LTO-6 Half-Height SAS Tape Drive
User Guide

August 2013
Comments... Suggestions... Corrections...

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LTO-6 Half-Height SAS Tape Drive
1 Safety and Environmental Notices

CAUTION!
Observe the safety instructions in the manual "Safety notes and other important information"!

Information on handling consumables
Please dispose of printer consumables and batteries in accordance with the applicable national regulations.

In accordance with EU directives, batteries must not be disposed of with unsorted domestic waste. They can be returned free of charge to the manufacturer, dealer or an authorized agent for recycling or disposal.

All batteries containing pollutants are marked with a symbol (a crossed-out garbage can). They are also marked with the chemical symbol for the heavy metal that causes them to be categorized as containing pollutants:
- Cd Cadmium
- Hg Mercury
- Pb Lead

Labels on plastic casing parts
Please avoid sticking your own labels on plastic parts wherever possible, since this makes it difficult to recycle them.

Returns, recycling and disposal
Please handle returns, recycling and disposal in accordance with local regulations.
Safety and Environmental Notices

The device must not be disposed of with domestic waste. This device is labeled in compliance with European directive 2002/96/EC on waste electrical and electronic equipment (WEEE).

This directive sets the framework for returning and recycling used equipment and is valid across the EU. When returning your used device, please use the return and collection systems available to you. Further information can be found at http://ts.fujitsu.com/recycling.

Details regarding the return and recycling of devices and consumables within Europe can also be found in the "Returning used devices" manual, via your local Fujitsu branch or from our recycling center in Paderborn:

Fujitsu Technology Solutions
Recycling Center
D-33106 Paderborn
Tel. +49 5251 8 18010
Fax +49 5251 8 333 18010

High safety use

This product has been designed and manufactured to be used in commercial and/or industrial areas as a server.

When used as visual display workplace, it must not be placed in the direct field of view to avoid incommoding reflections (applies only to TX server systems).

The device has not been designed or manufactured for uses which demand an extremely high level of safety and carry a direct and serious risk of life or body if such safety cannot be assured.

These uses include control of nuclear reactions in nuclear power plants, automatic airplane flight control, air traffic control, traffic control in mass transport systems, medical devices for life support, and missile guidance control in weapons systems (hereafter, "high safety use"). Customers should not use this product for high safety use unless measures are in place for ensuring the level of safety demanded of such use. Please consult the sales staff of Fujitsu if intending to use this product for high safety use.

For all other safety issues, please refer to the server's safety manual.
2 About This Book

This guide describes how to install and use the LTO-6 Half-Height SAS Tape Drive in the following chapters:

Chapter 3, "Introduction" on page 11 provides an overview and discusses device drivers.

Chapter 4, "Installing the drive" on page 19 gives unpacking, set up, and configuration information.

Chapter 5, “Operating the Drive” on page 23 describes the Unload Button, and Status Lights and explains the function of the Single-character Display. It gives instruction on inserting and removing a tape cartridge, and explains how to clean the tape drive.

Chapter 6, "Using Ultrium Media" on page 35 describes the types of tape cartridges to use and defines the conditions for storing and shipping them. It also describes how to handle the cartridges, how to set a cartridge’s write-protect switch.

Chapter 7, "Troubleshooting" on page 41 gives tips for solving problems with the drive.
About This Book
3 Introduction

The LTO-6 Half-Height SAS Tape Drive is a high-performance, high-capacity data-storage device that is designed to backup and restore open systems applications. It is the sixth generation in the Ultrium series of products, and is available with a Serial Attached SCSI interface (SAS).

Figure 1: View of the drive
3.1 Drive features

The drive offers the following features:

- 6 Gbps Serial Attached Small Computer Systems Interface (SAS)
- Half height form factor
- Native storage capacity of 2500 GB per cartridge (6250 GB at 2.5:1 compression)
- Maximum native data transfer rate of up to 160 MB per second
- Burst data transfer rate of 600 MB per second
- 512 MB read-and-write cache
- Support for encryption on Ultrium-4, Ultrium-5, and Ultrium-6 tape cartridges
- Single Character Display (SCD) operator panel
- Ready and Fault status lights
- Encryption status light
3.2 Front panel of drive

Figure 2: Front panel element descriptions

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Unload button</td>
</tr>
<tr>
<td>2</td>
<td>Ready/Activity status light (green LED)</td>
</tr>
<tr>
<td>3</td>
<td>Encryption Key (white LED)</td>
</tr>
<tr>
<td>4</td>
<td>Fault status light (amber LED)</td>
</tr>
<tr>
<td>5</td>
<td>Single character display (SCD)</td>
</tr>
<tr>
<td>6</td>
<td>SCD dot</td>
</tr>
</tbody>
</table>
Introduction

3.3  Rear panel of the SAS drive

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SAS/Power connector</td>
</tr>
<tr>
<td>2</td>
<td>Feature block switch (on the underside of the drive)</td>
</tr>
</tbody>
</table>

3.4  SAS interface

The drive has a Gbps SAS (Serial Attached SCSI) host interface.

