IBM 400/800GB LTO3 Tape Drive User's Guide

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Note

Before using this guide and the product it supports, read the information in Appendix C, “Service and Support,” on page 71 and Appendix D, “IBM Statement of Limited Warranty Z125-4753-08 04/2004,” on page 73.

Note

Please carefully review the information in “Cleaning the Drive Head” on page 14, “Updating Firmware” on page 26 and “Using Ultrium Media” on page 31 sections as periodic maintenance is not covered by the IBM warranty. Repairs or exchanges resulting from improper maintenance may result in billable service charges.

First Edition (May 2005)

Contents

Safety information

Before installing this product, read the Safety Information.

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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!

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.

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

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 produktu si prečítajte bezpečnostné informácie.

Pred namestitvijo tega proizvoda preberite Varnostne informacije.

Antes de instalar este producto lea la información de seguridad.

Läs säkerhetsinformationen innan du installerar den här produkten.

安裝本產品之前，請先閱讀「安全資訊」。

General safety guidelines

Always observe the following precautions to reduce the risk of injury and property damage.

Service

Do not attempt to service a product yourself unless instructed to do so by the IBM Support Center. Use only an IBM authorized service provider who is approved to repair your particular product.

Note: Some parts can be upgraded or replaced by the customer. These parts are referred to as Customer Replaceable Units, or CRUs. IBM expressly identifies CRUs as such, and provides documentation with instructions when it is appropriate for customers to replace those parts. You must closely follow all instructions when performing such replacements. Always make sure that the power is turned off and that the product is unplugged from any power source before you attempt the replacement. If you have any questions or concerns, contact the IBM Support Center.

Power cords and power adapters

Use only the power cords and power adapters supplied by the product manufacturer.

Never wrap a power cord around the power adapter or other object. Doing so can stress the cord in ways that can cause the cord to fray, crack or crimp. This can present a safety hazard.

Always route power cords so that they will not be walked on, tripped over, or pinched by objects.

Protect the cord and power adapters from liquids. For instance, do not leave your cord or power adapter near sinks, tubs, toilets, or on floors that are cleaned with liquid cleansers. Liquids can cause a short circuit, particularly if the cord or power adapter has been stressed by misuse. Liquids can also cause gradual corrosion of the power cord terminals and/or the connector terminals on the adapter which can eventually result in overheating.

Always connect power cords and signal cables in the correct order and ensure that all power cord connectors are securely and completely plugged into receptacles.

Do not use any power adapter that shows corrosion at the ac input pins and/or shows signs of overheating (such as deformed plastic) at the ac input or anywhere on the power adapter.

Do not use any power cords where the electrical contacts on either end show signs of corrosion or overheating or where the power cord appears to have been damaged in any way.

Extension cords and related devices

Ensure that extension cords, surge protectors, uninterruptible power supplies, and power strips that you use are rated to handle the electrical requirements of the product. Never overload these devices. If power strips are used, the load should not exceed the power strip input rating. Consult an electrician for more information if you have questions about power loads, power requirements, and input ratings.

Plugs and outlets

If a receptacle (power outlet) that you intend to use with your computer equipment appears to be damaged or corroded, do not use the outlet until it is replaced by a qualified electrician.

Do not bend or modify the plug. If the plug is damaged, contact the manufacturer to obtain a replacement.

Some products are equipped with a three-pronged plug. This plug fits only into a grounded electrical outlet. This is a safety feature. Do not defeat this safety feature by trying to insert it into a non-grounded outlet. If you cannot insert the plug into the outlet, contact an electrician for an approved outlet adapter or to replace the outlet with one that enables this safety feature. Never overload an electrical outlet. The overall system load should not exceed 80 percent of the branch circuit rating. Consult an electrician for more information if you have questions about power loads and branch circuit ratings.

Be sure that the power outlet you are using is properly wired, easily accessible, and located close to the equipment. Do not fully extend power cords in a way that will stress the cords.

Connect and disconnect the equipment from the electrical outlet carefully

Batteries

All IBM personal computers contain a non-rechargeable coin cell battery to provide power to the system clock. In addition many mobile products such as Thinkpad notebook PCs utilize a rechargeable battery pack to provide system power when in portable mode. Batteries supplied by IBM for use with your product have been tested for compatibility and should only be replaced with IBM approved parts.

Never attempt to open or service any battery. Do not crush, puncture, or incinerate batteries or short circuit the metal contacts. Do not expose the battery to water or other liquids. Only recharge the battery pack strictly according to instructions included in the product documentation.

Battery abuse or mishandling can cause the battery to overheat, which can cause gasses or flame to “vent” from the battery pack or coin cell. If your battery is damaged, or if you notice any discharge from your battery or the buildup of foreign materials on the battery leads, stop using the battery and obtain a replacement from the battery manufacturer.

Batteries can degrade when they are left unused for long periods of time. For some rechargeable batteries (particularly Lithium Ion batteries), leaving a battery unused in a discharged state could increase the risk of a battery short circuit, which could

shorten the life of the battery and can also pose a safety hazard. Do not let rechargeable Lithium-Ion batteries completely discharge or store these batteries in a discharged state.

Heat and product ventilation

Computers generate heat when turned on and when batteries are charging. Notebook PCs can generate a significant amount of heat due to their compact size. Always follow these basic precautions:

- Do not leave the base of your computer in contact with your lap or any part of your body for an extended period when the computer is functioning or when the battery is charging. Your computer produces some heat during normal operation. Extended contact with the body could cause discomfort or, potentially, a skin burn.
- Do not operate your computer or charge the battery near flammable materials or in explosive environments.
- Ventilation slots, fans and/or heat sinks are provided with the product for safety, comfort, and reliable operation. These features might inadvertently become blocked by placing the product on a bed, sofa, carpet, or other flexible surface. Never block, cover or disable these features.

CD and DVD drive safety

CD and DVD drives spin discs at a high speed. If a CD or DVD is cracked or otherwise physically damaged, it is possible for the disc to break apart or even shatter when the CD drive is in use. To protect against possible injury due to this situation, and to reduce the risk of damage to your machine, do the following:

- Always store CD/DVD discs in their original packaging
- Always store CD/DVD discs out of direct sunlight and away from direct heat sources
- Remove CD/DVD discs from the computer when not in use
- Do not bend or flex CD/DVD discs, or force them into the computer or their packaging
- Check CD/DVD discs for cracks before each use. Do not use cracked or damaged discs

Safety and Environmental Notices

When using this product, observe the danger and caution notices contained in this guide. The notices are accompanied by symbols that represent the severity of the safety condition.

The sections that follow define each type of safety notice.

Danger Notices

A danger notice calls attention to a situation that is potentially lethal or extremely hazardous to people.

	A lightning bolt symbol always accompanies a danger notice to represent a dangerous electrical condition.

Caution Notices

A caution notice calls attention to a situation that is potentially hazardous to people because of some existing condition. A caution notice can be accompanied by one of several symbols:

If the symbol is...	It means....
	A hazardous electrical condition with less severity than electrical danger.
	A generally hazardous condition not represented by other safety symbols.
 Class I	A hazardous condition due to the use of a laser in the product. Laser symbols are always accompanied by the classification of the laser as defined by the U. S. Department of Health and Human Services (for example, Class I, Class II, and so forth).
	A hazardous condition due to mechanical movement in or around the product.
 > 18 kg (40 lb)	A hazardous condition due to the weight of the unit. Weight symbols are accompanied by an approximation of the product's weight.

End of Life (EOL) Plan

This product is a purchased unit. Therefore, it is the sole responsibility of the purchaser to dispose of it in accordance with local laws and regulations at the time of disposal. This unit contains recyclable materials. The materials should be recycled where facilities are available and according to local regulations. Some areas may provide a product take-back program that ensures proper handling of the product. Contact your IBM representative for more information.

About This Guide

This guide includes the following information:

- "Product Description" on page 1 describes the drive, discusses supported servers, operating systems, and device drivers.
- "Installing the Drive" on page 5 tells how to unpack and set up the drive.
- "Operating the Drive" on page 11 describes the unload button, and status light on the drive. It explains the function of the message display and the single-character display. It tells how to insert and remove a tape cartridge, describes methods of updating drive firmware, and explains how to clean the drive. It also lists the diagnostic and maintenance functions that the drive can perform.
- "Using Ultrium Media" on page 31 describes the types of tape cartridges to use in the drive and defines the conditions for storing and shipping them. It also tells how to handle the cartridges, how to set a cartridge's write-protect switch, and how to order additional cartridges.
- "Resolving Problems" on page 43 gives tips for solving problems with the drive and includes a flowchart that analyzes when the drive requires maintenance.
- "Servicing the Drive" on page 52 gives instructions on servicing the drive.
- Appendix A, "TapeAlert Flags," on page 65 lists TapeAlert messages that are supported by the drive and that may aid during problem determination.
- Appendix B, "Specifications," on page 69 lists product specifications.

Related Publications

- *IBM®TotalStorage® LTO Ultrium Tape Drive SCSI Reference*, GA32-0450, gives information about the supported SCSI commands and protocol that govern the behavior of the SCSI interface for the IBM 3580 LTO Ultrium Tape Drive Model L33/L3H and the IBM TotalStorage Ultrium Tape Drive Model T800.
- *IBM Ultrium Device Drivers Programming Reference, GC35-0483 supplies information to application developers who want to integrate their open-systems applications with IBM-supported Ultrium hardware. The reference contains information about the application programming interfaces (APIs) for each of the various supported operating-system environments. You can obtain this reference via File Transfer Protocol (FTP) at* **ftp://ftp.software.ibm.com/storage/devdrv**.
- *IBM Translated Safety Notices*, 96P0851, provides translation of danger and caution notices.

Product Description

The IBM 400/800GB LTO3 Tape Drive is a high-performance, high-capacity data-storage device that is designed to backup and restore open systems applications. The drive is the third-generation in the Ultrium series of products. It is available as Model with a Small Computer Systems Interface (SCSI).

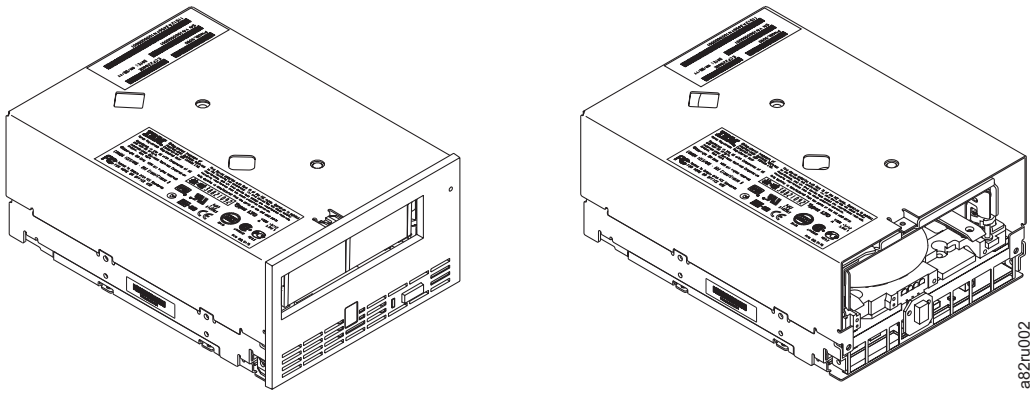


Figure 1. View of the drive with and without the bezel

The drive offers the following features:

- Ultra160 Low Voltage Differential (LVD) Small Computer Systems Interface
- 68-pin, D-shell connector (for SCSI signals, SCSI ID selection, and power connection)
- Native storage capacity of 400 GB per cartridge (800 GB at 2:1 compression)
- Native data transfer rate of up to 80 MB per second
- Burst data transfer rate of 160 MB per second
- New dual stage 16 channel head activator for precision head alignment to help support higher track density with improved data integrity and backwards compatibility with previous LTO generations
- Graceful dynamic braking designed to maintain tension until the tape comes to a complete stop, to help prevent stretching or breaking the tape, and loose tape wraps
- Larger internal buffer (the size has been doubled over the Ultrium 2 to 128 MB)
- New independent tape loader and threader motors designed to help with cartridge insertion in the tape drive.
- Highly integrated electronics designed to reduced the total number of components in the drive, lower chip temperatures, and reduce power requirements, helping to provide for a more reliable drive. The Generation 3 drive electronics also incorporate on-the-fly error correction of soft errors in the memory arrays in data and control paths.

