DC2000 Systems: Pocket-Size Backup

The seven DC2000-based tape drives reviewed here represent the first of a new generation of PC backup systems. But the drives' speeds could slow their acceptance in the marketplace.

DC2000 cartridges, which look like shrunken versions of 3M's immensely successful DC600-style tape cartridges, let you tote 40 megabytes of formatted data in your shirt pocket. The seven drives reviewed here from Advanced Digital Information Corp. (ADIC), Alloy Computer Products Inc., Archive Corp., Irwin Magnetic Systems Inc., Micro Design International Inc., Mountain Computers Inc., and Tallgrass Technologies Corp. are the first to use the DC2000 cartridges and may indeed be the first of the next generation of PC backup systems.

The products are as varied as the label "cartridge tape backup system" allows them to be. They use various standards, formats, and even packaging schemes. Yet any of them can make backing up your hard disk a simple—if time-consuming—process.

The key element to all of these cartridge tape backup systems is the new DC2000 data cartridge.

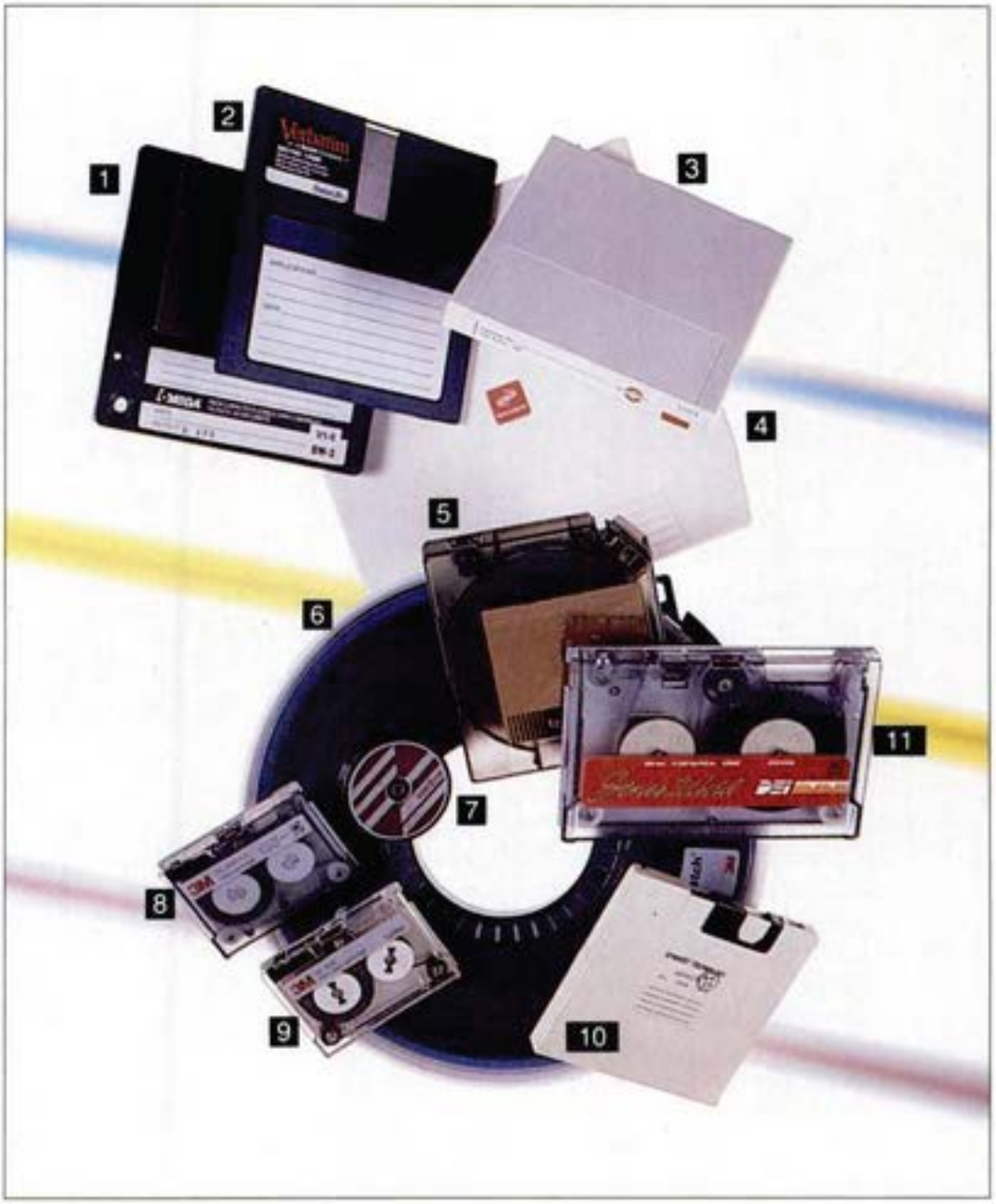
The DC2000 cartridge shines as a marvel of miniaturization. Compared with the 6- by 4- by ⅝-inch DC600 cartridge, which is the size of a paperback book, the DC2000's outer shell is just under 3¼ by 2½ by ⅝ inches, which makes it about the size of a cassette tape from your favorite recording star. While tape capacity was trimmed—from 600 to 205 feet—data capacity has suffered only slightly. The tape width is the same, ¼ inch, for both.

When the first DC2000 systems were introduced, the diminutive cartridges could hold 40 megabytes, versus 60 for the bigger DC600. Of course, technology doesn't stand still and standards are being hammered out for 300 and 600 megabytes on the larger tapes, 100 and 200 megabytes on the DC2000's.

The similarity between the DC600 and DC2000 cartridges hardly is an accident. Both are based on the same design principles and built from a solid aluminum baseplate and clear plastic protective shell. Inside, the same patented mechanism shuttles the tape between two hubs.

An elastic friction band wraps around the tape spools and gently pulls the medium along. Although a capstan system, like that used on audio- and videotape recorders, ushers the drive band along, no pinch roller ever touches the tape. In fact, the only part of the mechanism that actually touches the magnetic surface of the tape is the read/write head.

Currently, three companies hold licenses to use this technology and make cartridges: 3M, which originally developed the system; Data Electronics Inc. (DEI) and Hewlett-Packard Co., which does not currently sell cartridges in the retail market.



In addition to DC2000 systems, the options for backing up your data include **(1)** *Iomega's 5¼-inch Bernoulli cartridge,* **(2)** *Kodak's 12-megabyte cartridge,* **(3)** *a Dysan 5¼-inch removable Winchester cartridge,* **(4)** *Amcodyne's removable cartridge,* **(5)** *DEI's 3480 cartridge,* **(6)** *a nine-track open-reel tape,* **(7)** *Interdyne's spooled tape cartridge,* **(8** and **9)** *3M's DC2000 and DC1000 cartridges,* **(10)** *IDE and Systen's removable cartridge,* **(11)** *DEI's DC600 cartridge.*

DOUBLE STANDARD DC2000 cartridges differ from the DC600 style in their degree of standardization. The recording standards used by DC600-based systems evolved over more than a decade. The resulting confusion eventually led to the formation of the Quarter-Inch Compatibility (QIC) committee, comprised of tape drive manufacturers and other interested parties, to hammer out standards for drive manufacturers.

The QIC committee soon developed two standards for systems that are based on the DC2000 cartridge: QIC-40 and QIC-100. Additional standards, for advanced high-capacity systems, are currently in the works.

QIC-40 is aimed at the PC market. It has a tape format patterned closely after that used by MS-DOS disks, although recently certain aspects (the time and date format, for instance) have been modified to better match UNIX systems as well.

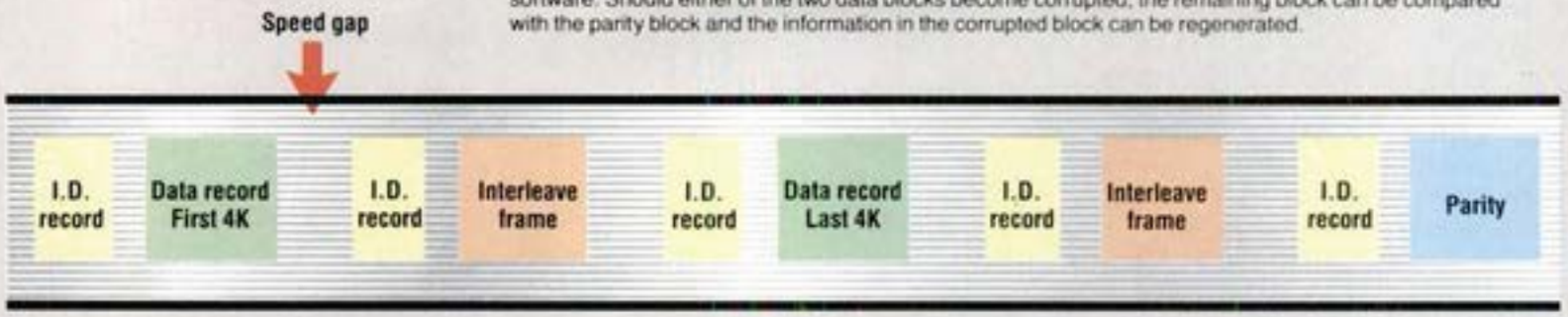
Under the QIC-40 standard, 20 tracks are arrayed across the width of the tape, each holding roughly 2 megabytes of data. Each track is broken into 68 segments of 29 sectors containing 1,024 bytes each. Each tape has the equivalent of a file allocation table that lists bad sectors contained on the tape so that no bytes are risked on bad or marginal media.

