EXABYTE

MAGNUM FULL-HEIGHT EXTERNAL TAPE DRIVE (LTO-2E AND LTO-3E)

PRODUCT MANUAL

PART NUMBER   1015469 Revision A

REVISION HISTORY

Revision	Date	Description
A	May 2006	Initial release.

NOTE: The most current information about this product is available at Exabyte's web site (www.exabyte.com).

PRODUCT WARRANTY CAUTION

The Exabyte Magnum Full-Height External Tape Drives (LTO-2e and LTO-3e) are warranted to be free from defects in materials, parts, and workmanship, and conforms to the current product specification. For the specific details of your warranty, refer to your sales contract or contact the company from which you purchased the tape drive.

The warranty for the tape drive shall not apply to failures caused by:

▶ Physical abuse or use not consistent with the operating instructions or product specifications.

▶ Use of any type of data cartridge other than an Exabyte LTO tape or an Exabyte-approved LTO data cartridge.

▶ Use of any type of cleaning material other than an Exabyte LTO tape Cleaning Cartridge.

▶ Repair or modification by any one other than Exabyte's personnel or agent in a manner differing from the maintenance instructions provided by Exabyte.

▶ Removal of the Exabyte identification label(s).

▶ Physical abuse due to improper packaging of returned drives.

If problems with the tape drive occur, contact Exabyte or your service provider; do not void the product warranty by allowing untrained or unauthorized personnel to attempt repairs.

⚠ **Caution**

Returning the tape drive in unauthorized packaging may damage the unit and void the warranty.

If you are returning the tape drive for repair, package it in its original packaging (or in replacement packaging obtained from your vendor).

FCC NOTICE

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

LASER SAFETY NOTICE

This tape drive contains components that comply with performance standards that are set by the U.S. Food and Drug Administration (Part 21CFR, 1040.10/11). This means that these products belong to a class of laser products that do not emit hazardous laser radiation. This classification was accomplished by providing the necessary protective housing and scanning safeguards to ensure that laser radiation is inaccessible during operation or is within Class I limits. External safety agencies have reviewed these products and have obtained approvals to the latest standards as they apply to this product type.

END OF LIFE (EOL) PLAN

This tape drive is a purchased unit. Therefore, it is the sole responsibility of the purchaser to dispose of it in accordance with local laws and regulations at the time of disposal. This unit contains recyclable materials. The materials should be recycled where facilities are available and according to local regulations.

To obtain general information	
Exabyte Corporate Headquarters	Exabyte Corporation 2108 55th Street Boulder, CO USA 80301 (303) 442-4333
World Wide Web	www.exabyte.com
To obtain technical support	
Exabyte Technical Support	www.exabyte.com/products/hardwarewarranty.cfm
To order supplies and accessories	
Exabyte Sales Support	1-800-774-7172
	1-800-392-8273 (Exabyte Media)
To obtain service	
Exabyte Service	www.exabyte.com/support/contact/index.cfm

Contents

Figures

NOTES

Tables

NOTES

How to Use This Manual

This manual describes how to install, operate, and maintain the Magnum FH External Tape Drive (LTO-2e and LTO-3e). It also provides functional, performance, and environmental specifications.

Where to Look for Information

Installation

If you are installing the tape drive for the first time, refer to the following chapters:

▸ Chapter 1 provides an overview of the tape drive's features and components.

▸ Chapter 2 provides instructions for installing the tape drive.

Operation and troubleshooting

Refer to these chapters for information about operating, maintaining, and troubleshooting your tape drive:

▸ Chapter 3 provides instructions for using the tape drive, including reading the single-character display and the status LED.

▸ Chapter 4 describes the types of tape cartridges to use and defines the conditions for storing and shipping them.

▸ Chapter 5 describes how to optimize your tape drive's performance.

▸ Chapter 6 provides troubleshooting recommendations.

Additional information

These chapters provide supplemental information about the tape drives.

▸ Chapter 7 provides specifications for the tape drive.

▸ The Glossary provides definitions of terms used in this manual and in other documentation associated with the tape drive.

Related Publications

For more information about the tape drive and the standards used by the tape drive, refer to the following publications. To download a PDF version of an Exabyte publication, visit the Exabyte web site (www.exabyte.com).

Hewlett-Packard Ultrium (LTO-2 and LTO-3) Publications

See the HP web site at www1.hp.com/storage/tapestorage.html to locate additional information about HP LTO Ultrium tape drives.

Standards Publications

These publications are available on the web at www.t10.org.

▸ *SCSI Parallel Interface-3 (SPI-3)*, International Committee on Information Technology Standards (INCITS)
▸ *SCSI-3 Stream Commands (SSC)*, American National Standards Institute (ANSI)
▸ *SCSI Stream Commands-2 (SSC-2)*, ANSI
▸ *SCSI Primary Commands-2 (SPC-2)*, ANSI
▸ *SCSI Primary Commands-3 (SPC-3)*, ANSI

CONVENTIONS USED IN THIS MANUAL

This manual uses the following conventions:

Note: Notes provide additional information or suggestions about the topic or procedure being discussed.

! Important Read information marked by the "Important" icon for information that will help you complete a procedure, avoid extra steps, or avoid future problems.

⚠ Caution Read the information marked by the "CAUTION" icon for information you must know to avoid damaging the tape drive or losing data.

⚡ Warning Read text marked by the "WARNING" icon for information you must know to avoid personal injury.

1

TAPE DRIVE FEATURES

The Exabyte Magnum FH External Tape Drive (LTO-2e and LTO-3e) offers high-capacity, performance, and technology designed for the midrange open systems environment. This manual describes the Linear Tape-Open (LTO) Generation 2 (LTO-2) and Generation 3 (LTO-3) tape drives.
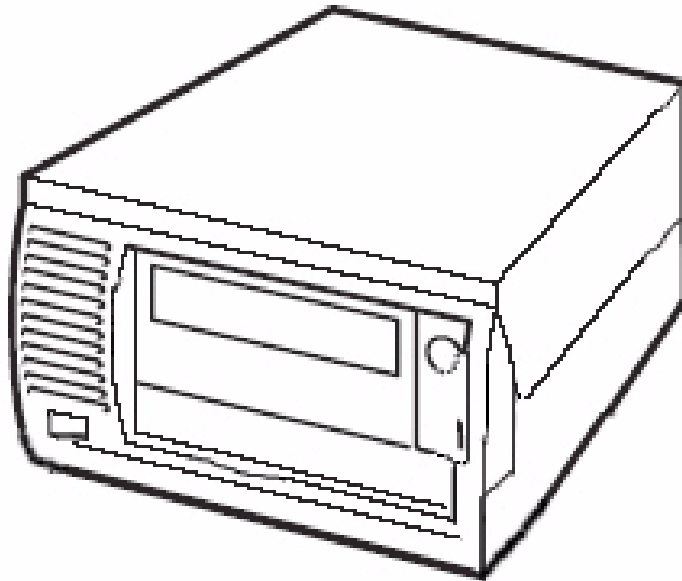
FRONT PANEL COMPONENTS

Your Ultrium tape drive has four LEDs (light emitting diodes) on the front panel, which indicate tape drive status. The power switch is also illuminated when power is switched on. These LEDs provide useful troubleshooting information. For additional information, also see:

▸ LED description — "Tape Drive LEDs" on page 17
▸ Eject button in normal operation — page 16
▸ Forced cartridge eject — page 24

Figure 1-1 shows the controls and indicators on the front panel of the tape drive. For more information about using these controls and indicators, see Chapter 3.

Eject button

Emergency reset

Power on/off   Cartridge door

Ready
Drive error
Tape error
Clean
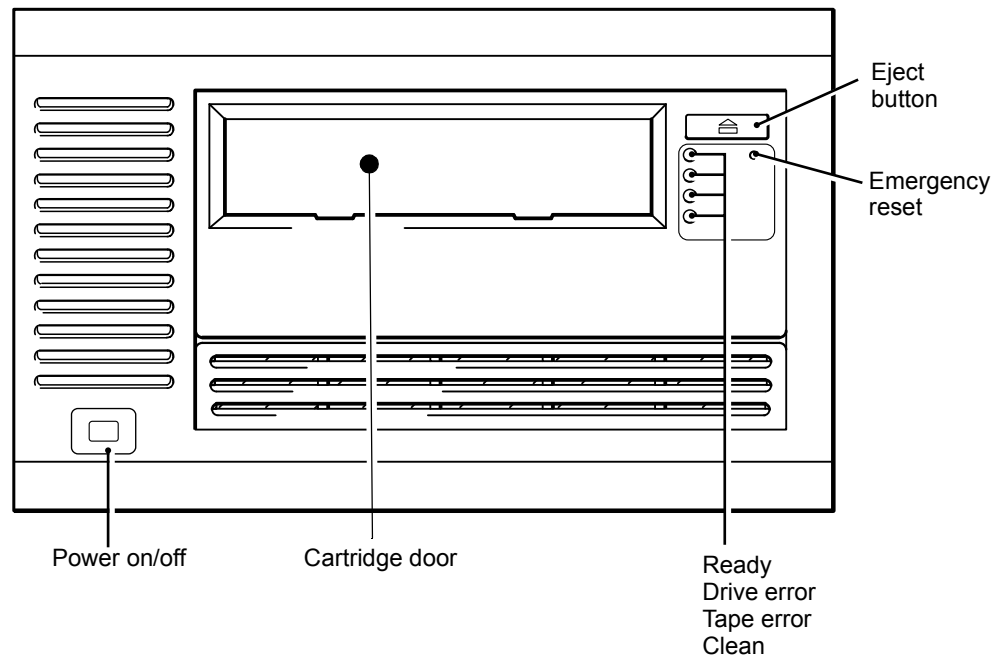
Figure 1-1   *Front-panel components*

Cartridge Door   Used for inserting the cartridge into the tape drive.

Eject Button   Used to unload the tape and eject the cartridge.

Power On/Off Switch   Used to turn power on and off.

Emergency Reset   Shows the power-on status of the tape drive.

Status LEDs (Light Emitting Diode)   Indicates the current operating status information, described below.

▸ Ready (top, green)

  ▸ On—the tape drive is ready for use
  ▸ Off—the tape drive power is off or there was a failure during self-test
  ▸ Flashing—the tape drive is busy

▸ Drive Error (second, amber)

  ▸ Off—no fault has been detected
  ▸ Flashing—the tape drive mechanism has detected a hardware error

▸ Tape Error (third, amber)

  ▸ Off—no fault has been detected

▶ Flashing—the tape currently in the tape drive is faulty.

This LED could come on for a number of reasons, but they all relate to the tape being in error in some way, such as damaged media or unsupported tape. Do not use the cartridge; replace it. The LED will go out when a tape load is started.

▶ Clean (bottom, amber)

   ▶ On—cleaning cartridge in use
   ▶ Off—the tape drive does not require cleaning
   ▶ Flashing—the tape drive needs cleaning

Accessibility features   The front panel of the Ultrium 3 tape drive has been designed for increased accessibility for persons with disabilities. This includes larger font labeling of the Status LEDs and an Eject button that has been designed for ease of use.

BACK PANEL COMPONENTS

AC Power Connector   Used to provide power through a grounded AC power connector.