Front Panel of the Drive

Figure 2 shows the front panel of the drive.

1	Status Light	3	Single-character Display (SCD)
2	Unload Button	4	SCD Dot

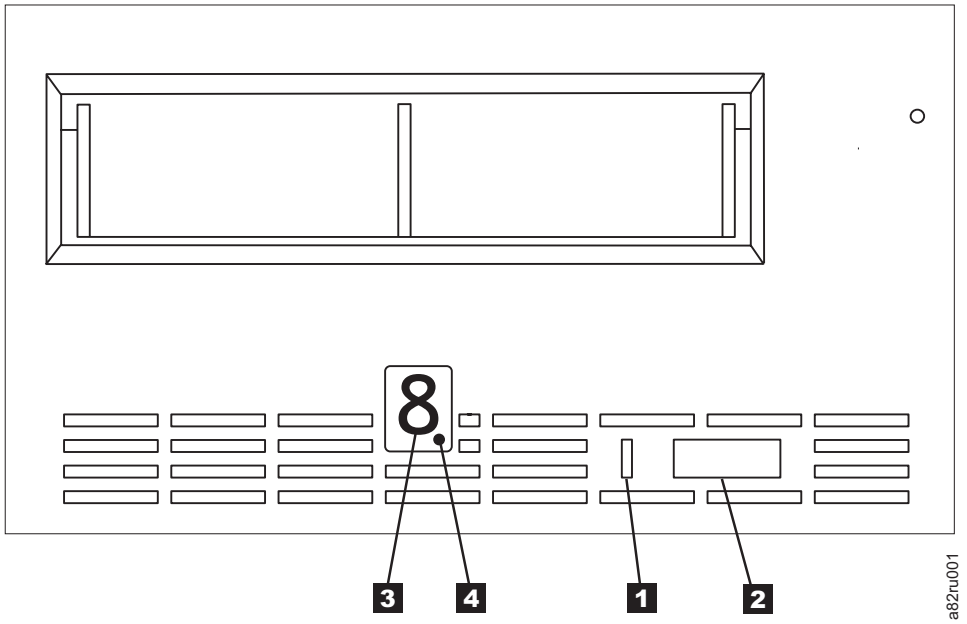


Figure 2. Front panel of the drive

Rear Panel of the SCSI Drive

1	SCSI connector	4	Library/Drive Interface (LDI or RS-422 interface) connector
2	SCSI ID connector	5	Serial port
3	Power connector		

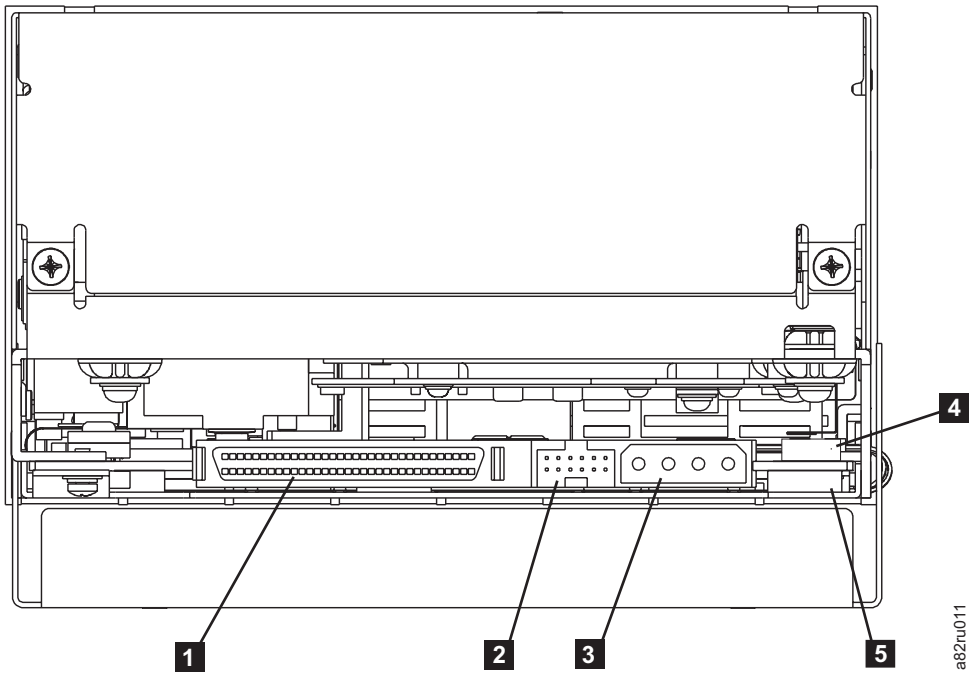


Figure 3. Rear panel of the drive

Speed Matching and Channel Calibration

To improve system performance, the drive uses a technique called *speed matching* to dynamically adjust its native (uncompressed) data rate to the slower data rate of a server. With speed matching, the drive operates at one of five speeds when reading or writing the Generation 3 cartridge format to achieve a native data rate of 40, 50, 60, 70, or 80 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 the appropriate data rate at which to operate. Speed matching dramatically reduces backhitch, the condition that occurs when a tape stops, reverses, and restarts motion. A backhitch is usually the result of a mismatch between the data rates of the server and the drive.

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 drive 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 30 seconds (default value; this is programmable via the mode pages); to exit, the drive must receive a command across the SCSI interface, a command across the Library/Drive Interface (LDI or RS-422 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 ten microseconds. Commands that require media motion may be delayed an additional 100 milliseconds because the tape must be retensioned.

SCSI Attachment

To communicate with a server, the drive uses the Ultra160 LVD SCSI interface.

Physical Characteristics of the SCSI Interface

The drive contains a high-density, 68-pin, D-shell receptacle connector (HD68) for attachment to the server. The HD68 connector includes the connectors for the SCSI signal, the SCSI ID, and the drive's power. The drive supports LVD SCSI cables with HD68 connectors.

Speed

The Ultra160 LVD SCSI interface is compatible with older SCSI technology and is capable of data transmission at 160 MB/s. Ultra160 SCSI uses the three management features of the Ultra3 SCSI standard that specifically affect data transfer rate:

- **Double transition clocking** - a data-transfer technique that enables data rates to double without increasing clock speed
- **Domain validation** - a procedure that detects and adjusts SCSI configuration issues that might prevent interoperation between SCSI devices
- **Cyclic redundancy check (CRC)** - an error-checking technique

Because the cables, connectors, and terminators are the same for the Ultra160 and Ultra2 SCSI interfaces, devices with those interfaces can be mixed on the same bus and each device can operate at its fully rated speed.

Installing the Drive

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

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

The steps that follow describe how to install the drive into an enclosure.

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

Installation Overview

__ 1. "Unpack the Drive"
__ 2. "Power Off the Server/Enclosure" on page 6
__ 3. "Set the SCSI ID" on page 7
__ 4. "Mount the Drive into the Server/Enclosure" on page 8
__ 5. "Connect and Test Power to the Drive" on page 9
__ 6. "Connect the Internal SCSI Cable" on page 9
__ 7. "Run Drive Diagnostics" on page 9
__ 8. "Install Device Drivers" on page 10
__ 9. "Connect the Enclosure's External SCSI Interface to the Server" on page 10

Unpack the Drive

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

Attention:

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

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

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

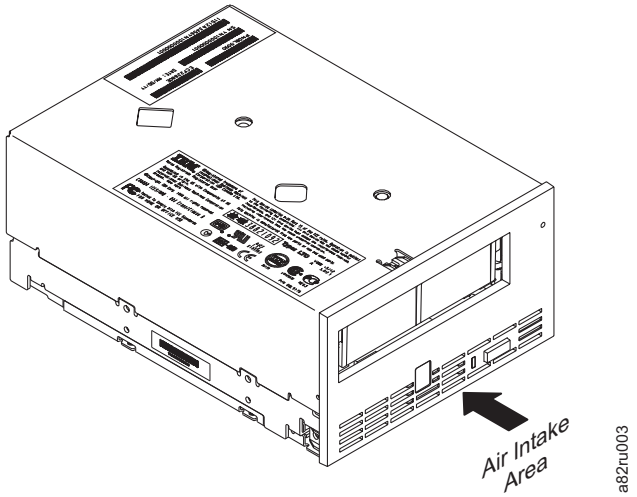


Figure 4. Temperature of the drive is taken near the air intake area

Power Off the Server/Enclosure

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

__ 2. Disconnect the power cord from both the electrical outlet and the host.

Set the SCSI ID

The SCSI ID can be set in one of two ways:

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

Setting the SCSI ID with Jumpers

The SCSI ID can be set on the drive by installing 2 mm jumpers on the drive's SCSI ID connector (see **2** in Figure 3). Your 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 (**2** in Figure 3).

__ 2. Before attaching the SCSI bus cable to the server, determine the SCSI ID. 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: If you set the SCSI ID to 15, the drive will not necessarily be set to that ID; instead, the drive will expect to receive the SCSI ID through a command over its LDI interface.

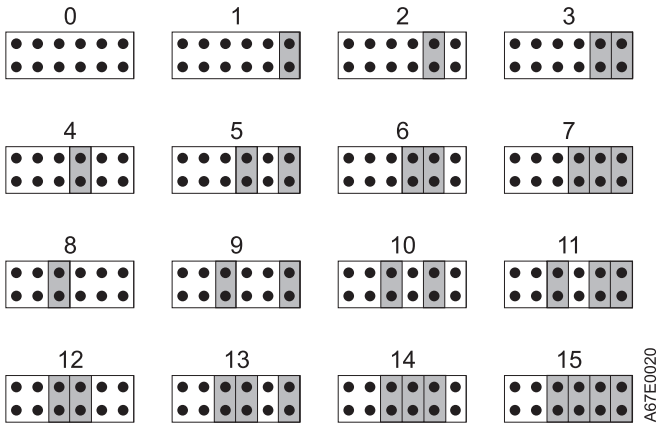


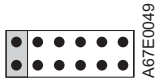
Figure 5. SCSI ID settings on the SCSI ID connector

Setting the SCSI ID with a SCSI ID Switch

If your enclosure uses a SCSI ID switch (rather than jumpers), connect the switch to the drive's SCSI ID connector **2** in Figure 3 . If any jumpers are preinstalled, 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 (SCSI Drive Only)

To supply TERMPOWER to the bus, locate one of the five jumpers shipped with the drive and place it on the SCSI ID connector as shown in the following figure. Place the jumper on the pins that are shaded.



Attention
SCSI termination must be provided externally to the drive.

Mount the Drive into the Server/Enclosure

To mount the drive into a enclosure:

__ 1. Remove the cover of your enclosure (refer to the instructions in the documentation provided with your enclosure).

__ 2. Place the drive into the enclosure so that the tape load compartment of the drive faces the tape load compartment of the enclosure.

__ 3. Insert two M3 screws into the mounting holes **2** of the two side brackets located on the left and right sides of the chassis.

Attention
When inserted into the drive, 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 drive may become damaged.

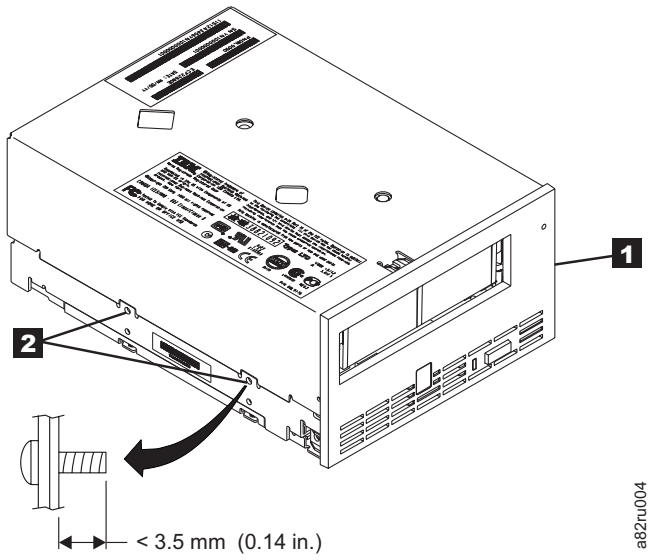


Figure 6. Mounting holes on drive. The holes are located on both sides of the drive. The drive is shown with a front bezel.