Data bits are written using the modified frequency modulation recording method (sometimes called "double-density") at a density of 10,000 bits per inch.

Tape drives under the QIC-40 standard

Formatting DC2000 Tapes

Most of the DC2000 systems reviewed here use PC/T tape format. This scheme stores data in 8K allocation units consisting of two 4K data blocks and an added parity block. The parity block is created from an "exclusive or" Boolean comparison (XOR) of the two 4K data blocks done by the backup software. Should either of the two data blocks become corrupted, the remaining block can be compared with the parity block and the information in the corrupted block can be regenerated.



run at either 25 or 50 inches per second when writing data, depending on the data transfer rate of the unit's floppy disk controller. These data transfer rates are comparable to normal double-density floppy disk drives (XT-style), which operate with a data transfer rate of 250K bits per second, and AT-style high-density (1.2-megabyte) controllers, which operate at 500K bits per second.

Under the QIC-40 standard, one-third of the possible 60-megabyte capacity of the DC2000 tape is devoted to format structure and error correction, using both cyclical redundancy checking and a Reed Solomon code (an efficient error-correction algorithm that's also used in such areas as interplanetary communications). As a result, an error rate of 1 in 10^{14} is claimed for QIC-40, a rate that predicts fewer errors than that achieved with most disk drives.

NO CIGAR The QIC-40 standard promises that you will be able to interface DC2000 tapes between tape drives of different manufacturers. And in fact, QIC-40 offers a level of compatibility comparable to that enjoyed by nine-track open-reel tape systems, usually regarded as the best of any medium.

However, the QIC-40 standard does not specify the exact arrangement of the tape file structure. Because there's no compatibility of file structure, you can read all the bytes off a tape on any system, but their structure will be lost. As a result, you can interchange tapes between different drives, but you might not be able to decipher the results.

Although the QIC-40 standard for DC2000 cartridges is stricter than those applied to DC600 tapes, the result is the same. Cartridges remain captive to the manufacturer and model of the system making them. What's needed for complete interchangeability of tapes is standard for file structure, which can be achieved only through the co-operative development of software or complete control of the software industry (à la MS-DOS).

QIC-100 is a looser standard than QIC-40 because it allows each manufacturer to develop its own controller. Hence QIC-100 is faster because it is not limited to the floppy disk interface speeds, as is QIC-40. On the other hand, the need for a separate controller makes a complete QIC-100 system more expensive.

QIC-100 puts 12 or 24 tracks across the tape at a recording density of 12,000 flux reversals per inch. The actual data density is somewhat less because the specification calls for Group-Coded Recording, which uses five flux reversals to encode each 4-bit nibble of data. (Although it sounds somewhat contrary to logic, GCR actually allows information to be packed tighter on a given recording medium.)

As with QIC-40, you must format the tapes used by QIC-100 before use. Every block of data (the manufacturer defines the length of data blocks) features a special Cyclic Redundancy Code block to detect data errors. In addition, the standard allows the use of error correction.

NOT SO SPEEDY As clever as these systems are, both have limitations. Some are related to the drive mechanism; others are software difficulties. All, however, result in longer waits than most AT users may be accustomed to.

For instance, most DC2000 drives use single-channel heads to squeeze 20 or 24 tracks across the ¼-inch tape width. A servomechanism moves the head up and down, tangential to the tape, to the proper position for each track. The head servomechanism senses the edge of the tape to index the head location exactly and ensure proper tracking.

Before a backup can begin, most drives look for the top edge of the tape, then back down a measured distance to ensure that the head will be located at the first track, which, according to the standard, is near the middle of the tape. This indexing process can take dozens of seconds.

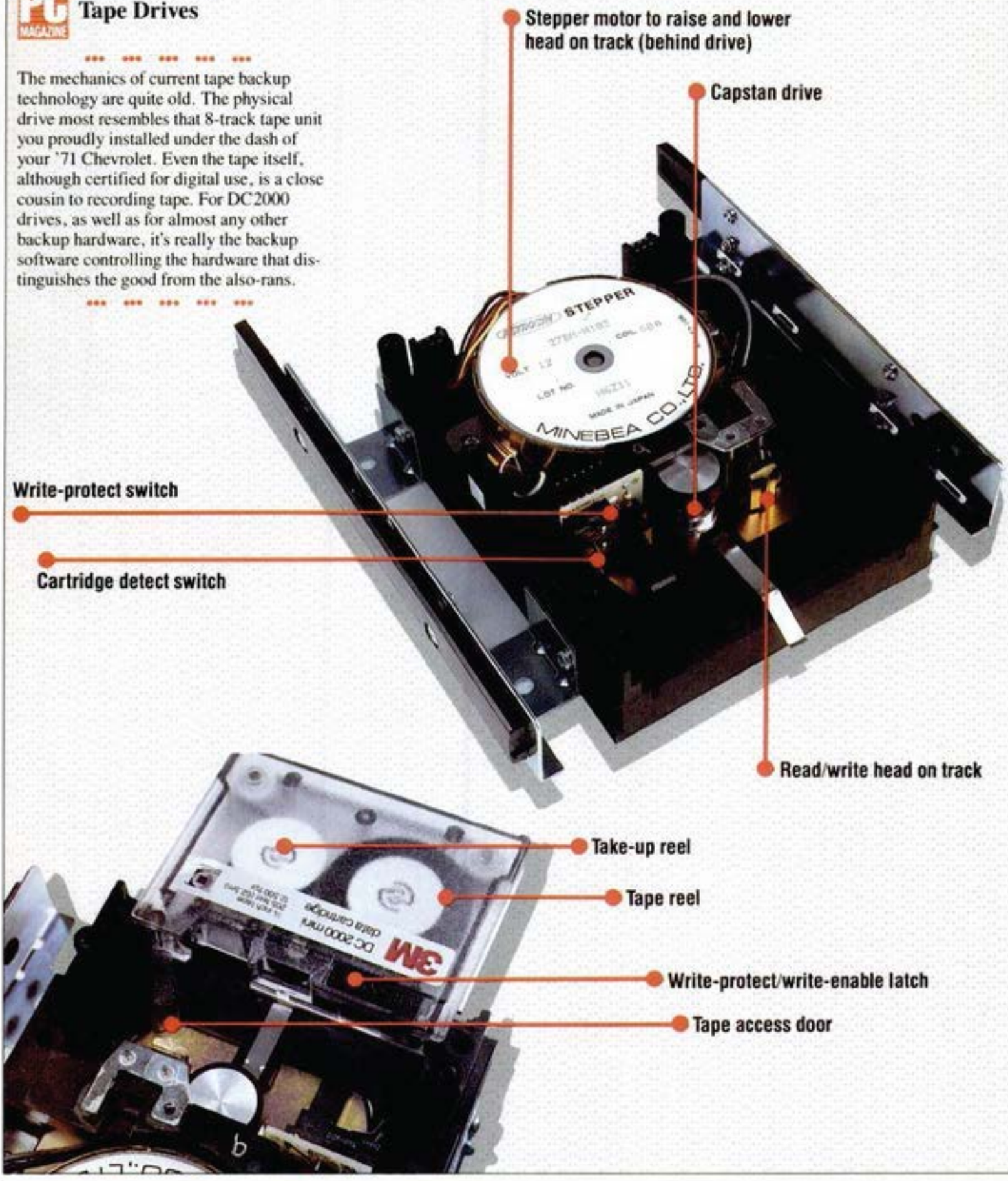
At first, QIC-40's use of standard floppy disk controllers seems like a winning combination. Since no special interface hardware is necessary, costs are cut and installation is easier because all you need do is to plug two cables (power and data/control) into the drive and then slide the unit into place.