SCSI Connectors   Used to connect the tape drive to the SCSI bus with two SCSI cables or one SCSI cable and a terminator.

SCSI ID Switch   Used to set the tape drive SCSI ID.

Back Panel LEDs   There are two LEDs on the back panel, described below.

▶ Act TERM (termination active)

   ▶ On—the tape drive enclosure is providing active termination on the SCSI bus
   ▶ Off—the tape drive enclosure is not providing active termination (there is another device or terminator attached to the SCSI-OUT connector)

▶ Fan/PWR Fault (fault on fan or power supply)

   ▶ Off—no fault has been detected
   ▶ On—a fault with the fan or power supply has been detected

Figure 1-2 shows the back-panel components of the of the tape drive.
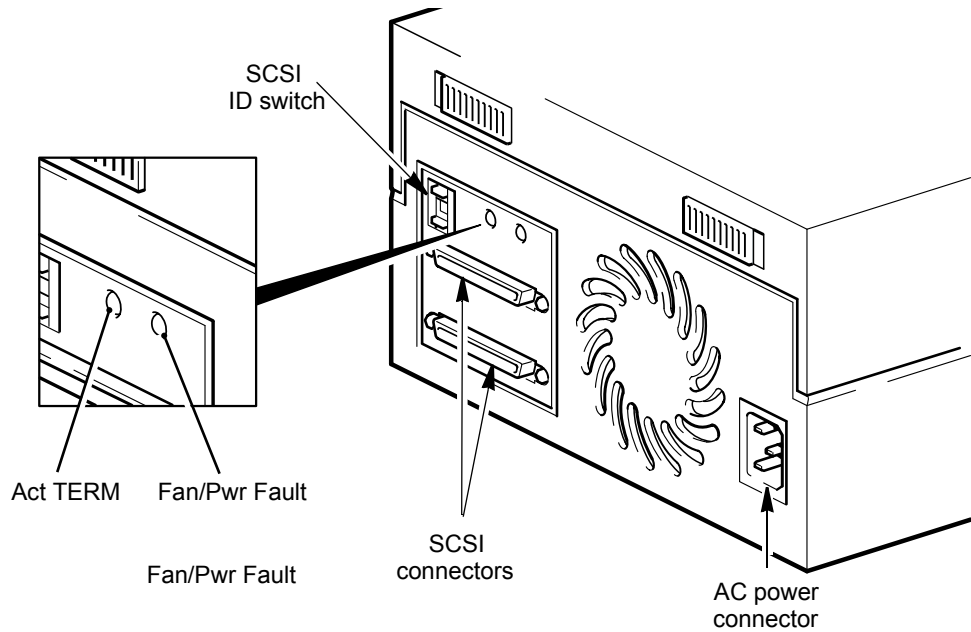
Figure 1-2   *Back-panel components*

TAPE DRIVE MODELS

RECOMMENDED MODELS

The following table shows the recommended usage models and "Tape Drive Performance" on page 27 provides further information about factors that can affect performance.

Table 1-1   *Recommended tape drive usage*

	Direct Attach, single storage server	**Across the Network, single storage server, multiple clients**
Ultrium 3	Recommended use a RAID disk subsystem	Requires careful design to utilize the tape drive's performance capabilities, even Gigabit Ethernet will limit performance
Ultrium 2	Recommended	Recommended anything less than Gigabit Ethernet may limit performance
Note: For Ultrium 2 tape drives, a RAID disk subsystem is also good practice, but a single disk may be sufficient, if it is a fast disk, such as a 15K RPM drive, and depending on your data's compressibility.		

The tape drive (B) can be used in a standalone or network environment. It should always be directly attached to a SCSI connector on the storage server (A), as shown in Figure 1-3.
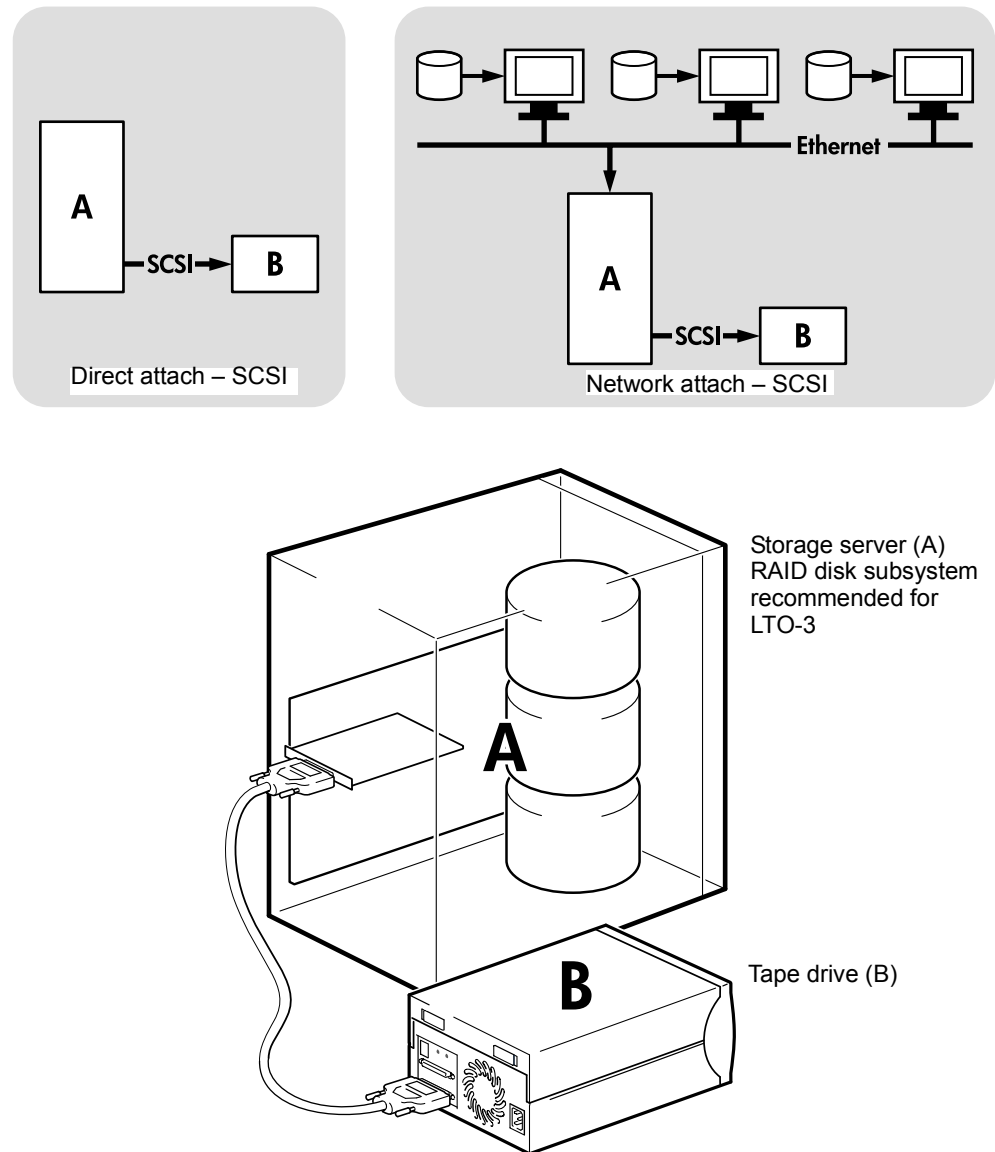
Figure 1-3   *Recommended tape drive usage*

OTHER MODELS

The tape drive may work with other usage models, such as network attach storage (NAS) and storage area networks (SAN), but there is currently no technical support for installing and using standalone Ultrium tape drives with these architectures. Similarly, connection to fibre channel may be possible, if you purchase and install a fibre channel/SCSI bridge, but it is not currently a supported option.

Notes

2

INSTALLING THE TAPE DRIVE

This chapter provides step-by-step instructions for installing the tape drive. The information in this chapter expands on the instructions in the *Quick Start* guide that accompanied your tape drive.

BEFORE YOU BEGIN

Before you begin the installation, follow these steps.

✔ **Ensure that the work area is free from conditions that could cause electrostatic discharge (ESD).** — Discharge static electricity from your body by touching a known grounded surface, such as a computer's metal chassis.

✔ **Inspect the Power Cord and Outlet** — Inspect the power cord plug to ensure that it matches the power receptacle. Ensure that the electrical outlets that you use are properly grounded and that the circuit breaker is turned on.

⚠ **Warning** An electrical outlet that is not correctly wired could place hazardous voltage on metal parts of the system or the devices that attach to the system. It is the responsibility of the customer to ensure that the outlet is correctly wired and grounded to prevent an electrical shock.

✔ **Power Down the Host Computer System** — Turn off all devices attached to the computer to which you plan to connect the tape drive, then turn off the computer. Disconnect all power cables.

✔ **SCSI bus Requirements** — To get optimum performance from your tape drive you need a SCSI bus that can transfer data at a rate that supports the tape drive's maximum burst transfer speed.

▸ LTO-3 — Ultrium 3 tape drives are high-performance Ultra 320 SCSI devices with a maximum burst transfer speed of 320 MB/second. They are designed to operate on a low voltage differential SCSI bus (LVDS). For optimum performance they should always be connected to a dedicated Ultra 320 SCSI bus.

▸ LTO-2 — Ultrium 2 tape drives are high-performance Ultra 160 SCSI devices with a maximum burst transfer speed of 160 MB/second. They are designed to operate on a low voltage differential SCSI bus (LVDS). For optimum performance they should be connected to a an Ultra 160 or Ultra 320 SCSI bus.

✔ **Additional Points** — Before starting to install your tape drive, you should consider the following points.

▸ Which operating systems are supported?

Ultrium tape drives can be connected to servers running under Windows® and most other industry-standard operating systems. Refer to your supplier for more information about the operating system versions that are supported.

▸ How do I connect the tape drive to my server?

Check the usage models on page 4. This shows how the Ultrium tape drive can be used in different system architectures.

You will need a properly installed and configured SCSI host bus adapter (HBA) or a built-in SCSI controller on your server with a spare LVD SCSI port.

For optimum performance your tape drive should be the only device on the SCSI bus. Do not attach the tape drive to the same SCSI bus as your disk drive or RAID controller. See also Table 2-1 on page 10.

▸ Do I need additional items for installation?

You received a 68-pin, wide, HD SCSI cable to connect your Ultrium tape drive. If your server does not have an HD SCSI port, you must purchase and install either an adapter or a different SCSI cable. The Ultrium tape drive is an HD device.

If the tape drive is not the only or last device on the SCSI bus, you must terminate the bus with a multimode terminator (included with the tape drive kit). If the tape drive is the only or last device on the bus, then the tape drive enclosure provides active termination and you do not need to install a separate terminator.

If you do not have a spare, suitably rated SCSI connector on your server, you must install a new HBA (also known as a SCSI card). You will need to purchase and install the new HBA into an unused, 64-bit PCI expansion slot within your server before installing your tape drive. Full installation instructions and all necessary cables and mounting hardware are normally provided with the HBA.

BACKUP SOFTWARE AND DRIVERS

BACKUP SOFTWARE

For optimum performance it is important to use a backup application that is appropriate for your system's configuration. In a direct attach configuration, where the tape drive is attached to a standalone server, you can use backup software that is designed for a single-server environment. In network configurations you will need backup software that supports enterprise environments.