To mount the drive into a server:

1. Refer to the option (or drive) installation instructions in your server Installation Guide.

Connect and Test Power to the Drive

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

To connect and test power to the drive:

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

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

__ 3. Connect the host's internal power cable to the power connector on the drive (see **3** in Figure 3 on page 3).

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

__ 5. Review the location of the Single-character Display (SCD) and the Status Light in "Single-character Display (SCD)" on page 11 and "Status Light" on page 11 (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 host:

- The SCD presents a series of random characters, then becomes blank (not lit).

> **Attention**
> If the SCD 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 host.

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

Connect the Internal SCSI Cable

Connect the enclosure's internal SCSI cable to the SCSI connector on the drive (see **1** in Figure 3).

Run Drive Diagnostics

__ 1. Replace the cover on the host.

__ 2. Connect the power cord to both the host and the electrical outlet.

__ 3. Power-on the host.

__ 4. Run one or more of the following drive diagnostics:

- "Function Code 1: Run Drive Diagnostics" on page 16
- "Function Code 6: Run SCSI Wrap Test" on page 20
- "Function Code 7: Run RS-422 Wrap Test" on page 20

If an error code appears on the single-character display (SCD), go to "Error Codes and Messages" on page 45. If no error appears, continue to the next step.

__ 5. Power-off the host.

__ 6. Disconnect the power cord from both the host and the electrical outlet.

Install Device Drivers

For information about installing device drivers, refer to the documentation for your server and/or Operating System.

Connect the Enclosure's External SCSI Interface to the Server

__ 1. Connect an external SCSI bus cable to both the enclosure and the server (for the location of the connectors, refer to the documentation for your enclosure and server).

__ 2. Run the appropriate SCSI attachment verification procedure from your server (for instructions, refer to the *IBM Ultrium Device Drivers Installation and User's Guide*).

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

Operating the Drive

Operating the drive involves using the following front panel items:

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

Single-character Display (SCD)

The SCD (see **3** in Figure 2) presents a single-character code for:

- Error conditions and informational messages:

  "Error Codes and Messages" on page 45 lists the codes for error conditions and informational messages. If multiple errors occur, the code with the highest priority (represented by the lowest number) displays first. When the error is corrected, the code with the next highest priority displays, and so on until no errors remain.
- Diagnostic or maintenance functions (while in maintenance mode only):

  "Diagnostic and Maintenance Functions" on page 15 lists the single-character codes that represent diagnostic or maintenance functions. To initiate a function the unit must be in maintenance mode.

The SCD is blank during normal operation.

SCD Dot

If a drive dump is present while the drive is in maintenance mode, a single red dot illuminates in the lower right corner of the SCD (). To copy the dump, see "Function Code 5: Copy Drive Dump" on page 19.

The SCD Dot turns off when you obtain the dump (by using an FMR tape, a SCSI command, or a library command).

Status Light

The Status Light (**1** in Figure 2) is a light-emitting diode (LED) that provides information about the state of the drive. The light can be green or amber, and (when lit) solid or flashing. The table below lists the conditions of the Status Light and Single-character Display (SCD) and provides an explanation of what each condition means.

Table 1. Meaning of Status Light and Single-character Display (SCD)

If the Status Light is...	and the SCD is...	Meaning
Off	Off	The drive has no power or is powered off.
Green	Off	The drive is powered on and in an idle state.
Flashing Green	Off	The drive is reading from the tape, writing to the tape, rewinding the tape, locating data on the tape, loading the tape, or unloading the tape.

Table 1. Meaning of Status Light and Single-character Display (SCD) (continued)

If the Status Light is...	and the SCD is...	Meaning
Flashing Green	Off	The 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 up to ten 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	Displaying Error Code	The drive is displaying error code(s) from the error code log on the SCD. For more information, see "Function Code A: Clear Error Code Log" on page 22" and "Error Codes and Messages" on page 45.
Amber	Red numbers, letters, or segments	The drive is powering on, resetting, or in maintenance mode.
Amber	Flashing 	The drive is exiting from maintenance mode. For more information, see "Function Code 0: Exit Maintenance Mode" on page 16".
Amber	Flashing selected function	The drive is executing the selected function while in maintenance mode.
Flashing Amber once per second	Displaying error code	An error occurred and the drive or media may require service, or it may require cleaning. Note the code on the SCD, then go to Table 9 to determine the action that is required.
Flashing Amber once per second	Displaying 	The drive needs cleaning.
Flashing Amber twice per second	Displaying Function Code  or Off	The drive is updating firmware.[1] The SCD will display a if using an FMR cartridge. The SCD will be off if using the SCSI interface. For more information, see ""Updating Firmware" on page 26.
Flashing Amber twice per second	Off	The drive detected an error and is performing a firmware recovery. It will reset automatically.
Flashing Amber twice per second	Flashing 	The drive is requesting a cartridge to be loaded.
Flashing Amber twice per second	Off	There is a drive dump in flash memory.

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

Unload Button

The Unload Button (**2** in Figure 2 in "Front Panel of the Drive" on page 2) performs the following functions:

Table 2. Functions that the Unload Button performs

Unload Button Function	How to Initiate the Function
Rewind the tape into the cartridge and eject the cartridge from the drive	Press the Unload Button once. The Status Light flashes green while the drive is rewinding and unloading. **Note:** During a rewind and eject operation, the drive does not accept SCSI commands from the server.
Place the drive in maintenance mode	Ensure that the drive is unloaded. Then, within two seconds, press the Unload Button three times. The drive is in maintenance mode when the Status Light becomes solid amber and  appears in the SCD. **Note:** While in maintenance mode, the drive does not accept SCSI interface commands.
Scroll through the maintenance functions	While in maintenance mode, press the Unload Button once per second to increment the display characters by one. When you reach the character of the diagnostic or maintenance function that you want (see "Diagnostic and Maintenance Functions" on page 15), press and hold the Unload Button for three seconds.
Exit maintenance mode	Press the Unload Button once per second until  displays. Then press and hold the Unload Button for three seconds. Maintenance mode is exited when the Status Light becomes solid green and the SCD becomes blank.
Force a drive dump (part of the maintenance mode)	**Attention:** If the drive detects a permanent error and displays an error code, it automatically forces a drive dump (also known as a save of the firmware trace). If you force a drive dump, the existing dump will be overwritten and data will be lost. After you force a drive dump, do not turn off the power to the drive or you may lose the dump data. Choose one of the following procedures: • If the drive is in maintenance mode (Status Light is solid amber), refer to "Function Code 4: Force a Drive Dump" on page 18. • If the drive is in operating mode (Status Light is solid or flashing green), press and hold the Unload Button for ten seconds. If captured dump data exists, the drive places it into a dump area.
Reset the drive	Press and hold the Unload Button on the drive for ten seconds. The drive saves a dump of the current drive state, then reboots to allow communication. Do not cycle power as this will erase the contents of the dump.

Inserting a Tape Cartridge

To insert a tape cartridge:

1. Ensure that the drive is powered-on.
2. Ensure that the write-protect switch is properly set (see "Write-Protect Switch" on page 34).
3. Grasp the cartridge so that the write-protect switch faces you (**1** in Figure 7 on page 14).
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.

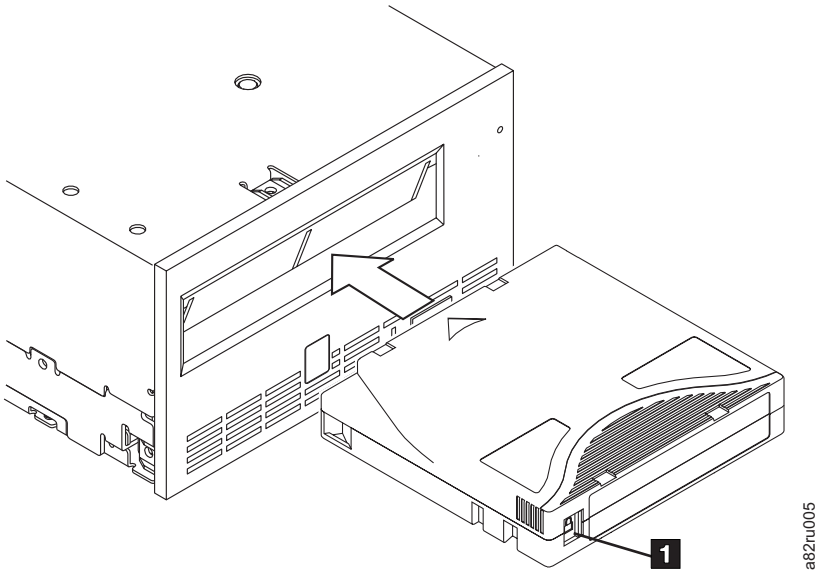


Figure 7. Inserting a cartridge into the drive

Removing a Tape Cartridge

To remove a tape cartridge:

1. Ensure that the drive is powered-on.
2. Press the Unload Button. The drive rewinds the tape and partially ejects the cartridge. The 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.

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

Mid-tape Recovery

If a power cycle or reset occurs while a cartridge is loaded, the drive will slowly rewind the tape and eject the cartridge.

Cleaning the Drive Head

Attention

When cleaning the drive head, use the LTO Ultrium Cleaning Cartridge. For more information, please see: http://www-307.ibm.com/pc/support/sit.wss/document.do?Indocid=MIGR-39931

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

To clean the head, insert the cleaning cartridge into the tape load compartment (see "Front Panel of the Drive" on page 2). The drive performs the cleaning automatically in less than two minutes then ejects the cartridge.

Note: If a cleaning cartridge is inserted when the drive does not need to be cleaned or a cleaning cartridge is inserted that has expired, the drive will automatically eject the cartridge.

The LTO Ultrium Cleaning Cartridge is valid for 50 uses.

Diagnostic and Maintenance Functions

The drive can:

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

The drive must be in maintenance mode to perform these functions.

Attention

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

Entering Maintenance Mode

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

1. Make sure that no cartridge is in the drive.
2. Press the Unload Button three times within two seconds.  appears in the Single-character Display (SCD), and the Status Light turns amber.

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

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

Function Code 0: Exit Maintenance Mode

Function Code  makes the drive available for reading and writing data.

1. Place the drive in maintenance mode. For instructions, see "Entering Maintenance Mode" on page 15.
2. Press and hold the Unload Button for 3 or more seconds to take the drive out of maintenance mode. The Status Light turns off.

   - If no error is detected,  temporarily appears in the SCD, then goes blank. The drive then exits maintenance mode.
   - If an error is detected, the SCD shows an error code but still exits maintenance mode. To determine the error, locate the code in Table 9 on page 45. To clear the error, turn the power off, then on again.

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

Function Code 1: Run Drive Diagnostics

Approximate Run Time = 20 minutes per loop

Total Number of Loops = 10

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

The diagnostic loops ten times. To stop the diagnostic and exit maintenance mode, press the Unload Button once to abort the test.

Attention

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

1. Place the drive in maintenance mode. For instructions, see "Entering Maintenance Mode" on page 15.
2. Press the Unload Button once per second until  appears in the SCD. (If you cycle past the desired code, press the Unload Button once per second until the code reappears.)
3. Press and hold the Unload Button for three or more seconds, then release it to select function  . The SCD changes to a flashing .
4. Insert a scratch (blank) data cartridge that is not write-protected (or the tape drive exits maintenance mode). The SCD changes to a flashing  and the test begins.

   Note: If you inserted an invalid or write-protected tape cartridge, error code  appears in the SCD. The tape drive unloads the cartridge and exits maintenance mode.

- If no error is detected, the diagnostic will loop and begin again. To stop the loop, press the Unload Button for one second and release. When the loop ends,  temporarily appears in the SCD. The drive rewinds and unloads the cartridge, and then exits maintenance mode. The solid amber Status Light turns off.
- If an error is detected, the Status Light flashes amber and the drive posts an error code to the SCD. To determine the error, locate the code in Table 9 on page 45. The tape drive unloads the tape cartridge and exits maintenance mode. To clear the error, turn the power off, then on again.

Function Code 2: Update Drive Firmware from FMR Tape

Attention

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

Function Code  loads drive firmware from a field microcode replacement (FMR) tape.

Attention: While the drive supports firmware update with a FUP tape, IBM recommends you update the drive firmware using the easier to use Tapetool found at http://www-307.ibm.com/pc/support/site.wss/document.do?lndocid=TAPE-FILES.

Attention: Customers should only attempt this step when requested by IBM service.

