IBM 200/400GB LTO-2 Tape Drive
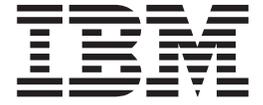
**IBM**

# User's Guide

**Note:**
Please carefully review the maintenance procedures in Chapter 4, "Operating the tape drive", on page 31 as periodic maintenance (cleaning, firmware upgrades, etc.) are not covered by the IBM Warranty. Repairs or exchanges resulting from improper maintenance will result in billable service charges.

IBM 200/400GB LTO-2 Tape Drive

# User's Guide

> **Note**
>
> Before using this guide and the product it supports, read the information in "Safety: Read first" on page iii and Appendix E, "Notices", on page 89

# Safety: Read first

Before installing this product, read the Safety Information.

مج، يجب قراءة    دات السلامة

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)。

Prije instalacije ovog produkta obavezno pročitajte Sigurnosne Upute.

Před instalací tohoto produktu si přečtěte příručku bezpečnostních instrukcí.

Læs sikkerhedsforskrifterne, før du installerer dette produkt.

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.

Lees voordat u dit product installeert eerst de veiligheidsvoorschriften.

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.

**iii**

Läs säkerhetsinformationen innan du installerar den här produkten.

安裝本產品之前，請先閱讀「安全資訊」。

# Contents

# Preface

## About this book

This manual contains information on the IBM 200/400 GB LTO-2 Internal Tape Drive. It is divided into the following parts:

**Part 1: Installation, use, and maintenance guide**

This section contains the product description, installation and operating instructions, and maintenance information in the following languages:

- English
- German
- French
- Spanish
- Italian
- Simplified Chinese
- Traditional Chinese
- Korean
- Japanese

**Part 2: Appendixes**

This section contains problem-solving, service, warranty, and notice information.

Be sure to retain your proof of purchase. It might be required for warranty service.

**Note:** The illustrations in this manual might be slightly different from your hardware.

## Related publications

Refer to the following publication for additional information:

- *IBM Total Storage LTO Ultrium Tape Drive SCSI Reference*, GA32-0450, provides the supported SCSI commands and protocol that govern the behavior of the SCSI interface for all models of the IBM Ultrium Tape Drive.

# Chapter 1. Introduction

The IBM 200/400 GB LTO-2 Internal Tape Drive is a fast/wide SCSI-3 tape drive for backing up and archiving files. These files can include multimedia, imaging, transaction processing, large databases, and other storage-intensive applications.

The IBM LTO- 2 Tape Drive is a high-performance, high-capacity data-storage device that is designed to backup and restore Open Systems applications. The drive can be integrated into an IBM external enclosure, such as a 3503B1X, or directly into some xSeries servers. The LTO-2 is the second-generation tape drive in the Ultrium series of products.

The LTO-2 offers the following features:

- Native storage capacity of up to 200 GB per cartridge (400 GB assuming 2:1 LTO Data Compression)
- Native sustained data transfer rate of up to 35 MB per second (up to 70 MB assuming 2:1 LTO Data Compression)

# Cartridge compatibility

The LTO-2 uses the IBM LTO Ultrium 200 GB Data Cartridge and is compatible with the cartridges of its predecessor, the IBM Ultrium Internal Tape Drive (called Generation 1). The LTO-2 performs the following functions:

- Reads and writes Generation 2 cartridges to Generation 2 format
- Reads and writes Generation 1 cartridges to Generation 1 format
- Does not write Generation 2 cartridges to Generation 1 format
- Does not write Generation 1 cartridges to Generation 2 format

The LTO-2 reads tapes that have been written by other licensed Ultrium 2 drives. It also writes to tapes that can be read by other licensed Ultrium 2 drives.

In addition to using the IBM LTO-2 Ultrium Data Cartridge with up to 200 GB capacity, the LTO-2 also offers read/write capability for certified LTO Ultrium tape cartridges.

# Speed matching and channel calibration

To improve system performance, the LTO-2 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 five speeds when reading or writing the Generation 2 cartridge format to achieve a native data rate of 17.5, 21.9, 26.25, 30.63, or 35 MB per second (MB/s). If the server's net (compressed) data rate is between two of the preceding native data rates, the drive calculates which of the two data rates at which to operate. (For example, if the server transfers data at 60 MB/s on the host bus, at 2:1 compression its net data rate is 30 MB/s. The drive will then dynamically choose to operate at a native data rate of 26.25 or 30.63 MB/s, whichever enables it to successfully receive the greatest amount of compressed data over the network.) 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.

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 recording channel's transfer function, the media, and characteristics of the drive head.

# Sleep mode

To conserve energy when circuit functions are not needed for drive operation, the LTO-2 features a power-management function that causes the drive's electronics to enter a low-power mode known as *sleep mode*. To enter sleep mode, the drive must be inactive for a minimum of 15 minutes; to exit, the drive must receive a command across the SCSI interface or a load or unload request. When in sleep mode, the drive's response time to commands that do not require media motion increases by up to 10 microseconds. Commands that require media motion may be delayed an additional 100 milliseconds because the tape must be retensioned.

## Software description

The IBM 200/400 GB LTO-2 Internal Tape Drive includes trial-version backup application CDs. These CDs contain popular backup and restore applications for Microsoft® Windows NT®, Novell NetWare, and other operating systems. You can install the application you choose for your computer system by following the installation instructions that come with the CD you select. However, these trial versions of the software expire after 30 to 90 days, depending on the application you use.

You can use the trial period to determine the best application for your specific computer configuration. For information on purchasing a permanent installation copy of the desired tape drive backup application, go to the IBM Web site at www.pc.ibm.com/ww/eserver/xseries/tape.html or follow the instructions on the CD.

The CD also contains backup applications that are used with other products but are not applicable to the 200/400 GB LTO-2 Internal Tape Drive. Please go to www.pc.ibm.com/us/compat, click on **Tape Backup Units**, then search for **59P6744** to see the current support list.

# Chapter 2. Installing the tape drive

This section contains information on installing the tape drive in IBM servers and other computers.

## Package contents

In addition to this book, this package contains:
* IBM 200/400 GB LTO-2 Internal Tape Drive
* Mounting screws
* Jumpers
* Backup application CDs (trial versions)
* Safety Information manual
* Cleaning cartridge
* Device drivers in the Device Driver folder on the *User's Guide* CD.
* Internal SCSI cable

Contact your place of purchase if an item is missing or damaged. Be sure to retain your proof of purchase and packing material. They might be required to receive warranty service.

## Installation requirements

To install this drive, you must have the following:
* Low-voltage (Ultra2)[1] or a SCSI-3 host adapter
* Documentation for your computer, SCSI bus adapter or external closure
* A SCSI-3 active terminator if you are installing the tape drive at the end of a SCSI-3 device chain[2] or an LVD active terminator if you are installing the tape drive at the end of an LVD SCSI device chain[2]
* Phillips and flat blade screwdrivers for the mounting screws and for opening your computer
* Flat-nose pliers (optional) to install and remove jumpers
* An available 5.25-inch full high drive bay

## Installing the drive in IBM servers

The tape drive is compatible with many IBM xSeries servers. Please go to ww.pc.ibm.com/us/compat, click on **Tape Backup Units**, then search for 59P6744 for a complete and current list of supported IBM hardware and software.

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1. This tape drive can be installed on an Ultra2 LVD SCSI device chain, but doing so will limit the performance of the drive.

2. SCSI termination might be provided with your computer or SCSI adapter. Refer to the documentation that comes with your computer or SCSI adapter for more information.

> **Attention:**
> To avoid static electricity damage when you handle the IBM 200/400GB
> LTO-2 Tape Drive, use the following precautions:
> - Limit your movement. Movement can cause static electricity to build
>   around you.
> - Always handle the LTO-2 carefully. Never touch exposed circuitry.
> - Prevent others from touching the LTO-2.
> - Before you unpack and install the LTO-2 into an enclosure, touch its
>   static-protective packaging to an unpainted metal surface on the enclosure
>   for at least 2 seconds. This reduces static electricity in the packaging and
>   your body.
> - When possible, remove the LTO-2 from its static-protective packaging and
>   install it directly into an enclosure without setting it down. When this is
>   not possible, place the tape drive's packaging on a smooth, level surface
>   and place the tape drive on the packaging.
> - Do not place the LTO-2 on the cover of the enclosure or on any other metal
>   surface.

The steps that follow describe how to install the LTO-2 into a server.

**Note:** Depending on the type of xSeries server, installation procedures may vary.
Before starting this installation, read these instructions and compare them to
the drive installation instructions for your server.

# Rear view of the SCSI drive

| | |
|---|---|
| **1** | Feature switches |
| **2** | SCSI connector |
| **3** | SCSI ID connector |
| **4** | Power connector |
| **5** | Library/Drive Interface (LDI or RS-422 interface) connector |
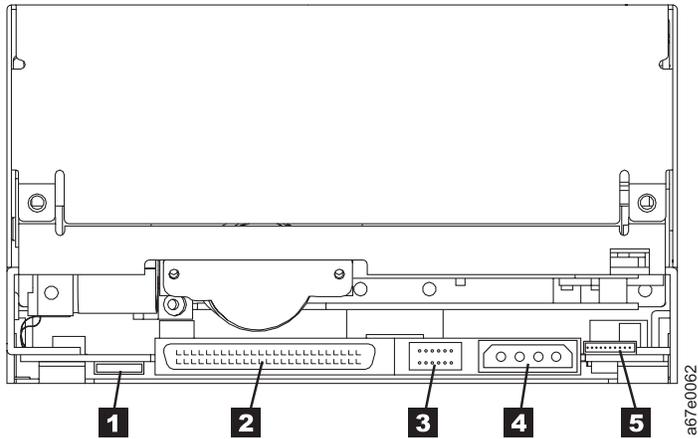


*Figure 1. Rear view of the IBM 200/400GB LTO-2 Tape Drive*

# Step 1. Remove power from the host

__ 1. Power-off the server (or the unit that provides power to the drive)

__ 2. Disconnect the power cord from the electrical outlet.

# Step 2. Set the SCSI ID

You can set the SCSI ID in one of two ways:

- By placing jumpers on the SCSI ID connector
- By using a remote SCSI ID switch that is connected to the SCSI ID connector

The sections that follow describe each method of setting the SCSI ID.

## Setting the SCSI ID with jumpers

You can set the SCSI ID on the LTO-2 by installing 2-mm jumpers on the drive's SCSI ID connector (see **3** in Figure 1 on page 7). Your tape drive may come set to a default SCSI configuration, with jumpers already installed. You can change the SCSI ID by rearranging, adding, or removing jumpers.

To set the SCSI ID:

__ 1. Locate the SCSI ID connector (see **3** in Figure 1 on page 7).

__ 2. Before attaching the SCSI bus cable to the server, decide the SCSI ID number that you want. Make sure that the ID is not being used by another device.

__ 3. Referring to Figure 2, find the ID number that you chose then place jumpers on the connector pins as shown (use a pair of needle-nose pliers to connect the jumpers to the pins that are shaded).

**Note:** Do not set the SCSI ID to 15. This is reserved for applications where the drive expects to receive the SCSI ID through a command over its LDI interface.
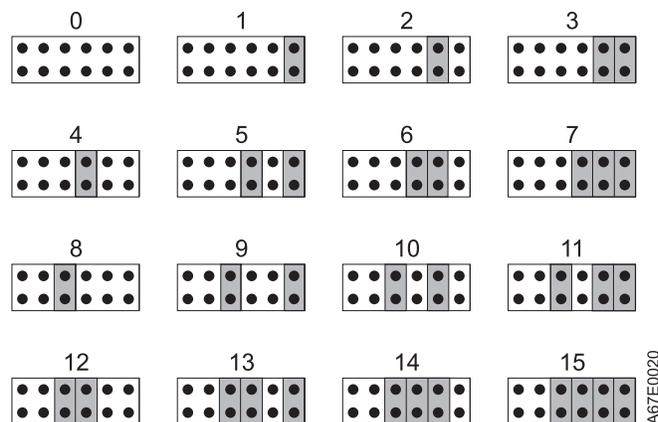


*Figure 2. SCSI ID settings on the SCSI ID connector*

## Setting the SCSI ID with a SCSI ID switch

For applications that use a SCSI ID switch (like an external enclosure), connect the switch to the drive's SCSI ID connector (see **3** in Figure 1 on page 7). If any jumpers are pre-installed, be sure to remove them before connecting the switch. The SCSI ID switch must be compatible with the drive's SCSI ID connector and must make an electrical connection between the same pins as the jumpers to achieve the same corresponding SCSI ID.

## Supplying TERMPOWER

To supply TERMPOWER to the bus, locate one of the five jumpers shipped with the LTO-2 and place it on the SCSI ID connector as shown in the following figure. Place the jumper on the pins that are shaded.
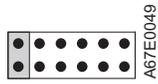
# Step 3. Mount the tape drive into the server

To mount the LTO-2 into a server:

__ 1. Remove the cover of your server (refer to the instructions in the server's documentation).

__ 2. Place the drive into the server so that its tape load compartment faces the front of the server.

__ 3. Use the supplied mounting screws to mount drive into server. Some server installations require use of mounting rails. For these applications, use the mounting screws to attach rails to the side of the LTO-2 drive and then slide the drive into the server.

**Attention:** When inserted into the LTO-2, the length of the mounting screws must not exceed 3.5 mm (0.14 in.) inside the chassis. If the length exceeds this measurement, the tape drive may become damaged.
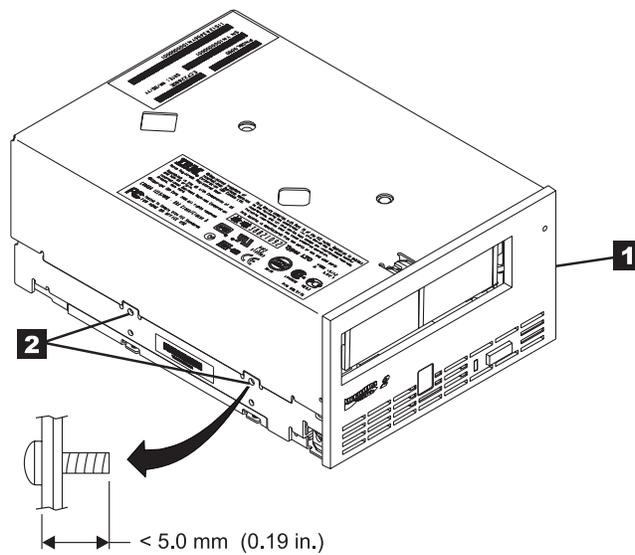


*Figure 3. Mounting holes on Ultrium 2 Tape Drive.* The holes are located on both sides of the drive.

## Step 4. Connect and test power to the tape drive

The LTO-2 does not contain its own power source; it must be powered externally.

To connect and test power to the LTO-2:

__ 1. Ensure that the server (or unit that supplies power to the drive) is powered off.

__ 2. Ensure that the power cord is disconnected from both the server and the power outlet.

__ 3. Connect the server's internal power cable to the power connector on the drive (see **4** in Figure 1 on page 7). Ensure that the connector is properly connected.

__ 4. Connect the power cord to the server and to the electrical outlet.

__ 5. Review the location of the single-character display and the status light on page 31 (if your drive does not have a bezel, note that the bulb of the status light is recessed and the light is not visible until lit). To ensure that the drive is receiving power, watch for the following while turning on the power to the server:

   • The single-character display presents a series of random characters, then becomes blank (not lit).

     **Note: If the single-character display does not come on, the drive may not be getting power.**

   • The status light briefly becomes solid amber, then becomes solid green.

__ 6. Power-off the server.

__ 7. Disconnect the power cord from both the server and the electrical outlet.

## Step 5. Connect the internal SCSI cable

Connect one end of the SCSI cable that came with the tape drive to the SCSI connector on the drive (see **2** in Figure 1 on page 7). Connect the other end to the SCSI connector within your server.

## Step 6. Run drive diagnostics

__ 1. Replace the cover on the server.

__ 2. Connect the power cord to both the server and the electrical outlet, then power-on the server.

__ 3. Run one or more of the following tape drive diagnostics. If an error code appears on the single-character display, go to Table 8 on page 49.

   • Function Code 1 - Run Tape Drive Diagnostics (see page 36).

   • Function Code 6 - Run Wrap Test (see page 39).

__ 4. Power-off the server, then disconnect the power cord from both the server and the electrical outlet.

## Step 7. Install the device drivers

For information about installing device drivers, refer to the **Readme** file in the **Device Driver** folder of the *User's Guide* CD.

## Step 8. Updating the configuration

For most computers, the configuration-setup utility program automatically recognizes the new tape drive. However, you might have to provide information about your system changes after you restart your computer.

Ensure that the appropriate advanced SCSI programming interface (ASPI) device drivers are installed to support the tape drive. Device drivers are usually provided with the SCSI adapter.

If your computer does not recognize the tape driver after startup or if you receive startup errors, run the configuration-setup utility program as described in the documentation that comes with your computer.

If all the indicators on either side of the tape drive blink in unison, there is a problem with the tape drive. Press the **Unload** button on the right side of the drive front panel to eject any tape that might be inserted and to reset the drive. If the problem persists, turn off the computer and turn it back on. If the problem continues, see Chapter 5, "Resolving problems", on page 47 for further steps.

## Step 9. Installing the backup and restore software

To use the drive, you must install an appropriate backup and restore application for your computer operating system. If you are using software not included in this package, follow the directions that came with your software. If you are using the trial software that came with this package, insert a trial CD into the CD-ROM drive and follow the on-screen installation and operating instructions.