A drive with a SAS (Serial Attached SCSI) interface can be linked directly to controllers. SAS is a performance improvement over traditional SCSI because SAS enables multiple devices (up to 128) of different sizes and types to be connected simultaneously with thinner and longer cables; its full-duplex signal transmission supports 6.0 Gb/s. SAS drives will auto-negotiate speed. There are no configurable topologies thus no setup is required for SAS interface.
3.5 Cartridge compatibility

The drive supports the following data cartridges:
- Ultrium-6 data cartridge at 2.5:1 compression (Read/Write)
- Ultrium-5 data cartridge at 2:1 compression (Read/Write)
- Ultrium-4 data cartridge at 2:1 compression (Read only)

Tip: Ultrium-1, Ultrium-2, and Ultrium-3 data cartridges are not supported.

3.6 Backup performance/capacity

The backup performance and backup capacity that can be used in one data cartridge varies depending upon the following factors:
- The conditions (attrition, dust, etc.) of the recording surface of the data cartridge to be used
- The dust and dirt condition of the product's magnetic head
- The data compression rate
- The workload on the server

3.7 LTO-6 tape drives and encryption

The LTO-6 tape drive include hardware capable of performing data encryption at full speed while writing data, and decrypting when reading.

Encryption is the process of changing data into a form that cannot be read until it is deciphered, protecting the data from unauthorized access and use. LTO-6 tape drives use the strongest version of the industry-standard AES encrypting algorithm to protect your data.

To make use of this feature you need:
- A backup application that supports hardware encryption
- Encryption is possible on LTO-4, LTO-5, and LTO-6 media.
- The LTO-4 data cartridge is read only on LTO-6 tape drive.
Introduction

3.7.1 When should I use encryption?

Your company policy will determine when you need to use encryption. For example, it may be mandatory for company confidential and financial data, but not for personal data. Company policy will also define how encryption keys should be generated and managed. Backup applications that support encryption will generate a key for you or allow you to enter a key manually.

Encryption with keys that are generated directly from passwords or passphrases may be less secure than encryption using truly random keys. Your application should explain the options and methods that are available. Please refer to your application’s user documentation for more information.

3.7.2 How do I enable encryption?

Hardware encryption is turned off by default and is switched on by settings in your backup application, where you also generate and supply the encryption key. Your backup application must support hardware encryption for this feature to work.

3.7.3 What happens if I don’t remember the key?

If you are unable to supply the key when requested to do so, neither you nor Technical Support will be able to access the encrypted data.

This guarantees the security of your data, but also means that you must be careful in the management of the encryption key used to generate the tape.

WARNING!

You should keep a record or backup of your encryption keys and store them in a secure place separate from the computer running the backup software.

3.7.4 Does encryption affect tape drive performance?

Hardware encryption can be used with or without compression and without speed or capacity impact.
3.7.5  Does the tape drive encrypt media in an earlier LTO format?

Encryption is supported only on LTO Ultrium-6 media, LTO Ultrium-5 media, and LTO Ultrium-4 media.

Encrypted LTO Ultrium-6, LTO Ultrium-5 and LTO Ultrium-4 tapes can be read on any compatible LTO tape drive that supports hardware encryption. (LTO-6 tape drives can read and write encrypted LTO Ultrium-6 media and LTO Ultrium 5 media. LTO-6 tape drives can read encrypted LTO Ultrium-4 media.)

Hardware encryption is not supported on any earlier LTO media, such as LTO Ultrium-3 media.

3.7.6  Where can I get more information?

For detailed instructions about enabling encryption please refer to the documentation supplied with your backup application. This will also highlight any default states, for example when copying tapes, that may need changing if using encrypted tapes.
3.8 LTO-6 tape drives and partitioning

The LTO-6 tape drive supports up to four tape partitions, when used with LTO Ultrium-6 cartridges. Tape partitioning is not supported with WORM (Write Once Read Multiple) cartridges or with earlier generations of cartridge. It is not supported on earlier-generation tape drives. If you insert a partitioned tape into a tape drive that does not support partitioning, it will be ejected.

To check for the latest information about support for partitioning and any required firmware upgrades, refer to the following web sites:


Refer to your backup application's documentation for information about creating and using partitions on the tape drive.

3.9 Feature Switches

The feature switch is located on the rear panel of the tape drive. Refer to "Rear panel of the SAS drive" on page 14 for the location of the switch. The switch positions are labeled 1 through 8. The on and off positions are marked on the switch. The default settings for the feature switches are all switches placed in the "OFF" position. Do not change the default settings.

3.10 Supported device drivers

Device drivers enable the drive to interact with a variety of servers. Current drivers, firmware and tools can be found on:

- DVD "Server View Suite"
  Search for "Lto" in fulltext search or search based on the server system under industry standard server.
  Search for "Storage" and "LTO6".

For the Japanese market please use the URL:

Please use the mentioned web links also for upgrade check and if the driver on Server View Suite DVD is an old version or lost/missing.
4 Installing the drive

Before starting this installation, read these instructions and compare them to the drive installation instructions for your server.

