1200 x 800 | TTL | 60 Hz, interlaced | | 20-MHz bandwidth, power 12 VDC, direct etch |
| 12DD962 | 12-inch, white | P4, standard | 1200 x 800 | TTL | 60 Hz, interlaced | | 20-MHz bandwidth, kit/chassis form, power 12 VDC |
| 12DM973 | 12-inch; amber, green | P134, P31; standard | 1200 x 775 | NTSC | 60 Hz, interlaced | | 20-MHz bandwidth, cabinet, tilt, swivel, power 120/240 VAC |
| 14CM981 | 14-inch; 8-, 16-color | P22 | 720 x 260 | TTL | 60 Hz, interlaced | | 18-MHz bandwidth, external brightness, power 120/240 VAC |
| 14CM983 | 14-inch; 8-, 16-color | P22 | 640 x 260 | TTL | 60 Hz, interlaced | | 18-MHz bandwidth, external brightness, power 120/240 VAC |
| 14DD963 | 14-inch; amber, green | P134, P31 | 1300 x 800 | TTL | 60 Hz, interlaced | | 20-MHz bandwidth, power 12 VDC |
| 15DD977 | 15-inch, green | P31, standard | 1100 x 800 | NTSC, TTL | 60 Hz, interlaced | | 30-MHz bandwidth, external brightness, direct etch, power 120 VAC |
| 15DD979 | 15-inch, green | P39, standard | 850 x 1100 | TTL | 60 Hz, interlaced | | 60-MHz bandwidth, external brightness, power 120 VAC |
| **AYDIN CONTROLS** | | | | | | | |
| 8810 Patriot | 13-inch; 16-color, 4096-color palette | standard, long persistence | 640 x 400 | RGB, TTL | 47 Hz–63 Hz, 70 Hz–80 Hz | 1,550(Q1) | 25-MHz bandwidth, cabinet; opt. rackmount, contrast/enhancement |
| 8811 Patriot | 13-inch; 16-color, 4096-color palette | standard, long persistence | 640 x 400 | RGB, TTL | 47 Hz–63 Hz, 70 Hz–80 Hz | 1,550(Q1) | 25-MHz bandwidth, cabinet; opt. contrast/enhancement |
| 8815 | 13-inch, 4096-color palette | standard, long persistence | 1024 x 600 | RGB | 40 Hz–70 Hz | 2,350(Q1) | 40-MHz bandwidth, cabinet, contrast/enhancement |
| 8830 | 29-inch; 16-color, 4096-color palette | standard, long persistence | 700 x 400 | RGB, TTL | 47 Hz–63 Hz | 1,800(Q1) | 25-MHz bandwidth, metal cabinet; opt. rackmount, contrast enhancement |
| 8831 | 19-inch; 16-color, 4096-color palette | standard, long persistence | 700 x 400 | RGB, TTL | 47 Hz–63 Hz, 70 Hz–80 Hz | 1,800(Q1) | 25-MHz bandwidth, plastic cabinet; opt. tilt, swivel, contrast/enhancement |
| 8835 | 19-inch, 4096-color palette | standard, long persistence | 1280 x 600 | RGB | 40 Hz–70 Hz | 2,500(Q1) | 40-MHz bandwidth, cabinet; opt. rackmount, contrast/enhancement |
| 8836 | 19-inch, 4096-color palette | standard, long persistence | 1280 x 600 | RGB | 40 Hz–70 Hz | 2,500(Q1) | 40-MHz bandwidth, cabinet; opt. tilt, swivel, contrast/enhancement |
| **BRIGHT UP INDUSTRIES INC.** | | | | | | | |
| CC1411 | 14-inch, 16-color | standard | | RGB, TTL | 50 Hz–60 Hz, interlaced | 579(Q1) | FCC-, UL-, CSA-approved; dark glass; cables; opt. swivel base |
| CC1421 | 14-inch, 16-color | standard | | RGB, TTL | 50 Hz–60 Hz | 629(Q1) | FCC-, UL-, CSA-approved; dark glass, anti-glare; cable; opt. swivel base |

## MONITORS
## TABLE 8

| Company Model | Display size (diagonal), color | Phosphor number | Display resolution (pixels) | Input signals | Vertical refresh (Hz) | Price ($) | Notes, features, options |
|---|---|---|---|---|---|---|---|
| CC1421-LP | 14-inch, 16-color | | | RGB, TTL | 50 Hz–60 Hz, interlaced | 689(Q1) | FCC-, UL-, CSA-approved; dark glass, anti-glare; cable; opt. swivel base |
| CT1403 | 14-inch | standard | | NTSC | 50 Hz–60 Hz, interlaced | 329(Q1) | FCC-, UL-approved; includes speaker and cable; opt. swivel base |
| **C. ITOH ELECTRONICS INC.** | | | | | | | |
| CIQ-5 | 5-inch, white | P4, standard | 576 x 189 | TTL | 60 Hz, non-interlaced | 185(Q1); 130(Q100) | 15-MHz bandwidth, UL-approved, bare chassis |
| CIQ-9 | 9-inch, white | P4, standard | 720 x 227 | TTL | 60 Hz, non-interlaced | 180(Q1); 125(Q100) | 15-MHz bandwidth, bare chassis, tilt |
| CIQ-9N | 9-inch, white | P4 | 720 x 300 | TTL | 60 Hz, non-interlaced | 180(Q1); 125(Q100) | 25-MHz bandwidth; UL-, CSA-approved; bare chassis; tilt |
| CIQ-12 | 12-inch, white | P4 | 720 x 227 | TTL | 60 Hz, non-interlaced | 180(Q1); 125(Q100) | 16-MHz bandwidth; UL-, CSA-approved; bare chassis; tilt |
| CIQ-12N | 12-inch, white | P4 | 720 x 300 | TTL | 60 Hz, non-interlaced | 180(Q1); 125(Q100) | 25-MHz bandwidth; UL-, CSA-approved; bare chassis; tilt |
| CIQ-14N | 14-inch, white | P4 | 720 x 300 | TTL | 60 Hz, non-interlaced | 200(Q1); 145(Q100) | 25-MHz bandwidth; UL-, CSA-approved; bare chassis; tilt |
| CIQ-15V | 14-inch, white | P4 | 720 x 1000 | TTL | 60 Hz, non-interlaced | 900(Q1); 520(Q100) | 80-MHz, bare chassis, tilt, half-tone |
| ICM-14 | 13-inch; blue, green, red | B22 | 720 x 374 | TTL | 60 Hz, non-interlaced | 1,150(Q1); 870(Q100) | 25-MHz bandwidth, bare chassis, tilt, half-tone; opt. long persistence |
| **CONRAC DIVISION (CONRAC CORP.)** | | | | | | | |
| 2400 | 19-inch, monochrome | P4, standard | 1280 x 960 | | 60 Hz, interlaced | 2,900(Q1) | |
| 2600 | 9-, 15-, 19-inch; monochrome | P4, standard | | | 60 Hz, interlaced | | |
| 5211 | 25-inch, color | P22, standard | 540 x 483 | RGB | 60 Hz, interlaced | 5,065(Q1) | |
| 7000 | 9-inch, 8-color | P22, standard | 440 x 330 | TTL | 60 Hz; interlaced, non-interlaced | 665(Q1) | |
| 7000 | 13-inch, 8-color | P22, standard | 720 x 560 | TTL | 60 Hz; interlaced, non-interlaced | 865(Q1) | |
| 7000 | 19-inch, 8-color | P22, standard | 900 x 675 | TTL | 60 Hz; interlaced, non-interlaced | 1,495(Q1) | |
| 7111 | 19-inch, color | P22, standard | 1024 x 768 | RGB | 60 Hz; interlaced, non-interlaced | 2,360(Q1) | opt. anti-glare screen |
| 7211 | 13-, 19-inch; color | P22, standard | 921 x 739/ 1080 x 809 | RGB | 60 Hz; interlaced, non-interlaced | 3,590(Q1); 3,859(Q1) | |
| 7311 | 19-inch, color | P22, standard | 1280 x 1024 | RGB | 60 Hz, non-interlaced | 4,325(Q1) | opt. direct etch |
| QQA | 15-, 17-, 21-inch, monochrome | P4, standard | | | 60 Hz, interlaced | 3,260(Q1); 3,745(Q1); 4,395(Q1) | |
| **DATACOPY** | | | | | | | |
| 500 High Resolution Display | 15-inch, white | P40, long persistence | 1728 x 2200 | ECL | 30 Hz, interlaced | 17,950(Q1) | requires computer interfaces: IBM PC (Model 112), Multibus (Model 220), Q-bus (Model 230), HP GPIO (Model 240) |
| **DYNAX INC.** | | | | | | | |
| AM30/ GM30 | 12-inch | P4A, P31 | | | | 199(Q1) | 200-MHz bandwidth |
| FC10 | 13-inch | | 640 x 200 | NTSC | | 599(Q1) | 30-MHz bandwidth, mono-mode switch |
| **ELECTROHOME LTD.** | | | | | | | |
| ECM 1301 | 13-inch, color | long persistence | 720 x 512 | RGB | interlaced | | |
| EVM Series | 9-, 12-, 15-, 17-, 23-inch; monochrome | P4, P39, P31 | | NTSC | | 571-939(Q1) | |
| **IKEGAMI ELECTRONICS (USA) INC.** | | | | | | | |
| CDA 143H | 14-inch, color | P22, standard | 1024 x 512 | RGB | 60 Hz, non-interlaced | 1,989(Q1); 1,890(Q100) | 40-MHz bandwidth; FCC-, CSA-, UL-, IEC-approved |

