



MAGNUM LTO HALF HEIGHT TAPE DRIVE

PRODUCT MANUAL



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PART NUMBER 1016200 Revision A

| REVISION HISTORY | Revision | Date | Description |
|-------------------------|-----------------|---------------|--------------------|
| | A | November 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 LTO Half Height Tape Drive is 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.

**CONTACTING
EXABYTE**

| 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 | |
| Technical Support | www.tandberg.com |
| 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 |



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HOW TO USE THIS MANUAL

This manual describes how to install, operate, and maintain the Magnum LTO Half Height Tape Drive. 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 how to install the tape drive in various operating systems.
- ▶ [Chapter 5](#) provides troubleshooting recommendations.

Additional information

These appendices provide supplemental information about the tape drives.

- ▶ [Appendix A](#) provides specifications for the tape drive.
- ▶ [Appendix B](#) describes the states of the front and back panel LEDs.

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).

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.

TAPE DRIVE INTRODUCTION

Congratulations on your new Exabyte Magnum LTO Half Height Tape Drive storage solution!

This chapter provides information about the Magnum LTO Half Height Tape Drive.



INTRODUCTION

This second-generation LTO tape drive is in half height form factor and is the smallest and fastest of its class available on the market today. Due to the low power consumption, low heat dissipation and multiple mounting holes, the LTO-2 half height tape drive can easily be integrated into desktop workstations and servers. Using advanced technologies, this drive offers twice the capacity and data transfer rates of the preceding generation but needs only half the space.

FEATURES AND BENEFITS

- ▶ Up to 400 GB capacity (assuming 2:1 data compression) and 173GB/hr. transfer rate (assuming 2:1 data compression) meet today's shrinking backup windows demand while lowering total cost of ownership.
- ▶ Ultra160 SCSI interface provides ultimate performance of the SCSI bus.
- ▶ The LTO-2 tape drive is backward read/write compatible with the LTO1 format. Coupled with the LTO roadmap, this provides the best investment protection.
- ▶ Embedded quality monitoring and test features provide preventive maintenance information for reduced down time.
- ▶ Low heat dissipation, small half-height 5.25-inch form factor with several mounting capabilities for easy and trouble free integration into servers and workstations.

TAPE DRIVE INSTALLATION

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.
- ✓ **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** — Ultrium half-height tape drives are high-performance Ultra 160 SCSI half-height devices with a maximum burst transfer speed of 160 MB/second. They are designed to operate on a low voltage differential SCSI bus (LVD). They should be connected to a SCSI connection on your storage server.

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.

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

SOLUTION CONTENTS

The tape drive ships with the following accessories.

Note: Please check the package contents before beginning the installation.

The internal tape drive kit includes:

- ▶ Internal LTO-2 half height tape drive
- ▶ Application software
- ▶ Quick Start Guide
- ▶ Warranty card

The external tape drive kit includes:

- ▶ Tabletop LTO-2 half height tape drive
- ▶ Power cord for U.S. and International use
- ▶ External SCSI cable
- ▶ External LVD/SE SCSI terminator
- ▶ Application software
- ▶ Quick Start Guide
- ▶ Warranty card

TAPE BACKUP SOFTWARE INSTALLATION

You need to install tape backup application software that supports the Exabyte tape drive. For the latest supported software version, please go to one of the following web sites:

- ▶ www.tandberg.com and select SUPPORT and LTO Support
- ▶ The backup application software vendor's web site

For installation of tape backup application software, please refer to the software vendor's installation guide. Please also see [Chapter 4](#) in this manual for installation of backup features embedded in the operating systems.

SOFTWARE DEVICE DRIVER INSTALLATION

If the backup application software does not detect the tape drive, or to obtain the latest operating system drivers and upgrades, please visit www.tandberg.com and select SUPPORT and LTO Support.

MECHANICAL INSTALLATION

Allowed mounting orientations—The allowed mounting position is either horizontal with the indicator LEDs to the right, or vertical with the indicator LEDs up, as shown in [Figure 2-1](#).



Figure 2-1 Allowed mounting orientations

Mounting specifications—The tape drive occupies a half-height 5.25-inch slot with mounting screws on both sides of the tape drive chassis or at the bottom of the tape drive.

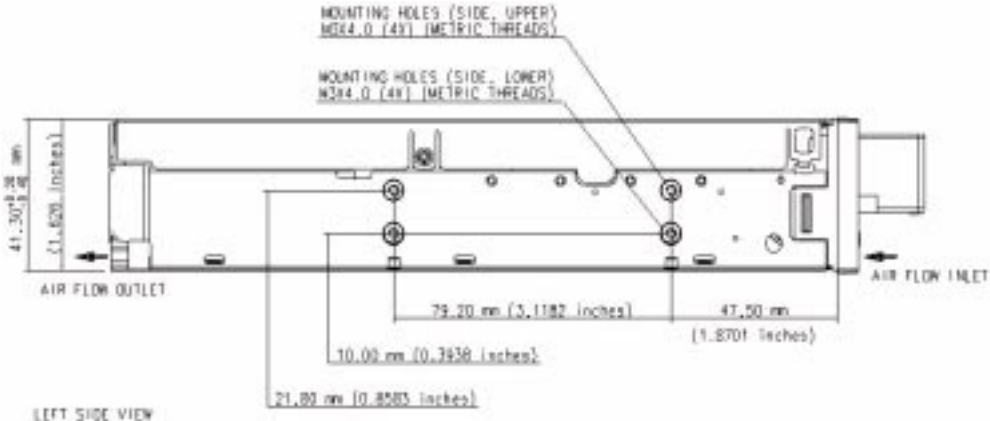


Figure 2-2 Mounting specifications

MOUNTING SCREW REQUIREMENTS

| | |
|---|--------|
| Use only M3 (metric) screws to mount the tape drive. | |
| Maximum permitted screw penetration: | 2.5 mm |
| Minimum required screw penetration: | 2.0 mm |
| Screw torque, mounting screws: | 0.5 Nm |
| Screws are supplied with all the Exabyte LTO tape drive variants. | |
| Bag with 4 screws and 4 SCSI ID jumpers | |

! Important

Do not use longer screws or higher screw torque than specified! Longer screws will encounter the bottom of the tape drive's casting and not secure the tape drive!

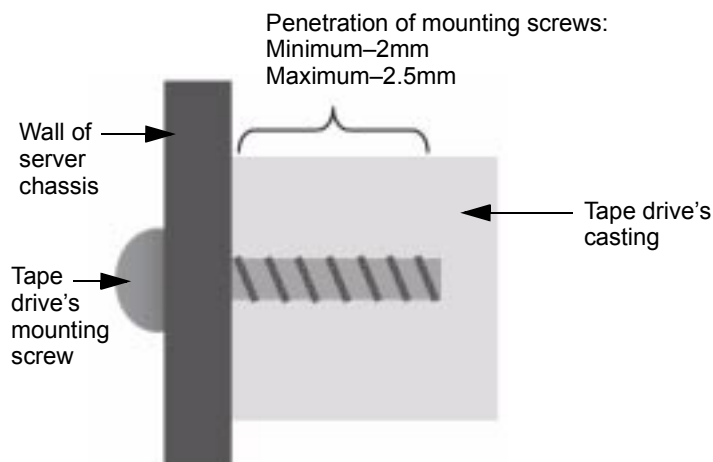


Figure 2-3 Mounting screw details

SCSI BUS INTERFACE

The tape drive is designed to operate on an Ultra 160 low voltage differential SCSI bus (LVD) with a burst transfer rate up to 160 MB/sec. The Ultra160 SCSI interface is backward compatible with older SCSI interfaces. Thus, all Ultra Wide SCSI interfaces may be used.

The tape drive features a high-density 68-pin (HD-68) connector for attachment to the server or to the interface connector in an external tabletop cabinet.

Attachment to the host computer is described below.

SCSI CONTROLLER BOARD INSTALLATION

Note: Before any SCSI device can be installed it is necessary to have a SCSI controller board installed. Please pay attention to the following points.

Make sure your computer is powered off before proceeding to the installation.

- ▶ If your computer is equipped with an on-board SCSI controller, before proceeding with the installation, you must first locate the SCSI connector on the computer motherboard.
 - ▶ Refer to the documentation provided with your computer to find out where this connector is located.
 - ▶ If multiple SCSI connectors are available, you can use any of them, unless your computer documentation mentions something different.
 - ▶ When done, firmly connect the SCSI connector to the Main-board connector and refer to [“SCSI Configuration” on page 7](#) and [“SCSI Bus Termination” on page 9](#).
- ▶ If your PC/Server requires a separate SCSI controller, make sure that it is properly installed before connecting your new tape drive.
- ▶ You will also need a software driver from the SCSI controller vendor to activate the SCSI controller. Please make sure you have the latest software driver for your SCSI controller loaded, and that the SCSI controller board is properly installed. Software drivers can be downloaded from the vendors' web site. Refer to the “READme” file for installation.
- ▶ Please refer to the PC/Server documentation for further information on how to install additional controller boards in the PC/Server, or ask your local supplier for assistance.

SCSI CONFIGURATION

All devices on a SCSI bus require their own unique identification, called SCSI IDs. If a SCSI ID conflict exists, some of the SCSI devices will not be recognized by your system. In many systems it is common to use the SCSI bus for the hard-drive and CD-ROM, as well as the tape drive. Remember that the SCSI controller uses SCSI ID 7.

