StorageTek LTO Half-Height SAS Tape Drive

User Guide

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About this guide

This guide provides information about:

- Installing the LTO SAS tape drive
- Using the LTO SAS tape drive
- Troubleshooting the LTO SAS tape drive

Intended audience

This guide is intended for users who install, operate and maintain the LTO tape drive.

Document conventions and symbols

Table 1 Document conventions

Convention	Element
Blue text: Table 1 on page 7	Cross-reference links and e-mail addresses
Blue, underlined text: http://www.oracle.com	website addresses
Bold text	• Keys that are pressed • Text typed into a GUI element, such as a box • GUI elements that are clicked or selected, such as menu and list items, buttons, tabs, and check boxes
Italic text	Text emphasis
`Monospace` text	• File and directory names • System output • Code • Commands, their arguments, and argument values
`Monospace, italic` text	• Code variables • Command variables
`Monospace, bold` text	Emphasized monospace text

WARNING!

Indicates that failure to follow directions could result in bodily harm or death.

CAUTION:

Indicates that failure to follow directions could result in damage to equipment or data.

IMPORTANT:

Provides clarifying information or specific instructions.

NOTE:

Provides additional information.

Technical support

Telephone numbers for worldwide technical support are listed on the support website: http://www.sun.com/contact/support.jsp.

Collect the following information before calling:

- Contract number
- Product serial numbers
- Product model names and numbers
- Error messages
- Operating system type and revision level
- Detailed questions

For continuous quality improvement, calls may be recorded or monitored.

Websites

For additional information, see the following websites:

- http://www.oracle.com — Corporate website
- http://www.oracle.com/us/products/servers-storage/storage/tape-storage/index.html — Storage products
- http://www.sun.com/contact/support.jsp — Support website
- http://docs.sun.com/ — Products documentation

Documentation feedback

Your feedback is welcome.

To make comments and suggestions about product documentation, please submit comments to: http://www.sun.com/secure/products-n-solutions/hardware/docs/feedback.

1 Before you start

In this chapter:

- "Important information about your new tape drive" on page 9
- "Supported models" on page 9
- "Which operating systems are supported?" on page 10
- "How do I connect the drive to my server?" on page 10
- "Power specifications" on page 11
- "Drivers" on page 11
- "Backup software" on page 11

Important information about your new tape drive

This guide describes how to install and operate Linear Tape-Open (LTO) SAS half-height internal and external tape drives.

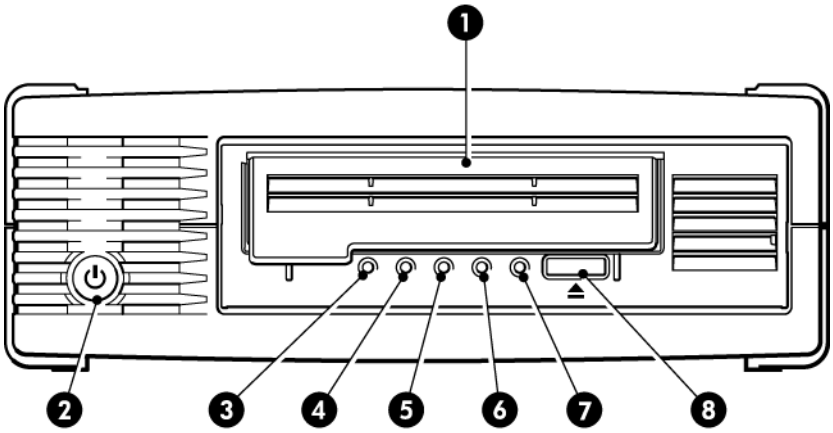
To connect a tape drive to your SAS server you require a SAS HBA that supports tape and a SAS cable. For the most up-to-date information about supported HBAs and cabling configurations, refer to http://docs.sun.com/app/docs/prod/storage.net#hic.

Supported models

This guide describes how to install and operate the following LTO tape drive models:

- **LTO-5 internal and external tape drives.** These are 6 Gb/s SAS devices with a maximum burst transfer speed of 600 MB/s. They can write uncompressed data at up to 140 MB/s (504 GB/hour).
- **LTO-4 internal and external tape drives.** These are 3 Gb/s SAS devices with a maximum burst transfer speed of 300 MB/s. They can write uncompressed data at up to 80 MB/s (288 GB/hour).
- **LTO-3 internal and external tape drives.** These are 3 Gb/s SAS devices with a maximum burst transfer speed of 300 MB/s. They can write uncompressed data at up to 60 MB/s (216 GB/hour).

For a detailed product specification, please refer to http://www.oracle.com/us/products/servers-storage/storage/tape-storage/index.html.



1. Cartridge door
2. On/Off switch (external drives only)
3. Encryption LED (only on LTO-5 tape drives)
4. Clean LED
5. Tape LED
6. Drive LED
7. Ready LED
8. Eject button

Figure 1 Front view of LTO–5 external tape drive

Which operating systems are supported?

LTO tape drives can be connected to servers running under Solaris, Linux and other major operating systems. Refer to http://www.oracle.com for the most recent information about the operating system versions that are supported.

How do I connect the drive to my server?

Installation requires a SAS host controller or host bus adapter (HBA) that supports tape.

Internal drives

The tape drive is installed into a spare drive bay in your server and is attached to the host server's internal SAS controller or SAS host bus adapter. See also “Installing an internal tape drive ” on page 13.

You need one industry-standard, 5¼-inch, half-height bay in which to install the LTO tape drive. Different models of server require different mounting methods. Refer to your server documentation for detailed information.

External drives

A SAS cable is required to connect to an external SAS port. If your server does not have an active external SAS port, you must purchase and install an additional HBA. (Some controllers have an external connector, but its default state is inactive because the SAS channels are in use for internal disks.) See also “Installing an external tape drive” on page 21.

Power specifications

For a detailed product specification, please refer to http://www.oracle.com/us/products/servers-storage/storage/tape-storage/index.html.

Table 2 Power specifications

	LTO-5 half-height tape drives	All other LTO half-height tape drives
Power consumption	7.5 Watts idle, 24 Watts typical, 40 Watts maximum	13 Watts idle, 26 Watts typical, 40 Watts maximum
Power requirements	+5V @ 4.1A typical +5V @ 4.3A maximum +12V @ 0.75A typical +12V @ 2.3A maximum	+5V @ 1.9A typical +5V @ 3.9A maximum +12V @ 0.7A typical +12V @ 2.5A maximum
Power requirements,external tape drives	100–240 VAC, 50-60 Hz, auto-ranging, 0.8A maximum	100–240 VAC, 50-60 Hz, auto-ranging, 0.7A maximum

Drivers

Tape drivers are available on SunSolve (http://sunsolve.sun.com.

- LTO-3HH and LTO-4HH SAS tape drives require Solaris 10 Update 5 (05/08) or later.
- LTO-5HH SAS tape drives require Solaris 10 Update 8 (10/09) or later.

