IBM LTO Ultrium 4 Half High Tape Drive

Installation and User's Guide

Important:
Review the maintenance information in Chapter 3, "Operating the drive" and in the *Warranty information* document that came with the drive, because periodic maintenance is not covered by the IBM warranty. Repairs or exchanges that result from improper maintenance might result in billable service charges.

IBM LTO Ultrium 4 Half High Tape Drive

Installation and User's Guide

Note:

Before using this information and the product it supports, read the general information in Appendix B, "Notices," on page 57, the *Safety Information* and *Environmental Notices and User Guide* documents on the IBM *Documentation* CD, and the *Important Notices* and *Warranty information* documents that come with the product.

Third Edition (May 2011)

Safety

Before installing this product, read the Safety Information.

قبل تركيب هذا المنتج، يجب قراءة الملاحظات الآمنية

Antes de instalar este produto, leia as Informações de Segurança.

在安装本产品之前，请仔细阅读 Safety Information
（安全信息）。

安裝本產品之前，請先閱讀「安全資訊」。

Prije instalacije ovog produkta obavezno pročitajte Sigurnosne Upute.

Před instalací tohoto produktu si přečtěte příručku bezpečnostních instrukcí.

Læs sikkerhedsforskrifterne, før du installerer dette produkt.

Lees voordat u dit product installeert eerst de veiligheidsvoorschriften.

Ennen kuin asennat tämän tuotteen, lue turvaohjeet kohdasta Safety Information.

Avant d'installer ce produit, lisez les consignes de sécurité.

Vor der Installation dieses Produkts die Sicherheitshinweise lesen.

Πριν εγκαταστήσετε το προϊόν αυτό, διαβάστε τις πληροφορίες ασφάλειας
(safety information).

לפני שתתקינו מוצר זה, קראו את הוראות הבטיחות.

A termék telepítése előtt olvassa el a Biztonsági előírásokat!

Prima di installare questo prodotto, leggere le Informazioni sulla Sicurezza.

製品の設置の前に、安全情報をお読みください。

본 제품을 설치하기 전에 안전 정보를 읽으십시오.

Пред да се инсталира овој продукт, прочитајте информацијата за безбедност.

Les sikkerhetsinformasjonen (Safety Information) før du installerer dette produktet.

Przed zainstalowaniem tego produktu, należy zapoznać się
z książką "Informacje dotyczące bezpieczeństwa" (Safety Information).

Antes de instalar este produto, leia as Informações sobre Segurança.

Перед установкой продукта прочтите инструкции по
технике безопасности.

Pred inštaláciou tohto zariadenia si pečítaje Bezpečnostné predpisy.

Pred namestitvijo tega proizvoda preberite Varnostne informacije.

Antes de instalar este producto, lea la información de seguridad.

Läs säkerhetsinformationen innan du installerar den här produkten.

Statement 1

DANGER

Electrical current from power, telephone, and communication cables is hazardous.

To avoid a shock hazard:

- **Do not connect or disconnect any cables or perform installation, maintenance, or reconfiguration of this product during an electrical storm.**
- **Connect all power cords to a properly wired and grounded electrical outlet.**
- **Connect to properly wired outlets any equipment that will be attached to this product.**
- **When possible, use one hand only to connect or disconnect signal cables.**
- **Never turn on any equipment when there is evidence of fire, water, or structural damage.**
- **Disconnect the attached power cords, telecommunications systems, networks, and modems before you open the device covers, unless instructed otherwise in the installation and configuration procedures.**
- **Connect and disconnect cables as described in the following table when installing, moving, or opening covers on this product or attached devices.**

To Connect:	**To Disconnect:**
1. Turn everything OFF.	1. Turn everything OFF.
2. First, attach all cables to devices.	2. First, remove power cords from outlet.
3. Attach signal cables to connectors.	3. Remove signal cables from connectors.
4. Attach power cords to outlet.	4. Remove all cables from devices.
5. Turn device ON.	

Statement 3

CAUTION:
When laser products (such as CD-ROMs, DVD drives, fiber optic devices, or transmitters) are installed, note the following:

- **Do not remove the covers. Removing the covers of the laser product could result in exposure to hazardous laser radiation. There are no serviceable parts inside the device.**
- **Use of controls or adjustments or performance of procedures other than those specified herein might result in hazardous radiation exposure.**

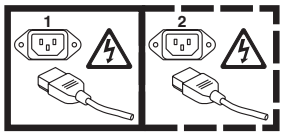
DANGER

Some laser products contain an embedded Class 3A or Class 3B laser diode. Note the following.

Laser radiation when open. Do not stare into the beam, do not view directly with optical instruments, and avoid direct exposure to the beam.

Statement 5

CAUTION:
The power control button on the device and the power switch on the power supply do not turn off the electrical current supplied to the device. The device also might have more than one power cord. To remove all electrical current from the device, ensure that all power cords are disconnected from the power source.



Statement 8

CAUTION:
Never remove the cover on a power supply or any part that has the following label attached.

Hazardous voltage, current, and energy levels are present inside any component that has this label attached. There are no serviceable parts inside these components. If you suspect a problem with one of these parts, contact a service technician.

Contents

Figures

Tables

Chapter 1. Product description

This tape drive is a high-performance, high-capacity data-storage device that is designed to back up and restore open systems applications. The drive can be integrated into any supported external tape enclosure or directly into a supported System x server. It is the fourth generation in the Ultrium series of products and is available with a Serial Attached SCSI (SAS) interface.

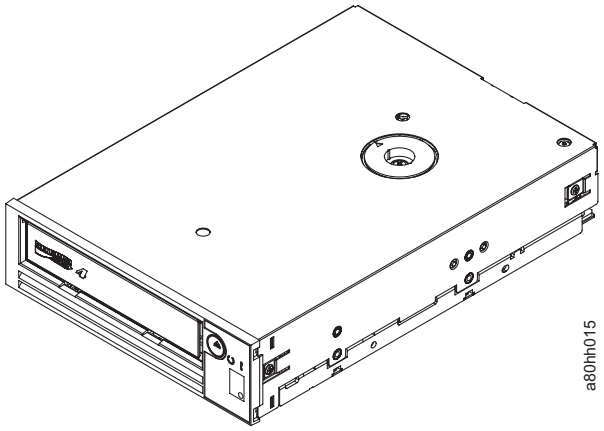


Figure 1. The IBM LTO Ultrium 4 Half High Tape Drive

The Customer Replaceable Unit (CRU) part numbers and the Option part numbers for the IBM LTO Ultrium 4 Half High Tape Drive are shown in the following list:

Table 1. CRU and Option part numbers

Description	CRU part number	Option part number
IBM Internal Half High LTO Gen 4 SAS Tape Drive	46X5672	44E8895
IBM External Half High LTO Gen 4 SAS Drive, with US line cord	95Y8007	3628L4X
IBM External Half High LTO Gen 4 SAS Drive, with no line cord	95Y8007	3628N4X
SAS cable, internal	44E8878	
Mini-SAS cable, external, 3 m x 4 plug	39R6532	
US line cord, 3 ft, 10 A / 125 V	39M5081	

Drive features

The drive offers the following features:

- Support for WORM (write once read many) on WORM cartridge types
- Native storage capacity of 800 GB per cartridge (1600 GB at 2:1 compression) when using Ultrium 4 cartridges
- Native data transfer rate of up to 120 MB per second
- Burst data transfer rate of 300 MB per second for the SAS interface
- 256 MB read-and-write cache

- Support for encryption of data on Ultrium 4 cartridges (SAS drive only)

Front panel of the drive

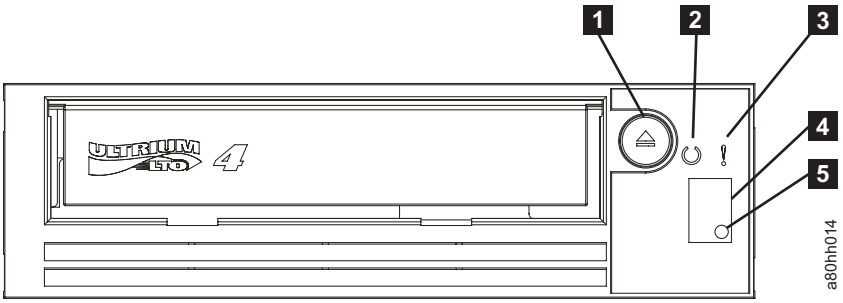


Figure 2. Front panel of the drive

1	Unload button	4	Single-character display (SCD)
2	Ready status LED	5	SCD dot
3	Fault status LED		

Rear view of the drive

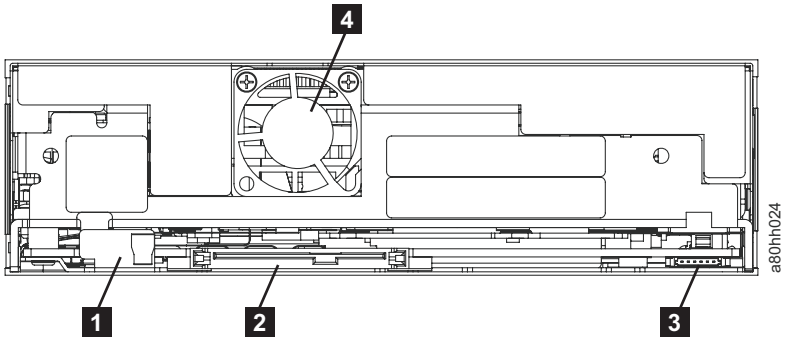


Figure 3. Rear view of the drive

1	Feature switches	3	RS-422 connector for library interfaces (LDI or ADI) selectable through feature switch 5
2	SAS and power connectors	4	Fan

Speed matching

To improve system performance, the drive uses a technique called *speed matching* to dynamically adjust its native (uncompressed) data rate to the slower data rate of a server. With speed matching, the drive operates at one of six speeds when it reads or writes the Ultrium 3 or Ultrium 4 cartridge format. Native data rates are as follows:

- Ultrium 4 (read/write): 30, 48, 66, 84, 103, or 120 MB per second (MBps)
- Ultrium 3 (read/write): 30, 40, 50, 60, 70, or 80 MBps

- Ultrium 2 (read only): 15, 19, 22, 26, or 30 MBps

If the net (compressed) data rate of the server is between two of the active data rates, the drive calculates the appropriate data rate at which to operate. Speed matching dramatically reduces *backhitch*, the condition that occurs when a tape stops, reverses, and restarts motion. A backhitch is usually the result of a mismatch between the data rates of the server and the drive.

Channel calibration

System performance is further optimized by a feature called *channel calibration*, in which the drive automatically customizes each read/write data channel to compensate for variations in such things as the transfer function of the recording channel, the media, and the characteristics of the drive head.

Encryption

The Ultrium 4 Half High Tape Drive supports host Application Managed Encryption (AME), using T10 encryption methods. Data encryption is supported with LTO Ultrium 4 Data Cartridges only.

The encryption enabled drive contains the necessary hardware and firmware to encrypt and decrypt host tape application data. Encryption policy and encryption keys are provided by the host application, and no encryption setup is required (or available) for this drive. A drive digital certificate is installed at manufacturing time. Each drive receives a unique serial number and certificate. The T10 application might validate each drive instance by checking the digital certificate of the drive.

Application-managed encryption is supported on Windows Server 2003, Linux®, and Solaris. Encryption requires the latest device drivers that are available for the tape drive. To download the latest device drivers, complete the following steps.

Note: Changes are made periodically to the IBM website. The actual procedure might vary slightly from what is described in this document.

1. Go to http://www-947.ibm.com/support/entry/portal/.
2. In the **Search within all of support & downloads** text field at the bottom of the screen, type `tape files` and press Enter.
3. In the list of search results, click the link **Tape Files (index) - Software for tape drives and libraries**.

SAS interface

A drive with a SAS (Serial Attached SCSI) interface can be linked directly to controllers. SAS provides better performance than 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 3.0 Gbps. In addition, SAS drives can be hot-plugged.

SAS drives auto-negotiate speed. There are no configurable topologies; therefore, feature switches are associated with SAS.

The drive contains a dual-port, SFF-8482 SAS connector. The SAS connector conforms to the Device Free (Plug) Connector form of the SFF-8482 standard "Unshielded Dual Port Serial Attachment Connector" as defined by the SFF

standards body. For more information, see http://www.sffcommittee.org or ftp://ftp.seagate.com/sff/SFF-8482.pdf for connector details.

Chapter 2. Installing the drive

Depending on the type of enclosure, installation procedures might vary. Refer to the enclosure documentation for drive installation. The following generic procedure can be used if the enclosure documentation is not available.

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 an enclosure, 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 in 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.

Installation overview

The following list of steps provides a brief overview of the installation process.

1. "Unpack the drive"
2. "Power off the enclosure" on page 6
3. "Set the feature switches" on page 6
4. "Mount the drive in an enclosure or server" on page 7
5. "Connect and test power to the drive" on page 8
6. "Connect the internal cable" on page 9
7. "Run drive diagnostics" on page 9
8. "Install device drivers" on page 9
9. "Connect the external interface cable (tape enclosure installations only)" on page 10
10. "Configure the drive to the server, switch, or hub" on page 10

Unpack the drive

About this task

Unpack the drive and store the packaging for future moves or shipping.

Acclimate the drive and media

About this task

Acclimation time is required if the temperature of the drive and media when unpacked is different than the temperature of its operating environment (measured at the front of the bezel near the air intake area as shown in Figure 4). The recommended acclimation time is four hours after the drive has been unpacked or one hour after any condensation that you can see has evaporated, whichever is greater. When acclimating the drive, apply the following measures:

- If the drive is colder than its operating environment and the air contains sufficient humidity, condensation might occur in the drive and damage it. When the drive has warmed to the operating temperature range (greater than 10°C or 50°F) and no danger of condensation is present (the air is dry), warm the drive more quickly by powering it on for 30 minutes. Use a diagnostic tape to test the drive before inserting a tape that contains data.
- If the drive is hotter than its operating environment, the tape can stick to the drive head. When the drive has cooled to the operating temperature range (less than 40°C or 104°F), cool the drive more quickly by applying airflow for 30 minutes. Power-on the drive and use a diagnostic tape to test it before inserting a tape that contains data.

If you are uncertain about whether the temperature of the drive is within the recommended operating range or the humidity is sufficient to cause condensation, acclimate the drive for the full four hours.

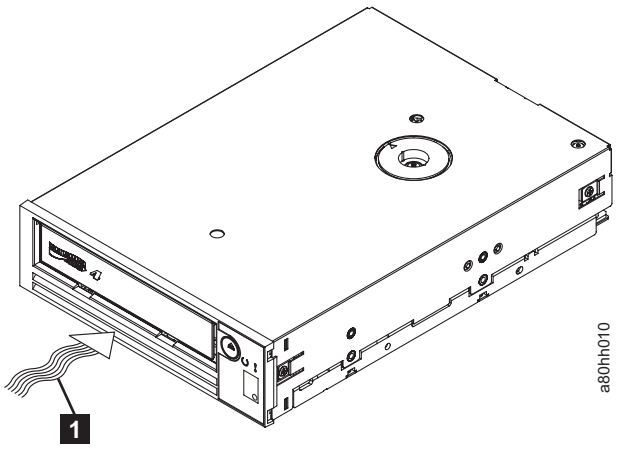


Figure 4. Temperature of the drive is taken near the air intake area [1]

Power off the enclosure

Procedure

1. Power-off the enclosure (or the unit that provides power to the drive).
2. Disconnect the power cord from both the electrical outlet and the enclosure.

Set the feature switches

The Ultrium 4 Tape Drive has eight factory-set feature switches by which the drive is configured for various functions. The feature switches are preset to the Off position at the factory but are described here in case you must change the feature-switch settings for your application.

The feature switches are on the rear panel of the tape drive. See **1** in the Figure 3 on page 2 for the location of the switches. The switches are labeled 1 through 8 and the On and Off positions are marked. The feature switches are defined in the following table.

Table 2. Feature switch definitions

Switch	On function	Off function
1	Library interface at 9 600 baud / polled	Library interface at 38 400 baud / non-polled
2	Library interface uses two stop bits	Library interface uses one stop bit
3	Reserved	Reserved
4	Library interface at 115 000 baud rate	Switch 1 active
5	Enable ADI	Enable LDI
6	Reserved	Reserved
7	Disable head brush ERP*	Enable head brush ERP*
8	Reserved	Reserved
Note: The default settings for the feature switches are all switches placed in the Off position. *The head brush error recovery procedure (ERP) is intended to prevent a permanent read or write error by removing debris that might have accumulated on the read or write head. In order to brush the head, the tape must be unthreaded to expose the head. This forces the loader to be cycled to enable re-thread. During the loader cycling, the back of the cartridge will temporarily extend beyond the front of the bezel. Extension of the cartridge is problematic in some automation environments, so you have the ability to disable this function. If the head brush ERP is disabled, the drive will immediately report the permanent error instead of activating the head brush ERP.		