SCSI ID SELECTION—INTERNAL TAPE DRIVE

Use jumpers to set the SCSI ID on the tape drive. The tape drive’s screen displays all SCSI device IDs during system startup.

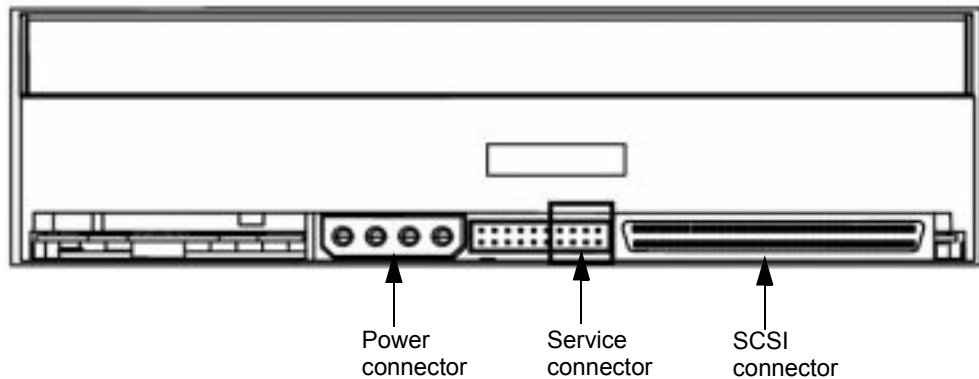


Figure 2-4 Internal tape drive connectors

The illustrations below show the service connector strap (jumper) settings for the SCSI ID (dark = strap/jumper mounted). All Exabyte Magnum LTO-2 half height tape drives are delivered with SCSI ID 2 set as the default.

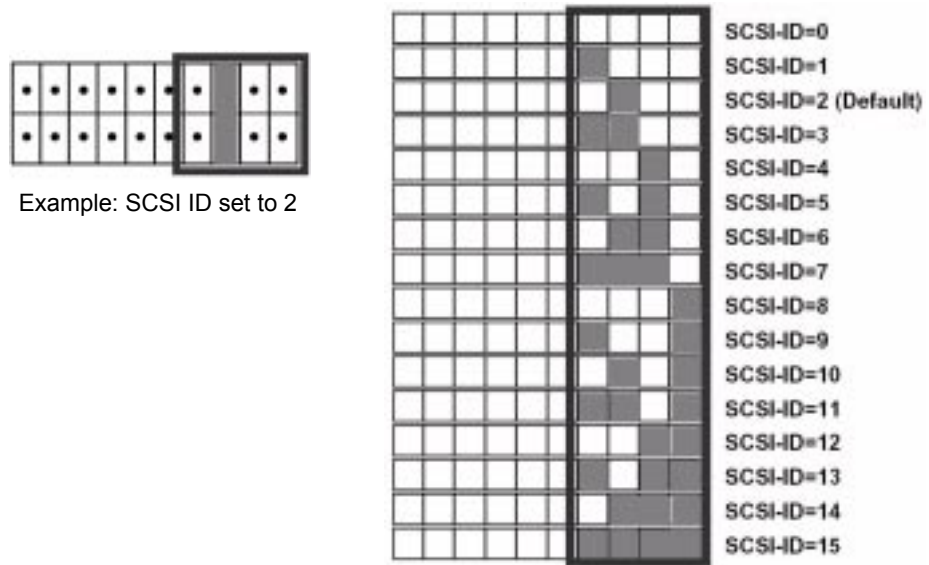


Figure 2-5 SCSI ID jumper settings

- ▶ If the tape drive is the only device on the SCSI bus, do not change the SCSI ID. The system automatically recognizes the tape drive.
- ▶ If the tape drive is *not* the only device on the SCSI bus, check the SCSI IDs of the other devices, then set the tape drive’s SCSI ID to a unique number (the SCSI host adapter typically uses ID 7).

SCSI ID SELECTION—EXTERNAL TABLETOP TAPE DRIVE

For the external tabletop tape drive, the SCSI ID switch is on the back of the unit. Change the ID by rotating the thumb-wheel switch.

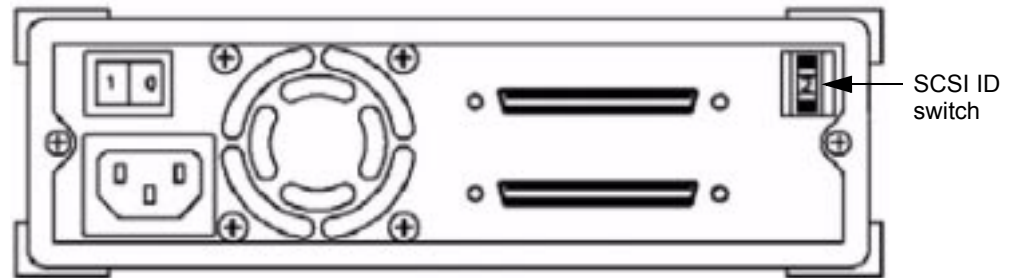


Figure 2-6 External tape drive connectors

SCSI BUS TERMINATION

TERMINATION IN GENERAL

A SCSI bus is susceptible to interference, such as noise from electrical motors and other electromagnetic devices. Also due to the speed of the data on the SCSI bus, it is of outmost importance to terminate the SCSI s properly.

INTERNAL TAPE DRIVE REQUIREMENTS

The SCSI-bus cable must be terminated in both ends according to SCSI specifications. If the tape drive is the last device on the bus, the bus must be terminated within 10 cm of the tape drive connection.

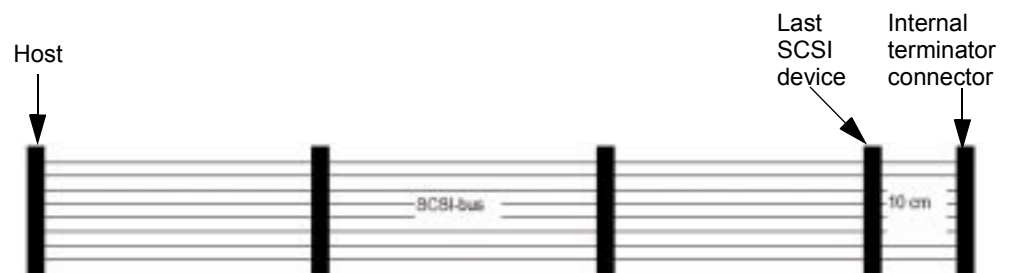


Figure 2-7 SCSI cable

The LTO-2 half height tape drive has a combined SCSI-LVD/SE interface embedded. The PC-98 Specification states that the termination of the SCSI bus system is a part of the SCSI cable and not a part of the SCSI device.

For internal devices, you must use a SCSI cable with an integrated terminator or a separate terminator applied to the end connector of the cable, 10 cm from the last device.

EXTERNAL TAPE DRIVE REQUIREMENTS

If the tape drive is the only device on the external SCSI bus, terminate it using the external terminator supplied in the kit.

If other external device(s) is/are present, you can install the tape drive in any position on the SCSI bus. The tape drive must be terminated if installed at the end of the SCSI bus (see [Figure 2-8](#)).

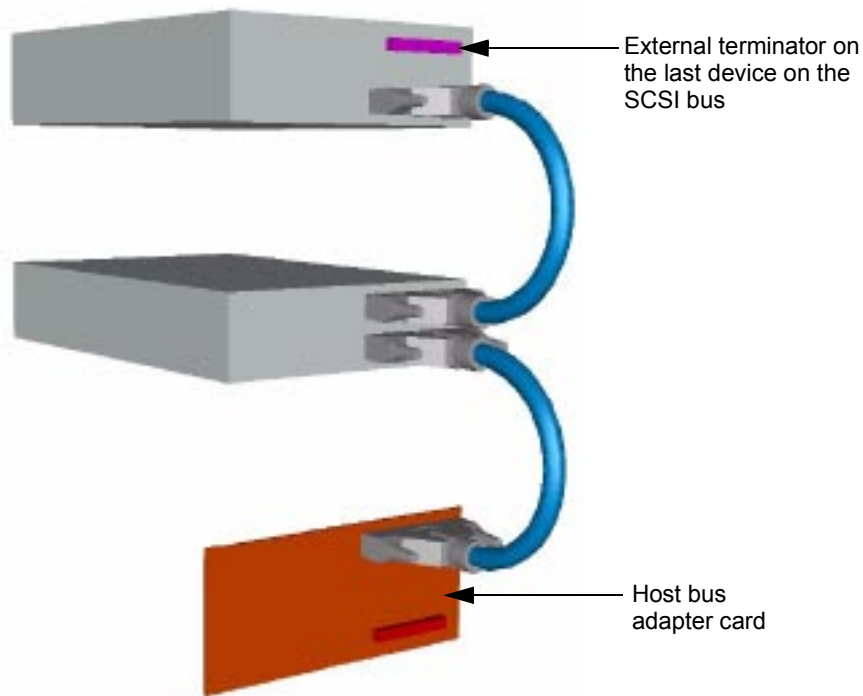


Figure 2-8 External tape drive termination

! Important

LTO-2 SCSI tape drives require an Ultra 3 or LVD 160 terminator to function properly on the SCSI bus. An inadequate terminator will result in various SCSI bus issues, including bus hangs and Read/Write failures.