Make sure you have a backup application that supports your tape drive and download any upgrades or patches, if required.

DRIVERS

Windows users

Before you install the tape drive, download the LTO driver from the manufacturer's web site. Refer to the accompanying "readme" file for specific installation instructions for Windows 2000, Windows XP and Windows Server 2003 drivers.

UNIX and OpenVMS users

The recommended backup applications use the operating system's standard, built-in device drivers. To upgrade drivers we recommend that you patch to the latest version of the operating system, following the instructions in the patch documentation.

UNPACK THE TAPE DRIVE

All Exabyte tape drives are tested, inspected, and carefully packaged at the factory. However, because shipping damage can occur, you should follow the steps below to unpack the tape drive:

1. Visually inspect the shipping container and notify your freight carrier immediately if you see any damage.

2. Place the shipping container on a flat, clean, stable surface. If parts are missing or the equipment is damaged, notify your supplier or Exabyte.

3. Save the original shipping container and packaging materials in case you need to reship the tape drive.

INSTALL THE TAPE DRIVE

Follow the steps below to install your Ultrium tape drive.

STEP 1. CHECK THE SCSI CONNECTION

Use the following questions to help you check your SCSI connection. If you answer 'Yes' to all these questions, you are ready to install your tape drive. If you answer 'No', you will probably need to purchase and install additional items.

1) Is there a spare SCSI port on the server?

No? → Purchase and install one of the recommended HBAs into an unused 64-bit PCI expansion slot. See table below.

Yes?

2) Does the SCSI bus type match the tape drive type, Ultra 320 (Generation 3) or Ultra 160 (Generation 2)?

No? → Performance may be impaired. Consider replacing your card with one of the recommended HBAs. See table below.

Yes?

3) Will the tape drive be the only device on the bus?
Do not connect to a RAID controller channel. This is for disk drives only.

No? → Performance may be impaired, depending upon the tape drive model and SCSI bus. Ultrium 3 drives should always be on a dedicated bus. See table below.

Yes?

4) Does the HBA/controller have a HD SCSI connector?

No? → Purchase and install the appropriate adapter.

Table 2-1 shows the recommended SCSI bus types for Ultrium tape drives.

Table 2-1 *Recommended SCSI bus types*

SCSI bus type	Transfer Speed	Recommended for...	
		LTO-3	**LTO-2**
Ultra 320 LVD	Up to 320 MB/s	Yes, one tape drive only per bus	Yes, for up to two drives per bus
Ultra 160 LVD	Up to 160 MB/s	Acceptable	Yes, one tape drive only per bus
Ultra 2 LVD	Up to 80 MB/s	No	Acceptable
Single-ended, wide	Up to 40 MB/s	No	No
		Do not connect to a narrow SCSI bus.	
High Voltage Differential	Up to 40 MB/s	No. The tape drive will not work and you may damage the tape drive or controller.	

Figure 2-1 shows two of the SCSI connector types.
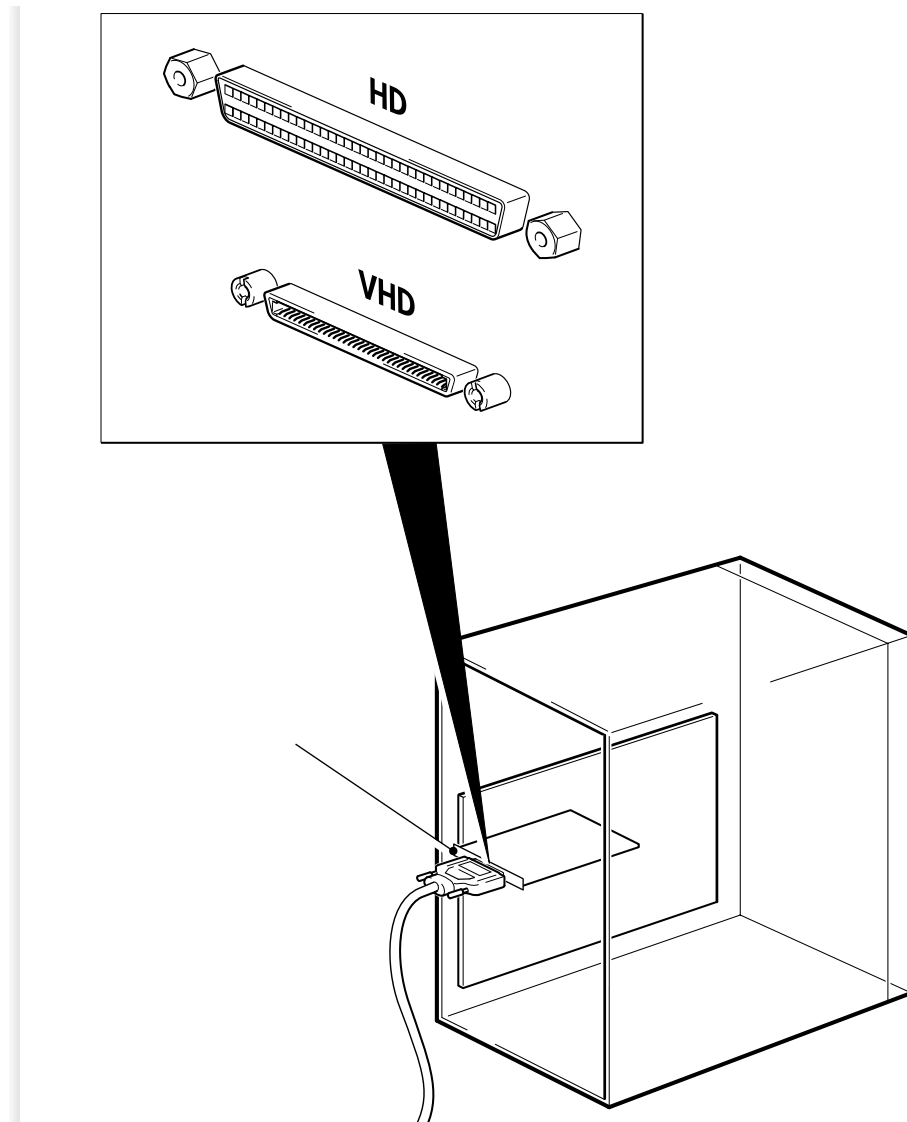
Figure 2-1 *SCSI bus connections*

STEP 2. CHECK THE TAPE DRIVE'S SCSI ID

! Important Your Ultrium tape drive is shipped with a default SCSI ID of 3, but it can be assigned any *unused* ID between 0 and 15. Do not use SCSI ID 7, which is reserved for the SCSI controller, or SCSI ID 0, which is typically assigned to the boot disk.

1. Determine whether you need to change the SCSI ID from the default of 3.

2. Change the tape drive's SCSI ID, if necessary.

Use a small screwdriver or a ball-point pen to press the indented SCSI ID selector buttons on the rear panel (see Figure 2-2) until the required value is displayed. Do not use a pencil because small bits of graphite could contaminate the tape drive.

> **Note:** The server and the tape drive SCSI IDs are only checked at power-on. To change the SCSI ID after installation, power down both the server and the tape drive, change the tape drive's SCSI ID, power up the tape drive, and then power up the server.
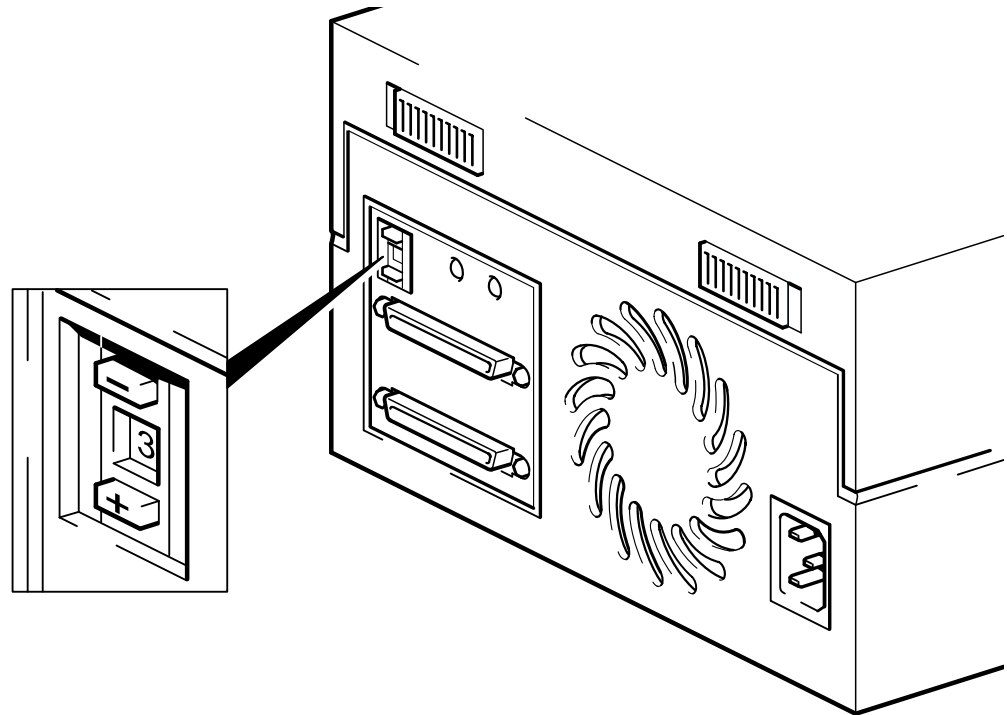
Figure 2-2 *SCSI ID change buttons*

STEP 3. CONNECT THE SCSI CABLE

SCSI cable   You received a 68-pin, wide, HD SCSI cable to connect your Ultrium tape drive. If your server does not have an HD SCSI port, you must purchase and install either an adapter or a different SCSI cable. The tape drive is an HD SCSI device.

⚠ **Caution**   To avoid damaging the server or tape drive, ensure that both are powered off while you attach the SCSI cable.

---

1. Make sure you are connecting to a recommended SCSI bus type. For optimum performance your tape drive should only be connected to a SCSI bus that can transfer data at a rate that supports the tape drive's maximum burst transfer speed. See "Check the SCSI Connection" on page 10. Do not connect the tape drive to a single-ended SCSI bus, to the same bus as your disk drive or to a RAID controller.

2. Perform a normal system shutdown and turn off power to the server and any connected peripherals.

3. Attach one end of the SCSI cable to the server's external SCSI connector and secure it by tightening the screws.

4. Attach the other end of the SCSI cable to the SCSI-IN connector on the rear panel of the tape drive and secure it by tightening the screws (see Figure 2-3). Do not connect the cable to the SCSI-OUT connector.

    The SCSI-OUT connector is only used when daisy-chaining two devices. We do not recommend daisy chaining LTO-3 tape drives.

Terminator Does the tape drive need a terminator?

▸ If the tape drive is on a dedicated SCSI bus, it does not require a terminator. When the cable is connected to the SCSI-IN connector, the enclosure provides active termination.

▸ If it is not the only device on the SCSI bus, you must make sure that the SCSI bus is terminated. You can do this in two ways:

   ▸ Place the tape drive at the end of the chain and attach the HD connection on the SCSI cable to the SCSI-IN connector; the enclosure provides active termination.

