Mini-Micro Systems

A CAHNERS PUBLICATION

SPRING 1983

Peripherals Digest

You've concluded that you need the performance and capacity that only an 8 inch Winchester drive can provide. Which one should you buy?
There are 109 different models available.
Of this 109, only 39 are 8 inch floppy form-factor compatible.
28 of these 109 perform an average seek in 30 milliseconds or less.
And of this 109, only 17 offer true SMD compatibility.
Puzzled?

Only *one* company provides a disk drive with all the features —

Kennedy and Model 7300

with the right size, the right interfaces and the right price.
Write or give us a call.

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SPECIFICATIONS:
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- Available 30-45 days ARO
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CIRCLE NO. 2 ON INQUIRY CARD

NOW MAKE YOUR SERIES/1 EVEN MORE EFFECTIVE.

Attach it to Control Data Miniperipherals.

Turn your price-performance problems into opportunities with Control Data's *full line* of Certainty® Series miniperipherals. They'll make your Series/1 even more effective for distributed processing and office automation—at a competitive price.

Why are Series/1 users linking up with Certainty Series products? The first benefit is exceptional capability for the price. You get printers that are faster than competitively priced units; disk drives with more storage for the money; removable media; even fixed and removable storage in one drive; integral controllers; full Series/1 compatibility.

Benefit #2: a full line—available right now. There's a complete family of disk drives. A complete line of printers, from the 410 Series letter quality printer to the 1130-lpm band printer. A pair of user-friendly displays—plus RTA (remote technical assistance).

Benefit #3 is complete support. More than 5000 Customer Engineers help make sure that Certainty miniperipherals live up to their name in operation.

Make increased effectiveness a Certainty. No matter how you're using your Series/1—for insurance, broadcasting, health care, banking or dozens of other applications—there's a Control Data miniperipheral that'll pay off for you in price *and* performance.

Call today for more information, toll-free 800/328-3390.

CONTROL DATA

Addressing society's major unmet needs as profitable business opportunities

CIRCLE NO. 1 ON INQUIRY CARD

THE COGITATOR. A NEW WAY TO THINK BIG IN A SMALL WAY.

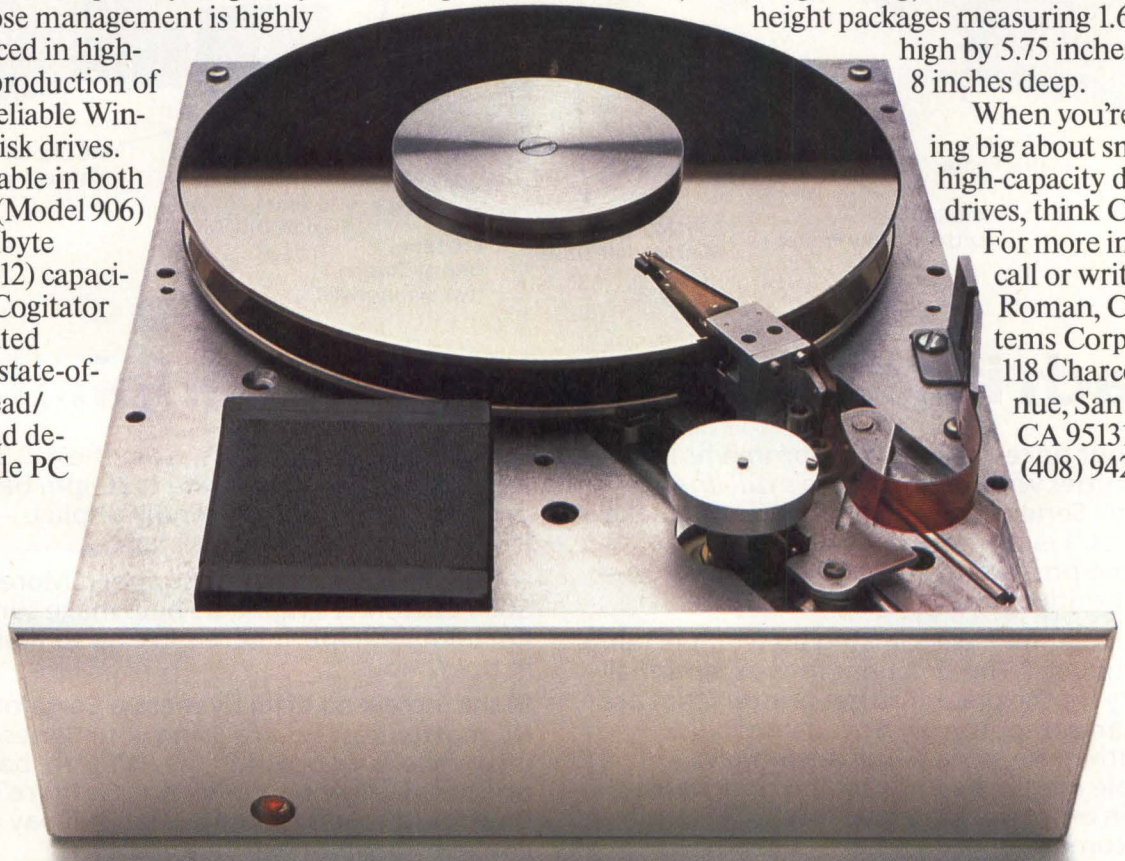
You are looking at a new, half-height, 5¼ inch Winchester disk drive called the Cogitator. You are looking at its actual size.

It was developed by Cogito Systems Corporation, whose management is highly experienced in high-volume production of quality, reliable Winchester disk drives.

Available in both 5 Mbyte (Model 906) and 10 Mbyte (Model 912) capacities, the Cogitator offers plated media, a state-of-the-art read/write head design, single PC board construction, and compatibility with the ST 506/412 industry standard interface. Both Cogitator models have an average access time of 85 milliseconds, including settling, and come in new half-height packages measuring 1.625 inches high by 5.75 inches wide by 8 inches deep.

When you're thinking big about small high-capacity disk drives, think Cogito.

For more information call or write Andy Roman, Cogito Systems Corporation, 118 Charcot Avenue, San Jose, CA 95131 (408) 942-8262.



(ACTUAL SIZE)

COGITO
SYSTEMS

CIRCLE NO. 5 ON INQUIRY CARD

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A Cahners Publication

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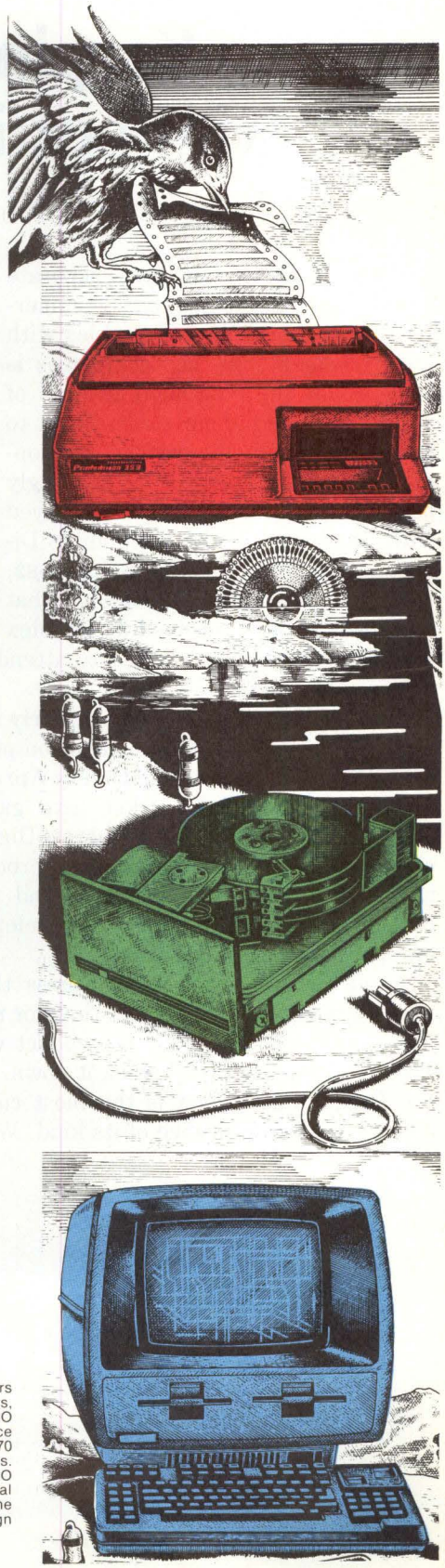

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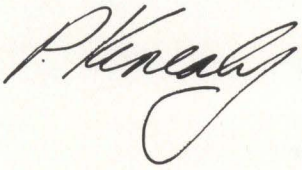
Editorial

Keeping up with our industry

You're reading the first separate issue of *Mini-Micro Systems'* Peripherals Digest. Its 73 pages of tables with 1200 products from 365 companies is evidence of the continued growth of our industry and of our commitment to keep you on top of product developments. Because of overwhelmingly positive reader response, we've stayed with the format of the Peripherals Digest bound into the November, 1982, edition of *Mini-Micro Systems*. That issue was so well received at Comdex '82, where it was distributed to attendees, that it was out of print within a few weeks.

Our sophisticated industry is clearly still hungry for basic product information and still wants advice on product selection. Our Peripherals Digest, to be published every April and November, will provide reliable product and market data gathered from comprehensive editorial surveys. Each Peripherals Digest will make its predecessor obsolete, and each will cover new product areas. This issue, we've added non-impact line printers, and for subsequent issues we're considering magnetic-tape drives, teleprinters, modems, multiplexers and graphics peripherals.

A microcomputer system insures that we won't forget anyone we've already listed when it's time for next November's edition. But if you know of a company or product we should cover but haven't, send us a note and we'll track it down. As we go to press, we know the Peripherals Digest is the most current, complete, usable and editorially rich reference of its kind. We intend to keep it that way.



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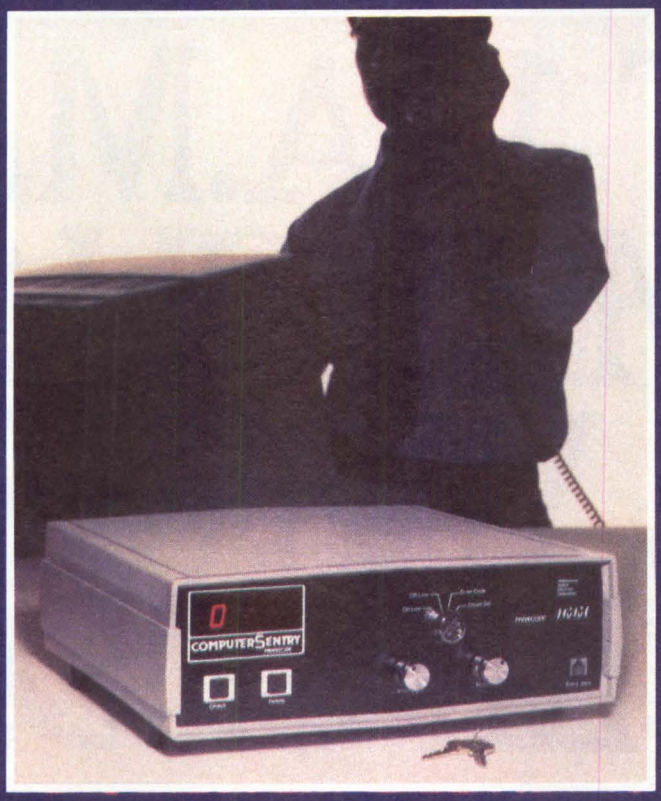
If you have dial-up access to your system, you have a serious problem. You are vulnerable to computer crime.



Here's a simple, affordable solution...a lock and a key.

Behind this lock and key is the same microprocessor technology you depend upon every day.

ComputerSentry™ is a dial-up access control device that prevents unauthorized access to your computer via dial-up lines.

A synthesized voice intercepts all inbound calls and asks for a code. Valid 6-digit codes activate your modem and let callers through to deal with your security software. Invalid codes activate one of ComputerSentry's three alarm modes, and deny the caller access to your modem. You get an extra level of security.

If you stop intruders before they can activate your modem, you stop them before they get into your system, period.

The person you authorize to use the ComputerSentry key is the only person who can set up and change valid codes. Others have no way of changing codes, let alone knowing what they are, unless you want them to.

Authorized callers from any location can input codes by Touchtone® or by voice using ComputerSentry's unique voice activation system.

It's that simple. An electronic lock at the portal to your system...an electronic Sentry challenging every caller...an extra measure of frontline security.

And it's compatible with any hardware, software, or communications protocol on the market today!

ComputerSentry operates in three different alarm modes, one of which diverts unauthorized calls to your security officer's telephone.

Remember, only one unauthorized access to your system could cost you hundreds of thousands of dollars.

One ComputerSentry costs only $1495...a small price for the peace of mind you will get from knowing you can stop even the most persistent hacker before he can activate your modem.

Get this extra measure of security. Become less vulnerable to computer crime. Try this affordable solution in your own shop for 30 days.

If during your 30 day risk free trial, you decide to send ComputerSentry back, for any reason, then do so and we will cancel your Purchase Order, no questions asked.*

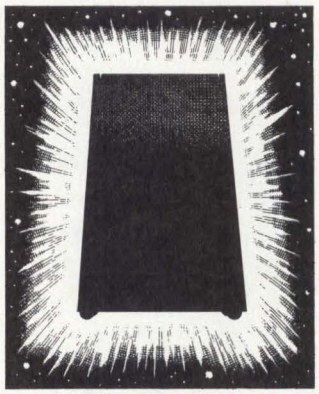
CIRCLE NO. 6 ON INQUIRY CARD

COMPUTERSENTRY

Computer Products Division
International Mobile Machines Corporation
100 N. 20th Street, Philadelphia, PA 19103, (215) 569-1300

*Call toll-free (800) 523-0103 Ext. 510. In Pennsylvania call (215) 569-1300 Ext. 510.

AT 11 A.M. ON MARCH 2ND, THE VAX™ WAS ECLIPSED.

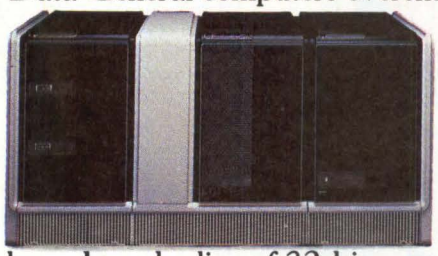


If you decided to buy a computer system before 11 A.M., March 2nd, it was possible to make a purchase decision without fully considering Data General.

But on that date, the world changed.

At 11 A.M., we introduced the most powerful 32-bit virtual supermini ever produced by a computer company. Our Eclipse™ MV/10000.

Yet the Eclipse MV/10000 is only the most recent in a series of steps we have taken to make Data General computers overshadow Digital's entire line of VAX computers.



So now, if you do a full evaluation of computer systems, the VAX no longer comes out ahead.

PERFORMANCE. The Eclipse MV/10000 executes 2500 kwets/sec. And transfers I/O at 28.6 mb/sec. The VAX 11/780 executes* 1200 kwets/sec. And transfers I/O at 13.3 mb/sec. A comparison that's no comparison.

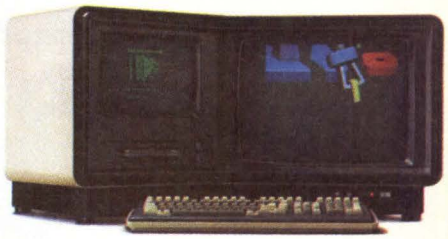
RANGE. With the Eclipse MV/10000, Data General has a broader line of 32-bit computer capability than Digital. Which means a Data General computer will better fit your exact needs. Whatever those needs may be.

PRICE. When you compare Data General Eclipse MV computers against Digital's VAX computers on the basis of price,* you get a very interesting perspective. The Eclipse MV/10000 has the same price as the VAX 11/780, but twice the performance. And the recently announced Eclipse MV/4000 has twice the performance of a VAX 11/730 at the same price.

COMPATIBILITY. We at Data General have made it a top priority to make our system's software and I/O compatible. So if your needs ever change, you can take your investment in software and peripherals onto other Data General computers. Which is something you can't do with Digital's VAX computers.

GRAPHICS. Also, we fully support our own color graphics terminals, high resolution color workstations, color graphics controllers and standard GKS software. All of which make the job of integrating your total application considerably easier.

SOFTWARE. Data General has the full range of systems software you'll need for whatever you need to do. Including a 32-bit Real Time Operating System. (Something else Digital doesn't have.)



Our systems software covers a wide range of applications – including Data Communications, Networking, Time-Sharing and Office Automation. Plus all the standard development languages. All to industry standards. And third-party applications software for mechanical, electrical and architectural engineering; imaging and process control.

SUPPORT. We do more than make computers today. We work with you to make your projects succeed. By going out of our way to be both accessible and helpful. With things like marketing support, a national phone center and remote diagnostics. In fact, we're offering uptime guarantees of up to 99%.

So when you look at where Data General is today – and where the competition is today – the VAX has been ECLIPSED.

For additional information contact Don McDougall, Director, Technical Products, M.S. F134, Data General Corporation, 4400 Computer Drive, Westboro, MA (617) 366-8911.

Data General

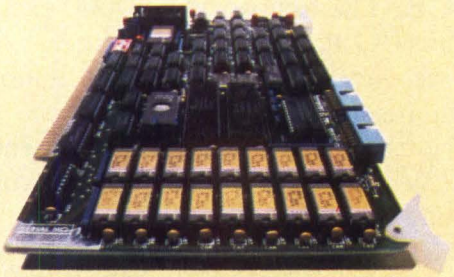
*Sources include trade press articles, Digital literature, industry reporting publications and data supplied by industry reporting services.

CIRCLE NO. 7 ON INQUIRY CARD

THE MULTIPROCESSOR WITH 64 BIT PROCESSING POWER.

Dazzled by 16-bit and 32-bit machines? When it comes to multiuser applications you've got to talk about TOTAL processing power. Not just the number of bits on a single processor.

In our new Betasystem II multiprocessor, we put eight SLAVENET™ processor boards together to give you 64-bit processing throughput. That's because the SLAVENET boards work in parallel to gobble up 64 bits of data each cycle.



But that's not all. Each SLAVENET processor board comes with 128K of RAM, so a fully-populated Betasystem II has 1,088K of on-board RAM. Imagine, over a MEGABYTE of RAM. Run at peak system performance no matter how many users are on-line.

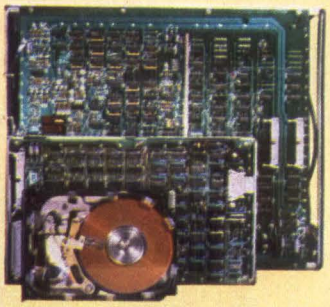
Just plug in processor boards to add up to 16 different users.

Get started with our low-cost single user system and expand to 16 users — without compromising performance — by plugging in more SLAVENET processor boards. Each board handles two users (at the lowest cost per user in the industry) or two simultaneous tasks.

The SLAVENET is a complete S-100 computer with 4Mhz Z-80 CPU, 128K RAM plus parity, software selectable bank-switch boundary, 2K or 4K EPROM, full interrupts and two serial ports.

PASCAL & CP/M®

The Betasystem II is available with two proven multiprocessor operating systems: IBS p-NET™ for UCSD Pascal™ or Fortran software and TURBODOS™ which gives access to over 2,000 CP/M-based business programs. Both systems let you take full advantage of the speed and power of our multiprocessor hard disk systems.



Up to 1,160 Mbytes on hard disk.

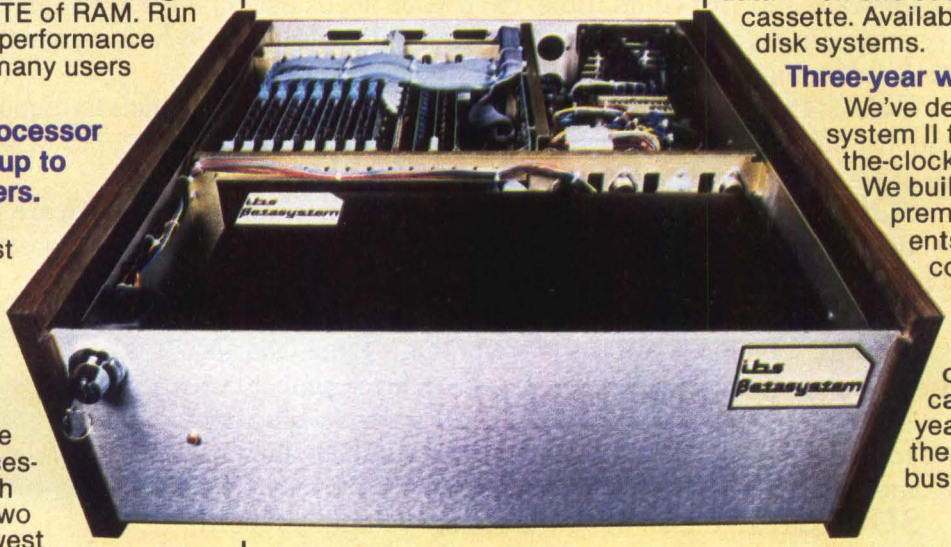
Choose from the latest 5″, 8″ or 14″ Winchester technology — from 5 to 1,160 Mbytes. New 5″ combination models offer up to 40 Mbytes in the base system chassis.

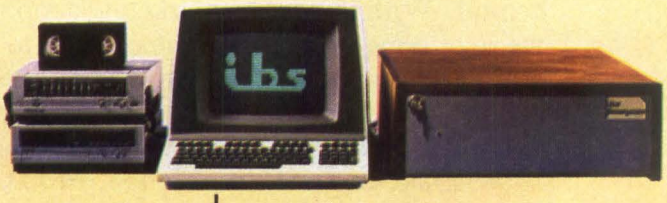
Introducing BACKSTOP!™

Our new, low-cost Videotape Archiving system BACKSTOP lets you use your home video recorder to backup 100 Mbytes of valuable data — on one economical video cassette. Available for all hard disk systems.

Three-year warranty.

We've designed the Betasystem II to take around-the-clock operation. We build each one with premium components, a superb cooling system and thoroughly test each system. That's why our base system carries a full three-year warranty — the longest in the business.





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CIRCLE NO. 8 ON INQUIRY CARD

How to use the Peripherals Digest

The Peripherals Digest is designed for ease of use by novice and veteran systems integrators alike. It is divided into four tabbed main sections: a printer chapter, a disk/diskette chapter, an alphanumeric terminal chapter and a directory of manufacturers.

Each of the three product sections has three subsections:

- a market overview compiled by Mini-Micro Systems editors;
- one or more "How to select . . ." articles written by leading peripherals marketers experienced at matching hardware to user requirements;
- one or more product pricing and specification tables arranged alphabetically by company, compiled by computer, and based on mailed surveys.

The directory of manufacturers is the last section of the Digest and is a consolidated alphabetical listing of all the vendors listed in the three product chapters. Each directory entry provides a vendor's mailing address and telephone number, as well as a circle number for the reader service card. Each entry is also keyed with the letters P, D or T to indicate whether the vendor makes printers, disks and/or terminals.

To use the Peripherals Digest most effectively, use the tabs to find the right section quickly.

To find addresses or phone numbers: use the directory of manufacturers.

To check prices or specifications:
- turn to the appropriate section,
- find the appropriate product table,
- find the vendor alphabetically.

To select a peripheral:
- turn to the appropriate section,
- check the market overview
- read "How to Select . . .,"
- refer to the product tables to rule out inappropriate products,
- refer to the directory of manufacturers to find where to contact prospective suppliers.

To comment on the Digest or suggest future chapters or entries, contact the Editor, Mini-Micro Systems Peripherals Digest, 221 Columbus Avenue, Boston, MA 02116.

It isn't just plug-compatible, it's software-compatible.

Introducing AMS 315, the first Winchester precisely designed to the storage specifications of 300-MB removable pack drives. So for the first time you get all the advantages of a 300-MB Winchester without rewriting your software. Or redesigning your interface.

We're truly SMD compatible.

Century's AMS 315 has the same 20,160 bytes per track.

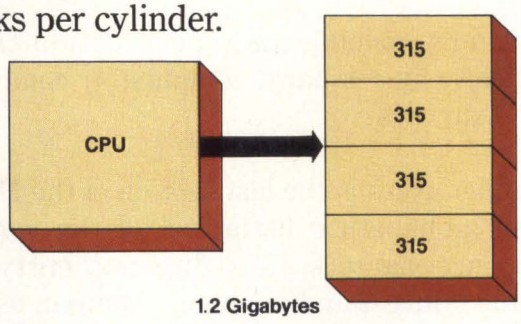
Same 19 tracks per cylinder.

Same 823 cylinders per spindle.

Same 3,600 RPM rotation.

All in one-third the space.

Using less than half the power.



Stack four AMS 315s for 1.2 gigabytes of Winchester storage in about the same space as your 300-MB removable pack drive.

At about two-thirds the initial delivered cost.

Plus you get more than twice the reliability and eliminate preventive maintenance so the on-going cost of ownership is less, too.

Expand your mass storage alternatives with Winchester technology. You'll see the difference right away. Your system never will.

Call to arrange a test drive.

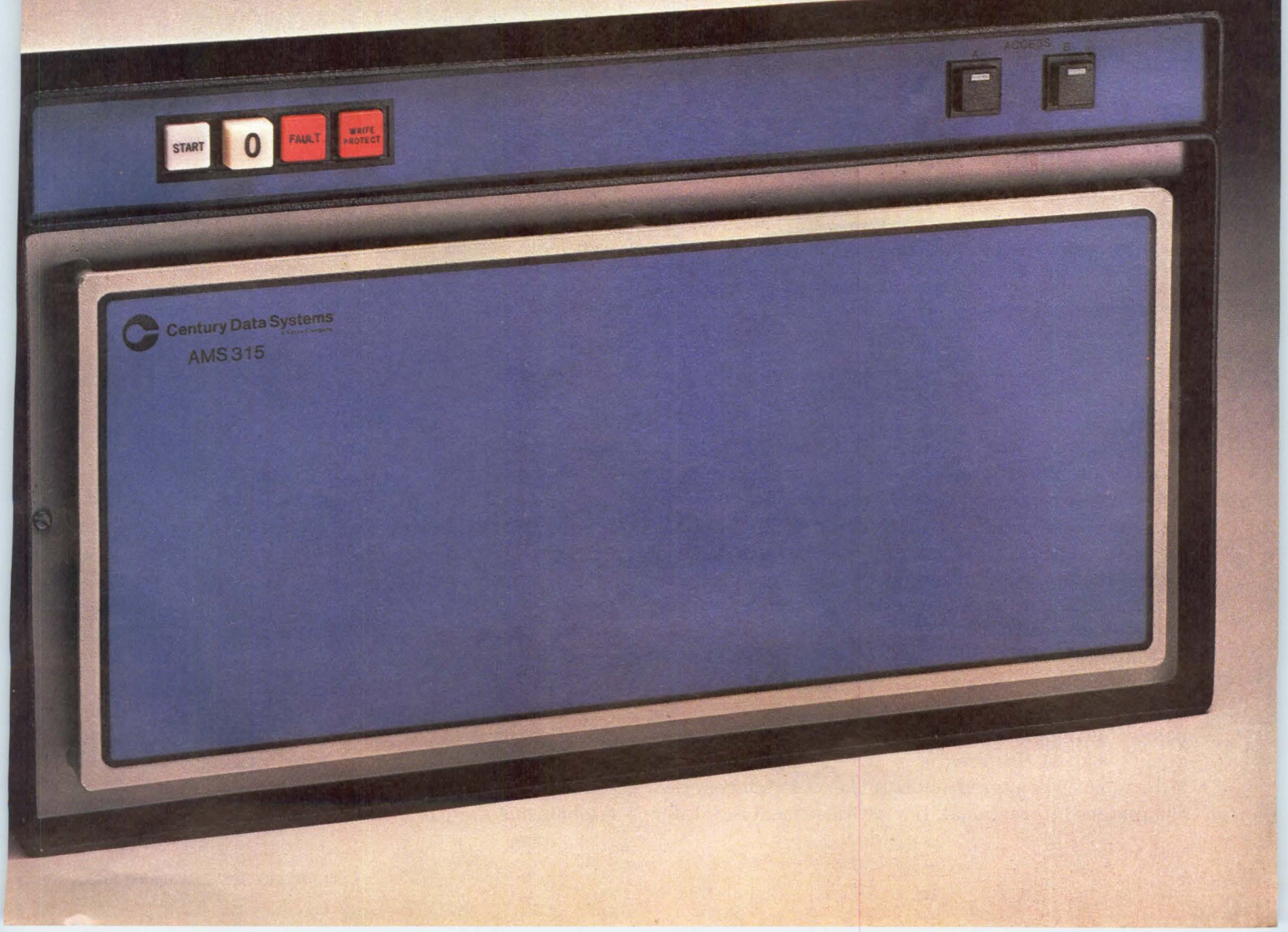
Century Data Systems, Marketing Communications C1-10, 1270 N. Kraemer Blvd., Anaheim, CA 92806, (714) 999-2660.

AMD House, Goldsworth Road, Woking, Surrey, England, GU 21 1JT, 44-4862-27272.

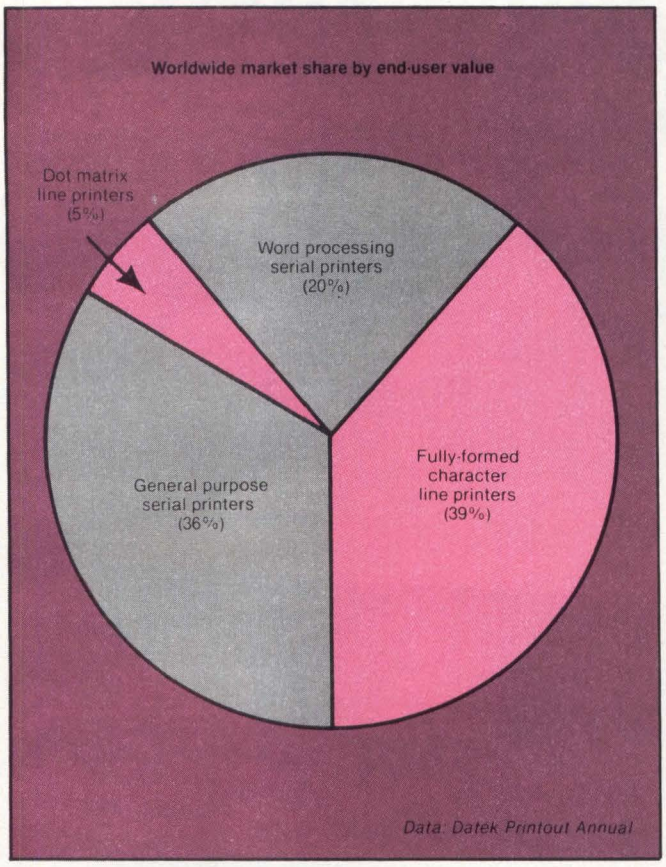
Century Data Systems
A Xerox Company

CIRCLE NO. 9 ON INQUIRY CARD

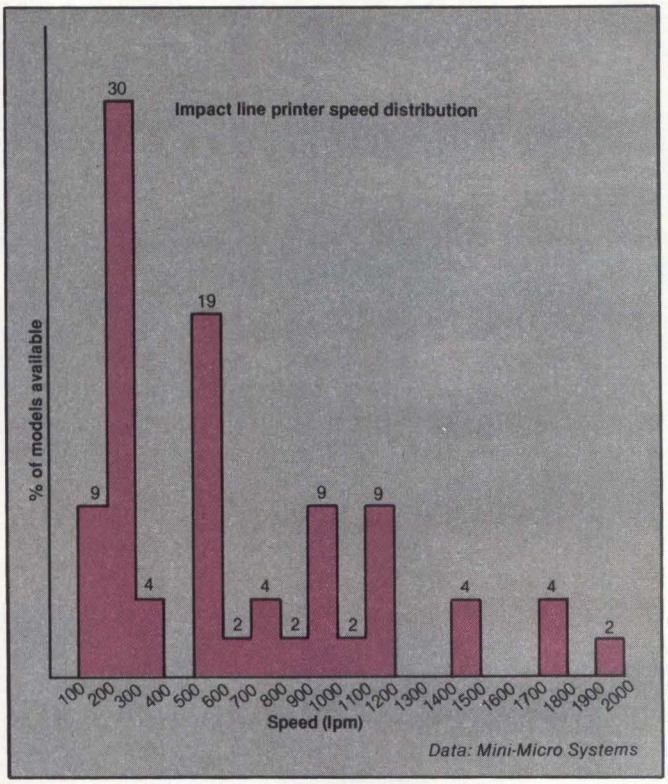
Finally, a Winchester that goes head-to-head, track-to-track, cylinder-to-cylinder, byte-to-byte with 300-MB removable pack drives.



Printer market overview



The 1981 revenue shares of the $4.6-billion worldwide impact printer market *reflect healthy sales of impact matrix and daisy-wheel serial printers and sluggish (economy-related) sales of impact line and non-impact page printers.*



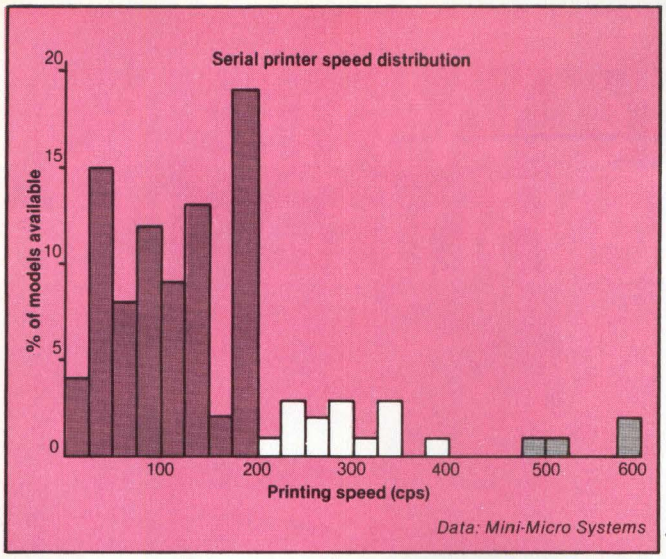
Impact line printer speeds fall into traditional ranges *based around multiples of 300 lpm. The 300-lpm speed is the most popular, followed by 600, 900/1000, 1200 and 1800 lpm. Many speed requirements can be satisfied by band, chain, train and matrix technologies. Expensive drum technology once dominated medium-speed line printers, but band technology is now dominant across most speed ranges.*

The past year was one of fantastic market growth for serial printers and a rather slow year for line printers. Driven by explosive home and business microcomputer markets, sales of impact matrix and solid-font serial printers topped $2 billion, up more than 40 percent from 1981. Impact line-printer sales were sluggish, hampered by economic pressures that affected sales of all high-cost capital goods and forced large OEM customers to defer shipments.

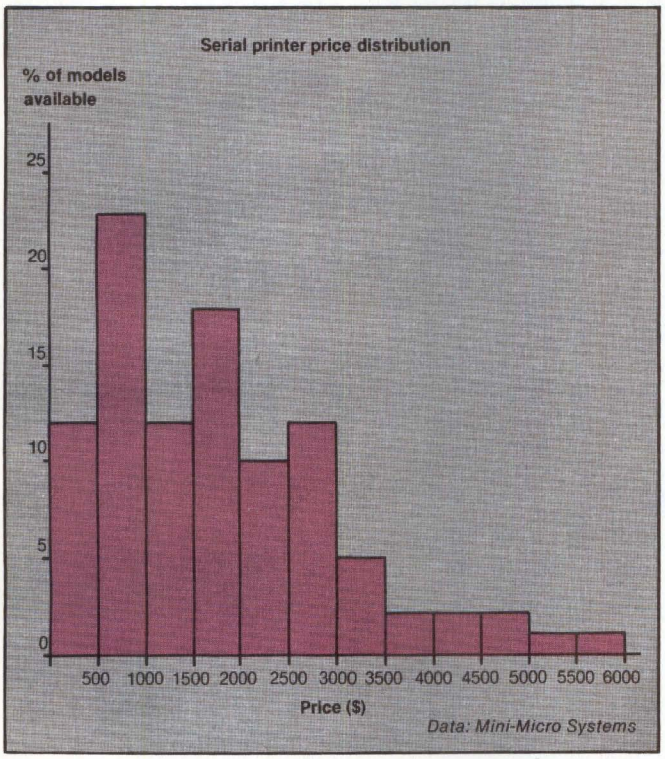
Two microcomputer market demands—low cost and flexibility—were behind the most significant serial-printer developments. Demand for inexpensive letter-quality output inspired a wave of less-than-$2000, letter-quality printers from SCM Corp., Primages, Inc., Computers International, Irwin/Olivetti and NEC Information Systems, Inc.

Demand for microcomputer printer flexibility has led Lear Siegler, Inc., Mannesmann-Tally Corp., Okidata Corp., General Electric Co., Facit, Inc., Integral Data Systems, Inc., Qantex, Santec Corp., Digital Equipment Corp. and others to introduce multi-mode printers that handle data-processing, draft-and near-letter-quality output. The new printers make two, three or even four passes per line of output and use print heads that contain nine, 14, 18 or more wires.

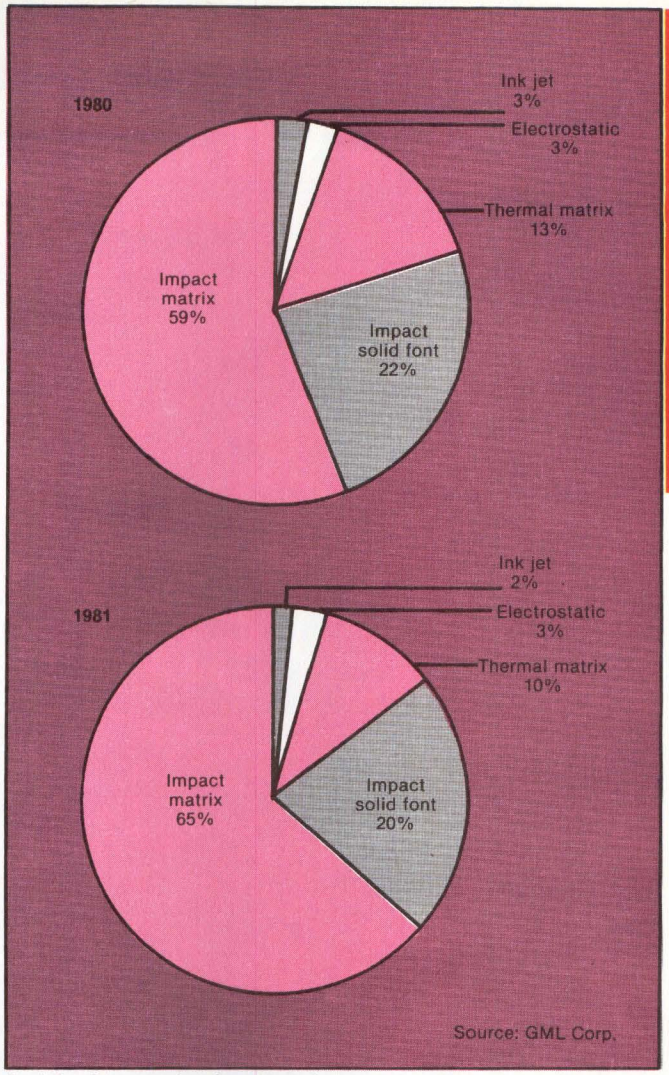
Non-impact serial printer technologies are getting lots of attention at the patent office, but not much more than usual in the market. Thermal mechanisms remain popular in portable and military printers, and ink-jet mechanisms are gaining most popularity in color units



Serial-printer speeds span a 600-cps range *to accommodate a wide variety of applications and price ranges. Solid-font daisy-wheel and thimble printers operate in the 15- to 70-cps range. Single-pass matrix printers operate between 30 and 300 cps, and multipass matrix printers print at many speeds, depending on resolution.*



Serial-printer prices *reflect the fact that microcomputer systems are creating the vast majorty of new serial-printer demand. Versatile microprocessor-based matrix printers are plentiful at less than $1000, and many solid-font, letter-quality printers are now available for less than $2000. As always, serial-printer prices are inversely proportional to speed and resolution.*



Serial-printer technology trends are toward matrix methods and away from solid fonts. *Fully formed character printers generate letter-quality output but print at 75 cps or less. Matrix printers reach 900 cps and generate near-letter-quality output at 50 to 150 cps. Thermal printing is losing popularity in serial printers but gaining interest in teleprinters. Electrostatic methods still suffer from low quality and high paper costs. Ink-jet printing is available in only a few expensive units but holds promise for the future.*

that are better called graphics hard-copy devices than character printers.

The impact line-printer market is dominated by band mechanisms, and the once-preeminent drum line printer has essentially gone out of production. Band printers offer economies and font changeability that other impact line-printer technologies are hard pressed to match. Band-printer speeds range from 300 to 1500 lpm. The fastest impact line printers still use chain/train technology to reach speeds of 2000 lpm or more.

Magnetic, ion-deposition, electrographic and electrophotographic printers once threatened only high-end impact line-printer vendors, but prices for these very fast, inherently flexible machines are dropping quickly and forcing medium- and even low-speed (300-lpm) impact line-printer prices downward. A 300-lpm impact line printer can be had today at an OEM price of less than $6000. Impact line printers will share more of their minicomputer turf with non-impact units in the next few years, and future issues of the *Peripherals Digest* will include non-impact line printers. □

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CIRCLE NO. 11 ON INQUIRY CARD

PRINTERS

Selecting a solid-font serial printer

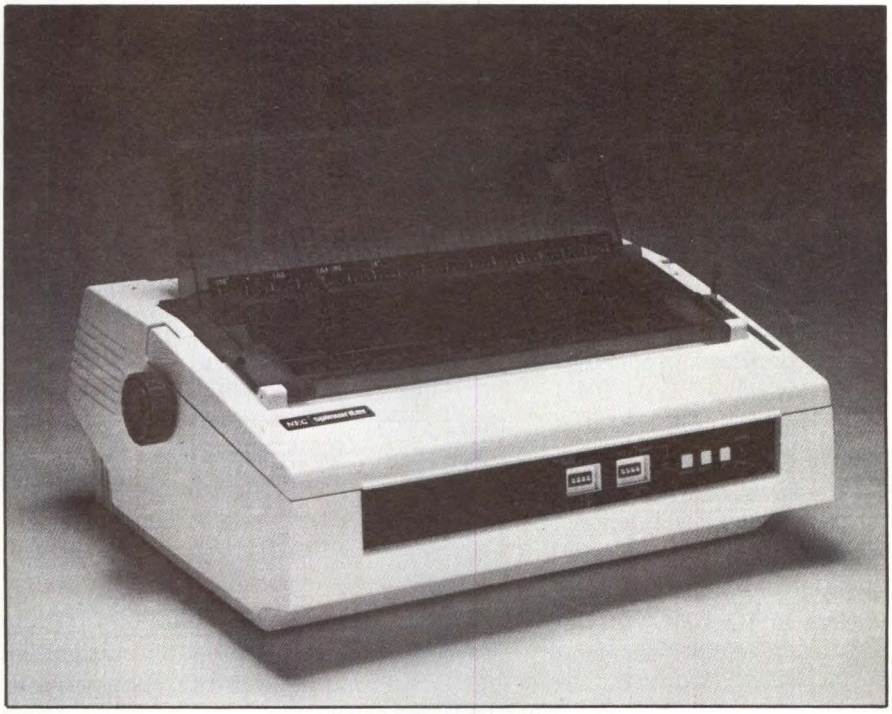
BRUCE THATCHER, NEC Information Systems Inc.

Long-term costs and total throughput are more important than price and speed ratings

An OEM's most important consideration in selecting a letter-quality printer is the same as in deciding between a letter quality versus a matrix, line or page printer—the user's application.

What degree of print quality and flexibility should the printer have? What levels of performance and functionality should it have? To what extent are reliability and maintainability important factors? And how does the OEM choose between the value a "Cadillac" printer adds to a system and the price advantage of a "Chevette" printer?

The answers to all these questions vary with the application, but the quality, performance and reliability specifications used in printer comparison remain constant.



Solid-font serial printers *like the NEC Information Systems Spinwriter are getting smaller, quieter and more intelligent. Solid-font serial printers are available across a wide price range with speeds from 12 to 55 cps.*

Print quality and flexibility

Solid-font serial printers offer varying degrees of print quality and flexibility that the OEM must relate to the user's application. High quality is important in word-processing and other applications in which printer output will find its way outside the user's organization. Quality is less important in applications that generate only in-house or draft documents. Data-processing applications such as accounting, which require better legibility than matrix printers can provide, can use letter-quality printers that have lower print quality.

The quality of a letter-quality printer is not subjective; an OEM can use hard, objective measures to evaluate it. For example, characters should be solid, without voids, have precisely the same contrast at the top as at the bottom and be the same height and width as the surrounding characters. The characters must register, that is, they

must align with each other, and they should be crisp, with no ragged or fuzzy edges. Minor variations accumulate, and the effect of several small flaws over a printed page makes the difference between a high-quality and a mediocre printout.

An OEM must also consider the available type sizes to meet the needs of various users. Most letter-quality printers offer a 10-, 12- or 15-pitch print size and proportional spacing (Fig. 1).

Pitch measures the horizontal density of letters—10 pitch indicates there are 10 characters per in. With each of these pitches, the space, or cell, a letter occupies is constant. Another capability of letter-quality printers, proportional spacing, varies the width of the cell according to the letter—"f," "i," "l" or "t" generally take one-third the space of an "m" or a "w" and one-half the space of all other letters. Visual tests indicate that proportionally spaced text is more pleasing to the eye than 10- or 12-pitch text. For applications in which the output goes outside a user's company, proportional spacing is desirable.

A more fundamental question about letter-quality printers is, "What is letter quality?" Does it mean "typewriter quality," or does it mean something more? These questions address the issue of printer flexibility.

Unlike typewriters, solid-font serial printers can print subscripts, superscripts and scientific or mathematical notations. Foreign-language, italic, boldface and OCR characters can be generated by switching print elements, but an OEM must specify them if they are required. Leading solid-font serial printers support dozens of character sets and styles.

Letter-quality printers typically use a daisy-wheel or a thimble printing element. In terms of range,

Typefaces for solid font letter quality printers typically come in 10- and 12-pitch, and proportional spacing. Pitch refers to the number of characters per inch, while in proportional spacing, narrow letters such as "f", "i", "l", and "t" generally take one-third the space of an "m" or "w", and half the space of all other letters.

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Fig. 1. Type samples *show the appearance of (top to bottom) 10- and 12-pitch and proportional-space type. Proportional spacing is more space-efficient and pleasing to the eye.*

the thimble, a 1- × 2-in,. device, like the ones used on NEC Information Systems Inc.'s printers, has greater capacity than most daisy-wheel print elements: 128 characters versus 88 to 96. The number of print elements available for a letter-quality printer affects flexibility and should be a major selection factor. Requirements for custom fonts for specific applications can limit an OEM's choice of products and manufacturers.

The type quality also is a function of a number of design considerations, each of which should be examined by an OEM. Mechanical actions differ. Rubber-band, wire-rope and solid-shaft carriage systems yield different costs and different positioning accuracies. The precision of the print hammer is also important: does the hammer strike the paper in precisely the correct place so that the character aligns with surrounding characters? Does the hammer strike firmly enough to create a solid, consistent letter, through several forms, without loss of readability?

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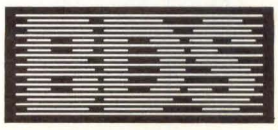

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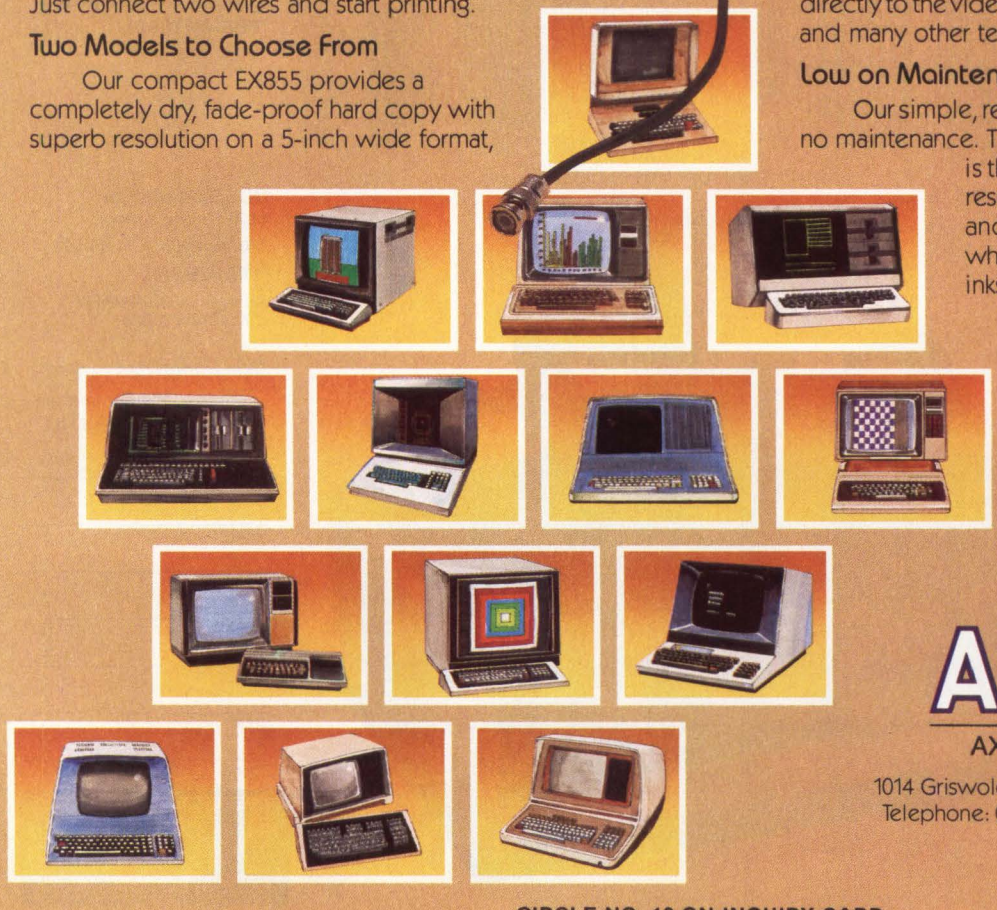
Axiom printers are backed by our distribution and service centers in the USA and 21 foreign countries.



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CIRCLE NO. 13 ON INQUIRY CARD

Performance and versatility

In performance, OEMs whose systems are used in stand-alone applications for, say, small-business systems, do not usually need more than 20- to 35-character-per-sec. performance in their printers, while a printer that is shared by several users calls for 55- to 60-cps performance. There is little correlation between solid-font printer speed and print quality, and lower speed does not necessarily mean higher quality print. Until printer manufacturers conquer the laws of inertia and acceleration, the performance of impact letter-quality printers is unlikely to go much beyond 55 to 60 cps. Even within these constraints, pure speed is misleading. The specification that really matters is throughput—the amount of time it takes to complete a printing task.

Increased throughput is typically achieved by clever engineering. Two of the most widely used techniques are bidirectional and logic-seeking printing (Fig. 2). Bidirectional printers don't waste time by returning the carriage to the left side of a page after a line is printed. Rather, they print the next line backward, from right to left. "Logic seeking" is a look-ahead capability that calculates the shortest path to the location of the next character to be printed, thus reducing non-printing time. Logic-seeking, bidirectional printing can increase the throughput of a printer 30 to 40 percent. Increasing the slew rate—the speed at which paper is moved vertically through the printer—improves throughput even more.

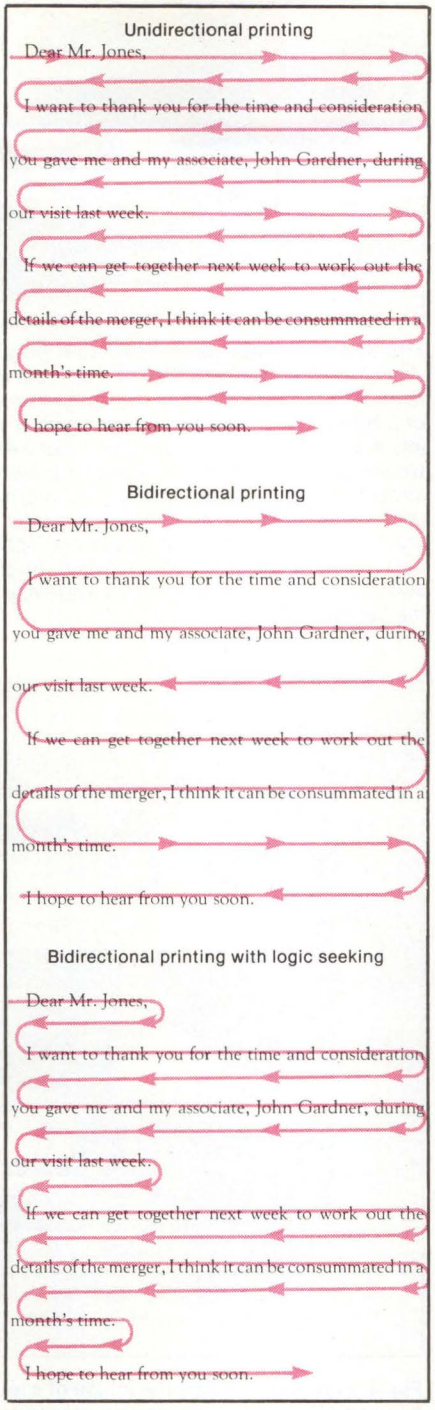

Fig. 2. Print-head paths in unidirectional and bidirectional, logic-seeking printing. A bidirectional printer is faster than a unidirectional printer, and a logic-seeking bidirectional printer is even faster.

The weight and rotational speed of the printing element are also factors: the faster the element can rotate, the faster it can be moved across the paper. NEC thimbles cluster the most frequently used characters together, so the distance the thimble must rotate to reach the next character is reduced.

Differences in forms-handling and interfacing versatility can help OEMs distinguish between units that have the same throughput. A solid-font serial printer should offer a wide selection of forms-handling equipment. Serial printer vendors and third-party manufacturers offer front inserters; cut-sheet feeders; twin-sheet feeders; friction platens; pin-feed platens; bottom-feed attachments; and vertical, horizontal and bidirectional forms tractors.

Interfacing flexibility is important to an OEM that must choose printers to connect its computers with those of its users. Most leading printers are available with RS232C, Centronics and current-loop interfaces, and many offer Diablo, Qume and other vendor interfaces.

OEMs also should consider an application's needs when determining whether a printer requires intelligence and memory. Adding intelligence in the form of a microprocessor can save the OEM a substantial amount of program development because more functions reside in the printer and not in the CPU. Functions such as bidirectional capabilities, proportional spacing, text justification, shadow printing, boldface printing, underscoring, centering and fine back-

DUTY CYCLE AND RELIABILITY

The term "duty cycle" is important to understanding printer reliability, but it confuses system integrators and end users alike. Duty cycle is the printer industry's term for the amount of time a printer actually creates documents, not the amount of time the printer is powered up.

For example, a printer with a 25-percent duty cycle actually prints 2 hours a day (25 percent of an 8-hour workday), even though it's on during all 8 hours.

Another factor often quoted in reliability statistics is the percentage of a page that is covered by text. An average page has about 40 percent of its page devoted to text. The rest is empty space. Duty cycles of 25 percent and page densities of 40 percent are nationwide averages for solid-font serial printers and are good bases for reliability comparisons.

spacing (backspacing in 1/120-in. increments) are standard or optional features for "intelligent" printers.

Printer memory, like printer intelligence, adds to cost and functionality. For most solid-font applications, 2K to 4K bytes of memory is typical. This is enough to buffer a full screen of text, so that a user can work on one page while another is printing. But there is a trade-off with buffers: a page being printed from a buffer can't easily be stopped from the terminal. So OEMs should make sure the printer has a "pause" switch on the front panel that interrupts printing from a buffer when paper and ribbons must be changed.

The growth of business graphics applications indicates that printers are increasingly used for graphics, where extreme precision is required. A letter-quality printer such as the NEC Spinwriter is capable of fine-line plotting 120 dots per in. horizontally and 48 dpi vertically.

Finally, an OEM should consider ease of use, examining whether users can easily change print elements or ribbons and whether there are indicator lights and function keys to make operations straightforward (Fig. 3).

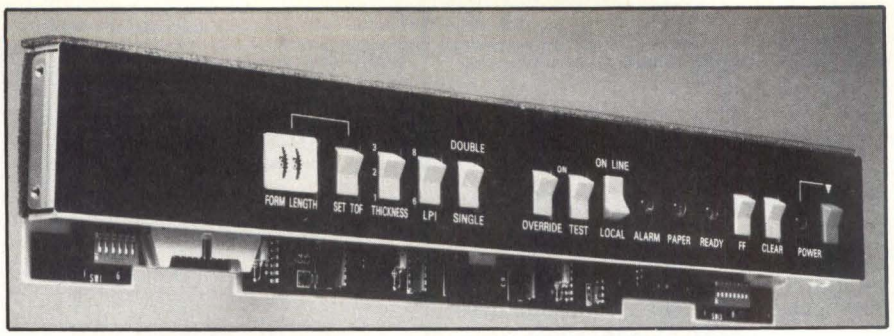

Fig. 3. An operator panel facilitates printing. *The functions keys on this front panel are (from left) thumb wheels that let a user set form length, a rocker switch to set the top of the form, a three-position switch that compensates for forms thickness and sets line spacing at 6 or 8 lines per in. and a two-position switch for single or double spacing. An override switch lets a user complete a page after it has cleared the "paper-out" condition, which ordinarily would stop the printing, and a test switch prints a pre-stored test for legibility, darkness, the straightness of the base line and horizontal and vertical registration. A selector switch lets the user control the printer locally or connect it to a computer system. Lights include an alarm indicator for malfunctions, a "paper-out" light that indicates when a printer runs out of paper and a ready light. A form-feed switch advances paper to the top of the next form, a clear switch clears alarm conditions once again, and there is a power on/off indicator and switch at the far right.*

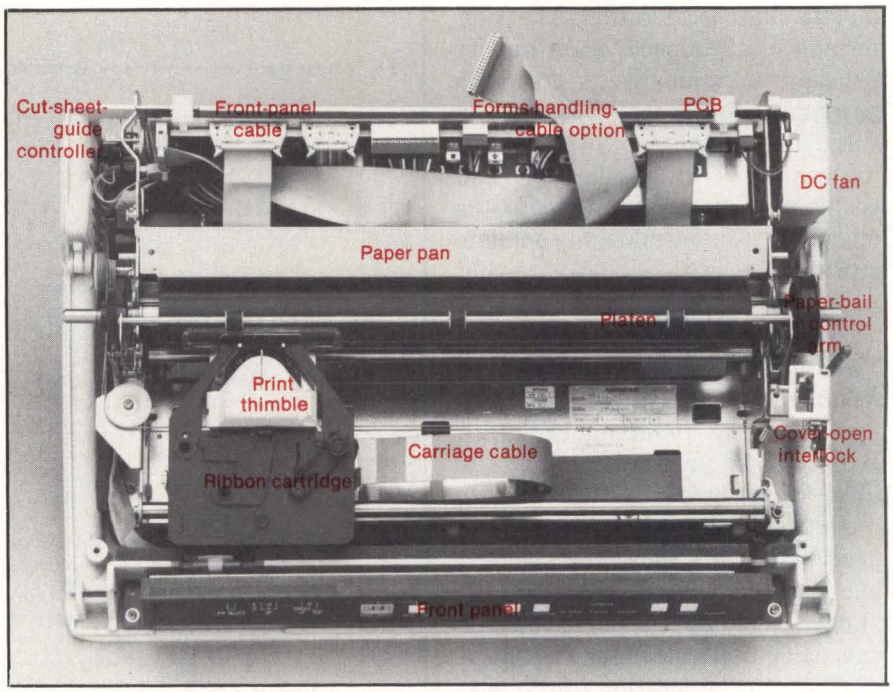

Fig. 4. Few parts occupy the inside of a letter-quality printer. *Parts-count reductions have boosted MTBF figures for leading units to more than 1 year of normal business use. Modular construction has driven MTTRs to less than 30 min.*

Reliability

Printer manufacturers have traditionally increased product reliability by reducing parts counts. When NEC replaced the model 5500 printer with the model 7700, the parts count was cut by roughly 50 percent, going from approximately 1200 parts to about 750. The result was a mean time between failure of 2500 hours (up 25 percent), the equivalent of nearly 14 months of 8-hour-per-day, 5-day-per-week operation. As a concept, the approach cannot be faulted; however, system integrators should look for a conservative design approach that lowers parts counts without straining the remaining hardware, which could actually increase failure rates.

Another strategy for increasing the reliability of a printer is careful engineering of the remaining mechanical assemblies, especially the hammer and carriage assemblies. NEC uses magnetically activated ballistic hammers in place of the more common mechanically activated clapper hammers, a change that boosted carriage assembly MTBF to 5000 hours and simultaneously decreased printer noise levels.

The same techniques that virtually eliminate preventive maintenance, such as self-lubricating bushings and self-adjusting drive systems, increase carriage assembly MTBF. Another potential trouble spot is the power supply. An efficient, lightweight switching reg-

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The longer you listen, the better it sounds.

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ulator power supply eliminates the need for bulky, heat-generating transformers and can be mounted on printed-circuit boards, eliminating nearly all mechanical wiring connections. Switchers also run at lower temperatures than other types of power supplies, and their operating voltages are selectable.

Finally, to help prevent electrically caused malfunctions, a printer should have a fully isolated bus, so there will be no damage from static-electricity discharge. Such discharge is possible in a system in which moving parts, paper and users can generate substantial static-electricity charges.

While MTBF is important, so is mean time to repair. A modular system is easier to maintain because faulty modules can be easily isolated and replaced. Leading solid-font printers are based around a few circuit boards, and most feature mechanical assemblies that can be removed and replaced using only a screwdriver. Parts commonality in printer families lets integrators stock fewer types of parts and still support their customers.

Printer manufacturers know the stresses applied to their products, and almost always implement stringent quality-control standards on components and subassemblies. A system integrator should consider the percentage of a printer's components that are manufactured by his printer supplier.

An OEM also should check to see if the printer has indicator lights that can alert users to minor problems that can be fixed easily without a service call, such as a paper jam or a depleted ribbon.

Life-cycle costs

System integrators, like end users, confuse the price of a printer with its cost. The price is simply the amount of money an OEM pays for the printer. The cost covers much more, including not only the amount a user spends for supplies and maintenance, but also the cost of down time. Providing too much maintenance service can hurt an OEM's bottom line, but selling high-margin supplies can help it.

A low-priced printer that is mismatched to the application could cost an OEM more because of the increased maintenance it requires. A lower priced system that has more down time and requires more maintenance hurts the user's bottom line and his perceptions of the system integrator. A user may judge the entire system by the availability of its letter-quality printer: if the user can't get the letter-quality output he needs, the entire system might as well be down. The danger to an OEM trying to sell such a customer additional systems or services is obvious. □

Bruce Thatcher is director of peripheral product marketing at NEC Information Systems Inc., Lexington, Mass.

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A real "time machine," it saves word processors at least a minute per page, eliminating forever the need to leave the keyboard and insert paper into the printer by hand.

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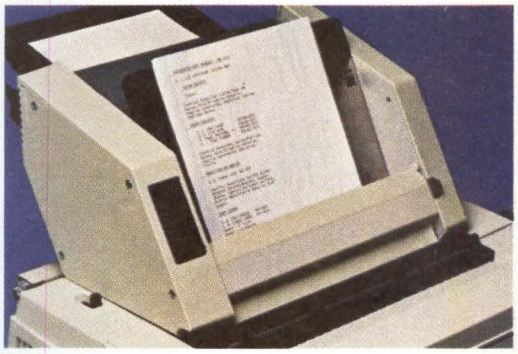
It selects the right paper size. Letterheads or bond sheets. Horizontal sheets for statistical typing. Changes margins automatically when necessary.

Its electronic sensors align sheets accurately and even signal when you're out of paper.



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Nobody offers you a wider variety of computer printers and printer experience than Facit/Dataroyal ... all the way from low cost ($695 list) matrix printers, to sophisticated graphics and color matrix printers, to models that print variable size characters and bar codes, to "daisy wheels" and a multimode near letter-quality printer. Industry standard parallel and RS232C serial interfaces are available in all printers.

Our products are built to perform day after day in the most rugged environments. We achieve that kind of reliability by incorporating modern, trouble-free LSI circuitry, and fewer moving mechanical parts along with a high level of quality control.

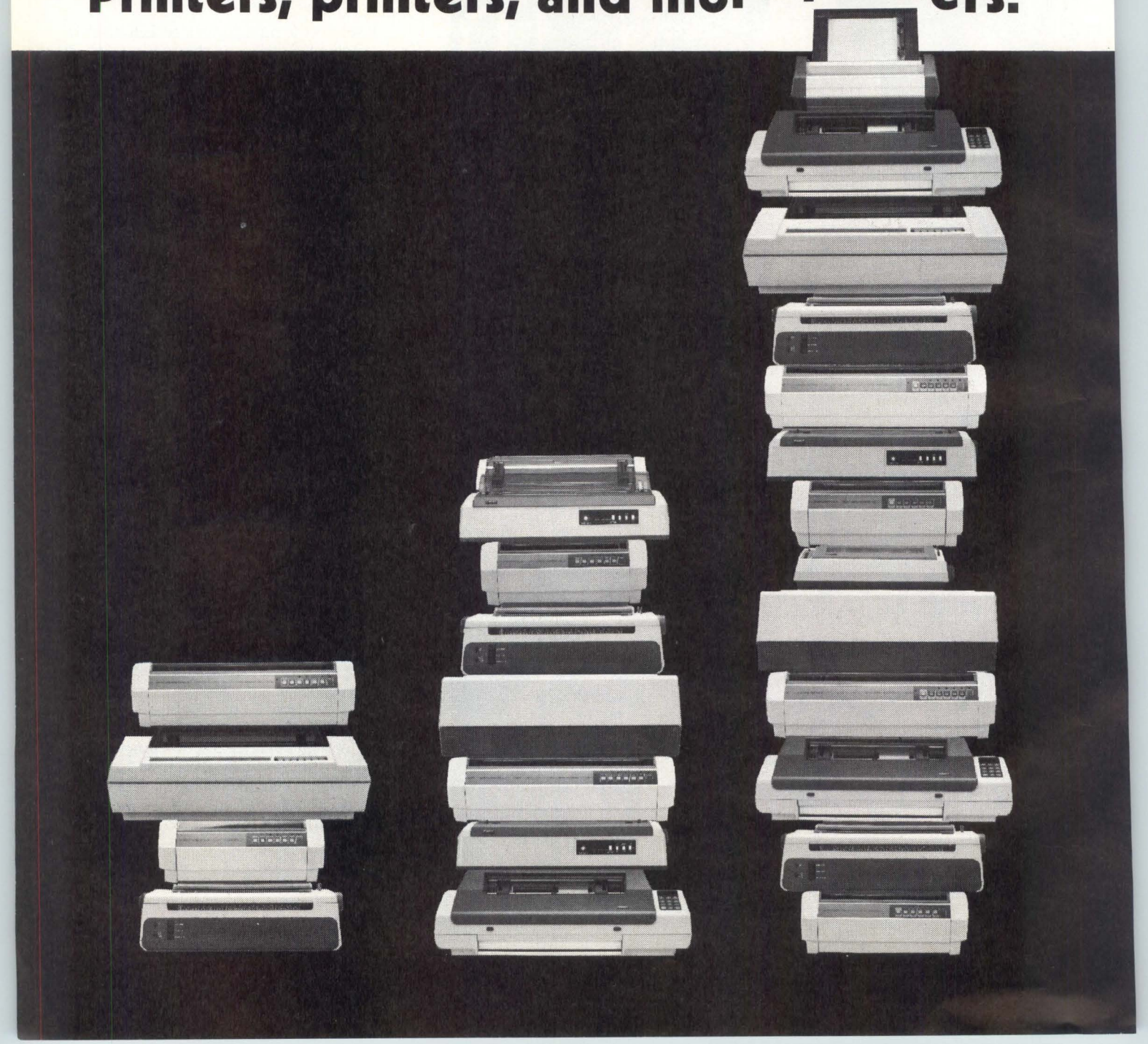
Hundreds of computer systems manufacturers choose Facit/Dataroyal products with confidence, as do a great number of Fortune 500 companies who use Facit/Dataroyal peripherals with their systems.

If you want a trouble-free printer, contact your local computer printer dealer or Facit/Dataroyal, 235 Main Dunstable Road, P.O. Box 828, Nashua, NH 03061, (603) 883-4157.

FACIT DATAROYAL

CIRCLE NO. 17 ON INQUIRY CARD

Printers, printers, and more printers.



SOLID-FONT SERIAL PRINTERS

Company Model	Printing method	Printing Speed (cps)	Chars./ line	Graphics (Y/N)	Multi-color (Y/N)	Multi-pass (Y/N)	Price ($)	Fonts
ANDERSON JACOBSON, INC.								
AJ 833	Daisywheel	45	132/158	Y	N	Y	3650	ASCII, APL, others
APPLE COMPUTER, INC.								
Daisy Wheel Printer	Daisywheel	40	198	Y	N	N	2195	Prestige Elite, bold, French, German, . . .
ATARI, INC.								
1020		12	20/80	Y	Y	N	299	International
BDS CORP.								
LQ-35	Daisywheel	35	132	Y	Y	N		
LQ-55	Daisywheel	55	132	Y	Y	N		
BURROUGHS CORP.								
AP1301	Daisywheel	35	132/198	N	N	N	4568	Pica
C. ITOH ELECTRONICS, INC.								
A10	Daisywheel	20	80	Y	N	N	995	
F10-40	Daisywheel	40	136	Y	N	N	1995	Downloadable character sets
F10-55	Daisywheel	55	136	Y	Y	N	2400	Downloadable character sets
COMPUTERS INTERNATIONAL, INC.								
Daisywriter 1500	Daisywheel	40	198	Y	N	N	760, Q100	20 fonts in 16 languages
Daisywriter 2000	Daisywheel	40	198	Y	N	N	1395	20 fonts in 16 languages
COMREX INTERNATIONAL, INC.								
CR-IC	Daisywheel	17	132/198			N	1155	
CR-IS	Daisywheel	17	132/198			N	1199	
DATA TERMINALS & COMMUNICATIONS								
DTC 380Z	Daisywheel	32	132/196		Y	N	1359	Numerous daisywheel cassettes
DATAPOINT CORP.								
9611	Daisywheel	30	132	N	N	N	3495	Courier 72
DATAPRODUCTS CORP.								
DP-35		35	132/196			N	1995	More than 150 fonts
DP-55		55	196			N	2495	More than 150 fonts
DI-AN CONTROLS, INC.								
8500/400	Drum	320	Unlimit	N	N	N	4515	OCR A
8510C	Drum	420	Unlimit	N	N	N	4200	OCR A
8510H	Drum	420	Unlimit	N	N	N	3700	OCR A
DIABLO SYSTEMS, INC.								
620	Daisywheel	25	132	Y	N	N	1595	Many printwheels
630	Daisywheel	40	132	Y	N	N	2340	Many printwheels
630 ECS	Daisywheel	40	132	Y	N	N	3000	Many printwheels
DIGITAL EQUIPMENT CORP.								
LQP02	Daisywheel	32	158	N	N	N	2800	Multiple daisywheels
FACIT/DATAROYAL								
4560	Daisywheel	22		N	N	N	1395	Uses 105–122 char. daisywheels
4565	Daisywheel	40	136	N	N	N	1895	

Company Model	Printing method	Printing Speed (cps)	Chars./ line	Graphics (Y/N)	Multi-color (Y/N)	Multi-pass (Y/N)	Price ($)	Fonts
FUJITSU AMERICA, INC.								
SP830	Daisywheel	80	132	Y	Y	N	2950	Many printwheels
HEWLETT-PACKARD								
HP2601A	Daisywheel	40	132/158	N	N	N	3950	Various 96-char. daisywheels
HP2602A	Daisywheel	25	132/158	N	N	N		Various 98-char. printwheels
IRWIN OLIVETTI, INC.								
DY 211		20	114/198	N	N		1350	20 fonts
DY 311		30	128/225	N	N		1960	20 fonts
LEADING EDGE PRODUCTS								
Printmaster F-10	Daisywheel	55		Y	Y	N		Many printwheels
Starwriter F-10	Daisywheel	40		Y	N	N		Many printwheels
NCR CORP.								
6455-2310	Daisywheel	33	132-198	Y	N	N	3075	Selection of 50 print fonts
NEC INFORMATION SYSTEMS								
2000R Spinwriter	Print thimble	20	136	Y	Y	N	1150	
3500D Spinwriter	Print thimble	35	136	Y	Y	N	1600	More than 60 print styles
3500Q Spinwriter	Print thimble	35	136	Y	Y	N	1600	More than 60 print styles
3500R Spinwriter	Print thimble	35	136	Y	Y	N	1700	More than 60 print styles
3510 Spinwriter	Print thimble	35	136	Y	Y	N	1875	More than 60 print styles
3515 Spinwriter	Print thimble	35	136	Y	Y	N	1925	More than 60 print styles
3520 Spinwriter	Print thimble	35	136	Y	Y	N	2500	More than 60 print styles
3525 Spinwriter	Print thimble	35	136	Y	Y	N	2550	More than 60 print styles
3530 Spinwriter	Print thimble	35	136	Y	Y	N	1875	More than 60 print styles
3550 Spinwriter	Print thimble	35	136	Y	Y	N	2250	More than 60 print styles
7700D Spinwriter	Print thimble	55	136	Y	Y	N	2100	More than 60 print styles
7700Q Spinwriter	Print thimble	55	136	Y	Y	N	2100	More than 60 print styles
7710 Spinwriter	Print thimble	55	136	Y	Y	N	2575	More than 60 print styles
7715 Spinwriter	Print thimble	55	136	Y	Y	N	2625	More than 60 print styles
7720 Spinwriter	Print thimble	55	136	Y	Y	N	3150	More than 60 print styles
7725 Spinwriter	Print thimble	55	136	Y	Y	N	3125	
7730 Spinwriter	Print thimble	55	136	Y	Y	N	2575	More than 60 print styles
PLESSEY PERIPHERAL SYSTEMS/DIST. PROD. DIV.								
LQ11	Print thimble	33	136	N	N	N	1920	Courier 72, European
PRIMAGES, INC.								
Image I	Daisywheel	45	135/162			N	1650, Q825	Courier 10, Versa-tile 10/12, Others
QUME CORP.								
Sprint 8	Daisywheel	35		Y	N	Y	1585	30 fonts, 25 sequences
Sprint 8	Daisywheel	50		Y	N	Y	1725	30 fonts, 25 sequences
Sprint II plus	Daisywheel	40	132-197	Y	N	Y	1680	30 fonts, 25 sequences
Sprint II plus	Daisywheel	55	132-197	Y	N	Y	1895	30 fonts, 25 sequences

XEROX

Okay. Tell me how I can replace my impact printer with the Xerox 2700 and get speedy printing, too.

Name/Title _____

Company _____

Street _____

City _____ State _____

Zip _____ Tel. ( ) _____

Mail to: Keith Davidson, Xerox Printing Systems Group, 880 Apollo Street, El Segundo, CA 90245. Or call toll-free, 1 (800) 556-1234, Ext. 95. In California, 1 (800) 441-2345, Ext. 95. MMPD 4/19/83

Okay. Tell me how I can replace my line printer with the Xerox 2700 and get letter-quality printing, too.

Name/Title _____

Company _____

Street _____

City _____ State _____

Zip _____ Tel. ( ) _____

Mail to: Keith Davidson, Xerox Printing Systems Group, 880 Apollo Street, El Segundo, CA 90245. Or call toll-free, 1 (800) 556-1234, Ext. 95. In California, 1 (800) 441-2345, Ext. 95. MMPD 4/19/83

There are two ways to look at the Xerox 2700.

The first is as a letter-quality printer. The second is as a speed printer.

That's because the Xerox 2700 distributed electronic printer actually functions as both.

But in a very creative way.

You see, it doesn't limit you to typical word processor and data processor type styles.

It lets you choose from a wide variety of font sizes, designs, styles and weights. And it lets you change them, even within a single line, if you want.

It also lets you print logos and signatures, actually format a page with headings and subheadings, and create simple forms or bar charts.

So your documents end up with a customized, print-shop look.

And the people you send them to end up getting them at a handy 12 pages per minute.

But what's nicer is, the Xerox 2700 is very small. And very quiet. So you can place it exactly where it's most convenient for the people who need it.

Terrific, you may be thinking, but what does this amazingly flexible, high-quality electronic printer cost?

Not at all what you'd expect.

To find out, just mail in one of our coupons.

Either one will bring you a very pleasant surprise.

XEROX® and 2700 are trademarks of XEROX CORPORATION.

The Xerox 2700 supports most systems that utilize Centronics 100, Dataproducts 2260 parallel interfaces and IBM bisynchronous interface protocol (2770/2780/3780).

CIRCLE NO. 18 ON INQUIRY CARD

Company Model	Printing method	Printing Speed (cps)	Chars./ line	Graphics (Y/N)	Multi-color (Y/N)	Multi-pass (Y/N)	Price ($)	Fonts
SIGMA								
Transtar 130	Daisywheel	16	132/165	Y	N	N	895	9 print styles
Transtar 140	Daisywheel	40	132/165	Y	N	N	1695	60 printwheels
SMITH CORONA								
TP-1	Daisywheel	12	126				895	Pica, Regency, Judicial, Tempo
TRANSTAR								
130	Daisywheel	16				N	895	Pica, elite
140	Daisywheel	40				N		ASCII
WANG LABORATORIES, INC.								
2281WCR	Daisywheel	30	270	N	N	N	6000	
2281WR	Daisywheel	30	198	N	N	N	4500	39 printwheels
6581W	Daisywheel	30	198	N	N	N	6000	39 printwheels
6581WC	Daisywheel	30	270	N	N	N	7000	39 printwheels
DW-20	Daisywheel	20	198	N	N	N	2695	39 printwheels
XEROX CORP.								
1730-320	Daisywheel	40					2395	
1730-340	Daisywheel	40					2995	Scientific, multilingual

It's not Magic, it's NEC.

Spinwriters™ and disk drives with supernatural reliability.

NEC peripherals are amazingly reliable. For example, our Spinwriter™ printers often run two years without a failure. Typically, our Winchesters run more than five years without a failure. One of our diskette drives has a field-proven reliability of 24,000 hours—that's an incredible 12 years in normal operation between unit failures. When the rare failure does occur, usually it can be fixed in less than 30 minutes.

So when you think peripherals, think NEC. For Spinwriter letter-quality printers, band printers and line printers. For Winchesters. For diskette drives. High performance peripherals that just keep running. It's not magic, it's NEC.

Spinwriter is a trademark of NEC Corporation.

NEC Information Systems, Inc.
5 Militia Drive, Lexington, MA 02173

☐ Have a representative call me.
☐ Send more information on NEC Peripherals.

Name

Title

Company

Address

City State Zip

Telephone

NEC
NEC Information Systems, Inc.

CIRCLE NO. 21 ON INQUIRY CARD

New WORD/SCRIBE™ Printers from Anadex:

Lasting Impressions.

Letter Quality and Finished Correspondence. High Speed Drafts. EDP Reports. Charts and Graphs. Now you can have them all in one very impressive package: Word/Scribe.

Our versatile new multi-mode printer, the Word/Scribe Model WP-6000, uses our new 18-wire print head and some exceptional engineering to produce crisp characters and razor-sharp graphics. Quality-built to meet your most exacting printing needs.

Word/Scribe gives you letter quality printing, with 10 or 12 pitch or proportional spacing, at speeds up to 150 CPS; correspondence quality up to 285 CPS; and draft/data processing up to 275 CPS.

For your graphics needs, dot-addressable graphics are provided at up to 144 x 144 dots-per-inch – impressive when you look at the photographs in this ad and realize they were reproduced using 133 line-per-inch screens.

Equally impressive are Word/Scribe's interfaces: RS-232-C Serial and Centronics compatible parallel with a sophisticated communications capability. And for word processing modes, we've added a Diablo 630* emulation package so you can save your software when you update your printers.

Friction feed, tractors, automatic sheet feeders, over 20K byte buffers, a variety of character sets (including your own, downloaded), the impressive list could go on – but unfortunately we have no more room here. For complete details contact us today....we think you'll be impressed.

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Anadex®

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A Quality Circle Member

The Impressive Word/Scribe from Anadex. Of Course.

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CIRCLE NO. 22 ON INQUIRY CARD

PRINTERS

Selecting a matrix serial printer

ART HYZER, General Electric Co.

A six-step process can help an integrator find the right unit

There are more than 500 serial printers on the market from more than 100 vendors. Too often, a buyer's decision is made on the basis of product specifications—how a supplier views his product. A buyer might make the right choice for the wrong reason. But a system integrator can make the right choice for the right reason by focusing on the user's point of view. In the eyes of the user, the printer is a means to an end. It's the output—the information in the form of a letter or financial report—that is the end product. System integrators must determine how performance benefits the delivery of output. This user focus adds logic and confidence to the buyer's role in the selection process. The six steps to the process are defining printer tasks, surveying products, comparing specifications, evaluating products, evaluating vendors and selecting a vendor.

Defining printer tasks

An OEM should start by defining the tasks to be handled by the printer in a user's application. For example, the volume of printing most influences the speed and type of printer selected. An occasional operating summary, a VisiCalc spread sheet or a bar chart from an Apple II may be well-served by a low-speed matrix printer. The same Apple II or minicomputer for more sophisticated business accounting or inventory control may benefit from a mid-range matrix or a high-speed line printer. A reasonable estimate of volume is needed to target the correct speed and duty-cycle capabilities.

Printer	A	B	C
Speed (cps)	100	100	100
Slew rate (ips)	1	3	10
Throughput (lpm)	90	108	116

Fig. 1. A throughput comparison of 100-cps printers *with different paper-advance speeds would look like this. If each printed 50-character lines at 10 characters per in., unit B would produce 20 percent more output than unit A. Unit C would produce 29 percent more output than unit A.*

Another element that affects how a printer handles its tasks is print quality. Accounting data are legible and reproducible with a low-density print matrix, while a high-density matrix satisfies word-processing and draft-quality printing requirements. Executive correspondence, legal briefs and other "image documents" may require a solid-font printer. Define print-quality requirements on what's good enough for current and anticipated applications.

You must also determine the types of paper you require. Many printers handle single-sheet paper such as letterhead in addition to roll or fan-fold paper, but this capability often adds to printer price. Letter volume should be estimated because the addition of a sheet feeder could improve printer efficiency and cut operator costs.

Some form applications require special features such as close tear-off or a document inserter not available on all printers. Multipart-forms requirements should also be identified. Form quality and construction may require a push/pull paper-handling system, a straight paper path or reduced print speeds. Never assume that your forms will work in any printer.

Task definition provides the system integrator with a specification that distinguishes user requirements from user desires. Whether you produce a formal document or writes a list on the back of an envelope, you are prepared for "solution" buying.

The product survey

A product survey is a data-gathering effort. This Peripherals Digest, Conference proceedings and product references from market research firms are good places to begin comparing printers. Keeping

task definitions in mind, the system integrator should use the comparison tables in these publications to assemble a list of printers and to get further information on those he may buy. Advertising and feature articles in trade publications provide detailed product information. Attending consumer- and industry-oriented equipment expositions yields much product data, and a round of telephone calls usually buries the caller in data sheets.

With appropriate product data on hand, the integrator can begin a detailed specification comparison. The specification comparison lets him weed out products that don't meet his application requirements. Its objective is to end up with half a dozen or fewer products most qualified to meet your requirements.

It is useful to develop a specification matrix of the contenders so you can easily see how their specifications match yours. Most data sheets do not provide all the performance, features and options information needed for the final comparison, but this is the time to contact supplier salespeople to help you fill in the matrix and to demonstrate the printers. Data collection for a detailed specification comparison takes a few weeks, but the specification matrix can be done in a day or two. Qualifying choices in this way reduces the time and expense of the next step.

Product evaluation

The detailed specification comparison should leave you with the two or three printers that best meet your needs on paper. Product evaluation answers the questions of real-life operation. Does it work? Does it perform consistently? Is it easy to use? Does it accommodate the defined variety of tasks? An evaluation should prove the integrity of the product in an application. Actual use highlights differences between products that look the same on paper and helps compare units with dissimilar specs. For example, serial matrix printer speed is rated in characters per second, but throughput, the completion of a printing task, can be rated in lines per minute, pages per minute or documents per hour.

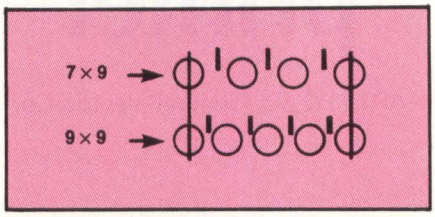


Fig. 2. Horizontal printer resolution *is often a matter of specifications. The circles above represent full dot positions, while the vertical marks indicate reserved dot positions. The reserved dot positions are used for diagonal fill and can be used as long as the same wire is not fired twice in succession.*

Throughput takes more into account than just print speed (Fig. 1). A printer's throughput depends on the format of the user's printed page and several secondary printer capabilities. Bidirectional printers print in both directions of carriage motion to enhance throughput. A logic-seeking printer moves the print head the shortest distance to the first character on the next line for better throughput. Line-feed time and paper-slew rate vary independently and together among printers. If a format has several blank lines between groups of data, as in an order form or an invoice, and a printer is equipped with vertical tabbing, then a faster slew rate produces a dramatic increase in throughput.

Two other features enhance printer throughput. Tabulated formats such as financial spread sheets can be produced faster by a printer with horizontal tabs and a two-speed carriage drive. With a high tab, or "blank-space skip-over," rate, the unit prints at 100 cps but tabs at 250 cps or more. This and other throughput-boosting features reduce actual printing time, enhancing printer work-load capacity and reliability. In turn, the performance of the host system is increased because the CPU spends less time waiting for the printer.