INTERNAL TAPE DRIVE INSTALLATION

Internal installation of the tape drive requires a free 5.25-inch half-height bay with an open front in your computer system.

1. Obtain access to the removable media bay.

Refer to the documentation supplied with your server for information about accessing the removable media bay.

2. Slide the tape drive into the bay, as shown in [Figure 2-9](#).



Figure 2-9 Installing the internal tape drive

3. Secure the tape drive to the bay.

If screws are required, use the screws supplied with the tape drive, or equivalent. See Section “[Mounting Screw Requirements](#)” on page 6.

4. Connect the power cable and the SCSI cable, as shown in [Figure 2-10](#).

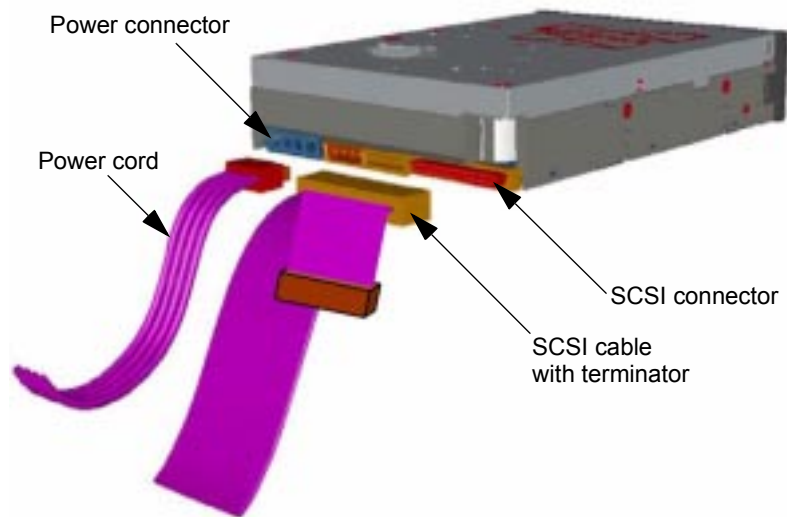


Figure 2-10 Internal tape drive cable connections

EXTERNAL TAPE DRIVE INSTALLATION

Ensure that the SCSI controller board has been installed and is working properly before installing the tape drive. Before starting, make sure the power is turned off.

Please read carefully the Information about the SCSI ID conflicts and SCSI termination in [“SCSI Configuration” on page 7](#) and [“SCSI Bus Termination” on page 9](#).

Note: : Do not connect the power cord until you connect all the other cables and the terminator.

To install a tabletop tape drive:

1. Connect the tape drive to your PC/Server with the enclosed SCSI cable to any of the two available SCSI connectors.
2. Install the terminator on the free connector on the back of the tape drive.

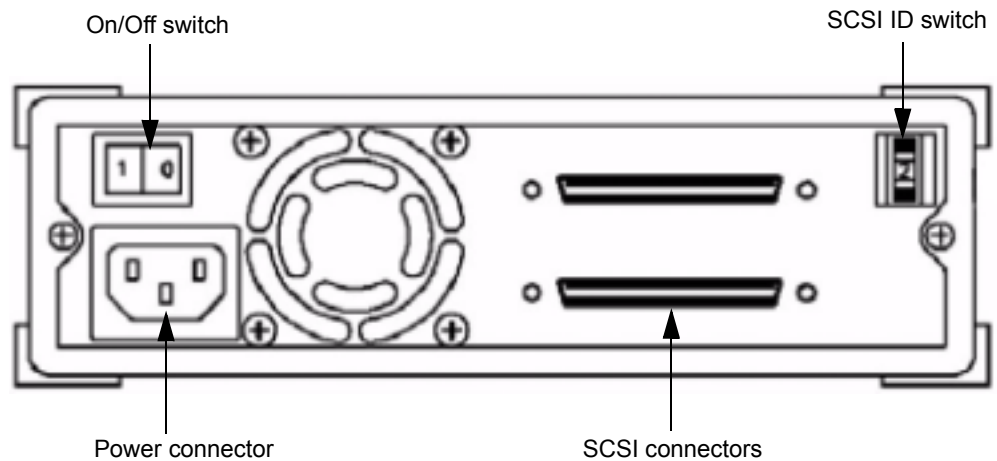


Figure 2-11 External tape drive back panel

3. Connect the female end of the power cord to the tape drive.
4. Connect the male end of the power cord to an available power outlet.
5. When you power up the system for the first time, make sure that all your SCSI devices are recognized by the SCSI controller board.

Remember to select a unique SCSI ID.

TAPE DRIVE OPERATION VERIFICATION

Once you have installed the tape drive hardware into the host computer, verify that it is functioning properly before you attempt to store data.

1. **For internal drives:** Power on the host computer.
2. **For external drives:** Power on the tape drive *before* switching on the host computer.
 - ▶ The tape drive runs its power-on self-test (POST), which exercises most of the tape drive's functionality without requiring a cartridge to be inserted.
 - ▶ All four LEDs light during power-up (see [“Front LED Indicators” on page 15](#)).
 - ▶ The Activity LED flashes during POST.
 - ▶ If any error occurs during POST, the tape drive flashes the Fault LED.
 - ▶ All LEDs are off after POST performs successfully.
 - ▶ If a tape cartridge is inserted, the tape drive loads the cartridge and the Ready LED illuminates.

Notes

3

TAPE DRIVE OPERATION

This chapter provides information about operating your tape drive.

FRONT LED INDICATORS

Table 3-1 describes the status of the front panel LEDs. See Appendix B for more information on LED operation.



Figure 3-1 Front panel LEDs

Table 3-1 Front LED indicator activity





| |  |  |  |  |
|--|---|---|---|---|
| Drive State | READY LED (Green) | ACTIVITY LED (Green) | CLEAN LED (Amber) | FAULT LED (Amber) |
| LED test: The LEDs illuminate in sequence | ON | ON | ON | ON |
| Power-On Self-Test: Starts in parallel with the LED test | Flashing in about 12 sec. | After 12 sec. Flashing during cartridge load | OFF | OFF |
| Cartridge not loaded | OFF | OFF | ON / OFF | OFF |

Table 3-1 Front LED indicator activity (continued)

| | | | | |
|--|----------|----------|----------|----------|
| Cartridge loaded, no activity | ON | OFF | ON / OFF | OFF |
| Cartridge loaded, activity | ON | Flashing | ON / OFF | OFF |
| Cleaning | OFF | Flashing | ON | OFF |
| Cartridge loading or unloading | OFF | Flashing | ON / OFF | OFF |
| Unrecoverable drive failure | ON / OFF | OFF | ON / OFF | Flashing |
| Over temperature | OFF | OFF | ON / OFF | ON |
| Media Error (wrong, write protected or harmed media) | OFF | Flashing | ON / OFF | Flashing |

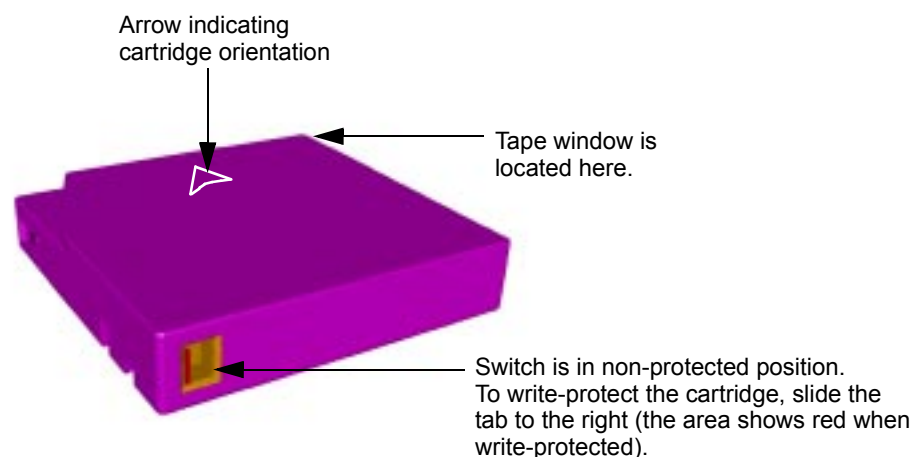
DATA CARTRIDGE OPERATION

Use only certified quality cartridges for the tape drive. Do not use worn or audibly noisy cartridges. Replace any cartridges that repeatedly require rewriting of large numbers of data-blocks per track.

WRITE PROTECTING THE CARTRIDGE

Write-protect the LTO cartridge by operating the write protect switch.

The Magnum LTO half height tape drive detects that the write-protect switch is set and will not allow any writing on the tape.

**Figure 3-2** Write protect switch

LOADING A DATA CARTRIDGE INTO THE TAPE DRIVE

The cartridge must be inserted with the label facing up and the tape dust cover towards the LEDs.

The drive has semi-soft load. In order not to damage the drive or the cartridge:

- ▶ DO NOT use extensive force.
 - ▶ BE SURE to insert the cartridge in correct orientation.
 - ▶ Use only approved LTO-specific data and cleaning cartridges.
1. Ensure that the LTO cartridge is correctly oriented with the arrow on the cartridge pointing up and towards the tape drive (see [Figure 3-3](#)).
 2. Push the LTO cartridge into the tape drive slowly until it stops, then release the cartridge.