# MONITORS
## TABLE 8

| Company Model | Display size (diagonal), color | Phosphor number | Display resolution (pixels) | Input signals | Vertical refresh (Hz) | Price ($) | Notes, features, options |
|---|---|---|---|---|---|---|---|
| CDA 203HLA | 20-inch, color | standard, long persistence | 1280 x 1024 | RGB | 30 Hz, interlaced | 2,690(Q1); 2,421(Q100) | 40-MHz bandwidth; FCC-, CSA-, UL-, IEC-approved |
| CDB 143H | 14-inch, 27-color | P22, standard | 1024 x 512 | TTL | 60 Hz, non-interlaced | 1,442(Q1); 1,370(Q100) | 40-MHz bandwidth; FCC-, CSA-, UL-, IEC-approved |
| DM 2050 | 20-inch, color | standard | 1280 x 1024 | RGB | 60 Hz, non-interlaced | 4,175(Q1); 3,500(Q100) | 100-MHz bandwidth; FCC-, CSA-, UL-, IEC-approved |
| **INFORMATION PERIPHERALS CORP. (INFOPERC)** | | | | | | | |
| DC-1453 | 12-, 13-inch | standard, long persistence | 720 x 420 | TTL | 60 Hz, non-interlaced | 900(Q1); 750(Q100) | |
| CD-1552 | 12-, 13-inch; 8-color | standard, long persistence | 720 x 240 | TTL | 60 Hz, non-interlaced | 900(Q1); 750(Q100) | |
| **MICROTOUCH SYSTEMS INC.** | | | | | | | |
| Point-1 Color | 13-inch, 16-color | | 640 x 400 | RGB | 50 Hz–60 Hz | 1,895(Q1); 1,395(Q100) | RS232C interface |
| Point-1 Monitor | 12-inch; amber, green | | | NTSC, TTL | 50 Hz | 1,495(Q1); 495(Q100) | RS232C interface |
| **MICROVITEC INC.** | | | | | | | |
| 1496/ DI2U | 14-inch, 16-color | standard | 653 x 585 | TTL | 45 Hz–65 Hz; interlaced, non-interlaced | 575(Q1) | 18-MHz bandwidth, FCC approved, dark glass, cabinet, IBM PC-compatible |
| 14L86/ DI2U | 14-inch, 16-color | long persistence | 895 x 585 | TTL | 45 Hz–65 Hz, interlaced | 895(Q1) | 18-MHz bandwidth, FCC-approved, dark glass, cabinet, IBM PC-compatible |
| **MITSUBISHI ELECTRONICS AMERICA INC.** | | | | | | | |
| AT1332A | 13-inch, 16-color | standard | 640 x 240 | TTL | 60 Hz | | 15-MHz bandwidth, cabinet |
| C3419 | 13-inch, infinite colors | standard | 720 x 540 | RGB | 50 Hz–60 Hz | | 20-MHz bandwidth, cabinet or rackmount |
| C3470 | 13-inch, infinite colors | standard | 720 x 540 | RGB | 40 Hz–70 Hz | | 25-MHz bandwidth, cabinet |
| C3479 | 13-inch, infinite colors | standard | 720 x 540 | RGB | 50 Hz–60 Hz | | 40-MHz bandwidth, cabinet |
| C3919 | 19-inch, infinite colors | standard | 760 x 400 | RGB | 40 Hz–70 Hz | | 25-MHz bandwidth, cabinet or rackmount |
| C3920 | 19-inch, infinite colors | standard | 760 x 400 | RGB | 40 Hz–70 Hz | | 25-MHz bandwidth, opt. cabinet |
| C3950 | 19-inch, infinite colors | standard | 800 x 600 | RGB | 40 Hz–70 Hz | | opt. cabinet |
| C5950 | 19-inch, infinite colors | standard | 1024 x 780 | RGB | 40 Hz–70 Hz | | opt. cabinet |
| C6479 | 13-inch, infinite colors | standard | 720 x 560 | RGB | 40 Hz–70 Hz | | 40-MHz bandwidth, cabinet or rackmount |
| **MONITERM** | | | | | | | |
| VR Series | 15-, 17-, 19-inch; amber, b&w, green, orange | standard, long persistence | 1024 x 1280 | TTL | 60 Hz–70 Hz; interlaced, non-interlaced | | |
| **MOTOROLA DISPLAY SYSTEMS** | | | | | | | |
| CM/ CH4000 Series | 14-inch; blue, green, red, white | | 720 x 480 | RGB | 47 Hz–63 Hz, interlaced | | 22-MHz bandwidth, opt. anti-glare treatment |
| DS4000/ 3000 Series | 12-, 15-inch; green, white | P4, P31, P39 | 950 x 380 | TTL | 47 Hz–63 Hz, non-interlaced | | power 110/220 VAC |
| HS4000/ 3000 Series | 12-, 15-inch; green, white | P4, P31, P39 | 1050 x 512 | TTL | 47 Hz–63 Hz, non-interlaced | | dark glass, acid etch |
| L40000 Series | 15-inch; green, white | P4, P104, P31; standard | 1024 x 1024 | TTL | 50 Hz–90 Hz, non-interlaced | | 100-MHz bandwidth, power 85–264 VAC |
| MD1000/ 1400 Series | 5-inch; green, white | P4, P31 | 500 x 240 | TTL | 47 Hz–63 Hz, non-interlaced | | kit/chassis form, power 12 VDC |
| MD1500/ 1700 Series | 7-inch; green, white | P4, P31; standard | 650 x 290 | TTL | 47 Hz–63 Hz, non-interlaced | | 22-MHz bandwidth, kit/chassis form, power 12 VDC |