# Chapter 3. Using the media

The IBM LTO-2 Tape Drive uses the following cartridge types:
- IBM LTO-2 Ultrium 200 GB Data Cartridge (Generation 2)(08L9870)
- IBM LTO Ultrium Universal Cleaning Cartridge (35L2086)

The LTO-2 is compatible with the cartridges of its predecessor, the IBM Ultrium Internal Tape Drive (Generation 1). Cartridge compatibility for the Ultrium 2 Tape Drive is as follows:
- Reads and writes Generation 2 cartridges to Generation 2 format
- Reads and writes Generation 1 cartridges to Generation 1 format
- Does not write Generation 2 cartridges to Generation 1 format
- Does not write Generation 1 cartridges to Generation 2 format

Figure 4 shows the IBM LTO-2 Ultrium 200 GB Data Cartridge and its components.
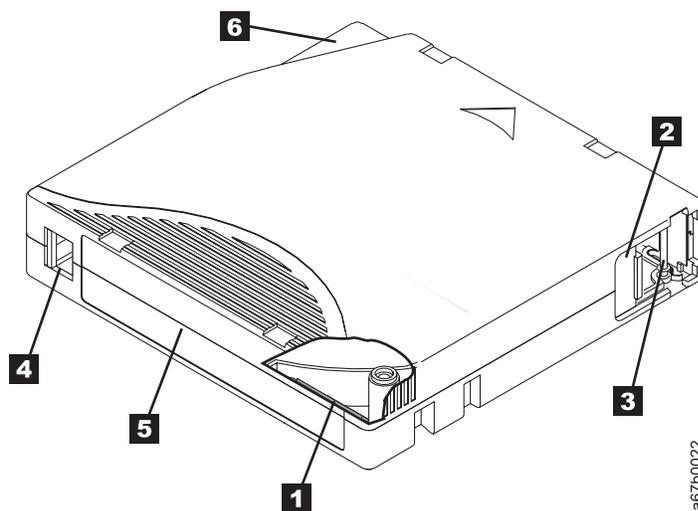


*Figure 4. The IBM LTO-2 Ultrium 200 GB Data Cartridge*

| | | | |
|---|---|---|---|
| 1 | LTO cartridge memory | 4 | Write-protect switch |
| 2 | Cartridge door | 5 | Label area |
| 3 | Leader pin | 6 | Insertion guide |

## Data cartridge

The IBM LTO-2 Ultrium 200 GB Data Cartridge contains 1/2-inch, dual-coat, metal-particle tape that has a native data capacity of 200 GB (400 GB at 2:1 compression). When processing the tape, the IBM LTO-2 Ultrium Tape Drive uses a linear, serpentine recording format, and reads and writes data on 512 tracks, eight tracks at a time. The first set of eight tracks 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 eight tracks for the return pass. This process continues until all tracks are written and the tape is full, or until all data is written.

The IBM LTO-2 Ultrium 200 GB Data Cartridge includes a Linear Tape-Open Cartridge Memory (LTO-CM) chip ( **1** in Figure 4 on page 13), 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's use. Whenever you unload a tape cartridge, the tape drive writes any pertinent information to the cartridge memory. The storage capacity of the LTO-CM is 4096 bytes.

The cartridge door **2** protects the tape from contamination when the cartridge is out of the drive. Behind the door, the tape is attached to a leader pin **3** . When you insert the cartridge into the drive, a threading mechanism pulls the pin (and tape) out of the cartridge, across the drive head, and onto a non-removable takeup reel. The head can then read or write data from or to the tape.

The write-protect switch **4** prevents data from being written to the tape cartridge. The label area **5** provides a location for you to place a label. Affix only a bar code label. When affixing a label, place it only in the recessed label area. A label that extends outside of the recessed area can cause loading problems in the drive. The insertion guide **6** is a large, notched area that prevents you from inserting the cartridge incorrectly.

The IBM LTO-2 Ultrium 200 GB Data Cartridge has a nominal cartridge life of 5000 load and unload cycles. The Generation 2 cartridge is purple; the Generation 1 cartridge is black.

## Cleaning cartridges

The LTO-2 is compatible with the IBM LTO Ultrium Cleaning Cartridge (part number 08L9124) and the IBM Cleaning Cartridge (Ultrium LTO 2) (part number 35L2086). Use of unsupported cleaning cartridges may void your warranty or result in billable service charges. You can view the most current support list at www.pc.ibm.com/support and search for "cleaning cartridges."

The IBM Cleaning Cartridge functions with Ultrium-format tape drives that are produced by compliance-verified manufacturers. The cartridge lets you buy and use a single cleaning cartridge for all of your tape drives, rather than spend time and money to support several different cleaning cartridges.

The IBM Cleaning Cartridge (Ultrium LTO 2) is downward-compatible with the Ultrium Internal Tape Drive (Generation 1). To enable your Generation 1 drive to use the cartridge, simply download and install the latest drive firmware (for instructions, see "Updating the firmware" on page 45).

The drive itself determines when a head needs to be cleaned. It alerts you by displaying **C** on the single-character display and causing the status light to become flashing amber. To clean the head, insert the cleaning cartridge into the tape load compartment (see Figure 17 on page 34). The tape drive performs the cleaning automatically. When the cleaning is finished, the drive ejects the cartridge.

To remove a cleaning cartridge, see "Unload button" on page 33. The IBM Cleaning Cartridge (Ultrium LTO 2) and the IBM LTO Ultrium Cleaning Cartridge are valid for 50 uses (the cartridge's LTO-CM chip tracks the number of times that the cartridge is used).

# Setting the write-protect switch

The position of the write-protect switch on the tape cartridge (see **1** in Figure 5) determines whether you can write to the tape:

- If the switch is set to (solid red), data cannot be written to the tape.
- If the switch is set to unlocked (black void), data can be written to the tape.

To set the switch, slide it left or right to the desired position.
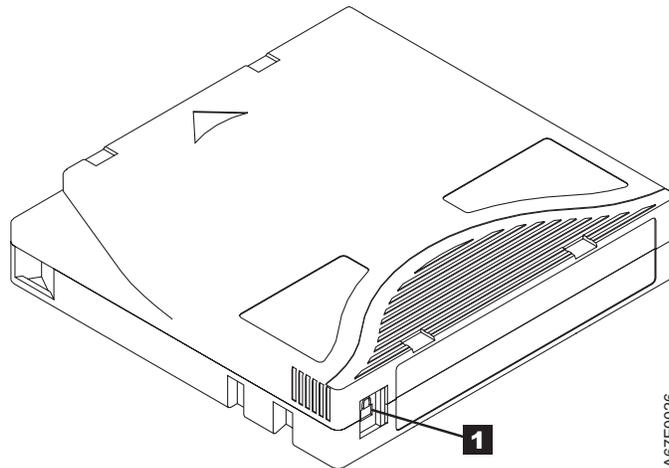


*Figure 5. Setting the write-protect switch*

# Handling the cartridges

**Attention:** Do not insert a damaged tape cartridge into your LTO-2. A damaged cartridge can interfere with the reliability of the drive and may 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. If you need to recover data from a damaged cartridge, contact your OEM Product Application Engineer (PAE).

Incorrect handling or an incorrect environment can damage the LTO Ultrium Tape Cartridge or its magnetic tape. To avoid damage to your tape cartridges and to ensure the continued high reliability of your LTO-2, use the following guidelines.

## Ensure proper packaging

- When you ship a cartridge, ship it in its 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 (see Figure 6 on page 17). They are available at `www.turtlecase.com` .

*Figure 6. 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 (see Figure 7).



*Figure 7. Double-boxing tape cartridges for shipping*

## Provide proper acclimation and environmental conditions

- Before you use a cartridge, let it acclimate to the normal operating environment for 1 hour. If you see condensation 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 "Environmental and shipping specifications for tape cartridges" on page 27.

## Perform a thorough inspection

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

- Inspect the cartridge's 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 you load first into the tape load compartment) and ensure that there are no gaps in the seam of the cartridge case (see **4** in Figure 9 on page 21). If there are gaps in the seam, the leader pin may be dislodged. Go to "Repositioning or reattaching a leader pin" on page 20.
- Check that the leader pin is properly seated.
- If you suspect that the cartridge has been mishandled but it appears useable, copy any data onto a good cartridge immediately for possible data recovery. Discard the mishandled cartridge.
- If you must recover data from a damaged cartridge, contact your service representative.
- 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 (see **2** in Figure 8 on page 20). If the leader pin has become dislodged, go to "Repositioning or reattaching a leader pin" on page 20.
- Do not handle tape that is outside the cartridge. Handling the tape can damage the tape's 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.

# Examples of cartridge problems

### Example: Improper placement of leader pin

The leader pin is misaligned. Perform the following steps:

1. Look for cartridge damage.
2. Use the IBM Leader Pin Reattachment Kit (part number 08L9129) to correctly seat the pin (see "Repositioning a leader pin" on page 20). Then, immediately use data recovery procedures to minimize chances of data loss.

### Example: split cartridge case

The cartridge's case is damaged. There is a high possibility of media damage and potential loss. Perform the following steps:

1. Look for cartridge mishandling.
2. Use the IBM Leader Pin Reattachment Kit (part number 08L9129) to correctly seat the pin (see "Repositioning a leader pin" on page 20). Then, immediately use data recovery procedures to minimize chances of data loss.
3. Review media-handling procedures.

# Repositioning or reattaching a leader pin

⚠️ **Attention:** Use a repaired tape cartridge only to recover data and move it to another cartridge. Continued use of a repaired cartridge may void the warranties of the drive and the cartridge.

If the leader pin in your cartridge becomes dislodged from its pin-retaining spring clips or detaches from the tape, you must use the IBM Leader Pin Reattachment Kit (part number 08L9129) to reposition or reattach it. (Do not reattach the pin if you must remove more than 7 meters (23 feet) of leader tape.) The sections that follow describe each procedure.

## Repositioning a leader pin

A leader pin that is improperly seated inside a cartridge can interfere with the operation of the drive. Figure 8 shows a leader pin in the incorrect **1** and correct **2** positions.

To place the leader pin in its proper position, you will need the following tools:
- Plastic or blunt-end tweezers
- Cartridge manual rewind tool (from Leader Pin Reattachment Kit, part number 08L9129)
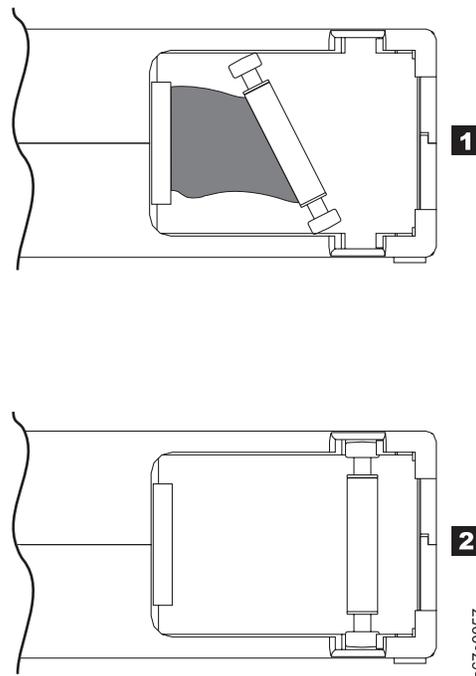


*Figure 8. Leader pin in the incorrect and correct positions.* The cartridge door is open and the leader pin is visible inside the cartridge.

To reposition the leader pin, perform the following steps.

1. Slide open the cartridge door (**1** in Figure 9) and locate the leader pin **2** (you may need to shake the cartridge gently to roll the pin toward the door).

2. With plastic or blunt-end tweezers, grasp the leader pin and position it in the pin-retaining spring clips **3** .

3. Press the leader pin gently into the clips until it snaps into place and is firmly seated. Ensure that there are no gaps in the seam of the cartridge **4** .

   **Attention:** If gaps exist, do not continue with this procedure and do not use the cartridge. Instead, contact your OEM Product Application Engineer (PAE).

4. Close the cartridge door.
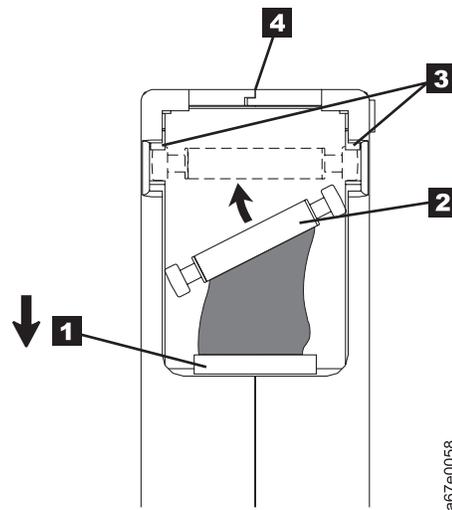


*Figure 9. Placing the dislodged leader pin into the correct position.* The cartridge door is open to show the leader pin.

5. To rewind the tape, insert the cartridge manual rewind tool (**1** in Figure 10) into the cartridge's hub **2** and turn it clockwise until the tape becomes taut.
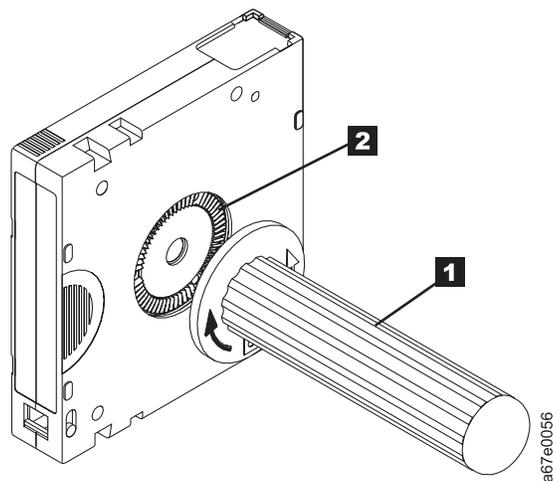


*Figure 10. Rewinding the tape into the cartridge*

6. Remove the rewind tool by pulling it away from the cartridge.

# Reattaching a leader pin

The first meter of tape in a cartridge is leader tape. Once the leader tape has been removed there is a possibility of tape breakage. After reattaching the leader pin, transfer data from the defective tape cartridge. **Do not reuse the defective tape cartridge**.

The Leader Pin Reattachment Kit contains three parts:

- **Leader pin attach tool** (see **1** in Figure 11). A plastic brace that holds the cartridge door open.
- **Cartridge manual rewind tool** (see **2** in Figure 11). A device that fits into the cartridge's hub and lets you wind the tape into and out of the cartridge.
- **Pin supplies** (see **3** in Figure 11). Leader pins and C-clips.

**Attention:**

- Use only the IBM Leader Pin Reattachment Kit to reattach the leader pin to the tape. Other methods of reattaching the pin will damage the tape, the drive, or both.
- Use this procedure on your tape cartridge only when the leader pin detaches from the magnetic tape and you must copy the cartridge's data onto another cartridge. Destroy the damaged cartridge after you copy the data. This procedure may affect the performance of the leader pin during threading and unloading operations.
- Touch only the end of the tape. Touching the tape in an area other than the end can damage the tape's surface or edges, which may interfere with read or write reliability.
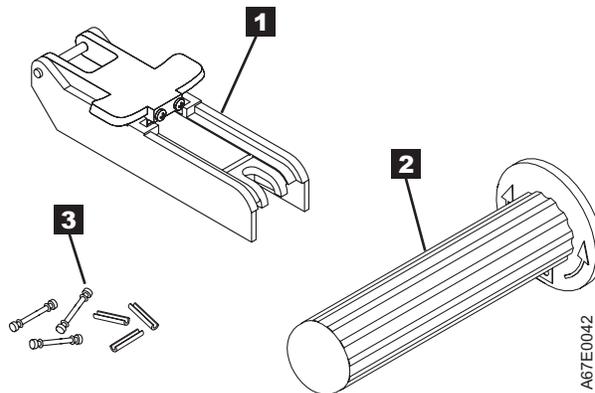


*Figure 11. Leader Pin Reattachment Kit*

The following procedure describes how to reattach a leader pin.

To reattach a leader pin by using the IBM Leader Pin Reattachment Kit:

1. Attach the leader pin attach tool ( **1** in Figure 12) to the cartridge **2** so that the tool's hook **3** latches into the cartridge's door **4** . Pull the tool back to hold the door open, then slide the tool onto the cartridge. Open the tool's pivot arm **5** .
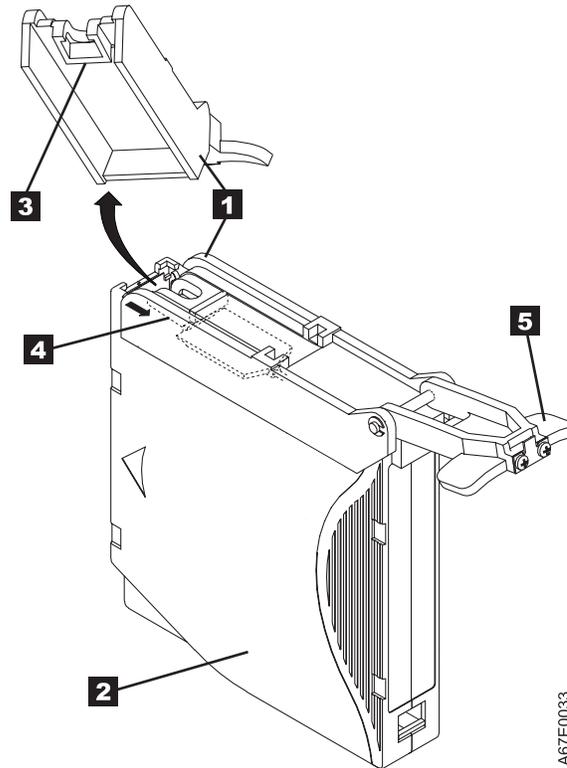


*Figure 12. Attaching the leader pin attach tool to the cartridge.* To hold the cartridge door open, hook the tool into the door and pull the tool back.

2. To find the end of the tape inside the cartridge, attach the cartridge manual rewind tool ( **1** in Figure 13) to the cartridge's hub **2** by fitting the tool's teeth between the teeth of the hub. Turn the tool clockwise until you see the end of the tape inside the cartridge. Then, slowly turn the rewind tool counterclockwise to bring the tape edge toward the cartridge door **3**.

3. Continue to turn the rewind tool counterclockwise until approximately 12.7 cm (5 in.) of tape hangs from the cartridge door. If necessary, grasp the tape and pull gently to unwind it from the cartridge.

4. Remove the rewind tool by pulling it away from the cartridge. Set the tool and the cartridge aside.
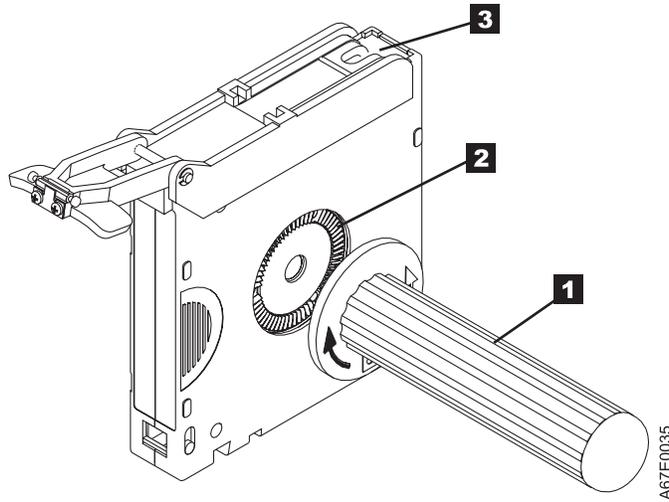


*Figure 13. Winding the tape out of the cartridge.* Turn the cartridge manual rewind tool clockwise to see the end of the tape, then turn it counterclockwise to bring the tape to the cartridge door.

5. On the leader pin ( **1** in Figure 14), locate the open side of the C-clip **2**. The C-clip is a small black part that secures the tape **3** to the pin.