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.

Further details about suitable products can be found on http://www.oracle.com/us/products/servers-storage/storage/tape-storage/029151.htm. It is important to check for software compatibility and install any recommended upgrades.

NOTE:

Certain backup applications require you to use their own tape driver instead of the Solaris tape driver.

---

2 Installing an internal LTO SAS tape drive

If you are installing an external LTO tape drive, please refer to “Installing an external tape drive” on page 21.

- “Prepare mounting bay” on page 13
- “Attach mounting hardware” on page 14
- “Install drive” on page 15
- “Connect SAS and power cables” on page 16
- “Secure the drive” on page 18
- “Reboot the server” on page 19

Prepare mounting bay

You need one industry-standard, 5¼-inch, half-height bay in which to install the LTO tape drive.

WARNING!

To avoid personal injury or damage to the server or tape drive, ensure that the server is disconnected from the main power supply while you install the drive.

CAUTION:

Static electricity can damage electronic components. Wear an antistatic wriststrap if possible. If not, to equalize the electromagnetic charges, touch a bare metal part of the chassis, such as the backplate. Similarly, touch a bare metal part of the drive before installing it.

---

1. Assemble the necessary tools and materials:
   - Phillips screwdriver
   - Flat-head screwdriver (if your server uses slotted screws)
   - Torx screwdriver (if your server uses torx screws)
   - Your server manuals (for reference during installation)
2. Perform a normal system shutdown and turn off the server and any connected peripherals.
3. Remove the cover and front panel from the server, as detailed in your server's documentation.

   As you work inside the server, you may have to disconnect other signal cables or power cables from other devices to maneuver the new drive into place. If you have to do this, make a note of their position and connections so you can put them back correctly later.

   NOTE:

   The server must provide forced cooling and be capable of drawing 6 cfm (0.17 m^3/minute or 10.08 m^3/hour) of air through the tape drive at up to 40° C ambient operation. This reduces to 4 cfm at 35° C ambient operation. Ensure that empty bays have the appropriate blank plates installed so that airflow is maintained.

   ---
4. Remove the filler panel from a spare 5¼-inch bay of your server, as described in your server's documentation. With some servers, you must also remove the half-height device divider.
5. You are now ready to install your tape drive.

Attach mounting hardware

If your server requires special rails or other hardware to install the tape drive, mount them on the tape drive now.

If your server does not require special mounting hardware, proceed to "Install drive" on page 15 now.

Check your server documentation to ascertain the correct method of mounting, and to check whether mounting hardware is provided with the server or must be purchased separately.

CAUTION:

The LTO half-height drive allows only 3 mm of the engagement of the screw into the drive. If you remove an existing drive, do not assume the screws that you remove are the correct length for your new LTO drive. Always use 3 mm screws and use washers or shims to tighten, if necessary.

Different models of server require different mounting methods. Always refer to your server documentation for details. The following diagrams illustrate common mounting methods. If mounting hardware is supplied with your tape drive, it may not be exactly the same as shown in the illustrations.

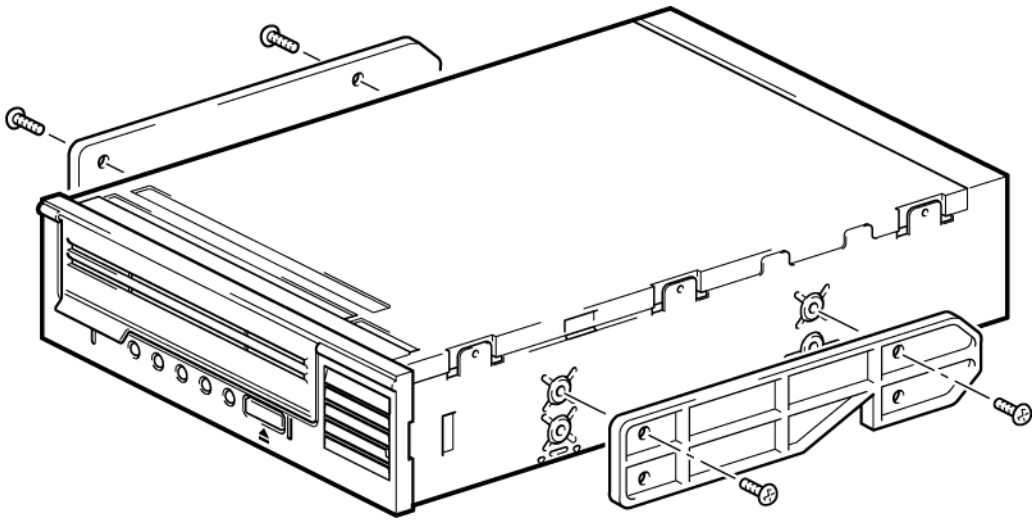
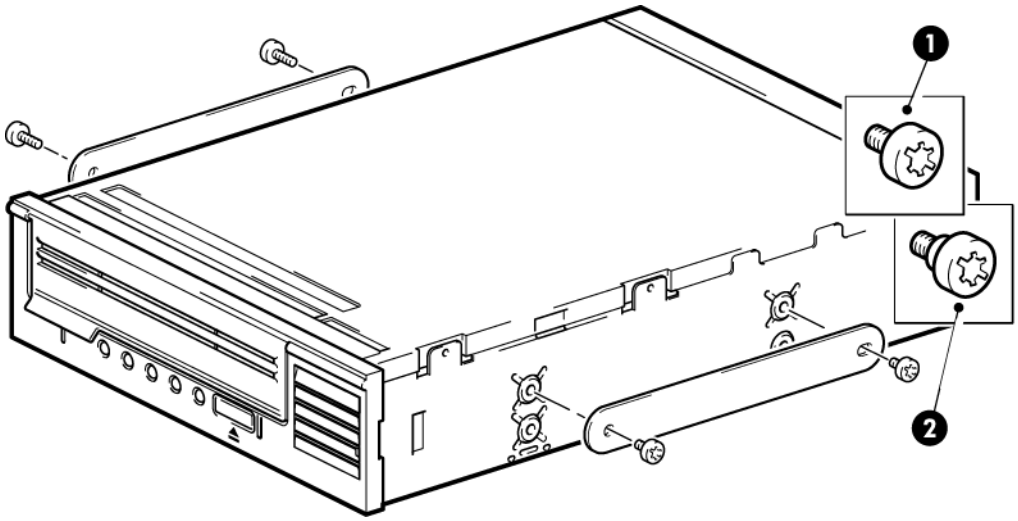


Figure 2 Attaching mounting rails



1. M3 mounting screws
2. M3 offset mounting screws

Figure 3 Attaching locating screws

Install drive

NOTE:

If cable access for the tape drive bay is awkward, it may be easier to access power and other connections if the tape drive is installed in the top bay. You may need to move other devices to lower bays to achieve this. Refer also to your server documentation.