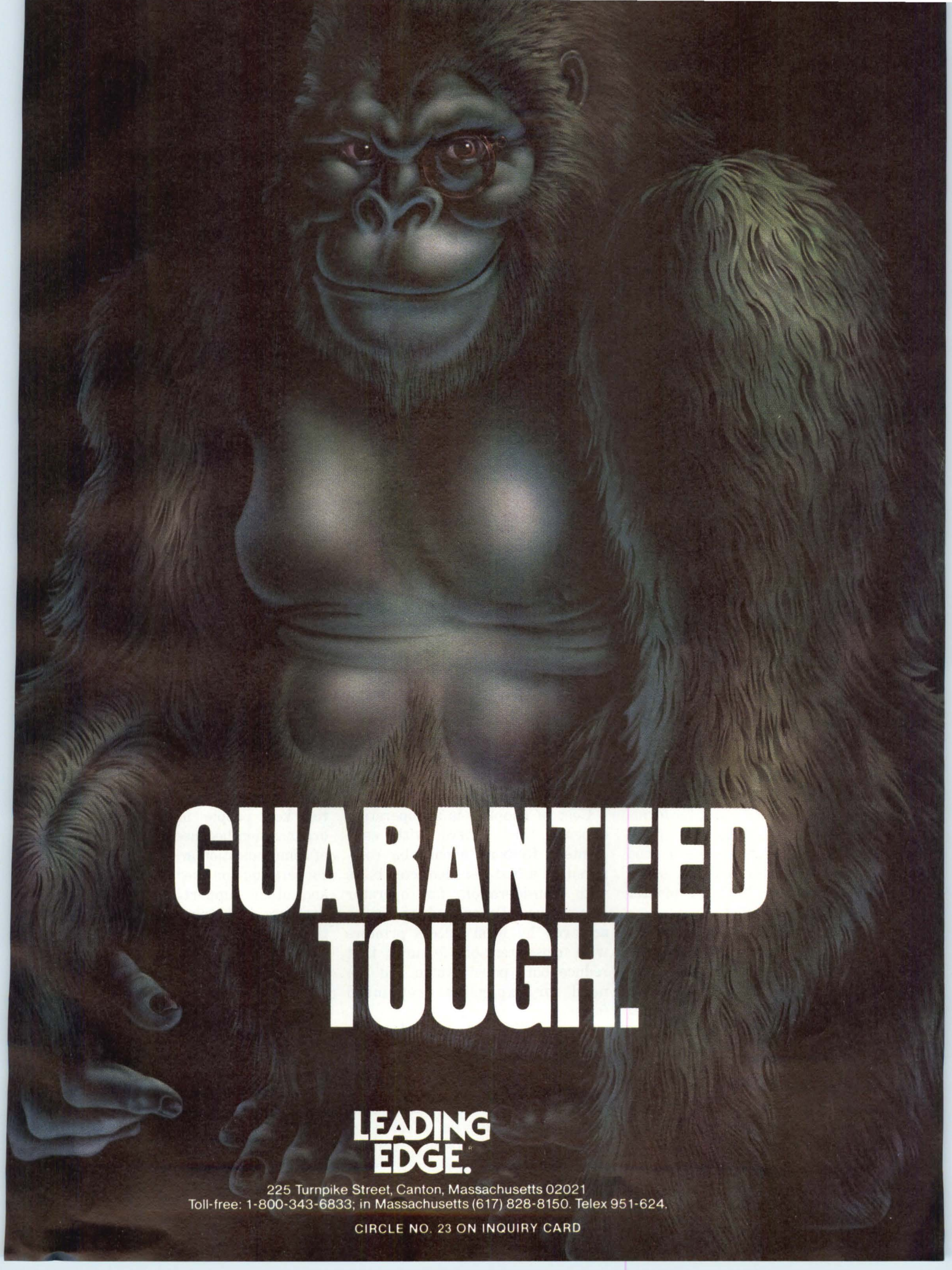
Speed is also a trade-off buyers must make in favor of print quality. But matrix printers now offer a solution for multifunctional desk-top and other small systems.

Print quality is a complex, subjective topic cluttered with buzzwords. Datek of New England provides a 3-day seminar on print quality. The basics of matrix-printer resolution are easy to understand if the buyer remembers that all manufacturers are bound by the laws of physics. Character resolution is determined by dot density and accuracy of dot positioning.

Data sheets list data or draft fonts as 7- × 9- or 9- × 9-dot. The first number is usually horizontal resolution, and the second is vertical resolution. Horizontal print density is not equal to resolution (Fig. 2). Multimode printers vary the horizontal resolution of characters to produce fast data-mode output or slower near-letter-quality output. Data-mode characters are produced at a printer's maximum print rate with a horizontal density of 4 of 7 or 5 of 9. Some manufacturers even use 4 of 11. Vertical density is equal to resolution since it is equal to the number of print wires in a print head. A 9 × 9 font therefore produces a higher quality character.

Character-formation speed is related to wire dynamics. The range of wire speeds is 500 to 2700 dots per sec. per wire. A 1400-dps matrix print head produces 9 × 9 characters at 200 cps. The same head produces 7 × 9 characters at about 230 cps. Near-letter-quality fonts are printed even slower. Data sheets show near-letter-quality fonts as 9 × 18, 24 × 9, 40 × 18 or other variations. The vertical density usually equals the resolution. The density is achieved either by print-wire geometry or by very precise paper positioning (Fig. 3).

The relationship between horizontal density and resolution in near-letter-quality fonts is not obvious and is often misleading. The horizontal density is achieved by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CIRCLE NO. 23 ON INQUIRY CARD

slowing the carriage to one-half or one-third of data-mode speed so that 2 or 3 times the data-mode density can be printed. Density is proportional to speed reduction.

Despite these figures, there is a noticeable difference among near-letter-quality printers. A font specified greater than 12 × 18 doesn't print more than 12 dots, but it resolves dot positions useful in font styling. Near-letter-quality printing is generally much more demanding of print-head and carriage-drive system tolerances. An evaluation shows whether a printer has the mechanical precision and durability to deliver near-letter-quality characters reliably.

Product evaluation must also include paper handling. An integrator should try a box of each type of paper or form used in his application. Paper quality and construction vary widely. Some forms have a heavy glue application, a cardboard insert or stiff folds causing line-spacing misregistration and feed-reliability problems. Printers with a straight paper path can help solve forms-related problems such as copy registration on multipart forms. Regardless of printer design, a buyer should check for forms problems as early as the initial printer demonstration. It's a good idea for the buyer to work out a combination with both the printer and the forms supplier.

The buyer should also check the last copy of multi-part forms for legibility. Today's high-performance print heads are more sensitive to variations in form thickness. If there is a problem, he should select a slower printer with greater impact force. If he must make this compromise, he should look for a printer with the throughput features mentioned earlier to retain most of the work-load capacity.

The most important part of a matrix printer evaluation probably is calculating cost of ownership,

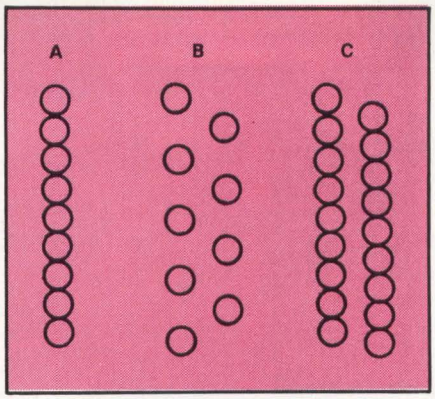


Fig. 3. Typical print-head geometries. *A total of 18 vertical dots are printed with a nine-wire head (A) by moving the paper one-half position. It requires a very precise paper-handling system. The paper-motion challenge is overcome (B) by interlacing dots in one print-head pass. The font might be described as 24 × 9, but it may sacrifice character height or true descenders. The best of both worlds (C) is more expensive. Some printers mechanically tilt the head or alter the nozzle geometry to avoid paper motion.*

which is the combined cost of purchase price, maintenance and supplies over the life of the printer. A printer's OEM and end-user purchase prices may be very attractive, but maintenance and supplies can devour the price savings in 12 to 24 months. Over the life of a printer, a $10 difference in monthly maintenance costs can offset a big difference in purchase price. Because most users keep a serial printer more than 5 years, the expected return on investment can be drastically reduced.

Cost of supplies is an operating expense that differs with each printer. Ribbons should be compared on a cost-per-character basis with consideration for operator convenience. Paper savings can be achieved by forms-access printers with close tear-off features that reduce both paper waste and the need for expensive preprinted forms.

More significant differences in cost of ownership are usually in maintenance costs. The number of service calls a printer requires is a function of reliability and duty cycle. It can also be affected by environment and operator competence. If all printers were designed for 100-percent duty cycles in any application, they would all weigh 100 lbs. or more. Mean-time-between-failure figures make assumptions about a printer's application. Valid cost-of-ownership calculations match a printer to its intended application. The buyer should get all prospective suppliers to discuss similar duty cycles before calculating costs. Suppliers can provide service data as well as parts usage and cost. First-year costs also vary with warranty lengths and limitations.

Vendor appraisal and selection

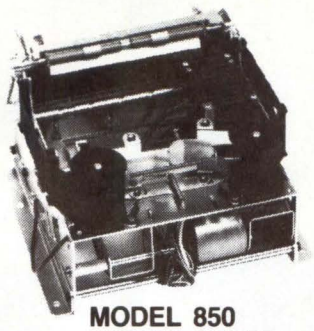
The last two steps in printer selection are vendor appraisal and selection. A vendor should add confidence to a purchase. The vendor can even offer creative solutions to application problems and should be appraised based on: stability, factory capability, quality controls, service and support and personality. These appraisal factors build confidence. Most apply to an OEM/manufacturer relationship, and depth varies with purchase volume. The last two factors apply to any level of buy/sell interest, and the last one is of special importance to OEMs. Every business has its own personality, a composite of its employees and their style of doing business. In selecting a vendor, the buyer should look for traits that match his style of doing business.

The buyer should be introduced to the key people in the vendor's organization because open channels of communication are needed to get cooperation on service, ordering and other support. The vendor's response in helping solve application needs is a good measure of the vendor's interest. The fit between the buyer's requirements and a vendor's normal product line is also important. If an application needs unique printer features, then a vendor with extra flexibility is needed. Not all products, organizations or manufacturing processes are structured to provide customized solutions. □

Art Hyzer is manager of product planning at General Electric Co., Waynesboro, Va.

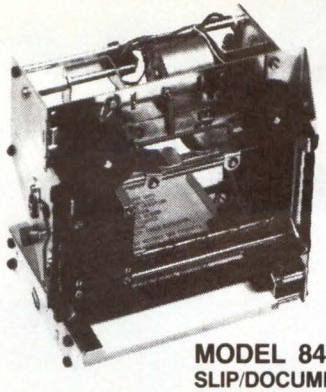
WESTREX
DOT MATRIX PRINTERS

800 SERIES



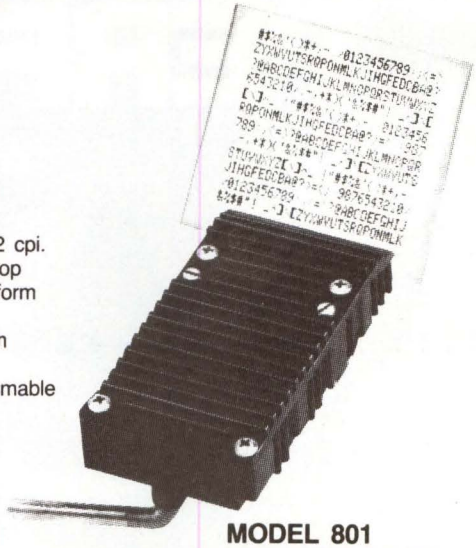
MODEL 850
JOURNAL PRINTER

- 51 columns at 12 cpi.
- Rewind
- Tear-off available
- Adjustable paper width
- Paper low sensor and more



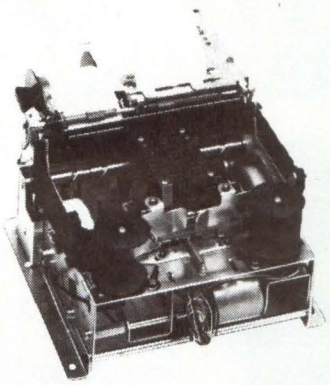
MODEL 840
SLIP/DOCUMENT PRINTER

- 40 columns at 12 cpi.
- Adjustable slip stop
- Top and bottom form sensors
- Side or front form insertion
- Optional programmable paper feed



MODEL 801
LOW PROFILE, LOW WEIGHT, PRINT HEAD

- 7 needle vertical array
- Low power consumption
- 100% duty cycle
- 100 million character life

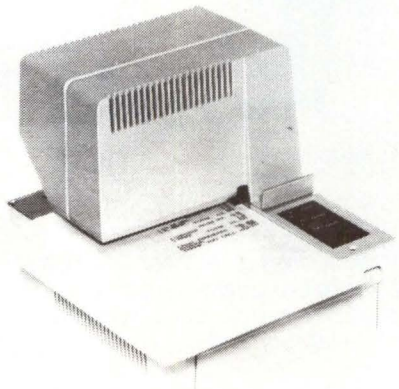


MODEL 820
SPLIT PLATEN PRINTER

- Two independently controlled print stations
- Up to 46 character print line
- Receipt tear off
- Journal rewind
- Up to 5 lines per second receipt printing

WESTREX
DOT MATRIX PRINTERS

8000 SERIES



MODELS 8400/8410

NEW!
STAND-ALONE, 150 CPS SLIP/DOCUMENT PRINTERS

Model 8400 and Model 8410 are new, packaged, stand-alone, alphanumeric, bi- directional, flat bed, Slip/Document dot matrix printers. They print up to 40 columns at 12 characters per inch at 3 lines per second. Both models provide side or front form insertion; top and bottom-of-form sensors and adjustable Slip/Document Stop. The print head employs a 7-needle vertical array that permits selection of fonts and characters (5×7, double width, etc). The character set is fully alphanumeric under software control. The 100% duty cycle print head life is rated at 100 million characters.

Model 8400 and Model 8410 are complete with control and drive electronics. Serial, RS-232C or TTY and parallel interfaces are available. Both units can provide multiple print lines and carbon or pressure sensitive copy.

Model 8410 additionally features a stepping motor paper drive system which permits variable and programmable forward/reverse line spacing for applications requiring line selection and/or unique form indexing.

AT THE NCC - BOOTH N3726

Litton

For full details, write or call us

WESTREX OEM PRODUCTS

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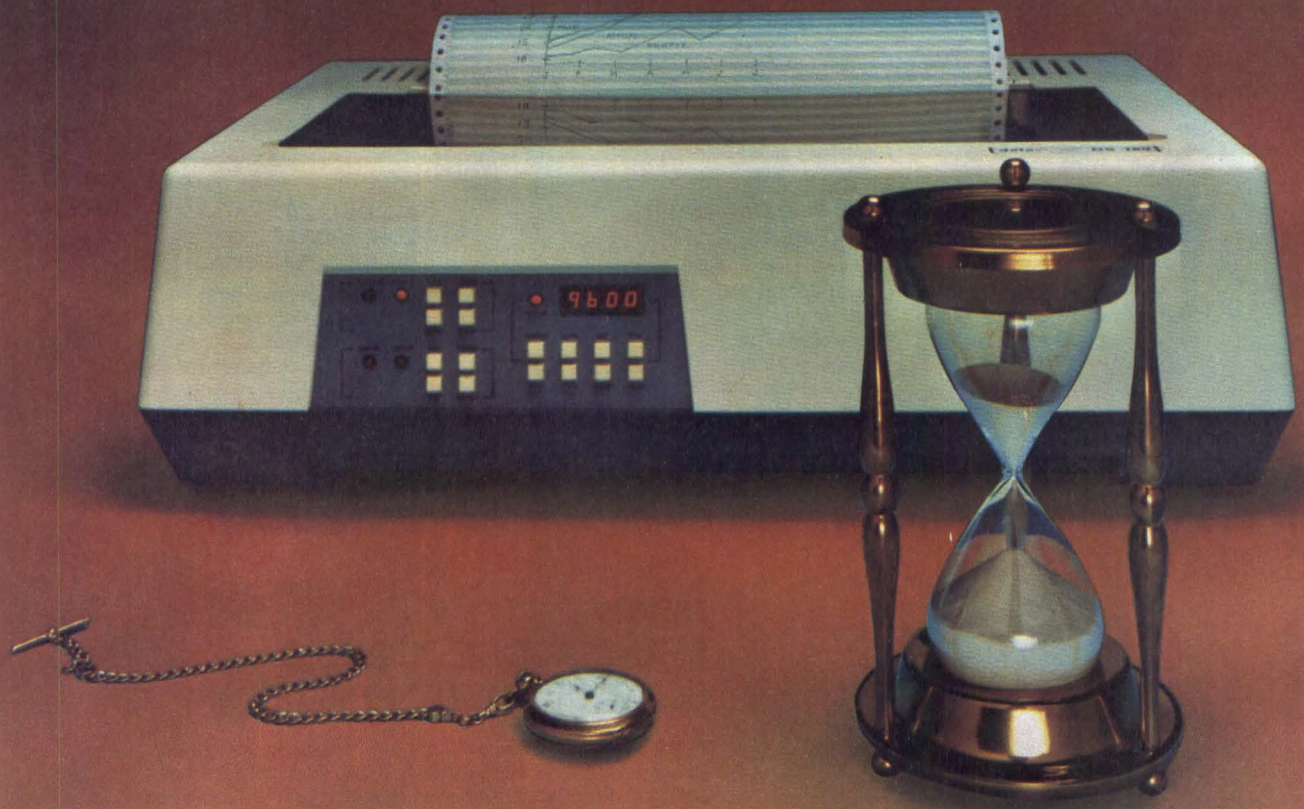
IN FRANCE — WESTREX OEM PRODUCTS, 103-105 Rue de Tocqueville, 750 Paris, France 01-766-32-70 TELEX: 610148
IN SWEDEN — WESTREX OEM PRODUCTS, Box 3503, S-17203 Sundbyberg, Sweden 46/8 + 981100 TELEX: 12139

CIRCLE NO. 24 ON INQUIRY CARD

TIME-PROVEN PERFORMANCE



While new printers with impressive specifications are introduced on an almost daily basis, only time will tell the true quality of the product. Over the past 2 years our customers have continued to buy the DS180 printer, not only because of its impressive performance and competitive price, but also because of our outstanding track record for product reliability and customer support.

We have continually improved on the performance of the DS180 by incorporating such enhancements as dot addressable graphics, 6 user-selectable print sizes and a 2000 character buffer. These features coupled with 180 cps printing, parallel and serial interfaces, adjustable tractor feed and over 40 other programmable features, make the DS180 one of the most versatile matrix printers available today.

Before you select your next printer, why not take a look at a time-proven performer—the Datasouth DS180.

The DS180 printer is available nationwide through our network of sales/service distributors.

datasouth computer corporation

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Telex: 6843018 DASOU UW CIRCLE NO. 25 ON INQUIRY CARD

MATRIX SERIAL PRINTERS

Company Model	Printing method	Printing speed (cps)	Chars./ line	Graphics (Y/N)	Multi-color (Y/N)	Multi-pass (Y/N)	Unit price ($)	Specify fonts
ADDMASTER CORP.								
171	7 x 5 impact	50	18/21	N	N	N	299	ASCII, Baudot
ALPHACOM, INC.								
Alphacom 42	thermal	80	40	Y	N		200	ASCII
AMPEREX ELECTRONIC CORP.								
GP150	9 x 9 impact	150	120	Y	Y	Y	2340	bar codes, Courier, Gothic, OCR
GP300	9 x 9 impact	300	120	Y	Y	Y	2825	bar codes, Courier, Gothic, OCR
GP300L	9 x 9 impact	300	144	Y	Y	Y	2985	bar codes, Courier, Gothic, OCR, Orator
ANACOM GENERAL CORP.								
150	9 x 9 impact	150	80/136	N	N	N	1495	5, 10 cpi
150Z	9 x 12 impact	150	85/132	Y	N	Y	1895	ASCII, graphics, italics
160	9 x 9 impact	150	80/136	N	N	N	1750	5, 10 cpi
160Z	9 x 12 impact	150	85/132	Y	N	Y	2150	ASCII, graphics, italics
ANADEX, INC.								
DP-9000A	9 x 9 impact	200	80/160	Y	N	N	1625	10, 12, 13.3 cpi
DP-9001A	11 x 9 impact	200	80/133	Y	N	N	1625	10, 12.5, 15, 16.7 cpi
DP-9500A	9 x 9 impact	200	132/176		Y	N	1725	10, 12, 13.3 cpi
DP-9501A	11 x 9 impact	200	132/220	Y	N	N	1725	10, 12.5, 15, 16.7 cpi
DP-9620A	7/13 x 9 impact	200	132/220	Y	N	N	1845	10, 12, 16.7 cpi
DP-9625A	18 x N impact	200	132/220	Y	N	Y	1995	10, 12, 16.7 cpi
WP-6000	18 x N impact	330	132/220	Y	N	N	3250	10, 12 pitch Serifa, Helvetica, scientific
ANDERSON JACOBSON, INC.								
AJ 650	7 x 9 ink jet	210	80/132	Y	N	Y	3400	ASCII, ANSI graphics, APL
AJ 864	5 x 9 impact	180	132–225	Y	N	Y	2995	ASCII, APL, graphics
APPLE COMPUTER, INC.								
Dot Matrix	7 impact	120	136	Y	Y	N	695	unlimited character sets
ATARI, INC.								
1025	7 x 7 impact	40	40/132	N	N	N	549	international
AXIOM CORP.								
EX-1601	8 x 5 electrosensitive	240	80	N	N	N	699	96 ASCII, 64 special chars.
EX-1620	20 x 11 electrosensitive	960	80	Y	N	N	899	96 ASCII, 64 special chars.
EX-401	8 x 5 electrosensitive	196	40/64	N	N	N	549	96 ASCII
EX-420	20 x 11 electrosensitive	480	40	Y	N	N	749	96 ASCII, 64 special chars.
IMP-4	9 x 7 impact	100	80/132	Y	N	Y	749	96 ASCII, 64 special chars.
BDS CORP.								
GP-300	18 x 50 impact	300	220	Y	Y	Y		various including bar code, OCR
AP1340	9 x 7 impact	230	132/220	N	N	N	3590	international
AP310	9 x 7 impact	90	82/132	N	N	N	1895	international
B9252	9 x 7 impact	150	132/220	N	N	N	1995	international
B9253	9 x 7 impact	120	66/132	Y	N	N	895	international
C. ITOH ELECTRONICS, INC.								
1550	9 x 7 impact	120	80	Y	N	N	995	ASCII 96, JIS 160, CG graphics 64, others

Company Model	Printing method	Printing speed (cps)	Chars./ line	Graphics (Y/N)	Multi-color (Y/N)	Multi-pass (Y/N)	Unit price ($)	Specify fonts
8510A	9 x 9 impact	120	80	Y	N	N	795	ASCII, Swedish, UK, Japanese, graphics
8600	7 x 9 impact	180	80	Y	Y	N	1500	ASCII, katakana, Greek, special, graphic
CANON USA, INC.								
PW-1080	9 x 9 impact	120	40/136	Y	N	Y	295, Q 1000	international
CENTRONICS DATA COMPUTER CORP.								
351	7 x 9 impact	200		Y	N	Y	2195	7 international char. sets
352	7 x 8 impact	200		Y	N	N	1795	7 international char. sets
353	7 x 8 impact	200		Y	N	Y	2495	
122	11 x 8 impact	120	132	Y	N	N		
150	9 x 7 impact	150	40/132	N	N	N		ASCII
152	9 x 7 impact	150	66/216	N	N	N		ASCII
159	9 x 7 impact	150	40/132	N	N	N		ASCII
COMPRINT								
9125	12 x 9 electrostatic	225	80	N	N	N	495	96 ASCII
912GP	12 x 9 electrostatic	225	80	N	N	N	495	96 ASCII
912P	12 x 9 electrostatic	225	80	N	N	N	495	96 ASCII
COMPUTER TRANSCEIVER SYSTEMS, INC.								
420 RO	7 x 5 impact	80	140	Y	N	N	795	14 print sizes
P 200	7 x 5 thermal	120	136	Y	N	N		custom fonts
COOSOL, INC.								
103B	impact	200	136	Y	Y	Y	3500	programmable
DATA GENERAL CORP.								
4350 Series	7 x 7 impact	340	132	N	N	N	6450	ASCII, international
4422	9 x 9 impact	150	136	N	N	N	2290	ASCII
6193	7 x 9 impact	180	132, 220	N	N	N	4050	ASCII, international
DATA IMPACT PRINTERS								
84G	7 x 7 impact	100	132	Y	N	Y	795	10, 12, 16.5, 5, 6, 8.25 cpi
DIP 81	7 x 7 impact	100		N	N	Y	449	10, 5 cpi
DIP 81A	7 x 7 impact	100		N	N	Y	499	10, 12, 16.5, 5, 6, 8.5 cpi
DIP 92	7 x 9 impact	100		Y	N	Y	695	10, 12, 16.5, 5, 6, 8.25 cpi
DATA IMPACT PRODUCTS INC.								
D-92	7/11 x 9 impact	100	40/132		N	Y	399	ASCII
DATA MACHINES INTERNATIONAL								
DMI40	5 x 7 impact	80	40	Y	N	Y	250	
DATAPOINT CORP.								
9621	9 x 9 impact						2500	64-, 96-char. sets, upper case only
9627	9 x 9 impact						895	
DATAPRODUCTS CORP.								
M-100	9 x 14 impact						2950	programmable
M-120	7 x 7 impact						2650	wide selection
M-200	7 x 7 impact						2950	wide selection

What's unique about the GE 3000 printer family is its commonality.

"They're all the same only different." That's the simple advantage of General Electric's new GE 3000 series of printers...single design simplicity without the application limitations of a single model product line.

Our basic concept is application driven price/performance matching. Choose speeds from 40 to over 400 cps. Single or dual mode printing. Type quality from EDP to NLQ. Multi-color printing. Graphics. 80 and 136 column models. Selectable type fonts. Accessible, easily programmable set-up by either the operator or the system. Multi-model flexibility...all with high parts commonality.

Now, you can stock just one line of printers, yet meet a diversity of needs. Enjoy every advantage of single source supply. With each printer backed by General Electric's worldwide service.

Take a close look at any of the GE 3000 printers. You'll find they're easy to use, lightweight, functionally styled, reliable tabletop matrix printers. And when you take the entire GE 3000 series altogether, they stack up beautifully compared to everything else on the market today.

General Electric. We introduced the first fully electronic printer with LSI circuitry in 1969. And our complete line today makes us the industry leader you should look to first.

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For the solution to your printing needs, call
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GENERAL ELECTRIC

CIRCLE NO. 26 ON INQUIRY CARD

NOW, A TASK FORCE OF ONE THAT BRINGS REVOLUTIONARY NEW SKILLS TO DOT MATRIX PRINTING.

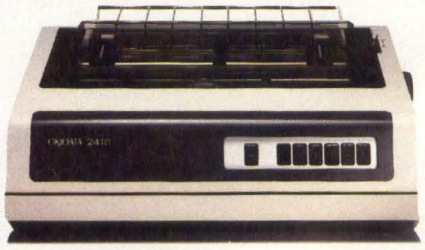
Outmaneuvers Lines and Daisies at 350 cps. Okidata's new multifunction Pacemark 2410 is strategically designed to give business systems three printers in one remarkable machine. At 350 cps, it moves out data at line speeds of up to 420 lpm. At 85 cps, it produces correspondence quality three times faster than most of its daisywheel rivals. And at 175 cps, it takes charge of draft quality data needs with extra-dense characters.

But that's just the opening salvo. This high powered dot matrix printer comes with an arsenal of additional skills and features. Two-color printing. Dot addressable graphics. An ASCII 96-character set, plus resident and alternate 96-character downline loadable sets. And a range of column capabilities from 136 to 233.

Tough As Nails. Recruit a 2410 for your system and let it run. This machine is not going to suffer from battle fatigue. Or duty cycle limitations. It's armed with our long-life, stored-energy print head with 9 tungsten pins that crank out up to 500,000,000 characters with ruthless precision. Add laser welded, precision controlled construction and a rugged, stamped steel frame, and you've got a machine that's virtually invincible. Inside and out.

Compatibility Plus. The 2410 is compatible with the front lines names in high performance desktops and small business computers, as well as most low-end minis. And it's available with either an industry compatible parallel or three different serial interfaces, including RS 232C. Others will soon be available.

Mean Machine. Nice Price. You'd expect a machine this capable and this tough to cost an arm and a leg. It doesn't. Suggested retail is $2995; $2695 for its data-processing-only partner, the Pacemark 2350. For more information about Okidata's mean new Pacemark business machines, call 1-800-OKIDATA. In New Jersey, (609) 235-2600.



OKIDATA

Mt. Laurel, New Jersey 08054.

A subsidiary of Oki Electric Industry Company, Ltd.

CIRCLE NO. 27 ON INQUIRY CARD

Company Model	Printing method	Printing speed (cps)	Chars./ line	Graphics (Y/N)	Multi-color (Y/N)	Multi-pass (Y/N)	Unit price ($)	Specify fonts
DATASOUTH COMPUTER CORP.								
DS180	9 x 7 impact						1595	ASCII, APL, 7 international
DS220	9 x 7 impact						1995	ASCII, APL, 7 int'l, Courier, Helvetica
DATEL-INTERSIL								
APP-20A1	5 x 7 thermal	21	20	N	N	N	625	ASCII
APP-20A21	5 x 7 thermal	21	20	N	N	N	725	
APP-20A3	5 x 7 thermal	21	20	N	N	N	795	
APP-48A1	5 x 7 thermal	57	48	N	N	N	995	96 ASCII
APP-48A2	5 x 7 thermal	57	48	N	N	N	1095	
APP-48A3	5 x 7 thermal	57	48	N	N	N	1095	96 ASCII
DECISION DATA COMPUTER CORP.								
6541-02	7 x 5 impact	150	132	N	N	N	4195	96 characters standard, foreign optional
6541-05	9 x 5 impact	150	132	N	N	N	5314	96 characters standard, foreign optional
6541-07	9 x 5 impact	150	132	N	N	N	4463	96 characters standard, foreign optional
DIGITAL EQUIPMENT CORP.								
LA12	9 x 9 impact	150	132	Y	N	N	1995	
LA120	7 x 7 impact	180	216	N	N	N	2750	
LA34/38	9 x 7 impact	30	216	Y	N	N	1270	
LA50	7 x 9 impact	100	132	Y	N	N	850	
LETTERPRINTER 100	9 x 9 impact	240	216	Y	N	Y	2860	Courier and Orator standard, foreign
DIGITEC CORPORATION								
6430	7 x 5 electrostatic	64	21/32	N	N	N	399	standard, bold
6431	7 x 5 electrostatic	64	21/32	N	N	N	549	standard, bold
6432	7 x 5 electrostatic	64	21/32	N	N	N	549	standard, bold
6433	7 x 5 electrostatic	64	21/32	N	N	N	430	standard, bold
6434	7 x 5 electrostatic	64	21/32	N	N	N	430	standard, bold
6470	7 x 5 thermal	42	21	N	N	N	445	standard, bold
6471	7 x 5 thermal	42	21				595	standard, bold
6472	7 x 5 thermal	42	21				595	standard, bold
6473	7 x 5 thermal	42	21				595	standard, bold
6474	7 x 5 thermal	42	21				475	standard, bold
6510	7 x 5 electrostatic	64	21/32				455	standard, bold
6520	7 x 5 electrostatic	64	21/32				455	standard, bold
6550	7 x 5 thermal	42	21	N	N	N	595	standard, bold
6560	7 x 5 thermal	42	21	N	N	N	525	standard, bold
EATON CORP./PRINTER PRODUCTS DIV.								
7000+	7 x 7 impact	50	40	N	N	N	425	
ENVISION								
420	36 x 18 impact	300	248	Y	Y	Y	3950	pica, elite, Orator, script, italics, bold
430	36 x 18 impact	300	248	Y	Y	Y	4950	pica, elite, Orator, script, italics, bold
EPSON AMERICA INC.								
FX-80	9 x 9 impact	160	40/132	Y	N			
MX 80 F/T	9 x 9 impact	80	40/132	Y	N		525	

Company Model	Printing method	Printing speed (cps)	Chars./ line	Graphics (Y/N)	Multi-color (Y/N)	Multi-pass (Y/N)	Unit price ($)	Specify fonts
MX-100	9 x 9 impact	80	68/233	Y	N		749	
MX-80	9 x 9 impact	80	40/132	Y	N		494	
EXTEL CORPORATION								
A Series	5 x 7 impact	30	80	N	N	N	1310	128 ASCII, Baudot
FACIT/DATAROYAL								
4510	9 x 15 impact	100	40/80	Y	N	N	695	multiple, 8 foreign
4542	9 x 9 impact	250	150	Y	Y	N	4125	proportional
4544	9 x 9 impact	250	150	Y	Y	N		
4570	9 x 9 impact	250			N	Y	3995	8 selectable fonts
IPS 5000	9 x 9 impact	125	80/136	N	N	N	1110	96 ASCII
IPS 5000A	9 x 9 impact	150	80/136	N	N	N	1160	96 ASCII
IPS 5000C	9 x 9 impact	165	80/136	Y	N	N	1595	7 selectable fonts
IPS 5000V	9 x 9 impact	165	80/136	Y	N	Y	2095	bar codes, selectable fonts
FLORIDA DATA CORP.								
OSP 120	impact	600	237	Y	N	Y	3900	
OSP 125	impact	600	237	N	N	Y	4300	
OSP 130	impact	600	237	Y	N	Y	4100	
GENERAL ELECTRIC CO.								
GE 200 KSR	7 x 9 impact	200	136	N	Y	N	2350	ASCII, international
GE 200 Printer	7 x 9 impact	200	136	N	N	N	2465	ASCII, international
GE 200 RO	7 x 9 impact	200	136	N	Y	N	2160	ASCII, international
GE 200 Split Platen	7 x 9 impact	200	35/75	N		N	3895	ASCII, international
GE 2030 KSR	9 x 7 impact	60	132	Y	N	N	1250	ASCII, international
GE 2030 RO	9 x 7 impact	60	132	Y	N	N	1175	ASCII, international
GE 2120 KSR	9 x 7 impact	150	132	Y	N	N	2195	ASCII, international
GE 2120 RO	9 x 7 impact	150	132	Y	N	N	2120	ASCII, international
GE 3010	9 x 9 impact	160	136	Y	N	N	1300	96 ASCII, 64 graphics chars.
GE 3014	9 x 9/18 impact	160	136	Y	Y	Y	1550	96 ASCII, 64 graphics chars.
GE 3180	9 x 9 impact	300	136	Y	N	N	1990	16 foreign, condensed, expanded, programmable
GE 3181	9 x 9 impact	300	80	Y	N	N	1930	16 foreign, condensed, expanded, programmable
GE 3184	9 x 9/18 impact	300	136	Y	Y	Y	2360	16 foreign, condensed, expanded, programmable
GE 3185	9 x 9/18 impact	300	80	Y	N	Y	2300	16 foreign, condensed, expanded, programmable
GE 3204	9 x 9/18 impact	334	136	Y	Y	Y	2610	16 foreign, condensed, expanded, programmable
GE 3240	9 x 9 impact	400	136	Y	N	N	2340	16 foreign, condensed, expanded, programmable
GE 3244	9 x 9/18 impact	400	136	Y	Y	Y	2840	16 foreign, condensed, expanded, programmable
GE 3300	9 x 9 impact	334	136	Y	N	N	2275	16 foreign, condensed, expanded, programmable
GE 3304	9 x 9/18 impact	334	136	Y	Y	Y	2675	16 foreign, condensed, expanded, programmable
GE 3400	9 x 9 impact	520	136	Y	N	N	2630	16 foreign, condensed, expanded, programmable

LASER PRINTING.

IT'S YOURS FOR AS LITTLE AS $17,500.

On the right you're looking at sample output from our IMPRINT-10™.

If you're considering a local laser printer, we can deliver, at an unmatched price and performance level.

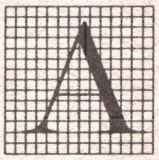
Practical Applications

The IMPRINT-10 provides line printer speed, daisy wheel quality, plotter graphics capability and typesetter font flexibility.

In the office, it's producing reports and internal documents at higher speeds and with substantially less noise than other printing devices. In data processing, it's delivering higher quality output than line printers in convenient 8½" x 11" page size. IMPRINT-10's allow graphic plotter users to merge high quality graphics with high quality text. Graphic arts applications include proofing for typesetting and demand publishing.

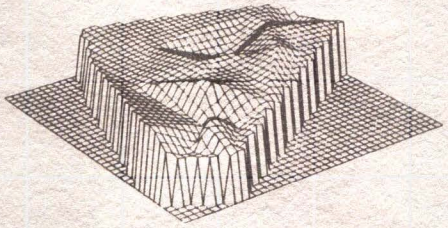
Proven Hardware, Exceptional Software

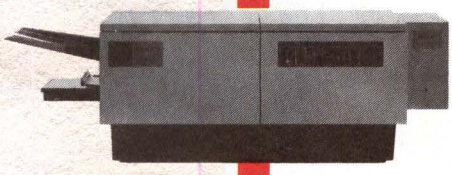
The IMPRINT-10 uses a proven electrophotographic marking engine that has provided reliable service to thousands. Exceptional software is the key to IMPRINT-10 versatility. After years of development at a leading university, Imagen's proprietary image processing software produces superior results with both efficiency and ease of use.

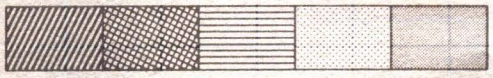


The difference between one typeface and another is often very subtle; it may be no more than a slight difference in the shape of the serif, the length of the ascenders and descenders, or the size of the x-height. But regardless of how small the difference, the typeface, AND THEREFORE THE APPEARANCE OF THE PRINTED PAGE, WILL BE AFFECTED.

$$\Psi(P) = \frac{1}{4\pi} \oint_S \left(\Psi \nabla \frac{e^{ikr}}{r} - \frac{e^{ikr}}{r} \nabla \Psi \right) \cdot \mathbf{n}\, da$$







Satisfied Users

In the 15 months prior to its commercial announcement over a hundred IMPRINT-10 systems have been in field use. Many customers have multiple systems installed and most customers are now planning future installations.

Let Us Prove Our Claims

Call or write for more information about the IMPRINT-10. We want the opportunity to prove that its performance can't be beat.

If you are thinking about laser printing, then you should be thinking about Imagen.

IMAGEN™

IMAGEN Corporation
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Mountain View, CA 94043
(415) 960-0714

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CIRCLE NO. 28 ON INQUIRY CARD

Color output for $1995 . . . and less.

The Prism color printers from Integral Data Systems give you great color hard copy for less than you'd pay for most other quality colorless matrix printers.

The fully optioned 132 column Prism Printer turns complex data into colorful, communicative information that you can really use. Practical information that can help you develop ideas, make decisions and effectively communicate with others. Detailed inventory data, lengthy sales analyses and financial models can now be displayed more clearly and precisely than ever before with colorful text, charts and graphs.

And color is just part of the Prism Printer story.

Text quality print at up to 150 cps, with proportional spacing and automatic text justification make the Prism Printer ideal for all your correspondence requirements. A new cut sheet feeder automatically positions an 8½″ x 11″ sheet for quick, hassle-free loading, while a software selectable Sprint Mode lets you fly through data at over 200 cps. And if your requirement is for only an 80 column printer, or if you simply don't need some of the performance features mentioned, other configurations of the Prism Printer are available for even less.

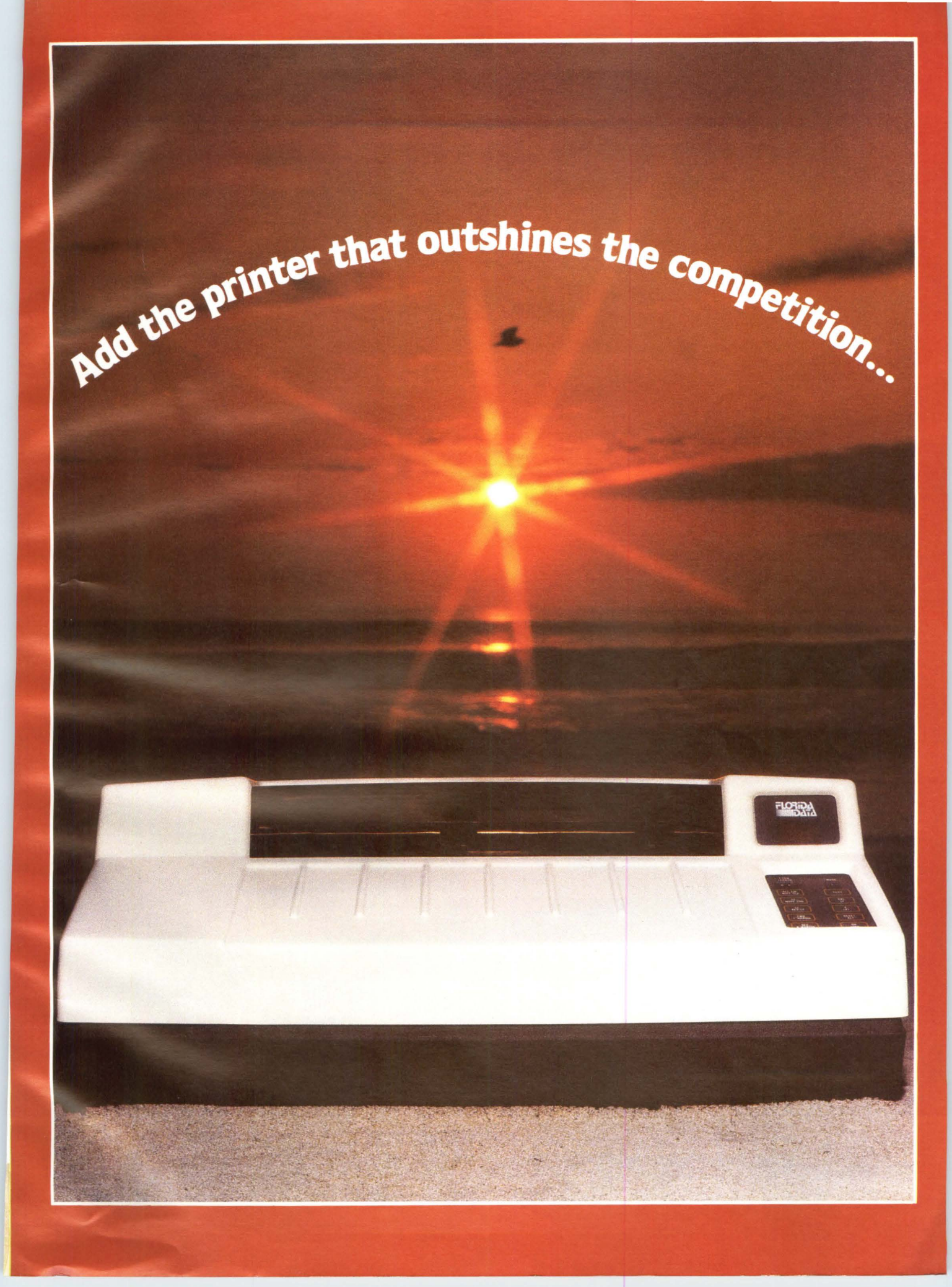
How much less? Call toll free (800) 258-1386 (New Hampshire, Alaska and Hawaii, call (603) 673-9100) or write. We'll color your output affordable . . . at just $1995. And less.

Affordable color. Now. Meet the Prism Printer™ from Integral Data Systems.

Integral Data Systems, Inc.
A Whole New Spectrum of Imaging Ideas
Milford, NH 03055 Telex: 953032
CIRCLE NO. 29 ON INQUIRY CARD

Company Model	Printing method	Printing speed (cps)	Chars./ line	Graphics (Y/N)	Multi-color (Y/N)	Multi-pass (Y/N)	Unit price ($)	Specify fonts
GE 3404	9 x 9/18 impact	5090	136	Y	Y	Y	3085	16 foreign, condensed, expanded, programmable
GE200 Document Hand.	7 x 9 impact	200	105	N		N	5752	ASCII
GE200 Forms Access	7 x 9 impact	200	136	N		N	2705	ASCII, international
HEATH CO.								
Z-25	impact	150		Y	N	N	1595	
HEWLETT-PACKARD								
HP2631B	7 x 9 impact	180	56–227	N	N	N	3900	128 ASCII, 8 ISO languages
HP2631G	impact	180	56–227	Y	N	N	4900	128 ASCII, 8 ISO languages, line drawing
HP2671A	9 x 15 thermal	120	80/132	N	N	N	1195	
HP2671G	9 x 15 thermal	120	80/132	Y	N	N	1495	
HP2673A	9 x 15 thermal	120	40–132	Y	N	N	2195	
HI-G CO., INC.								
9/132PS	9/18 x 9 impact	165	136	Y	N	Y	1395	ASCII
9/80SF	9/18 x 9 impact	150	67	Y	N	Y	1195	ASCII
9/80	9/18 x 9 impact	150	80	Y	N	Y	1050	ASCII
HONEYWELL								
PRO 1005/7005	7 x 7 impact	120	132	N	N	N	3390	96 ASCII
PRO 1901	7 x 9 impact	120	132	N	N	N	4000	96 ASCII
PRO 7070/7071	9 x 7 impact	100	80/132	N	N	N	1195	96 ASCII
PRO 9614/9114	7 x 7 impact	160	132	N	N	N	3360	96 ASCII
IBM Did not respond: see directory for address.								
INFO SCRIBE, INC.								
500	9/18 x 9 impact	75/150	136	N	N	N	872, Q 100	ASCII, foreign, special
1000	7/14 x 9 impact	100/200	136	Y	N	N	1046, Q 100	ASCII, foreign, special
1100	7/14 x 9 impact	40/200	136	Y	N	Y	1285, Q 100	ASCII, foreign, special
1200	7 x 9 impact	40/200	132	Y	Y	Y	1396, Q 100	ASCII, foreign, special
1500	9/18 x 9 impact	200/400	132	Y	N	N	1676, Q 100	ASCII, foreign, special
INTEGRAL DATA SYSTEMS, INC.								
Prism 132	24/18 x 9 impact	200	32	Y	Y	N	1499	
Prism 80	24/18 x 9 impact	200	80	Y	Y	N	1299	
INTERNATIONAL MICROTRONICS CORP. Did not respond: see directory for address.								
IRWIN OLIVETTI, INC.								
JP 101	7 x 5/7 dry ink jet	130	80	Y	N	N	499	
TH 240	7 x 5 thermal	320	80	Y	N	N	850	8 char. sets
JAPAN DIGITAL LABORATORY								
JDL-P700	impact	70/400		Y	N	N		ASCII
JDL-P200	impact	70		Y	N	N		
JDL-P300	thermal	70		Y	N	N		
LEADING EDGE PRODUCTS								
Prowriter II 1550	9 x 7 impact	120		Y	N	N		pica, elite, compressed, elongated
Prowriter/8510A	9 x 7 impact	120		Y	N	N		pica, elite, compressed, elongated

Company Model	Printing method	Printing speed (cps)	Chars./ line	Graphics (Y/N)	Multi-color (Y/N)	Multi-pass (Y/N)	Unit price ($)	Specify fonts
LEAR SIEGLER/DATA PRODUCTS DIVISION								
310	9 x 7 impact	180	136/224	N	N	N	2045	international
VersaPrint 500	7 x 9 impact	180	136/224	Y	N	Y	1695	USASCII, UKASCII, international
VersaPrint 510	7 x 9 impact	180	136/224	Y	N	Y	1995	USASCII, UKASCII, international
VersaPrint 520	7 x 9 impact	180	136/224	Y	Y	Y	2195	USASCII, UKASCII, international
VersaPrint 530	7 x 9 impact	180	136/224	Y	Y	Y	2495	USASCII, UKASCII, international
MANNESMANN TALLY								
M78-5 Trim Form	impact	200					4345	ASCII, OCR A, B, bar codes
MT160	9 x 7 impact	40/160	80	Y	N		845	
MT440	7 x 9 impact	400		Y			2495	USASCII, European
MDS TRIVEX								
8087	7 x 8 impact	180	132	N	N	N	4500	
MEMOREX COMMUNICATIONS GROUP								
1300	7 x 7 impact	100	80	N	N	N	950	N
2087	7 x 9 impact	180	132	N	N	N	5995	N
MEPCOM INTERNATIONAL INC.								
EZPrint 40	5 x 7 impact	65	20/80	Y	N	Y		
EZPrint 21	5 x 7 impact	65	10/40	Y	N	Y		
MICRO PERIPHERALS, INC.								
Printmate 150	7/11 x 9 impact	150	231	Y	N	Y	995	96 ASCII, 3 foreign
Printmate 99	7/11 x 9 impact	100	80/136	Y	N	Y	695	96 ASCII
MICROTEK Did not respond: see directory for address.								
MOTOROLA, INC.								
702	7 x 7 impact	120	10–132	N	N	Y	2500	64 ASCII
703	7 x 7 impact	180	10–132	N	N	Y	3125	96 ASCII
MSI DATA CORP.								
BC 400	5 x 7 impact	48	40	N	N	N	1012, Q 100	English, German, Italian, Japanese, Swedish, Finnish
BC 420	5 x 7 impact	48	40	N	N	N	1125, Q 100	English, German, Italian, Japanese, Swedish, Finnish
VM 400	5 x 7 impact	48	40	N	N	N	975, Q 100	English, German, Italian, Japanese, Swedish, Finnish
NCR CORP.								
2600	5 x 8 thermal	30	80	N	N	N		upper/lower case ASCII with descenders
6410	7 x 7 impact	90	80	N	N	N		upper/lower case ASCII
6425	5 x 7 thermal	240	80	N	N	N		upper/lower case ASCII
6441	7 x 7 impact	180	132	N	N	N		64 ASCII
NOVELL DATA SYSTEMS, INC.								
I-800	9 x 9 impact	150	80/224	N	N	Y	1295	96 USASCII, Korean
OKIDATA CORP.								
Microline 80	7 x 9 impact	80	80/132	Y	N	N	449	96 ASCII, 64 block shapes
Microline 82A	9 x 9 impact	120	80/132	Y	N	Y	549	96 ASCII, 64 block shapes
Microline 83A	9 x 9 impact	120	136/224	Y	N	Y	899	96 ASCII, 64 block shapes
Microline 84	9 x 9 impact	200	136/231	Y	N	Y	1395	96 ASCII


Add the printer that outshines the competition...

...and you'll unharness the power

Florida Data OSP Printers increase computer productivity: fast, reliable and versatile.

Whether your computer costs $3,000 or $300,000, it's only as efficient and productive as your output devices. That's why from the beginning Florida Data has had one primary objective: to design and build the fastest and most versatile impact serial matrix printers for the wide variety of printing and paper handling requirements encountered in business, word processing and data processing applications.

Office Systems Printers unmatched price/performance

As a result of Florida Data's effort to date, the Office Systems Printers have been established as the performance leaders. In design. In speed. In versatility. In operator convenience. The OSP family simply outshines the competition in price/performance and cost of ownership.

Printhead technology leader

The power of the OSP is Florida Data's proprietary printhead technology, utilizing the "magnetic stored energy" principle and incorporating innovative materials that have advanced the state of the art. The eight-wire OSP printhead is the world's fastest: each wire generates 2700 dots per second. Florida Data's leading edge research and development has resulted in five major patents on the printhead alone.

World's fastest matrix printer

Printing at 600 to 780 characters per second in one-pass draft mode, 150 cps in two-pass correspondence and 100 cps in three-pass letter quality modes, the OSP breaks output bottlenecks for data and word processing applications. In fact, the OSP is 10 times faster than daisy wheel printers in draft mode and twice as fast in letter quality mode.

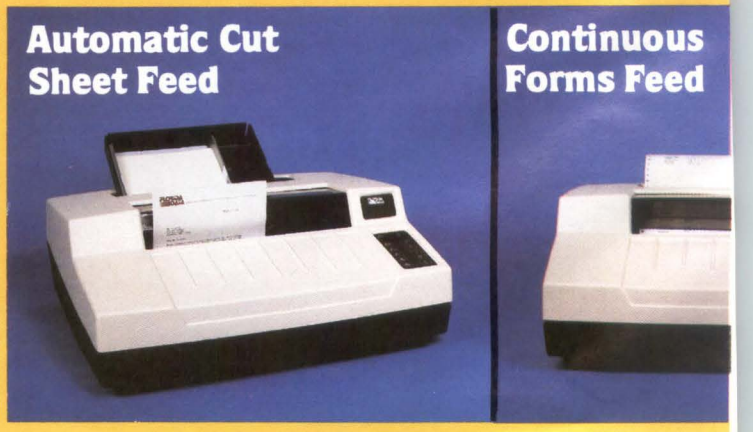
In most applications the OSP will do the work of two or more printers. Florida Data printers really shine at those end-of-the-month peak printing periods when you need speed and performance to get the job done on time.

Florida Data's brightest highlight...versatility

Florida Data printers are in a class by themselves when you consider the many different kinds of printing they can handle. As computers become more powerful and versatile the need to provide more printed output will continue to grow. Whether you are printing data, text, equations, graphics or any other business applications, the OSP simply outshines the competiton.

Take font changes. You have virtually unlimited electronic font selection. The printer has enough memory to store up to ten resident fonts. Or the computer can load additional fonts, signatures and logos, etc. They are selectable by a flick of a switch or through computer commands. You can even change **type** *styles* and character SIZES in the middle of a sentence. The OSP provides compressed print at 13, 15, 17 and 18 characters per inch to allow up to 237 column printing for spread sheet and planning data formats.

Take special applications. Florida Data has an automatic "video capture" font development system which can provide you with custom fonts, signatures and logos. Bar codes, OCR-A and OCR-B, Greek-scientific, and many other special fonts are already available.



and performance of your computer

Take media changes. The triple paper path mechanism easily and quickly handles many different kinds of paper for different jobs. You can be printing 8½ X 11 letters with OSP standard integrated automatic cut sheet feeder, and switch to tractor feed paper, multi part forms, labels, paychecks, legal size pages, or custom forms, in seconds, without any hardware changes. The OSP is the only printer with tractors and sheet feeder which can be installed at the same time!

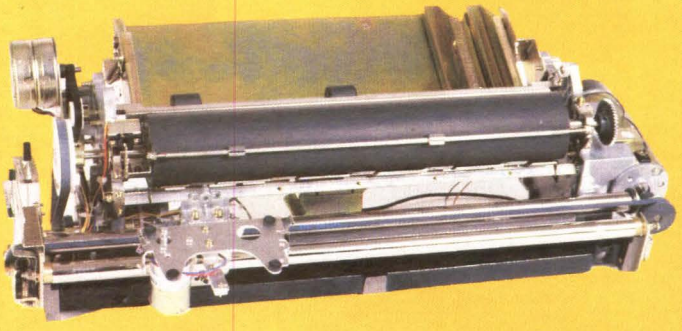
Take word processing. The OSP 130 emulates the Diablo 1650/630 protocol supporting 37 word processing commands and 12 font commands for type style, print speed and character size selection. The OSP is the only printer which gives you draft copies at 600 cps using word processing features in the exact image of your final high resolution copy. Bold, shadow, underline, superscript, subscript, proportional print, horizontal/vertical motion indexing and page formatting are all part of the standard OSP firmware. You can even use these features in data processing applications for special effects on spread sheets, billing documents, program listings, etc.

The model OSP 125's interface is compatible with the parallel Diablo hytype I and Qume Sprint III. Both ASCII and spoke wheel addressing are supported along with resident multi-fonts which are operator switch selectable. The OSP 125 intelligently performs auto underline, bold and shadow completely transparent to existing software drivers, enhancing the printer through put.

Take graphics. The raster graphics option provides bi-direction plotting, space compression, data replication and selectable resolution up to 360 X 384 dots per inch. The OSP graphics mode allows you to select from wide range of dot densities and speed for draft or final high resolution graphics output.

It's the kind of versalitily that eliminates the bottleneck encountered with other printers and unharnesses the power and performance of your computer.

Rugged heavy-duty mechanism



In 1981 Florida Data entered into an agreement with Brother Industries, Ltd. of Nagoya, Japan, one of the most respected electromechanical precision manufacturers in the world, to manufacture the FDC designed heavy-duty printer mechanism. This unique mechanism design has cast side frames, rigid cast rail support, a ball bearing carriage, a single-lever paper adjustment and a built-in automatic cut sheet feeder. The automatic bail control assures unmatched reliability in feeding cut sheet paper.

Displays printer status
- On-line
- Line number
- Fault codes

Reliable membrane switches
- Clearly labeled
- Adjustable bell
- Configuration switches under cover

FLORIDA DATA

OSP SPECIFICATIONS
All features standard unless otherwise noted

FONT SETS
1 each, 1, 2 and 3 pass pre-stored fonts; 10 or 12 cpi, plus one 18 cpi 1 pass font.

OPTIONAL: up to 10 fonts total, any combination of pre-stored and down loaded.

Available pre-stored sets include 10, 12, 13, 15, 17, 18 cpi plus proportional.

CHARACTER FORMATS
Horizontal — 45, 60, 90, 120 dpi density, resolution to 1/360 in. (.0706mm).

Vertical — 64, 128, 192 dpi (1, 2, 3 pass)

Two high or two wide or both.

PRINTHEAD
Patented stored energy principle, 8 wires, .0132 in. (.335 mm) diameter, 1/64 in. (.397 mm) spacing, long life ruby guide.

Pin cycle time — 370 microseconds.

PRINT SPEED
(10 cpi): 1 pass: 600 cps, 460 cps

2 pass: 150 cps, 115 cps

3 pass: 100 cps, 57.5 cps

PAPER HANDLING
Continuous forms — width 3 to 15 in. (7.62-38.1 cm), adjustable tractors, bottom feed, single lever paper tension adjustment.

Automatic cut sheet (cassette) — width 8 to 12 in. (20.3 to 30.5 cm) length 8 to 15 in. (20.3 to 38.1 cm).

Single sheet — width 3 to 15 in. (7.62 to 38.1 cm). Demand loaded from top.

HORIZONTAL FORMAT
Programmable: horizontal motion index, offsets, left margin, tab stops and absolute tabs.

Maximum print line 132 characters at 10 cpi, 237 characters at 18 cpi.

VERTICAL FORMAT
Programmable: vertical motion index, top and bottom margins, tab stops and absolute tabs.

Control panel: 6 or 8 lpi, single or double line feeds, top and bottom margins.

Line spacing: 48 lpi to .384 lpi including 6, 8, 12, 16 lpi.

COMMAND SET
Diablo, Qume, NEC compatible. Optional bidirectional graphics, font down load. Overstrike mode plus Diablo WP enhancements: auto bold, shadow, underline.

INTERFACES
RS-232 protocols:

Xon/Xoff, ETX/ACK, DTR/$\overline{\text{DTR}}$ (pin 20), RDY (pin 11)

7 or 8 bit data, even: odd or no parity.

DTR and RDY sync. on stop bit.

Baud rates: up to 19200.

OPTIONAL: Centronics, Data Products, IBM, NCR, Burroughs, Honeywell, UNIVAC, HASP.

OSP-125: Diablo (Hytype I, Hypro 6), Qume 13 bit parallel, ASCII or printwheel position addressing.

CONTROL PANEL
MEMBRANE SWITCHES & THUMBWHEEL SWITCHES:

FORMS LENGTH (1/6 to 16.5 inches in 1/6 inch increments)

MODE (Fonts: 10 positions)	SET TOP MARGIN
SET TOP OF FORM	SET BOTTOM MARGIN
BUFFER CLEAR	SELF TEST
FORM FEED	DOUBLE LINE FEED
MODE CHANGE	

INDICATORS:

Two 7-segment digits for printer status and line numbers.

LINE FEED	8 LINES PER INCH
REVERSE LINE FEED	ERROR RESET
PAPER FORWARD	ON LINE
PAPER REVERSE	

Individual indicators: TEST MODE, DOUBLE LINE FEED, 8 LINES PER INCH, ON LINE.

BUFFER
512 characters, 2560 characters (opt)

RIBBON
Diablo Hytype II type cartridge, nylon ribbon.

DIAGNOSTICS
30 status conditions detected and reported.

Self test mode selectable from front panel.

GRAPHICS (OPTIONAL)
High speed, bidirectional.

RS-232, Centronics or Data Products parallel interface.

Horizontal dot density 45, 60, 90, 120 dpi, resolution to 1/360 inch.

Vertical dot density to 384 dpi.

Data stream features run length coding for compression.

POWER REQUIREMENTS
Standby 75 VA Maximum 500 VA

100 — 250 VAC (± 10%), 50 or 60 Hz.

ENVIRONMENTAL REQUIREMENTS
45°F (7°C) to 106°F (41°C) operating temperature

-20°F (-29°C) to 135°F (57°C) storage temperature

PHYSICAL
Height: 9.5 in. (24.1 cm) Width: 25 in. (63.5 cm) Depth: 28 in. (71.1 cm)

Weight: 85.5 pounds (38.8 kg)

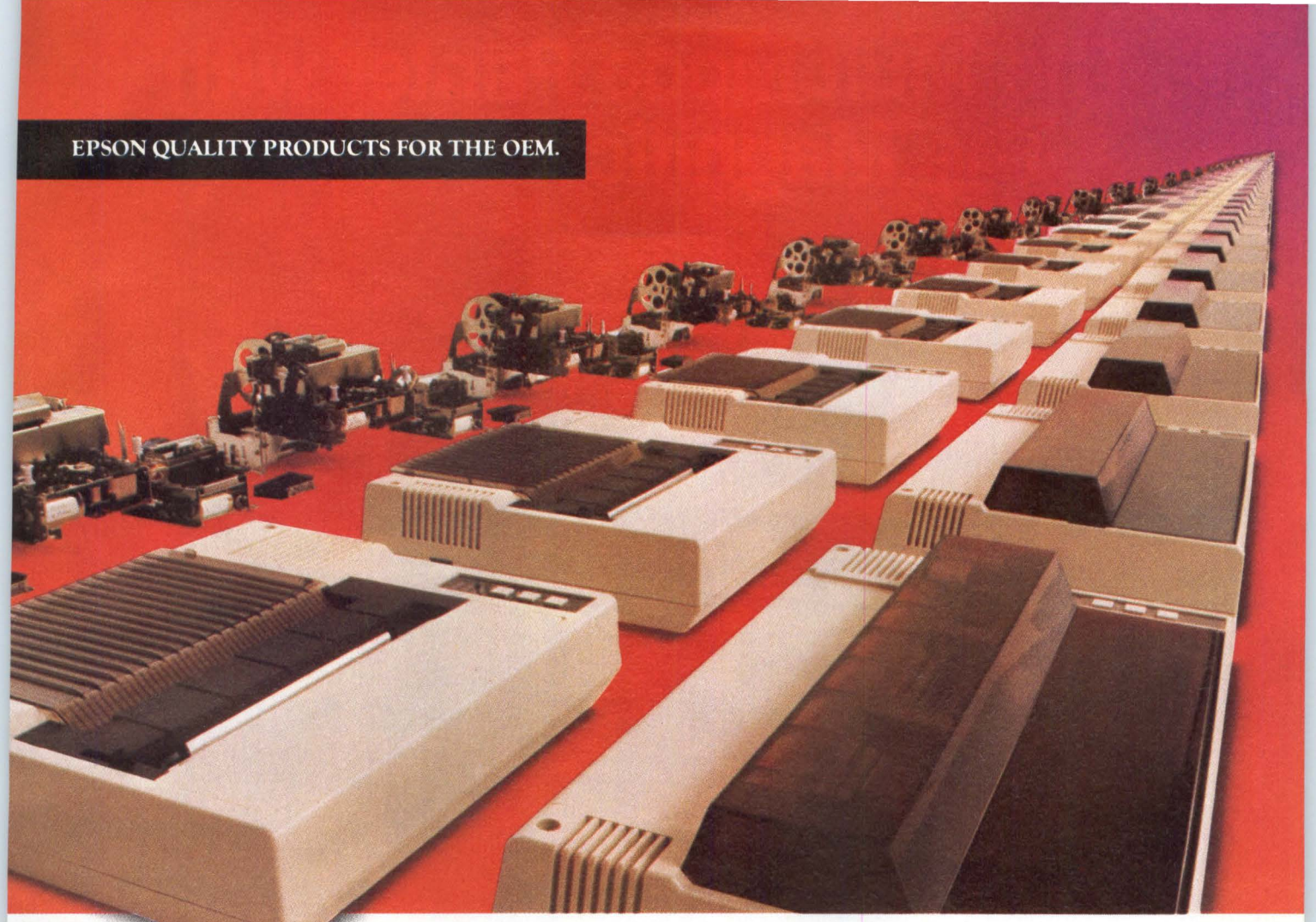
FLORIDA DATA

FLORIDA DATA CORPORATION
600D John Rodes Blvd., Melbourne, FL 32935
Phone (305) 259-4700

Company Model	Printing method	Printing speed (cps)	Chars./ line	Graphics (Y/N)	Multi-color (Y/N)	Multi-pass (Y/N)	Unit price ($)	Specify fonts
Microline 92	9 x 9 impact	160	40/136	Y	N	Y	699	96 ASCII
Microline 93	9 x 9 impact	160	68/233	Y	N	Y	1249	96 ASCII
Pacemark 2350	impact	350	68/132	Y	Y	Y	2550	expanded, compressed
Pacemark 2410	impact	350	68/132	Y	Y	Y	2850	96 ASCII
PANASONIC INDUSTRIAL CO.								
KX-P1090	9 x 9 impact	96	80/96	Y	N	N	55	pica, elite
KX-P1160	9 x 13 impact	196	136/163	Y	N	N	1750	pica, elite
PLESSEY PERIPHERAL SYSTEMS/DIST. PROD. DIV								
LC11	9 x 9 impact	150	132	Y	N	N	1420	
PRACTICAL AUTOMATION, INC.								
8-Series	9 x 7 impact	250	80	N	N	N	675	ASCII, European
PRINTACOLOR CORP.								
IS8001	inkjet	45	80	Y	Y	N	4495	intelligent systems A, B, or C
PRINTEK, INC.								
910	9 x 9 impact	200	136/227	Y	N	Y	1595	96 ASCII, 7 foreign char. sets
920	9 x 9 impact	340	136/227		Y	Y	2395	96 ASCII, 7 foreign char. sets
PRINTER PRODUCTS (CAPITOL CIRCUITS)								
100	5/10 x 7 impact	65	27	N	Y	N	460	upside-down line, elongated
100T	5/10 x 7 impact	65	40	N	N	N	660	upside-down line, elongated
270	5/10 x 7 impact	65	40	N	N	N	660	upside-down line, elongated
S400	5/10 x 7 impact	150	40	N	N	N	775	upside-down line, elongated
S400L	5/10 x 7 impact	48	40	N	N	N	795	upside-down line, elongated
S400T	5/10 x 7 impact	150	40	N	N	N	775	upside-down line, elongated
PRINTER SYSTEMS CORP.								
M 100	9 x 14 impact	140		Y	N	N	2895	ASCII, international
T 1600	7 x 9 impact	200		N	N	N	1695	ASCII, international
T 1800	40 x 18 impact	50/200		N	N	Y	1995	ASCII, international, 18 x 9
M 200	7 x 7 impact	340		N	N	N	2895	ASCII, international
PRINTER TERMINAL COMMUNICATIONS CORP. Did not respond: see directory for address.								
QANTEX, DIV. OF NORTH ATLANTIC IND.								
7020	9 x 7/12 impact	180	136/244	Y	N	Y	1625	APL, Trend, Courier
7030	9 x 7/12 impact	180	136/244	Y	N	Y	1995	APL, Courier, scientific, Trend, Cubic
QWINT SYSTEMS, INC.								
KSR 740 Series	7 x 5 impact	65	137	Y	N	N	995	upper/lower case ASCII, Baudot, expanded
MSR 740 Series	7 x 5 impact	65	137	Y	N	N	1195	upper/lower case ASCII, Baudot, expanded
RO 740 Series	7 x 5 impact	65	137	Y	N	N	795	upper/lower case ASCII, Baudot, expanded
RACAL-MILGO INFORMATION SYSTEMS								
4285	9 x 9 impact	120	80/132	Y	N	N	824	ASCII
4287	7 x 7 impact	200	132	N	N	N	3099	ASCII
4287N	7 x 7 impact	200	132	N	N	N	3599	ASCII
4293/4294	7 x 9 impact	200	136/224	N	N	N	3399-4294	ASCII

Company Model	Printing method	Printing speed (cps)	Chars./ line	Graphics (Y/N)	Multi-color (Y/N)	Multi-pass (Y/N)	Unit price ($)	Specify fonts
RADIO SHACK								
DMP 200	N x 9 impact	120	132	Y	N			
DMP 2100	16 x 11 impact	160	136	Y	N		1995	
DMP 400	N x 9 impact	140	132	Y	N			
DMP 500	N x 9 impact	220	132	Y	N		1795	
DMP 100	7 x 5 impact	50	80	Y	N		399	
RAMTEK CORP.								
4100 Colorgraphic P.	5 x 7 impact		132	Y	Y	N	6995	
SANTEC CORP.								
Variflex S700 Print.	impact	390	237	Y	N	Y	2860, Q 100	various including Arabic, Hebrew
SCI SYSTEMS, INC.								
1080	electrosensitive	1100				N	500, Q 100	
1100	electrosensitive	2200				N	295, Q 100	
1110	electrosensitive	2200	136	N	N	N	765, Q 100	
1800	electrosensitive	6600	132	Y	N	N	1545, Q 100	
1870	electrosensitive					N	1580, Q 100	graphics
SIEMENS COMMUNICATIONS SYSTEMS, INC.								
2712	9 x 12 ink jet	270	80/132				3225	
PT-88T	9 x 9 ink jet	150	80/132				1000	
SIGMA								
Transtar 315	7 x 8 impact	50	120	Y	Y	N	599	
SONY CORP. OF AMERICA								
OA-P1110	24 x 32 thermal	17						
STAR MICRONICS, INC.								
DP-8480	7 x 9 impact	80	80	Y	N	Y	399	international
GEMINI-10	9 x 9 impact	100	80	Y	N	Y	499	many selectable
GEMINI-15	9 x 9 impact	100	132	Y	N	Y	645	many selectable
SYNTEST CORP.								
SP-2000	7 x 5 impact	100	80	N	N	N	925	64 ASCII
SP-302	7 x 5 impact	50	40	N	N	N	482	64 ASCII
SP-308	7 x 5 impact	50	40	N	N	N	820	64 ASCII
SP-308T/D	7 x 5 impact	50	40	N	N	N	970	64 ASCII
SP-314	7 x 5 impact	80	40	Y	N	Y	605	96 ASCII
SP-400	7 x 5 thermal	24	40	N	N	N		96 ASCII
TDC								
GPM-40-B	impact	100	40	Y	N	N	130, Q 1000	customer option
GPM-40-G/12	impact	100	40	Y	N	N	135, Q 1000	customer option
GPM-80-B	impact	150	80	Y	N	N	160, Q 1000	customer option
GPM-80-B/12	impact	100	80	Y	N	N	165, Q 1000	customer option
HPM-136	impact	150	136	Y	N	N	188, Q 1000	customer option
HPM-80 FT	impact	150	80	Y	N	N		customer option
TELETYPE CORP.								
43	7 x 9 impact	30	80/132	N	N	N	1272	upper/lower case ASCII

EPSON QUALITY PRODUCTS FOR THE OEM.



DESIGN EPSON PRINTER RELIABILITY INTO YOUR SYSTEM. AND GET SOMETHING EXTRA.

With our new serial dot matrix printers, for instance, you can choose features such as 160 cps print speed, *correspondence quality,* pica, elite and over 60 character weights and sizes; 7 *dot addressable graphic modes* including 1 to 1 aspect ratio; user-defined character sets, and more.

But you get something extra whenever you design Epson OEM products into your system. You get confidence. Confidence because you're dealing with the #1 OEM manufacturer of serial dot matrix printers and mechanisms on the planet — we shipped over 7 million this year. Confidence because of the exceptional reliability designed into each unit — out of box failure rate is measured in tenths of a percent. And confidence because of our dedication to quality that has made that record possible.

You get value, too. Epson printers give you the lowest total cost of ownership in the industry. And they can be customized from the inside out to meet your unique system requirements.

We simply don't have room to tell you all the Epson extras. But if you call or write we'll fill you in on all the details. Do it today.

EPSON

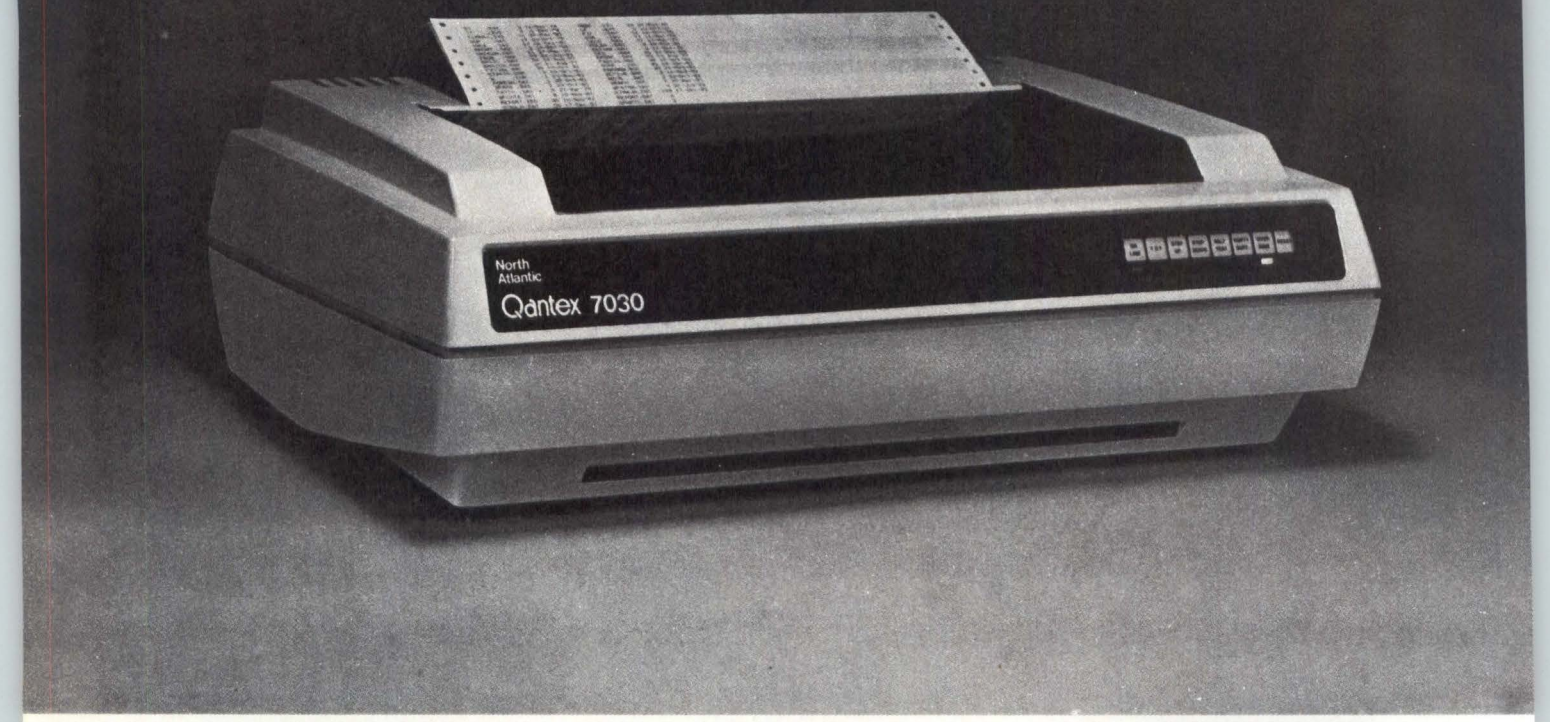
EPSON AMERICA, INC.

OEM Products Division
Printer Group
3415 Kashiwa Street, Torrance,
CA 90505 (213) 534-0360
TELEX 182412

SW Region (714) 751-1919 • NW Region (408) 985-8828 • SE Region (404) 458-9666 NE Region (617) 245-8007 • CENTRAL Region (815) 455-2570

CIRCLE NO. 31 ON INQUIRY CARD

The MultiMode Printer with The Magnificent Fonts



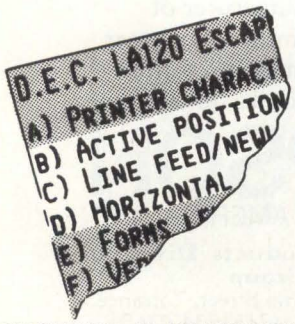
MultiMode Printer Offers Flexibility

. . . At a Sensible Price

"Flexibility" means instantaneous call up of any of this trend-setting machine's many features whether for *word processing, data processing, graphics* or *forms generation*. Using either of the two built in interfaces, an external keyboard or downloading from your computer, you can program the Qantex Model 7030 to do more.

The "Beautiful" Font

Compare the "Beauty" of our printed letters for the word processing fonts which include Cubic, Trend, Spokesman, Courier, Italics, Script, OCR-A, APL, Scientific plus *downloaded* fonts from your computer. Draft copy modes include 8 resident fonts — U.S., U.K., German, French, Spanish, Swedish, Finnish, Norwegian and Danish.



Other features include high resolution graphics — 144 x 144, single pass and double pass word processing, and 180 cps data processing modes and user defined formats.

Operator initiated, the MultiMode printer provides a complete printed status report of operating parameters and diagnostics.

For more information, or a demo, call us about the new Qantex Model 7030 MultiMode Printer.

CIRCLE NO. 32 ON INQUIRY CARD

north atlantic
Qantex
60 Plant Avenue, Hauppauge, NY 11788
(516) 582-6060 (800) 645-5292

Company Model	Printing method	Printing speed (cps)	Chars./ line	Graphics (Y/N)	Multi-color (Y/N)	Multi-pass (Y/N)	Unit price ($)	Specify fonts
AP200	7 x 7 impact	340	132	N	N	N	3868	upper/lower case ASCII or EBCDIC
TELPAR, INC.								
PL20C	5 x 8 thermal	50	20	N	N	N	395	
PL20RM	5 x 8 thermal	50	20	N	N	N	575	
PS48C	5 x 7 thermal	30	48	N	N	N	768	
TEXAS INSTRUMENTS, INC.								
743 RO	5 x 7 thermal	30	80/136	N	N	N	895	
781 RO	5 x 7 thermal	30	80	N	N	N	1395	
810 RO	9 x 7 impact	150	132	N	N	N	1645	
820 RO	9 x 7 impact	150	132	N	N	N	1995	
825 RO	9 x 7 impact	75	132	N	N	N	1565	
840 RO	9 x 7 impact	75	132	N	N	N	995	
850 RO	15/9 x 9 impact	150	134	Y	N	Y	599	
Enhanced 810 RO	23 x 28 impact	225		Y	N	Y	2295	Courier, Helvetica, elite in 10, 12 pitch
TEXPRINT, INC.								
C-120 (complete RO)	impact	180	165	Y	Y	Y	3395	
Decolor (kit)	impact	180	165	Y	Y	Y	995	
Decplot (kit)	impact	180	165	Y	N	N	595	
Texplot	7 x 5 thermal	30	80/136	Y	N	N	450	
TRANSTAR								
315	impact	50		Y	Y	N	599	
TRIFORMATION	Did not respond: see directory for address.							
VICTOR DATA PRODUCTS								
5080	7 x 5 impact	100	80	Y	N	N	995	
WANG LABORATORIES, INC.								
2233	9 x 9/7 impact	120	158	N	N	N	2500	
2235	9 x 9/7 impact	220	132	N	N	N	3500	
5533	9 x 9/7 impact	120	158	N	N	N	3500	
5535	9 x 9/7 impact	220	132	N	N	N	4500	
5577	impact	192		Y	N	Y	5975	Courier, Prestige elite
WESTREX OEM PRODUCTS								
821	7 x 5 impact	150	51	N	N	N	230, Q 100	ASCII
822	7 x 5 impact	150	51	N	N		230, Q 100	ASCII
823	7 x 5 impact	150	51	N	N		230, Q 100	ASCII
824	7 x 5 impact	150	51	N	N	Y	230, Q 100	ASCII
825	7 x 5 impact	150	51	N	N	Y	230, Q 100	ASCII
840	7 x 5 impact	150	40	N	N	Y	202, Q 100	ASCII
8400	7 x 5 impact	150	40	Y	N	Y	675, Q 100	ASCII
841	7 x 5 impact	150	40	Y	N	Y	230, Q 100	ASCII
8410	7 x 5 impact	150	40	Y	N	Y	700, Q 100	ASCII
ZENITH DATA SYSTEMS								
Z-125	9 x 9 impact	150	132/217	Y				95 ASCII, 33 block graphic chars.

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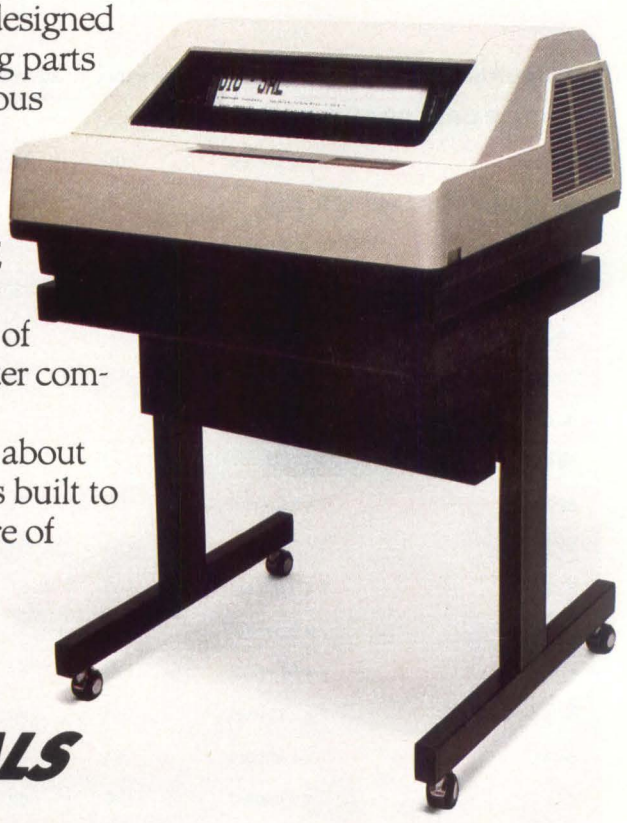

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CIRCLE NO. 33 ON INQUIRY CARD

PRINTERS

Selecting a line printer

JOHN V. HARKER, Dataproducts Corp.

Initial price is just a guide—duty cycle, speed, cost of supplies and other factors must also be considered

In some respects, life gets easier every day for those in the market for new printers. Manufacturers are achieving higher price/performance levels by designing machines with greater reliability, increased flexibility, more operator conveniences and better environmental characteristics—all at lower cost. But as the range of alternatives increases, so does the difficulty of deciding what to buy.

The overriding issue in selecting a printer is its intended applications. What and how much will the machine be expected to do? It makes little sense to spend top dollar for a heavy-duty printer that will stand idle most of the time. On the other hand, pushing a less expensive, light-duty unit beyond its design limits will probably lead to costly system down time and expensive service calls.

Several key application factors influence printer selection. Critical to the initial price in any line printer purchase is the unit's speed, duty cycle and output volume; the print quality and flexibility; requirements forms-handling features; interfacing requirements; options or accessories; supplies needed; and vendor support.

Price versus performance

Line printer speeds range from 300 to 3000 lines per min. for fully formed character printers and 150 to 18,000 lpm for dot-matrix units. Prices range from $800 to $400,000. Price should not be considered in a vacuum. Speed, output volume and duty cycle are also important qualifiers (See p.56).

Print speed should be determined by output requirements. For example, very high-speed (3000- to 18,000-lpm) printers are generally used for high-volume printing with large mainframe systems. Such printers should be considered when output is more than 1 million pages per month. High-speed (1000- to 3000-lpm) printers are usually associated with medium- or large-scale computers. This speed range produces 100,000 to 500,000 pages per month. Printers in the 300- to 1000-lpm speed class are most often used with small-business systems and generate between 20,000 and 150,000 pages per month.

However, there's more to speed and output volume than meets the eye. Output volume depends on a printer's duty cycle, or the ratio of printing time to the number of hours the printer is actually under power. Printers are not designed to print 100 percent of the time. An average medium- or high-speed printer's duty cycle is about 25 to 40 percent. The relationship between print speed, output volume and duty cycle (Fig. 1) becomes clearer by example. Suppose an application requires a daily output of 10,000 single-sheet forms, each containing 50 lines of printed information. The printer must produce 10,000 × 50,

or 500,000, lines of copy daily. If a customer is considering using a 1200-lpm printer, it would take about seven hours—almost a full workday—to complete the job.

But when duty cycle is introduced into this equation, the same job takes four days to complete if the printer runs on a 25-percent duty cycle and two-and-a-half days on a 40-percent duty cycle. Either more than one printer or a considerably faster unit is needed. And that affects budget. Despite budget restrictions, a less expensive printer designed for light duty cycles should not be bought to handle high-volume applications. The printer may produce the required output, but extra down time and the cost of replacing prematurely worn-out parts would probably soon offset any initial saving.

Print quality trade-offs

An application dictates not only print speed and price, but print quality as well. Clean, legible copy is a must on invoices, statements and letters going outside a company. Lower print quality may be acceptable if the printout is strictly for internal use. Print quality ranges from letter quality to draft or utility quality. Legibility depends on several factors: printing technology, type of ribbon or ink, quality and type of paper, number of copies and printer maintenance.

Line printers offer two distinct types of characters: fully formed or dot matrix. Fully formed or shaped characters resemble those produced by typewriters and are generated by band, belt, drum, chain and train printers. All of these technologies provide high-quality printing. If not adjusted properly, however, they all can cause line smear or character misregistration. Drum printers which use vertically moving fonts may produce vertical misregistration, or wavy lines, while band and belt printers, which use horizontally moving fonts, may cause horizontal misregistration, or uneven spacing between characters on a line.

Dot-matrix characters consist of an array (matrix) of closely spaced dots and are generated by impact-matrix and most non-impact line printers. The number of dots used to form a character can vary considerably; the greater the number of dots used in the matrix, the better the resolution and print quality. Although some consider dot-matrix print quality less desirable than that of fully formed characters, manufacturers are now designing machines that can produce matrix characters of such fine resolution that the output approaches letter quality. In addition, advances in multifunctional matrix units offer still another alternative to print quality. These printers operate at switch-selectable speeds allowing the same machine to generate high-resolution characters and, at a higher speed, draft- or utility-quality output.

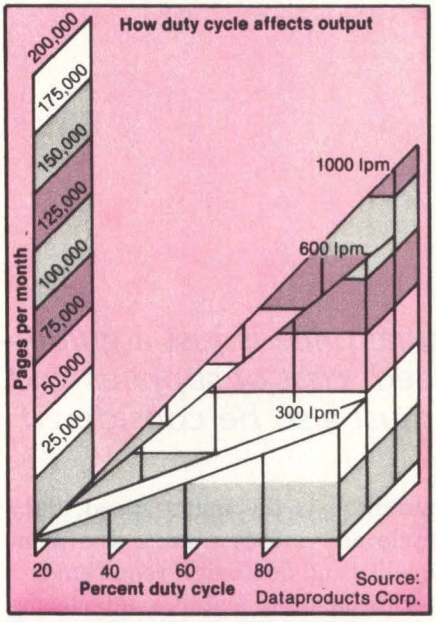

Fig. 1. Both print speed and duty cycle *must be considered when estimating total monthly output capabilities of any printer. The graph shows expected output volume for Dataproducts printers at different duty cycles. Calculations are based on a single-shift application in which an average of two-thirds of the lines on a 66-line, 11-in.-long form are to be printed.*

To check print quality, request print samples and look for clear, sharp characters that have no extraneous ink, smudging or background clutter. Ask that print samples be run on specific papers using new and used ribbons. The print technology, ribbon-inking density and paper finish affect print quality. If multipart forms will be used, request additional samples to ensure an acceptable bottom copy.

Font flexibility

The printer technology selected determines not only the print quality but also the availability of fonts and the number of characters in a character set. Line printers using fully formed characters fall into two categories: vertical font carriers, or drum printers, and horizontal font carriers, such as band, belt, chain or train printers.

A drum has a complete set of characters embossed around its circumference for each printing position. Each character appears on the drum with a frequency corresponding to the number of printable columns. A 132-column printer, for example, has 132 Es on its drum. Drum printers come with 48-, 64- or 96-character sets, or two sets of 48. Though the font carriers are available in different character sets, as well as various alphabets such as Farsi and Katakana, most drum printers do not have interchangeable drums. The font chosen will be the one used for all printing needs. Although the font flexibility of this type of printer is limited, drum life is usually measured in years.

Horizontal font printers have greater character-set and font flexibility than drum printers. An operator can easily change bands, chains or trains so that more than one type style and character set can be used on the same printer. The steel bands used on band printers, for example, are available in a broad range of font styles (including various alphabets, math and scientific symbols) in 48-, 64-, 96- or 128-character sets.