6. Remove the C-clip from the leader pin by using your fingers to push the clip away from the pin. Set the pin aside and discard the clip.
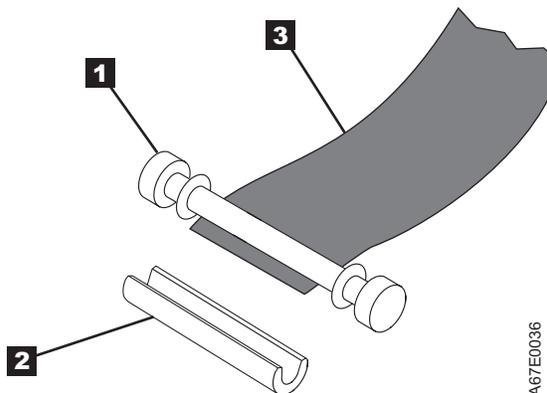


*Figure 14. Removing the C-clip from the leader pin.* Use your fingers to push the C-clip from the leader pin.

7. Position the tape in the alignment groove of the leader pin attach tool (see **1** in Figure 15).

8. Place a new C-clip into the retention groove **2** (Figure 15) on the leader pin attachment tool and make sure that the clip's open side faces up.

9. Place the leader pin (from step 6 on page 24) into the cavity **3** (Figure 15) of the leader pin attach tool.

**Attention:** To prevent the leader pin from rolling into the cartridge, in the following step use care when folding the tape over the pin.

10. Fold the tape over the leader pin and hold it with your fingers (see Figure 15).

> **Note:** Use care to ensure that the tape is centered over the leader pin. Failure to properly center the tape on the pin will cause the repaired cartridge to fail. When the tape is properly centered, a 0.25-mm (0.01-in.) gap exists on both sides of the pin.
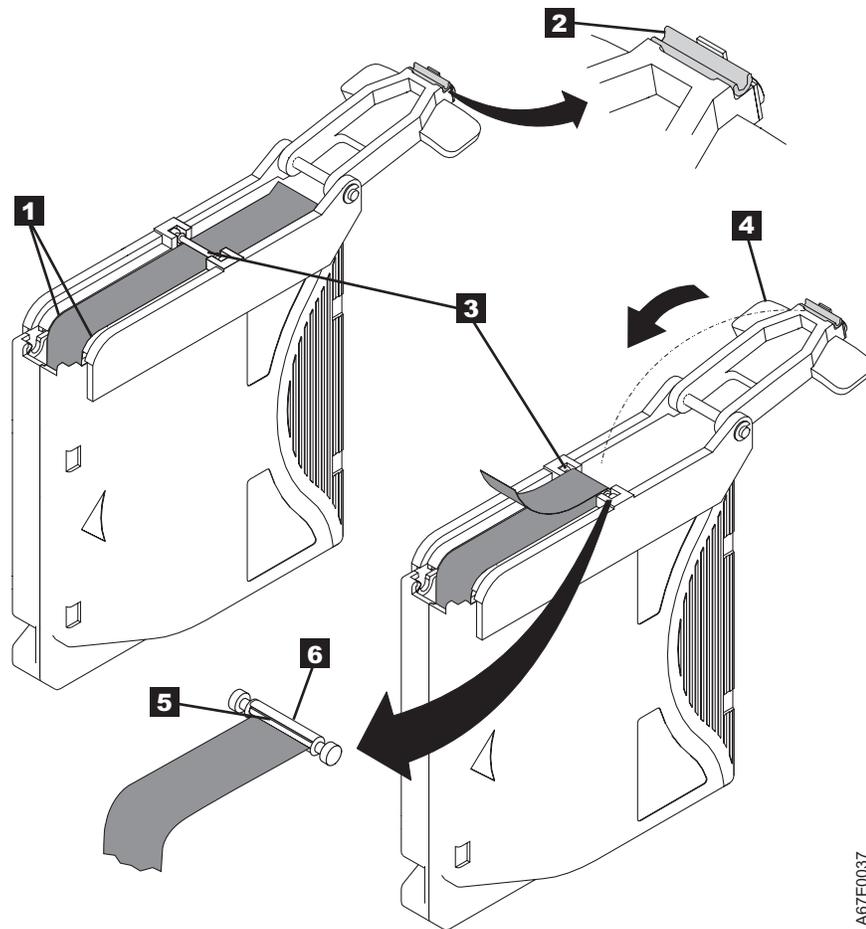


*Figure 15. Attaching the leader pin to the tape*

11. Close the pivot arm **4** of the leader pin attach tool by swinging it over the leader pin so that the C-clip snaps onto the pin and the tape.

12. Swing the pivot arm open and trim the excess tape **5** so that it is flush with the reattached leader pin **6** .

13. Use your fingers to remove the leader pin from the cavity **3** in the leader pin attach tool.
14. Use the cartridge manual rewind tool to wind the tape back into the cartridge (wind the tape clockwise). Ensure that the leader pin is latched by the pin-retaining spring clips on each end of the leader pin.
15. Remove the rewind tool.
16. Remove the leader pin attach tool by lifting its end up and away from the cartridge.



**Attention:**   Use a repaired tape cartridge only to recover data and move it to another cartridge. Continued use of a repaired cartridge may void the warranties of the drive and the cartridge.

# Environmental and shipping specifications for tape cartridges

Before you use a tape cartridge, acclimate it to the operating environment for 24 hours or the time necessary to prevent condensation in the drive (the time will vary, depending on the environmental extremes to which the drive 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 1 gives the environment for operating, storing, and shipping LTO Ultrium Tape Cartridges.

*Table 1. Environment for operating, storing, and shipping the LTO Ultrium Tape Cartridge*

| Environmental Specifications | | | | |
|---|---|---|---|---|
| **Environmental Factor** | **Operating** | **Operational Storage[1]** | **Archival Storage[2]** | **Shipping** |
| Temperature | 10 to 45°C (50 to 113°F) | 16 to 32°C (61 to 90°F) | 16 to 25°C (61 to 77°F) | −23 to 49°C (−9 to 120°F) |
| Relative humidity (noncondensing) | 10 to 80% | 20 to 80% | 20 to 50% | 5 to 80% |
| Wet bulb temperature | 26°C (79°F) | 26°C (79°F) | 26°C (79°F) | 26°C (79°F) |
| **Notes:** <br> 1. Operational storage equals less than 1 year. <br> 2. Archival storage equals 1 to 10 years. | | | | |

## 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 may 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 1200 oersted peak field over the entire space that the cartridge occupies). Degaussing makes the cartridge unusable.

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

## Ordering media supplies

Table 2 lists the cartridges and media supplies that you can order for the IBM LTO-2 Ultrium 2 Tape Drive. To order media supplies, visit the web at www.ibm.com/storage/lto.

*Table 2. Media supplies for the IBM LTO-2 Ultrium 2 Tape Drive*

| IBM Part Number | Product Description |
|---|---|
| 08L9870 | IBM LTO-2 Ultrium 200 GB Data Cartridge (includes only human-writable labels) |
| 19P5897 | IBM LTO-2 Ultrium 200 GB Data Cartridge Bar Code Labels, sheet of 20, black and white |
| 08L9124 | IBM LTO Ultrium Cleaning Cartridge (includes only human-writable labels) |
| 35L2086 | IBM Cleaning Cartridge (Ultrium LTO 2) |
| 08L9267 | IBM LTO Ultrium Cleaning Cartridge Bar Code Labels, sheet of 20, black and white |

# Ordering custom bar code labels

If custom bar code labels are required for your data or cleaning cartridges, order them directly from the authorized label suppliers in Table 3.

*Table 3. Authorized suppliers of custom bar code labels*

| In America | In Europe and Asia |
|---|---|
| EDP/Colorflex<br>697 South Pierce Street<br>Louisville, CO 80027<br>U. S. A.<br>Telephone: 800-522-3528<br>www.colorflex.com/Ai/Home.asp | EDP Europe, Ltd.<br>43 Redhills Road<br>South Woodham Ferrers<br>Chelmsford, Essex CM3 5UL<br>U. K.<br>Telephone: 44 (0) 1245-322380<br>www.edpeurope.com/media_labelling.htm |
| Dataware (LTO 2 only)<br>7570 Renwick<br>Houston, TX 77081<br>U. S. A.<br>Telephone: 800-426-4844<br>www.datawarelabels.com/ | Dataware Labels Europe<br>Heubergstrasse 9<br>D-83052 Bruckmuhl-Gotting<br>Germany<br>Telephone: 49 806-29455<br>www.datawarelabels.com/ |
| NetC<br>P. O. Box 320784<br>Fairfield, CT 06432<br>U. S. A.<br>Telephone: 203-372-6382<br>www.netcllc.com/ | NetC Europe Ltd<br>Town Farm Bungalow<br>North Curry<br>Taunton<br>Somerset U. K. TA3 6LX<br>Telephone: 44 (0) 1823 491439<br>www.netclabels.co.uk |
| | NetC Asia Pacific Pty Ltd<br>Locked Bag 14<br>Kenthurst<br>NSW Australia 2156<br>Telephone: 61 (0) 2 9654 8272<br>www.netclabels.com.au |

# Chapter 4. Operating the tape drive

When operating the LTO-2, refer to Figure 16 which shows the front of the unit.

1  Status light

2  Unload button

3  Single-character display

4  Single red dot
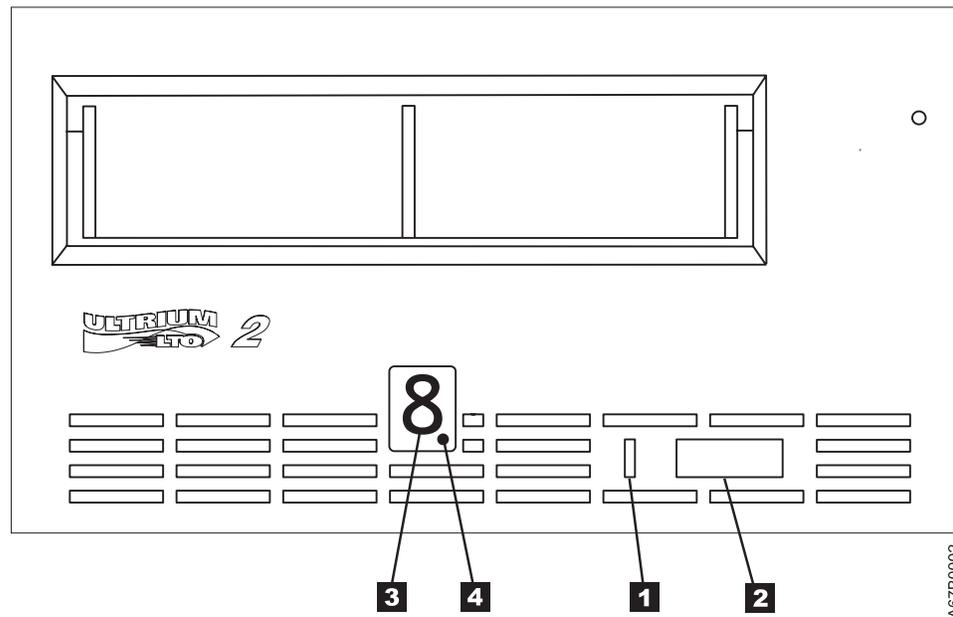
Figure 16. Front view of the IBM LTO-2 Tape Drive

# Status light

The status light (**1** in Figure 16 on page 31) is a light-emitting diode (LED) that provides information about the state of the LTO-2 Tape Drive. The light can be green or amber, and (when lit) solid or flashing. Table 4 lists the conditions of the status light and provides an explanation of what each condition means.

*Table 4. Meaning of Status Light Activity*

| Color and Condition of Status Light | Meaning |
|---|---|
| Off | The tape drive has no power or is powered off. |
| Green/Solid | The tape drive is powered on and is idle. |
| Green/Flashing | The tape drive is reading from the tape, writing to the tape, rewinding the tape, locating data on the tape, loading the tape, or unloading the tape.<br><br>The status light also flashes green if the tape drive contains a cartridge during the power-on cycle. In this case, the drive completes POST and slowly rewinds the tape (the process may take approximately 13 minutes). The light stops blinking and becomes solid when the drive completes the recovery and is ready for a read or write operation. To eject the cartridge, press the unload button. |
| Amber/Solid | The tape drive is powering on, is resetting, or is in maintenance mode. For information about the functions that are available when the drive is in maintenance mode, see "Selecting a diagnostic or maintenance function" on page 36. |
| Amber/Flashing | One of the following applies:<br>• If the light flashes once per second, an error occurred and the tape drive or media may require service. Note the code on the single-character display, then go to Table 8 on page 49 to determine the action that is required. If a solid **C** appears in the single-character display, the drive needs cleaning.<br>• If the light flashes twice per second, the tape drive is updating firmware. For more information, see "Updating the firmware" on page 45.<br>• If the light flashes once per second, the tape drive is updating firmware. For more information, see "Updating the firmware" on page 45.<br>• If the light flashes twice per second, the tape drive detected an error and is performing a firmware recovery. It resets automatically. |

## Unload button

The unload button (**2** in Figure 16 on page 31) enables you to perform the following functions:

- Rewind the tape into the cartridge and eject the cartridge from the tape drive. For more information, see "Removing a tape cartridge" on page 35.
- Enter or exit maintenance mode, or perform diagnostic or maintenance functions. For more information, see "Selecting a diagnostic or maintenance function" on page 36.
- Perform a panic reset of the drive. **Attention**: If the tape drive detected a permanent error and displayed an error code, it automatically forces a drive dump (also known as a save of the firmware trace). If you perform a panic reset of the drive, the existing dump will be overwritten and lost. To perform a panic reset, press and hold the unload button on the drive for 10 seconds. The drive forces a dump and overwrites the existing dump. The drive then reboots to allow communication.

## Single-character display

The LTO-2 features an LED (**3** in Figure 16 on page 31) that presents a single-character code for:

- Diagnostic or maintenance functions
- Error conditions and informational messages

Table 5 on page 36 lists each single-character code that is used for diagnostic or maintenance functions. Table 8 on page 49 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.

### Single red dot

The single-character display is blank during normal operation. However, if a drive dump is present while the drive is in maintenance mode, a single red dot illuminates on the display. To copy the dump to tape, see Function Code 5 in Table 5 on page 36.

The red dot turns off when you obtain the dump (by using an FMR tape or a SCSI command). If no dump is present while the drive is in maintenance mode, the single red dot does not illuminate.

# Inserting a tape cartridge

To insert a tape cartridge:

1. Ensure that the LTO-2 is powered-on.

2. Ensure that the write-protect switch is properly set (see "Setting the write-protect switch" on page 16).

3. Grasp the cartridge so that the write-protect switch faces you (see **1** in Figure 17).

4. Slide the cartridge into the tape load compartment.

   **Notes:**

   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.
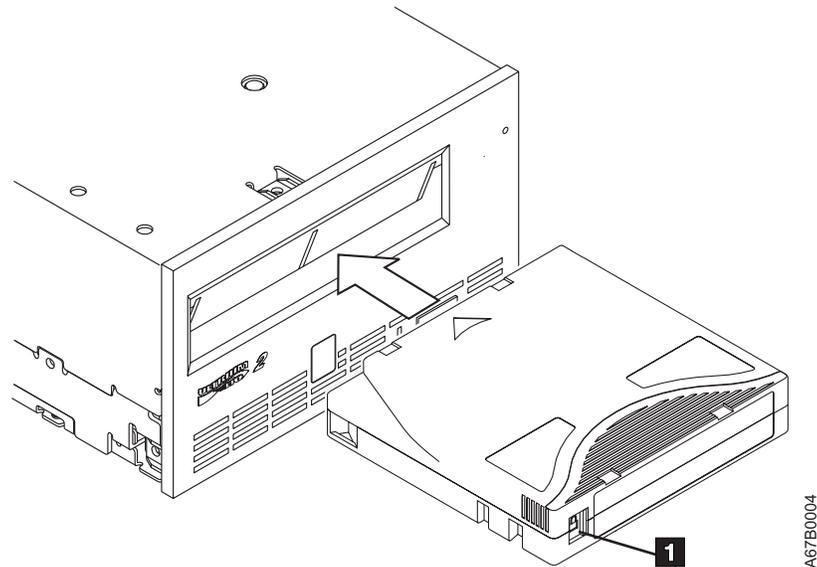


*Figure 17. Inserting a cartridge into the LTO-2*

## Removing a tape cartridge

To remove a tape cartridge:

1. Ensure that the LTO-2 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.

If you are unable to remove the cartridge, see "Manually removing a tape cartridge" on page 58. Whenever you unload a tape cartridge, the tape drive writes any pertinent information to the cartridge memory.

## Cleaning the drive head

**Attention:** To clean the drive head, use the IBM 35L2086 LTO Ultrium Cleaning Cartridge.

**Note:** You must use only IBM supported cleaning cartridges. Use of unsupported cleaning cartridges may void your warranty or result in billable service charges. You can view the most current support list at www.pc.ibm.com/support and search for "cleaning cartridges."

Clean the drive head whenever **C** displays on the single-character display and the status light is flashing amber. To clean the head, insert the cleaning cartridge into the tape load compartment (see Figure 17 on page 34). The drive performs the cleaning automatically. When the cleaning is finished, the drive ejects the cartridge. Most universal cleaning cartridges are generally valid for 50 cleanings.

# Selecting a diagnostic or maintenance function

The LTO-2 can run diagnostics, test write and read functions, test a suspect tape cartridge, update its own firmware, and perform other diagnostic and maintenance functions. The drive must be in maintenance mode to perform these functions. To place the drive in maintenance mode and select a diagnostic or maintenance function, see Table 5.

**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.

**Note:** For best results, Function Codes 2-7 should be performed by IBM qualified service persons. Otherwise, perform these codes only when instructed to do so by IBM service or support.