Mount the drive in an enclosure or server

About this task

When you mount the drive in an enclosure, observe the following guidelines:

- Use the installation instructions for your enclosure if possible.
- Use the drive rails that come with your enclosure or server, unless you have x3400 or x3500 System x servers. Mount the drive into x3400 or x3500 System x servers using the metal rails included with your tape drive.
- Do not obstruct the ventilation slots at the rear of the drive.

Attention: When the mounting screws or drive rail prongs are inserted into the drive, they must not extend farther than 2.5 mm (0.098 in.) inside the chassis. Otherwise, they might damage the drive.

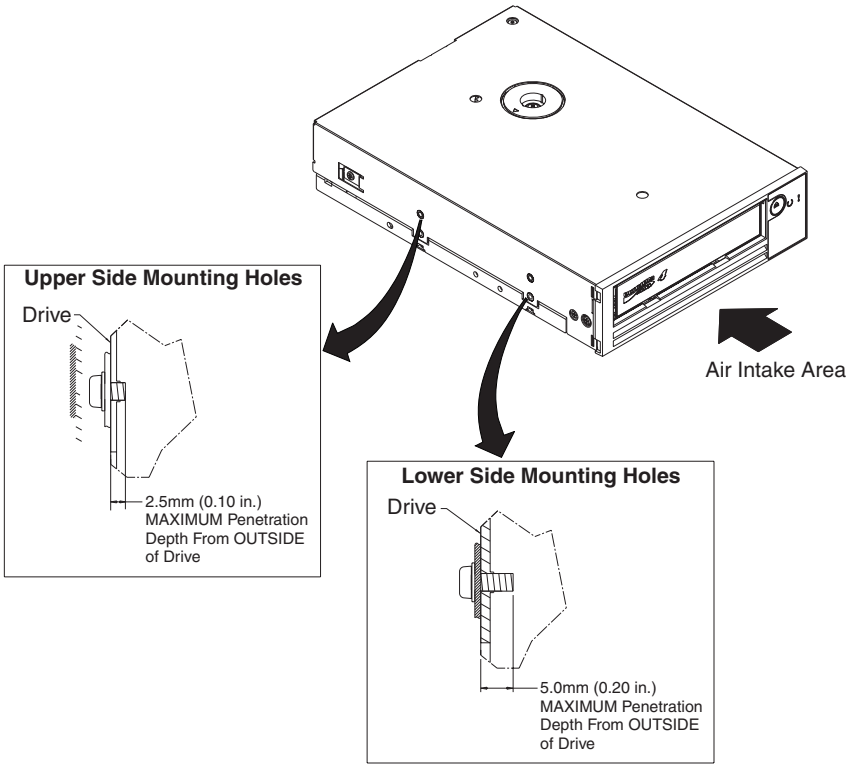


Figure 5. Mounting holes on the drive. The holes are located on both sides of the drive. The drive is shown with a front bezel.

Connect and test power to the drive

About this task

The drive does not contain its own power source; it must be powered externally.

To connect and test power to the drive, complete the following steps:

1. Ensure that the enclosure (or unit that supplies power to the drive) is powered off.
2. Ensure that the power cord is disconnected from both the enclosure and the power outlet.
3. Connect the enclosure internal power cable to the power connector on the drive (see **2** in "Rear view of the drive" on page 2).
4. Connect the power cord to the enclosure and to the electrical outlet.
5. Review the location of the single-character display (SCD) and the status LED in Figure 2 on page 2. To ensure that the drive is receiving power, watch for the following while turning on the power to the enclosure:
   - During the power-on/initialization and POST (Power-On Self Test), the SCD briefly displays

     , then becomes blank (not lit) when POST is complete and there are no POST errors. If a POST error has been detected, an error code will be displayed in the SCD and the status LED will flash amber.

Attention: If the SCD does not come on, the drive might not be getting power.

- The status LED will be OFF during the initial power-on and initialization. The status LED briefly becomes green and then becomes amber during the remainder of the power-on and initialization phase. The status LED becomes solid green after the power-on/initialization and POST are complete.

6. Power-off the enclosure.
7. Disconnect the power cord from both the enclosure and the electrical outlet.

Connect the internal cable

About this task

Connect the enclosure internal SAS cable to the SAS connector on the drive. Attach the host side (data and power) of the SAS cable included with your tape drive to the SAS and power connectors on your server. Then, attach the drive side to the drive connector (see **2** in Figure 3 on page 2).

Run drive diagnostics

Procedure

1. Replace the cover on the enclosure.
2. If you are not already connected to a power source, connect the power cord to both the enclosure and the electrical outlet.
3. Power-on the enclosure.
4. Run one or more of the following drive diagnostics:
   - "Function Code 1: Run drive diagnostics" on page 19
   - "Function Code 6: Run host interface wrap test" on page 25
   - "Function Code 7: Run RS-422 wrap test" on page 26

   If an error code appears on the single-character display (SCD), go to "Error codes and messages" on page 46. If no error appears, continue to the next step.
5. Power-off the enclosure.
6. Disconnect the power cord from both the enclosure and the electrical outlet.

Install device drivers

About this task

For information about installing device drivers, refer to the documentation for your enclosure. To download the latest device drivers, complete the following steps.

Note: Changes are made periodically to the IBM website. The actual procedure might vary slightly from what is described in this document.

1. Go to http://www-947.ibm.com/support/entry/portal/.
2. In the **Search within all of support & downloads** text field at the bottom of the screen, type `tape files` and press Enter.
3. In the list of search results, click the link **Tape Files (index) - Software for tape drives and libraries**.

Connect the external interface cable (tape enclosure installations only)

About this task

For information about connecting the enclosure, refer to the documentation for your enclosure.

Connect the external SAS interface to the server

About this task

To connect the enclosure to the SAS interface, complete the following steps:

Procedure

1. Connect the external SAS cable that ships with the drive to both the enclosure and the server (for the location of the connectors, refer to the documentation for your enclosure and server).
2. Run the appropriate SAS attachment verification procedure for your server.

Results

If you want to power a device on or off while it is connected to the same bus as a drive, you can do so if, during the power-on cycle, you quiesce all devices (including the drive) on the bus.

Configure the drive to the server, switch, or hub

About this task

To configure the drive to work with the server, refer to the documentation for that server, switch, or hub.

The drive is now ready for use.

Chapter 3. Operating the drive

Operating the drive involves using the following front panel items:

- Single-character display (SCD)
- SCD dot
- Status LED
- Unload button

Single-character display (SCD)

The SCD (**2** in Figure 2 on page 2) presents a single-character code for:

- Error conditions and informational messages
- Diagnostic or maintenance functions (while in Maintenance Mode only)

"Error codes and messages" on page 46 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.

"Diagnostic and maintenance functions" on page 16 lists the single-character codes that represent diagnostic or maintenance functions. To initiate a function, the unit must be in Maintenance Mode.

The SCD is blank during normal operation.

SCD dot

If a drive dump is present while the drive is in Maintenance Mode, a single red dot illuminates in the lower right corner of the SCD (). To copy the dump, see "Function Code 5: Copy drive dump" on page 24.

The SCD Dot is on solid if the dump is in ROM memory. The SCD Dot flashes if the dump is in FLASH memory.

The SCD Dot turns off when you obtain a dump (by using ITDT, a library command, a SCSI command, or "Function Code 5: Copy Drive Dump) or update the drive firmware.

Note: If the drive dump is stored in ROM memory (SCD Dot on solid), the dump will be lost when you turn OFF the power or reset the drive.

Status LED

The status light-emitting diode (LED) (**4** in Figure 2 on page 2) that provides information about the state of the drive. The LED can be green or amber, and (when lit) solid or flashing. Table 3 on page 12 lists the conditions of the status light and single-character display (SCD) and provides an explanation of what each condition means. The SCD dot – a small LED dot near the lower right corner of the single-character display – serves as a dump indicator. When this dot is lit, a dump file is stored in the drive and can be retrieved.

Table 3. Meaning of status LED and single-character display (SCD)

Indicator			Status condition	Action
Single-character display (red)	**"Ready" LED (green)**	**"Fault" LED (amber)**		
				
"1"	Off	On	Maximum operating temperature exceeded[1]	Reduce drive temperature.
"1" Flashing	Flashing	On	Self test is in progress	Wait for test to complete.
"2"	Off	On	Input voltage failure	Check input power connections.
"3"	Off	Flashing[2]	Drive firmware failure[3]	Update to latest level firmware.
"4"	Off	Flashing[2]	Drive firmware or hardware failure[3]	Clean drive and/or replace cartridge if needed. Retry operation. If it fails again, see SK/ASC/ASCQ in User's Guide for action.
"5"	Off	Flashing[2]	Unrecoverable drive failure	
"6"	Off	On	Drive or media failure[4]	
"6" or "7"[5]	Off	On	Cleaning cartridge loaded, clean failed	Replace cleaning cartridge, which may have expired.
"7"[5]	Off	On	Media error	Replace cartridge. Possible expired cleaning cartridge.
"8"	Off	Flashing	SAS interface failure	Check SAS cable & connector.
"A"	Off	On	Recoverable drive error[6]	Clean drive & retry operation.
"C"[7]	Off or On	On[7]	Cleaning is required (clean bit is set)	Clean drive as soon as possible.
"C"[7]	Flashing	Off	Cleaning in progress	Wait for cleaning to complete.
"F"[5]	Off	On	Incorrect firmware update tape used	Replace firmware update tape.
"H"	Off	Flashing	Firmware update failed[8]	Retry firmware update operation.
"J"[5]	Off	On	Incorrect (incompatible) media	Insert correct media type.
"P"[5]	Off	On	Media is write-protected (and write operation was attempted)	Use media not write-protected.
Segments Flashing[2]	Off	Off or On	Power-on self-test in progress	Wait 30-60 seconds.
Off	Both LEDs Flashing Together		Firmware update is in progress	Wait for update to complete.
On[9]	Flashing Rapidly[2]	On	Drive is in service mode	
3.0 sec On[10]	3.0 sec On[10]	3.0 sec On[10]	After power-on self-test and drive reset[10]	
Off or "C"[7]	Off	Off or On[7]	No cartridge is loaded	
Off or "C"[7]	Flashing[2]	Off or On[7]	Cartridge is loading or unloading	
Off or "C"[7]	On	Off or On[7]	Cartridge is loaded, no activity	
Off or "C"[7]	Flashing	Off or On[7]	Data cartridge is loaded, activity	

Table 3. Meaning of status LED and single-character display (SCD) (continued)

Indicator			Status condition	Action
Single-character display (red)	**"Ready" LED (green)**	**"Fault" LED (amber)**		
8	○	!		

Notes:

1. The "Fault" LED must be solid to indicate an overtemp condition (media temperature greater than 52°C or 125°F). If a tape is present, it must be ejected. This LED will remain on until the drive temperature drops below a lower secondary temperature limit, and one of the following two conditions is also met:
   - A data or cleaning cartridge is inserted.
   - A POR cycle or hard bus reset occurs.
2. When used in this table, "Flashing" refers to a 1 Hz (±10%) flash rate, and "Flashing Rapidly" refers to a 4 Hz (±10%) flash rate.
3. A drive dump should be stored before the drive is powered-off.
4. The failure cannot be isolated to either faulty drive or media.
5. The error code on single-character display is cleared when the cartridge is removed from the drive.
6. The error condition will be cleared when the drive is powered-off. The drive is not disabled.
7. When a drive needs cleaning, the Fault LED must be on solid and a "C" must appear on the single-character display. In most cases, the drive will continue to function, but it should be cleaned as soon as possible. A POR cycle must not turn off this indicator.
8. The firmware update failed and the drive is not functional. The drive boot code is in control and the firmware download should be retried. The drive can be identified via an INQUIRY command and is thereby bootable while in this state.
9. When the drive is in service mode, the "Fault" LED will be on solid and the single character display will indicate the current service mode state.
10. Immediately following a power-on self-test sequence or drive reset, both LEDs, all segments of the single-character display, and the SCD dot must be on solid for 3 seconds (±10%).

Unload button

The unload button (**5** in Figure 2 on page 2) performs the following functions:

Table 4. Functions that the unload button performs

Unload button function	How to initiate the function
Rewind the tape into the cartridge and eject the cartridge from the drive	Press the unload button once. The status LED flashes green while the drive is rewinding and unloading. **Note:** During a rewind and eject operation, the drive does not accept SCSI commands from the server.
Place the drive in Maintenance Mode	Ensure that the drive is unloaded. Then, within two seconds, press the unload button three times. The drive is in Maintenance Mode when the status LED becomes solid amber and 0 appears in the SCD.
Scroll through the maintenance functions	While in Maintenance Mode, press the unload button once per second to increment the display characters by one. When you reach the character of the diagnostic or maintenance function that you want (see "Diagnostic and maintenance functions" on page 16), press and hold the unload button for three seconds.

Table 4. Functions that the unload button performs (continued)

Unload button function	How to initiate the function
Exit Maintenance Mode	Press the unload button once per second until 0 displays. Then, press and hold the unload button for three seconds. Maintenance Mode is exited when the status LED becomes solid green and the SCD becomes blank.
Force a drive dump (part of the Maintenance Mode)	**Attention:** If the drive detects a permanent error and displays an error code, it automatically forces a drive dump (also known as a save of the firmware trace). If you force a drive dump, the existing dump will be overwritten and data will be lost. After you force a drive dump, do not turn off the power to the drive or you might lose the dump data. Choose one of the following procedures: • If the drive is in Maintenance Mode (status LED is solid amber), refer to "Function Code 4: Force a drive dump" on page 24. • If the drive is in Operating Mode (status LED is solid or flashing green), press and hold the unload button for ten seconds. If captured dump data exists, the drive places it into a dump area (for information about retrieving the data, see "Obtaining a drive dump" on page 52).
Reset the drive	Press and hold the unload button until the drive begins the reset procedure (SCD will display random patterns and the status LED will be amber). **Note:** If a tape cartridge is loaded in the drive, the drive will unload the tape. Repeat the "Reset the drive" procedure after the tape is unloaded. The drive saves a dump of the current drive state, then reboots to allow communication. Do not cycle power as this will erase the contents of the dump.

Inserting a tape cartridge

Before you begin

Attention: Do not leave the tape cartridge in the drive when the drive is inactive or when the power is off. Otherwise, the tape cartridge might be damaged.

About this task

To insert a tape cartridge:

Procedure

1. Ensure that the drive is powered-on.
2. Ensure that the write-protect switch on the tape cartridge is properly set.
3. Grasp the cartridge so that the write-protect switch faces you (see **1** in Figure 6 on page 15).
4. Slide the cartridge into the tape load compartment.

   Note:

   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 (turn it off, then on), the tape will reload.
   c. Do not attempt to load a cartridge when the drive is in Maintenance Mode until the drive requests it.

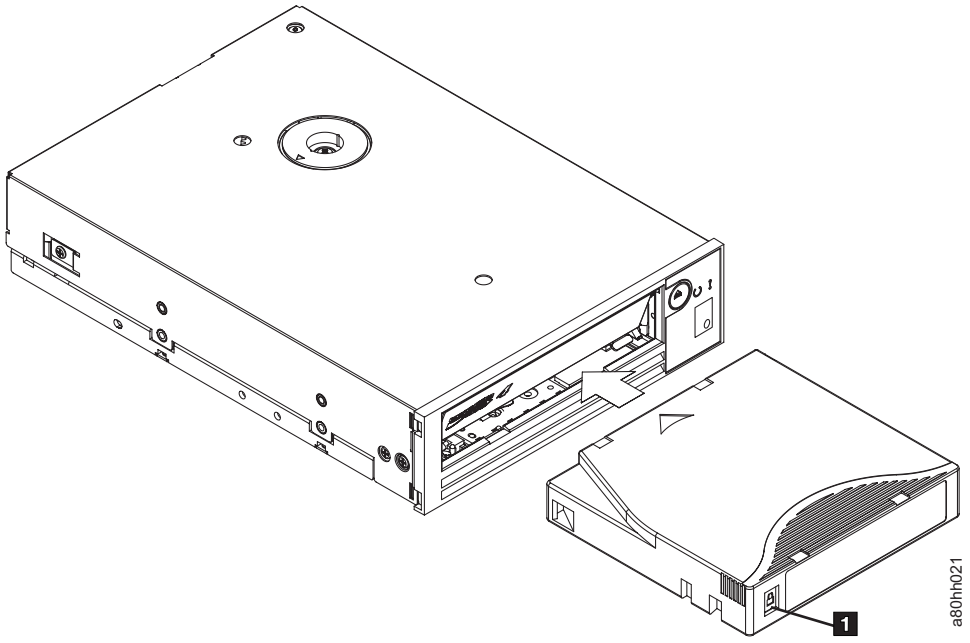


Figure 6. Inserting a cartridge into the drive

Removing a tape cartridge

About this task

To remove a tape cartridge:

Procedure

1. Ensure that the drive is powered-on.
2. Press the unload button. The drive rewinds the tape and partially ejects the cartridge. The status 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.