4.1 Avoiding drive damage

To avoid static electricity damage when handling the drive, use the following precautions:

- Limit your movement. Movement can cause static electricity to build around you.
- Always handle the drive carefully. Never touch exposed circuitry.
- Prevent others from touching the drive.
- Before unpacking and installing the drive into a server, touch its static-protective packaging to an unpainted metal surface on the enclosure for at least two seconds. This reduces static electricity in the packaging and your body.
- When possible, remove the drive from its static-protective packaging and install it directly into an enclosure without setting it down. When this is not possible, place the drive’s packaging on a smooth, level surface and place the drive on the packaging.
- Do not place the drive on the cover of the enclosure or on any other metal surface.
Installing the drive

4.2 Installation overview

1. "Install the SAS drive connector" on page 20
2. "Mount the drive into a PRIMERGY server" on page 20
3. "Install device drivers" on page 21

4.3 Install the SAS drive connector

Install the customer-supplied SAS drive connector to the rear panel of the drive (1 in figure 3 on page 14). The SAS connector also includes the power connector for the drive.

4.4 Mount the drive into a PRIMERGY server

When mounting the drive into a server:

- Use an appropriate screw length.
- Ensure that no objects such as screw heads, cables, or adjacent devices, are pressing against the frame.
- Do not obstruct the ventilation slots at the rear of the drive.
- Allow sufficient space for accessing the drive’s front panel controls.

To mount the drive into a server:

1. Remove the 5 1/4 inch cover of your server (refer to the instructions in the documentation provided with your server).
2. Place the drive into the server so that the tape load compartment of the drive faces the tape load compartment of the server.
3. Insert four screws into the lower mounting holes of the side brackets located on the left and right sides of the chassis.
Installing the drive

Attention
When inserted into the drive, the length of the mounting screws must not exceed 2.5 mm (0.10 in.) for the upper mounting holes and 5.0 mm (0.20 in.) for the lower mounting holes inside the chassis. If the length exceeds this measurement, the drive may become damaged.

4.5 Install device drivers

For information about installing device drivers, refer to the RIS-relevant information sheet or the documentation on the following web sites:


Install the driver according to the driver's readme file.
Installing the drive
5 Operating the Drive

Operating the drive involves using the following front panel items:

- Single-character Display (SCD)
- SCD Dot
- Status Lights
-Unload Button

5.1 Single-character Display (SCD)

The SCD (5 in "Front panel of drive" on page 13) presents a single-character code for error conditions and informational messages:

"Error Codes and Messages" on page 44 lists the codes for error conditions and informational messages. If multiple errors occur, the code with the highest priority (represented by the lowest number) displays first. When the error is corrected, the code with the next highest priority displays, and so on until no errors remain.

The SCD is blank during normal operation.

5.2 Status Lights

The Status Lights (2 and 4 in "Front panel of drive" on page 13) are light-emitting diodes (LEDs) that provides information about the state of the drive. The Ready status light is green and the Fault status light is amber, and (when lit) solid or flashing.

<table>
<thead>
<tr>
<th>Mode</th>
<th>SCD</th>
<th>Ready LED (green)</th>
<th>Fault LED (amber)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operational</td>
<td>blank</td>
<td>On</td>
<td>Off</td>
</tr>
<tr>
<td>Activity (tape movement) in Operational Mode</td>
<td>blank</td>
<td>Flashing</td>
<td>Off</td>
</tr>
<tr>
<td>Maintenance</td>
<td>solid character</td>
<td>Flashing</td>
<td>On</td>
</tr>
</tbody>
</table>

Table 1: Status Light Modes
Operating the Drive

<table>
<thead>
<tr>
<th>Mode</th>
<th>SCD</th>
<th>Ready LED (green)</th>
<th>Fault LED (amber)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Executing Maintenance Selection</td>
<td>flashing character</td>
<td>Off</td>
<td>On</td>
</tr>
<tr>
<td>Error Condition</td>
<td>solid character</td>
<td>Off</td>
<td>Flashing</td>
</tr>
<tr>
<td>Power-On / Reset Initialization</td>
<td>random segments</td>
<td>Off</td>
<td>On</td>
</tr>
</tbody>
</table>

Table 1: Status Light Modes

Maintenance mode is not supported. If the drive is in a maintenance mode, power cycle the server.

The table 2 lists the conditions of the Status Lights and Single-character Display (SCD) and provides an explanation of what each condition means.

<table>
<thead>
<tr>
<th>If the green Ready Status Light is... and the amber Fault Status Light is... and the SCD is... and the SCD Dot is...</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off                                                            Off                                Off                  Off</td>
<td>The drive has no power or is powered off.</td>
</tr>
<tr>
<td>Green/Solid                                                    Off                                Off                  Off</td>
<td>The drive is powered on and in an idle state.</td>
</tr>
<tr>
<td>Flashing Green (once per second)                              Off                                Off                  Off</td>
<td>The drive is reading from the tape, writing to the tape, rewinding the tape, locating data on the tape, loading the tape, or unloading the tape.</td>
</tr>
</tbody>
</table>

Table 2: Meaning of Status Lights and Single-character Display (SCD)
Operating the Drive

Table 2: Meaning of Status Lights and Single-character Display (SCD)

