# TK50 CompacTape Cartridge Subsystem

## The Small Revolution

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### The TK50 Tape Subsystem Meets Your Needs for High-Capacity Data Storage for Microsystems

The TK50 sets new standards for data integrity and reliability in a microsystem tape drive. Its 95 Mbyte capacity allows it to back up any of Digital's mini-Winchester disks onto a single CompacTape cartridge. Yet it is extremely compact—small enough to fit into the same size slot as a mini-floppy drive (such as Digital's RX50) in a MicroVAX or MicroPDP-11 system box, or to be mounted in small tabletop or rackmountable enclosures designed for 5¼-inch form factor storage devices. The TK50's innovative, simplified streaming design contributes to several of these benefits.

The TK50 combines the reliability, compatibility, and high performance that are Digital's hallmarks. It is an industry leadership cartridge tape product that meets your needs for disk backup, software distribution, data collection, archiving, and data interchange.

Designed and built by Digital, the TK50 is a complete subsystem that contains many of the same features—such as an intelligent controller, complete onboard microdiagnostics, extensive error-correcting capabilities, and software compatibility that allows you to use most existing nine-track tape utilities—found on larger, more expensive subsystems. Yet this impressive device comes with a micro-sized price tag. With the TK50, Winchester-based microcomputers have truly come of age.

## Highlights

- 95-Mbyte maximum formatted capacity and streaming performance are ideal for backing up high-capacity mini-Winchester disks or handling large application programs. The pocket-sized half-inch tape cartridge is easy to transport, yet rugged.
- Exceptional protection for your data: read-after-write, Cyclic Redundancy Check (CRC), and Error Correction Code (ECC) combine with precise control of tape speed and tension to maximize data integrity.
- Simplified mechanical and electrical design results in high reliability, low cost, and ease of use.
- Your cost of ownership is low, because the TK50 is a truly maintenance-free product, requiring no field adjustments and no preventive maintenance—not even head cleaning.
- The drive is easy to install because it uses the same mounting and occupies the same 5¼ inch form-factor as a mini-Winchester disk; it can be packaged in a system enclosure or in a standalone tabletop box.
- Compatible with all of Digital's current Q-bus and UNIBUS systems including the MicroVAX and MicroPDP-11. Supported by Tape MSCP protocol in all Digital 16- and 32-bit operating systems. Used as a software distribution device.
- Calibration tracks and automatic gain control ensure transportability of programs and data between TK50 subsystems.
- A 16-Kbyte write-through cache enhances performance while maintaining data integrity.

## Exceptional Data Integrity and Transportability

With its powerful microcode-based electronics, gentle tape handling and self-adjusting design, the TK50 safeguards your data and ensures its transportability to any TK50 drive, for software distribution or data interchange.

The Cyclic Redundancy Check (CRC) automatically detects errors during writing and reading of data and causes them to be corrected "on the fly," without the need to reposition the tape. During "read" operations, the controller uses a powerful Error Correction Code (ECC) to correct data errors. Although it is highly unlikely, as many as 25 percent of the data blocks in a cartridge could contain errors and the TK50 would be able to correct them! In addition, the TK50 performs a read-after-write check to ensure that each bit is verified immediately after it has been recorded. This combination of CRC, ECC, and read-after-write is a major advance among microsystem tape drives.

From a mechanical viewpoint, the CompacTape cartridge encloses and protects the tape during storage and transportation, and the TK50 drive protects it in use through gentle handling. A short, simple tape path, low tape tension, and exceptionally smooth operation all contribute to this gentleness. The smoothness is possible because tape speed and tension are accurately controlled by a microprocessor-based servo system and the two reel motors.

*The white plastic leader allows automatic threading of tape through the TK50's simple tape path. The recording surface touches only the head, thus minimizing mechanical wear and enhancing data integrity.*

A tachometer mounted in a tape path roller guide provides accurate feedback directly to the microprocessor which then exerts precise control over the motors. The motors themselves minimize speed and torque variations and enhance the drive's uniform operation.

This uniformity, plus the drive's self-adjusting design, ensure that your data cartridge can be read on any TK50 tape drive. The first time a CompacTape (TK50-K) cartridge is written on by a TK50 subsystem, two reference bursts are automatically recorded at the beginning of tape. Thereafter, whenever that cartridge is loaded into any TK50 drive, the head will automatically align itself to the reference bursts, thus ensuring that it is in line to read the data tracks correctly. In addition, while reading the reference bursts, the drive normalizes its signal amplification circuitry to further ensure correct reading of the tape.

**Simplified Design for Reliability and No Preventive Maintenance**

Simplicity is often a key to success and has made the TK50 a leader in reliability. When you are ready to use it, the drive will be ready to run.

In the TK50, reliability is enhanced because there are fewer electronic and mechanical parts than in conventional designs, and the parts that are used are rugged. For example, the ferrite-and-ceramic head, and the ball bearing brushless DC motors are all designed for long life. In addition, many of the key functions of the TK50 are controlled by microcode, which is inherently very reliable.