## MONITORS
## TABLE 8

| Company Model | Display size (diagonal), color | Phosphor number | Display resolution (pixels) | Input signals | Vertical refresh (Hz) | Price ($) | Notes, features, options |
|---|---|---|---|---|---|---|---|
| MD2000/ 2800 Series | 9-inch; green, white | P4, P31; standard | 650 x 290 | TTL | 47 Hz–63 Hz, non-interlaced | | 22-MHz bandwidth, kit/chassis form, power 12 VDC |
| MD3570/ 3970 Series | 12-inch; green, white | P4, P31, P39 | 800 x 320 | TTL | 47 Hz–63 Hz, non-interlaced | | 25-MHz bandwidth, kit/chassis, power 12 VDC |
| S40000 Series | 15-inch, green | P39, long persistence | 1024 x 1024 | TTL | 50 Hz–90 Hz, interlaced | | 50-MHz bandwidth, power 85–264 VAC |
| **NEC HOME ELECTRONICS (U.S.A.) INC. (PERSONAL COMPUTER DIV.)** | | | | | | | |
| JC-1215A | 12-inch, 8-color | standard | | NTSC | 60 Hz, interlaced | 399(Q1) | |
| JC-1216 DFA | 12-inch, 16-color | standard | 640 x 240 | RGB | 60 Hz | 599(Q1) | |
| JC-1410P2A | 14-inch, 16-color | standard | 640 x 400 | RGB | 56.4 Hz, interlaced | 998(Q1) | 30-MHz bandwidth |
| JC-1460DA | 14-inch, 16-color | standard | 500 x 240 | RGB | 60 Hz | 499(Q1) | |
| **PANASONIC CO. LTD.** | | | | | | | |
| CT-1111 D | 10-inch, color | standard | | NTSC | interlaced | 369(Q1) | |
| CT-3173 M | 13-inch, 16-color | standard | 40 x 25 | RGB, TTL | non-interlaced | 469(Q1) | |
| CT-9072 M | 19-inch, color | standard | | NTSC | interlaced | 619(Q1) | |
| CTF-1394 M | 13-inch, color | standard | 40 x 25 | NTSC | interlaced | 419(Q1) | |
| CTF-1495 M | 14-inch, 16-color | standard | 80 x 25 | RGB, TTL | non-interlaced | 499(Q1) | |
| CTF-2095 M | 20-inch, 16-color | standard | 80 x 25 | RGB, TTL | non-interlaced | 510(Q1) | |
| **PANASONIC INDUSTRIAL CO. (DIV. OF MATSUSHITA ELECTRIC CORP. OF AMERICA)** | | | | | | | |
| BT-P4500D | 45-inch, 16-color | P1 | 640 x 240 | RGB, NTSC, TTL | 60 Hz; interlaced, non-interlaced | 4,995(Q1) | FCC Class B-, UL-approved; non-glare screen; swivel stand |
| DT-D1300D | 13-inch, 16-color | P22, standard | 580 x 240 | NTSC, TTL | 60 Hz; interlaced, non-interlaced | 499(Q1) | direct etch, non-glare screen |
| DT-H103 | 10-inch, 16-color | P22, standard | 640 x 240 | | 60 Hz, non-interlaced | | non-glare screen, swivel stand |
| DT-M140 | 14-inch, 16-color | P22, standard | 660 x 240 | RGB, NTSC, TTL | 60 Hz; interlaced, non-interlaced | 699(Q1) | dark glass, non-glare screen |
| DT-S101 | 10-inch, 16-color | P22, standard | | NTSC | 60 Hz, interlaced | 339(Q1) | dual mode |
| TR-120M1PA | 12-inch, green | P31, standard | | NTSC | 60 Hz, non-interlaced | 219(Q1) | direct etch, non-glare screen, opt. swivel stand |
| TR-120MDPA | 12-inch, amber | standard | | NTSC | 60 Hz, non- interlaced | 239(Q1) | direct etch, non-glare screen, opt. swivel stand |
| TR-122M9P | 12-inch, green | P39, long persistence | | TTL | 49.55 Hz, interlaced | 249(Q1) | FCC Class B-, UL-approved; direct etch; non-glare screen |
| TR-122MYP | 12-inch, yellow | long persistence | | TTL | 49.55 Hz, interlaced | 259(Q1) | FCC Class B-, UL-approved; opt. direct etch; non-glare screen |
| TX-12H3P | 12-inch, 16-color | P22, standard | 640 x 240 | TTL | 60 Hz, interlaced | 699(Q1) | FCC Class B-, UL-approved; non-glare screen; swivel stand |
| **PRINCETON GRAPHIC SYSTEMS** | | | | | | | |
| HX-9 | 9-inch, 756-color | standard | 690 x 240 | TTL | non-interlaced | 750(Q1) | IBM-compatible, built-in green/amber switch |
| HX-9E | 9-inch; 16-, 64-color | standard | 640 x 240, 640 x 350 | TTL | non-interlaced | 650(Q1) | Apple-, IBM-compatible |
| HX-12 | 12-inch, 16-color | standard | 690 x 240 | RGB, TTL | 60 Hz, non-interlaced | 699(Q1) | 15-MHz bandwidth; rackmount; cabinet; FCC Class B-, UL-approved; anti-glare treatment |
| HX-12E | 12-inch; 16-, 64-color | P22, standard | 690 x 240, 690 x 350 | RGB, TTL | non-interlaced | 785(Q1) | anti-glare treatment |

## MONITORS
## TABLE 8

| Company Model | Display size (diagonal), color | Phosphor number | Display resolution (pixels) | Input signals | Vertical refresh (Hz) | Price ($) | Notes, features, options |
|---|---|---|---|---|---|---|---|
| MAX-12 | 12-inch, amber | PC134, standard | 720 x 350, 640 x 200 | RGB, TTL | 50 Hz–60 Hz, non-interlaced | 249(Q1) | 23-MHz bandwidth; rackmount; cabinet; FCC Class B-, UL-approved; anti-glare treatment |
| SR-12 | 12-inch, 16-color | standard | 690 x 400 | RGB, TTL | 60 Hz, non-interlaced | 799(Q1) | 30-MHz bandwidth, rackmount, FCC Class B approved |
| SR-12P | 12-inch, 4096-color palette | standard | 690 x 480 | RGB | non-interlaced | 999(Q1) | anti-glare treatment |
| **QUADRAM CORP.** | | | | | | | |
| Amber-chrome | 12-inch; amber, monochrome | P134, standard | 720 x 350 | TTL | 50 Hz, non-interlaced | 250(Q1) | dark glass, anti-glare tube, cable, manual |
| Quad-chrome I | 12-inch, 16-color | P3 | 690 x 240 | TTL | 60 Hz, non-interlaced | 695(Q1) | FCC-, UL-approved; cable, manual |
| Quad-chrome II | 14-inch, 16-color | P134, standard | 640 x 240 | TTL | 60 Hz, non-interlaced | 599(Q1) | cable, manual |
| Quad-screen | 17-inch; b&w, monochrome | P4, long persistence | 968 x 512 | TTL | 60 Hz, non-interlaced | 1,995(Q1) | cable, software, controller |
| **SHARP ELECTRONICS CORP.** | | | | | | | |
| 12M-15BU | 12-inch, green | P31 | 640 x 200 | NTSC | 60 Hz, non-interlaced | 155(Q1) | non-glare screen |
| 12M-15BUA | 12-inch, amber | PDB | 640 x 200 | NTSC | 60 Hz, non-interlaced | 165(Q1) | non-glare screen |
| 12M-22U | 12-inch, 16-color | P22 | 640 x 200 | RGB | 60 Hz, non-interlaced | 569(Q1) | non-glare screen |
| 13M-31U | 13-inch, 8-color | P22 | 280 x 350 | NTSC | 60 Hz, non-interlaced | 339(Q1) | audio jack |
| **SYSTEMS RESEARCH LABORATORIES INC.** | | | | | | | |
| 2106 | 13-, 19-inch; user-definable colors | P22; standard, long persistence | 1280 x 1024 | RGB, TTL | 25 Hz–90 Hz | | 100-MHz bandwidth, rackmount, select-a-rate |
| 2110 | 19-inch, user-definable colors | P22, standard | 1280 x 1024 | RGB, TTL | 25 Hz–90 Hz | | 100-MHz bandwidth, rackmount, select-a-rate |
| **TAXAN CORP.** | | | | | | | |
| 115 | 12-inch, green | P39, long persistence | 640 x 200 | NTSC | 60 Hz, non-interlaced | 169(Q1) | 20-MHz bandwidth; plastic cabinet; FCC Class B-, UL-, CSA-approved |
| 116 | 12-inch, amber | PUL, long persistence | 640 x 200 | NTSC | 60 Hz, non-interlaced | 179(Q1) | 20-MHz bandwidth; plastic cabinet; FCC Class B-, UL-, CSA-approved |
| 121 | 12-inch, green | P39, long persistence | 640 x 350 | TTL | 50 Hz, non-interlaced | 189(Q1) | 20-MHz bandwidth; plastic cabinet; FCC-, UL-, CSA-approved |
| 122 | 12-inch, amber | PUL, long persistence | 640 x 350 | TTL | 50 Hz, non-interlaced | 199(Q1) | 20-MHz bandwidth; plastic cabinet; FCC-, UL-, CSA-approved |
| 410 | 12-inch; 16-, 4096-color | B22, standard | 510 x 200 | RGB, TTL | 60 Hz, non-interlaced | 469(Q1) | 15-MHz bandwidth; FCC Class B-, UL-approved |
| 411 | 12-inch, 16-color | B22, standard | 510 x 200 | TTL | 60 Hz, non-interlaced | 499(Q1) | 15-MHz bandwidth; FCC Class B-, UL-approved |
| 420 | 12-inch; 16-, 4096-color | B22, standard | 640 x 200 | RGB, TTL | 60 Hz, non-interlaced | 579(Q1) | 18-MHz bandwidth; FCC Class B-, UL-approved |
| 420L | 12-inch; 16-, 4096-color | B22, long persistence | 640 x 400 | RGB, TTL | 60 Hz, interlaced | 579(Q1) | 18-MHz bandwidth; FCC Class B, UL-approved |
| 425 | 12-inch, 16-color | B22, standard | 640 x 200 | TTL | 60 Hz, non-interlaced | 609(Q1) | 18-MHz bandwidth; FCC Class B-, UL-approved |
| 440 | 12-inch, 16-color | B22 | 640 x 400 | TTL | 60 Hz, non-interlaced | 799(Q1) | 22-MHz bandwidth; FCC Class B-, UL-approved |
| **TECHLAND SYSTEMS INC.** | | | | | | | |
| Cub | 14-inch, green | long persistence | 895 x 585 | RGB | 60 Hz; interlaced, non-interlaced | 845(Q1) | 15-MHz bandwidth, rackmount |
| **TEKNIKA ELECTRONICS CORP.** | | | | | | | |
| MJ-10 | 13-inch, 16-color | P22, standard | 400 x 240 | NTSC | 60 Hz, non-interlaced | 299(Q1) | FCC-, UL-, CSA-approved |
| MJ-22 | 13-inch; 16-color, 32-color palette | P22, standard | 506 x 240 | NTSC, TTL | 60 Hz, non-interlaced | 499(Q1) | FCC-, UL-, CSA-approved |
| **TEKTRONIX INC.** | | | | | | | |
| GMA 201 | 19-inch, white | P4, standard | 1336 x 2048 | NTSC | 60 Hz, non-interlaced | 3,675(Q1); 2,830(Q100) | 200-MHz bandwidth; rackmount; UL-, CSA-approved; opt. cabinet |