The tape drive detects the cartridge and a motor-driven load mechanism locks the cartridge automatically in the correct position.

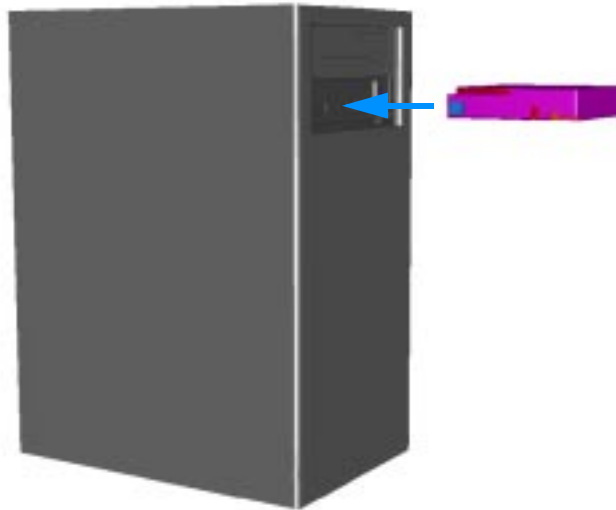


Figure 3-3 Cartridge insertion

EJECTING A DATA CARTRIDGE FROM THE TAPE DRIVE

You can eject the cartridge either by pressing the eject button located on the tape drive's front panel, or by issuing an Unload SCSI command. The tape drive automatically rewinds and ejects the cartridge (soft unload).

When removing the cartridge, wait until the soft-eject function has terminated its operation, then pull the cartridge straight out of the tape drive.



Figure 3-4 Eject button

CLEANING THE TAPE DRIVE

Prior to use, adapt the LTO cleaning cartridge to the operating environment for a time at least equal to the period it has been out of the operating environment and outside or above 10°C – 35°C (up to a maximum of 24 hours). Recommended operating temperature is 25°C/77°F or below (see [Appendix A, Specifications](#)).

RECOMMENDED CLEANING INTERVAL

The Clean LED steady ON indicates that a head cleaning operation is recommended. The tape drive is still fully operational with this LED steady ON, although we do recommend cleaning the tape drive when this LED illuminates to help ensure successful tape drive operation.

The LED illuminates:

- ▶ After 100 hours of tape running time has elapsed
- ▶ If the Media Management Algorithm detects a severely degraded write performance
or
- ▶ If a hard Read/Write error occurs.

You cannot turn off the LED with a power cycle. The LED is only reset after a successful cleaning cycle.

Note: When the tape drive's cleaning LED (third from left) illuminates steady amber, it indicates that cleaning is required. Clean the tape drive following the instructions in the next section.

Always clean the head if the tape drive performs large numbers of rewrite or reread operations. Immediately clean the head if hard Read or Write errors occur.

CLEANING PROCEDURE

Load the cleaning cartridge into the tape drive. The cleaning process begins automatically. This is indicated by the front LEDs on the product as follows:

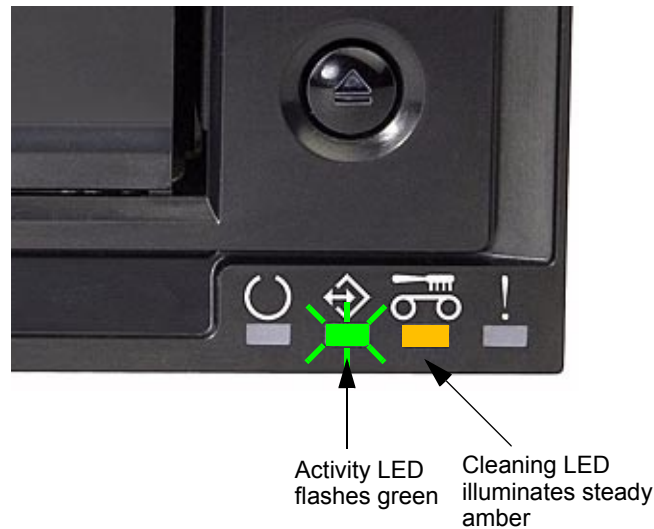


Figure 3-5 Activity and Cleaning LEDs

The tape drive ejects the cartridge when cleaning completes (about 3 minutes).

- ▶ **Successful cleaning**—If the cleaning was successful, the CLEANING LED turns OFF.
- ▶ **Unsuccessful cleaning**—If the cleaning was NOT successful, the CLEANING LED stays ON.
 - ▶ The LTO cleaning cartridge can be used about 50 times in the tape drive.
 - ▶ Replace the cleaning cartridge if the tape drive ejects it and the CLEANING LED is still constant AMBER.

HANDLING AND STORING LTO CARTRIDGES

To improve data reliability and cartridge life, it is important to handle and store the cartridges properly.

HANDLING LTO CARTRIDGES

- ▶ Do not drop LTO cartridges
- ▶ Make sure the air around the tape drive and the LTO cartridge storage area is clean
- ▶ Prior to use, adapt the LTO cartridge to the operating environment for a time at least equal to the period it has been out of the operating environment outside and above 10°C – 35°C (up to a maximum of 24 hours). Recommended operating temperature is 25°C or below (see [Appendix A, Specifications](#)).
- ▶ Replace worn or excessively noisy LTO cartridges

STORING LTO CARTRIDGES

Store the LTO cartridges in their protective case.

STORAGE CONDITION

Store LTO cartridges in a cool, dry environment. Avoid high temperatures. Recommended maximum temperature is 25°C/77°F and 50% RH humidity.

Do not store LTO cartridges near devices such as computer monitors, TV sets, or loudspeakers with strong magnetic fields (not exceeding 4000A/m).

4

SOFTWARE INSTALLATION

This chapter contains information for installing tape drives in the following operating system environments:

- ▶ “Windows 2000/2003/XP” on page 21
- ▶ “SCO Open Server” on page 22
- ▶ “SCO UnixWare” on page 24
- ▶ “Sun Solaris” on page 25
- ▶ “IBM AIX” on page 26
- ▶ “HP/UX” on page 27
- ▶ “Linux” on page 28

Please see www.tandberg.com SUPPORT /software compatibility for the most current backup application software compatibility information.

This chapter also provides information about tools available for the tape drive.

WINDOWS 2000/2003/XP

WINDOWS TAPE DRIVER

The LTO-2 half height tape drive requires an additional driver that is available at www.tandberg.com.

WINDOWS TAPE DRIVER INSTALLATION

1. Right-click on *My Computer*.
2. Select *Manage*, you should see the tape drive under “Other devices” with a “?”.
3. Select the device, right click and *Properties*.
4. Select the appropriate driver location.
5. Follow the instructions on the screen.

WINDOWS EMBEDDED BACKUP APPLICATION

The Backup application is included in the Windows Operating System.

Before running the application, make sure the tape driver for your LTO-2 half height tape drive is properly installed. See [Chapter 2, “Tape Drive Installation](#).

To start the application:

1. Click on *START*.
2. Click on *Programs*.
3. Click on *Accessories*.
4. Click on *System tools*.
5. Select *Backup*.

SCO OPEN SERVER

HOST ADAPTER

SCO OS includes a driver for most SCSI host adapters.

If you cannot find the appropriate driver, please refer to the installation guide provided with the SCSI interface adapter.

To install the host adapter:

1. Login as root.
2. Type the following command: MKDEV TAPE.
3. Select Install a SCSI Tape Drive.
4. Enter the prefix of the SCSI host adapter that supports this device. (Typing “h” lists the supported SCSI host adapters.)
5. Which SCSI host adapter supports this device?
If only one SCSI host adapter is installed select 0. If two SCSI host adapters of the same type are installed, select 1.
6. What is the target ID for this device? (The Exabyte default SCSI ID is 2.)
7. What is the LUN of this device? (Must be set to 0).
8. Update the SCSI Configuration?
Check first that the table on the screen is conformed to the tape drive configuration.
9. Press Return for the next three questions to use the default settings.

10. Select Tape Device Types. Choose 1 for Generic SCSI-1/SCSI-2 tape drive.

Note : The Kernel has to be rebuilt to reflect the new Hardware configuration, and a reboot is mandatory before you can use your LTO-2 tape drive.

For any questions related to this operating system or its embedded Backup applet, please refer to the documentation provided on the SCO OS CD-ROM.

SCO OPEN SERVER SYSTEM COMMANDS

TAR, CPIO and DD allow simple backup, verify, or restore operations to be performed.

Two different device drivers can be used:

- ▶ A Non Rewind device driver (used to perform append Backup)
- ▶ A Rewind device driver (used only to perform overwrite backup)

For a complete explanation on how to use the system commands, please refer to the SCO Open Server documentation, or the online help (MAN command).

Tar command examples:

| Command | Action |
|--------------------------------------|---|
| <code>tar cvf /dev/rStp0 /etc</code> | Performs the backup of the /etc directory |
| <code>tar tvf /dev/rStp0</code> | Reads the data on the tape |
| <code>tar xvf /dev/rStp0</code> | Restores the data from the tape to the current directory tree |

SCO OPEN SERVER BACKUP MANAGER

SCO Open Server Graphic Interface

1. Click on System Administration.
2. Double-click on Backup Manager.
3. Follow the instructions on the screen.

SCO Open Server Console

1. Login as Root.
2. Type SCOADMIN.
3. Select Backup Manager.

SCO UNIXWARE

HOST ADAPTER

SCO UnixWare includes a driver for most SCSI host adapters.