Another aid to trouble-free operation is the latching mechanism which accurately positions the cartridge so that the cartridge leader and drive leader will mesh properly for reliable autothreading.

Finally, the TK50 is the first drive in the industry to require no preventive maintenance—no adjustments—not even head cleaning! A combination of head shape and materials with the exceptionally smooth, high quality tape used in CompacTape cartridges means that virtually no particles are shed in normal operation, and head cleanings are not necessary.

It all adds up to trouble-free operation and low cost of ownership.

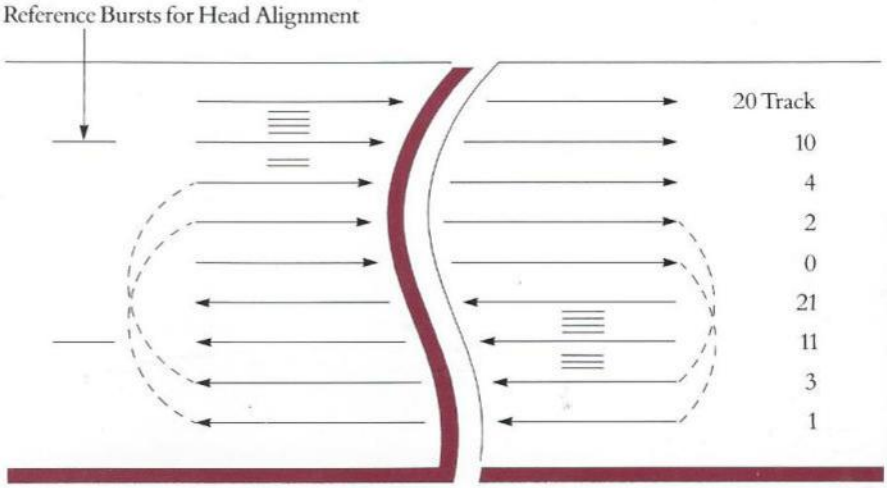
## High Capacity and Good Performance in a Small Package

The CompacTape (TK50-K) cartridge is a Digital-designed, publicly available, compact cartridge with up to 95 Mbytes of formatted capacity* — more than enough to back up any of Digital's mini-Winchester disks with no need for media changes.

Although the cartridge measures approximately 4 by 4 by 1 inches (10 by 10 by 2.5 cm), it achieves its capacity by containing 600 feet of half-inch tape (182.9m by 1.3 cm) on a single reel (the takeup reel is part of the drive). Recording is on 22 tracks in serial serpentine fashion, allowing high capacity at low cost. You can write protect the tape by setting an easily visible slide switch on the front of the cartridge. The cartridge's compact size and rugged design make it easy to carry or ship, and its capacity allows it to transport large application programs, operating systems or databases, in addition to its backup capability.

As a streaming tape drive, the TK50 is ideal for the applications listed above, which involve long continuous data transfers. The subsystem is designed to run for relatively long periods without stopping, writing or reading blocks of data and interblock gaps as it goes, and it includes several features to help optimize its operation:

- 75 ips speed gives a peak total transfer rate of 62.5 Kbytes/sec, and a peak transfer rate for user data of 45 Kbytes/sec.
- 16 Kbyte write-through cache buffer in the controller enhances performance of slower host systems while avoiding risks to data integrity. (Other cache designs can lose data). The write-through design does not allow data in memory to be erased until a copy of the data is safely on tape.
- The Tape MSCP protocol allows the TK50 controller to queue commands and data from the host system.
- Redundant blocks may be written (within limits), thereby allowing the drive to continue streaming and reducing the need to reposition.
- In both reading and writing operations, error correction takes place without stopping tape motion to do a reposition.




*The TK50 records data on 22 tracks in serial serpentine fashion. The head assembly contains two pairs of read/write gaps and records one track in each direction before stepping to the next position. Tracks are numbered in the order recorded.*

## An Intelligent Controller for Enhanced Maintainability, Compatibility, and Performance

A TK50 controller is a single module that includes the microprocessor system with extensive diagnostics and microcode, a system bus interface, and the TK50 drive interface.

* In order to enhance streaming performance with certain host system characteristics, redundant blocks may be written (as described above), thereby reducing cartridge capacity somewhat. Capacity will still be sufficient for single-cartridge backups under most conditions. Similarly, performance will vary, depending on the application and a number of host system parameters. Consult your sales representative to estimate the performance and capacity to be expected with your software and system configuration.

Built-in diagnostics monitor the drive and controller to assure the user that the system is performing properly, and isolate problems should any arise. While the subsystem runs diagnostics, the CPU is free to perform other functions. On powerup, the controller comprehensively checks its own logic and data paths. At the same time, the drive tests itself, and will continue to do so during idle time. The testing takes about one second and is transparent to the user. Should a problem arise, a light flashes on the front panel, and more extensive diagnostics can be run to isolate the problem to either the drive or controller; these two components are the only field-replaceable units, which makes repair an easy swapping process, should it ever be needed.