# MONITORS
## TABLE 8

| Company Model | Display size (diagonal), color | Phosphor number | Display resolution (pixels) | Input signals | Vertical refresh (Hz) | Price ($) | Notes, features, options |
|---|---|---|---|---|---|---|---|
| GMA 301 | 19-inch, color | P22, standard | 480 x 640 | RGB | 60 Hz, non-interlaced | 4,020(Q1); 3,095(Q100) | 30-MHz bandwidth; rackmount; UL-, CSA-approved; opt. cabinet |
| GMA 302 | 19-inch, color | P22, standard | 768 x 1024 | RGB | 60 Hz, non-interlaced | 3,675(Q1); 2,830(Q100) | 60-MHz bandwidth; rackmount; UL-, CSA-approved; opt. cabinet |
| GMA 303 | 19-inch, color | P22, standard | 1024 x 1280 | RGB | 60 Hz, non-interlaced | 4,345(Q1); 3,346(Q100) | 90-MHz bandwidth; rackmount; UL-, CSA-approved; opt. cabinet |
| GMA 304 | 19-inch, color | standard | 1024 x 1280 | RGB | 60 Hz, non-interlaced | 9,240(Q1); 7,115(Q100) | 90-MHz bandwidth; rackmount, UL-, CSA-approved; opt. cabinet |
| **ZENITH RADIO CORP. (COMPONENTS & SYSTEMS GROUP)** | | | | | | | |
| Custom Color Displays | 9-, 12-, 13-, 19-, 25-inch; color | | | | | | designed to customer specifications |
| Custom Mono-chrome Displays | 5-, 7-, 9-, 12-, 14-, 15-inch; monochrome | | | | | | designed to customer specifications |
| **XTRON COMPUTER EQUIPMENT CORP.** | | | | | | | |
| AA12X | 12-inch, amber | P134/H10, standard | | NTSC | 60 Hz; interlaced, non-interlaced | 129(Q1) | FCC approved, 4-way tilt and swivel base, dark glass |
| AG12X | 12-inch, green | P31, standard | | NTSC | 60 Hz; interlaced, non-interlaced | | |
| IA12X | 12-inch, amber | P8, standard | | TTL | 60 Hz, interlaced | 169(Q1) | FCC approved, 4-way tilt and swivel base, dark glass |
| IG12X | 12-inch, green | P39, standard | | TTL | 60 Hz, interlaced | | |
| Comcolor I | 14-inch, 8-color | P22 | | NTSC | 60 Hz, non-interlaced | 229(Q1) | FCC-, UL-approved; built-in audio speaker |

Information was solicited but not received from the following manufacturers:

Algol Technology Inc.
Amdek Corp.
Ball Electronics Displays
Barco Industries Inc.
Comrex International
Dotronix Inc.
Elector USA
Emulex/Prsyst
Hitachi Densi
Hitachi Corp. of America Ltd.
IBM Corp. (Entry Systems Div.)
Industrial Data Terminals Corp.
KSI (Kawa Systems International)
Leading Edge Products Inc.
Micro Display Systems
Monitron Corp.
Nissei Sangyo Corp. (NSA Inc.)
Saber Technology Corp.
Sakata USA
Samsung Electronics America Inc.
Sanyo Electric Inc.
Sigma Design
Sony Corp. of America
Sumitronics Inc.
Tatung Co. of America
Toshiba America Inc.
Video Monitors Inc.
Vidstar Inc.

For information on their products, consult the Supplementary Manufacturers' Directory of Digest Products on Page 110

# MANUFACTURERS' DIRECTORY OF DIGEST PRODUCTS

**ADDS (APPLIED DIGITAL DATA SYSTEM INC.)**
100 Marcus Blvd.
Hauppauge, NY 11787
(516) 231-5400
Table 7
**Circle 309**

**ADAGE INC.**
One Fortune Dr.
Billerica, MA 01821
(617) 667-7070
Table 7
**Circle 310**

**AED INC. (ADVANCED ELECTRONIC DESIGN)**
440 Potero Ave.
Sunnyvale, CA 94086
(408) 733-3555
Table 1, 7
**Circle 311**

**ALPHA DATA INC.**
20750 Marilla St.
Chatsworth, CA 91311-4488
(818) 882-6500
Table 1
**Circle 312**

**AMCODYNE INC.**
1301 S. Sunset St.
Longmont, CO 80501
(303) 772-2601
Table 1, 3
**Circle 313**

**AMERICAN COMPUTER HARDWARE CORP.**
2205 S. Wright St.
Santa Ana, CA 92705
(714) 549-2688
Table 5
**Circle 314**

**AMTRON CORP.**
2260 De La Cruz Blvd.
Santa Clara, CA 95050
(408) 748-8500
Table 8
**Circle 315**

**ANN ARBOR TERMNALS INC.**
6175 Jackson Rd.
Ann Arbor, MI 48103
(313) 663-8000
Table 7
**Circle 316**

**APPLE COMPUTER INC.**
20525 Mariani Ave.
Cupertino, CA 95014
(408) 973-2042
Table 5
**Circle 317**

**ASEA INDUSTRIAL SYSTEMS INC. (PROCESS AUTOMATION DIV.)**
16250 W. Glendale Dr.
New Berlin, WI 53151
(414) 785-3242
Table 7
**Circle 318**

**AT&T TELETYPE CORP.**
5555 Touhy Ave.
Skokie, IL 60077
(312) 982-2000
Table 5
**Circle 319**

**AUDIOTRONICS CORP.**
7428 Bellaire Ave.
N. Hollywood, CA 91605
(818) 765-2645
Table 8
**Circle 320**

**AYDIN CONTROLS**
414 Commerce Dr.
Fort Washington, PA 19034
(215) 542-7800
Table 7, 8
**Circle 321**

**BASF AG**
Gottleib-Dailmer-Str. 10
6800 Mannheim
Federal Republic of Germany
0621/4008
Table 4
**Circle 322**

**BERING INDUSTRIES INC.**
1400 Fulton Place
Fremont, CA 94539
(415) 651-3300
Table 4
**Circle 323**

**BRIGHT UP INDUSTRIES INC.**
7158 Industrial Park Blvd.
Mentor, OH 44060
(216) 951-7252
Table 8
**Circle 324**

**BURROUGHS CORP.**
Burroughs Place
Detroit, MI 48323
(313) 972-7000
Table 7
**Circle 325**

**C. ITOH ELECTRONICS INC.**
5301 Beethoven St.
Los Angeles, CA 90066
(213) 306-6700
Table 8
**Circle 326**

**CIE TERMINALS**
2505 McCabe Way
Irvine, CA 92713
(714) 660-1800
Table 5, 7
**Circle 327**

**CALCOMP**
2417 W. LaPalma
Anaheim, CA 92801
(714) 821-2000
Table 7
**Circle 328**

**CENTRONICS DATA COMPUTER CORP.**
One Wall St.
Hudson, NH 03051
(603) 883-0111
Table 5
**Circle 329**

**CENTURY DATA SYSTEMS INC.**
1270 N. Kraemer Blvd.
Anaheim, CA 92806
(714) 632-7500
Table 1, 2, 3
**Circle 330**

**CHARLES RIVER DATA SYSTEMS INC.**
983 Concord St.
Framingham, MA 01532
(617) 626-1000
Table 1
**Circle 331**

**CIFER PLC.**
Avro Way, Bowerhill
Melksham, Wiltshire
SN12 6TP, England
(0225) 706361
Table 7
**Circle 332**

**COLORGRAPHICS COMMUNICATIONS CORP.**
P.O. Box 80448
Atlanta, GA 30366
(404) 455-3291
Table 7
**Circle 333**

**CONRAC DIVISION (CONRAC CORP.)**
600 N. Rimsdale Ave.
Covina, CA 91722
(818) 966-3511
Table 8
**Circle 334**

**CONTROL DATA CORP. (MINI MICRO SYSTEMS)**
2200 Berkshire Lane
Minneapolis, MN 55441
(800) 328-3390
Table 1, 3
**Circle 335**