If the appropriate driver cannot be found, please refer to the installation guide provided with the SCSI host adapter.

INSTALLATION

1. Install the tape drive.
2. Turn on the PC.
3. During the boot process, SCO UnixWare automatically detects the tape drive and installs the correct tape driver.

Note: For any questions related to this operating system or its embedded Backup applet, please refer to the documentation provided on the SCO CD-ROM.

SCO UNIXWARE SYSTEM COMMAND

TAR, CPIO and DD allow simple Backup, Verify or Restore operations to be performed.

Two different device drivers can be used:

- ▶ A *Non Rewind* device driver (used to perform append backup)
- ▶ A *Rewind* device driver (used only to perform overwrite backup)

For a complete explanation on how to use the system commands, please refer to the SCO UnixWare documentation, or the online help (MAN command).

Tar command examples:

| Command | Action |
|---|---|
| <code>tar cvf /dev/rmt/c0s0 /etc</code> | Performs the backup of the /etc directory |
| <code>tar tvf /dev/rmt/c0s</code> | Reads the data on the tape |
| <code>tar xvf /dev/rmt/c0s</code> | Restores the data from the tape to the current directory tree |

SUN SOLARIS

TAPE DRIVE INSTALLATION

1. Install the tape drive.
2. Turn on the SUN workstation or server.
3. Use `rm -f /dev/rmt/*` to remove any reference to old tape device, and then use `devfsadm -c tape`.

This re-configures the `/dev/rmt` directory for the tape drive to work properly on the machine.

For improved performance using the tape drive, a specific system file can be modified:

```
/kernel/drv/st.conf
```

ST.CONF File entries for Tandberg 420LTO:

```
"TANDBERGTS400", "Tandberg 420LTO LTO", "TANDBERG_TS400";
```

```
TANDBERG_TS400 = 1,0x36,0,0x9639,3,0x00,0x40,0x42,2;
```

* Will be "TANDBERG_TS400" until Q2/06

SUN SYSTEM COMMAND

TAR, CPIO and DD allow simple Backup, Verify or Restore operations to be performed.

Two different device drivers can be used:

- ▶ A *Non Rewind* device driver (used to perform append backup)
- ▶ A *Rewind* device driver (used only to perform overwrite backup)

Tar command examples:

| Command | Action |
|--|---|
| <code>tar cvf /dev/rmt/0cb /etc</code> | Performs the backup of the <code>/etc</code> directory |
| <code>tar tvf /dev/rmt/0cb</code> | Reads the data on the tape |
| <code>tar xvf /dev/rmt/0cb</code> | Restores the data from the tape to the current directory tree |

For a complete explanation on how to use the system commands, please refer to the Sun documentation, or the online help (MAN command).

IBM AIX

TAPE DRIVE INSTALLATION

To install any of the LTO-2 tape drives on IBM AIX, the `smit` utility must be used.

Be sure the SCSI ID of the tape drive is not used in the SCSI sub-system.

1. Install the tape drive.
2. Login as *root*.
3. Run `smit` devices.
4. Select Tape Drive.
5. Follow the instructions on the screen.

For improved performance on the tape drive, the default block size should be set to 0 and the density to default LTO type:

1. Run `smit` devices.
2. Select Change/Show characteristics of a tape drive.
3. Select the tape driver you want to modify.
4. Set the BLOCK size to 0
5. You can set the density codes that the LTO-2 half height tape drives support by entering the value of 66 (0x42 for LTO2) in the field DENSITY setting #1 and #2 respectively.

IBM AIX SYSTEM COMMAND

TAR, CPIO and DD allow simple Backup, Verify or Restore operations to be performed.

Two different device drivers can be used:

- ▶ A *Non Rewind* device driver (used to perform append backup)
- ▶ A *Rewind* device driver (used only to perform overwrite backup)

Please refer to the IBM AIX documentation for more information.

Tar command examples:

| Command | Action |
|-------------------------------------|---|
| <code>tar cvf /dev/rmt0 /etc</code> | Performs the backup of the /etc directory |
| <code>tar tvf /dev/rmt0</code> | Reads the data on the tape |
| <code>tar xvf /dev/rmt0</code> | Restores the data from the tape to the current directory tree |

IBM AIX STORAGE MANAGER

This application is part of the operating system. Install as follows:

1. Open the System Administrator window.
2. Double-click on *Storage Manager*.
The list of available tape device(s) appears on the screen.
3. Follow the instructions on the screen to continue

For any questions related to this application or its installation, please refer to the IBM online documentation.

HP/UX**TAPE DRIVE INSTALLATION**

To install the tape drive, use the SAM utility.

1. Login as *root*.
2. Run *SAM*.
3. Select Peripheral Devices.
4. Select Action/Add.

The tape drive is automatically detected and the necessary drivers installed.

HP/UX SYSTEM COMMAND

TAR, CPIO and DD allow simple Backup, Verify, or Restore operations to be performed.

Two different device drivers can be used:

- ▶ A *Non Rewind* device driver (used to perform append backup)
- ▶ A *Rewind* device driver (used only to perform overwrite backup)

Tar command examples:

| Command | Action |
|-------------------------------------|---|
| <code>tar cvf /dev/rmt0 /etc</code> | Performs the backup of the /etc directory |
| <code>tar tvf /dev/rmt0</code> | Reads the data on the tape |
| <code>tar xvf /dev/rmt0</code> | Restores the data from the tape to the current directory tree |

For a complete explanation on how to use the system commands, please refer to the HPUX documentation, or the online help (MAN command).

LINUX**SCSI HOST ADAPTER**

Linux contains a driver for most SCSI host adapters.

If the driver cannot be found, please refer to the documentation provided with the SCSI host adapter.

TAPE DRIVE INSTALLATION

1. Install the tape drive.
2. Turn on the PC.

During the boot process, Linux automatically detects the tape drive and installs the correct tape driver. For improved performance using the tape drive, a specific system file can be modified:

`/etc/stinit.def`

stinit.def File entries for Tandberg 420LTO:

```

manufacturer="TANDBERG" model = "TS400" {
scsi2logical=1
can-bsr=1
auto-lock=0
two-fms=0
drive-buffering=1
buffer-writes
read-ahead=1
async-writes=1
can-partitions=1
fast-mteom=1
mode1 blocksize=0 density=0x42 compression=1 # 400 GB, native
mode2 blocksize=0 density=0x42 compression=0 # 200 GB, LTO}

```

For any questions related to this operating system or its embedded backup applet, please refer to the documentation provided on the Linux CD-ROM.

LINUX SYSTEM COMMAND

TAR, CPIO and DD allow simple Backup, Verify, or Restore operations to be performed.

Two different device drivers can be used:

- ▶ A *Non Rewind* device driver (used to perform append backup)
- ▶ A *Rewind* device driver (used only to perform overwrite backup)

Tar command examples:

| Command | Action |
|------------------------------------|---|
| <code>tar cvf /dev/st0 /etc</code> | Performs the backup of the /etc directory |
| <code>tar tvf /dev/st0</code> | Reads the data on the tape |
| <code>tar xvf /dev/st0</code> | Restores the data from the tape to the current directory tree |

For a complete explanation on how to use the system commands, please refer to the Linux documentation, or the online help. (MAN command).

TAPE DRIVE UTILITIES

Go to www.tandberg.com/SUPPORT/Utilities to find the following software tools.

FLASHIT – FIRMWARE UPGRADE UTILITY

This utility is used to update the tape drive's firmware. FlashIt:

- ▶ Is a simple program used to upgrade the microcode in the tape drive.
- ▶ communicates with the devices through their SCSI interface.
- ▶ automatically finds all supported SCSI devices in your system (not disks).
- ▶ guides you in locating microcode files and gives you an indication of which microcode files can be used to upgrade the selected device.
- ▶ comes in separate versions for DOS, Windows 95/98/ME and Windows NT/2000/2003/XP.

Note: For more information, please see the *User Guide* available at www.tandberg.com (select Tape Drives, then select Software).

TDKIT – TOOL FOR TESTING AND DOWNLOADING FIRMWARE

TDkit is a program used to inspect and change some of the tape drive parameters and to execute simple tape operations. It also:

- ▶ gives the operator the option to perform tests to check the reliability of the SCSI connection, the tape drive, and the media.
- ▶ can also be used to upgrade the drive firmware and perform a data dump for deep analyses.

Download TDkit from www.tandberg.com (select Tape Drives, then select Software).

5

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.

HARDWARE CHECKING

Check that the:

- ✓ system recognizes the tape drive during the boot process
- ✓ SCSI host adapter recognizes the tape drive during its initialization
- ✓ tape drive Front Panel LED status (see [Appendix B, Tape Drive LEDs](#))
- ✓ SCSI ID of the drive is not conflicting on the SCSI bus (see [“SCSI Configuration” on page 7](#))
- ✓ power cable is inserted correctly (see [“External Tape Drive Installation” on page 12](#))
- ✓ SCSI cable connections including termination are made correctly (see [“SCSI Configuration” on page 7](#) and [“SCSI Bus Termination” on page 9](#))

! Important LTO-2 SCSI tape drives require an Ultra 3 or LVD 160 terminator to function properly on the SCSI bus. An inadequate terminator will result in various SCSI bus issues, including bus hangs and Read/Write failures.