However, you're stuck with the floppy disk controller's relatively slow data transfer rate. The older DC600-style systems had no such speed limits and often transferred bytes ten times faster at hard disk speeds, 5 megabits per second.

Both QIC-40 and QIC-100 require you to format tapes before use. However, by

Inside DC2000 Tape Drives

The mechanics of current tape backup technology are quite old. The physical drive most resembles that 8-track tape unit you proudly installed under the dash of your '71 Chevrolet. Even the tape itself, although certified for digital use, is a close cousin to recording tape. For DC2000 drives, as well as for almost any other backup hardware, it's really the backup software controlling the hardware that distinguishes the good from the also-rans.



the manufacturers' own accounts, formatting the entire 40-megabyte tape capacity takes half an hour. Even that figure ignores such collateral matters as winding and rewinding the tape and indexing the read/write head.

In my trials, the time from the keystroke that invokes the format command until control returns to the host computer often measures more than 40 minutes. And during that time you can use your computer for nothing else.

You can buy preformatted tapes—for a price ranging from an additional $1 to $5. But judging from the underwhelming acceptance of preformatted disks (think of DEC's Rainbow 100, for instance), I don't think many will choose this option.

The preformatted approach does offer some benefits. During the formatting process, bad sectors can be reserved. The format also allows individual tape sectors to be accessed randomly. Consequently, some of the cartridge systems examined here attempt to mimic floppy disks.

Additionally, preformatting adds place markers to the take that make it easy to append files to a partially used tape. That's one reason why many DC600-based systems will not allow you to append to a tape, yet all of these DC2000 systems do.

GOOD ENOUGH The result is that most of this current crop of DC2000 systems take up one floppy disk slot and substitute a frustratingly slow single-purpose backup system that uses small cartridges. With most of these systems, backing up a full 32-megabyte DOS partition will take 20 to 30 minutes or more.

Nonetheless, these systems may be good enough. All make workable backup systems despite their slowness. Irwin Magnetics, for instance, has been extremely successful in selling its proprietary DC1000-based systems that impose many of the same speed limits.

In fact, there are a number of legitimate reasons for investing in one of these systems. Any backup system is better than none. If you've never had a fast backup system, the slower throughput may not be apparent or bothersome. And there are effective strategies for avoiding the wait. For example, you can use a time-initiated backup program that will take care of everything at night or during your lunch break; many of these systems include such software. There is hope, too, that as these systems become more developed, they're likely to get better and faster.

As we tested these systems, it became apparent that many of the speed problems that we encountered were software based: they have to be, when two systems operating at an identical data transfer rate differ by a factor of two for the backup speed on the same task. Moreover, even at floppy disk rates, these systems theoretically should be able to transfer more than 3 megabytes per minute—a rate several systems claim and none deliver.

DC2000 Systems: Summary of Features

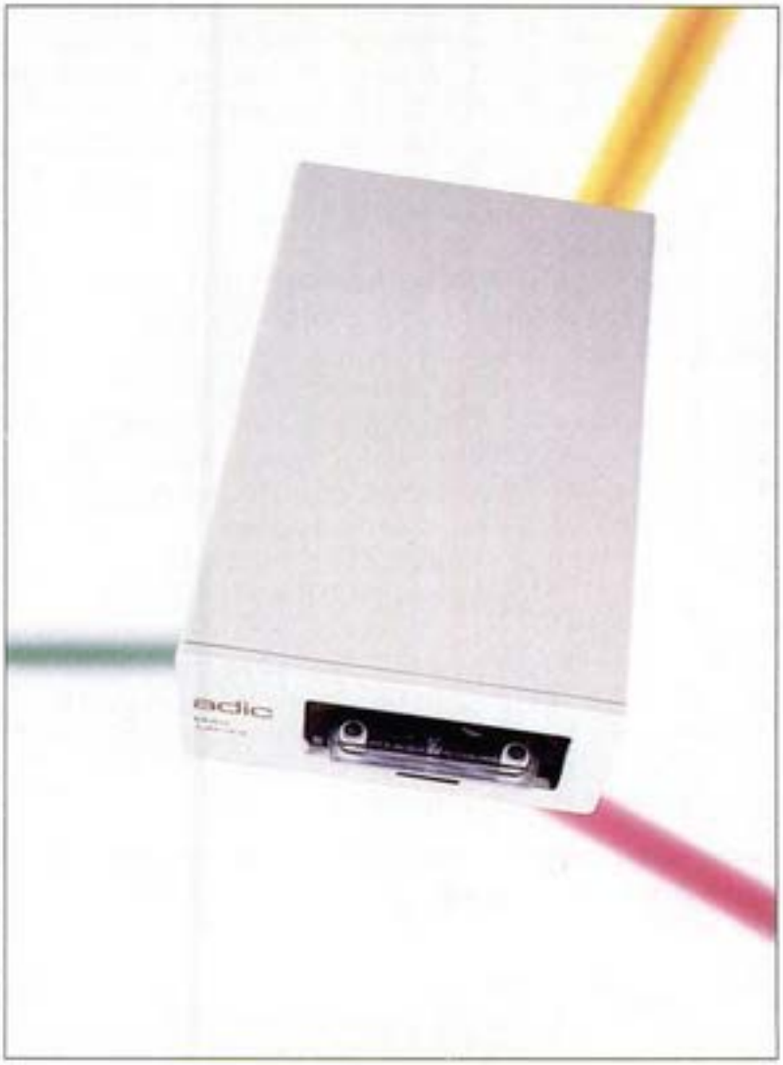
(Products listed in ascending price order)

	MDI External MT-40P/AT Micro Design International Inc.	**Archive XL 5540** Archive Corp.	**Alloy APT-40 Model 500** Alloy Computer Products Inc.	**Irwin 145 and Irwin 445** Irwin Magnetic Systems Inc.	PC **Mountain TD4440** Mountain Computer Inc.	**TG-1040e HS** Tallgrass Technologies Corp.	**ADIC TD-440** Advanced Digital Information Corp.
List price	$595 (internal unit) $695 (external unit)	$649 (for XT) $699 (for AT)	$695	$795 (internal Irwin 145) $895 (external Irwin 445)	$795	$795 (internal unit) $1,095 (external unit)	$1,390 (internal unit) $1,590 (external unit)
Price per megabyte	$14.88 (internal) $17.38 (external)	$16.23 (for XT) $17.48 (for AT)	$17.38	$19.88 (Irwin 145) $22.38 (Irwin 445)	$19.88	$19.88 (internal) $27.38 (external)	$43.44 (internal) $49.69 (external)
Capacity (megabytes), formatted	40	40	40	40	40	40	32
Internal or external	Both	Internal	Internal	Both	Internal	Both	Both
Tape drive interface	Floppy disk	Floppy disk	Floppy disk	Floppy disk	Floppy disk	Proprietary	SCSI
Size of unit (HWD in inches)	3 × 8¼ × 9	1½ × 5¾ × 7	1¾ × 5¾ × 7	2 × 4½ × 7½	1¾ × 5¾ × 8	7 × 4 × 14½	3 × 6½ × 11
System specification	Proprietary	QIC-40	Proprietary	Proprietary	QIC-40	QIC-100	QIC-100
File-by-file backup	●	●	●	●	●	●	●
Image backup	○	○	○	○	●	●	○
Floppy emulation	○	○	○	○	○	○	●
User interface	Menu	Menu	Menu	Menu	Menu/command	Menu	DOS
Automatic backup	●	○	●	●	●	●	○
Batch mode	●	●	●	●	●	●	●

PC—Indicates Editor's Choice ●—Yes ○—No

Improved software might push performance times of QIC-40 systems down near that of high-speed floppy disk backup systems—limited, however, by the overhead required for error-correction codes and the necessities of the drive mechanism. QIC-100 systems should be able to fly as fast as DC600-based backup units.

But for now, I suggest that those on tight budgets ignore the high tech and invest in a fast floppy disk backup program. If you can afford it, you'll be better off (and probably much happier) spending a few hundred dollars more on a DC600 system. To help you judge for yourselves, we review seven products, which are listed in alphabetical order by manufacturer.



The ADIC TD-440 is an external 3- by 6½- by 11-inch drive that connects to the host PC through an SCSI interface using an 8-bit interface expansion board. The unit thinks it's a disk drive—it uses familiar DOS commands like COPY and CHKDSK and needs no special software for daily backup.

ADVANCED DIGITAL INFORMATION CORP.

ADIC TD-440

The sturdy ADIC TD-440 from Advanced Digital Information Corp. is an external tape system that thinks it's a disk drive. Once installed, it reacts to most DOS commands as any disk would, but more slowly. That disk similarity rates as the TD-440's strongest and weakest suit.