   ▸ Attach the HD connection on the SCSI cable to the SCSI-IN connector and use the SCSI-OUT connector on the tape drive to connect to the next device in the chain. Make sure that the last device in the chain is terminated with an LVD multimode terminator.
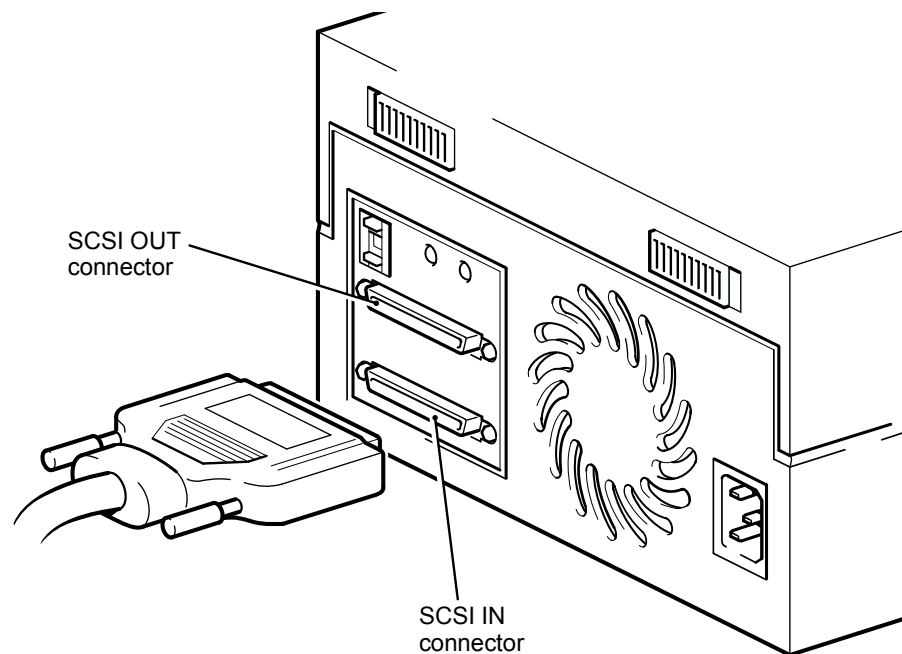
Figure 2-3   *SCSI cable connection*

STEP 4. CONNECT THE POWER CABLE

An external Ultrium tape drive will operate using any voltage in the range 100–240 volts (50-60 Hz). No adjustment is needed.

1. Plug the power cable securely into the socket on the rear panel of the tape drive.

2. Plug the other end of the power cable into the power outlet.
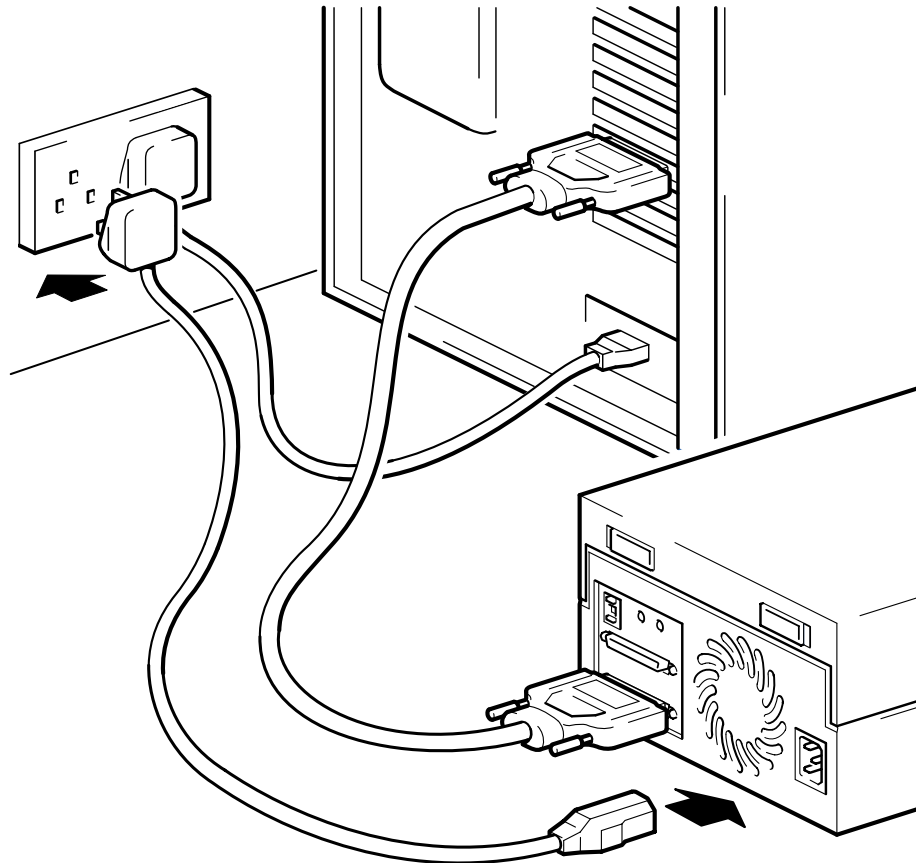
Figure 2-4   *Power cable connection*

STEP 5. VERIFY THE INSTALLATION

Check the operation   To check the operation, follow these steps.

1. Power on the tape drive and the server. The tape drive will run its hardware self-test, which takes about 5 seconds. If self-test

   ▶ Passes—the green Ready LED flashes and then shows steady green.
   ▶ Fails—the Drive Error and Tape Error LEDs flash, while the Ready and Clean LEDs are off. This continues until the tape drive is reset.

   See "Tape Drive LEDs" on page 17 for more information about the LEDs.

2. Install drivers and backup software.

    For all operating systems ensure that you have downloaded any upgrades necessary for your backup application (see page 9).

3. Verify that the tape drive installation was successful.

    Note: If you encounter a problem during this verification procedure, turn to "Troubleshooting" on page 29 for help in diagnosing and fixing the problem.

4. Use a blank Ultrium cartridge to carry out a backup and restore test to check that the tape drive can write data to tape. Refer to your backup application documentation for specific instructions. See "Data Cartridges" on page 21 for more information about recommended cartridges.

Load a cartridge   Follow these steps to load a cartridge into the tape drive.

1. Insert the cartridge into the slot in the front of the tape drive with the white arrow uppermost and facing the tape drive door. Apply gentle pressure until the tape drive takes the cartridge and loads it.

Arrow indicates
leading direction

Affix bar code
label here
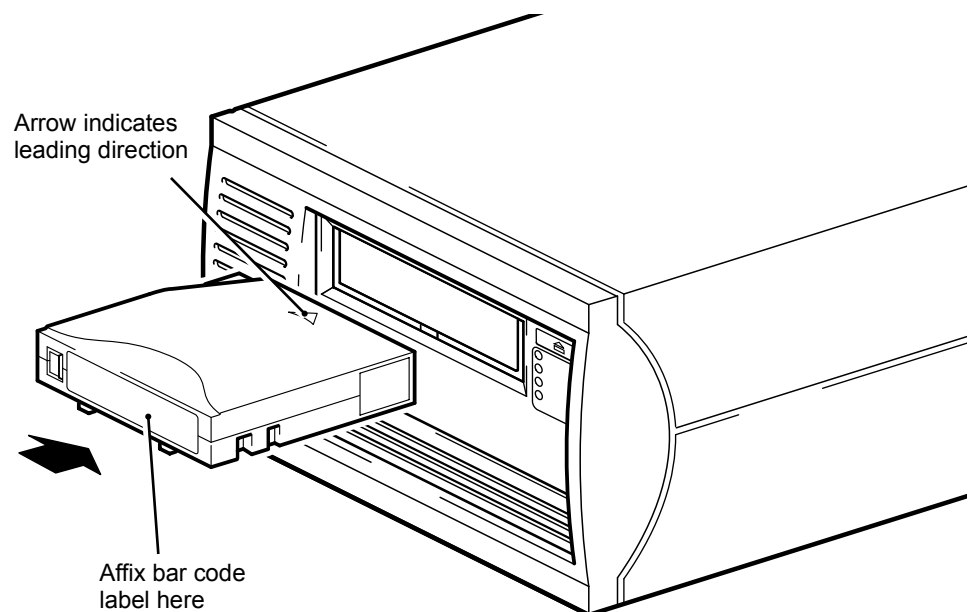
Figure 2-5   *Loading a cartridge (LTO-2 shown)*

2. The Ready light flashes green while the tape drive performs its load sequence. When the cartridge is loaded, the Ready light shows steady green.

Unload a cartridge   To unload a cartridge from the tape drive, press the Eject button on the front panel (see Figure 2-6).

The tape drive will complete its current task, rewind the tape to the beginning, and eject the cartridge. The rewind process may take up to 15 minutes. The Ready light will flash to indicate that the unload is still in progress.

⚠ **Caution**	Never try to remove a cartridge before it is fully ejected and avoid powering off the tape drive while a cartridge is still loaded (because the tape loses tension in the power-off state).
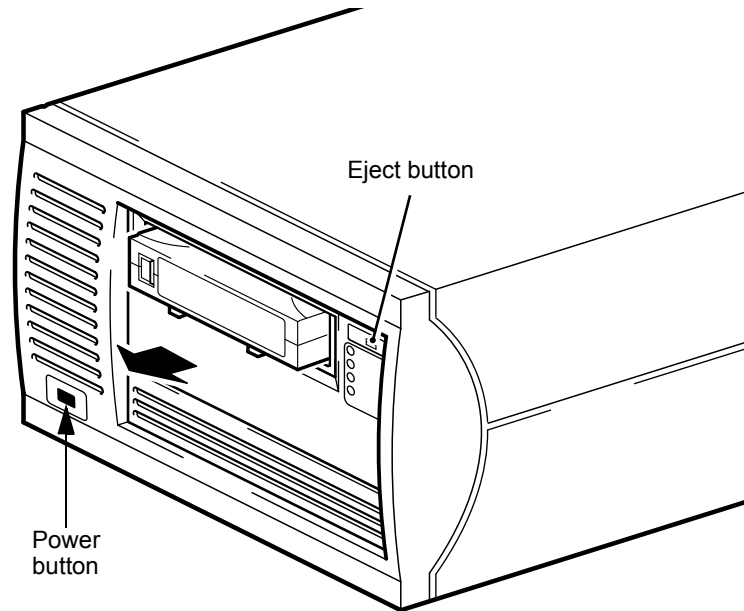
Figure 2-6   *Unloading a cartridge (LTO-2 shown)*