Slide the tape drive into the open bay, aligning the tray or rails with the slots in the bay, as shown in Figure 4 on page 16.

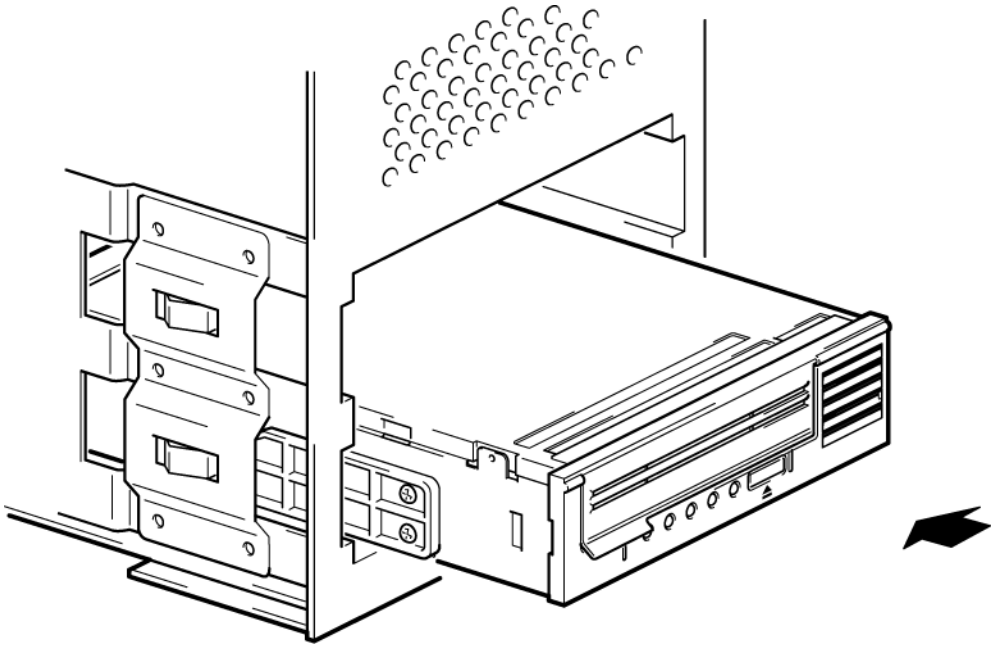


Figure 4 Installing tape drive

NOTE:

The illustration shows a server that uses mounting rails. If your server does not use mounting hardware, check that the holes in the chassis are aligned with the holes in the side of the tape drive.

Do not secure the drive at this point because you may have to move the drive to get the cables into place.

Connect SAS and power cables

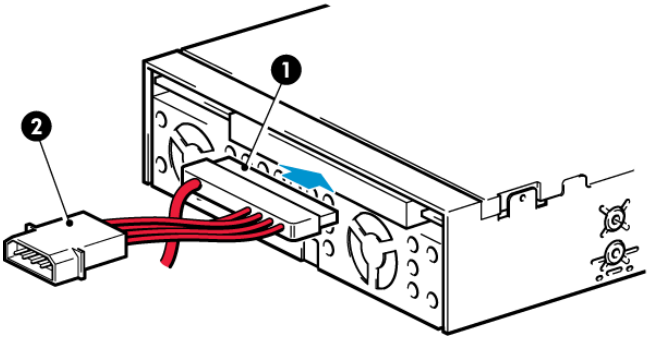
IMPORTANT:

A SAS HBA and SAS cable are required. The connector on the SAS drive is a SAS plug connector as per SFF–8482.

1. If a SAS HBA is not already installed, follow the instructions supplied with the HBA to install it before you install the tape drive.
2. Connect the purchased SAS cable to the new HBA. The connector on the SAS drive is a SAS plug connector as per SFF–8482.

3. Connect the SAS cable to the tape drive, as illustrated below. Note the difference in power cabling for LTO-5 and all earlier LTO tape drives.

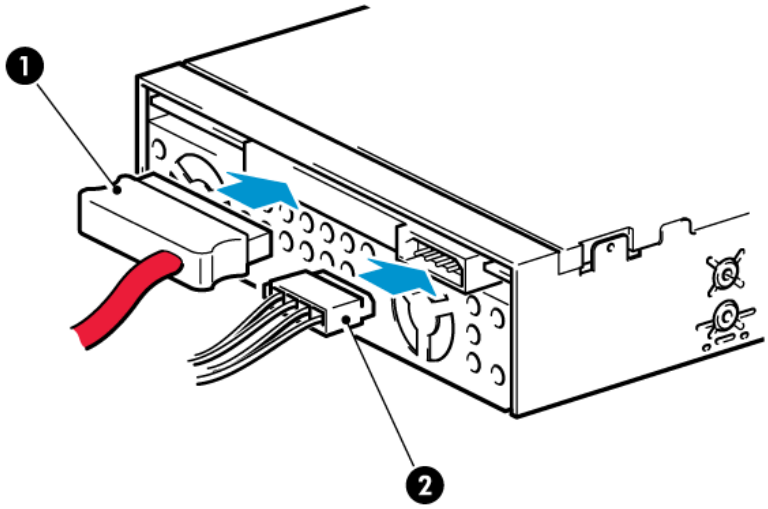
   LTO-5 tape drives: Connect a spare power cable from the server's internal power supply to the power connector on the SAS data cable.



1. Power connector on data cable
2. SAS connector to tape drive (SFF-8482 SAS cable with power)

Figure 5 Connecting cables to the LTO—5 tape drive

All other LTO tape drives: Connect a spare power cord from the server's internal power supply to the power connector on the tape drive.



1. SAS data connector to tape drive (SFF-8482 cable without power)
2. Separate power connector

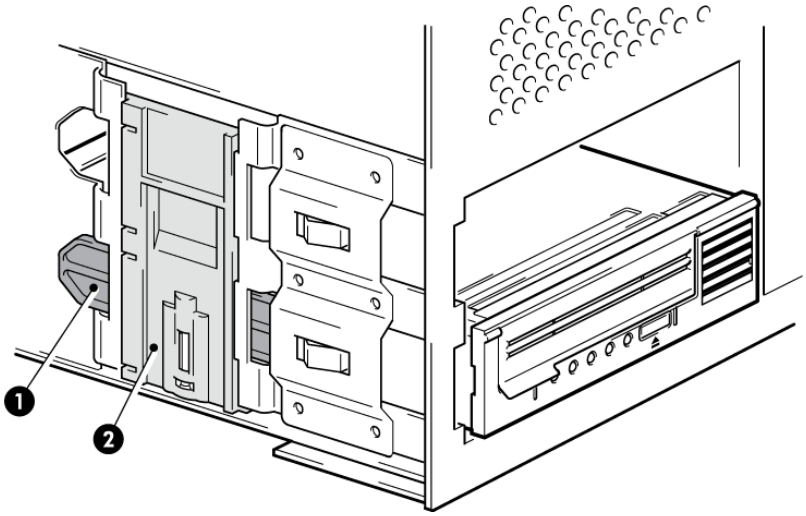
Figure 6 Connecting cables to all other LTO tape drives

CAUTION:

Never use a cable where power is supplied through the SAS connector because this may damage the drive. Always use a spare power cord from the server's internal power supply to connect to the conventional power connector on the drive itself. (This caution does not apply to LTO-5 tape drives, see Figure 5 on page 17.)