<table>
<thead>
<tr>
<th>If the green Ready Status Light is...</th>
<th>and the amber Fault Status Light is...</th>
<th>and the SCD is...</th>
<th>and the SCD Dot is...</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flashing Green (once per second)</td>
<td>Off</td>
<td>Off</td>
<td>Off</td>
<td>If the drive contains a cartridge during the power-on cycle, the drive completes POST and slowly rewinds the tape (the process may take up to thirteen minutes). The light stops blinking and becomes solid when the drive completes the recovery and is ready for read or write operation. To eject the cartridge, press the unload button.</td>
</tr>
<tr>
<td>Off</td>
<td>Amber/Solid</td>
<td>Displaying an error code</td>
<td>On/Off</td>
<td>The drive is displaying error code(s) from the error code log on the SCD. For more information, see &quot;Error Codes and Messages&quot; on page 44.</td>
</tr>
</tbody>
</table>
Operating the Drive

<table>
<thead>
<tr>
<th>If the green Ready Status Light is...</th>
<th>and the amber Fault Status Light is...</th>
<th>and the SCD is...</th>
<th>and the SCD Dot is...</th>
<th>Meaning</th>
</tr>
</thead>
</table>
| Off / On                             | Off / On                               | Displaying random segments/Blank/displaying "8"/Blank | Off       | During power on, or a drive reset, the drive front panel will display drive progress as follows:  
1. SCD will display random segments (no LEDs ON)  
2. SCD will go blank (LEDs - Green ON, Amber OFF)  
3. SCD will display random segments (LEDs - Green OFF, Amber ON)  
4. SCD will display [8] (LEDs - Green OFF, Amber ON)  
5. SCD will go blank (LEDs - Green ON, Amber OFF) after a successful power on or reset.  
If an error is detected during the power on or reset, the tape drive posts an error code to the SCD. To determine the error, locate the code in "Error Codes and Messages" on page 44. |
| Off                                  | Flashing Amber (once per second)       | Displaying error code | Off       | An error occurred and the drive or media may require service, or it may require cleaning. Note the code on the SCD, then go to "Error Codes and Messages" on page 44 to determine the action that is required. |

Table 2: Meaning of Status Lights and Single-character Display (SCD)
### Operating the Drive

| If the green Ready Status Light is... and the amber Fault Status Light is... and the SCD is... and the SCD Dot is... | Meaning |
|---|---|---|---|---|
| Off | Flashing Amber | Displaying "C" | Off | The drive needs cleaning. |
| Off | Flashing Amber | Displaying Function Code "2" or Flashing | Off | The drive is updating firmware. The SCD will display a "2" if using an FMR cartridge. The SCD will be off if using the SCSI interface. For more information, see *Updating Firmware* on page 33. |
| Off | Flashing Amber (twice per second) | Off | Off | The drive detected an error and is performing a firmware recovery. It will reset automatically. |
| Off | Solid Amber | Flashing "c" | Off | The drive is requesting a cartridge to be loaded. |
| Off | Flashing Amber (twice per second) | Off | On | There is a drive dump in flash memory. |

1 Power should not be removed from the drive until the microcode update is complete. The drive indicates that the update is complete by resetting and performing POST.

Table 2: Meaning of Status Lights and Single-character Display (SCD)
5.3 Unload Button

The Unload Button (1 in "Front panel of drive" on page 13) performs the following functions:

<table>
<thead>
<tr>
<th>Unload Button Function</th>
<th>How to Initiate the Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rewind the tape into the cartridge and eject the cartridge from the drive</td>
<td>Press the Unload Button once. The Ready/Activity status light flashes green while the drive is rewinding and unloading.</td>
</tr>
</tbody>
</table>

During a rewind and eject operation, the drive does not accept SCSI commands from the server.

Maintenance mode is not supported. If the drive is in a maintenance mode, power cycle the server.

Table 3: Functions that the Unload Button performs
5.4 Inserting a Tape Cartridge

To insert a tape cartridge:

1. Ensure that the drive is powered on.
2. Grasp the cartridge so that the write-protect switch faces you (see 1 in figure 4).
3. Slide the cartridge into the tape load compartment.

   a) If the cartridge is already in an ejected position and you want to reinsert it, remove the cartridge then insert it again.

   b) If the cartridge is already loaded and you cycle the power, the tape will reload.

Figure 4: Inserting a cartridge into the drive
Operating the Drive

5.5 Removing a Tape Cartridge

To remove a tape cartridge:

1. Ensure that the drive is powered-on.

2. Press the Unload Button. The drive rewinds the tape and partially ejects the cartridge. The Ready Light flashes green while the tape rewinds, then goes out before the cartridge partially ejects.

3. After the cartridge partially ejects, grasp the cartridge and remove it.

   Important: Always remove an ejected cartridge before reinserting.

Whenever you unload a tape cartridge, the drive writes any pertinent information to the cartridge memory.

5.6 Mid-tape Recovery

If reset occurs while a cartridge is loaded, the drive will slowly rewind the tape and eject the cartridge. If a power cycle occurs while a cartridge is loaded, the drive will slowly rewind the tape. The drive will not automatically eject the cartridge.

The Ready light flashes and the SCD will be counting down from 9 to 0, indicating the approximate cartridge rewinding status. Between the counts, the SCD displays random segments while the tape is rewinding into the cartridge. Push the Unload Button to eject the cartridge when the Ready light stops flashing.
5.7 Cleaning the Drive Head

Attention: When cleaning the drive head, use a LTO Ultrium Cleaning Cartridge.

Clean the drive head whenever "C" displays on the Single-character Display and the Fault status light is flashing amber once per second.