Its resemblance to a disk makes the TD-440 familiar to the user and to DOS. You use DOS commands like COPY, MKDIR, ERASE, and CHKDSK to run the little tape drive. As a result, you need no special software for your daily backup.

ADIC doesn't give you much software, either. The TD-440 system comes with a device driver, a formatting program (the drive is incompatible with DOS FORMAT), testing utilities, plus the SARCHIVE file-by-file backup and SRESTORE restoration utilities. The last two are not documented in the accompanying manual.

The 3- by 6½- by 11-inch (HWD) all-metal box has a gray-beige pebble finish and no controls other than those on the drive and the power switch on the rear panel. A red LED on the front panel indicates that the drive is active.

The system connects to the host PC through a SCSI interface using an 8-bit interface expansion board that's 5 inches long. ADIC supplies a full meter of cable. The SCSI interface hints that this same unit may appear in other systems—maybe even the Macintosh. A power cable is supplied for plugging the drive into a wall outlet.

You configure your system by adding the ADIC device driver to your CONFIG.SYS file. During the process, your only major choice is whether the tape appears as one big 32-megabyte drive or two individual 17.8-megabyte units. The latter is the default.

Before use, you format the tapes per the QIC-100 standard. Although the documentation claims the process requires 48 minutes, it actually finishes in 41. ADIC also supplies preformatted cartridges.

Performance is not a virtue of the TD-440. The PC Labs BIGFILE test, which copies a 10-million-byte file using DOS, required 24 minutes, versus about 2 minutes to move the same file between hard disks. Using the SARCHIVE program supplied by ADIC, the 10-million-byte backup required just over 13 minutes. Restoring the same file took 35.

Backing up the 1,586-subdirectory environment in the PC Labs SCATTER test proved frustrating. The TD-440 does not handle multiple subdirectories well. Creating one subdirectory seven levels down

FACT FILE

ADIC TD-440
Advanced Digital Information Corp.
14737 NE 87th
P.O. Box 2996
Redmond, WA 98052
(800) 336-1233
(206) 881-8004
List Price: $1,590 (external unit); $1,390 (internal unit).
Requires: 128K RAM; DOS 2.0 or later.
In Short: An internal tape backup system based on the QIC-100 that uses an SCSI interface and software to emulate a random access disk drive, yielding slow operation for conventional backup.

CIRCLE 662 ON READER SERVICE CARD

and writing one 2K file inside it required almost 5 minutes of shuttling the tape back and forth. SARCHIVE records subdirectories faster, but in manual mode it requires confirmation before it backs up each subdirectory. I did not test it fully because I had little desire to sit in front of the test AT and mash the Y key 1,586 times, doubtless over a period of days.

ADIC has one further inconvenience. Before you can remove a cartridge from the drive, you must run a special program to flush the buffers used by the system and thereby guarantee that everything you sent to tape actually gets there. Presumably you'll also want to run this program before shutting down your PC.

If you're looking for disklike performance, look elsewhere. If familiarity breeds content, a dedicated DOS-lover might find affection for the TD-440.

ALLOY COMPUTER PRODUCTS INC.

Alloy APT-40 Model 500

Although based on a floppy disk interface, the Alloy APT-40 Model 500 is not a QIC-40 system. Instead, it relies on a data format that Alloy has designed to facilitate using tape as an exchange medium and has used successfully for a number of years in larger cartridge tape systems. In fact, the TIP in the name of the Alloy software, *TIP-40*, stands for Tape Interchange Program.

The APT-40 Model 500 drive itself is a compact unit; the controller and mechanicals fit easily into a 3½-inch form factor package. To spin its capstan, the drive uses a belt-driven servo drive motor with an optical sensor. The head scans across tape tracks using a thin helical screw drive. No eject button is provided or required: you simply slide tapes in and pull them out when you are done.

As with all of the systems reviewed here, Alloy requires you to format tapes before use. Up to 20 tracks can be formatted to yield up to 40 megabytes of on-tape storage. Or you can format even numbers of tracks to achieve smaller capacities but save time. Alloy claims that a full format takes 30 minutes; however, the process—from the time of last required keystroke to when you regain control of the system—actually requires about 35.

PC MAGAZINE FACT FILE

Alloy APT-40 Model 500
Alloy Computer Products Inc.
100 Pennsylvania Ave.
Framingham, MA 01701
(617) 875-6100
List Price: $695
Requires: 128K RAM; 256K RAM recommended; DOS 2.0 or later; AT floppy disk controller.
In Short: An internal file-by-file backup system, based on the DC2000 cartridge that uses your computer's existing floppy disk controller and fits a half-height drive bay.

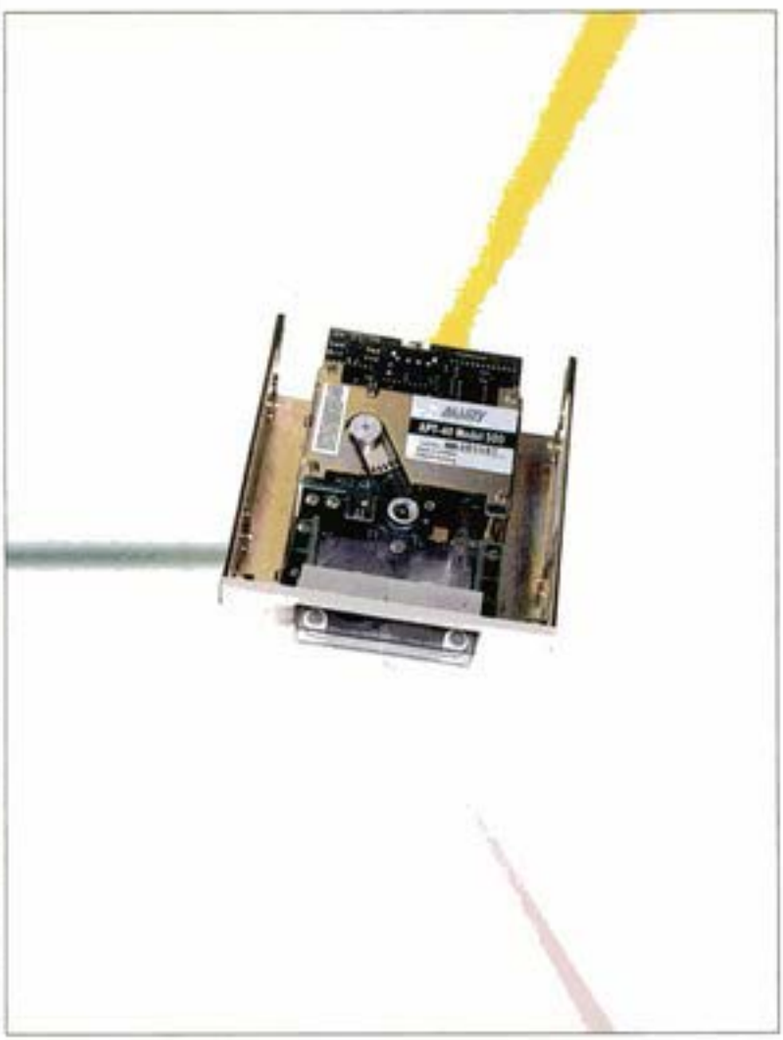
CIRCLE 664 ON READER SERVICE CARD

According to Alloy, its drive is currently certified only for DEI tapes. Although cartridges from 3M are not certified, they worked fine during our testing and resulted in no errors.

You install the APT-40 Model 500 drive just as you would a floppy disk: by plugging it into the B: drive connector and sliding it into a vacant half-height drive bay. The small drive adapts to the 5¼-inch form factor by using metal brackets on each side and includes standard AT mounting rails. The drive reads and writes tape at 50 inches per second at the AT's 500K-bit-per-second data transfer rate. The Alloy APT-40 Model 250 is similar but slower, designed for the 250K-bit-per-second rate of PCs and XTs.

The Alloy software adaptation is not quite as successful as the drive mechanism. In attempting to work like Alloy's DC600-style backup software, the *TIP-40* version imposes leisurely delays because of the constraints of the drive mechanism. For instance, when you load the program, you'll find yourself waiting for nearly 2 minutes while the tape drive initializes itself and, often, retensions the tape.