SOFTWARE CHECKING

Check that the:

- ✓ operating system does not report a problem during the boot
- ✓ driver for the SCSI host adapter is present and loaded properly
- ✓ correct tape device driver has been installed properly, if applicable

- ✓ Backup software does not report any error messages when loading

If any problems occur, reinstall the backup application software and verify that it recognizes the tape drive. Refer to your backup application's documentation for additional information.

VERIFYING RECENT CHANGES

If the tape drive was installed previously and operating correctly but is now incurring a problem, verify any recent changes to the system to ensure that these changes are not causing the problem. Try the following:

- ✓ If the system configuration has changed—remove the change to see if it affected the tape drive.
- ✓ If an operating system corrective patch has been installed—remove it to see if it affected the tape drive.
- ✓ If a SCSI device has been added—check for SCSI ID conflicts.
- ✓ If a SCSI device has been added—check if the SCSI termination has been properly set.

! Important

LTO-2 SCSI tape drives require an Ultra 3 or LVD 160 terminator to function properly on the SCSI bus. An inadequate terminator will result in various SCSI bus issues, including bus hangs and Read/Write failures.

STANDALONE DIAGNOSTICS

The main objective for the standalone diagnostics test is to test the complete tape drive as comprehensive and fast as possible without any tape drive configuration or host support. The tool can also be used to verify data cartridges.

STARTING THE TEST

A standalone diagnostic test requires a tape that is not write-protected. The media type can be any media type that supports a tape format that can be written by the tape drive.



Caution

Since the test involves write operations, the existing tape contents will be destroyed! Use a cartridge

Make sure that no cartridge is loaded in the tape drive—If a cartridge is loaded, press the eject button to unload the cartridge before proceeding.

Aborting the test—It is possible to abort the test and eject the cartridge by pressing the eject button. The tape drive indicates the detection of the abort request by flashing both the Ready and Activity LEDs. Depending on the stage you abort the test, it may take a while before the tape drive begins the eject operation.

1. Enter Service Mode by pressing the Eject Button for at least 6 seconds.

The Ready LED flashes fast (indicating that the tape drive is in Service Mode and that Service entry number 1 is active).

2. Insert the tape cartridge into the tape drive within 15 seconds.

The tape drive loads the cartridge and the Ready LED flashes indicating that Standalone Diagnostics has started.

The eject button has now returned to normal mode.

When the cartridge has been ejected, all LEDs are turned off (the Cleaning LED may however be on).

The Ready LED continues flashing during the complete test. The Activity LED flashes when the test performs tape motion.

If no cartridge has been inserted after 15 seconds, the LEDs revert back to their initial state and the Eject Button must be pressed for 6 seconds again to get back to Service Mode.

TEST SEQUENCE

The Standalone Diagnostics test performs the following operations:

Collect Information. Reads and stores tape drive and medium information:

- ▶ Firmware and Drive ID
- ▶ Tape type and format
- ▶ Cartridge serial number
- ▶ Error History Log and Log page 0x33 from EEPROM
- ▶ Run-time counters from EEPROM

Mainboard Test. Tests the main board hardware.

Cartridge Manipulation Test. The Cartridge Manipulation Test performs the same mechanical movement operations as those performed during Cartridge Load and Eject.

Read/Write Test. This test involves actual reading and writing on the tape medium. A write pass and a read pass are executed.

When the test completes without errors, the tape drive ejects the tape cartridge. No LEDs are illuminated (the Cleaning LED may however be on).

FAILURE INDICATION

When the tape drive detects a failure, the tape is not ejected and the Failure LED flashes.

You can retrieve detailed information using the 'Receive Diagnostic Results' SCSI command.

If a write protected, unsupported, or damaged tape cartridge is inserted for the Standalone Diagnostics test, the tape drive ejects it and the Failure and Activity LEDs flash while the Ready LED is off. Turn off the two flashing LEDs by pressing the eject button.

MEDIA MANAGEMENT REPORTING

Media Management (MM) is a feature embedded in the tape drive's firmware that monitors the Read and Write performance of the tape drive and media. Write performance information is written on the media header every time the media is rewound, and before the media is unloaded.

CLEANING IS REQUIRED

If the Write performance is below a factory set re-write threshold, the tape drive reports that cleaning is required.

It does this by setting the Clean LED to steady AMBER, and sending information to the backup application software using the SCSI Tape Alert reporting standard.



Figure 5-1 Backup Exec reporting that the tape drive needs cleaning


```

TAPE ***TapeAlert*** The following information is for Device[0]:
TAPE E6918 The tape drive needs cleaning:
1. If the operation has stopped eject the tape and clean
the drive.
2. If the operation has not stopped wait for it to finish
and clean the drive.
Check user's manual for cleaning instructions.
    
```

Figure 5-2 ARCserve reporting that the tape drive needs cleaning

If the tape drive operates normally after cleaning, both the media and the tape drive are functioning properly.

DEGRADED MEDIA

If the write performance is still below the re-write threshold after cleaning, MM reports via the Clean LED (set to steady AMBER) and the backup application software that the media is degraded.

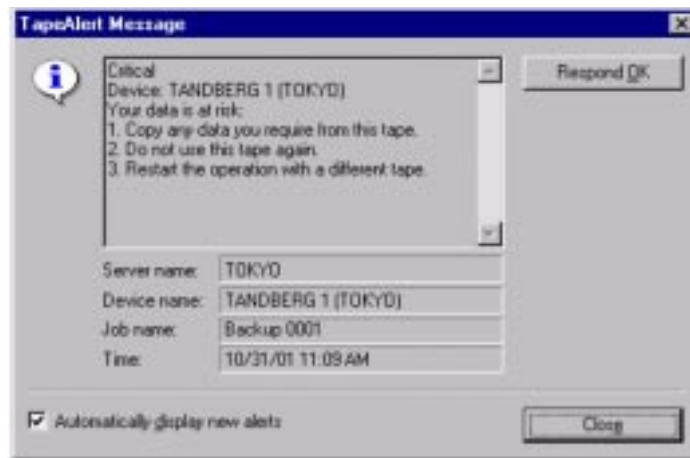


Figure 5-3 Backup Exec reporting that the media is degraded

The degraded media warning is a warning that the cartridge is less safe, and if it continues to be used, it may become worn to the point where drive cannot write or read successfully using this cartridge.

```

TAPE ***TapeAlert*** The following information is for Device[0]:
TAPE E6913 Your data on tape[10/26/01 1:25 PM] serial
number[303145] is at risk.
1. Copy any data require from this tape. Do not use this
tape again.
2. Restart operation with a different tape.
    
```

Figure 5-4 ARCserve reporting that the media is degraded

PROBLEM SITUATIONS

DEAD ON ARRIVAL

- ✓ Check LED activity at power up—All four LEDs flash for two seconds at power up and the Ready LED flashes for several seconds while the power-on self-test is running. See [Appendix B, Tape Drive LEDs](#).
- ✓ Make sure that the power supply used is working—measure with an external voltmeter or use a verified supply.
- ✓ Perform “drive dead test” when supply is verified—Push the eject button for at least 6 seconds to enter the “drive dead test”. The Activity LED should keep flashing for approximately 15 seconds.

If the tape drive is still unresponsive, remove all the cables except the power cable and perform the “drive dead test” again; a defective cable or SCSI host bus adapter may leave the tape drive in a reset condition.

TAPE DRIVE FAILS WITH SPORADIC ERRORS

- ✓ **Terminator.** Check the terminator used on the tape drive.

! **Important** LTO-2 SCSI tape drives require an Ultra 3 or LVD 160 terminator to function properly on the SCSI bus. An inadequate terminator will result in various SCSI bus issues, including bus hangs and Read/Write failures.

LTO-2 SCSI tape drives are Ultra 160 SCSI devices and require a minimum Ultra 160 non-RAID SCSI card, Ultra 160 rated SCSI cabling, and an Ultra 3 Active SCSI terminator. Cabling and termination rated higher (Ultra 320, for example) is also acceptable.

An appropriate terminator is stamped with Ultra 3 or LVD 160 and “Active Negation.”

Your library was shipped with the appropriate terminator. If you incorporate the library into an existing setup that is not properly terminated, or if the original terminator is replaced during setup, you may experience the failures described below.

Failure symptoms include:

- ▶ Read/Write failure
- ▶ Bus hangs
- ▶ Connectivity issues—tape drive not seen on bus or drops off bus
- ▶ Command failures—commands to this device may fail while commands to other devices on the bus may work properly

DAMAGED FRONT BEZEL

There are no electrical parts or cables in the front bezel.

1. Eject and remove any cartridge in the tape drive before replacing the front bezel.
2. Remove the damaged front bezel—Use a small flat screwdriver or your fingernails to lift the small plastic “ears” on each side of the tape drive.
3. Install the new bezel—Push it gently onto the front of the tape drive until the “ears” snap into place on each side.