**CONTROL DATA CORP. (OEM PRODUCT SALES)**
P.O. Box 0
Minneapolis, MN 55440
(612) 853-8100
Table 1, 3
**Circle 336**

**CONTROL DATA CORP.**
P.O. Box 12313
Oklahoma City, OK
73157-2313
(405) 324-3000
Table 3, 4
**Circle 337**

**CYNTHIA PERIPHERALS CORP.**
766 San Aleso Ave.
Sunnyvale, CA 98120
(408) 745-0855
Table 5
**Circle 338**

**DACOLL LTD.**
Dacoll House, Gardners Lane
Bathgate, W. Lothian
EH48 ITP, England
(0506) 56565
Table 7
**Circle 339**

**DATA COMPASS**
400 N. Tustin Ave.
Suite 231
Santa Ana, CA 92705
(714) 550-8071
Table 4
**Circle 340**

**DATA GENERAL CORP.**
4400 Computer Dr.
Westboro, MA 02158
(617) 366-8911
Table 5
**Circle 341**

**DATACOPY CORP.**
1215 Terra Bella Ave.
Mountain View, CA 94043
(415) 965-7900
Table 8
**Circle 342**

**DATAMEDIA CORP.**
7401 Central Hwy.
Pennsauken, NJ 08109
(609) 665-5400
Table 7
**Circle 343**

**DATAPOINT CORP.**
9725 Datapoint Dr.
San Antonio, TX 78284
(512) 699-7000
Table 2, 5
**Circle 344**

**DATAPRODUCTS CORP.**
6200 Canoga Ave.
Woodland Hills, CA 91365
(213) 887-8451
Table 5
**Circle 345**

**DATREX INC.**
3536 W. Osborn Rd.
Phoenix, AZ 85019
(602) 272-9491
Table 3
**Circle 346**

**DELPHAX SYSTEMS**
315 University Ave.
Westwood, MA 02090
(617) 461-1414
Table 5
**Circle 347**

**DIABLO SYSTEMS INC. (XEROX CO.)**
P.O. Box 5030 910
Fremont, CA 94537
(415) 498-7786
Table 5
**Circle 348**

**DICONIX INC.**
3800 Space Dr.
Dayton, OH 45414
(513) 898-3644
Table 5
**Circle 349**

**DIGITAL ENGINEERING INC.**
630 Bercut Dr.
Sacramento, CA 95814
(916) 447-7600
Table 7
**Circle 350**

**DIGITAL EQUIPMENT CORP.**
146 Main St.
Maynard, MA 01754
(617) 897-5111
Table 2, 4, 5, 6, 7
**Circle 351**

**DISC TECH ONE INC.**
849 Ward Dr.
Santa Barbara, CA 93111
(805) 964-3535
Table 2
**Circle 352**

**DYNAX INC.**
6070 Rickenbacker Rd.
Commerce, CA 90040
(213) 727-1227
Table 8
**Circle 353**

**ELECTROHOME LTD.**
809 Wellington St. N.
Kitchener, Ontario
N2G 4J6, Canada
(519) 744-7111
Table 8
**Circle 354**

**ELECTRONIC PROCESSORS INC.**
1265 W. Dartmouth Ave.
Englewood, CO 80110
(303) 761-8540
Table 6
**Circle 355**

**EPSON AMERICA INC.**
23600 Telo St.
Torrance, CA 90505
(213) 534-4500
Table 5
**Circle 356**

**EVANS & SUTHERLAND**
580 Arapaen Dr.
P.O. Box 8700
Salt Lake City, UT 84108
(801) 582-5847
Table 7
**Circle 357**

**EXXON OFFICE SYSTEMS CO.**
777 Long Ridge Rd.
Stamford, CT 06902
(203) 329-5000
Table 5
**Circle 358**

**FUJITSU AMERICA INC.**
3055 Orchard Dr.
San Jose, CA 95134
(408) 946-8777
Table 1, 5
**Circle 359**

**GENERAL BUSINESS TECHNOLOGY INC.**
1891 McGaw Ave.
Irvine, CA 92714
(714) 261-1891
Table 5
**Circle 360**

**GENERAL OPTRONICS CORP. (PRINTER DIV.)**
2 Olsen Ave.
Edison, NJ 08820
(201) 549-9000
Table 5
**Circle 361**

**GENERAL ROBOTICS CORP.**
57 N. Main St.
Hartford, WI 53027
(414) 673-6800
Table 2
**Circle 362**

**GENICOM CORP.**
One General Electric Dr.
Waynesboro, VA 22980
(703) 949-1170
Table 5
**Circle 363**

**GENISCO COMPUTERS CORP.**
3545 Cadillac Ave.
Costa Mesa, CA 92626
(714) 556-4916
Table 7
**Circle 364**

**GRAPHON CORP.**
Tower One, 5th Floor
1901 S. Bascom Ave.
Campbell, CA 95008
(408) 371-8500
Table 7
**Circle 365**

**GRECO SYSTEMS**
372 Coogan Way
El Cajon, CA 92002
(619) 442-0205
Table 4
**Circle 366**

**HMW ENTERPRISES INC.**
604 Salem Rd.
Etters, PA 17319
(717) 938-4691
Table 7
**Circle 367**

**HARRIS CORP. (COMPUTER SYSTEMS DIV.)**
2101 W. Cypress Creek Rd.
Ft. Lauderdale, FL 33309
(305) 974-1700
Table 2, 5
**Circle 368**

**HETRA COMPUTER AND COMMUNICATIONS INDUSTRIES INC.**
1151 S. Eddie Allen Rd.
P.O. Box 970
Melbourne, FL 32901
(305) 723-7731
Table 5
**Circle 369**

**HEWLETT-PACKARD CO.**
3000 Hanover St.
Palo Alto, CA 94304
(415) 857-1501
Table 7
**Circle 370**

**HEWLETT-PACKARD CO. (BOISE DIV.)**
1311 Chinden Blvd.
P.O. Box 15
Boise, ID 83707
(208) 323-6000
Table 5
**Circle 371**

**HEWLETT-PACKARD CO. (DISC MEMORY DIV.)**
P.O. Box 39
Boise, ID 83707
(208) 323-3530
Table 1, 2, 3
**Circle 372**

**HITACHI AMERICA LTD.**
950 Elm Ave., Suite 100
San Bruno, CA 94066
(415) 872-1902
Table 1, 4
**Circle 373**

**HUMAN DESIGNED SYSTEMS INC.**
3440 Market St.
Philadelphia, PA 19104
(215) 382-5000
Table 7
**Circle 374**

**IBM CORP.**
Old Orchard Rd.
Armonk, NY 10504
(914) 765-9600
Table 6
**Circle 375**

**I2 INTERFACE INC.**
21101 Osborne St.
Canoga Park, CA 91304
(818) 341-7914
Table 4
**Circle 376**

**IBIS SYSTEMS INC.**
5775 Lindero Canyon Rd.
Westlake Village, CA 91362
(818) 706-2505
Table 2
**Circle 377**

**ID SYSTEMS CORP.**
6175 W. Shamrock Ct.
Dublin, OH 43017
(614) 776-0440
Table 7
**Circle 378**

**IKEGAMI ELECTRONICS (USA) INC.**
37 Brook Ave.
Maywood, NJ 07607
(201) 368-9171
Table 8
**Circle 379**

**IMS INTERNATIONAL**
2800 Lockheed Way
Carson City, NV 89701
(702) 883-7611
Table 7
**Circle 380**

**IMAGEN CORP.**
2650 San Tomas Expwy.
Santa Clara, CA 95052
(408) 986-9400
Table 5
**Circle 381**

**IMLAC CORP.**
150 A St.
New England Industrial Park
Needham, MA 02194
(617) 449-4600
Table 7
**Circle 382**

**INFORMATION PERIPHERALS CORP. (INFOPERC)**
1615 Shawsheen Rd.
Tewksbury, MA 01876
(617) 851-3535
Table 8
**Circle 383**

**INTEGRAPH CORP.**
One Madison Industrial Park
Huntsville, AL 35807
(205) 772-2000
Table 7
**Circle 384**

**IOMEGA CORP.**
1815 W. 4000 South
Roy, UT 84067
(801) 776-7304
Table 4
**Circle 385**

**IOMEGA CORP.**
1821 W. 4000 South
Roy, UT 84067
(801) 776-7350
Table 2, 3
**Circle 386**

**ITHACA INTERSYSTEMS INC.**
1650 Hanshaw Rd.
Ithaca, NY 14850
(607) 273-2500
Table 7
**Circle 387**

**JAPAN COMPUTER CORP.**
Mabuchi L.K. Building
Higashi Kanda
2-6-9 Chiyoda-ku
Tokyo, 101, Japan
(03) 864-8111
**Circle 388**

**KAYE INSTRUMENTS INC.**
15 DeAngelo Dr.
Bedford, MA 01730
(617) 275-0300
Table 5
**Circle 389**

**KEL INC.**
400 W. Cummings Park
Woburn, MA 01801
(617) 933-7852
Table 7
**Circle 390**

**KENNEDY CO.**
1600 S. Shamrock Ave.
Monrovia, CA 91016
(818) 357-8831
Table 1, 2
**Circle 391**

**KEYNOTE COMPUTER PRODUCTS INC.**
145 Columbia St. W.
Waterloo, Ontario
N2L 3L2, Canada
(519) 884-3440
Table 7
**Circle 392**