To clean the head, insert the cleaning cartridge into the tape load compartment (see "Front panel of drive" on page 13). The drive performs the cleaning automatically in less than three minutes then ejects the cartridge.

The drive will automatically eject an expired cleaning cartridge.

An LTO Ultrium Cleaning Cartridge is valid for 50 uses.

5.8 Cautions Concerning Backup

5.8.1 Ejecting the data cartridge after backup

- Do not leave the data cartridge in this product.
  Doing so makes the data cartridge wear faster, because the longer it is used, the faster it wears. The tape recording surface of the data cartridge is exposed when inserted in this product and if it is left in this state for a long time it will easily be affected by suspended particles of dust. Insert the data cartridge just before the backup operation, and remove it immediately after the operation.

- Do not turn off the power with the data cartridge inserted.
  If the power is turned off with the data cartridge inserted, it takes a while before this product can be used after the next power-on.
Operating the Drive

5.8.2 Data compression rate

This product has a data compression function included in the hardware.

Although the data compression rate is approximately 250%, it varies depending on the data content.

Data that has already been compressed by software is not effected by this product.

Some backup software has a data compression function prior to transfer, however, do not compress data by software if the hardware compression function is on.

5.8.3 Backup performance/capacity

The backup performance and backup capacity that can be used in one data cartridge varies depending upon the following factors:

- The conditions (attrition, dust, etc.) of the recording surface of the data cartridge to be used
- The dust and dirt condition of the product's magnetic head
- The data compression rate
- The workload on the server

5.8.4 Points to note during system configuration

When repeatedly using a single data cartridge, all the data can be lost if the backup fails. Also, if a backup data cartridge becomes damaged, the data cannot be recovered.

Damage in the event of a failure can be minimized if two or more data cartridges are used for backup operation. For example, use different data cartridges for each day of the week.
5.9 Diagnostic and Maintenance Functions

Please note that Fujitsu does not support maintenance mode. If the drive is in a maintenance mode, power cycle the server.

5.10 Updating Firmware

Attention: When updating firmware, do not power-off the drive until the update is complete, or the firmware may be lost.

Periodically check for updated levels of drive firmware by visiting the web at:

  Search for "lto" in fulltext search or search based on the server system under industry standard server.

  Search for "Storage" and "LTO6".

For the Japanese market please use the URL:

Please use the mentioned web links also for upgrade check and if the driver on Server View Suite DVD is an old version or lost/missing.
6 Using Ultrium Media

To achieve best performance we recommend to use only "Fujitsu - Preferred Quality" LTO Ultrium data cartridges.

6.1 Overview

Figure 5: LTO Ultrium Data Cartridge

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cartridge door</td>
</tr>
<tr>
<td>2</td>
<td>Write-protect Switch</td>
</tr>
<tr>
<td>3</td>
<td>Label area</td>
</tr>
</tbody>
</table>
6.2 Cartridge Compatibility

<table>
<thead>
<tr>
<th>Tape Drive</th>
<th>LTO Ultrium Data Cartridges</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2500 GB (Ultrium-6)</td>
</tr>
<tr>
<td>Ultrium-6</td>
<td>Read/Write</td>
</tr>
<tr>
<td>Ultrium-5</td>
<td>Read/Write</td>
</tr>
<tr>
<td>Ultrium-4</td>
<td>Read/Write</td>
</tr>
<tr>
<td>Ultrium-3</td>
<td>Read/Write</td>
</tr>
<tr>
<td>Ultrium-2</td>
<td>Read/Write</td>
</tr>
<tr>
<td>Ultrium-1</td>
<td>Read/Write</td>
</tr>
</tbody>
</table>

Table 4: Ultrium cartridge compatibility with Ultrium tape drives
6.3 Using the correct media

6.3.1 Cleaning cartridges

Use the universal cleaning cartridge. It may be used for up to 50 cleans.

6.3.2 Data cartridges

LTO-6 tape drives use the LTO-6 tape cartridges referred to in chapter “Cartridge Compatibility” on page 36. 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 Ultrium 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 LTO 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.

6.3.3 Cartridge life

To avoid a backup failure due to worn media, replace the media (data cartridge) before either of the following occur:

- After one year of use
- After being used 1000 times

The lifespan of media varies depending on the environment (temperature, humidity, dust, etc.) and operating conditions of this product.

**IMPORTANT:**

The data cartridge is a replaceable part. Worn media can cause problems such as magnetic tape surface damage, dirty magnetic head, many media errors, and so on.
6.3.4 Write protecting cartridges

**CAUTION!**

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. The location of the write-protect tab is illustrated by figure 6.

![Write-protect tab](image)

Figure 6: Write protecting a cartridge
CAUTION!
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 Ultrium format cartridges. This will destroy pre-recorded servo information and make the cartridge unusable.

6.3.5 Cleaning the tape drive

Perform magnetic head cleaning when the following occurs:
– Periodically (once every three months)
– When the drive requests to be cleaned.

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

To clean the tape drive:
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 2 minutes or more).

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

6.3.6 Handling cartridges

● Do not touch the tape media.
● Do not open the drive door and 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).
Using Ultrium Media

- Do not drop cartridges or handle them roughly.
- Stick labels onto the label area only.
- Do not bulk erase (or degauss) Ultrium format cartridges because this will render them unusable.
- Attach the label at the location shown in the following figure.