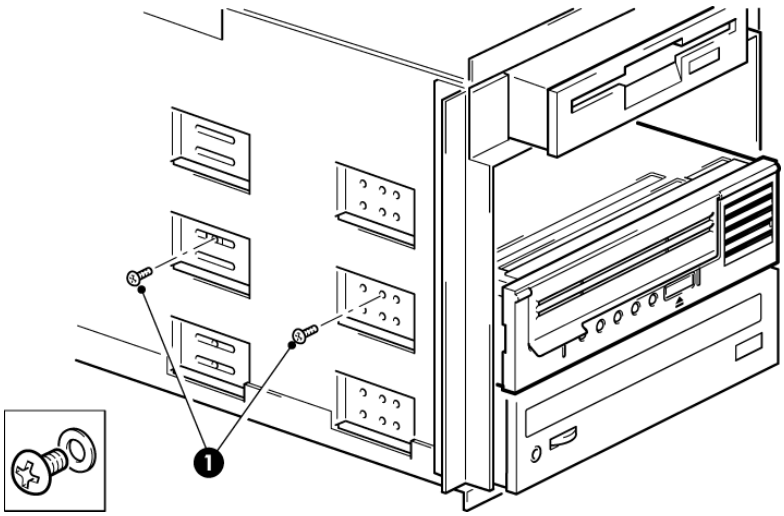
Secure the drive

1. Secure the drive, as described in your server documentation. The following diagrams are examples only.



1	Plastic rail	2	Server latch

Figure 7 Securing drive, mounting hardware used



1	M3 screws

Figure 8 Securing drive, no mounting hardware used

NOTE:

Use 3 mm screws and, if you cannot tighten the screws, use washers to secure them.

---

2. Ensure blank plates are in place over empty bays and replace the cover on the server.

Reboot the server

Reboot the server to power up the tape drive and server.

Watch the boot screen carefully after installation. If there are any errors or unexpected messages go back and check the SAS cabling carefully.

- Have you installed the correct SAS cable?
- Have you reconnected all devices securely?

If this does not resolve the problem, refer to “Troubleshooting” on page 37 for further guidelines.

3 Installing an external LTO SAS tape drive

If you are installing an internal LTO tape drive, please refer to “Installing an internal tape drive ” on page 13.

In this chapter:

- “HBAs and cables” on page 21
- “Connecting the tape drive to an external SAS port” on page 21
- “Reboot the server ” on page 23

HBAs and cables

This chapter describes how to connect your tape drive to an external port on the host controller or new HBA. If the server has an active external SAS port, a recommended SAS cable is required to connect to it. If the server does not have an active external port, you must purchase and install an additional HBA that supports external connection to tape and a recommended cable.

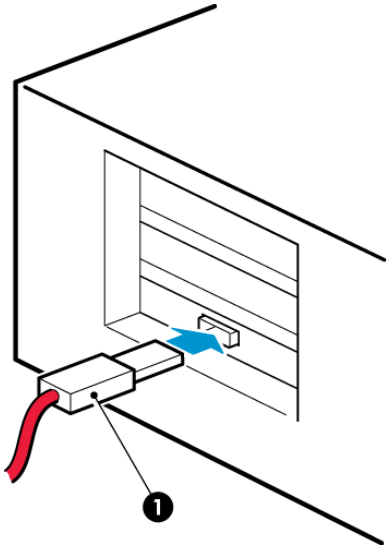
NOTE:

If you use a recommended cable (not supplied) to attach directly to the external SAS port and the tape drive does not function, one possible cause is that the port is inactive or not supported for external tape devices. Refer to your server documentation for further information on supported configurations.

Connecting the tape drive to an external SAS port

1. If installing a new HBA, follow the instructions supplied with the HBA to install it.

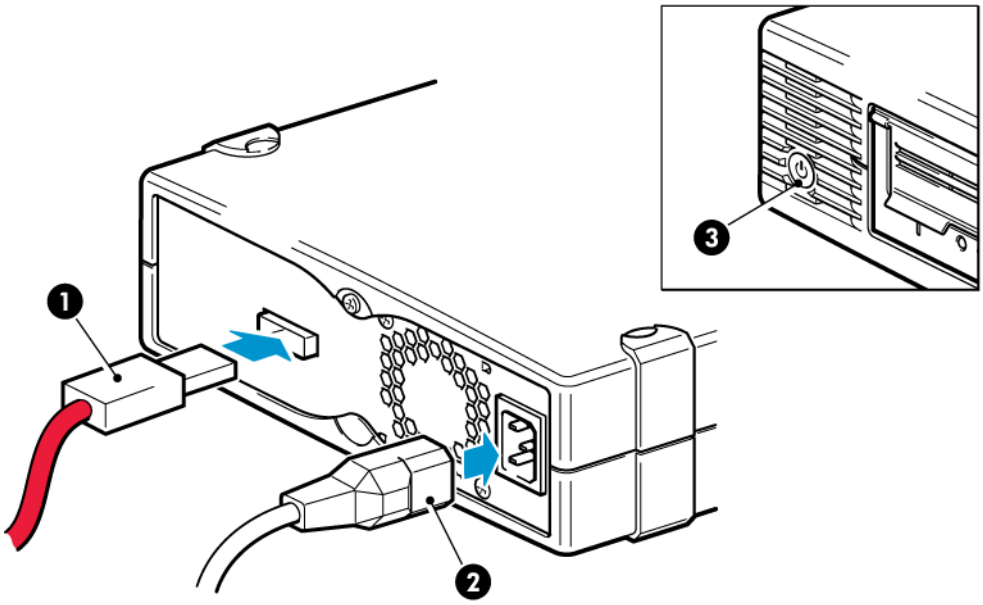
2. Connect the purchased SAS cable to the external SAS connector on the new HBA.



1. SAS connector on server (types may vary, mini-SAS SFF-8088 shown)

Figure 9 Connecting the SAS cable to the server

3. Connect the SAS and power cables to the tape drive and plug the other end of the power cable into the power outlet, as shown below.



1. SAS connector
2. Power connector
3. Power on/off switch

Figure 10 Connecting the SAS and power cables

Reboot the server

Switch on the tape drive and power up the server. The power on/off switch is on the front panel.