The character set selected not only determines the specific symbols or letters used, but also affects the print speed of fully formed character printers (See p.59). A

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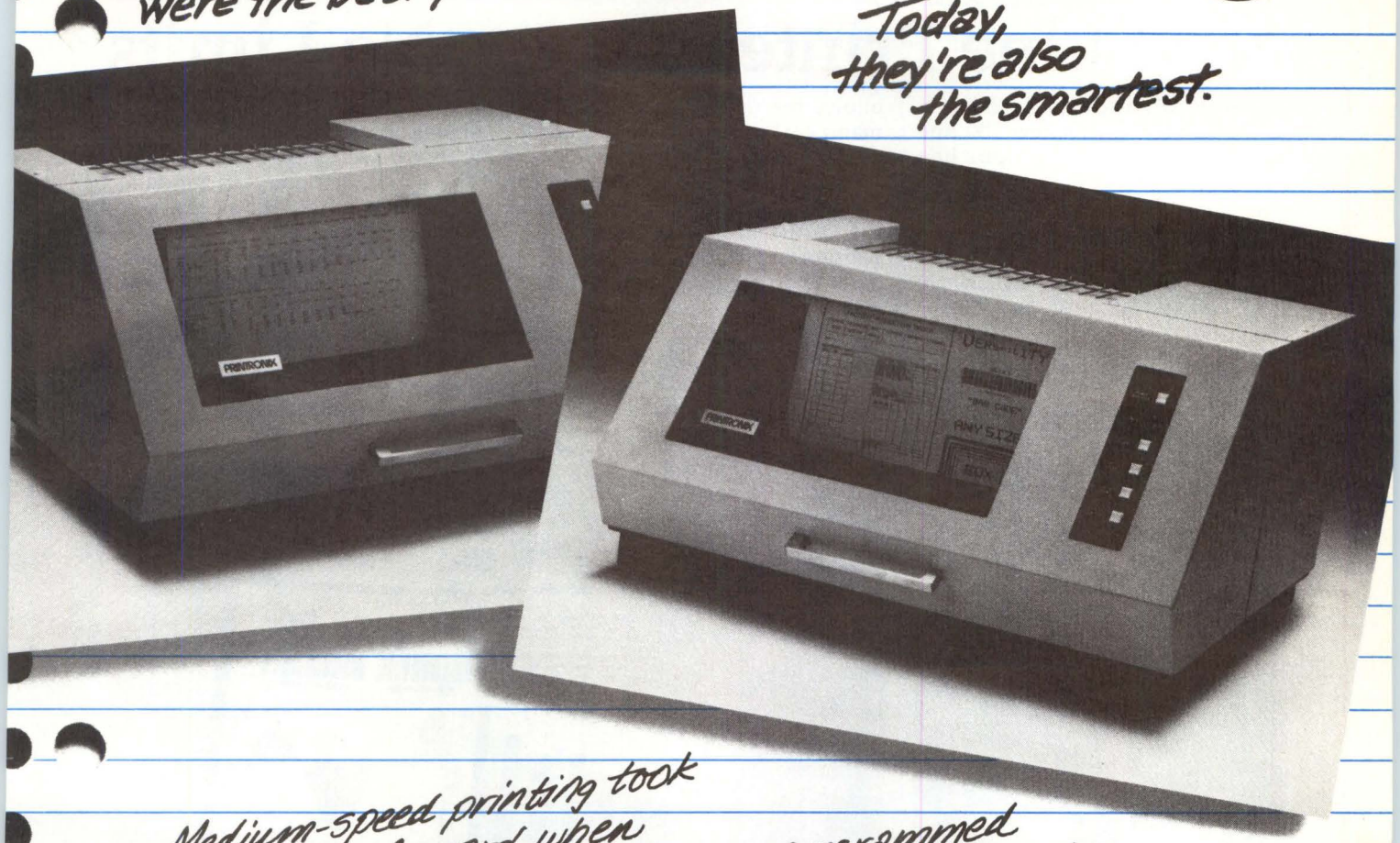

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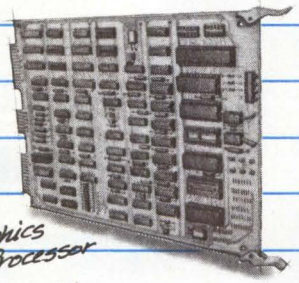

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CIRCLE NO. 34 ON INQUIRY CARD

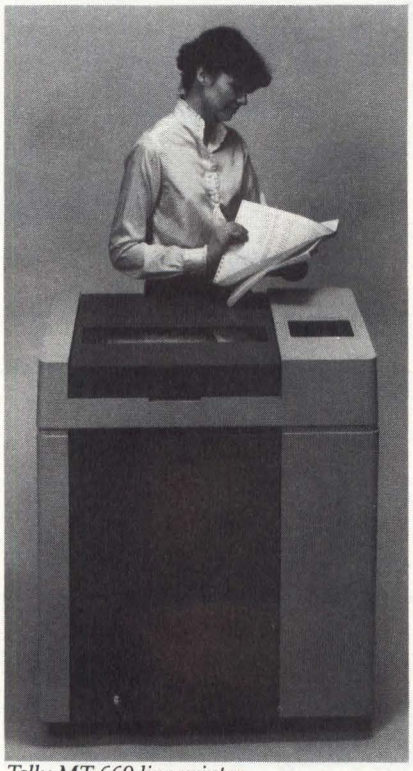
PRINTER REPORT

New Line Printer Knows No Limits

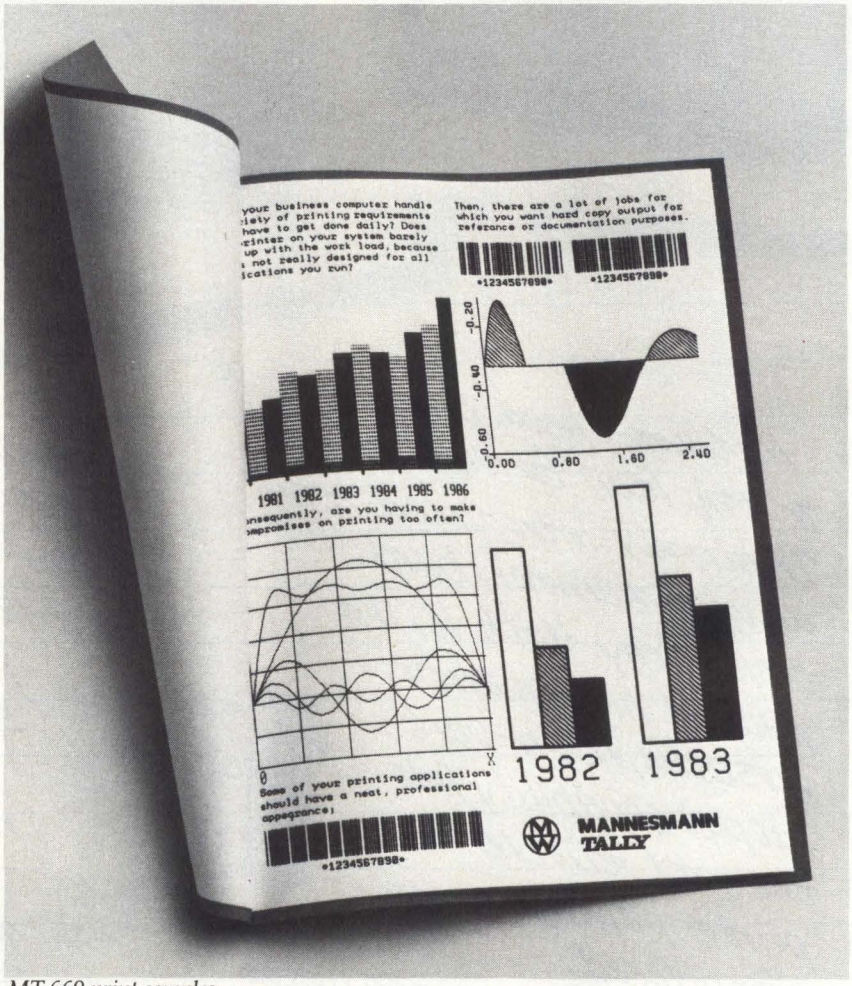
Delivery of evaluation units is underway for Tally's new 600 line per minute multi-function line printer that drew rave responses at the '82 NCC. The Tally MT 660 offers features previously unavailable on line printers.

The technically advanced printer takes full advantage of the inherent flexibility of matrix printing to serve a wide spectrum of applications. Capable of multi-mode operation, the unit can produce letter quality text for high volume word processing printing, computer graphics with high resolution, label characters including bar code and OCR for material handling plus all types of special characters and symbols. A bonus feature is the resident host defined symbol generator that allows the user to call up on demand customized characters of his design.

Designed to provide numerous operator conveniences and features, the futuristic MT 660 offers whisper quiet office operation, an easy-change cartridge ribbon system, front panel forms set-up, self-diagnostics and status display feedback. Targeted towards professionals that demand high performance precision printing, the MT 660 delivers 100% duty cycle operation at 600 lines per minute without preventive maintenance. The printer emphasizes modular construction throughout its design for low cost of repair and parts replacement. With the unit's self-diagnostics, a service technician can quickly test each module in the machine to isolate the fault. The unit is priced under $10,000. Production delivery is scheduled to begin in March.



Tally MT 660 line printer



MT 660 print samples

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CIRCLE NO. 35 ON INQUIRY CARD

1000-lpm Dataproducts band printer, for example, may print at 1100 lpm using a 48-character set, 1025 lpm at 64 characters and 820 lpm at 96 characters. Generally, the smaller the character set, the higher the number of character sets on the font carrier and the higher the print speed.

Availability of fonts and character sets for impact matrix and most non-impact line printers is a different issue. The advantage here is that the same print mechanism can generate an unlimited number of character sets because type fonts are stored electronically in memories. Simply by exchanging one stored character set for another, the font can be changed. On some matrix printers, character spacing, height and width as well as font style can be varied under switch or program control, and others can generate bar codes, block letters and high-resolution graphics including form overlays, logos, graphs and charts—in color, if desired.

Forms-handling requirements

An important indication of a printer's flexibility is its forms-handling ability. Most line printers accommodate different paper widths and preprinted multipart forms and control the vertical printing format.

If printing tasks involve the use of different paper widths, the printer must accommodate these sizes. Most 132-column line printers, for example, can handle paper as wide as 19 in. Most 80-column printers are limited to a maximum printing width of 8 in. (at 10 characters per in.). Some band and matrix printers have the added flexibility of being able to print either condensed or expanded characters. This means that the same information could be printed on a 14-in. sheet of paper or condensed to fit on a standard 8½-in. sheet.

To print special multipart forms, such as payroll checks or invoices, an impact printer, which can provide multiple copies (usually two to six including the original) in a single pass, is needed. Although non-impact printers produce only one copy in a single pass, they can duplicate a printed page as many times as needed with all copies having the same print quality as the first. For applications requiring highly formatted or preprinted forms, a printer equipped with a vertical format unit may be desirable. A VFU enables information to be printed on portions of a form by automatically omitting spaces where desired. This can significantly increase throughput by enabling the printer to slew between printed lines. VFUs can read punched tape or can be loaded directly from a computer.

A unit may need to accommodate different paper widths and preprinted multipart forms or control the vertical printing format.

Other printer features that facilitate forms and paper handling include adjustable form-thickness controls, paper pullers, power stackers and form-length select switches.

Supplies

The amount of paper used is a function of the application. Volume printing does not generally lend itself economically to the use of printers requiring special paper. Similarly, applications requiring multiple copies can become very expensive if secondary reproduction techniques are needed.

Ribbon expense, which may seem insignificant at first, can be substantial over the life of a printer. Price is a factor, but the least expensive ribbon to buy may not be the least expensive in use. A more expensive ribbon may last longer and cost less in the long run. Ribbon changing, no matter how infrequent, is bothersome, and installation should be easy and clean.

The procedure for loading paper into the printer is also important. Because paper must be loaded frequently into any printer, the procedure should be simple and require minimal time, without awkward physical contortions. If pin-feed paper is used, tractor faceplates should be exposed and tractor teeth clearly visible when loading paper. A well-engineered printer provides marks for aligning the top-of-form and left margins for preprinted form usage.

Options and accessories

The selection of options or accessories should be based on end-user application requirements and the skill of the printer operator. Find out if the operator will be a highly skilled technician or someone who will simply turn the machine on, load paper and change ribbons.

By using microprocessors for printer control, manufacturers have been able to design features that minimize down time and service calls and provide for unattended operation. Sophisticated built-in diagnostic displays can monitor machine status, automatically displaying any changes. This enables an operator to identify or correct problems—many times without a service call. And with a built-in self-test feature, the operator can run the printer off line to verify correct operation.

How character size can affect print speed

	Character-set size		
	48	64	96
Printer model*	Actual print speed (lpm)		
B-300	320	300	230
B-600	650	650	550
B-1000	1100	1025	820
BP-1500	1500	1200	900
BP-2000	2000	1650	1100

*Model number equals rated speed in lpm.

Some manufacturers equip their printers with audio alarms or built-in status sensors to indicate

conditions such as paper-out and paper and ribbon motion. These features are user conveniences that provide for unattended operation and reduce the possibility of data loss.

Other options, such as special interfaces, universal power supplies and forms-handling features, enhance printer operation and flexibility. Again, the combination of options and accessories selected should be based on need.

When comparing printers, be aware that one manufacturer may offer several accessories as standard equipment, while another may offer the same features as options. Understand exactly what is included in the sticker price and what's extra.

Interfacing considerations

A printer with great performance on paper can turn out to be useless if it's not compatible with your system. The printer must be able to communicate with the computer. Line printers are connected to the computer through a parallel or, occasionally, a serial controller. When the computer sends instructions to print, the controller must transfer data to the printer in a form the printer can understand, then verify that the printer has received the data.

The variables that must be considered when matching a printer and computer include baud rates, protocols, word length and parity. Printers and computers generally match easily, but not always. Compatibility problems can be resolved, but it's important to discuss the requirements before buying.

Environmental considerations

It's a good idea to follow the manufacturer's installation specifications for the printer's environment. However, as systems leave the computer room and enter the office, so will printers. As a result, several additional factors should be considered.

One is noise, which can affect the concentration, comfort and productivity of people working near the printer. Because noise has become a sensitive issue in the last few years, several manufacturers have designed printers with fully enclosed cabinets that reduce operating noise levels from 70 to 75 dBA to approximately 60 to 55 dBA, which is quieter than most office typewriters.

The application dictates not only print speed and price, but print quality as well.

Another environmental consideration is appearance. If a unit is to become part of an office, it should fit in with the other office furniture and machines.

Extremes of temperature and humidity can affect line-printer operation. They should be placed in an area that meets the manufacturer's specifications for those conditions. The printer must be properly grounded, and antistatic carpets should be installed to minimize static-electricity discharge. Some manufacturers offer static eliminators to reduce the possibility of static discharge. If a printer has special power requirements, they should be taken into account. A number of printer manufacturers offer universal power supplies that allow the same printer to accommodate different power sources.

For safety, the printer should conform to federal, state and local codes. All electrical devices introduced as of January, 1981, must conform to Federal Communications Commission regulations, and, in some areas, Underwriters Laboratories approval is required. In Canada, printers must adhere to Canadian Standards Association requirements. In Europe, units must meet the recommendations of the International Electrotechnical Commission.

Vendor considerations

Line printers are available from a number of sources: computer or communications suppliers, system houses, printer manufacturers and distributors. The key factor in selecting the type of vendor is the level of support required.

SUMMARY OF LINE PRINTER TECHNOLOGIES

	Technology	Speed (lpm)	Advantages	Limitations	Price Range
Impact	Impact matrix	150 to 600	High resolution with dense matrix, font flexibility, graphics capability	Lower reliability with higher duty cycles, low resolution with sparse dot matrix	$5000 to $16,400
	Drum	300 to 2000	High reliability, good medium to high duty cycle	Limited character fonts, slight vertical mis-registration	$10,000 to $60,000
	Chain or train	300 to 2000	Good print quality, interchangeable charactersets, as many as 128 characters	Chain or train track wear	$15,000 to $70,000
	Band or belt	150 to 3000	Interchangeable fonts, good print quality, high reliability	Belt and drive wear, entire band replacement for individual worn character	$7000 to $100,000
Non-Impact	Electrostatic	300 to 18,000	Graphics capability, versatile fonts, high speed, quiet	Special paper, wet toner	$5000 to $165,000
	Xerographic	800 to 14,000	High speed, high resolution, quiet, multiple character sets, 132-column lines, eliminates preprinted forms	High cost, high maintenance, high-volume applications	$18,000 to $400,000
	Thermal	180 to 480	Quiet, graphics capability	Special paper	$800 to $1300

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CENTRONICS® PRINTSTATIONS

CIRCLE NO. 36 ON INQUIRY CARD

Computer and communications suppliers can lease or sell an entire system and take full responsibility for its installation and maintenance. Minicomputer manufacturers and terminal suppliers often have extensive service organizations dedicated to maintaining user equipment. Their service facilities are well-staffed and have adequate part supplies to provide all levels of support with a reasonable turnaround time.

System supply houses usually specialize in developing hardware/software combinations to suit their customers' needs. Once they've developed the system, it may be turned over to the buyer for operation and upkeep. Some system houses refer customers to the hardware manufacturer or a third-party maintenance organization to service the equipment.

If the buyer can assume responsibility for providing the necessary hardware interface, software, maintenance and service, a printer manufacturer may be the lowest cost hardware source. The initial saving may eventually be eaten by maintenance and spare-part expenses if a customer cannot integrate and maintain the equipment. Some manufacturers, however, maintain field-service organizations. Such groups are often established to provide advisory support to OEM customers. Other manufacturers actively solicit end-user business and are prepared to provide full field service.

Still other manufacturers have authorized distributors who stock inventory for resale and may offer varying levels and combinations of support and post-sale service. This can range from providing a printer directly from stock to offering extended credit terms, contracting flexibility and application assistance. Post-sale service may include installation and on-site maintenance capabilities. And, in addition to selling the printer, some distributors provide an integrated printer subsystem consisting of the printer as well as the associated interface and/or controller.

Horizontal font carriers have greater character-set and font flexibility than drum printers.

Total cost of ownership

Perhaps the single most important consideration in the selection of a printer, after basic performance specifications, is the total cost of ownership. This includes the initial purchase price and the cost of supplies, maintenance and spare parts over the expected life of the unit. When analyzing competing products, an inherently superior product with a higher initial cost is likely, over its life, to incur a lower cost of ownership, in which case the higher purchase price is easily justified. A comprehensive analysis should include a thorough life-cycle cost study.

Three fundamental factors contributing to a printer's cost are reliability, periodic maintenance requirements and the cost of supplies. Reliability, or mean time between failure, means how long a printer will run before something goes wrong. If the failure rate is too high, repair and part costs are prohibitive. A printer's reliability depends on its design, manufacturing and maintenance.

The requirement for periodic maintenance is a function of the soundness of a printer's design. All devices are designed to operate at some duty level. Generally, the simpler a design, the more reliable a product. An inherently simple electromechanical system properly used requires little maintenance. A more complex or improperly used system requires more frequent and more costly maintenance.

The cost of ribbons and paper will influence the total cost of ownership. The price for supplies will depend on what's being printed and the print quality needed. Just as a higher priced printer may, in the long run, justify its initial expense, higher quality ribbons and paper may eventually pay for themselves.

Regardless of whether a line printer is selected for its stand-alone merits or for integration into a complete system, all of the foregoing selection criteria should be applied (See p.61). The relative weights of each criterion may vary from one application to the next, but if the selection process begins by sorting matrix from fully formed character printers and then balancing the parameters of speed, output volume and duty cycle, the rest will fall easily into place. □

LINE PRINTER SELECTION CHECKLIST

1. Speed
2. Output volume
3. Duty cycle
4. Technology
   - a. fully formed versus dot-matrix characters
   - b. impact versus non-impact
5. Font flexibility
6. Forms-handling capabilities
7. Supplies
8. Options and accessories
9. Interfacing considerations
10. Environment
    - a. noise
    - b. printer appearance
    - c. temperature, humidity
    - d. power and safety requirements
11. Vendor considerations
    - a. initial hardware purchase
    - b. post-sale support: installation and maintenance
12. Total cost of ownership
    - a. MTBF
    - b. maintenance requirements
    - c. cost and availability of supplies

John V. Harker is senior vice president, marketing and corporate development, for Dataproducts Corp., Woodland Hills, Calif.

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CIRCLE NO. 37 ON INQUIRY CARD

LINE PRINTERS

Company Model	Printer type	Speed (LPM)	Chars./ line	No. of copies	Specify fonts	Price ($)	Special features
BDS CORPORATION							
1500	band	1500	132	6			pow. paper stacker, acoustic cabinet, static eliminator, self-test
B-1000	band	1000	132	6	Gothic, OCR-A, B, international		pedestal paper receptacle, self-test, static eliminator, 12 ch. DAVFU
B-300	band	300	132	6	Gothic, OCR-A, B, international		pedestal paper receptacle, self-test, static eliminator, 12 ch. DAVFU
B-600	band	600	132	6	Gothic, OCR-A, B, international		pedestal paper receptacle, self-test, static eliminator, 12 ch. DAVFU
C. ITOH ELECTRONICS INC.							
CI-300	impact matrix	80/300	220	8	ASCII, international, bar code, OCR	4500	dual microprocessors with RAM and ROM
CI-600	impact matrix	170/600	220	8	ASCII, international, bar code, OCR	5700	dual microprocessors with RAM and ROM
CENTRONICS DATA COMPUTER CORP.							
I	belt	900	132	6	48, 64, 96, 128ASCII	12550	acoustic cabinet, towel ribbon
II	belt	1200	132	6	48, 64, 96, 128ASCII	13740	acoustic cabinet, towel ribbon
III	belt	1600	132	6	48, 64, 96, 128ASCII	18600	acoustic cabinet, towel ribbon
6081/6085	band	300/750	132/136	6			touch-sensitive control panel
6080/34	band	300/750	132	6			12-channel VFU, paper sensor
9372-1	train	1200	132				power forms stacker
9372-11	train	1600	132				power forms stacker
9372-111	train	2000	132				power forms stacker
937-111	train	2000	132				power forms stacker
DATA GENERAL CORP.							
4327	band	300	132	6	USASCII	8900	
4364	band	600	132	6	USASCII	12900	
4373	band	1200	136	6	USASCII	28500	
DATA PRINTER CORP.							
1200	chain	1200	132	6	48, 64, 96ASCII		
1210	chain	1000	132	6	48, 64, 96ASCII		
1260	chain	600	132	6	48, 64, 96ASCII		
3101	band	1000	132	6	48, 64, 96ASCII		
3121	band	1200	132	6	48, 64, 96ASCII		
3601	band	600	132	6	48, 64, 96ASCII		
3751	band	750	132	6	48, 64, 96ASCII		
BT 1500	band	1500	132	6	48, 64, 96ASCII		
DATAPOINT CORP.							
9660	laser-scanned elec.	1300	240/480	1	many	65000	5 input drawers, 10 user-addressable output bins, lock box
9257	band	300	132	4	ASCII	10800	variable forms length, self-test, dual tractor
9258	band	600	132	4	ASCII	14500	variable forms length, self-test, dual tractor
9266	drum	900	132	6	ASCII	29750	acoustic cabinet
DATAPRODUCTS CORP.							
B-1000	band	1000	132/136	6	more than 50 English, foreign, math, science	12800	diagnostic display, self-test, acoustic cabinet, Dataproducts interface

Company Model	Printer type	Speed (LPM)	Chars./ line	No. of copies	Specify fonts	Price ($)	Special features
B-300	band	300	132/136	6	more than 50 English, foreign, math, science	7000	diagnostic display, self-test, Dataproducts interface
B-600	band	600	132/136	6	more than 50 English, foreign, math, science	8825	diagnostic display, self-test, Dataproducts interface
BP-1500	band	1500	132/136	6	more than 50 English, foreign, math, science	21875	diagnostic display, self-test, DAVFU, Dataproducts interface
BP-2000	band	2000	132/136	6	more than 50 English, foreign, math, science	26000	diagnostic display, self-test, DAVFU, Dataproducts interface
DECISION DATA COMPUTER CORP.							
6610	drum	1000	64			22000	swing open gate, forms jam sense, speed and system upgrade
6665	drum	650	64			17000	swing open gate, forms jam sense, speed and system upgrade
6680	drum	800	64			19000	swing open gate, forms jam sense, speed and system upgrade
6703	impact matrix	300	48			6995	coarse/fine vert-horiz adjustment, lighted print area
6807	belt	700	48/96			12100	power paper pull, operator panel, remote visible alarm, LED display
6811	belt	1100	48/96			17000	power paper pull, operator panel, remote visible alarm, LED display
6814	belt	1400	48/96			23000	power paper pull, operator panel, remote visible alarm, LED display
DELPHAX SYSTEMS							
A2460	ion deposition					12000	
DIGITAL ASSOCIATES CORP.							
1200	chaintrain	1200	132/136				automatic vacuum system
1210	chaintrain	1000	132/136	6	48, 64, 96, 128ASCII		automatic vacuum system
1260	chaintrain	600	132/136	6	48, 64, 96, 128ASCII		static eliminator, 12 ch. VFU or FLSS, DAVFU, paper pull, self-test
9380-12E	band	1200	132/136	6	48, 64, 96, 128ASCII		acoustic cabinet, LED diagnostic display, FLSS, DAVFU
9380-18E	band	1600	132/136	6	48, 64, 96, 128ASCII		acoustic cabinet, LED diagnostic display, FLSS, DAVFU
9383E	band	300	132/136	6	48, 64, 96, 128ASCII		acoustic cabinet, LED diagnostic status display
9386E	band	600	132/136	6	48, 64, 96, 128ASCII		acoustic cabinet, LED diagnostic status display
9389E	band	900	132/136	6	48, 64, 96, 128ASCII		acoustic cabinet, LED diagnostic status display
B-1000	band	1025	132/136	6	48, 64, 96ASCII		acoustic cabinet, LED diagnostic display, self-test, FLSS
B-300	band	300	132/136	6	48, 64, 96ASCII		LED diagnostic display, self-test, FLSS, pedestal, paper shelf
B-600	band	600	132/136	6	48, 64, 96ASCII		LED diagnostic display, self-test, FLSS, pedestal, paper shelf
BP-1500	band	1200	132/136	6	48, 64, 96ASCII		enclosed cabinet, LED diagnostic status display, self-test
BP-2000	band	1650	132/136	6	48, 64, 96ASCII		
BT-1500	band	1200	132/136	6	48, 64, 96, 128ASCII		enclosed cabinet, self-test, 12 ch. VFU/FLSS, 4 motor tractors
M-100	impact matrix	96	132	6	128ASCII		self-test, FLSS, LED status display
M-120	impact matrix	120	132	6	128ASCII		self-test, FLSS, LED status display
M-200	impact matrix	200	132	6	128ASCII		self-test, FLSS, LED status display
P-150	impact matrix	150	132	6	64, 96ASCII		plot mode, static eliminator, underlining

Company Model	Printer type	Speed (LPM)	Char/ line	No. of copies	Specify fonts	Price ($)	Special features
P-300	impact matrix	300	132	6	64, 96ASCII		plot mode, static eliminator, underlining
P-600	impact matrix	600	132	6	64ASCII, 96ASCII, double-high		plot mode, static eliminator, underlining
T-150	belt	340	132	6	48, 64, 96ASCII		interchangeable carbon/nylon ribbons, 2-channel VFU, self-test
T-340	belt	340	132	6	48, 64, 96ASCII		2-channel VFU, pedestal, self-test, alarm
DIGITAL EQUIPMENT CORP.							
LP27	band	800/1200		6	64, 96ASCII	27990	LED diagnostic display
FUJITSU AMERICA, INC.							
M3071A	laser diode	1000			OEM provides controller	5100	
FUJITSU							
3052A	laser	21200		1			
GENERAL ELECTRIC CO.							
GE 310	belt	425	132		ASCII	4835	
GE 510	belt	425	132		ASCII, international	5795	
HARRIS CORP.							
4270	chain	900	132/136	6	96ASCII	40900	acoustic cabinet, controller
4330	band	600	132/136	6	64ASCII	14950	acoustic cabinet, controller
4335	band	450	132/136	6	96ASCII	14950	acoustic cabinet, controller
HEWLETT PACKARD							
2608S	impact matrix	350	132		block, math, linedrawing	11170	high-density mode graphics, HP-IB interface, paperout & jam detector
2680A	optical	45	255		programmable	91600	2:1 and 4:1 reduction, optional graphics
2608A	impact matrix	250/400	132	6	ASCII, international		graphics capability, paper baskett
2611A	chain	430/600	132	6	ASCII		paper puller, paper out/jam detection
2619A	chain	750/1000	132	6	ASCII, OCR-B		paper puller, paper out/jam detection
2685/40	electrographic		255		40 character sets		
HITACHI							
LB72	laser	2730					
HONEYWELL INFORMATION SYSTEMS, INC.							
PRU9109/ 9609	drum	900	136	6	OCR-B	26500	print speeds rated at 64-character set
PRU9117/ 9617	belt	300	136	5	OCR-B	11500	print speeds rated at 64-character set
PRU9118/ 9617	belt	600	136	5	OCR-B	17500	print speeds rated at 64-character set
HOUSTON INSTRUMENTS							
8220	electrostatic	1000	132	1	96ASCII	3995	
IBM							
3800 model 3	split-beam laser	20040			59 character sets	315000	
MANNESMANN TALLY							
T-3000 Series	impact matrix	300	132	6	96USASCII		quietized cabinet, self-test
MT600	impact matrix	300/900			bar codes, OCR-A, B	9000	self-diagnostics, graphics capability
MILTOPE CORP.							
HSP 3609-212A	impact matrix	400	80/132	4	128ASCII	19800	

Company Model	Printer type	Speed (LPM)	Chars./ line	No. of copies	Specify fonts	Price ($)	Special features
LP 3036	impact matrix	300	36/42	2	64ASCII	7500	
TP 2000	thermal matrix (7x9)	160	40/66		64ASCII	7500	
TP 3000	thermal matrix	300	80/132		64ASCII		
TP 4080	thermal matrix	160	40/80		64ASCII		
NBI INC.							
OASys Laser	laser					19900	
NEC INFORMATION SYSTEMS							
L300	band	300	136	5	NEC Gothic, OCRB	5250, OEM, Q1	electronic VFU, enhanced print mode, interfaces
L600	band	600	136	5	NEC Gothic, OCRB	6920, OEM, Q1	electronic VFU, enhanced print mode, interfaces
PLESSEY PERIPHERAL SYSTEMS							
LP 11	impact matrix	300	132	6	96ASCII	6405	
PRINTER SYSTEMS CORP.							
PSC-B1000	band	1000	132	6	ASCII, international	11535	acoustic cabinet
PSC-B300	band	300	132	6	ASCII, national	5588	
PSC-B600	band	600	132	6	ASCII, national	7184	
PSC-BP1500	band	1200	132	6	ASCII, national	19125	acoustic cabinet
PSC-T3000	band	300	132	6	ASCII, national	5495	
PRINTRONIX, INC.							
MVP	impact matrix	120	132/170	6	96ASCII	3745	underlining, internal diagnostics, forms-length selector
P-150	impact matrix	150	132	6	96ASCII	4695	Dataproducts/Centronics interfaces, EVFU up to 160 characters, optional intelligent graphics processor
P-300	impact matrix	300	132	6	96ASCII	5595	Dataproducts/Centronics interfaces, EVFU up to 160 characters, optional intelligent graphics processor
P-600	impact matrix	600	132	6	96ASCII	7695	Dataproducts/Centronics interfaces, EVFU up to 160 characters, optional intelligent graphics processor
QUALITY MICRO SYSTEMS INC.							
Lasergraphix 1200	laser		132		10 fonts standard		
RACAL-MILGO INFO. SYSTEMS INC.							
4295	impact matrix	300	132	6	96ASCII	6332	
ROYAL BUSINESS MACHINES INC.							
Omniprinter	electrostatic				elite, pica, courier, Letter Gothic		
SOUTHERN SYSTEMS INC.							
M-100	impact matrix	56/145	40/132	6	bar codes		
QT300	band	220/360	132/198	6			quiet cabinet, self-test
QT600	band	440/720	132/198	6			quiet cabinet, self-test
QT1000	band	740/1200	132	6			quiet cabinet, self-test
QT1200	band	890/1440	132	6			quiet cabinet, self-test
Mercurion I	ion deposition	5280				60000	single sheet feed, self-test, VFU compatibility
STC/DOCUMATION							
IMPACT 3000	band	1800	132/150	6	many		speeds to 3000 lpm, auto-stacker, VFU, direct access VFU, counter

Company Model	Printer type	Speed (LPM)	Chars./ line	No. of copies	Specify fonts	Price ($)	Special features
UNIV. 1000	band	1000	132	6	many	14000, Q100	speeds to 1600 lpm, auto-stacker, VFU, direct access VFU, counter
TELETYPE CORP.							
40	belt	300	80/132	6	ASCII	3262	input buffer, asynchronous/synchronous, point-point or multi.
4540	belt	300	80/132	6	ASCII or EBCDIC	5595	input buffer, quiet floor cabinet
TRILOG, INC.							
C-144	impact matrix	190	132	6	96ASCII	11500	for color hard copy from terminals w/non-square aspect ratio
C-60	impact matrix	300	132/220	6	96ASCII	11500	color output on plain paper 60x72
C-100	impact matrix	250	132/220	6	96ASCII	11500	100x100 dpi graphics resolution
T-100	impact matrix	250	132/220	6	96ASCII	8200	near-letter printing quality
T-1100A	impact matrix	250	132/220	6	96ASCII	9050	versatec interface
TIP-150	impact matrix	150	132/220	6	96ASCII	3900	field-upgradable to 300 lpm
TIP-300	impact matrix	300	132/220	6	96ASCII	4900	non-stop printing
WANG LABORATORIES, INC.							
5573/ 2273V-1	band	250	132	6	64, 96ASCII	9000	
5574	band	600	132	6	64, 96ASCII	12500	
5575	band	1100	136	6	64, 96ASCII	29500	
XEROX CORP.							
2700	laser					18995	

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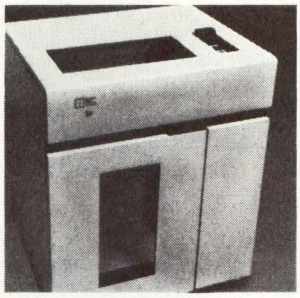
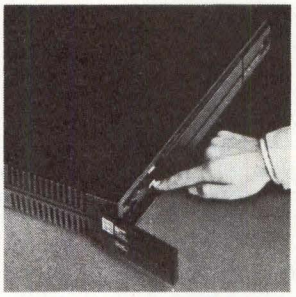
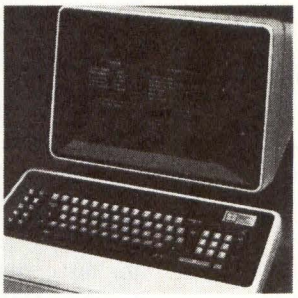
- Coarse & fine paper position
- Pedestal mounted—no extra furniture needed



Band Printer
- 700, 1100 and 1400 lpm
- S/34, S/38 5251-12 compatible
- Coarse & fine paper position
- Power paper puller
- Front & rear control panels
- Field expandable speeds
- LED status display
- Compatible with IBM print bands



Cluster Controller
- S/34, S/38 5251-12 compatible
- Functions as separate unit
- Single cluster feature: 4 ports standard; 8 ports also available
- EIA interface standard
- Expansion feature standard
- Works up to 50 feet away from modem



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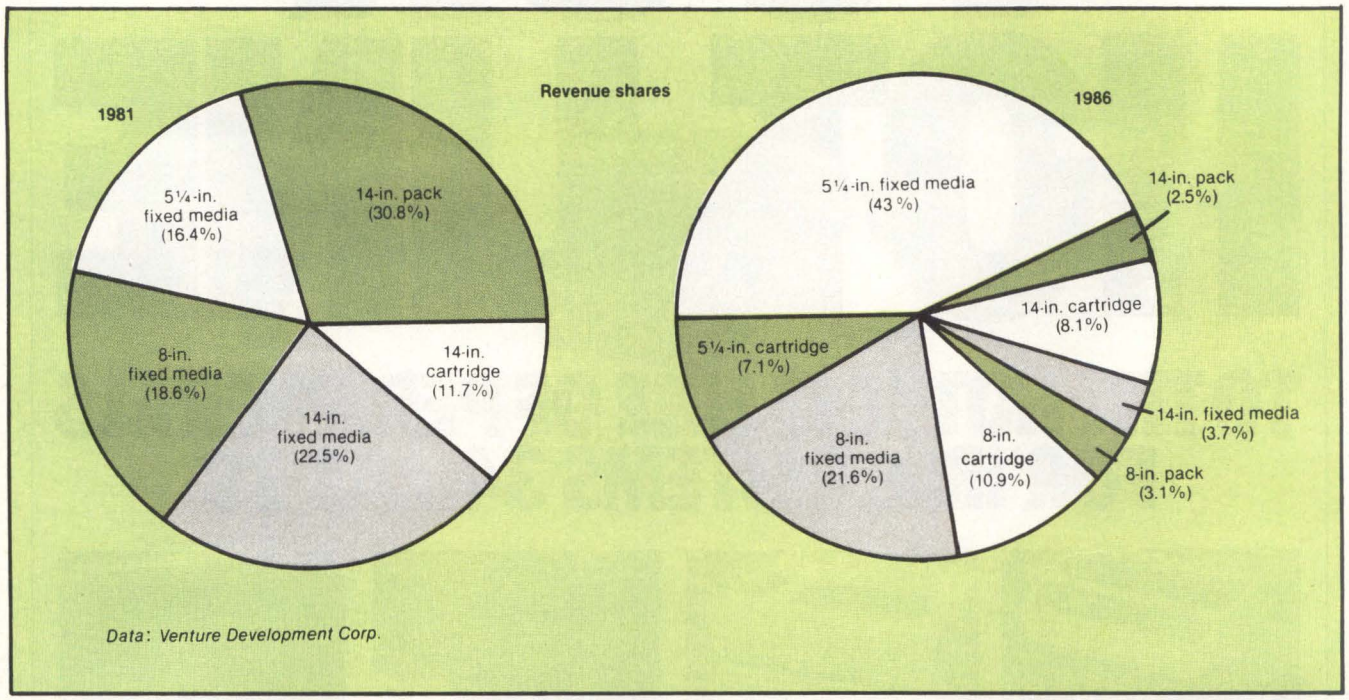
CIRCLE NO. 122 ON INQUIRY CARD

Disk market overview



End-user hard-disk revenues will grow *20.4 percent annually from $7 billion in 1981 to $17.8 billion in 1986, according to Venture Development Corp. Winchesters, which constituted 58.7 percent of rigid-disk dollars in 1981, will account for 82.8 percent of sales in 1986.*

The disk and diskette drive industries were more than prosperous in 1982. Unit prices kept falling, while performance, measured in storage capacity, access time, transfer rate and physical size kept improving. The most popular hard disks were 8-in. drives, followed by 14- and 5¼-in. sizes. Winchesters accounted for roughly 60 percent of end-user hard-disk revenues and will account for 82 percent by 1986. The markets for 8- and 5¼-in. floppy disk drives were each worth roughly $400 million in 1982, but demand for 5¼-in. diskette drives, estimated at 30 to 50 percent annually, exceeds the 20-percent annual growth forecast for 8-in. diskette drives. Overall end-user hard-disk revenues were roughly $8.4 billion this year and are expected to grow at 20 percent annually.

The three major issues in the floppy markets are drive prices, form factors and storage capacities. OEM prices for 5¼-in. floppies will be less than $200 (with electronics) within two years, as large U.S. manufacturers such as Tandon Corp., Shugart Associates and Micro Peripherals, Inc., exploit overseas manufacturing economies.

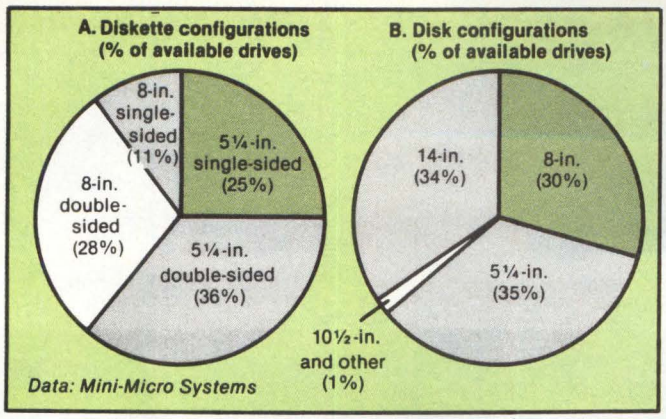
Sizewise, users clearly prefer smaller floppies. While 8-in. drives still use the most standard diskette, they are losing favor. Half-height, 8-in. drives have proved popular with system integrators that want to give their systems mid-life kickers without retooling, and double-sided, 8-in. drives have overcome their bad reliability reputations. But many analysts believe that 8-in. shipments have already peaked. Minifloppy 5¼-in. drives will be the most popular form factor, at least until a standard sub-5¼-in. microfloppy emerges.

Diskette capacities have begun to stabilize within these form factors. Double-sided, 8-in. drives hold 1.6M or 3.2M bytes, and 5¼-in. diskette drives from Control Data Corp., Irwin/Olivetti, Remex Corp., Shugart, Micropolis Corp., Micro Peripherals and Qume Corp. now store 1M byte.

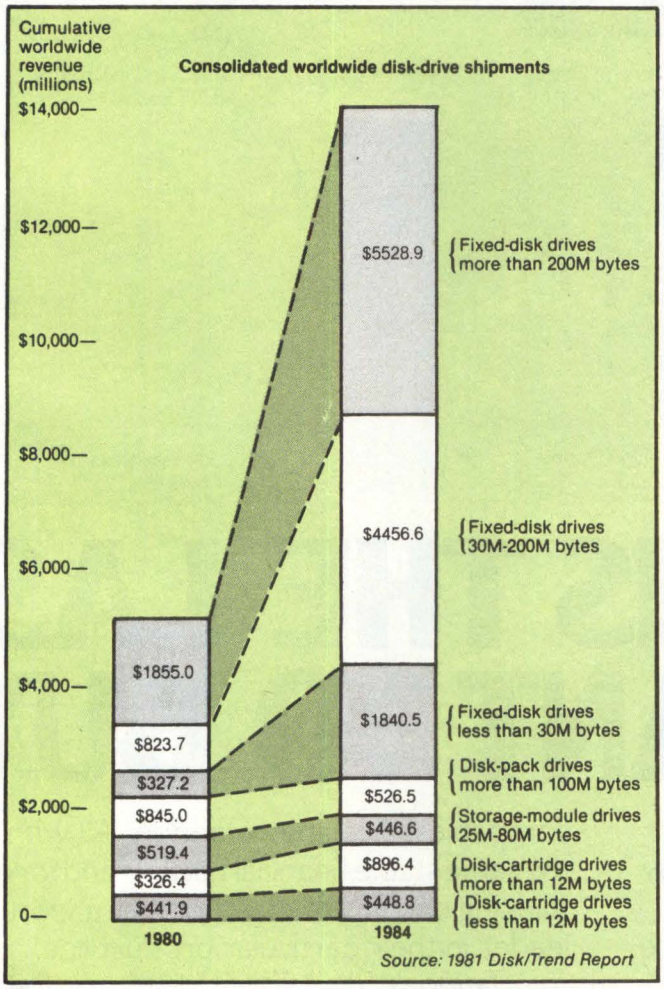
Disk-drive progress

IBM disk drive	First customer shipment	Recording density (bits per sq. in.)
350	1957	2.1×10^3
1311	1963	5.1×10^4
2311	1965	1.1×10^5
2314	1966	2.2×10^5
3330	1971	7.8×10^5
3340	1973	1.7×10^6
3350	1976	3.1×10^6
3370	1979	7.7×10^6
3380	(1981)	1.2×10^7

Introductions have typically doubled disk-storage *densities every 2½ years, leading to today's 5000-fold improvement compared with 1956 performance.*

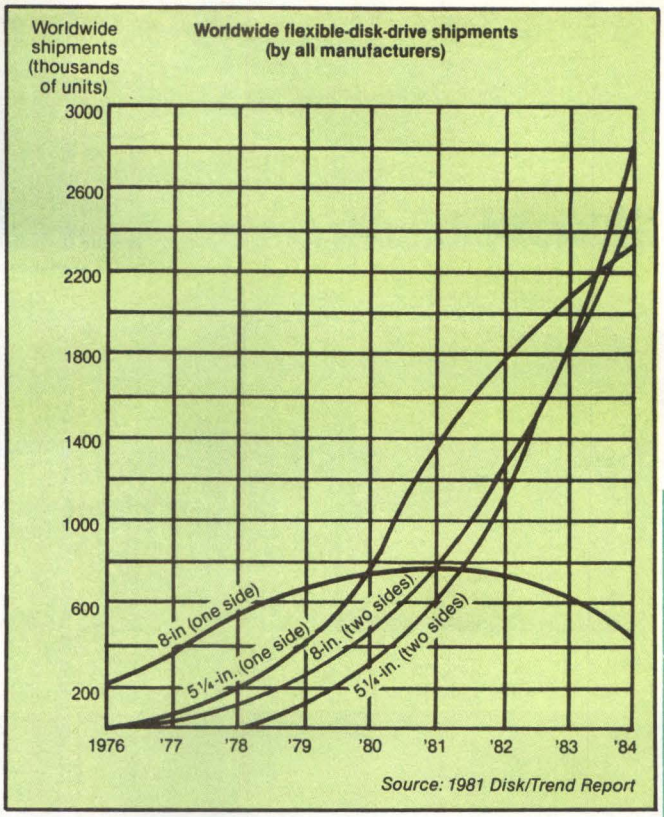


Disk and diskette drive configurations are numerous and change slowly *over time. The 5¼-in. disk drives are outselling all other rigid-disk-drive sizes, and 5¼-in. diskette drives are doing as well in their markets. The 10½-in. rigid disk drives have all but disappeared, and single-sided diskette drives of all sizes are losing market share. Makers of 3½- and 3¼-in. diskette drives are still competing to establish a standard size for sub-5¼-in. diskette drives.*



Disk-drive revenues will grow at least 29 percent annually through 1984. *Strongest growth will occur in the fixed-disk markets, with lower capacity Winchester drives leading the way.*

On the hard-disk side, recent developments center on increasing capacities and media removability. The 5M-byte, first-generation, 5¼-in. Winchesters of 1980 gave way to 2M- to 40M-byte, 5¼-in. Winchesters in 1981 and 1982, and prototypes for 60M- to 180M-byte, 5¼-in. devices should appear by year-end. This year,



Floppy-disk shipments reflect the trend toward greater floppy-disk capacity. *Shipments of single-sided, 8-in. drives have already peaked. Worldwide shipments of all types of floppy drives during 1980 totaled 2019 units and should be 8259 in 1984, a compound annual growth rate of 42 percent.*

Optical versus magnetic media (percentage by shipment value)

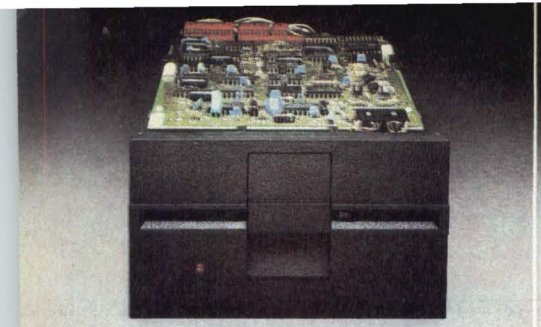
	1982	1985	1990
Floppy	51.3	52.8	46.9
Winchester	8.4	16.7	28.7
Hard pack	40.3	27.3	14.9
Optical	—	3.3	9.4
Total	100.0	100.0	100.0

Data: International Resource Development, Inc.

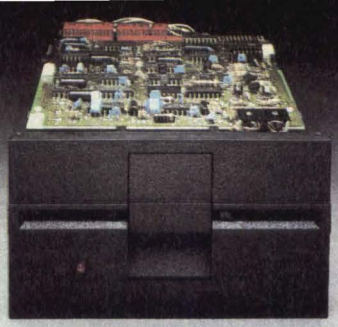
Storage-media growth will be paced by Winchesters and optical technologies *for the remainder of the decade. Winchesters will more than triple their current penetration by 1990. Optical devices, rare today, will grow 23 percent annually beginning in 1985.*

CDC, DMA Systems, Inc., and others announced new removable-disk units to cater to the backup needs of small system users. Optical disks could revolutionize first high- then low-end drive markets, but production optical disks are unlikely before 1984.

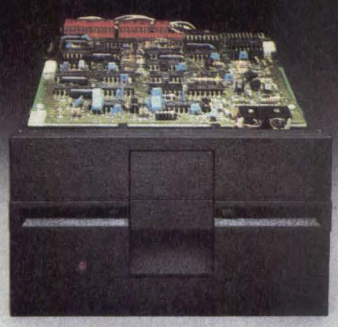
The mature high-end disk market should remain healthy as usual. The 8-in. disk market should prosper for a few more years, but is on the wane. The mini-Winchester and minidiskette markets are like the CRT market of the late 1970s. Dozens of new entrants are cropping up, and everyone knows a shakeout will come, but demand seems inexhaustible, the stakes are immense, and there's room for more than a handful of survivors. □



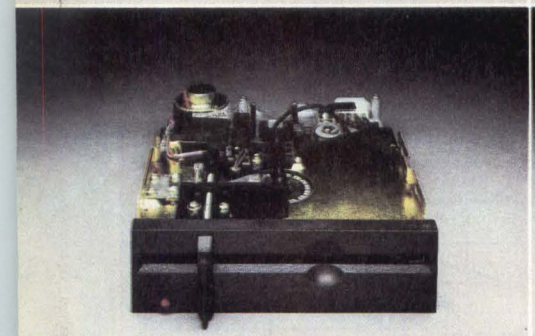
TM100-1 5¼" Floppy
48TPI 250KB



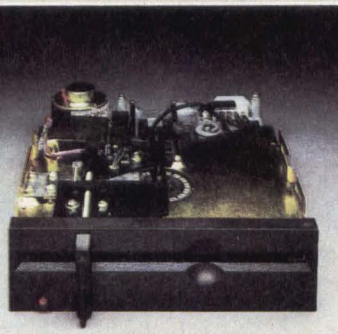
TM100-2 5¼" Floppy
48TPI 500KB



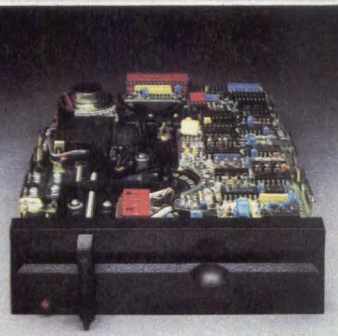
TM100-3/3M 5¼" Floppy
96/100TPI 500KB



TM50-1M 5¼" ThinLine Floppy
48TPI 250KB (Mechanics)



TM50-2M 5¼" ThinLine Floppy
48TPI 500KB (Mechanics)



TM50-1 5¼" ThinLine Floppy
48TPI 250KB

TM848-1 8" ThinLine Floppy
48TPI 800KB

TM848-2 8" ThinLine Floppy
48TPI 1.6MB

TM501 5¼" Winchester
6.4MB

TANDON IS THE LAST
WANT TO BUY

Because once you buy from Tandon, you'll realize there's no reason ever to buy from anyone else.

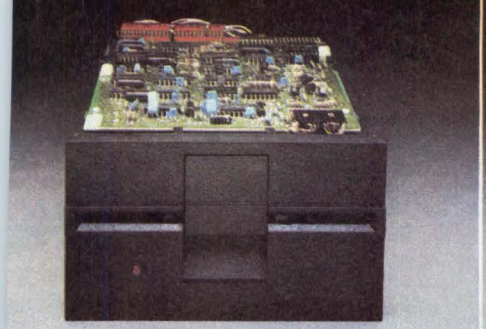
We're the world's number one source for 5¼" floppies, 8" ThinLine™ floppies, and 5¼" Winchesters. For three very good reasons: our three producing divisions.

Each of our divisions is a specialist in its field. That means they can concentrate their energies on producing what they know best. It's as if we owned three disk drive companies. All named Tandon. All with the same stable financial backing and forward-thinking corporate direction. All a world leader in their particular product line.

Tandon's 5¼" floppy division is the world's largest producer of 5¼" floppies. They produce more drives every month than anyone else. For some of the biggest names in the computer industry.

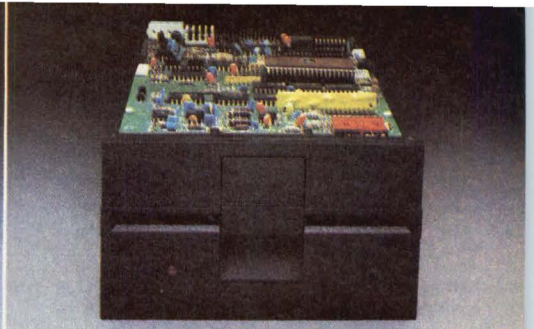
We introduced the 8" ThinLine drive to give you traditional 8" storage capacity in

ThinLine is a trademark of Tandon Corporation. Tandon Corporation. 20320 Prairie, Chatsworth, CA 91311, (213)
Atlanta (404) 934-0620 • Chicago (312) 530-7401 • Dallas (214) 423-6260 • Irvine (714) 675-2928 • Sunnyvale (408) 745-6303 • Frankfurt, West

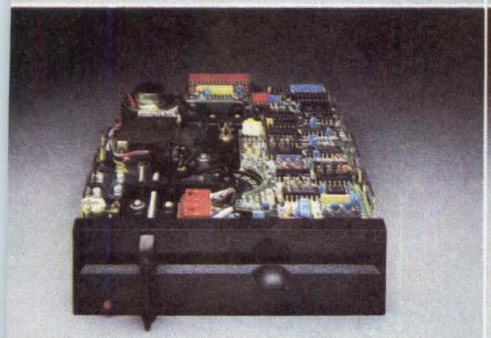


TM100-4/4M 5¼" Floppy
96/100TPI 1MB

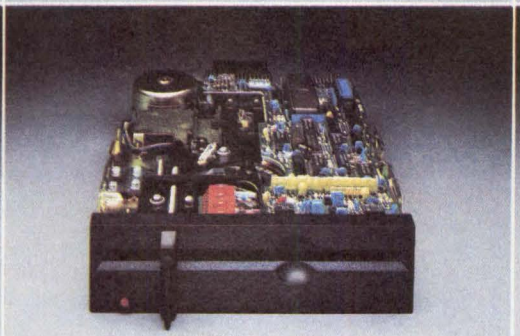
TM101-4* 5¼" Floppy
96TPI 1MB



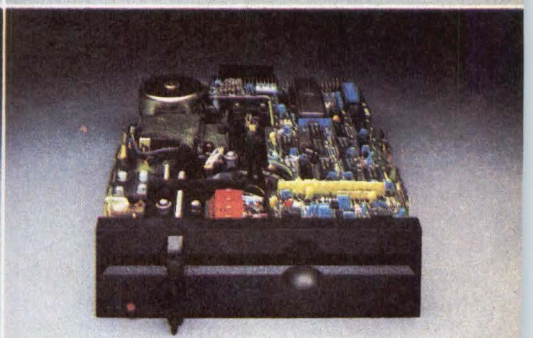
TM102-2* 5¼" Floppy
96TPI 2MB



TM50-2 5¼" ThinLine Floppy
48TPI 500KB

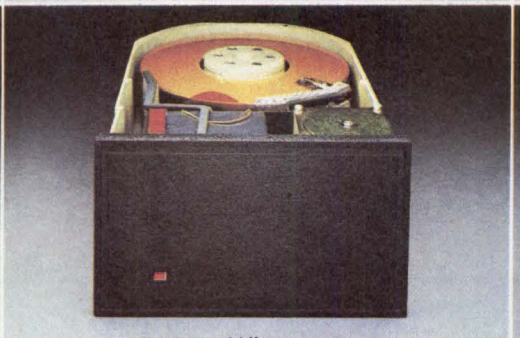


TM55-2* 5¼" ThinLine Floppy
48TPI 500KB

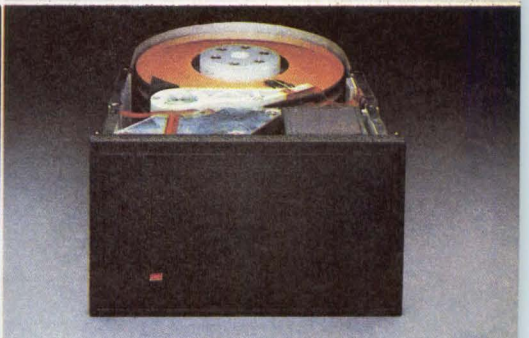


TM55-4* 5¼" ThinLine Floppy
96TPI 1MB

TM502 5¼" Winchester
12.8MB



TM503 5¼" Winchester
19.2MB



TM703 Winchester
30MB (Closed-Loop)

PLACE YOU'LL EVER A DISK DRIVE.

half the space. Our 8" ThinLine division is by far the world's largest producer of these popular drives.

Our Winchester division is now delivering 5¼" drives in both open-loop and high performance closed-loop models. They have current capacity to produce 40,000 drives a month.

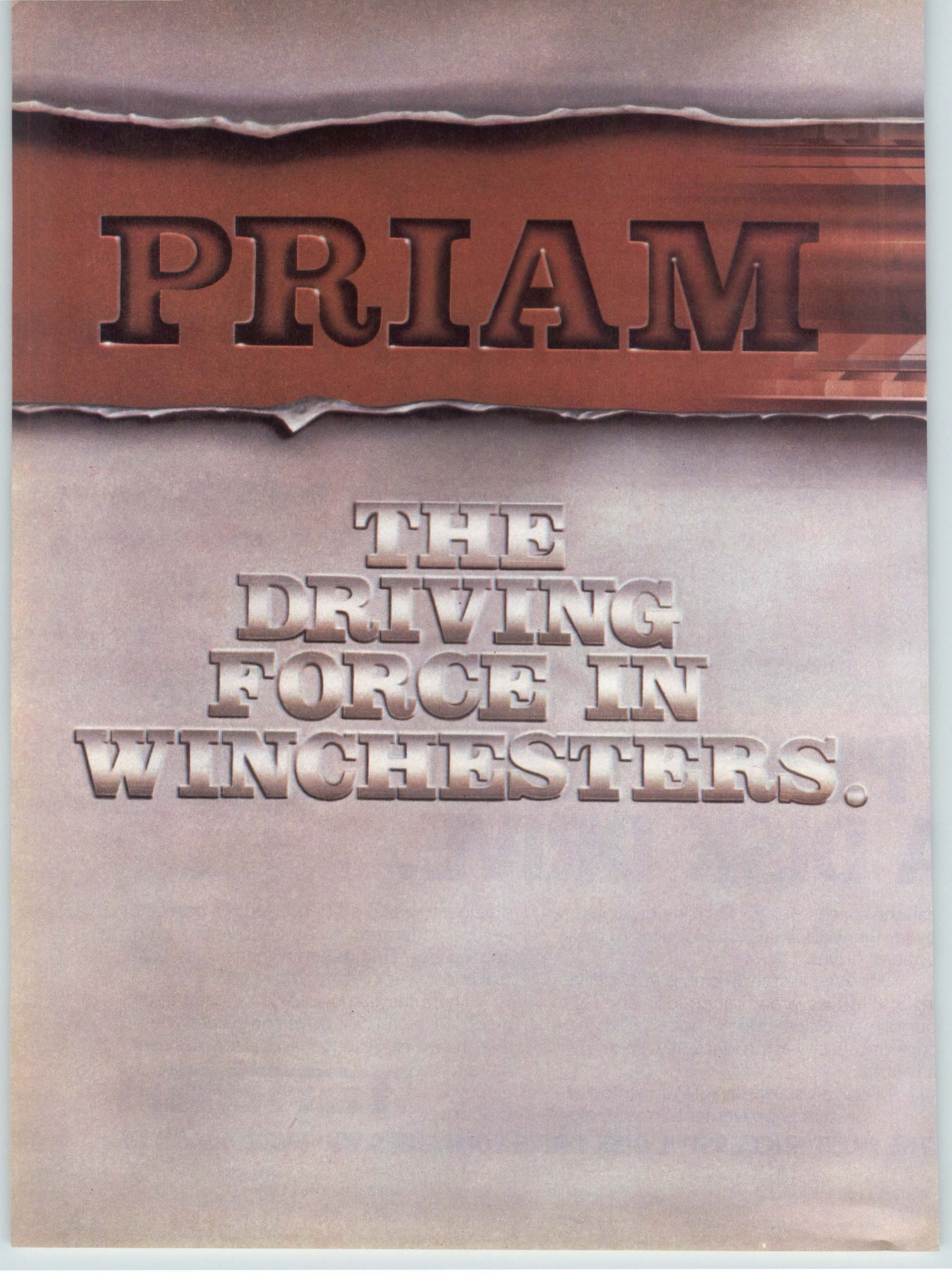
All our divisions share Tandon's dedication to constant improvements in technology, productivity, and efficiency. With a degree of vertical integration no other company even approaches. That means higher quality control and lower costs to you.

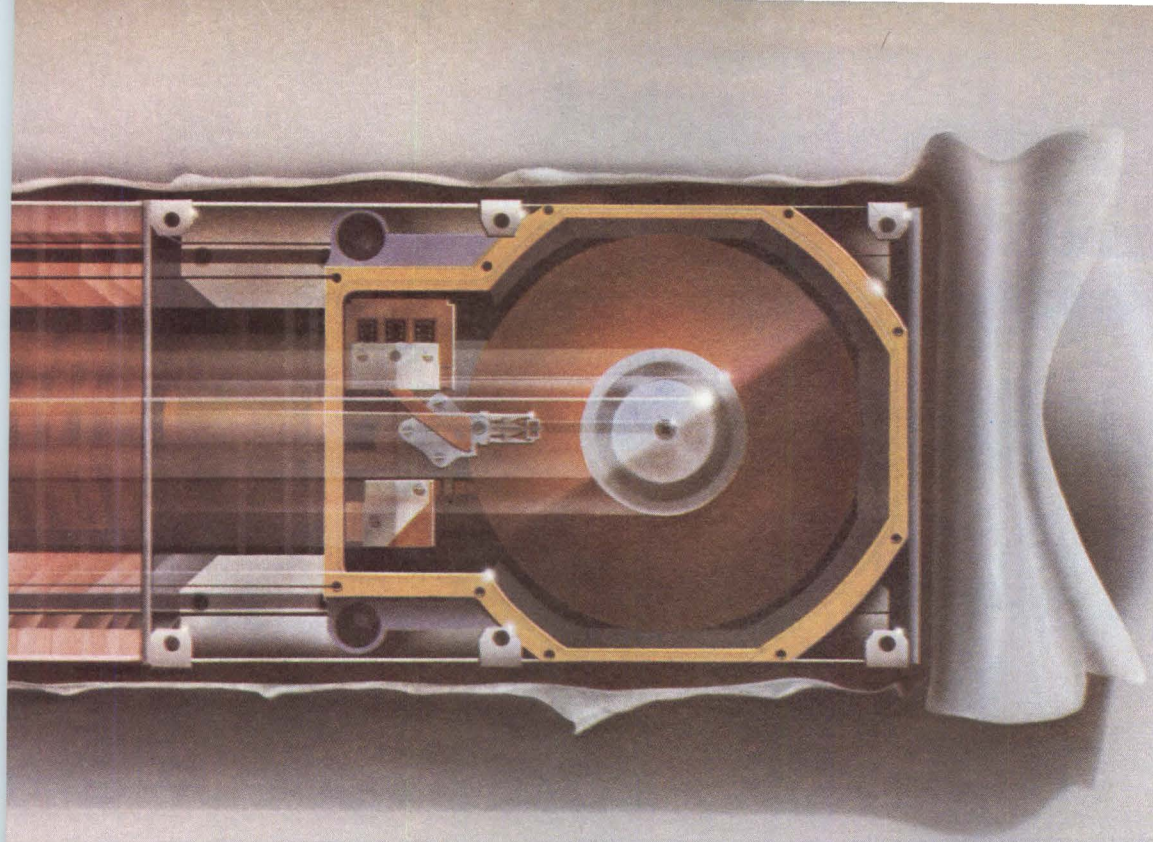
That's the Tandon story. It's made us the most successful disk drive companies you ever heard of. And the last place you'll ever have to go to buy a disk drive.

Tandon

THE MOST SUCCESSFUL DISK DRIVE COMPANIES YOU EVER HEARD OF.

993-6644, TWX: 910-494-1721, Telex: 194794. Regional Sales Offices: Boston (617) 938-1916 • New York (201) 449-7720
ermany 6107-2091, Telex 411547 • London, England (0734) 664-676 Telex: 848411. Distributors: Hall-Mark, Kierulff, Schweber. *Microprocessor Controlled


PRIAM
THE
DRIVING
FORCE IN
WINCHESTERS.



In the world of Winchesters, only one company delivers the proven technology and breadth of line you need—PRIAM.

PRIAM Time. We've paid our dues by delivering thousands of Winchester disc drives. We've proven our technical superiority and high reliability in the field. We're the force to be reckoned with on the high-performance Winchester scene.

A growing family of winners. From the beginning in 1978, PRIAM has been the driving force in high-end Winchester technology. We've proven our technology in the 14-inch Winchester market with our 34, 68 and 158 Mbyte units. Our 8-inch drives have capacities of 35, 70 and 105 Mbytes in a floppy-sized package. And, we're adding a 50 Mbyte 5¼-inch drive to our growing family.

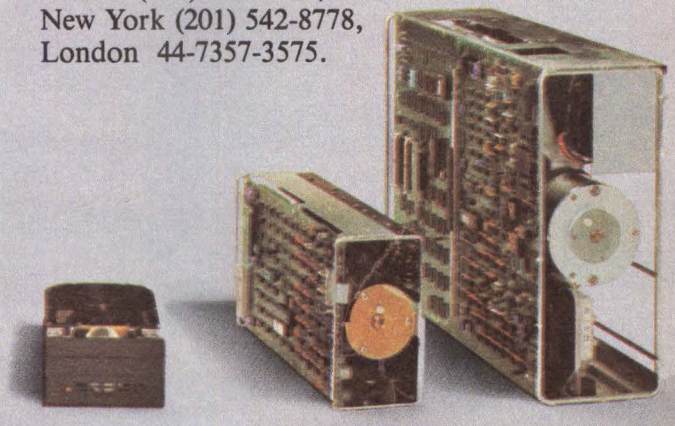
PRIAM Winchester Family.

Size	Model	Capacity (MB)	Access Time
14″	3350	34	45 ms
	6650	68	45 ms
	15450	158	45 ms
8″	3450	35	42 ms
	7050	70	42 ms
	804	105	42 ms
5¼″	502	50	35 ms

SMART Interfaces. PRIAM gives you the finest in interfacing flexibility. Our intelligent interfaces can control up to four drives in any mix, plus tape or floppy backup. They're your fastest and easiest route to putting a Winchester database in your system. Or, if you have an SMD or ANSI controller, our drives can be supplied with a matching interface.

We keep listening. We're driving upward to higher capacities, more compact packaging and enhanced performance with increased emphasis on quality and reliability. We believe our customers deserve high quality products. And we've committed the resources to meet that objective.

If you're thinking about Winchesters, think PRIAM. For more details, call (408) 946-4600 or the sales office nearest you. Los Angeles (714) 994-3593, Minneapolis (612) 854-3900, Boston (617) 444-5030, New York (201) 542-8778, London 44-7357-3575.



PRĪAM

20 West Montague Expwy.
San Jose, CA 95134
(408) 946-4600
TWX 910-338-0293
FAX 408-946-5679

See Us At Comdex, Booth #4804

CIRCLE NO. 40 ON INQUIRY CARD

Our 8″ Slimline disk drives are the smallest and our 5¼″ half heights are rolling out by the truck load.

That's R&D you can bank on: Response and Delivery.

You say you need drives that are half the height but all-the-way reliable? From a source that's equally reliable? And you want a choice of configurations too?

Our response is a line of 5¼″ Slimline™ drives built with three different bezels and door styles, your choice of direct or belt drive motors, and either of two densities, 48 TPI or 96 TPI. But only one quality standard: the highest.

They come single or double-sided, with capacities from 250 Kbytes to 1 Mbyte. And for those who can do with a little less speed MPI responds with a consumer model at a lower price tag.

And when you wanted smaller, compact 8″ drives, we replied with the smallest ones there are. Our 8″ Slimline™ series. Only 2″ thick and 11.5″ deep. The selection doesn't end there. You can also get a 4.6″ bezel as well as a half size version at 2.3″.

To the cry for ever-smaller disks, MPI answered with the smallest disk drive ever. A 3″ micro floppy that interfaces with 5¼″ systems, handles 500 Kbytes of data and uses media protected by a hard shell so you can carry it in your shirt pocket safely.

That's how MPI operates. By responding with what you need. Then delivering. By the truck load from the West Coast. By the ship load from Singapore. Our own second source in the Orient that duplicates the precision production of our California plant. What's more, we are manufacturing our own heads.

That all adds up to MPI's kind of R & D. Response and Delivery. And that makes us the company to bank on.

MPI
MICRO PERIPHERALS, INC.

Micro Peripherals, Inc., 9754 Deering Ave., Chatsworth, CA 91311 Phone (213) 709-4202 TWX (910) 494-1213
MPI, Inc. Europe, 11A Reading Rd., Pangbourne, Berkshire, RG8 7LR England Phone 7357-4711 Telex 848 135 MPI EURO

CIRCLE NO. 41 ON INQUIRY CARD

Selecting minifloppies

Plenty of models are available, assuring a sensible match with almost any system configuration

Despite its high level of technology, the 5¼-in. floppy disk drive is a tolerant and reliable product. With millions of drives shipped, it has overtaken the 8-in. floppy as the leading peripheral storage device for small systems. During 1983, 28 manufacturers offering 95 models will compete for a minifloppy market of more than $1.2 billion. These 95 models offer a wide variety of features with commensurate variations in price. The major criteria for model selection are capacity, speed, reliability and system compatibility.

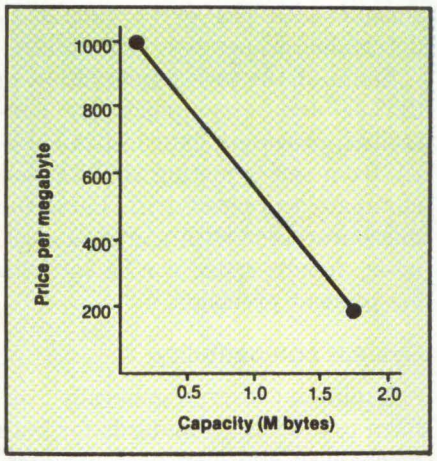


Fig. 1. Price per megabyte for minifloppy drives *is lowest for large-capacity drives, but small-capacity drives offer lower absolute cost, which may be paramount in basic price-sensitive systems.*

Capacity

The capacity required from a minifloppy drive depends on the system application. The available range is 125K to 3.3M bytes. Capacity is determined by the track-per-inch density, bit-per-inch density on the smallest (innermost) track and the number of disk sides used for recording. Minifloppies initially used 48-tpi technology that was a carry-over from 8-in. drives. In 1977, the double-density design was introduced, and it evolved into the present 96-tpi standard.

The storage capacity available to a user (formatted capacity) may be less than the stated (unformatted) disk capacity because of sectoring. Disk space can be lost to sector identification codes or to unused fractions of a sector at the end of a track. Disks are hard or soft sectored. A hard-sectored disk has 16 holes at the inner radius that establish the start point for each sector. A 17th hole defines the start position for each track. A soft-sectored disk has only one punched hole that defines the start position for each track. In this case, the controller has the flexibility to define the number of sectors per track.

Drive capacity can be increased by various methods of encoding data or by recording at a constant bit-per-inch density to give increased storage capacities in the large-circumference outer tracks.

Speed

Drive speed can be described in a number of ways: rotational speed, track-to-track head-positioning speed and head-switching speed. These specifications are often expressed in terms of time, the mathematical reciprocal of speed. Of the various time specifications, perhaps the most important is random access time to data (Fig. 2).

Track-to-track access time, one of the determinants of random access time, is strongly influenced by the design of the actuator mechanism. The two most important designs are the lead screw and the taut band, with average track-to-track access times of 6 and 3 msec., respectively. However, the greater speed of the taut band must be balanced against its higher noise level and lower reliability.

Reliability

There are three types of disk drive errors: soft (recoverable read errors), hard (nonrecoverable errors resulting in loss of data) and seek (failure to reach the required track). Error rates for the three types of errors are almost always quoted as: 1 soft error in 10^9 bits read and 1 seek error in 10^6 seek operations. All well-designed drives can meet these specifications under ideal conditions, but some may fail to do so under actual operating conditions because of heat, dust contamination and electrical noise.

Alignment stability is a feature of drive design that is not specified directly, but it strongly affects the

reliability of disk interchange. During manufacturing, drives are aligned in temperature- and humidity-controlled conditions using calibrated alignment diskettes. The resolution of such alignment techniques is around +/-50 μin., although the absolute accuracy of each measurement is closer to +/-150 μin. The alignment diskettes expand and contract appreciably with variations in temperature and humidity, so a customer planning to verify alignment should consult with the drive vendor to determine proper test procedures.

Some of the latest generation of drives are microprocessor controlled, providing improved reliability from self-adjusting circuits that eliminate sources of drift. Using the microprocessor with a crystal oscillator, spindle speed can be set with 0.1-percent precision.

System compatibility

Minifloppy drives generally conform to industry standards for both mechanical and electrical specifications. It is unwise, however, to assume that apparently identical drives from different manufacturers can be used as plug-in replacements. Standard minifloppy drive dimensions are 3¼ × 5¾ × 8 in., assuming the drive is mounted with a horizontal disk-access slot. Some models, however, have minor dimensional variations, and even minor variations can prevent one drive from fitting in the space provided for another model.

Also important is whether the drive bezel is "designed into" the system front panel or fits behind slots provided in the overall system fascia. In either case, drives cannot be considered multi-sourced unless all front-panel items such as disk-access slots, door configurations and "in-use" LED positions are identical.

Connectors to the drive's power supply and controller should be checked for conformance to industry standards. Power demand should be assessed for peak as well as average current. The average current can be used to estimate cooling requirements, but high peak current roads can seriously affect overall system performance.

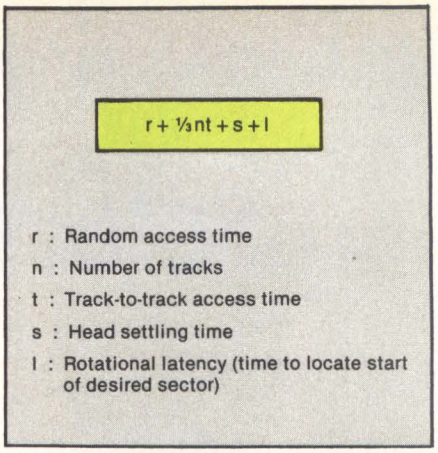


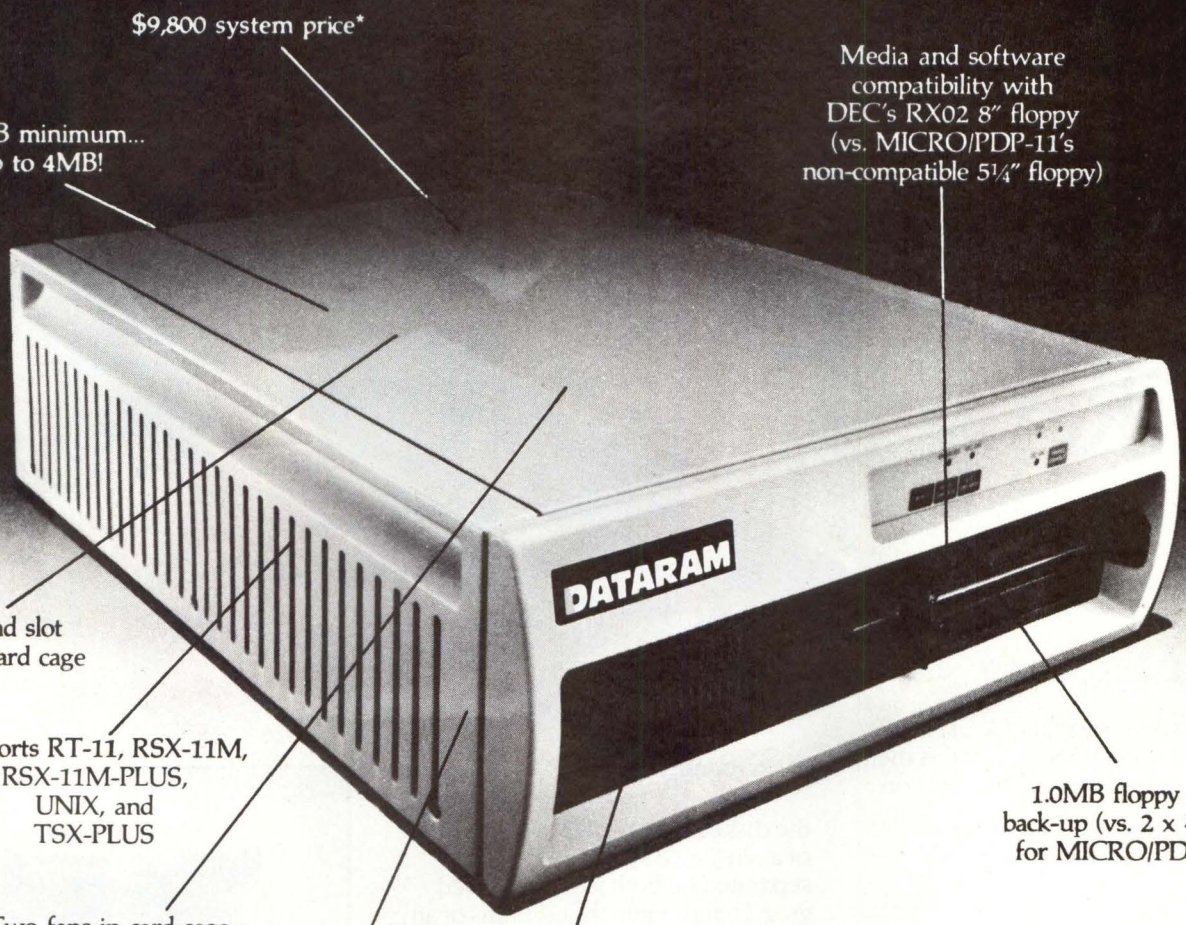
Fig. 2. Random access time to data *is a function of the variables shown above. Typical values for minifloppies are n=80 tracks, t=3 to 6 msec., s=15 msec., and l=100 msec. (half the typical disk rotation time of 200 msec.). Plugging these values into the formula gives an access-time range of 195 to 257 msec. The "one-third" factor in the formula arises from the fact that, on average, the head and the desired data are separated by one-third of the number of tracks on the disk. Although mathematically correct only for an infinite number of tracks, this formula provides a valid approximation for all designs except those in which the number of bits per track is not constant.*

Other considerations

System integrators should also consider a product's options and overall availability. Options commonly offered on minifloppy drives are automatic door locking, disk ejection and various methods to reduce head wear.

With the exception of the recently introduced nonstandard 3M-byte drives, almost all minifloppies have an adequate second source. For users of small quantities of drives, product availability is unlikely to present a problem. However, high-volume users require timely product delivery and should therefore review a potential supplier's manufacturing capability, quality controls and multi-sourcing for drive components. □

Like DEC's.



$9,800 system price*

256KB minimum... up to 4MB!

Media and software compatibility with DEC's RX02 8" floppy (vs. MICRO/PDP-11's non-compatible 5¼" floppy)

8-quad slot Q-bus card cage

Supports RT-11, RSX-11M, RSX-11M-PLUS, UNIX, and TSX-PLUS

Two fans in card cage area (vs. one in MICRO/PDP-11)

RL02-compatible 10MB 5¼" Winchester disk standard; 20MB optional

1.0MB floppy disk back-up (vs. 2 x 400KB for MICRO/PDP-11)

Space for future 40MB cartridge tape drive.

See Dataram at NCC '83

Booth S5284

Only better.

By paying a little more than you would for a MICRO/PDP-11, you can get a lot more! Like an 8" RX02-compatible floppy. 10MB or 20MB 5¼" Winchester and space for a 5¼" cartridge tape. Two fans provide push-pull air flow in the card cage area.

The A22 with LSI-11/23, 256KB, 10MB Winchester, and 8" floppy is only $9,800. 30-day delivery.

For more information, forward this coupon to us, or, for faster response, call (609) 799-0071.

☐ Send information. ☐ Contact me immediately.

Name

Company

Address

City State Zip Phone

Return to:
Dataram Corporation, Princeton Road, Cranbury, NJ 08512

*$9,800 is single-quantity domestic price for A22 with LSI-11/23, 256KB, 10MB Winchester and RX02-compatible 8" floppy.

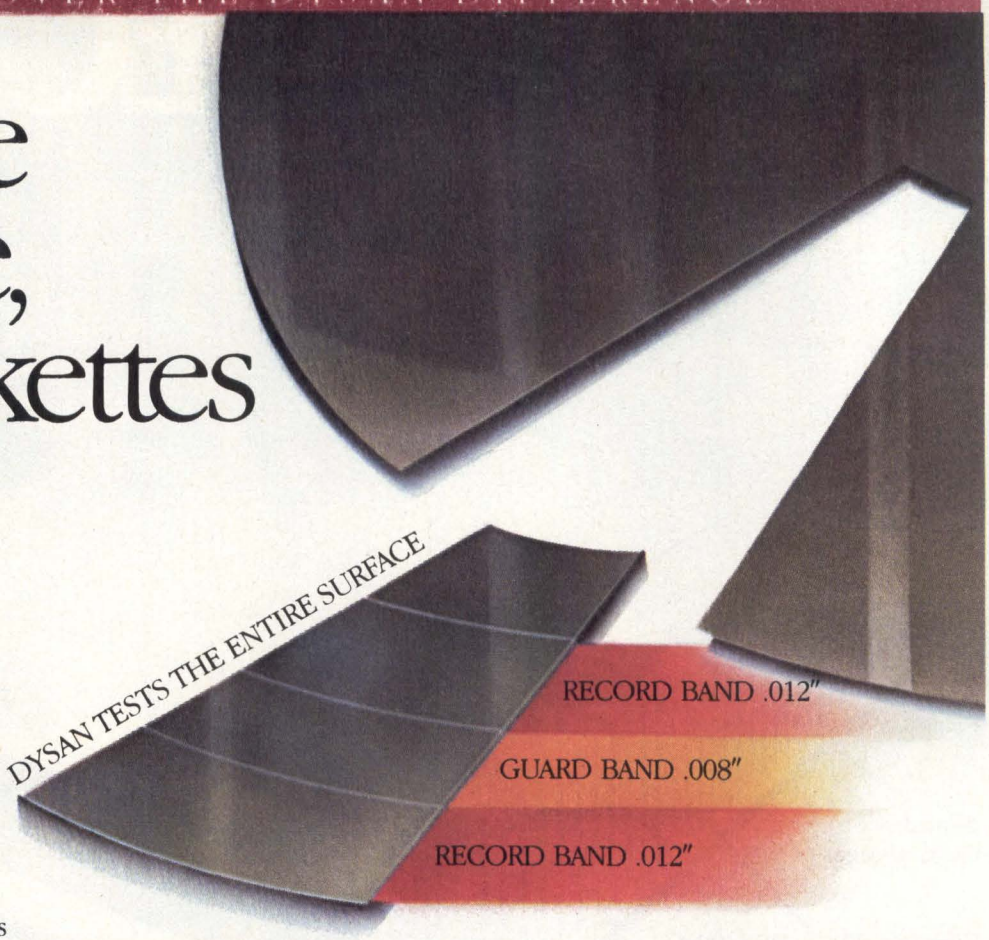
CIRCLE NO. 43 ON INQUIRY CARD

DATARAM

Dataram Corporation ☐ Princeton Road ☐ Cranbury, New Jersey 08512 ☐ Tel: 609-799-0071 ☐ TWX: 510-685-2542

DISCOVER THE DYSAN DIFFERENCE

On The Surface, All Diskettes Seem Alike.



But They're Not.

Most diskette manufacturers claim that they 100% surface test their diskettes—and they do. But only on the tracks.

Dysan goes a bit further and tests not only on but between the tracks. By 100% testing both on-and-between-tracks, Dysan certifies that both the primary track and the guard band areas on every diskette are 100% bit error-free, totally void of missing or extra pulse. That can make quite a bit of difference in your system's performance. Temperature and humidity distortions or slight head misalignments won't cause the user to write on untested areas. That means fewer errors, greater data integrity, and more confidence with every keystroke.

Background:

Magnetic tracks on the surface of the diskette are twelve thousandths of an inch (.012) in width and are separated on both sides by erased guard bands eight thousandths of an inch (.008) in width to protect the flux change information on the tracks.

Other Benefits:

Dysan diskettes also incorporate a proprietary DY[10]™ lubricant which guards against signal loss caused by surface abrasion and resonation. Advanced burnishing techniques are used to flatten microscopic surface peaks. This provides optimum head-to-disc interface. On top of that an exclusive "hands-off" auto load certification system allows Dysan to test each and every diskette and eliminates any possibility of handling errors prior to packaging and shipment.

These superior product characteristics protect your true investment in a floppy diskette. The actual cost of a diskette is not just the purchase price, but the purchase price *plus* the time you spend to fully load the disc. That's a big investment. And that's why Dysan goes a bit further to make diskettes which are the finest that money can buy.

You can select from a complete line of premium 8" and 5¼" diskettes, single or double density, certified on one side or both sides, soft or hard sectored.

DY[10] is a trademark of Dysan Corporation.