Results

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

Mid-tape recovery

About this task

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.

Cleaning the drive head

About this task

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

Clean the drive head whenever  displays on the single-character display and the status LED is flashing amber once per second. It is not recommended that you clean the drive head on a periodic basis; only when the drive requests to be cleaned.

Note: In Maintenance Mode, a flashing  with the **solid** amber status LED means to insert a cartridge, not clean the drive head.

To clean the head, insert the cleaning cartridge into the tape load compartment (see "Front panel of the drive" on page 2). The drive performs the cleaning automatically in less than two minutes then ejects the cartridge. The drive will perform a short Load/Unload Test while ejecting the drive. Wait for the drive to finish before removing the cartridge.

Note: The drive will automatically eject an expired cleaning cartridge.

The LTO Ultrium Cleaning Cartridge is valid for 50 uses.

Diagnostic and maintenance functions

The drive can:

- Run diagnostics
- Test write and read functions
- Test a suspect tape cartridge
- Update firmware
- Perform other diagnostic and maintenance functions

The drive must be in Maintenance Mode to perform these functions.

Attention: Maintenance functions cannot be performed concurrently with read or write operations. While in Maintenance Mode, the tape drive does not accept SCSI commands from the server. The tape drive does accept LDI or RS-422 commands.

Table 5 describes each diagnostic and maintenance function that the drive can perform, gives the function code that appears on the single-character display (SCD), and directs you to the instructions for performing the function. It is recommended that you use a customer-supplied scratch (blank) data cartridge for diagnostic testing.

Table 5. Diagnostic and maintenance functions

Function Code	Diagnostic or Maintenance Function	Instructions Location
	**Exit Maintenance Mode:** Causes the drive to become available for reading and writing data.	"Function Code 0: Maintenance Mode" on page 19

Table 5. Diagnostic and maintenance functions (continued)

Function Code	Diagnostic or Maintenance Function	Instructions Location
	**Run drive diagnostics:** Runs tests to determine whether the drive can properly load and unload cartridges, and read and write data.	"Function Code 1: Run drive diagnostics" on page 19
	**Update tape drive firmware from FMR tape:** Loads updated firmware from a field microcode replacement (FMR) tape.	"Function Code 2: Update drive firmware from FMR tape" on page 22
	**Create FMR tape:** Copies its field microcode replacement (FMR) data to a customer-supplied scratch (blank) data cartridge.	"Function Code 3: Create FMR tape" on page 23
	**Force a drive dump:** Performs a dump of data (also known as saving a microcode trace).	"Function Code 4: Force a drive dump" on page 24
	**Copy drive dump:** Copies data from a drive dump (captured by using Function Code 4) to the beginning of a customer-supplied scratch (blank) data cartridge, copies a drive dump to flash memory, or erases a dump from flash memory.	"Function Code 5: Copy drive dump" on page 24
	**Run host interface wrap test:** Performs a check of the circuitry from and to the connector.	"Function Code 6: Run host interface wrap test" on page 25
	**Run RS-422 wrap test:** This test causes the drive to perform a check of the circuitry and connector for the RS-422 interface.	"Function Code 7: Run RS-422 wrap test" on page 26
	**Unmake FMR tape:** Erases the FMR data on a customer-supplied scratch (blank) data cartridge and rewrites the cartridge memory on the tape. This turns the cartridge into a valid customer-supplied scratch data cartridge.	"Function Code 8: Unmake FMR tape" on page 27
	**Display error code log:** Displays the last 10 error codes, one at a time (the codes are ordered; the most recent is presented first and the oldest (tenth) is presented last).	"Function Code 9: Display error code log" on page 28
	**Clear error code log:** Erases the contents of the error code log.	"Function Code A: Clear error code log" on page 28
	**Insert cartridge into tape drive:** This function cannot be selected by itself, but is a part of other maintenance functions (such as Run Tape Drive Diagnostics and Create FMR Tape) that require a tape cartridge to be loaded.	"Function Code C: Insert cartridge into tape drive" on page 29
	**Test cartridge and media:** Performs tests to ensure that a suspect cartridge and its magnetic tape are acceptable.	"Function Code E: Test cartridge and media" on page 29
	**Write performance test:** Performs tests to ensure that the drive can read from and write to tape.	"Function Code F: Write performance test" on page 30
	**Test head:** Performs tests to ensure that the tape drive head and tape-carriage mechanics are working correctly.	"Function Code H: Test head" on page 31
	**Fast read/write test:** Performs tests to ensure that the drive can read from and write to tape.	"Function Code J: Fast read/write test" on page 32
	**Load/unload test:** Tests the drive ability to load and unload a tape cartridge.	"Function Code L: Load/unload test" on page 33
	**Enable post error reporting:** When selected, deferred-check conditions are reported to the host.	"Function Code P: Post error reporting enabled" on page 34

Table 5. Diagnostic and maintenance functions (continued)

Function Code	Diagnostic or Maintenance Function	Instructions Location
U	**Disable post error reporting:** When selected, deferred-check conditions are NOT reported to the host.	"Function Code U: Post error reporting disabled" on page 34

Entering Maintenance Mode

About this task

The drive must be in Maintenance Mode to run drive diagnostics or maintenance functions. To place the unit in Maintenance Mode:

Procedure

1. Make sure that no cartridge is in the drive.
2. Press the unload button three times within two seconds. 0 appears in the single-character display (SCD), and the status LED turns amber.

   Note: If a cartridge is in the tape drive, it will eject the first time that you press the unload button and the drive will not be placed in maintenance mode. To continue placing the drive in Maintenance Mode, perform the preceding step.

Results

Maintenance functions cannot be performed concurrently with read or write operations. While in Maintenance Mode, the drive does not receive SCSI commands from the server.

If a drive dump is present while the drive is in Maintenance Mode, a single red dot illuminates in the lower right corner of the SCD. Refer to "SCD dot" on page 11.

Exiting Maintenance Mode

About this task

The drive must be in Function Code 0 in order to exit Maintenance Mode.

To exit Maintenance Mode:

Procedure

1. Press the unload button once per second until 0 appears in the SCD. (If you cycle past the desired code, press the unload button once per second until the code appears.)
2. Press and hold the unload button for three or more seconds, then release it.

About this task

To exit Maintenance Mode when an error is displayed:

Procedure

1. Press the unload button three times within two seconds to clear the error code and return to Function Code  .
2. Press and hold the unload button for three or more seconds, then release it.

Results

Note: The drive will exit Maintenance Mode automatically when:

- it completes a maintenance function
- there is an error code for anything other than a hardware problem
- no action has occurred for 10 minutes

The drive will not exit Maintenance Mode automatically if there is an error code displayed that indicates there is a hardware problem.

Function Code 0: Maintenance Mode

About this task

Function Code  makes the drive available for running drive diagnostics or maintenance functions, or exiting from Maintenance Mode.

Procedure

1. Place the drive in Maintenance Mode. For instructions, see"Entering Maintenance Mode" on page 18.
2. To exit Maintenance Mode, see "Exiting Maintenance Mode" on page 18.

Results

The drive exits Maintenance Mode automatically after it completes a maintenance function or after 10 minutes if no action has occurred.

Function Code 1: Run drive diagnostics

About this task

Approximate Run Time = 20 minutes per loop

Total Number of Loops = 10

Function Code  runs tests that determine whether the drive can properly load and unload cartridges and read and write data.

Press the unload button to stop the diagnostic and exit Maintenance Mode. Pressing the unload button once will abort the test at the end of the current test loop. Pressing the unload button twice will abort the test immediately. Wait for the drive to rewind the tape and unload the cartridge.

Record the time it takes for the test to complete. Compare the recorded time with the approximate run time. If the test runs successfully but the execution time is significantly longer than the approximate run time, run "Function Code F: Write performance test" on page 30. If the Write Performance Test fails, replace the media.

Attention: For this test, insert only a scratch (blank) data cartridge or a cartridge that can be overwritten. During the test, the drive overwrites the data on the cartridge.

Note: If you inserted an invalid tape cartridge (e.g. Gen 1, WORM media, or non-FMR cartridge), error code  appears in the SCD and the amber Fault status LED flashes. If you inserted a write-protected cartridge, or the media has read-only compatibility (e.g., Gen2 media), error code  appears in the SCD. Press the unload button. The tape drive unloads the cartridge and exits Maintenance Mode after the cartridge is removed.

Procedure

1. Place the drive in Maintenance Mode. For instructions, see "Entering Maintenance Mode" on page 18.
2. Press the unload button once per second until  appears in the SCD. (If you cycle past the desired code, press the unload button once per second until the code reappears.)
3. Press and hold the unload button for three or more seconds, then release it to select function  . Wait for the SCD to change to a flashing  .
4. Insert a scratch (blank) data cartridge. The SCD changes to a flashing  and the test begins.
   - If no error is detected, the diagnostic will exit Maintenance Mode,  temporarily appears in the SCD, and the drive returns to Operational Mode (SCD blank, Green Ready/Activity status LED ON, and the Amber Fault status LED is OFF).
   - If an error is detected, the Fault status LED flashes amber and the drive posts an error code to the SCD. To determine the error, locate the code in "Error codes and messages" on page 46. To clear the error, either turn the power off and then on again, or reboot the drive by pressing and holding the unload button for 10 seconds.

Running a diagnostic self-test

Before you begin

You can use this procedure to perform a complete set of diagnostic tests on your Ultrium 4 tape drive without affecting server operation. This 4-minute test can also be used to verify the performance of an LTO tape cartridge.

About this task

To complete the diagnostic self-test, make sure that there is not a cartridge inserted in the drive and complete the following steps:

Procedure

1. Enter diagnostic mode by pressing and holding the unload button for approximately 7 seconds. Release the button when all of the drive LEDs are lit.
2. Insert a scratch (blank) LTO Ultrium-4 data cartridge within 15 seconds or the drive will revert back to operating mode. If an Ultrium-4 data cartridge is not

available, you can use a blank Ultrium-3 data cartridge. Make sure that the cartridge is not write-protected or damaged. If a cleaning cartridge is inserted while the drive is in diagnostic mode, it will be ejected.

Important: Use a blank cartridge that does not contain data. During the self-test, the cartridge will be rewritten with a test pattern and any data on the cartridge will be destroyed.

3. Read the LCD and determine the self-test results. The self-test reveals one of the following conditions:
   - **Test Passed**

     If self-testing is complete and no problems are detected, the cartridge is ejected from the drive and the LED is not lit. This means that the tape drive and the tape cartridge are functioning. The drive is no longer in diagnostic mode, and has been returned to normal operation.

     Note: If the yellow Fault LED stays lit and  is displayed, the self-test is complete and cleaning is required. For information about cleaning the drive, see Cleaning the drive head.
   - **Drive Failure**

     When a drive problem is detected, the cartridge will remain loaded, the yellow Fault LED will flash, and  is displayed.
   - **Media Failure**

     When a media problem is detected, the cartridge will remain loaded inside the drive, the yellow Fault LED will remain on, and  is displayed. Repeat the self-test using another tape cartridge, and replace the defective media.
   - **Incorrect Cartridge**

     If an incorrect tape cartridge was inserted, the cartridge is ejected, the Fault LED remains on, and  ,  , or  is displayed. The self-test cannot be performed if the inserted cartridge is one of the following:

     – Write-protected, indicated by 

     – Damaged, indicated by 

     – Not write-compatible with the drive, indicated by 

     Press the unload button to end the self-test and return the drive to normal operating mode. Run the self-test again with a compatible cartridge.
4. Press the unload button to eject the tape cartridge and return the drive to normal operation.

   Note: If the self-test did not detect a problem, the cartridge will be ejected from the drive and the LED will not be lit. The drive has been returned to normal operating mode.

Function Code 2: Update drive firmware from FMR tape

About this task

Attention: When updating drive firmware, do not power-off the drive until the update is complete or the firmware might be lost. The primary firmware update process requires update files. FMR tape updates should only be attempted if the firmware files are not available, or not working. To download the primary firmware update files, complete the following steps.

Note: Changes are made periodically to the IBM website. The actual procedure might vary slightly from what is described in this document.

1. Go to http://www-947.ibm.com/support/entry/portal/.
2. In the **Search within all of support & downloads** text field at the bottom of the screen, type `tape files` and press Enter.
3. In the list of search results, click the link **Tape Files (index) - Software for tape drives and libraries**.

Function Code  loads drive firmware from a field microcode replacement (FMR) tape. The FMR tape must have been created from a LTO Gen4 tape drive with the same host interface (SCSI U160, SCSI U320, SAS, or Fibre Channel).

Procedure

1. Place the drive in Maintenance Mode. For instructions, see "Entering Maintenance Mode" on page 18.
2. Press the unload button once per second until  appears in the SCD. (If you cycle past the desired code, press the unload button once per second until the code reappears.)
3. Press and hold the unload button for three or more seconds, then release it to select the function. The SCD changes to a flashing  .
4. Insert the FMR tape cartridge. The SCD changes to a flashing  . The tape drive loads the updated firmware from the FMR tape into its erasable programmable read-only memory (EPROM) area.
   - During the reboot, the SCD presents a series of random characters. The SCD briefly displays  , then becomes blank (not lit) when POST is complete. The status lights will be amber during the reboot and change to green after a successful reboot.
   - If the update completes successfully, the tape drive rewinds and unloads the FMR tape, resets itself, and is ready to use the new firmware. The drive automatically reboots.
   - If the update fails, the tape drive posts an error code to the SCD. To determine the error, locate the code in "Error codes and messages" on page 46. The drive then unloads the FMR tape and exits Maintenance Mode after the cartridge is removed.

Function Code 3: Create FMR tape

About this task

Function Code copies the drive field microcode replacement (FMR) data to a scratch data cartridge. The resulting FMR tape can only be used to update the firmware on other LTO Gen4 tape drives with the same host interface (SCSI U160, SCSI U320, SAS, or Fibre Channel). The primary firmware update process requires update files. FMR tape updates should only be attempted if the firmware files are not available, or not working. To download the primary firmware update files, complete the following steps.

Note: Changes are made periodically to the IBM website. The actual procedure might vary slightly from what is described in this document.

1. Go to http://www-947.ibm.com/support/entry/portal/.
2. In the **Search within all of support & downloads** text field at the bottom of the screen, type `tape files` and press Enter.
3. In the list of search results, click the link **Tape Files (index) - Software for tape drives and libraries**.

Attention: For this function, insert only a scratch (blank) data cartridge or a cartridge that can be overwritten. During the test, the drive overwrites the data on the cartridge.

Note: If you inserted an invalid tape cartridge (e.g. Gen 1, WORM media, or non-FMR cartridge), error code  appears in the SCD and the amber Fault status LED flashes. If you inserted a write-protected cartridge, or the media has read-only compatibility (e.g., Gen2 media), error code  appears in the SCD. Press the unload button. The tape drive unloads the cartridge and exits Maintenance Mode after the cartridge is removed.

Procedure

1. Place the drive in Maintenance Mode. For instructions, see “Entering Maintenance Mode” on page 18.
2. Press the unload button once per second until  appears in the SCD. (If you cycle past the desired code, press the unload button once per second until the code reappears.)
3. Press and hold the unload button for three or more seconds, then release it to select the function. The SCD changes to a flashing  .
4. Insert a scratch (blank) data cartridge that is not write protected (or the tape drive exits Maintenance Mode). The SCD changes to a flashing  . The tape drive copies the FMR data to the scratch data cartridge.
   - If the tape drive creates the FMR tape successfully, it rewinds and unloads the new tape, exits Maintenance Mode, and the tape is ready to use.
   - If the tape drive fails to create the FMR tape, it displays an error code. To determine the error, see “Error codes and messages” on page 46. The tape drive then unloads the FMR tape and exits Maintenance Mode after the cartridge is removed.