*Table 5. Diagnostic and maintenance functions*

| **Function Code 1 - Run SCSI Drive Diagnostics** |
| --- |
| Causes the tape drive to run self tests.<br><br>**Attention:** Insert only a scratch data cartridge for this test. Data on the cartridge will be overwritten.<br>1. Make sure that no cartridge is in the drive.<br>2. Within a 1.5-second interval, press the unload button three times. The status light becomes solid amber, which means that the drive is in maintenance mode.<br>3. Press the unload button once per 1.5 seconds until **1** appears in the single-character display. If you cycle past **1**, continue to press the unload button until it redisplays.<br>4. To select the function, press and hold the unload button for 3 seconds. After you select the function, **1** flashes, the drive runs diagnostics for approximately 90 seconds, then **C** flashes. When **C** flashes, the drive is waiting for a cartridge.<br>5. Within 60 seconds, insert a scratch data cartridge (or the tape drive exits maintenance mode). After you insert the cartridge, **1** flashes:<br>  • If the diagnostic completes successfully, it begins again and runs for a maximum of 10 times. Each loop takes approximately 20 minutes to run. After the tenth loop, the diagnostic stops and automatically exits maintenance mode. To halt the diagnostic, press the unload button within the first 20 minutes of the test (or the diagnostic will run another 20 minutes). The drive acknowledges the request by slowing the length of time that the currently displayed character flashes on the single-character display (from twice per second to once per second). The diagnostic continues to the end of its loop and then stops. The tape drive then displays **0**, rewinds and unloads the cartridge, and exits maintenance mode.<br>  • If the diagnostics fail, the status light flashes amber and an error code displays. The tape drive unloads the tape cartridge and exits maintenance mode. To resolve the error, locate the code in Table 8 on page 49. |

*Table 5. Diagnostic and maintenance functions  (continued)*

| Function Code 2 - Update Tape Drive Firmware from FMR Tapes |
| --- |
| Causes the tape drive to load updated firmware from a field microcode replacement (FMR) tape.<br><br>**Attention:**   Do not power-off the tape drive while loading code.<br>1.  Make sure that no cartridge is in the drive.<br>2.  Within a 1.5-second interval, press the unload button three times. The status light becomes solid amber, which means that the drive is in maintenance mode.<br>3.  Press the unload button once per 1.5 seconds until **2** appears in the single-character display. If you cycle past **2**, continue to press the unload button until it redisplays.<br>4.  To select the function, press and hold the unload button for 3 seconds. After you select the function, **C** flashes. When **C** flashes, the drive is waiting for a cartridge. Within 60 seconds, insert the FMR tape cartridge (or the tape drive exits maintenance mode). After you insert the cartridge, **2** flashes and the tape drive loads the updated firmware from the FMR tape cartridge into its erasable programmable read-only memory (EPROM) area:<br> • If the update completes successfully, the tape drive displays **0**, rewinds and unloads the FMR tape, resets itself, and is ready to use the new firmware.<br> • If the update fails, the tape drive posts an error code to the single-character display (to resolve the error, see Table 8 on page 49). The drive then unloads the FMR tape and exits maintenance mode. |

*Table 5. Diagnostic and maintenance functions  (continued)*

| Function Code 3 - Create FMR Tape |
| --- |
| Causes the tape drive to copy its field microcode replacement (FMR) data to a scratch data cartridge.<br><br>**Attention:**  If you select this function, the tape drive will overwrite existing data on the scratch data cartridge.<br>1. Make sure that no cartridge is in the drive.<br>2. Within a 1.5-second interval, press the unload button three times. The status light becomes solid amber, which means that the drive is in maintenance mode.<br>3. Press the unload button once per 1.5 seconds until **3** appears in the single-character display. If you cycle past **3**, continue to press the unload button until it redisplays.<br>4. To select the function, press and hold the unload button for 3 seconds. After you select the function, **C** flashes. When **C** flashes, the drive is waiting for a cartridge. Within 60 seconds, insert a scratch data cartridge that is not write protected (or the tape drive exits maintenance mode). After you insert the cartridge, **3** flashes and the tape drive copies the FMR data to the scratch data cartridge:<br><ul><li>If the tape drive creates the FMR tape successfully, it displays **0**, rewinds and unloads the new FMR tape, and exits maintenance mode.</li><li>If the tape drive fails to create the FMR tape, it displays **7**, unloads the FMR tape, and exits maintenance mode.</li></ul> |
| **Function Code 4 - Force a Drive Dump** |
| Causes the tape drive to perform a collection (or *dump*) of data. (A drive dump is also known as a save of the firmware trace.) The dump (firmware trace) can only be analyzed by IBM.<br>**Note:** When an error code displays, a red dot also displays to remind you that a dump already exists. If you perform Function Code 4, it will overwrite the dump and cause the error information to be lost.<br>1. Make sure that no cartridge is in the drive.<br>2. Within a 1.5-second interval, press the unload button three times. The status light becomes solid amber, which means that the drive is in maintenance mode.<br>3. Press the unload button once per 1.5 seconds until **4** appears in the single-character display. If you cycle past **4**, continue to press the unload button until it redisplays.<br>4. To select the function, press and hold the unload button for 3 seconds. After you select the function, **4** displays, followed by **0**. The single-character display then goes blank, and the tape drive exits maintenance mode.<br><br>An illuminated red dot on the single-character display indicates that a drive dump has been created. To retrieve the dump from the drive, see Function Code 5 on page 39.<br><br>You can also perform this operation when the tape drive is in normal operating mode. Simply press and hold the unload button for 10 seconds. |

*Table 5. Diagnostic and maintenance functions  (continued)*

| **Function Code 5 - Copy the Drive Dump to Tape (at Beginning of Tape)** |
|---|
| Causes the tape drive to copy data from a drive dump (captured with Function Code 4) to the beginning of a scratch data cartridge. An illuminated red dot on the single-character display indicates that a drive dump has been created.<br><br>1.  Make sure that no cartridge is in the drive.<br><br>2.  Within a 1.5-second interval, press the unload button three times. The status light becomes solid amber, which means that the drive is in maintenance mode.<br><br>3.  Press the unload button once per 1.5 seconds until **5** appears in the single-character display. If you cycle past **5**, continue to press the unload button until it redisplays.<br><br>4.  To select the function, press and hold the unload button for 3 seconds. After you select the function, **C** flashes. When **C** flashes, the drive is waiting for a cartridge. Within 60 seconds, insert a scratch data cartridge that is not write-protected (or the tape drive exits maintenance mode). After you insert the cartridge, **5** flashes and the tape drive writes the dump data to the tape (at the beginning of the tape). When the function is complete, **0** displays, the drive rewinds and unloads the tape, and exits maintenance mode.<br><br>    From the server, issue the SCSI READ command to read the dump from the tape to a file or electronic image. For information about where to send the electronic image, contact your OEM Product Application Engineer (PAE). |
| **Function Code 6 - Run SCSI Wrap Test** |
| Causes the drive to perform a check of the SCSI circuitry from and to the SCSI connector.<br><br>To run the test, perform the following procedure.<br><br>**Running a SCSI Wrap Test**<br><br>This test evaluates the SCSI circuitry. A SCSI LVD wrap plug, a SCSI LVD terminator, and a Y-cable are required for this procedure.<br>**Note:** You can terminate the Generation 1 drive internally while running the SCSI wrap test. Internal termination is not built into the Generation 2 drive, therefore you must run the SCSI wrap test by using a Y-cable and external termination.<br><br>Before you select this function, you must configure the drive to supply term power, terminate the SCSI bus, and attach the SCSI wrap plug. Configure the drive to supply term power by placing a jumper on pin 6 of the drive's SCSI ID connector (as shown by the shaded area in the figure below).<br><br><br><br>Connect a Y-cable to the drive's SCSI connector. Place a terminator on one end of the Y-cable and the wrap plug on the other end.<br><br>1.  Ensure that the drive does not contain a cartridge.<br><br>2.  Within a 1.5-second interval, press the unload button three times. The status light becomes solid amber, which means that the drive is in maintenance mode.<br><br>3.  Press the unload button once per 1.5 seconds until **6** appears in the single-character display. If you cycle past **6**, continue to press the unload button until it redisplays.<br><br>4.  To select the function, press and hold the unload button for 3 seconds. After you select the function, the tape drive automatically starts the test:<br><br>    •  If the test is successful, it loops and begins again. To halt the test, press the unload button. The drive acknowledges the request by slowing the length of time that the currently displayed character flashes on the single-character display (from twice per second to once per second). The test continues to the end of its loop, then stops. **0** displays and the drive exits maintenance mode. To continue to isolate the problem, go to "Fixing SCSI bus errors" on page 53 and locate the steps to take after you run the SCSI wrap test.<br><br>    •  If the test fails, **8** displays, the test stops, and the tape drive exits maintenance mode. To resolve the error, replace the tape drive (see "Removing a SCSI tape drive from an enclosure" on page 57). |

*Table 5. Diagnostic and maintenance functions (continued)*

| **Function Code 7 - Run LDI or RS-422 Wrap Test** |
|---|
| Causes the tape drive to perform a check of the circuitry from and to the LDI or RS-422 connector.<br><br>Before you select this function, attach an LDI or RS-422 wrap plug to the tape drive's LDI or RS-422 connector (in place of the LDI or RS-422 cable).<br>1. Make sure that no cartridge is in the drive.<br>2. Within a 1.5-second interval, press the unload button three times. The status light becomes solid amber, which means that the drive is in maintenance mode.<br>3. Press the unload button once per 1.5 seconds until **7** appears in the single-character display. If you cycle past **7**, continue to press the unload button until it redisplays.<br>4. To select the function, press and hold the unload button for 3 seconds. After you select the function, **7** flashes and the tape drive automatically starts the test:<br>   • If the test is successful, it loops and begins again. To halt the test, press the unload button. The test continues to the end of its loop and then stops. The tape drive then displays **0** and exits maintenance mode.<br>   • If the test fails, **9** displays, the test stops, and the tape drive exits maintenance mode. To resolve the error, locate **9** in Table 8 on page 49. |

*Table 5. Diagnostic and maintenance functions (continued)*

| **Function Code 8 - Convert FMR Tape to Scratch Tape** |
|---|
| Causes the tape drive to erase the field microcode replacement (FMR) data on a scratch data cartridge and rewrite the cartridge memory on the tape. This turns the cartridge into a valid scratch data cartridge. <br><br> 1. Make sure that no cartridge is in the drive. <br><br> 2. Within a 1.5-second interval, press the unload button three times. The status light becomes solid amber, which means that the drive is in maintenance mode. <br><br> 3. Press the unload button once per 1.5 seconds until **8** appears in the single-character display. If you cycle past **8**, continue to press the unload button until it redisplays. <br><br> 4. To select the function, press and hold the unload button for 3 seconds. After you select the function, **C** flashes. When **C** flashes, the drive is waiting for a cartridge. Within 60 seconds, insert the FMR cartridge (or the tape drive exits maintenance mode). After you insert the cartridge, **8** flashes, the tape drive erases the firmware on the tape, then rewrites the header in the cartridge memory to change the cartridge to a valid scratch data cartridge: <br> • If the operation is successful, the tape drive displays **0**, rewinds and ejects the newly converted scratch data cartridge, and exits maintenance mode. <br> • If the operation is not successful, an error code displays. To resolve the error, locate the code in Table 8 on page 49. |
| **Function Code 9 - Display Error Code Log** |
| Causes the tape drive to display 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). <br><br> 1. Make sure that no cartridge is in the drive. <br><br> 2. Within a 1.5-second interval, press the unload button three times. The status light becomes solid amber, which means that the drive is in maintenance mode. <br><br> 3. Press the unload button once per 1.5 seconds until **9** appears in the single-character display. If you cycle past **9**, continue to press the unload button until it redisplays. <br><br> 4. To select the function, press and hold the unload button for 3 seconds. After you select the function, press the unload button to view the most recent error code. Press the unload button again to view successive error codes. If you press the unload button for 3 seconds after the tenth error code displays, **0** displays (if there are no errors in the log) and the drive exits maintenance mode. |

*Table 5. Diagnostic and maintenance functions (continued)*

| |
|---|
| **Function Code A - Clear Error Code Log** |
| Causes the tape drive to erase the contents of the error code log. |
| 1. Make sure that no cartridge is in the drive. |
| 2. Within a 1.5-second interval, press the unload button three times. The status light becomes solid amber, which means that the drive is in maintenance mode. |
| 3. Press the unload button once per 1.5 seconds until **A** appears in the single-character display. If you cycle past **A**, continue to press the unload button until it redisplays. |
| 4. To select the function, press and hold the unload button for 3 seconds. After you select the function, the tape drive erases all errors from the error code log, displays **0**, then exits maintenance mode. |
| **Function Code C - Insert Cartridge into Tape Drive** |
| This function cannot be selected by itself. It relates to other maintenance functions (such as Run Tape Drive Diagnostics or Create FMR Tape) that require an FMR tape cartridge or scratch tape cartridge that is not write protected. |
| **Function Code E - Test Cartridge & Media** |
| Causes the tape drive to perform a Write/Read test (on the edge bands) to ensure that a suspect cartridge and its magnetic tape are acceptable. The tape drive takes approximately 10 minutes to run the test. |
| **Attention:** Data on the suspect tape will be overwritten. |
| 1. Make sure that no cartridge is in the drive. |
| 2. Within a 1.5-second interval, press the unload button three times. The status light becomes solid amber, which means that the drive is in maintenance mode. |
| 3. Press the unload button once per 1.5 seconds until **E** appears in the single-character display. If you cycle past **E**, continue to press the unload button until it redisplays. |
| 4. To select the function, press and hold the unload button for 3 seconds. After you select the function, **C** flashes. When **C** flashes, the drive is waiting for a cartridge. Within 60 seconds, insert the suspect data cartridge (or the tape drive exits maintenance mode). After you insert the cartridge, **E** flashes and the test begins: |
|   &bull; If no error is detected, the test begins again and runs for a maximum of 10 times. After the tenth loop, the test stops and the drive automatically exits maintenance mode. To halt the test, press the unload button. The drive acknowledges the request by slowing the length of time that the currently displayed character flashes on the single-character display (from twice per second to once per second). The test continues to the end of its loop and then stops. The tape drive then rewinds and unloads the cartridge, displays **0**, and exits maintenance mode. |
|   &bull; If an error is detected, the tape drive displays **7**, unloads the tape cartridge, and exits maintenance mode. To resolve the error, locate **7** in Table 8 on page 49. |

*Table 5. Diagnostic and maintenance functions (continued)*

| **Function Code F - Fast Read/Write Test** |
|---|

Causes the tape drive to perform tests to ensure that the drive can read from and write to tape. This diagnostic performs fewer tests than the Run Tape Drive Diagnostics test (Function Code 1). The tape drive takes approximately three minutes to run the test. The Fast Read/Write Test is not as comprehensive a test and is not recommended for isolating errors between the drive and the media.

**Attention:** Data on the suspect tape will be overwritten.

1. Make sure that no cartridge is in the drive.
2. Within a 1.5-second interval, press the unload button three times. The status light becomes solid amber, which means that the drive is in maintenance mode.
3. Press the unload button once per 1.5 seconds until **F** appears in the single-character display. If you cycle past **F**, continue to press the unload button until it redisplays.
4. To select the function, press and hold the unload button for 3 seconds. After you select the function, **C** flashes. When **C** flashes, the drive is waiting for a cartridge. Within 60 seconds, insert the suspect data cartridge (or the tape drive exits maintenance mode). After you insert the cartridge, **F** flashes and the test begins.

   - If no error is detected, the test begins again and runs for a maximum of 10 times. Each loop takes approximately 3 minutes to run. After the tenth loop, the test stops and the drive automatically exits maintenance mode. To halt the test, press the unload button. The drive acknowledges the request by slowing the length of time that the currently displayed character flashes on the single-character display (from twice per second to once per second). The test continues to the end of its loop and then stops. The tape drive then rewinds and unloads the cartridge, displays **0**, and exits maintenance mode.
   - If an error is detected, the tape drive displays an error code, unloads the tape cartridge, and exits maintenance mode. To resolve the error, locate the code in Table 8 on page 49.

| **Function Code H - Test Head** |
|---|

Causes the tape drive to perform the Head Resistance Measurements test and a Write/Read test (on the center of the tape). The drive runs these tests to ensure that the tape drive's head and tape-carriage mechanics are working correctly. The tape drive takes approximately 10 minutes to run the test.

1. Make sure that no cartridge is in the drive.
2. Within a 1.5-second interval, press the unload button three times. The status light becomes solid amber, which means that the drive is in maintenance mode.
3. Press the unload button once per 1.5 seconds until **H** appears in the single-character display. If you cycle past **H**, continue to press the unload button until it redisplays.
4. To select the function, press and hold the unload button for 3 seconds. After you select the function, **C** flashes. When **C** flashes, the drive is waiting for a cartridge. Within 60 seconds, insert a scratch data cartridge (or the tape drive exits maintenance mode). After you insert the cartridge, **H** flashes and the test begins:

   - If no error is detected, the test begins again and runs for a maximum of 10 times. Each loop takes approximately 10 minutes to run. After the tenth loop, the test stops and the drive automatically exits maintenance mode. To halt the test, press the unload button. The drive acknowledges the request by slowing the length of time that the currently displayed character flashes on the single-character display (from twice per second to once per second). The test continues to the end of its loop and then stops. The tape drive then rewinds and unloads the cartridge, displays **0**, and exits maintenance mode.
   - If an error is detected, the tape drive displays **5**, unloads the tape cartridge, and exits maintenance mode. To resolve the error, locate **5** in Table 8 on page 49.

*Table 5. Diagnostic and maintenance functions  (continued)*

| Function Code L - Reserved for Future Use |
|---|
| Reserved for future use. |

| Function Code P or U - Enable or Disable Post Error Reporting |
|---|
| Used by support personnel during error detection, this function is an alternate method of setting or preventing the post error (PER) bit in the SCSI Read-Write Error Recovery Page. For more information, refer to the MODE SENSE command in the *IBM LTO-2 Ultrium Tape Drive SCSI Reference*.<br><br>1. Make sure that no cartridge is in the drive.<br><br>2. Within a 1.5-second interval, press the unload button three times. The status light becomes solid amber, which means that the drive is in maintenance mode.<br><br>3. Perform one of the following:<br>  • To enable post error reporting, press the unload button once per 1.5 seconds until **U** appears in the single-character display. If you cycle past **U**, continue to press the unload button until it redisplays.<br>  • To disable post error reporting, press the unload button once per 1.5 seconds until **P** appears in the single-character display. If you cycle past **P**, continue to press the unload button until it redisplays.<br><br>4. To select the function, press and hold the unload button for 3 seconds. After you select the function, the drive displays one of the following:<br>  • **P** to indicate that post error reporting is enabled.<br>  • **U** to indicate that post error reporting is disabled. |

## Exiting maintenance mode

To manually exit maintenance mode, press the unload button once per second until **0** appears on the single-character display. Press and hold the unload button for 3 seconds. The drive exits maintenance mode (the solid amber status light becomes solid green, then turns off).

You can also exit maintenance mode by pressing the unload button during any maintenance or diagnostic function.

## Updating the firmware

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

Periodically check for updated levels of drive firmware by visiting the web at `www.pc.ibm.com/support` and search for 59P6744. You can update your drive's firmware by:

- Obtaining the new firmware image and downloading it to the drive through the SCSI interface
- Downloading the Firmware Update CD from IBM at www.pc.ibm.com/support.

For instructions about how to obtain a new firmware image or FMR tape, visit the preceding Web site. The preceding Web site includes instructions for downloading firmware or obtaining a Firmware Update CD.

# Chapter 5. Resolving problems

If you encounter problems when running the LTO-2 Tape Drive, refer to Table 6. If the problem is not identified in Table 6, refer to "Methods of receiving errors and messages". The color and condition of the status light may also indicate a problem. For more information, see "Status light" on page 32.