Once running, the *TIP-40* program is so easy to use that you won't need its documentation. A single preliminary menu



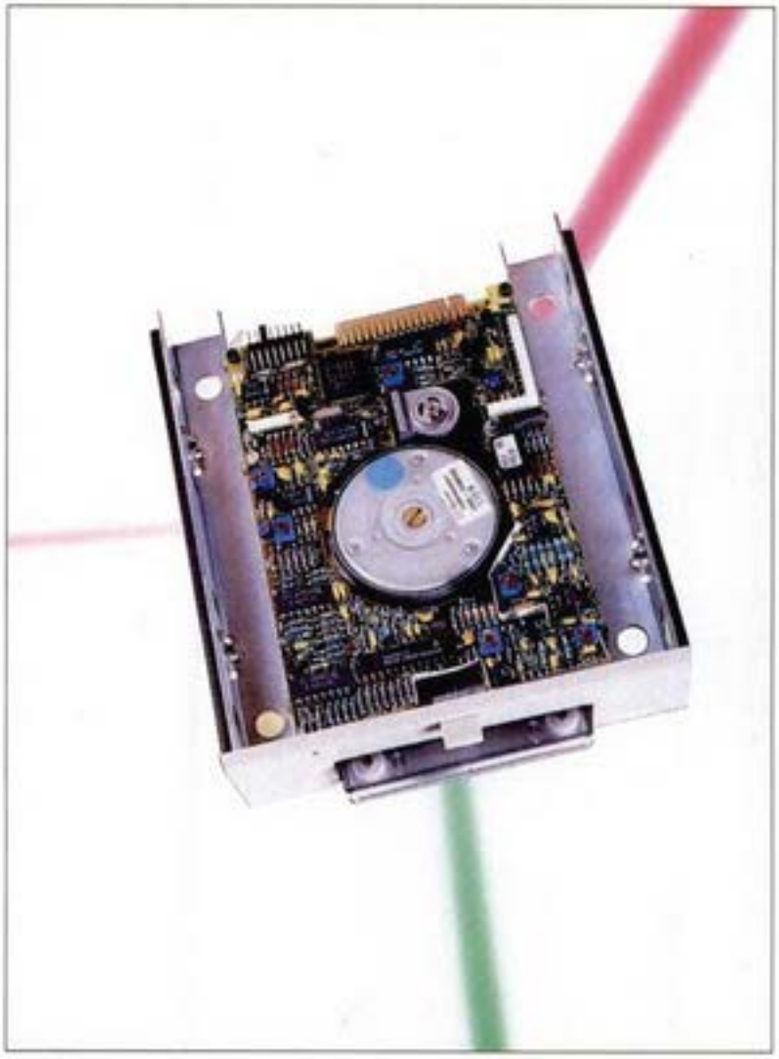
The controller and mechanism of the compact Alloy APT-40 Model 500 fits easily into a 3½-inch form factor package. The system's TIP-40 *software uses Alloy's own data format. You install the 1¾- by 5¾- by 7-inch drive by plugging it into the B: drive connector and sliding it into a vacant half-height drive bay.*

gives you your choice of system activities—backup, restore, and utility functions. Submenus activate the desired operations. *TIP-40* contains only file-by-file functions and has no image mode, but it furnishes all the normal file selection abilities and allows batch processing.

When it comes to putting data to tape, performance is lost to software overhead. At 11 minutes, the backup of a single, 10-million-byte file in the BIGFILE test was endurable. But the system took nearly 28 minutes to handle the multiple file-and-subdirectory SCATTER test.

Actually, this time is comparable to that demonstrated by Alloy's DC600 system in earlier testing even though DC600s tend to be faster systems, so obviously the speed culprit is the software.

Although slow, the Alloy can be a useful backup system when running TIPTOK, a program included with the system that automatically starts backing up at an appointed time.



The Archive XL 5540 closely follows the QIC-40 standard and operates at a data transfer rate of 500 kilobits per second off a standard AT floppy disk controller. Unlike most DC2000 drives, the 1½- by 5¼- by 7-inch XL 5540 swallows a cartridge. You press a button atop the cartridge slot to eject the cartridge.

ARCHIVE CORP.

Archive XL 5540

The Archive XL 5540 system is based on a 3½-inch form factor DC2000 drive that fastens easily to a standard AT half-height drive slot with a pair of steel channels and mounting rails. The drive uses a direct-drive capstan motor, a rotary positioner, and large helical screw to raise and lower the read/write head.

A hinged plastic door guards the cartridge slot and pivots upward when you slide in a tape. Unlike most other DC2000 style drives, the Archive completely swallows a tape cartridge. Pressing a push button atop the slot ejects the cartridge. To the right of the release button is a red drive activity LED.

The Archive XL 5540 closely follows the QIC-40 standard and operates at a data transfer rate of 500K bits per second off a standard AT floppy disk controller. A similar model, the 5240, is rated at 250K bits per second for XT applications.

Installation is a matter of sliding the drive into the B: drive bay, plugging it into the B: drive connector on your floppy disk data cable, and attaching a power supply cable to the drive. The Archive drive is unusual in that some systems (including mine) will think that it is a malfunctioning floppy disk drive if you leave a cartridge in the drive when you boot up.

The drive is controlled by Archive's *QICstream* backup software. *QICstream* is marked by a very simple menu system—just a few lines of text on the screen—that's also amenable to batch file operation.

In some ways the Archive software deserves the attention of other manufacturers. It keeps you posted on all the arcane activities involved in operating the QIC-40 system, to the point of telling you when it is looking for the top edge of the tape. Although such messages don't do anything for system performance, they are reassuring, especially considering the lengthy waits all these DC2000 tape systems engender.

The software appears to be designed to implement a simple backup system, giving you the option of full backups or a backup of changed files only. If you wish, you can also individually select files for backing up, but there is no provision for true image backups.

That said, the Archive system is slow, even compared with other DC2000 systems. Backing up during the 10-million-

PC MAGAZINE FACT FILE

Archive XL 5540
Archive Corp.
1650 Sunflower
Costa Mesa, CA 92626
(714) 641-0279
List Price: $649 (for XT); $699 (for AT).
Requires: 256K RAM; DOS 2.0 or later; floppy disk controller.
In Short: An internal file-by-file backup system, based on the QIC-40 standard for the DC2000 cartridge, that operates slowly through your computer's existing floppy disk controller.

CIRCLE **663** ON READER SERVICE CARD

byte BIGFILE test required 11 minutes, 24 seconds. Backing up a 1,578-subdirectory hierarchy (with two 2K files in each subdirectory) during the SCATTER test required 27 minutes, 49 seconds.

The Archive drive is the most sturdily built of all the drives reviewed here. As a complete system, however, it doesn't live up to its potential.

IRWIN MAGNETIC SYSTEMS INC.

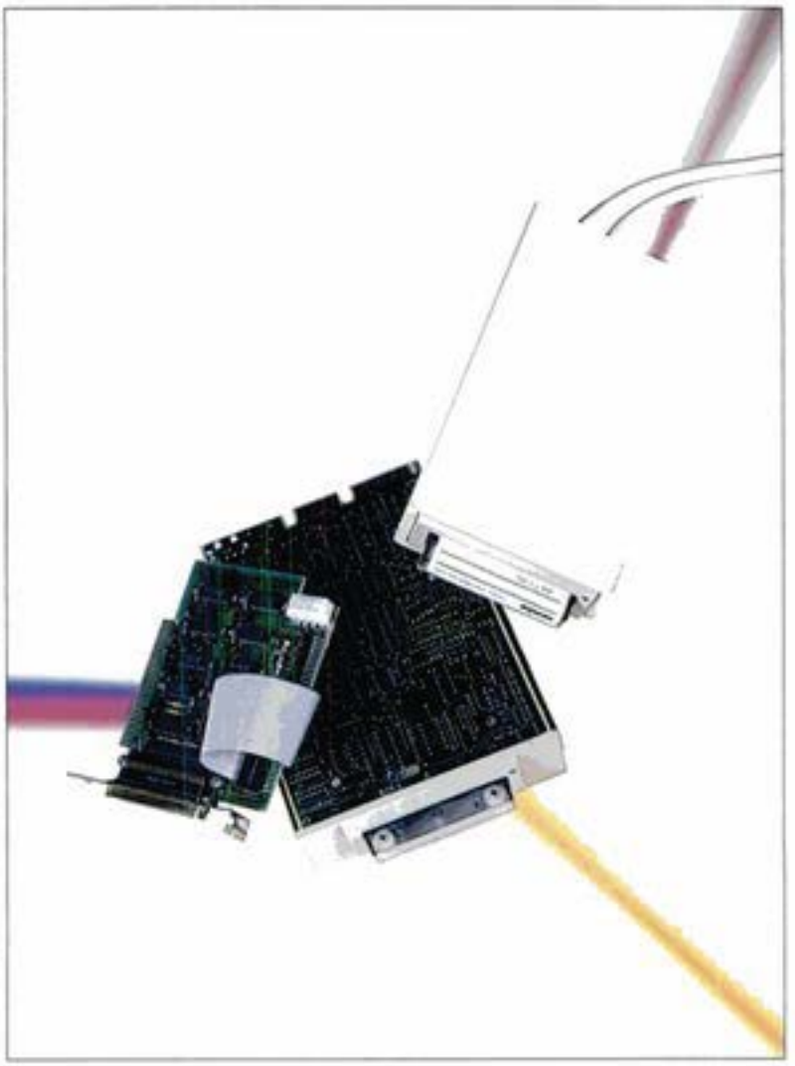
Irwin 145 (Internal) Irwin 445 (External)

More PCs depend on tape drives made by Irwin than those of any other manufacturer. Irwin was among the first to acknowledge the need for compact, inexpensive tape backup systems for PCs. And it has built several systems based on the smaller DC1000 and DC2000 cartridges.