**KIMTRON CORP.**
2225-I Martin Ave.
Santa Clara, CA 95050
(408) 727-1510
Table 7
**Circle 393**

**LANPAR TECHNOLOGIES INC.**
85 Torbay Rd.
Markham, Ontario
L3R 1G7, Canada
(416) 475-9123
Table 7
**Circle 394**

**LEENSHIRE LTD.**
Moorside Rd., Winnall
Winchester, Hampshire
England
(0962) 64175
Table 7
**Circle 395**

**LEXIDATA CORP.**
755 Middlesex Turnpike
Billerica, MA 01865
(617) 663-8550
Table 7
**Circle 396**

**LIBERTY ELECTRONICS**
625 Third St.
San Francisco, CA 94107
(415) 543-7000
Table 7
**Circle 397**

**LUNDY ELECTRONICS & SYSTEMS INC.**
One Robert Lane
Glen Head, NY 11545
(516) 671-9000
Table 7
**Circle 398**

**MANNESMANN TALLY CORP.**
8301 S. 180th St.
Kent, WA 98032
(206) 251-5524
Table 5
**Circle 399**

**MATROX ELECTRONIC SYSTEMS LTD.**
1055 St. Regis Blvd.
Dorval, Quebec
H9P 2T4, Canada
(514) 685-2630
Table 7
**Circle 400**

**MEGADATA CORP.**
35 Orville Dr.
Bohemia, NY 11716
(516) 589-6800
Table 7
**Circle 401**

**MEGATAPE CORP.**
1041 Hamilton Rd.
P.O. Box 317
Duarte, CA 91010-0317
(818) 357-9921
Table 6
**Circle 402**

**MEGATEK CORP.**
9645 Scranton Rd.
San Diego, CA 92121
(619) 455-5590
Table 7
**Circle 403**

**MEGAVAULT MEMORIES**
6431 Independence Ave.
Woodland Hills, CA 91367
(818) 884-7300
Table 1, 2
**Circle 404**

**MEMOREX CORP.**
San Tomas at
Central Expressway
Santa Clara, CA 95052
(408) 987-1000
Table 2
**Circle 405**

**MICROPOLIS CORP.**
21123 Nordhoff St.
Chatsworth, CA 91311
(818) 709-3306
Table 1
**Circle 406**

**MICRO-TERM INC.**
512 Rudder Rd.
St. Louis, MO 63026
(314) 343-6515
Table 7
**Circle 407**

**MICROTOUCH SYSTEMS INC.**
400 W. Cummings Park
Woburn, MA 01801
(617) 935-0080
Table 8
**Circle 408**

**MICROVITEC INC.**
1943 Providence Ct.
Airport Perimeter Business Ctr.
College Park, GA 30337
(404) 991-2246
Table 8
**Circle 409**

**MILTOPE CORP.**
1770 Walt Whitman Rd.
Melville, NY 11747
(516) 420-0200
Table 2, 3, 4, 5
**Circle 410**

**MITSUBISHI ELECTRONICS AMERICA INC.**
991 Knox St.
Torrance, CA 90502
(213) 515-3993
Table 8
**Circle 411**

**MODULAR COMPUTER SYSTEMS INC.(MODCOMP)**
1650 W. McNab Rd.
P.O. Box 6099
Ft. Lauderdale, FL 33310
(305) 974-1380
Table 1, 5
**Circle 412**

**MONITERM**
5740 Green Circle Dr.
Minnetonka, MN 55344
(612) 935-4151
Table 8
**Circle 413**

**MOTOROLA DISPLAY SYSTEMS**
1299 E. Algonquin Rd.
Schaumberg, IL 60196
(312) 576-6960
Table 8
**Circle 414**

**NCR CORP.**
1700 S. Patterson Blvd.
Dayton, OH 45479
(513) 445-5000
Table 2, 4, 5
**Circle 415**

**NEC HOME ELECTRONICS (U.S.A.) INC. (PERSONAL COMPUTER DIV.)**
1401 Estes Ave.
Elk Grove Village, IL
60007-5463
(312) 228-5900
Table 8
**Circle 416**

**NEC INFORMATION SYSTEMS INC.**
1414 Mass. Ave.
Boxborough, MA 01719
(617) 264-8000
Table 1, 4
**Circle 417**

**NATIONAL SEMICONDUCTOR DATACHECKER/DTS**
1050 Stewart Dr.
Sunnyvale, CA 94086
(408) 749-7880
Table 1, 2
**Circle 418**

**NEW GEA CORP.**
335 Oser Ave.
Hauppauge, N.Y. 11788
(516) 434-8400
Table 7
**Circle 419**

**NEWBURY DATA RECORDING LTD.**
Hawthorne Rd.
Staines, Middlesex
TW18 3BJ, England
(0784) 61500
Table 1, 3, 5, 7
**Circle 420**

**NORTHERN TELECOM INC. (MEMORY SYSTEMS DIV.)**
100 Phoenix Dr.
P.O. Box D
Ann Arbor, MI 48106
(313) 973-4620
Table 1
**Circle 421**

**PANASONIC CO. LTD.**
333 Meadowlands Pkwy.
Secaucus, NJ 07094
(201) 392-4571
Table 8
**Circle 422**

**PANASONIC INDUSTRIAL CO. (DIV. OF MATSUSHITA ELECTRIC CORP. OF AMERICA)**
One Panasonic Way
Secaucus, NJ 07094
(201) 392-4644
Table 8
**Circle 423**