3

TAPE DRIVE LEDS

This chapter describes the states of the front panel LEDs. Figure 3-1 shows the controls and indicators on the front panel of the tape drive.
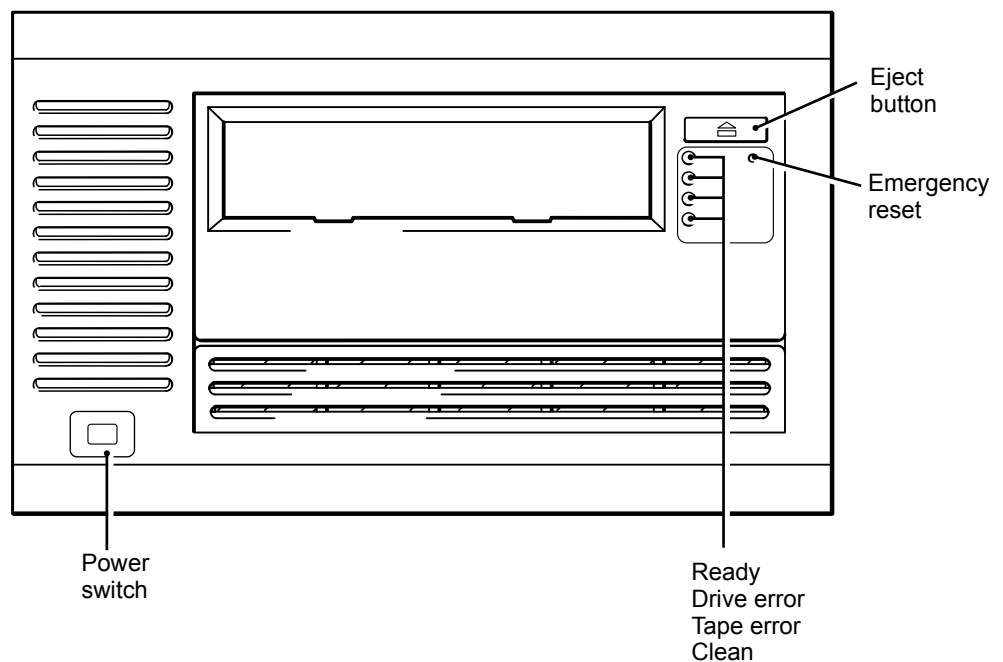
Figure 3-1 *Front-panel LEDs*

LED STATES DURING SELF TEST

The tape drive performs a power on self-test whenever power is applied or the tape drive is reset. The test takes about 5 seconds.
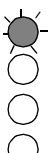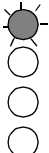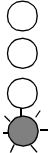
If the self test:

▶ Passes—The green Ready light flashes several times and then remains illuminated. All other LEDs remain off.

▶ Fails—the Drive Error and Tape Error LEDs flash, while the Ready and Clean LEDs are off.
This continues until the tape drive is reset.

LED STATES FOR TROUBLESHOOTING

Front panel LEDs   Use the following table to interpret the front panel LED sequences and the appropriate action to take, if any.

Table 3-1   *Front panel LED states for troubleshooting*

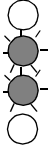| LED Sequence	Cause	Action required
	All LEDs OFF. Tape drive may not have power, may be faulty or may have been power cycled or reset during a firmware upgrade.	Check the power supply to the server. If the power supply is present and all LEDs remain off, press emergency reset (see page 2) or power cycle the tape drive. If it still fails, call for service.
	Ready and Clean OFF. Drive Error and Tape Error FLASHING. The tape drive has failed to execute power-on self test (POST).	Power cycle or reset the tape drive. If the error condition reappears, call for service.
	Ready is ON. The tape drive is ready for operation.	None. This is normal.
	Ready is FLASHING. The tape drive is carrying out a normal activity (read, write).	None. If the tape drive is upgrading firmware, do not reset or power cycle it.
	Ready is FLASHING fast. The tape drive is downloading firmware.	None. Do not reset or power cycle the tape drive.
	Ready is OFF, others are ON. Firmware is being reprogrammed.	None. Do not reset or power cycle the tape drive.
	Clean is FLASHING. The tape drive requires cleaning.	▪ Load the Ultrium universal cleaning cartridge. See Table 4-1 on page 21 for supported cartridges and instructions. ▪ If the Clean LED is still flashing when you load a new or known data cartridge after cleaning, call for service.

Table 3-1   *Front panel LED states for troubleshooting (continued)*

LED Sequence	Cause	Action required
	Ready is FLASHING and Clean is ON. Cleaning is in progress.	None. The cleaning cartridge will eject on completion. The cleaning cycle can take up to 5 minutes to complete.
	Tape Error is FLASHING. The tape drive believes the current tape or the tape just ejected is faulty.	1. Unload the tape cartridge. Make sure that you are using the correct format cartridge; an Ultrium data cartridge or Ultrium universal cleaning cartridge. (see Table 4-1 on page 21). 2. Reload the cartridge. If the Tape Error LED still flashes or starts flashing during the next backup, load a new or known, good cartridge. If the Tape Error LED is now off, discard the "suspect" tape cartridge. If it is still on, call for service.
or	*The tape is ejected immediately and Tape Error is FLASHING, or Drive Error FLASHES on unloading tape.* The tape cartridge memory (CM) may be faulty.	Write-protect the cartridge by sliding the red switch on the tape cartridge (see Figure 4-2 on page 23). The tape can be loaded and the data read. Once the data is recovered, the cartridge must be discarded.
	Drive Error FLASHING. The drive mechanism has detected an error.	Load a new cartridge. If the error persists, power cycle or reset the tape drive. If the Drive Error LED remains on, call for service.
	Drive Error, Tape Error and Ready FLASHING. There is a firmware download problem.	Insert a cartridge to clear the LED sequence. If the condition persists, call for service.
then	*Drive Error and Ready ON with Tape Error and Clean OFF. Sequence alternates repeatedly.* The tape drive has a firmware error.	Power cycle or reset the tape drive. Upgrade the firmware. If the condition persists, call for service.

Back panel LEDs   Use Figure 3-2 and Table 3-2 to interpret the back panel LED sequences and the appropriate action to take, if any.
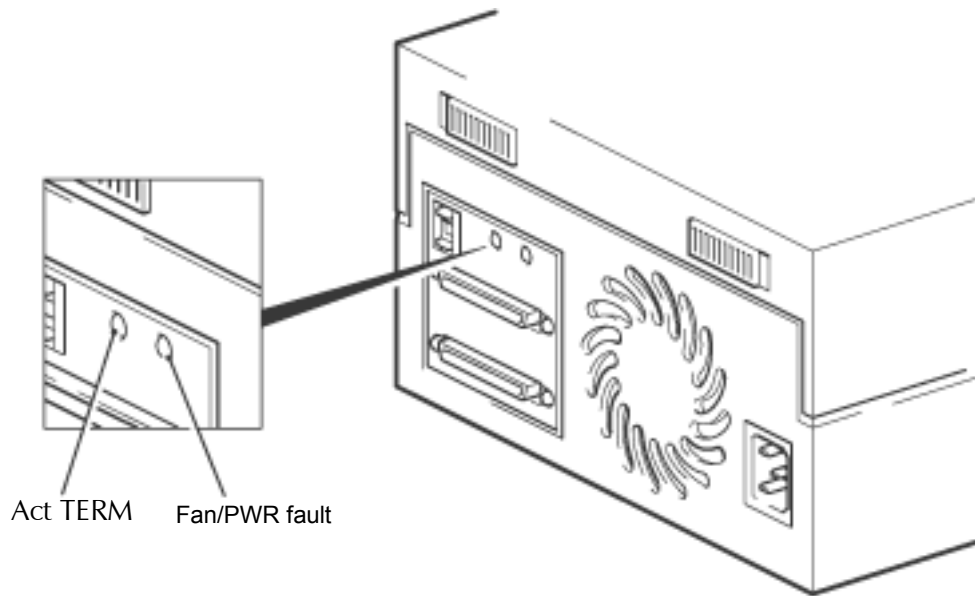

Act TERM   Fan/PWR fault

Figure 3-2   *Back panel LEDs*

Table 3-2   *Back panel LED states for troubleshooting*

LED Sequence	Cause	Action required
○○	*The Act Term LED is OFF.* The enclosure is not providing auto-termination.	▪ Check that the tape drive's SCSI cable is connected to the SCSI-IN connector. ▪ Check whether a terminator or other SCSI cable is plugged into the SCSI-OUT connector. If a terminator is connected, remove it. If another SCSI cable is connected, make sure that the SCSI chain is terminated at the last device. See "Terminator" on page 13.
●◒	*The Fan/PWR LED is amber.* There has been an enclosure failure or the cooling fan is not working correctly.	Call for service.

4

ULTRIUM MEDIA

Use only data cartridges and cleaning cartridges designed specifically for LTO Ultrium tape drives.

DATA CARTRIDGES

Ultrium tape drives use Ultrium tape cartridges. These are single-reel cartridges that match your tape drive's format and are optimized for high capacity, throughput and reliability. Compatible media can be recognized by the Ultrium logo, which is the same as the logo on the front of your tape drive. Do not use other format cartridges in your tape drive and do not use Ultrium cartridges in other format tape drives.

For optimum performance always use a data cartridge that matches the specification of your tape drive, (see Figure 4-1). A lower specification will have a lower transfer speed and may not support write activities; a higher specification will not support read or write. We recommend:

▸ LTO-3—Ultrium 800 GB RW (assumes 2:1 compression) and Ultrium 800 GB (assumes 2:1 compression) WORM tape cartridges

▸ LTO-2—Ultrium 400 GB (assumes 2:1 compression) tape cartridges

Table 4-1 *Data cartridge compatibility*

	Ultrium 200 GB	Ultrium 400 GB	Ultrium 800 GB	WORM 800 GB
Type of Drive				
Ultrium 3	Read only	Write and Read	Write and Read	Write Once, Read Many
Ultrium 2	Write and Read	Write and Read	No	No

WORM DATA CARTRIDGES (LTO-3 *ONLY*)

The LTO-3 tape drive includes support for both rewriteable and WORM data cartridges. Write-Once, Read-Many (WORM) data cartridges provide for an enhanced level of data security against accidental or malicious alteration of data on the tape cartridge. The WORM data cartridge can be appended to maximize the full capacity of the tape cartridge, but the user will be unable to erase or overwrite data on the cartridge. WORM data cartridges are clearly identified by their distinctive, two-tone cartridge color.