*Table 6. Troubleshooting tips for the IBM 200/400GB LTO-2 Tape Drive*

| If the problem is this.... | Do this.... |
|---|---|
| A code displays on the single-character display and the status light flashes amber. | The tape drive detected an error or is directing you to an informational message. See Table 8 on page 49. |
| The status light or single-character display never turns on. | The tape drive has no power. Check the power at the power source. Connect power to the tape drive (see "Step 4. Connect and test power to the tape drive" on page 11). If the problem persists, replace the tape drive. |
| The tape drive will not load a tape cartridge. | One of the following has occurred:<br>• 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 tape drive, then turn it back on. After the status light becomes solid green, press the unload button to eject the cartridge.<br>• The tape cartridge was inserted incorrectly. To properly insert a cartridge, see "Inserting a tape cartridge" on page 34.<br>• The tape cartridge may be defective. Insert another tape cartridge. If the problem exists for multiple cartridges, the tape drive is defective. Replace the tape drive (see "Removing a SCSI tape drive from an enclosure" on page 57 ).<br>• The tape drive has no power. Connect power to the tape drive (see "Step 4. Connect and test power to the tape drive" on page 11). |
| The tape drive will not unload the tape cartridge. | The tape cartridge is stuck or is broken. Press the unload button. If the cartridge does not eject, turn off the power to the tape drive, then turn it back on (note that the mid-tape recovery could take up to 5 minutes to complete). If the cartridge still does not eject, manually remove it (see "Manually removing a tape cartridge" on page 58). |
| The server received TapeAlert flags. | See Appendix B, "TapeAlert flags", on page 71. |
| The server reported SCSI problems (such as selection or command time-outs, or parity errors). | See "Fixing SCSI bus errors" on page 53. |
| Codes display on the single-character display, but the status light does not turn on. | The tape drive is defective. Replace the tape drive (see "Removing a SCSI tape drive from an enclosure" on page 57). |
| The tape drive does not respond to server commands. | Press and hold the unload button on the drive for 10 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 Table 7 on page 48 as a guide for identifying error codes and message codes reported by the LTO-2, its enclosure (if applicable), or the server.

**Note:** The codes on the single-character display 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 Table 8 on page 49. Codes that occur while in maintenance mode are defined in Table 5 on page 36.

*Table 7. Methods of receiving errors and messages for the IBM TotalStorage LTO Ultrium 2 Tape Drive*

| If the error or message was presented by.... | Do this.... |
|---|---|
| | |
| The enclosure's display (if the tape drive is enclosed in a library or autoloader) | Refer to the documentation for the enclosure. |
| The tape drive's single-character display and the status light flashes amber | See Table 8 on page 49. To determine the meaning of status light activity, see "Status light" on page 32. |
| The tape drive's single-character display and the status light is solid amber | See Table 5 on page 36. To determine the meaning of status light activity, see "Status light" on page 32. |
| SCSI log sense data (such as TapeAlert flags) or SCSI drive sense data | See Appendix B, "TapeAlert flags", on page 71, Table 8 on page 49. |
| Drive sense data sent to a library (if the tape drive is enclosed in a library) | Refer to your library's documentation, then see Table 8 on page 49. |
| The tape drive's error log | See Table 8 on page 49. |

# Descriptions and corrective actions for errors and messages

Table 8 gives descriptions of the errors and messages that pertain to the LTO-2, and tells what to do when you receive them.

**Attention:** If the tape drive detects a permanent error and displays an error code other than 0, 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 tape drive or you may lose the dump data.

*Table 8. Codes for error conditions and informational messages for the IBM 200/400GB LTO-2 Tape Drive.* The single-character display clears if you power-off the drive.

| Code | Cause and Action |
|---|---|
| 0 | No error occurred and no action is required. This code displays:<br><br>• When power is cycled (turned off, then on) to the tape drive.<br><br>• When diagnostics have finished running and no error occurred.<br><br>**Note:** The single-character display is blank during normal operation of the tape drive. |
| 1 | Cooling problem. The tape drive detected that the recommended operating temperature was exceeded. Perform the following action:<br><br>1. If a fan is present in the enclosure, ensure that it is rotating and is quiet. If not, replace the fan (for instructions about replacing the fan, see your enclosure's documentation).<br><br>2. Remove any blockage that prevents air from flowing freely through the tape drive.<br><br>3. Ensure that the operating temperature and airflow is within the specified range (see Appendix C, "Specifications", on page 75).<br><br>4. If the operating temperature is within the specified range and the problem persists, replace the tape drive.<br><br>The error code clears when you power-off the tape drive or place it in maintenance mode. |
| 2 | Power problem. The tape drive detected that the externally supplied power is either approaching the specified voltage limits (the drive is still operating) or is outside the specified voltage limits (the drive is not operating). Perform the following action:<br><br>1. Ensure that the power connector is properly seated.<br><br>2. Ensure that the proper dc voltages are being applied within the tolerances allowed (see Appendix C, "Specifications", on page 75).<br><br>3. If the proper voltages are being applied but the problem persists, replace the tape drive.<br><br>The error code clears when you power-off the tape drive or place it in maintenance mode. |
| 3 | Firmware problem. The tape drive determined that a firmware error occurred. Perform the following action:<br><br>1. Collect a drive dump from one of the following:<br>   **Note:** Do not force a new dump; the tape drive has already created one.<br><br>  • Server's SCSI interface by using a device driver utility or system tool. To obtain a dump, determine whether your server is installed with a utility that can read files from the server's memory. If it is, use that utility to obtain the dump. You will be instructed where to send the dump information by the IBM service or support person who asked you to obtain the dump.<br><br>  • Enclosure (refer to the procedures for reading a drive dump in your enclosure's documentation)<br><br>  • Ultrium 2 Tape Drive (to read a drive dump, use Function Code 5 in Table 5 on page 36)<br><br>2. Power the tape drive off and on, then retry the operation that produced the error.<br><br>3. If the problem persists, download new firmware and retry the operation.<br><br>The error code clears when you power-off the tape drive or place it in maintenance mode. |
| 4 | Please contact IBM Support by following the instructions in Appendix D, "Product warranty and support information", on page 77. |

*Table 8. Codes for error conditions and informational messages for the IBM 200/400GB LTO-2 Tape Drive  (continued).*  The single-character display clears if you power-off the drive.

| Code | Cause and Action |
|------|------------------|
| 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 drive will not allow you to insert a cartridge if the current cartridge was successfully ejected. The error code may clear when you cycle power to the tape drive or place it in maintenance mode. If the problem persists, replace the tape drive. |

| Code | Cause and Action |
|------|------------------|
| 6 | Tape drive or media error. The drive determined that an error occurred, but it cannot isolate the error to faulty hardware or to the tape cartridge. Perform the following action:<br><br>**For problems with writing data:**<br><br>If the problem occurred while the drive was writing data to the tape, and if you know the volume serial number (located on the cartridge label) of the tape cartridge loaded in the drive when the problem occurred, retry the operation with a different cartridge:<br>• If the operation succeeds, the original cartridge was defective. Copy data from the defective cartridge and discard it.<br>• If the operation fails and another drive is available, insert the cartridge into the other drive and retry the operation.<br>  – If the operation fails, discard the defective cartridge.<br>  – If the operation succeeds, insert a scratch cartridge into the first drive and run the tape drive diagnostics (see Function Code 1 in Table 5 on page 36).<br>    - If the diagnostics fail, replace the drive.<br>    - If the diagnostics succeed, the error was temporary.<br>• If the operation fails and another drive is not available, insert a scratch cartridge into the drive and run the tape drive diagnostics (see Function Code 1 in Table 5 on page 36).<br>  – If the diagnostics fail, replace the drive.<br>  – If the diagnostics succeed, discard the cartridge.<br><br>If the problem occurs with multiple tape cartridges or if you do not know the tape cartridge's volume serial number, run the tape drive diagnostics (see Function Code 1 in Table 5 on page 36):<br>• If the diagnostics fail, replace the tape drive.<br>• If the diagnostics succeed, run the Test Head diagnostic (see Function Code H in Table 5 on page 36).<br>  – If the Test Head diagnostic fails, replace the tape drive.<br>  – If the Test Head diagnostic succeeds, replace the cartridges that caused the problem.<br><br>The error code clears when you remove the tape cartridge or place the drive in maintenance mode.<br><br>**For Problems with Reading Data:**<br><br>If the problem occurred while the drive was reading data from the tape, and if you know the volume serial number of the tape cartridge, perform one of the following procedures:<br>• If another drive is available, insert the cartridge into the other drive and retry the operation:<br>  – If the operation fails, discard the defective cartridge.<br>  – If the operation succeeds, insert a scratch cartridge into the first drive and run the tape drive diagnostics (see Function Code 1 in Table 5 on page 36):<br>    - If the diagnostics fail, replace the drive.<br>    - If the diagnostics succeed, the error was temporary.<br>• If another drive is not available, insert a scratch cartridge into the drive and run the tape drive diagnostics (see Function Code 1 in Table 5 on page 36):<br>  – If the diagnostics fail, replace the drive.<br>  – If the diagnostics succeed, discard the cartridge.<br><br>If the problem occurs with multiple tape cartridges or if you do not know the tape cartridge's volume serial number, run the tape drive diagnostics (see Function Code 1 in Table 5 on page 36):<br>• If the diagnostics fail, replace the tape drive.<br>• If the diagnostics succeed, run the Test Head diagnostic (see Function Code H in Table 5 on page 36).<br>  – If the Test Head diagnostic fails, replace the tape drive.<br>  – If the Test Head diagnostic succeeds, replace the cartridges that caused the problem.<br><br>The error code clears when you remove the tape cartridge or place the drive in maintenance mode. |

*Table 8. Codes for error conditions and informational messages for the IBM 200/400GB LTO-2 Tape Drive (continued).* The single-character display clears if you power-off the drive.

| Code | Cause and Action |
|---|---|
| 7 | A high probability of media error. The tape drive determined that an error occurred because of a faulty tape cartridge. Try another tape cartridge. If the problem occurs with multiple tape cartridges, see "Resolving media-related problems" on page 55.<br><br>The error code clears when you remove the tape cartridge or place the drive in maintenance mode. |
| 8 | **For SCSI drive:**<br><br>Tape drive or SCSI bus failure. The tape drive determined that a failure occurred in the tape drive's hardware or in the SCSI bus. See "Fixing SCSI bus errors" on page 53. The error code clears 10 seconds after the drive detected the error or when you place the drive in maintenance mode. |
|  |  |
| 9 | Tape drive or LDI (RS-422) error. The tape drive determined that a failure occurred in the tape drive hardware or in the LDI (RS-422) connection. Run the LDI or RS-422 wrap test (see Function Code 7 in Table 5 on page 36):<br>• If the diagnostic fails, replace the tape drive.<br>• If the diagnostic runs successfully, the problem is with the enclosure or the cable to the enclosure. Refer to your enclosure's documentation.<br><br>The error code clears when you place the drive in maintenance mode. |
| o, c, b, or h | No error or message assigned. There may be a problem with the single-character display. Turn the power off, then on and determine whether all segments on the single-character display are lit. If so, you may have a down-level version of both your enclosure's firmware and documentation (the documentation may not describe all of the available error codes). Refer to the latest version of the firmware or documentation. |
| A | Tape drive hardware problem. The tape drive determined that a problem occurred which degraded the operation of the tape drive, but it did not restrict continued use. If the problem persists, replace the tape drive. The drive is usable, though the single-character display continues to indicate an error and the status light flashes amber.<br><br>The error code may clear when you cycle power to the tape drive or place it in maintenance mode. |
| B | No error or message is assigned. See error code 8 in this table. |
| C | The tape drive needs to be cleaned. Clean the tape drive. See "Cleaning the drive head" on page 35.<br><br>The error code clears when you clean the tape drive or place it in maintenance mode. |
| D | No error or message assigned. See error code 0 in this table. |

# Resolving problems reported by the server

The procedure for fixing SCSI bus errors varies, depending on whether the error is consistent or intermittent, and whether your configuration contains single or multiple LTO-2s. The sections that follow describe how to fix each type of error.

## Fixing SCSI bus errors

### Fixing a consistent error with a single drive on a SCSI bus

1. Ensure that the power is on to the LTO-2.
2. Ensure that the tape drive's SCSI address is the same as the SCSI address assigned by the server.
3. Run the SCSI wrap test (see Function Code 6 in Table 5 on page 36).
   - If the test runs successfully, replace the SCSI terminator first, then the SCSI cable and the interposer (if installed). Repeat the operation that caused the error. If you replaced the SCSI terminator or SCSI cable and the problem persists, the fault is with the server's hardware or software. To isolate the cause of the failure, refer to the server's service documentation.
   - If the test fails, replace the tape drive (see "Removing a SCSI tape drive from an enclosure" on page 57).

### Fixing a consistent error with multiple drives on a SCSI bus

When a consistent error occurs in a configuration that has multiple tape drives on the SCSI bus, you must determine if the problem exists with more than one tape drive. If the problem is with all of the devices on the SCSI bus, the bus is stuck in a SCSI phase and cannot change to another phase or the SCSI cable from the server to the first device is defective.

1. Ensure that the SCSI cable from the server to the first device is connected.
2. Disconnect all but the first tape drive on the SCSI bus. Move the terminator to the first SCSI device.
3. Run a device driver utility (such as IBM's *ntutil* or *tapeutil*) to determine whether the error will occur.
   - If the error occurs, run the SCSI wrap test on the first tape drive (see Function Code 6 in Table 5 on page 36).
     – If the test runs successfully, replace the SCSI terminator first, then the SCSI cable and the interposer (if installed) to the first tape drive. Repeat the operation that caused the error. If you replaced the SCSI terminator or SCSI cable and the problem persists, the fault is with the server's hardware or software. To isolate the cause of the failure, refer to the server's service documentation.
     – If the test fails, replace the tape drive (see "Removing a SCSI tape drive from an enclosure" on page 57).
   - If the error does not occur, connect one tape drive at a time back to the bus and repeat step 3 for each tape drive until you can identify which drive is defective.

     **Note:** Ensure that the SCSI terminator is always on the last tape drive on the SCSI bus.
4. Determine if the problem is with only one tape drive or with two or more tape drives.
   - If the problem is with only one tape drive, run the SCSI wrap test on that tape drive (see Function Code 6 in Table 5 on page 36).

- If the test runs successfully, replace the SCSI terminator first, then the SCSI cable to that tape drive and interposer (if installed).
- If the test fails, replace the tape drive (see "Removing a SCSI tape drive from an enclosure" on page 57).
- If the problem is with two or more tape drives, locate the first tape drive that has the error and replace the SCSI cable that connects the tape drive and the interposer (if installed).

## Fixing an intermittent error with a single drive on a SCSI bus

1. Replace the SCSI terminator on the tape drive.
2. Run the operation that caused the error. If the problem persists, the problem may be with the cable.
3. Isolate which cable is causing the problem by replacing one cable at a time and running the operation that caused the error after each replacement. If the problem persists after all cables have been replaced, the problem may be with the Ultrium 2 Tape Drive.
4. Replace the tape drive (see "Removing a SCSI tape drive from an enclosure" on page 57). If the problem persists, the problem is with your server. Consult your server's documentation.

## Fixing an intermittent error with multiple drives on a SCSI bus

Refer to the server's error logs to determine which tape drive is the source of the problem:

- If only one tape drive is reporting a SCSI failure, replace that tape drive (see "Removing a SCSI tape drive from an enclosure" on page 57).
- If multiple tape drives are reporting SCSI failures, the problem may be with the terminator or the SCSI cables:
  - Replace the terminator and run the operation that caused the error. If the problem persists, the problem may be with the cables.
  - Isolate which cable is causing the problem by replacing one cable at a time and run the operation that caused the error after each replacement.

## Resolving media-related problems

To resolve problems that are related to media, the LTO-2's firmware includes:

- Test Cartridge & Media diagnostic that verifies whether a suspect cartridge and its magnetic tape are acceptable for use.
- Statistical Analysis and Reporting System (SARS) to assist in isolating failures between media and hardware. To determine the cause of failure, SARS uses the cartridge performance history that is saved in the cartridge memory (CM) and the drive performance history that is kept in the drive's flash erasable programmable read-only memory (EPROM). Any failures that SARS detects are reported as TapeAlert flags on the server (see Appendix B, "TapeAlert flags", on page 71).

  **Attention:** If you insert the IBM LTO Ultrium Data Cartridge into another manufacturer's tape drive, the SARS data in the cartridge memory may become lost or invalid.

If you encounter a media-related problem, use the following procedure:

**Attention:** When you run the Test Cartridge & Media diagnostic, data on the suspect tape is overwritten. Use only a scratch data cartridge to run the test.

1. If possible, run the tape cartridge in a different tape drive. If the operation in the other tape drive fails and **6** or **7** displays, replace the media. If the operation succeeds, run the Test Cartridge & Media diagnostic (see Function Code E in Table 5 on page 36).
2. If the Test Cartridge & Media diagnostic fails, replace the media. If it runs successfully, clean the tape drive and run the tape drive diagnostics (see "Cleaning the drive head" on page 35 and Function Code 1 in Table 5 on page 36).
3. If the tape drive diagnostics fail, replace the tape drive. If the tape drive diagnostics run successfully, perform the operation that produced the initial media error.

# Chapter 6. Servicing the tape drive

## Removing a SCSI tape drive from an enclosure

To remove an IBM 200/400GB LTO-2 Tape Drive from an enclosure, perform the following steps:

1. Ensure that the tape drive does not contain a tape cartridge.
2. Deconfigure the drive from the server (for instructions, see your server's documentation).
3. Turn off the power to the enclosure. Disconnect the power cable from the enclosure and the electrical outlet.
4. Remove the cover of the enclosure.
5. Disconnect the internal power cable from the power connector (see **4** in Figure 18).
6. If connected, disconnect the internal LDI (RS-422) cable from the LDI (RS-422) connector **5**.
7. Disconnect the internal SCSI cable from the SCSI connector **2**.
8. Perform one of the following procedures on the SCSI ID connector **3**:
   - If your enclosure uses an internal SCSI ID switch, disconnect it from the SCSI ID connector.
   - If your enclosure uses jumpers to set the SCSI ID, do not remove them from the connector.
9. Remove the mounting screws from the side brackets of the chassis (see **2** in Figure 3 on page 10).
10. Remove the tape drive from the enclosure.
11. To reassemble, reverse these steps.
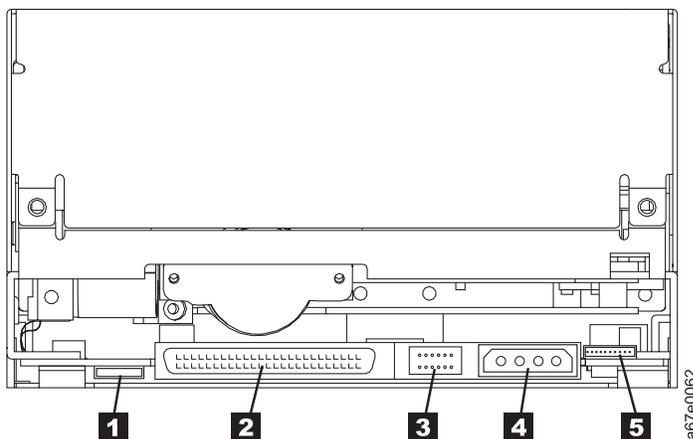


*Figure 18. Rear view of the IBM 200/400GB LTO-2 Tape Drive*

# Manually removing a tape cartridge

If problem-determination procedures identify the LTO-2 as the source of a problem, you can optionally perform one of the following:

- Replace the entire unit. For more information, contact your OEM Product Application Engineer (PAE).
- Manually remove the cartridge (see "Removing the Cartridge").
- If you are unable to manually remove the cartridge, contact trained service personnel for assistance. Refer the service personnel to the instructions in "Fixing an internal jam" on page 61.