**PARADYNE CORP.**
8550 Ulmerton Rd.
Largo, FL 33540
(813) 530-2222
Table 5
**Circle 424**

**PERTEC PERIPHERALS CORP.**
9600 Irondale Ave.
Chatsworth, CA 91311
(818) 882-0030
Table 1
**Circle 425**

**PHILLIPS PERIPHERALS INC.**
385 Oyster Point Blvd.
S. San Francisco, CA 94080
(415) 952-3000
Table 5
**Circle 426**

**PRIAM CORP.**
20 W. Montague Expwy.
San Jose, CA 95134
(408) 946-4000
Table 1
**Circle 427**

**PRINCETON GRAPHIC SYSTEMS**
601 Ewing St., Bldg. A
Princeton, NJ 08540
(609) 683-1660
Table 8
**Circle 428**

**PRINTACOLOR CORP.**
6040 Northbelt Dr.
Norcross, GA 30071
(404) 448-2675
Table 5
**Circle 429**

**PRINTER SYSTEMS CORP.**
9055 Comprint Ct.
P.O. Box 6020
Gaithersburg, MD 20877
(301) 258-5060
Table 5
**Circle 430**

**PRINTRONIX INC.**
17500 Cartwright Rd.
Irvine, CA 92713
(714) 863-1900
Table 5
**Circle 431**

**PSITECH INC.**
18368 Bandilier Circle
Fountain Valley, CA 92708
(714) 964-7818
Table 7
**Circle 432**

**QMS INC.**
P.O. Box 81250
Mobile, AL 36608
(205) 633-4300
Table 5
**Circle 433**

**QUADRAM CORP.**
4355 International Blvd.
Norcross, GA 30093
(404) 923-6666
Table 8
**Circle 434**

**QUALOGY INC.**
2241 Lundy Ave.
San Jose, CA 95131
(408) 946-5800
Table 2, 4
**Circle 435**

**QUANTUM CORP.**
1804 McCarthy Blvd.
Milpitas, CA 95035
(408) 262-1100
Table 1
**Circle 436**

**QUME CORP.**
**(subsidiary of ITT)**
2350 Qume Dr.
San Jose, CA 95131
(408) 942-4000
Table 7
**Circle 437**

**RCA DATA COMMUNICATIONS PRODUCTS**
New Holland Ave.
Lancaster, PA 17101
(800) RCA-0094
Table 7
**Circle 438**

**RACET COMPUTES LTD.**
1855 W. Katella Ave. #255
Orange, CA 92667
(714) 997-4950
Table 2
**Circle 439**

**RICOH CORP.**
5 Dedrick Place
West Caldwell, NJ 07006
(201) 882-2000
Table 5
**Circle 440**

**ROSSCOMP CORP.**
1695 Macarthur
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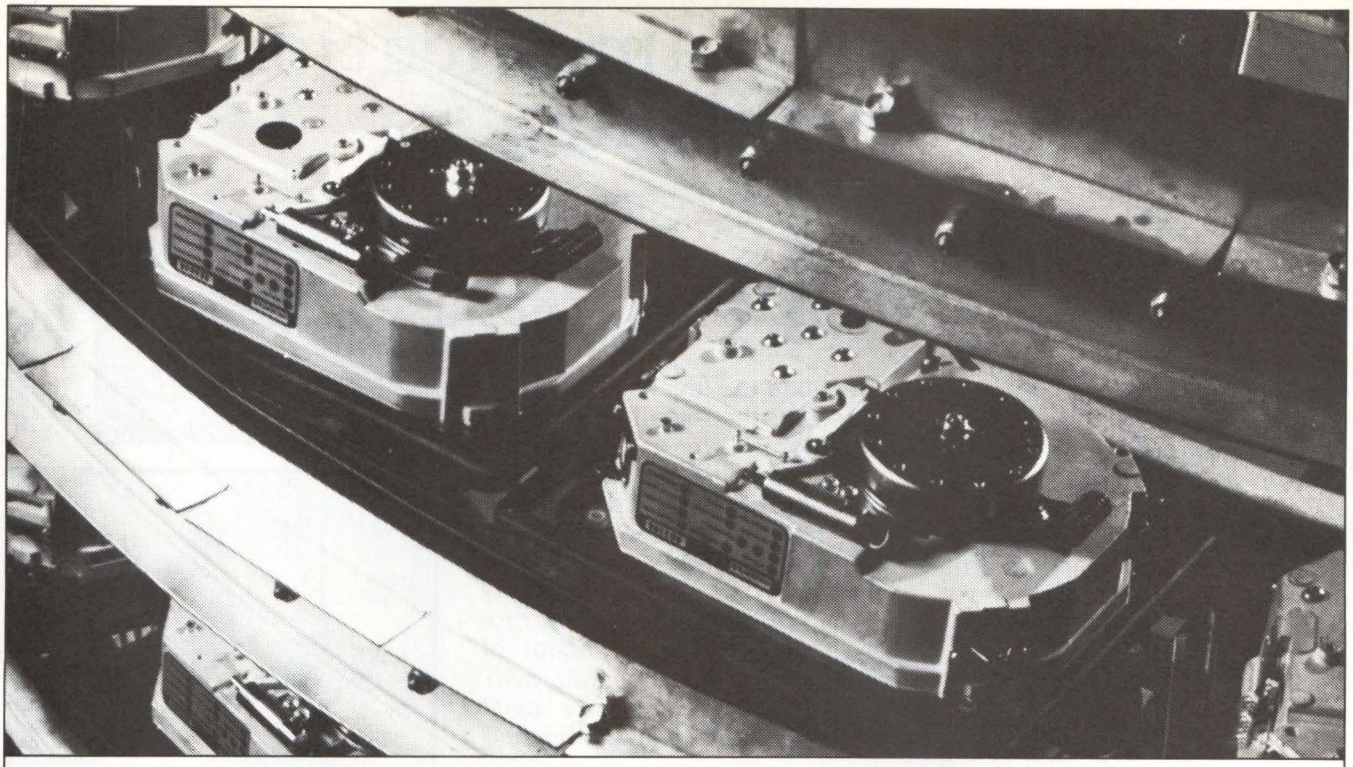

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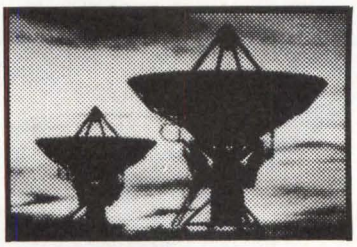

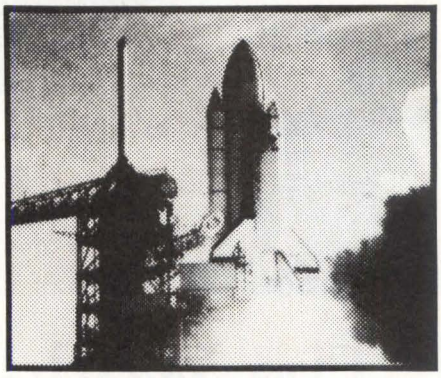

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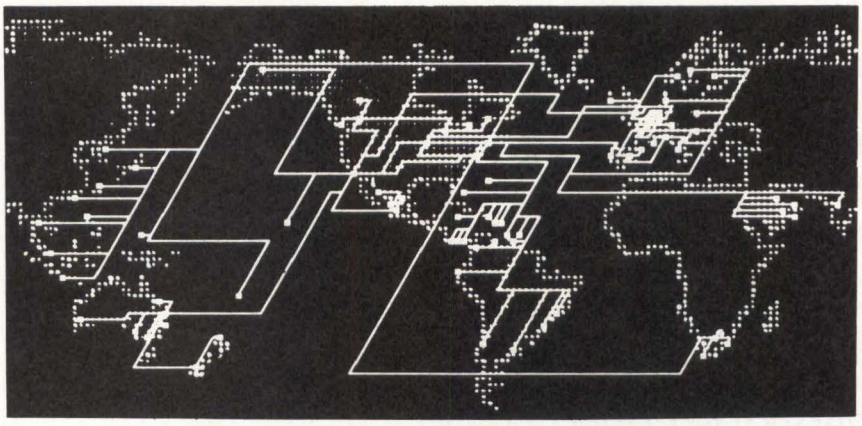

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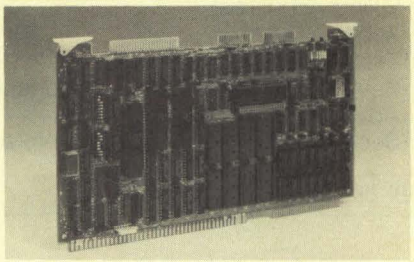

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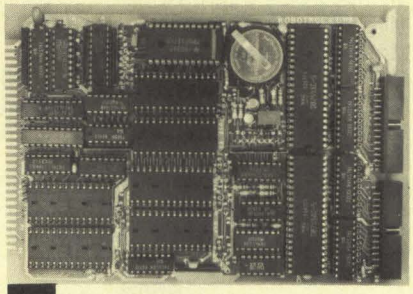
In addition to 10 MHz, the NEW MBx8000 SBC features a single width SBX connector for adding standard expansion modules, such as the SBSxFDC Floppy Controller. MBx8000 maintains all the capabilities of its predecessor, the MB8000: Z8001/Z8002 CPU 4/6/10 MHz; 32K/128K/512K DRAM; up to 48K static RAM or EEPROM: up to 128K EPROM; 2 RS-232 ports; 40 parallel I/O lines; six 16-bit counter-timers; etc. Z8000™ Zilog. SINGLE BOARD SOLUTIONS, 7669 RAinbow Drive, Cupertino, CA 95104. (408) 253-0181

**CIRCLE NO. 200 ON INQUIRY CARD**



***STD CLOCK, MEMORY, I/O BOARD.*** The RSD-7758 features a battery backed 14 digit real time clock w/prog. interrupt, six 28 pin bytewide memory sockets, 48 buffered parallel I/O lines. Available options: up to 48K bytes battery backed RAM and 32 high current open collector drivers for parallel I/O. Board is memory mapped and decodes either 16, 17 or 20 address lines. Consult factory for other available configurations. ROBOTROL CORP., 16100 Caputo Drive, Morgan Hill, CA 95037. (408) 778-0400.

**CIRCLE NO. 201 ON INQUIRY CARD**

**ZX-5000™**

**EXTENDED RANGE™ SURGE SUPPRESSORS**

The **ZX-5000** Extended Range series surge suppressors provide the most advanced protection available on the market today against spikes, surges and noise disturbances.

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COMPUTER SECURITY DIVISION
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607-277-4301

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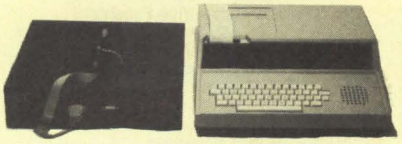
**CURE *YOUR* DOT MATRIX PRINT HEADACHES WITH THE NEW PDC SYSTEM 100**



**The new PDC System 100 Dot Matrix Print Head Tester features:**

- Wide function ranges for 7, 8, 9, or 18 needles
- 1 — 2000 Hz needle frequencies
- 50 — 800 microsecond time to impact range
- .03 — 8.5 lbs. impact force range
- 16 impact pattern combinations with 5 impact maximum
- 25 available test cycles
- 20 character display
- internal printer

**Price:** $10,500 for basic system. Custom built systems also available.

**Peripheral Development Corporation**
103 Phillips Road
East Greenwich, RI 02818
Tel. (401) 885-1969

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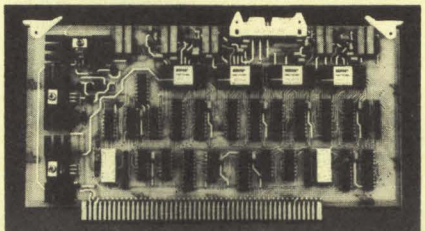

***16 Bit/4 Channel D/A Board***

***The high resolution IEEE-696 test, measurement and control solution.***

- ☐ *Address channels individually or in any combination.*
- ☐ *Switch selectable 8 or 16 bit addressing.*
- ☐ *Power on initialization to one of two switch selectable reference levels.*

**NE** Nathaniel Electronics P.O. BOX 51, NEW HAVEN, VT. 05472 phone: (404)-438-3998

**CIRCLE NO. 204 ON INQUIRY CARD**

**IBM PC TAPE BACKUP**

- Cipher 5210 Subsystem
- 25MB (formatted) capacity
- Menu Driven Software
- No Additional Card
- $1025[00] with 6 mos. warranty

Available From:

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# "LATER" IS TOO LATE.