To check whether your backup or archive software application supports WORM cartridges, refer to the manufacturer's web site.
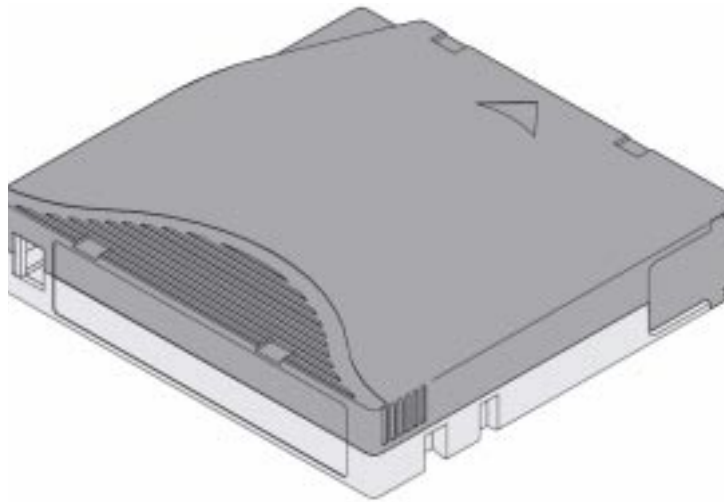
Figure 4-1   *WORM data cartridge (two-toned)*
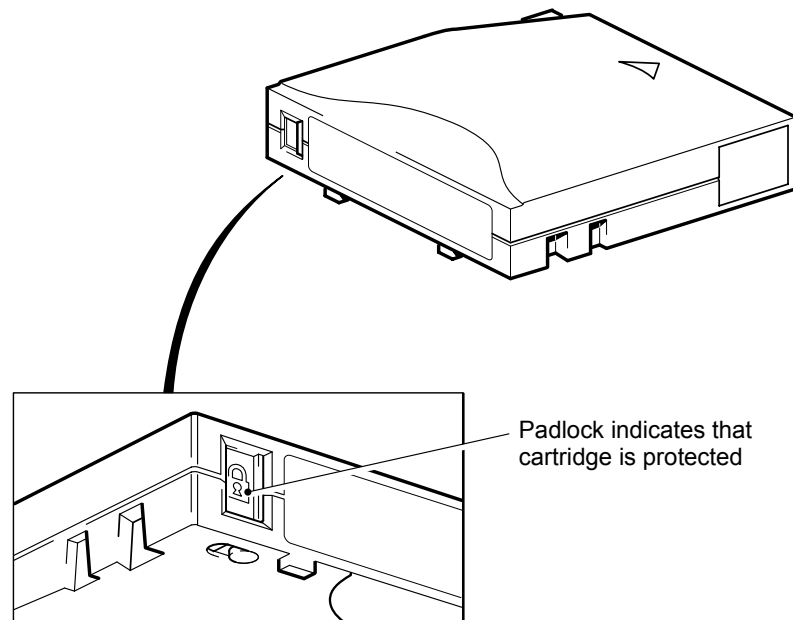
WRITE-PROTECT SWITCH

If you want to protect the data on a cartridge from being altered or overwritten, you can write-protect the cartridge.

Always remove the cartridge from the tape drive before you change the write protection (see Figure 4-2).

‣ To write-protect a cartridge—slide the tab so the padlock is visible
‣ To write-enable a cartridge—slide the tab so the padlock is *not* visible

Write-protection will not prevent a cartridge being erased by bulk-erasure or degaussing. Do not bulk erase Ultrium format cartridges. This will destroy pre-recorded servo information and make the cartridge unusable.

Padlock indicates that
cartridge is protected

Figure 4-2   *Write-protecting data cartridges*

CLEANING CARTRIDGES

You must use Ultrium cleaning cartridges with Ultrium tape drives, as other cleaning cartridges will not load and run. We recommend the Ultrium universal cleaning cartridge. Unlike some earlier Generation 1 Ultrium cleaning cartridges, the Ultrium universal cleaning cartridge is designed to work with any Ultrium tape drive. Do not use other format cartridges in your tape drive and do not use Ultrium cartridges in other format tape drives.

CARTRIDGE USE AND CARE

Follow the guidelines in this section to resolve problems and properly use cartridges.

PROBLEM RESOLVING CHECKLIST

If you experience any problems using branded cartridges, check:

▸ You are using the correct cartridge for your tape drive, see Table 4-1 on page 21.

▸ The cartridge case is intact and that it contains no splits, cracks or damage.

▸ The cartridge has been stored at the correct temperature and humidity.

▸ The write-protect switch is fully operational. It should move from side to side with a positive click.

CARTRIDGE USE

Follow these guidelines to maintain the integrity of your cartridges.

▸ Do not touch the tape media.

▸ Do not attempt to clean the tape path or tape guides inside the cartridge.

▸ Do not leave cartridges in the tape drive. The tape loses tension in the power-of state, which can lead to problems, particularly if the tape drive has been moved.

▸ Do not leave cartridges in excessively dry or humid conditions.

▸ Do not leave cartridges in direct sunlight or in places where magnetic fields are present (for example, under telephones, next to monitors or near transformers).

▸ Do not drop cartridges or handle them roughly.

▸ Stick labels onto the label area only.

▸ Do not bulk erase Ultrium format cartridges.

CARTRIDGE OPERATING AND STORAGE ENVIRONMENT

To prevent condensation and for long life, the cartridge should only be operated or stored as follows:

▸ Day-to-day storage (in plastic container): 16° C to 32° C (60° F to 90° F)

▸ Operation: 10° C to 45° C (50° F to 113° F)

▸ Humidity: 20% to 80% Relative Humidity

Tapes intended for archiving data should be stored in the plastic containers, at temperatures between 5°C and 23°C (41°F and 73°F) and 10% to 50% relative humidity. Wet bulb temperature should not exceed 26°C (78°F).

We also recommend storing cartridges on their side.

CARTRIDGE TROUBLESHOOTING

Cartridge is jammed   If the cartridge is jammed or the backup application is unable to eject it, you can force eject the cartridge.

1. Press and hold the Eject button on the front of the tape drive for 10 seconds.

2. Wait for the cartridge to be ejected. This process may take up to 15 minutes (the maximum rewind time). It is important that you allow sufficient time for the tape drive to complete this process. If you interrupt it, you may damage the media or the tape drive.

3. If the cartridge is still jammed, press the emergency reset button as shown on Figure 1-1 on page 2. (Use the tip of a paperclip to press the button.)

4. Wait for the tape drive to reset and get back to the loaded position. The Ready light stops flashing. This process may take up to 15 minutes (the maximum rewind time) to complete.

5. Press and hold the Eject button for 10 seconds.

If the cartridge is still jammed, the tape drive has failed. Contact your supplier.

The tape drive will not accept cartridge (or ejects it immediately) The cartridge is probably incompatible, see Table 4-1 on page 21. If the cartridge is compatible, it may have been damaged, for example it may have been dropped, the cartridge memory may be corrupted or the tape drive may have a fault.

⚠️ **Caution** Never force the cartridge into the tape drive.

1. Check that the tape drive has power (the power cable is properly connected and the ready LED is on).

2. Check that you are using the correct media. Only use Ultrium media, we recommend

   ▸ LTO-3—Ultrium 800 GB cartridges or 800 GB WORM cartridges
   ▸ LTO-2—Ultrium 400 GB cartridges

3. Make sure that you have loaded the cartridge with the correct orientation (see "Load a cartridge" on page 15).

4. Check for damage to your media (to the cartridge case, leader pin or cartridge teeth) and discard it if it is damaged.

5. Use a new or known, good piece of media and see if it loads. If it does, the original cartridge is faulty and should be discarded.

6. Check if another Ultrium tape drive will accept the cartridge. If it does, the original tape drive may be faulty.

Before calling customer service, please check that the tape drive is responding and that it can be seen on the SCSI bus.

Notes

5

TAPE DRIVE PERFORMANCE

This chapter provides information about optimizing your tape drive's performance. Various factors can affect data throughput, particularly in a network environment or if the tape drive is not on a dedicated SCSI bus. If your tape drive is not performing as well as expected—for example, if backup windows are longer than expected—consider the following points.

SCSI BUS

Is the tape drive on a dedicated SCSI bus?

▸ We recommend that the tape drive is the only device on the SCSI bus. If it is not, ensure other devices are LVD-compliant. If they are single-ended, the bus will switch to single-ended mode with a lower transfer speed. There will also be restrictions on cable length.

▸ Auto termination powers down when the tape drive powers down. This can cause a problem, if there are other devices on the SCSI bus.

SYSTEM REQUIREMENTS

Can your system deliver the required performance?

▸ LTO-3—The Ultrium 3 tape drive can write uncompressed data at up to 80 MB/s (288 GB/hour) or compressed data at up to 160 MB/s (576 GB/hour), assuming 2:1 compression.

These drives are extremely high-performance devices. If performance is not meeting expectations, the problem almost certainly lies with the system architecture.

▸ LTO-2—The Ultrium 2 tape drive can write uncompressed data at up to 30 MB/s (108 GB/hour) or compressed data at up to 60 MB/s (216 GB/hour), assuming 2:1 compression.

To get this performance it is essential that your whole system can deliver this performance. In most cases, the backup application will provide details of the average time taken at the end of the backup.

Typical areas where bottlenecks can occur are:

▸ **Disk subsystem**
LTO-3 — A single spindle disk will not be able to deliver good data throughput for an Ultrium 3 tape drive, at any compression ratio. To maximize the capability of your Ultrium 3 tape drive, utilize aggregated disk sources (RAID) with multiple disk spindles.

LTO-2 — A single spindle disk may well be sufficient for an Ultrium 2 tape drive depending on your data's compressibility. Best practice to ensure good throughput is to utilize multiple disk spindles or data sources.

▸ **System architecture**
LTO-3 — Be aware of the architecture of your data protection environment; multiple clients backed up over a network may mean you are unable to take advantage of the Ultrium 3 because the Ethernet infrastructure connecting such systems may limit performance.

LTO-2 — For Ultrium 2 drives, the aggregation of multiple client sources over a network remains a good way of delivering good performance. Some enterprise class backup applications can be made to interleave data from multiple sources, such as clients or disks, to keep the tape drive working at optimum performance.

▸ **Tape media type**
The data cartridge should match the specification of the tape drive. A lower specification will have a lower transfer speed (see "Data Cartridges" on page 21).

LTO-3 — Use Ultrium 800 GB or Ultrium 800 GB WORM cartridges
LTO-2 — Ultrium 400 GB cartridges

▸ **Data and file types**
File size—The type of data being backed up or restored can affect performance. Typically, small files incur greater overhead in processing and access than large files. Equally, data that is not compressible will always limit the speed at which the tape drive can write/read data. You will achieve no more than native rates with uncompressible data.

Example file types—Examples of files that compress well are plain text files, spreadsheets; those that compress poorly are those that are either compressed as part of their format (such as, JPEG photographic files) or stored as compressed (such as: .ZIP files or .gz/.Z files on Unix platforms).

6

TROUBLESHOOTING

This chapter provides troubleshooting tips. The first step in problem-solving is establishing whether the problem lies with the cartridge, the tape drive, the host server and its connections, or with the way the system is being operated.

Most modern SCSI host bus adapters locate and display attached devices when the system is booting up.

▶ Windows systems—if you swap or connect a product when your system is running, you will need to reboot the system.

▶ IA32 systems— usually need to be rebooted.

▶ UNIX systems—may have pluggable drivers, which allow drives to be attached to a running system and detected without rebooting.

If the device is not detected on boot up, there is probably a problem with the physical hardware: cables, termination, connections, power or the host bus adapter itself. If the device is displayed during boot up but cannot be found in the operating system, this is more likely to be a software problem.

▶ If you encounter a problem during installation and need further clarification, refer to the ""Problems Encountered During Installation" on page 30" section on page 30.

▶ If a problem arises during testing after you have installed the tape drive, refer to the symptom-based section "Testing after Installation" on page 30.

▶ For more information about LED sequences, refer to "Tape Drive LEDs" on page 17.

▶ For information about cartridges, refer to "Cartridge Use and Care" on page 23.