The controller also implements the Tape Mass Storage Control Protocol (Tape MSCP), the software heart of the Digital Storage Architecture (DSA). By conforming to DSA, the TK50 enjoys compatibility with a broad range of Digital's systems and storage devices. The DSA software drivers are or soon will be in all of Digital's 16- and 32-bit operating systems, and the command set is virtually identical to that used for our nine-track drives—the TU81 and TA78. This means that writing programs to use the TK50 is a straightforward, familiar process.

The Digital Storage Architecture allows for independent evolution of storage devices, system hardware and operating system software and greatly simplifies future product migration. Through this approach, we can bring new technology to our users quickly, while we protect and enhance your investment in our current products.

Finally, as mentioned earlier, the controller enhances TK50 subsystem performance by allowing queuing of commands and data and error correction without repositioning.

### A Wide Range of System and Software Support

The TK50 can be supported by all of Digital's 16-bit and 32-bit operating systems,* and will be used as a software distribution device. With its Q-bus and UNIBUS interfaces, it can also adapt to a wide range of system hardware. Although the TK50 is designed primarily for MicroVAX and MicroPDP-11 systems, it can easily be used on our larger UNIBUS-based VAX and PDP-11 systems. This provides an easy way for software developers to transport programs from a large development machine to a Q-bus based system, or for data to be moved between small and large machines.

### Ease of Use

Users hope computers will simplify their work, not complicate it, and so the TK50 is designed to be easy to install, simple to operate, and maintenance free.

The subsystem can be packaged in several ways, to suit the needs of end users and OEMs. The drive can be mounted in Digital's standard microsystem enclosures, occupying the same size slot as a 5¼-inch form factor Winchester disk or diskette drive and drawing power from the system power supply. If your system has no such spaces available, you can order the TK50 in a compact, standalone tabletop box that includes its own power supply and connects to the system by a shielded cable. And for custom configurations, the TK50 is also available in a similar standalone box that is designed for rackmounting. OEMs who wish to design their own packaging will find the process easy and familiar, since the TK50's mounting and space requirements are very similar to those of our RX50 floppy disk drive.

Once the unit is installed, operation is straightforward. You insert a cartridge into the drive, press the button on the front panel, and the drive automatically threads the tape and advances to the beginning of tape (BOT) marker. A light on the front panel indicates when the cartridge is locked in place and ready to be used, and a switch on the cartridge indicates whether the tape is write-protected. If a problem arises, the front panel light will flash rapidly to alert you. All other operations are initiated and controlled via the host system, and use familiar tape commands.

### For Further Information . . .

The TK50 is designed to Digital's high standards of quality and reliability. Its industry-leading combination of capacity, data integrity, ruggedness, compact size, and low cost make the TK50 an especially valuable addition to your MicroVAX, MicroPDP-11 or other Digital mini or microsystem. Contact your sales representative for further information.

* Consult your sales representative to be sure you have an operating system release that includes the Tape MSCP driver, which is required to support the TK50.

## Specifications

| | | |
|---|---|---|
| **Performance** | | |
| Read/write speed | 75 in/s, streaming | |
| Peak Data transfer rate | Total 62.5 Kbytes/s<br>User data: 45 Kbytes/s | |
| **Data Organization** | | |
| Number of data tracks | 22 | |
| Recording method | Serial, serpentine pattern | |
| Recording density | 6667 bits/in | |
| Record size | Variable to (64 Kbytes – 1 byte) | |
| Maximum capacity | 95 Mbytes (formatted) | |
| Recording medium | 182.9-m length (600 ft), 1.3-cm width (0.5 in) magnetic tape | |
| Interface | Q-bus, UNIBUS | |
| **Operating Environment** | | |
| Temperature range | 10 – 40°C (50 – 104°F) | |
| Relative humidity | 20 – 80% | |
| Maximum wet bulb | 25°C (77°F) | |
| Maximum altitude (operating) | 3655m (12,000 ft) | |
| Maximum acoustic noise | 35 dBA | |
| **Power Requirements** | | |
| Drive (max operating) | +12 V @ 2.4A; + 5 V @ 1.4 A | |
| Controller (maximum operating) | +5 V @ 3.0 A | |
| Power consumption Drive/Controller | 35 W/15 W | |
| Cooling Requirements | 1.5 cu m/min (5 cu ft/min) minimum | |
| **Physical Dimensions** | | |
| Without bezel | 8.2 (h) x 14.5 (w) x 21.4 (d) cm, (3.23 x 5.70 x 8.44 in) | |
| Bezel | 8.6 (h) x 14.9 (w) x 0.9 (d) cm, (3.38 x 5.88 x 0.35 in) | |
| Weight w/o cartridge | 2.3 kg (5.0 lb) | |
| Cartridge dimensions | 10.4 x 10.4 x 2.5 cm, (4.1 x 4.1 x 1.0 in) | |
| **Configuration Rules** | | |
| Maximum drives per controller | 1 | |
| Maximum controllers per CPU | 4 | |
| Current drawn by controller (dc) | 2.8 A (typical) | |
| Controller mounting requirements | Q-bus<br>UNIBUS | Dual module<br>Quad module |

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