1. Place the drive in maintenance mode. For instructions, see "Entering Maintenance Mode" on page 15.
2. Press the Unload Button once per second until  appears in the SCD. (If you cycle past the desired code, press the Unload Button once per second until the code reappears.)
3. Press and hold the Unload Button for three or more seconds, then release it to select the function. The SCD changes to a flashing  .
4. Insert the FMR tape cartridge (or the tape drive exits maintenance mode). The SCD changes to a flashing  . The tape drive loads the updated firmware from the FMR tape into its erasable programmable read-only memory (EPROM) area.
   - If the update completes successfully, the tape drive rewinds and unloads the FMR tape, resets itself, and is ready to use the new firmware. The drive automatically reboots.
   - If the update fails, the tape drive posts an error code to the SCD. To determine the error, locate the code in Table 9 on page 45. The drive then unloads the FMR tape and exits maintenance mode. Contact Technical Support for problem determination or machine replacement.

Function Code 3: Create FMR Tape

Function Code  copies the drive's field microcode replacement (FMR) data to a scratch data cartridge.

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

Attention: Customers should only attempt this step when requested by IBM service.

1. Place the drive in maintenance mode. For instructions, see "Entering Maintenance Mode" on page 15.
2. Press the Unload Button once per second until  appears in the SCD. (If you cycle past the desired code, press the Unload Button once per second until the code reappears.)
3. Press and hold the Unload Button for three or more seconds, then release it to select the function. The SCD changes to a flashing  .
4. Insert a scratch (blank) data cartridge that is not write protected (or the tape drive exits maintenance mode). The SCD changes to a flashing  . The tape drive copies the FMR data to the scratch data cartridge.

   Note: If you inserted an invalid or write-protected tape cartridge, error code  appears in the SCD. The tape drive unloads the cartridge and exits maintenance mode.

   - If the tape drive creates the FMR tape successfully, it rewinds and unloads the new tape, exits maintenance mode, and the tape is ready to use.
   - If the tape drive fails to create the FMR tape, it displays an error code. To determine the error, see Table 9 on page 45. The tape drive then unloads the FMR tape, exits maintenance mode.

Function Code 4: Force a Drive Dump

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

Attention: Customers should only attempt this step when requested by IBM service.

1. Place the drive in maintenance mode. For instructions, see "Entering Maintenance Mode" on page 15.
2. Press the Unload Button once per second until  appears in the SCD. (If you cycle past the desired code, press the Unload Button once per second until the code reappears.)

3. Press and hold the Unload Button for three or more seconds, then release it to select the function. The drive performs the dump. The SCD shows  , then goes blank. To access the contents of the dump, see "Function Code 5: Copy Drive Dump."

   Note: You can also force a drive dump when the tape drive is in normal operating mode. Simply press and hold the Unload Button for ten seconds.

Function Code 5: Copy Drive Dump

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

> **Attention**
>
> For the  -  function, insert only a scratch (blank) data cartridge or a cartridge that may be overwritten. During the test, the drive overwrites the data on the cartridge.

Attention: Customers should only attempt this step when requested by IBM service.

1. Place the drive in maintenance mode. For instructions, see "Entering Maintenance Mode" on page 15.
2. Press the Unload Button once per second to cycle through the following functions:
   -  -  : no function
   -  -  : copy dump to tape
   -  -  : copy dump to flash memory
   -  -  : erase flash memory

   If you cycle past the desired code, press the Unload Button once per second until the code reappears.
3. Press and hold the Unload Button for three or more seconds, then release it to select one of the above functions. The SCD changes to a flashing .
4. Insert a scratch (blank) data cartridge that is not write protected (or the tape drive exits maintenance mode). The SCD flashes the selection number while performing the function.

   Note: If you inserted an invalid or write-protected tape cartridge, error code  appears in the SCD. The tape drive unloads the cartridge and exits maintenance mode.

   - If the copy operation completes successfully, the tape drive rewinds and unloads the tape, and exits maintenance mode.

- If the copy operation fails, an error code appears in the SCD. To determine the error, locate the code inTable 9 on page 45. The tape drive unloads the tape cartridge and exits maintenance mode.

Function Code 6: Run SCSI Wrap Test

Approximate Run Time = 10 seconds per loop

Number of Loops = This test runs until stopped by pressing the Unload Button.

Function Code  performs a check of the SCSI circuitry from and to the SCSI connector.

Note: This test requires that the drive be terminated by either the terminator on the connector or at the end of the bus. Before you select this function, disconnect the SCSI cable of the drive that is closest to the server. Then, attach the SCSI wrap plug to that SCSI connector.

Attention: Customers should only attempt this step when requested by IBM service.

1. Place the drive in maintenance mode. For instructions, see "Entering Maintenance Mode" on page 15.
2. Press the Unload Button once per second until  appears in the SCD. (If you cycle past the desired code, press the Unload Button once per second until the code reappears.)
3. Make sure that the SCSI wrap plug is connected to one of the SCSI connectors at the rear of the drive.
4. Make sure that the drive is terminated at one of its SCSI connectors or at the SCSI bus.
5. Press and hold the Unload Button for three or more seconds, then release it to select the function. The drive automatically starts the test (one loop of which lasts for less than one second).
   - If no error is detected, the test will loop and begin again. To stop the loop, press the Unload Button for one second and release. When the loop ends, function code  temporarily appears in the Single-character Display. The drive then exits maintenance mode. Disconnect the SCSI wrap plug.
   - If an error is detected, the test stops, error code  appears in the SCD. To determine the error, locate  in Table 9 on page 45. To clear the error, turn the power off, then on again.

Function Code 7: Run RS-422 Wrap Test

This test causes the drive to perform a check of the circuitry from and to the LDI or RS-422 connector.

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

Attention: Customers should only attempt this step when requested by IBM service.

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  appears in the Single-character Display (SCD). If you cycle past  , continue to press the Unload Button until it displays again.
4. To select the function, press and hold the Unload Button for three seconds.

   After you select the function,  flashes and the drive automatically starts the test.
   - If the test is successful, it loops and begins again. To half the test, press the Unload Button. The test continues to the end of its loop and then stops. The drive then displays  and exits maintenance mode.
   - If the test fails,  displays, the test stops, and the drive exits maintenance mode. To resolve the error, locate  in Table 9 on page 45

Function Code 8: Unmake FMR Tape

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

Attention: Customers should only attempt this step when requested by IBM service.

1. Place the drive in maintenance mode. For instructions, see "Entering Maintenance Mode" on page 15.
2. Press the Unload Button once per second until  appears in the SCD. (If you cycle past the desired code, press the Unload Button once per second until the code reappears.)
3. Press and hold the Unload Button for three or more seconds, then release it to select function  . The SCD changes to a flashing  .
4. Insert the FMR data cartridge (or the tape drive exits maintenance mode). The SCD changes to a flashing  . The tape drive erases the firmware on the tape and rewrites the header in the cartridge memory to change the cartridge to a valid scratch (blank) data cartridge:
   - If the operation is successful, the tape drive displays function code  , rewinds and unloads the newly converted scratch data cartridge, and exits maintenance mode.
   - If the operation is not successful, an error code displays. To determine the error, locate the code in Table 9 on page 45. To clear the error, turn the power off, then on again.

Function Code 9: Display Error Code Log

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

1. Place the drive in maintenance mode. For instructions, see "Entering Maintenance Mode" on page 15.
2. Press the Unload Button once per second until  appears in the SCD. (If you cycle past the desired code, press the Unload Button once per second until the code reappears.)
3. Press and hold the Unload Button for three or more seconds, then release it to view the most recent error codes.
4. Press the Unload Button again to view successive error codes. Let two to three seconds pass between each depression.
5. After viewing all error codes, exit this function and maintenance mode by pressing the Unload Button again.

Function Code A: Clear Error Code Log

Function Code  erases the contents of the error code log.

1. Place the drive in maintenance mode. For instructions, see "Entering Maintenance Mode" on page 15.
2. Press the Unload Button once per second until  appears in the SCD. (If you cycle past the desired code, press the Unload Button once per second until the code reappears.)
3. Press and hold the Unload Button for three or more seconds, then release it to select the function.  flashes in the SCD, followed by  . The tape drive erases all errors from the error code log. The tape drive exits maintenance mode.

Function Code C: Insert Cartridge into Tape Drive

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

Function Code E: Test Cartridge & Media

Approximate Run Time = 15 minutes per loop

Total Number of Loops = 10

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

The diagnostic loops ten times. To stop the diagnostic and exit maintenance mode, press the Unload Button once to abort the test.

Attention

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

1. Place the drive in maintenance mode. For instructions, see "Entering Maintenance Mode" on page 15.
2. Press the Unload Button once per second until  appears in the SCD. (If you cycle past the desired code, press the Unload Button once per second until the code reappears.)
3. Press and hold the Unload Button for three or more seconds, then release it to select the function. The SCD changes to a flashing  .
4. Ensure that the write-protect switch on the suspect cartridge is off, then insert the cartridge (or the tape drive exits maintenance mode). The SCD changes to  . The tape drive runs the tests.
   - If no error is detected, the test will loop and begin again. To stop the loop, press the Unload Button for one second and release. When the loop ends,  temporarily appears in the SCD. The drive rewinds the tape, unloads the cartridge, and exits maintenance mode.
   - If an error is detected the test stops,  or  appears in the SCD (another code could appear). To determine the error, locate  or  in Table 9 on page 45. The drive unloads the tape cartridge, exits maintenance mode. To clear the error, turn the power off, then on again.

Function Code F: Fast Read/Write Test

Approximate Run Time = 5 minutes

Total Number of Loops = 10

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

The diagnostic loops ten times. To stop the diagnostic and exit maintenance mode, press the Unload Button once to abort the test.

Attention

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

1. Place the drive in maintenance mode. For instructions, see "Entering Maintenance Mode" on page 15.
2. Press the Unload Button once per second until  appears in the SCD. (If you cycle past the desired code, press the Unload Button once per second until the code reappears.)

3. Press and hold the Unload Button for three or more seconds, then release it to select the function. The SCD changes to a flashing C.
4. Insert a scratch (blank) data cartridge that is not write-protected (or the tape drive exits maintenance mode). The SCD changes to a flashing F. The tape drive runs the tests.

   Note: If you inserted an invalid or write-protected tape cartridge, 7 appears in the SCD. The tape drive unloads the cartridge and exits maintenance mode.

   - If no error is detected, the test will loop and begin again. To stop the loop, press the Unload Button for one second and release. When the loop ends, 0 temporarily appears in the SCD. The drive rewinds and unloads the tape, partially ejects the cartridge, then exits maintenance mode. The solid amber Status Light turns off.
   - If an error is detected, the Status Light flashes amber, the tape drive posts an error code to the SCD. To determine the error, locate the code in Table 9 on page 45. The tape drive unloads the cartridge and exits maintenance mode. To clear the error, turn the power off, then on again.

Function Code H: Test Head

Approximate Run Time = 10 minutes

Total Number of Loops = 10

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

The diagnostic loops ten times. To stop the diagnostic and exit maintenance mode, press the Unload Button once to abort the test.

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

1. Place the drive in maintenance mode. For instructions, see "Entering Maintenance Mode" on page 15.
2. Press the Unload Button once per second until H appears in the SCD. (If you cycle past the desired code, press the Unload Button once per second until the code reappears.)
3. Press and hold the Unload Button for three or more seconds, then release it to select the function. The SCD changes to a flashing C.
4. Insert a scratch (blank) data cartridge that is not write-protected (or the tape drive exits maintenance mode). The SCD changes to a flashing H. The tape drive runs the tests.

- If no error is detected, the test will loop and begin again. To stop the loop, press the Unload Button for one second and release. When the loop ends, 0 temporarily appears in the SCD. The drive rewinds the tape and unloads the cartridge. The drive then exits maintenance mode.
- If an error is detected the test stops, error code 5 appears in the SCD. To determine the error, locate 5 in Table 9 on page 45. The drive unloads the tape cartridge and exits maintenance mode. To clear the error, turn the power off, then on again.

Function Code L: Load/Unload Test

Approximate Run Time = 3 seconds per loop

Total Number of Loops = 10

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

The diagnostic loops ten times. To stop the diagnostic and exit maintenance mode, press the Unload Button once to abort the test.