PROBLEMS ENCOUNTERED DURING INSTALLATION

Table 6-1 *Installation problem checklist*

Circumstance	Description	Further information
Unpacking	Some parts appear to be missing or damaged	Contact your vendor if any parts need replacing.
There is a SCSI ID conflict	The SCSI ID is already in use	The Ultrium tape drive has its SCSI ID set to 3 by default. This should only be changed if this number is already in use. Instructions on how to change the SCSI ID are on page 11.
How should the SCSI bus be configured?	Correct configuration of the SCSI bus with multiple drives can be a complex area and more help may be required.	Daisy chaining devices is not recommended for the Ultrium 3 tape drive.
How should the SCSI bus be terminated?	It is unclear if the bus is already terminated or where an additional terminator should be placed.	Both ends of a SCSI bus must be terminated (see "Terminator" on page 13).
Is the correct SCSI host bus adapter installed?	The server already has a SCSI host bus adapter but it is difficult to determine what type it is.	You can check the SCSI configuration from the boot-up screen or from Windows Device Manager.
	The server may not have a SCSI host bus adapter installed.	If not, you will need to purchase one. See "Check the SCSI Connection" on page 10.
Do drivers need to be installed, and, if so, which ones?	It is unclear whether there is a need to install drivers onto the system and more help is required.	For detailed information specific to your system check the software vendor's web site. (Backup software that states support for Ultrium tape drives also provides the required drivers.)

TESTING AFTER INSTALLATION

Remember that the system recognizes devices during boot-up. If you swap or connect a product when your system is running, you will need to reboot the system. Rebooting the system will reset devices and will often resolve problems. It is good practice to reboot every time you add a driver or install firmware.

⚠️ **Caution** Never power off the tape drive while a cartridge is still loaded or during a firmware upgrade.

Table 6-2 *Post-installation problem checklist*

Circumstance	Possible reason	Recommended action
The server does not reboot after installation	You have connected the tape drive to an existing SCSI bus that has other devices connected to it and the SCSI address of your Ultrium tape drive is identical to the address used by another device.	Make sure that each device on the SCSI bus has a unique ID (see "Check the Tape Drive's SCSI ID" on page 11). We recommend that the Ultrium tape drive is connected to a dedicated host bus adapter. Do not connect the tape drive to a disk RAID controller as this is not supported.
	You have installed an additional SCSI host bus adapter and its resources are clashing with an existing adapter.	Remove the new host bus adapter and check the server documentation.
	You have disconnected the power or SCSI cable from the server's boot disk during the tape drive installation process.	Check that the cables to *all* devices are firmly connected. Also see "Connect the SCSI Cable" on page 12 and "Connect the Power Cable" on page 14.
The server boots but does not recognize the tape drive	The SCSI or power cable is not connected properly.	▪ Check that the cables to the tape drive are firmly connected (see "Connect the SCSI Cable" on page 12 and "Connect the Power Cable" on page 14). ▪ Ensure that the SCSI cable is LVDS-compliant and does not have any bent pins. Replace, if necessary.
	The SCSI bus is not terminated correctly.	Check that the SCSI bus is actively terminated.The external tape drive has automatic termination by default, as long as the SCSI cable is connected to the connector marked 'SCSI-IN'. The green LED on the rear panel marked Act TERM will be lit if termination is automatic. Refer also to: ▪ The documentation for your SCSI controller and any other SCSI devices you have installed on the SCSI bus ▪ "Terminator" on page 13
	The tape drive's SCSI ID address is not unique.	Make sure that each device connected to the SCSI controller has a unique SCSI ID. Remember that 7 is normally reserved for the host bus adapter (see "Check the Tape Drive's SCSI ID" on page 11).

Table 6-2   *Post-installation problem checklist (continued)*

Circumstance	Possible reason	Recommended action
The application does not recognize the tape drive	The application does not support the tape drive.	Check that the tape drive is installed properly (see Chapter 2). Refer to the software vendor's World Wide Web site and load any service packs as necessary.
	Some applications require drivers to be loaded.	Check that the correct SCSI and tape drive drivers are installed. Consult the software application's installation notes for details.
The tape drive does not work	If the tape drive does not power up (all LEDs are off), the power cable may not be connected to the tape drive properly.	▪ The power on/off switch incorporates a green LED. If this is not on, check the power cable connection and replace the cable if necessary. ▪ If the power supply is present and all LEDs remain off, call for assistance. See "Connect the Power Cable" on page 14.
	If the self-test fails (see "LED States During Self Test" on page 17), there may be a hardware or firmware failure.	▪ If there is a cartridge in the tape drive, remove it. Reset or power down the tape drive and power it up again. ▪ If the self-test still fails, call for assistance.

CLEAN THE TAPE DRIVE

Ultrium tape drives do not require regular cleaning. An Ultrium universal cleaning cartridge should only be used when the orange Clean LED is flashing. If the Clean LED is flashing, follow these steps:

1. Insert the Ultrium universal cleaning cartridge.

2. The tape drive will carry out its cleaning cycle and eject the cartridge on completion (which can take up to 5 minutes). During the cleaning cycle the orange Clean LED will be on solidly and the green Ready LED will flash.

    Each Ultrium universal cleaning cartridge cleaning cartridge can be used up to 50 times with Ultrium tape drives. If the cleaning cartridge is ejected immediately with the Tape Error LED on, it has expired.

7

SPECIFICATIONS

This chapter provides specifications for the Magnum FH External Tape Drive (LTO-2e and LTO-3e).

SIZE AND WEIGHT

Table 7-1 shows the dimensions and weight for tape drive. The external tape drive is a standalone unit that can fit on a desktop.

Table 7-1 *Size and weight*

Specification	Measurement
Height (with bezel)	12.0 cm (4.7 in.)
Length (with bezel)	29.7 cm (11.7 in.)
Width (with bezel)	21.8 cm (8.6 in.)

POWER SPECIFICATIONS

The power specifications for the tape drive include both the requirements for the tape drive and the enclosure components.

The tape drive uses an internal switching power supply. You do not need to change any input settings. The power supply automatically adjusts for changes in voltages and frequency within the specified range. Table 7-2 lists the power specifications for the tape drive.

Table 7-2 *Power specifications*

Input voltage[a]	100 to 240 VAC
Frequency	50 to 60 Hz, auto-ranging

[a] Autoswitching input selection; no user selection required.

POWER CORD SPECIFICATIONS

The tape drive is shipped with two power cords: One for use in the US and Canada, and one for use in Europe.

US, Canada, and European Power Cord Specifications

Table 7-3 *Power Cord Specifications*

Power Cord	Description	Use	Connectors and Cordage	Certifications
US/Canada	2.3-meter (7.5-foot), three-conductor	120-volt	▪ One molded NEMA 5-15P male connector ▪ One molded IEC 320/EN60320 female connector ▪ Cordage is 18 AWG	UL Listed CSA Certified
European	2.5-meter (8.2-foot)	230 to 250-volt	▪ One CEE 7/7 male connector ▪ One IEC 320 C13 female connector ▪ Cordage is CENELEC HD-21	VDE approved

Requirements for International 220 VAC Power Cord

If you plan to use the library in a location other than the US/Canada or Europe, you must supply a power cord that meets the following specifications:

▶ The power cord must have a grounded attachment plug of the proper type, rating, and safety approval for the intended country.

▶ The power cord must have an IEC 320/EN60320 female connector on one end.

The cordage must be harmonized to CENELEC publication HD-21. The electrical characteristics and rating must be minimum H05VVF3G1.00 (10 A).

SAFETY AND REGULATORY COMPLIANCE

The Magnum FH External Tape Drive (LTO-2e and LTO-3e) complies with the regulatory agency standards listed on the product label located on the enclosure when installed in accordance with this manual.

GLOSSARY

2:1 Compression   The relationship between the quantity of data that can be stored with compression as compared to the quantity of data that can be stored without compression. In 2:1 compression, twice as much data can be stored with compression as can be stored without compression.

American National Standards Institute (ANSI)   Organization that sets standards for SCSI and the safety of electrical devices.

ampere (A)   A unit of measure for electric current that is equivalent to a flow of one coulomb per second, or equivalent to the current produced by one volt applied across a resistance of one ohm.

adapter   See *adapter card*.

adapter card   A circuit board that adds function to a computer.

backups   The short-term retention of records used for restoring essential business and host files when vital data has been lost because of program or host errors or malfunctions.

bar code   A code representing characters by sets of parallel bars of varying thickness and separation which are read optically by transverse scanning.

bar code label   A specially coded label that can be affixed to a tape cartridge and which enables a device to identify the cartridge and its volume serial number

bezel   The removable frame that fits over the front of the tape drive.

bus   In a network, the electrical pathway between a computer and other devices.

byte   A string that consists of a certain number of bits (usually 8) which are treated as a unit and represent a character. A byte is a fundamental unit of data.

C   See *Celsius (C)*.

capacity   The amount of data that can be contained on storage media and expressed in bytes.

cartridge   See *tape cartridge*.

cartridge door   On a tape cartridge, the hinged barrier that can be opened to access, or closed to protect, the magnetic tape within the cartridge.

Celsius (C)   Having a thermostatic scale on which the interval between the freezing point and the boiling point of water is divided into 100 degrees, with 0 degrees representing the freezing point and 100 degrees representing the boiling point.

cleaning cartridge   A tape cartridge that is used to clean the heads of a tape drive. Contrast with data cartridge.

compression   The reduction in size of data to save space by eliminating gaps, empty fields, redundancies, and unnecessary data to shorten the length of records or blocks. Either the backup application or the tape drive can perform compression.

configure   To describe to a host the devices, optional features, and programs installed on the system.

current   The quantity of charge per unit of time. Current is measured in amperes.

cycle power   To apply and remove electrical power to a device within a short time span.

data   Any representations such as characters or analog quantities to which meaning is, or might be, assigned.

data cartridge   A tape cartridge that is dedicated to storing data. Contrast with *cleaning cartridge*.

data compression   See *compression*.

data transfer rate   The average number of bits, characters, or blocks per unit of time that pass between corresponding equipment in a data transmission system. The rate is expressed in bits, characters, or blocks per second, minute, or hour.

DC   See *direct current (DC)*.

degauss   To make a magnetic tape nonmagnetic by exposing the tape to electrical coils which carry currents that neutralize the magnetism of the tape.

device   Any hardware component or peripheral, such as a tape drive or tape library, that can receive and send data.

device driver   A file that contains the firmware that is needed to use an attached device.

diagnostic   A software program that is designed to recognize, locate, and explain faults in equipment or errors in programs.

direct current (DC)   An electric current flowing in one direction only and substantially constant in value.

drive   A data-storage device that controls the movement of the magnetic tape in a tape cartridge. The tape drive houses the mechanism (drive head) that reads and writes data to the tape.

drive dump   The recording, at a particular instant, of the contents of all or part of one storage device into another storage device, usually as a safeguard against faults or errors, or in connection with debugging.

drive head   The component that records an electrical signal onto magnetic tape, or reads a signal from tape into an electrical signal.

Driver   See *device driver*.

dump   See *drive dump*.

eject   To remove or force out from within.

error log   Maintained by the tape drive, a list that contains the ten most recent error codes. The codes identify errors that pertain to the tape drive.

Exabyte   (1) A network storage backup company that designs, manufactures, and markets industry-leading data storage products including tape drives and automated tape libraries.
(2) measurement of data:
One Exabyte =

> 1,000 Petabytes, or
> 1,000,000 Terabytes, or
> 1,000,000,000 Gigabytes, or
> 1,000,000,000,000 Megabytes, or
> 1,000,000,000,000,000 Kilobytes, or
> 1,000,000,000,000,000,000 bytes

file   A named set of records that are stored or processed as a unit.