The Irwin 145 (Internal) and 445 (External) drives are among the latest. These tape transports are available either unadorned, expanded to fit a half-height, 5¼-inch drive bay (the Irwin 145), or in a minuscule external chassis that's only 2 by 4½ by 7½ inches (the Irwin 445).

These cartridge units share the same technology, interface, and software. As with previous Irwin efforts, these newer units do not follow any committee-endorsed standard. But because of their sheer volume of sales, they may become a standard in themselves.

The Irwin interface is based on the standard floppy disk controller, but the drives do not connect directly to the floppy disk cable. Instead, a special interface card intercepts the signals from the controller to the floppy disk, plays with them, then sends them on their way again.



The Irwin 145 (Internal) and Irwin 445 (External) drives do not use a committee-endorsed standard. The interface is based on a standard floppy disk controller, but the 2- by 4½- by 7½-inch drives do not connect directly to the floppy disk cable; a special interface card intercepts signals from the controller to the floppy disk before sending them along.

The Irwin adapter is an 8-bit-bus short card that slides into the expansion slot next to the native drive controller. The Irwin interface has the ribbon cable that would ordinarily connect floppy disks to their controller. You use a short ribbon cable, which Irwin supplies, to connect the interface to the header on the same controller to which you would normally attach the floppy disk cable.

In addition, for the Irwin 445 external tape drive, you must connect a power cable—like the one you'd normally plug into a tape or disk drive—to the controller card. The 445 does not have an internal power supply but rather draws its current through its direct cable connection to the AT's power supply. This power connection to the interface card eliminates the need to draw high currents through (and possibly overload) the AT's internal expansion bus.

The Irwin software consists of a substantial set of programs that bear the name *EzTape*. Supplied on two diskettes, *EzTape* is easy to install, handling the entire chore automatically except for a quick switch of the disks.

EzTape is completely file oriented and operates either directly through a menu-driven front end or through batch files. Irwin simplifies its operation by including two ready-made batch files, BACKALL and CHANGED, that back up either your entire hard disk or just the modified files. You'll need to learn nothing more than these commands for most ordinary backup routines.

Additionally, you can take full manual control and back up and restore individual files through the *EzTape* moving-bar menu system. Or you can build parameter files to automate your personal backup system.

EzTape allows you to include or ex-

PC MAGAZINE FACT FILE

Irwin 145 (Internal)
Irwin 445 (External)
Irwin Magnetic Systems Inc
2101 Commonwealth Blvd.
Ann Arbor, MI 48105
(800) BACKUP1
(313) 996-3300
List Price: $795 (internal); $895 (external).
Requires: DOS 2.0 or later; 256K RAM.
In Short: DC2000-based tape backup system using a proprietary standard operated through your computer's existing floppy disk controller with additional Irwin hardware.

CIRCLE **661** ON READER SERVICE CARD

clude individual files (including hidden and system files) from backup sessions; alternatively, you can key your backups to file attribute bytes or time and date.

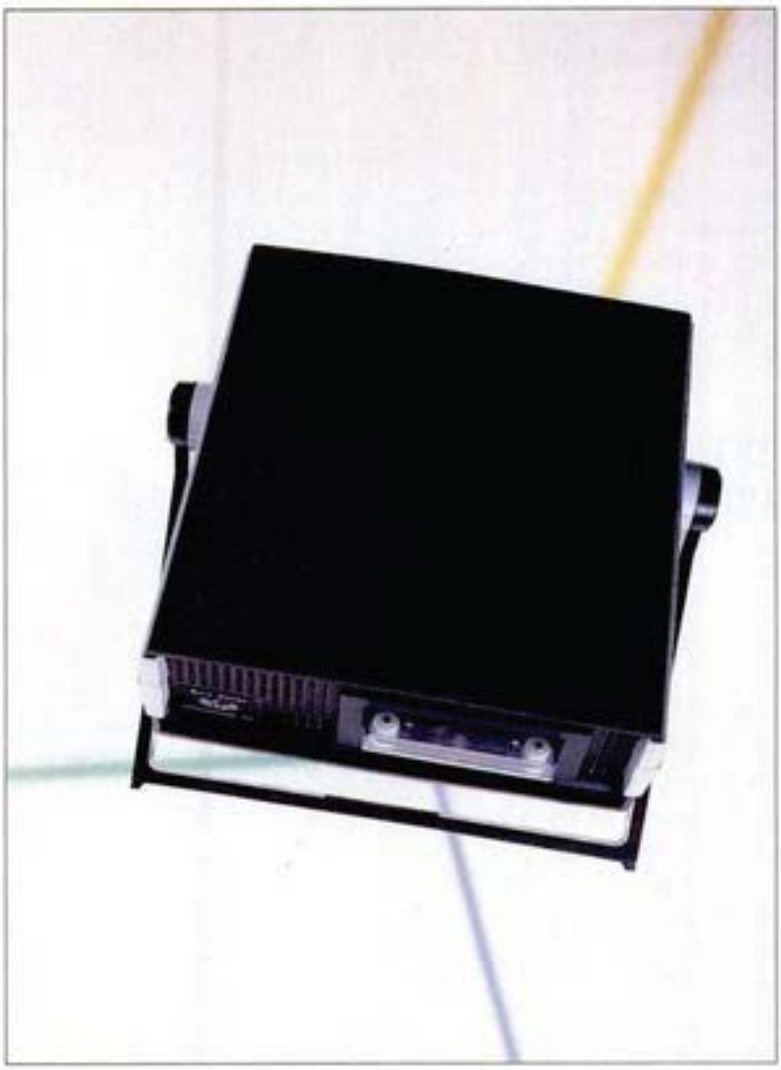
Irwin also includes some useful utilities. One of these, TFORMAT, formats tapes (although Irwin supplies preformatted tapes). The process takes just over half an hour. *EzStart* allows you to set the date and time at which a backup session will automatically start, allowing your system to make backups unattended.

The performance of the Irwin system rates in the middle of the pack when compared with other DC2000 systems, requiring about 9 minutes to back up the single, contiguous 10-million-byte BIGFILE test. It was unable to handle a hierarchy of subdirectories during the SCATTER tests, however, begging off with the error message: "The length of this path exceeds the limit. Files in this directory and it's [*sic*] subdirectories will not be backed up."

MICRO DESIGN INTERNATIONAL INC.

MDI External MT-40P/AT

Micro Design International is not a tape drive manufacturer but a system integrator that takes components from others and then assembles them into tightly integrated subsystems. Although the MDI External MT-40P/AT is based on an Alloy APT-40 Model 500 cartridge tape drive and Alloy's own *TIP-40* software, Micro Design adds an important benefit to its backup system: portability.



Micro Design International's 3- by 8¼- by 9-inch MDI External MT-40P/AT is based on the Alloy APT-40 Model 500 but adds an important benefit: portability. The drive and power supply are packaged in a case with a handle. Since the system is operated by a standard AT floppy controller, it requires no additional interface board.

Micro Design packages the Alloy drive and a small linear-technology power supply together in a black plastic instrument case with a large handle. Hence, you can move it from computer to computer, backing up a whole office-full of data with one small hardware investment.

Because it is operated by a standard AT floppy controller, the External MT-40P/AT requires no additional interface board. It does, however, use some fancy cabling to access the output of the AT's disk controller.

Micro Design supplies a "paddle board" that plugs into the B: drive output of the existing AT floppy disk data cable. To make the connection, you slide a second cable onto the other end of the paddle board and route it to the rear panel of the host computer. You then mount a connector on the far end of the cable onto the outside of the AT chassis with hardware that Micro Design provides with the system.

You connect another length of cable between the new external floppy disk jack and the rear of the External MT-40P/AT. The cabling system costs $50 and can be ordered separately so that you can modify several ATs to share one tape drive.