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

1. Place the drive in maintenance mode. For instructions, see "Entering Maintenance Mode" on page 15.
2. Press the Unload Button once per second until L appears in the SCD. (If you cycle past the desired code, press the Unload Button once per second until the code reappears.)
3. Press and hold the Unload Button for three or more seconds, then release it to select the function. The SCD changes to a flashing C.
4. Insert a scratch (blank) data cartridge that is not write-protected (or the tape drive exits maintenance mode). The SCD changes to a flashing L. The tape drive runs the tests.
   - If no error is detected, the test will loop and begin again. To stop the loop, press the Unload Button for one second and release. When the loop ends, 0 temporarily appears in the SCD. The drive rewinds the tape and unloads the cartridge. The drive then exits maintenance mode.
   - If an error is detected the test stops, 6 appears in the SCD. To determine the error, locate 6 in Table 9 on page 45. The drive unloads the tape cartridge and exits maintenance mode. To clear the error, turn the power off, then on again.

Function Code P: Enable Post Error Reporting

When selected, deferred-check conditions are reported to the host. Therefore, temporary errors are reported in the sense data. This selection is normally used as a request from support personnel. Default is U (disabled).

1. Place the drive in maintenance mode. For instructions, see "Entering Maintenance Mode" on page 15.
2. Press and hold the Unload Button for three seconds while U appears in the SCD. The SCD changes to P then exits maintenance mode.

Function Code U: Disable Post Error Reporting

When selected, turns Post Error reporting off. Deferred-check conditions (temporary errors) are NOT reported to Host (normal mode of drive operation).

Default is U (disabled).

1. Place the drive in maintenance mode. For instructions, see "Entering Maintenance Mode" on page 15.
2. Press and hold the Unload Button for three seconds while P appears in the SCD. The SCD changes to U then exits maintenance mode.

Updating Firmware

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

Update drive firmware using:

- Using Tapetool (recommended)
- The SCSI interface
- The LDI or RS-422 interface
- A field microcode replacement (FMR) tape cartridge

To update the firmware, refer to the following sections.

Updating Firmware using Tapetool

Periodically check for updated levels of drive firmware by visiting the web at http://www-307.ibm.com/pc/support/site.wss/document.do?Indocid=TAPE-FILES.

The Tapetool file and instructions for use are included in this URL.

Updating Firmware through the SCSI Interface

When updating drive firmware by using the SCSI interface, the procedure varies, depending on whether your server uses an IBM tape device driver or a non-IBM tape device driver (such as a driver from Sun, Hewlett-Packard, or Microsoft®).

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

To update firmware from a server that uses a non-IBM tape device driver, refer to the documentation for that device.

Updating Firmware through the Library/Drive Interface

The drive includes a firmware update feature that allows a tape library to download firmware to the drive by using the Library/Drive Interface (LDI) while the drive performs normal host operations on logical unit number (LUN) 0 of the SCSI Protocol Interface. The update typically takes 63 seconds and a maximum of 140 seconds. The command may be received by the SCSI interface or the LDI (RS-422) interface.

Note: If a Power-on Reset command is received while a cartridge is loaded in the drive, the drive will respond with a Check Condition. It will not activate the new code level until you cycle power, or until a Power-on Reset command is received and the drive does not contain a cartridge.

ITDT SCSI Firmware Update, Dump Retrieval and Library/Drive Test Tool

A newly designed tool, ITDT, is a tool with multiple functional capability and is a very quick, convenient and efficient method for both drive and library firmware updates. As a note, both drive and library dump retrievals can be performed by the tool as well. Currently, the tool is very similar to the LTO-TDX drive only firmware update and drive dump retrieval tool (explained in detail later on in the Tape Drive Update firmware paragraph in this section).

Below are some of the capabilities of this tool:

1. Firmware update capability via SCSI to all IBM LTO Tape Drive and Tape Library products.
2. The tool does not require any special device drivers.
3. The tool is available for most major platforms (Windows®, AIX®, SUN, NetWare).
4. Linux
5. The tool is capable of uploading drive and library dump files.
6. The tool's primary function is thoroughly testing a drive. However, if the library is online to the server/host where the tool resides, ITDT will communicate with the drive through the library to load and unload a test cartridge thereby exercising some library functions.
7. The tool scans the SCSI bus and will find and display for selection all IBM LTO devices. The tool will not display and allow for selection any non-IBM device.
8. Each function has "Help" selection which explains the required syntax as well as a brief explanation of the particular function.
9. A Readme text file will be posted with the .exe file for a thorough explanation of initial tool download information from the web as well as explanation of tool capabilities.
10. The tool is currently a "command line" tool with a simple entry by keying in the executable name, itdt, from the directory where the tool is located.

In the following firmware update sections which explain each method in detail, only a brief mention of ITDT will be made since the Readme text file will more fully explain tool usage.

LTO-TDX: LTO SCSI and Fibre Drive Firmware Download & LTO Drive Dump Upload Tool

The tool, LTO-TDX, is an alternative method for downloading LTO drive firmware across the SCSI bus or fibre channel. In addition, this tool can be used to upload LTO drive error dumps. The following information describes how to obtain the tool and lists its capabilities.

1. The tool supports all IBM LTO Generation 1, Generation 2, and Generation 3 SCSI and FC drives. The tool will not support any other manufacturer's LTO drive. The tool is available for three different operating systems:
   - **LTO-TDX_WinTool** (for Windows operating systems)
   - **LTO-TDX_NWTool** (for Netware operating systems)
   - **LTO-TDX_LxTool** (for operating systems)
   - Linux
2. The tool can perform two functions:
   a. Download firmware to the drive
   b. Upload a dump of the drive firmware logs from the drive to a computer system
3. The tool is distributed from the IBM web site. Download the tool by visiting **http://www.ibm.com/storage/support/lto/**. The install package or an executable file will be placed on the host system in a location chosen by the user.
4. When the user opens the install package, he will be presented with a license agreement that he must accept to proceed with the install. The user will also be presented with a license anytime the executable file is copied to another location where the firmware or dump folders do not exist. The tool will detect the missing folders at launch and present the user license, assuming that this is the first launch of a new copy of the tool. There will also be a function that allows the user to view the license at will when he starts the tool.
5. The Windows install package will create a directory for the tool on the user's hard disk and place the executable file (the tool) in that directory. The install package will also load the file into the Programs Menu accessed via the ″Start″ button and put an icon on the desktop of the Windows operating system. The install package will perform a similar function on any other operating system that has a similar structure.
6. Selection of the icon on the desktop or selection of the tool from the Program Menu will start the tool and create the ″LTO Firmware″ and ″LTO Dumps″ files in the directory with the executable tool file.
7. The user must first put the firmware to be downloaded in the firmware folder.
8. Any dumps created will be put in the dump folder.
9. The tool will present a list of the supported devices on the bus. The tool will allow selection of a target device and then perform the download or the dump on the target device.
10. The tool itself is a command line tool but it is menu driven and very simple to use.
11. The program displays are in English.
12. The user is responsible to make sure the drive is not in use when firmware is downloaded or a dump is taken. He also must remove any cartridge from the drive or the firmware download function will not work.

13. If the user does make a mistake, the program will respond with instructive error messages.
14. If no IBM LTO tape drives are on the bus, the tool will inform the user that there are none before closing the tool window.

Firmware Download Function

1. The tool is capable of displaying the current firmware level for any drive on the bus.
2. The tool does a check to see if a cartridge is in the drive (cartridge present sensor activated). If a cartridge is present, an error will be posted and the user will be asked to remove the cartridge.
3. The tool downloads code to IBM LTO drives ONLY. The tool will recognize ULT3580-TDX inquiry string devices as well as ULTRIUM-TDX devices. The letter ″X″ could be 1, 2, or 3.
4. The tool is capable of loading back level (older) code.
5. The program presents the user with a numbered list of firmware files available for selection from the LTO Firmware folder. The user can then select the number of the firmware file for the program to load.
6. After the firmware has been loaded into drive memory the drive automatically reboots. The tool discourages the user from power cycling the drive before the reboot is complete. A message is displayed saying *″Updating.....Please Wait″* until the reboot is complete. A gauge displays progress.
7. A *″Wait″* message is displayed on the user screen during firmware load.
8. If the program tries to load code and it fails with a sense Key 5 and an ASC/ASCQ of 82/83, the following wording is displayed: ″Bad Firmware Detected. The firmware is the wrong type for your tape drive or the file is corrupted.″ Verify that you are downloading the correct level of firmware then repeat the procedure.

Drive Log Dump Function

1. When the dump function is executed on a drive, the tool will read the existing dump on the drive, force a dump, then read the forced dump. This will create two dump files.
2. The two dump files created by the dump function will be time stamped with year, month, day, and seconds and contain the drive serial number. The first dump file read has an ″A″ suffix. The second file produced has a ″B″ suffix.
3. The Tool will place the files that are created in the ″LTO Dumps″ folder in the directory with the tool.
4. The tool creates the dump files with a file type of .dmp.

Updating the Firmware with an FMR Tape Cartridge

Tip

After creating an FMR tape (see “Function Code 3: Create FMR Tape” on page 18), the firmware of multiple drives can be updated with the same FMR tape. After updating the drive firmware, unmake the FMR tape (see “Function Code 8: Unmake FMR Tape” on page 21) and use it as a data cartridge.

To update the drive’s firmware from an FMR tape cartridge:

1. Ensure that a cartridge is not loaded in the drive.

2. Place the drive in maintenance mode by pressing the Unload Button three times within a two seconds. The Status Light becomes solid amber, which means that the drive is in maintenance mode.
3. Press the Unload Button once per second until  displays, then press and hold the button for three seconds. When  flashes, the drive is waiting for a cartridge.
4. Insert the FMR tape cartridge.  flashes, the drive loads the updated firmware from the cartridge, and the Status Light flashes amber. When the update completes successfully,  displays and the cartridge automatically ejects.

The drive resets itself and automatically activates the new firmware.

If the update fails, an error code displays. To resolve the error, locate the code in Table 9 on page 45.

Using Ultrium Media

Figure 8 shows the LTO Ultrium 400 GB Data Cartridge and its components. For more information, please go to http://www-307.ibm.com/pc/support/sit.wss/document.do?Indocid=MIGR-39931

1	LTO cartridge memory	4	Write-protect Switch
2	Cartridge door	5	Label area
3	Leader Pin	6	Insertion guide

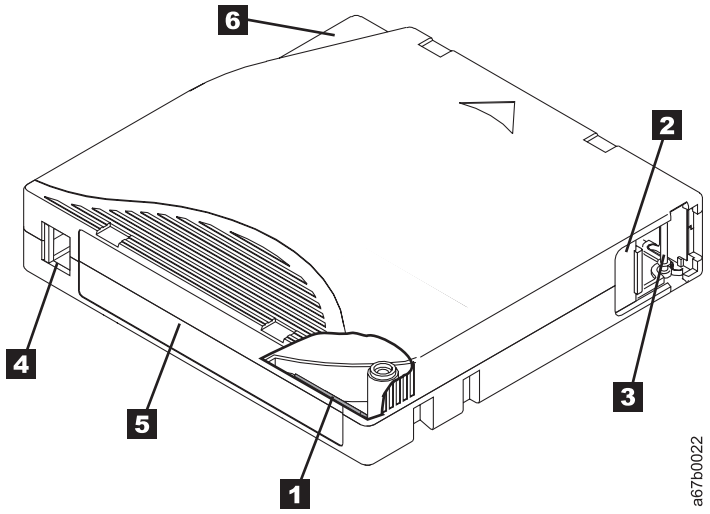


Figure 8. The LTO Ultrium 400 GB Data Cartridge

Cartridge Compatibility

Table 3. Ultrium data and cleaning cartridge compatibility with Ultrium tape drive

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

Data Cartridge

All three generations of Ultrium data cartridges contain 1/2-inch, dual-coat, metal-particle tape. The native data capacity of Ultrium data cartridges is as follows:

- The Ultrium 3 cartridge has a native data capacity of 400 GB (800 GB at 2:1 compression).
- The Ultrium 2 cartridge has a native data capacity of 200 GB (400 GB at 2:1 compression).
- The Ultrium 1 cartridge has a native data capacity of 100 GB (200 GB at 2:1 compression).