Watch the boot screen carefully after installation. If there are any errors or unexpected messages go back and check the SAS cabling carefully.

If this does not resolve the problem, refer to “Troubleshooting” on page 37 for further guidelines.

4 Verify installation

Once you have installed the drive hardware, check that drivers have been installed correctly and that you have the correct version of backup software, and verify that the tape drive is functioning properly before you store your valuable data.

We recommend that you download the latest driver from the SunSolve website (http://www.sunsolve.sun.com/show.do?target=tous). See also "Drivers" on page 11.

NOTE:

Certain backup applications require you to use their own tape driver instead of the Solaris tape driver.

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1. Switch on the drive and the server.
2. The tape drive will run its hardware self-test, which takes about 5 seconds. If the self-test passes, the green Ready LED flashes and then shows steady green. If the test fails, the Drive Error and Tape Error LEDs flash, while the Ready and Clean LEDs are off. This continues until the drive is reset. See "Understanding the LEDs" on page 27 for more information about front panel lights.
3. Verify that the tape drive installation was successful.
4. For all operating systems ensure that you have downloaded any upgrades necessary for your backup application.
5. Carry out a backup-and-restore test to check that the drive can write data to tape. Use a blank cartridge.

   Native backup applications can be used to check basic tape drive operation, but they will not support all the advanced features of your tape drive. We recommend that you upgrade your software application before running this test.

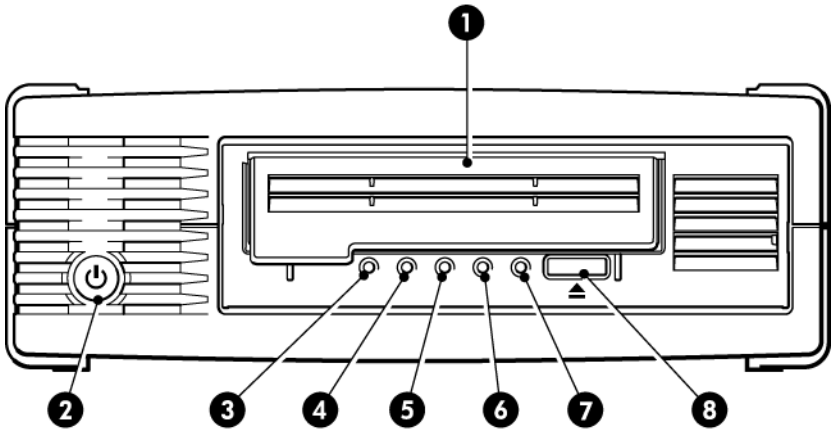
5 Understanding the LEDs

In this chapter:

- "Your StorageTek LTO tape drive" on page 27
- "Understanding LED sequences" on page 28

Your StorageTek LTO tape drive

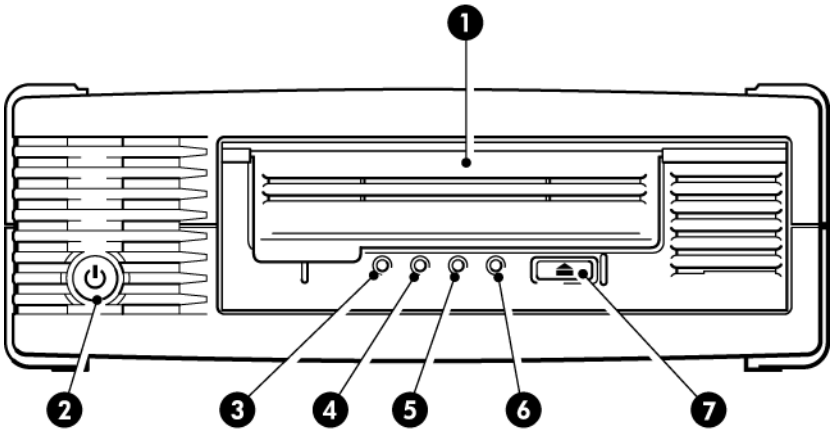
See also "Understanding LED sequences" on page 28.



1. Cartridge door
2. On/Off switch (external drives only)
3. Encryption LED
4. Clean LED
5. Tape LED
6. Drive LED
7. Ready LED
8. Eject button

Figure 11 Front view of StorageTek LTO-5 external tape drive

Earlier versions of the Ultrium tape drive do not have an Encryption LED.



1. Cartridge door
2. On/Off switch (external drives only)
3. Clean LED
4. Tape LED
5. Drive LED
6. ReadyLED
7. Eject button

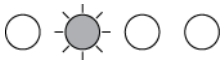
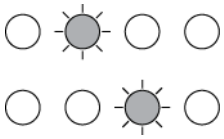
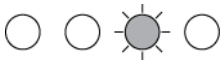
Figure 12 Front view of StorageTek LTO-4 external tape drive

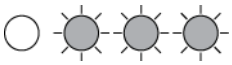
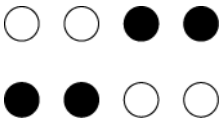
Understanding LED sequences

The meaning of different patterns of LEDs is as follows:

Table 3 LED sequences

LED Sequence	Cause	Action required
○ ○ ○ ○ *All LEDs OFF.*	Drive may not have power, may be faulty or may have been power-cycled or reset during a firmware upgrade.	Make sure the drive is switched on. The power on/off switch on an external drive incorporates a green LED. Check the power cable connection and replace the cable if necessary. On external drives, you can use the power cable from your monitor or another device to check that the connection is working. If the power supply is present and all LEDs remain off, power-cycle or reset the drive. If it still fails, call for service.
○ ☼ ☼ ○ *Ready and Clean OFF. Drive and Tape FLASH.*	The drive has failed to execute power-on self-test (POST).	Power-cycle or reset the drive. If the error condition reappears, call for service.
○ ○ ○ ● *Ready is ON.*	The drive is ready for operation.	None. This is normal.

LED Sequence	Cause	Action required
 Ready FLASHES.	The drive is carrying out a normal activity (read, write).	None. If the drive is upgrading firmware, do not reset or power-cycle it.
 Ready FLASHES fast.	The drive is downloading firmware.	None. Do not reset or power cycle the drive.
 Ready is OFF, others are ON.	Firmware is being reprogrammed.	None. Do not reset or power cycle the drive.
 Clean FLASHES.	The drive requires cleaning.	Load the LTO cleaning cartridge. See "Cleaning cartridges" on page 33 for supported cartridges and instructions. If the Clean LED is still flashing when you load a new or known good data cartridge after cleaning, call for service.
 Ready FLASHES 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 FLASHES.*	The drive believes the current tape or the tape just ejected is faulty.	Unload the tape cartridge. Make sure that you are using the correct format cartridge; an LTO data cartridge or LTO Universal Cleaning Cartridge. (See "Use the correct media" on page 33.) Reload the cartridge. If the Tape LED still flashes or starts flashing during the next backup, load a new or known-good cartridge. If the Tape LED is now off, discard the 'suspect' tape cartridge. If it is still on, call for service.
 *The tape is ejected immediately and Tape FLASHES, or Drive FLASHES on unloading tape.*	The tape cartridge memory (CM) may be faulty.	Write protect the cartridge by sliding the switch on the tape cartridge, see "Write protecting cartridges" on page 34. The tape can be loaded and the data read. Once the data is recovered, the cartridge must be discarded.
 *Drive FLASHES.*	The drive mechanism has detected an error.	Load a new cartridge. If the error persists, power cycle or reset the drive. If the Drive LED remains on, call for service.