Function Code 4: Force a drive dump

About this task

Function Code 4 performs a dump of data collected by the drive (this process is also known as saving a microcode trace).

Procedure

1. Place the drive in Maintenance Mode. For instructions, see "Entering Maintenance Mode" on page 18. If a drive dump is present while the drive is in Maintenance Mode, a single red dot illuminates in the lower right corner of the SCD. Refer to "SCD dot" on page 11. The SCD Dot is on solid if the dump is in ROM memory or flashes if the dump is in FLASH memory. If the drive dump is stored in ROM memory (SCD Dot on solid), the dump will be lost when you turn OFF the power or reset the drive. The SCD Dot turns off when you obtain a dump.
2. Press the unload button once per second until 4 appears in the SCD. (If you cycle past the desired code, press the unload button once per second until the code reappears.)
3. Press and hold the unload button for three or more seconds, then release it to select the function. The drive performs the dump. The SCD shows 0, then goes blank. To access the contents of the dump, see "Function Code 5: Copy drive dump."

   Note: You can also force a drive dump when the tape drive is in normal operating mode. Simply press and hold the unload button for ten seconds. This causes the drive to reboot.

Function Code 5: Copy drive dump

About this task

Function Code 5 copies data from a drive dump (captured in Function Code 4) to the beginning of a scratch (blank) data cartridge.

Attention: For this function, insert only a scratch (blank) data cartridge or a cartridge that can be overwritten. During the test, the drive overwrites the data on the cartridge.

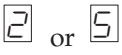
Note: If you inserted an invalid tape cartridge (e.g. Gen 1, WORM media, or non-FMR cartridge), error code 7 appears in the SCD and the amber Fault status LED flashes. If you inserted a write-protected cartridge, or the media has read-only compatibility (e.g., Gen2 media), error code P appears in the SCD. Press the unload button. The tape drive unloads the cartridge and exits Maintenance Mode after the cartridge is removed.

Procedure

1. Place the drive in Maintenance Mode. For instructions, see "Entering Maintenance Mode" on page 18. If a drive dump is present while the drive is in Maintenance Mode, a single red dot illuminates in the lower right corner of the SCD. Refer to "SCD dot" on page 11. The SCD Dot is on solid if the dump

is in ROM memory or flashes if the dump is in FLASH memory. If the drive dump is stored in ROM memory (SCD Dot on solid), the dump will be lost when you turn OFF the power or reset the drive. The SCD Dot turns off when you obtain a dump.

2. Press the unload button once per second until  appears in the SCD. If you cycle past the desired code, press the unload button once per second until the code reappears.
3. Press and hold the unload button for three or more seconds, then release it to select the function. Then, press the unload button once per second to cycle through the following functions:
   -  : no function
   -  : copy dump to tape
   -  : copy dump to flash memory
   -  : erase flash memory

   If you cycle past the desired code, press the unload button once per second until the code reappears.
4. Press and hold the unload button for three or more seconds, then release it to select one of the above functions.
5. If you selected  the drive will exit Maintenance Mode. If you selected  or  the SCD will change to a flashing  while the procedure is being performed. After the procedure is completed the drive will exit Maintenance Mode. If you selected  the SCD will change to a flashing  indicating that a data cartridge is to be inserted.
6. Insert a scratch (blank) data cartridge that is not write protected. If you do not insert a blank data cartridge, the tape drive will exit Maintenance Mode. The SCD flashes the selection number while performing the function.
   - If the copy operation completes successfully, the tape drive rewinds and unloads the tape, and exits Maintenance Mode after the cartridge is removed.
   - If the copy operation fails, an error code appears in the SCD. To determine the error, locate the code in “Error codes and messages” on page 46. The tape drive unloads the tape cartridge and exits Maintenance Mode after the cartridge is removed.

Function Code 6: Run host interface wrap test

About this task

Approximate Run Time = 10 seconds per loop

Number of Loops = This test runs until stopped by pressing the unload button.

Function Code  performs a check of the host interface circuitry and host connector on the drive. Function Code 6 is not supported on the SCSI U320.

Function Code 6 is selectable on the SCSI U320 drive but the test will always exit with  on the SCD.

Procedure

1. Make sure that the host interface wrap plug is connected to the host interface connector at the rear of the drive. A SFF-8482 SAS cable should be connected to the rear of the drive. Connect the wrap plug to the SFF-8482 SAS connector port to be tested.
2. Place the drive in Maintenance Mode. For instructions, see "Entering Maintenance Mode" on page 18.
3. Press the unload button once per second until  appears in the SCD.
4. Continue to press the unload button once per second to cycle through the following functions:
   a.  -  : exit
   b.  -  : test the primary SAS port
   c.  -  : test the secondary SAS port
   d.  -  : test both primary and secondary SAS ports at the same time (requires a wrap plug in both ports)
5. Press and hold the unload button for three or more seconds, then release it to select one of the above functions. The drive automatically starts the test. If you cycle past the desired code, press the unload button once per second until the code reappears.
6. The SCD will display a flashing  during the test.
   - If no error is detected, the diagnostic will exit Maintenance Mode,  temporarily appears in the SCD, and the drive returns to Operational Mode (SCD blank, Green Ready/Activity status LED ON, and the Amber Fault status LED is OFF).
   - If an error is detected, the Fault status LED flashes amber and the drive posts an error code to the SCD. To determine the error, locate the code in "Error codes and messages" on page 46. To clear the error, either turn the power off and then on again, or reboot the drive by pressing and holding the unload button for 10 seconds.

Function Code 7: Run RS-422 wrap test

About this task

This test causes the drive to perform a check of the circuitry and connector for the RS-422 interface. This connector supports the Library Drive Interface (LDI) and the Automation Drive Interface (ADI).

Before selecting this function, attach an LDI or RS-422 wrap plug to the drive's LDI or RS-422 connector (in place of the LDI or RS-422 cable).

Procedure

1. Make sure that no cartridge is in the drive, and the appropriate wrap plug is attached to the RS-422 connector.

2. Place the drive in Maintenance Mode. For instructions, see “Entering Maintenance Mode” on page 18.
3. Press the unload button once per second until  appears in the single-character display (SCD). If you cycle past  , continue to press the unload button until it displays again.
4. To select the function, press and hold the unload button for three seconds. After you select the function,  flashes and the drive automatically starts the test.
   - If no error is detected, the diagnostic will exit Maintenance Mode,  temporarily appears in the SCD, and the drive returns to Operational Mode (SCD blank, Green Ready/Activity status LED ON, and the Amber Fault status LED is OFF).
   - If an error is detected, the Fault status LED flashes amber and the drive posts an error code to the SCD. To determine the error, locate the code in “Error codes and messages” on page 46. To clear the error, either turn the power off and then on again, or reboot the drive by pressing and holding the unload button for 10 seconds.

Function Code 8: Unmake FMR tape

About this task

Function Code  erases the field microcode replacement (FMR) data and rewrites the cartridge memory on the tape. This converts the cartridge into a valid scratch (blank) data cartridge.

Procedure

1. Place the drive in Maintenance Mode. For instructions, see “Entering Maintenance Mode” on page 18.
2. Press the unload button once per second until  appears in the SCD. (If you cycle past the desired code, press the unload button once per second until the code reappears.)
3. Press and hold the unload button for three or more seconds, then release it to select function  . The SCD changes to a flashing  .
4. Insert the FMR data cartridge (or the tape drive exits maintenance mode). The SCD changes to a flashing  . The tape drive erases the firmware on the tape and rewrites the header in the cartridge memory to change the cartridge to a valid scratch (blank) data cartridge:

   Note: If you inserted an invalid tape cartridge (e.g. Gen 1, WORM media, or non-FMR cartridge), error code  appears in the SCD and the amber Fault status LED flashes. If you inserted a write-protected cartridge, or the media has read-only compatibility (e.g., Gen2 media), error code  appears in the SCD. Press the unload button. The tape drive unloads the cartridge and exits Maintenance Mode after the cartridge is removed.

- If no error is detected, the diagnostic will exit Maintenance Mode,  temporarily appears in the SCD, and the drive returns to Operational Mode (SCD blank, Green Ready/Activity status LED ON, and the Amber Fault status LED is OFF).
- If an error is detected, the Fault status LED flashes amber and the drive posts an error code to the SCD. To determine the error, locate the code in "Error codes and messages" on page 46. To clear the error, either turn the power off and then on again, or reboot the drive by pressing and holding the unload button for 10 seconds.

Function Code 9: Display error code log

About this task

Function Code  displays the last ten error codes, one at a time (the codes are ordered; the most recent is presented first and the oldest is presented last). If there are no errors in the log, function code  displays in the single-character display (SCD) and exits Maintenance Mode.

Procedure

1. Place the drive in Maintenance Mode. For instructions, see "Entering Maintenance Mode" on page 18.
2. Press the unload button once per second until  appears in the SCD. (If you cycle past the desired code, press the unload button once per second until the code reappears.)
3. Press and hold the unload button for three or more seconds, then release it to view the most recent error code.
4. Press the unload button again to view successive error codes. Let two to three seconds pass between each depression. The SCD will display  when all the error codes have been displayed.
5. After viewing all error codes, exit this function by pressing the unload button again. The SCD will display  and exit Maintenance Mode.

Function Code A: Clear error code log

About this task

Function Code  erases the contents of the error code log.

Procedure

1. Place the drive in Maintenance Mode. For instructions, see "Entering Maintenance Mode" on page 18.
2. Press the unload button once per second until  appears in the SCD. (If you cycle past the desired code, press the unload button once per second until the code reappears.)

3. Press and hold the unload button for three or more seconds, then release it to select the function. A flashes in the SCD, followed by 0. The tape drive erases all errors from the error code log and exits Maintenance Mode.

Function Code C: Insert cartridge into tape drive

About this task

This function cannot be selected by itself, but is part of other maintenance functions (such as Run Tape Drive Diagnostics and Create FMR Tape) that require a tape cartridge to be inserted.

Function Code E: Test cartridge and media

About this task

Approximate Run Time = 15 minutes per loop

Total Number of Loops = 10

Function Code E performs tests that determine whether a suspect cartridge and its magnetic tape are acceptable.

Press the unload button to stop the diagnostic and exit Maintenance Mode. Pressing the unload button once will abort the test at the end of the current test loop. Pressing the unload button twice will abort the test immediately. Wait for the drive to rewind the tape and unload the cartridge.

Attention: When you perform this test, data on the suspect tape will be overwritten.

Note: If you inserted an invalid tape cartridge (e.g. Gen 1, WORM media, or non-FMR cartridge), error code 7 appears in the SCD and the amber Fault status LED flashes. If you inserted a write-protected cartridge, or the media has read-only compatibility (e.g., Gen2 media), error code P appears in the SCD. Press the unload button. The tape drive unloads the cartridge and exits Maintenance Mode after the cartridge is removed.

Procedure

1. Place the drive in Maintenance Mode. For instructions, see "Entering Maintenance Mode" on page 18.
2. Press the unload button once per second until E appears in the SCD. (If you cycle past the desired code, press the unload button once per second until the code reappears.)
3. Press and hold the unload button for three or more seconds, then release it to select the function. The SCD changes to a flashing C.
4. Ensure that the write-protect switch on the suspect cartridge is off, then insert the cartridge (or the tape drive exits Maintenance Mode). The SCD changes to E. The tape drive runs the tests.

- If no error is detected, the diagnostic will exit Maintenance Mode,  temporarily appears in the SCD, and the drive returns to Operational Mode (SCD blank, Green Ready/Activity status LED ON, and the Amber Fault status LED is OFF).
- If an error is detected, the Fault status LED flashes amber and the drive posts an error code to the SCD. To determine the error, locate the code in "Error codes and messages" on page 46. To clear the error, either turn the power off and then on again, or reboot the drive by pressing and holding the unload button for 10 seconds.

Function Code F: Write performance test

About this task

Approximate Run Time = 5 minutes per loop

Total Number of Loops = 10

Function Code performs tests to ensure that the drive can read from and write to tape.

Press the unload button to stop the diagnostic and exit Maintenance Mode. Pressing the unload button once will abort the test at the end of the current test loop. Pressing the unload button twice will abort the test immediately. Wait for the drive to rewind the tape and unload the cartridge.

Attention: For this test, insert only a scratch (blank) data cartridge or a cartridge that might be overwritten. During the test, the drive overwrites the data on the cartridge.

Note: If you inserted an invalid tape cartridge (e.g. Gen 1, WORM media, or non-FMR cartridge), error code  appears in the SCD and the amber Fault status LED flashes. If you inserted a write-protected cartridge, or the media has read-only compatibility (e.g., Gen2 media), error code  appears in the SCD. Press the unload button. The tape drive unloads the cartridge and exits Maintenance Mode after the cartridge is removed.

Procedure

1. Place the drive in Maintenance Mode. For instructions, see "Entering Maintenance Mode" on page 18.
2. Press the unload button once per second until  appears in the SCD. (If you cycle past the desired code, press the unload button once per second until the code reappears.)
3. Press and hold the unload button for three or more seconds, then release it to select the function. The SCD changes to a flashing  .
4. Insert a scratch (blank) data cartridge. The SCD changes to a flashing  and the tape drive runs the tests.

Note: If you inserted an invalid tape cartridge (e.g. Gen 1, WORM media, or non-FMR cartridge), error code 7 appears in the SCD and the amber Fault status LED flashes. If you inserted a write-protected cartridge, or the media has read-only compatibility (e.g., Gen2 media), error code P appears in the SCD. Press the unload button. The tape drive unloads the cartridge and exits Maintenance Mode after the cartridge is removed.

- If no error is detected, the diagnostic will exit Maintenance Mode, 0 temporarily appears in the SCD, and the drive returns to Operational Mode (SCD blank, Green Ready/Activity status LED ON, and the Amber Fault status LED is OFF).
- If an error is detected, the Fault status LED flashes amber and the drive posts an error code to the SCD. To determine the error, locate the code in "Error codes and messages" on page 46. To clear the error, either turn the power off and then on again, or reboot the drive by pressing and holding the unload button for 10 seconds.

Function Code H: Test head

About this task

Approximate Run Time = 10 minutes per loop

Total Number of Loops = 10

Function Code H performs tests to ensure that the tape drive head and tape-carriage mechanics work correctly.

Record the time it takes for the test to complete. Compare the recorded time with the approximate run time. If the test runs successfully but the execution time is significantly longer than the approximate run time, run "Function Code F: Write performance test" on page 30. If the Write Performance Test fails, replace the media.

Press the unload button to stop the diagnostic and exit Maintenance Mode. Pressing the unload button once will abort the test at the end of the current test loop. Pressing the unload button twice will abort the test immediately. Wait for the drive to rewind the tape and unload the cartridge.

Attention: For this test, insert only a scratch (blank) data cartridge or a cartridge that can be overwritten. During the test, the drive overwrites the data on the cartridge.

Note: If you inserted an invalid tape cartridge (e.g. Gen 1, WORM media, or non-FMR cartridge), error code 7 appears in the SCD and the amber Fault status LED flashes. If you inserted a write-protected cartridge, or the media has read-only compatibility (e.g., Gen2 media), error code P appears in the SCD. Press the unload button. The tape drive unloads the cartridge and exits Maintenance Mode after the cartridge is removed.

Procedure

1. Place the drive in Maintenance Mode. For instructions, see "Entering Maintenance Mode" on page 18.
2. Press the unload button once per second until H appears in the SCD. (If you cycle past the desired code, press the unload button once per second until the code reappears.)
3. Press and hold the unload button for three or more seconds, then release it to select the function. The SCD changes to a flashing C.
4. Insert a scratch (blank) data cartridge. The SCD changes to a flashing H. The tape drive runs the tests.
   - If no error is detected, the diagnostic will exit Maintenance Mode, 0 temporarily appears in the SCD, and the drive returns to Operational Mode (SCD blank, Green Ready/Activity status LED ON, and the Amber Fault status LED is OFF).
   - If an error is detected, the Fault status LED flashes amber and the drive posts an error code to the SCD. To determine the error, locate the code in "Error codes and messages" on page 46. To clear the error, either turn the power off and then on again, or reboot the drive by pressing and holding the unload button for 10 seconds.