When processing tape in the cartridges, Ultrium Tape Drives use a linear, serpentine recording format. The Ultrium 3 drive reads and writes data on 704 tracks, sixteen tracks at a time. The Ultrium 2 drive reads and writes data on 512 tracks, eight tracks at a time. The Ultrium 1 drive reads and writes data on 384 tracks, eight tracks at a time. The first set of tracks (sixteen for Ultrium 3; eight for Ultrium 2 and 1) is written from near the beginning of the tape to near the end of the tape. The head then repositions to the next set of tracks for the return pass. This process continues until all tracks are written and the cartridge is full, or until all data is written.

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 the cartridge is inserted into the drive, a threading mechanism pulls the pin (and tape) out of the cartridge, across the drive head, and onto a non-removable take-up reel. The head can then read or write data from or to the tape.

The write-protect switch **4** prevents data from being written to the tape cartridge. The label area **5** provides a location to place a label. The insertion guide **6** is a large, notched area that prevents the cartridge from being inserted incorrectly.

Both generations of the LTO Ultrium Data Cartridge have a nominal cartridge life of 5000 load and unload cycles.

Cleaning Cartridge

With each drive, a specially labeled LTO Ultrium Cleaning Cartridge is supplied to clean the drive heads. The drive itself determines when a head needs to be cleaned. It alerts you by displaying on the Single-character Display. To clean the head, insert the cleaning cartridge into the tape load compartment (see “Inserting a Tape Cartridge” on page 13). The drive performs the cleaning automatically. When the cleaning is finished, the drive ejects the cartridge.

Note: If a cleaning cartridge is inserted when the drive does not need to be cleaned or when the cartridge has expired, the drive will automatically eject the cartridge.

To remove a cleaning cartridge, see “Unload Button” on page 12.

The Cleaning Cartridges are valid for 50 uses.

Bar Code Label

A bar code label contains:

- A volume serial number (VOLSER) that is human-readable
- A bar code that the library can read

Table 4. Bar code label requirements for Ultrium tape drives and libraries

Ultrium Tape Drive/Library	Bar Code Label Requirements
3580	Not required
3581	Required
3582	Required
3583	Required
3584	Required

When read by a library's bar code reader, the bar code identifies the cartridge's VOLSER to the library. The bar code also tells the library whether the cartridge is a data cartridge or cleaning cartridge. In addition, the bar code includes the two-character media-type identifier Lx, where x equals 1, 2, or 3. L identifies the cartridge as an LTO cartridge. 1 indicates that the cartridge is the first generation of its type; 2 indicates that the cartridge is the second generation of its type; 3 indicates that the cartridge is the third generation of its type. Figure 9 shows a sample bar code label for the LTO Ultrium Tape Cartridge.

Tape cartridges can be ordered with the labels included or with custom labels. To determine the complete specifications of the bar code and the bar code label, contact your sales representative.

When attaching a bar code label to a tape cartridge, place the label only in the recessed label area (**4**). A label that extends outside of the recessed area can cause loading problems in the drive.

Attention: Do not place any type of mark on the white space at either end of the bar code. A mark in this area may prevent the library from reading the label.

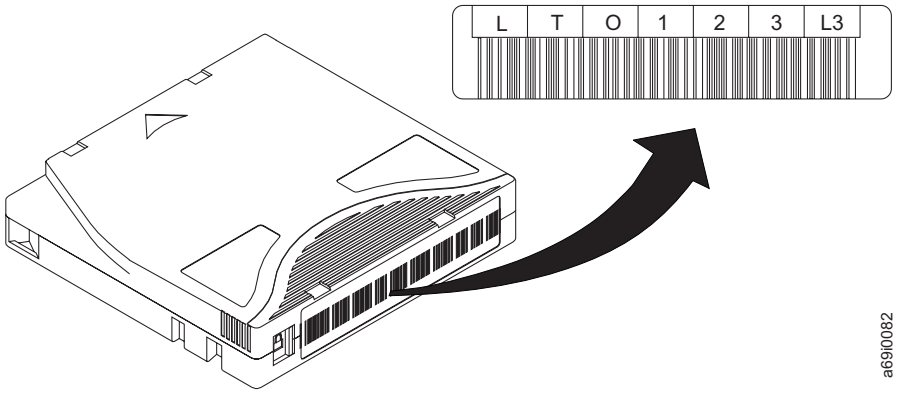


Figure 9. Sample bar code label on the LTO Ultrium 3 Tape Cartridge. The volume serial number (LTO123) and bar code are printed on the label.

Guidelines for Using Bar Code Labels

Apply the following guidelines whenever using bar code labels:

- Do not reuse a label or reapply a used label over an existing label.

- Before you apply a new label, remove the old label by slowly pulling it at a right angle to the cartridge case.
- Use peel-clean labels that do not leave a residue after being removed. If there is glue residue on the cartridge, remove it by gently rubbing it with your finger. Do not use a sharp object, water, or a chemical to clean the label area.
- Examine the label before applying it to the cartridge. Do not use the label if it has voids or smears in the printed characters or bar code (a library's inventory operation will take much longer if the bar code label is not readable).
- Remove the label from the label sheet carefully. Do not stretch the label or cause the edges to curl.
- Position the label within the recessed label area (**5** in Figure 9 on page 33).
- With light finger pressure, smooth the label so that no wrinkles or bubbles exist on its surface.
- Verify that the label is smooth and parallel, and has no roll-up or roll-over. The label must be flat to within 0.5 mm (0.02 in.) over the length of the label and have no folds, missing pieces, or smudges.
- Do not place other machine-readable labels on other surfaces of the cartridge. They may interfere with the ability of the drive to load the cartridge.

Write-Protect Switch

The position of the write-protect switch on the tape cartridge (**1** in Figure 10) determines whether you can write to the tape. If the switch is set to the:

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

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

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

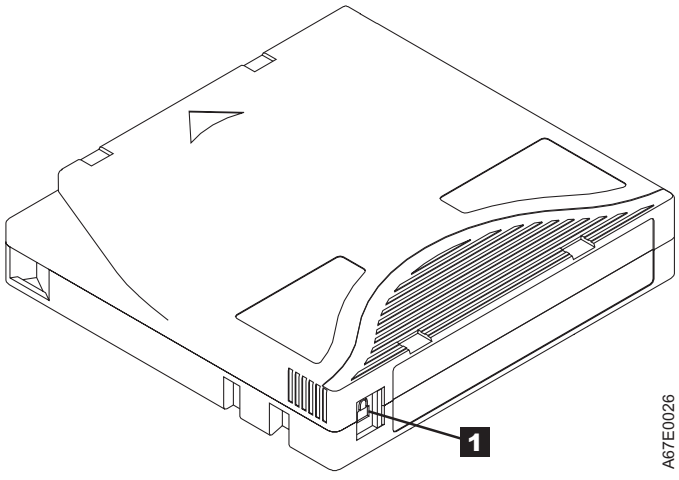


Figure 10. Setting the write-protect switch

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 seven 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 11 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)

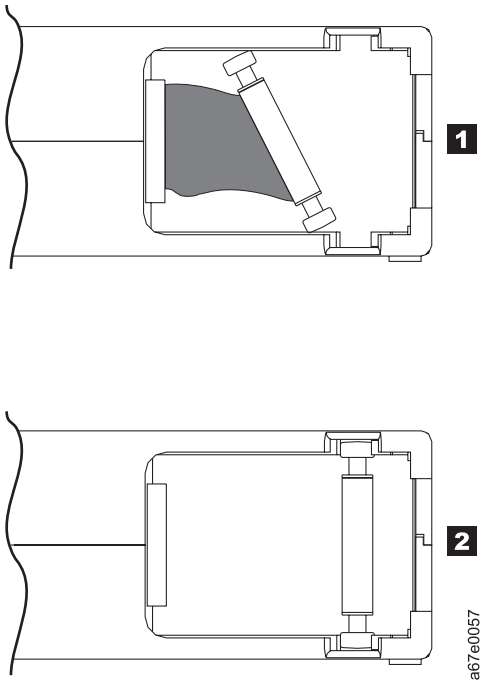


Figure 11. Leader pin in the incorrect and correct positions. The cartridge door is open and the leader pin is visible inside the cartridge.

To reposition the leader pin, perform the following steps.

1. Slide open the cartridge door and locate the leader pin (**2** in Figure 12 on page 36. 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 in Figure 12).
3. Press the leader pin gently into the clips until it snaps into place and is firmly seated.
4. Close the cartridge door.

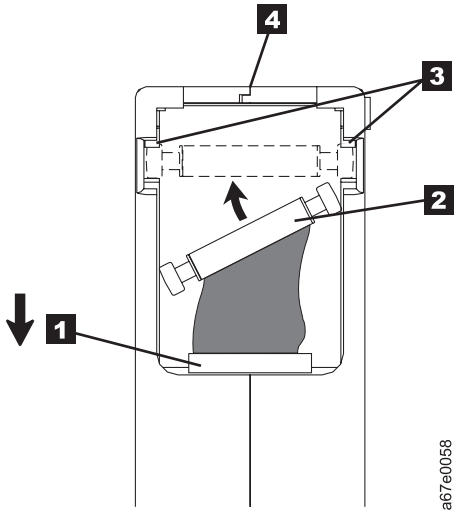


Figure 12. Placing the dislodged leader pin into the correct position. The cartridge door is open to show the leader pin.

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

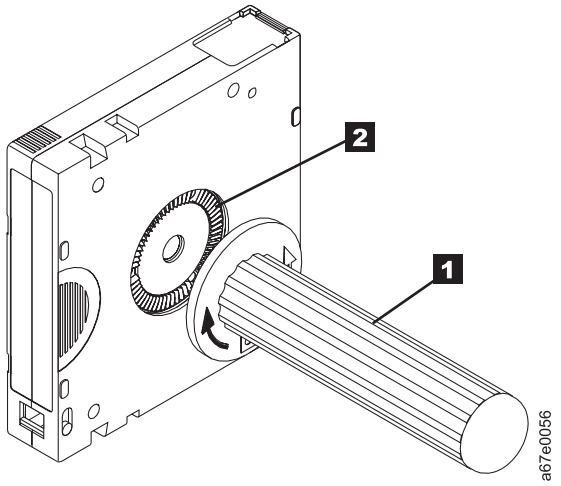


Figure 13. Rewinding the tape into the cartridge

6. Remove the rewind tool by pulling it away from the cartridge.
7. 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.

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** (**1**). A plastic brace that holds the cartridge door open.
- **Cartridge manual rewind tool** (**2**). A device that fits into the cartridge's hub and lets you wind the tape into and out of the cartridge.
- **Pin supplies** (**3**). 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.

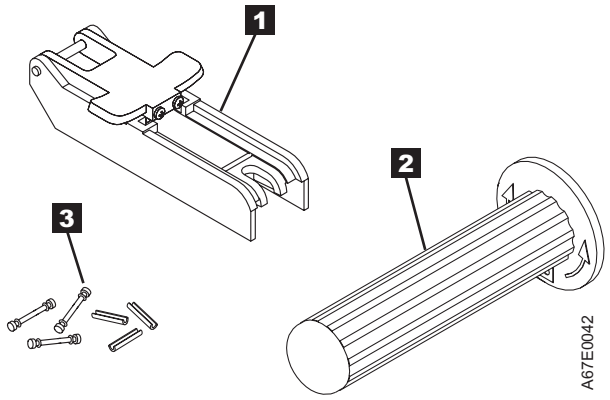


Figure 14. Leader Pin Reattachment Kit

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** 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**.

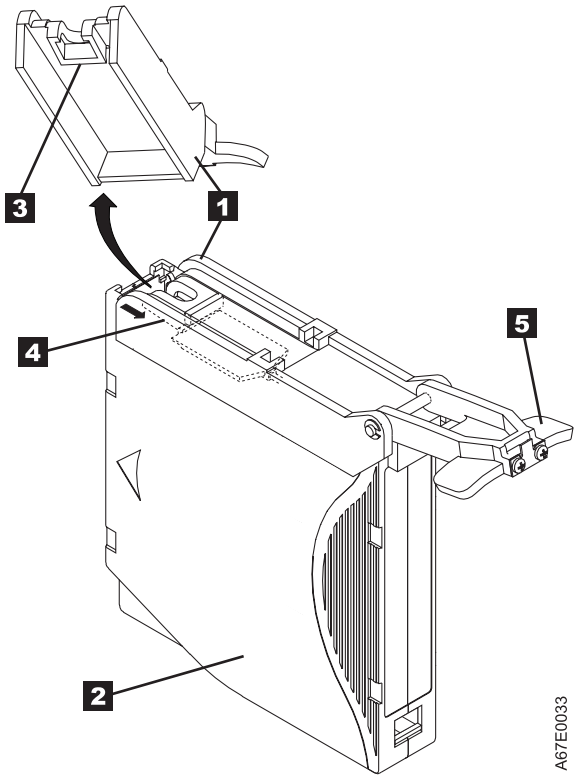


Figure 15. Attaching the leader pin attach tool to the cartridge. To hold the cartridge door open, hook the tool into the door and pull the tool back.