FTP site   Any electronic repository of information that uses the File Transfer Protocol (FTP) for transferring files to and from hosts. Use of an FTP site requires a user ID and possibly a password.

firmware   The proprietary code that is usually delivered as part of an operating system. Firmware is more efficient than software that is loaded from an alterable medium, and is more adaptable to change than pure hardware circuitry. An example of firmware is the Basic Input/Output System (BIOS) in read-only memory (ROM) on a PC motherboard.

GB   See *Gigabyte*.

Gigabyte   One billion (1 000 000 000) bytes.

ground   An object that makes an electrical connection with the earth.

GLOSSARY

hardware   The physical equipment or devices that form a computer. head. See *drive head*.

head   A device that uses induction to write a data pattern onto magnetic media and then uses either inductance or magnetoresistance to read the data back.

Head Resistance Measurements test   Part of the Test Head diagnostic, a procedure that determines whether the tape drive's head works correctly. The test measures the head's ability to withstand cracks and other defects.

host   The controlling or highest-level system in a data communication configuration. Synonymous with *server*.

ID   Identifier.

inch (in.)   A unit of length equal to 1/36 yard or 25.4 mm.

input/output (I/O)   Data that is provided to a computer or data that results from computer processing.

insertion guide   On the surface of the tape cartridge, a large, notched area that prevents you from inserting the cartridge incorrectly.

install   (1) To set up for use or service. (2) The act of adding a product, feature, or function to a host or device either by a singular change or by the addition of multiple components or devices.

interposer   An adapter-like device that allows a connector of one size and style to connect to a mating connector of a different size and style. Data provided to the computer or data resulting from computer processing.

I/O   See *input/output (I/O)*.

jumper   (1) A tiny connector that fits over a pair of protruding pins in a connector. A jumper can be moved to change electrical connectors. When in place, the jumper connects the pins electrically. (2) To place a jumper on a connector pin.

label   A slip of paper with an adhesive backing that can be written on and affixed to a tape cartridge as a means of identification or description.

label area   On the LTO Ultrium Tape Cartridge, a recessed area next to the write-protect switch where a bar code label must be affixed.

LED   Light Emitting Diode. A semiconductor diode that emits light when subjected to an applied voltage and that is used in an electronic display.

Linear Tape-Open (LTO)   A type of tape storage technology developed by the IBM Corporation, Hewlett-Packard, and Certance. LTO technology is an "open format" technology, which means that its users will have multiple sources of product and media. The "open" nature of LTO technology enables compatibility between different vendors' offerings by ensuring that vendors comply with verification standards. The LTO technology is implemented in two formats: the Accelis format focuses on fast access; the Ultrium format focuses on high capacity. The Ultrium format is the preferred format when capacity (rather than fast access) is the key storage consideration.

Load   The process of inserting a cartridge into the tape drive. Following the insertion of a tape cartridge into the tape load compartment, the act of positioning the tape (performed by the tape drive) for reading or writing by the tape drive's head.

loop   (1) A series of instructions that is repeated until a terminating condition is reached. (2) To connect so as to complete a loop.

Low Voltage Differential (LVD)   A low-noise, low-power, and low-amplitude electrical signaling system that enables data communication between a supported host and the tape drive. LVD signaling uses two wires to drive one signal over copper wire. The use of wire pairs reduces electrical noise and crosstalk.

LTO   See *Linear Tape-Open (LTO)*.

LVD   See *Low Voltage Differential (LVD)*.

magnetic tape   A tape with a magnetizable surface layer on which data can be stored by magnetic recording. maintenance mode. The state of operation in which the tape drive must be before it can run diagnostics, verify write and read operations, verify a suspect tape cartridge, update its own firmware, and perform other diagnostic and maintenance functions.

MB   See *Megabyte (MB)*.

media   The plural of medium.

medium   A physical material in or on which data may be represented, such as magnetic tape.

Megabyte (MB)   One million (1 000 000) bytes.

msec   Millisecond; one-thousandth of a second.

network   A configuration of data processing devices and software that is connected for information interchange.

Noise   Any kind of magnetic or electric interference detected by the electronics.

oersted   The unit of magnetic field strength in the unrationalized centimeter-gram-second (cgs) electromagnetic system. The oersted is the magnetic field strength in the interior of an elongated, uniformly wound solenoid that is excited with a linear current density in its winding of one ampere per 4 pi centimeters of axial length.

offline   The operating condition that the tape drive is in when the host's applications cannot interact with it.

online   The operating condition that the tape drive is in when the host's applications can interact with it.

Open Systems   Computer systems whose standards are not proprietary.

operating environment   The temperature, relative humidity rate, and wet bulb temperature of the room in which the tape drive routinely conducts processing.

parity   The state of being even-numbered or odd-numbered. A parity bit is a binary number that is added to a group of binary numbers to make the sum of that group always odd (odd parity) or even (even parity).

parity error   A transmission error that occurs when the received data does not have the parity that is expected by the receiving system. This usually occurs when the sending and receiving systems have different parity settings.

port   (1) A system or network access point for data entry or exit. (2) A connector on a device to which cables for other devices such as display stations and printers are attached. (3) The representation of a physical connection to hardware. A port is sometimes referred to as an adapter; however, there can be more than one port on an adapter.

power connector   Located at the rear of the tape drive, the connector to which the internal power cable of an enclosure connects.

power cord   A cable that connects a device to a source of electrical power.

power-off   To remove electrical power from a device.

power-on, powered-on   (1) To apply electrical power to a device. (2) The state of a device when power has been applied to it.

read   To acquire or interpret data from a storage device, from a data medium, or from another source.

reboot   To reinitialize the execution of a program by repeating the initial program load (IPL) operation.

record   The smallest distinct set of data bytes that is supplied from a host for processing and recording by a tape drive, and the smallest distinct set of data to be read from tape, reprocessed, and made available to a host by a tape drive.

relative humidity   The ratio of the amount of water vapor actually present in the air to the greatest amount possible at the same temperature.

reset   To return a device or circuit to a clear state.

scratch cartridge   A data cartridge that contains no useful data, but can be written to with new data.

SCSI   See *Small Computer Systems Interface (SCSI)*.

SCSI bus   (1) A collection of wires through which data is transmitted from one part of a computer to another. (2) A generic term that refers to the complete set of signals that define the activity of the Small Computer Systems Interface (SCSI).

SCSI ID   A unique address (from 1 to 15) assigned to each device attached to a SCSI bus. See also *bus*.

SCSI connector   Located at the rear of the tape drive, the connector that facilitates commands to and from the host, and to which the internal SCSI cable of an enclosure connects.

SCSI device   Anything that can connect into the SCSI bus and actively participate in bus activity.

SCSI ID connector   Located at the rear of the tape drive, the connector that enables the tape drive's SCSI address to be set. Addresses are determined by the placement of jumpers on the pins.

SCSI interface   See *Small Computer Systems Interface (SCSI)*.

second (s)   One sixtieth of a minute.

sense data   Data that describes an I/O error. Sense data is presented to a host in response to a Sense I/O command.

server   A functional unit that provides services to one or more clients over a network. Examples include a file host, a print host, or a mail server. Synonymous with *host*.

single-character display   Located at the front of the tape drive, an LED that presents an alphabetical or numeric code which represents a diagnostic or maintenance function, error condition, or informational message.

sleep mode   A power-management function that causes the tape drive's electronics to automatically enter a low-power mode by which to conserve energy.

Small Computer Systems Interface (SCSI)   A standard used by computer manufacturers for attaching peripheral devices (such as tape drives, hard disks, CD-ROM players, printers, and scanners) to computers (hosts). Pronounced "scuzzy." Variations of the SCSI interface provide for faster data transmission rates than standard serial and parallel ports (up to 160 megabytes per second). The variations include:

▸ **Fast/Wide SCSI:** Uses a 16-bit bus, and supports data rates of up to 20 MB/second.
▸ **SCSI-1:** Uses an 8-bit bus, and supports data rates of 4 MBps.
▸ **SCSI-2:** Same as SCSI-1, but uses a 50-pin connector instead of a 25-pin connector, and supports multiple devices.
▸ **Ultra SCSI:** Uses an 8- or 16-bit bus, and supports data rates of 20 or 40 MB/second.
▸ **Ultra2 SCSI:** Uses an 8- or 16-bit bus and supports data rates of 40 or 80 MB/second.
▸ **Ultra3 SCSI:** Uses a 16-bit bus and supports data rates of 80 or 160 MB/second.
▸ **Ultra160 SCSI:** Uses a 16-bit bus and supports data rates of 160 MB/second.

software   Programs, procedures, rules, and any associated documentation pertaining to the operation of a computer system.

speed matching   A technique used by the tape drive to dynamically adjust its native (uncompressed) data rate to the slower data rate of a host. Speed matching improves system performance and reduces backhitch.

Streaming   An operational mode that occurs when the data transfer rate to or from the host closely matches the tape drive's data transfer rate, allowing the tape drive to read or write data in a continuous stream.

tape cartridge   A removable storage case that houses belt-driven magnetic tape that is wound on a supply reel and a takeup reel.

tape drive   A data-storage device that controls the movement of the magnetic tape in a tape cartridge. The tape drive houses the mechanism (drive head) that reads and writes data to the tape. Its native data capacity is 100 GB per cartridge; with 2:1 compression, its capacity is up to 200 GB.

tape path   Within a tape drive, the channel in which the media moves.

terminate   To prevent unwanted electrical signal reflections by applying a device (known as a terminator) that absorbs the energy from the transmission line.

terminator   (1) A part that is used to end a SCSI bus. (2) A single-port, 75-ohm device that is used to absorb energy from a transmission line. Terminators prevent energy from reflecting back into a cable plant by absorbing the radio frequency signals. A terminator is usually shielded, which prevents unwanted signals from entering or valid signals from leaving the cable system.

transfer rate   See *data transfer rate*.

Ultra160 LVD SCSI interface   See *Small Computer Systems Interface (SCSI)*.

unload   The act (performed by the tape drive) of unthreading tape from the tape drive's internal tape path and returning it (with the leader block) to the tape cartridge.

utility   See *utility program*.

utility program   A computer program that supports computer processes. For example, a diagnostic program, a trace program, or a sort program.

V DC   Volts DC (direct current).

volt   The SI (international) unit of potential difference and electromotive force. Formally defined as the difference of electric potential between two points of a conductor that carries a constant current of one ampere when the power dissipated between these points is equal to one watt.

wet bulb temperature   The temperature at which pure water must be evaporated adiabatically at constant pressure into a given sample of air in order to saturate the air under steady-state conditions. Wet bulb temperature is read from a wet bulb thermometer.

write   To make a permanent or transient recording of data in a storage device or on a data medium.

write protected   Applicable to a tape cartridge, the condition that exists when some logical or physical mechanism prevents a device from writing on the tape in that cartridge.

write-protect switch   Located on the tape cartridge, a switch that prevents accidental erasure of data. Pictures of a locked and unlocked padlock appear on the switch. When you slide the switch to the locked padlock, data cannot be written to the tape. When you slide the switch to the unlocked padlock, data can be written to the tape.

Write/Read test   Part of the Test Head diagnostic, a procedure that determines whether the tape drive can correctly read from and write to tape.

Notes

INDEX

Notes