LED Sequence	Cause	Action required
 *Drive, Tape and Ready FLASH.*	There is a firmware download problem.	Insert a cartridge to clear the LED sequence. If the condition persists, call for service.
 *Drive and Ready ON with Tape and Clean OFF. Alternates repeatedly.*	The drive has a firmware error.	Power cycle or reset the drive. Upgrade the firmware. If the condition persists, call for service.

Encryption LED, LTO-5 models only

The encryption LED may be blue or amber, as described in the following table. The state of the other LEDs depends upon the activity, as described below.

Table 4 Encryption LED, LTO—5 tape drives

Encryption LED (Blue or Amber)	State
On	At power on
Off	The drive is idle and there is no encryption key.
Off with Ready flashing green	The tape drive is reading/writing unencrypted data from another host or unloading a cartridge.
On (solid blue)	The drive is idle but the encryption key is loaded. The drive is ready to read/write encrypted data.
On (solid blue) with Ready flashing green	The drive is reading/writing encrypted data.
Alternate flashing, blue and amber	There is an encryption related error. This is cleared after unload executes or successful encryption/decryption resumes. See also “Encryption troubleshooting” on page 39.

NOTE:

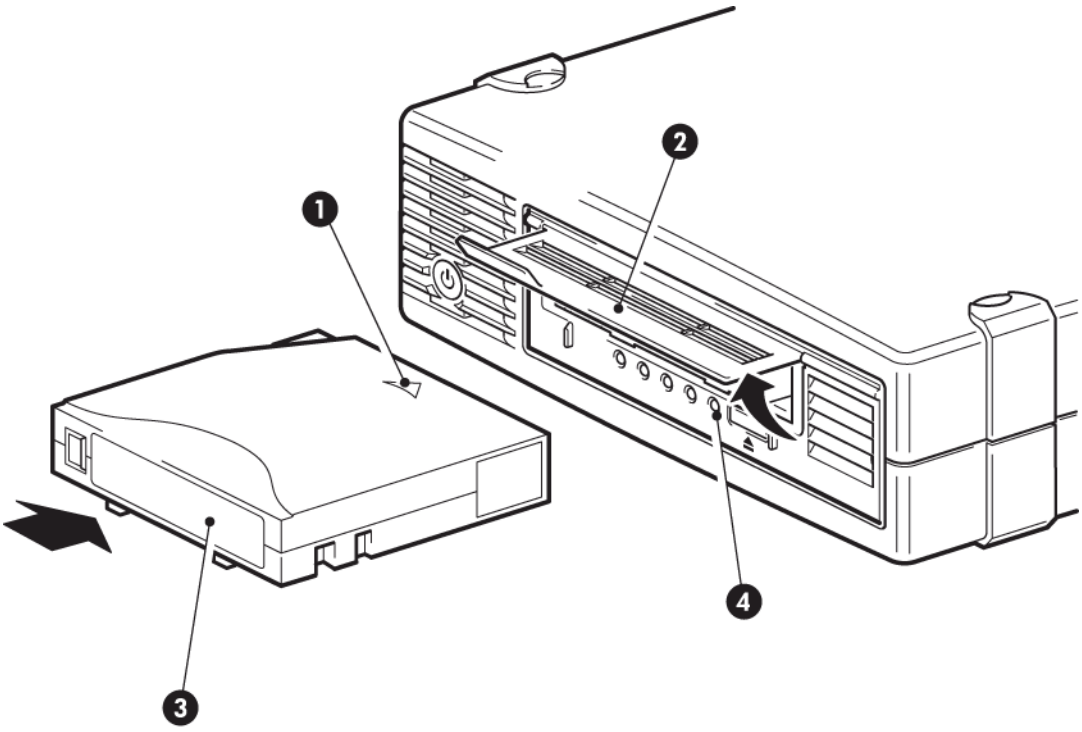
The Encryption LED only functions if you are using backup software that supports hardware encryption and this feature is enabled in the backup application.

6 Operating your tape drive

In this chapter:

- "Loading a cartridge" on page 31
- "Unloading a cartridge" on page 32
- "Removing power from the drive" on page 32

Loading a cartridge



1. Arrow indicates leading direction
2. Cartridge door
3. Label area
4. Ready light

Figure 13 Inserting a cartridge

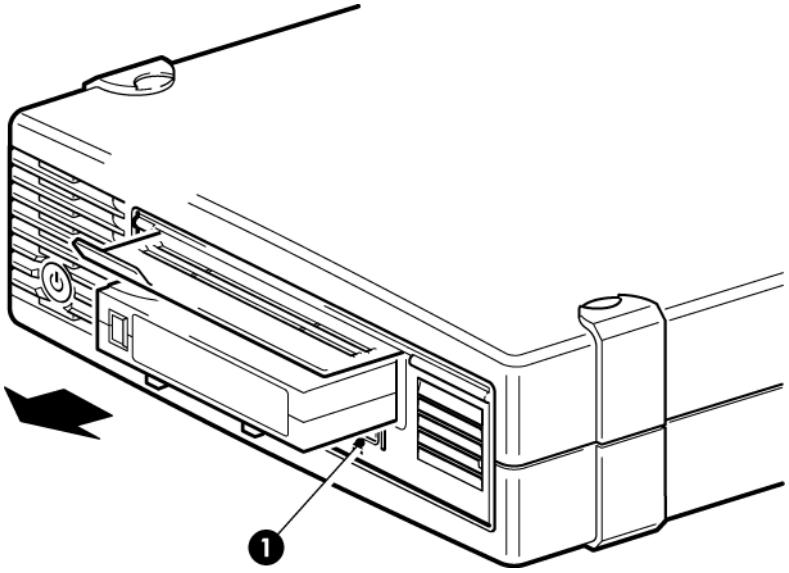
1. Lift the cartridge door and insert the cartridge into the slot in the front of the drive with the white arrow uppermost and facing the drive door.
2. Apply gentle pressure until the drive takes the cartridge and loads it.
3. The Ready light flashes green while the drive performs its load sequence. When the cartridge is loaded, the Ready light shows steady green.

Unloading a cartridge

CAUTION:

Never try to remove a cartridge before it is fully ejected.