TAPE DRIVE NOT DETECTED BY THE OPERATING SYSTEM (OS)

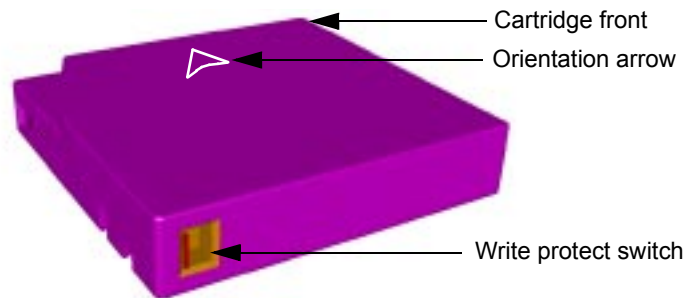
- ✓ Check LED activity at Power Up—All four LEDs flash for two seconds at power up and the Ready LED flashes for several seconds while the power-on self-test is running. See [Appendix B, Tape Drive LEDs](#).
- ✓ Check the SCSI ID—Each device on the SCSI bus needs a unique SCSI ID. The SCSI ID is set with jumpers on the back of the tape drive. See [“SCSI ID Selection—Internal Tape Drive” on page 8](#) or [“SCSI ID Selection—External Tabletop Tape Drive” on page 9](#).
- ✓ Check SCSI termination—Terminate the SCSI bus at the end of the cable; a defective terminator may leave the drive in a reset condition. See [“SCSI Bus Termination” on page 9](#).

! Important LTO-2 SCSI tape drives require an Ultra 3 or LVD 160 terminator to function properly on the SCSI bus. An inadequate terminator will result in various SCSI bus issues, including bus hangs and Read/Write failures.

WILL NOT INSERT OR HOLD MEDIA OR MEDIA NOT RECOGNIZED

- ✓ Check cartridge type—The Magnum LTO Half Height Tape Drive only accepts LTO-1 or LTO-2 type data or cleaning cartridges. If a wrong type of cartridge is inserted, it can be mechanically prevented from being inserted or electrically rejected after insertion.
- ✓ Check media orientation—The arrow on the cartridge must point into the tape drive facing up when the tape drive is mounted horizontally with the LEDs on the right.
Media can be inserted only the “correct way”; the tape drive blocks the media if it is inserted incorrectly. See [“Data Cartridge Operation” on page 16](#).
- ✓ Try using a new cartridge—If it loads correctly, check the failing cartridge for damage.

- ✓ Check failing media for pin damage (the buckling pin):



- Hold the cartridge in your hand with the Write Protect Switch to your left and orientation arrow pointing away from you.
- On the right side (in the front of the cartridge) is a small door that can be opened by sliding it toward you.

Inside the cartridge you should see a metal pin, which should be parallel with the cartridge front, and is held in place by two metal grippers at each end (top and bottom of the cartridge). The media should be attached to this pin, with only the top and bottom sections of the pin visible.

If the pin is missing, loose, or damaged the tape will be damaged and rejected from the tape drive.

NOISY TAPE DRIVE

There are no fans in the tape drive and the noise should be very low in idle mode. When the tape moves, noise can come from the media itself. The tape drive has a steady sound when streaming. The sound is “intermittent” if the host is not delivering data at the data rate of the tape drive.

- ✓ Check to see if the noise comes from the cartridge—Insert a new cartridge after checking it for any damage.
- ✓ Check that the tape drive is mounted correctly—If the tape drive is mounted incorrectly, it can produce noise when the tape moves. See [“Mechanical Installation” on page 5](#).

CARTRIDGE IS STUCK INSIDE THE TAPE DRIVE

- ✓ Try to eject the cartridge by pushing the eject button. See [Figure 3-4 on page 18](#).
- ✓ Perform a tape drive reset using the Service mode—Service mode is entered by keeping the eject button pressed for at least six seconds. The Activity LED flashes.

- a. To reset the tape drive, push the eject button once more to make the Activity LED flash. While this LED is flashing, press the eject button twice. This should make the tape drive reset itself.

If the button is not pushed for 15 seconds, the eject button reverts back to its original cartridge eject function.

- b. Power cycle the tape drive (switch power off, then back on, if possible). See [Figure 2-11 on page 12](#).

FAULT LED FLASHES AMBER AND THE ACTIVITY LED IS “OFF”

The tape drive reports that it has a failure.

- ✓ Reset the tape drive using the Service mode—Service mode is entered by keeping the eject button pressed for at least six seconds. The Ready LED flashes.

- a. To reset the tape drive, push the eject button once more to make the Activity LED flash. While this LED is flashing, press the eject button twice. This should make the tape drive reset itself.

If the button is not pushed for 15 seconds, the eject button reverts back to its original cartridge eject function.

- b. Power cycle the tape drive (switch power off, then back on, if possible). See [Figure 2-11 on page 12](#).

FAULT LED FLASHES AMBER AND THE ACTIVITY LED FLASHES

The tape drive signals Media Error. To eject the cartridge, press the eject button (see [Figure 3-4 on page 18](#)).

- ✓ Check if the media is correct (see [“Media Specifications and Compatibility” on page 43](#)).
- ✓ Check the write protection switch position (see [“Write Protecting the Cartridge” on page 16](#)).
- ✓ Check if the media is damaged (see also [“Degraded Media” on page 35](#)).
- ✓ Check if an expired cleaning cartridge was used (Clean LED is On).

CLEANING LED IS ILLUMINATED

The Cleaning LED illuminates 100 hours after the last cleaning operation or after an unrecoverable Read or Write error. Unrecoverable Read or Write errors may be a result of debris on the Read/Write head. If the Cleaning LED was switched ON by the “100 hours” function, the tape drive operates normally. You should always clean the tape drive when the Cleaning LED is ON.

- ✓ Run cleaning operation with cleaning tape—The Cleaning LED indicates that the tape drive needs cleaning due to elapse of 100 hours since last cleaning or a hard Write /Read error occurred that may be caused by debris on the head(s).
- ✓ If the Cleaning LED is still on after running the cleaning operation, check for an expired cleaning tape. A cleaning tape can be used 50 times. If an expired cleaning tape is used, the tape drive ejects the cleaning tape and the Cleaning LED remains illuminated.

INCORRECT DATA COMPRESSION

- ✓ Check if data is already compressed—Data may have been compressed by software in the host computer.

In some cases data will actually expand when subjected to the compression. This may, for example, be the case when sending already compressed data to the tape drive with the compression option enabled. In this case the tape drive automatically turns compression from “on” to “off” to optimize the data storage.

! Important

Magnum LTO Half Height Tape Drives have compression ON by default. Turn compression OFF using the SCSI Mode Select command.

- ✓ Turn OFF software compression—The compression is performed in the tape drive’s hardware. Therefore any other compression software in the host or on the host bus adapter should be turned off.

The data is compressed using the SLDC (Streaming Lossless Data Compression) algorithm that is based on ALDC (Adaptive Lossless Data Compression). The SLDC format is defined in the ECMA-321 standard. Two enhancements are introduced:

- ▶ Uses two methods to reduce expansion of uncompressible data
- ▶ Uses embedded code words

SLOW PERFORMANCE

- ✓ Check that the software driver for the tape drive is the latest version. Running without a software driver or with the wrong software driver can cause the tape drive to run with low performance due to wrong block size and buffer usage.
- ✓ Clean the tape drive (see [“Cleaning the Tape Drive”](#) on page 18).
- ✓ Perform a tape drive diagnostics test (see [“Standalone Diagnostics”](#) on page 32).

INTERMITTENT FAILURES

If the tape drive fails intermittently:

- ✓ Clean the tape drive (see [“Cleaning the Tape Drive”](#) on page 18).
- ✓ Check termination on the SCSI bus (see [“SCSI Bus Termination”](#) on page 9).
- ✓ Check the operating system logs for any errors.

If the problem occurs in the middle of an operation:

- ✓ Retry the operation with a different data cartridge.
- ✓ If the error occurs when the software scans for the files to be backed up, please operate a SCANDISK (or similar) operation to check the state of the File System(s) and hard disk.

If the error occurs always on the same file or directory:

- ✓ Try to remove the file or directory from the backup operation to see if that corrects the problem.
- ✓ Try with a different data cartridge.

TAPE REMOVAL PROCEDURE

Available upon request; good technical knowledge is required (see [page iv](#)).

Notes

A

SPECIFICATIONS

This chapter provides specifications for the tape drive.