## The window of opportunity in voice applications processing is wide open.

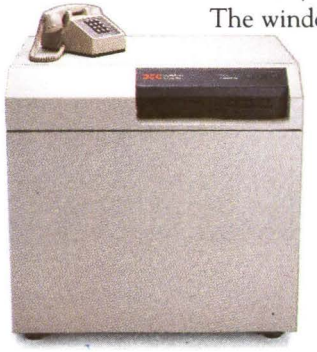
The billion-dollar digital voice processing market is emerging now. As an aggressive PBX or computer OEM, are you ready to get your share?

You can be—if you start now by investigating the new DSC-2000 VoiceServer™ from Digital Sound Corp. It's the only available all-digital end-to-end applications processing system optimized for real-time voice capabilities. And it's got some powerful advantages going for it.

**EARLY MARKET ENTRY** R&D in voice processing is costly and time-consuming. But at DSC, our scientists have years of hardware and software experience in speech processing, minimizing your product development time.

And because the VoiceServer uses only industry-standard computer and telephony interfaces, integrating it into your system is easy.

**PRODUCT EXCLUSIVITY** You don't want another "me too" product. With the VoiceServer's Open System Architecture,™ Multibus and UNIX System V software, customization becomes simple. And our software packages for voice mail/file applications are just a starting point. Off-the-shelf software makes it easy to add concurrent voice, data and communications processing.



**OBSOLETE PROOF** DSC is already developing the next generation of digital voice applications: converting text to voice, recognizing spoken commands, and more. You can offer these enhancements to VoiceServer users as future options—without obsoleting your customer's system. Result: extended product life-cycle plus additional revenues for you.

**MAXIMUM PROFITABILITY** The VoiceServer costs about a fifth as much as other systems that don't do nearly as much. It delivers high-quality digitized speech at a third the bit rate of competitive products. It cost-effectively handles 200-4,000 stations.

Put all these figures together, and they spell low costs, and high profits for PBX or computer OEMs. We wouldn't want it any other way.

The window of opportunity in the digital voice applications market is wide open right now. Better call DSC and start locking in your share.

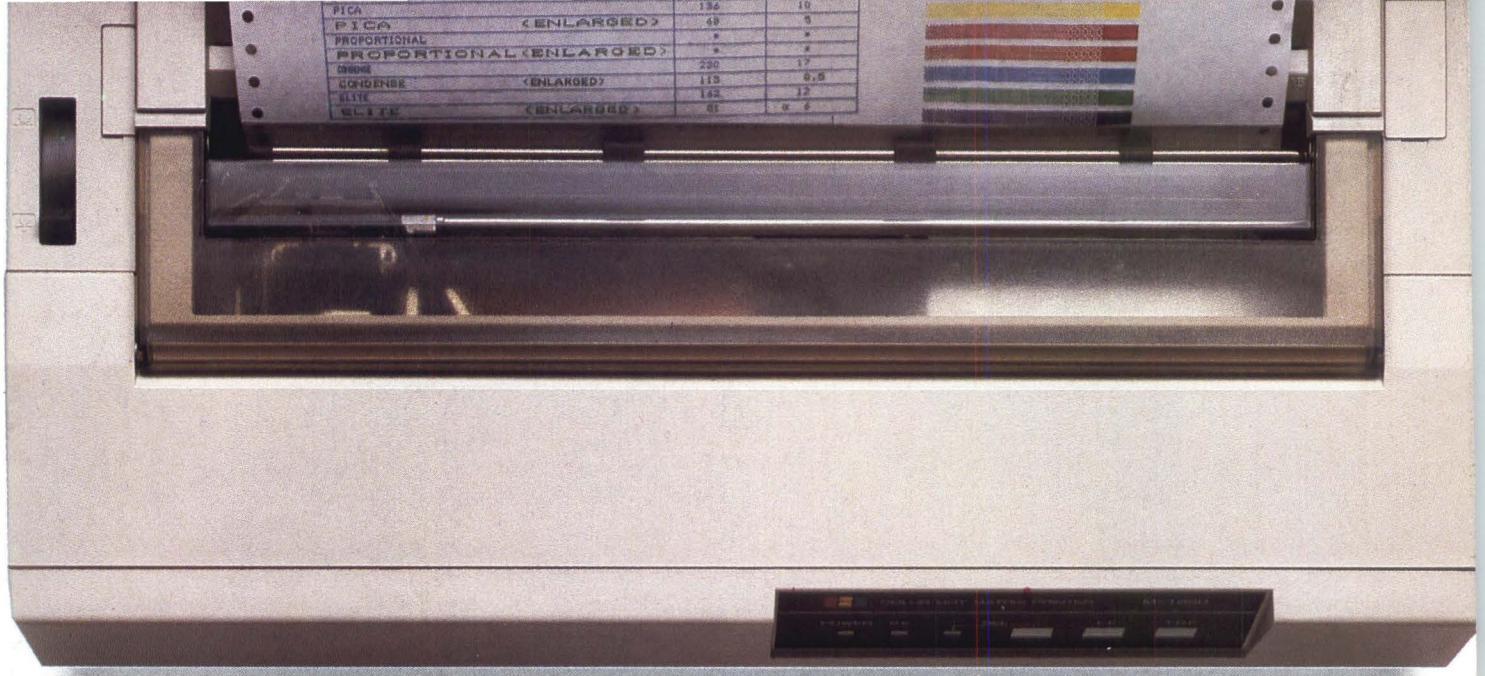
VOICESERVER™ by

DSC

**Digital Sound Corporation**
2030 Alameda Padre Serra
Santa Barbara, CA 93103
(805) 569-0700



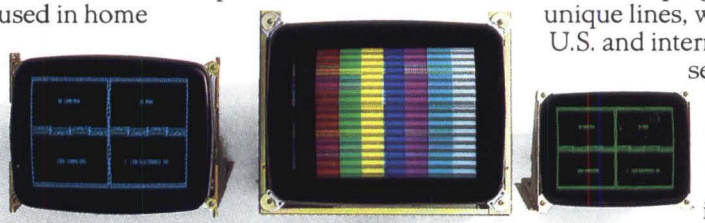
**CIRCLE NO. 52 ON INQUIRY CARD**



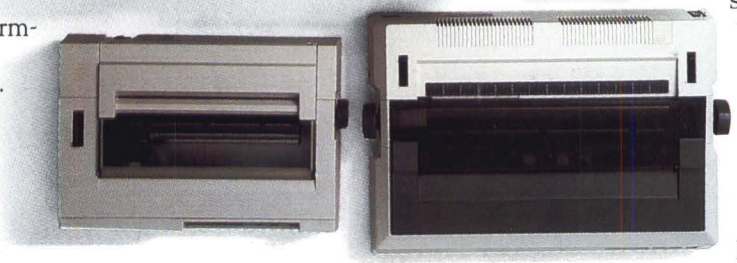

# If you've only seen our fine print, you're missing some great lines.

When people try C.Itoh Electronics' high performance daisywheel or dot matrix printers, they're quite impressed. So impressed, in fact, that our line of printers just may be the most widely used in home and business—nationwide.

But our commitment to the electronics industry doesn't end there. You see, we also offer OEM's and end-users a wide variety of state-of-the-art electronic products. All with the same reliability and performance that has everyone talking about our printers.

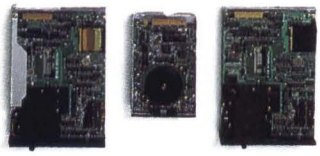


For starters, there's our line of clearly superior Liquid Crystal Displays. Thin, lightweight and compact, they come in an almost endless array of modules to satisfy virtually any application.



Then there's our selection of Minifloppy and Microfloppy Disk Drives. They offer exceptional reliability and easy-to-integrate high density storage.

We sell a full range of CRT monitors, too. And each delivers unprecedented levels of character clarity.



Finally, there's our CIE 2400/3600 plotters. Available in 24- and 36-inch models, they provide the fastest 400 DPI performance on the market today.

Of course, it takes more than a great product to make a sale. There's also that little intangible called working with the customer. And work with you we will. To develop products that meet your specifications.

In addition to developing and marketing our own unique lines, we buy products from many U.S. and international manufacturers and sell them to the worldwide market. So you can benefit from a world of experience and the latest developments.

We also recognize the importance of outstanding support to all of our customers—OEM's, Systems Integrators, Distributors, or End-Users. And don't forget the solid backing of C.Itoh, our $60 billion parent company with 125 years of experience and offices worldwide.

So call or write C.Itoh Electronics for more information on our lines of high performance printers, LCDs, disk drives, CRTs, or plotters. And find out what you've been missing. C.Itoh Electronics, Inc., Headquarters, 5301 Beethoven St., Los Angeles, CA 90066, Tel (213) 306-6700, Telex 65-2451, TWX 910-343-7446, FAX (213) 390-1188.

**C.Itoh** *Electronics, Inc.*

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