One

First in a Series

100% Surface Testing

dysan Dysan CORPORATION

Corporate Headquarters:
5201 Patrick Henry Drive
Santa Clara, CA 95050
(800) 551-9000

CIRCLE NO. 44 ON INQUIRY CARD

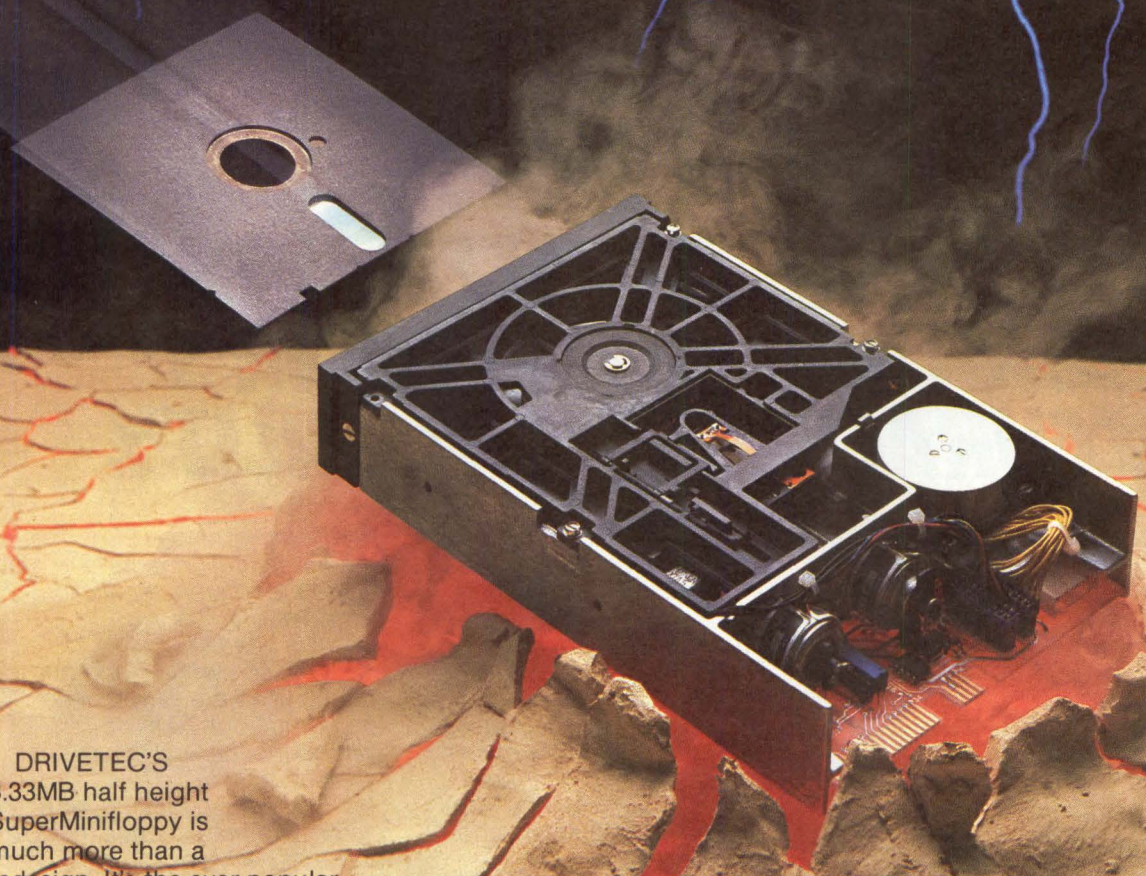
5¼-IN. DISKETTE DRIVES

Company Model	Single-sided (Y/N)	Double-sided (Y/N)	Capacity (K bytes)	Avg. access time (msec.)	Transfer rate (K bytes/sec.)	Tracks/ surface	Tracks/ in.	Price ($)	Dimensions (H x W x D, in.)
ALPS ELECTRIC CO., LTD.									
AFD211	Y	N	250	156	250	40	48		1.61x5.75x8.0
AFD212	N	Y	500	156	250	80	48		1.61x5.75x8.0
AFD221	Y	N	500	94	250	80	96		1.61x5.75x8.0
AFD222	N	Y	1000	94	250	160	96		1.61x5.75x8.0
AMLYN CORP.									
1850	Y	N	1600	95	500	154	170	300, Q1000	3.25x5.75x8.00
1860	N	Y	3200	95	500	154	170	370, Q1000	3.25x5.75x8.00
5460	Y	N	8000	95	250	160	170	610, Q1000	3.25x5.75x8.00/10.45
5850	Y	N	8000	88	500	154	170	610, Q1000	3.25x5.75x8.00/10.45
A506	Y	N	8000	88	500	154	170	635, Q1000	3.25x5.75x8.00/10.45
ANDERSON JACOBSON, INC.									
AJ460	N	Y	204			40		1595	8x13.5x22.5
APPLE COMPUTER, INC.									
Disk II	Y	N	140		125	35	48	545	3.25x5.75x8.00
Disk III	Y	N	140		125	35	48	435	4.12x6.35x8.80
ATARI, INC.									
810	Y	N	90	40	120	40	48	599	4.5x9.5x12
BASF									
6106	Y	N	250	156	250	40	48		2.1x5.8x7.5
6108	N	Y	500	156	250	400	48		2.1x5.8x7.5
6118	N	Y	1000	158	250	80	96		2.1x5.8x7.5
C. ITOH ELECTRONICS, INC.									
YD-380T	N	Y	1600	91	500	77	96	350, Q1000	1.6x5.8x8
CANON USA, INC.									
MDD221	N	Y	1000	95	250	80	96	250, Q1000	
MDD422	N	Y	2000	95	250	80	96	335, Q1000	
MDD423	N	Y	2000	95	250	80	96	370, Q1000	
COLUMBIA DATA PRODUCTS									
400	Y	N	180	463	250	35	48	2195	5.3x7.0x13.5
COMMODORE BUSINESS MACHINES									
2031	Y	N	170		125	35	48	595	
4040	N	Y	330		125	35	48	1295	7.1x15.0x15.5
8050	Y	N	1050		125	77	96	1795	7.1x15.0x15.5
8250	N	Y	2100		125	77	96	2195	7.1x15.0x15.5
CONTROL DATA CORP.									
CDC 9408	Y	Y	250	80	250	40	48	175, Q2500	3.38x5.88x8
CDC 9409	Y	Y	500	80	250	40	48	230, Q2500	3.38x5.88x8
CDC 9409T	N	Y	1000	132	250	80	96	310, Q2500	3.38x5.88x8
DRIVETEC, INC.									
320	N	Y	3330	118	500	160	192	333, Q500	1.62x5.75x8

Company Model	Single-sided (Y/N)	Double-sided (Y/N)	Capacity (K bytes)	Avg. access time (msec.)	Transfer rate (K bytes/sec.)	Tracks/ surface	Tracks/ in.	Price ($)	Dimensions (H x W x D, in.)
HEWLETT-PACKARD									
82901	N	Y	540	187		33	48	2230	4.3x16.75x14.74
82902	N	Y	270	187		33	48	1520	4.3x11x14.74
9130	N	Y	270	187		33	48	860	4.72x7.09x10.51
HONEYWELL									
DIU 9607/9107	N	Y	800	160	164	80		1400	8.8x5x10
IRWIN/OLIVETTI, INC.									
FD501	Y	N	250	333	250	40	48	176, Q500	3.3x5.8x8.0
FD591	Y	N	500	80	250	80	96	275, Q500	3.3x5.8x8.0
FD592	Y	Y	1000	80	250	80	96	324, Q500	3.3x5.8x8.0
MICRO PERIPHERALS, INC.									
501	Y	N	250	72	250	40	48	150, Q1000	1.68x5.75x7.5
501C	Y	N	250	267	250	40	48	140, Q1000	1.68x5.75x7.5
502	N	Y	500	72	250	40	48	190, Q1000	1.68x5.75x7.5
502C	N	Y	500	267	250	40	48	180, Q1000	1.68x5.75x7.5
51	Y	N	250	84	250	40	48	160, Q1000	3.25x5.75x7.75
52	N	Y	500	84	250	40	48	200, Q1000	3.75x5.75x7.75
901	Y	N	500	85	250	80	96	190, Q1000	1.68x5.75x7.5
902	N	Y	1000	85	250	80	96	245, Q1000	1.68x5.75x7.5
91	Y	N	500	150	250	80	96	200, Q1000	3.25x5.75x7.75
92	N	Y	1000	150	250	80	96	255, Q1000	3.25x5.75x7.75
MICRO-SCI									
A143	N	Y	572		250	140	96	659	3.75x6x8.75
A2	Y	N	143		250	35	48	345	3.75x6x8.75
A3	Y	N	143		250	35	48	379	3.75x6x8.75
A40	Y	N	164		250	40	48	379	3.75x6x8.75
A70	Y	N	286		250	70	96	529	3.75x6x8.75
A73	Y	N	286		250	70	48	529	3.73x6x8.75
MICROPOLIS CORP.									
1115-2	Y	N	480		250	77	100	199, Q1000	3.25x5.75x8
1115-4	N	Y	960		250	77	100	248, Q1000	3.25x5.75x8
1115-5	Y	N	500		250	80	96	199, Q1000	3.25x5.75x8
1115-6	N	Y	1000		250	80	96	248, Q1000	3.25x5.75x8
1117-6	N	Y	1660		500	80	96	300, Q1000	3.25x5.75x8
MITSUBISHI ELECTRONICS AMERICA, INC.									
M4851	N	Y	500	94	250	40	48		1.61x5.75x8
M4852	N	Y	1000	94	250	80	96		1.61x5.75x8
M4853	N	Y	1000	94	250	80	96		1.61x5.75x8
M4854	N	Y	1600	91	500	77	96		1.61x5.75x8
M4855	N	Y	2000	94	500	80	96		1.61x5.75x8

RE-CREATION:

DRIVETEC'S 3.33MB Super Minifloppy



DRIVETEC'S 3.33MB half height SuperMinifloppy is much more than a redesign. It's the ever popular minifloppy completely re-created for the systems and applications of the 80's. And beyond.

Its low cost, $333.00 in OEM quantities, makes it the perfect floppy upgrade. Add super performance specs like 3.33 MB unformatted capacity, 3 msec track-to-track access and 500 Kbit/sec transfer rate-and you've suddenly got a Winchester replacement too. And the low cost and durability of its floppy media provides the lowest offline (for archival storage or backup) storage cost of any existing disk drive.

DRIVETEC re-created this floppy drive for higher reliability too. A proprietary track following servo system ensures on-track read/write head positioning and diskette interchange. Unique Gumball Heads™ virtually eliminate head and media wear. "Absolute-Vertical" clamping provides accurate, repeatable diskette registration. These features, along with many others, are so precisely incorporated into the SuperMinifloppy™ that only one adjustment is required in the manufacturing process. That means enhanced manufactureability and serviceability.

For more information about the SuperMinifloppy, contact Ivo Adam, vice president of marketing, at (408) 942-1515. Or write DRIVETEC, 2140 Bering Drive, San Jose, CA 95131. It could make your system a super success.

DRIVETEC

Floppies for the 80's. And beyond.

CIRCLE NO. 45 ON INQUIRY CARD

A STRONG STATEMENT ABOUT OUR STREAMER'S ACCURACY AND RELIABILITY.

We're standing on our streamer to show you just how well Tandberg's 3200 family of 20 MB and 45 MB ¼" cartridge drives are engineered. Of course, we didn't design them to be stepstools.

DESIGNED FOR DATA INTEGRITY.

Unlike most other drives, the 3200's body is fully cast to keep drive mechanisms stable and accurate. What's more, Tandberg's exclusive 3-point positioning and cartridge locking system ensures that cartridges are always correctly loaded and can't be jarred off track.

And while others still use less accurate mechanical referencing to locate the edge of the tape, Tandberg's exclusive Floating Head System finds this reference point dynamically using a signal seeking method. A precision, microprocessor-controlled stepping motor then locates the desired track—with better than 16 track accuracy. (Since our 20 MB and 45 MB units have 4 and 9 tracks respectively, the system is at least twice as accurate as it needs to be.)

Tandberg's system completely eliminates interchangeability problems caused by cartridge wear, drive wear, and mechanical tolerance build-up. It's the main reason why our streamer gets more reliable performance from ¼" cartridge tapes than anyone else in the industry.

A HEAD ABOVE THE COMPETITION.

Our 20 MB drive has the same cast body, the same cartridge lock, the same head positioning system as our 45 MB unit. Even the standard features are the same: QIC compatible interface, expandable circular FIFO buffer (up to 16 KB) for increased throughput, and full saturation recording. So what's the difference between our 20 and 45?

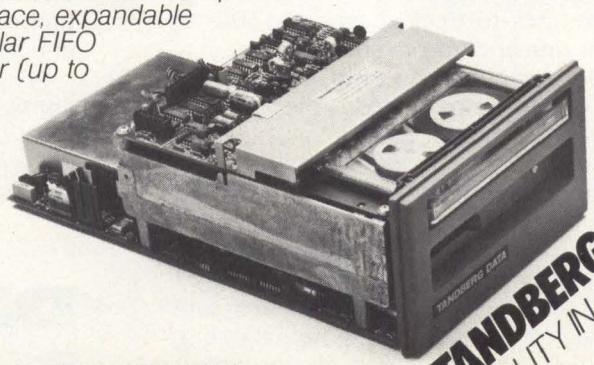
The head.

One screwdriver and one 9 track head are all you need to upgrade our 20 to 45 MB—with no mechanical adjustments whatsoever.

So if you're looking for a streamer that's accurate, reliable, and extremely flexible, step up to the only one you can stand on.

Tandberg.

For more information contact, Tandberg Data Inc., DATA STORAGE DIVISION, 571 North Poplar, Suite H, Orange, CA 92668/(714) 978-6771.



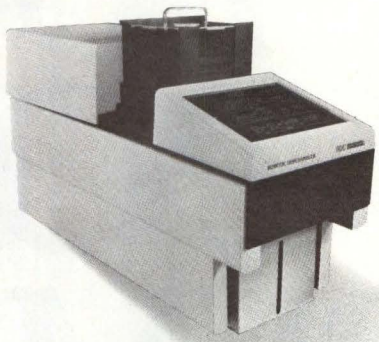
TANDBERG DATA
QUALITY IN EVERY BIT.

CIRCLE NO. 46 ON INQUIRY CARD

Company Model	Single-sided (Y/N)	Double-sided (Y/N)	Capacity (K bytes)	Avg. access time (msec.)	Transfer rate (K bytes/sec.)	Tracks/ surface	Tracks/ in.	Price ($)	Dimensions (H x W x D, in.)
PERCOM DATA									
AT88-S1	Y	N	88			40	48	488	6.5x5x12
RFD40-S1	Y	Y	320		250	40	48	699	6.5x5x12
TFD340	Y	Y	320		250	40	48	579	6.5x5x12
PHILIPS DATA SYSTEMS									
H1100	N	Y	438	5		35	48		2.3x5.9x8.4
QUME CORP.									
QumeTrak 142	N	Y	500	160	250	40	48	185, Q500	1.625x5.75x8
QumeTrak 542	N	Y	500	241	250	40	48	210, Q500	3.25x5.75x8
QumeTrak 592	N	Y	1000	91	250	80	96	315, Q500	3.25x5.75x8
REMEX CORP.									
RFD480	N	Y	500	80	250	40	48	230, Q1000	2.11x5.75x8.0
RFD481	Y	N	250	80	250	40	48	195, Q1000	2.11x5.75x8.0
RFD485	N	Y	500	80	250	40	48	200, Q1000	1.61x5.75x8.0
RFD486	Y	N	250	80	250	40	48	150, Q1000	1.61x5.75x8.0
RFD960	N	Y	1000	940	250	80	96	260, Q1000	2.11x5.75x8.0
RFD961	Y	N	500	94	250	80	96	230, Q1000	2.11x5.75x8.0
RFD965	N	Y	1000	94	250	80	96	245, Q1000	1.61x5.75x8.0
RFD966	Y	N	500	94	250	80	96	200, Q1000	1.61x5.75x8.0
SHUGART ASSOCIATES									
SA200	Y	N	250	358	250	40	48	120, Q500	2.05x5.75x7.87
SA400	Y	N	250	275	250	40	48	165, Q500	3.25x5.75x8.25
SA405	Y	N	250	93	250	40	48	170, Q500	3.25x5.75x8.25
SA410	Y	N	500	93	250	80	96	240, Q500	3.25x5.75x8.25
SA455	N	Y	500	94	250	80	96	185, Q500	1.62x5.75x8.46
SA460	N	Y	1000	158	250	800	96	285, Q500	3.25x5.75x8.25
SA465	N	Y	1000	94	250	80	96	225, Q500	1.62x5.75x8.46
TANDON CORP.									
TM100-1	Y	N	250	75	250			200, Q500	
TM100-2	N	Y	500	75	250			275, Q500	
TM100-3M	Y	N	500	90	250			275, Q500	
TM100-4M	N	Y	1000	90	250			300, Q500	
TM101-4	N	Y	1000	90	250			330, Q500	
TM102-2	N	Y	2000	90	500			430, Q500	
TM50-1	Y	N	250	287		250		130 (OEM)	
TM50-2	N	Y	500	287		250		150 (OEM)	
TM55-2	N	Y	500	75	250			200 (OEM)	
TM55-4	N	Y	1000	90	250			255 (OEM)	
TEAC CORP.									
FD-50B	Y	Y	500	25		77	100		3.3x5.8x8.0
FD-50B	Y	Y	250	25		40	48		3.3x5.8x8.0
FD-50C	Y	Y	481	25		77	100		3.3x5.8x8.0

Company Model	Single-sided (Y/N)	Double-sided (Y/N)	Capacity (K bytes)	Avg. access time (msec.)	Transfer rate (K bytes/sec.)	Tracks/ surface	Tracks/ in.	Price ($)	Dimensions (H x W x D, in.)
FD-50E	Y	Y	500	25		80	96		3.3x5.8x8.3
FD-50F	Y	Y	1000	10		80	96		3.3x5.8x8.0
TECHTRAN INDUSTRIES, INC.									
980X	Y	N	200	85	286	35	46	1485	5.25x10x11.75
980XX	N	Y	400	85	268	35	46	1585	5.25x10x11.75
981X	Y	N	200	85	268	35	46	1985	5.25x10x11.75
TERMINAL DATA CORP.									
S4S2000/10	Y	N	632	100	125	40		995	8.5x14x9
TOSHIBA CORP.									
ND-04D	N	Y	500	80	250	40	48		5.75x1.61x8.27
ND-06D	N	Y	1000	97	250	80	96		5.75x1.61x8.27
WESTERN TELEMATIC, INC.									
DataMate II	Y	N	328	0		80	96	1995	5.75x12.0x14.0
MiniMate III	Y	Y	816	0		80	96	1475	4.75x8.75x12.5
WORLD STORAGE TECHNOLOGY, LTD.									
FDD 100-5	Y	Y	250	20		40	48		3.3x5.8x8.3
FDD 196-5	Y	Y	500	10		80	96		3.3x5.8x8.3
FDD 200-5	Y	Y	500	20		40	48		3.3x5.8x8.0
FDD 296-5	Y	Y	1000	10		80	96		3.3x5.8x8.3
Y-E DATA, INC.									
YD-274	N	Y	500	281	250	40	48		3.25x5.75x8
YD-280	N	Y	1000	95	250	80	96		3.25x5.75x8
YD-380T	N	Y	1600	91	500	77	96		1.6x5.75x8
YD-480	N	Y	1000	95	250	80	96		1.6x5.75x8
YD-580	N	Y	500	148	250	40	48		1.6x5.75x8
ZENITH DATA SYSTEMS									
Z-37	N	Y	1300	260	250	80	96	1699	6.1x13.25x13.75
Z-87	Y	N	320	433	128	40	48	899	6.1x13.25x13.25

LET OUR ROBOT'S FINGERS DO YOUR HANDLING



AND OUR IC-475 DO YOUR DISKETTE COPYING — INITIALIZING — TESTING

FOR FAST — ACCURATE — AUTOMATIC — GENTLE PROCESSING OF YOUR DISKETTES

The Robotic Disk Handler

The RDH will effectively enhance the processing of diskettes in companies involved in media manufacturing — initializing and/or copying diskettes.

- **Your operator is free to perform other tasks** — The RDH loads and unloads up to 100 diskettes, unattended.
- **Decrease your loss of diskettes due to damage in handling** — The RDH will handle your diskettes very gently as it simulates the action of a human hand.
- **Your need for two systems is eliminated** — The RDH converts from an 8'' to a 5 1/4'' operation in just 2-4 minutes.

The IC-475 Initialize/Copy System

- **Save time and money** — Copy on one revolution — verify on the next — and step on the third. Nothing is faster! That's less than 25 seconds for a 5 1/4'' s/s disk and less than 40 seconds for an 8'' s/s disk. This saves you production time and costs.
- **Increase your customer base** — ADC has an unparalleled format library of well over 200 for your selection. Add formats as needed, increasing your capability to service *more* customers.
- **You need only one system** — Our IC-475 handles 8'', 5 1/4'' and 3 1/2'' media through software controls. No need to buy separate systems.

SALES/SERVICE CENTERS AROUND THE WORLD

Contact your nearest ADC branch office and discover more benefits that are provided by these two systems:

ADC APPLIED DATA COMMUNICATIONS

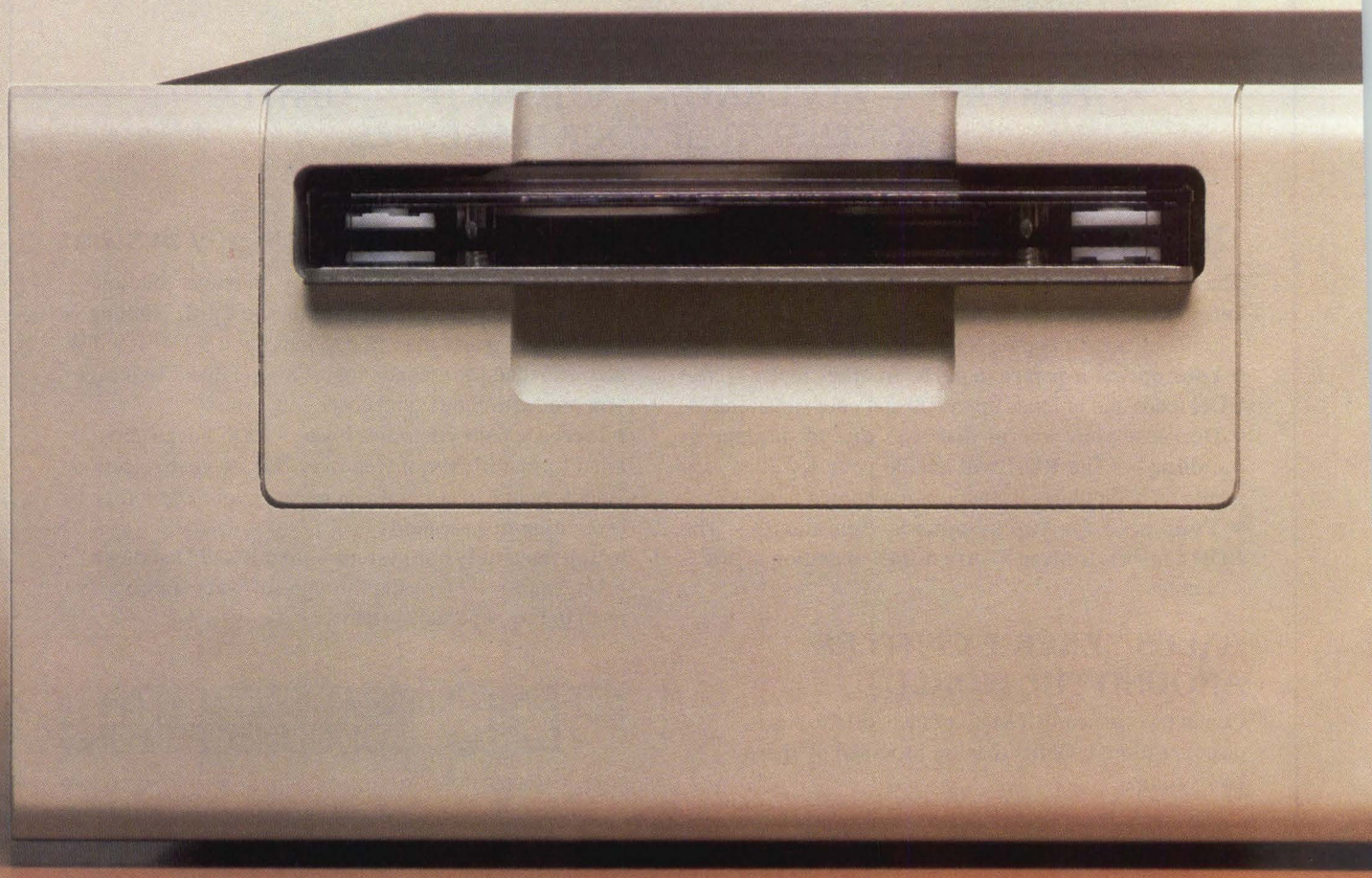
14272 CHAMBERS ROAD, TUSTIN, CALIFORNIA 92680 (714) 731-9000

TUSTIN, CA (714)731-9000 — DALLAS, TX (214)352-4012 — WASH., DC (703)356-7450 — BOSTON, MA (617)273-4844 — SANTA CLARA, CA (408)748-8686

ALSO: TOKYO • FRANKFURT • PARIS • LONDON • STOCKHOLM • OSLO • MILANO • COPENHAGEN SYDNEY • BOMBAY • TAIPEI

CIRCLE NO. 47 ON INQUIRY CARD

BUILT BY POPULAR DEMAND.



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DEC and PDP are registered trademarks of Digital Equipment Corporation.

See Us At NCC, Booth #P-7424

Introducing the DSD 890 DEC-Compatible Winchester/Tape.

Last year, Digital users made a big deal about our 880 Winchester/Floppy system, with its incomparable features, performance and price. And ever since then, they've been crying for more of the same, only with a tape back-up instead of a floppy.

So be it.

Witness the 890 Winchester/Tape. A 31.2 Mb Winchester and an ANSI standard ¼" cartridge tape drive for quick and inexpensive archival storage, back-up and software distribution. All in one neat package.

To get the same kind of capacity from Digital, you'd need a whole rack full of equipment.

Three RL02s and a TS-11, to be exact.

And you still wouldn't get the same kind of performance. The 890 is up to 15% faster than the RL02, thanks to our non-interleaved data transfer mode. (We can even handle simultaneous instructions to the Winchester and tape with no, we repeat, no degradation in performance.)

There's a big difference in price, too.

The 890 is about half the Digital alternative.

Yet it's just as compatible.

Our Winchester emulates the three RL02s you don't have to buy. And our tape emulates the TS-11 so that you can use all of DEC®'s handy back-up utilities. What's more, our emulation of the RL02 and TS-11 allows you to take full advantage of 22-bit addressing.

We've even designed our front bezel so it goes nicely with a PDP®-11/23.

And we've improved our HyperDiagnostics.™

Not an easy task to be sure, but on the 890, one button runs all self-diagnostics and testing. You don't even have to take off the bezel; there's a convenient little open/close front door instead.

Some things remain unchanged, though.

Like our Rapid Module Exchange,™ HyperService,™ and our nationwide sales and support network.

Because, quite frankly, we think they're already pretty good.

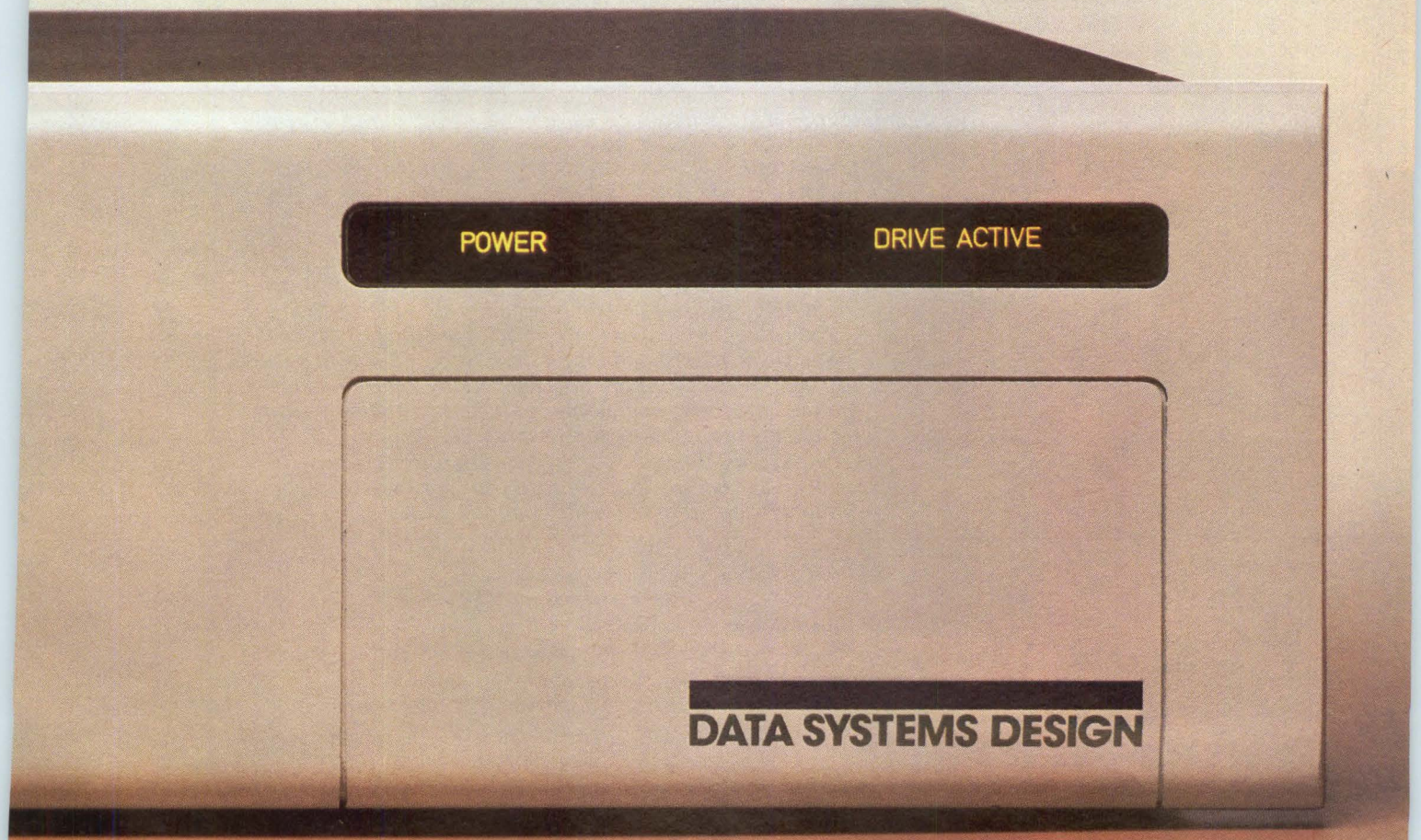
But if there's anything you think we can do to improve them, please let us know.

We don't want to say we're responsive, but when you say "jump," we leave the ground and wait for further notice.

Which explains why we're so high on the 890.

Corporate Headquarters: 2241 Lundy Avenue, San Jose, CA 95131. Eastern Region Sales and Service: Norwood, MA, (617) 769-7620. Central Region Sales and Service: Dallas, TX, (214) 980-4884. Western Region Sales: Santa Clara, CA, (408) 727-3163.

DATA SYSTEMS DESIGN



INTERNATIONAL SALES: Australia 03/544 3444; Belgium and Luxembourg 02/7209038; Canada 416/625 1907; Denmark 02/63 22 33; Finland 90/88 50 11; France 03/411 5454; Hong Kong and Peoples Republic of China 03/696231; Israel 52-52444; Italy 02/4047648; Japan, Osaka 06/323 1707, Tokyo 03/345 1411; Netherlands 02977-22456; New Zealand 04/693 008; Norway 02/78 94 60; Singapore, Malaysia, and Indonesia 2241077; Spain 01/433 2412; Sweden 08/38 03 70; Switzerland 01/741 41 11; United Kingdom 7073/34774; West Germany and Austria 089/1204-0; Yugoslavia 61/263 261

CIRCLE NO. 48 ON INQUIRY CARD

Mini-Micro Systems invites you to attend

THE STATE OF THE MARKET

June 6-9, 1983, Silverado Country Club, Napa, California

Three fundamental changes have rewritten the rules of the marketplace...

1 *Forget the differences between micros, minis and mainframes; for positioning look now to the unfolding price/performance and application niches.*

2 *Peripherals* have *become the pivotal elements; note how they permit or prevent a computer system from moving down the price/performance curve.*

3 *"Standard" operating systems and application software are powerful new forces catapulting some computer systems forward but, dooming many to obscurity.*

Learn how you can win under the new rules. Join us at Mini-Micro Systems' ***State of the Market '83.*** *A conference you can't afford to miss.*

The Computer System Marketplace – June 6 & 7, 1983
The Peripherals Marketplace – June 8 & 9, 1983

Reserve June 6-9, for Mini-Micro Systems' ***State of the Market '83*** *when, once again, we bring you and our authoritative speakers together to examine the critical forces changing the market for computers and their peripherals. At least once a year it's productive for all of us to step back from the portion of the market we know best and take a fresh look at the total picture. This conference is your annual opportunity to do so and we've expanded the program this year to include a comprehensive look into the marketplace for peripherals.*

Due to space limitation, conference registration must be restricted to 200 attendees. To ensure your conference attendance, promptly fill out and return the coupon below.

☐ ***June 6-9, 1983*** ***Full conference program***
$795.00 in advance ($895.00 at the door)

☐ ***June 6-7, 1983*** ***The Computer Systems Marketplace***
$495.00 in advance ($595.00 at the door)

☐ ***June 8-9, 1983*** ***The Peripherals Marketplace***
$495.00 in advance ($595.00 at the door)

☐ *Register me for the seminar(s) indicated above. I'm enclosing a check payable to MMS Market Center.*

☐ *I'd like to know more. Please send me more detailed information.*

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Please complete coupon and mail to:

MINI-MICRO SYSTEMS MARKET CENTER

221 Columbus Ave., Boston, MA. 02116
(617) 536-7780

No other back-up stacks up.

Memorex's 400 Series Fixed/ Removable Drives. The New Dynamics Of Data Back-Up.

The world of information back-up just became a lot more dynamic. And the new Memorex 400 Series is the reason why. These Winchester disc drives deliver 10 or 15 formatted megabytes of storage in a single, compact and cost-efficient package. They are compatible with industry 5.25-inch mounting, media and interface standards. The Model 410 features 5 megabytes fixed and 5 megabytes removable, while the 415 provides 10 megabytes fixed and 5 removable.

Innovations In Reliability And Performance.

Gone are the low performance, inconvenience and marginal reliability of tape and floppy back-up approaches. Gone, too, are the question marks that have punctuated previous fixed/removable offerings. Indeed, the features built into the Memorex 400 Series make others pale by comparison. Features which experience tells us are *mandatory* to ensure reliable operation with removable cartridge media.

For instance, there's a unique cartridge media self-seal, a protective head enclosure door and a high performance closed loop air and purge system that together deliver unparalleled contamination protection. There's an embedded servo voice coil actuator that positions the heads accurately, ensuring media interchangeability and excellent data integrity. There are proven air bearing head mechanics, with dynamic loading to prevent head/media contact, and a head retraction system that protects both the heads and the media when the cartridge is removed or the drive powered down.

More Than Data Back-Up.

Integral back-up is only one way to look at the Memorex 400 Series. You can look at it as a versatile, economical, high-quality data base as well. With proven Winchester reliability, and fast voice coil access time, with the convenience of a foolproof front-loading cartridge and the data security achieved with hard disc standards. And with the cost efficiencies inherent in a small cartridge, compact design and all-DC power requirements.

Working Within the Systems

Immediate Delivery And Worldwide Support.

Two other points about the Memorex 400 Series. One, we have them, in production quantities, ready for immediate shipment, complete with evaluation kits to speed your system integration. And two, we back them, comprehensively, with a responsive technical support network that stretches around the world.

High reliability and performance. Integral back-up. Proven technology. Standard mounting and interface. Compact and cost-efficient design. Immediate delivery. These are just some of the ingredients that have earned Memorex its reputation in the OEM marketplace for "Working Within The Systems."

MEMOREX

A Burroughs Company

OEM Equipment Sales, Service and Marketing, San Tomas at Central Expressway, Santa Clara, California 95052, (408) 987-3308, Telex 334-492.
In Europe: OEM Equipment Sales—England: Staines, Telephone 0784 51488, Telex 935013; West Germany: Hamburg, Telephone 0406 322075, Telex 215019; Frankfurt, Telephone 061 166051, Telex 411240.

CIRCLE NO. 49 ON INQUIRY CARD

Their quality. Our Price.

When CPX decided to offer floppy diskettes and floppy head cleaning kits, our main criterion was value.

And that's what we are now offering. The best price vs. high performance ratio that you will find.

Data integrity is too important to leave to chance. That's why we offer the Protectors — cleaning kits and floppy disks that will help cut down on data losses.

Our 5¼" and 8" floppy diskettes have an extra attention to detail because your drive is only as good as the media you use. This high-reliability media is evenly coated, fully lubricated, and self-lubricating for less wear. Each disk is 100% tested and waranteed. And CPX disks are available with reinforcement rings for extra protection.

But your drive won't care about the media quality if the heads are dirty. Our head cleaning kits for 5¼" and 8" disk drives will ensure clean heads with minimum effort, eliminating the need for several expensive field service calls. Contamination is safely and thoroughly removed from read/write heads, for minimized data loss from dust or other particles.

Keep your system up and running with the CPX Protectors. Just give us a call for more information.

CPX™

CORPORATE OFFICE: 19821 Nordhoff Street • Northridge • CA 91324 • Phone (213) 341-3783 • Telex 18-1537
NORTHEASTERN REGION: 3001 Hadley Road • Building 5B • South Plainfield • NJ 07080 • Phone (201) 756-8040
SOUTHWESTERN REGION: 5250 Gulfton • Building 4 • Suite 6 • Houston • TX 77081 • Phone (713) 661-3424

CIRCLE NO. 50 ON INQUIRY CARD

8-IN. DISKETTE DRIVES

Company Model	Single-sided (Y/N)	Double-sided (Y/N)	Capacity (K bytes)	Avg. access time (msec.)	Transfer rate (K bytes/sec.)	Tracks/ surface	Tracks/ in.	Price ($)	Dimensions (H x W x D, in.)
ADVANCED ELECTRONIC DESIGN, INC.									
FLEX02	Y	Y	1000	91	500	77	96	3710	5.3x17.6x21
WINC-05	Y	Y	1000		500	77	96	5033	5.2x17.6x16
BASF									
6104	N	Y	1600	76	500	77	48		4.3x8.7x14.1
6105	N	Y	1600	76	500	77	48		2.2x8.5x13.0
BURROUGHS CORP.									
MD-122	N	Y	3131	40		139	150		5.5x10.0x20.5
CALDISK									
142M	Y	N	802		500	77	48	550	4.9x8.4x15
143M	N	Y	802		500	77	48	610	4.9x8.4x15
143M1	Y	N	802		500	77	48	510	4.9x8.4x15
842D	Y	N	802	6	500	77	48	495	4.9x8.4x15
CHARLES RIVER DATA SYSTEMS, INC.									
FD311	Y	N	800	211	250		48	2395	5.25x17.3x22
FD511	N	Y	1600	91	500		48	3295	5.25x17.3x22
MF211	Y	N	800	211	250		48	3450	10.5x19x22
COMARK CORP.									
MF80-DSS	Y	N	1000	210		77	48	3295	6.96x17.4x22.63
MF85-DDS	Y	Y	200	91	500	77	48	3495	6.96x17.4x22.63
MF85-DSS	Y	N	1000	210	500	77	48	2995	6.96x17.4x22.63
CONTROL DATA CORP.									
CDC 9404	Y	N	400	260	250	77	48	425, Q2500	4.97x8.78x14
CDC 9404-B	Y	N	800	275	500	77	48	330, Q2500	4.97x8.78x14
CDC 9406-1	N	Y	800	40	250	77	48	530, Q2500	4.97x8.78x14.2
CDC 9406-4	N	Y	1600	91	500	77	48	485, Q2500	4.65x8.55x14
DATA SYSTEMS DESIGN									
440	Y	N	512	246	500	77	48	3895	5.25x17.6x21
480	N	Y	1024	296	500	77	48		5.25x17.6x21
DATAPOINT CORP.									
1402	Y	N	500		500	77		3000	7.2x21.8x23
1403	N	Y	2000		500	77		4150	7.2x21.8x23
1404	Y	N	1000		500	77		3000	7.2x21.8x23
ELCOMATIC LTD.									
ACP1500	N	Y	3200	91	500	154	96	550, Q500	4.4x8.5x12
ACP700(AC)	N	Y	1600	91	500	77	48	408, Q500	4.4x8.5x12
ACP750(AC)	N	Y	1000	91	500	77	48	442, Q500	4.4x8.5x12
HEWLETT-PACKARD									
9885	Y	N	500	267			48	3850	5.25x16.75x17.25
9895	N	Y	1150	179			48	5910	7.6x19.0x22.6
HONEYWELL									
DIU 9603/9103	N	Y	600	260	250	77		2000	7.3x17.5x22

Company Model	Single-sided (Y/N)	Double-sided (Y/N)	Capacity (K bytes)	Avg. access time (msec.)	Transfer rate (K bytes/sec.)	Tracks/ surface	Tracks/ in.	Price ($)	Dimensions (H x W x D, in.)
INNOTRONICS CORP.									
410	Y	Y	802	8		77	48		4.4x9.0x14.0
420	Y	Y	802	8		77	48		4.4x9.0x14.0
IRWIN/OLIVETTI, INC.									
FD502	Y	Y	500	333	250	40	48	235, Q500	3.3x5.8x8.0
MATCHLESS SYSTEMS									
SL-848-1	Y	N	1300	3	500	77	48		2.5x8.5x14.0
SL-848-2	N	Y	2600	3	500	77	48		2.5x8.5x14
MEMOREX CORP.									
550	Y	Y	802	10		77	48		4.4x8.8x14.0
651	Y	N	312	10		64	48		4.5x9.0x14.0
MICRO PERIPHERALS, INC.									
41	Y	N	800	91	500	77	48	305, Q1000	2x8.55x11.5
42	N	Y	1600	91	500	77	48	350, Q1000	2x8.55x11.5
MILTOPE CORP.									
DD400	Y	Y	1000	6	500	77	48	4975	6x10x18
MITSUBISHI ELECTRONICS AMERICA, INC.									
M2894-63	N	Y	1600	91	500	77	58		4.63x8.5x14.13
M2896-63	N	Y	1600	91	500	77	48		2.25x8.55x12.40
MOTOROLA MICROSYSTEMS									
EXORdisk III	N	Y	1600		250	77	48	5195	6.96x17.75x23.5
NCR CORP.									
NCR7642	Y	N	243	260		73		2050	11.0x19.0x21.0
NEC INFORMATION SYSTEMS									
FD1164	Y	N	800		500	77	48	310, Q1000	2.28x8.55x13.19
FD1165	N	Y	1600		500	77	48	370, Q1000	2.28x8.55x13.19
PERSCI, INC.									
270/277	Y	N	1600	33	500	77	48	1595	8.6x4.4x15
299B	N	Y	3200	33	500	77	48	2495	8.72x4.38x15.4
PLESSEY PERIPHERAL SYSTEMS									
XSV21	Y	N	1000	250	75	77			5.25x19x27
XSV31B	N	Y	2000	250	75	77			5.25x19x27
QUME CORP.									
QumeTrak 242	N	Y	1600	91	500	77	48	415, Q500	2.25x8.55x12.6
QumeTrak 842	N	Y	1600	91	500	77	48	445, Q500	4.5x8.55x14.57
REMEX CORP.									
RFD2000	Y	N	800	91	500	77	48	290, Q1000	4.56x8.55x14.0
RFD4000	N	Y	1600	91	500	77	48	380, Q1000	4.56x8.55x14.0
SCIENTIFIC MICRO SYSTEMS, INC.									
FWT series	Y	Y	1600	91	500	77	48	3900	5.25x19.0x22.0

Today, people are solving their back-up problems with this fast, reliable, 10 MB disk cartridge drive.

IOMEGA's 10 Megabyte cartridge drive outperforms most winchesters.

So you can back-up 10 Megabytes from your fixed disk in less than 30 seconds.

The easy to use cartridge sports the industry's lowest price tag, only $30 each in OEM quantities.

IOMEGA's imbedded closed-loop servo guarantees interchangability of cartridges between drives. And the standard interface is SCSI compatible.

Solve your backup problems with the fast, reliable IOMEGA 10 Megabyte cartridge drive.

Call IOMEGA for a personal demonstration. **And ask about our OEM Special Evaluation Offer.**

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Company Model	Single-sided (Y/N)	Double-sided (Y/N)	Capacity (K bytes)	Avg. access time (msec.)	Transfer rate (K bytes/sec.)	Tracks/ surface	Tracks/ in.	Price ($)	Dimensions (H x W x D, in.)
SHUGART ASSOCIATES									
SA801	Y	N	800	210	500	77	48	355, Q500	4.62x8.55x14.25
SA810	Y	N	800	89	500	77	48	345, Q500	2.31x8.55x12
SA851	N	Y	1600	91	500	77	48	450, Q500	4.62x8.55x14.25
SA860	N	Y	1600	89	500	77	48	420, Q500	2.31x8.55x12
TANDON CORP.									
TM848-1	Y	N	800	91	250			350, Q500	
TM848-2	N	Y	1600	91	250			405, Q500	
TOSHIBA CORP.									
ND-40D	N	Y	1600	94	500	77	48		8.55x2.24x12.13
WORLD STORAGE TECHNOLOGY, LTD									
FDD 100-8	Y	Y	802	6		77	48		4.5x8.6x14.3
FDD 200-8	Y	Y	1600	3		77	48		4.5x8.6x14.3
Y-E DATA, INC.									
YD-174D	N	Y	1600	91	500	77	48		4.5x8.55x14.57
YD-180	N	Y	1600	91	500	77	48		2.25x8.55x12.6

INTRODUCING THE LATEST IN FAMILY PLANNING.

OUR LITTLE ONE.

There's a great future ahead of this one.

And for a number of reasons.

Not the least of which is the fact the new SA300 Microfloppy uses the standard 3½" cartridge media.

And as part of a new generation of products, our SA300 will open up a whole new generation of applications for you.

Smaller, more compact portable and personal computers, desktop systems, electronic typewriters, and all kinds of computerized office equipment.

It's no toy, either. At 80 tracks per surface and 300 RPM, the SA300 uses proven technology to yield half a megabyte of storage in this single-sided version.

What's more, it's also I/O compatible with the bigger Minifloppies. And has the same transfer rate. So it can be integrated into your new system without a big software or controller investment.

And like most youngsters, the SA300 is very quick. Just 6 milliseconds, track-to-track.

But surprisingly well-behaved. Thanks to microprocessor-controlled electronics and internal write-protect circuitry.

Still, it uses less power than an 8-watt nightlight.

Because it's so small though, we expect our new Microfloppy to get bounced around a bit.

So we've made it extra rugged. With things like a dependable, brushless direct drive DC spindle motor. And a die cast aluminum base casting.

Even the media is tough. In order to withstand the rigors of shirt pockets, crowded briefcases and even inquisitive little fingers, it's protected by a hard shell, and an automatic cartridge shutter.

The SA300 is the handiwork of one of our "Venture Groups," a special engineering and marketing team chartered with developing new products and getting them out the door, quickly.

As for the SA300, their latest accomplishment, the kid, as they say, definitely has possibilities.

OUR BETTER HALVES.

This could be love at first sight.

And perfectly understandable, considering how much our new half-height drives have going for them.

Take our half-height SA810/860 8" floppy drives, for instance.

Their 12" CRT depth means they can sit next to a screen. Or, you can put two of them anywhere a full-sized 8" floppy used to be. For an instant system upgrade, up to 3.2 megabytes.

Looking for something more compact?

Our half-height, double-sided SA455/465 Minifloppy™ drives were made for you. The 48tpi SA455 delivers 500 Kbytes, while the 96tpi SA465, a healthy 1 megabyte of unformatted capacity.

And they're quick. Just 3 msec track-to-track for the SA465, and 6 msec for the SA455.

They'll stand by you, too. Like our 8" half-heights, these new Minifloppy drives are moved by brushless direct drive DC motors, and deliver an endearing 10,000 hours MTBF—25% more than most full-height drives.

Finally, meet our new 5¼" half-height Winchesters, the SA706/712. With 6.6 or 13.3 megabytes unformatted capacity and more data protection features than any other small Winchester on the market. Features like 4-point shock and vibration mountings, head landing zones, automatic spindle and actuator locks, and a new low-mass head. All of which make it a perfect match for your rugged portable system. Or team it up with our half-height Minifloppies and get a combination that'll have your competition talking. To themselves.

Of course, all these drives are available in full-height versions. All from the company that gave birth to the OEM disk drive industry ten years ago.

Which just goes to show you how important it is to marry into the right family.

IT'S A NEW FROM

GENERATION SHUGART.

THE GLEAM IN OUR EYE.

Oh, do we have plans for you.

Last year, we spent $20 million on R & D.

And the same on capital equipment.

This year we'll do likewise, and more.

We're not trying to impress you.

They're just the facts of life.

Because the fact is, there is no one who can commit the kind of resources to furthering the state-of-the-art in this business that we can.

What kinds of advancements are we looking at?

State-of-the-art media, thin film heads, vertical recording, and particularly exciting developments in optical recording technology. (Just imagine what you could do with 10 times the storage capacity currently available ...)

And when we've improved and refined our designs some more, we'll tell the world. In fact, you will be seeing some tech articles sometime this year.

A lot of our work is paying off right now.

In higher quality levels, thanks to our implementation of progressive assembly, robotics, automated manufacturing and Class 100 clean tunnels.

In faster, more reliable disk drives and controllers in all sizes, achieved through custom LSI technology and improved vendor quality levels, and the benefits of the ten years of experience in this industry.

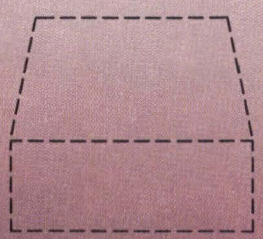
And in better service and support, by constantly improving the largest service and support network in the business.

Our new generation is more than just new products.

It's a new presence that will drive an entire industry to provide you with the kinds of options that will allow you to do some pretty exciting new things yourself.

Because we can see you've got that same gleam.

So maybe it's time we got together.



THE PROUD PARENTS.

Success seems to be hereditary.

More than 10 years ago, Shugart produced the first OEM floppy disk drive, and gave birth to an industry.

A little later, we presented the industry with the first Minifloppy.

Today, we have more than 3,000,000 floppies in the field.

And more than 100,000 rigid disk drives.

In between, we've managed to produce the largest family of disk drives in the world.

From 14-inch Winchesters to our new 3½" Microfloppy.

And we're not about to stop here.

We'll continue to provide you with the greatest number of options in disk storage.

And commit our considerable resources to improving those products so they can improve yours.

We'll be there when you need us, too.

With worldwide sales, service, and support. We do, after all, have to take care of our own.

And who knows? Maybe we can help you build a family of your own.

For a copy of our full line brochure, contact Shugart, 475 Oakmead Parkway, Sunnyvale, CA 94086. (408) 733-0100.

Shugart

THE NEW ARRIVALS.

Cute, aren't they?

And smart, too.

But then, what do you expect from a custom LSI chip set?

Our new SA1600 "SASI" Controllers have the intelligence to provide true device independence. The on-board microcomputer and four custom chips take on many of the tasks previously performed by the host CPU. Such as distributed arbitration, over-lapped seeks, buffering, and more. So overall system performance is improved since the CPU is free to go on to bigger and better things.

These little babies are reliable, too. Again, thanks to our custom chip set, we were able to reduce the number of components.

Which also means that our SA1600 Series won't put you in the poorhouse. Especially with a price that's less than half that of previous models.

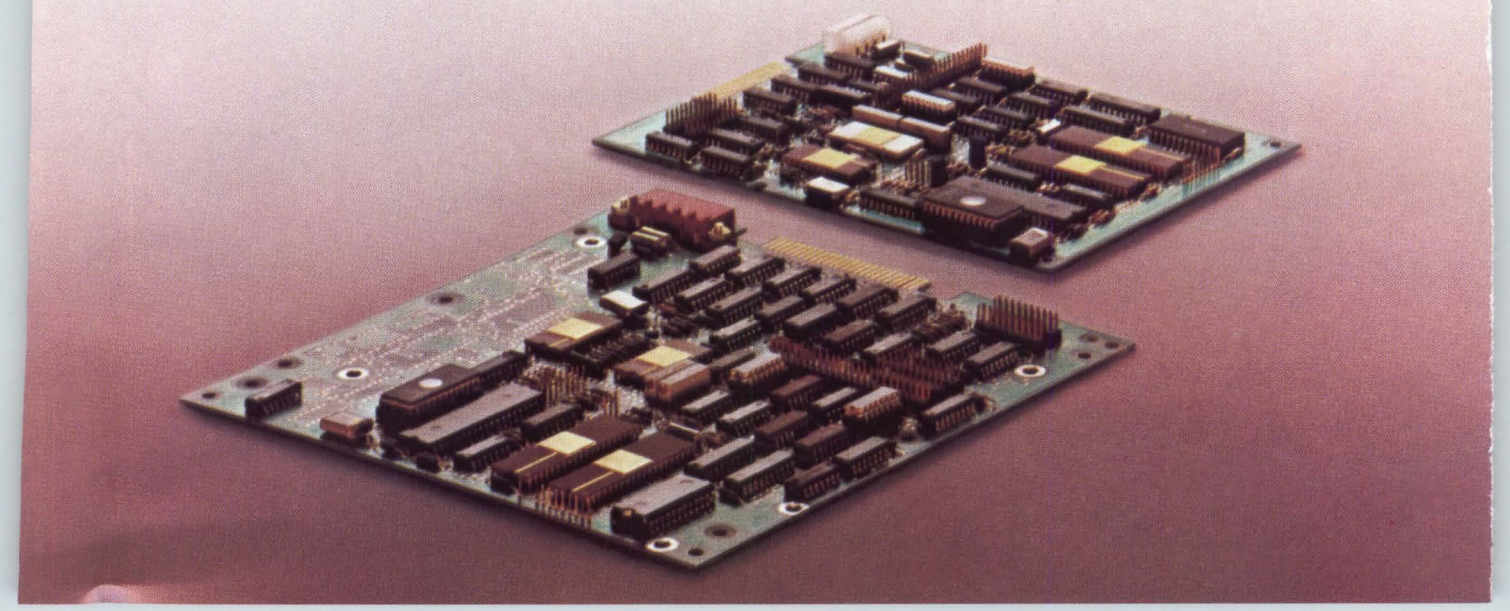
And, of course, like all Shugart controllers the SA1600 Series comes with the industry standard SASI (Shugart Associates Standard Interface). Which means faster systems integration, which means faster evaluation and implementation, which means faster time to market. Since interface protocols and firmware are already in place.

Want to upgrade or switch drives? SASI will accommodate anything we make or plan to make.

And the SA1600 Series is just as accommodating. They'll handle SA1400 commands, yet give you improved error detection, better speed and buffering, and automatic bad spot reallocation.

The SA1600 Series Controllers. Better performance, higher reliability, and lower cost.

Congratulations are definitely in order.



FASTEST WINCHESTER DRIVE TESTER!

DUAL MICROPROCESSOR BASED MWX-1000 PROVIDES FAST PRODUCT THROUGHPUT.

Compact portable and rack mounted versions.

Key up the drive configuration of any type Winchester drive having ST506 or SA1000 interface and the new MWX-1000 Winchester Analyzer is ready for work. Its dual microprocessors make it the fastest and most powerful QA, production or field service Winchester ever offered *...the MWX-1000 is from Wilson, the 10-year leader in test exercisers.*

Imagine full interactive testing with operator prompting, and field programmable analysis modes to expose even stubborn intermittent errors. The MWX-1000 has them. And it all comes packaged in a carrying case that measures only 16½"x6"x20". The system version takes only 5¼" of rack space.

Big-system test functions include full basic drive test, format and verify test, drive performance test, and full drive margin test. These apply to 5¼" or 8" drives, multiple-head drives and drives with 4.35 MHz or 5 MHz data transfer rate. The basic unit supports up to four drives (16-drive system available).

The *go anywhere* MWX-1000 is your best partner to quickly analyze Winchester drives.

More Max Series Peripheral Analyzers

Wilson's giant step into the future with microprocessor logic now offers you a growing line of MAX Series Analyzers.

MFX-1000 Floppy Drive Analyzer supports all standard floppy disk drives. It analyzes all basic drive functions including formatting and verification, drive performance margins, and allows head alignment without a scope.

MPX-1000 Printer Analyzer tests and exercises all currently available printers. It checks ASCII 64 or 96 character patterns, graphics patterns, format printing, spacing, vertical and horizontal alignment, and set of characters-per-line and lines-per-page.

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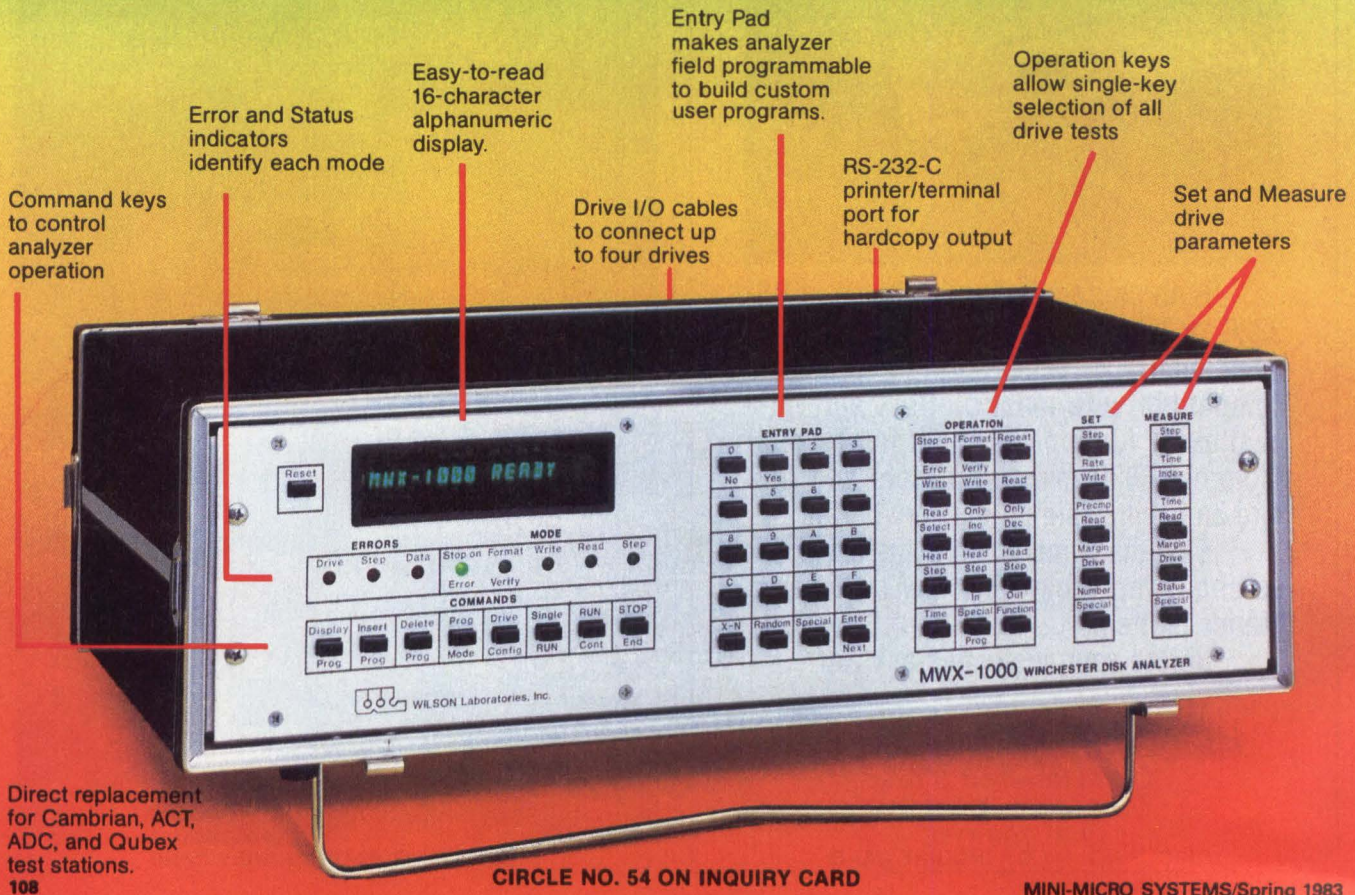


Selecting a 5¼-in. Winchester

RAYMOND BROOKE, Computer Memories Inc.

High-capacity, high-performance 5¼-in. Winchesters are a good match for 16-bit microcomputers

Current 5¼-in. Winchesters offer a wide range of technologies and prices. In selecting a drive, system integrators must carefully match each drive's capabilities against a system's requirements. Among the most important criteria in selection are capacity, performance, interfacing and reliability.

Capacity and performance

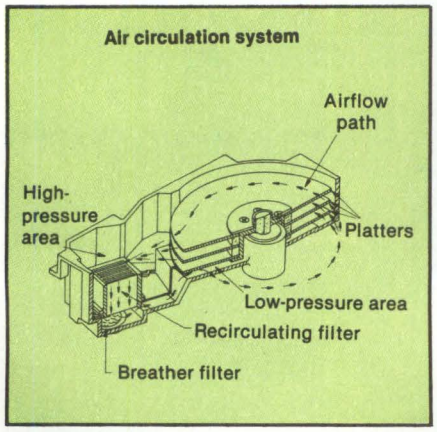
Overpowering a slow, 8-bit microcomputer with a high-performance, large-capacity 5¼-in. Winchester when a floppy disk drive can do the job is seldom cost-effective or practical. A 16-bit system with a variety of data- and word-processing functions, however, can benefit measurably with a Winchester drive. In terms of capacity, most single-user systems can get by on 10M bytes. But if a system is intended for multi-user text processing or CAD/CAM, capacities of 30M bytes or more are mandatory.

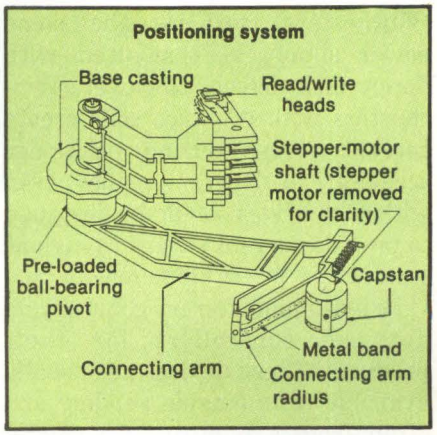
Most Winchester disk drives on the market offering capacities less than 12M bytes use the same technologies, including oxide-coated aluminum platters and a ferrite-type read/write head. Most drive manufacturers buy their platters from the same vendors. These lower capacity drives generally use stepper motor-driven metal bands to position the heads. These mechanisms generally have no on-board intelligence to monitor or correct their positioning accuracy and are rarely used on drives with capacities beyond 10M bytes.

The second generation of 5¼-in. oxide-platter-based drives uses servo-controlled out-line actuators for positioning, achieving capacities as high as 100M bytes. These schemes use on-board intelligence to monitor positioning data on the disk, increasing accuracy and data reliability. In addition, access times are typically reduced from 100 to 40 msec., an important difference in multi-user and highly interactive applications.

Interfacing

Most 5¼-in. Winchesters are form-factored to fill the space occupied by 5¼-in. floppy disk





Computer Memories Inc. 5000 series 5¼-in. Winchesters *use a stepper motor and metal band to position heads. The platters and heads are in a sealed module with a recirculating filtered-air system and a breather filter to equalize pressure in the module with the surrounding air. The 5000 series stores as much as 19M bytes.*

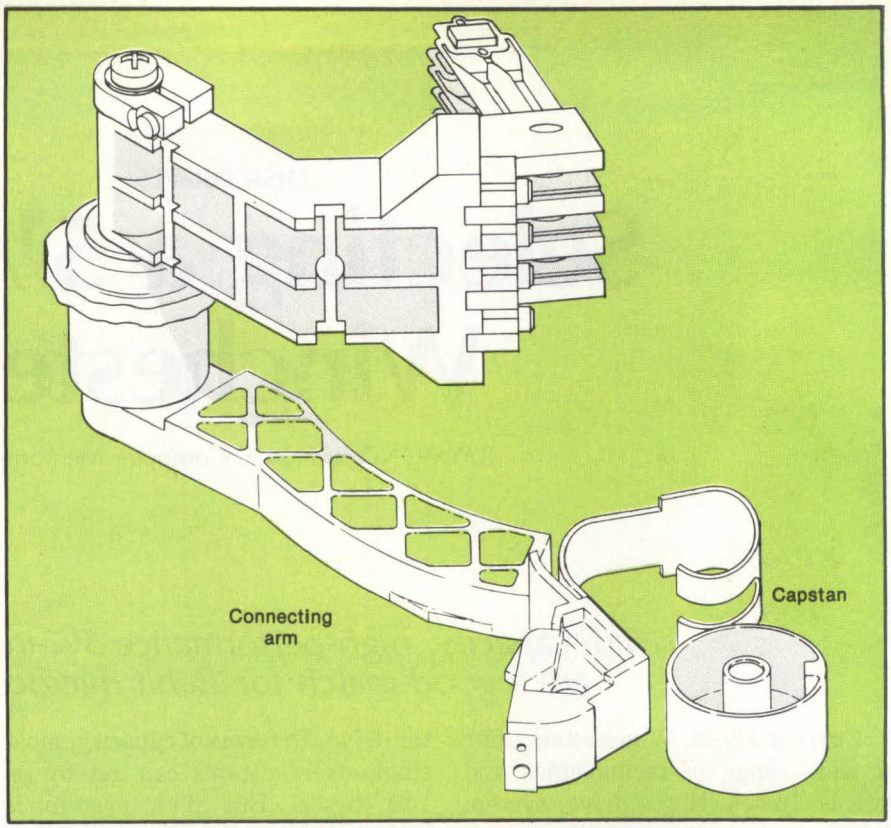
drives: 3½ × 5¾ × 8 in. Even drive mounting screw holes and mounting hardware are the same on many drives. Some drives, however, are more than 8 in. deep to facilitate unique positioner design or on-board electronics. This extra depth can interfere with a power-supply connection, a fan or other components in the rear of the slot. Even if the drive does squeeze in, it can alter airflow and cause overheating.

Most low- to mid-capacity, 5¼-in. disk drives use the industry-standard ST-506 interface. While drives with capacities of as much as 40M bytes operate efficiently with this interface, higher capacity drives may require an intelligent interface such as the Standard Committee standard interface (formerly Shugart Associates' standard interface). This intelligence allows faster data-transfer rates. In terms of physical connections, industry-standard 34-, 20- or 4-pin connectors are best.

Higher capacity drives are mandatory for systems intended for multi-user word processing or CAD/CAM.

Power requirements should be considered as well. Most 5¼-in. Winchesters can use the same power supply as that used with floppy disk drives. However, Winchesters with DC voice coils create current surges during positioner acceleration. Power supplies used with such drives should be designed to provide current surges as high as 3.5A at 12V for 40 to 50 msec.

Drive manufacturers generally do not sell controllers for their products. These devices are usually available from outside vendors and often from a number of vendors. The drive manufacturer should be able to help a system integrator find



Positioning mechanism for 40M-byte drive *incorporates larger capstan and increased arm rigidity to improve positioning accruacy.*

NEW TECHNOLOGIES, NEW CAPACITIES

By 1988, 5¼-in. Winchesters storing as much as 600M bytes may be available. These new drives will use plated media, thin-film heads and vertical recording techniques, with 1000 tracks per in. and recording densities of 100,000 bits per in. The accompanying chart shows the evolution of 5¼-in. Winchester technologies and capacities.

PROJECTED 5¼-IN. WINCHESTER CAPACITY GROWTH

Year	Capacity (M bytes)	Technology	Tracks per in.	Bits per in.	Bits per sq. in.
1981	20	Oxide media, monolithic head, longitudinal recording	345	9000	3×10^6
1982	40	Oxide media, monolithic head, longitudinal recording	690	9000	6×10^6
1983	80	Oxide media, monolithic or composite head, longitudinal recording	800	15,000	12×10^6
1984-1985	150	Plated media, composite or thin-film, longitudinal recording	1000	2500	25×10^6
1986-1987	300	Plated media, vertical recording	1000	50,000	50×10^6
1988-1989	600	Plated media, vertical recording	1000	100,000	100×10^6

A new company entered the 5¼" Winchester market.

And closed the door behind them.

140 megabytes.
And it's only the beginning.

Who makes Winchesters with proven technology, eight platters, and the most capacity available? Maxtor. Our founders are people you already know. Industry veterans totally familiar with Winchester technology. So not only were we prepared to build a better drive, we knew what was important to OEMs. Price. Quality. Reliability. Availability. Support as you need it. We built Maxtor to satisfy those needs. And deliver the drives you've been waiting for . . . low-cost 5¼" Winchesters with the highest capacity on the market.

Our doors are always open to OEMs. Let's talk. Call Leon Malmed at (408) 748-7740. Maxtor Corporation, 5201 Lafayette Street, Santa Clara, California 95050.

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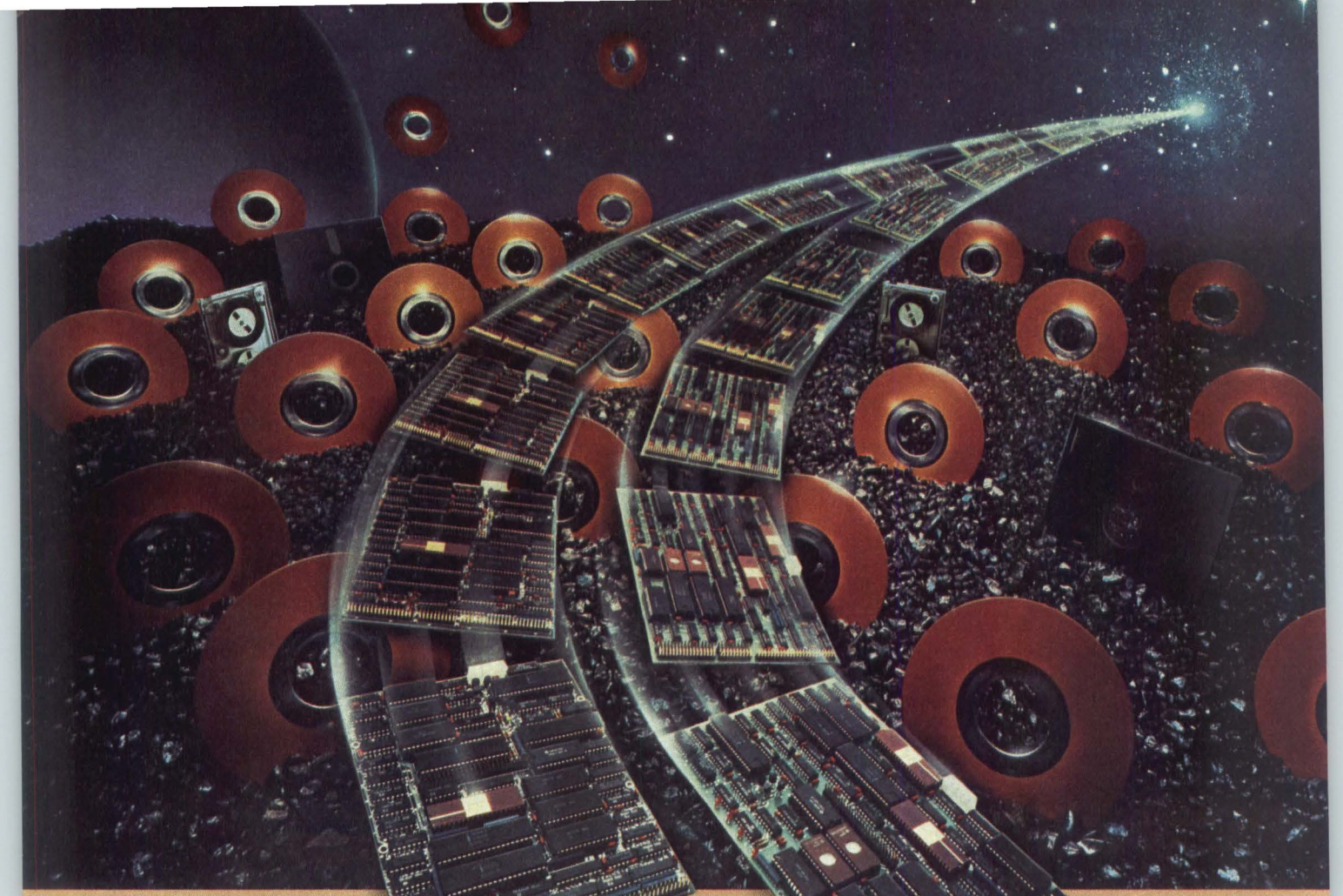
Maxtor



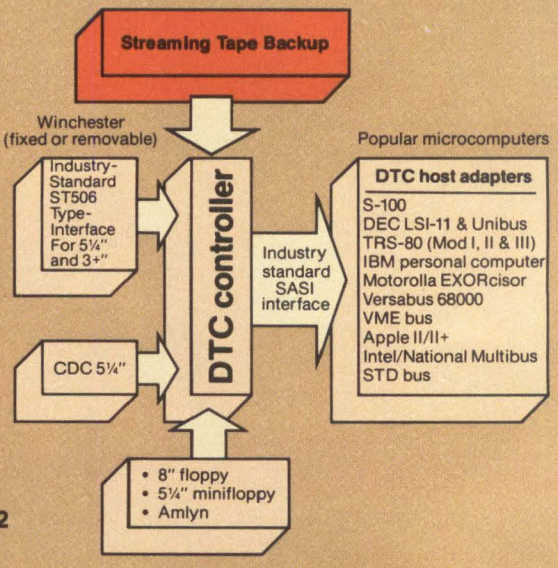
DTC Controllers for Little Winchesters with Tape Backup.

One controller does it all. Supports two Winchesters, fixed or removable, in 5.25" or 3+," *and* streaming tape. Offers selective direct tape access or automatic save/restore. Programmable for different drive types. Complete with host adapters that link full-featured Winchester/tape backup control with your favorite micro. It's the new 540 from DTC.

Available from Arrow, Hamilton/Avnet, Kierulff, and more than 25 international distributors. Or order in OEM quantities direct from DTC. For information, circle our readers' service number. For faster response, call (408) 496-0434. In the East, call (617) 275-4044.

Easier system integration

DTC drive enclosures can simplify integration of drives, controller, power supply and cabling. Call us.



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the right controller. These considerations can affect the choice of drive: controllers designed for new drive technologies might not yet be second-sourced or standardized, while an inexpensive drive could require a custom controller that negates cost savings and slows deliveries.

Reliability

Disk reliability can make or break a system's reputation. In reviewing drive reliability specifications, a system integrator finds written specs that are similar from drive to drive. These specs, however, may not provide an accurate picture of the drive's reliability.

A mean-time-to-repair figure, for example, doesn't always relate directly to installed systems. In most instances, a failure results in swapping a board or the entire drive, with the defective item being sent to a repair depot. The MTTR is more important if the system integrator is establishing his own repair network. In this case, the integrator should figure the spare parts recommended by the drive

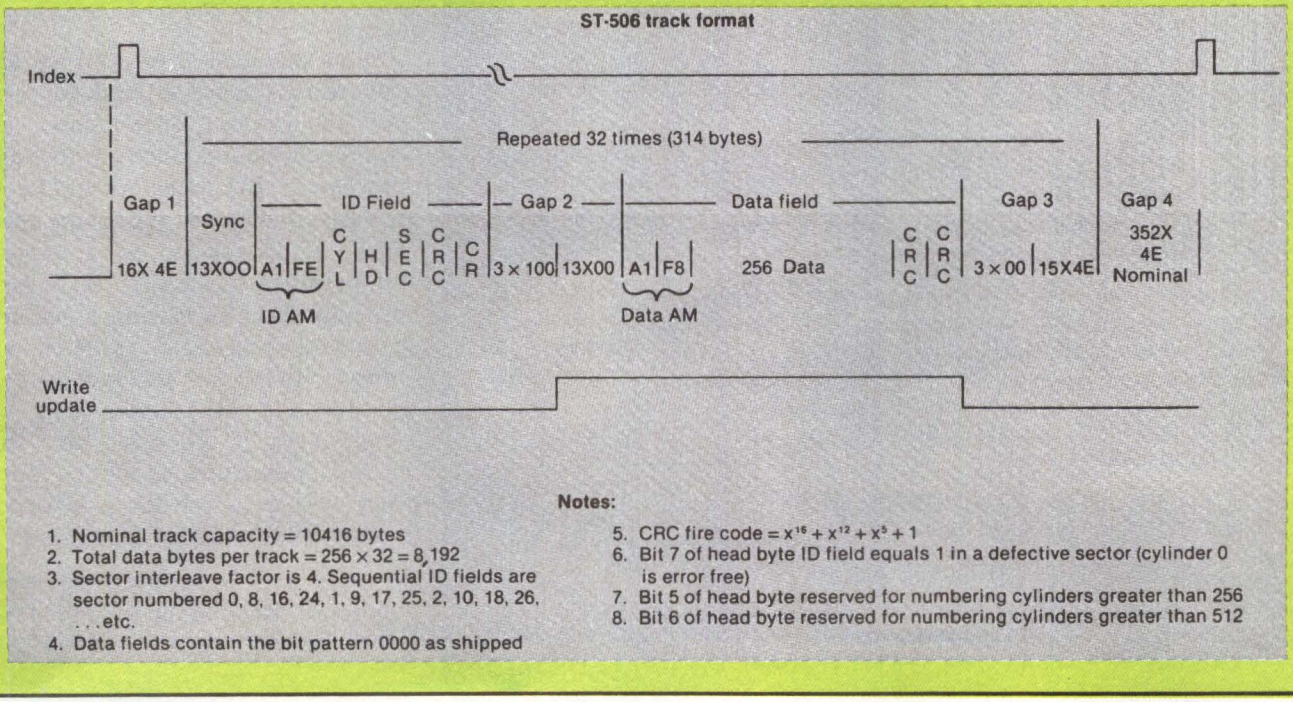
DISK STANDARDS AND HISTORY

The importance of a set of standards that permits disk-controller compatibility can be seen by the impact that the compatibility issue had on the early market for 8-in. Winchester disk drives. A controller standard had not been established when these devices were first introduced in the late 1970s. As a result, by late 1979, various 8-in. Winchester "standards" included Shugart Associates' SA1000 and other vendor-specific interfaces.

In contrast, most vendors of 5¼-in. Winchesters have adhered to a single controller specification, first defined by Seagate Technology for its ST-506 6M-byte, 5¼-in. Winchester. There were a number of reasons for this, not the least of which was the recognition by drive vendors that a standard was necessary if the market for smaller drives was to avoid the disarray that categorized the 8-in. market.

Another reason for the ready acceptance of the ST-506 is the homogeneity of early 5¼-in. Winchester applications versus the diversity of early 8-in. Winchester applications. Many vendors of 8-in. Winchesters, including Shugart and Quantum Technology Corp. were able to make good use of the lower performance (4.34M bits per sec.) interface defined for the SA1000. Other vendors of 8-in. drives initially offered high-performance Winchesters that demanded higher speed controllers standardized by ANSI at 7.37M bps. With few exceptions, however, vendors of 5¼-in. Winchesters entered the market with hardware that allowed designers to upgrade the capacities of existing single-user, single-task floppy-disk-drive-based system.

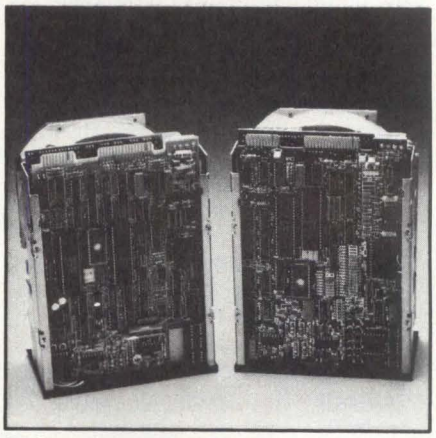
The two key specifications that define ST-506 compatibility are transfer rate (5M bits per sec.) and the number of bytes per track (10,416). All controllers specified as "ST-506 compatible" are based on these specifications, and almost all 5¼-in. Winchesters on the market meet these standards.



Notes:

1. Nominal track capacity = 10416 bytes
2. Total data bytes per track = 256 × 32 = 8,192
3. Sector interleave factor is 4. Sequential ID fields are sector numbered 0, 8, 16, 24, 1, 9, 17, 25, 2, 10, 18, 26, . . . etc.
4. Data fields contain the bit pattern 0000 as shipped
5. CRC fire code = $x^{16} + x^{12} + x^5 + 1$
6. Bit 7 of head byte ID field equals 1 in a defective sector (cylinder 0 is error free)
7. Bit 5 of head byte reserved for numbering cylinders greater than 256
8. Bit 6 of head byte reserved for numbering cylinders greater than 512

manufacturer into the total cost of ownership. The accessibility of reparable parts should also be evaluated. While drives are manufactured and assembled in environmentally controlled clean rooms, they are seldom repaired under these exacting standards. The media/head enclosure should remain sealed even in field-service operations. If the drive manufacturer has not kept as many serviceable parts as possible outside the disk enclosure, repairs must often be made at the factory.



On-board circuitry *for 40M-byte drive (right) includes more components than the 19M-byte drive due to increased intelligence required for closed loop servo positioning.*

Some manufacturers can provide test results from an independent test laboratory. Such tests can include shock and vibration testing, supplying information about a drive's ability to withstand the rigors of a desk-top environment. Temperature-sensitivity tests are also important for machines that are subjected to frequent power-on and -off situations. But the best source of reliability information may be other users of the drive, and the drive manufacturer should be more than willing to provide a prospective OEM with a list of such users. □

Raymond Brooke is president of Computer Memories Inc., Chatsworth, Calif.

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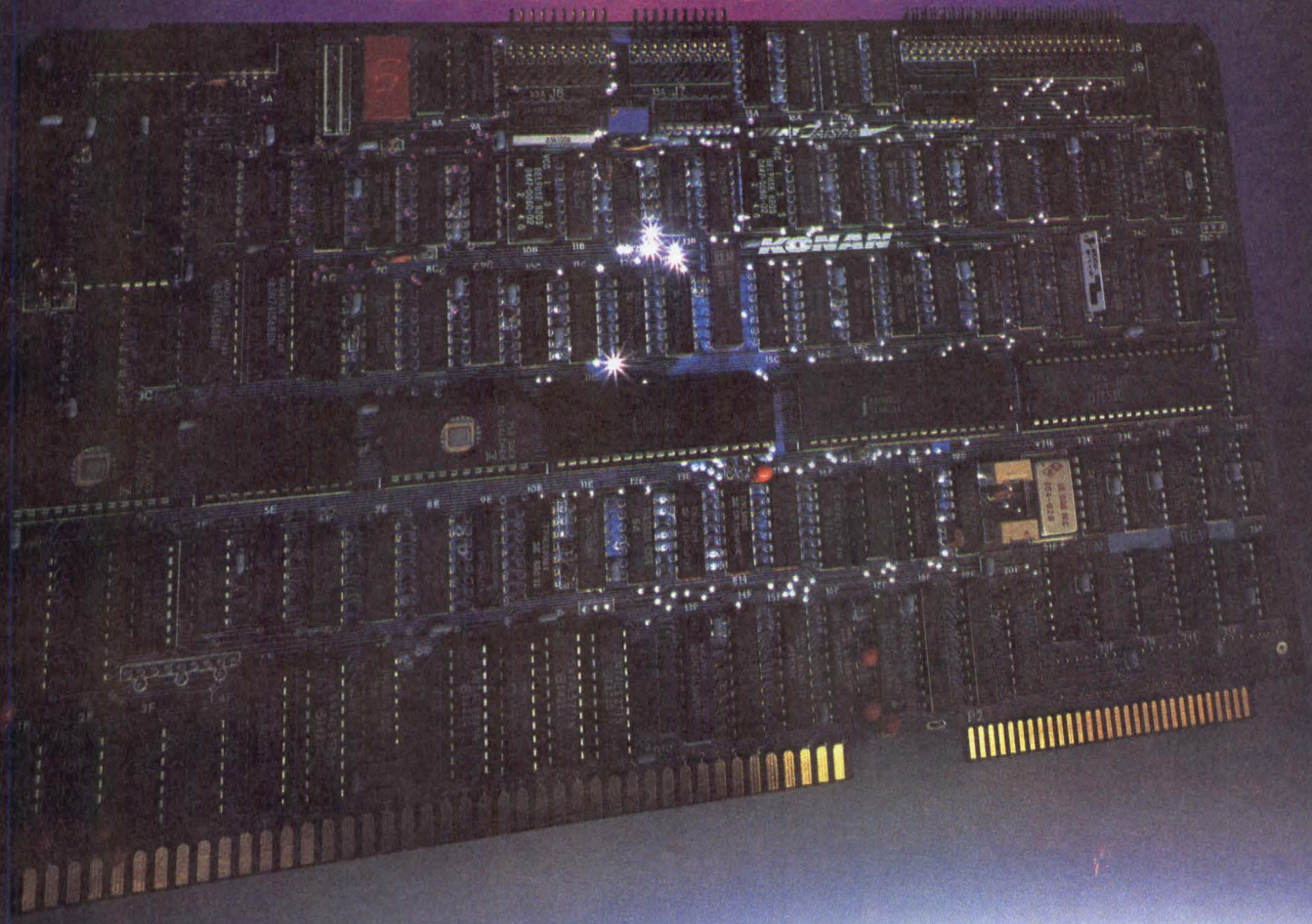

The Challenge: *Pack the controlling power of Multiple Boards onto one. Build-in high performance. Engineer-in reliability & versatility. Provide a simple, yet sophisticated interface. And do it all at an unheard of low price.*

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An elegantly simple interface even allows you to transfer up to 256 sectors with a single command. The command block contains full drive parameters, mode control, host buffer address of the next command, a 16-byte command block which may reside anywhere in host memory and a whole lot more.

Couple design flexibility, quality and an unbeatable price and your choice is simple...TAISHO from Konan.

$735 *Quantity 500*

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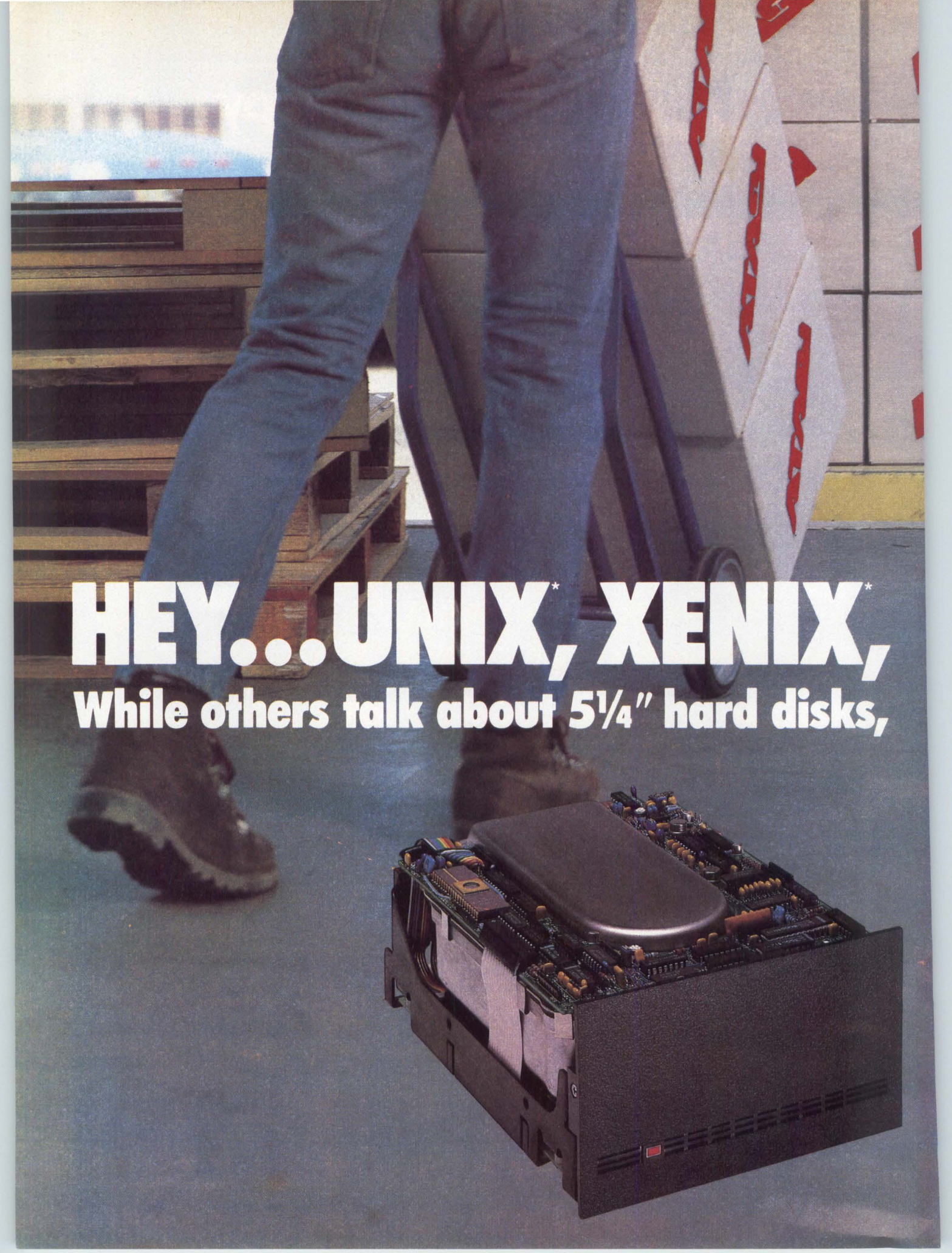
CIRCLE NO. 59 ON INQUIRY CARD


HEY...UNIX*, XENIX*,
While others talk about 5¼" hard disks,

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Why wait? ATASI is shipping 3 sizes of 5¼" hard disks right now.