A similar model, the External MT-40P/XT, is available for backing up PCs and XTs. Based on the Alloy APT-40 Model 250 drive, the XT model operates somewhat more slowly due to its 250K-bit-per-second data transfer rate (compared with 500K bits per second for the AT model) but requires no cabling work. It plugs directly into the floppy disk expansion connector on the rear of the XT controller.

The Micro Design software strongly resembles the *TIP-40* program that Alloy supplies. Only the full-screen Alloy initial logo display is missing. Consequently, the Micro Design system operates just like the Alloy APT-40 Model 500 and delivers vir-

FACT FILE

MDI External MT-40P/AT
Micro Design International Inc.
6985 University Blvd.
Winter Park, FL 32792
(800) 228-0891
(305) 677-8333
List Price: $695; $595 for internal unit; Adapter, $50.
Requires: 256K RAM; DOS 2.0 or later; floppy disk controller.
In Short: A DC2000 tape backup system in a portable case for shuttling between PCs; based on Alloy hardware and file-by-file software.

CIRCLE 660 ON READER SERVICE CARD

PC MAGAZINE Performance Tests: DC2000 Systems

(Times given in minutes)

Even the best DC2000 system is no faster than a high-speed floppy disk backup system. The reason to choose a DC2000 system, then, is because it gives you the ability to hold 40 megabytes in one package rather than on 3 dozen high-density—or over 100 double-density—floppy disks. The QIC-100 standard used by the ADIC and Tallgrass systems is not limited by the speed of the floppy disk controller, as is the QIC-40 standard used by the Mountain Computer and Archive Corp. units. However, current implementations do not exploit this standard's full speed potential. In comparison, the Genoa 3200 Series DC 600 system can back up BIGFILE in just over 2 minutes and doesn't require you to preformat the tape, making it your best choice when performance counts most.

		BIGFILE		SCATTER
	Format time	Backup time	Restore time	Backup time
Mountain TD4440 Mountain Computer Inc.	54.5	5.9	4.8	13.2
Archive XL 5540 Archive Corp.	42.8	11.4	6.8	27.8
ADIC TD-440 Advanced Digital Information Corp.	41.0	13.1*	35.0*	DNF†
Irwin 145 and Irwin 445 Irwin Magnetic Systems Inc.	39.5	9.1‡	5.1	Error§
MDI External MT-40P/AT Micro Design International Inc.	38.3	8.9	6.8	33.5
Alloy APT-40 Model 500 Alloy Computer Products Inc.	38.3	8.9	6.8	33.6
TG-1040e HS Tallgrass Technologies Corp.	38.0	9.3	6.9	Error§

* Using the TD-440's SARCHIVE utility.
† Did not finish because backup process required more than 10 hours.
‡ Without verification.
§ Did not finish because the program was unable to handle that number of files and or subdirectories and reported an error.

The BIGFILE performance test measures a backup system's ability to deal with large databaselike files. The test creates a hard disk environment containing a single 10-million-byte (exactly) file that the systems reviewed here backed up and restored.

The SCATTER performance test challenges a program's ability to back up files scattered in an elaborately divided DOS subdirectory structure. The test creates an inverted tree of 1,578 subdirectories and fills each one with two files.

tually identical performance.

Based on Alloy's proprietary tape format (rather than the expected QIC-40 standard), the Micro Design system also requires you to format tape cartridges before use, a process that takes about 38 minutes. Each tape holds a maximum of 40 megabytes when all of the 20 available tracks are formatted.

In the Micro Design implementation, operation of the *TIP-40* software can require a lot of waiting. For instance, when loading the control software, you must wait while the tape's tension and the head are indexed before you're given control.

A single preliminary menu gives you a choice of system activities: backup, restore, and utility functions. Submenus activate the desired operations. Batch file and automatic backup operation at an appointed time are all available.

The portable design makes the MT-40P/AT an interesting alternative to Alloy's own unit. If you have a number of systems to back up regularly, it can be a workable solution.

MOUNTAIN COMPUTER INC.
Mountain TD4440

Of all the tape systems here, the Mountain TD4440 is the only one that hints at the capabilities of the QIC-40 (revision D) standard. On long, contiguous blocks of data, it nearly achieves the speed of an advanced floppy disk backup system, requiring 6 minutes to back up the 10-million-byte file of the BIGFILE test.

The Mountain Computer tape drive itself represents a bold new move for the company: it's the first drive that Mountain itself manufactures. Although the drive mechanicals are compact enough to easily fit a 3½-inch form factor bay, its integral control electronics actually require a full 5¼-inch slot. Metal brackets and AT mounting rails extend the sides of the chassis so that it can fit into a full-size, half-height drive slot.

Unusual among these tiny tape transports, the Mountain uses a direct drive motor (no belt) and a clever helix-and-lever mechanism for raising and lowering the read/write head. There's no door to cover the drive slot, nor a cartridge-release push button. You just slide in a tape and pull it out when you're done.

As with most QIC-40 drives, the Mountain plugs directly into the 1.2-megabyte (500K-bit-per-second transfer rate) floppy disk controller electronics of an AT or compatible. The only other connection you need is for power.

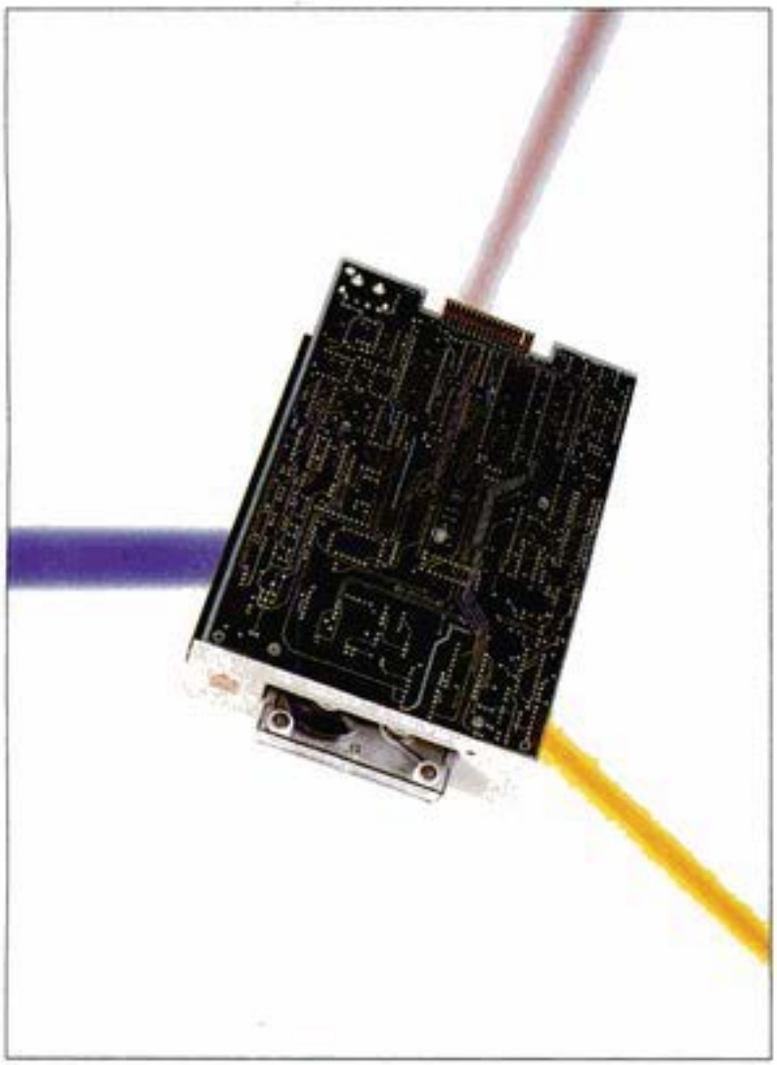
Four floppy disks full of software ac-

EDITOR'S CHOICE

PC MAGAZINE FACT FILE

Mountain TD4440
Mountain Computer Inc.
360 El Pueblo Rd.
Scotts Valley, CA 95066
(800) 458-0300 (outside Calif.)
(408) 438-6650
List Price: $795
Requires: 256K RAM; DOS 2.0 or later; AT floppy disk controller.
In Short: The fastest DC2000 tape backup system of this group. Capable of both file-by-file and image backups, it operates through your existing floppy disk controller under the QIC-40 standard.

CIRCLE **659** ON READER SERVICE CARD



The Mountain TD4440 is the only system reviewed here that nearly achieves the speed of an advanced floppy disk backup system. The 1¾- by 5¾- by 8-inch TD4440 also stands out from other DC2000 systems because of its unusual direct-drive motor and helix-and-lever mechanism for raising and lowering the read/write head.

company the system. Installing this large amount of code is completely automatic and even allows you to stop halfway through if you just want to take advantage of its menu-driven features alone. The full package also allows command-driven operation.