Always use the supplied label.

![Label position](image)

Figure 7: Attaching a label to media

6.3.7 Storage environment

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

- Day-to-day storage (in plastic container): 16° C to 32° C (60° F to 90° F)
- Non-condensing relative humidity: 20% to 80% (storage)
- Wet bulb temperature should not exceed 26° C (79° F)

Tapes intended for long-term storage should be stored in the plastic containers, at temperatures between 5° C and 23° C (41° F and 73° F) and 20% to 60% relative humidity.
7 Troubleshooting

If you encounter problems when running the drive, refer to table 5. The states of the status lights may also indicate a problem.

<table>
<thead>
<tr>
<th>If the problem is this...</th>
<th>Do this...</th>
</tr>
</thead>
</table>
| The amber Fault status light is flashing slowly. | This indicates one of the following failures has occurred:  
- Unrecoverable drive failure - power cycle the system. If the problem persists, contact your support partner.  
- Firmware upgrade failure - Retry the firmware upgrade. If it still fails, contact your support partner.  
- Media failure or incorrect Media - Perform one of the following:  
  - This indicates that incorrect media has been inserted into the drive. If the drive does not eject the cartridge, press the Unload button to eject the cartridge.  
  - This indicates that media failure. Press the Unload button to eject the cartridge from the drive. Remove the cartridge from the drive and inspect it for damage and debris. Verify that the Write-Protect Switch on the cartridge is in the unlocked position (see "Write protecting cartridges" on page 38). |
| The amber Fault status light is solid ON. | This indicates that the drive has reached its maximum operating temperature. Power OFF the drive until the temperature of the drive has returned to the normal operating temperature range. If the problem persists, check the environmental conditions. |
| The green Ready/Activity status light never turns ON. | The drive has no power. Check the power at the power source. Connect power to the drive. If the problem persists, replace the drive. |

Table 5: Half-high drive troubleshooting tips
The drive will not load a tape cartridge.

- A tape cartridge is already inserted. To remove the cartridge, press the Unload button. If the cartridge does not eject, turn off the power to the drive, then turn it back on. After the green Ready/Activity status light becomes solid ON, press the Unload button to eject the cartridge.
- The tape cartridge was inserted incorrectly. To properly insert a cartridge, see "Inserting a Tape Cartridge" on page 29.
- The tape cartridge may be defective. Insert another tape cartridge. If the problem exists for multiple cartridges, the drive is defective. Replace the defective drive with a new drive.
- The drive has no power. Connect power to the drive.
- The drive has exceeded its maximum operating temperature. Power OFF the drive until the temperature of the drive has returned to the normal operating temperature range. If the problem persists, check the environmental conditions.

The drive will not unload the tape cartridge.

- The tape cartridge is stuck or is broken. Press the Unload button. If the cartridge does not eject, turn off the power to the server, then turn it back on (note that the mid-tape recovery could take up to ten minutes to complete). If the cartridge still does not eject, contact your support partner.

The drive does not respond to server commands.

- Power cycle the server. If the problem reappears, please contact your support partner.

<table>
<thead>
<tr>
<th>If the problem is this...</th>
<th>Do this...</th>
</tr>
</thead>
<tbody>
<tr>
<td>The drive will not load a tape cartridge.</td>
<td>One of the following has occurred:</td>
</tr>
<tr>
<td></td>
<td>● A tape cartridge is already inserted. To remove the cartridge, press the Unload button. If the cartridge does not eject, turn off the power to the drive, then turn it back on. After the green Ready/Activity status light becomes solid ON, press the Unload button to eject the cartridge.</td>
</tr>
<tr>
<td></td>
<td>● The tape cartridge was inserted incorrectly. To properly insert a cartridge, see &quot;Inserting a Tape Cartridge&quot; on page 29.</td>
</tr>
<tr>
<td></td>
<td>● The tape cartridge may be defective. Insert another tape cartridge. If the problem exists for multiple cartridges, the drive is defective. Replace the defective drive with a new drive.</td>
</tr>
<tr>
<td></td>
<td>● The drive has no power. Connect power to the drive.</td>
</tr>
<tr>
<td></td>
<td>● The drive has exceeded its maximum operating temperature. Power OFF the drive until the temperature of the drive has returned to the normal operating temperature range. If the problem persists, check the environmental conditions.</td>
</tr>
</tbody>
</table>

| The drive will not unload the tape cartridge. | The tape cartridge is stuck or is broken. Press the Unload button. If the cartridge does not eject, turn off the power to the server, then turn it back on (note that the mid-tape recovery could take up to ten minutes to complete). If the cartridge still does not eject, contact your support partner. |

| The drive does not respond to server commands. | Power cycle the server. If the problem reappears, please contact your support partner. |

Table 5: Half-high drive troubleshooting tips
# 7.1 Methods of Receiving Errors and Messages

Use this section as a guide for identifying error codes and message codes reported by the drive, its enclosure (if applicable), or the server.