All high capacity: 19.84 Mbytes/33.07 Mbytes/46.3 Mbytes
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All conventional technology
All ST506 compatible
All cost-effective
All with closed loop servo system and linear voice coil positioner
And all made right here in the U.S.A.
All you have to do is call

ATASI

ATASI Corporation, 2075 Zanker Road, San Jose, CA 95131 (408) 995-0335

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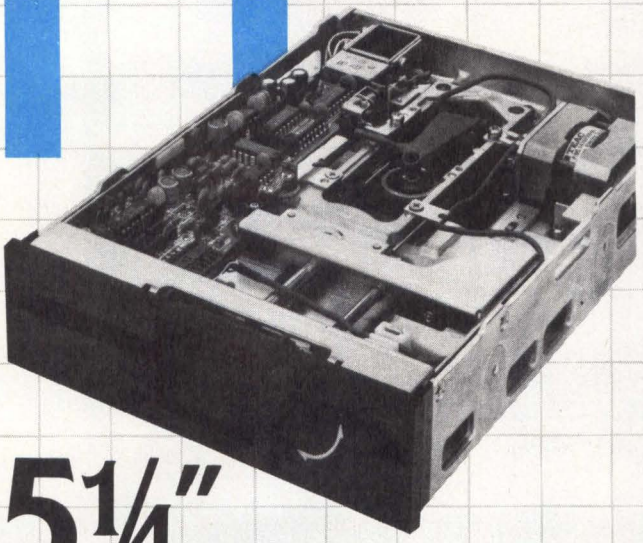
HALF HIGH



5¼" Floppy Disk Drives

TEAC FD-55 Series

AT 1⅝" HIGH, TEAC FD-55 SERIES 5¼" FLOPPY DISK drives use half the space and run cool at half the power of conventional drives. High-reliability, low-noise brushless DC motors provide an MTBF of over 10,000 hours, backed by a one-year parts and labor warranty.

FD-55A	FD-55B	FD-55E	FD-55F
• 48tpi	• 48tpi	• 96tpi	• 96tpi
• 40 track	• 40 track	• 80 track	• 80 track
• 250KB	• 500KB	• 500KB	• 1MB
• single side	• double side	• single side	• double side

Power Requirements:
DC +12V ±5% 0.3A typical, 0.7A max.
DC + 5V ±5% 0.5A typical, 0.7A max.

Phone, write or wire TEAC Corporation of America for complete technical data, price and delivery.

TEAC

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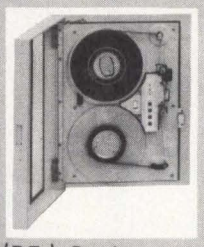
Montebello, CA 90640
213/726-0303

CIRCLE NO. 61 ON INQUIRY CARD

Tape subsystems? IDT has the right solution...



Series 1012 TMS "Virgo" Streaming Tape Transports

TD 1012-1

Basic vertical transport with reels up to 10½", 9-track, IBM compatible, Read-after-Write; 100 ips streaming, 12.5 ips start-stop. Integrated industry-standard formatter, 1600 cpi (P.E.). Rack mountable. Available without front door.

TD 1012-2

Drawer mounted version of the TD 1012-1, incorporating identical specifications and performance, with drawer slides.

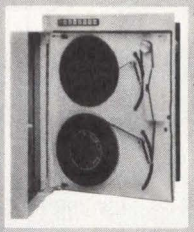
TD 1012-3

Table-top mounted version, including same specifications and performance of TD 1012-1.

Series 1050 Magnetic Tape Drives and Subsystems

TD 1050

Basic tension arm magnetic tape subsystem with up to 10½" reels, speeds from 18.75 to 45 ips, 9-track, P.E. (1600 cpi) and/or NRZI (800 cpi). Available in 21 separate models which are compatible with a variety of host systems, for example: GPIB, RS232C, parallel I/O, Multibus and others.



TD 1750

75 ips tension arm magnetic tape subsystem, Read-after-Write, 9 track, P.E. (1600 cpi). Same interfaces available as TD 1050.

Series TDC 3000 Digital Cartridge Drives and Subsystems

Digital cartridge drives featuring DC-300 ¼" tape or 450 ft. tape cartridges, integral power supply, 4-track raw head and track protect. 10 to 30 ips read/write; 90 ips search. 1600 bpi packing density. Available with formatters and interfaces compatible with a variety of host systems.

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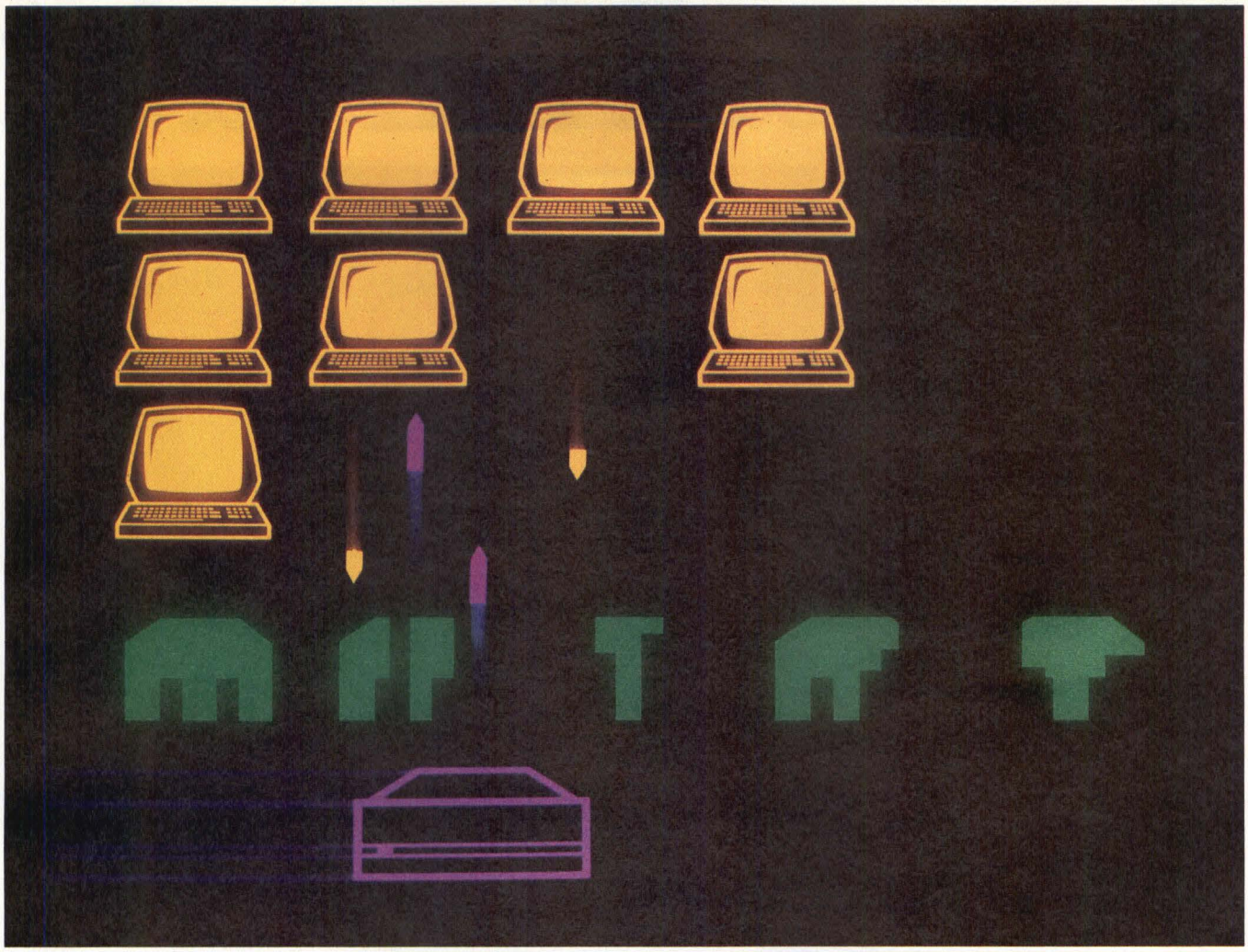


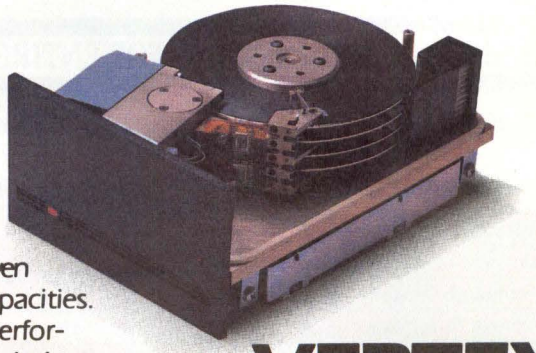
DON'T LET 5 1/4" WINCHESTERS SHOOT DOWN YOUR MULTI-USER SYSTEM PLANS

Now you can design truly high performance systems with the VERTEX V100 5¼" family; 31MB, 52MB, 72MB capacity; 30 msec average access time; industry standard mounting, interface and transfer rate.

There was a time when "high performance system" meant "big disk system." Not anymore. The low cost VERTEX V100 family brings you big disk performance, all right. But in a compact 5¼" format. What's more, your system is probably already designed for the V100 family since it uses the industry standard interface and 5 Mbits/sec transfer rate.

The V100 family is actually the first of a series of VERTEX drives designed for even higher performance and capacities. That means you get peak performance today with superior design integrity. And each VERTEX drive is backed by a team that has been responsible for the design and manufacture of over 3,000,000 disk drives. So while VERTEX is a new company, our production and quality assurance programs have been fine-tuned to deliver highly reliable products, on time. You can plan on it!

Don't delay your high performance system plans any longer. Call Norm Hayes, Director of Marketing, today at (408) 942-0606. Or write VERTEX, 2150 Bering Drive, San Jose, CA 95131.



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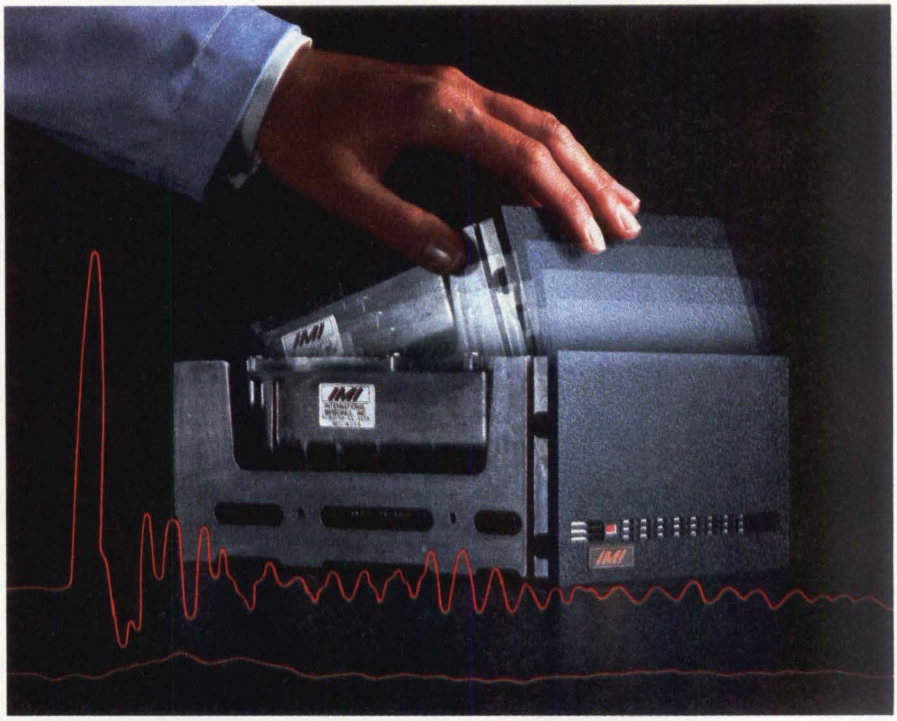
PERIPHERALS

You Can Plan On Us . . .

CIRCLE NO. 63 ON INQUIRY CARD

This won't hurt a bit.



Accelerometer waveforms. Upper trace: frame. Lower trace: HDA.

AND HERE'S THE PROOF.

To prove that our new 5000H Series 5¼" Winchesters can stand up to the knocks that desk-top systems often go through, even in the office, we put them through some brutal drop-tests.

We really let them have it. 1500 Gs on the outside frame.*

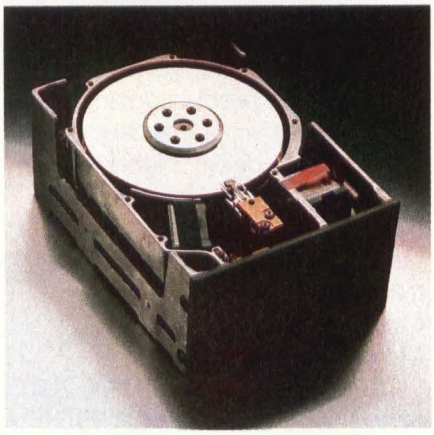
And what happened?

Nothing.

No head crashes. No media damage. No component misalignment. No loss of data or processing performance.

That's because 5000H Series drives have an exclusive 2-piece shock isolation system. The head/disk assembly is recessed within a rugged outer frame, where integral shocks at the center of gravity reduce impulses to the HDA by over 90%.

*Accelerometer reading for 3" drop-test.



They also have thin-film plated media, which is over 1000 times harder than ferric-oxide coatings, and which combines with the shock isolation design to make the drive even less vulnerable to head crashes and subsequent data loss.

During installation and use, even in the most demanding applications, 5000H Series drives ensure data integrity and reliable operation.

A new thermally stable design enhances data reliability over a wider temperature range.

And to reduce EMI/RFI noise susceptibility, the read/write preamps are located right on the head stack – where they combine with the higher performance of plated media to deliver the best signal-to-noise ratio in the industry.

68 MSEC AVERAGE ACCESS FOR ENTIRE 5000H SERIES LINE.

That includes head settling time.

At this speed, your system can excel in critical comparative benchmark tests.

And depending upon the drive model and interface selected, it can meet a wide range of capacity requirements.

IMI 5000H Series	5006H	5012H	5018H
Unformatted Capacity (Mbytes)	6.38/7**	12.76/14	19.14/21
Formatted Capacity (Mbytes)	5/6.3	10/12.5	15/18.8
Access Time (msec)	68	68	68
Number of Disks	1	2	3
RPM	3600	3600	3600

** Industry standard interface and format/Industry standard interface with expanded format.

INDUSTRY'S ONLY 2-YEAR WARRANTY.

The design of the IMI 5000H Series drive makes it the most reliable 5¼"Winchester ever built.

But the proof is in the warranty. For if the drive couldn't withstand extreme shock and vibration, the last thing we'd do is give it an unprecedented 2-year warranty.

For spec sheets and further information, including the higher capacities and faster access times we have planned for the future, call or write:
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IMI

We're at it again.

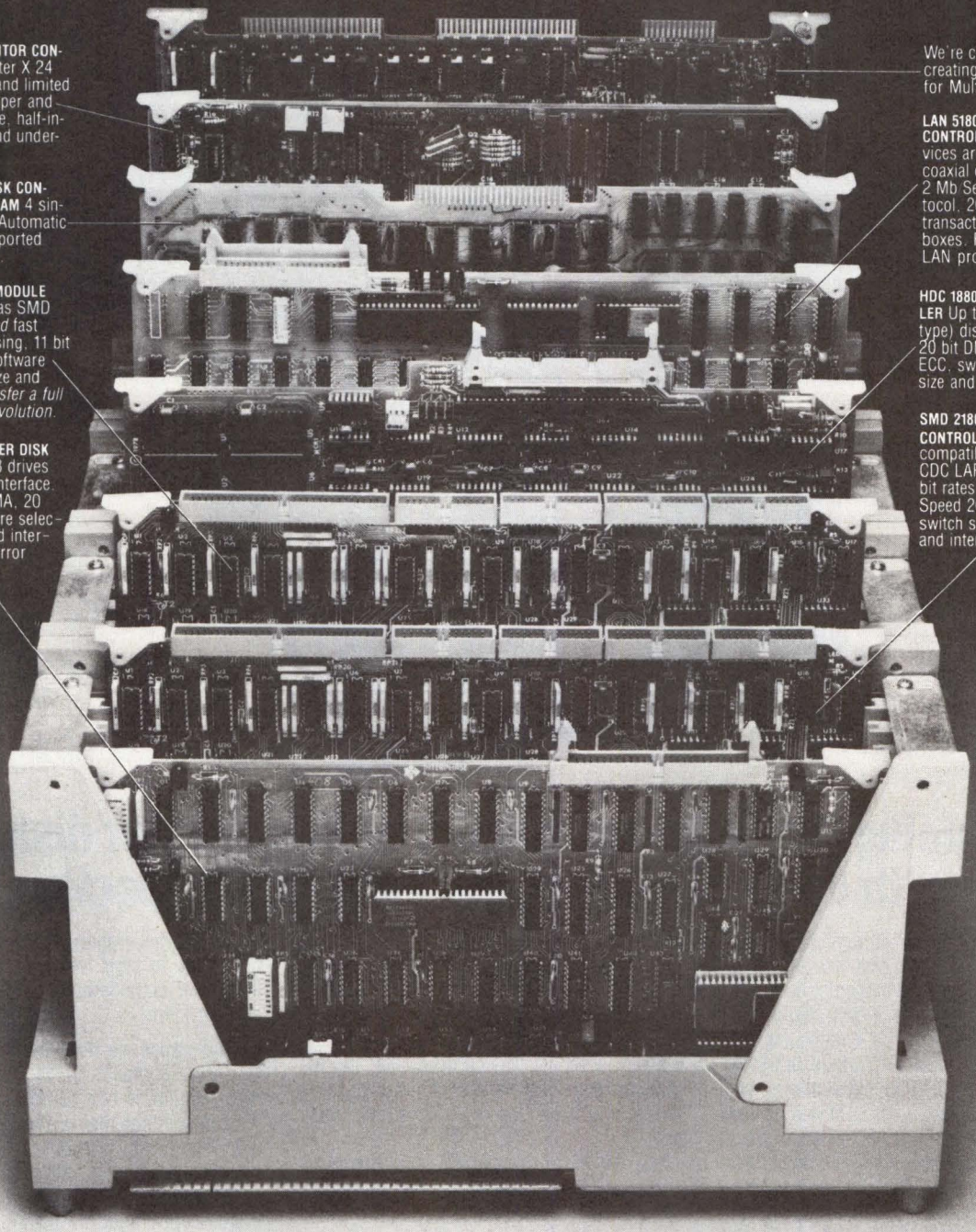
CIRCLE NO. 64 ON INQUIRY CARD

5¼-IN. FIXED DISK DRIVES

Company Model	Capacity (M bytes)	Avg. access time (msec.)	Transfer rate (K bits/ sec.)	No. of data surfaces	Bytes/ track	Actuator type	Interface type	Price ($)	Special features
ADVANCED ELECTRONICS DESIGN, INC.									
Winc 05	12.38	93	259			stepper	Q-bus	5033	includes 500K-byte floppy drive, RL01, RX02 emulation
AMPEX CORP.									
PYXIS 13	13.3	90	625	4	10417	rotary	ST506		temp. compensating head positioning, auto head lock
PYXIS 20	20.0	90	625	6	10417	rotary	ST506		temp. compensating head positioning, auto head lock
PYXIS 27	26.7	90	625	8	10417	rotary	ST506		temp. compensating head positioning, auto head lock
PYXIS 7	6.7	90	625	2	10417	rotary	ST506		temp. compensating head positioning, auto head lock
APPLE COMPUTER, INC.									
Profile	5	95	625	4	8192			2195	
ATASI CORP.									
3020	19.8	30	625	3	10416	linear voice coil	ST506	1470, Q1000	dedicated landing zone, auto. carriage lock, shock mounted
3033	33.1	30	625	5	10416	linear voice coil	ST506	1800, Q1000	dedicated landing zone, auto. carriage lock, shock mounted
3046	46.3	30	625	7	10416	linear voice coil	ST506	2150, Q1000	dedicated landing zone, auto. carriage lock, shock mounted
ATHENAEUM TECHNOLOGY, INC.									
Aegis 10/10	12.75	35	625	4	10420	linear voice coil	ST506	1500, Q500	soft sectoring
Aegis 30	38.25	35	625	6	10420	linear voice coil	ST506	1500, Q500	soft sectoring
BASF AG									
6183	9.6	61							brushless DC motor
6184	14.4	92							brushless DC motor
CARDIFF TECH.									
D240	20	25	625	4	10416	linear voice coil	ST506 (706)	1350, Q1000	dynamically-loaded 3370-type, R/W heads, 20 embedded servo
F 240, F 360	40	25	625	4	10416	linear voice coil	ST 506		dynamically-loaded 3370-type R/W heads, embedded track servo
R120		25	625	2	10416	linear voice coil	ST506 (706)		dynamically-loaded 3370-type R/W heads, embedded track servo
COGITO SYSTEMS CORP.									
906	6.4	85		1			ST506/412	725, Q500	thin film-plated media, manganese-zinc heads
912	12.8	85		2			ST506/412	825, Q500	thin film-plated media, manganese-zinc heads
COMPUTER MEMORIES, INC.									
CM5206	6.4	80	625	2	10400	open loop stepper	ST506	650, Q500	on-board microprocessor, manganese-zinc heads
CM5412	12.8	80	625	4	10400	open loop stepper	ST506	775, Q500	on-board microprocessor, manganese-zinc heads
CM5619	19.1		625	10	10400	open loop stepper	ST506	900, Q500	on-board microprocessor, manganese-zinc heads
CM5640	40			6	10400	closed loop servo	ST506		on-board microprocessor, manganese-zinc heads
CM6426	26.7	40	625	4	10400	rotary torque	ST506	1035, Q500	
CM6640	40	40	625	6	10400	rotary torque	ST506	1170, Q500	
SM6213	13.3	40	625	2	10400	rotary torque	ST506	890, Q500	
CONTROL DATA CORP.									
CDC 9415-3	19/32	50	605	3	10080	rotary voice coil	FDI/LDI/ISI	1175, Q1000	LSI circuits, variable sectoring

Company Model	Capacity (M bytes)	Avg. access time (msec.)	Transfer rate (K bits/ sec.)	No. of data surfaces	Bytes/ track	Actuator type	Interface type	Price ($)	Special features
CDC 9415-5	19/32	50	625	3	10080	rotary voice coil	ST5XX	1485, Q1000	LSI circuits, variable sectoring
CORVUS SYSTEMS, INC.									
6MB	6.7	125	960	4	12000	steel band	various	3195	6 month warranty
DATAPOINT CORP.									
9301	20	75	3125		6144		microbus	8000	integrated 20MB tape drive for backup
9313/9315	5/10	85						3950	includes 1MB floppy disk drive
DISCTRON, INC.									
D507	6.38	77	625	2	8192	rotary stepper motor	ST506/412	555, Q1000	
D514	12.75	77	625	4	8192	rotary stepper motor	ST506/412	655, Q1000	
D519	19.13	77	625	6	8192	rotary stepper motor	ST506/412	755, Q1000	
D526	25.5	77	625	8	8192	rotary stepper motor	ST506/412	895, Q1000	
D620	25.5	35	625	3	8192	linear voice coil	ST506/412		half-height drive available third quarter 1983
D640	42.5	35	625	5	8192	linear voice coil	ST506/412		half-high drive available third quarter 1983
DMA SYSTEMS									
26F	26	40	625	4	10890	linear motor		990, Q1000	
39F	39	40	625	4	10890	linear motor		1250, Q1000	
5		40	625	2	10890	linear motor		995, Q1000	
5/10	13	40	625	4	890	linear motor		1395, Q1000	
5/15	6.5	40	625	4	10890	linear motor		1450, Q1000	
5/5	6.5	40	625	4	10890	linear motor		1275, Q1000	
EVOTEK CORP.									
ET-5510	7.81	49	625	2	10416	stepper motor/ linear actuator	ST506		thin-film plated media, microprocessor controlled
ET-5520	15.62	49	625	4	10416	stepper motor/ linear actuator	ST506		thin-film plated media, microprocessor controlled
ET-5540	31.24	49	625	8	10416	stepper motor/ linear actuator	ST506		thin-film plated media, microprocessor controlled
ET-5810	12.90	49	1025	2	17220				thin-film plated media, microprocessor controlled
ET-5820	25.83	49	1025	4	17220				thin-film plated media, microprocessor controlled
ET-5830	38.75	49	1025	6	17220				
ET-5840	51.68	49	1025	8	17220				
ST-5530	23.43	49	625	6	10416	stepper motor/ linear actuator	ST506		thin-film plated media, microprocessor controlled
FUJITSU AMERICA, INC.									
M2231	6.7	95	625	2	10416	stepper motor	ST506		
M2233	13.3	95	625	4	10416	stepper motor	ST506		
M2234	20	95	625	6	10416	stepper motor	ST506		

More Multibus.™ And less.



VMC 186 VIDEO MONITOR CONTROLLER 80 Character X 24 line alphanumeric and limited graphic display. Upper and lower case. Reverse, half-intensity, flashing, and underline attributes.

FDC 1680 FLOPPY DISK CONTROLLER WITH 16K RAM 4 single density drives. Automatic DMA into the dual-ported on-Board 16K RAM.

SMD 2181 STORAGE MODULE CONTROLLER Same as SMD 2180 except *damned* fast DMA 24 bit addressing. 11 bit Error Correction, software selectable sector size and interleave. *Can transfer a full track in one disk revolution.*

WDC 2880 WINCHESTER DISK CONTROLLER Up to 8 drives with ANSI X3T9.3 interface. Very high speed DMA, 20 bit address. Software selectable sector size and interleave factor. 11 bit Error Correction.

We're constantly at work creating new capabilities for Multibus.

LAN 5180 LOCAL AREA NETWORK CONTROLLER Up to 255 devices are supported on a coaxial cable. Data rates up to 2 Mb Sec. SDLC HDLC protocol, 20 bit DMA, automatic transaction completion, mailboxes. First in a family of LAN products.

HDC 1880 HARD DISK CONTROLLER Up to 4 cartridge (5440 type) disk drives. High speed 20 bit DMA. Automatic Retry, ECC, switch selectable sector size and interleave.

SMD 2180 STORAGE MODULE CONTROLLER Up to 4 SMD compatible drives (including CDC LARK), 8-300 MBytes, bit rates to 20 Mb/S. High Speed 20 bit DMA, ECC, switch selectable sector size and interleave.

Now, the most talented Multibus specialists in the country bring you more Multibus options than ever before. And less.

More technology with less risk. More function with less cost. And more support with less hassle.

When you're ready to expand your Multibus capabilities, talk to us. We're the specialists who give you more. And less.

Entire rigid disk controller family is software interchangeable. Automatic completion of simple multisector commands, automatic recovery from errors, bad track mapping, full sector buffering, extensive diagnostic reporting. Variable burst DMA in 8 or 16 bit systems. Software drivers and disk subsystems also available.

INTERPHASE corporation

We stay ahead of our competition so you can stay ahead of yours.
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CIRCLE NO. 65 ON INQUIRY CARD

RODIME's exciting new dimension... 3½"

Introducing the ultra-compact, 3½" Winchester disk drive with up to 10 megabytes formatted capacity

There's an exciting new dimension to Winchester disk drives. With one-fourth the volume of a standard 5¼" Winchester disk drive and the same height as a half-height 5¼" drive, our new RO 350 3½" Winchester disk drive brings high capacity storage (up to 10 megabytes formatted) to applications you never thought of before. Its light weight, low power requirements and 85 millisecond access time open up a whole new world of Winchester applications. Portable computers. Compact desk top systems. Intelligent terminals. Point-of-sale terminals. Industrial controllers. Navigation and guidance systems. Portable instrumentation. (In fact, there are few places our light weight, ultra-compact 3½" Winchester disk drives can't be used.)

A new dimension of design versatility

The RO 350 gives you tremendous freedom and flexibility in designing systems. Take a look at the number of ways this compact approach can work:

- Uses industry-standard ST506 interface which makes it compatible with all major 5¼" Winchester controllers.
- Is a compact 3½" drive for those tight spots other drives cannot fit.
- Directly replaces half-height 5¼" disk drives (with Rodime sub-frame).
- When faced with space problems, the RO 350 plus controller card will fit into the same space as a standard 5¼" Winchester disk drive.
- Two RO 350 drives easily fit in the same space as a standard 5¼" Winchester disk drive.

A new dimension of technical excellence

RODIME's reputation for technical excellence is further enhanced with the design of this ultra-compact Winchester disk drive. Using advanced large-scale integration, the entire electronics for the drive are on a single, compact board. In addition to its compact size and weight (about one-third the weight of a standard 5¼" drive), there are other design innovations. Power consumption is only 13 watts—half of a 5¼" drive's power requirements. Access time is 85 milliseconds. The rugged design of the RO 350 translates to high resistance to shock, an important consideration for portable computer systems.

Our no-nonsense tradition

Our ultra-compact, 3½" Winchester disk drive continues our no-nonsense tradition. It's a philosophy that has made our family of 5¼" Winchester disk drives, with capacities up to 54 megabytes, the preferred drives of OEMs and system integrators worldwide. It's a philosophy built on quality, reliability and performance.

To find out how our new 5 and 10 megabyte 3½" Winchester disk drives can add a new dimension to your system design, or for details of our entire Winchester disk drive line, call or write today.

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Nasmyth Road, Southfield Industrial Estates
Glenrothes, Fife, KY6, 2SD, Scotland
Telephone: 0592 774704

CIRCLE NO. 66 ON INQUIRY CARD

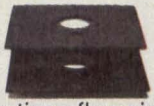
RODIME

Company Model	Capacity (M bytes)	Avg. access time (msec.)	Transfer rate (K bits/ sec.)	No. of data surfaces	Bytes/ track	Actuator type	Interface type	Price ($)	Special features
HEWLETT-PACKARD									
9133A	6.38	168	500	4	7680	stepper motor	HP-IB	4260	includes 3½-in. microfloppy drive
9133B	12.7	85	500	4	7680	stepper motor	HP-IB	5120	includes 3½-in. microfloppy drive
9134A	6.38	168	500	4	7680	stepper motor	HP-IB	3500	
9134B	12.7	85	500	4	7680	stepper motor	HP-IB	4360	
9135A	6.38	168	500	4	7680	stepper motor	HP-IB	4760	includes 5¼-in. floppy drive
INTERNATIONAL MEMORIES, INC.									
5006H	6.38	68	625	1	10417	stepper	ST506/412	535, Q500	
5012H	12.75	68	625	2	10417	stepper	ST506/412	615, Q500	
5018H	19.13	68	625	3	10417	stepper	ST506412	715	
5040H	41	68	625	3	10417	stepper	ST506/412		
IRWIN/OLIVETTI, INC.									
416	16	34	675	2	9952	rotary voice coil	Irwin	1140, Q500	embedded servo
510	12.2	33	675	2	9952	rotary voice coil	Irwin	1650, Q500	built-in cart. tape drive, embedded servo
516	16	34	675	2	9952	rotary voice coil	Irwin	1794, Q500	built-in cart., embedded servo
LEADING EDGE									
Hard Disk III	6.4–19.1	85	1000		10400	split band stepper	IBM PC, TRS-80	1995	6.4, 12.8, 19 MB versions available, 6 month warranty
MAEZON-DIVISION OF KONAN CORP.									
V-10000	12.76	85	625	4	10416	stepper motor		2295	CP/M, DOS, PASCAL
V-15000	19.14	85	625	6	10416	stepper motor		2595	CP/M, DOS, PASCAL
V-5000	6.38	85	625	2	10416	stepper motor		1995	CP/M, DOS, PASCAL
MAXTOR CORP.									
XT-1065	66.93	30	625	7	10416	rotary voice coil	ST506/412	1520, Q1000	closed loop servo system, plated media
XT-1105	105.18	30	625	11	10416	rotary voice coil	ST506/412	2100, Q1000	closed loop servo system, plated media
XT-1140	143.43	30	625	15	10416	rotary voice coil	ST506/412	2690, Q1000	closed loop servo system, plated media
MICROPOLIS CORP.									
1302	17.3	38	625	2	10416	voice coil	ST506		
1303	34.6	38	625	2	10416	voice coil	ST506		
1304	51.9	38	625	6	10416	voice coil	ST506		
MICROSCIENCE INTERNATIONAL CORP.									
HH612	12.76	85	625	2	8192	stepper motor	ST506	700, Q1000	half-height drive, closed loop, thin-film media, shock mount
MINISCRIBE CORP.									
2006	6.4	85	625	2	8192	rack and pinion	ST412	498, Q500	
2012	12.8	855	625	81	8192	rack and pinion	ST412	596, Q500	
3006	6.4	85	625	2	10416	rack and pinion	ST412	447	half-height drive, plated media
3012	12.8	155	624	2	10416	rack and pinion	ST412	530, Q500	half-height drive, plated media
4020	20	120	625	6	8192	rack and pinion	ST412	647, Q500	

Company Model	Capacity (M bytes)	Avg. access time (msec.)	Transfer rate (K bits/ sec.)	No. of data surfaces	Bytes/ track	Actuator type	Interface type	Price ($)	Special features
MITSUBISHI ELECTRONICS AMERICA, INC.									
M4863-2	6.66	75	625	4	10417		SA600, ST506		
M4863-3	10	75	625	6	10417		SA600, ST506		
NEC INFORMATION SYSTEMS									
5214	6.45	85	625	2	10416	split band, stepper motor	ST506/406		
5224	12.91	85	625	4	10416	split band, stepper motor			
5234	19.37	85	625	6	10416	split band, stepper motor			
NEW WORLD COMPUTER CO., INC.									
2/0	2	19	500	1	13000	stepper motor	New World	496, Q500	
2/2	2	19	500	2	13000	stepper motor	New World	836, Q500	removable sealed Winchester cartridge
4/0	4	19	500	2	13000	stepper motor	New World	756, Q500	
4/2	4	19	500	3	13000	stepper motor	New World	996, Q500	removable sealed Winchester cartridge
4/4	4	19	500	4	13000	stepper motor	New World	1196, Q500	removable sealed Winchester cartridge
NIPPON ELECTRIC INDUSTRY CO., LTD.									
RD-4064	6.4	85	625	2	10416	linear	ST412		WD-1000-compatible disk controller
RD-4127	12.7	85	625	4	10416	linear	ST412		WD-1000-compatible disk controller
RD-4191	19.1	85	625	6	10416	linear	ST412		WD-1000-compatible disk controller
RD-4225	25.5	85	625	8	10416	linear	ST412		WD-1000-compatible disk controller
RD-5067	6.7	70	625	4	10416	linear	ST506		WD-1000-compatible disk controller
RD-5133	13.3	70	625	8	10416	linear	ST506		WD-1000-compatible disk controller
RS-5100	10.0	70	625	6	10416	linear	ST506		WD-1000-compatible disk controller
PERCOM DATA									
PHD-AP	5/30	85	625	8	8192			2050	4–8 data surfaces
PHD-PC	5/30	85	625	8	9182			2050	4–8 data surfaces
PHD-RS	5/30	85	625	8	8192			2050	data surfaces from 4–8
PLESSEY PERIPHERAL SYSTEMS									
FDV21H	10.4	70	625	6	8192	stepper motor	Q-bus		RL01, RL02 emulator, expands to 40 MB
POLYMORPHIC SYSTEMS									
HD/18	18	70	625	4	10417		ST506	4439	cabinet, controller, power supply, cables, software
HD/18+	18	70	625	4	10417		ST506	6439	cabinet, controller, power supply, cables, software
QUANTUM CORP.									
Q2010	10.66	55	543	2	8200	rotary torque	Q2000/ SA1000	1200, Q500	
Q520	21.33	45	625	4	8192	rotary torque	ST506/412	1100, Q500	automatic actuator lock
Q530	31.99	45	625	6	8192	rotary torque	ST506/412	1300, Q500	automatic actuator lock
Q540	42.66	45	625	8	8192	rotary torque	ST506/412	1500, Q500	automatic actuator lock
RODIME PLC									
RO 201	6.67	90	625	2	8192	stepper motor	ST506	525, Q1000	microprocessor, diagnostics, temperature, compensation

A "true" Winchester memory system with no buts about it.

Dual floppies are ok...



but micros have already outgrown low-capacity, poor-reliability, slow-access-time floppies.

Winchester with floppy is better...

but it's really just a glorified floppy memory system.

Winchester with tape... is as good as floppies...

but tape cartridges aren't really right—except for routine archiving.

DMA's 5¼" Winchester solution:

A memory system that makes sense instead of problems. The Micro-Magnum™ fixed/removable disk drive has mass storage, data portability, and backup in one device.

The Micro-Magnum 5/5: 5¼" fixed Winchester—backed by a reliable 5¼" industry-standard removable Winchester cartridge.

With 6.5 MBytes fixed and 6.5 MBytes removable (5-and-5 MBytes, formatted), it has enough capacity to handle almost any application.

And, Micro-Magnum's access time is just 40 milliseconds.

The right kind of removability and security.

Unlike floppies, Micro-Magnum's cartridge matches the fixed disk capacity one for one. Unlike streaming tapes, the 5¼" cartridge provides random access.

Unlike *both* floppies and tapes, Micro-Magnum provides the same access time, the same data rates, the same zero maintenance schedule for both fixed and removable files.

Full disk-to-disk backup takes less than 90 seconds.

The right way to protect data.

Micro-Magnum features a unique retractable head that never touches the disk. Plus a self-sealing clean air system that prevents contaminants from reaching the data—even after thousands of cartridge insertions.

And Micro-Magnum features an embedded servo for reliable cartridge interchange and positioning accuracy.

Just the right size.

Micro-Magnum matches mini-floppy front panel dimensions. The space-saving fixed/removable concept uses only one front panel. And you can adapt existing 5¼" Winchester drive controllers.

We're shipping.

Others promise delivery. Our class 100 manufacturing facility is producing. We're delivering.

The Micro-Magnum fixed/removable disk drive: The true Winchester memory system... without any ifs, ands, or buts.

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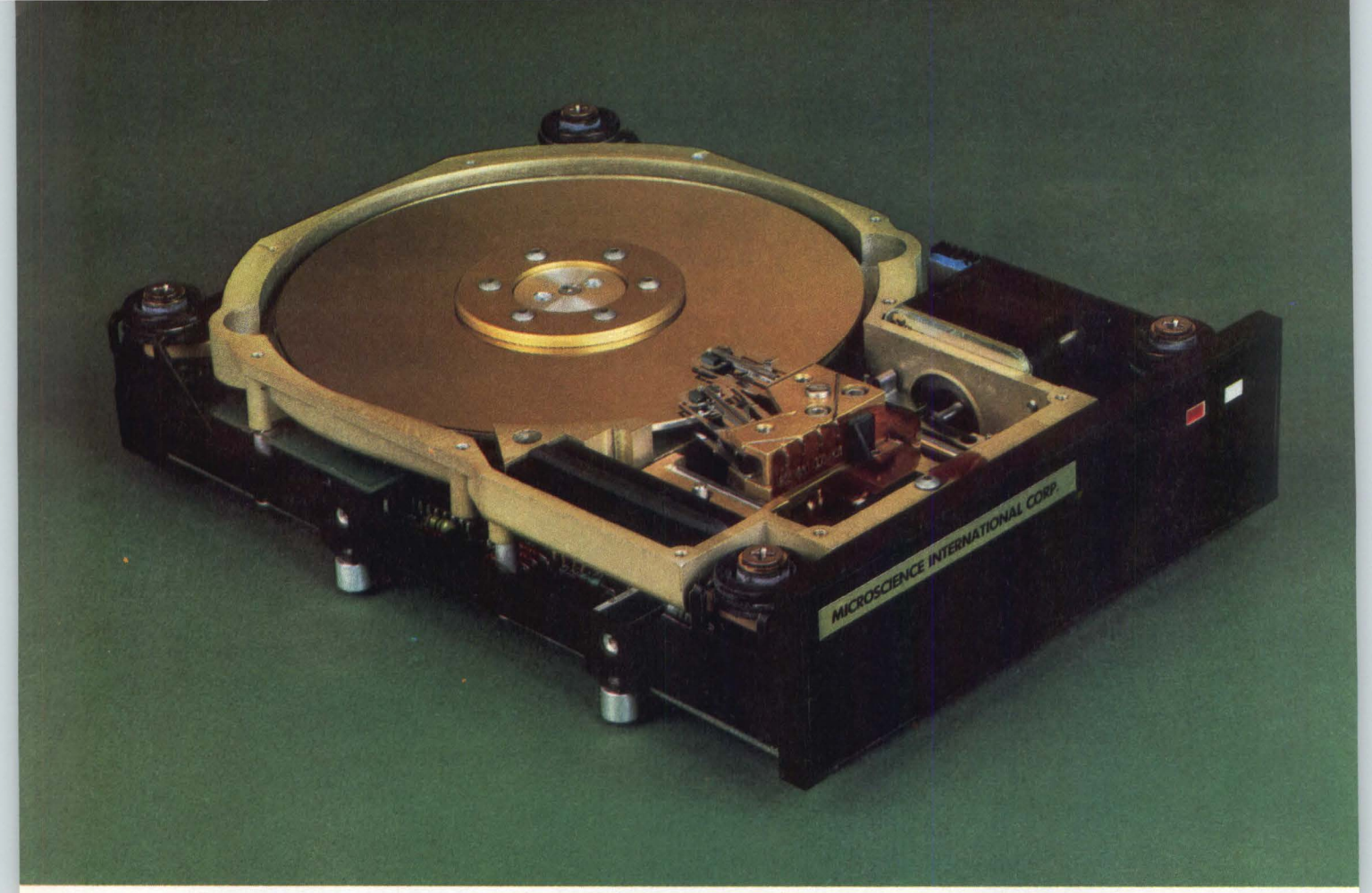
DMA SYSTEMS

Just what the industry needs.

CIRCLE NO. 67 ON INQUIRY CARD



10 MBYTES IN A SLIM 1.63 INCHES

Keen engineering design packs 10 megabytes of formatted data into a slim 1.63-inch high 5¼-inch Winchester disk drive.

Plated media, closed-loop positioning, and guard bands all work together to put 12.7 megabytes of unformatted data into this slim-line package. The Microscience HH-612 combines proven technology with a unique design that utilizes dual microprocessors to maintain stepper motor closed-loop positioning, and precise spindle motor velocity.

Self diagnostics continuously monitor electronic performance, motor velocity, and head positioning accuracy.

The HH-612, designed to meet the needs of compact transportable computers and portable personal computers, is shock mounted and operates in any position. The drive also features sealed media with filtered air for reliable, continuous operation.

Storage compatibility is convenient and simplified with the industry standard ST506 interface.

Microscience second sources electronic and mechanical components to assure dependable delivery.

For more information on the HH-612, or to arrange immediate delivery of an OEM evaluation unit, write **Microscience International Corporation**, 575 East Middlefield Road, Mountain View, CA 94043 or call (415) 961-2212.

Microscience International Corporation

CIRCLE NO. 68 ON INQUIRY CARD

Company Model	Capacity (M bytes)	Avg. access time (msec.)	Transfer rate (K bits/ sec.)	No. of data surfaces	Bytes/ track	Actuator type	Interface type	Price ($)	Special features
RO 202	13.33	90	625	4	8192	stepper motor	ST506	650, Q1000	microprocessor, diagnostics, temperature, compensation
RO 203	20	90	625	6	8192	stepper motor	ST506	775, Q1000	microprocessor, diagnostics, temperature, compensation
RO 204	26.67	90	625	8	8192	stepper motor	ST506	895, Q1000	microprocessor, diagnostics, temperature, compensation
RO 206	40	50	625	6	8192	stepper motor	ST506		microprocessor, diagnostics, temperature, compensation
RO 208	53.34	50	625	8	8192	stepper motor	ST506		microprocessor, diagnostics, temperature, compensation
SANTA CLARA SYSTEMS, INC.									
SCS-5 Series	5–15	85			8192			1995	controller, software cables, 5, 10, 15 MB versions available
SCS-5R Series	5, 10, 15	70			8192			2895	controller, software cables, 5, 10, 15 MB fixed capac. avail.
SCIENTIFIC MICRO SYSTEMS, INC.									
MDX Series	15	85	625	4	9216	band	ST506	4500, Q50	includes DEC or Multibus back plane, controller/ power supply
SEAGATE TECHNOLOGY									
ST206	6.38	85	500	2		stepper motor	ST500	745, Q500	half-height drive
ST406	6.38	85	625	2	10416	stepper motor	ST506	610, Q500	
ST412	12.76	85	625	4	10416	stepper motor	ST596	760, Q500	
ST419	19.14	85	500	6	625	stepper motor	ST506	895, Q500	
ST506	6.38	170	625	4	10416	stepper motor	ST506	700, Q500	
ST706	6.38	85	500	2	625	stepper motor	ST506	900	
SHUGART ASSOCIATES									
SA605	6.66	99	625	4	8192	band		675, Q500	built-in four-point shock mounts, dedicated head landing
SA606	10.0	99	625	6	8192	band		760, Q500	built-in four-point shock mounts, dedicated head landing
SA612	12.76	99	625	6	8192	band		800 OEM	built-in four-point shock mounts, dedicated head landing
SA706	6.67	99	625	2	8192	band		550 OEM	built-in four-point shock mounts, dedicated head landing
SA712	13.33	99	625	4	8192	band		650 OEM	built-in four-point shock mounts, dedicated head landing
SYQUEST TECHNOLOGY									
SQ306F	6.38	70	500		10416	stepper motor	ST506	500, Q500	a 3.9-inch disk (removable version available)
TALLGRASS TECHNOLOGIES CORP.									
TG-1000	6.25	85	636	2	10240	stepper motor	IBM-PC	2295	full-track buffer
TG-1200	12.5	85	636	4	10240	stepper motor	IBM-PC	2895	full-track buffer
TG-1400	19.7	120	636	4	10240	stepper motor	IBM-PC	3595	full-track buffer
TG-3006	6.25	85	636	2	10240	stepper motor	IBM-PC	3095	built-in tape backup
TG-3012	12.5	85	636	4	10240	stepper motor	IBM-PC	3795	built-in tape backup
TG-3020	19.7	85	636	4	10240	stepper motor	IBM-PC	4495	built-in tape backup
TG-3035	35	45	636	5	10240	voice coil	IBM-PC		built-in tape backup
TANDON CORP.									
TM501	6.4	85	624	2	10400	rotary stepper	industry standard	595, Q500	
TM502	12.8	85	625	4	10400	rotary stepper	industry standard	750, Q500	
TM503	19.2	85	625	6	10400	rotary stepper	industry standard	875, Q500	
TM703	30	39	625	5	10400	rotary voice coil	industry standard	1095	

Company Model	Capacity (M bytes)	Avg. access time (msec.)	Transfer rate (K bits/ sec.)	No. of data surfaces	Bytes/ track	Actuator type	Interface type	Price ($)	Special features
TEXAS INSTRUMENTS, INC.									
525/122	12.76	100	625	4			ST412	1575	
525/61	6.38	100	625	2			ST506	1225	
UNITED PERIPHERALS									
UP-9705	6.38	85	500	4	8192	stepper motor	SASI	2995	error correction compatible with most small computers
UP9800	6.38	85	500	4	8192	stepper motor	HPIB	2995	error correction compatible with most HP computers
VERTEX PERIPHERALS									
V130	30.8	30	625	3	10416	rotary voice coil	ST506/412	1480, Q100	thin film media
V150	51.4	30	625	10	416	rotary voice coil	ST506/412	1880, Q100	thin film media
V170	72	30	625	7	10416	rotary voice coil	ST506/412	2200, Q100	thin film media
WESTERN DYNEX CORP.									
WD505		55	625	2	10416	stepper motor	ST506	495	soft-sectored open loop positioning, temperature compensation
XCOMP									
8	10	120	625	1	10916	stepper motor	ST506	2195	
8x8	20	120	625	2	10416	stepper motor	ST506	2595	

5¼-in diskette drives

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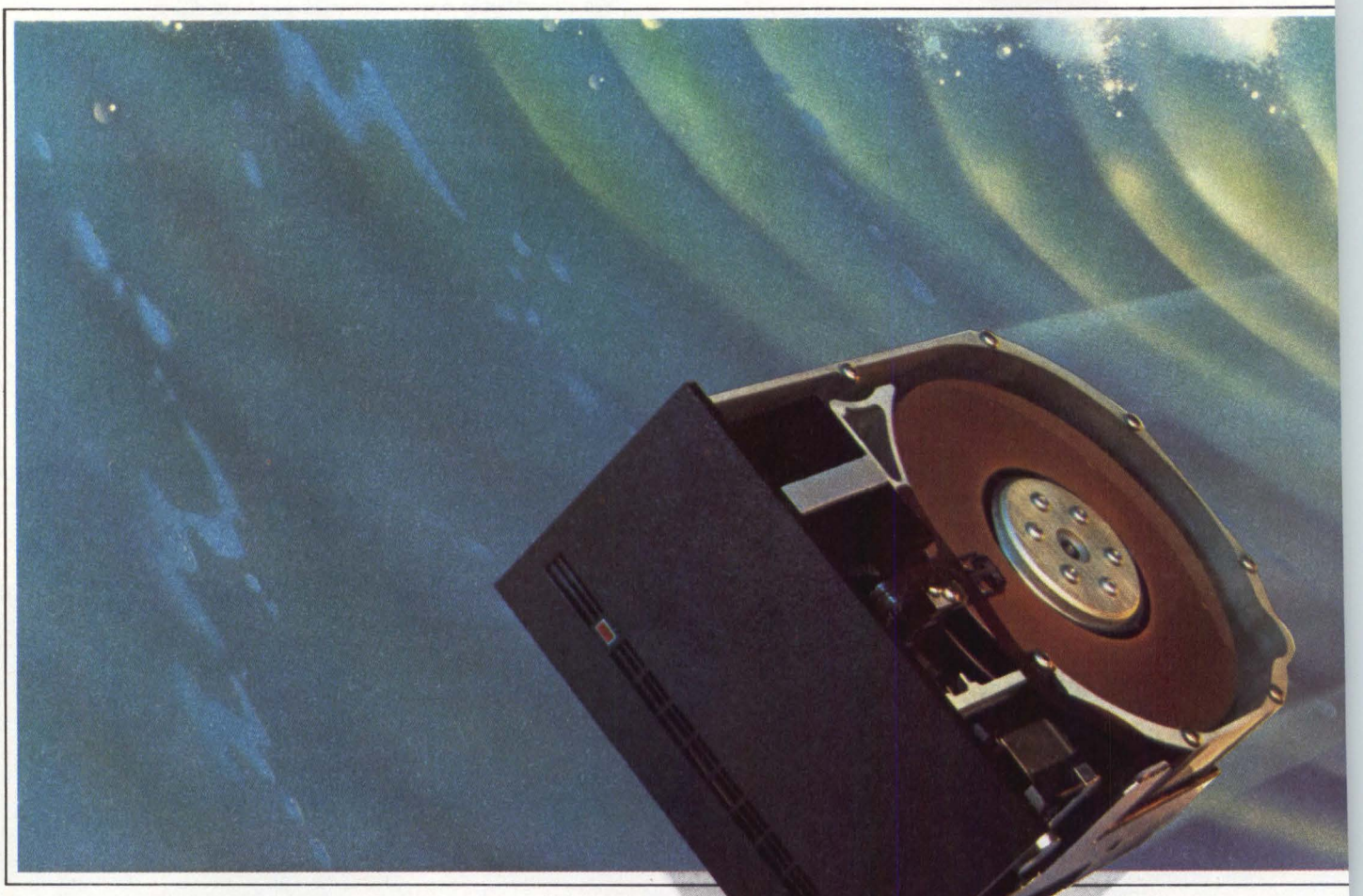
The Seagat



Seagate's ST400 Series is the most popular family of Winchester disc drives ever offered. And no wonder. These 5¼" Winchesters deliver more value for your money. More quality. More reliability. More performance. And all at a better price.

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The right features.

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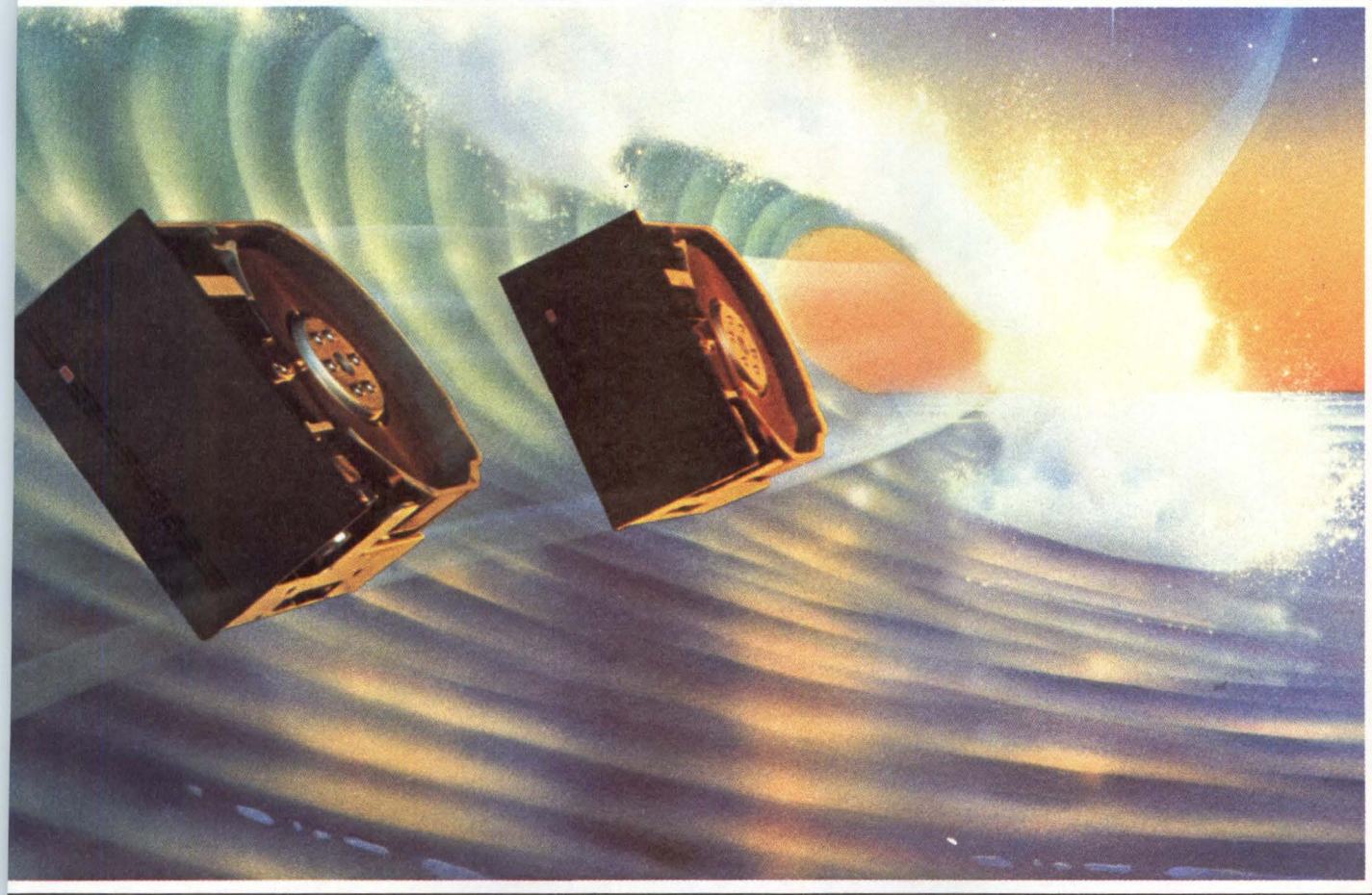

removable cartridge drive. Need a more compact drive? Pack more data in less room with our new ST206 half-high Winchester. Both new drives store 6.38 megabytes (unformatted) with reliable bit and track densities.

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"Turning the tide in disc technology"

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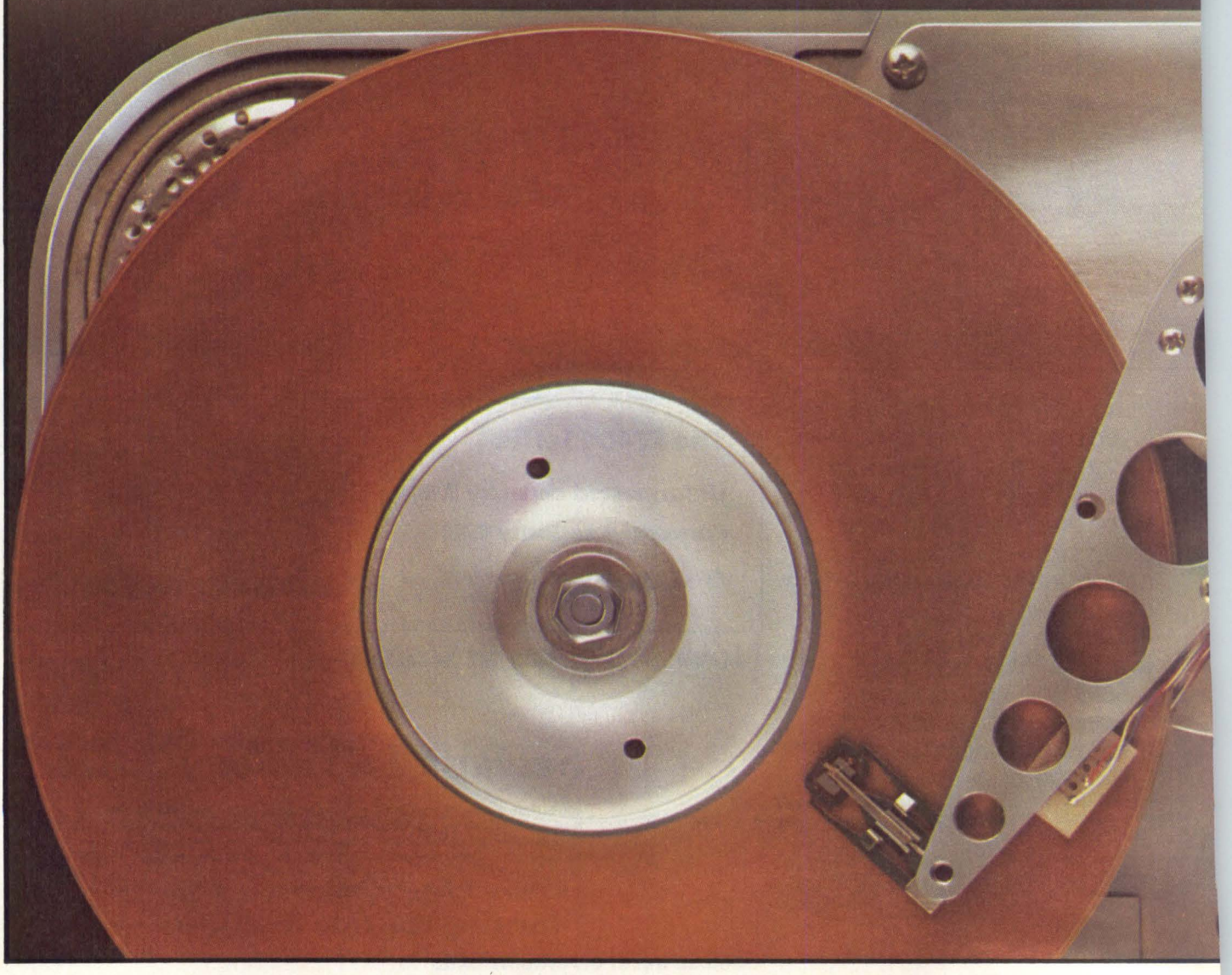

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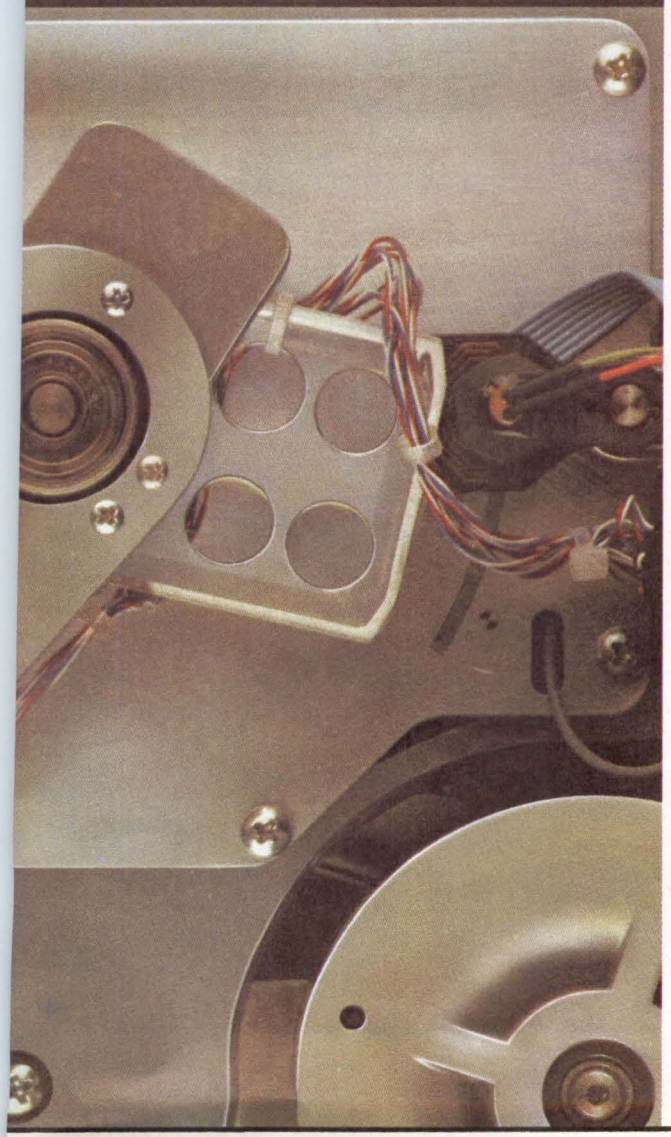

85 Megabytes.

This is the Quantum Q2080™ disk drive.

Our new 85 megabyte, 40 millisecond, 8″ Winchester.

And a Quantum leap in Winchester technology.

Because packed into this desktop-sized package is everything we've ever learned about taking a good idea and making it better.

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But it takes even more to improve access time, reliability, and availability—all at the same time.

That's where our Quantum Mechanics came in handy.

For the Q2080 drive, we developed the industry's simplest closed loop servo system. Exact head positioning derived from a dedicated servo disk surface.

In addition, we also decreased access time to 40 milliseconds, which is comparable to that found in drives having expensive voice coil actuators.

Yet we did both in such a way as to make the Q2080 easy to produce in high volume. Which is something we're both very much interested in.

The best part of all this magic, though, is that it enabled us to build a drive that's more economical than classical closed loop servo products.

In fact, the Q2080 drive has been designed to be the lowest priced 85 Mb 8″ Winchester on the market.

Which means it'll pay off handsomely in your new office automation and local area network applications.

The new 85 Mb Q2080 Winchester.

Amazing what a little tinkering can do.

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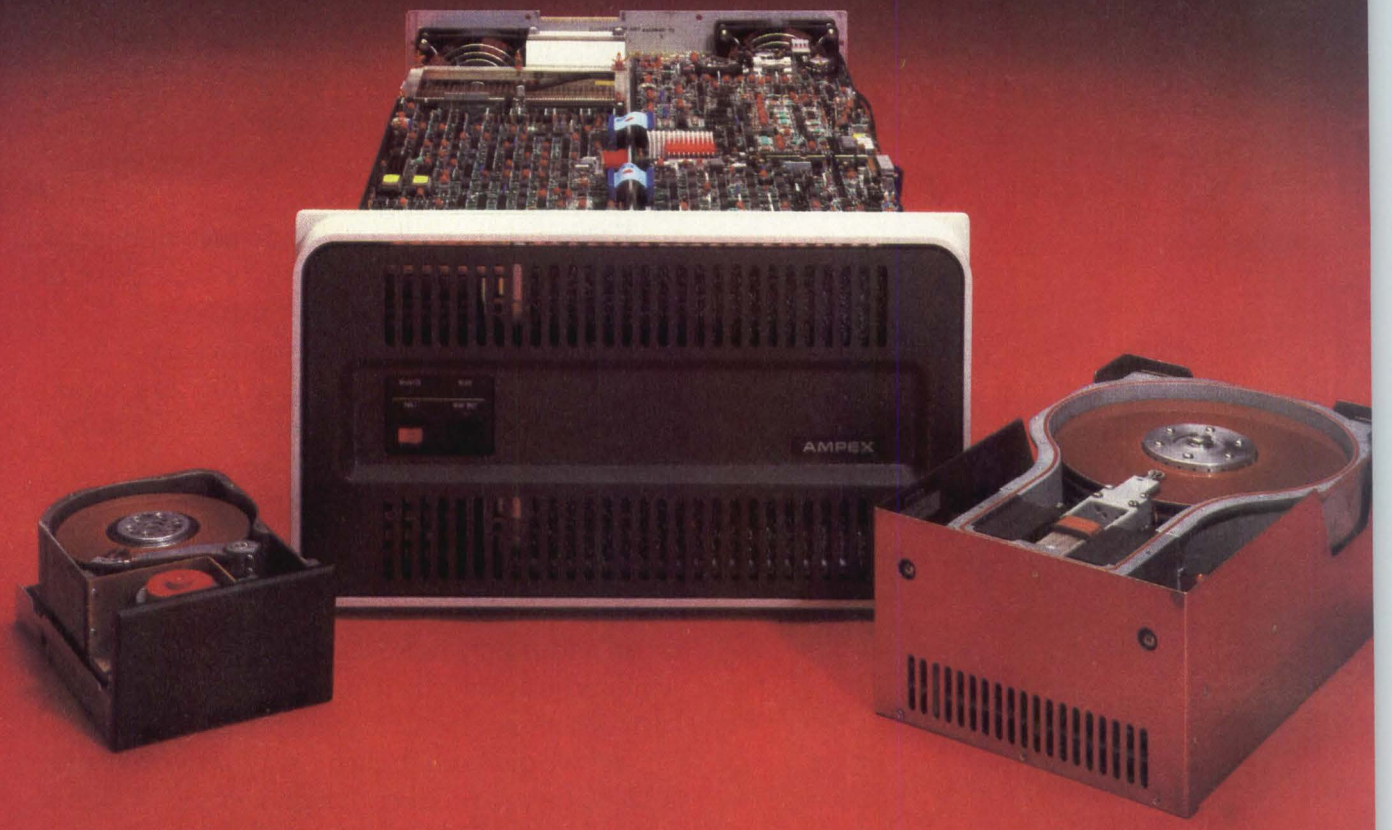

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Our Winchester disk drives are backed by a continuing Ampex commitment to leading-edge technology research, automated processes, and vertical integration beginning with heads and media; by a highly professional worldwide service and support organization; and by manufacturing capacity in excess of a half-million square feet located in four countries.

That's why you can count on Ampex to deliver whatever you need in Winchester disk drives, today and tomorrow.

CIRCLE NO. 73 ON INQUIRY CARD

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Selecting large-capacity, add-on disk drives

WALLACE J. BAUCHIERO, Century Data Systems Inc.

Consider 14-in. disk drives to complement small but high-performance systems

High-capacity mass storage is no longer exclusively for mainframe systems. Superminis, minis and even microcomputers now have virtual-address spaces that extend into the gigabyte range to support large databases, large programs and multiple users with large, complex applications. System integrators wishing to select an add-on disk subsystem to offer their customers face a selection process more complex than selecting their computer system's base disk drive.

Choosing an add-on drive involves an initial examination of the expansion options, a study of the impact these choices have on other system elements and, finally, a reevaluation of the storage options to determine an optimum system solution. The major factors in selecting add-on disks are cost per megabyte, disk size, performance characteristics and interface compatibility.

Evaluating the options

The starting point in every storage expansion is not just the present mass-storage facility but the whole computer system and its application environment. No aspect of hardware, software or user interaction should be ignored. Reduced to simplest terms, the objective is to obtain the most storage for the fewest dollars and still maintain system performance. The three general approaches to disk expansion include supplementing the existing drives with more of the same, adding higher capacity drives to the existing drives and replacing the existing drives with one or more higher capacity drives.

Even the simplest solution—add-on drives with exactly the same capacities and interface requirements as the existing units—can directly affect operating-system performance. Space requirements can become a problem as multiple units are added. At the very least, a system integrator gives up the per-megabyte cost advantages that accompany higher capacity disks.

Keeping a storage system intact and adding one or more large-capacity drives is even more complex. Again, the number of spindles would increase, and there would be added cost complications at the controller and device levels. The added drives could also reduce the efficiency of the operating system or even require rewriting disk utility programs to reflect new disks with different cylinder capacities and transfer rates. Multiple drive types could also mean doubling or tripling a system integrator's spare-parts inventory, training, documentation and other field-support obligations.

The third option is to replace the storage subsystem with a limited number of large drives, typically 14-in. units with capacities in the 300M- to 700M-byte range. Such a strategy takes maximum advantage of the per-megabyte savings that occur as disk size and capacity-per-spindle increase. Considering the central role that disk storage plays in most applications, the replace-

ment strategy forces the system integrator to reconsider nearly every aspect of the system design, from the disk interface to backup requirements and from file-management schemes to multi-user response times. While a high-capacity disk strategy may reduce the price per megabyte, it yields a hollow victory if other system costs escalate or performance falls below an acceptable level.

Adjusting price costs

The true cost per megabyte is not always apparent. Using figures published in the previous issue of Peripherals Digest (MMS, November, 1982, p. 279), for example, price per megabyte for 5¼-in. Winchesters in the 10M- to 15M-byte range varies from $61 to $135, from $56 to $93 for 8-in. drives in the 25M- to 35M-byte range and from $22 to $47 for 14-in. disks in the 150M- to 200M-byte range.

There are numerous reasons for these 2:1 price differentials. One explanation is the steep discount given for quantity orders. Suppliers committed to volume manufacturing tend to emphasize discounted prices; others, perhaps basing their future on technological innovations, may publish only their list prices. A first step, then, in normalizing prices for comparison is to standardize around a single quantity range. If a vendor won't quote a price for the given range, estimate anticipated annual volume for the drives and apply industry-standard discounts.

Prices can be further normalized by analyzing the differences between drives with the same size and capacity. For example, a drive may or may not include a power supply. Depending on whether adequate system power is available, power-supply adjustments should be made to the cost of the drives being considered.

Similar variations can be found in on-board electronics. Some drives

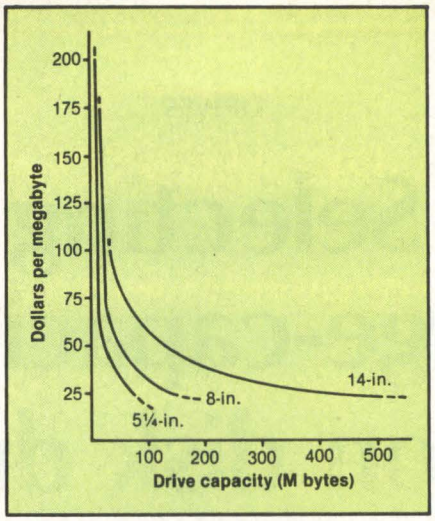

Fig. 1. Per-megabyte storage costs *vary with drive size and capacity. Per-megabyte storage costs drop for 5¼-in. Winchester drives as capacity increases because spindle and head-positioning mechanisms, for example, remain relatively constant-expense items—independent of capacity. Per-megabyte costs for 8-in. drives follow a similar pattern. High-capacity 14-in. Winchesters reduce per-megabyte storage costs to their lowest level. The 14-in. drives' capacities can also justify performance features that would be prohibitively expensive on lower capacity drives.*

do little more than write and read flux reversals on the disk surfaces, relying on controller electronics to provide all timing and data-separation functions. Other drives are intelligent peripherals with nearly all the conventional controller functions built in. The trade-offs are between the relative costs of

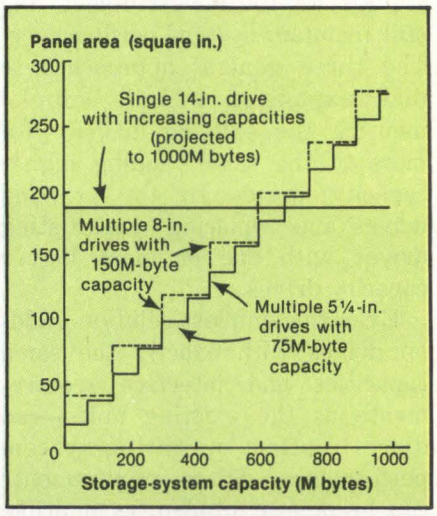

Fig. 2. Space advantages of smaller drives disappear *as total storage requirements climb to the gigabyte range. Larger Winchester drives often represent an optimum size for large storage systems.*

drive and controller (or controller chip set) and any changes that may be required in the system software to accommodate each controller/drive combination.

When these and other system-related considerations are factored into discounted drive prices, the spread between comparable drives is usually narrowed to 20 percent or less. Moreover, the remaining differences normally reflect specification-sheet features that translate directly to system performance.

Fig. 1 shows the trend lines in fully normalized per-megabyte drive prices. As expected, prices per megabyte drop sharply as capacity is initially increased. Once capacity is increased beyond the capacity of a single drive in a size range, per-megabyte costs stabilize because increasing capacity means adding more drives. Innovations such as plated media and thin-film heads will without doubt depress per-megabyte prices, allowing more data to be stored in an industry-standard envelope. It will take a truly revolutionary new technology to change today's per-megabyte cost significantly.

Form factors

Form factors can influence the decision to expand a storage system by adding more of the same or to replace drives with higher capacity units. This is especially true if the computer system is based on 5¼- or 8-in. drives. Assuming a maximum of 75M bytes for 5¼-in. drives and 150M bytes for 8-in. drives, at least 14 5¼-in. units or seven 8-in. units would be required to provide 1G byte of on-line storage. Just four 256M-byte or two 500M-byte, 14-in. Winchesters could provide equivalent storage in less than one rack-type cabinet. For a given capacity, the total volume of drives required (a function of drive size and number) varies greatly, depending on whether 5¼-, 8- or 14-in. drives are used (Fig. 2).

Performance considerations

The 14-in. drives can directly enhance system performance in two

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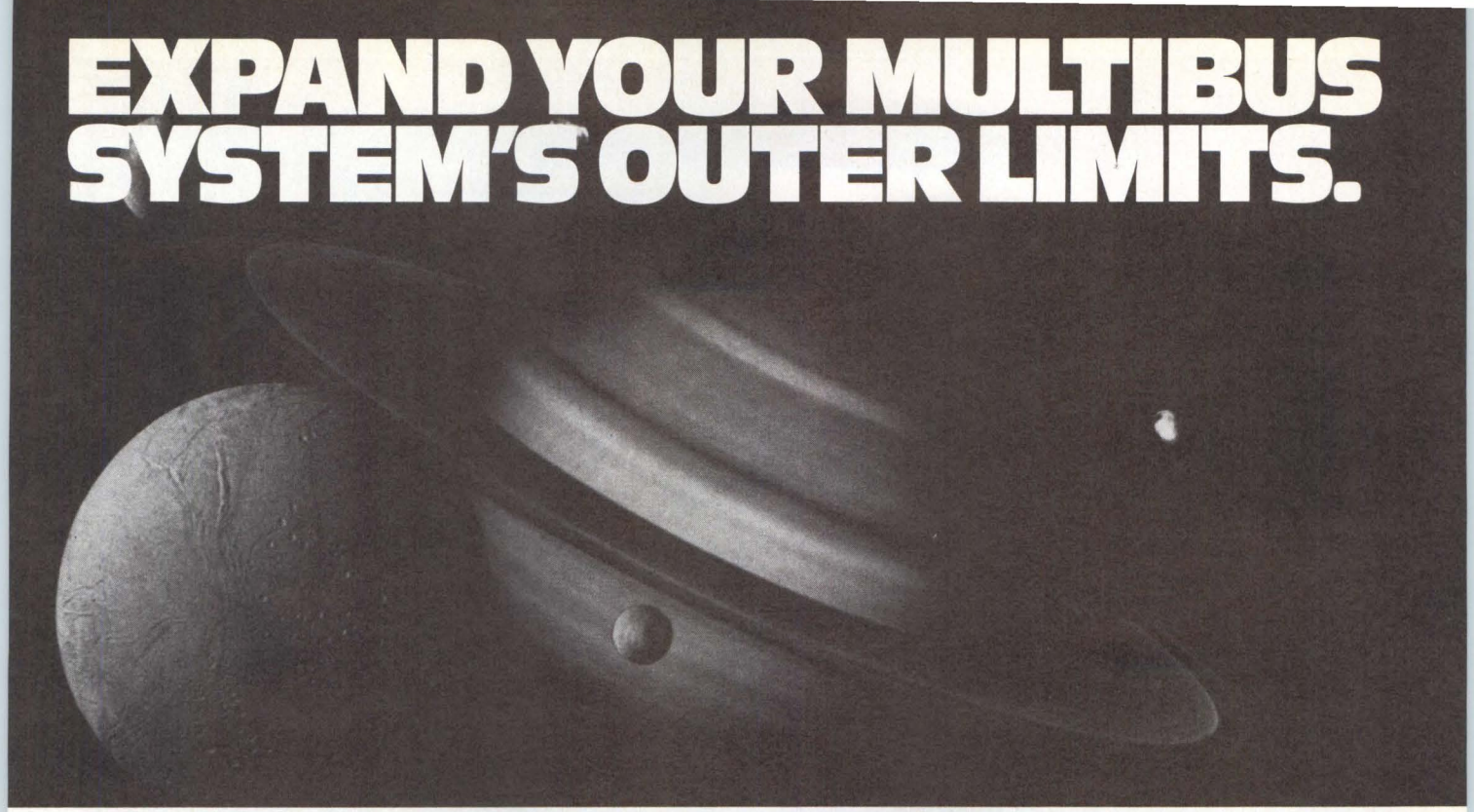

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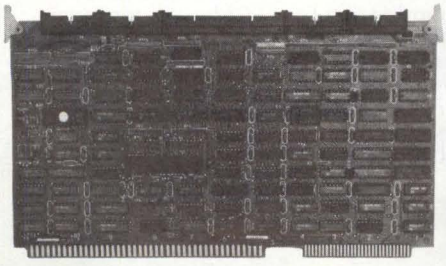
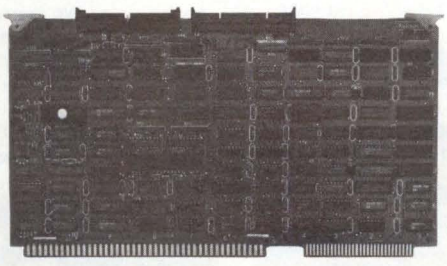
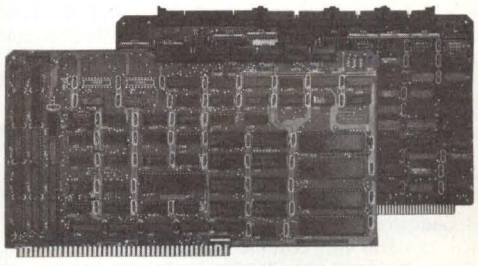


Xylogics 450 Multibus Disk Peripheral Controller.



Xylogics 472 Multibus Tape Peripheral Controller.



Xylogics 440 Multibus Disk Peripheral Controller.

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critical areas: access time and transfer rate. There are exceptions, but 14-in. drive technology has generally migrated downward from mainframe performance levels, while smaller drives were initially designed for lower performance, desk-top and small-business systems.

Access time, for example, can be reduced by faster but more expensive voice coils—an important benefit in an interactive, multi-user environment with frequent swapping of program overlays and user files. The 14-in. drives have historically used faster head-positioning systems to keep up with mainframe hosts, and large Winchesters still offer shorter access times than their smaller relatives (Fig. 3).

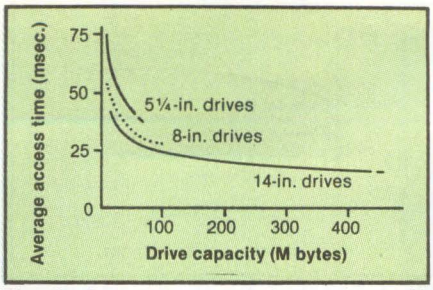


Fig. 3. Average access times *drop with increased drive size and capacity. Faster, more expensive head-positioning actuators, justified by the added capacity, contribute to the enhanced performance.*

Transfer rate is a function of the number of bytes per track and the rotation rate. With a larger disk, 14-in. drives can store more bytes on each track without complex and expensive bit-packing techniques, sharply increasing the transfer rate at any rotation speed (Fig. 4). Smaller disks will probably never achieve the new ultra-high data-transfer rates for 14-in. disks—as high as 3M bytes per sec. Higher transfer rates can, however, degrade system performance if a system cannot accept successive sectors at the rate they are read off of a disk. With the data-transfer

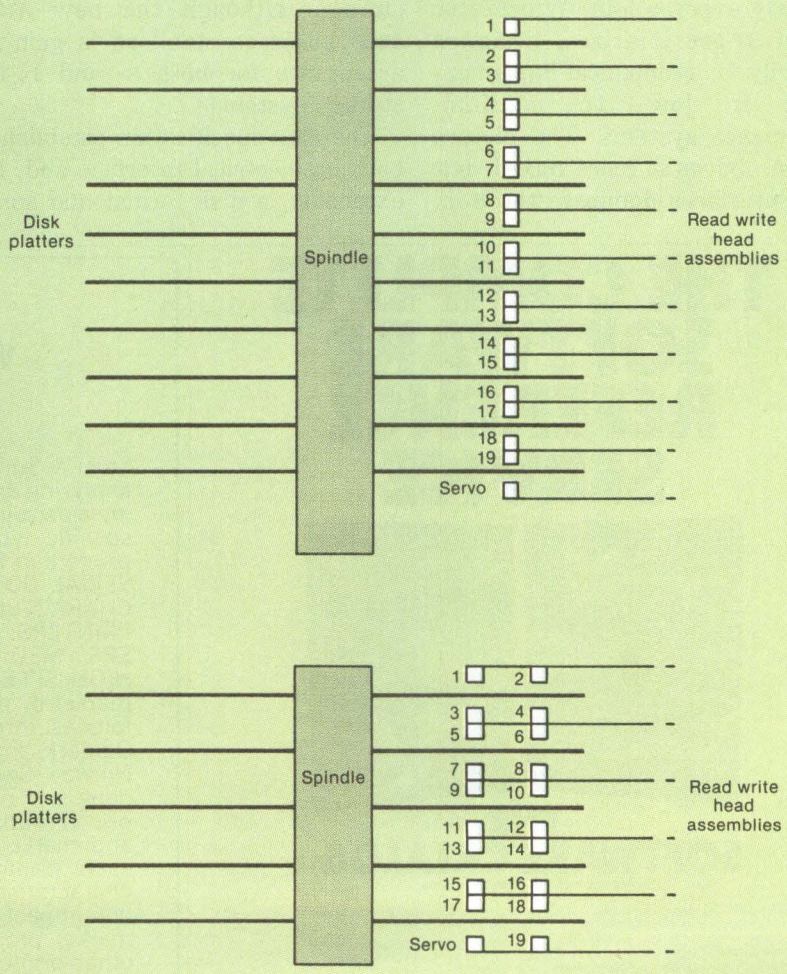
ACHIEVING SMD COMPATIBILITY

The true test of disk compatibility is software compatibility. Just as operating-system utilities can be sensitive to transfer-rate changes, file-management software is vulnerable to any change in the amount of data stored on tracks or within a cylinder.

A standard 256M-byte (315M-byte, unformatted) SMD pack has 10 disks, 20 disk surfaces, 19 read/write heads and one track-following servo head (see figure). This arrangement must be exactly duplicated by a Winchester drive to reproduce the pack's track and cylinder capacities.

Earlier Winchesters in this capacity range had 15 or fewer heads. But a recently developed Century Data Systems Winchester, the AMS 315, provides software transparency by positioning 19 read/write heads and a servo head on 10 disk surfaces in a drive that occupies less than one-third the space required by the equivalent removable-pack unit.

The shift to 14-in. drives offers a number of other system advantages. There is a significant reduction in per-megabyte storage costs. A recently introduced 500M-byte Century Data drive, at $19 per megabyte, is the lowest cost disk storage available. Advanced drives with more than 1G byte per spindle offer other performance benefits, but are still priced higher than the per-megabyte costs of conventional drives in the 500M- to 700M-byte range.



Differing disk designs can be compatible. *Industry-standard 256K-byte removable disk pack (top) has 19 recording surfaces and a dedicated servo surface for positioning the read/write heads. Century Data Systems' AMS 315 Winchester emulates the SMD disk pack by positioning 19 read/write heads and a servo head on 10 disk surfaces—providing software transparency in a storage-expansion drive that occupies less than one-third the space required for a removable-pack drive with the same capacity.*

buffers momentarily full, the disk surface would have to go through a full revolution before the next sequential sector could be read—sharply reducing effective data-transfer rate.

Interface compatibility

The shift to larger, higher performance disks means an almost-inevitable major alteration in the disk/host interface. Controllers to accommodate this change without significant alterations in system software will be available, but their effect on system performance must be carefully evaluated.

Nearly every 5¼-in. Winchester has an ST-506 interface, designed primarily for economical implementation in low- to medium-performance systems. The picture for 8-in. drives is more mixed, but three interfaces dominate the 8-in. scene. The proprietary SA-1000 interface is designed for compatibility with the 8-in. flexible disks that medium Winchesters initially replaced. For higher performance systems, especially 14-in. drives, the standard is the decade-old SMD interface developed for mainframe storage, although the new ANSI 1226 interface standard is gaining acceptance for both 8- and 14-in. storage systems.

The SMD specification establishes both an electrical interface and, by extension, a disk format and some transfer-rate limitations. A number of vendors, notably Century Data Systems Inc., offer SMD-compatible Winchester drives designed to expand computer systems that are based on the widely used 256M-byte, (C315M-byte, unformatted) 14-in. SMD disk-pack drive (see "Achieving SMD compatibility," p. 141).

Accelerated efforts are under way to develop new microprocessor-based interfaces (such as SASI/SCSI, ISI and IPI) that will remove transfer-rate limitations and simultaneously permit nearly universal interchangeability between different drive sizes, capacities and technologies. But until they arrive, system integrators offering disk-expansion products should remember SMD-compatible Winchesters.□

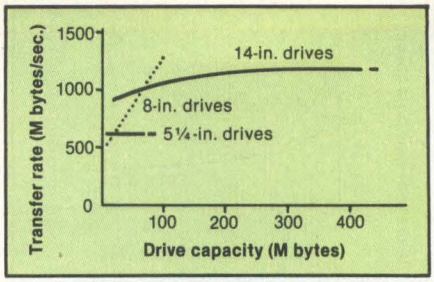


Fig. 4. Transfer rates *are also a function of drive size and capacity—increasing with expanded disk diameters, higher bit densities and faster disk surface speeds.*

Wallace J. Bauchiero is vice president of marketing and business planning at Century Data Systems Inc., Anaheim, Calif.

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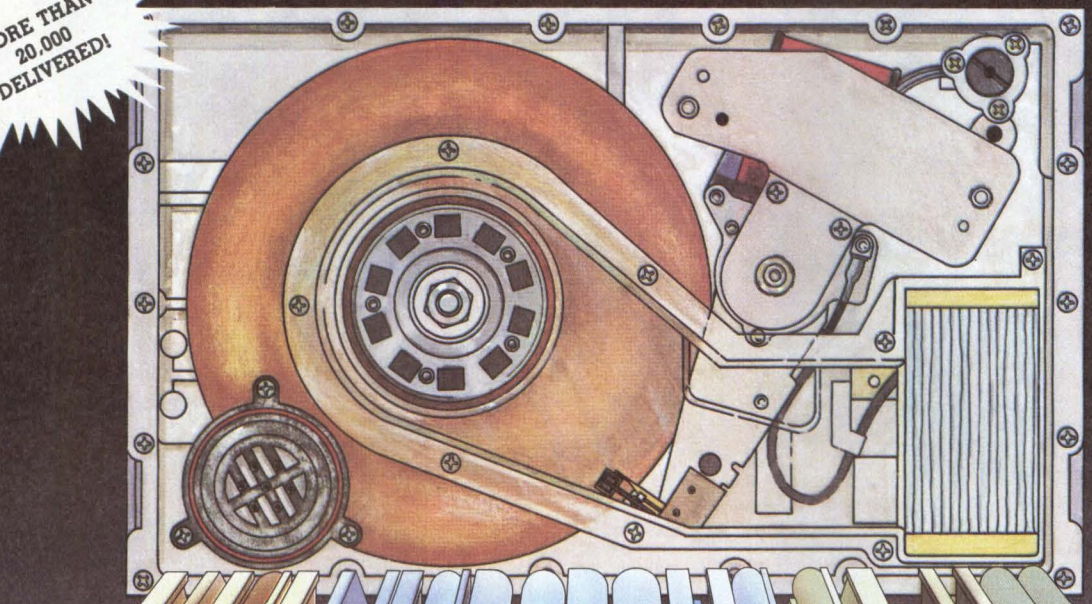

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Using your existing controllers and software, replace your 8-inch floppies - or -expand your SA-1000 based Winchesters. Our SA-1100 compatible interface will do it, with its industry standard data density, data rate, and disk rpm.