This control software is obviously derived from Mountain's previous *FileSafe* series—and that means it's well-thought-out, clean, and generally easy to operate. All of the expected file-oriented back-up features are available including whole disk, tagged, and selected file backups. You back up files chosen by date or archive attribute, and you can exclude files that you don't want to back up.

Full disk or partition image backups are also permitted. Commendably, individual file restorations are possible from these image backups.

A special AutoRun program will automatically make backups at an appointed time providing your system is idle and its clock is properly set. If you're using your computer at the appointed backup time, AutoRun will remind you that its time is due without interfering with your work. By using response files during batch operation in command-driven mode, you can custom-tailor the most exotic and complex backup sessions to run completely unattended.

If you're as impatient as most AT owners, you'll welcome the relatively high speed of the TD4440 system: its 6-minute BIGFILE backup time is topped only by its under 5-minute restoration time for the same file. The multiple subdirectory environment of the SCATTER test required just over 13 minutes to back up, including nearly a minute devoted to tagging all the files.

The biggest problem encountered with the TD4440 was an unusual incompatibility with a device driver that shot the machine into the 23rd century, at least based on its time and date displays. Some interaction with the driver prevented the backup process from being completed. Cleaning up CONFIG.SYS allowed the system to operate flawlessly. Mountain is investigating this situation.

■ If you're as impatient as most AT owners, you'll welcome the TD4440's relatively high speed.

TALLGRASS TECHNOLOGIES CORP.

TG-1040e HS

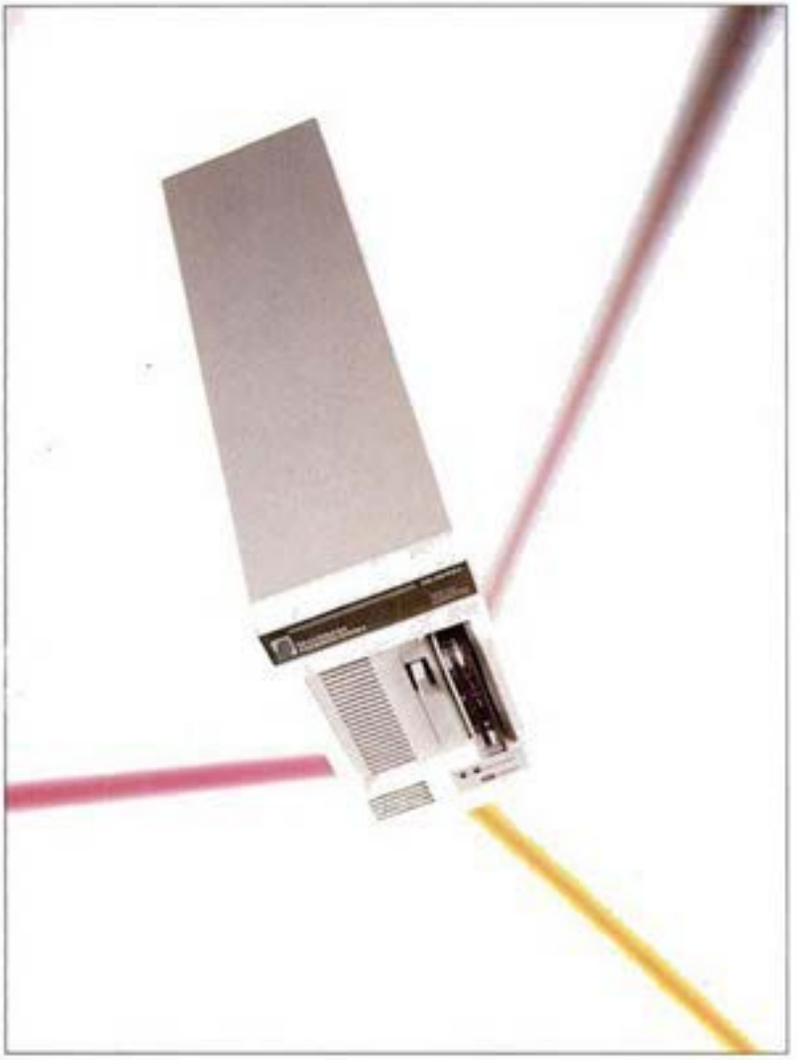
At 7 by 4 by 14½ inches, the Tallgrass Technologies TG-1040e HS can hold two full-size, half-height drive units. Besides holding its 5¼-inch form factor DC2000-based tape transport, it has a large enough power supply (50-watt) and enough mounting hardware and space to add a hard disk. In this way, you can make a complete external mass storage system with its own built-in backup. The Tallgrass tape system is also available as a bare drive for installation inside AT system units.

Its all-steel construction and office-equipment beige finish implies sturdiness

PC MAGAZINE FACT FILE

TG-1040e HS
Tallgrass Technologies Corp.
11100 West 82nd St.
Overland Park, KS 66214
(800) 228-3475
(913) 492-6002
List Price: $1,095 (external); $795 (internal).
Requires: 256K RAM; 640K RAM recommended; DOS 2.1 or later.
In Short: A QIC-100-based tape backup system that uses a proprietary controller for file-by-file or image backups. Includes *X-Tree* and *BackTrack* for disk management and automatic time-controlled backing up.

CIRCLE **658** ON READER SERVICE CARD



The TG-1040e HS measures 7 by 4 by 14½ inches and can hold two full-size, half-height drive units. It has a large enough power supply and enough mounting hardware and space to add a hard disk. These features make it possible for you to create a complete external mass storage system with its own built-in backup.

PC MAGAZINE EDITOR'S CHOICE

• Mountain TD4440

If you're looking for a fast, trouble-free backup system, investigate a DC600-based cartridge system and forget the high-tech DC2000. Although putting 40 megabytes in your pocket is a great idea, these implementations are not a good match for the expectations of the AT user who has invested his dollars in a high-performance machine to eliminate waiting.

Of the systems evaluated here, however, the hands-down winner is the Mountain TD4440. It's the fastest, its software is up to just about any challenge, and it gives you nearly every backup feature you might need. The Tallgrass TG-1040e HS comes in a close runner-up in speed. And it includes a wealth of backup and utility software that puts it among the top choices.

and long life. And, in fact, the Tallgrass external TG-1040e HS is a heavyweight for a little system.

Built around mechanicals that should fit a 3½-inch form factor, the Tallgrass drive (like the Mountain) uses a 5¼-inch-wide circuit board for its control electronics and direct-drive motor. The Tallgrass drive has a head-positioning mechanism different from that of the Mountain and a large push button to release and eject cartridges.

The TG-1040e conforms to the QIC-100 standard, although the company calls it PC/T in its documentation. In fact, Tallgrass's PC/T was the precursor to the QIC-100 standard.

As with all QIC-100 systems, the TG-1040e HS requires its own interface: a full-length, XT-height, 8-bit bus expansion board that plugs into its host computer. A meter-long cable connects the TG-1040e chassis to the interface board, and the chassis plugs into a standard wall outlet.

The Tallgrass support software rates as a mature product, derived from the company's well-received earlier tape systems. It provides both image and file-by-file modes with all the expected options, including selective backups by date and archive attribute. In addition, individual files or groups of files can be restored from an image backup.

Also included with the system is the Tallgrass automatic backup program, called *BackTrack*, and the *X-Tree* hard disk operating environment. *BackTrack* operates in the background and regularly backs up any new files or those that have been changed shortly after their creation or alteration. *BackTrack*'s only inconvenience is the slow system response when it's in operation. (This setup can be adjusted to fit your computing style to minimize its effect on your normal routine.)

Unfortunately, the normal (Tape Management System) backup software is not such a good match for the TG-1040e HS system. Entering the menu-driven section of the backup program entails a lengthy wait while the tape drive readies itself, typically a delay of about 50 seconds. In backing up the single-file, 10-million-byte BIGFILE test, the screen remains nearly blank with little hint of how things are going for nearly the total duration of the 9-minute process. Restoration of this file required just under 7 minutes.

Attempting to back up the SCATTER hierarchy of files and subdirectories with the TG-1040e HS system was completely unsuccessful and ended in the error message: "Failed to create directory entry." Consequently, the system failed to create a favorable impression on us.

Used only as a conventional backup system, the TG-1040e HS rates as rather ho-hum. However, used with *BackTrack*, it is a unique backup alternative, almost invisible, that does its best to keep your backups up-to-date.

Winn L. Rosch is a contributing editor of PC Magazine.