Function Code J: Fast read/write test

About this task

Approximate Run Time = 5 minutes per loop

Total Number of Loops = 10

Function Code J performs tests to ensure that the drive can read from and write to tape.

Record the time it takes for the test to complete. Compare the recorded time with the approximate run time. If the test runs successfully but the execution time is significantly longer than the approximate run time, run "Function Code F: Write performance test" on page 30. If the Write Performance Test fails, replace the media.

Press the unload button to stop the diagnostic and exit Maintenance Mode. Pressing the unload button once will abort the test at the end of the current test loop. Pressing the unload button twice will abort the test immediately. Wait for the drive to rewind the tape and unload the cartridge.

Attention: For this test, insert only a scratch (blank) data cartridge or a cartridge that can be overwritten. During the test, the drive overwrites the data on the cartridge.

Note: If you inserted an invalid tape cartridge (e.g. Gen 1, WORM media, or non-FMR cartridge), error code 7 appears in the SCD and the amber Fault status LED flashes. If you inserted a write-protected cartridge, or the media

has read-only compatibility (e.g., Gen2 media), error code  appears in the SCD. Press the unload button. The tape drive unloads the cartridge and exits Maintenance Mode after the cartridge is removed.

Procedure

1. Place the drive in Maintenance Mode. For instructions, see "Entering Maintenance Mode" on page 18.
2. Press the unload button once per second until  appears in the SCD. (If you cycle past the desired code, press the unload button once per second until the code reappears.)
3. Press and hold the unload button for three or more seconds, then release it to select the function. The SCD changes to a flashing  .
4. Insert a scratch (blank) data cartridge. The SCD changes to a flashing  and the tape drive runs the tests.
   - If no error is detected, the diagnostic will exit Maintenance Mode,  temporarily appears in the SCD, and the drive returns to Operational Mode (SCD blank, Green Ready/Activity status LED ON, and the Amber Fault status LED is OFF).
   - If an error is detected, the Fault status LED flashes amber and the drive posts an error code to the SCD. To determine the error, locate the code in "Error codes and messages" on page 46. To clear the error, either turn the power off and then on again, or reboot the drive by pressing and holding the unload button for 10 seconds.

Function Code L: Load/unload test

About this task

Approximate Run Time = 15 seconds per loop

Total Number of Loops = 10

Function Code  tests the drive ability to load and unload a tape cartridge.

Press the unload button to stop the diagnostic and exit Maintenance Mode. Pressing the unload button once will abort the test at the end of the current test loop. Pressing the unload button twice will abort the test immediately. Wait for the drive to rewind the tape and unload the cartridge.

Attention: Even though no data is written during this test, it is recommended that you use a blank (scratch) cartridge for this test.

Procedure

1. Place the drive in Maintenance Mode. For instructions, see "Entering Maintenance Mode" on page 18.
2. Press the unload button once per second until  appears in the SCD. (If you cycle past the desired code, press the unload button once per second until the code reappears.)

3. Press and hold the unload button for three or more seconds, then release it to select the function. The SCD changes to a flashing  .
4. Insert a scratch (blank) data cartridge. The SCD changes to a flashing  and the tape drive runs the tests.
   - If no error is detected, the diagnostic will exit Maintenance Mode,  temporarily appears in the SCD, and the drive returns to Operational Mode (SCD blank, Green Ready/Activity status LED ON, and the Amber Fault status LED is OFF).
   - If an error is detected, the Fault status LED flashes amber and the drive posts an error code to the SCD. To determine the error, locate the code in "Error codes and messages" on page 46. To clear the error, either turn the power off and then on again, or reboot the drive by pressing and holding the unload button for 10 seconds.

Function Code P: Post error reporting enabled

About this task

When Post Error Reporting is enabled, deferred-check conditions are reported to the host and temporary errors are reported in the sense data. Function Code  will be displayed in Maintenance Mode when the drive has Post Error Reporting enabled.

This selection is normally used as a request from support personnel.

Procedure

1. Place the drive in Maintenance Mode. For instructions, see "Entering Maintenance Mode" on page 18.
2. Press the unload button once per second until either  or  appears in the SCD.  or  will appear in the SCD to indicate the current setting for Post Error Reporting. If you cycle past the desired code, press the unload button once per second until the code reappears.
3. Exit Maintenance Mode if you do not want to change the current setting for Post Error Reporting. For instructions, see "Exiting Maintenance Mode" on page 18.
4. To disable Post Error Reporting, press and hold the unload button for three seconds while  appears in the SCD. The SCD changes to  after you release the unload button.
5. Press the unload button once per second to select another Maintenance Mode Function. To exit Maintenance Mode, refer to "Exiting Maintenance Mode" on page 18.

Function Code U: Post error reporting disabled

About this task

When Post Error Reporting is disabled, deferred-check conditions are not reported to the host and temporary errors are not reported in the sense data. This is the normal (default) setting for the drive. When the drive has Post Error Reporting

disabled, Function Code U will be displayed in Maintenance Mode. The drive will default to Post Error Reporting disabled after a reboot or power off/on cycle.

Procedure

1. Place the drive in Maintenance Mode. For instructions, see "Entering Maintenance Mode" on page 18.
2. Press the unload button once per second until either P or U appears in the SCD. P or U will appear in the SCD to indicate the current setting for Post Error Reporting. If you cycle past the desired code, press the unload button once per second until the code reappears.
3. Exit Maintenance Mode if you do not want to change the current setting for Post Error Reporting. For instructions, see "Exiting Maintenance Mode" on page 18.
4. To disable Post Error Reporting, press and hold the unload button for three seconds while P appears in the SCD. The SCD changes to U after you release the unload button.
5. Press the unload button once per second to select another Maintenance Mode Function. To exit Maintenance Mode, refer to "Exiting Maintenance Mode" on page 18.

Updating firmware

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

It is the customer's responsibility to ensure that this drive has the latest firmware. To download the latest firmware updates, complete the following steps.

Note: Changes are made periodically to the IBM website. The actual procedure might vary slightly from what is described in this document.

1. Go to http://www-947.ibm.com/support/entry/portal/.
2. In the **Search within all of support & downloads** text field at the bottom of the screen, type `tape files` and press Enter.
3. In the list of search results, click the link **Tape Files (index) - Software for tape drives and libraries**.

Updating firmware through the host interface

About this task

For instructions about updating firmware from a server that uses an IBM tape device driver, refer to the *IBM Tape Device Drivers Installation and User's Guide*.

Updating the firmware with an FMR tape cartridge

About this task

To update the drive firmware from an FMR tape cartridge, complete the following steps:

1. Create an FMR tape (see “Function Code 3: Create FMR tape” on page 23). A single FMR tape can be used to update multiple drives if the drives are the same drive type (e.g. LTO Gen4) and host interface (e.g. SCSI, SAS, fibre channel).
2. Update the drive firmware (see “Function Code 2: Update drive firmware from FMR tape” on page 22).

After updating the drive firmware, the FMR tape can be used as a data cartridge by using the "Unmake FMR Tape" function (see “Function Code 8: Unmake FMR tape” on page 27).

Chapter 4. Using Ultrium media

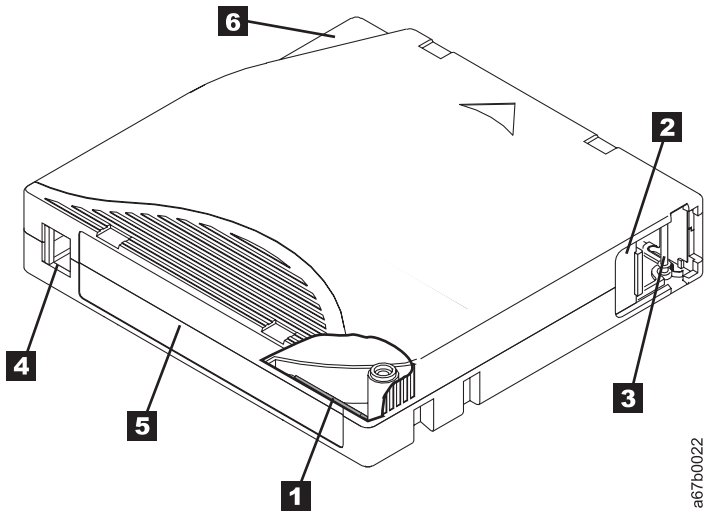


Figure 7. The LTO Ultrium Data Cartridge

1	LTO cartridge memory	A chip that contains information about the cartridge and the tape, as well as statistical information about the cartridge use. (For more information, see "Cartridge Memory chip (LTO-CM)" on page 38.)
2	Cartridge door	Protects the tape from contamination when the cartridge is out of the drive.
3	Leader pin	The tape is attached to a leader pin, behind the cartridge door. When the cartridge is inserted into the drive, a threading mechanism pulls the pin (and tape) out of the cartridge, across the drive head, and onto a non-removable take-up reel. The head can then read or write data from or to the tape.
4	Write-protect switch	Prevents data from being written to the tape cartridge. (For more information, see "Write-protect switch" on page 38.)
5	Label area	Provides a location to place a label.
6	Insertion guide	A large, notched area that prevents the cartridge from being inserted incorrectly.

Types of cartridges

Ultrium media is available in the following types:

- "Data cartridge"
- "WORM (Write Once, Read Many) cartridge" on page 39
- "Cleaning cartridge" on page 40

Data cartridge

All generations of Ultrium data cartridges contain a half-inch, dual-coat, metal-particle tape. When processing tape in the cartridges, Ultrium Tape Drives use a linear, serpentine recording format.

Each generation of data cartridge is identified by case color, native data capacity, recording format and nominal cartridge life.

Data cartridge	Case color	Native data capacity	Recording format*	Nominal cartridge life (load/unload cycles)
Ultrium 4	Green	800 GB (1600 GB at 2:1 compression)	Reads and writes data on 896 tracks, sixteen tracks at a time.	20,000
Ultrium 3	Slate Blue	400 GB (800 GB at 2:1 compression)	Reads and writes data on 704 tracks, sixteen tracks at a time	20,000
Ultrium 2	Purple	200 GB (400 GB at 2:1 compression)	Reads and writes data on 512 tracks, eight tracks at a time	10,000
Ultrium 1	Black	100 GB (200 GB at 2:1 compression)	Reads and writes data on 384 tracks, eight tracks at a time	5,000
* The first set of tracks (sixteen for Ultrium 4 and 3; eight for Ultrium 2 and 1) is written from near the beginning of the tape to near the end of the tape. The head then repositions to the next set of tracks for the return pass. This process continues until all tracks are written and the cartridge is full, or until all data is written.				

Cartridge Memory chip (LTO-CM)

All generations of the LTO Ultrium Data Cartridges include a Linear Tape-Open Cartridge Memory (LTO-CM) chip (**1** in Figure 7 on page 37), that contains information about the cartridge and the tape (such as the name of the manufacturer that created the tape), as well as statistical information about the cartridge use. The LTO-CM enhances the efficiency of the cartridge. For example, the LTO-CM stores the end-of-data location which, when the next time this cartridge is inserted and the WRITE command is issued, enables the drive to quickly locate the recording area and begin recording. The LTO-CM also aids in determining the reliability of the cartridge by storing data about its age, how many times it has been loaded, and how many errors it has accumulated. Whenever a tape cartridge is unloaded, the tape drive writes any pertinent information to the cartridge memory.

The storage capacity of the LTO Generation 4 LTO-CM is 8160 bytes. LTO Generations 1, 2, and 3 have an LTO-CM capacity of 4096 bytes.

Write-protect switch

The position of the write-protect switch on the tape cartridge (see **4** in Figure 7 on page 37) determines whether you can write to the tape. If the switch is set to:

- The locked position (solid red), data cannot be written to the tape.
- The unlocked position (black void), data can be written to the tape.

If possible, use your server application software to write-protect your cartridges (rather than manually setting the write-protect switch). This allows the server software to identify a cartridge that no longer contains current data and is eligible to become a scratch (blank) data cartridge. Do not write-protect scratch (blank) cartridges; the tape drive will not be able to write new data to them.

If you must manually set the write-protect switch, slide it left or right to the desired position.

WORM (Write Once, Read Many) cartridge

Certain records retention and data security applications require a Write Once, Read Many (WORM) method for storing data on tape. The LTO Ultrium generation 3 and 4 drives enable WORM support when a WORM tape cartridge is loaded into the drive.

Because standard read/write media are incompatible with the WORM feature, a specially formatted WORM tape cartridge (see Figure 8) is required. Each WORM cartridge has a unique, worldwide cartridge identifier (WWCID), which comprises the unique CM chip serial number and the unique tape media serial number.

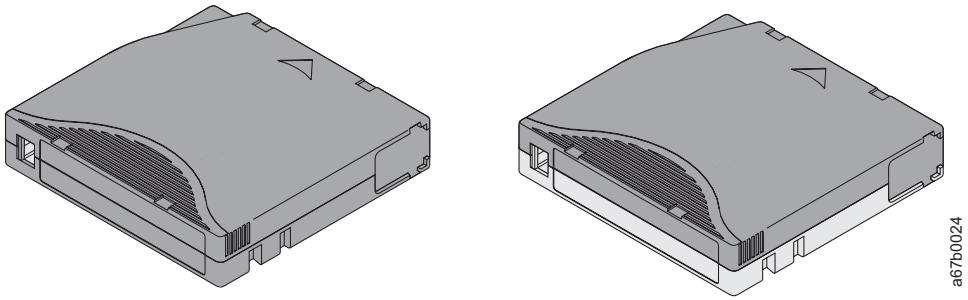


Figure 8. Ultrium Data Cartridge on the left; WORM Cartridge on the right

Type of cartridge	Case color	Native data capacity	Recording format*
Ultrium 4 WORM	Green and Silvery gray	800 GB (1600 GB at 2:1 compression)	Reads and writes data on 896 tracks, sixteen tracks at a time.
Ultrium 3 WORM	Slate Blue and Silvery gray	400 GB (800 GB at 2:1 compression)	Reads and writes data on 704 tracks, sixteen tracks at a time
* The first set of tracks (sixteen for Ultrium 4 and 3; eight for Ultrium 2 and 1) is written from near the beginning of the tape to near the end of the tape. The head then repositions to the next set of tracks for the return pass. This process continues until all tracks are written and the cartridge is full, or until all data is written.			

Data security on WORM media

Certain built-in security measures help ensure that the data written on a WORM cartridge does not become compromised, for example:

- The format of a WORM tape cartridge is unlike that of standard read/write media. This unique format prevents a drive that lacks WORM-capable firmware from writing on a WORM tape cartridge.
- When the drive senses a WORM cartridge, the firmware prohibits the changing or altering of user data already written on the tape. The firmware keeps track of the last appendable point on the tape.

WORM media errors

The following conditions cause WORM media errors to occur:

- Information in the servo manufacturer word (SMW) on the tape must match information from the cartridge memory (CM) module in the cartridge. If it does not match:
  - a full-high tape drive will post a media Error Code 7 on the single-character display (SCD)

– a library will post an error on the operator control panel

- Inserting a WORM tape cartridge into a drive that is not WORM capable causes the cartridge to be treated as an unsupported medium. The drive will report a media Error Code 7. Upgrading the drive firmware to the correct code level will resolve the problem.

Requirements for WORM capability

To add WORM capability to your LTO Ultrium generation 3 or generation 4 drive(s), drive firmware must be at the correct code level, and you must use either Ultrium 3 400 GB WORM tape cartridges or Ultrium 4 800 GB WORM tape cartridges.

Cleaning cartridge

With each library, a specially labeled LTO Ultrium Cleaning Cartridge is supplied to clean the drive head. The drive itself determines when a head needs to be cleaned. To clean the head, insert the cleaning cartridge into the tape load compartment of the drive or the Input/Output (I/O) station of the library. The cleaning is performed automatically. When the cleaning is finished, the cartridge is ejected.

Note: The drive will automatically eject an expired cleaning cartridge.

IBM cleaning cartridges are valid for 50 uses. The cartridge's LTO-CM chip tracks the number of times that the cartridge is used.