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Average Access (ms, ⅓ stroke)	42	42	45
Data Transfer Rate*	7.375	7.375	4.333

*Mbits per second.

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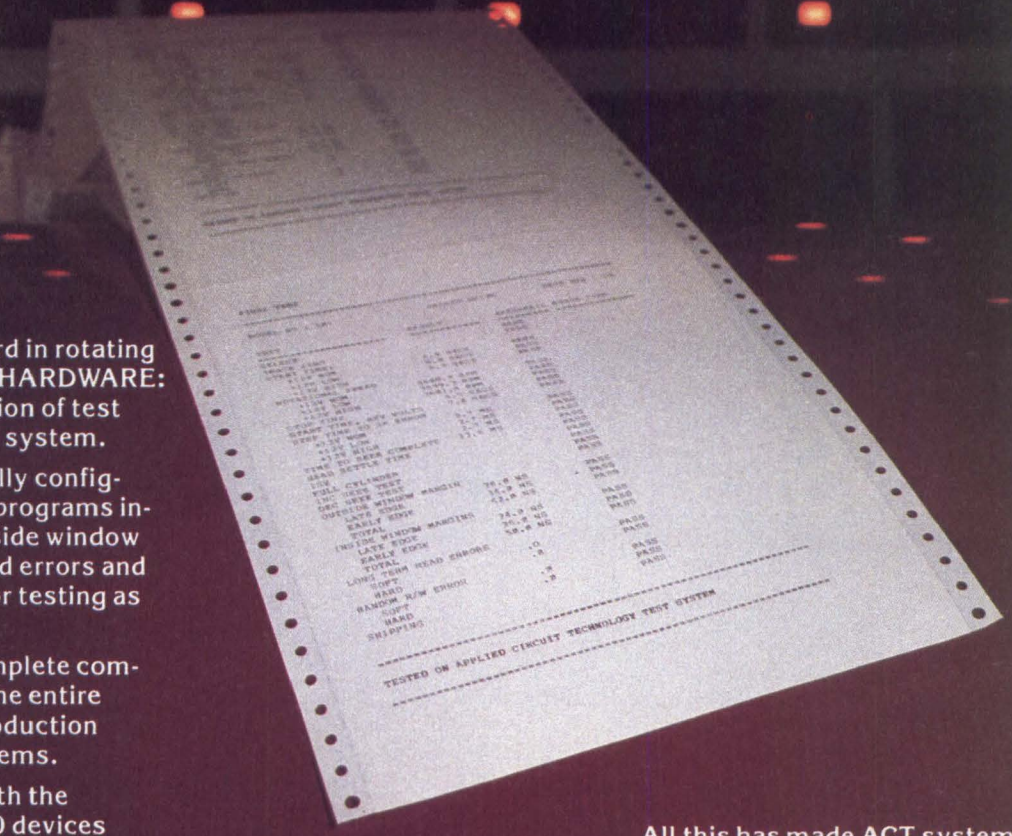

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8-IN. AND LARGER FIXED DISK DRIVES

Company Model	Capacity (M bytes)	Avg. access time (msec.)	Transfer rate (K bits/ sec.)	No. of data surfaces	Bytes/ track	Actuator type	Interface type	Price ($)	Special features
3M/DATA RECORDING DIV.									
8432	20	65	933	4	11008	rotary stepper	ANSI 1226	1735, Q100	
8533	60	29	933	4	15360	rotary voice coil	ANSI 1226	3380, Q100	
ADVANCED ELECTRONICS DESIGN, INC.									
Winc 08	47.6	70	219			stepper	Q-bus	9430	RL02 emulation
ALPHA DATA, INC.									
80-8-128	16			1	8500		UNIBUS, DG, Perkin-Elmer	10000	fixed head/disk syst; sealed disk/head enclos; direct drive
80-8-256	32			1	18500		UNIBUS, DG, Perkin-Elmer	15000	fixed head/disk syst; sealed disk/head enclos; direct drive
80-8-512	64			2	18500		UNIBUS, DG, Perkin-Elmer	24000	fixed head/disk syst; sealed disk/head enclos; direct drive
Atlas	128		10000	3	20160	rotary	ANSI, SMD	8800	retractable head, brushless DC motor
AMCODYNE, INC.									
Arapahoe 7110	25.8	35	1229	4	20672	linear voice coil	SMD	3175, Q100	ramp-launched heads, embedded servo, 8-in. floppy dimensions
AMPEX CORP.									
Capricorn model 165	165.9	30	1209	5	20160	linear voice coil	SMD		self-diagnostics, auto head lock
Capricorn model 165E	165.9	30	1209	5	20160	linear voice coil	SMD		self-diagnostics, auto head lock
Capricorn model 330	330.0	30	1209	8	20160	linear voice coil	SMD		self-diagnostics, auto head lock
DFR-932	16	30	1209	2	20160	linear, rotary	SMD/CMD		address mark format
DFR-964	48	30	1209	4	20160	linear, rotary	SMD/CMD		address mark format
DFR-996	80	30	1209	6	20160	linear, rotary	SMD/CMD		address mark format
DM-9300		28	1209	19	20160	linear voice coil	SMD		quiet kit
DM-9300A		28	1209	19	20160	linear voice coil	SMD		quiet kit, 823 cylinders
DM-940		28	1209	5	20160	linear voice coil	SMD		rack slide mount
DM-980		28	1209	5	20160	linear voice coil	SMD		rack slide mount
Scorpio Model 48	49.7	32	1209	3	20160	linear voice coil	SMD, ANSI		self-diagnostics, auto head lock
Scorpio Model 80	82.9	32	1209	5	21060	linear voice coil	SMD, ANSI		self-diagnostics, auto head lock
APPLIED PERIPHERAL SYSTEMS									
4830	337.1, 405	25	1200	5	40960	linear	SMD	8671, Q100	thin-film heads, self-diagnostics, RLL recording code technique
4835	337.1	25	2020	5	40960	linear	SMD	8671, Q100	thin-film heads, self-diagnostics, RLL recording code technique
BALL COMPUTER PRODUCTS DIVISION									
BDA 100		30	1200	5	20160	linear motor	SMD		19-in. rack mount, variable sector sizes
BDA 160		30	1200	5	20160	linear motor	SMD		19-in. rack mount, variable sector sizes
BDA 50		30	806	5	13440	linear motor	SMD/ TRIDENT		19-in. rack mount, variable sector sizes
BDA 80		30	1200	5	20160	linear motor	SMD/ TRIDENT		19-in. rack mount, variable sector sizes

Company Model	Capacity (M bytes)	Avg. access time (msec.)	Transfer rate (K bits/ sec.)	No. of data surfaces	Bytes/ track	Actuator type	Interface type	Price ($)	Special features
CENTURY DATA SYSTEMS									
AMS 315		25	1208	19	20160	linear voice coil	SMD	6220, Q200	emulates CDC9766 and AMPEX 9300A, address mark sectoring
AMS 380		25	1280	14	32000	linear voice coil	SMD	6000, Q200	closed-loop servo, ventilated spindle, shock mounting
AMS 513		25	1280	19	32000	linear voice coil	SMD	6600, Q200	dual access optional, operator control panel, off-track det.
C2048	34.2	30	1209	6	20160	linear voice coil	SMD	2750, Q200	Winchester/ANSI standard cartridge, 51.2MB unformatted capacity
M160		50	1280	7	32000	torquer	Marksman, SMD	7680, Q200	closed-loop servo, ventilated spindle, shock mounting
M20		65	960	2	24000	stepper	Marksman	5620, Q200	intelligent, tape back-up, shock mounting
M40		65	960	4	24000	stepper	Marksman	6035, Q200	intelligent, tape back-up, on-board diagnostic routines
M80		50	960	7	24000	torquer	Marksman, SMD	7045, Q200	closed-loop servo, ventilated spindle, shock mounting
T200/ 202-SA		30	806	19	13440	linear motor	TTL/SMD	8950, Q200	dual access optional
T300/302/ 306-SA		30	1209	19	20160	linear motor	TTL/SMD	9750, Q200	T306-CDC9766 compatible; dual access optional
T50-SA		30	806	5	13440	linear motor	TTL	4925, Q200	tabletop or rack-slide mount, dual access optional
T536		30	1209	19	20160	linear motor	SMD	13000, Q200	ruggedized high environment CDC9766 compatible drive; dual access optional
T80/82-SA		30	1209	5	20160	linear motor	TTL/SMD	5675, Q200	table-top or rack-slide mount; access optional
CHARLES RIVER DATA SYSTEMS									
DK-32F	40	50	205	4	8200	rotary torque/ stepper	SASI, VERSABUS	10500	
DK-32R	40	65	205	8	8200	rotary torque/ linear voice coil	SASI, VERSABUS	14500	
COMPUTER DYNAMICS									
SA 1002	5.3	70	4300	2	10400	stepper	ST506	400, Q10	
WIN5	5.3	70	4300	2	10400	stepper	IBM PC, S-100, STD, Apple, Heath	1400, Q10	
CONTROL DATA CORP.									
CDC 9410	8/24/32/40	42	806	1	10416	rotary voice coil	FDI/LDI/ISI/ SMD	1350, Q500	variable sectoring, integral data recovery, sealed module
CDC 9410-1K	24.8/31.0	42	543	4	10416	rotary voice coil	SA1XXX	1625, Q500	variable sectoring, sealed module
CDC 9412	80.4	25	1209	5	20736	rotary voice coil	LDI/ISI/SMD	2770, Q500	fixed and variable sectoring, dual channel access, rack mount
CDC 9427H	6	35	313	4	7825	linear voice coil	CDD	3830, Q500	integral power supply
CDC 9448	16/48/80	30	1209	2	20160	linear voice coil	SMD	4730, Q500	write protect, integral data recovery, integral power supply
CDC 9455	8.35	42	1208	4	20672	linear voice coil	LSI/ISI/SMD	2345, Q500	32/64 sectors, integral data recovery, sealed data module
CDC 9457	25	35	1209	4	20672	rotary voice coil	LDI/ISI/SMD	3070, Q500	32/64 sectors, integral data recovery, sealed data module

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Everybody else's half-height 5¼" floppy disk drive is at least 41 mm high.

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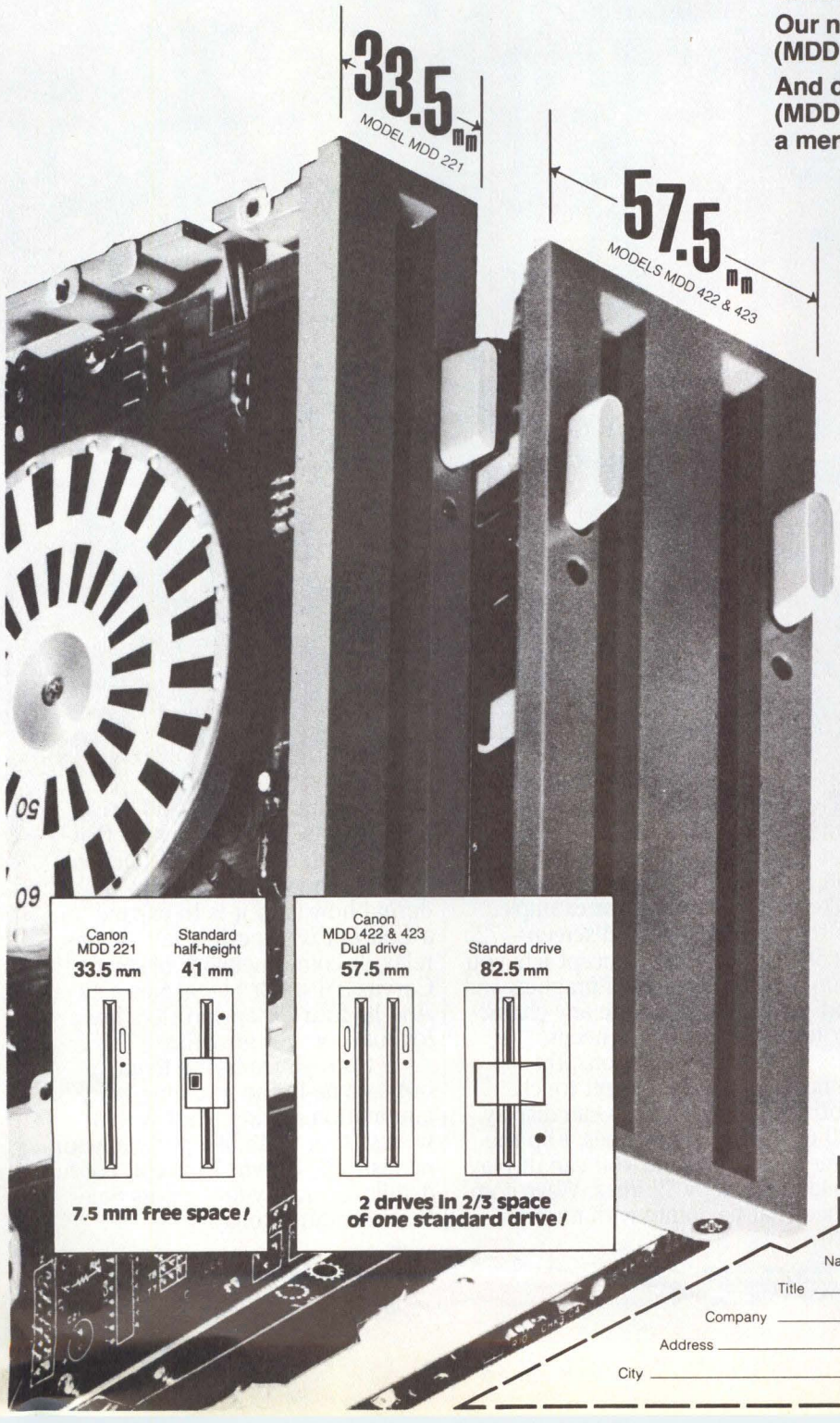
And our 2-megabyte dual disk drives (MDD 422 and 423) are only 57.5 mm high — a mere 28.75 mm per megabyte!



User convenience

- Single-pushbutton media locking and ejection. Anti-crunch mechanism prevents damage to improperly inserted media. Pushbutton is locked while drive is in R/W operation.

Reliability

- Wear and shock resistant thin head — *designed and manufactured by Canon.*
- Soft-landing head mechanism eliminates tap damage.
- Brushless direct drive motor.
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- Circuitry designed for least amount of noise interference.

Design Benefits

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- Front panel removable.
- Available with standard half-height panel as option.
- Industry compatible interface.
- Low power consumption.

Dual Drives — MDD 422, MDD 423

- Two drives equal only ⅔ the height of standard 5¼" floppy drive.
- Cost savings: less than the cost of 2 separate drives.
- Power savings: two drives require approximately the same power as only one drive.
- MDD 422 has one stepper for both drives; MDD 423 has separate stepper for each drive.

We have a lot more to tell you about these drives. Call Lee Heller at (516) 488-6700, Ext. 4958, or mail the coupon to Canon U.S.A., Inc., Peripherals Division, One Canon Plaza, Lake Success, NY 11042.

CIRCLE NO. 79 ON INQUIRY CARD

Canon

Please send more information on your floppy drives.

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mm

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The Corvus Concept has a real soft spot in its heart for OEMs and systems integrators. That's why we offer so many software tools—ISO Pascal, FORTRAN 77, and many more. Plus plenty of internal memory to use those tools: up to half a megabyte.

Our user interface is as soft a sell as you'll ever find, too. Take display formats, for example. With a fully bit-mapped screen—720 by 560 pixels—the Concept lets you mix any combination of graphics and text you want. Or create any character font your customer needs.

For display positions, the Concept is an equally soft touch. Horizontally, the screen can display 120 characters by 56 lines. Flip the screen vertically and you can display 80 characters by 72 lines. We've combined that flexibility with multiple windows, finger-tip tilt and swivel adjustments, and 10 soft keys that define up to 40 displayed functions.

By the way, if you're wondering how hard it is to expand a Concept with peripheral add-ons, relax. It comes network ready via the Corvus OMNINET™ local area network. And its four expansion slots leave lots of room for growth.

So if you're trying to carve out a niche in the booming office automation market, start with a workstation that's like putty in your hands—the Corvus Concept. For full details, contact your Corvus Sales Representative today.

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CIRCLE NO. 80 ON INQUIRY CARD

Company Model	Capacity (M bytes)	Avg. access time (msec.)	Transfer rate (K bits/ sec.)	No. of data surfaces	Bytes/ track	Actuator type	Interface type	Price ($)	Special features
CDC 9730	80/160	30	1209	3	20160	rotary voice coil	SMD	4515, Q500	integral power supply, rack mount
CDC 976X		30	1209	5	20160	linear voice coil	SMD	5840, Q500	single or dual channel, integral power supply
CDC 9775	679	25	1209	20	20160	linear voice coil	SMD	14860, Q500	internal diagnostics, single or dual channel
CORVUS SYSTEMS, INC.									
11MB	11.3	35	648	3	10800	linear voice coil	various		6 month warranty
20MB	20.5	35	648	5	10800	linear voice coil	parallel		6 month warranty
CVM SYSTEMS									
M80-F	80	25	1200	5	20736	rotary voice coil	SMD	4450	operator control front panel, rack-mount shelf
R-50		30	819	3	20480	voice coil	SMD	4850	mounted in subsystem cabinet
CYNTHIA PERIPHERAL CORP.									
0120		50	920	2	12800	voice coil	Radial	4185	optional easy box
D125		50	920	2	12800	voice coil	SASI	5265	intelligent interface; easy box optional
D140	12	50	920	4	12800	voice coil	Radial	6180	optional easy box
D145	12	50	920	4	12800	voice coil	SASI	9225	intelligent interface; easy box optional
DATA GENERAL CORP.									
6060		43	806	19	12288		Data General	32250	
6061		43	806	19	12288		Data General	35900	
6122		43	1209	19	17920		Data General	43350	
6160	73	38	1209	3	17920		Data General	18000	
6161	147	38	1209	5	17920		Data General	24000	
6214	675	38	1209	20			Data General	50000	
DATA SYSTEMS DESIGN									
880	8/20/31	65	143					6175	RL02 emulation, Q-bus compatible
890	31	65	143					10300	
DATAPOINT CORP.									
9310		75	0	2	12288		microbus	7850	
9395	135	30	1209	8	16384		memory bus and periph. control	31950	
DATREX, INC.									
Series 6000	6.25	35	312	4	7700	linear	numerous	2590	integral power supply
WD505		55	625	2	10416	stepper	ST506	975	soft-sectored, open-loop positioning, temp. compensation
DIGITAL DEVELOPMENT CORP.									
530M	11		337	4	11500				militarized head per track
750	4.8		1200	2	18750				head per track
M6000	4.8		600	4	18750	pneumatic			ruggedized head per track
DISC TECH ONE, INC.									
3306	80	35	988	6	20160	voice coil	SMD	3750	
4160	160	35	1210	5	20160	voice coil	SMD	5000	
4300	300	35	1278	7	25872	voice coil	SMD	6000	

Company Model	Capacity (M bytes)	Avg. access time (msec.)	Transfer rate (K bits/ sec.)	No. of data surfaces	Bytes/ track	Actuator type	Interface type	Price ($)	Special features
DISCTRON, INC.									
D1600	157.5	30	1209	7	20160	linear voice coil	SMD		
DP 100		60	875	2	12440	linear voice coil	Data Peripherals	1390, Q1000	
DP 400	46.4	60	875	4	13440	linear voice coil	Data Peripherals	1540, Q1000	
FUJITSU AMERICA, INC.									
M2280	84.3	27	1012	5	20480	rotary voice coil	SMD		cooling fan
M2280	84.3	27	1012	3	20480	rotary voice coil/ clsd. loop servo	SMD		
M2284	168.6	27	1012	5	20480	rotary voice coil/ clsd. loop servo	SMD		
M2284	168.6	27	1012	10	20480	rotary voice coil	SMD		cooling fan
M2294	335.5	27	1012	16	20480	rotary voice coil	SMD		cooling fan
M2294	335.5	27	1012	9	20480	rotary voice coil/ clsd. loop servo	SMD		
M2301	11.9	70	1200	2	24320	stepper	SA4000		high transfer rate
M2301BE	11.9	70	150	2	14320	buffered stepper motor	SA4000		
M2302	23.7	70	1200	4	24320	stepper	SA4000		high transfer rate
M2303	47.5	70	1200	8	24320	stepper	SA4000		high transfer rate
M2303BE	23.7	70	150	4	24320	buffered stepper motor	SA4000		
M2303BE	47.5	70	150	8	24320	buffered stepper motor	SA4000		
M2311	48.2	20	1229	5	20480	rot. voice coil/ clsd. loop servo	SMD		power supply, fan, rack mount kit, dual port
M2312	84.4	20	1229	7	20480	rot. voice coil/ clsd. loop servo	SMD		power supply, fan, rack mount kit, dual port
M2351	474		1859	28	28160	rot. voice coil/ clsd. loop servo modified	SMD		universal power supply, front panel and fan
HARRIS CORP., COMPUTER SYSTEMS DIVISION									
5332	80	30	1200	5	161280	linear voice coil	SMD	19900	controller
5352	160	30	1200	5	161280	linear voice coil	SMD	23700	controller
5632		38	1209	5	161280	linear voice coil	SMD	20900	controller
5652		38	1209	19	161280	linear voice coil	SMD	26500	controller
5662	675	33	1209	20	170949	linear voice coil	SMD	31900	controller
HEWLETT-PACKARD									
7906	19.6	33	749	3	12288	linear	16-bit TTL	17350	HP-IB interface optional
7908		538	500	89		rotary	HP-IB	10100	integrated 16.7M or 67M byte cartridge tape drive
7911	28.1	35	983	1	16384	rotary	HP-IB	14800	integrated 16.7M or 67M byte cartridge tape drive
7912	65.6	35	983	3	16384	rotary	HP-IB	17350	integrated 16.7M or 67M byte cartridge tape drive
7914	132.1	35	1000	4	16384	rotary	HP-IB	16400	integrated cartridge tape drive
7914TD	132.1	35	1000	4	16384	rotary	HP-IB	26540	includes 1600-bpi ½-in. magnetic tape drive
7920	50	33	749	5	12288	linear	16-bit TTL	19400	HP-IB interface optional
7925	120	33	749	9	16384	linear	16-bit TTL	22510	HP-IB interface optional
7933 & 7935	404	33	1250	13	23552	linear	HP-IB	26690	standard 208 volts

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Now you can have a bright, sharp image that's easy to read. For only $5,975. Which means our compact new color graphics terminal is setting completely new price/performance standards.

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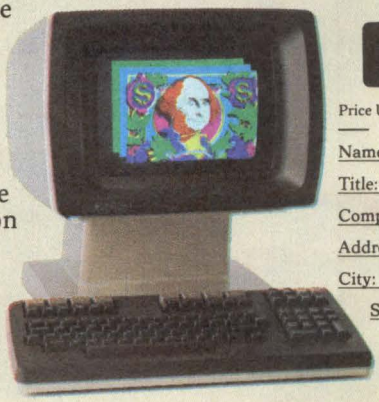
Of course, it's also software-compatible. In addition to HP's DSG/3000 and Graphics/1000-II software, the 2627A runs PLOT 10 from Tektronix, SAS's SAS/GRAPH, Precision Visual's DI-3000 and GRAFMAKER, ISSCO'S DISSPLA and TELL-A-GRAF.

But that's not all; the 2627A has user-definable softkeys and graphics edit keys that make this one of the easiest-to-use terminals on the market. It even gives you complete alphanumeric capability. In a separate memory. So whether you're interested in business or technical applications, just return this coupon and we'll send you more information. Or call your local HP sales office. We're listed in the white pages.



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MMS 4/19

Company Model	Capacity (M bytes)	Avg. access time (msec.)	Transfer rate (K bits/ sec.)	No. of data surfaces	Bytes/ track	Actuator type	Interface type	Price ($)	Special features
HIGHTRACK COMPUTER									
HT160	160	30	1200	10	20160	rotary	SMD		
HT40	48	30	1200	3	20160	rotary	SMD		
HT80	80	30	1200	5	20160	rotary	SMD		
HONEYWELL									
CDS9648/ 9148	8.5	50	1200	4	16384		Honeywell DPS 6	12500	
CDU9636/ 9136	16	30	1200	2	16384		Honeywell DPS 6	13500	
CDU9638/ 9138	80	30	1200	6	16384		Honeywell DPS 6	16000	
MSU9602/ 9102	80	1200	500	16	384		Honeywell DPS 6	19300	
MSU9604/ 9104		30	1200	19	16384		Honeywell DPS 6	33000	
IBIS SYSTEMS, INC.									
1250 (OEM)	1400	16	3000	16	47476	split-linear motor	digital, bit serial		
1400 (OEM)	1400	16	1200	16	47476	split-linear motor	custom		
5380-A4	2520	16	3000	30	47476	split-linear motor	digital, bit serial	81995	single port, 1 device controller
5380-AA4	2520	16	3000	30	47476	split-linear motor	digital, bit serial	93710	dual port, 2 device controllers, supports dynamic path selection
5380-B4	2520	16	3000	30	47476	split-linear motor	digital, bit serial	68020	single port
5380-BB4	2520	16	3000	30	47476	split-linear motor	digital, bit serial	71120	dual port
IBM									
3310A1	64.5	27	1031	11	16384	rotary	IBM	14280	fixed block architecture, single drive control
3310A2	64.5	27	1031	11	16384	rotary	IBM	23730	fixed block architecture, two drives and control
3310B1	64.5	27	1031	11	16384	rotary	IBM	11300	fixed block architecture, attaches to 3310A
3310B2	64.5	27	1031	11	16384	rotary	IBM	20750	fixed block architecture, 2 drives attaches to 3310A
3340A2		25	885	12	8368	linear radial	IBM	24570	count-key-data, 2 drives & control
3340B1		25	885	11	8368	linear radial	IBM	13510	count-key-data, attaches to 3340A
3340B2		25	885	22	8638	linear radial	IBM	17200	
3344B2	280	25	885	15	8368	linear radial	IBM	41600	
3344B2F	280	25	885	15	8368	linear radial	IBM	43250	fixed head storage/drive
3350A2	635	25	1198	15	19069	linear radial	IBM	41600	ckd
3350A2F	635	25	1198	15	19069	linear radial	IBM	51910	ckd, 1MB fixed head capacity
3350B2	635	25	1198	15	19069	linear radial	IBM	32940	ckd, attaches to 3350A
3370A1	571.3	20	1859	12		linear	IBM	44350	fixed block architecture, two actuators & control
3370B1	571.3	20	1859	12		linear	IBM	29550	fixed block architecture, two actuators, attaches to 3370A1
3375A1	819.7	19	1859	12		linear	IBM	50720	two actuators and control
3380AA4	1520	16	3000	15	47476	linear	IBM	116050	4 actuators, two controllers for dynamic path selection
3380B4	1520	16	3000	15	47476	linear	IBM	84240	4 actuators, attaches to 3380 or AA4

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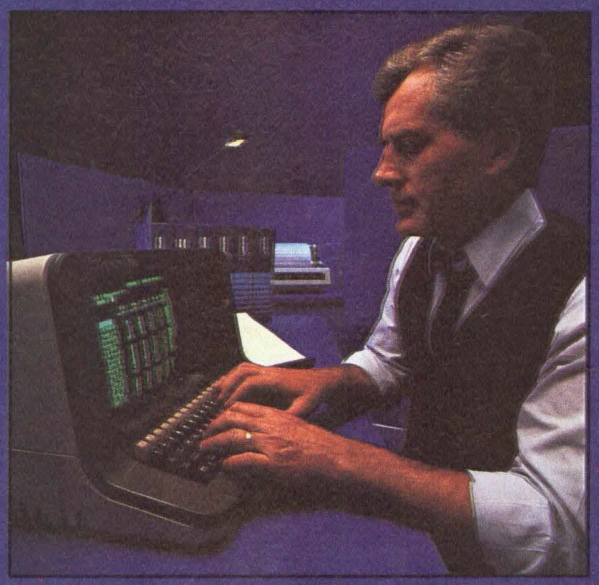

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CIRCLE NO. 82 ON INQUIRY CARD

Company Model	Capacity (M bytes)	Avg. access time (msec.)	Transfer rate (K bits/ sec.)	No. of data surfaces	Bytes/ track	Actuator type	Interface type	Price ($)	Special features
INTERNATIONAL MEMORIES, INC.									
8100	94.13	39	543	4	8192	linear voice coil	SA1000, ST506, IMI, ANSI		
KENNEDY COMPANY									
53160	165	30	1000	5	20160	rotary voice coil	SMD	4625, Q100	mounts in standard 19-in. rack; comes w/slides, has int. PS
5380	82	30	1000	5	20160	rotary voice coil	SMD	3700, Q100	mounts in standard 19-in. rack; comes w/slides, internal PS
6172	24.5	40	800	31	13344	linear voice coil	SMD, ANSI, DISK BUS	1595, Q100	
6173	40.9	40	800	5	13344	linear voice coil	SMD, ANSI, DISK BUS	2195, Q100	
7340	41.4	30	1209	5	20160	rotary voice coil	SMD, ANSI, PICO-BUS	2650, Q100	8-in. floppy drive footprint
7380	82	30	1209	5	20160	rotary voice coil	SMD, ANSI, PICO-BUS	3195, Q100	8-in. floppy drive footprint
MEGAVAULT									
MV116	116.1	45	1209	7	20160	rotary voice coil	SMD, ANSI	2900, Q500	microprocessor based, alum. casting & cover, AC or DC power
MV20L	20.4	45	543	3	10416	rotary voice coil	SA1000, ST512	1800, Q500	microprocessor based, alum. casting & cover, AC or DC power
MV212	212.2	45	1209	8	20160	rotary voice coil	SMD, ANSI	3240, Q500	microprocessor based, alum. casting & cover, AC or DC power
MV25L	25.7	45	543	3	10416	rotary voice coil	SA1000, ST512	1990, Q500	microprocessor based, alum. casting & cover, AC or DC power
MV26	26.6	45	812	3	13545	rotary voice coil	SMD, ANSI	1990, Q500	microprocessor based, alum. casting & cover, AC or DC power
MV34L	34.1	45	543	5	10416	rotary voice coil	SA1000, ST512	1995, Q500	microprocessor based, alum. casting & cover, AC or DC power
MV42L	42.8	45	543	5	10416	rotary voice coil	SA1000, ST512	2200, Q500	microprocessor based, alum. casting & cover, AC or DC power
MV44	44.4	45	812	5	13545	rotary voice coil	SMD, ANSI	2200, Q500	microprocessor based, alum. casting & cover, AC or DC power
MV48	49.7	45	1209	3	20160	rotary voice coil	SMD, ANSI	2480, Q500	microprocessor based, alum. casting & cover, AC or DC power
MV48L	47.8	45	543	7	10416	rotary voice coil	SA1000, ST512	2190, Q500	microprocessor based, alum. casting & cover, AC or DC power
MV60L	60	45	543	7	10416	rotary voice coil	SA1000, ST512	2390, Q500	microprocessor based, alum. casting & cover, AC or DC power
MV62	62.1	45	812	7	13545	rotary voice coil	SMD, ANSI	2390, Q500	microprocessor based, alum. casting & cover, AC or DC power
MV83	82.9	45	1209	5	20160	rotary voice coil	SMD, ANSI	2690, Q500	microprocessor based, alum. casting & cover, AC or DC power
MVP132	132.3	45	4836	8	20160	rotary voice coil	SMD	6500, Q500	microprocessor based, alum. casting & cover, AC or DC power
MICROPOLIS CORP.									
1202ANSI	26.8	42	922	3	15364	voice coil	ANSI X3T9.3		
1202SA	20.6	42	922	3	15364	voice coil	SA1100		
1203ANSI	44.6	45	542	5	10416	voice coil	ANSI X3T9.3		
1203SA	34.3	45	542	6	10416	voice coil	SA1100		
1221	8.9	42	922	1	15364	voice coil			

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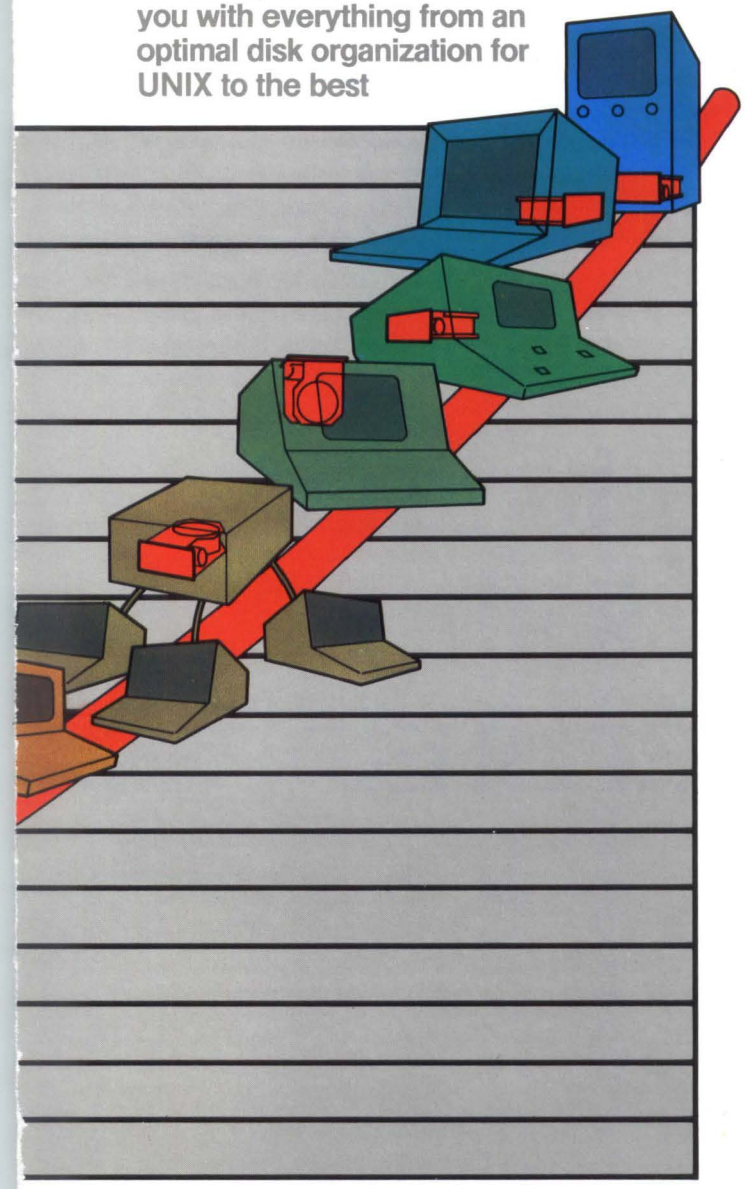

Or enjoy a head start by taking advantage of where you are.

Our industry standard footprint and ST506, SMD, and SASI interfaces mean your system's probably ready to incorporate Evotek's performance today.

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The U

Head Landing Zones: Our high storage density gives us extra space for head landing zones on every disk platter. Use the zones during power down or shipping to protect the integrity of your recorded data.

Plated Media for Survivability: Our thin-film media is three times harder than conventional ferric oxide. Perfect for withstanding the thousands of start/stops inherent in desktop applications.

Comfortable in Harsh Environments: A specially sealed shaft, pressure equalization port, and proprietary air filtration system eliminate the chance of contamination under the bubble. Evotek drives are remarkably adaptable to harsh environments like factories. Or offices.

Smooth Drive Performance: Military grade shock mounts protect your drive during shipping. They also mean you won't be embarrassed the first time someone pounds your keyboard a little too enthusiastically. Or sets your product on a tabletop a little too carelessly.

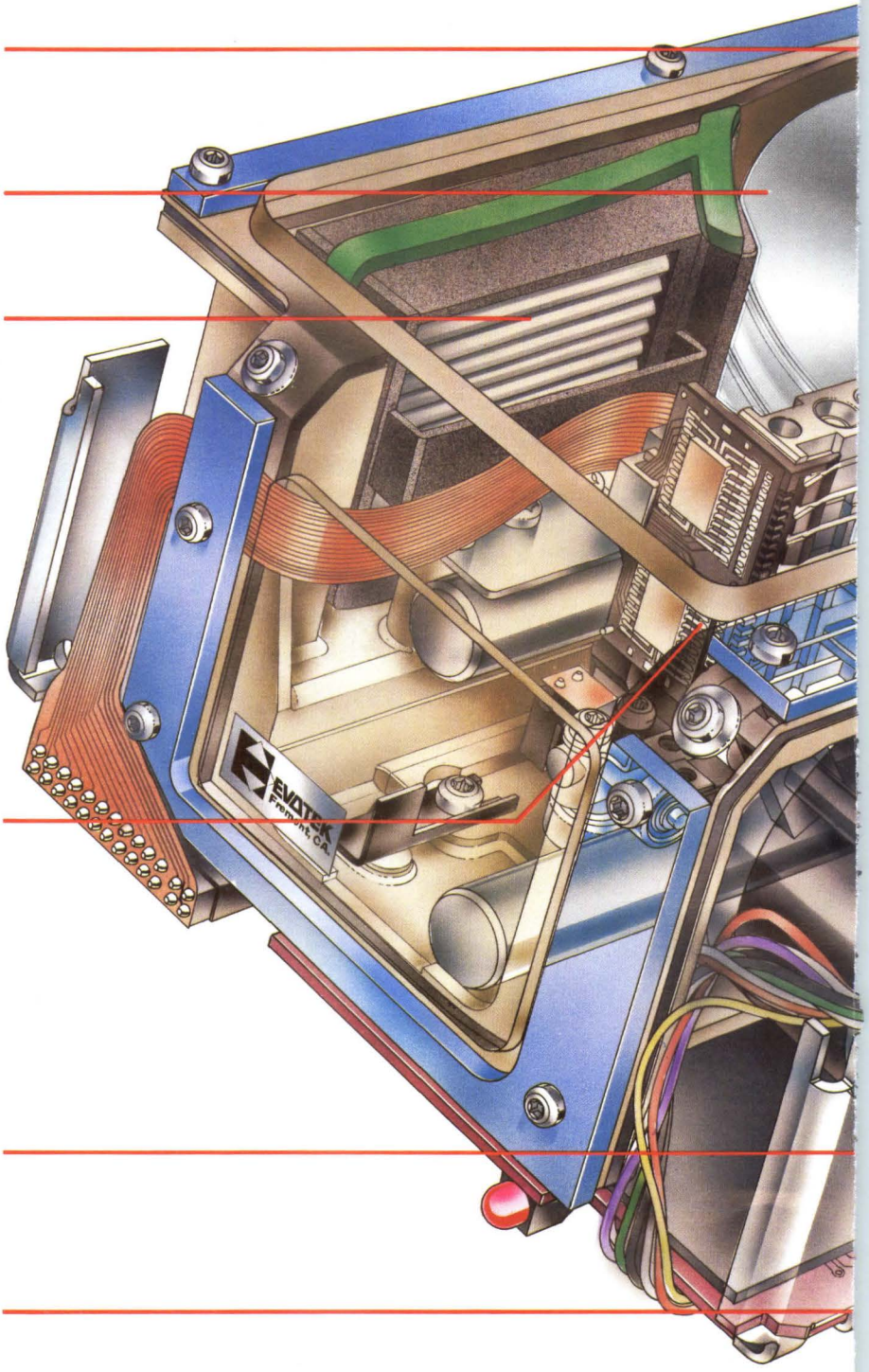
Plug and Play: Evotek drives conform to industry standards like ST506. They're compatible with a wide range of popular 5¼-inch controllers, including the one you're using now.

Quick Access Time: A linear actuator and microprocessor control give us an access time of 49 ms, including settling. That's twice as fast as many other Winchesters, and critical for swapping, data collection, and telecommunications applications.

Extra Capacity: Our wide bandwidth read/write channel lets you expand your storage capacity with a simple controller change. Switch from MFM encoding to the popular Run Length Limited (RLL) codes and increase capacity from 51.7 to 73.3 mbytes.

Intelligence: An on-board microprocessor controls head positioning and compensates for thermal expansion and contraction of the platters. In an office, a factory, or the field, no matter what the application, your system will take the heat. And the cold.

Faster Data Transfer: Two families of drives give you a choice of two transfer rates. Choose the standard 5.0 mbit/second rate, or our faster, IBM-compatible 8.2 mbit/second rate (ideal for graphics and local area network applications).



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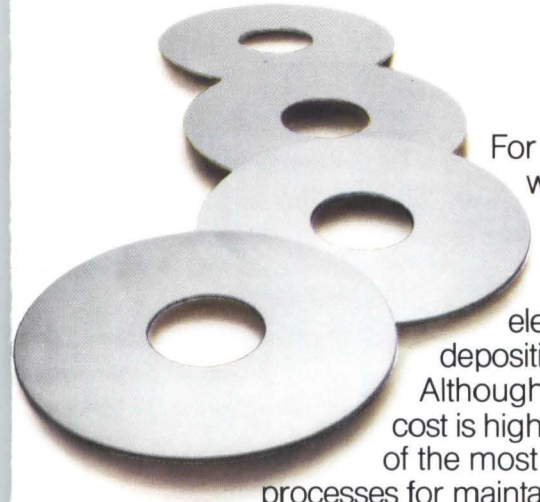


For example, we're one of the few lines to use electrolytic deposition. Although its initial cost is high, it's one of the most accurate processes for maintaining film thicknesses in the 750 Angstrom range.

Automated disk handling equipment will be standard throughout the industry in six to 12 months. We're using it today to cut contamination losses and improve yields by 60%.

And we're the only 5¼-inch plated media maker using track by track testing instead of the faster, but less accurate, "fly by" method.

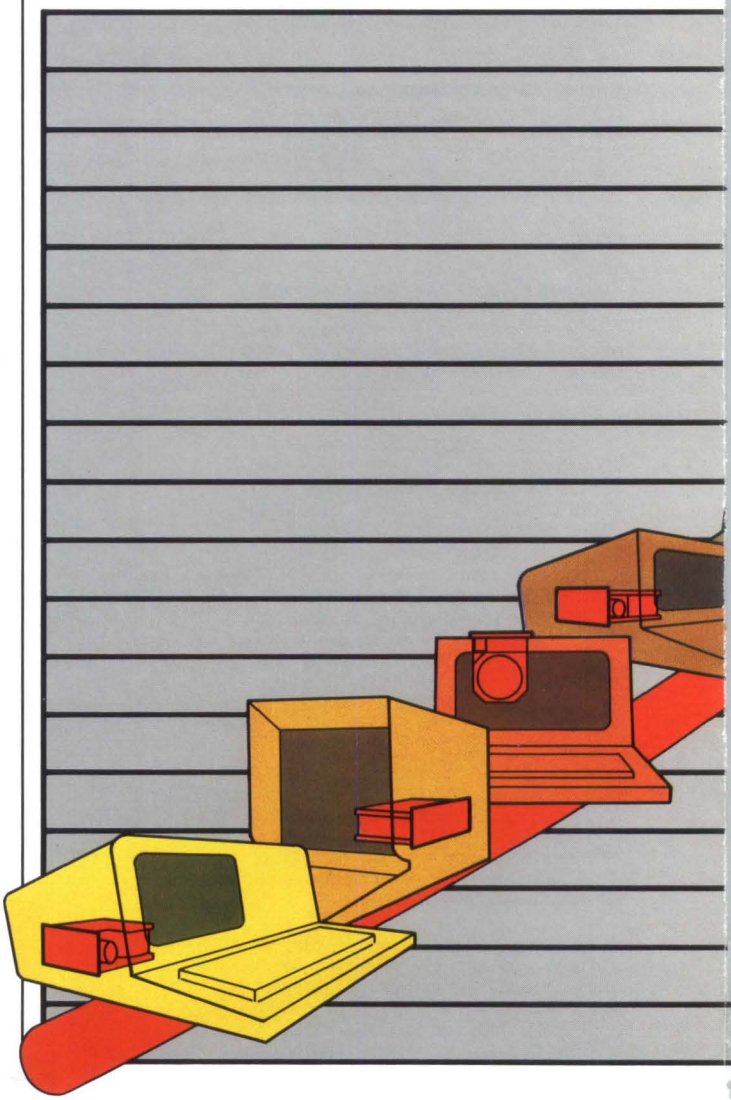
Our quality and consistency earned us an invitation to second source a leading 14-inch thin-film media supplier. And, after careful evaluation, we accepted them as our second source. Which assures you of a continued supply of media and drives.

There are easier ways to build our product. But none which are as consistently reliable. And reliability over time is our goal. Because our business relationship may begin with a promise, but it endures through performance.

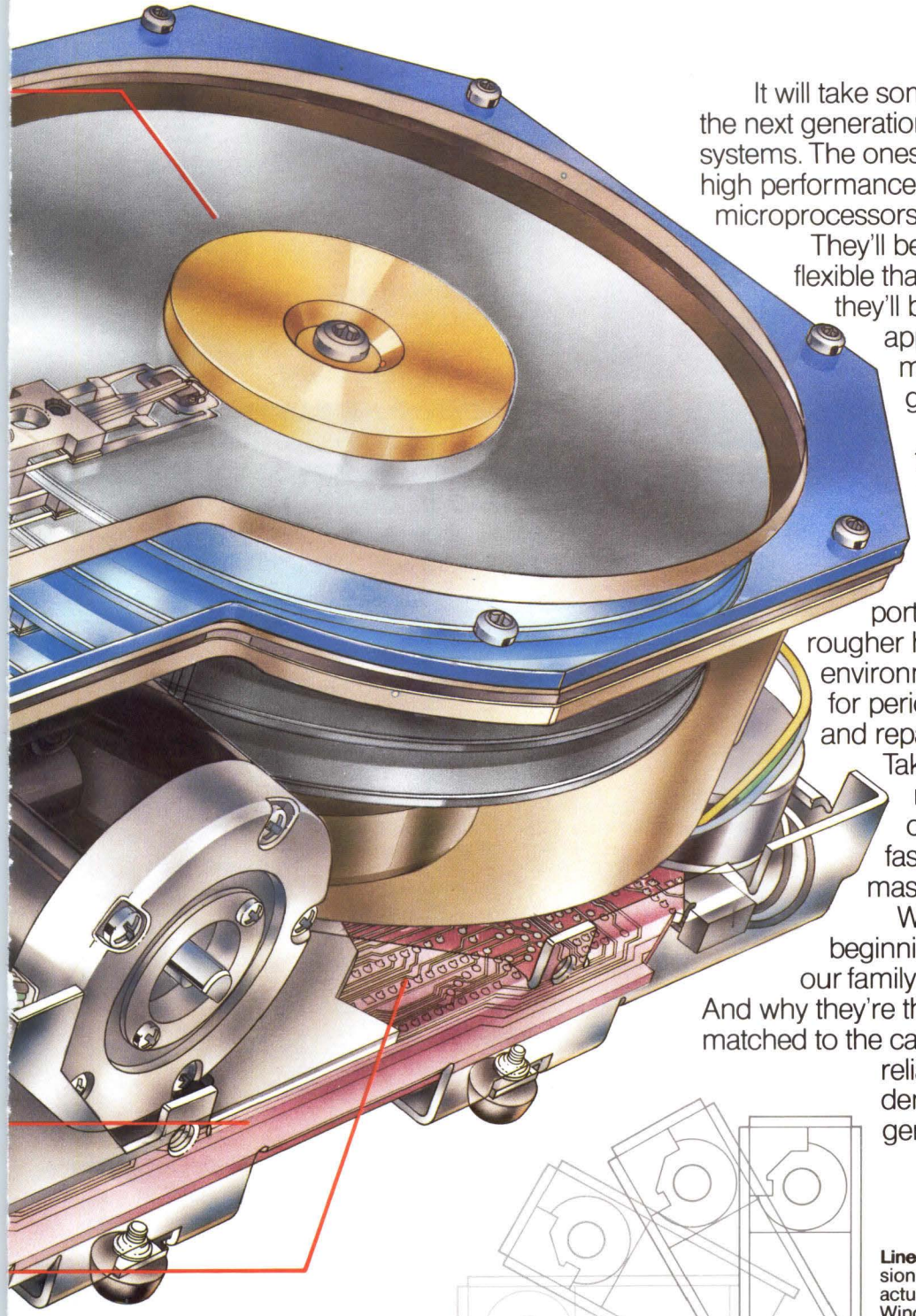
The reward for choosing Evotek? Time and money.

Evotek drives, along with high performance 16-bit and 32-bit microprocessors, are opening up opportunities for supermini performance in desktop packages. And they're finding their way into powerful, personal graphics workstations, and compact, yet sophisticated, medical equipment.

History has proven that the first



Upside.



It will take something special to build the next generation of microcomputer systems. The ones that will revolve around high performance 16-bit and 32-bit microprocessors.

They'll be more powerful and flexible than today's systems. So they'll be pressed into new applications, not used to make today's applications go faster.

They'll improve throughput by a factor of four. So they'll be hungrier for data, and less prone to wait for it.

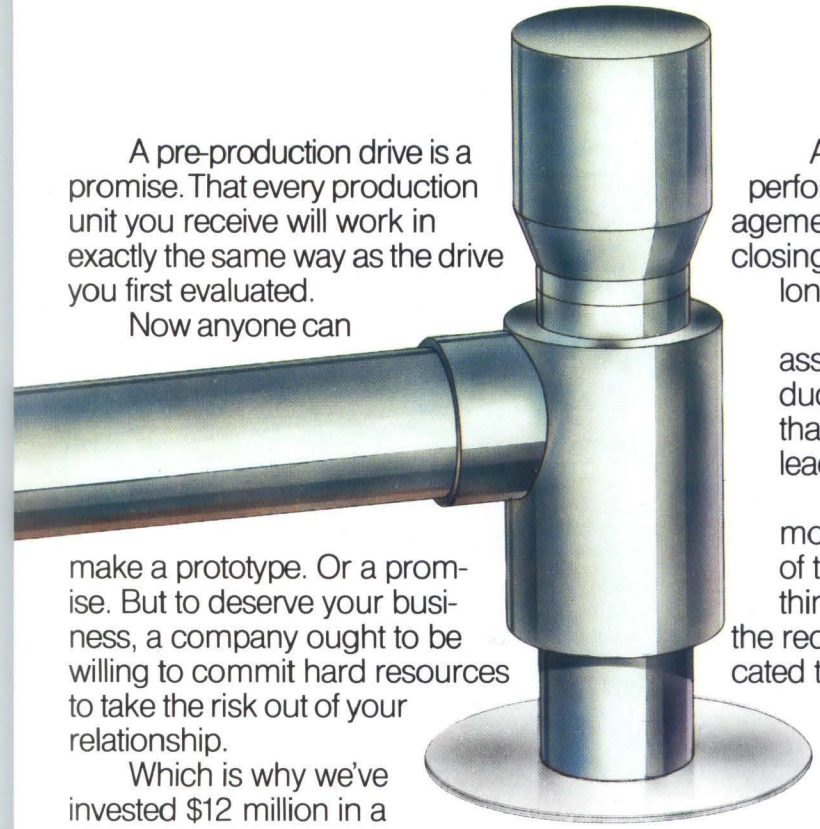
They'll be more portable. So they'll face rougher handling and harsher environments, without the time for periodic maintenance and repair.

Taking advantage of this market requires a new set of tools. Including smaller, faster, more rugged mass storage.

Which, from the very beginning, is how we designed our family of 5¼-inch Winchesters. And why they're the only drives uniquely matched to the capacity, performance, reliability, and availability demands of the next generation of applications.

Linear Actuator for Flexibility: Our precision designed, six-bearing linear actuator is borrowed from 14-inch Winchester technology. It's driven by a five-phase microcontrolled stepper motor, and the combination lets you mount Evotek drives at any angle. Our design fits your design.

The Risk.



A pre-production drive is a promise. That every production unit you receive will work in exactly the same way as the drive you first evaluated.

Now anyone can make a prototype. Or a promise. But to deserve your business, a company ought to be willing to commit hard resources to take the risk out of your relationship.

Which is why we've invested $12 million in a production facility where 70% of our drive assembly (including Class 100 clean room operations) is performed through robotics. It's money well spent.

Robotics, for example, allows us to use a single torque screw to anchor disk platters to the spindle. That eliminates a minor alignment problem in 10 mbyte disks which becomes catastrophic in high performance 50 mbyte applications.

But robotics is only a start.

To maintain quality over time, we borrowed a well-known principle of electronics—feedback.

At full capacity, our facility builds hundreds of thousands of drives a year. Yet each drive is completely assembled by a single person. And then tested on the spot.

Assemblers get a measure of their performance with every drive. And management can fine tune the operation faster, closing the loop of problems today, not long after they've been forgotten.

But more importantly, our approach assures you of a consistency of production across the board. Consistency that's the hallmark of manufacturing leaders around the world.

Nowhere is that consistency more critical than in the manufacture of thin-film (plated) media. Because the thinner and purer the media, the higher the recording density. And the less complicated the read/write electronics.

So we operate the largest 5¼-inch plated media line anywhere. Besides giving us absolute control over quality, our in-house facility lets us take advantage of the latest manufacturing techniques sooner.

Company Model	Capacity (M bytes)	Avg. access time (msec.)	Transfer rate (K bits/ sec.)	No. of data surfaces	Bytes/ track	Actuator type	Interface type	Price ($)	Special features
1222	26.7	42	922	2	15364	voice coil			
1223	44.6	42	922	3	15364	voice coil			
1400ANSI	100/200	28	1248		20800	voice coil	ANSI X3T9.3		
1400SA	50/100	28	542		10416	voice coil	SA1100		
1400SMD	80/160	26	1200		20160	voice coil	SMD		
1420	74/148	28	922		15364	voice coil	Micropolis intelligent int.		
MITSUBISHI ELECTRONICS AMERICA, INC.									
M2860-1	21.73	35	806	3	13440	linear	SMD		
M2860-2	50.71	35	806	7	13440	linear	SMD		
M2860-3	85.37	30	1200	7	20160	linear	SMD		
MOHAWK DATA SCIENCES CORP.									
2172		70	195	2	6144		proprietary	7712	includes drive controller
2174	10	87	889	2	15616		parallel	8200	expandable from 10M to 20M bytes
2175-1	13	30	1209	2	16384		proprietary	14720	
2175-2	39	30	1209	4	16384		proprietary	21680	
2175-3	65	30	1209	6	16384		proprietary	28680	
NATIONAL MEMORY SYSTEMS CORP.									
NMS01	84	1200	500	20	20480	servo controlled	SMD	5500	
NMS01.5	48	20	1200	4	20480	servo controlled	SMD	3000, Q50	
NMS02	168	27	1200	4	20480	servo controlled	SMD	7500	
NEC INFORMATION SYSTEMS									
5244	25.83	85	625	8	10416	split band, stepper motor	ST506/406		
D1510	331.5	20	1200	15	19968	linear voice coil	SMD	9800, Q100	
D1550	663	20	1200	15	19968	linear voice coil	SMD	13500, Q100	
D2220	25.0	30	1200	3	20480	rotary voice coil	SMD	2375, Q100	
D2230	42.5	30	1200	5	20480	rotary voice coil	SMD	2735, Q100	
D2246	85.0	25	1200	6	20480	rotary voice coil	SMD	3200, Q100	mounting frame terminators, AM detect
D2250	167	25	1200	8	20480	rotary voice coil	SMD		mounting frame terminators, AM detect
PERTEC									
D3321/ D3322	3.17	55	195	4	7812	linear voice coil	various options	3975, Q100	
D3341/ D3342	3.17	48	313	4	7812	linear voice coil	many	3975, Q100	
D3421/ D3422	6.34	55	195	4	7812	linear voice coil	many	3975, Q100	
D3441/ D3442	6.34	48	313	4	7812	linear voice coil	many	3975, Q100	
D3461/ D3462	19.03	55	195	8	7812	linear voice coil	many	4720, Q100	
D3481/ D3482	19.03	48	313	8	7812	linear voice coil	many	4720, Q100	

←— For information circle 83

SYSTEMS HOUSE REWRITES ENTIRE SOFTWARE LIBRARY.

Feat takes one billion man hours.

Marathon Computers, a major systems house, has converted its entire minicomputer business software library to microcomputers. In an incredible feat of endurance begun over a year ago, the entire Marathon staff worked eighty hour weeks.

"It's too bad the Company couldn't have survived long enough to see this victory, beamed Marathon President, Torne Keds, flashing the "V" sign to his workers. "This is a feat we can all be proud of!"

One Marathon employee said that his sense of accomplishment was somewhat dampened by his lack of a pay check. "We could have gotten the software we needed from Trac Line," the former worker explained. "Instead of rewriting our library, we could have been out selling systems."

Keds acknowledged that Marathon had gone off course while the monumental software project was in progress. "We had no time for customers," he said, "and we had nothing to sell them. Why would they want our minicomputers when the micros cost so much less!" Keds admitted he could have kept his company running with the help of Trac Line software. "But think of the pride of authorship," he told the crowd. "Think of our sense of accomplishment. That has to be worth something!"

While acknowledging that it was certainly worth something, receivers for Marathon were unable to provide an exact value.

Company Model	Capacity (M bytes)	Avg. access time (msec.)	Transfer rate (K bits/ sec.)	No. of data surfaces	Bytes/ track	Actuator type	Interface type	Price ($)	Special features
PRIAM CORP.									
1070	11	73	900	4	15151	stepper motor	Priam, SMD, ANSI	1315, Q500	on-board data separator
3450	35	42	806	5	13440	linear voice coil	PRIAM, SMD, ANSI	1950, Q500	DC motor, data separator, automatic carriage & spindle lock
7050	70	42	806	5	13440	linear voice coil	PRIAM, SMD, ANSI	2450, Q500	DC motor, data separator, automatic carriage & spindle lock
804	105	42	1210	5	20160	linear voice coil	Priam, SMD, ANSI	3150, Q500	DC motor, data separator, automatic carriage & spindle lock
Diskos 15450	158	45	1040	3	20160	linear voice coil	Priam, SMD, Smart	3440, Q500	DC motor, data separator, common interface w/ 8-in. drives
Diskos 3350	34	45	1040	1	20160	linear voice coil	Priam, SMD, Smart	1900, Q500	DC motor, data separator, common interface w/ 8-in. drives
Diskos 6650	68	45	1040	1	20160	linear voice coil	Priam, SMD, Smart	2235, Q500	DC motor, data separator, common interface w/ 8-in. drives
QUANTUM CORP.									
Q2020	21.33	60	543	4	8200	rotary torque	Q2000/ SA1000	1500, Q500	
Q2030	32	60	543	6	8200	rotary torque	Q2000/ SA1000	1800, Q500	
Q2040	42.66	65	543	8	8200	rotary torque	Q2000/ SA1000	2100, Q500	
Q2080	85.45	40	543	7	8200	rotary torque	Q2000/ SA1000	2450, Q500	automatic actuator lock
SANTA CLARA SYSTEMS, INC.									
SCS Series	10–80	55			8192			7310	controller, software cables, 10, 20, 30, 40, 80 MB fixed capacity
SCS Series	10–80	55			8192			6100	controller, software, cables, 10, 20, 30, 40, 80 MB versions
SCIENTIFIC MICRO SYSTEMS, INC.									
DSX Series	85	40	543	7	10420	rotary torque	Q2000/ SA1000	5000, Q50	includes DEC or Multibus back plane, controller/power supply
FWT Series	85	40	543	7	10420	rotary torque	Q2000/ SA1000	5000, Q50	includes controller, power supply, enclosure/interface for DEC
SHUGART ASSOCIATES									
SA1002	5.33	70	543	2	8200	band		995, Q500	
SA1004	10.67	70	543	4	8200	band		1205, Q500	
SA1104	203.	35	543	3	8200	closed loop servo	SA1000	1650, Q500	built-in four-point shock mounts, dedicated head landing
SA1106	33.9	35	543	5	8200	closed loop servo	SA1000	1980, Q500	built-in four-point shock mounts, dedicated head landing
SA4004	14.5	65	887	2	15400	band		1450, Q500	
SA4008	29.0	65	887	4	15400	band		1850, Q500	
STORAGE TECHNOLOGY									
8654	1346	23	1198	30	19969	linear voice coil	native interface	32125, Q100	
8775	673	23	1198	15	19969	linear voice coil	ANSI/SMD	13786, Q100	diagnostics, microprocessor controlled adjustment

Company Model	Capacity (M bytes)	Avg. access time (msec.)	Transfer rate (K bits/ sec.)	No. of data surfaces	Bytes/ track	Actuator type	Interface type	Price ($)	Special features
SYSTEM INDUSTRIES									
	675	30	1200	19			SMD	25000	dual channel optional, self test
	160	30	1000				SMD	9000	dual channel optional
	475	25	1900				SMD	16500	std. dual channel
TECSTOR, INC.									
series 3/100	99.6	29	1209	3	20160	rotary voice coil	SMD	4450, Q100	spares commonality between all series 3
series 3/166	165.9	29	1209	5	20160	rotary voice coil	SMD	4950, Q100	spares commonality between all series 3
series 3/199	199.1	29	1209	6	20160	rotary voice coil	SMD	5450, Q100	spares commonality between all series 3
series 3/315	315.2	29	1209	9	20160	rotary voice coil	SMD	5950, Q100	spares commonality between all series 3
series 3/332	331.8	29	1209	10	20160	rotary voice coil	SMD	5950, Q100	spares commonality between all series 3
series 3/83	82.9	29	1209	2	20160	rotary voice coil	SMD	4450, Q100	spares commonality between all series 3
TELEFILE COMPUTER PRODUCTS									
T3283		30	1209	19	20160	voice coil	SMD	28320	hard or soft sectoring, single-phase power requirement
T3285	673	23	1198	15	19969	voice coil	SMD	43938	hard or soft sectoring, self-test diagnostics, dual access
TOSHIBA CORP.									
MK182F	83	35	1210	5	20160	rotary voice coil	SMD		
MK184F	116.1	35	1210	7	20160	rotary voice coil	SMD		
MK186F	165.9	35	1210	10	20160	voice coil	SMD		
MK80F-10	15.3	40	1210	2	20160	rotary voice coil	SMD		
MK80F-20	23	40	1210	3	20160	rotary voice coil	SMD		
MK80F-30	38.3	40	1210	5	20160	rotary voice coil	SMD		
U.S. DESIGN									
CSS-870	70	42	800	5	13440	voice coil	Q-bus, unibus, multibus	9995	22M-byte ¼-in. cartridge tape drive
CSS-835	35	42	800	5	13440	voice coil	Q-bus, unibus, multibus	8995	22M-byte ¼-in. cartridge tape drive
VERMONT RESEARCH CORP.									
5017-4	26	45	673	4	12800	linear voice coil	drive level		power supply, data recovery, auto. actuator lock
8010	11	33	614	4	8192	linear voice coil	ANSI, SASI drive level		high-flying heads, closed loop servo, integral diagnostics
8520	22	33	614	4	8192	linear voice coil	ANSI, SASI drive level		high-flying heads, closed loop servo, integral diagnostics
WESTERN DYNEX CORP.									
series 6000	6.25	35	312	4	7700	linear voice coil		2100	interface compatibility with other drives, integral power
ZENITH DATA SYSTEMS									
Z67	11	70	596					5995	includes floppy disk

What's it worth to you...if Zilog can prove that System 8000 is the most powerful Unix-based microcomputer you can buy?*

SEE US AT COMDEX SPRING 83, BOOTH #1356.
SEE US AT NCC, BOOTH #S5611.

There's only one way to prove that one computer system will outperform all others. Benchmark it. Test it. Then compare the results! That's the challenge we're giving to OEM's and systems houses serious about multi-user systems. Run your benchmarks on any other two UNIX-based micros and...

1. WE'LL PROVE...that the System 8000 has more raw computing power—so your CPU-bound programs run faster.

2. WE'LL PROVE...that the System 8000 achieves higher data throughput; that it can open bottlenecks in your I/O-bound applications.

3. WE'LL PROVE...that the System 8000 supports the UNIX operating system more efficiently; that our computers spend less time running the operating system and more time running your programs.

4. WE'LL PROVE...that the System 8000 family best withstands the demands of a multi-user environment; that its carefully designated architecture compares with that of minicomputers.

So, what's it worth to you if we can prove System 8000 is the most powerful UNIX-based micro you can buy? Money? Time? How about your success as an OEM?

The System 8000 family is priced from $14,950 to $37,950. Its industry-compatible languages open a wide range of minicomputer applications, making it the best buy for your money. But don't take our word for it...

Take the System 8000 Challenge. Send for our challenge kit and test any other two UNIX-based micros. Bring your results into any Zilog sales office and compare them with the tests you run on the System 8000. If we don't win, then we'll give you something valuable for taking the challenge. Call Zilog toll free at 800-841-2255 for your challenge kit and start comparing today.

*UNIX is a trademark of Bell Laboratories.

Zilog

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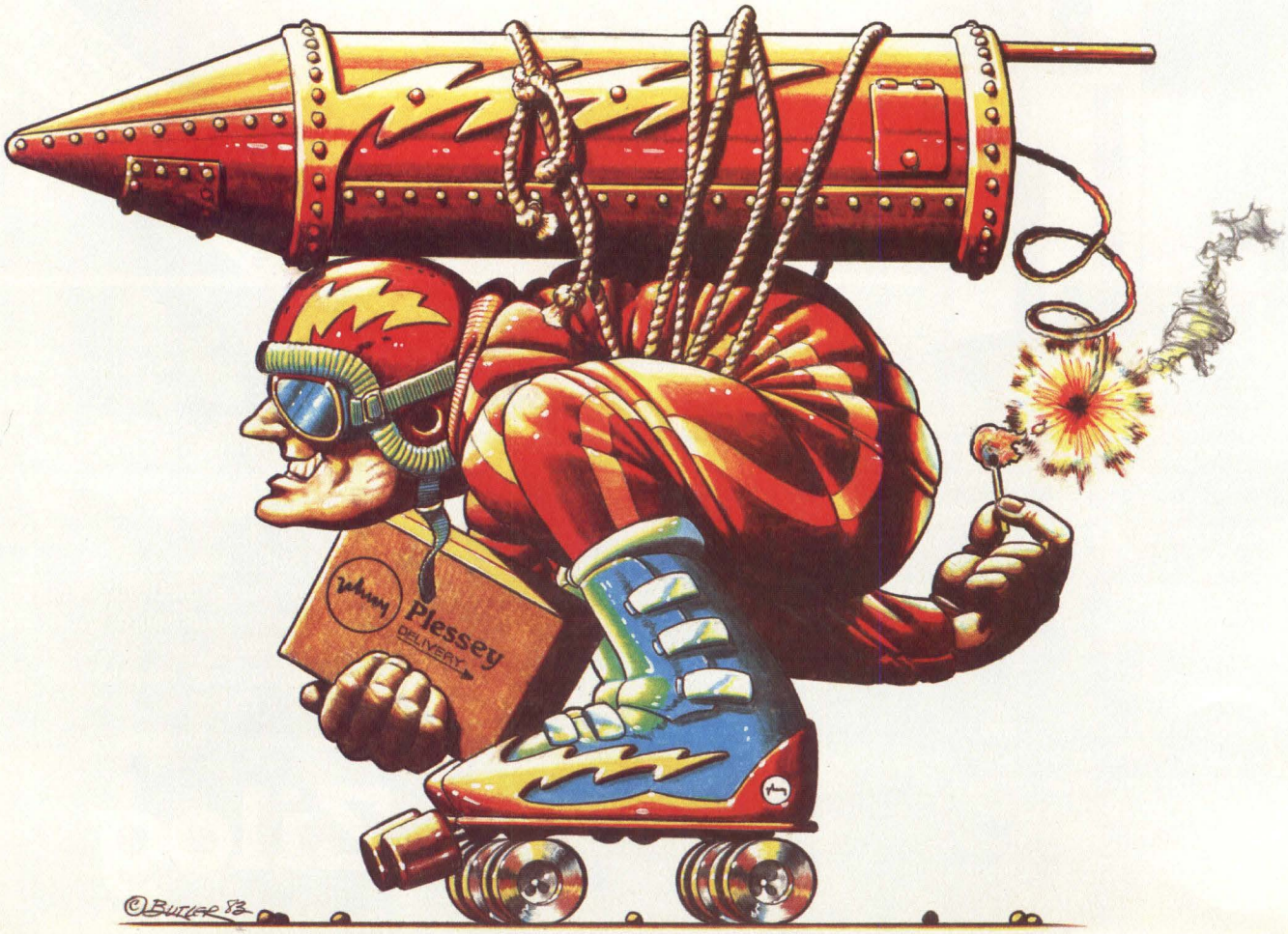
CIRCLE NO. 85 ON INQUIRY CARD

NOBODY DELIVERS DEC CONTROLLERS LIKE PLESSEY.



Because nobody has the range of DEC-compatible controllers and mass storage subsystems that Plessey has.

Controllers, floppies, cartridges, disc packs, Winchesters and magnetic tape, including a proven ¼" streamer. All the storage you need for your LSI-11, PDP-11 or VAX computers. (Complete subsystems with savings of up to 50%, too).

Just check the chart, then check us out at (800) 992-8744.

We can also help your budgets and your systems with communications multiplexers. And with a huge selection of memories, typically 30% less expensive than the DEC equivalents. 32 kbytes to 1 Mbyte. ECC, parity and non-parity. MOS and non-volatile core. They're fully DEC-compatible, but run up to 30% faster, occupy less space and come with an extensive 1-year warranty.

And we'll back you up with our own worldwide network of factory-trained specialists. They can service products from a variety of vendors and answer all your questions about configuration, operation or software.

You get the responsiveness of an in-house technician at a fraction of the cost.

Nobody else even comes close.

For the rest of the story, contact: Plessey Peripheral Systems, Computer Products Division, 1674 McGaw Avenue, Irvine, CA 92714. Telephone (800) 992-8744 or (714) 540-9945.

CONTROLLER	EMULATION	COMPATIBLE DRIVES	FORMATTED CAPACITY
Q-BUS			
Floppy:			
PM-XCV21	RX02	Shugart/NEC/Qume. Single or double-density	512KB per drive (x2)
PM-XCV31	RX03	Shugart/NEC/Qume. Double-sided/double-density	1024KB per drive (x2)
Disc Cartridge/ SMD/MMD:			
PM-DCV06A	RK06	CDC Phoenix CMD Drive or Ampex DFR9xx Series (32, 64, or 96MB ea.)	Min: 28MB (2 logical RK06) Max: 8 logical RK06; up to 2 physical drives
PM-DCV02A	RM02	80MB CDC 9762 SMD/80 CDC 9730-80 MMD/ 160MB CDC 9730-160 MMD	Min: 67MB (1 logical RM02) Max: 2 physical drives/4 logical RM02 (268MB total)
	RM05	300MB CDC 9766 SMD/600MB CDC 9775 FMD/ (also any CDC-compatible SMD interface)	Min: 256MB (1 logical RM05) Max: 2 physical drives/4 logical RM05 (1024MB total)
Fixed (Winchester):			
PM-FCV21	RL01/02	Industry-standard, Seagate technology interfaced 5.25" Winchester drives with buffered seek	Min: 10.4MB (1 RL02 or 2 RL01) Max: 41.6MB (4 physical drives/4 logical RL02) or any combination of RL01/02 up to 4 logical drives
Tape:			
PM-CCV11A	N/A	Cipher 'Quarterback'	20MB per 450-ft. cartridge
UNIBUS			
Floppy:			
PM-XC21	RX02	Shugart/NEC/Qume. Single or double density	512KB per drive (x2)
PM-XC31	RX03	Shugart/NEC/Qume. Double-sided/double-density	1024KB per drive (x2)
Disc Cartridge:			
PM-DC06A	RK06	CDC Phoenix CMD Drive or Ampex DFR932 Series (32, 64, or 96MB ea.)	Min: 28MB (2 logical RK06) Max: 8 logical RK06 with up to 4 physical drives
SMD (Removable)/ MMD (Fixed):			
PM-DC02A	RM02	80MB CDC 9762 SMD/80MB CDC 9730-80 MMD/ 160MB CDC 9730-160MMD	Min: 67MB (1 logical RM02) Max: 268MB (4 logical RM02)
	RM05	300MB CDC 9766 SMD/600MB CDC 9775 FMD/ (also any CDC-compatible SMD interface)	Min: 256MB (1 logical RM05) Max: 1024MB (4 logical RM05)
Tape:			
PM-TC11B	TM11	Kennedy or Pertec 1/2-inch, 9-track, reel-to-reel; 12.5 to 125ips; 800/1600bpi	4 Tape Transports per controller
VAX			
SMD (Removable) MMD (Fixed):			
PM-DCG03	RM03/ RM05/ RM80	80MB CDC 9762 SMD/160MB CDC 9730-160 MMD (2 logical RM03 or 1 logical RM80)/300MB CDC 9766 SMD (1 logical RM05)/ 474MB Fujitsu M2351 (3 logical RM80)/600MB CDC 9775 FMD (2 logical RM05)/(also any CDC-compatible, SMD interface)	Min: 67MB (1 logical RM03) Max: 2048MB (8 logical RM05) Supports up to 4 physical or 8 logical drives

PLESSEY. ASK ANYBODY.

CIRCLE NO. 86 ON INQUIRY CARD

DISK DRIVES FROM VRC

RELIABILITY IN UNFRIENDLY ENVIRONMENTS

From 0° to 50° C, from the heat of the desert to the chill of the arctic circle, VRC disk drives operate with a high MTBF. Tolerance to thermal extremes, shock and vibration are part of the design criteria that has made Vermont Research the leading supplier of memory products for unfriendly environments.

VRC 8520 8-INCH CARTRIDGE DISK DRIVE

The VRC 8520 puts 22 megabytes of storage capacity into virtually any existing system. An ANSI standard 11 megabyte removable cartridge and an 11 megabyte fixed disk, in a one-over-one configuration, give you the flexibility to create back-up files and off-line storage in one compact unit. Integral ANSI, SASI or DEC interfaces are available making the 8520 and 8010 plug-compatible with most host systems. Power supply package adding only 3.9 in. (99.06MM) to length is available.

NON-CONTACT, HIGH-FLYING HEADS ASSURE RELIABILITY

The VRC 8520 incorporates non-contact, high-flying heads that never touch the media in stop, start or transit modes. The stop mode automatically locks heads in a retracted position with manual intervention unnecessary for moving or shipping. A proprietary embedded-servo head positioning system minimizes re-seeks and eliminates head alignment problems. To protect heads and media from particulate damage, a closed-loop air filtration system has been combined with a self-sealing ANSI cartridge. Microprocessor controlled self-diagnostics, modular construction and accessible sub-assemblies make the 8520 easy to service; MTTR is 30 minutes. No preventive maintenance is required.

WE FIT IN PRACTICALLY ANYWHERE

The VRC 8520 is designed for high-capacity storage in fixed or mobile installations. Where less capacity is required, the VRC 8010 offers 11 megabytes of storage on an 8-inch removable cartridge. Both units are available with ANSI, SASI or DEC interfaces and optional power supplies.

For more information contact:

Vermont Research Corporation,
Precision Park,
North Springfield, VT 05150.
Tel: 802/886-2256. TWX: 710/363-6533.

In Europe call or write:
Vermont Research Ltd.
Cleeve Road, Leatherhead,
Surrey, England
Tel: Leatherhead 376221. TLX: 23280.

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VERMONT RESEARCH LTD.

Memory Products for Systems That Can't Stand Failure

CIRCLE NO. 87 ON INQUIRY CARD

Selecting a 5¼-in. storage subsystem

DON MINAMI, DMA Systems Corp.

Small cartridge-disk drives put fast on-line and backup storage in a floppy form factor

Selecting a 5¼-in. storage subsystem involves more than choosing a Winchester disk drive. In almost every instance, the Winchester replaces flexible-disk drive(s) that provided file-copying, program-loading and data-exchange functions plus random access storage. A storage subsystem must include, therefore, a removable-media backup—either a traditional floppy or one of the newer, higher capacity micro-peripherals based on streaming-tape drives or rigid-disk cartridges.

Selecting the optimum Winchester disk-plus-backup combination involves classical price-performance trade-offs in which cost factors must be weighed according to an end user's application. Moreover, performance measurements must account for packaging restraints, power requirements and ease of operation and the effect these have on data integrity and long-term device reliability.

Selection options

There are three principal kinds of removable media that fit into the form factor established by 5¼-in. floppy disk drives: 5¼-in. diskettes, ¼-in. tape cartridges and 5¼-in. cartridge disks (Fig. 1). The three types of backup media give a system integrator a choice of four Winchester-plus configurations (Fig. 2).

A Winchester storage subsystem with 5¼-in. floppy backup is the most familiar of these options. Hundreds of thousands of 5¼-in. hard and floppy disk drives are shipped each year, resulting in manufacturing economies that make the Winchester/floppy combination the most attractive alternative if original-equipment costs are the dominant concern. Balanced against this advantage, however, is a relatively limited amount of on-line backup capacity—typically 250K bytes to 1M byte, with a few models extending this range to 2M bytes.

Tape backup also has a long history. The ¼-in. cartridge is now into its second decade as a standardized data-storage medium. But streaming applications, which increase both the transfer rate and the potential cartridge capacity by minimizing inter-block gaps, are relatively new. Streaming-cartridge drives that fit 5¼-in. form factors are just now reaching the market. With capacities as high as 45M bytes, tape cartridges easily outdistance the other options in the amount of data that can be stored or

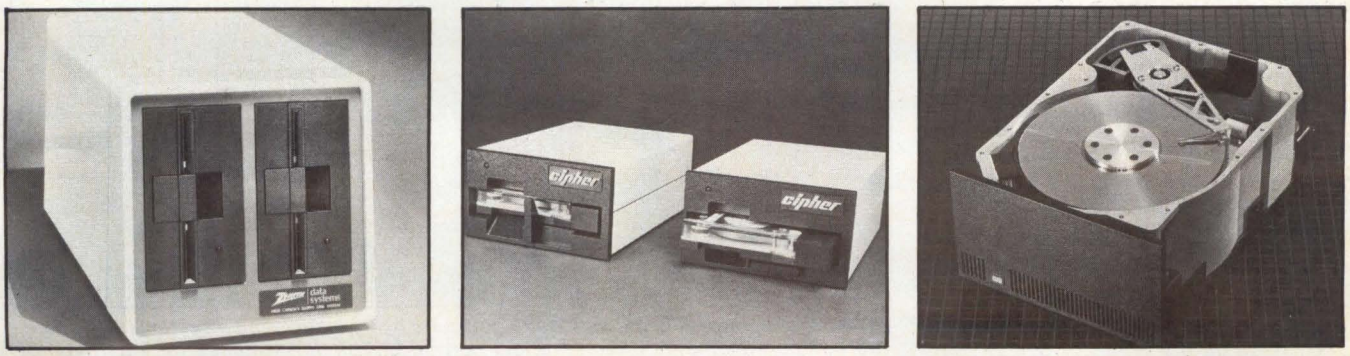


Fig. 1. Three types of removable media storage drives—*5¼-in. floppy disk drives, ¼-in. cartridge-tape drives and 5¼-in. cartridge-disk drives—can serve as backup for 5¼-in. fixed-disk Winchesters within a 5¼-in. form factor.*

Selection factors in order of importance	Backup device			
	5¼-in. floppy disk	¼-in. tape cartridge	Fixed removable disk	Removable-only disk
Device reliability			x	x
Data integrity			x	x
Subsystem cost	x			
Media cost/M byte		x		
Media cost/unit	x			
Subsystem size			x	
Power requirements			x	
Access time			x	x
Backup time		x		

Fig. 2. Application-dependent selection factors *for determining the optimum Winchester-plus-backup combination. Order-of-importance listing is the result of in-depth interviews with a cross section of computer manufacturers, system integrators and consultants.*

retrieved without operator intervention. They also offer very low per-megabyte media costs. Data access times, however, are another matter. Even at streaming speeds, it may take several minutes to reach the area on a serially recorded tape where desired data are stored.

The 5¼-in. rigid-disk cartridge is the latest type of removable media. Its advantages stem from the fact that, with disk-cartridge backup, both primary and secondary storage are based on one technology and can even share the same mechanical assemblies, on-board electronics and interface controller. Random-access speed and transfer rates match those of the fixed Winchester drives.

Individual disk cartridges can provide 5M to 6M bytes of unformatted, on-line backup. This can be combined with nearly 20M bytes of fixed capacity in a single fixed/removable unit. Systems that require more mass storage typically back up fixed-disk Winchesters with a single fixed/removable unit or a separate removable-only drive.

A system integrator's first task is to compare these three types of removable media—floppy, tape and rigid disk—and select the backup technique that best fits the users' applications. It is an "apples-and-oranges" evaluation, but priorities can be applied to the selection criteria to organize and direct comparison.

Selection priorities

The order-of-importance listing of selection factors in Fig. 2 is based on three independent, in-depth surveys of computer-equipment manufacturers, system integrators and consultants performed by DMA Systems Corp. More than 100 responses are represented. Nearly all respondents incorporate floppy disks in their system designs; all but a few are evaluating or planning to evaluate higher capacity backup alternatives. The end-user product in most cases is a small-business system, but word processors and intelligent terminals are also common.

The survey results show two surprises. First, despite a highly competitive business environment, reliability takes precedence over cost. Reliability problems can be very costly for suppliers with geographically dispersed customer bases.

The second surprise is that performance characteristics such as access and backup times are of

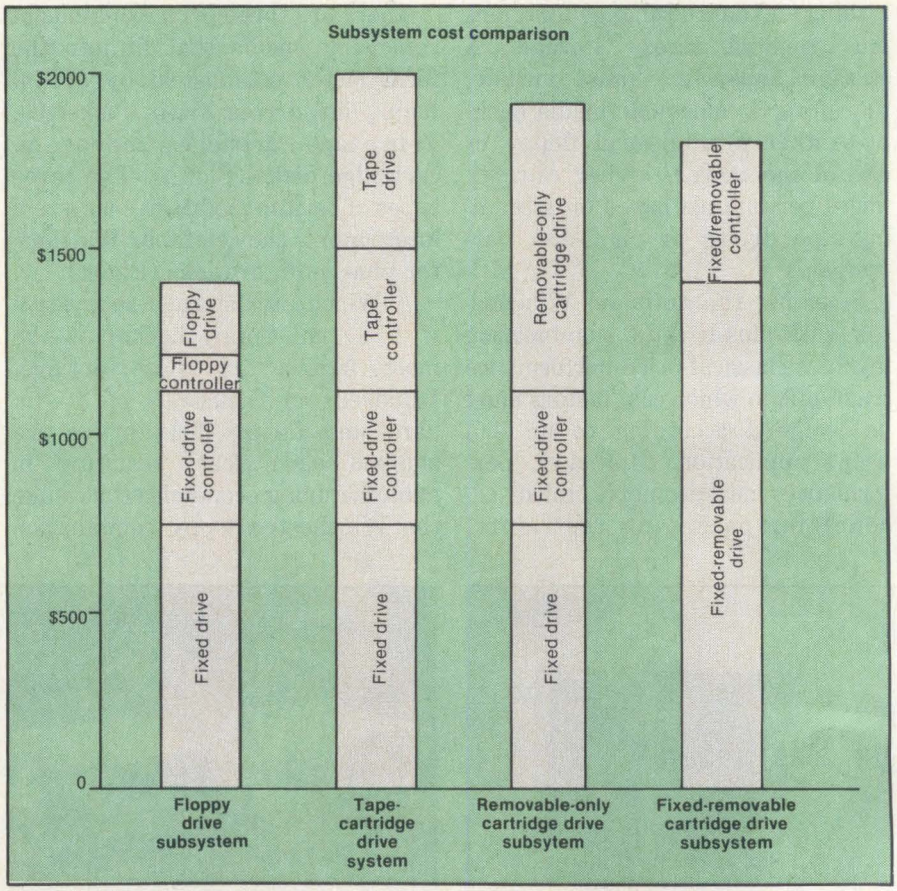
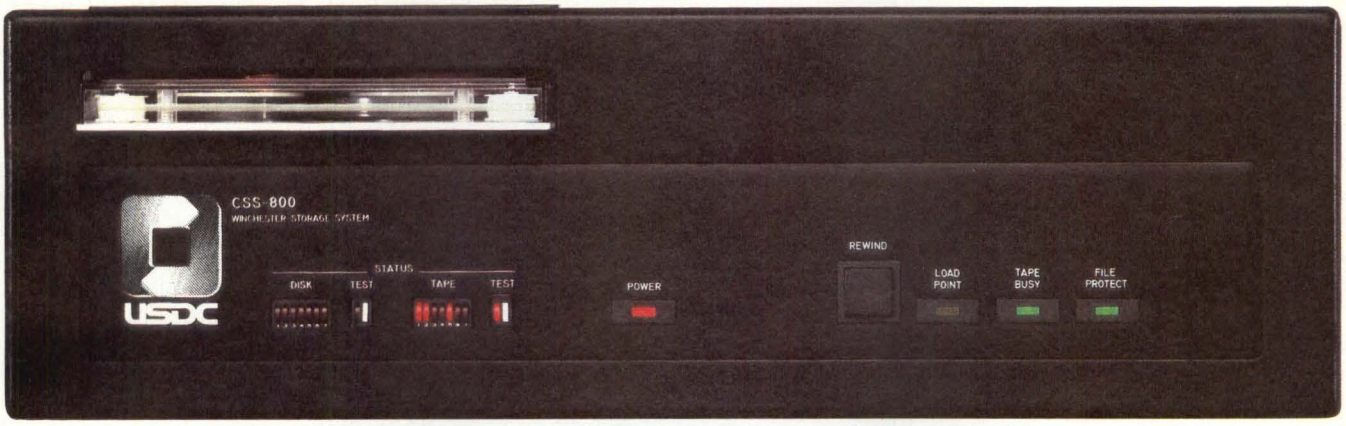


Fig. 3. Backup device costs *are fixed costs paid by the user when a system is installed. The comparative costs directly reflect current production volumes for each type of device. Controller/interface prices are important parts of total subsystem prices, but are often excluded.*

The Long Wait Is Over



The CSS-800 Compact Storage System

Work loads are growing, you need more storage, your system can't keep up the pace, and everyone's waiting for you to come up with an answer. The CSS-800 is the answer you've been waiting for—a storage system with larger capacity and data management features needed to upgrade system performance.

When long waits for disk access hold back your system and limit its throughput, faster storage is the key to performance. The CSS-800's exclusive architecture with cache memory and look-ahead buffering can speed throughput up to 90%. Where other systems control data flow simplistically, the 800 strategically responds to software and data usage without adding to host overhead time. With 70 Mbytes of disk storage, your mini or micro can store more data, handle more concurrent users, run large programs more effectively, and do more processing in less time than ever before.

When More Is Less Our 70-Mbyte disk and integral cartridge tape backup are housed in a rackmount or desktop package 5¼ inches high and weighs only 42 pounds. Each controller can accommodate three add-on storage systems for a total on-line capacity of 280 Mbytes. When space is as important as time, you can't beat the CSS-800.

When More Costs Less The CSS-800 is priced below any other system with comparable capacity to give you the best cost per Mbyte and price/performance ratios in the industry. The 800 gives you more capacity and greater speed for less money than you'd spend for an ordinary disk drive.