> **Attention:**
>
> If you are not a trained service person, do not attempt to open the drive for repairs. Attempting a repair other than the manual removal of a tape cartridge will void your warranty.

## Removing the Cartridge

If a tape cartridge fails to eject from the LTO-2, you can manually remove the cartridge. The following tools are required for the procedure:

- 2.5-mm allen wrench
- Small-blade screwdriver or potentiometer-setting tool
- 2-mm hex wrench
- #3 Phillips screwdriver
- Needle-nose pliers
- Flashlight (optional)

**Attention:** Before performing this procedure, note the following:

- Ensure that you have attempted all normal methods of removing the tape cartridge from the drive. Refer to "Removing a tape cartridge" on page 35 and the troubleshooting tips in Table 6 on page 47.
- This procedure may damage the stuck tape cartridge. If you use this procedure, copy the data from the stuck cartridge to another cartridge. If you choose to reuse the stuck cartridge, refer to the instructions in "Repositioning or reattaching a leader pin" on page 20. If you believe the cartridge has been damaged, replace it.
- Do not use a power screwdriver to perform this procedure because it can destroy the tape.
- Never touch the head or electronic components within the drive. Touching may cause contamination or damage by electrostatic discharge.

To manually remove a tape cartridge, perform the following steps:

1. Place the drive so that the front faces you, then tilt it on its left side (see Figure 19).
2. Locate the access hole at the bottom of the unit (see **1** in Figure 19).
3. Insert a 2.5-mm allen wrench into the access hole and position the wrench so that it is seated in the screw of the supply reel motor.
4. Push open the door of the tape load compartment and locate the flag **2** on the drive's takeup reel.
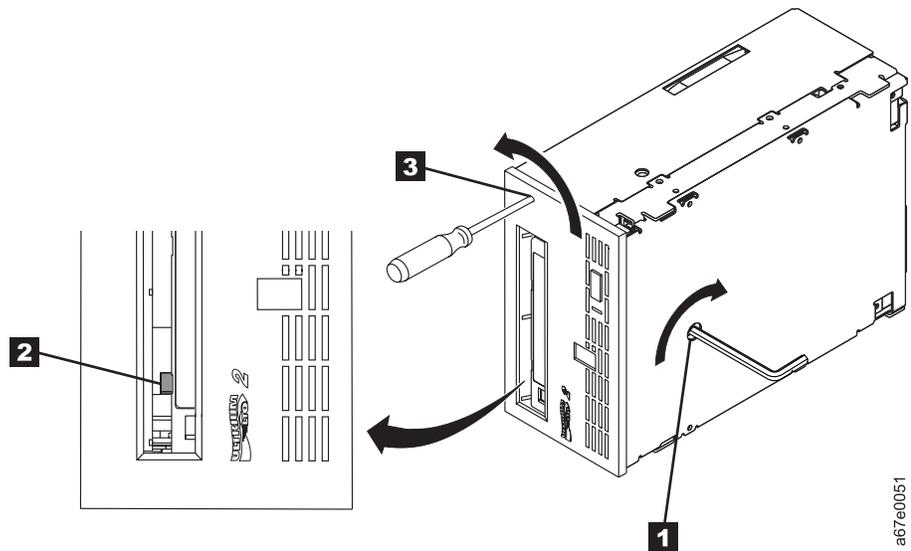


*Figure 19. Determining whether the tape is broken*

**Attention:** In the following step, rotate the allen wrench clockwise, not counterclockwise. A counterclockwise motion may damage the tape.

5. To determine whether the tape is broken, watch the flag **2** on the drive's takeup reel while you rotate the allen wrench **1** clockwise (do not let the wrench move counterclockwise):

   - If you feel resistance to the allen wrench while attempting to turn the supply reel motor screw clockwise, go to step 7 on page 60.
   - If the takeup reel turns when you rotate the supply reel motor screw clockwise with the allen wrench, the tape is not broken. Go to step 6 on page 60.
   - If the takeup reel does not turn when you rotate the supply reel motor screw clockwise with the allen wrench and if supply reel motor screw rotates freely, the tape is broken. You must determine the location of the leader block. To do so, insert a small-blade screwdriver or potentiometer-setting tool into the access hole for the loader motor gear **3**. Rotate the screwdriver counterclockwise. You may have to rotate for a lengthy period:
     - If the cartridge moves up, the tape is completely in the cartridge and the leader block is in the home position. Continue rotating the screwdriver until the cartridge ejects. Remove the cartridge.
     - If you feel resistance and the cartridge does not move up, the leader block is not in the home position. Go to "Fixing an internal jam" on page 61.

6. Continue to rotate the allen wrench until you feel resistance. The tape has been rewound as far as it can go without unthreading.

   **Note:** The number of required rotations depends on where the beginning of the tape is on the cartridge's takeup reel. You may have to rotate the allen wrench for a lengthy period.

7. With the allen wrench still inserted into the bottom access hole, insert a small-blade screwdriver or potentiometer-setting tool into the access hole for the loader motor gear **3**.

8. While keeping torque on the supply reel motor screw and rotating the allen wrench **1** clockwise, rotate the loader motor gear with the small-blade screwdriver **3** counterclockwise (see arrow). As you rotate the screwdriver, the allen wrench moves slightly.

9. With the small-blade screwdriver, continue to rotate the loader motor gear in the unload direction (counterclockwise):

   • If you feel no resistance to the allen wrench and the cartridge slowly moves up and out of the tape load compartment to the fully ejected position, the procedure was successful. Remove the small-blade screwdriver and go to step 10.

   • If you feel resistance to the allen wrench and the cartridge does not move, the loader mechanism is jammed or the leader block is not at the home position. Remove the small-blade screwdriver and go to "Fixing an internal jam" on page 61.

10. Remove the tape cartridge.

11. To ensure that the drive operates properly, refer to page 36 and select Function Code 1 - Run Tape Drive Diagnostics.

After you remove the stuck tape cartridge, copy the data on the tape to another tape. Then, if appropriate, return the stuck tape cartridge in its original packaging or in the packaging from its replacement to your reseller. If the leader pin detached from the tape in the cartridge, go to "Repositioning or reattaching a leader pin" on page 20.

# Fixing an internal jam

> **Attention:**
> This procedure must be performed only by trained service personnel.
>
> If problem-determination procedures identify the LTO-2 Tape Drive as the source of a problem, replace the entire unit. If you are not a trained service person, do not attempt to open the drive for repairs. Attempting a repair other than the manual removal of a tape cartridge will void your warranty.
>
> Before performing this procedure, ensure that you have completed the steps that begin on page 59. Do not attempt this procedure until you have completed these steps.

If you have reached this point, the tape is broken or the leader pin dropped (or looked like it dropped) from the leader block. To fix these conditions, perform the following procedure.

1. If the drive is mounted in an enclosure, perform the procedure to remove it (see "Removing a SCSI tape drive from an enclosure" on page 57).
2. Place the drive on a nonslip surface.
3. Remove the cover of the drive by performing the following steps:
   a. Use an appropriate tool to remove the three screws and washers (see **1** in Figure 20 on page 62) that secure the bezel **2** . Remove the bezel.
   b. Use a screwdriver to remove the four cover-mounting screws and washers **3** .
   c. Remove the cover by lifting it up. Set the cover aside.
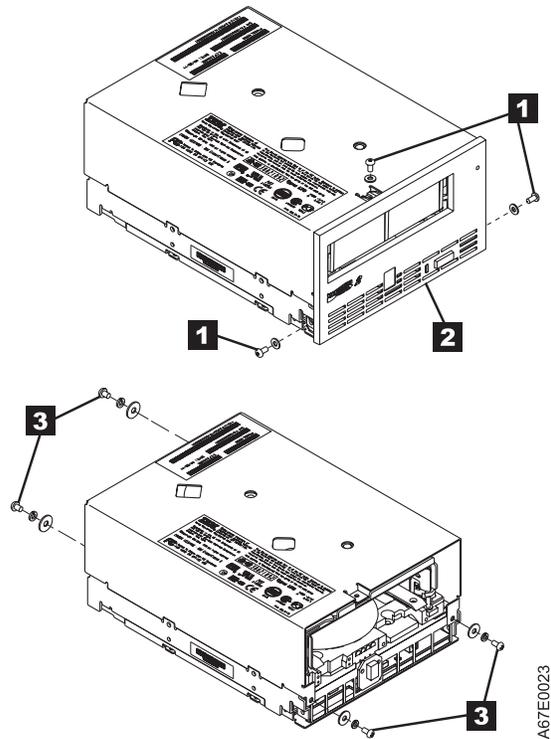
*Figure 20. Removing the top cover of the drive*

4. Examine the drive to determine the cause of the problem:

   - If the tape is broken, do not attempt repair. Return the drive and the stuck tape to your reseller for maintenance (note that your tape will be scrapped).
   - If the leader pin dropped from the leader block, go to step 5 on page 63 and continue this procedure.
   - If the leader block pulled the tape (but not the pin) from the spool so that it looks like the pin was dropped, go to step 5 on page 63 and continue this procedure.

5. Place the tape drive so that the front faces you, then tilt it on its left side (see Figure 21).
6. At the bottom of the drive, locate the access hole ( **1** in Figure 21).

**Attention:** In the following steps, do not allow drive components to touch the head **2** . Damage may result to the head.

7. Insert a 2.5-mm allen wrench into the access hole and position the wrench so that it is seated in the screw of the supply reel motor.
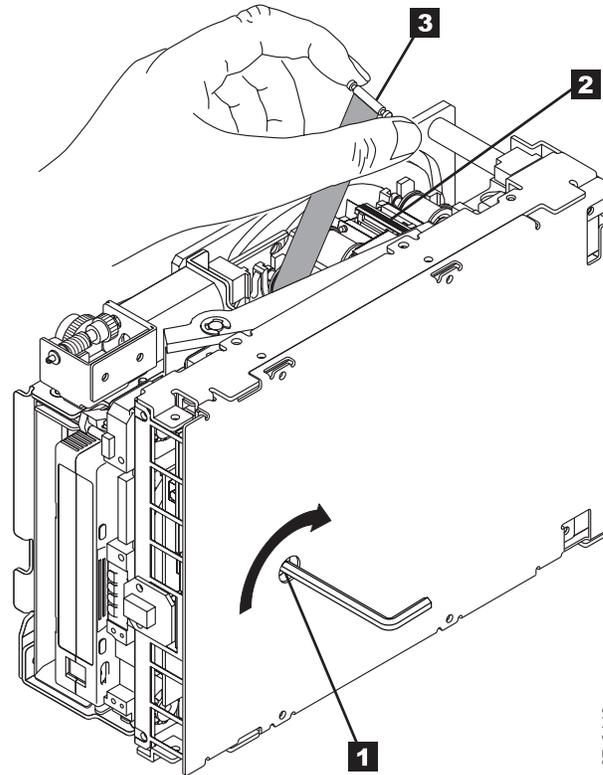


*Figure 21. Rewinding the leader pin into the tape cartridge*

8. With clean needle-nose pliers, grasp the end of the leader pin and pull it out of the cartridge so that you can grip it with your fingers (see **3** in Figure 21).

   **Note:** If the leader pin is not connected to the tape, set the pin aside. After you remove the cartridge, reattach the pin (see "Repositioning or reattaching a leader pin" on page 20).

9. While keeping the tape taut with your fingers, rotate the allen wrench clockwise **1** to wind the excess tape into the cartridge. Guide the leader pin toward the cartridge and drop it inside the cartridge door. Ensure that no tape is left outside of the cartridge. Remove the allen wrench.

    **Note:** Do not attempt to seat the leader pin into the cartridge's clips; this will interfere with the motion of the leader block.

10. Manually rotate the loader motor gear (see **1** in Figure 22) in the unload direction (counterclockwise) until the leader block **2** reaches the last roller **3** .

11. While manually rotating the loader motor gear in the unload direction, guide the end of the leader block **2** into the white guide block **4** .
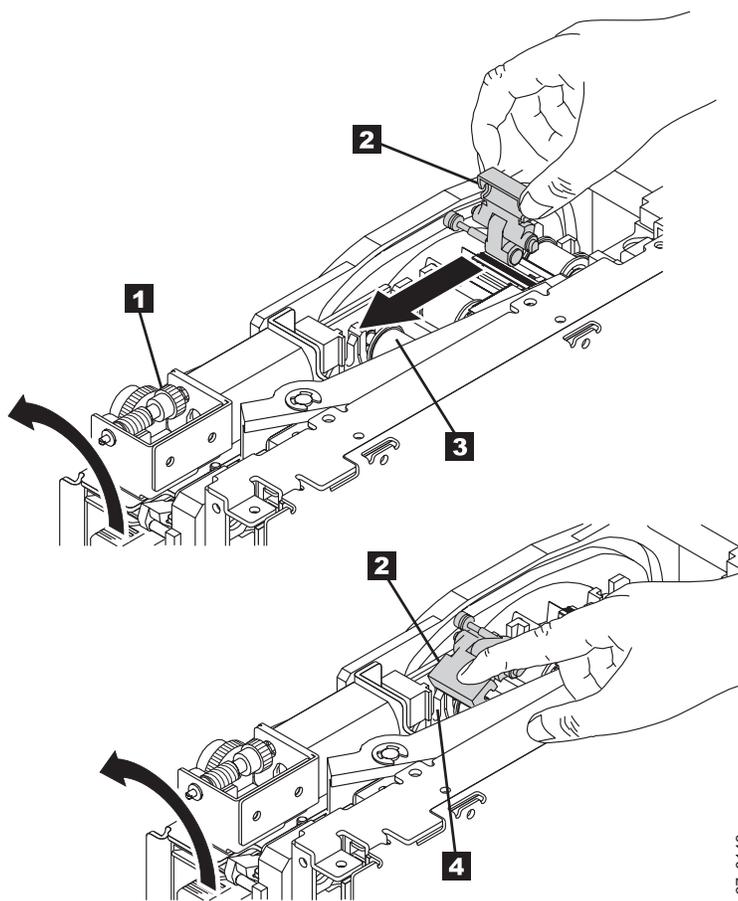


*Figure 22. Guiding the leader block into the home position*

12. Rotate the loader motor gear in the unload direction until the leader block is fully inside the drive.

13. Continue to rotate the loader motor gear counterclockwise. The leader block retracts and occupies the opening to the drive (see **1** in Figure 23).
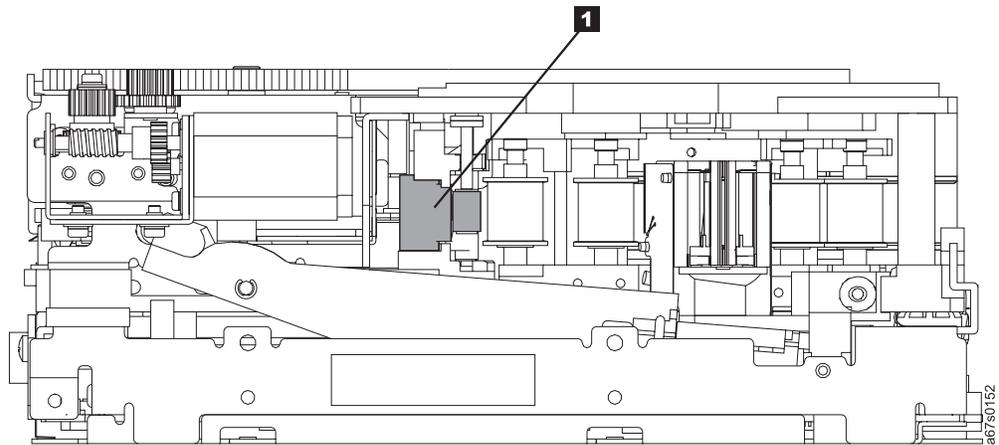


*Figure 23. Rotating the loader motor gear so that the leader block retracts.* The drive is shown on its side. The head is on the right and the arm of the head brush at the bottom of the figure.

14. Rotate the loader motor gear counterclockwise until you feel resistance and the cartridge rises and ejects (see Figure 24).
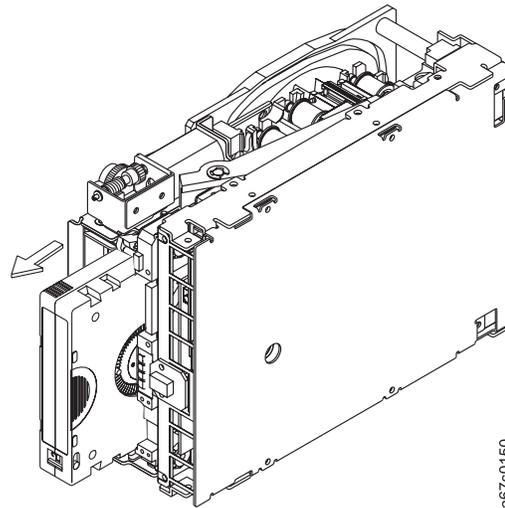


*Figure 24. Rotating the loader motor gear until the cartridge ejects*

15. Remove the tape cartridge. If the leader pin is not seated correctly in the cartridge, see "Repositioning or reattaching a leader pin" on page 20.
16. Copy the data on the stuck tape cartridge to another cartridge. If appropriate, return the stuck tape cartridge for analysis in its original packaging or in the packaging from its replacement.
17. Reassemble the tape drive by reversing the preceding steps.
18. To ensure that the drive operates properly, refer to page 36 and select Function Code 1 - Run Tape Drive Diagnostics.

# Appendix A. Tools and supplies

Table 9 lists the tools and supplies that you can use with the IBM TotalStorage LTO Ultrium 2 Tape Drive. To order tools and supplies, visit the web at `www.ibm.com/storage/lto`.