2. To find the end of the tape inside the cartridge, attach the cartridge manual rewind tool 1 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 13 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.

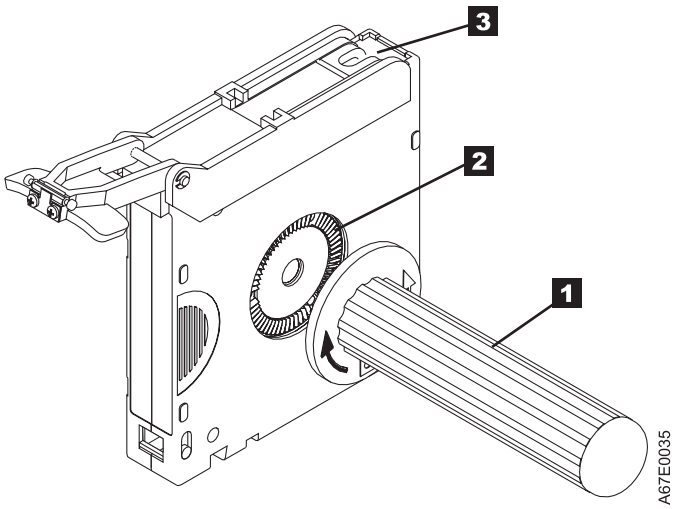


Figure 16. Winding the tape out of the cartridge. Turn the cartridge manual rewind tool clockwise to see the end of the tape, then turn it counterclockwise to bring the tape to the cartridge door.

5. On the leader pin 1 , 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.

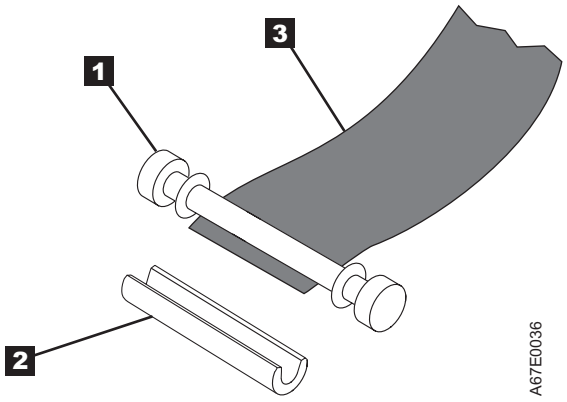


Figure 17. Removing the C-clip from the leader pin. Use your fingers to push the C-clip from the leader pin.

7. Position the tape in the alignment groove of the leader pin attach tool **1** .
8. Place a new C-clip into the retention groove **2** () on the leader pin attachment tool and make sure that the clip's open side faces up.
9. Place the leader pin into the cavity **3** 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 18).

    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.

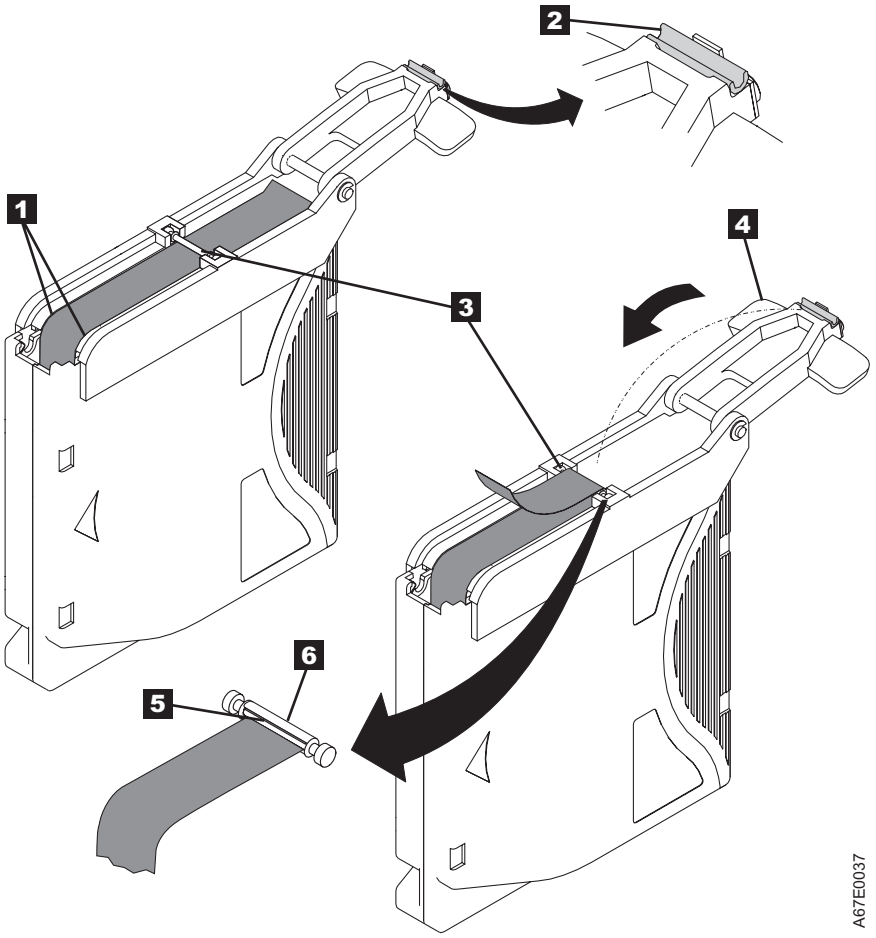


Figure 18. Attaching the leader pin to the tape

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.

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 5 lists the cartridges and media supplies that you can order for the 400/800GB LTO3 Tape Drive.

Table 5. Ordering media supplies for the drive

Supply Item	Method of Ordering
IBM TotalStorage LTO Ultrium 400 GB Data Cartridge	• http://www-307.ibm.com/pc/support/site.wss/document.do?Ind0cidMIGR-39931 • If you do not have Internet access, order the cartridge from any authorized IBM Business Partner. • Call 1-888-IBM-MEDIA.
IBM TotalStorage LTO Ultrium 200 GB Data Cartridge (without bar code label) Order VOLSER labels separately.	• http://www-307.ibm.com/pc/support/site.wss/document.do?Ind0cidMIGR-39931 • If you do not have Internet access, order the cartridge from any authorized IBM Business Partner or your IBM Sales Representative. • Call 1-888-IBM-MEDIA.

Table 5. Ordering media supplies for the drive (continued)

Supply Item	Method of Ordering
IBM TotalStorage LTO Ultrium 200 GB Data Cartridge (with bar code label) Bar code labels are preapplied to cartridges.	• Order as part number 19P5887 through an IBM-authorized distributor (for the closest distributor, visit the web at `http://www.ibm.com/storage/media`). Specify the VOLSER characters that you want. • If you do not have Internet access, order the cartridge from any authorized IBM Business Partner or your IBM Sales Representative. Specify the VOLSER characters that you want. • Call 1-888-IBM-MEDIA. Specify the VOLSER characters that you want.
IBM LTO Ultrium 100 GB Data Cartridge (without bar code label) Order VOLSER labels separately.	• http://www-307.ibm.com/pc/support/site.wss/document.do?Ind0cidMIGR-39931 • If you do not have Internet access, order the cartridge from any authorized IBM Business Partner or your IBM Sales Representative by specifying Machine Type 3589 Model 003. • Call 1-888-IBM-MEDIA.
IBM LTO Ultrium 100 GB Data Cartridge (with bar code label) Bar code labels are preapplied to cartridges.	• Order the cartridge from any authorized IBM Business Partner or your IBM Sales Representative by specifying Machine Type 3589 Model 002. Specify the VOLSER characters that you want.
IBM TotalStorage LTO Ultrium Cleaning Cartridge (universal cleaning cartridge for use with Ultrium 1, Ultrium 2, and Ultrium 3 drives; without bar code label) Order VOLSER labels separately.	• http://www-307.ibm.com/pc/support/site.wss/document.do?Ind0cidMIGR-39931 • If you do not have Internet access, order the cartridge from any authorized IBM Business Partner or your IBM Sales Representative. • Call 1-888-IBM-MEDIA.
IBM TotalStorage LTO Ultrium Cleaning Cartridge (universal cleaning cartridge for use with Ultrium 1, Ultrium 2, and Ultrium 3 drives; with bar code label) Bar code labels are preapplied to cartridges.	• Order as part number 35L2087 through an IBM-authorized distributor (for the closest distributor, visit the web at `http://www.ibm.com/storage/media`). • If you do not have Internet access, order the cartridge from any authorized IBM Business Partner or your IBM Sales Representative. • Call 1-888-IBM-MEDIA.
Leader Pin Reattachment Kit	Order as part number 08L9129 through an IBM-authorized distributor (for the closest distributor, visit the web at `http://www.ibm.com/storage/media`).

Ordering Bar Code Labels

The 400/800GB LTO2 Tape Drive does not require cartridge bar code labels. However, if you use your data cartridges or cleaning cartridges in an IBM tape library product, you may need cartridge bar code labels if your tape library product requires them. You can order these labels separately from the IBM Data Cartridges and Cleaning Cartridges.

You can order bar code labels directly from the authorized label suppliers in Table 6.

Table 6. Authorized suppliers of custom bar code labels

In America	In Europe and Asia
EDP/Colorflex 2550 W. Midway Blvd. Broomfield, CO 80020 U. S. A. Telephone: 800-522-3528 http://www.colorflex.com/	EDP Europe, Ltd. 43 Redhills Road South Woodham Ferrers Chelmsford, Essex CM3 5UL U. K. Telephone: 44 (0) 1245-322380 http://www.edpeurope.com/media_labelling.htm
Dataware P.O. Box 740947 Houston, TX 77274 U. S. A. Telephone: 800-426-4844 http://www.datawarelabels.com/	Dataware Labels Europe Heubergstrasse 9 D-83052 Bruckmuhl-Gotting Germany Telephone: 49 8062-9455 http://www.datawarelabels.com/
NetC P. O. Box 1067 Fairfield, CT 06825 U. S. A. Telephone: 203-372-6382 http://www.netcllc.com/	NetC Europe Ltd Town Farm Bungalow The Pavement North Curry TA3 6LX Somerset U. K. Telephone: 44 (0) 1823 49 1439 http://www.netclabels.co.uk
	NetC Asia Pacific Pty Ltd Locked Bag 1 Kenthurst NSW 2156 Australia Telephone: 61 (0) 2 4573 6556 http://www.netclabels.com.uk

Resolving Problems

If you encounter problems when running the drive, refer to the table below. If the problem is not identified there, refer to “Methods of Receiving Errors and Messages” on page 44. The color and condition of the Status Light may also indicate a problem. For more information, see “Status Light” on page 11.

Table 7. Troubleshooting tips

If the problem is this....	Do this....
A code displays on the Single-character Display (SCD) and the Status Light flashes amber.	The drive detected an error or is directing you to an informational message. See Table 9 on page 45.