Cartridge compatibility

Table 6. Ultrium cartridge compatibility with Ultrium tape drives

Tape Drive	LTO Ultrium Data Cartridges			
	800 GB (Ultrium 4)	400 GB (Ultrium 3)	200 GB (Ultrium 2)	100 GB (Ultrium 1)
Ultrium 4	Read/Write	Read/Write	Read only	
Ultrium 3		Read/Write	Read/Write	Read only
Ultrium 2			Read/Write	Read/Write
Ultrium 1				Read/Write

Handling cartridges

Attention: Do not insert a damaged tape cartridge into the drive. A damaged cartridge can interfere with the reliability of a drive and might void the warranties of the drive and the cartridge. Before inserting a tape cartridge, inspect the cartridge case, cartridge door, and write-protect switch for breaks.

Incorrect handling or an incorrect environment can damage cartridges or their magnetic tape. To avoid damage to your tape cartridges and to ensure the continued high reliability of your LTO Ultrium Tape Drives, use the following guidelines.

Provide training

- Post procedures that describe proper media handling in places where people gather.

- Ensure that anyone who handles tape has been properly trained in handling and shipping procedures. This includes operators, users, programmers, archival services, and shipping personnel.
- Ensure that any service or contract personnel who perform archiving are properly trained in media-handling procedures.
- Include media-handling procedures as part of any services contract.
- Define and make personnel aware of data recovery procedures.

Provide proper acclimation and environmental conditions

- Before using a cartridge, let it acclimate to the normal operating environment for one hour. If condensation is visible on the cartridge, wait an additional hour.
- Ensure that all surfaces of a cartridge are dry before inserting it.
- Do not expose the cartridge to moisture or direct sunlight.
- Do not expose recorded or blank cartridges to stray magnetic fields of greater than 100 oersteds (for example, terminals, motors, video equipment, X-ray equipment, or fields that exist near high-current cables or power supplies). Such exposure can cause the loss of recorded data or make the blank cartridge unusable.
- Maintain the conditions that are described in Table 7 on page 44.

Perform a thorough inspection

After purchasing a cartridge and before using it, perform the following steps:

- Inspect the cartridge packaging to determine potential rough handling.
- When inspecting a cartridge, open only the cartridge door. Do not open any other part of the cartridge case. The upper and lower parts of the case are held together with screws; separating them destroys the usefulness of the cartridge.
- Inspect the cartridge for damage before using or storing it.
- Inspect the rear of the cartridge (the part that loads first into the tape load compartment) and ensure that there are no gaps in the seam of the cartridge case. If there are gaps in the seam (see Figure 9 on page 42), the leader pin might be dislodged.

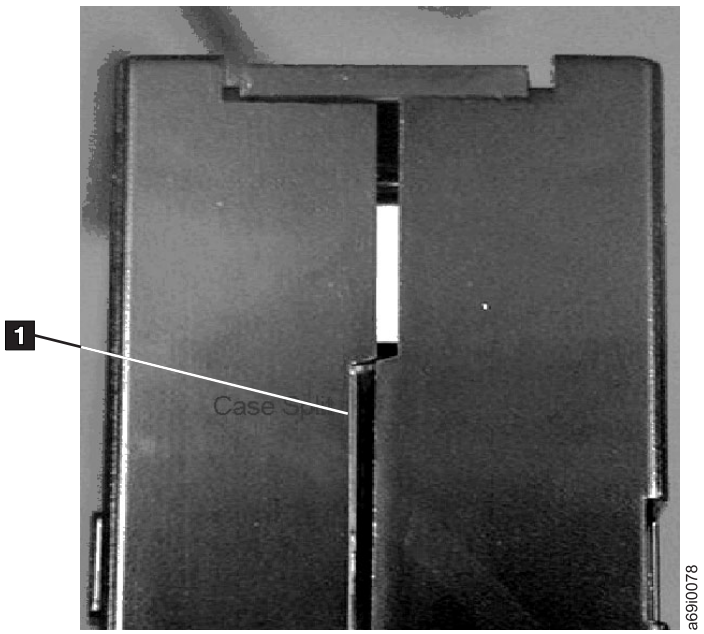


Figure 9. Checking for gaps in the seams of a cartridge

- Check that the leader pin is properly seated.
- If you suspect that the cartridge has been mishandled but it appears usable, copy any data onto a good cartridge immediately for possible data recovery. Discard the mishandled cartridge.
- Review handling and shipping procedures.

Handle the cartridge carefully

- Do not drop the cartridge. If the cartridge drops, slide the cartridge door back and ensure that the leader pin is properly seated in the pin-retaining spring clips.
- Do not handle tape that is outside the cartridge. Handling the tape can damage the tape surface or edges, which may interfere with read or write reliability. Pulling on tape that is outside the cartridge can damage the tape and the brake mechanism in the cartridge.
- Do not stack more than six cartridges.
- Do not degauss a cartridge that you intend to reuse. Degaussing makes the tape unusable.

Ensure proper packaging

- When shipping a cartridge, use the original or better packaging.
- Always ship or store a cartridge in a jewel case.
- Use only a recommended shipping container that securely holds the cartridge in its jewel case during transportation. Ultrium Turtlecases (by Perm-A-Store) have been tested and found to be satisfactory . They are available at **http://www.turtlecase.com**.

Figure 10. Tape cartridges in a Turtlecase

- Never ship a cartridge in a commercial shipping envelope. Always place it in a box or package.
- If you ship the cartridge in a cardboard box or a box of a sturdy material, ensure the following:
  - Place the cartridge in polyethylene plastic wrap or bags to protect it from dust, moisture, and other contaminants.
  - Pack the cartridge snugly; do not allow it to move around.
  - Double-box the cartridge (place it inside a box, then place that box inside the shipping box) and add padding between the two boxes.

Figure 11. Double-boxing tape cartridges for shipping

Environmental and shipping specifications for tape cartridges

Before you use a tape cartridge, acclimate it to the operating environment to prevent condensation in the drive (the time will vary, depending on the environmental extremes to which the cartridge was exposed).

The best storage container for the cartridges (until they are opened) is the original shipping container. The plastic wrapping prevents dirt from accumulating on the cartridges and partially protects them from humidity changes.

When you ship a cartridge, place it in its jewel case or in a sealed, moisture-proof bag to protect it from moisture, contaminants, and physical damage. Ship the cartridge in a shipping container that has enough packing material to cushion the cartridge and prevent it from moving within the container.

Table 7. Environmental specifications for operating, storing, and shipping the LTO Ultrium Tape Cartridge

Environmental factor	Operating	Operational storage[1]	Archival storage[2]	Shipping
Temperature	10°C to 45°C (50°F to 113°F)	16°C to 32°C (61°F to 90°F)	16°C to 25°C (61°F to 77°F)	-23°C to 49°C (-9°F to 120°F)
Relative humidity (non-condensing)	10% to 80%	20% to 80%	20% to 50%	5% to 80%
Maximum wet bulb temperature	26°C (79°F)	26°C (79°F)	26°C (79°F)	26°C (79°F)

Note:

1. The short term or operational storage environment is for storage durations of up to six months.
2. The long term or archival storage environment is for durations of six months up to ten years.
3. Local tape temperature in excess of 52°C might cause permanent tape damage.

Disposing of tape cartridges

Under the current rules of the U.S. Environmental Protection Agency (EPA), regulation 40CFR261, the LTO Ultrium Tape Cartridge is classified as non-hazardous waste. As such, it can be disposed of in the same way as normal office trash. These regulations are amended from time to time, and you should review them at the time of disposal.

If your local, state, country (non-U.S.A.), or regional regulations are more restrictive than EPA 40CFR261, you must review them before you dispose of a cartridge. Contact your account representative for information about the materials that are in the cartridge.

If a tape cartridge must be disposed of in a secure manner, you can erase the data on the cartridge by using a high-energy AC degausser (use a minimum of 4000 Oersted peak field over the entire space that the cartridge occupies). The tape should make two passes through the field at 90 degree orientation change for each pass to achieve complete erasure. Some commercial degaussers have two magnetic field regions offset 90 degrees from each other to accomplish complete erasure in one pass for higher throughput. Degaussing makes the cartridge unusable.

If you burn the cartridge and tape, ensure that the incineration complies with all applicable regulations.

Chapter 5. Resolving problems

If you encounter problems when running the drive, refer to Table 8. If the problem is not identified in Table 8, refer to “Methods of receiving errors and messages” on page 46. The color and condition of the status LED might also indicate a problem. For more information, see “Status LED” on page 11.

Table 8. Troubleshooting tips

Problem description	Corrective action
A code displays on the single-character display (SCD) and the status LED flashes amber.	The drive detected an error or is directing you to an informational message. See “Error codes and messages” on page 46. If a code displays on the single-character display (SCD) and the status LED is solid amber or off (i.e. not flashing), the drive is powering on, resetting, or in maintenance mode. See Chapter 3, “Operating the drive,” on page 11.
The status LED or SCD never turns on.	The drive has no power. Check the power at the power source. Connect power to the drive (see “Connect and test power to the drive” on page 8). If the problem persists and the power source has been verified as good, replace the drive.
The drive will not load a tape cartridge.	One of the following has occurred: • 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 status LED becomes solid green, 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 14. • The tape cartridge might be an invalid media type or the cartridge might be defective. Check that the cartridge is a valid media type (see “Types of cartridges” on page 37). Insert another valid tape cartridge. If the problem exists for multiple valid cartridges, power cycle or reboot the drive. If the power cycle or reboot is successful, run the drive diagnostics (see “Diagnostic and maintenance functions” on page 16). If the power cycle or reboot is not successful, replace the drive. • The drive has no power. Connect power to the drive (see “Connect and test power to the drive” on page 8). • The drive is in Maintenance Mode. See “Diagnostic and maintenance functions” on page 16.
The drive will not unload the tape cartridge.	• Make sure the tape is not in use. If an application is reading, writing, or rewinding a tape, or processing during a power-on or reboot, the tape will not unload immediately. Wait for the operation to complete. • If the tape is stuck or broken, press the unload button. If the cartridge does not eject, turn off the power to the drive, 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 service representative.
The server received TapeAlert flags.	For more information, see Appendix D, “TapeAlert flags supported by the drive,” on page 67.
The server reported SCSI problems (such as selection or command time-outs, or parity errors).	See your server documentation.

Table 8. Troubleshooting tips (continued)

Problem description	Corrective action
Codes display on the SCD, but the status LED does not turn on.	The status LED does not turn on immediately during a power-on or reboot. During the power-on or reboot, random patterns will display on the SCD while the status LED is not on. If a code displays on the SCD, but the status LED does not turn on, refer to "Error codes and messages."
The drive does not respond to server commands.	Press and hold the unload button on the drive for ten seconds to force a drive dump. The drive will save the dump and then reboot to allow communication to the drive to occur. Do not cycle power, as this will erase the contents of the dump.

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.

Note: The codes on the single-character display (SCD) have different meanings, depending on whether they display during normal operations or while the drive is in Maintenance Mode. Codes that occur during normal operations are defined in "Error codes and messages." Codes that occur while in maintenance mode are defined in "Diagnostic and maintenance functions" on page 16.

Table 9. Methods of receiving errors and messages

Source of error or message display	Corrective action
The enclosure display (if the drive is enclosed in a library or autoloader)	Refer to the documentation for the enclosure.
The drive SCD and the Fault status LED flashes amber	See "Error codes and messages." To determine the meaning of status LED activity, see "Status LED" on page 11.
The drive SCD and the Fault status LED is solid amber	See "Diagnostic and maintenance functions" on page 16. To determine the meaning of status LED activity, see "Status LED" on page 11.
SCSI log sense data (such as TapeAlert flags) and SCSI drive sense data at the server console	See "Error codes and messages."
Drive sense data sent to a library (if the drive is enclosed in a library)	Refer to your library documentation, then see "Error codes and messages."
The drive error log	See "Error codes and messages" and "Viewing the drive error log" on page 53.

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 LED (Green Ready/Activity status LED 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.
- To clear the error code displayed on the SCD and power cycle the drive, press the unload button for ten seconds. A drive dump will be created.

Attention: If the drive detects a permanent error and displays an error code other than  , it automatically performs a drive dump. If you force a drive dump, the existing dump will be overwritten and data will be lost. After you force a drive dump, do not turn off the power to the drive or you might lose the dump data.

Table 10. Error codes on the single-character display

Error Code	Cause and Action
	**No error occurred and no action is required.** This code displays when diagnostics have finished running and no error occurred. **Note:** The single-character display is blank during normal operation of the tape drive.
	**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 (see Appendix C, “Specifications,” on page 65). Clear the error code by power cycling the tape drive or placing the drive in Maintenance Mode. If the operating temperature and airflow are within the specified range and the problem persists, replace the drive.
	**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 actions: 1. Ensure that the power connector is properly seated. 2. Ensure that the proper dc voltages are being applied within the tolerances allowed (see Appendix C, “Specifications,” on page 65). 3. If the proper voltages are not being applied, service the power supply. 4. If the proper voltages are being applied, power off/on the tape drive to see if the problem repeats. 5. Replace the tape drive if the problem persists. The error code clears when you place the tape drive in Maintenance Mode.
	**Firmware problem.** The tape drive determined that a firmware error occurred. Perform the following actions: 1. Collect a drive dump from one of the following: **Note:** Do not force a new dump; the tape drive has already created one. • Server host interface by using a device driver utility or system tool • Ultrium Tape Drive (to copy and read a drive dump, use “Function Code 5: Copy drive dump” on page 24) 2. Power the tape drive off and on, then retry the operation that produced the error. 3. If the problem persists, download new firmware by completing the following steps. **Note:** Changes are made periodically to the IBM website. The actual procedure might vary slightly from what is described in this document. a. Go to http://www.ibm.com/systems/support/. b. Under **Product support**, click **Hardware upgrades**. c. Under **Popular links**, click **Tape files** to display the matrix of downloadable files for tape drives. d. Download the appropriate files and retry the operation. 4. If the problem persists, send the drive dump that you collected in step 1 to your IBM support representative. The error code clears when you place the tape drive in Maintenance Mode.

Table 10. Error codes on the single-character display (continued)

Error Code	Cause and Action
4	**Firmware or hardware problem.** The tape drive determined that a firmware or tape drive hardware failure occurred. Perform the following actions: 1. Collect a drive dump from one of the following: **Note:** Do not force a new dump; one already exists. • Server host interface by using a device driver utility or system tool • Ultrium Tape Drive (to copy and read a drive dump, use "Function Code 5: Copy drive dump" on page 24) 2. Power the tape drive off and on, then retry the operation that produced the error. The error code clears when you place the tape drive in Maintenance Mode. 3. If the problem persists, download new firmware and retry the operation; if new firmware is not available, replace the drive.
5	**Tape drive hardware problem.** 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 might clear when you cycle power to the tape drive or place it in Maintenance Mode. If the problem persists, replace the drive. **Note:** Copy the drive dump to flash memory before returning the drive. For instructions, refer to "Function Code 5: Copy drive dump" on page 24.
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 tape cartridges are not supported in the Ultrium 4 Half High Tape Drive. • Drive will not accept an expired Cleaning Cartridge. • Drive will not accept a WORM cartridge when running diagnostic tests in Maintenance Mode. • 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 actions: **For problems with writing data:** If the problem occurred while the tape drive was writing data to the tape, retry the operation with a different cartridge: • If the operation succeeds, the original cartridge was defective. Copy data from the defective cartridge and discard it. • If the operation fails and another tape drive is available, insert the cartridge into the other unit and retry the operation. – If the operation fails, discard the defective cartridge. – If the operation succeeds, insert a scratch data cartridge into the first unit and run "Function Code 1: Run drive diagnostics" on page 19. - If the diagnostics fail, replace the tape drive. - If the diagnostics succeed, the error was temporary. • If the operation fails and another tape drive is not available, insert a scratch data cartridge into the unit and run "Function Code 1: Run drive diagnostics" on page 19. – If the diagnostics fail, replace the tape drive. – If the diagnostics succeed, discard the cartridge.