On DEC Now! Totally DEC* compatible, the CSS-800 emulates the RK07 disk and TU10 tape drives so there is DEC system support available now under RSX-11M, RSTS/E, and RT-11 operating system as well as DSM, TSX and UNIX. Q-bus or Unibus host interfaces are standard features.

And Don't Wait for Repairs We also know that you need a storage unit that is dependable as well as fast. The CSS-800 uses Winchester technology to achieve maximum availability. Built-in diagnostics assure the reliability of all drives, controllers, and interfaces. Modular design makes repairs fast and easy. We've backed the 800 with TRW's nationwide service program to insure prompt and complete maintenance.

U.S. Design Corporation is a leader in providing performance enhancements for the mini/micro computer community. Call us toll free at (800) 368-2811 TODAY and we'll show you the technology of TOMORROW.

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lesser concern—as long as they are within acceptable limits as defined by user applications. Each of the selection criteria, therefore, serves two functions: to eliminate a device from further consideration if it is outside the limits and to evaluate and select the best among several acceptable alternatives.

No product, for example, can survive its introductory phase unless it demonstrates minimal reliability. Floppy storage is and probably will always be the least reliable backup option, but the popularity of floppies shows that they're reliable enough for many current applications. Rigid disks will always be the most reliable, if for no other reason than the fact that both other options, floppy disks and tape, are subject to the wear and tear of direct head-to-recording-surface contact throughout their lifetimes.

Hardware reliability and data integrity again become crucial selection factors when a type of backup has been chosen and a decision must be made among competing device designs and manufacturers. Small reliability differences can impact a user's financial and psychological cost of ownership.

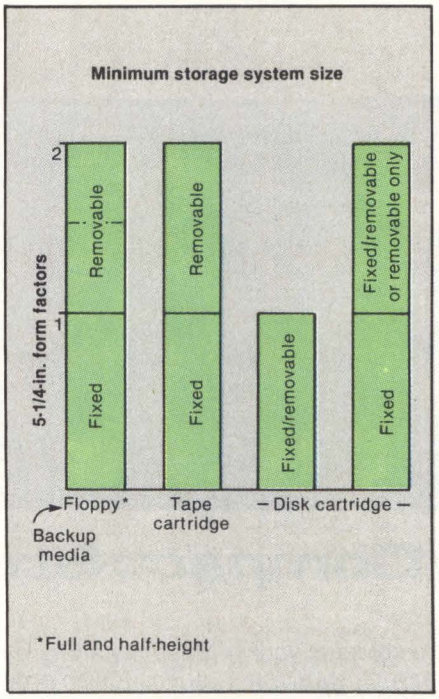

Fig. 4. A fixed/removable disk-cartridge drive *combines both primary storage and backup within a single 5¼-in. form factor. The combined unit also reduces subsystem power requirements by half.*

Removable media			
Reliability measures	**Floppy disks**	**Tape cartridge**	**Disk cartridge**
Soft errors	1 in 10^9	1 in 10^8	1 in 10^{10}
Hard errors	1 in 10^{12}	1 in 10^{10}	1 in 10^{12}
MTBF (hours)	2000	3500	8000
Preventative maintenance	yes	yes	no

Fig. 5. Disk-cartridge reliability *is an extension of fixed Winchester reliability. Both floppies and tape cartridges record data on a vulnerable plastic substrate—with direct head-to-surface contact.*

On-line capacities and costs

After reliability, sub-assembly and media costs are the most important concerns in devising an optimum storage subsystem. Associated with these costs is the on-line backup capacity—a factor survey respondents rarely included in their listings of selection criteria. Systems with apparently similar backup requirements were reported with backup capacities from 250K to 45M bytes.

One explanation for this wide range is a varying emphasis on the functions performed by the backup facility: full-disk "dumps" versus archival storage of selected files versus periodic program and database loads by individual users.

Another explanation is varying valuations of an end user's time. In principle, every backup device, independent of its on-line capacity, can store and retrieve an umlimited amount of data—provided the user is willing to make the necessary number of media changes. If only a limited amount of data is to be

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A new Winchester controller. Plus floppy controller. On one low cost board. Small enough to mount atop a 5¼" drive. And ST500/SA1000 compatible. "Smart," you say? What did you expect from the Wizards of Winchester Disk Controllers?

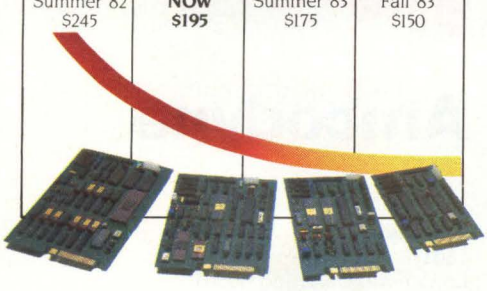
We promised you more for less. Our new WD1002 delivers. At $195 (U.S. OEM quantities) it's $50 less than its predecessor, the WD1001.

The big news, though, is that we've made the WD1002 the brainiest disk controller yet, with an abundance of new LSI innovations. Such as our WD1010 single-chip Winchester controller device. It replaces the microprocessor on our earlier boards. And about 25 other devices. Plus we've added the new WD1014 Error Correction device and the WD1015 Buffer Manager device.

Because just about every system with a Winchester has a floppy nearby, we included our new WD279X single chip floppy disk controller, too. So you get a complete, powerful solution on one reliable 5¾" x 8" board. And you're on the upgrade path to our upcoming WD1003 and WD1004 boards.

U.S. OEM Quantities

WD1001	**WD1002**	WD1003	WD1004
Summer '82	**NOW**	Summer '83	Fall '83
$245	**$195**	$175	$150



To make our disk controllers even more irresistible, we'll customize them to your bus and form factor. Or sell you our LSI, along with everything you need to build a controller yourself.

It doesn't take too much brains to see that it's safe, smart and simple to commit your disk-based systems to WD. Call our controller hotline, 714/966-7827 and we'll arrange to sit down with you and get into the details you need.

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Components Group, 2445 McCabe Way, Irvine, CA 92714, (714) 557-3550

Introducing the first removable Whitney technology disk drive for OEMs.

Cartridge convenience with fixed media performance and reliability in an 8-inch, fixed/removable drive.

- **50 Mbytes Total Storage**
- **25 Mbyte ANSI Standard Cartridge**
- **35 msec average access**
- **CDC Lark™ compatible SMD interface**
- **8-inch floppy envelope**

Now there's a disk drive with the combination of speed, capacity, reliability and packaging efficiency to complement your high-performance mini- or microcomputer based system.

It's the Arapahoe 7110 from Amcodyne.

Arapahoe features advanced Whitney head suspension and read/write technologies derived from the latest generation of mainframe disk drives. Improved aerodynamic stability, superior head/disk compliance and higher signal-to-noise ratio result in data reliability that is substantially better than that attainable with Winchester technology.

Arapahoe incorporates a microprocessor-controlled/embedded-servo system to eliminate the head/disk alignment problems which handicapped early cartridge disk drives. The microprocessor directs all head-movement operations and computes the runout profile for each cartridge. The result is fast, accurate seeks and absolute tracking accuracy for cartridge interchangeability.

Reliability is further assured by Arapahoe's proprietary head-loading mechanism and positive-pressure clean-air system. When a cartridge is loaded, Arapahoe's heads are held off the disk until the cartridge is purged to a fixed-media cleanliness level. Only then are the heads lowered into flying position. Together, these features mean you can employ Arapahoe with confidence in a wide variety of office, laboratory or industrial environments.

For Arapahoe product specifications and a free monograph on Whitney, the technology that's replacing Winchester in high performance disk, contact Amcodyne.

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backed up (or loaded) or little value is given to the user's time, the system integrator should select a low-cost, low-capacity backup device. By comparison, if large quantities of data are to be transferred and operator convenience is an important sales feature, removable capacity becomes a critical selection factor.

The subsystem cost should be evaluated based not on device cost, but on fundamental requirements of the submemory system cost, which includes mass storage, I/O and backup.

Based on device cost, floppy drives are a clear choice, with OEM quantity prices reaching $200 or less, compared to approximately $500 for a streaming tape drive and about $800 for a removable-only disk cartridge drive. The fixed/removable drives have the removable and fixed disks integrated and are around $1300. The fixed disk drives costs are around $700.

Added to these prices should be the controller circuitry required to interface the device with the host processor. Again, mass-produced floppies with standard controller chip sets that sell for less than $100 are the low end. Cartridge disk drives can connect directly to volume-produced 5¼-in. Winchester controllers that sell for less than $300. Tape-cartridge drives, by comparison, are neither standardized nor produced in volume. The various intelligent controllers they require add at least $400 to the cost of a storage subsystem.

By adding these costs, the subsystem cost is derived. At first glance, and for lower capacity systems, a floppy-based subsystem appears to have cost advantages, with fixed removable, removable-only and tape subsystems following in that order (Fig. 3). However, in terms of transferring large quantities of data, and considering operator convenience, rigid disk cartridge devices become the cost effective solution.

Similar cost comparisons apply to the media itself. Backup function, data volume and operator convenience again determine whether the per-unit or per-megabyte cost should be the important figure of merit. A floppy disk can be bought for a lower cost than tape or disk cartridges. Floppies may continue to be an economically feasible distribution medium for microcomputer software for hundreds or thousands of users. One result may be a three-tier configuration: fixed Winchester for mass storage, a high-capacity tape or cartridge disk device for backup and a low-cost floppy for I/O.

Floppies are unfeasible, however, when large amounts of data must be permanently stored and per-megabyte media costs become the important measure. The lowest cost storage medium, in this case, is cartridge tape. Rigid-disk-cartridge costs, however, are competitive in terms of equivalent megabyte capacity. Future end-user costs will soon be in the $40-50 range— similar to the price of a box of floppies.

Size, power, performance

Disk cartridges offer distinct advantages in nearly all the selection categories. Only disk-cartridge technology, for example, can provide both fixed and removable storage in a single 5¼-in. footprint (Fig. 4). The two disks in a fixed/removable drive share a single spindle and a single head-positioning actuator, saving space and power. Such half-height, fixed/half-height, removable disk-storage subsystems can store approximately 26M bytes per diskette drive slot.

Disk-cartridge drives also deliver Winchester-league access times and transfer rates. Records can be retrieved in 40 msec. or less, compared to average access times of 80 to more than 150 msec. for floppy drives. Streaming-tape accesses are measured in seconds or even minutes, depending on the location of the files along the tape.

Transfer rates follow a similar pattern: 625K bytes per sec. for disk-cartridge transfers, 250K bytes per sec. for floppies, 90K bytes per sec. for streaming-tape cartridges. These figures can be misleading, however, in the case of sustained, high-volume backup operations. The tape-cartridge figure, for example, is both a maximum and a minimum and applies only if a system can sustain continuous tape motion.

What price reliability?

In one selection category, however, disk-cartridge backup has no peer. Winchester technology is the most reliable magnetic-storage technique available—by every reliability measure: soft (correctable) error rate, hard (not correctable) error rate and mean time between failures (Fig. 5).

DMA drives are also designed with the assumption that the computer systems will occasionally be moved by untrained personnel; DMA heads are automatically retracted and locked when the drives are turned off for safe system transportability. The heads remain in a contamination-proof compartment until the cartridge is fully seated, and they never contact the disk surface, even during start-up. The cartridge itself is purged with a fan-driven blast of filtered air as the enclosed disk is brought up to speed. Only then are the heads lowered to their "flying height" above the revolving surface.

These design details should be considered when making the final selection among a few acceptable 5¼-in. storage subsystems. Backup plays a key role in overall system price and performance and should never be an afterthought. Backup is also a part of the critical human interface, and must be as user-friendly and dependable as price and performance constraints permit. □

Don Minami is vice president of marketing at DMA Systems Corp., Goleta, Calif.

Just another CDC 9762 look-alike?

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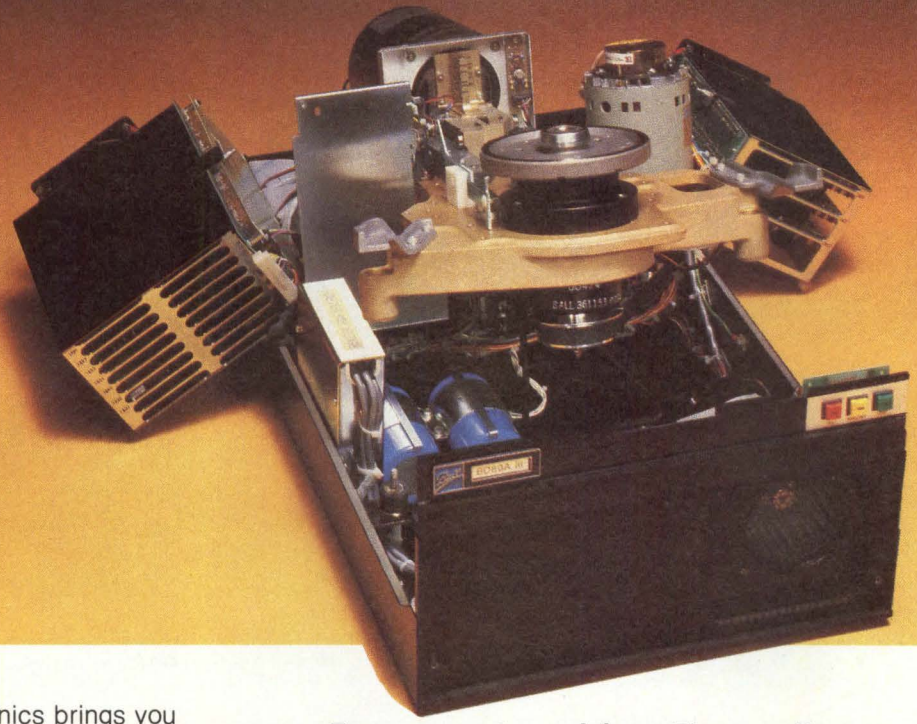

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High data and drive reliability — With the BDA-80, you can trust the data and the drive. All moving parts in the actuator and disk-pack well are sealed in a clean-room environment. And the industry's first triple cooling system provides positive circulation of cool, filtered air to all devices that are vulnerable to failure due to heat buildup.

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Uncompromising design, trustworthy performance — Ball Electronics' designers anticipated *all* needs of the OEM and end user with the aim of achieving superior reliability, dependability, and convenience. Result: The BDA-80 with *all* — not just some — of the features you want and demand.

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CIRCLE NO. 93 ON INQUIRY CARD

CARTRIDGE DISK DRIVES

Company Model	Disk size 14-in.	10½-in.	8-in.	5¼-in.	Fixed capacity (unformatted, M bytes)	Removable capacity	Avg. access time (msec.)	Transfer rate (K bytes/sec.)	No. of data surfaces	Bytes/ track
AMCODYNE, INC.										
Arapahoe 7110	N	N	Y	N	25.8	25.8	35	1229	4	20672
AMPEX CORP.										
DFR-932	Y	N	N	N	16	16	30	1209	2	20160
DFR-964	Y	N	N	N	48	16	30	1209	4	20160
DFR-996	Y	N	N	N	80	16	30	1209	6	20160
DM-9300	Y	N	N	N		300	28	1209	19	20160
DM-9300A	Y	N	N	N		300	28	1209	19	20160
DM-940	Y	N	N	N		40	28	1209	5	20160
DM-980	Y	N	N	N		80	28	1209	5	20160
ATHENAEUM TECHNOLOGY, INC.										
Aegis 10/10	N	N	N	Y	12.75	12.75	35	625	4	10420
BALL ELECTRONIC SYSTEMS DIV.										
BDA 100	Y	N	N	N		103.22	30	1200	5	20160
BDA 50	Y	N	N	N		54.7	30	806	5	13440
BDA 80	Y	N	N	N		82.9	30	1200	5	20160
CARDIFF TECH.										
D240	N	N	N	Y	20	20	25	625	4	10416
R120	N	N	N	Y		20	25	625	2	10416
CENTURY DATA SYSTEMS										
T200/202-SA	Y	N	N	N		208	30	806	19	13440
T300/302/306-SA	Y	N	N	N		312	30	1209	19	20160
T50-SA	Y	N	N	N		54.7	30	806	5	13440
T536	Y	N	N	N		315.2	30	1209	19	20160
T80/82-SA	Y	N	N	N		82.1	30	1209	5	20160
CHARLES RIVER DATA SYSTEMS										
DK-32R	N	N	Y	N	40	13	65	205	8	8200
CONTROL DATA CORP.										
CDC 9427H	Y	N	N	N	6	6	35	313	4	7825
CDC 9448	Y	N	N	N	16/48/80	16	30	1209	2	20160
CDC 9455	N	N	Y	N	8.35	8.35	42	1208	4	20672
CDC 9457	N	N	Y	N	25	25	35	1209	4	20672
CDC 9710	N	N	N	N		82.9	30	1209	5	20672
CDC 976X	Y	N	N	N		40/80/30	30	1209	5	20160
CVM SYSTEMS										
R-50	Y	N	N	N		50.6	30	819	3	20480
CYNTHIA PERIPHERAL CORP.										
0120	N	Y	N	N		12	50	920	2	12800
D125	N	Y	N	N		12	50	920	2	12800
D140	N	Y	N	N	12	12	50	920	4	12800
D145	N	Y	N	N	12	12	50	920	4	12800

Actuator type	Interface type	Price ($)	Special features
linear voice coil	SMD	3175, Q100	ramp-launched heads, embedded servo, 8-in. floppy dimensions
linear, rotary	SMD/CMD		address mark format
linear, rotary	SMD/CMD		address mark format
linear, rotary	SMD/CMD		address mark format
linear voice coil	SMD		quiet kit
linear voice coil	SMD		quiet kit, 823 cylinders
linear voice coil	SMD		rack slide mount
linear voice coil	SMD		rack slide mount
linear voice coil	ST506	1500, Q500	soft sectoring
linear motor	SMD		variable-length sectoring
linear motor	Trident/SMD		variable-length sectoring
linear motor	Trident/SMD		variable-length sectoring
linear voice coil	ST506	1350, Q1000	dynamically-loaded 3370-type, R/W heads, 20 embedded servo
linear voice coil	ST506		dynamically-loaded 3370-type R/W heads, embedded track servo
linear motor	TTL/SMD	8950, Q200	dual access optional
linear motor	TTL/SMD	9750, Q200	T306-CDC9766 compatible; dual access optional
linear motor	TTL	4925, Q200	tabletop or rack-slide mount; dual access optional
linear motor	SMD	13000, Q200	ruggedized high environment CDC9766 compatible drive; dual a
linear motor	TTL/SMD	5675, Q200	tabletop or rack-slide mount; access optional
rotary torque/linear voice coil	SASI VERSABUS	14500	
linear voice coil	CDD	3830, Q500	integral power supply
linear voice coil	SMD	4730, Q500	write protect, integral data recovery, integral power supply
linear voice coil	LSI/ISI/SMD	2345, Q500	32/64 sectors, integral data recovery, sealed data module
rotary voice coil	LDI/ISI/SMD	3070, Q500	32/64 sectors, integral data recovery, sealed data module
linear voice coil	SMD-compatible	4370, Q500	fixed/variable sectoring, dual channel access, rack mount
linear voice coil	SMD	5840, Q500	single or dual channel, integral power supply
voice coil	SMD	4850	mounted in subsystem cabinet
voice coil		4185	optional easy box
voice coil	SASI	5265	intelligent interface; easy box optional
voice coil	Radial	6180	optional easy box
voice coil	SASI	9225	intelligent interface; easy box optional

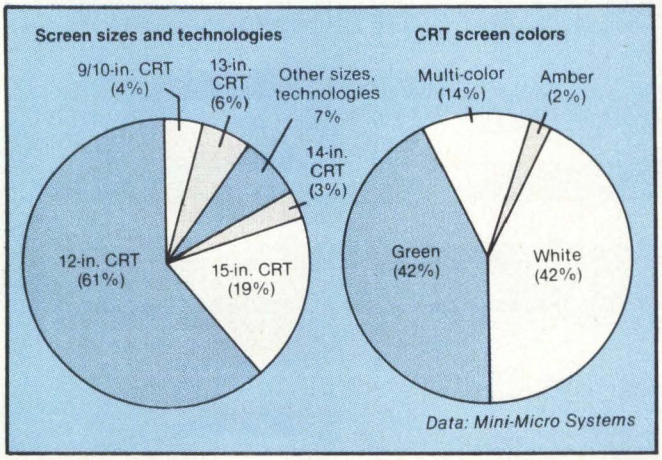
Company Model	Disk size 14-in.	10½-in.	8-in.	5¼-in.	Fixed capacity (unformatted, M bytes)	Removable capacity	Avg. access time (msec.)	Transfer rate (K bytes/sec.)	No. of data surfaces	Bytes/ track
DATA GENERAL CORP.										
6060	Y	N	N	N		96	43	806	19	12288
6061	Y	N	N	N		192	43	806	19	12288
6122	Y	N	N	N		277	43	1209	19	17920
DATAPOINT CORP.										
9310	N	Y	N	N		10	75	0	2	12288
9395	Y	N	N	N	135	67	30	1209	8	16384
DATREX, INC.										
Series 6000	Y	N	N	N	6.25	6.25	35	312	4	7700
DISCTRON, INC.										
DP 100	N	N	Y	N		11.6	60	875	2	12440
DMA SYSTEMS										
5	N	N	N	Y		6.5	40	625	2	10890
5/10	N	N	N	Y	13	6.5	40	625	4	890
5/15	N	N	N	Y	6.5	19.5	40	625	4	10890
5/5	N	N	N	Y	6.5	6.5	40	625	4	10890
HARRIS CORP., COMPUTER SYSTEMS DIVISION										
5632		Y				80	38	1209	5	161280
5652	Y					300	38	1209	19	161280
HEWLETT-PACKARD										
7906	Y	N	N	N	19.6	9.8	33	749	3	12288
7920	Y	N	N	N	50	50	33	749	5	12288
7925	Y	N	N	N	120	120	33	749	9	16384
HONEYWELL										
CDS9648/9148	N	N	Y	N	8.5	8.5	50	1200	4	16384
CDU9636/9136	Y	N	N	N	16	16	30	1200	2	16384
CDU9638/9138	Y	N	N	N	80	16	30	1200	6	16384
MSU9602/9102	Y	N	N	N	80	30	1200	500	16	384
MSU9604/9104	Y	N	N	N		300	30	1200	19	16384
IBM										
3340A2	Y	N	N	N		140	25	885	12	8368
3340B1	Y	N	N	N		70	25	885	11	8368
3340B2	Y	N	N	N		140	25	885	22	8638
MOHAWK DATA SCIENCES CORP.										
2172	Y	N	N	N		2.5	70	195	2	6144
2175-1	Y	N	N	N	13	13	30	1209	2	16384
2175-2	Y	N	N	N	39	13	30	1209	4	16384
2175-3	Y	N	N	N	65	13	30	1209	6	16384
NEW WORLD COMPUTER CO., INC.										
2/2	N	N	N	Y	2	2	19	500	2	13000
4/2	N	N	N	Y	4	2	19	500	3	13000
4/4	N	N	N	Y	4	4	19	500	4	13000

Actuator type	Interface type	Price ($)	Special features
	DATA GENERAL	32250	
	DATA GENERAL	35900	
	DATA GENERAL	43350	
	microbus	7850	
	memory bus and periph. control	31950	
linear	numerous	2590	integral power supply
linear voice coil	Data Peripherals	1390, Q1000	
linear motor		995, Q1000	
linear motor		1395, Q1000	
linear motor		1450, Q1000	
linear motor		1275, Q1000	
linear voice coil	SMD	20900	controller
linear voice coil	SMD	26500	controller
linear	16-bit TTL	17350	HP-IB interface optional
linear	16-bit TTL	19400	HP-IB interface optional
linear	16-bit TTL	22510	HP-IB interface optional
	Honeywell DPS 6	12500	
	Honeywell DPS 6	13500	
	Honeywell DPS 6	16000	
	Honeywell DPS 6	19300	
	Honeywell DPS 6	33000	
linear radial	2 HEADS/SURFACE	24570	count-key-data, 2 drives & control
linear radial	2 HEADS/SURFACE	13510	count-key-data, attaches to 3340A
linear radial		17200	
	proprietary	7712	includes drive controller
	proprietary	14720	
	proprietary	21680	
	proprietary	28680	
stepper motor	NEW WORLD	836, Q500	removable sealed Winchester cartridge
stepper motor	NEW WORLD	996, Q500	removable sealed Winchester cartridge
stepper motor	NEW WORLD	1196, Q500	removable sealed Winchester cartridge

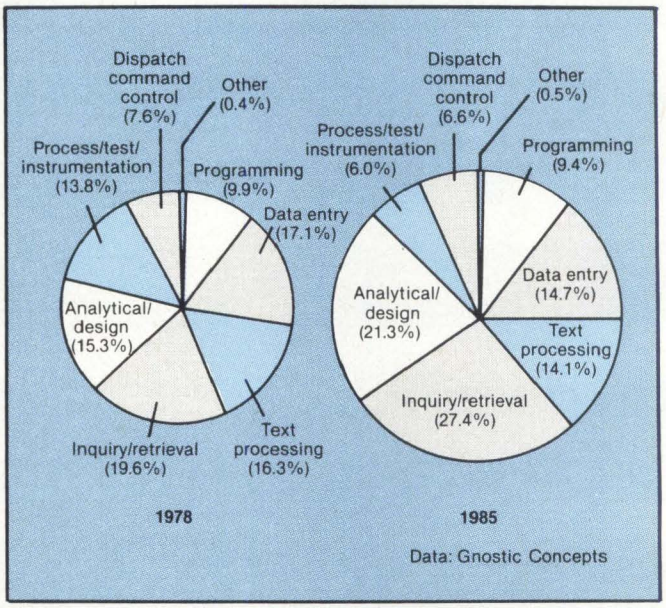
Company Model	Disk size 14-in.	10½-in.	8-in.	5¼-in.	Fixed capacity (unformatted, M bytes)	Removable capacity	Avg. access time (msec.)	Transfer rate (K bytes/sec.)	No. of data surfaces	Bytes/ track
PERTEC										
D3321/D3322	Y	N	N	N	3.17	3.17	55	195	4	7812
D3341/D3342	Y	N	N	N	3.17	3.17	48	313	4	7812
D3421/D3422	Y	N	N	N	6.34	6.34	55	195	4	7812
D3441/D3442	Y	N	N	N	6.34	6.34	48	313	4	7812
D3461/D3462	Y	N	N	N	19.03	6.34	55	195	8	7812
D3481/D3482	Y	N	N	N	19.03	6.34	48	313	8	7812
POLYMORPHIC SYSTEMS										
HD/18+	N	N	N	Y	18	5	70	625	4	10417
QUANTUM CORP.										
Q2010	N	N	N	Y	10.66		55	543	2	8200
SANTA CLARA SYSTEMS, INC.										
SCS Series			Y		10–80	10	55			9182
SCS-5R Series				Y	5,10,15	6.4	70			8192
SEAGATE TECHNOLOGY										
ST706	N	N	N	Y	6.38		85	500	2	625
SYQUEST TECHNOLOGY										
SQ306R	N	N	N	N		6.38	70	625	2	10415
VERMONT RESEARCH CORP.										
5017-4	Y	N	N	N	26	26	45	673	4	12800
8010	N	N	Y	N	11	11	33	614	4	8192
8520	N	N	Y	N	22	11	33	614	4	8192
WANG LABORATORIES										
2260	Y				6.25	6.25	35	497	4	7812
2265V-1	Y	N	N	N		80	30	1200	5	20160
2265V-2	Y	N	N	N		300	30	1200	19	20160
2265V-2B	Y					300		1200	19	20160
2280N-1	Y	N	N	N	16.3	32.6	30	1200	2	20160
2280N-2	Y	N	N	N	16.3	65.16	30	1200	4	20160
2280N-3	Y	N	N	N	16.3	97.3	30	1200	6	20160
2280V-1	Y	N	N	N	16.3	32.6	30	1200	2	20160
2280V-2	Y	N	N	N	16.3	65.16	30	1200	4	20160
2280V-3	Y	N	N	N	16.3	97.73	30	1200	6	20160
6580-1	Y	N	N	N	16.3	32.6	30	1200	2	20160
6580-2	Y	N	N	N	16.3	32.6	30	1200	2	20160
6580-3	Y	N	N	N	16.3	97.73	30	1200	6	20160
WESTERN DYNEX CORP.										
Series 6000	Y	N	N	N	6.25	6.25	35	312	4	7700
WD505	N	N	N	Y		6.38	55	625	2	10416

Actuator type	Interface type	Price ($)	Special features
linear voice coil	various	3975, Q100	
linear voice coil	many	3975, Q100	
linear voice coil	many	3975, Q100	
linear voice coil	many	3975, Q100	
linear voice coil	many	4720, Q100	
linear voice coil	many	4720, Q100	
	ST506	6439	cabinet, controller, power supply, cables, software
rotary torque	Q2000/SA1000	1200, Q500	
		7310	controller, software cables. 10, 20, 30, 40, 80 MB fixed capac.
		2895	controller, software cables. 5, 10, 15 MB fixed capac. avail.
stepper motor	ST506	900 OEM	
stepper motor	ST506	500, Q500	closed loop digital servo, half the height of a 5¼-in. drive
linear voice coil	drive level		power supply, data recovery, auto. actuator lock
linear voice coil	ANSI, SASI drive level		high-flying heads, closed loop servo, integral diagnostics
linear voice coil	ANSI, SASI drive level		high-flying heads, closed loop servo, integral diagnostics
linear voice coil	HAWK	10700	includes 22C12 disk controller
linear voice coil	SMD	17000	
linear voice coil	SMD	34000	
linear voice coil	SMD	23000	2nd through 4th drive when used with 2265V-2
linear voice coil	SMD	17000	
linear voice coil	SMD	18000	
linear voice coil	SMD	19000	
linear voice coil	SMD	17000	
linear voice coil	SMD	18000	
linear voice coil	SMD	19000	
linear voice coil	SMD	17000	
linear voice coil	SMD	17000	
linear voice coil	SMD	19000	
linear		2100	interface compatibility with other drives, integral power
stepper	ST506	495	soft-sectored open loop positioning, temperature compensation

Alphanumeric terminal market overview



Displays are bigger and easier on the eyes. *Diagonal 12-in. displays are built into nearly two-thirds of today's terminals, but many of the newer units offer 15-in. and larger displays. Green phosphor screens are standard on as many terminals as white ones are, and green is a more popular option. Amber screens have yet to catch on, but color screens are quickly gaining popularity as the micros and memory needed to run them get less expensive.*

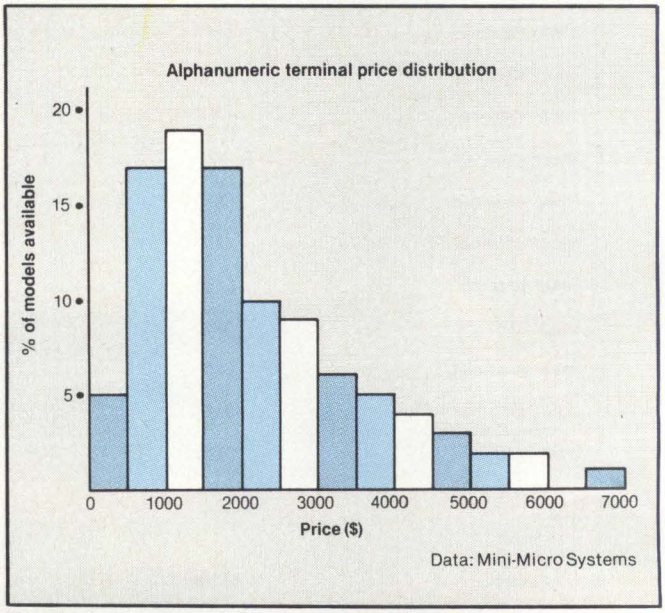


Display terminal applications are changing *but promise solid futures for all terminal types. The two fastest growing applications are good examples: inquiry/retrieval applications are served by dumb and low-end smart terminals, and analytical/design applications are served by intelligent terminals, many with graphics and color capability.*

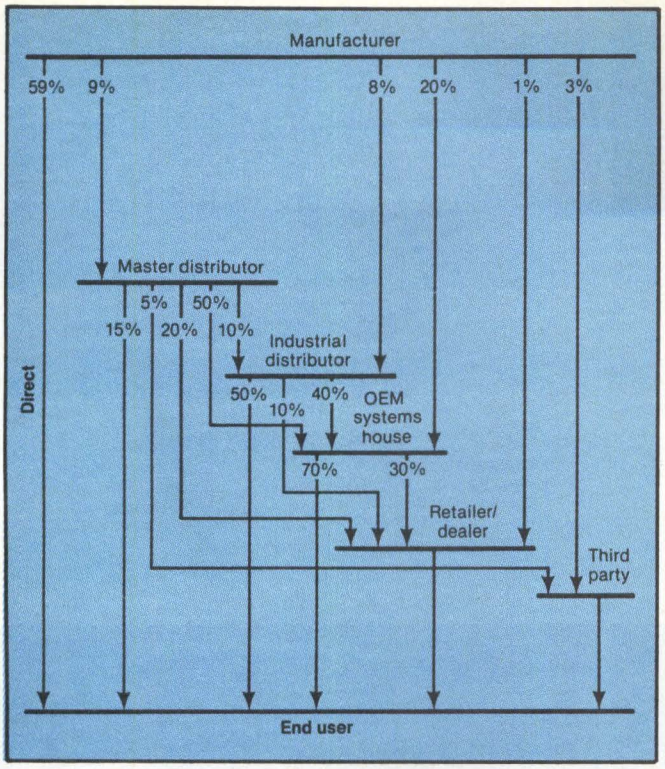
The alphanumeric terminal market had a relatively calm year. Competition was tougher than 1981, but technical innovations were fewer and less spectacular than in previous years. The definitions that have characterized terminal types are becoming increasing blurred. With distribution channels becoming more numerous, thanks to retailers, mail-order suppliers and industrial distributors, market analysts have a tougher time, but buyers have more options.

The terms "dumb terminal" and "low-end terminal" used to mean the same thing, but because of rampant price cutting, the less-than-$1000 low end now encompasses a number of smart or editing terminals. At the high-end, distinctions between intelligent terminals and desk-top microcomputers blur as more micros gain flexible communications capabilities and as micro sales induce terminal vendors to re-label their high-end terminals as microcomputer *systems*.

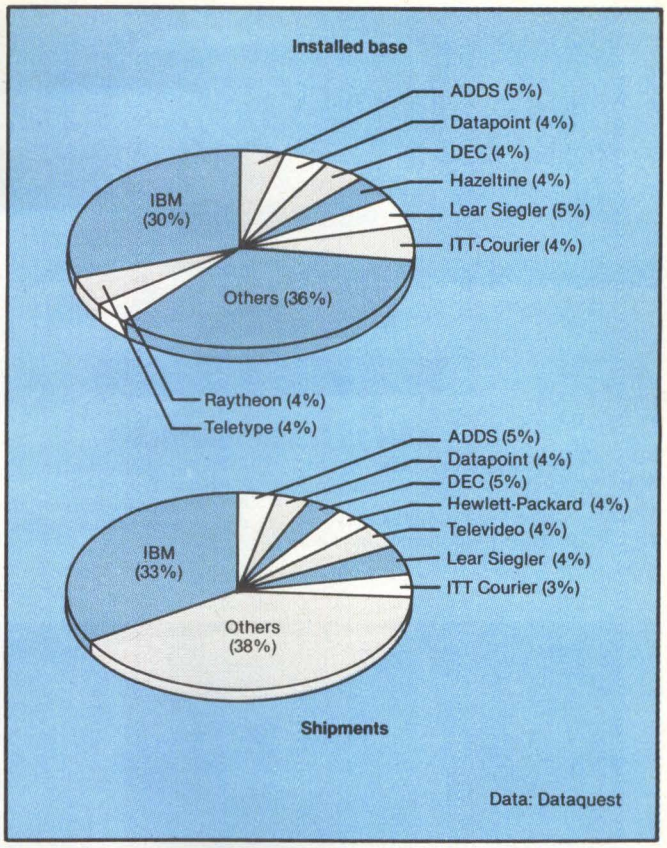
Gnostic Concepts estimates the installed base of terminals at 3.4 million units, and Dataquest estimates that 1 million alphanumeric terminals will be sold in the U.S. alone this year. By 1985, annual U.S. shipments should top 2 million units. The U.S. accounts for roughly half of annual world shipments, but its share will fall to roughly 48 percent by 1985, according to Creative Strategies International.



Terminal prices are falling and becoming more homogeneous. *Taken from the product tables that follow, these data mirror the intense competition in the dumb and low-end editing markets in which features are standardized, and price differentials of only a few percentage points affect large- and small-volume buying decisions.*



An alphanumeric CRT terminal distribution model *developed by Gnostic Concepts, Menlo Park, Calif., is evidence of the maturity of the terminal market. According to Gnostic, direct mail, telemarketing and retail sales methods will gain importance in the future. Even today, though, more than half of all alphanumeric terminals are sold directly by manufacturers to end users.*



The 1981 terminal market shares *reveal that IBM still sells more terminals than the six next-largest vendors combined. With 1981 shipments of roughly 1 million units, though, even a tiny share can mean huge revenues.*

Intelligent terminals shipments

Year	Units	Price ($000)
1976	73,000	324,516
1977	133,000	624,036
1978	163,000	764,796
1979	165,000	774,180
1980	206,000	1,067,080
1981	307,000	1,590,777
1982	420,000	2,196,190
1983	576,000	3,031,638
1984	789,000	4,184,934
1985	1,081,767	5,776,629

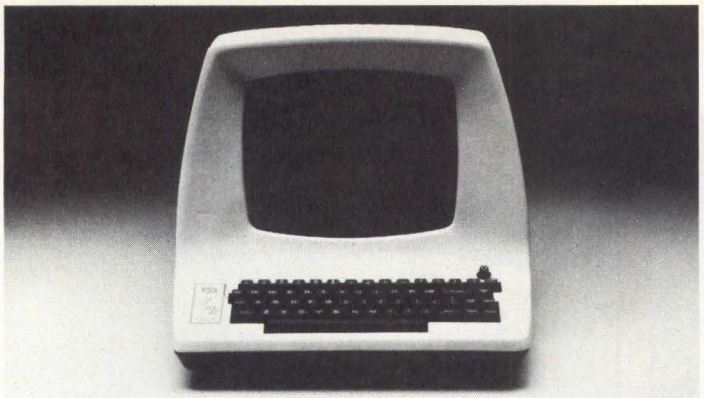
Data: Frost and Sullivan

Intelligent-terminal shipments have flourished *as a result of their local processing power and flexible approach to emulating older, large-volume terminals. In a recent survey, Frost and Sullivan concluded that, thanks to a 1980 installed base of 820,000 units and a 37-percent projected annual growth rate, "programmable terminals may lead into distributed data processing rather than the reverse."*

The numerous market-research houses tracking the terminal market estimate different annual market growth rates, but most agree that intelligent terminals sales will grow the fastest (35 to 40 percent revenue growth) followed by smart terminals (20 to 30 percent) and dumb terminals (10 to 20 percent). Demand for alphanumeric terminals of every capability will be fueled by distributed data processing, sales of new multi-user microcomputers and new value-added communications networks such as videotex, The Source, Prestel and Dialog.

The research firms are also in relative agreement on who the leaders are. IBM Corp. is far and away the leader in installed base and in annual shipments, with five or six times the shipments of its closest competitor. The top 10 or so suppliers account for four-fifths of annual sales. Terminal industry revenues are large enough, though, that even a fraction of a percent of market share can sustain a new entrant.

Technologically, the industry followed through on the promises of 1981. Ergonomics got more than lip service as easy-to-read, easy-to-use terminals appeared from U.S. as well as European manufacturers. The CRT promises to remain the dominant display technology through the late 1980s. The standard storage media for intelligent terminals are 8- and 5¼-in. diskette drives, but the new micro-diskette technologies hold great promise. Intelligent-terminal memory capacities average 64K bytes, but are growing as memory prices fall. Many of 1982's technological promises are related to portable terminals. They are one of the more glamorous terminal types and are usually programmable, but their portability imposes design limitations that affect prices and user-friendliness.



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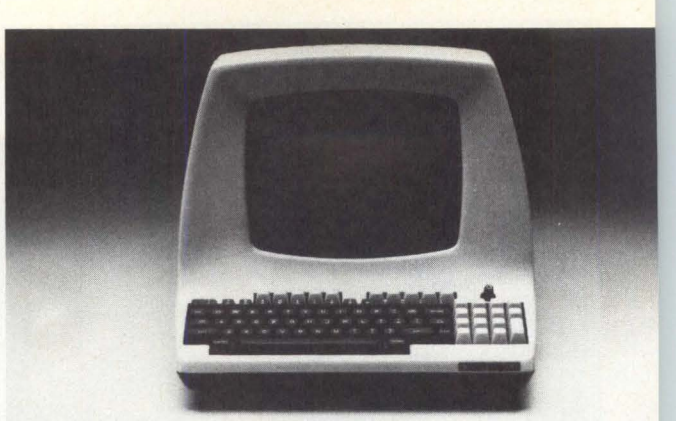

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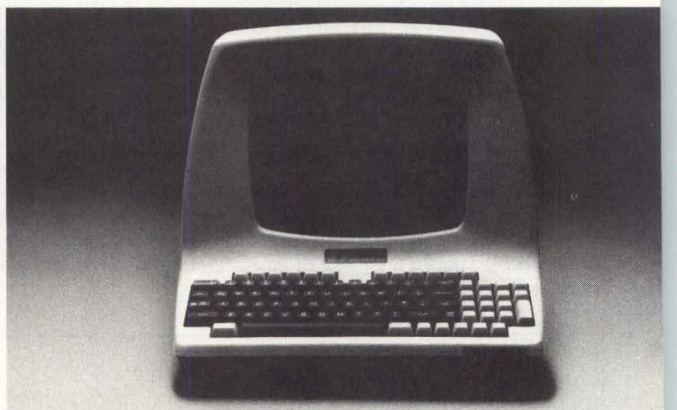

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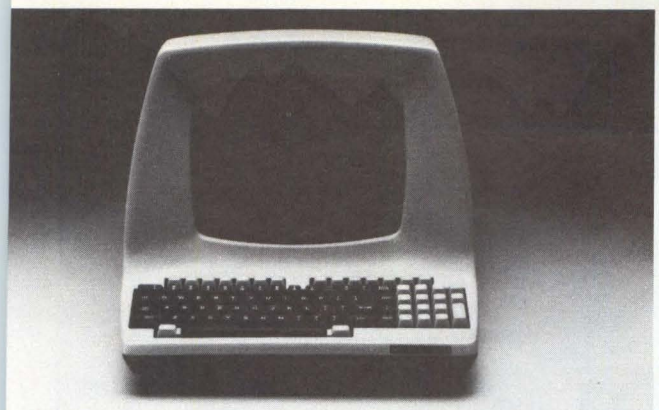

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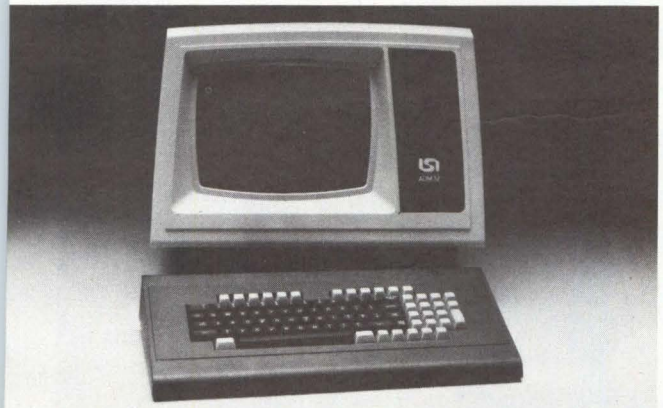

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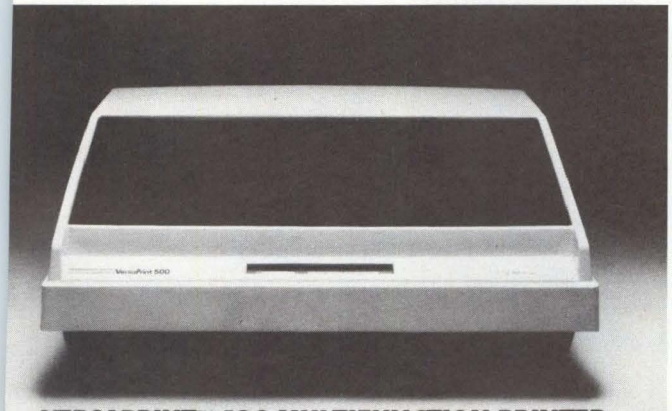

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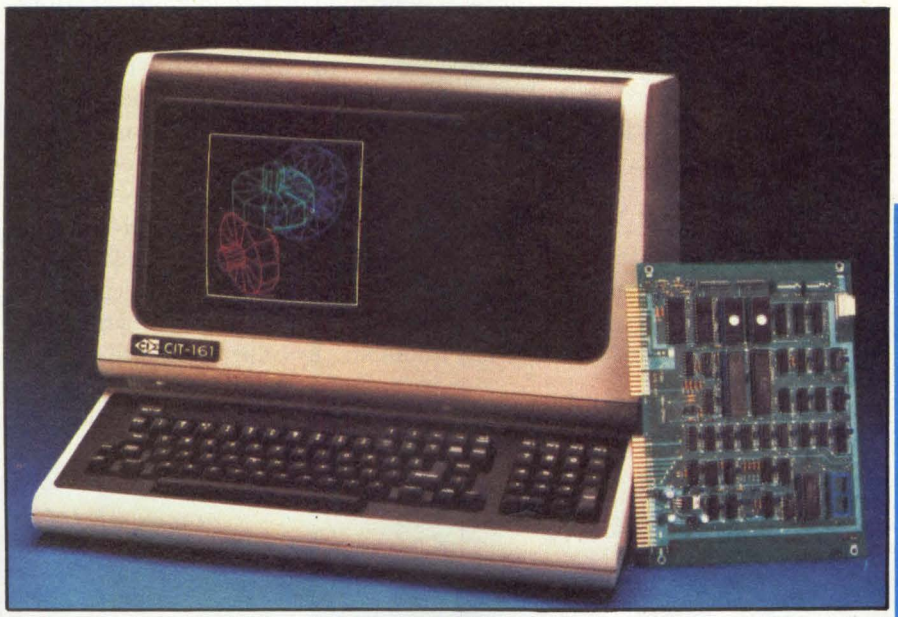
Selecting a smart terminal

JOSEPH FRIEDMAN, C. Itoh Electronics

Smart terminals offer advanced features at little more than dumb terminal prices

In the same way a system's configuration should reflect current and future applications, its supporting terminals should reflect design elements that will keep it from becoming obsolete. Choosing a terminal with staying power requires understanding the impact of intelligence on price and performance, compatibility and emulation issues, application-specific capabilities and ergonomics.



Add-on graphics capabilities *eliminate the need for users to choose between higher priced graphics terminals and terminals with no graphics capabilities. The C. Itoh DEC VT100-compatible color terminal (above) accepts a bit-mapped graphics board for business graphics and CAD applications.*

The role of intelligence

As microprocessor chips increased in sophistication, system designers found they could move intelligence around to various parts of a system. Infusing terminals with intelligence, or firmware, opened a whole new area for terminal manufacturers that found they could add features directly to the terminal without relying on the host CPU or system-resident software. As a result, terminals began to be distinguised as "dumb," "smart" or "intelligent," depending on the power of their firmware. Users could choose between buying a relatively inexpensive but dumb terminal and relying on the host CPU for its intelligence, or buying a smart though significantly more expensive terminal and saving the CPU for other tasks.

Today, quasi-smart terminals have emerged as a major force in the terminal market. As user sophistication grows, and as applications require more precise planning and design, terminals are playing a far greater role than just hardware add-ons.

Compatibility and emulation

Perhaps the most important aspect of terminal-system integration is compatibility/emulation. These are the watchwords both for OEMs and system integrators designing entire systems and for end users looking for add-on capabilities after a system has been purchased.

The difference between compatibility and emulation can be considerable. Though both definitions imply plug compatibility, saying a terminal is compatible, for example, with Digital Equipment Corp. or

Tektronix Inc. terminals usually suggests that the compatible terminal accepts 90 to 95 percent of DEC or Tektronix software. An emulating terminal supports 100 percent of the software and, therefore, enters a significantly larger established application market.

No terminal was ever intended to span the range of display solutions.

The term "compatibility" is most useful when it concerns appearance. What a terminal "looks like" has an important psychological impact on productivity. If 50 DEC VT100s were installed and 25 more were required, the impact on operators of different-appearing terminals would be significant, even though the terminals had identical performance. Consistency of tools has proven to be one of the most important factors in maintaining high productivity.

Compatibility with standards is essential if a terminal is expected to be used when a system expands into new applications. An OEM defeats obsolescence by providing its customers with a migratory path that allows new technology to be integrated with minimal expense and discomfort. This allows users to adapt their terminals to new application software that produces, for example, color or graphics displays.

From manufacturers' and users' standpoints, terminal obsolescence is virtually eliminated when the American National Standards Institute recommendations are designed into the terminals. Because of the broad acceptance of ANSI standards, users are assured their terminals will remain functional for years to come. While future generations of terminal technology will undoubtedly provide more and more functions, it is all but certain they too will be based on the ANSI mnemonic standard, which describes how devices respond to application software. In the past, there was no agreement on how features were to be implemented. While all terminals performed the same basic functions, they could not communicate with each other because commands were defined by different codes. One terminal's performance would not match another in the same application.

ANSI recommendations restored order and established commonality among terminals. Today, programs can be run on different devices because they conform to ANSI standards. The only point at issue is how many features have been implemented on a terminal, resulting in subsets and supersets of standard software programs.

Intelligent terminals may not be the best solution if more advanced software is a future possibility.

Examples of terminals keeping pace with increased system assignments are C. Itoh Electronics' plug-in graphics card options for both its monochrome and color DEC-emulating terminals, the CIT-101 and CIT-161, respectively. The CIG-201 card for the CIT-101 terminal and the CIG-261 card for the CIT-161 extend the terminals' application life by making the terminals Tektronix compatible, allowing them to use a vast store of graphics software.

OEMs serving vertical or specialty markets must anticipate their customers' needs by integrating terminals that best meet the users' current and future requirements. Color or graphics may not initially be required, but OEMs serving the broad-based business market require highly flexible terminals that can be adapted easily to a now considerable repertoire of software. These markets are best served by a terminal that can perform a variety of tasks.

In all cases, the OEM's system offering is especially price/performance sensitive with respect to terminals. The issue of terminal intelligence resurfaces. It must be decided how much intelligence necessary for terminal operation should be placed in the system's overhead—that is, whether the burden should be in the CPU, or

The DEC VT100-like keyboard *(right) provides one aspect of thorough terminal emulation. Terminals designed to replace popular terminals such as the VT100 often duplicate the original down to the color of the plastic to ease a user's transition.*

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whether the terminal should carry its own weight by absorbing some of the editing or processing functions.

Many OEMs are finding that if more advanced software is a future possibility, intelligent terminals are not necessarily the best long-term answer. Once a user is "saddled" with the terminal's intelligence, upgrading of system software must be matched to the smart terminal. Alternatively, by keeping the terminal less intelligent, an OEM maintains greater design flexibility.

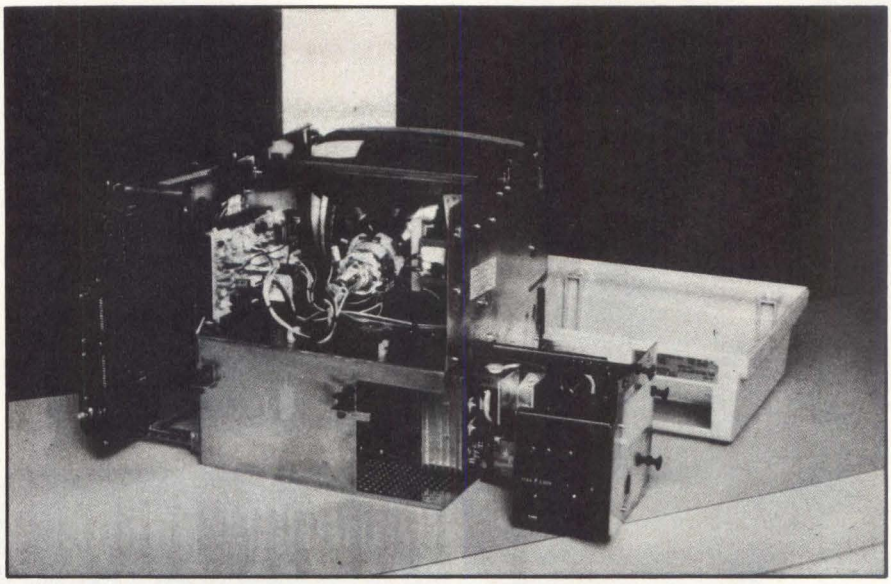
Conversely, if a system is using a dumb terminal and it is necessary to expand it to a multi-station operation, a burden that might result in system degradation could be placed on the CPU. By designing a quasi-smart terminal into a system's initial and future structure, the system's capability will not be taxed if the terminal can perform some processing or editing.

Application-specific capabilities

No one terminal was ever intended to span the range of display solutions, although applications exist for which specific terminals are best suited. While graphics and color attract much market attention, a great need still exists for basic terminals. C. Itoh's DEC-compatible CIT-80 is an example of a basic terminal. It is designed to assemble, collate and access only alphanumeric data on a continual basis. These tasks require terminals that are CPU managed, falling below the quasi-smart level of terminal intelligence. The CIT-80 is frequently customized by OEMs with add-on boards or custom firmware to provide more subtle data-display management.

More sophisticated application-directed terminals, such as C. Itoh's CIT-101 and its color counterpart, the CIT-161, to a quasi-smart extent, can manage themselves.

C. Itoh's entry into graphics has been along two paths: by plug-in graphics cards and by Tektronix-compatible graphics terminals. The monochrome CIT-414 and color CIT-427 Tektronix-compatible terminals address the two major graphics applications: engineering or CAD/CAM previewing and business graphics.



Terminal service access *is simplified by sliding sub-assemblies and plug-in boards.*

The CIT-414 and -427 are terminals designed for specific applications. In CAD/CAM environments, they are used to preview designs and confirm that no major errors exist. While CAD/CAM design typically requires high resolutions of 1024 × 1024 or greater, previewing can be accomplished with medium resolutions of 512 × 512 and even 480 × 240. Once engineers are satisfied with the preview level, they can verify and complete the design project on the larger, high-resolution graphic display system.

Before the availability of previewing terminals, CAD/CAM users were required to add a $15,000 high-resolution device, which was purchased primarily for previewing. The medium-resolution CIT-414 and -427 terminals provide monochrome previewing for less than $1900 and color previewing for approximately $3600, respectively.

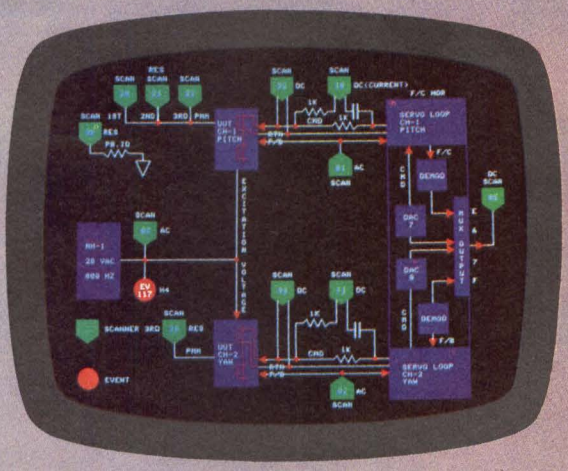
Business graphics in the Tektronix-defined environment has evolved more slowly than in the DEC market because a high-resolution terminal carries the same basic price as the remainder of the system. But now, the business market is adapting Tektronix application software cost-effectively to $8000 to $12,000 minicomputer and microcomputer systems.

Color alphanumeric terminals have also not created a significant market demand until recently. Color terminals sell for $500 to $1000 more than monochrome terminals, and OEMs and end users must be convinced that color could be translated directly into productivity and profit. However, the problem of application software remains. There is still a distinct lack of application software that supports color alphanumeric terminals.

Ergonomics

Little attention has been given to the effects on users of prolonged terminal operation until recently. Today, the ergonomic movement has created a new generation of terminals—not in technical characteristics, but in packaging mechanics and operation. Terminal ergonomics concentrate on reducing eye and hand fatigue. Ergonomic terminals tilt to reduce glare, swivel to make efficient use of available work space, which continues to shrink, and elevate to provide a more

THE BEST HAS JUST BECOME THE BEST DEAL.



Ramtek's popular 6211 Colorgraphic Terminal is now just $4995.* This versatile desk-top unit is ideally suited for the majority of color graphic applications in CAD, science, business, and control systems. Rack mounted (without monitor), it's even more of a value at just $3995.

Need data terminal functions, too? The companion 6221 with full VT 100™ compatibility is priced at just $5995. Plus, a discount is available on 6211 and 6221 systems when both a color printer and 35 mm slide camera are purchased.

The price of quality has never been lower. Volume discounts are also available. For details, call our office nearest you. Or, contact us at 2211 Lawson Lane, Santa Clara, CA 95050. (408) 988-1044.

Ramtek

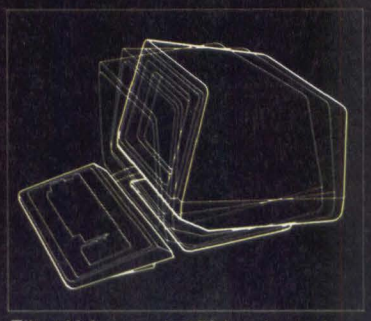
OUR EXPERIENCE SHOWS.

World Headquarters—Santa Clara, CA (408) 988-2211 **European Offices**—Amsterdam (31) 2968-5056; London (8956) 76211; Cologne (2234) 78021 **U.S. Offices**—Dallas, TX (214) 422-2200; Los Angeles, CA (714) 979-5351; Seattle, WA (206) 575-1600; Chicago, IL (312) 397-2279; Houston, TX (713) 774-2233; McLean, VA (703) 893-2020; Denver, CO (303) 694-0758; Cleveland, OH (216) 524-1882; Upper New York/Canada (716) 425-1742; New Jersey (201) 238-2090; Florida (305) 645-0780; Boston, MA (617) 273-4590; Atlanta, GA (404) 252-5066.

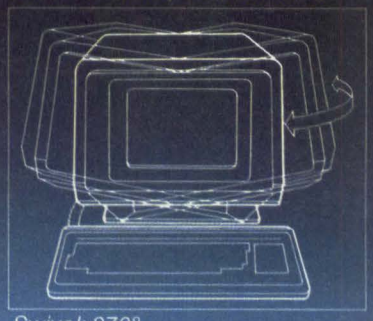
*Light pen sold separately.

VT 100 is a registered trademark of Digital Equipment Corporation.

VISUAL presents ergonomic elegance and high performance in a low-cost terminal.



Tilt: 10° forward, 15° backward



Swivel: 270°

VISUAL 50 and VISUAL 55 represent a new approach in low-cost terminals. Although they cost drastically less, they offer features you expect only from the high priced units.

For example, the enclosure is ergonomically designed in lightweight plastic and can easily be swiveled and tilted for maximum operator comfort. A detached keyboard, smooth scroll, large 7x9 dot matrix characters and non-glare screen are a few of the many human engineering features normally offered only on much higher priced terminals.

Another distinctive feature of the VISUAL 50 and VISUAL 55 is their emulation capability. Both terminals are code-for-code compatible with the Hazeltine Esprit,™ ADDS Viewpoint,™ Lear Siegler ADM-3A™ and DEC VT-52.® In addition, the VISUAL 55 offers emulations of the Hazeltine 1500 and VISUAL 210. Menu-driven set-up modes in non-volatile memory allow easy selection of terminal parameters.

And you're not limited to mere emulation. As the chart shows, the VISUAL 50 and 55 have features and versatility the older, less powerful low-cost terminals simply cannot match.

The VISUAL 55 extends the VISUAL 50 performance by adding 12 user-programmable function keys, extended editing features and selectable scrolling regions.

Both terminals are UL listed and exceed FCC Class A requirements and U.S. Government standards for X-ray emissions.

Call or write for full details.

FEATURE COMPARISON CHART

FEATURE	VISUAL 50/55	Hazeltine Esprit	ADDS Viewpoint	Lear Siegler ADM-5	TeleVideo® 910
Tilt and Swivel	YES	NO	NO	NO	NO
Detached Keyboard	YES	NO	YES	NO	NO
N-Key Rollover	YES	NO	YES	NO	NO
Audible Key Click	YES	YES	NO	NO	NO
Menu Set-Up Mode	YES	NO	NO	NO	NO
Status Line	YES	NO	NO	NO	NO
Full 5 Attribute Selection	YES	NO	NO	NO	YES
Smooth Scroll	YES	NO	NO	NO	NO
Line Drawing Character Set	YES	NO	NO	NO	NO
Block Mode	YES	YES	NO	NO	YES
Insert/Delete Line	YES	YES	NO	NO	YES
Bi-Directional Aux Port	YES	YES	NO	YES	NO
Columnar Tabbing	YES	YES	NO	NO	YES
Independent RCV/TX Rates	YES	NO	NO	NO	NO
Answerback User Programmable	YES	NO	NO	OPT.	NO

Service available in principal cities through Sorbus Service, Division of Management Assistance, Inc.

VISUAL See for yourself

Visual Technology Incorporated
540 Main Street, Tewksbury, MA 01876
Telephone (617) 851-5000. Telex 951-539

CIRCLE NO. 98 ON INQUIRY CARD

comfortable user posture. The aim is increased user productivity, measured by fewer errors, less stress, greater accuracy and more user satisfaction.

Some basic ergonomic features that terminal manufacturers consider when developing their next generations of human-responsive terminals include:

- Keyboard design considerations, which include distance and height of key caps from the perpendicular surface of the table and placement of the keys. Palm rests are effective in reducing stress caused by constant use.
- Display size, a consideration in which larger does not necessarily mean better. Because raster-scan devices present data in matrix format, lines between dots become more noticeable and bothersome as spaces become bigger, and user performance and satisfaction drop.
- Video resolution, which cannot be achieved with a low-cost monitor and so continues to be a terminal's major cost factor. Resolution is not subjective, but a quantifiable characteristic: poor resolution creates stress and reduces efficiency.
- Phosphor choice, which is highly subjective and a matter of user preference. Black-and-white screens are the standard, but some users find green and amber presentations less stressful.
- Video highlighting is a feature in which some devices call attention to errors or screen areas by blinking. But many users find blinking distracting and fatiguing to their eyes. One alternative is using a dedicated area on the screen for error or system messages. Color is a particularly effective visual highlighting technique. □

Joseph Friedman is marketing manager, video terminals, at C. Itoh Electronics, Los Angeles, Calif.

Buy a BitGraph™ Terminal for $4995 and save the tough decision for later.

With BitGraph, you get a lot to choose from. For starters, it's a high resolution graphics terminal. And thanks to state-of-the-art raster-scan technology and a 1024 x 768 pixel display, its pictures are spectacular. So good, in fact, you won't be able to come up with many graphics jobs BitGraph can't do. It can handle business, scientific and engineering applications.

But graphics is just the beginning. BitGraph is also an exceptional text processing terminal. Its full-page format makes it perfect for document previewing and editing. What's more, its high resolution screen can reproduce almost any type font.

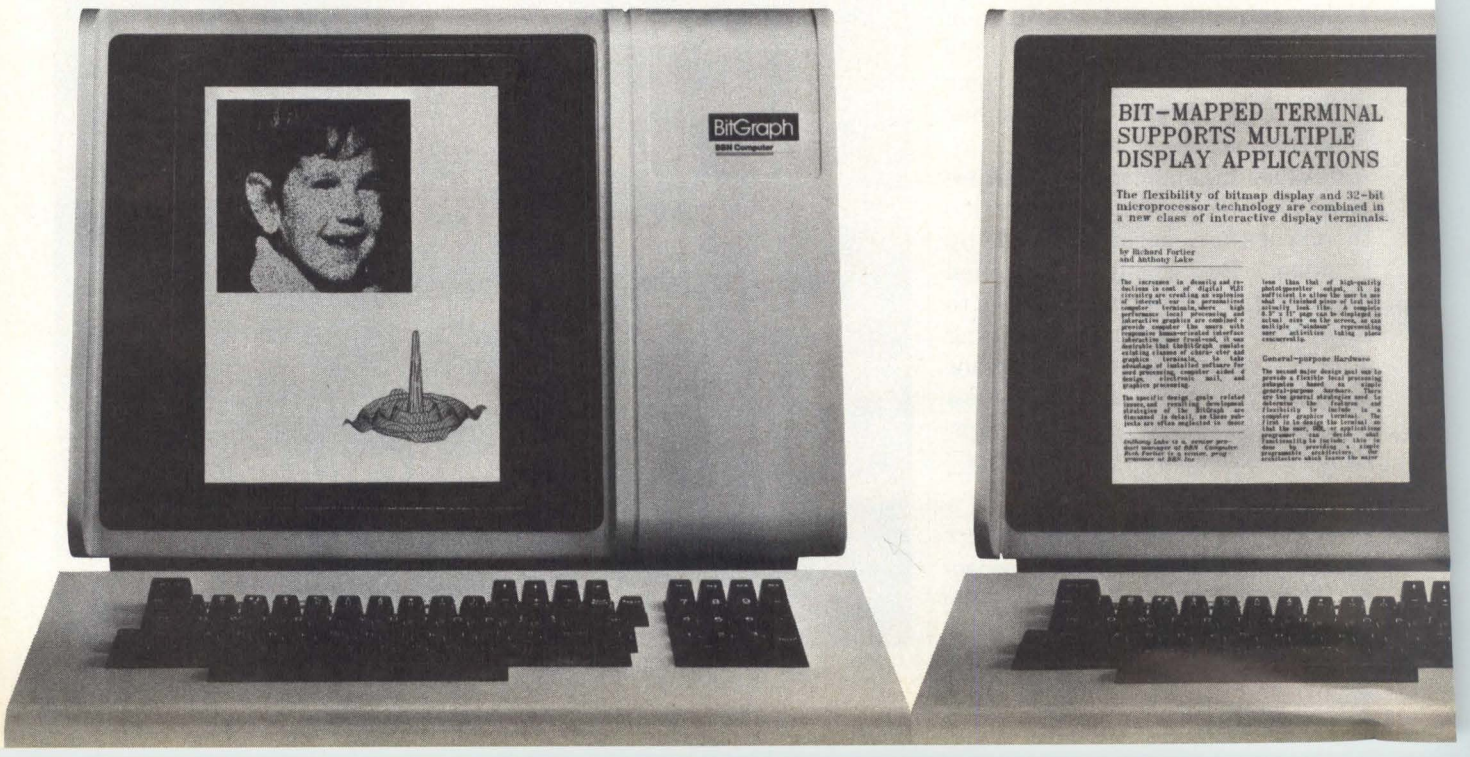
And, to make your decision even harder, BitGraph is a text *and* graphics terminal as well. It can mix words and pictures anywhere on the screen, and in any combination.

BitGraph has a lot of other things going for it, too. Like its high performance 68000 microprocessor (user programmable with up to 512K RAM). Its ability to emulate the Tektronix® 4010 and DEC's VT100™ and VT52™ terminals. And its compatibility—it can plug into just about any host system through

BUY BEFORE

BitGraph is a high resolution—
1024 x 768 pixels—graphics terminal.*

BitGraph is a multiple font
text terminal.*



an RS232 port. Plus BitGraph has a high-speed parallel printer interface.

And then there's the price. At $4995, no other terminal can come close to delivering so much for your money.

Of course, you may have already decided exactly why you want a BitGraph, and we think that's great. But isn't it a nice feeling to know that you can always change your mind.

For more information about all the things BitGraph can do, send in the coupon or call (617) 497-3268.

BitGraph is a trademark of BBN Computer Corporation.
DEC VT100 and VT52 are trademarks of Digital Equipment Corporation.
Tektronix is a registered trademark of Tektronix, Inc.

*Actual screen reproduction.

I want to know more about BitGraph.™

☐ Please send me a brochure.
☐ Please have your sales representative call.

Name

Company Phone

Address

City State Zip

Send to: BBN Computer Corp., Marketing
33 Moulton Street, Cambridge, MA 02238.

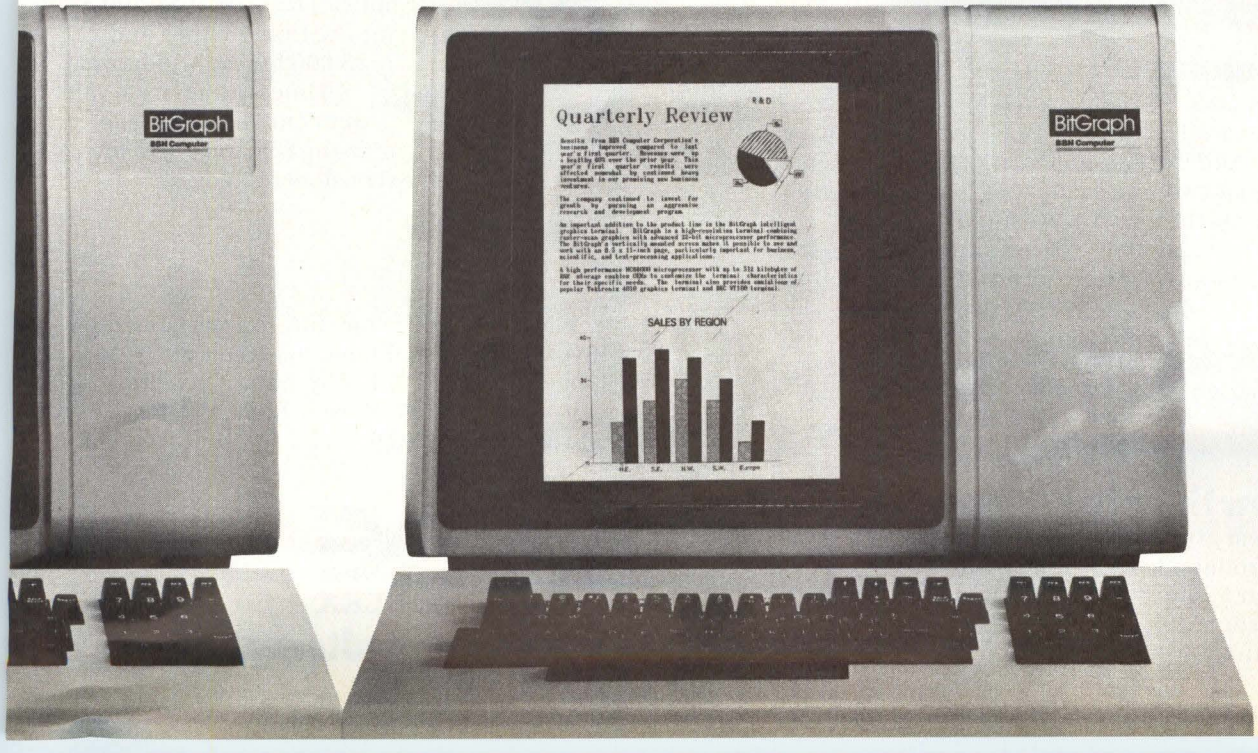
BBN Computer

A subsidiary of Bolt Beranek and Newman Inc.

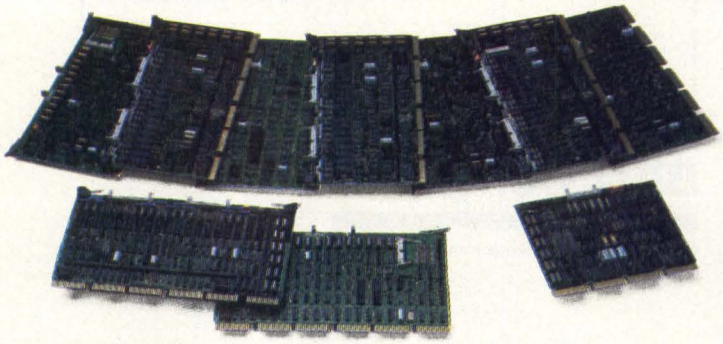
YOU CHOOSE.

BitGraph is a combination text *and* graphics terminal.*

CIRCLE NO. 101 ON INQUIRY CARD

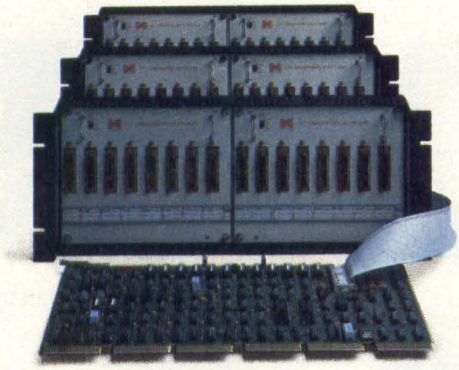


Five reasons why DEC users should buy Emulex communications controllers.



Broad product line featuring our new DMF-32 emulation.

Nobody covers LSI-11, PDP-11, and VAX-11 users' needs like Emulex. More than 15 software-transparent controllers emulating DH11, DZ11, DV11 and DMF-32. All deliver improved line-handling capabilities, in a smaller package, at lower costs.



More channels.

Emulex's new DMF-32 emulation is typical. One controller board handles up to 64 lines, vs. only eight per DEC module. And Emulex offers *all* lines with modem control, not just two. For even more lines, Emulex's Statcon Series is the answer. We simply add a low-cost port concentrator, so that with one controller board you can connect up to 256 remote *and* local terminals.

Easy growth path.

As your system grows, upgrading is simple with Emulex controllers. Just change PROM sets. Example: DH to DMF for $350. In addition, Emulex's advanced microprocessor architecture is consistent throughout the product line. Think of the inventory savings.

Fewer backplane slots.

Emulex communications controllers pack so much capability onto each board that fewer boards are needed. Take a 64-line DH11 emulation. Emulex does on one board what it takes DEC to do on 36. Think of the savings in rack space, to say nothing of price.

Lower prices.

For instance, a DEC DH11 controller lists at $8,950 per 16 lines, with expansion chassis costing $3,000 or more. Compare that to Emulex's CS11/H at $4,500 for the first 16 lines and $3,000 for each additional 16 lines. At 64 lines, you suddenly have savings of about $23,000 and a lot of extra slots to boot.

Don't speculate with your communications controller dollars. Invest in Emulex. Phone toll free: (800) 854-7112. In California: (714) 662-5600. Or write: Emulex Corporation, 3545 Harbor Blvd., P.O. Box 6725, Costa Mesa, CA 92626.

EMULEX

The genuine alternative.

As your terminal needs accelerate, move to Ann Arbor. We make the CRTs used by hard-driving professionals from M.I.T. to Stanford.

Take our Ann Arbor Ambassador, for instance. Nothing about it slows you down. The editing commands use line pointers to virtually eliminate the need for pad characters. The ANSI coding lets you put parameters in your commands to speed up execution.

And that's just for starters. The Ambassador does what no other alphanumeric terminal can: it gives you a 60-line display with zoom. You choose the format best suited to your software and your comfort—24 lines, 30 lines, 48 lines. Whatever. Then instantly zoom up to 60 to see what a printout will look like. Recapture something that scrolled by too fast. Or simply check for context.

Like all Ann Arbor products, the Ambassador uses a large, easy-to-read screen—either portrait or landscape. The case can be tilt/swivel or rack mounted. And the detached keyboard provides dozens of programmable keys to save you time.

Of course, starting at $1595, the Ambassador isn't for everyone. Just for the thousands of professionals who really want to move.

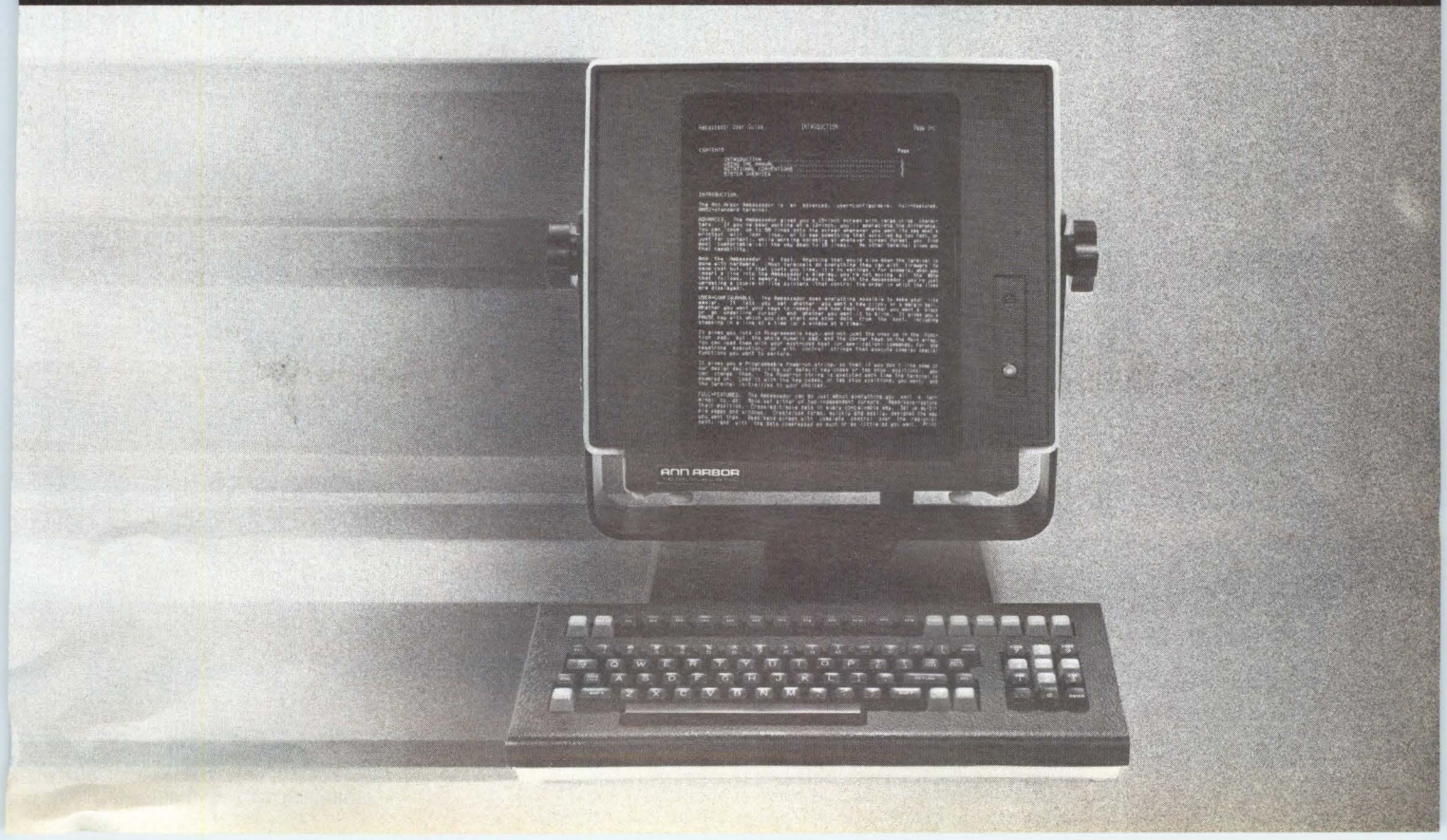
For more information, call 313/663-8000. Or write us at Ann Arbor Terminals, Inc., 6175 Jackson Road, Ann Arbor, Michigan 48103. But don't wait too long—the Ambassadors are going fast!

ANN ARBOR
TERMINALS

CIRCLE NO. 103 ON INQUIRY CARD

Once you've worked with them, you won't work without them.

0 to 60 in less than a second.