<table>
<thead>
<tr>
<th>If the error or message was presented by....</th>
<th>Do this....</th>
</tr>
</thead>
<tbody>
<tr>
<td>The drive’s SCD and the Fault status light flashes amber</td>
<td>See &quot;Error Codes and Messages&quot; on page 44. To determine the meaning of Status Light activity, see &quot;Status Lights&quot; on page 23.</td>
</tr>
</tbody>
</table>

Table 6: Methods of receiving errors and messages
7.2 Error Codes and Messages

If the drive detects a permanent error, it will display the error code on the SCD and flash the Amber Fault status light (Green Ready/Activity status light will be Off).

- Make note of the error code displaying on the SCD prior to removing a cartridge or clearing the SCD error code.
- If an error occurred with a cartridge in the drive, push the Unload Button to eject the cartridge.

<table>
<thead>
<tr>
<th>Error Code</th>
<th>Cause and Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;0&quot;</td>
<td>No error occurred and no action is required. This code displays when diagnostics have finished running and no error occurred. The Single-character Display is blank during normal operation of the tape drive.</td>
</tr>
</tbody>
</table>
| "1"        | Temperature problem. The tape drive detected that the recommended operating temperature was exceeded. Perform one or more of the following actions:  
- Ensure that the cooling fan is rotating and is quiet. If not, refer to your enclosure documentation.  
- Remove any blockage that prevents air from flowing freely through the tape drive.  
- Ensure that the operating temperature and airflow is within the specified range.  
Clear the error code by power cycling the tape drive. If the operating temperature and airflow are within the specified range, and the problem persists, contact your support partner. |

Table 7: Error codes on the Single-character Display
Troubleshooting

"2" Power problem. The tape drive detected that the externally supplied power is outside the specified voltage limits (the tape drive is not operating). Perform the following action:
1. Ensure that the power connector is properly seated.
2. Ensure that the proper dc voltages are being applied within the tolerances allowed.
3. If the proper voltages are not being applied, support the power supply.
4. If the proper voltages are being applied, power off/on the tape drive to see if the problem repeats.
5. If the problem persists, contact your support partner.

"3" Firmware problem. The tape drive determined that a firmware error occurred. Perform the following action:
1. Power the tape drive off and on, then retry the operation that produced the error.
2. If the problem persists, download new firmware and retry the operation.
3. If the problem persists, contact your support partner.

"4" Firmware or hardware problem. The tape drive determined that a firmware or tape drive hardware failure occurred. Perform the following action:
1. Power the tape drive off and on, then retry the operation that produced the error.
2. If the problem persists, download new firmware and retry the operation; if new firmware is not available, contact your support partner.

<table>
<thead>
<tr>
<th>Error Code</th>
<th>Cause and Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;2&quot;</td>
<td><strong>Power problem.</strong> The tape drive detected that the externally supplied power is outside the specified voltage limits (the tape drive is not operating). Perform the following action:</td>
</tr>
<tr>
<td></td>
<td>1. Ensure that the power connector is properly seated.</td>
</tr>
<tr>
<td></td>
<td>2. Ensure that the proper dc voltages are being applied within the tolerances allowed.</td>
</tr>
<tr>
<td></td>
<td>3. If the proper voltages are not being applied, support the power supply.</td>
</tr>
<tr>
<td></td>
<td>4. If the proper voltages are being applied, power off/on the tape drive to see if the problem repeats.</td>
</tr>
<tr>
<td></td>
<td>5. If the problem persists, contact your support partner.</td>
</tr>
<tr>
<td>&quot;3&quot;</td>
<td><strong>Firmware problem.</strong> The tape drive determined that a firmware error occurred. Perform the following action:</td>
</tr>
<tr>
<td></td>
<td>1. Power the tape drive off and on, then retry the operation that produced the error.</td>
</tr>
<tr>
<td></td>
<td>2. If the problem persists, download new firmware and retry the operation.</td>
</tr>
<tr>
<td></td>
<td>3. If the problem persists, contact your support partner.</td>
</tr>
<tr>
<td>&quot;4&quot;</td>
<td><strong>Firmware or hardware problem.</strong> The tape drive determined that a firmware or tape drive hardware failure occurred. Perform the following action:</td>
</tr>
<tr>
<td></td>
<td>1. Power the tape drive off and on, then retry the operation that produced the error.</td>
</tr>
<tr>
<td></td>
<td>2. If the problem persists, download new firmware and retry the operation; if new firmware is not available, contact your support partner.</td>
</tr>
</tbody>
</table>

Table 7: Error codes on the Single-character Display
## Troubleshooting

<table>
<thead>
<tr>
<th>Error Code</th>
<th>Cause and Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;5&quot;</td>
<td><strong>Tape drive hardware problem.</strong> The drive determined that a tape path or read/write error occurred. To prevent damage to the drive or tape, the tape drive will not allow you to insert a cartridge if the current cartridge was successfully ejected. The error code may clear when you cycle power to the tape drive. If the problem persists, contact your support partner.</td>
</tr>
</tbody>
</table>
| "6"        | **Tape drive or media error.** The tape drive determined that an error occurred, but it cannot isolate the error to faulty hardware or to the tape cartridge. Ensure the tape cartridge is the correct media type:  
  - Ultrium-1, Ultrium-2, and Ultrium-3 tape cartridges are not supported by the LTO-6 Tape Drive. If the Ultrium-1, Ultrium-2, or Ultrium-3 cartridge is loaded, SCD is displayed as "J".  
  - Drive will not accept an expired Cleaning Cartridge.  
  - Drive will not write over existing datasets on a WORM cartridge. Ensure you are appending datasets on WORM media rather than attempting to write over existing datasets  
If the tape cartridge is the correct media type, perform the following action:  
1. Clean the drive with the cleaning cartridge.  
2. Retry the operation.  
3. If the problem persists, contact your support partner.  
The error code clears when you remove the tape cartridge. |