Table 10. Error codes on the single-character display (continued)

Error Code	Cause and Action
	If the problem occurs with multiple tape cartridges, run "Function Code 1: Run drive diagnostics" on page 19: • If the diagnostics fail, replace the tape drive. • If the diagnostics succeed, run"Function Code H: Test head" on page 31. – If the diagnostic fails, replace the tape drive. – If the diagnostic succeeds, replace the cartridges that caused the problem. The error code clears when you remove the tape cartridge or place the tape drive in Maintenance Mode. **For problems with reading data:** If the problem occurred while the tape drive was reading data from the tape, perform one of the following procedures: • If another tape drive is available, insert the cartridge into the other unit and retry the operation: – If the operation fails, discard the defective cartridge. – If the operation succeeds, insert a scratch data cartridge into the first unit and run "Function Code 1: Run drive diagnostics" on page 19: - If the diagnostic fails, replace the tape drive. - If the diagnostic succeeds, the error was temporary. • If another tape drive is not available, insert a scratch data cartridge into the unit and run "Function Code 1: Run drive diagnostics" on page 19: – If the diagnostic fails, replace the tape drive. – If the diagnostic succeeds, discard the cartridge. If the problem occurs with multiple tape cartridges, run "Function Code 1: Run drive diagnostics" on page 19: • If the diagnostic fails, replace the tape drive. • If the diagnostic succeeds, run "Function Code H: Test head" on page 31. – If the diagnostic fails, replace the tape drive. – If the diagnostic succeeds, replace the cartridges that caused the problem. The error code clears when you remove the tape cartridge or place the tape drive in Maintenance Mode.

Table 10. Error codes on the single-character display (continued)

Error Code	Cause and Action
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 tape cartridges are not supported by the Ultrium 4 Half High Tape Drive. • Drive will not accept an expired Cleaning Cartridge. • Drive will not accept a WORM cartridge when running diagnostic tests in Maintenance Mode. • Drive will not accept an FMR tape unless the drive is performing “Function Code 8: Unmake FMR tape” on page 27. • 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. If possible, run the tape cartridge in a different tape drive. If the operation in the other unit fails and 6 or 7 displays, replace the media. If the operation succeeds, run “Function Code E: Test cartridge and media” on page 29. **Attention:** When you run the Test Cartridge and Media diagnostic, data on the suspect tape is overwritten. Use only a scratch data cartridge to run the test. • If the diagnostic fails, replace the media. • If the diagnostic succeeds, clean the drive head (see “Cleaning the drive head” on page 16) and run “Function Code 1: Run drive diagnostics” on page 19. – If the drive diagnostic fails, replace the drive. – If the drive diagnostic succeeds, perform the operation that produced the initial media error. The error code clears when you remove the tape cartridge or place the tape drive in Maintenance Mode.
8	**Interface problem.** The tape drive determined that a failure occurred in the tape drive hardware or in the host bus. See Chapter 5, “Resolving problems,” on page 45. If 8 was displayed while running "Function Code 6: Host Interface Test": 1. Verify the correct interface wrap tool was attached during the test. The test will fail if the correct interface wrap tool is not attached. 2. If the correct interface wrap tool was attached during the test, replace the drive. The error code clears when you place the tape drive in Maintenance Mode.
9	**Tape drive or RS-422 error.** The tape drive determined that a failure occurred in the tape drive hardware or in the RS-422 connection. See “Function Code 7: Run RS-422 wrap test” on page 26 or refer to the Library procedures to isolate the problem to the drive. The error code clears when you place the tape drive in Maintenance Mode.

Table 10. Error codes on the single-character display (continued)

Error Code	Cause and Action
A	**Degraded operation.** The tape drive determined that a problem occurred that 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. **Note:** The drive is usable, though the single-character display continues to indicate an error and the Fault status LED flashes amber. The error code might clear when you cycle power to the tape drive or place it in Maintenance Mode. To determine if the problem is with the drive hardware or the tape media, perform the following procedures: 1. If possible, run the tape cartridge in a different drive. If the operation in the other drive fails and 6 or 7 displays, replace the media. If the operation succeeds, run the Test Cartridge and Media diagnostic (see "Function Code E: Test cartridge and media" on page 29). 2. If the Test Cartridge and Media diagnostic fails, replace the media. If it runs successfully, clean the failing drive and run the drive diagnostics (see "Cleaning the drive head" on page 16 and "Function Code 1: Run drive diagnostics" on page 19). Record the time it takes for the test to complete. Compare the recorded time with the approximate run time. If the test runs successfully but the execution time is significantly longer than the approximate run time, run "Function Code F: Write performance test" on page 30. If the Write Performance Test fails, replace the media. If the drive diagnostics run successfully, perform the operation that produced the initial drive error. 3. If the problem persists, replace the drive. If it is not possible to run the tape cartridge in a different drive, perform the following procedures: 1. Clean the failing drive and run the drive diagnostics (see "Cleaning the drive head" on page 16 and "Function Code 1: Run drive diagnostics" on page 19). Record the time it takes for the test to complete. Compare the recorded time with the approximate run time. If the test runs successfully but the execution time is significantly longer than the approximate run time, run "Function Code F: Write performance test" on page 30. If the Write Performance Test fails, replace the media. If the drive diagnostics run successfully, run the Test Cartridge and Media diagnostic (see "Function Code E: Test cartridge and media" on page 29). 2. If the Test Cartridge and Media diagnostic fails, replace the media. If it runs successfully, perform the operation that produced the initial drive error. 3. If the problem persists, replace the drive.
C	**The tape drive needs to be cleaned.** Clean the tape drive. See "Cleaning the drive head" on page 16. The error code clears when you clean the tape drive or place it in Maintenance Mode.

Table 10. Error codes on the single-character display (continued)

Error Code	Cause and Action
E	**Encryption error.** Displayed when the drive detects an error associated with an encryption operation. If the problem occurred while the tape drive was writing data to or reading data from, the tape: 1. Check the host application to ensure the host application is providing the correct encryption key. • Refer to the *IBM Tape Device Drivers Encryption Support* documentation and the *IBM LTO Ultrium Tape Drive SCSI Reference* documentation for the Sense Data returned for an encryption operation. • Retry the encryption operation after the host application problems have been resolved. 2. Check the operation of the tape drive by resetting the drive and running POST. See Table 4 on page 13. • 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 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, or when the drive is placed in Maintenance Mode.
P	**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 2 tape cartridges are not supported in the Ultrium 4 Half High 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 or place the tape drive in Maintenance Mode.
	Broken tape. If a tape is stuck in the drive, return the drive to IBM for tape removal and recovery. See Information for authorized service personnel for information about removing a SAS tape drive from an enclosure.

Obtaining a drive dump

You can obtain a drive dump by selecting a function code on the drive or by using a device driver utility (or a system tool) on the server. The sections that follow describe each method.

Using the drive

About this task

To obtain a drive dump directly from the drive:

Procedure

1. Make sure that no cartridge is in the drive.
2. Enter Maintenance Mode, see "Entering Maintenance Mode" on page 18.
3. Copy the drive dump to a scratch (blank) data cartridge. See "Function Code 5: Copy drive dump" on page 24.
4. Insert the tape into a drive.

5. From the server, issue the SCSI READ command to read the dump from the tape to a file or electronic image (you may need to issue the command several times to read the complete dump).
6. To determine where to send the file for analysis, contact your OEM Product Application Engineer (PAE).

Using a device driver utility

About this task

To obtain a drive dump by using a device driver utility, determine whether your server is installed with a utility that can read files from the server memory. If it is, use that utility to obtain the drive dump.

For information about using IBM utility programs to obtain drive dumps, see the *IBM Ultrium Device Drivers Installation and User's Guide*.

To determine where to send a file that contains a drive dump to be analyzed, contact your OEM Product Application Engineer (PAE).

Viewing the drive error log

About this task

The drive keeps an error log that you can use to identify and correct errors. The log contains the 10 most recent error codes, which appear (one at a time) on the single-character display (SCD).

To view the drive error log:

Procedure

1. Make sure that no cartridge is in the drive.
2. Within two seconds, press the unload button three times. The status LED becomes solid amber, which means that the drive is in Maintenance Mode.
3. Press the unload button once per second until  appears in the SCD.
4. Press and hold the unload button for three seconds to view the most recent error code.
5. Refer to "Error codes and messages" on page 46 to determine the meaning of the code and the action to take.
6. Press the unload button to view the next error code. (The codes are ordered; the most recent is presented first and the oldest (tenth) is presented last.)
7. Continue to press the unload button until the ten error codes have been displayed. After you display the tenth error code, the drive automatically exits Maintenance Mode.

Results

Resolving problems reported by the server

The procedure for fixing interface bus errors varies, depending on whether the error is consistent or intermittent, and whether your configuration contains single or multiple drives.

Replacing the tape drive

The drive is a Tier 1 customer replaceable unit (CRU). Replacement of Tier 1 CRUs is your responsibility. If IBM installs a Tier 1 CRU at your request, you will be charged for the installation.

For more information about the terms of the warranty and getting service and assistance, see the *Warranty information* document that came with the tape drive.

If you are instructed to return a component, follow all packaging instructions, and use any packaging materials for shipping that are supplied to you.

The following table lists the replaceable components.

Table 11. CRU and Option part numbers

Description	CRU part number	Option part number
IBM Internal Half High LTO Gen 4 SAS Tape Drive	46X5672	44E8895
IBM External Half High LTO Gen 4 SAS Drive, with US line cord	95Y8007	3628L4X
IBM External Half High LTO Gen 4 SAS Drive, with no line cord	95Y8007	3628N4X
SAS cable, internal	44E8878	
Mini-SAS cable, external, 3 m x 4 plug	39R6532	
US line cord, 3 ft, 10 A / 125 V	39M5081	

Appendix A. Getting help and technical assistance

If you need help, service, or technical assistance or just want more information about IBM® products, you will find a wide variety of sources available from IBM to assist you. This section contains information about where to go for additional information about IBM and IBM products, what to do if you experience a problem with your system, and whom to call for service, if it is necessary.

Before you call

Before you call, make sure that you have taken these steps to try to solve the problem yourself:

- Check all cables to make sure that they are connected.
- Check the power switches to make sure that the system and any optional devices are turned on.
- Use the troubleshooting information in your system documentation, and use the diagnostic tools that come with your system. Information about diagnostic tools is in the *Problem Determination and Service Guide* on the IBM *Documentation* CD that comes with your system.
- Go to the IBM support website at http://www.ibm.com/supportportal/ to check for technical information, hints, tips, and new device drivers or to submit a request for information.

You can solve many problems without outside assistance by following the troubleshooting procedures that IBM provides in the online help or in the documentation that is provided with your IBM product. The documentation that comes with IBM systems also describes the diagnostic tests that you can perform. Most systems, operating systems, and programs come with documentation that contains troubleshooting procedures and explanations of error messages and error codes. If you suspect a software problem, see the documentation for the operating system or program.

Using the documentation

Information about your IBM system and preinstalled software, if any, or optional device is available in the documentation that comes with the product. That documentation can include printed documents, online documents, readme files, and help files. See the troubleshooting information in your system documentation for instructions for using the diagnostic programs. The troubleshooting information or the diagnostic programs might tell you that you need additional or updated device drivers or other software. IBM maintains pages on the World Wide Web where you can get the latest technical information and download device drivers and updates. To access these pages, go to http://www.ibm.com/supportportal/ and follow the instructions. Also, some documents are available through the IBM Publications Center at http://www.ibm.com/shop/publications/order/.

Getting help and information from the World Wide Web

On the World Wide Web, the IBM website has up-to-date information about IBM systems, optional devices, services, and support. The address for IBM System x® and xSeries® information is http://www.ibm.com/systems/x/. The address for IBM BladeCenter® information is http://www.ibm.com/systems/bladecenter/. The address for IBM IntelliStation® information is http://www.ibm.com/systems/intellistation/.

You can find service information for IBM systems and optional devices at http://www.ibm.com/supportportal/.

Software service and support

Through IBM Support Line, you can get telephone assistance, for a fee, with usage, configuration, and software problems with System x and xSeries servers, BladeCenter products, IntelliStation workstations, and appliances. For information about which products are supported by Support Line in your country or region, see http://www.ibm.com/services/supline/products/.

For more information about Support Line and other IBM services, see http://www.ibm.com/services/, or see http://www.ibm.com/planetwide/ for support telephone numbers. In the U.S. and Canada, call 1-800-IBM-SERV (1-800-426-7378).

Hardware service and support

You can receive hardware service through your IBM reseller or IBM Services. To locate a reseller authorized by IBM to provide warranty service, go to http://www.ibm.com/partnerworld/ and click **Find Business Partners** on the right side of the page. For IBM support telephone numbers, see http://www.ibm.com/planetwide/. In the U.S. and Canada, call 1-800-IBM-SERV (1-800-426-7378).

In the U.S. and Canada, hardware service and support is available 24 hours a day, 7 days a week. In the U.K., these services are available Monday through Friday, from 9 a.m. to 6 p.m.

IBM Taiwan product service

台灣 IBM 產品服務聯絡方式：
台灣國際商業機器股份有限公司
台北市松仁路 7 號 3 樓
電話：0800-016-888

IBM Taiwan product service contact information:
IBM Taiwan Corporation
3F, No 7, Song Ren Rd.
Taipei, Taiwan
Telephone: 0800-016-888

Appendix B. Notices

This information was developed for products and services offered in the U.S.A.

IBM may not offer the products, services, or features discussed in this document in other countries. Consult your local IBM representative for information on the products and services currently available in your area. Any reference to an IBM product, program, or service is not intended to state or imply that only that IBM product, program, or service may be used. Any functionally equivalent product, program, or service that does not infringe any IBM intellectual property right may be used instead. However, it is the user's responsibility to evaluate and verify the operation of any non-IBM product, program, or service.

IBM may have patents or pending patent applications covering subject matter described in this document. The furnishing of this document does not give you any license to these patents. You can send license inquiries, in writing, to:

IBM Director of Licensing
IBM Corporation
North Castle Drive
Armonk, NY 10504-1785
U.S.A.

INTERNATIONAL BUSINESS MACHINES CORPORATION PROVIDES THIS PUBLICATION "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF NON-INFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Some states do not allow disclaimer of express or implied warranties in certain transactions, therefore, this statement may not apply to you.

This information could include technical inaccuracies or typographical errors. Changes are periodically made to the information herein; these changes will be incorporated in new editions of the publication. IBM may make improvements and/or changes in the product(s) and/or the program(s) described in this publication at any time without notice.

Any references in this information to non-IBM websites are provided for convenience only and do not in any manner serve as an endorsement of those websites. The materials at those websites are not part of the materials for this IBM product, and use of those websites is at your own risk.

IBM may use or distribute any of the information you supply in any way it believes appropriate without incurring any obligation to you.

Trademarks

The following terms are trademarks of International Business Machines Corporation in the United States, other countries, or both:

IBM
IBM logo
System x
xSeries

Microsoft, Windows, and Windows NT are trademarks of Microsoft Corporation in the United States, other countries, or both.

Adobe and PostScript are either registered trademarks or trademarks of Adobe Systems Incorporated in the United States, other countries, or both.

Linux is a registered trademark of Linus Torvalds in the United States, other countries, or both.

Other company, product, or service names may be trademarks or service marks of others.

Important notes

Processor speed indicates the internal clock speed of the microprocessor; other factors also affect application performance.

CD or DVD drive speed is the variable read rate. Actual speeds vary and are often less than the possible maximum.

When referring to processor storage, real and virtual storage, or channel volume, KB stands for 1024 bytes, MB stands for 1 048 576 bytes, and GB stands for 1 073 741 824 bytes.

When referring to hard disk drive capacity or communications volume, MB stands for 1 000 000 bytes, and GB stands for 1 000 000 000 bytes. Total user-accessible capacity can vary depending on operating environments.

Maximum internal hard disk drive capacities assume the replacement of any standard hard disk drives and population of all hard disk drive bays with the largest currently supported drives that are available from IBM.

Maximum memory might require replacement of the standard memory with an optional memory module.

IBM makes no representation or warranties regarding non-IBM products and services that are ServerProven®, including but not limited to the implied warranties of merchantability and fitness for a particular purpose. These products are offered and warranted solely by third parties.

IBM makes no representations or warranties with respect to non-IBM products. Support (if any) for the non-IBM products is provided by the third party, not IBM.

Some software might differ from its retail version (if available) and might not include user manuals or all program functionality.

Particulate contamination

Attention: Airborne particulates (including metal flakes or particles) and reactive gases acting alone or in combination with other environmental factors such as humidity or temperature might pose a risk to the tape drive that is described in this document. Risks that are posed by the presence of excessive particulate levels or concentrations of harmful gases include damage that might cause the tape drive to malfunction or cease functioning altogether. This specification sets forth limits for particulates and gases that are intended to avoid such damage. The limits must not be viewed or used as definitive limits, because numerous other factors, such as temperature or moisture content of the air, can influence the impact of particulates or environmental corrosives and gaseous contaminant transfer. In the absence of specific limits that are set forth in this document, you must implement practices that maintain particulate and gas levels that are consistent with the protection of human health and safety. If IBM determines that the levels of particulates or gases in your environment have caused damage to the tape drive, IBM may condition provision of repair or replacement of tape drive or parts on implementation of appropriate remedial measures to mitigate such environmental contamination. Implementation of such remedial measures is a customer responsibility.