ALPHANUMERIC TERMINALS

Company Model	Dumb (Y/N)	Editing (Y/N)	Intelligent (Y/N)	Graphics (Y/N)	Portable (Y/N)	Color (Y/N)	Display	Screen format (col. x lines)	Price ($)
ADVANCED ELECTRONICS DESIGN, INC.									
512	N	N	Y	Y	N	Y	13/19-in. CRT	85 x 53	9500
767	N	N	Y	Y	N	Y	13/19-in. CRT	127 x 63	14000
AMALGAMATED WIRELESS, LTD.									
8602	N	Y	N	Y	N	Y	14-in. 7-color CRT	80 x 25	2300, Q200
VTE-6	N	Y	N	N	N	N	12-in. white/green CRT	80 x 25	2400, Q200
AMPEX CORP.									
D-30	N	Y	N		N	N	12-in. green/amber/white CRT	80 x 25	629, Q100
D-80	N	Y	N		N	N	white/green/amber CRT	80 x 25	729, Q100
D-81	N	Y	N		N	N	white/green/amber CRT	80 x 25	764, Q100
ANDERSON JACOBSON, INC.									
AJ 510	N	Y	N	Y	N	N	15-in. green CRT	80 x 24	1995
AJ 520	N	N	N	Y	N	N	15-in. green/amber CRT	80/132 x 24	2395
ANDROMEDA SYSTEMS									
VDT II	Y	N	N	Y	N	N	12-in. B&W CRT	80 x 24	1700
ANN ARBOR TERMINALS, INC.									
Ambassador	N	Y	N	N	N	N	15-in. green CRT	80 x 18/60	1595
Genie	N	Y	N	N	N	N	15-in. white CRT	80 x 18/30	1395
Genie Plus	N	Y	N	N	N	N	15-in. white CRT	80 x 18/30	1195
Guru	N	Y	N	N	N	N	15-in. green CRT	170 x 66	2195
APPLIED DIGITAL DATA SYSTEMS, INC.									
Viewpoint A-1	Y	N	N	N	N	N	12-in.	80 x 24	650
Viewpoint A-2	Y	N	N	N	N	N	12-in.	80 x 24	650
Viewpoint/3A-Plus	Y	N	N	N	N	N	12-in.	80 x 24	650
Viewpoint/60	N	Y	N	Y	N	N	12-in. green, white	80 x 25	895
Viewpoint/78	Y	N	N	Y	N	N	12-in. green, white	80 x 25	1095
Viewpoint/90	N	Y	N	Y	N	N	12-in. green, white	80 x 25	1195
Viewpoint/Color	N	Y	N	Y	N	Y	13-in.	80 x 25	1095
ARTS COMPUTER PRODUCTS, INC.									
combination unit	Y	N	N	N	N	Y	12/25-in. CRT	40 x 22	10649
LPVT	Y	N	N	N	N	Y	12/25-in. CRT	49 x 22	6999
Orator	Y	N	Y	N	N	Y	CRT	80 x 24	4649
AXLON, INC.									
Datalink 1000	Y	N	N	N	Y	N	16-char. LCD	16 x 1	399
AYDIN CONTROLS									
Aycon/15	Y	N	N	Y	Y	Y	13/25-in. CRT	72/80 x 34/48	10000
Aycon/17	N	Y	N	Y	Y	Y	13/25-in. CRT	72/80 x 48	2400
Aycon/17PCT	N	Y	N	Y	Y	Y	13/25-in. CRT	80 x 48	3400
AZURDATA, INC.									
Scorepad 2.5	N	Y	N	N	Y	N	LED	24 x 1	1850
BBN COMPUTER									
BitGraph	N	N	Y	Y	N	N	15-in. B&W CRT	85 x 66	5000

Interfaces	Specify fonts	Special features
RS232, current loop, DMA (DEC)	5 x 7, 7 x 12	Tektronix emulation
RS232, current loop, DMA (DEC)	5 x 7, 7 x 12	anti-aliased, vector drawings, Tektronix emulation 4010 series
dual RS232C	multi 256 character set, double-size	tilt/swivel screen, daisy-chain clustering
dual RS232C	96ASCII	tilt screen, daisy-chain clustering
RS232C, 20mA loop, printer port		detached keyboard, page/scroll, 20 prog. keys
EIA, CCITT	ASCII, graphics	video attributes: variable intensity, inverse, underline, blink
EIA, CCITT	ASCII	smart terminal, 21K memory, 24 programmable keys, video
DEC LSI-11 Q-Bus	ASCII, graphics	Teletronics 40-10 graphics capabilities, others
RS232 standard; RS442, 20A, optional	95ASCII	zoom, 38 function keys, printer port
RS232 standard; RS442, 20A, optional	95ASCII	zoom, 38 function keys, printer port
RS232 standard; RS442, 20A, optional	95ASCII	zoom, 26 function keys, meta key mode
RS232 standard; RS442, 20A, optional	95ASCII	horizontal, vertical zoom, 38 programmable keys
RS232C	5 x 7	ADDS-compatible, 3 function keys, detachable keyboard, tilt screen
RS232C	5 x 7	
RS232C	5 x 7	
RS232C, RS442, current loop	128ASCII	detachable keyboard, 16 function keys
RS232C, RS422, current loop	128ASCII	detachable keyboard, IBM extended character set, 2-position screen
RS232C, RS442, current loop	128ASCII, 256 custom symbols	detachable keyboard, 30 programmable function keys
RS232C, RS442, current loop	128ASCII	detachable low-profile keyboard, tilt/swivel cabinet
RS232C, asynchronous ASCII	large print, others	synthetic speech, buffer review system
RS232C, asynchronous ASCII	large print, others	buffer review system
RS232C, asynchronous ASCII	Helvetica, varying sizes	synthetic speech, buffer review system
serial TTL TV interface	upper-case only	built-in 300/110 baud modem
Bisynchronous	process control font	OEM packaging, 2 character sizes
RS232C, Bisynchronous		OEM packaging, reprogrammable characters, 2 character sizes, light pen
RS232C		2 character sizes, 64K bytes RAM, CP/M, OEM packaging
RS232C		20-character keyboard, 64K bytes memory, 32K bytes ROM
RS 232, 20 mA		emulates DEC VT-52, VT-100, Tektronix 4010

Company Model	Dumb (Y/N)	Editing (Y/N)	Intelligent (Y/N)	Graphics (Y/N)	Portable (Y/N)	Color (Y/N)	Display	Screen format (col. x lines)	Price ($)
BEEHIVE INTERNATIONAL									
ATL-008	N	Y	N	Y	N	N	14-in. green CRT	80/132 x 24	1395
DM83	N	Y	N	N	N	N	12-in. green CRT	80 x 24	1995
Topper	N	Y	N	N	Y	N	12-in. green CRT	80 x 24	2995
BURR-BROWN RESEARCH CORP.									
TM25	Y	N	N	N	Y	N	LED	8 x 1	249
TM27	Y	N	N	N	Y	N	LED	8 x 1	250
TM70	Y	N	N	N	Y	N	LED	12 x 1	450
TM71	Y	N	N	N	Y	N	LED	16 x 1	595
TM71B	Y	N	N	N	Y	N	LED	16 x 1	1495
TM77	Y	N	N	N	Y	N	LED	16 x 1	595
TM77B	Y	N	N	N	Y	N	LED	16 x 1	1495
BURROUGHS CORP.									
DE700	N	N	Y	N	N	N	12-in. green CRT	80 x 26	3995
MT785	N	N	Y	N	N	N	12-in. green CRT	80 x 26	3072
MT985	N	Y	N	N	N	N	12-in. green CRT	80/40 x 26	2010
C. ITOH ELECTRONICS									
CIT-101	Y	N	N	Y	N	N	12-in. B&W/green/amber CRT	80/132 x 24	1695
CIT-161	Y	N	N	Y	N	Y	12-in. 8-color CRT	80/132 x 24	2795
CIT-414	N	N	N	Y	N	N	12-in. green CRT	80 x 24	1895
CIT-500	N	Y	N	N	N	N	15-in. green CRT	80 x 66	1995
CIT-80	Y	N	N	N	N	N	12-in. B&W/green/amber CRT	80 x 24	1195
CALCOMP									Did not respond;
CALLAN DATA SYSTEMS									
CD100L	N	N	Y	Y	N	N	12-in. green CRT	80 x 25	2995
CD100M	N	N	Y	Y	N	N	12-in. green CRT	80 x 25	3450
CARTERFONE COMMUNICATIONS CORP.									
7276	N	N	Y	N	N	N	12-in. B&W CRT	80 x 24	2995
7700	N	Y	N	N	N	N	12-in. green CRT	64 x 23	6800
7800 Series	N	Y	N	Y	N	N	12-in. B&W CRT	80 x 24	2280
9830	N	Y	N	N	N	N	12-in. green CRT	80/40 x 24/12	1795
CHROMATICS, INC.									
CG Series	N	Y	Y	Y	N	Y	13–19-in. 8-color raster	85 x 48	6000
CT 4100	N	Y	Y	Y	Y	Y	13-in. 8-color raster	80 x 48	2995
CT 4200	N	Y	Y	Y	Y	Y	13-in. 8-color raster	85 x 40	3995
CT 4300	N	Y	Y	Y	Y	Y	13-in. 8-color raster	85 x 48	6995
CIFER SYSTEMS, LTD.									Did not respond;
COBAR, INC.									
3100	N	Y	N	Y	N	N	12-in. white/green/amber CRT	80/132 x 24	1195
3132	N	Y	N	Y	N	N	15-in. white/green/amber CRT	80/132 x 24	1495
3830	N	Y	N	N	N	N	15-in. white/green/amber CRT	80/132 x 25	1795
CODEX CORP.									
CDX268	N	Y	N	Y	Y	N	15-in. green/amber CRT	80 x 25	1895

Interfaces	Specify fonts	Special features
RS232, RS422, 20mA current loop		MC68008 processor, horizontal/vertical scrolling, multiple windows
Burroughs TD1, dual RS232		Burroughs TD830 and MT983 compatible
dual RS232	ASCII, EBCDIC	IBM 3270 compatible with CC76 cluster controller (BSC, SNA)
RS-232-C, 20mA current loop	numeric	sealed, tactile feel keyboard, function keys
RS422	numeric	sealed, tactile feel keyboard, polled operation, function keys
RS232C, 20mA current loop	alphanumeric	sealed, tactile feel keyboard, polled operation, function keys
RS232C, 20mA current loop, RS422	alphanumeric	sealed keyboard, polled operation, function keys
RS232C, RS422	alphanumeric	integral bar code wand, 5 switch-selectable bar codes
RS232C, 20mA current loop, RS422	alphanumeric	sealed numeric keyboard, polled operation, function keys
RS232C, RS422	alphanumeric	integral bar code wand, 5 switch-selectable bar codes
RS232C	7 x 9	
RS232C	7 x 9	
RS232C	7 x 9	
RS232C, 20mA current loop	128ASCII, 128 alternate	DEC VT-100 compatible, printer port, detached keyboard
RS232C, 20mA current loop	128ASCII, 128 alternate	ANSI X3.64, printer port, detached keyboard
RS232C, 20mA current loop	128ASCII	ANSI alphanumeric mode, crosshair cursor, graphic print port
RS232C, 20mA current loop	256-character set, RAM loadable	full-page display, programmable keys, character set, printer port
RS232C, 20mA current loop	128ASCII	DEC VT-52 compatible, printer port, detached keyboard
see directory for address		
RS232C	ASCII	14-slot DEC Q-Bus backplane
RS232C	ASCII	8-slot Multibus backplane
EIA RS232		IBM 3270 BSC/SNA compatible
EIA RS232		communicates concurrently with TWX, DDD, TLX, PTL
EIA RS232		supports 83B3, 8A1, 85A, or X-6N, X-OFF protocols
EIA RS232, TDI		Burroughs TD 830 compatible
RS232C, RS422, PIO/MDA	192 user-defined	512 x 512 resolution, 8 programmable function keys
RS232C	256 characters	4-page screen memory, tone generator, character graphics
RS232C	256 characters	512 x 384, tone generator
RS232C	256 characters	1024 x 768, tone generator
see directory for address		
		printer port, user-programmable function keys
		printer port, conversation port, programmable function keys
RS232C, RS422		detachable keyboard, 12 function keys

Company Model	Dumb (Y/N)	Editing (Y/N)	Intelligent (Y/N)	Graphics (Y/N)	Portable (Y/N)	Color (Y/N)	Display	Screen format (col. x lines)	Price ($)
COLORGRAPHIC COMMUNICATIONS CORP.									
MVI-100	N	N	Y	Y	N	Y	13-in. CRT	80 x 24/28	2750
COLUMBIA DATA									Did not respond;
COMARK CORP.									
MB85-12	N	N	Y	N	N	N	12-in. B&W CRT	80 x 24	
MB851	N	N	Y	N	N	N	12-in. B&W CRT	80 x 24	
QB111	N	N	Y	Y	N	N	12-in. B&W CRT	80 x 24	
COMMUNICATIONS AND SPECIAL SOFTWARE									
Workstation I	N	N	Y	N	N	N	11-in. white CRT	80 x 24	6395
COMPUTEK, INC.									
Display 8115	N	Y	N	Y	N	N	12-in. CRT	80 x 25	
Display 8125	N	N	Y	Y	N	N	12-in. CRT	80 x 25	
Display 8135	N	N	Y	Y	N	N	12-in. CRT	80 x 25	
COMPUTER TALK, INC.									
423	N	N	Y	Y	Y	N	11-in. B&W CRT	64/72/80 x 20/22/25	3606
427	N	N	Y	Y	N	N	11-in. B&W CRT	64 x 20/30	3136
COMPUTERWISE, INC.									
TransTerm 1	Y	N	N	N	Y	N	B&W LCD	32 x 2	449
TransTerm 2	Y	N	N	N	Y	N	B&W LCD	80 x 1	549
TransTerm 3	Y	Y	N	N	Y	N	B&W LCD	40 x 2	499
COMTERM, LTD.									Did not respond;
CONTROL CONCEPTS									
CC-3276	N	Y	N	N	Y	N	12-in. green CRT	80 x 24	3350
EM-3275	N	Y	N	N	Y	N	12-in. green CRT	80 x 24	2500
EM-3276	N	Y	N	N	Y	N	12-in. green CRT	80 x 24	2600
CPU COMPUTERS, LTD.									Did not respond;
CROMEMCO, INC.									
C-1	Y	N	N	Y	Y	N	12-in. green	80 x 25	295
C10	N	Y	N	Y	Y	N	12-in. green	80 x 25	995
CYBERNEX, LTD.									
MDL-150	N	Y	N	Y	N	N	12-in. B&W CRT	80 x 25	
XL-87	N	Y	N	N	N	N	12-in. B&W CRT	80 x 25	
DACOLL ENGINEERING SERVICES, LTD.									
M242	N	Y	N	N	N	N	12-/15-in. green CRT	80/132 x 25	
M248	N	Y	Y	Y	N	N	12/15-in. green CRT	80/132 x 25	1367
M262	N	Y	Y	Y	N	N	12/15-in. green CRT	80/132 x 25/132	1032
DATA GENERAL CORP.									
280C	Y	N	N	N	N	Y	13-in. CRT	80 x 24	3750
6110APL	Y	N	N	N	N	N	12-in. B&W CRT	80 x 24	2700
D200	Y	N	N	N	N	N	12-in. B&W CRT	80 x 24	1950
D400	N	Y	Y	N	N	N	12-in. P31 green CRT	80/135 x 24	2300

Interfaces	Specify fonts	Special features
RS232C I/O, RS232C output only	128ASCII, 32-line drawing, 256 user-defined	horizontal scroll, 4 addressable cursors, 24 programmable function keys
see directory for address		
RS232C, 48-line parallel I/O		8-slot IEEE 796 card file, 5-MHz 8085 CPU
RS232C, 48-line parallel I/O		8-slot IEEE 796 card file, 5-MHz 8085 CPU, sealed terminal
RS232C		
IBM 3270 bisynchronous, universal asynchronous	ASCII, math, line drawing	simultaneous IBM, asynchronous communications
dual RS232C	128 characters	video attributes, 96-key keyboard
dual RS232C, RS449 port optional	128 characters	RAM, dual 5¼-inch floppies
dual RS232C, RS449 port optional	128 characters	80K bytes RAM, one 5¼-in. floppy, one 5½-in. Winchester
RS232C	ASCII	light pen
RS232C	ASCII	Z80 processor
RS232C		block send mode, polled/multidrop mode
RS232C		24-line buffer memory
RS232C		1920 character buffer, battery powered
see directory for address		
RS232C standard; RJ11C optional	EBCDIC	controller, display, keyboard, printer port
RS232C standard; RJ11C optional	EBCDIC	controller, display, keyboard, printer port
RS232C standard; RJ11C optional	EBCDIC	controller, display, keyboard, printer port
see directory for address		
S-100 bus serial interface	American, bold, graphics, scientific	
RS232C, Centronics parallel, serial printer	American, bold, graphics, scientific	64K bytes RAM, 24K bytes ROM
	96 characters	detached keyboard, numeric pad, Hazeltine emulator optional
RS 232, 20 mA		
V24, 20mA		9 screen attributes
V24, 20mA		
RS-170 output; RS232C, 20mA	same as D400	
RS232C, 20mA	APL graphics, 96ASCII	
RS232C, 20mA	U.S., U.K., Danish/Norwegian, French, German	
RS232C, 20mA	same as D200	24 windows, horizontal scrolling, multi-lingual, special characters

Company Model	Dumb (Y/N)	Editing (Y/N)	Intelligent (Y/N)	Graphics (Y/N)	Portable (Y/N)	Color (Y/N)	Display	Screen format (col. x lines)	Price ($)
D450	N	Y	Y	Y	N	N	12-in. P31 green CRT	80/135 x 24	2800
DATA TYPE, INC.									
Autograph 110	N	Y	N	Y	N	N	12-in. green CRT	80 x 24	1795
Autograph 120	N	Y	N	Y	N	N	12-in. green CRT	80 x 24	1995
Autograph 125	N	Y	N	Y	N	N	12-in. green CRT	80 x 25	2195
Autograph 150	N	Y	N	Y	N	N	12-in. green CRT	80 x 25	2395
Autograph X5A	N	Y	N	Y	N	Y	14-in. color CRT	132 x 34	4995
Autograph XKI	N	Y	N	Y	N	N	15-in. green CRT	132 x 34	4495
DATAMEDIA CORP.									
3270-Series	N	Y	N		N	N	14-in. green CRT	80 x 24	
ColorScan 10	N	Y	N		N	Y	12-in. 8-color CRT	80/132 x 24	3195
ColorScan 30	N	Y	N		N	Y	12-in. 8-color CRT	80/132 x 24	3195
ColorScan 60	N	Y	N		N	Y	12-in. 8-color CRT	80/132 x 24	3395
ColorScan 70	N	Y	N		N	Y	12-in. 8-color CRT	80/132 x 24	3195
Excel 10	N	Y	N		N	N	12/14-in. white/green CRT	80/132 x 24	1695
Excel 20	N	Y	N		N	N	12/14-in. white/green CRT	80/132 x 24	1495
Excel 30	N	Y	N		N	N	12/14-in. white/green CRT	80/132 x 24	995
Excel 50	N	Y	N		N	N	12/14-in. white/green CRT	80/132 x 24	1840
Excel 60	N	Y	N		N	N	12/14-in. white/green CRT	80/132 x 24	1895
Excel 70	N	Y	N		N	N	12/14-in. white/green CRT	80/132 x 24	1395
DATAPOINT									
8220	Y	N	N	N	N	N	12-in. amber CRT	80 x 24	1895
DATAVUE CORP.									
132-C	N	Y	N	Y	N	N	13.5-in. green/amber/B&W CRT	80/132 x 24	1795
DECISION DATA COMPUTER CORP.									
3751-11	N	Y	N	N	N	N	15-in. green/gray CRT	80 x 25	2100
DELTA DATA SYSTEMS CORP.									
2830 II	N	Y	N	N	N	N	12-in. green CRT	40 x 24	2150
7303	N	Y	N	N	N	N	15-in. green CRT	80 x 28	4855
DENTRONIX SYSTEMS, INC.									
200	N	Y	N	N	N	N	12/15-in. white/green/amber CRT	80 x 25	1450
400	N	N	Y	Y	N	N	12-in. white/green/amber CRT	81/135 x 25	1650
DIGITAL EQUIPMENT CORP.									
RT-100	Y	N	N	N	N	N	12-in. B&W CRT	132 x 24	3900
RT-102	Y	N	N	N	N	N	12-in. B&W CRT	132 x 24	4000
RT-137	Y	N	N	N	N	N	12-in. B&W CRT	132 x 24	5300
VT-100	Y	N	N	Y	N	N	12-in. B&W CRT	132 x 24	1945
VT-101	Y	N	N	N	N	N	12-in. B&W CRT	132 x 24	1350
VT-102	Y	N	N	N	N	N	12-in. B&W CRT	132 x 24	1945
VT-125	Y	N	N	Y	N	N	12-in. B&W CRT	132 x 24	3800
VT-131	N	Y	N	N	N	N	12-in. B&W CRT	132 x 24	1985

Interfaces	Specify fonts	Special features
RS232C, 20mA	same as D200	same as D400
RS232C, 20mA loop	128ASCII character English, French, German	emulations: Televideo 910, Teletronix 4010
RS232C, 20mA loop	96ASCII character English, French	emulations: Televideo 920, Teletronix 4010
RS232C, 20mA loop	128ASCII character English, French, German	emulations: Televideo 925, Teletronix 4010
RS232C, 20mA loop	128ASCII character English, alternate program	emulations: Televideo 950, Teletronix 4010
RS232C, 20mA loop	128ASCII character	emulations: Televideo 925, Teletronix 4014/4027
RS232C, 20mA loop	128ASCII character	emulations: Televideo 925, Teletronix 4014
IBM 3275/3276-BSC	96EBCDIC	
RS232C, 20mA loop	128ASCII	
RS232C, 20mA loop	128ASCII	ADDS, Hazeltine, Lear Siegler emulator
RS232C, 20mA loop	128ASCII	
RS232C, 20mA loop	128ASCII	
RS232C, 20mA loop	128ASCII	
RS232C, 20mA loop	128ASCII	
RS232C	96ASCII plus 32 control	
RS232C, 20mA loop	96ASCII, 69 APL	
RS232C, 20mA loop	128ASCII	
RS232C, 20mA loop	128ASCII	
RS232C	7 x 9	detached keyboard, 10 function keys, local printer capability
RS232C	128 ASCII, programmable fonts	16 programmable function keys, 5-page memory, 24 terminal emulations
IBM 5251-1/11, 5/34 and 5/38	188-character multinational set	detachable low-profile keyboard, auto dimmer
RS232C		
RS232C		8 split screens, programmable function keys
RS232C or current loop	foreign, custom	Data General D200 replacement
RS232C or current loop	foreign, custom	Data General D400/450 replacement
RS232C	96ASCII	
RS232C	96ASCII	
RS232C	96ASCII	bar code reader
RS232C	96ASCII	
RS232C	96ASCII	
RS232C	96ASCII	printer port, advanced video option
RS232C	96ASCII	bit-mapped graphics, printer port
RS232C	96ASCII	local editing with block transmission mode

Company Model	Dumb (Y/N)	Editing (Y/N)	Intelligent (Y/N)	Graphics (Y/N)	Portable (Y/N)	Color (Y/N)	Display	Screen format (col. x lines)	Price ($)
DIRECT, INC.									
1025	N	N	Y	Y	Y	N	12-in. green/white CRT	80/132 x 24/28	3950
1031	N	N	Y	Y	Y	N	12-in. green/white CRT	80/132 x 24/28	3450
825	N	N	Y	Y	Y	N	12-in. green/white CRT	80/132 x 24/28	1890
828/1	N	N	Y	Y	Y	N	12-in. green/white CRT	80/132 x 24/28	2790
831	N	N	Y	Y	Y	N	12-in. green/white CRT	80/132 x 24/28	1395
DTI DATA TERMINALS CORP.									
FALS 200	N	Y	N	Y	N	N	12-in. green/white CRT	80 x 24	995
DTI 200 (DG)	N	Y	N	N	N	N	12-in. green/white CRT	80 x 24	995
DTI 200 (DG)	N	Y	N	N	N	N	12-in. green/white CRT	80 x 24	995
DTI 6053 (DG)	N	Y	N	N	N	N	12-in. green/white CRT	80 x 24	995
DTI Basic Four (MAI)	N	Y	N	N	N	N	12-in. green/white CRT	80 x 24	995
DTI Editor (DEC)	N	Y	N	Y	N	N	12-in. green/white CRT	80/132 x 24	995
DTI Prism (MD)	N	Y	N	N	N	N	12-in. green/white CRT	80 x 24	995
E 52 (DEC)	N	Y	N	Y	N	N	12-in. green/white CRT	80 x 24	995
Entry 81 (LS81)	N	Y	N	N	N	N	12-in. green/white CRT	80 x 24	995
Genius 300	N	Y	N	N	N	N	12-in. green/white CRT	80 x 24	995
HZ1510 Plus	N	Y	N	N	N	N	12-in. green/white CRT	80 x 24	995
Proterm 80 (DEC)	N	Y	N	Y	N	N	12-in. green/white CRT	80/132 x 24	995
Video Plus (DEC)	N	Y	N	N	N	N	12-in. green/white CRT	80 x 24	995
DY-4 SYSTEMS, INC.									
VGT-100	N	Y	N	Y	N	N	15-in. green CRT	80/132 x 16/24	2771
VGT-100H	N	Y	N	Y	N	N	15-in. green CRT	80/132 x 16/24	2966
ECS MICROSYSTEMS, INC.									
4000	N	N	Y	N	N	N	12-in. green CRT	80 x 25	1995
4700	N	N	Y	N	N	N	12-in. green CRT	80 x 25	6995
5460	N	N	Y	N	N	N	12-in. green CRT	80 x 25	3995
4200	N	N	Y	N	N	N	12-in. green CRT	80 x 25	2595
4100	N	N	Y	N	N	N	12-in. green CRT	80 x 25	2895
4500	N	Y	Y	N	N	N	12-in. green CRT	80 x 25	3995
ELBIT USA									Did not respond;
ELECTROMAGNETIC SCIENCES, INC.									
DP1001	N	Y	N	N	Y	N	red LED	16 x 1	
DP1010	N	Y	N	N	N	N	green vacuum fluorescent	40 x 1	
DP1020	N	Y	N	N	N	N	green vacuum fluorescent	40 x 2	
ENVISION									
210	N	Y	N	N	N	Y	13-in. CRT	80 x 24	2750
220	N	N	Y	Y	N	Y	13-in. CRT	80 x 24	4950
230	N	N	Y	Y	N	Y	13-in. CRT	80 x 24	6950
EPIC COMPUTER PRODUCTS									
14E	N	Y	N	Y	N	N	14-in. green CRT	80 x 25	995

Interfaces	Specify fonts	Special features
dual RS232C ports	96 character ISO, 31 line drawing characters	dual 300K-byte disk drives, CP/M V2.2, H-P block mode compatible
dual RS232C ports	96 character ISO, 31 line drawing characters	dual 300K-byte disk drives, CP/M V2.2, DEC block mode compatible
RS232C	96 character ISO	H-P block mode compatible, 16K display memory
RS232C	96-character ISO, loadable character fonts	H-P block mode, VT100 compatible, 32K display memory
RS232C	96-character ISO, loadable character fonts	DEC block mode compatible, 16K-byte display memory
RS232C, 20mA	128ASCII	programmable attributes, transparent print, local/line spy modes
RS232C, 20mA	128ASCII	detached keyboard, selectable baud rates, local/line modes
RS232C, 20mA	128ASCII	detached keyboard, line/local spy modes, switch selectable baud rate
RS232C, 20mA	128ASCII	detached keyboard, selectable baud rates, local/line modes
RS232C, 20mA	128ASCII	detached keyboard, selectable baud, local/line modes
RS232C, 20mA	128ASCII	local/conv/page modes, detached keyboard, 256-character receive buffer
RS232C, 20mA	7 x 9	local/line/spy modes, reverse video
RS232C, 20mA	128ASCII	local/conv/page modes, detached keyboard, 256-character receive buffer
RS232C, 20mA	7 x 9	programmable attributes, transparent print, local/line spy modes
RS232C, 20mA	ASCII	programmable attributes, transparent print, local/line spy modes
RS232C, 20mA	128ASCII	2-page memory, local/line modes
RS232C, 20mA	128ASCII	local/conv/page modes, detached keyboard, 256-character receive buffer
RS232C, 20mA	7 x 9	video attributes, function keys, 2-page mode
RS232	APL	
RS232	APL	
RS232, SIO		communications protocol
RS232, GPIB, SIO		80K RAM, CP/M, 1M-byte floppy drive, 10M-byte Winchester disk
RS232, GPIB, SIO		80K RAM, CP/M, 2.5M-byte floppy disk drive
RS232, SIO		80K RAM, CP/M, (requires 4650 system)
RS232, SIO		communications protocols
RS232, SIO		80K RAM, CP/M, 2.5M-byte floppy disk drives
see directory for address		
bar-code wand, 2-way radio	16 segment	radio-linked
bar-code wand, RS232	5 x 7 dot matrix	self-contained radio link
bar-code wand, RS232	5 x 7 dot matrix	self-contained radio link
RS232	96USACII, 32 graphics characters	user-defined character sets, programmable softkeys
RS232	96USACII, 32 graphics characters	graphics drawings, hardware zoom/pan
RS232	96USACII, 32 graphics characters	display list, local transformation
dual RS232C	128 ASCII, 48 international characters	

Company Model	Dumb (Y/N)	Editing (Y/N)	Intelligent (Y/N)	Graphics (Y/N)	Portable (Y/N)	Color (Y/N)	Display	Screen format (col. x lines)	Price ($)
FALCO DATA PRODUCTS									
TS-1	N	Y	Y	Y	N	N	12-in. B&W/green/amber CRT	80 x 25	1295
TS-100/132	N	Y	N	Y	N	N	12-in. green CRT	80/132 x 24	1295
TS-100SP	N	Y	Y	Y	N	N	12-in. green/amber CRT	80/254 x 25	1495
TS-132	N	Y	Y	Y	N	N	12-in. green/amber CRT	80 x 25	
TS-2	N	Y	Y	Y	N	N	12-in. B&W/green/amber CRT	80 x 25	1495
TS-2624	N	Y	Y	Y	N	N	12-in. green/amber CRT	80 x 25	1995
TS-42	N	Y	Y	Y	N	N	12-in. B&W/green/amber CRT	80 x 25	1795
FUNGUS COMPUTER PRODUCTS, LTD.									Did not respond;
G.R. ELECTRONICS									
PT12	N	Y	Y	N	Y	N	2-in. black LED	12 x 1	425
PT8	N	N	Y	N	Y	N	2-in. black LED	8 x 1	395
VDU	N	Y	Y	N	Y	N	37-in. black LCD	20 x 2	995
GENERAL DIGITAL CORP.									
VuePoint	N	N	Y	N	Y	N	10-in. orange on black plasma panel	40 x 12	3500
VuePoint Rackmount	N	N	Y	N	N	N	10-in. orange on black plasma panel	40 x 12	3950
Avant 250	N	Y	N	N	N	N	12-in. white/green CRT	80 x 24	1095
Avant 251	N	Y	N	N	N	N	12-in. white/green CRT	80 x 24	1095
SW 10	N	Y	N	N	N	N	12-in. green/amber/white CRT	80 x 25	899
SW 80	N	Y	N	Y	N	N	12-in. green/amber/white CRT	80 x 25	995
GENISCO COMPUTER CORP.									
G-1000	N	N	Y	Y	N	N	19-in. white CRT	146 x 66	9950
HARRIS CORP.									
8675	N	Y	N	Y	N	N	12-in. green CRT	80 x 25	1195
8685	N	Y	N	Y	N	N	12-in. green CRT	80 x 25	1950
8686	N	Y	N	Y	N	N	12-in. green CRT	80 x 25	1950
HAZELTINE CORP.									
Esprit I	N	Y	N	N	N	N	12-in. green CRT	80 x 24	595
Esprit II	N	Y	N	N	N	N	12-in. green CRT	80 x 24	645
Esprit III	N	Y	N	Y	N	N	12-in. green CRT	80 x 25	895
Executive 10	N	Y	N	Y	N	N	12-in. green CRT	80 x 25	1195
Executive 80/20	N	Y	N	Y	N	N	15-in. green CRT	80/132 x 25	1250
Executive 80/30	N	Y	N	Y	N	N	15-in. green CRT	80/132 x 25	1400
HEATH DATA SYSTEMS									
HS19-2	N	N	Y	Y	N	N	12-in. green CRT	80 x 24	625
HS19-3	N	N	Y	N	N	N	12-in. white CRT	80 x 25	595
HEWLETT-PACKARD CO.									
2382A	N	Y	N	N	Y	N	9-in. white CRT	80 x 24	1720
2621B	N	Y	N	N	N	N	12-in. white/amber/green CRT	80 x 24	1645
2622A	N	Y	N	N	N	N	12-in. white/amber/green CRT	80 x 24	2210

Interfaces	Specify fonts	Special features
two RS232 ports	French, German, Swedish	set-up screen, programmable function keys
RS232 standard; 20 mA current loop optional		emulates DEC VT-52, VT-100
RS232 standard; 20 mA, RS422 optional		set-up screen, 28 programmable function keys
two RS232C ports	French, German, Swedish	DEC VT-132 emulation block mode, printer port
two RS232C ports	French, German, Swedish	Lear Seigler ADM1, ADM2 emulation, programmable function keys
two RS232C ports	French, German, Swedish	Hewlett-Packard, 2624, set-up screen, printer port
two RS232C ports	French, German, Swedish	Lear Seigler ADM42 emulation, programmable function keys
see directory for address		
20mA, RS232, or dual		300/1200 baud, baud rate on block send modes
20mA, RS232, or dual		128ASCII codes
20mA, RS232, RS422		128ASCII codes, 13 selectable baud rates up to 9600
RS232	special character sets	3-page memory, touch scanner
RS232	special character sets	touch scanner, microprocessor
RS232	ASCII, forms graphics, international character sets	programmable function keys, printer port
RS232	ASCII, forms graphics	programmable function keys, printer port
RS232	ASCII, forms graphics, international characters	programmable function keys, printer port
RS232	ASCII, forms graphics, international characters	3-page memory, non-vol. programmable funct., print. port
RS232C		1024 x 792 resolution, hard copy port
RS232	128ASCII	block mode
RS232, RS422	128ASCII	numeric keypad, 20 programmable keys, auxiliary port
RS232, RS422	128ASCII	industry standard keyboard layout
dual RS232 ports	ASCII	block mode, VT-52 package
dual RS232 ports	ASCII	block mode, local print
dual RS232 ports	ASCII, line drawing graphics	block mode, buffer print, smooth scroll, video attributes
dual RS232 ports	ASCII, line drawing	horizontal split screen, programmable function keys, video
dual RS232 ports	ASCII, line drawing	horizontal split screen, programmable function keys, video
dual RS232 ports	ASCII, line drawing	2-page memory, data/video attributes, programmable function keys
RS232C	ASCII	DEC VT-52 software compatible, 8 programmable keys
RS232C	ASCII	DEC VT-100 software compatible, 8 programmable keys
RS232C	international languages, line drawing	8 screen-label keys, block mode, detached keyboard
RS232, RS422, 20mA	international languages	8 screen-label keys, numeric keypad, detached keyboard
RS232, 20mA, RS422	international languages, line drawing	8 screen-labeled keys, block mode, detached keyboard

Company Model	Dumb (Y/N)	Editing (Y/N)	Intelligent (Y/N)	Graphics (Y/N)	Portable (Y/N)	Color (Y/N)	Display	Screen format (col. x lines)	Price ($)
2623A	N	Y	N	Y	N	N	12-in. white/green/amber CRT	80 x 24	3800
2624B	N	Y	N	N	N	N	12-in. white/green/amber CRT	80 x 24	3035
2626A	N	Y	N	N	N	N	white/green/amber CRT	80 x 24	4400
2626W	N	Y	N	N	N	N	12-in. white/amber/green CRT	80 x 24	5000
2627A	N	Y	N	Y	N	Y	12-in. white CRT	80 x 24	5975
2647F	N	N	Y	Y	N	N	12-in. B&W CRT	80 x 24	9950
2703A	N	Y	Y	Y	N	Y	12-in. white CRT	80 x 24	19900
HITACHI, LTD.									Did not respond;
HMW DATA SYSTEMS, GMBH									
Color 1	N	N	Y	Y	N	Y	13-in. 32-color CRT	80 x 24/48	4000
Color 2001	N	N	Y	Y	N	Y	13-in. 8-color CRT	80 x 24/48	3000
Color 4001	N	N	Y	Y	N	Y	13-in. 8-color CRT	80 x 24/48	6000
HMW ENTERPRISES, INC.									
9081	N	N	Y	Y	N	Y	19-in. 8 background colors CRT	80 x 48	5100
90B3-S	N	N	Y	Y	N	Y	13-in. 8 background colors CRT	80 x 48	4100
9203	N	N	Y	Y	N	Y	13-in. 8 background colors CRT	80 x 48	5500
HONEYWELL, INC.									
VIP 200/7205/7207	N	Y	N	Y	N	N	12-in. white CRT	80 x 24	1980
VIP 7201	N	Y	N		N	N	12-in. green CRT	80 x 24	795
VIP 7301/7303/7307	N	Y	N	Y	N	N	12-in. green CRT	80 x 25	1900
VIP 7801/-02/-04/-05	N	Y	N	Y	N	N	12/15-in. white/green CRT	80 x 25	3175
VIP7814	N	Y	N	Y	N	N	12-in. green CRT	80 x 25	2700
VTS 7710	N	Y	N	Y	N	N	12-in. green CRT	80 x 24	5785
VTS 7740	N	Y	N	Y	N	N	12-in. green CRT	80 x 24	13450
HUMAN DESIGNED SYSTEMS, INC.									
Concept 108	N	Y	N	Y	N	N	12-in. white/green/amber CRT	80/132 x 25	1295
Concept APL8	N	Y	N	Y	N	N	12-in. white/green/amber CRT	80/132 x 25	1495
Concept AVT	N	Y	N	Y	N	N	12-in. amber CRT	80/132 x 25	1295
Concept AVT APL8	N	Y	N	Y	N	N	12-in. amber CRT	80/132 x 25	1495
Concept CVT-APL	N	Y	N	Y	N	N	12-in. amber CRT	80/132 x 25	2095
Concept GVT	N	Y	N	Y	N	N	12-in. amber CRT	80/132 x 25	1895
IBM CORP.									Did not respond;
ICL, LTD.									Did not respond;
ICOT CORP.									
700	Y	N	N		N	N	12-/14-in. green CRT	80/132 x 24/27	1500
701	Y	N	N		N	N	12-/14-in. green CRT	80/132 x 12/43	1750
757/767/768	N	Y	N		N	N	12-/14-in. green CRT	80/132 x 12/43	1995

Interfaces	Specify fonts	Special features
RS232, RS422, 20mA, printer	international characters, line drawing	8 screen-labeled keys, detached keyboard with numeric keypad
RS232, RS422, 20mA, printer	international, line drawing	8 screen-labeled softkeys, detached keyboard with numeric keypad
RS232, RS422, 20mA, printer	international, line drawing	8 screen-labeled softkeys, detached keyboard with numeric keypad
RS232, RS422, 20mA, printer	international languages, line drawing characters	8 softkeys, word processing, detached keyboard with numeric keypad
RS232, RS422, 20mA	international languages	8 softkeys, graphics keypad, rubber band line
RS232, RS422, HP IB, 20mA	international languages	8 softkeys, numeric/graphics keypad, floppy disk drive
RS232, RS422	international languages	8 softkeys, autoplot & paintbrush software, floppy disks
see directory for address		
RS232C	512 displayable characters	programmable keyboard
RS232C	128 displayable	
RS232C	256 displayable characters	dual microprocessor-based
RS232C, 20mA current loop	64 ASCII, 256 special characters	48K bytes memory, ISC 8001G plug compatible
RS232C, 20mA current loop	64 ASCII, 256 special characters	48K bytes memory, ISC 8001G plug compatible
RS232C, 20mA current loop	64 ASCII, 256 special characters	membrane keyboard, 48K bytes memory, ISG 8001C plug compatible
RS232C, 20/60mA current loop		
RS232C, RS422		detached kbd. with numeric keypad, 7 dual-function keys
RS232C, RS422A, 20mA current loop, mil 188C		
RS232C, 20/60mA current loop	ASCII	multi-drop cluster
RS232C	7 x 8	printer adapter, scrolling detachable keyboard with numeric keypad
RS232C	96ASCII	cluster controller with keyboard, display with printer optional
RS232C	96ASCII	cluster controller with keyboard, display with printer optional
RS232, current loop	upper/lower case ASCII	4-page memory, 43 programmable keys, windowing, self-test
RS232, current loop	upper/lower case ASCII, APL	4-page memory, 43 programmable keys, windowing, self-test
RS232, current loop	upper/lower case ASCII	4-page memory, windowing, 43 programmable keys, self-test, DEC VT-100 compatible
RS232, current loop	upper/lower case ASCII, APL	4-page memory, windowing, 43 programmable keys, self-test, DEC VT-100 compatible
RS232, current loop	ASCII, APL	4-page memory, windowing, 43 programmable keys, DEC VT-100 compatible
RS232, current loop	ASCII	4-page memory, windowing, 43 programmable keys, DEC VT-100 compatible
see directory for address		
see directory for address		
RS232, RS422		
RS232, RS422		
RS232, RS422		

Company Model	Dumb (Y/N)	Editing (Y/N)	Intelligent (Y/N)	Graphics (Y/N)	Portable (Y/N)	Color (Y/N)	Display	Screen format (col. x lines)	Price ($)
ID SYSTEMS CORP.									
ID-100	Y	N	N	N	Y	Y	12-in. black CRT	80/132 x 24	3895
ID-100 MVA	Y	N	N	Y	Y	N	12-in. black CRT	80/132 x 24	2895
ID-100 MVB LP	Y	N	N	Y	Y	N	12-in. black CRT	80/132 x 24	3895
ID-100 VA	Y	N	N	Y	Y	Y	12-in. black CRT	80/132 x 24	4395
ID-100 VB LP	Y	N	N	Y	Y	Y	12-in. black CRT	80/132 x 24	5895
ID-100 VB SP	Y	N	N	Y	Y	Y	12-in. black CRT	80/132 x 24	5395
ID-188 VA	N	N	Y	Y	Y	Y	12-in. black CRT	80/132 x 24	8595
ID-188 VB LP	N	N	Y	Y	Y	Y	12-in. black CRT	80/132 x 24	10095
ID-188 VB SP	N	N	Y	Y	Y	Y	12-in. black CRT	80/132 x 24	9595
IMLAC CORP.									
Series II	N	N	Y	Y	N	N	19-in. green Vector CRT	80 x 50	15750
IMS INTERNATIONAL									
IMS Ultimate	N	Y	N	Y	Y	N	12-in. green CRT	80 x 24	1095
INDUSTRIAL DATA TERMINALS									
IDT-1900	N	N	Y	Y	N	Y	19-in. CRT	85 x 25	7490
IDT-2200	N	N	Y	Y	N	Y	19-in. CRT	85 x 51	11995
INFORMER COMPUTER TERMINALS									
201/202/203/204/205							9-/12-in. CRT		
301	Y	N	N		N	N	6-in. white CRT	32 x 16	1675
304	N	Y	N		N	N	9-in. white CRT	32/80 x 16/24	1650
375	N	Y	N		N	N	9/12-in. green CRT	80 x 24	2400
376	N	Y	N		N	N	9/12-in. green CRT	80 x 24	1950
377	N	Y	N		N	N	9/12-in. green CRT	80 x 24	1700
378	N	Y	N		N	N	9/12-in. green CRT	80 x 24	1700
401	Y	N	N		N	N	9-in. green CRT	80 x 24	690
INTECOLOR CORP.									
2405	N	Y	N	Y	Y	Y	13-in. CRT	80 x 24	995, Q100
8001G	N	N	Y	Y	Y	Y	19-in. CRT	80 x 48	2095, Q100
8001R	N	N	Y	Y	Y	Y	19-in. CRT	80 x 48	2995, Q100
8301G	N	N	Y	Y	Y	Y	13-in. CRT	80 x 48	2295, Q100
8301R	N	N	Y	Y	Y	Y	13-in. CRT	80 x 48	3195, Q100
INTEGRATED DATA SYSTEMS									
ID-1219	N	Y	Y	Y	N	Y	19-in. CRT	80 x 48	4295
ID-212	N	Y	N	Y	N	Y	12-in. CRT	80 x 24	2425
ID-213	N	Y	Y	Y	N	Y	13-in. CRT	80 x 32	3145
ID-813	N	Y	N	Y	N	Y	13-in. CRT	80 x 32	2925
ID-819	N	Y	N	Y	N	Y	19-in. CRT	80 x 48	3950

Interfaces	Specify fonts	Special features
RS232C	ASCII, British, line drawing, graphics	VT-100 compatible
RS232C	ASCII, British, line drawing, graphics	VT-100 compatible, plot 10, 4010, 4014 compatible, 512 x 256 gray scale
RS232C	ASCII, British, line drawing, graphics	VT-100 compatible, plot 10, 4010, 4014 compatible, 608 x 480 gray scale
RS232C	ASCII, British, line drawing, graphics	VT-100 compatible, plot 10, 4010, 4014 compatible, 512 x 256 resolution
RS232C	ASCII, British, line drawing, graphics	VT-100 compatible, plot 10, 4010, 4014 compatible, 608 x 480 resolution
RS232C	ASCII, British, line drawing, graphics	VT-100 compatible, plot 10, 4010, 4014 compatible, 608 x 480 resolution
RS232C		256K RAM, 2 floppy disk drives, CP/M-86, VT-100 compatible, 512 x 256 resolution
RS232C		265K RAM, 2 floppy disk drives, CP/M-86, VT-100 compatible, 608 x 480 resolution
RS232C		256K RAM, 2 floppy disk drives, VT-100 compatible, 608 x 480 resolution
light pen, digital tablet, Tektronix 4611, 4631, hard copy, V-80 hard copy		64K bytes vector memory, 2040 x 2048 resolution
RS232		programmable function keys, 9 x 12 character resolution
RS232, 20mA	macroplot, microfont	dot-address. graphics, absolute, relative vectors
RS232, 20mA	macrofont, microfont, customfont	macrograph, vecpics, rampics, dot-addressable graphics
		IBM 3270 compatible
RS232, asynchronous	128ASCII	emulation for various mini or microcomputers
RS232, RS422, 20mA, current loop, asynchronous	128ASCII	emulation for various mini or microcomputers
RS232, BSC	128ASCII	IBM 3275-2 compatible
RS232, BSC, SNA/SDLC		compatible, w/3276 2- or -12-in. single terminal configuration
RS232, coaxial		IBM 3277-2 compatible
RS232, coaxial		IBM 3278-2 compatible
RS232, asynchronous		emulation for various mini or microcomputers
RS232C, 20mA current loop		36 programmable function keys, 2-page memory, ANSI X 3.64 compatible
	64ASCII, 64 special ISA characters	plots 160H x 192V; firmware for vector, bar graph, plot points
		480H x 384V grid, alphanumeric overlay
	64ASCII, 64 special ISA characters	plots 160H x 192V; firmware for vector, bar graph, plot points
RS232C	64ASCII	
RS232C or 20mA, current loop	128ASCII, 128 special characters	Multibus computer chassis, high-power, power supply
RS232C or 20mA, current loop	128ASCII, 128 special characters	detachable keyboard
RS232C or 20mA, current loop	128ASCII, 128 special characters	Multibus computer chassis, high-power, power supply
RS232C, or 20mA, current loop	128ASCII, 128 special characters	detachable keyboard
RS232C or 20mA, current loop	128ASCII, 128 special characters	detachable keyboard

Company Model	Dumb (Y/N)	Editing (Y/N)	Intelligent (Y/N)	Graphics (Y/N)	Portable (Y/N)	Color (Y/N)	Display	Screen format (col. x lines)	Price ($)
INTELLIGENT SYSTEMS CORP.									
2405	N	N	Y	Y	N	Y	13-in. multi-color CRT	80 x 24	1495, Q100
8001G	N	N	Y	Y	N	Y	19-in. multi-color CRT	80 x 48	2095, Q100
8001R	N	N	Y	Y	N	Y	19-in. multi-color CRT	80 x 48	2995, Q100
INTERNATIONAL ANASAZI, INC.									
Emulog-200	N	Y	N	N	N	N	12-in. green CRT	80 x 24	1250
INTERNATIONAL ENTRY SYSTEMS INC.									
Datacorder II	N	N	Y	N	Y	N	green LED, CRT	40 x 1	3995
Datacorder I	N	N	Y	N	Y	N	green LED, CRT	16 x 1	2295
INTERTEC DATA SYSTEMS									
Intertube	N	Y	N	Y	Y	N	12-in B&W CRT	80 x 25	
KIMTRON CORP.									
ABM 85	N	Y	N	Y	N	N	12-in. green/amber CRT	80 x 25	795
ABM 85-3/5	N	Y	N	N	N	N	12-in. green CRT	80 x 25	495
ABM 85H	N	Y	N	Y	N	N	12-in. green/amber CRT	80 x 25	825
ABM 86	N	Y	N	Y	N	N	12-in. green/amber CRT	80/132 x 24/27	995
KGT-100	N	Y	N	Y	N	N	12-in. green/amber CRT		1800
LANPAR, LTD.									Did not respond;
LEAR SIEGLER/DATA PRODUCTS DIV.									
ADM-22	N	Y	N	N	N	N	12-in. green	80 x 24	695
ADM-23	N	Y	N	N	N	N	12-in. white/green	80 x 24	795
ADM-24	N	Y	N	N	N	N	12-in. green/white	80 x 25	1195
ADM-31	N	Y	N	Y	N	N	12-in. white/green	80 x 24	1095
ADM-32	N	Y	N	Y	N	N	12/15-in. white/green	80 x 25	1295
ADM-36	N	Y	N	Y	N	N	12/15-in. white/green		1195
ADM-3A	Y	N	N	Y	N	N	12-in. white/green	80 x 24	595
ADM-42	N	Y	N	N	N	N	15-in. white/green	80 x 25	2195
ADM-5	Y	N	N	Y	N	N	12-in. white/green	80 x 24	645
LEE DATA CORP.									
All-in-one					N	N	15-in. CRT	80/132 x 24/43	
0700	N	Y	N	Y	Y	N	15-in. CRT		2733
1220	Y	N	N	N	Y	N	15-in. green/gray CRT	80/132 x 24/43	
1230	Y	N	N	N	Y	Y	15-in. green/gray CRT	80 x 24/32	
1218	Y	N	N	N	Y	N	15-in. green/gray CRT	80 x 24	
LEXICON, INC.									
Lexiscope 4000	N	N	Y	Y	N	N	12-in. green CRT	80 x 25	2500, Q50
LIBERTY ELECTRONICS USA									
Freedom 100	N	Y	N	Y	Y	N	12-in. green	80 x 25	595
Freedom 50	N	Y	N	N	Y	N	12-in. green CRT	80 x 25	395, Q1000
LYNWOOD SCIENTIFIC DEVELOPMENTS LTD.									
Alpha-Colour	N	N	Y	Y	Y	Y	15-in. green CRT	80 x 30	6037
Alpha-Graphic	N	N	Y	Y	Y	N	15-in. green CRT	80 x 30	4287

Interfaces	Specify fonts	Special features
RS232C, 20mA loop	64ASCII standard, 32 lower case optional	
RS232C, 20mA loop standard, parallel optional	64ASCII plus 64 ISA graphics standard	
RS232C, 20mA loop standard, parallel optional	64ASCII plus 64 ISA graphic standard	
EIA RS232, current loop	7 x 9 dot matrix	emulates Data General D200 or 6053
Centronics printer, RS232		10-key alphanumeric keyboard, 80-line printer
Centronics printer, RS232		10-key alphanumeric keyboard, 80-line printer
communications, auxiliary interfaces	96ASCII	video attributes, numeric keypad, self-diagnostics
RS232C	ASCII, graphics, international characters	
RS232C	ASCII	
RS232C, optional RS422	ASCII, graphics, international characters	
RS232C, RS422 optional	ASCII, graphics	
RS232C	ASCII, graphics	
see directory for address		
RS232C, current loop	USASCII, business graphics	detachable keyboard, non-volatile set-up mode
RS232C	USASCII	51-line memory
RS232C	USASCII, international character sets, business graphics	48-line memory
RS232C, current loop	USASCII, business graphics	polling, 2 pages of display
RS232C, current loop	USASCII, business graphics	smooth scroll, x-on/x-off, 2-page display, detachable keyboard
RS232C, RS422, current loop	USASCII, intl char sets, bus. graphics	DEC VT-100 compatible with advanced video option
RS232C, 20mA current loop	USASCII	
RS232C, current loop	USASCII	16 function keys, detachable keyboard, tilt display, 4-page display
RS232C, 20mA current loop	USASCII	numeric keypad
		six keyboard styles
serial parallel, IBM 327X		
IBM 3278		
IBM 3279		
IBM 3278		
Data General Nova/Eclipse bus plug-in		560 x 500 graphics resolution, H-P 2648A compatible commands
RS232 or 20mA loop	international	
RS232C or 20mA loop	international	
dual RS232C		detachable keyboard, adjustable screen angle
dual RS232C		detachable keyboard, adjustable screen angle

Company Model	Dumb (Y/N)	Editing (Y/N)	Intelligent (Y/N)	Graphics (Y/N)	Portable (Y/N)	Color (Y/N)	Display	Screen format (col. x lines)	Price ($)
MATROX ELECTRONIC SYSTEMS LTD.									
CTM-300	N	Y	N	Y	Y	Y	12-in. CRT	132 x 48	
MDS TRIVEX, INC.									
8078-1	Y	N	N	N	N	N	15-in. green CRT	12 x 1	1700
8078-2	Y	N	N	N	N	N	15-in. green CRT	80 x 24	1700
8078-3	Y	N	N	N	N	N	15-in. green CRT	80 x 24/32	1700
8078-4	Y	N	N	N	N	N	15-in. green CRT	80 x 24/43	1700
MEGADATA CORP.									
8188	N	N	Y	Y	N	N	15-in. amber/green/red CRT	80/132 x 20/30	2500, Q100
850	N	N	Y	Y	N	N	15-in. green CRT	80 x 25	2200, Q100
MEMOREX COMMUNICATIONS GROUP									
2051	N	Y	N	N	N	N	15-in. green CRT	80 x 24	
2078	N	Y	N	Y	N	N	15-in. green CRT	80/132 x 12/43	3600
2079	N	Y	N	Y	N	Y	13-in. CRT	80 x 24/32	6000
MICRO PRODUCTS CORP.									
MPC 1100	N	Y	N	Y	N	N	14-in. B&W/amber/green	80 x 25	1695
MPC 1200	N	Y	N	N	N	N	14-in. B&W/amber/green	80 x 25	1795
MPC 1250	N	Y	N		N	N	14-in. B&W/amber/green	80/132 x 25	3495
MPC 2100	N	Y	N	Y	N	Y	14-in. 8-color	80 x 48	2995
MPC 2150	N	Y	N	Y	N	Y	14-in. 8-color	80 x 48	4395
MICRO-TERM, INC.									
ERGO 2000	N	Y	N	Y	N	N	12-in. green CRT	80 x 24	1095
ERGO 301	N	Y	Y	Y	N	N	12-in. green/amber CRT	132 x 25	895
ERGO 4000	N	Y	N	Y	N	N	15-in. green CRT	80 x 66	1895
MIME 340	N	Y	N	Y	N	N	12-in. green CRT	80 x 24	750
MIME 740	N	Y	Y	Y	N	N	12-in. green CRT	132 x 25	1175
ERGO 201	N	Y	N	Y	N	N	12-in. green/amber CRT	80 x 25	695
MICRODATA CORP.									
5750	N	N	Y	N	N	N	12-in. B&W CRT	80 x 25	5100
7450	N	N	Y	N	N	N	9-in. B&W CRT	40 x 13	1990
7510	N	N	Y	N	N	N	12-in. B&W CRT	80 x 25	6825
Prism II	Y	N	N	N	N	N	12-in. B&W CRT	80 x 24	2200
Prism IV	N	Y	N	N	N	N	12-in. green CRT	80 x 25	2200
MICROPAD									Did not respond;
MILTOPE CORP.									
MIL-TERM-280	N	Y	N	Y	N	N	plasma panel	80 x 25	15600
MULTITECH INDUSTRIAL CORP.									
D75	N	Y	N	Y	N	N	15-in. B&W CRT	80 x 24	

Interfaces	Specify fonts	Special features
RS232C, Centronics parallel printer port	upper/lower ASCII, control, European chars	2K RAM, 18 user-programmable keys, detachable keyboard
Trivex 8074; IBM 3274/3276 control; IBM plug compatible	upper/lower case, EBCDIC or ASCII	selectable cursor, automatic self-test, detachable keyboard, sunflex
Trivex 8074; IBM 3274/3276 control; plug compatible	upper/lower case, EBCDIC or ASCII	selectable cursor, automatic self-test, detachable keyboard, sunflex
Trivex 8074; IBM 3274/3276 controller; IBM plug compatible	upper/lower case, EBCDIC or ASCII	selectable cursor, automatic self-test, detachable keyboard, sunflex
Trivex 8074; IBM 3274/3276 controller; IBM plug compatible	upper/lower case, EBCDIC or ASCII	selectable cursor, automatic self-test, detachable keyboard, sunflex
RS232, RS449, RS170, parallel, fast link		16-bit micro, 128K bytes RAM, 155-key keyboard
RS232, parallel GPIB		8-bit micro, 64K bytes RAM, 155-key keyboard
direct attach twin AX IBM system 34-38	EBCDIC	non-glare, tilt screen, line and column indicator
category A coax (3270)	EBCDIC, ASCII, APL	non-glare, tilt screen, line and column indicator
category A coax (3270)	EBCDIC, ASCII, APL	non-glare, tilt screen, line and column indicator
dual RS232C ports	8 x 10	8-page memory, smooth scroll, split screen, 12 programmable function keys
dual RS232C ports	8 x 10	8-page memory, smooth scroll, split screen, 12 programmable function keys
dual RS232C ports		8-page memory, DEC Regis compatible, 768 x 480 bit-mapped graphics
dual RS232C ports	8 x 10	8-page memory, smooth scroll, split screen, 12 programmable function keys
dual RS232C ports		8-page memory, ISC 8301R compatible, 480 x 384 bit-mapped graphics
RS232	8 foreign optional	block mode, protected fields, printer port, smooth scroll
RS232	alternate character set	double high/wide, scrolling window, advanced video, printer port
RS232	alternate character set	4 video attributes, printer port, 15 programmable function keys
RS232	32 graphics characters	block mode, protected fields, printer port
RS232	alternate character set	double high/wide, scrolling window, advanced video, printer port
RS232		block mode, 16 function keys, custom modes, smooth scroll, screen saver
RS232C	96 ASCII	2-page memory, movable keyboard, function keys
	64 character set standard (96 optional)	detached keyboard
	96 character set standard	detached keyboard, video attributes
RS232C	96 ASCII	self-diagnostic programs, movable keyboard, selectable cursor
RS232C	96 ASCII	tilt and swivel screen, function keys
see directory for address		
RS232C, MIL-STD-188C	64, 96, 128 ASCII	
RS232C, Centronics parallel		outputs 22,000 Chinese characters

Company Model	Dumb (Y/N)	Editing (Y/N)	Intelligent (Y/N)	Graphics (Y/N)	Portable (Y/N)	Color (Y/N)	Display	Screen format (col. x lines)	Price ($)
NABU COMMERCIAL TERMINALS									
3100	N	Y	N	N	N	N	12-in. B&W/amber/green CRT	80 x 24	1095
4503	Y	N	N	N	N	N	12-in. green CRT	80 x 24	450
NABU 414H	N	Y	N	N	N	N	12-in. B&W/amber/green CRT	80 x 25	1095
NABU 4152	Y	N	N		N	N	12-in. B&W/amber/green CRT	80 x 25	1095
NABU 415APL	N	Y	N	N	N	N	12-in. B&W/amber/green CRT	80 x 25	1295
NABU 4404	Y	N	N	N	N	N	12-in. B&W/amber/green CRT	80 x 24	695
NABU 4404-GX	Y	N	N	Y	N	N	12-in. B&W/amber/green CRT	80 x 25	
NCR CORP.									
7900-1	Y	N	N	N	N	N	12-in. green CRT	80 x 25	1500
7900-2	Y	N	N	N	N	N	12-in. green CRT	80 x 25	3170
7900-3	N	Y	N	Y	N	N	12-in. green CRT	80 x 25	3500
7900-4	N	Y	N	Y	N	N	12-in. green CRT	80 x 25	2495
7901	Y	N	N	N	N	N	12-in. green CRT	80 x 24	850
NORAND CORP.									Did not respond;
NORSK DATA, AS									Did not respond;
NORTHERN TECHNOLOGIES, LTD.									
Vision 1000	N	N	N	Y	N	N	12/15-in. green CRT	80/132 x 24	1195
Vision 2000	N	Y	N	Y	N	N	12/15-in. green CRT	80/132 x 25	1595
NORTHERN TELECOM SYSTEMS CORP.									Did not respond;
ONTEL CORP.									
1503	N	N	Y	Y	N	N	15-in. B&W/green/amber CRT	80 x 25	1195, Q250
1505	N	N	Y	Y	N	N	15-in. B&W/green/amber CRT	80 x 25	1495, Q100
1507	N	N	Y	Y	N	N	15-in. B&W/green/amber CRT	80 x 25	2695, Q100
AMIGO	N	N	Y	Y	N	N	12-in. green CRT	80 x 25	1100, Q500
PARADYNE CORP.									
PDS 270	N	Y	N	N	N	N	15-in. green CRT	80 x 25	3000
PDS TECHNOLOGIES INC.									
1150				Y	N	N	15-in. CRT		1500
PERRY DATA SYSTEMS, INC.									
9200	Y	N	N	N	N	N	9-in. green CRT	64 x 12	1545
9310	Y	N	N	N	N	N	12-in. green CRT	80 x 24	3495
9460	Y	N	N	N	N	N	12-in. green CRT	80 x 24	3495
PHAZE INFORMATION MACHINES CORP.									
P3278	N	Y	N		N	N	12-in. green CRT		1995
PHOENIX COMPUTER GRAPHICS, INC.									
1024-1	N	N	Y	Y	Y	Y	13/19-in. CRT	80 x 60	17000
1024-2	N	N	Y	Y	Y	Y	13/19-in. CRT	80 x 60	26000

Interfaces	Specify fonts	Special features
RS232C		4 hili. attrb/char, bidirc. smooth scroll, full edit., 31 gra. cha abs. and rel. cursor address., det. up/lo case typwtr-styl. kbd
RS232C	European	Hazeltine 1510 comp, character/line ins/del, dir. x-y cursor address
RS232C	ASCII	detached upper/lower case typewriter-style keyboard, u&d scroll, hor. tabs, tr. mode
RS232C	APL, ASCII	25th status line, character rubout in APL interact. mode, ind. w.h.re
RS232C	European	Lear Siegler ADM-3A comp., detached upper/lower case typewriter-style keyboard, ch. hl
RS232C		ADM-3A comp., PLOT-10 & GINO-F software comp., 25th status line
RS232C, current loop		off-line screen print feature, detached keyboard, character mess. mode, touch-tone numeric pad
NCR/DLC communications		10 dedicated function keys, mess/page mode transm, touch-tone numeric pad
RS232C, current loop		detached keyboard, touch-tone numeric pad
RS232C, current loop		detached keyboard, touch-tone numeric pad
RS232C, current loop		2-position tilt monitor, detached keyboard, character mode transmission
see directory for address		
see directory for address		
RS232C standard, 20mA optional	96 ASCII, 96 Canadian, French, line drawing	ergonomic design, 2-page memory, VT-100 compatible, 4 programmable function keys
RS232C standard, 20mA optional	96 ASCII, 96 Canadian, French, line drawing	ergonomic design
see directory for address		
asynchronous/synchronous communications; serial, parallel printer	128 characters in prom	64K-byte memory, detachable keyboard, printer port, display attributes
asynchronous/synchronous communications; serial, parallel printer	256 characters in prom	64K-byte memory, printer port, DMA controller, display attributes
asynchronous/synchronous communications; serial, parallel printer	256 characters in prom	64K-byte memory, detachable keyboard, 4 DMA controllers
RS232, parallel	user programmable, 640x300 dot graphics	64K-byte user memory, 44K-byte display buffer, detachable keyboard
RS232C, CCITT current loop		4 keyboards
RS232		
RS232C, RS422	ASCII	custom point-of-sale terminal
RS232C, RS422	ASCII	point-of-sale terminal, 80-column printer, cash drawer
RS232C, RS422, Centronics parallel	ASCII	point-of-sale terminal, 40-column printer, cash drawer
		IBM 3278-2 replacement
RS232C, DMA to host, parallel	programmable	1024 x 1024 resolution, 128K bytes RAM, joystick
RS232C, DMA to host, parallel	programmable	1M-byte floppy, 10M-byte Winchester, CP/M-86, PCGL, BASIC, FORTRAN

Company Model	Dumb (Y/N)	Editing (Y/N)	Intelligent (Y/N)	Graphics (Y/N)	Portable (Y/N)	Color (Y/N)	Display	Screen format (col. x lines)	Price ($)
PIICEON, INC.									
System I	N	N	Y	N	N	N	15-in. green CRT	80 x 33/66	1508, Q1500
System II	N	N	Y	N	N	N	15-in. green CRT	80 x 33/66	1833, Q1500
System III	N	Y	N	N	N	N	15-in. green CRT	80 x 33/66	3666, Q1500
PLESSEY PERIPHERAL SYSTEMS									
PT100B	N	Y	N	Y	N	N	12-in. B&W/green/amber CRT	80/132 x 24	1450
PRIME COMPUTER									
PST 100	N	Y	N	Y	N	N	15-in. white CRT	80 x 25	1595
PROTOCOL COMPUTERS INC.									
PCI 78	N	Y	N		N	N		80 x 25	995
PCI 51	N	Y	N		N	N		80 x 25	995
PSITECH									
GT1609					Y	N	12-in. white CRT	85 x 24	
GT215	Y	N	N	Y	N	N	15-in. white CRT	85 x 24	2350, Q250
GT800				Y	Y	N	12-in. white CRT	80 x 25	
GTC214	Y	N	N	Y	N	Y	14-in. CRT	85 x 48	4300, Q250
GTC224	Y	N	N	Y	N	Y	14-in. CRT	85 x 48	4350, Q250
GTC319	Y	N	N	Y	N	Y	19-in. CRT	85 x 48	4750, Q250
QUADRAM CORP.									
Omega Data X7	N	Y	N	Y	N	N	17-in. white CRT	80/160 x 66	2595
QUME CORP.									
QVT-102	N	Y	N	Y	N	N	12-in. green CRT	80 x 25	695
QVT-103	N	Y	N	Y	N	N	12-in. green/amber CRT	80/132 x 25	895
QVT-108	N	Y	N	Y	N	N	12-in. green/amber CRT	80 x 25	895
RACAL-MILGO, COMPUTER PRODUCTS DIV.									
4010 8AI	N	Y	N	N	N	N	15-in. green CRT	80 x 25	3555
4015 8AI	N	Y	N	N	N	N	15-in. green CRT	80 x 24	4155
4220/U200	N	Y	N	N	N	N	15-in. green CRT	80 x 24/12	3370
4220/UTS 20	N	Y	N	N	N	N	15-in. green CRT	80 x 24/12	3370
4270	N	Y	N	N	N	N	15-in. green CRT	80 x 24	2560
4276	N	Y	N	N	N	N	15-in. green CRT	80 x 24	3950
4278	N	Y	N	N	N	N	15-in. green CRT	80/132 x 24	
SCI SYSTEMS, INC.									
2404 I, K, 2405	N	N	Y	N	N	N	9-in. green/white CRT	40/80 x 24	
SCOTT SYSTEMS INC.									
Access	N	N	Y		N		9-/12-in. CRT		
C530	N	Y	N	Y	N	N	12-in.green CRT	80 x 25	595
SIEMENS COMM. SYSTEMS, INC.									
T4100 Message Term.	N	Y	N	N	N	N	12-in. B&W CRT	80 x 25	2500
Text Terminal T4200	N	N	Y		N	N	B&W CRT	82 x 21	7087
SOLID STATE TECHNOLOGY, INC.									
8100 Series	N	N	Y	N	N	N	12-in. B&W CRT	80 x 25	2995, Q200

Interfaces	Specify fonts	Special features
2 serial, 1 parallel		8086 CPU, 128K RAM
2 serial, 1 parallel		8086 CPU, 128K RAM, .5M-byte floppy
2 serial, 1 parallel		8086 CPU, 128K RAM, .5M-byte floppy, 12.76M-byte Winchester
RS232C or 20mA current loop	96 ASCII	VT-100 emulation, universal P/S
EIA	international character sets	windows, detachable keyboard, user-programmable function keys
		IBM 3278 replacement
		IBM 5251 replacement
RS232, parallel, synchronous	programmable	16-slot card cage, 512 x 240 dot-addressable graphics
dual RS232	programmable	512 x 240 dot-addressable graphics, macros
RS232, parallel, synchronous		8-slot card cage
dual RS232	programmable	512 x 480 dot-addressable graphics
dual RS232	programmable	512 x 480 resolution graphics, color palette
dual RS232	programmable	rack-mount hiresolution monitor, 512 x 480 resolution graphics
VT-100, ANSI	96 ASCII, graphics	split screen, programmable keys, detachable keyboard, 2K-byte buffer
RS232C standard; current loop optional		menu set-up mode, tilt/swivel screen, low-profile keyboard, 4 emulations
RS232C standard; current loop optional		DEC VT-100 compatible, 2-page memory
RS232C, standard; current loop optional		TVI 925 compatible, 2-page memory, 11 function keys
RS232C	ASCII	6 programmable function keys, 8-page memory
RS232C	ASCII	printer buffer
RS232C	ASCII	4 programmable function keys, field & character blink & blank, protected fields
RS232C	ASCII	22 programmable function keys, field control characters, field & character blink & blank
	ASCII, EBCDIC	24 programmable function keys, off/line self-diagnosis, password data security
RS232C		self-contained controller, 24 programmable function keys, field blink
	ASCII, EBCDIC	tilt/swivel screen, security key lock, blink underline, reverse video
CARD READER, RS232, DISKETTE		integral high-speed electrostatic printer
		64K bytes RAM, 16K bytes EEPROM
RS232C		softstart setup from kbd.
telex, TWX, DDD	7 x 9 dot matrix	
		includes a printer, floppy disk drives
RS232C, 20mA	256 displayable characters	multi-tasking, 5¼-in. floppy, integral printer, BASIC, COBOL

Company Model	Dumb (Y/N)	Editing (Y/N)	Intelligent (Y/N)	Graphics (Y/N)	Portable (Y/N)	Color (Y/N)	Display	Screen format (col. x lines)	Price ($)
SOROC TECHNOLOGY, INC.									
Challenger	N	Y	N	Y	N	N	12-in. green CRT	80 x 25	399, Q200
IQ 130	N	Y	N	Y	N	N	12-in. green CRT	80 x 25	490, Q200
IQ 135	N	Y	N	Y	N	N	12-in. green CRT	80 x 25	995, Q200
IQ 150	N	Y	N	Y	N	N	12-in. green CRT	80 x 25	1395, Q200
SPERRY UNIVAC									
UTS 20	N	Y	N	N	N	N	12-in. green CRT	80 x 25	2337
UTS 40	N	N	Y	N	N	N	12-in. green CRT	80 x 25	3219
SRA COMMUNICATIONS, AB									
SRA-II				N	N	N	15-in. amber CRT	80 x 24	2200
TAB PRODUCTS CO.									
TAB 132/15	N	Y	N	Y	N	N	15-in. green/white CRT	80/132 x 27	2100
TAB 132/15-G	N	Y	N	Y	N	N	15-in. green/white CRT	80/132 x 27	3295
TANDBERG DATA, INC.									
TDV2200	N	Y	N	Y	N	N	15-in. green CRT	80 x 25	1875
TDV-2230	N	Y	N		N	N	15-in. green CRT	80 x 24	1875
TDV-2235	N	Y	N		N	N	15-in. CRT	80 x 24	1875
TEC, INC.									
ET100	N	Y	N	Y	N	N	15-in. CRT	80/132 x 25	1975
ET80	N	Y	N	Y	N	N	15-in. CRT	80/132 x 25	1975
TEC 630	N	Y	N	Y	N	N	12-in. white/green CRT	80 x 25	1310
TEKTRONIX, INC.									
TEK 4025A	N	Y	N	Y	Y	N	12-in. green CRT	80 x 34	5900
TELCON INDUSTRIES, INC.									
GC 100	N	N	Y	N	Y	N	7-in. green CRT	80 x 24	
GC 500	Y	N	N	N	Y	N	7-in. green CRT	80 x 24	
TELEFUNKEN CORP., AEG									Did not respond;
TELERAM COMMUNICATIONS CORP.									
Teleram 3000	N	Y	N	Y	Y	N	black-on-white LCD	80 x 4	2995
TELERAY									
100	N	Y	N	Y	N	N	12-in. 3168 CRT	24 x 1	1595
16	N	Y	N	Y	N	N	12-in. green/white/amber CRT	80 x 25	1545
16/7801	N	Y	N	Y	N	N	12-in. green/white/amber CRT	80 x 25	1795
16APL	N	Y	N	Y	N	N	12-in. 1920 CRT	25 x 1	1695
16GRF	N	Y	N	Y	N	N	12-in. green/white/amber CRT	80 x 25	3040
7	N	Y	N	Y	N	N	12-in. green/white/amber CRT	80 x 25	1295
TELETEX COMMUNICATION CORP.									
3000	N	Y	N			N	12-in. green CRT	80 x 25	595

Interfaces	Specify fonts	Special features
RS232		separate keyboard, 14 programmable functions
RS232		14 programmable functions
RS232		separate keyboard, tilt & swivel, 14 programmable functions
RS232	alternate character sets	120 lines memory, 128 programmable function keys, smooth scroll
RS232C	international character sets	operator parameter set-up, protected format, unlimited field
RS232C	international character sets	COBOL programmable, operates CP/M
twinax for IBM S/34 & IBM S/38	8 x 16 dot matrix	ergonomic design, low-profile keyboard
RS232, 20mA loop, 60mA loop	ASCII and business graphics	detachable keyboard, video attributes
RS232, 20mA loop, 60mA loop	ASCII, APL, business graphics	detachable keyboard, video attributes
RS232C, RS422, current loop, printer interface		low-profile keyboard, soft-switches, programmable function keys
		DEC VT-100 emulation
		Data General 6053, D200 emulation
RS232C standard; 20/60mA, RS449 optional	international	VT-131 emulation, 9 user-programmable function keys
RS232C standard, 20/60mA, RS449 optional	international	18 programmable function keys, double high/wide characters
RS232C standard; 20mA optional	international	6 function keys, detached keyboard, xon/xoff
RS232C	128ASCII	16K bytes display memory, forms mode, hard copy output
RS232	128ASCII	32 bytes RAM, emulates DEC VT-52 and VT-100, ADDS Viewpoint
RS232	128ASCII	emulates DEC VT-52 and VT-100 ADDS Viewpoint
see directory for address		
RS232C std., extra serial opt.	4 graphics characters	CP/M, telecomm. software, 128K-byte bubble memory
RS232C standard, current loop optional	ASCII, 32 line drawing graphics	non-volatile function memory, 4 smooth scroll rates, 6 video attributes
RS232C standard, current loop optional	128ASCII, 64 mosaic, 64 line drawing	4-page memory, 32 macro keys, smooth scroll
RS232C standard, current loop optional	128ASCII, 64 mosaic, 64 line drawing	Honeywell 7801 compatible
RS232C standard, current loop optional	128ASCII, 64 mos., 64 line drawing, 96 APL	4-page memory, 32 macro keys, calculator mode, smooth scroll
RS232C	128ASCII, 64 mosaic, 64 line drawing	240 x 640 graphics, Plot 10 compatible, Tektronix 4010/4014 emulation
RS232C standard, current loop optional	128ASCII, 64 mosaic, 64 line drawing	2-page memory, 32 programmable macro keys, smooth scroll, numeric keyboard
RS232C	128 ASCII	detached kbd. with 11 function keys, numeric keypad

Company Model	Dumb (Y/N)	Editing (Y/N)	Intelligent (Y/N)	Graphics (Y/N)	Portable (Y/N)	Color (Y/N)	Display	Screen format (col. x lines)	Price ($)
TELETYPE CORP.									
4420	N	Y	N	N	N	N	13-in. B&W CRT	80 x 24	4105
4430	N	Y	N	N	N	N	13-in. B&W CRT	80 x 24	3977
4541	N	Y	N	N	N	N	13-in. B&W CRT	80 x 25	
4543	N	Y	N	N	N	N	13-in. B&W CRT	80 x 25	
TELEVIDEO SYSTEMS INC.									
910	Y	N	N	N	N	N	12-in. green CRT	80 x 24	699
910 Plus	N	Y	N	N	N	N	12-in. green CRT	80 x 24	699
912	N	Y	N	N	N	N	12-in. green CRT	80 x 24	925
925	N	Y	N	N	N	N	12-in. green CRT	80 x 25	995
950	N	Y	N	N	N	N	12-in. green CRT	80 x 25	1195
970	N	Y	N	N	N	N	14-in. green CRT	80 x 25	1495
TELEX COMPUTER PRODUCTS, INC.									
178	Y	N	N	N	N	Y	12-in. CRT	80 x 24	2805
278	N	Y	N	N	N	N	15-in. CRT	80/132 x 24/43	2350
279	N	Y	N	N	N	N	14-in. CRT	80 x 24	3900
TELEX TERMINAL COMMUNICATIONS, INC.									Did not respond;
TELPAR INC.									
IT801	N	Y	N	Y	Y	Y	12-in. CRT	80 x 24	3200
IT802	N	Y	N	Y	N	Y	19-in. CRT	80 x 48	3950
TERAK CORP.									
8510B	N	N	Y	Y	N	N	12-in. green CRT		8345
8600	N	N	Y	Y	N	Y	13-in. multi-color CRT		15970
TEXAS INSTRUMENTS INC.									
OPTI 940	N	Y	N	N	N	N	12-in. B&W CRT	80/132 x 12/24	1895
THOMAS ENGINEERING CO.									
TEC 780X	N	Y	N	Y	Y	N	12/14-in. B&W/green CRT	80 x 25	1895
TRANSIAC CORP.									
TR1024	N	N	Y	Y	N	N	15-in. green CRT	146 x 70	4500
TYMSHARE INC.									
410	Y	N	N	Y	Y	N	9-in. gray CRT	40/80 x 24	495
415	Y	N	N	Y	Y	N	9-in. gray CRT	40/80 x 24	649
420	N	Y	N	N	N	N	12-in. gray CRT	80 x 24	2127
425	N	Y	N	N	N	N	12-in. gray CRT	80 x 24	1195
430	Y	N	N	N	N	N	12-in. gray CRT	80 x 24	649
444	N	N	Y	N	N	N	11-in. gray CRT	80 x 24	3740
470	N	Y	N		N	N	12-in. gray CRT	80 x 24	1995
Scanset XL	Y	N	N	Y	Y	N	9-in. white CRT	40/80 x 25	895
VIDEO DATA SYSTEMS									
RDU-2000	Y	N	N	Y	N	Y			3495
VISUAL TECHNOLOGY INC.									
V100	Y	N	N	Y	N	N	12-in. white CRT	80/132 x 24	1345

Interfaces	Specify fonts	Special features
EIA RS232C, 20/60mA current	upper/lower case ASCII	buffered display, character/line/page transmission
EIA RS232C	upper/lower case ASCII	multi-point poll selectable
EIA RS232C	EBCDIC or ASCII	IBM 3270 compatible, remote or local cluster configurations
EIA RS232C	EBCDIC	
dual RS232C ports	English, French, German, Spanish	5 video attributes, emulates ADM-3A/5, Hazeltine 1410, ADDS 25
dual RS232C ports	ASCII	erase to end of line/page, character/line insert or delete
dual RS232C ports	ASCII	protect mode, tabs self-test, numeric keypad
RS232C standard, 20mA current loop optional	English, French, Spanish, German	detached keyboard, function keys, clock, screen-saver
RS232C	ASCII	programmable function keys, 15 graphics characters, line lock
RS232C standard; RS422 optional	USASCII, UKASCII, international	double-high/double-wide characters, ergonomic design, ANSI codes
IBM 3274/3276, Telex 174/276		more than 30 keyboard selections
IBM 3274/3276 Telex 174/276		more than 30 keyboard selections
IBM 3274/3276, Telex 174/276		more than 30 keyboard selections
see directory for address		
RS232 or current loop	ASCII, 128 graphic symbols	160 x 96 dot matrix resolution graphics
RS232 or current loop	ASCII, 128 graphic symbols	16 x 192 dot resolution graphics
RS232C	640 x 480 graphics resolution	
RS232C	640 x 480 graphics resolution	price includes dual floppies, microcomputer with RAM
E1ARS232C	7 x 9	vertical, horizontal screen splits, 1-page memory, others
EIA, RS232C, current loop	128ASCII	
RS232, DMA	USASCII, math, 192 user-defined	Plot-10 & ANSI compatible zoom, scroll, pan
EIA RS232, RS449 printer port	5 x 9	12 programmable function keys, mosaic/supplementary graphics
RS499 printer port, RS232	5 x 9	automatic dial, automatic log on, internal 300 baud modem
RS232C		
RS232C, auxiliary port, 20mA loop		2-page display, numeric keypad
RS232C, auxiliary port		
RS232		integral 120cps thermal printer, 4K-byte memory
RS232		3270 compatible, 16 programmable function keys, detachable keyboard
RS11C, RS449, RS232C	ASCII, mosaics	includes built-in telephone, modem
RS232C		requires user-provided monitor
RS232C, 20mA	USASCII	emulates DEC VT-100 with AVO option

Company Model	Dumb (Y/N)	Editing (Y/N)	Intelligent (Y/N)	Graphics (Y/N)	Portable (Y/N)	Color (Y/N)	Display	Screen format (col. x lines)	Price ($)
V110	Y	N	N	Y	N	N	12-in. white CRT	80/132 x 24	1395
V300	N	Y	N	Y	N	N	12-in. white CRT	80 x 25	1150
V330	N	Y	N	Y	N	N	12-in. white CRT	80 x 25	1150
V400	N	Y	N	Y	N	N	12-in. white CRT	80/132 x 24	1695
V50	N	Y	N	Y	N	N	12-in. white CRT	80 x 25	695
V500	N	Y	N	Y	N	N	14-in. green CRT	80 x 34	2495
V55	N	Y	N	Y	N	N	12-in. green CRT	80 x 25	845
V550	N	Y	N	Y	N	N	14-in. green CRT	80 x 34	2695
WANG LABORATORIES, INC.									
5536-4	N	Y	N	N	N	N	12-in. green CRT	80 x 24	4900
ERGO 2	N	Y	N	N	N	N	12-in. green CRT	80 x 24	5200
ERGO 3	N	Y	N	N	N	N	12-in. B&W CRT	80 x 24	5300
Professional Computer	N	N	Y	Y	N	Y	12-in. CRT	80 x 25	2700
WARREN LOGIC, LTD.									Did not respond;
WESTINGHOUSE CANADA, LTD.									
W1642	N	N	Y	Y	N	N	12-in. green CRT	80 x 25	2300
W1640	N	N	Y	Y	N	N	12-in. green CRT	80 x 25	2400
W1642T	N	N	Y	Y	N	N	12-in. green CRT	80 x 25	2450
WORDPLEX CORP.									
80-4	N	Y	N	N	N	N	15-in. gray CRT	80 x 24	11800
80-2	N	Y	N	N	N	N	15-in. gray CRT	80 x 24	5100
80-3	N	Y	N	N	N	N	15-in. gray CRT	80 x 24	8812
WYSE TECHNOLOGY									
WY-100	N	Y	N	N	N	N	12-in. green CRT	80 x 26	995
WY-200	N	N	Y	N	N	N	14-in. green CRT	80/132 x 26	1295
WY-210	N	N	Y	N	N	N	14-in. green CRT	80/132 x 26	1595
WY-220	N	N	Y	N	N	N	14-in. green CRT	80/132 x 26	1695
WY-300	N	Y	N	N	N	Y	12-in. multi-color CRT	80 x 26	1295
ZENITH DATA SYSTEMS									
Z-19	N	Y	N	Y	N	N	12-in. green CRT	80 x 25	895
Z-29	N	Y	N	Y	N	N	12-in. green CRT	80 x 25	849
ZT-1	N	Y	N	Y	Y	N	12-in. green CRT	80 x 25	699
ZENTEC									
8000	N	N	Y	N	N	N	12-in. green/B&W/amber CRT	80 x 25	1200, Q250
Cobra	N	Y	N	N	N	N	12-in. green CRT	80 x 25	875, Q250
Zephyr	N	Y	N	N	N	N	12-in. B&W CRT	80 x 25	800, Q250
ZMS-35	N	Y	N	N	N	N	12-in. B&W CRT	80 x 25	950, Q250

Interfaces	Specify fonts	Special features
RS232C, 20mA	USASCII	Data General D200 emulation
RS232C, 20mA	international character sets	ANSI X3.64, VT-100/VT-52 protocol compatible, user-programmable function keys
RS232C, 20mA	international character sets	D200, VT-52, 1500, ADM3A emulation, user-programmable function keys
RS232C, 20mA	USASCII	ANSI X3.64 compatible
dual RS232C ports	international character sets	emulates Viewpoint, Esprit, VT-52, ADM3A
dual RS232C ports	international character sets, math symbols	VT-52, ADM3A, D200, Hazeltine 1500 emulation
dual RS232C ports	international character sets	extended editing, scrolling region, programmable function keys
dual RS232C ports	international character sets, math symbols	VT-100, VT-52 protocol, ANSI X3.64 compatible
RS232 optional Wang Datalink		
RS232 Wangnet optional Wang Datalink		
RS232, Wangnet, Wang Datalink		Avoid: 900
RS232 synchronous, RS232 bisynchronous	8 x 10	320K-byte diskette drive
see directory for address		
Honeywell, Univac, Ipars, serial printer		clustered or standalone
Honeywell, Univac, Ipars, serial printer		clustered or standalone
83B3 Telenet		standalone
	upper and lower case	dedicated word processor including disk drives
	upper and lower case	dedicated word processor including disk drives
	upper and lower case	dedicated word processor including disk drives
dual RS232	96ASCII, 32 control and line drawing	split screens, swivel, tilt screen
dual RS232	96ASCII, 32 control & line drawing characters	multiple windows, 32K bytes memory, swivel/tilt screen
dual RS232	96ASCII, 32 control & line drawing characters	multiple windows, 128K bytes memory, swivel/tilt screen
RS232, RS422	96ASCII, 32 control & line drawing characters	multiple windows, 128K bytes memory, swivel/tilt screen
dual RS232	96ASCII, 32 control and line drawing	soft character generator
RS232C	English, French, German, Spanish	numeric keypad, DEC VT-52 compatible
RS232	English, French, German, Spanish	emulates DEC VT-100, Lear Siegler ADM-3A, Hazeltine 1500
parallel RJ-11, RJ-12, RJ-13	block graphics	built-in-auto-dial, 300-baud modem
RS232, 20mA loop	128ASCII standard, 224 characters optional	detached keyboard, 16K-byte memory, numeric-, function-, cursor pads
RS232, 20mA loop	128ASCII	detached keyboard, numeric-, function-, cursor pads
RS232, 20mA loop	128ASCII	numeric-, function-, cursor pads
RS232, 20mA loop		numeric-, function-, cursor pads

The New Rixon Intelligent R212A Modem...

The Intelligent R212A has literally leap-frogged the competition and revolutionized the 212A modem market. All beta site customers report that the Intelligent R212A is the most amazing 1200 BPS full duplex modem with an integral automatic dialer they have ever seen. Installation is the simplest of any modem ever because all options are soft (programmed from the keyboard)—no screw drivers or tools required, just plug it in.

The Intelligent R212A features:

- Automatic log on to databases with a single key stroke
- User friendly HELP list menu
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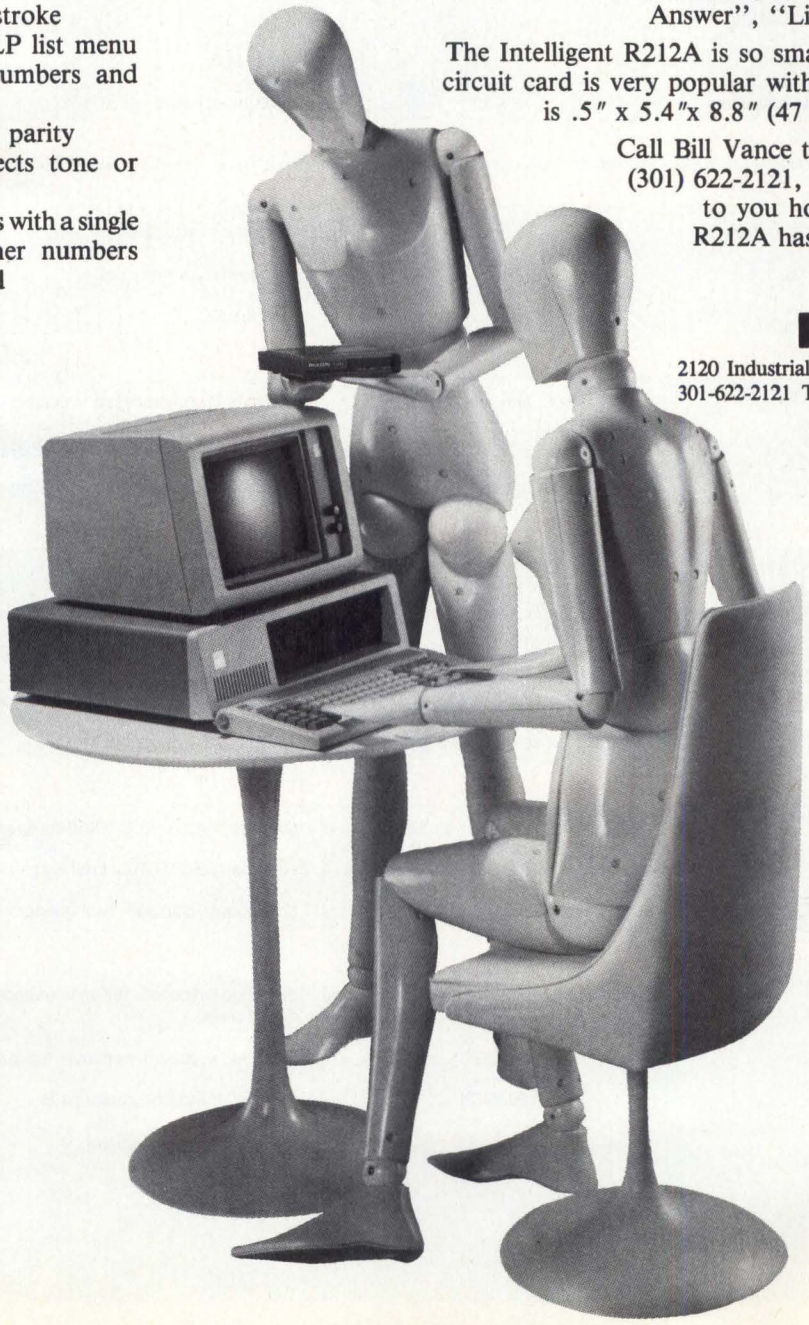

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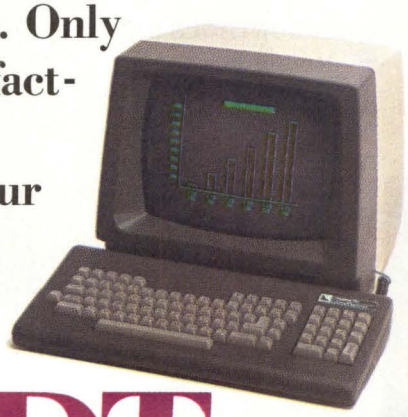

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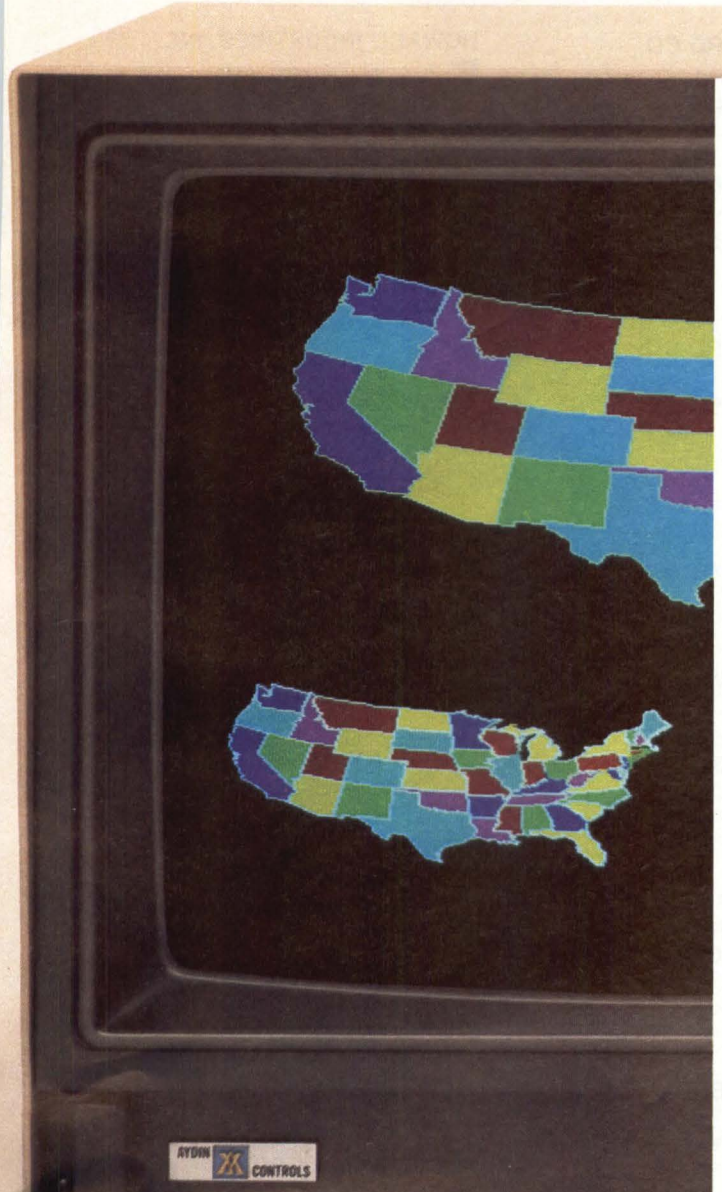
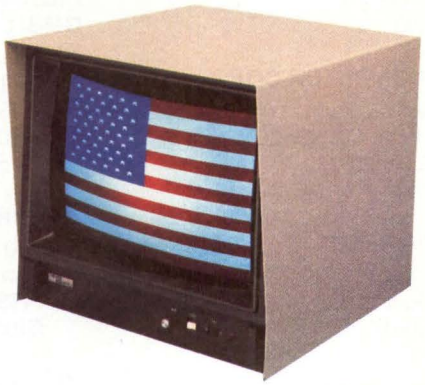


Aydin Controls, a leader in high resolution color display terminals, now manufactures Patriot™, its own in-line gun series of color monitors. The Patriot series will supplement Aydin's well known family of delta and in-line gun monitors.

Patriot's 13-inch Model 8810 and 19-inch Model 8830 both offer the latest state-of-the-art features plus all of the advantages of American technology and manufacturing. Patriot features high video bandwidth, wide horizontal line rates, fixed convergence, excellent high voltage regulation, modular construction, analog or TTL inputs and rack mountability. The Patriot Series can be customized to fit special needs.

Patriot monitors provide outstanding performance at an attractive price coupled with an 18-month OEM warranty; off-the-shelf availability; quick delivery of spare parts; and fast, reliable service. For more information contact Aydin Controls, 414 Commerce Drive, Fort Washington, PA 19034. Tel: 215-542-7800 (TWX 510-661-0518).



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