*Table 9. Tools and supplies for the IBM 200/400GB LTO-2 Tape Drive*

| IBM Part Number | Product Description |
|:---:|---|
| 08L9129 | Leader pin reattachment kit |
| - - | 2.5-mm allen wrench (procure locally) |
| - - | Plastic or blunt-end tweezers (procure locally) |
| 08L9870 | IBM LTO-2 Ultrium 200 GB Data Cartridge |
| 08L9124 | IBM LTO Ultrium Cleaning Cartridge |
| 35L2086 | IBM Cleaning Cartridge (Ultrium LTO 2) |
| 19P5897 | IBM LTO Ultrium Data Cartridge bar code labels |
| 08L9267 | IBM LTO Ultrium Cleaning Cartridge bar code labels |

# Appendix B. TapeAlert flags

TapeAlert is a patented technology and standard of the American National Standards Institute (ANSI) that defines conditions and problems that are experienced by tape drives. The technology enables a server to read TapeAlert flags from a tape drive through the SCSI or Library/Drive Interface (LDI or RS-422 interface). The server reads the flags from Log Sense Page 0x2E. This appendix lists the TapeAlert flags that are supported by the IBM 200/400GB LTO-2 Tape Drive.

## TapeAlert Flags supported by the drive

| \ Flag Number | Flag Parameter (in hex) | Flag | Description | Action Required |
|---|---|---|---|---|
| \ TapeAlert Flags Supported by the IBM 200/400GB LTO-2 Tape Drive |||||
| 3 | 03h | Hard error | 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 4, 5, or 6 in this table. |
| 4 | 04h | Media | Set for any unrecoverable read, write, or positioning error that is due to a faulty tape cartridge. | Replace the tape cartridge. |
| 5 | 05h | Read failure | 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. If Flag 4 is not set, see error code 6 in Table 8 on page 49. |
| 6 | 06h | Write failure | 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 9 is also set, make sure that the write-protect switch is set so that data can be written to the tape (see "Setting the write-protect switch" on page 16). If Flag 4 is also set, the cartridge is defective. Replace the tape cartridge. If Flag 4 is not set, see error code 6 in Table 8 on page 49. |
| 8 | 08h | Not data grade | Set when severe servo errors occur while loading a tape cartridge. | Replace the tape cartridge. If this error occurs with multiple tapes, see error code 6 in Table 8 on page 49. |
| 9 | 09h | Write protect | Set when the tape drive detects that the tape cartridge is write-protected. | Make sure that the cartridge's write-protect switch is set so that the tape drive can write data to the tape (see "Setting the write-protect switch" on page 16). |
| 10 | 0Ah | No removal | 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's operating system. |

| TapeAlert Flags Supported by the IBM 200/400GB LTO-2 Tape Drive | | | | |
|---|---|---|---|---|
| Flag Number | Flag Parameter (in hex) | Flag | Description | Action Required |
| 11 | 0Bh | Cleaning media | Set when you load a cleaning cartridge into the drive. | No action required. |
| 12 | 0Ch | Unsupported format | Set when you load an unsupported cartridge type into the drive or when the cartridge format has been corrupted. | Use a supported tape cartridge. |
| 15 | 0Fh | Cartridge memory chip failure | Set when a cartridge memory (CM) failure is detected on the loaded tape cartridge. | Replace the cartridge. If this error occurs on multiple tapes, see error code 6 in Table 8 on page 49. |
| 16 | 10h | Forced eject | Set when you manually unload the tape cartridge while the drive was reading or writing. | No action required. |
| 18 | 12h | Tape directory corrupted in the cartridge memory | 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 | 14h | Clean now | Set when the tape drive detects that it needs cleaning. | Clean the tape drive. See "Cleaning the drive head" on page 35. |
| 21 | 15h | Clean periodic | 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. See "Cleaning the drive head" on page 35. |
| 22 | 16h | Expired clean | Set when the tape drive detects a cleaning cartridge that has expired. | Replace the cleaning cartridge. |
| 23 | 17h | Invalid cleaning tape | Set when the drive expects a cleaning cartridge and the loaded cartridge is not a cleaning cartridge. | Use a valid cleaning cartridge. |
| 30 | 1Eh | Hardware A | Set when a hardware failure occurs which requires that you reset the tape drive to recover. | If resetting the drive does not recover the error, use the error code from the single-character display, library user interface, or SCSI drive sense data. See Table 8 on page 49. |
| 31 | 1Fh | Hardware B | Set when the tape drive fails its internal self tests. | Use the error code on the single-character display, library user interface, or SCSI drive sense data. See Table 8 on page 49. |
| 32 | 20h | Interface | Set when the tape drive detects a problem with the SCSI or LDI (RS-422) interface. | Locate error code 8 or 9 in Table 8 on page 49. |
| 33 | 21h | Eject media | Set when a failure occurs that requires you to unload the cartridge from the drive. | Unload and reload the tape cartridge. |

| TapeAlert Flags Supported by the IBM 200/400GB LTO-2 Tape Drive | | | | |
|---|---|---|---|---|
| Flag Number | Flag Parameter (in hex) | Flag | Description | Action Required |
| 34 | 22h | Download fail | Set when an FMR image is unsuccessfully downloaded to the tape drive via the SCSI interface. | Ensure that it is the correct image. Download the FMR image again. |
| 36 | 24h | Drive temperature | Set when the drive's temperature sensor indicates that the drive's temperature is exceeding the recommended temperature of the enclosure (see Table 10 on page 75). | See error code 1 in Table 8 on page 49. |
| 37 | 25h | Drive voltage | Set when the drive detects that the externally supplied voltages are either approaching the specified voltage limits or are outside the voltage limits (see Table 10 on page 75). | See error code 2 in Table 8 on page 49. |
| 39 | 27h | Diagnostics required | Set when the drive detects a failure that requires diagnostics to isolate the problem. | See error code 6 in Table 8 on page 49. |
| 51 | 33h | Tape directory invalid at unload | Set when the tape directory on the tape cartridge that was previously unloaded is corrupted. The file-search performance is degraded. | Rebuild the tape directory by reading all the data |
| 52 | 34h | Tape system area write failure | 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 | 35h | Tape system area read failure | 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. |

# Appendix C. Specifications

Table 10 gives the physical, power, and environmental specifications for the IBM 200/400GB LTO-2 Tape Drive. Specifications for tape cartridges are given in "Environmental and shipping specifications for tape cartridges" on page 27.

*Table 10. Specifications for the IBM 200/400GB LTO-2 Tape Drive*

| Specification | Measurement | |
|---|---|---|
| | **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** | |
| | | |
| Tolerance (see Note 1) | + 5 Vdc and + 12 Vdc (±10%) | |
| Power supply current for 5 Vdc (see Note 2) | 1.3 A minimum | |
| | 3.1 A maximum | |
| Power supply current for 12 Vdc (see Note 2) | 0.2 A minimum | |
| | 1.1 A maximum | |
| Power supply peak for 5 Vdc (the instantaneous power by the power supply) | 3.3 A for 100 ms 15.5 W | |
| Power supply peak for 12 Vdc (the instantaneous power by the power supply) | 4.1 A for 2 ms 49.2 W | |
| Power usage for typical idle mode with no cartridge | 10.9 W | 13.9 W |
| Power usage for typical idle mode with a cartridge loaded | 12.7 W | 15.7 W |
| Power usage for reading and writing at 6.22 m/s | 29 W | 32 W |
| Power usage for sleep mode with no cartridge | 9.0 W | 12.0 W |
| Power usage for sleep mode with a cartridge loaded | 10.8 W | 13.8 W |
| **Other Specifications (for both interface types)** | | |

*Table 10. Specifications for the IBM 200/400GB LTO-2 Tape Drive (continued)*

| Maximum altitude | 3048 m (10,000 ft) for operating and storage | | |
| --- | --- | --- | --- |
| | 12192 m (40,000 ft) for shipping | | |
| Extraction force | 250 to 750 gms-force | | |
| **Environmental Specifications (for both interface types)** | | | |
| **Environmental Factor** | **Operating (see Note 3)** | **Storage** | **Shipping** |
| Drive temperature | 10 to 40°C (50 to 104°F) | 1 to 60°C (33.8 to 140°F) | −40 to 60°C (−40 to 140°F) |
| Relative humidity (noncondensing) | 20 to 80% | 10 to 90% | 10 to 90% |
| Wet bulb temperature | 26°C (78.8°F) | 26°C (78.8°F) | 26°C (78.8°F) |

**Notes:**

1. Measured at the drive's power connector.

2. The + 5 Vdc and + 12 Vdc maximum currents do not occur simultaneously. The Ultrium 2 Tape Drive monitors voltage and reports problems to the server.

3. Measured in front of the bezel, near the air intake area.

# Appendix D. Product warranty and support information

## Warranty period

The warranty period varies by machine type and country or region. Contact your place of purchase for warranty service information. Some IBM machines are eligible for on-site warranty service, depending on the country or region where service is performed.

**Prior to on-site warranty service, you are required to go through problem determination with an IBM service specialist call center technician.**

A warranty period of 3 years on parts and 0 years on labor means that IBM will provide warranty service without charge for:

- parts only; on an exchange basis, in the first, second, and third years of the warranty period. IBM will charge you for any labor it provides in performance of the repair or replacement.
- The IBM Machine Warranties Web site at www.ibm.com/servers/support/machine_warranties/ contains a worldwide overview of the IBM Statement of Limited Warranty for IBM Machines, a glossary of terms used in the Statement of Limited Warranty, Frequently Asked Questions (FAQ), and links to Product Support Web pages. The IBM Statement of Limited Warranty is available from this Web site in 29 languages in Portable Document Format (PDF).

**Machine** - IBM 200/400GB LTO-2 Tape Drive

| Warranty period | Service delivery method |
|---|---|
| Parts - 3 years, labor - 0 years | Customer carry-in or mail-in |

## Problem determination

Prior to on-site warranty service, you are required to go through problem determination with an IBM service specialist call center technician. The service specialist will run diagnostic tests on the hardware and check the software.

### Running diagnostics
The IBM service specialist will help you determine whether your equipment is functioning as specified. It might be necessary to isolate the failing system, IBM component, or both from any active production environment to run diagnostics and perform defect-isolation programs. You are responsible for making the system, IBM component, or both available for running diagnostics and defect-isolation programs.

### Checking software
The IBM service specialist will help you ensure that the correct BIOS code, firmware, device drivers, and other supporting IBM software are installed and correctly configured. It might be necessary to manually gather information about the relevant software levels or run IBM-approved utility programs to gather this information. It might be necessary to isolate the failing from any active production environment to gather this information. Youare responsible, with assistance from the support specialist, for gathering this information. The IBM Statement of Limited Warranty does not include on-site assistance with this activity.

# Warranty service and support

With the original purchase of an IBM xSeries system, you have access to extensive service and support. During the IBM Machine warranty period, you may call IBM or your reseller for problem-determination assistance under the terms of the IBM Statement of Limited Warranty.

The following services are available during the warranty period:

- **Problem determination** - Trained personnel are available to assist you with determining if you have a hardware problem and deciding what action is necessary to fix the problem.
- **IBM hardware repair** - If the problem is determined to be cause by IBM hardware under warranty, trained service personnel are available to provide the applicable level of service, either on-site or at an IBM service center as determined by IBM.
- **Engineering Change management** - Occassionally, there might be changes that are required after a product has been shipped from IBM. In those instances, IBM will make Engineering Changes (ECs) available that apply to your hardware.
- **Customer replaceable units** (CRUs) - Some parts of IBM xSeries systems are designated as customer replaceable units. IBM ships CRUs to you for replacement by you. CRUs include keyboards, monitors, memory, diskette drives, hard disk drives, and mice (this list is not inclusive of all CRUs).

The following items are not covered under warranty service:

- Replacement or use of non-IBM parts. All IBM parts contain a 7-character identification in the format IBM FRU XXXXXXX.
- Identification of software problem sources.
- Installation of customer replaceable units (CRUs).
- Installation and configuration of BIOS code, firmware, or device drivers that are designated as customer installable.

See the IBM Statement of Limited Warranty for a full explanation of IBM warranty terms. Be sure to retain your proof of purchase to obtain warranty service.

Please have the following information ready when you call:

- The machine type and model of your IBM hardware product (if available)
- Serial numbers of your IBM hardware products
- A description of the problem
- The exact wording of any error messages
- Hardware and software configuration information

# International warranty service

If your travel with your xSeries system or relocate it to a country or region where your system is sold and serviced by IBM or IBM resellers authorized to perform warranty service, International Warranty Service (IWS) is available during the warranty period. Eligible IBM systems are identified by their four-digit machine types.

You can obtain IWS through the service delivery method (such as depot, carry-in, or on-site) provided in the servicing country or region. Service methods and procedures vary by country or region, and some services or parts might not be available in all countries or regions. Service centers in certain countries or regions

might not be able to service all models of a particular machine type. In addition, some countries or regions might have fees and restrictions that apply at the time of service.

To determine whether you system is eligible for IWS, go to www.ibm.com/pc/support/ and click **Warranty lookup**.

## Purchasing additional services

During and after the warranty period, you can purchase additional services, such as support for IBM and non-IBM hardware, operating systems, and application programs; network setup and configuration; upgraded or extended hardware repair services; and custom installations. Service availability and service name might vary by country or region.

For more information about these service, contact your IBM marketing representative.

# IBM Statement of Limited Warranty Z125-4753-06 8/2000

This warranty statement consists of two parts: Part 1 and Part 2. Be sure to read Part 1 and the country-unique terms in Part 2 that apply to your country or region.

## Part 1 - General Terms

This Statement of Limited Warranty includes Part 1 - General Terms and Part 2 - Country-unique Terms. The terms of Part 2 replace or modify those of Part 1. The warranties provided by IBM in this Statement of Limited Warranty apply only to Machines you purchase for your use, and not for resale, from IBM or your reseller. The term "Machine" means an IBM machine, its features, conversions, upgrades, elements, or accessories, or any combination of them. The term "Machine" does not include any software programs, whether pre-loaded with the Machine, installed subsequently or otherwise. Unless IBM specifies otherwise, the following warranties apply only in the country where you acquire the Machine. Nothing in this Statement of Limited Warranty affects any statutory rights of consumers that cannot be waived or limited by contract. If you have any questions, contact IBM or your reseller.

**The IBM Warranty for Machines**

IBM warrants that each Machine 1) is free from defects in materials and workmanship and 2) conforms to IBM's Official Published Specifications ("Specifications"). The warranty period for a Machine is a specified, fixed period commencing on its Date of Installation. The date on your sales receipt is the Date of Installation unless IBM or your reseller informs you otherwise. If a Machine does not function as warranted during the warranty period, and IBM or your reseller are unable to either 1) make it do so or 2) replace it with one that is at least functionally equivalent, you may return it to your place of purchase and your money will be refunded.

**Extent of Warranty**

The warranty does not cover the repair or exchange of a Machine resulting from misuse, accident, modification, unsuitable physical or operating environment, improper maintenance by you, or failure caused by a product for which IBM is not responsible. The warranty is voided by removal or alteration of Machine or parts identification labels.

THESE WARRANTIES ARE YOUR EXCLUSIVE WARRANTIES AND REPLACE ALL OTHER WARRANTIES OR CONDITIONS, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OR CONDITIONS OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THESE WARRANTIES GIVE YOU SPECIFIC LEGAL RIGHTS AND YOU MAY ALSO HAVE OTHER RIGHTS WHICH VARY FROM JURISDICTION TO JURISDICTION. SOME JURISDICTIONS DO NOT ALLOW THE EXCLUSION OR LIMITATION OF EXPRESS OR IMPLIED WARRANTIES, SO THE ABOVE EXCLUSION OR LIMITATION MAY NOT APPLY TO YOU. IN THAT EVENT, SUCH WARRANTIES ARE LIMITED IN DURATION TO THE WARRANTY PERIOD. NO WARRANTIES APPLY AFTER THAT PERIOD.

**Items Not Covered by Warranty**

IBM does not warrant uninterrupted or error-free operation of a Machine.

Any technical or other support provided for a Machine under warranty, such as assistance via telephone with "how-to" questions and those regarding Machine set-up and installation, will be provided WITHOUT WARRANTIES OF ANY KIND.

**Warranty Service**

To obtain warranty service for a Machine, contact IBM or your reseller. If you do not register your Machine with IBM, you may be required to present proof of purchase.

During the warranty period, IBM or your reseller, if approved by IBM to provide warranty service, provides without charge certain types of repair and exchange service to keep Machines in, or restore them to, conformance with their Specifications. IBM or your reseller will inform you of the available types of service for a Machine based on its country of installation. At its discretion, IBM or your reseller will 1) either repair or exchange the failing Machine and 2) provide the service either at your location or a service center. IBM or your reseller will also manage and install selected engineering changes that apply to the Machine.

Some parts of IBM Machines are designated as Customer Replaceable Units (called "CRUs"), e.g., keyboards, memory, or hard disk drives. IBM ships CRUs to you for replacement by you. You must return all defective CRUs to IBM within 30 days of your receipt of the replacement CRU. You are responsible for downloading designated Machine Code and Licensed Internal Code updates from an IBM Internet Web site or from other electronic media, and following the instructions that IBM provides.

When warranty service involves the exchange of a Machine or part, the item IBM or your reseller replaces becomes its property and the replacement becomes yours. You represent that all removed items are genuine and unaltered. The replacement may not be new, but will be in good working order and at least functionally equivalent to the item replaced. The replacement assumes the warranty service status of the replaced item. Many features, conversions, or upgrades involve the removal of parts and their return to IBM. A part that replaces a removed part will assume the warranty service status of the removed part.

Before IBM or your reseller exchanges a Machine or part, you agree to remove all features, parts, options, alterations, and attachments not under warranty service.

You also agree to
1. ensure that the Machine is free of any legal obligations or restrictions that prevent its exchange;
2. obtain authorization from the owner to have IBM or your reseller service a Machine that you do not own; and
3. where applicable, before service is provided:
   a. follow the problem determination, problem analysis, and service request procedures that IBM or your reseller provides;
   b. secure all programs, data, and funds contained in a Machine;
   c. provide IBM or your reseller with sufficient, free, and safe access to your facilities to permit them to fulfill their obligations; and
   d. inform IBM or your reseller of changes in a Machine's location.

IBM is responsible for loss of, or damage to, your Machine while it is 1) in IBM's possession or 2) in transit in those cases where IBM is responsible for the transportation charges.

Neither IBM nor your reseller is responsible for any of your confidential, proprietary or personal information contained in a Machine which you return to IBM or your reseller for any reason. You should remove all such information from the Machine prior to its return.

**Limitation of Liability**

Circumstances may arise where, because of a default on IBM's part or other liability, you are entitled to recover damages from IBM. In each such instance, regardless of the basis on which you are entitled to claim damages from IBM (including fundamental breach, negligence, misrepresentation, or other contract or tort claim), except for any liability that cannot be waived or limited by applicable laws, IBM is liable for no more than

1. damages for bodily injury (including death) and damage to real property and tangible personal property; and
2. the amount of any other actual direct damages, up to the charges (if recurring, 12 months' charges apply) for the Machine that is subject of the claim. For purposes of this item, the term "Machine" includes Machine Code and Licensed Internal Code.