1. Press the Eject button on the front panel.



1. Eject button

Figure 14 Ejecting a cartridge

2. The drive will complete its current task, rewind the tape to the beginning, and eject the cartridge. The rewind process may take up to 10 minutes. The Ready light will flash to indicate that the unload is still in progress.

Removing power from the drive

To ensure reliable operation, do not remove power from the drive during read, write, fast-search, load and unload activities.

7 Use the correct media

In this chapter:

- "Ordering media" on page 33
- "Cartridges" on page 33
- "WORM data cartridges" on page 34
- "Write protecting cartridges" on page 34
- "Cleaning the tape drive" on page 35
- "Handling cartridges" on page 35
- "Operating and storage environment" on page 36

Ordering media

Use the Ultrium data and cleaning tape cartridges designed for your tape drive. To order data and cleaning cartridges please use the contact information below to locate the nearest tape media reseller.

In the US contact 1 877 STK Tape

Outside US contact tapemediaorders_ww@oracle.com

Cartridges

Cleaning cartridges

The recommended cleaning cartridge is the Ultrium Universal Cleaning Cartridge. This cleaning cartridge is designed to work with any LTO drive. It may be used for up to 50 cleans.

NOTE:

Do not use the earlier LTO cartridge (Blue), or LTO cartridges from other manufacturers.

Data cartridges

LTO tape drives use Ultrium tape cartridges. These are single-reel cartridges that match your drive's format and are optimized for high capacity, throughput and reliability. Compatible media can be recognized by the LTO logo, which is the same as the logo on the front of your 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. A lower specification will have a lower transfer speed and may not support write activities; a higher specification will not support read or write.

Table 5 Data cartridge compatibility

Tape drive model	Ultrium 200 GB* data cartridge	Ultrium 400 GB* data cartridge	Ultrium 800 GB* data cartridge	Ultrium 1.6 TB* data cartridge	Ultrium 3 TB* data cartridge
LTO-5	not supported	not supported	read only	read/write and write once/read many	**read/write and write once/read many**
LTO-4	not supported	read only	read/write and write once/read many	**read/write and write once/read many**	not supported
LTO-3	read only	read/write	**read/write and write once/read many**	not supported	not supported
* Capacity assumes 2:1 compression.					

WORM data cartridges

LTO-5, LTO–4 and LTO–3 tape drives include support for both re-writable and Write-Once, Read-Many (WORM) data cartridges. WORM 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. Any attempt to modify a WORM cartridge to enable writing over existing data will result in the media becoming permanently write protected. It should still be readable in a WORM drive, depending upon the severity of the tampering, but no further appended backups will be possible.

WORM data cartridges are clearly identified by their distinctive, two-tone cartridge color. They can only be used with LTO tape drives that support the WORM feature.

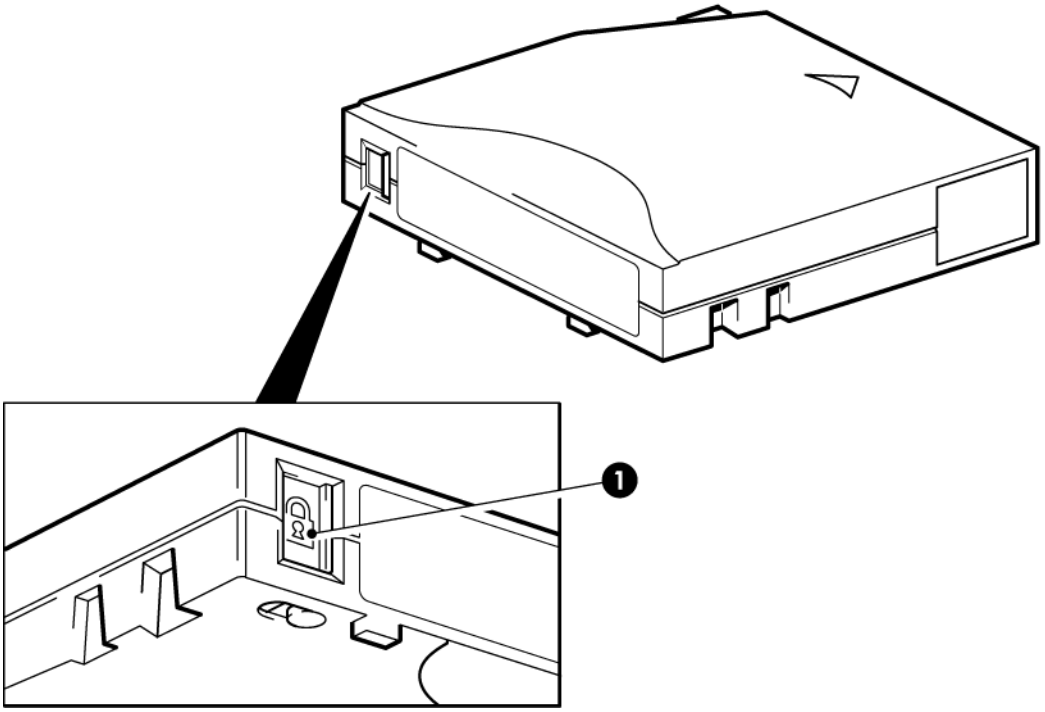
Write protecting cartridges

WARNING!

Always remove the cartridge from the tape drive before you change the write protection.

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

- To write protect a cartridge, push the switch to the right to prevent any data recording on the cartridge. Note the padlock on the tab that indicates that the cartridge is protected.
- To write enable a cartridge, push the switch to the left to allow data recording on the cartridge.



1. Write-protect tab

Figure 15 Write protecting a cartridge

Write protection will not protect your cartridges against magnets. Write protection will not prevent a cartridge being erased by bulk-erasure or degaussing. Do **not** bulk erase LTO format cartridges. This will destroy pre-recorded information and make the cartridge unusable.

Cleaning the tape drive

You must use the Ultrium Universal Cleaning Cartridge with LTO tape drives, as other cleaning cartridges will not load and run.

To clean the tape drive:

LTO tape drives do not require regular cleaning. An Ultrium Universal Cleaning Cartridge should only be used when the orange Clean LED is flashing.

1. Insert the Ultrium Universal Cleaning Cartridge.
2. The 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 solid and the green Ready LED will flash.

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

Handling 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 drive. The tape loses tension in the power-off state, which can lead to problems, particularly if the 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 (or degauss) LTO format cartridges because this will render them unusable.

Operating and storage environment

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

- Operation: 100° C to 45° C (50° F to 113° F)
- Day-to-day storage (in plastic container): 16° C to 32° C (60° F to 90° F)
- Non-condensing relative humidity: 10% to 80% (operating), 20% to 60% (non-operating)

Tapes intended for long-term storage should be stored in the plastic containers, at temperatures between 5° C and 25° C (41° F and 75° F) and 20% to 60% relative humidity.