Table 12. Limits for particulates and gases

Contaminant	Limits
Particulate	• The room air must be continuously filtered with 40% atmospheric dust spot efficiency (MERV 9) according to ASHRAE Standard 52.2[1]. • Air that enters a data center must be filtered to 99.97% efficiency or greater, using high-efficiency particulate air (HEPA) filters that meet MIL-STD-282. • The deliquescent relative humidity of the particulate contamination must be more than 60%[2]. • The room must be free of conductive contamination such as zinc whiskers.
Gaseous	• Copper: Class G1 as per ANSI/ISA 71.04-1985[3] • Silver: Corrosion rate of less than 300 Å in 30 days

[1] ASHRAE 52.2-2008 - *Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size*. Atlanta: American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.

[2] The deliquescent relative humidity of particulate contamination is the relative humidity at which the dust absorbs enough water to become wet and promote ionic conduction.

[3] ANSI/ISA-71.04-1985. *Environmental conditions for process measurement and control systems: Airborne contaminants*. Instrument Society of America, Research Triangle Park, North Carolina, U.S.A.

Documentation format

The publications for this product are in Adobe Portable Document Format (PDF) and should be compliant with accessibility standards. If you experience difficulties when you use the PDF files and want to request a web-based format or accessible PDF document for a publication, direct your mail to the following address:

Information Development
IBM Corporation
205/A015
3039 E. Cornwallis Road
P.O. Box 12195
Research Triangle Park, North Carolina 27709-2195

U.S.A.

In the request, be sure to include the publication part number and title.

When you send information to IBM, you grant IBM a nonexclusive right to use or distribute the information in any way it believes appropriate without incurring any obligation to you.

Electronic emission notices

Federal Communications Commission (FCC) statement

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

Properly shielded and grounded cables and connectors must be used in order to meet FCC emission limits. IBM is not responsible for any radio or television interference caused by using other than recommended cables and connectors or by unauthorized changes or modifications to this equipment. Unauthorized changes or modifications could void the user's authority to operate the equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Industry Canada Class A emission compliance statement

This Class A digital apparatus complies with Canadian ICES-003.

Avis de conformité à la réglementation d'Industrie Canada

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

Australia and New Zealand Class A statement

Attention: This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

European Union EMC Directive conformance statement

This product is in conformity with the protection requirements of EU Council Directive 2004/108/EC on the approximation of the laws of the Member States relating to electromagnetic compatibility. IBM cannot accept responsibility for any failure to satisfy the protection requirements resulting from a nonrecommended modification of the product, including the fitting of non-IBM option cards.

Attention: This is an EN 55022 Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

Responsible manufacturer:
International Business Machines Corp.
New Orchard Road
Armonk, New York 10504
914-499-1900

European Community contact:
IBM Technical Regulations, Department M456
IBM-Allee 1, 71137 Ehningen, Germany
Telephone: +49 7032 15-2937
E-mail: tjahn@de.ibm.com

Germany Class A statement

Deutschsprachiger EU Hinweis:

Hinweis für Geräte der Klasse A EU-Richtlinie zur Elektromagnetischen Verträglichkeit

Dieses Produkt entspricht den Schutzanforderungen der EU-Richtlinie 2004/108/EG zur Angleichung der Rechtsvorschriften über die elektromagnetische Verträglichkeit in den EU-Mitgliedsstaaten und hält die Grenzwerte der EN 55022 Klasse A ein.

Um dieses sicherzustellen, sind die Geräte wie in den Handbüchern beschrieben zu installieren und zu betreiben. Des Weiteren dürfen auch nur von der IBM empfohlene Kabel angeschlossen werden. IBM übernimmt keine Verantwortung für die Einhaltung der Schutzanforderungen, wenn das Produkt ohne Zustimmung der IBM verändert bzw. wenn Erweiterungskomponenten von Fremdherstellern ohne Empfehlung der IBM gesteckt/eingebaut werden.

EN 55022 Klasse A Geräte müssen mit folgendem Warnhinweis versehen werden: "Warnung: Dieses ist eine Einrichtung der Klasse A. Diese Einrichtung kann im Wohnbereich Funk-Störungen verursachen; in diesem Fall kann vom Betreiber verlangt werden, angemessene Maßnahmen zu ergreifen und dafür aufzukommen."

Deutschland: Einhaltung des Gesetzes über die elektromagnetische Verträglichkeit von Geräten

Dieses Produkt entspricht dem "Gesetz über die elektromagnetische Verträglichkeit von Geräten (EMVG)". Dies ist die Umsetzung der EU-Richtlinie 2004/108/EG in der Bundesrepublik Deutschland.

Zulassungsbescheinigung laut dem Deutschen Gesetz über die elektromagnetische Verträglichkeit von Geräten (EMVG) (bzw. der EMC EG Richtlinie 2004/108/EG) für Geräte der Klasse A

Dieses Gerät ist berechtigt, in Übereinstimmung mit dem Deutschen EMVG das EG-Konformitätszeichen - CE - zu führen.

Verantwortlich für die Einhaltung der EMV Vorschriften ist der Hersteller:
International Business Machines Corp.
New Orchard Road
Armonk, New York 10504

914-499-1900

Der verantwortliche Ansprechpartner des Herstellers in der EU ist:
IBM Deutschland
Technical Regulations, Department M456
IBM-Allee 1, 71137 Ehningen, Germany
Telephone: +49 7032 15-2937
E-mail: tjahn@de.ibm.com

Generelle Informationen:

Das Gerät erfüllt die Schutzanforderungen nach EN 55024 und EN 55022 Klasse A.

Japan VCCI Class A statement

この装置は、情報処理装置等電波障害自主規制協議会（ＶＣＣＩ）の基準に基づくクラスＡ情報技術装置です。この装置を家庭環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求されることがあります。

This is a Class A product based on the standard of the Voluntary Control Council for Interference (VCCI). If this equipment is used in a domestic environment, radio interference may occur, in which case the user may be required to take corrective actions.

Japan Electronics and Information Technology Industries Association (JEITA) statement

高調波ガイドライン適合品

Japanese Electronics and Information Technology Industries Association (JEITA) Confirmed Harmonics Guideline (products less than or equal to 20 A per phase)

Korea Communications Commission (KCC) statement

이기기는 업무용으로 전자파 적합등록을 받은 기기이오니, 판매자 또는 사용자는 이점을 주의하시기 바라며, 만약 잘못 구입하셨을 때에는 구입한 곳에서 비업무용으로 교환하시기 바랍니다.

Please note that this equipment has obtained EMC registration for commercial use. In the event that it has been mistakenly sold or purchased, please exchange it for equipment certified for home use.

Russia Electromagnetic Interference (EMI) Class A statement

ВНИМАНИЕ! Настоящее изделие относится к классу А.
В жилых помещениях оно может создавать радиопомехи, для снижения которых необходимы дополнительные меры

People's Republic of China Class A electronic emission statement

声　　明

此为 A 级产品。在生活环境中，
该产品可能会造成无线电干扰。
在这种情况下，可能需要用户对其
干扰采取切实可行的措施。

Taiwan Class A compliance statement

警告使用者:
這是甲類的資訊產品，在
居住的環境中使用時，可
能會造成射頻干擾，在這
種情況下，使用者會被要
求採取某些適當的對策。

Appendix C. Specifications

Physical specifications

Width	146.0 mm (5.75 in.) without bezel
	148.3 mm (5.84 in.) with bezel
Length	205.5 mm (8.09 in.) without bezel
	210.5 mm (8.29 in.) with bezel
Height	82.5 mm (3.25 in.) without bezel
	84.8 mm (3.34 in.) with bezel
Weight (without a cartridge)	3 kg (6 lb 10 oz)

Power specifications

Power measurements	**SAS drive**
Idle Mode (no cartridge)	12.5 W
Idle Mode (cartridge loaded)	14.5 W
Reading and writing (at 4.1 m/s)	22.0 W

Environmental specifications

Environmental factor	**Operating**	**Storage**	**Shipping**
Drive temperature	10°C to 40°C (50°F to 104°F)	-40°C to 60°C (-40°F to 140°F)	-40°C to 60°C (-40°F to 140°F)
Relative humidity	20% to 80% 26°C wet bulb maximum	10% to 90% noncondensing	10% to 90% noncondensing

Drive temperature and relative humidity are measured in front of the bezel, near the air intake area (see Figure 4 on page 6).

Other specifications

Maximum altitude	3048 m (10 000 ft) for operating and storage
	12 192 m (40 000 ft) for shipping
Cartridge extraction force	250 to 750 gm

Appendix D. TapeAlert flags supported by the drive

TapeAlert is a standard that defines status conditions and problems experienced by devices such as tape drives, autoloaders, and libraries. The standard enables a server to read TapeAlert messages (called *flags*) from a tape drive via the SCSI bus. The server reads the flags from Log Sense Page 0x2E.

This library is compatible with TapeAlert technology, which provides error and diagnostic information about the drives and the library to the server. Because library and drive firmware might change periodically, the SNMP interface in the library does not require code changes if devices add additional TapeAlerts that are not supported today. However, should this occur, the MIB is written to minimize impact to the SNMP monitoring station. At the time of this writing, the TapeAlert flags in this appendix correctly represent TapeAlerts that will be sent. The MIB file should not be taken to mean that all traps that are defined in the MIB will be sent by the library or that they will be sent in the future.

This appendix lists TapeAlert flags that are supported by the Ultrium Tape Drives.

Table 13. TapeAlert flags supported by the Ultrium Tape Drive

Flag Number	Flag	SNMP Trap	Description	Action Required
3	Hard error	Yes	Set for any unrecoverable read, write, or positioning error. (This flag is set in conjunction with flags 4, 5, or 6.)	See the Action Required column for Flag Number 4, 5, or 6 in this table.
4	Media	Yes	Set for any unrecoverable read, write, or positioning error that is due to a faulty tape cartridge.	Replace the tape cartridge.
5	Read failure	Yes	Set for any unrecoverable read error where isolation is uncertain and failure could be due to a faulty tape cartridge or to faulty drive hardware.	If Flag 4 is also set, the cartridge is defective. Replace the tape cartridge.
6	Write failure	Yes	Set for any unrecoverable write or positioning error where isolation is uncertain and failure could be due to a faulty tape cartridge or to faulty drive hardware.	If Flag Number 9 is also set, make sure that the write-protect switch is set so that data can be written to the tape (see “Write-protect switch” on page 38). If Flag Number 4 is also set, the cartridge is defective. Replace the tape cartridge.
8	Not data grade	No	Set when the cartridge is not data-grade. Any data that you write to the tape is at risk.	Replace the tape with a data-grade tape.
9	Write protect	No	Set when the tape drive detects that the tape cartridge is write-protected.	Ensure that the cartridge write-protect switch is set so that the tape drive can write data to the tape (see “Write-protect switch” on page 38).

Table 13. TapeAlert flags supported by the Ultrium Tape Drive (continued)

Flag Number	Flag	SNMP Trap	Description	Action Required
10	No removal	No	Set when the tape drive receives an UNLOAD command after the server prevented the tape cartridge from being removed.	Refer to the documentation for your server operating system.
11	Cleaning media	No	Set when you load a cleaning cartridge into the drive.	No action required.
12	Unsupported format	No	Set when you load an unsupported cartridge type into the drive or when the cartridge format has been corrupted.	Use a supported tape cartridge.
14	Unrecoverable snapped tape	Yes	Set when the operation failed because the tape in the drive snapped.	Do not attempt to extract the old tape cartridge. Call the tape drive supplier help line.
15	Cartridge memory chip failure	Yes	Set when a cartridge memory (CM) failure is detected on the loaded tape cartridge.	Replace the tape cartridge.
16	Forced eject	No	Set when you manually unload the tape cartridge while the drive was reading or writing.	No action required.
18	Tape directory corrupted in the cartridge memory	No	Set when the drive detects that the tape directory in the cartridge memory has been corrupted.	Re-read all data from the tape to rebuild the tape directory.
20	Clean now	No	Set when the tape drive detects that it needs cleaning.	Clean the tape drive.
21	Clean periodic	No	Set when the drive detects that it needs routine cleaning.	Clean the tape drive as soon as possible. The drive can continue to operate, but you should clean the drive soon.
22	Expired clean	Yes	Set when the tape drive detects a cleaning cartridge that has expired.	Replace the cleaning cartridge.
23	Invalid cleaning tape	Yes	Set when the drive expects a cleaning cartridge and the loaded cartridge is not a cleaning cartridge.	Use a valid cleaning cartridge.
30	Hardware A	Yes	Set when a hardware failure occurs that requires that you reset the tape drive to recover.	Contact Technical Support.
31	Hardware B	Yes	Set when the tape drive fails its internal Power-On Self Tests.	Note the error code on the single-character display, then contact Technical Support.
32	Interface	Yes	Set when the tape drive detects a problem with the SCSI, Fibre Channel, or RS-422 interface.	Contact Technical Support.
33	Eject media	Yes	Set when a failure occurs that requires you to unload the cartridge from the drive.	Unload the tape cartridge, then reinsert it and restart the operation.

Table 13. TapeAlert flags supported by the Ultrium Tape Drive (continued)

Flag Number	Flag	SNMP Trap	Description	Action Required
34	Download fail	No	Set when an FMR image is unsuccessfully downloaded to the tape drive through the SCSI or Fibre Channel interface.	Ensure that it is the correct FMR image. Download the FMR image again.
36	Drive temperature	Yes	Set when the drive's temperature sensor indicates that the drive temperature is exceeding the recommended temperature of the library.	Contact Technical Support.
37	Drive voltage	Yes	Set when the drive detects that the externally supplied voltages are either approaching the specified voltage limits or are outside the voltage limits.	Contact Technical Support.
39	Diagnostics required	No	Set when the drive detects a failure that requires diagnostics for isolation.	Contact Technical Support.
51	Tape directory invalid at unload	No	Set when the tape directory on the tape cartridge that was previously unloaded is corrupted. The file-search performance is degraded.	Use your backup software to rebuild the tape directory by reading all the data.
52	Tape system area write failure	Yes	Set when the tape cartridge that was previously unloaded could not write its system area successfully.	Copy the data to another tape cartridge, then discard the old cartridge.
53	Tape system area read failure	Yes	Set when the tape system area could not be read successfully at load time.	Copy the data to another tape cartridge, then discard the old cartridge.

Table 13. TapeAlert flags supported by the Ultrium Tape Drive (continued)

Flag Number	Flag	SNMP Trap	Description	Action Required
55	Loading Failure	Yes	When loading a tape into a drive, a hardware malfunction can prevent the tape from being loaded into the drive, or the tape may actually get stuck in the drive.	Possible causes: 1. A drive hardware error that prevents the tape from being loaded. 2. A damaged tape that cannot be loaded in the drive. Take this action if the tape cartridge will not load in the drive: 1. Remove the tape cartridge from the library and inspect it for damage. If damaged, discard it. 2. Try another cartridge in that tape drive. If it still fails, replace the drive sled. Take this action if the tape is stuck in the drive: 1. Attempt to unload the tape from the drive using the host backup application that is currently using the drive, or using the remote or local UI. 2. If the cartridge will not unload, contact Service for assistance.

Table 13. TapeAlert flags supported by the Ultrium Tape Drive (continued)

Flag Number	Flag	SNMP Trap	Description	Action Required
56	Unload Failure	Yes	When attempting to unload a tape cartridge, a drive hardware malfunction can prevent the tape from being ejected. The tape may actually be stuck in the drive.	Possible causes: 1. A drive hardware error that prevents the tape from being unloaded. 2. A damaged tape that cannot be unloaded from the drive. Take this action if the tape will not unload from the drive: 1. If possible, manually remove the tape cartridge from the drive and inspect it for damage. If damaged, discard it. 2. Try removing the drive sled and replacing it. This will cause the drive sled to reboot. A reboot should cause the tape cartridge to rewind and unload if possible. If the cartridge unloads, remove it from the library and inspect it. If damaged, discard it. Take this action if the tape is stuck in the drive: 1. Attempt to unload the tape from the drive using the host backup application that is currently using the drive, or via the remote or local UI. 2. If the cartridge will not unload, contact Service for assistance.

Index

R

S

T

U

W

Part Number: 60Y1485

Printed in USA

(1P) P/N: 60Y1485