This limit also applies to IBM's suppliers and your reseller. It is the maximum for which IBM, its suppliers, and your reseller are collectively responsible.

UNDER NO CIRCUMSTANCES IS IBM LIABLE FOR ANY OF THE FOLLOWING: 1) THIRD-PARTY CLAIMS AGAINST YOU FOR DAMAGES (OTHER THAN THOSE UNDER THE FIRST ITEM LISTED ABOVE); 2) LOSS OF, OR DAMAGE TO, YOUR RECORDS OR DATA; OR 3) SPECIAL, INCIDENTAL, OR INDIRECT DAMAGES OR FOR ANY ECONOMIC CONSEQUENTIAL DAMAGES, LOST PROFITS OR LOST SAVINGS, EVEN IF IBM, ITS SUPPLIERS OR YOUR RESELLER IS INFORMED OF THEIR POSSIBILITY. SOME JURISDICTIONS DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATION OR EXCLUSION MAY NOT APPLY TO YOU.

**Governing Law**

Both you and IBM consent to the application of the laws of the country in which you acquired the Machine to govern, interpret, and enforce all of your and IBM's rights, duties, and obligations arising from, or relating in any manner to, the subject matter of this Agreement, without regard to conflict of law principles.

# Part 2 - Country-unique Terms

AMERICAS

**BRAZIL**

Governing Law: The following is added after the first sentence:Any litigation arising from this Agreement will be settled exclusively by the court of Rio de Janeiro.

NORTH AMERICA

Warranty Service: *The following is added to this Section:*To obtain warranty service from IBM in Canada or the United States, call 1-800-IBM-SERV (426-7378).

**CANADA**

Governing Law: *The following replaces "laws of the country in which you acquired the Machine"* in the first sentence: laws in the Province of Ontario.

**UNITED STATES**

Governing Law: *The following replaces "laws of the country in which you acquired the Machine"* in the first sentence: laws of the State of New York.

<u>**ASIA PACIFIC**</u>

**AUSTRALIA**

The IBM Warranty for Machines: *The following paragraph is added to this Section:* The warranties specified in this Section are in addition to any rights you may have under the Trade Practices Act 1974 or other similar legislation and are only limited to the extent permitted by the applicable legislation.

Limitation of Liability: *The following is added to this Section:* Where IBM is in breach of a condition or warranty implied by the Trade Practices Act 1974 or other similar legislation, IBM's liability is limited to the repair or replacement of the goods or the supply of equivalent goods. Where that condition or warranty relates to right to sell, quiet possession or clear title, or the goods are of a kind ordinarily acquired for personal, domestic or household use or consumption, then none of the limitations in this paragraph apply.

Governing Law: *The following replaces "laws of the country in which you acquired the Machine"* in the first sentence: laws of the State or Territory.

**CAMBODIA, LAOS, AND VIETNAM**

Governing Law: *The following replaces "laws of the country in which you acquired the Machine"* in the first sentence:laws of the State of New York.

*The following is added to this Section:* Disputes and differences arising out of or in connection with this Agreement shall be finally settled by arbitration which shall be held in Singapore in accordance with the rules of the International Chamber of Commerce (ICC). The arbitrator or arbitrators designated in conformity with those rules shall have the power to rule on their own competence and on the validity of the Agreement to submit to arbitration. The arbitration award shall be final and binding for the parties without appeal and the arbitral award shall be in writing and set forth the findings of fact and the conclusions of law.

All proceedings shall be conducted, including all documents presented in such proceedings, in the English language. The number of arbitrators shall be three, with each side to the dispute being entitled to appoint one arbitrator.

The two arbitrators appointed by the parties shall appoint a third arbitrator before proceeding upon the reference. The third arbitrator shall act as chairman of the proceedings. Vacancies in the post of chairman shall be filled by the president of the ICC. Other vacancies shall be filled by the respective nominating party. Proceedings shall continue from the stage they were at when the vacancy occurred.

If one of the parties refuses or otherwise fails to appoint an arbitrator within 30 days of the date the other party appoints its, the first appointed arbitrator shall be the sole arbitrator, provided that the arbitrator was validly and properly appointed.

The English language version of this Agreement prevails over any other language version.

**HONG KONG AND MACAU**

Governing Law: *The following replaces "laws of the country in which you acquired the Machine" in the first sentence:* laws of Hong Kong Special Administrative Region.

**INDIA**

Limitation of Liability: *The following replaces items 1 and 2 of this Section:*
1. liability for bodily injury (including death) or damage to real property and tangible personal property will be limited to that caused by IBM's negligence;
2. as to any other actual damage arising in any situation involving nonperformance by IBM pursuant to, or in any way related to the subject of this Statement of Limited Warranty, IBM's liability will be limited to the charge paid by you for the individual Machine that is the subject of the claim.

**JAPAN**

Governing Law: *The following sentence is added to this Section:* Any doubts concerning this Agreement will be initially resolved between us in good faith and in accordance with the principle of mutual trust.

**NEW ZEALAND**

The IBM Warranty for Machines: *The following paragraph is added to this Section:* The warranties specified in this Section are in addition to any rights you may have under the Consumer Guarantees Act 1993 or other legislation which cannot be excluded or limited. The Consumer Guarantees Act 1993 will not apply in respect of any goods which IBM provides, if you require the goods for the purposes of a business as defined in that Act.

Limitation of Liability: *The following is added to this Section:* Where Machines are not acquired for the purposes of a business as defined in the Consumer Guarantees Act 1993, the limitations in this Section are subject to the limitations in that Act.

**PEOPLE'S REPUBLIC OF CHINA (PRC)**

Governing Law: *The following replaces this Section:* Both you and IBM consent to the application of the laws of the State of New York (except when local law requires otherwise) to govern, interpret, and enforce all your and IBM's rights, duties, and obligations arising from, or relating in any manner to, the subject matter of this Agreement, without regard to conflict of law principles.

Any disputes arising from or in connection with this Agreement will first be resolved by friendly negotiations, failing which either of us has the right to submit the dispute to the China International Economic and Trade Arbitration Commission in Beijing, the PRC, for arbitration in accordance with its arbitration rules in force at the time. The arbitration tribunal will consist of three arbitrators. The language

to be used therein will be English and Chinese. An arbitral award will be final and binding on all the parties, and will be enforceable under the Convention on the Recognition and Enforcement of Foreign Arbitral Awards (1958).

The arbitration fee will be borne by the losing party unless otherwise determined by the arbitral award.

During the course of arbitration, this Agreement will continue to be performed except for the part which the parties are disputing and which is undergoing arbitration.

## EUROPE, MIDDLE EAST, AFRICA (EMEA)

*THE FOLLOWING TERMS APPLY TO ALL EMEA COUNTRIES:* The terms of this Statement of Limited Warranty apply to Machines purchased from IBM or an IBM reseller.

**Warranty Service:**

If you purchase an IBM Machine in Austria, Belgium, Denmark, Estonia, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland or United Kingdom, you may obtain warranty service for that Machine in any of those countries from either (1) an IBM reseller approved to perform warranty service or (2) from IBM. If you purchase an IBM Personal Computer Machine in Albania, Armenia, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Georgia, Hungary, Kazakhstan, Kirghizia, Federal Republic of Yugoslavia, Former Yugoslav Republic of Macedonia (FYROM), Moldova, Poland, Romania, Russia, Slovak Republic, Slovenia, or Ukraine, you may obtain warranty service for that Machine in any of those countries from either (1) an IBM reseller approved to perform warranty service or (2) from IBM.

If you purchase an IBM Machine in a Middle Eastern or African country, you may obtain warranty service for that Machine from the IBM entity within the country of purchase, if that IBM entity provides warranty service in that country, or from an IBM reseller, approved by IBM to perform warranty service on that Machine in that country. Warranty service in Africa is available within 50 kilometers of an IBM authorized service provider. You are responsible for transportation costs for Machines located outside 50 kilometers of an IBM authorized service provider.

**Governing Law:**

The applicable laws that govern, interpret and enforce rights, duties, and obligations of each of us arising from, or relating in any manner to, the subject matter of this Statement, without regard to conflict of laws principles, as well as Country-unique terms and competent court for this Statement are those of the country in which the warranty service is being provided, except that in 1) Albania, Bosnia-Herzegovina, Bulgaria, Croatia, Hungary, Former Yugoslav Republic of Macedonia, Romania, Slovakia, Slovenia, Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Russia, Tajikistan, Turkmenistan, Ukraine, and Uzbekistan, the laws of Austria apply; 2) Estonia, Latvia, and Lithuania, the laws of Finland apply; 3) Algeria, Benin, Burkina Faso, Cameroon, Cape Verde, Central African Republic, Chad, Congo, Djibouti, Democratic Republic of Congo, Equatorial Guinea, France, Gabon, Gambia, Guinea, Guinea-Bissau, Ivory Coast, Lebanon, Mali, Mauritania, Morocco, Niger, Senegal, Togo, and Tunisia, this Agreement will be construed and the legal relations between the parties will be

determined in accordance with the French laws and all disputes arising out of this Agreement or related to its violation or execution, including summary proceedings, will be settled exclusively by the Commercial Court of Paris; 4) Angola, Bahrain, Botswana, Burundi, Egypt, Eritrea, Ethiopia, Ghana, Jordan, Kenya, Kuwait, Liberia, Malawi, Malta, Mozambique, Nigeria, Oman, Pakistan, Qatar, Rwanda, Sao Tome, Saudi Arabia, Sierra Leone, Somalia, Tanzania, Uganda, United Arab Emirates, United Kingdom, West Bank/Gaza, Yemen, Zambia, and Zimbabwe, this Agreement will be governed by English Law and disputes relating to it will be submitted to the exclusive jurisdiction of the English courts; and 5) in Greece, Israel, Italy, Portugal, and Spain any legal claim arising out of this Statement will be brought before, and finally settled by, the competent court of Athens, Tel Aviv, Milan, Lisbon, and Madrid, respectively.

*THE FOLLOWING TERMS APPLY TO THE COUNTRY SPECIFIED:*

**AUSTRIA AND GERMANY**

The IBM Warranty for Machines: *The following replaces the first sentence of the first paragraph of this Section:* The warranty for an IBM Machine covers the functionality of the Machine for its normal use and the Machine's conformity to its Specifications.

*The following paragraphs are added to this Section:*The minimum warranty period for Machines is six months. In case IBM or your reseller is unable to repair an IBM Machine, you can alternatively ask for a partial refund as far as justified by the reduced value of the unrepaired Machine or ask for a cancellation of the respective agreement for such Machine and get your money refunded.

Extent of Warranty: *The second paragraph does not apply.*

Warranty Service: *The following is added to this Section:* During the warranty period, transportation for delivery of the failing Machine to IBM will be at IBM's expense.

Limitation of Liability: *The following paragraph is added to this Section:* The limitations and exclusions specified in the Statement of Limited Warranty will not apply to damages caused by IBM with fraud or gross negligence and for express warranty.

*The following sentence is added to the end of item 2:* IBM's liability under this item is limited to the violation of essential contractual terms in cases of ordinary negligence.

**EGYPT**

Limitation of Liability: *The following replaces item 2 in this Section:* as to any other actual direct damages, IBM's liability will be limited to the total amount you paid for the Machine that is the subject of the claim. For purposes of this item, the term "Machine" includes Machine Code and Licensed Internal Code.

*Applicability of suppliers and resellers (unchanged).*

**FRANCE**

Limitation of Liability: *The following replaces the second sentence of the first paragraph of this Section:* In such instances, regardless of the basis on which you are entitled to claim damages from IBM, IBM is liable for no more than: *(items 1 and 2 unchanged).*

**IRELAND**

Extent of Warranty: *The following is added to this Section:*Except as expressly provided in these terms and conditions, all statutory conditions, including all warranties implied, but without prejudice to the generality of the foregoing all warranties implied by the Sale of Goods Act 1893 or the Sale of Goods and Supply of Services Act 1980 are hereby excluded.

Limitation of Liability: *The following replaces items one and two of the first paragraph of this Section:* 1. death or personal injury or physical damage to your real property solely caused by IBM's negligence; and 2. the amount of any other actual direct damages, up to 125 percent of the charges (if recurring, the 12 months' charges apply) for the Machine that is the subject of the claim or which otherwise gives rise to the claim.

*Applicability of suppliers and resellers (unchanged).*

T*he following paragraph is added at the end of this Section:* IBM's entire liability and your sole remedy, whether in contract or in tort, in respect of any default shall be limited to damages.

**ITALY**

Limitation of Liability: *The following replaces the second sentence in the first paragraph:* In each such instance unless otherwise provided by mandatory law, IBM is liable for no more than: 1. (unchanged) 2. as to any other actual damage arising in all situations involving nonperformance by IBM pursuant to, or in any way related to the subject matter of this Statement of Warranty, IBM's liability, will be limited to the total amount you paid for the Machine that is the subject of the claim.*Applicability of suppliers and resellers (unchanged).*

*The following replaces the third paragraph of this Section:* Unless otherwise provided by mandatory law, IBM and your reseller are not liable for any of the following: (items 1 and 2 unchanged) 3) indirect damages, even if IBM or your reseller is informed of their possibility.

**SOUTH AFRICA, NAMIBIA, BOTSWANA, LESOTHO AND SWAZILAND**

Limitation of Liability: *The following is added to this Section:* IBM's entire liability to you for actual damages arising in all situations involving nonperformance by IBM in respect of the subject matter of this Statement of Warranty will be limited to the charge paid by you for the individual Machine that is the subject of your claim from IBM.

**UNITED KINGDOM**

Limitation of Liability: *The following replaces items 1 and 2 of the first paragraph of this Section:*
1. death or personal injury or physical damage to your real property solely caused by IBM's negligence;
2. the amount of any other actual direct damages or loss, up to 125 percent of the charges (if recurring, the 12 months' charges apply) for the Machine that is the subject of the claim or which otherwise gives rise to the claim;

*The following item is added to this paragraph:* 3. breach of IBM's obligations implied by Section 12 of the Sale of Goods Act 1979 or Section 2 of the Supply of Goods and Services Act 1982.

*Applicability of suppliers and resellers (unchanged).*

*The following is added to the end of this Section:* IBM's entire liability and your sole remedy, whether in contract or in tort, in respect of any default shall be limited to damages.

# Appendix E. Notices

IBM may not offer the products, services, or features discussed in thisdocument in all 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 userfs responsibility to evaluate and verify the operation of any non-IBM product, program, or service.

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Any performance data contained herein was determined in a controlled environment. Therefore, the result obtained in other operating environments may vary significantly. Some measurements may have been made on development-level systems and there is no guarantee that these measurements will be the same on generally available systems. Furthermore, some measurements may have been estimated through extrapolation. Actual results may vary. Users of this document should verify the applicable data for their specific environment.

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IBM

IBM logo

HelpCenter

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

# Federal Communications Commission (FCC) Statement

IBM 200/400GB LTO-2 Tape Drive

**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.

Responsible party:

International Business Machines Corporation

New Orchard Road

Armonk, NY 10504

Telephone: 1-919-543-2193

**FC** Tested To Comply
With FCC Standards

FOR HOME OR OFFICE USE

**Industry Canada Class B emission compliance statement**

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

**Avis de conformite a la reglementation d'Industrie Canada**

Cet appareil numérique de la classe B est conform à la norme NMB-003 du
Canada.

**Deutsche EMV-Direktive (electromagnetische Verträglichkeit)**

Dieses Gerät ist berechtigt in Übereinstimmung mit dem deutschen EMVG vom
9.Nov.92 das EG-Konformitätszeichen zu führen.

Der Aussteller der Konformitätserklärung ist die IBM UK, Greenock.

Dieses Gerät erfüllt die Bedingungen der EN 55022 Klasse B.

**Europen Union - emission directive**

This product is in conformity with the protection requirements of EU Council
Directive 89/336/ECC 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 non-recommended modification of the product,
including the fitting of non-IBM option cards.

This product has been tested and found to comply with the limits for Class B
Information Technology Equipment according to CISPR 22/European Standard EN
55022. The limits for Class B equipment were derived for commercial and
industrial environments to provide reasonable protection against interference with
licensed communication equipment.

**Union Européenne - Directive Conformité électromagnétique**

Ce produit est conforme aux exigences de protection de la Directive 89/336/EEC
du Conseil de l'UE sur le rapprochement des lois des États membres en matière de
compatibilité électromagnétique.

IBM ne peut accepter aucune responsabilité pour le manquement aux exigences de
protection résultant d'une modification non recommandée du produit, y compris
l'installation de cartes autres que les cartes IBM.

Ce produit a été testé et il satisfait les conditions de l'équipement informatique de
Classe B en vertu de CISPR22/Standard européen EN 55022. Les conditions pour
l'équipement de Classe A ont été définies en fonction d'un contexte d'utilisation

commercial et industriel afin de fournir une protection raisonnable contre l'interférence d'appareils de communication autorisés.

**Union Europea - Normativa EMC**

IBM non accetta responsabilità alcuna per la mancata conformità alle normative di protezione dovuta a modifiche non consigliate al prodotto, compresa l'installazione di schede e componenti di marca diversa da IBM.

Questo prodotto è conforme alle normative di protezione ai sensi della Direttiva del Consiglio dell'Unione Europea 89/336/CEE sull'armonizzazione legislativa degli stati membri in materia di compatibilità elettromagnetica.

Le prove effettuate sul presente prodotto hanno accertato che esso rientra nei limiti stabiliti per le le apparecchiature di informatica Classe B ai sensi del CISPR 22/Norma Europea EN 55022. I limiti delle apparecchiature della Classe B sono stati stabiliti al fine di fornire ragionevole protezione da interferenze mediante dispositivi di comunicazione in concessione in ambienti commerciali ed industriali.

**Unione Europea - Directiva EMC (Conformidad électromagnética)**

Este producto satisface los requisitos de protección del Consejo de la UE, Directiva 89/336/CEE en lo que a la legislatura de los Estados Miembros sobre compatibilidad electromagnética se refiere.

IBM no puede aceptar responsabilidad alguna si este producto deja de satisfacer dichos requisitos de protección como resultado de una modificación no recomendada del producto, incluyendo el ajuste de tarjetas de opción que no sean IBM.

Este producto ha sido probado y satisface los límites para Equipos Informáticos Clase B de conformidad con el Estándar CISPR22 y el Estándar Europeo EN 55022. Los límites para los equipos de Clase B se han establecido para entornos comerciales e industriales a fin de proporcionar una protección razonable contra las interferencias con dispositivos de comunicación licenciados.

이 기기는 가정용으로 전자파 적합등록을 한 기기로서

주거지역에서는 물론 모든 지역에서 사용할 수 있습니다.

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高調波ガイドライン適合品

**IBM** ®

Part Number:  71P9205

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