TAPE DRIVE CAPACITY AND PERFORMANCE

Table A-1 Tape drive capacity and performance

| Tape Drive Model | Tape Format | Capacity ^a | Sustained Transfer Rate ¹⁾ | Interface Type |
|-------------------|-------------|-----------------------|---------------------------------------|----------------|
| LTO-2 half height | Ultrium 2 | 200/400 GB | 24/48 Mbyte/sec | Ultra160 |
| | Ultrium 1 | 100/200 GB | 16/32 MByte/sec | Ultra160 |

^a Capacity and transfer rate given in native/compressed (assuming 2:1 compression)

MEDIA SPECIFICATIONS AND COMPATIBILITY

Table A-2 Media specifications and compatibility

| Drive Model | Media Name | Tape Length | Capacity (Native) |
|-------------------|--|-------------|-------------------|
| LTO-2 Half Height | LTO Ultrium Generation 2 (Native format) | 609 m | 200 Gbyte |
| | LTO Ultrium Generation 1 (Read/Write compatible) | 609 m | 100 GByte |

MECHANICAL DIMENSIONS

- ▶ Standard tape drive mounting—Fits in a 5.25-inch half-height (“slim-line”) enclosure for diskette, CD/DVD-ROM or disk drive, and has standard mounting holes for a half-height tape drive.
- ▶ Dimensions (maximum)—
 - ▶ Height—1.625 inch (41.3mm)
 - ▶ Width—5.75 inch (146.0)
 - ▶ Depth—8.4 inch (214 mm)

POWER REQUIREMENTS

Table A-3 Power requirements

| Drive Model | Voltage input | Value |
|----------------|---------------------------------|--|
| LTO-2 Internal | DC input (typical operation) | 5 VDC / 2.1 A, 12 VDC / 0.8 A |
| LTO-2 External | AC input | 50-60 Hz: 100 VAC / 0.6 A or 240 VAC / 0.3 A |

HEAT DISSIPATION

The LTO-2 half height tape drive as standalone:

- ▶ Operating—18 W
- ▶ Sleep mode with cartridge inserted—9 W

DATA COMPRESSION

DEFINITION

Data Compression is a way to increase capacity on a storage device. Compression ratios are normally specified to be 2:1, meaning that it is possible to store twice as much data on the tape as without data compression. However, the compression rate depends on the type of data. For example, ordinary text files can be compressed in a much higher rate than program and picture files.

TYPES OF COMPRESSION

There are two ways to compress data: hardware compression and software compression.

- ▶ Hardware compression means that the data compression is done by the electronics in the storage device. Hardware compression is more efficient and faster than software compression.
- ▶ Software compression means that an application program in the host computer is compressing the data before it is sent to the storage device.

The Magnum LTO Half Height Tape Drive use SLDC hardware compression. This feature is enabled per default but the user may turn off data compression through the application software.

Note: If the data are compressed by software in the host computer, and then sent to a device that does hardware compression, the data have a tendency to expand instead of being compressed.

Be sure to turn the software data compression off if using the LTO-2 half height tape drive, which has embedded hardware compression.

POWER CORD SPECIFICATIONS

The external 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 A-4 Power Cord Specifications

| Power Cord | Description | Use | Connectors and Cordage | Certifications |
|------------------|---------------------------------------|-----------------|--|----------------------------|
| US/Canada | 2.3-meter (7.5-foot), three-conductor | 120-volt | <ul style="list-style-type: none"> ▪ 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 | <ul style="list-style-type: none"> ▪ 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 LTO Half Height Tape Drive complies with the regulatory agency standards listed on the product label located on the tape drive or external enclosure when installed in accordance with this manual.

Notes

B

TAPE DRIVE LEDs

This chapter describes the states of the front panel LEDs. [Figure B-1](#) shows the controls and indicators on the front panel of the tape drive..



Figure B-1 Front panel LEDs

Table B-1 Front LED behavior during normal operation





| |  |  |  |  |
|--|---|---|---|---|
| Drive State ^a | READY LED (Green) | ACTIVITY LED (Green) | CLEAN LED (Amber) | FAULT LED (Amber) |
| LED-test. The LEDs turn ON in sequence. Power-On Self-Test Starts in parallel with the LED-test. ^b | ON Flashing in about 12 sec. | ON After 12 sec. Flashing during cartridge load | ON OFF | ON OFF |
| Diagnostic Activity / POST ^c | Flashing | OFF | OFF | OFF |
| Aborting Diagnostic Test | Flashing | ON / OFF / Flashing | ON ^d / OFF | Flashing |
| Cartridge not loaded | OFF | OFF | ON ^d / OFF | OFF |

Table B-1 Front LED behavior during normal operation (continued)

| | | | | |
|---|----------|----------|-----------------------|-----------------------|
| Cartridge loaded, no activity | ON | OFF | ON ^d / OFF | OFF |
| Cartridge loaded, activity | ON | Flashing | ON ^d / OFF | OFF |
| Cleaning | OFF | Flashing | ON | OFF |
| Cartridge loading or unloading | OFF | Flashing | ON ^d / OFF | OFF |
| Unrecoverable drive failure | ON / OFF | OFF | ON ^d / OFF | Flashing ^e |
| Firmware download in progress | Flashing | OFF | ON ^d / OFF | OFF |
| Firmware update in progress | Flashing | Flashing | ON ^d / OFF | OFF |
| Firmware download failure ^f | Flashing | Flashing | ON ^d / OFF | Flashing ^e |
| Over temperature ^g | OFF | OFF | ON ^d / OFF | ON |
| Aborting Diagnostic Test | Flashing | ON / OFF | ON ^d / OFF | Flashing |
| Media Error (wrong, write protected, or harmed media) | OFF | Flashing | ON ^d / OFF | Flashing |

^a Some of the states are difficult to see due to short duration.

^b LEDs are also used to indicate fatal errors at an early power-up stage. This is accomplished by turning the LEDs ON one-by-one:

- The Ready LED as early as possible (after CPU-initialization).
- The Activity LED before initialization of serial communication interface (DACI).
- The Clean LED after PROM checksum test.
- The Fault LED after the CPU and SRAM Tests

After all LEDs are lit there is no controlled stop, and if the next LED-phase (flashing Ready LED) never appears, the system has crashed somewhere in the remaining part of the POST/PUI Part1. All LEDs are steady on for approximately 2 seconds.

^c When a diagnostic activity leads to media operations (load/eject, Read/Write etc.) the LED behavior changes to a behavior that corresponds to this kind of operation in a normal activity, but with Ready LED still flashing.

^d The Clean LED steady ON indicates that a head cleaning operation is recommended (the tape drive is still fully operational with this LED steady ON) the LED is triggered after 100 hours of tape running time has elapsed, if the Media Management Algorithm has detected severely degraded write performance, or if a hard read/write error has occurred. The LED is not turned off by a power cycle. The LED is reset when cleaning has completed successfully. The Clean LED is also turned on during Head Brush operation (no sticky).

-
- e The Fault LED flashes to indicate an unrecoverable error. An unrecoverable error is an error condition that results in the tape drive not being able to function unless initiator, operator, or service intervention is applied. An unrecoverable tape drive failure is usually the result of a hardware error condition. One of the following actions will be needed to clear the flashing Fault LED:
- Hard SCSI Reset
 - Cartridge Emergency Eject
 - Power Cycle
 - Retry Firmware Download
- An unrecoverable cartridge (media) failure is usually the result of a defective cartridge, media, or cartridge tape and will require the drive to eject the cartridge (if possible) to clear the flashing LED.
- f Firmware download failed and the tape drive is not functional. The tape drive boot code is in control and the firmware download should be retried. The tape drive can be identified via an INQUIRY command and is thereby bootable while in this state.
- g The Fault LED illuminates to indicate an over temperature (tape temperature $> 47^{\circ}\text{C}$). If a tape is present it will be ejected. The LED remains on until one of the following conditions are met:
- the drive temperature goes below the preset maximum, and a new data or leaning cartridge is inserted
 - the drive temperature goes below the preset maximum, and the tape drive is power cycled

Notes



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.

Active Termination Enhanced SCSI termination that provides better stability and noise immunity of the electrical signals on the SCSI-bus lines.

ALDC Adaptive Lossless Data Compression. A hardware data compression method.

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.

ASPI Advanced SCSI Programming Interface. Standard SCSI software that acts as a liaison between host adapters and SCSI device drivers. ASPI enables host adapters and device drivers to share a single SCSI hardware interface.

Auto sensing Tape drive feature that allows detection of the best transfer rate to use for optimizing performance on the SCSI-bus.

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 software program that enables a computer to communicate with peripheral devices such as a hard disk or tape drives. Each type of device needs a different device driver. Device drivers are stored on a computer's hard disk and are typically loaded into memory at the initial power up.

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*.

EEPROM Electrically Erasable Programmable Read Only. An integrated circuit typically used to store configuration information.

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.

GUI Graphical User Interface. Software that interacts with the user.

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. See *SCSI ID*.

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. LVD allows longer SCSI Bus length.

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 4π 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.

Overwrite A method of recording over data previously written on tape without performing an erase operation.

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.

PNP Plug and Play. A hardware and software mechanism that provides an automatic way for the system to self-configure system resources such as I/O ports, IRQ, and DMA channels between PNP cards and other devices in the system.

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.

RWW Read While Write. The tape drive automatically and internally reads the data just being written to the tape to avoid writing to bad block.

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

SCAM SCSI Configured AutoMagically. A SCSI protocol that assigns automatically SCSI IDs to SCAM capable devices such as the Magnum LTO Half Height Tape Drive when you boot the system.

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.

SLDC™ Streaming Lossless Data Compression. The hardware data compression method specified as the standard for the two Ultrium tape formats and thus used with the Magnum LTO Half Height Tape Drive.

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.

The Magnum LTO Half Height Tape Drive utilizes the SCSI Ultra320 interface, which allows for a transfer rate of up to 320 MB/s on the bus.

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 \(SCSI\)](#).

Ultra/Ultra2 A 16-bit WIDE SCSI/LVD interface used with the Magnum LTO Half Height Tape Drive.

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.



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