8 Troubleshooting

In this chapter:

- "General Procedure" on page 37
- "Optimizing performance" on page 38
- "Problems with cartridges" on page 39

General procedure

If a problem occurs, the first step is to try to establish whether the problem lies with the cartridge, the drive, the host computer and connections, or the way the system is being operated.

Has the system just been installed?

There could be an installation problem:

1. Check through the information in the relevant installation chapter of this guide.
2. Has the system booted? If not, check that all hard disks are correctly seated in the hard disk bay and then check the cabling between the disks and the SAS controller.
3. Has the system booted but the operating system has not seen the tape drive? Check that the drive has power, the READY light should be illuminated. If it is not, check that the power cable is connected correctly to the tape drive. If READY is illuminated, check the cabling between the tape drive and the SAS controller.
4. Are appropriate drivers and application software installed on the host?
5. Check the environmental conditions against the specified limits.

Table 6 Environmental specifications for LTO tape drives

	Temperature range	**Non-condensing humidity range**
Operating	50° to 95° F (10° to 40° C) at a minimum of 6 CFM airflow	20 to 80% RH (non-condensing)
Storage	–40° to 151° F (–40° to 66° C)	10 to 95% RH (non-condensing)

Are you using new cartridges or a different brand of cartridge? Have you been using the particular cartridge for a very long time?

The problem could lie with the cartridge:

1. Check through the media chapter, "Use the correct media" on page 33.
2. Check that you are using an Ultrium cartridge. Compatible media can be recognized by the LTO logo, which is the same as the logo on the front of your drive.
3. Use the correct media type, for example:
   - Ultrium 3 TB RW and Ultrium 3 TB WORM tape cartridges for use with LTO–5 tape drives.
   - Ultrium 1.6 TB RW and Ultrium 1.6 TB WORM tape cartridges for use with LTO–4 tape drives.
   - Ultrium 800 GB RW and Ultrium 800 GB WORM tape cartridges for use with LTO–3 tape drives.
4. Has the cartridge been write protected? See "Write protecting cartridges" on page 34.
5. Clean the tape heads with the cleaning cartridge, see "Cleaning cartridges" on page 33. Make sure you are using the Ultrium Universal Cleaning Cartridge.
6. Try the operation again.
7. If the problem still occurs, try using a different cartridge.

8. If the problem is still there, the problem probably lies with the drive or the host computer.

Has the drive been moved recently? Have any cables been disconnected and reconnected? Has the environment changed—unusually hot, cold, damp or dry? Has there been dust or dirt near the drive. Have reasonable precautions against static been taken?

The problem could lie with the drive:

1. Check the cables and connectors.
2. Clean the tape heads with the cleaning cartridge.
3. If the problem persists, check the environmental conditions against the specified limits, see Table 6 on page 37. Perhaps move the drive to a more suitable site.

Has a new operating system been installed in the host computer? Has new backup software been installed?

The problem could lie with the host or the software. Consult the computer's operating manuals, the software manual, or seek help from a service engineer.

Optimizing performance

Various factors can affect tape drive performance, particularly in a network environment. In nearly all cases when performance is not as expected, it is the data rates of the disk subsystem that cause the bottleneck.

If your tape drive is not performing as well as expected—for example, if backup windows are longer than expected—please consider the following points before contacting Customer Support.

Can your system deliver the required performance?

- The LTO–5 tape drive can write uncompressed data at up to 140 MB/s (504 GB/hour).
- The LTO–4 tape drive can write uncompressed data at up to 80 MB/s (288 GB/hour).
- The LTO–3 tape drive can write uncompressed data at up to 60 MB/s (216 GB/hour).

To obtain 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**
  A single-spindle disk will not be able to deliver good data throughput at poor compression ratios. Best practice to ensure good throughput is to utilize multiple disk spindles or data sources.
- **System architecture**
  Be aware of the architecture of your data protection environment.
  The aggregation of multiple client sources over a network provides a good way of delivering good performance, but anything less than Gigabit Ethernet will limit performance for LTO tape drives.
  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 33). Use:
  - Ultrium 3 TB R/W or Ultrium 3 TB WORM cartridges with LTO–5 tape drives
  - Ultrium 1.6 TB R/W or Ultrium 1.6 TB WORM cartridges with LTO–4 tape drives
  - Ultrium 800 GB R/W or Ultrium 800 GB WORM cartridges with LTO–3 tape drives
- **Data and file types**
  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 drive can write/read data. You will achieve no more than native rates with uncompressible data.
  Examples of files that compress well are plain text files, spreadsheets; those that compress poorly 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).

Problems with cartridges

If you experience any problems using LTO branded cartridges, check:

- 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. This prevents condensation. See the insert included with the tape cartridge for storage conditions.
- The write-protect switch is fully operational. It should move from side to side with a positive click.

The cartridge is jammed

If the cartridge is jammed or the backup application is unable to eject it, you can force eject the cartridge. If the failure occurs regularly, contact Customer Support.

1. Either press and hold the Eject button on the front of the tape drive for at least 10 seconds.
2. Wait for the cartridge to be ejected. This process may take up to 10 minutes (the maximum rewind time). It is important that you allow sufficient time for the drive to complete this process. If you interrupt it, you may damage the media or the tape drive. The drive is then reset as though you had turned the power off and then on again.

   You may lose data if you force eject a cartridge. The tape may also become unreadable because an EOD (End of Data) mark may not be properly written.
3. If the cartridge is still jammed, the tape drive has failed, contact Customer Support.

The drive will not accept the cartridge (or ejects it immediately)

The cartridge may have been damaged, for example dropped, or the drive may have a fault. If it is a cleaning cartridge, it has probably expired and should be discarded immediately. For data cartridges:

1. Check that the drive has power (the power cable is properly connected and the Ready LED is on).
2. Check that you are using the correct media. Use only Ultrium media, (see “Use the correct media” on page 33).
   - Ultrium 3 TB RW and Ultrium 3 TB WORM tape cartridges for use with LTO–5 tape drives.
   - Ultrium 1.6 TB RW and Ultrium 1.6 TB WORM tape cartridges for use with LTO–4 tape drives.
   - Ultrium 800 GB RW and Ultrium 800 GB WORM tape cartridges for use with LTO–3 tape drives.
3. Make sure that you have loaded the cartridge with the correct orientation (see “Loading a cartridge” on page 31).
4. Check for damage to your media 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 LTO drive of the same model will accept the cartridge. If it does, the original drive may be faulty. Before calling customer service, please check that the tape drive is responding.

Encryption troubleshooting

- Ensure that you are using an LTO-5 or LTO-4 tape drive and Ultrium 3 TB or 1.6 TB media, respectively.
- Ensure that your software supports hardware encryption. It may be necessary to update the software. Consult your software vendor for more information.
- Ensure that the correct key or pass phrase has been entered.
- Ensure that your HBA supports the encryption commands. It may be necessary to update the firmware.

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