Table 7: Error codes on the Single-character Display
Troubleshooting

"7"  Media error. The tape drive determined an error occurred because of a faulty tape cartridge or an invalid tape cartridge. Ensure the tape cartridge is the correct media type:
- Ultrium-1, Ultrium-2, and Ultrium-3 tape cartridges are not supported by the LTO-6 Tape Drive. If the LTO-1, LTO-2, or LTO-3 cartridge is loaded, SCD is displayed as "J".
- Drive will not accept an expired Cleaning Cartridge.
- Drive will not write over existing datasets on a WORM cartridge. Ensure you are appending datasets on WORM media rather than attempting to write over existing datasets.

If the tape cartridge is the correct media type, try another tape cartridge. If the problem occurs with multiple tape cartridges, use the following procedure:
1. Clean the drive with the cleaning cartridge.
2. Retry the operation.
3. If the problem persists, retry the operation with a new or a known good cartridge. If the operation succeeds, discard the defective tape cartridge. If the problem persists also with the new tape cartridge, the problem probably lies with the drive. Contact your support partner.

The error code clears when you remove the tape cartridge.

"8"  Interface problem. The tape drive determined that a failure occurred in the tape drive's hardware or in the host bus. Check the cabling between the tape drive and the SAS controller. If the problem persists, contact your support partner.

Table 7: Error codes on the Single-character Display
Troubleshooting

Error Code | Cause and Action
---|---
"A" | **Degraded operation.** The tape drive determined that a problem occurred which degraded the operation of the tape drive, but it did not restrict continued use. If the problem persists, determine whether the problem is with the drive or the media.

The drive is usable, though the Single-character Display continues to indicate an error and the Fault status light flashes amber. The error code may clear when you cycle power to the tape drive.

To determine if the problem is with the drive hardware, or the tape media, perform the following procedure:

1. Clean the drive with the cleaning cartridge.
2. Retry the operation.
3. If the problem persists, retry the operation with a new or a known good cartridge. If the operation succeeds, discard the defective tape cartridge. If the problem persists also with the new tape cartridge, the problem probably lies with the drive. Contact your support partner.

"C" | **The tape drive needs to be cleaned.** Clean the tape drive. See "Cleaning the Drive Head" on page 31.

The error code clears when you clean the tape drive.

Table 7: Error codes on the Single-character Display
Troubleshooting

"e" Encryption Error. Displayed when the drive detects an error associated with a encryption operation. If the problem occurred while the tape drive was writing data to, or reading data from, tape:

1. Check the host application to ensure the host application is providing the correct encryption key.
   - Retry the encryption operation after the host application problems have been resolved.
2. Check the operation of the tape drive by power cycling the server and running POST. See table 3 on page 28.
   - Refer to the error code displayed on the SCD if the drive reset and POST fails.
   - Retry the encryption operation if the drive reset and POST complete without errors.
3. Check the media.
   - Ensure the correct media is being used. Data encryption is supported with LTO Ultrium-4, Ultrium-5, and Ultrium-6 Data Cartridges only.
   - Retry the encryption operation with the tape cartridge in another encryption enabled drive. Replace the media if the problem repeats with the same tape cartridge in multiple drives.

If the problem occurred while the tape drive was running POST or diagnostics, replace the drive.

The error code clears with the first attempted write/read after the encryption key is changed.

Table 7: Error codes on the Single-character Display
Troubleshooting

<table>
<thead>
<tr>
<th>Error Code</th>
<th>Cause and Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;P&quot;</td>
<td>Write operation to a write protected cartridge has been attempted (this includes any attempt to overwrite a WORM protected tape). Ensure the tape cartridge is the correct media type. Writes to Ultrium-1, Ultrium-2, Ultrium-3, and Ultrium-4 tape cartridges are not supported in the LTO-6 Tape Drive. If the tape cartridge is the correct media type, check the write-protect switch on the cartridge. The drive will not write to a write-protected cartridge. The error code clears when you remove the tape cartridge.</td>
</tr>
<tr>
<td>&quot;J&quot;</td>
<td>Incompatible media was used. The tape drive detected an unsupported cartridge was loaded or the cartridge loaded has an incompatible format. Ensure the tape cartridge is the correct media type. See &quot;Cartridge Compatibility&quot; on page 36.</td>
</tr>
<tr>
<td>&quot;u&quot;</td>
<td>Firmware update is in progress. The drive is in the process of uploading and flashing Firmware. Do not power cycle the server.</td>
</tr>
</tbody>
</table>

Figure "8" **Mid-tape Recovery.** Drive is recovering from power cycle with tape in drive. The figure "8" is broken up with a countdown indicating progress in ten’s percentage to completion (9,8,7,6,5,4,3,2,1). Please wait until mid tape recovery ends.

Table 7: Error codes on the Single-character Display
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