Table 7. Troubleshooting tips (continued)

If the problem is this....	Do this....
The Status Light or SCD never turns on.	The drive has no power. Check the power at the power source. Connect power to the drive (see "Connect and Test Power to the Drive" on page 9). If the problem persists, replace the drive.
The drive will not load a tape cartridge.	One of the following has occurred: • A tape cartridge is already inserted. To remove the cartridge, press the Unload Button. If the cartridge does not eject, turn off the power to the drive, then turn it back on. After the Status Light becomes solid green, press the Unload Button to eject the cartridge. • The tape cartridge was inserted incorrectly. To properly insert a cartridge, see "Inserting a Tape Cartridge" on page 13. • The tape cartridge may be defective. Insert another tape cartridge. If the problem exists for multiple cartridges, the drive is defective. Replace the drive. • The drive has no power. Connect power to the drive (see "Connect and Test Power to the Drive" on page 9).
The drive will not unload the tape cartridge.	The tape cartridge is stuck or is broken. Press the Unload Button. If the cartridge does not eject, turn off the power to the drive, then turn it back on (note that the mid-tape recovery could take up to ten minutes to complete). If the cartridge still does not eject, contact IBM Support.
The server received TapeAlert flags.	See Appendix A. See Appendix A, "TapeAlert Flags," on page 65.
The server reported SCSI problems (such as selection or command time-outs, or parity errors).	See "Fixing SCSI Bus Errors" on page 50.
The library reported an LDI or RS-422 communication problem with the drive.	The LDI or RS-422 circuitry may be defective. Run the LDI or RS-422 wrap test ("Function Code 7: Run RS-422 Wrap Test" on page 20). If the test runs successfully but the problem persists, refer to your library's service documentation.
Codes display on the SCD, but the Status Light does not turn on.	The drive is defective. Replace the drive.
The drive does not respond to server commands.	Press and hold the Unload Button on the drive for ten seconds to force a drive dump. The drive will save the dump and then reboot to allow communication to the drive to occur. Do not cycle power, as this will erase the contents of the dump.

Methods of Receiving Errors and Messages

Use Table 8 as a guide for identifying error codes and message codes reported by the drive, its enclosure (if applicable), or the server.

Note: The codes on the Single-character Display (SCD) have different meanings, depending on whether they display during normal operations or while the drive is in maintenance mode. Codes that occur during normal operations are defined in Table 9 on page 45. Codes that occur while in maintenance mode are defined in "Diagnostic and Maintenance Functions" on page 15.

Table 8. Methods of receiving errors and messages

If the error or message was presented by....	Do this....
The enclosure's display (if the drive is enclosed in a library or autoloader)	Refer to the documentation for the enclosure.

Table 8. Methods of receiving errors and messages (continued)

If the error or message was presented by....	Do this....
The drive's SCD and the Status Light flashes amber	See "Error Codes and Messages." To determine the meaning of Status Light activity, see "Status Light" on page 11.
The drive's SCD and the Status Light is solid amber	See "Diagnostic and Maintenance Functions" on page 15. To determine the meaning of Status Light activity, see "Status Light" on page 11.
SCSI log sense data (such as TapeAlert flags) and SCSI drive sense data at the server console	See "Error Codes and Messages."
Drive sense data sent to a library (if the drive is enclosed in a library)	Refer to your library's documentation, then see "Error Codes and Messages."
The drive's error log	See "Error Codes and Messages" and "Viewing the Drive Error Log" on page 49.

Error Codes and Messages

The table below gives descriptions of the errors and messages that pertain to the drive, and tells what to do when you receive them.

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

Table 9. Error codes on the Single-character Display. To clear error and cycle power, press the Unload Button for ten seconds. A drive dump will be created.

Error Code	Cause and Action
	No error occurred and no action is required. This code displays: • When power is cycled (turned off, then on) to the tape drive. • When diagnostics have finished running and no error occurred. **Note:** The Single-character Display is blank during normal operation of the tape drive.
	Cooling problem. The tape drive detected that the recommended operating temperature was exceeded. Perform one or more of the following actions: • Ensure that the cooling fan is rotating and is quiet. If not, refer to your enclosure documentation. • Remove any blockage that prevents air from flowing freely through the tape drive. • Ensure that the operating temperature and airflow is within the specified range (see "Physical Specifications" on page 69). • If the operating temperature is within the specified range and the problem persists, replace the drive. The error code clears when you power-off the tape drive or place it in maintenance mode.
	Power problem. The tape drive detected that the externally supplied power is approaching the specified voltage limits (the tape drive is still operating) or is outside the specified voltage limits (the tape drive is not operating). Perform the following action: 1. Ensure that the power connector is properly seated. 2. Ensure that the proper dc voltages are being applied within the tolerances allowed (see "Physical Specifications" on page 69). 3. If the proper voltages are being applied but the problem persists, replace the unit. The error code clears when you power-off the tape drive or place it in maintenance mode.

Table 9. Error codes on the Single-character Display (continued). To clear error and cycle power, press the Unload Button for ten seconds. A drive dump will be created.

Error Code	Cause and Action
3	Firmware problem. The tape drive determined that a firmware error occurred. Perform the following action: 1. Collect a drive dump from one of the following: **Note:** Do not force a new dump; the tape drive has already created one. • Server's SCSI interface by using a device driver utility or system tool • Ultrium Tape Drive (to copy and read a drive dump, use "Function Code 5: Copy Drive Dump" on page 19) 2. Power the tape drive off and on, then retry the operation that produced the error. 3. If the problem persists, download new firmware and retry the operation. 4. If the problem persists, send the drive dump that you collected in step 1 to your Support Center. The error code clears when you power-off the tape drive or place it in maintenance mode.
4	Firmware or tape drive problem. The tape drive determined that a firmware or tape drive hardware failure occurred. Perform the following action: 1. Collect a drive dump from one of the following: **Note:** Do not force a new dump; one already exists. • Server's SCSI interface by using a device driver utility or system tool • Ultrium Tape Drive (to copy and read a drive dump, use "Function Code 5: Copy Drive Dump" on page 19) 2. Power the tape drive off and on, then retry the operation that produced the error. The error code clears when you power-off the tape drive or place it in maintenance mode. 3. If the problem persists, download new firmware and retry the operation; if new firmware is not available, replace the drive.
5	Tape drive hardware problem. The drive determined that a tape path or read/write error occurred. To prevent damage to the drive or tape, the tape drive will not allow you to insert a cartridge if the current cartridge was successfully ejected. The error code may clear when you cycle power to the tape drive or place it in maintenance mode. If the problem persists, replace the drive. **Note:** Copy the drive dump to flash memory before returning the drive. For instructions, refer to "Function Code 5: Copy Drive Dump" on page 19.

Table 9. Error codes on the Single-character Display (continued). To clear error and cycle power, press the Unload Button for ten seconds. A drive dump will be created.

Error Code	Cause and Action
6	Tape drive or media error. The tape drive determined that an error occurred, but it cannot isolate the error to faulty hardware or to the tape cartridge. Perform the following action: **For Problems with Writing Data:** If the problem occurred while the tape drive was writing data to the tape, and if you know the volume serial number (located on the cartridge label) of the tape cartridge that was loaded in the drive when the problem occurred, retry the operation with a different cartridge: • If the operation succeeds, the original cartridge was defective. Copy data from the defective cartridge and discard it. • If the operation fails and another tape drive is available, insert the cartridge into the other unit and retry the operation. – If the operation fails, discard the defective cartridge. – If the operation succeeds, insert a scratch data cartridge into the first unit and run "Function Code 1: Run Drive Diagnostics" on page 16. - If the diagnostics fail, replace the tape drive. - If the diagnostics succeed, the error was temporary. • If the operation fails and another tape drive is not available, insert a scratch data cartridge into the unit and run "Function Code 1: Run Drive Diagnostics" on page 16. – If the diagnostics fail, replace the tape drive. – If the diagnostics succeed, discard the cartridge. If the problem occurs with multiple tape cartridges or if you do not know the tape cartridge's volume serial number, run "Function Code 1: Run Drive Diagnostics" on page 16: • If the diagnostics fail, replace the tape drive. • If the diagnostics succeed, run "Function Code H: Test Head" on page 24. – If the diagnostic fails, replace the tape drive. – If the diagnostic succeeds, replace the cartridges that caused the problem. The error code clears when you remove the tape cartridge or place the tape drive in maintenance mode. **For Problems with Reading Data:** If the problem occurred while the tape drive was reading data from the tape, and if you know the volume serial number of the tape cartridge, perform one of the following procedures: • If another tape drive is available, insert the cartridge into the other unit and retry the operation: – If the operation fails, discard the defective cartridge. – If the operation succeeds, insert a scratch data cartridge into the first unit and run "Function Code 1: Run Drive Diagnostics" on page 16: - If the diagnostic fails, replace the tape drive. - If the diagnostic succeeds, the error was temporary. • If another tape drive is not available, insert a scratch data cartridge into the unit and run : – If the diagnostic fails, replace the tape drive. – If the diagnostic succeeds, discard the cartridge. If the problem occurs with multiple tape cartridges or if you do not know the tape cartridge's volume serial number, run "Function Code 1: Run Drive Diagnostics" on page 16: • If the diagnostic fails, replace the tape drive. • If the diagnostic succeeds, run "Function Code H: Test Head" on page 24. – If the diagnostic fails, replace the tape drive. – If the diagnostic succeeds, replace the cartridges that caused the problem. The error code clears when you remove the tape cartridge or place the tape drive in maintenance mode.

Table 9. Error codes on the Single-character Display (continued). To clear error and cycle power, press the Unload Button for ten seconds. A drive dump will be created.

Error Code	Cause and Action
	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, 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 unit fails and  or  displays, replace the media. If the operation succeeds, run "Function Code E: Test Cartridge & Media" on page 22. • If the diagnostic fails, replace the media. • If the diagnostic succeeds, clean the drive head (see "Cleaning the Drive Head" on page 14) and run "Function Code 1: Run Drive Diagnostics" on page 16. – If the drive diagnostic fails, replace the drive. – If the drive diagnostic succeeds, perform the operation that produced the initial media error. The error code clears when you remove the tape cartridge or place the tape drive in maintenance mode.
	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. The error code clears 10 seconds after the drive detected the error or when you place the drive in maintenance mode.
	Tape drive or RS-422 error. The tape drive determined that a failure occurred in the tape drive's hardware or in the RS-422 connection. Replace the tape drive. The error code clears 10 seconds after the drive detected the error or when you place the tape drive in maintenance mode.
	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 drive. The drive is usable, though the Single-character Display continues to indicate an error and the Status Light flashes amber. The error code may clear when you cycle power to the tape drive or place it in maintenance mode.
	No error or message is assigned. See error code  in this table.
	The tape drive needs to be cleaned. Clean the tape drive. See "Cleaning the Drive Head" on page 14. The error code clears when you clean the tape drive or place it in maintenance mode.
	No error or message assigned. See error code  in this table.
	The Unload Button is depressed. Verify that the button pushes freely.

Obtaining a Drive Dump

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

Using the Drive

To obtain a drive dump directly from the drive:

1. Make sure that no cartridge is in the drive.
2. Within two seconds, 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 second until  appears in the Single-character Display.
4. To select the function, press and hold the Unload Button for three seconds. After you release the button,  flashes. Within 60 seconds, insert a scratch data cartridge that is not write-protected. After you insert the cartridge,  flashes and the drive writes the dump data to the scratch tape. When the function is complete, the drive rewinds and unloads the tape.
5. Insert the tape into a drive.
6. From the server, issue the SCSI READ command to read the dump from the tape to a file or electronic image (you may need to issue the command several times to read the complete dump).
7. To determine where to send the file for analysis, contact your Product Application Engineer (PAE).

Using a Device Driver Utility

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

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

Viewing the Drive Error Log

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

To view the drive error log:

1. Make sure that no cartridge is in the drive.
2. Within two seconds, 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 second until  appears in the SCD.
4. Press and hold the Unload Button for three seconds to view the most recent error code.
5. Refer to Table 9 on page 45 above to determine the meaning of the code and the action to take.
6. Press the Unload Button to view the next error code. (The codes are ordered; the most recent is presented first and the oldest (tenth) is presented last.)

7. Continue to press the Unload Button until the ten error codes have been displayed. After you display the tenth error code, the drive automatically exits maintenance mode.

To redisplay the error codes, repeat steps 1 through 7.

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 drives. The sections that follow describe how to fix each type of error.

Fixing SCSI Bus Errors

Note: If you are using a Storage Area Network (SAN) Data Gateway to convert a drive with a SCSI interface to a Fibre Channel interface, ensure that the problem is occurring between the SAN Data Gateway and the drive by running the SCSI wrap test on the drive and running the SCSI loopback test on the SAN Data Gateway. (To run the SCSI wrap test, see "Function Code 6: Run SCSI Wrap Test" on page 20; to run the SCSI loopback test, refer to the section about that test in the *IBM Storage Area Network Gateway Module Setup, Operator, and Service Guide*.)

Fixing a Consistent Error with a Single Drive on a SCSI Bus:

1. Ensure that the power is on to the drive.
2. Ensure that the 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: Run SCSI Wrap Test" on page 20).
   - If the test fails, 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 again, replace the drive.
   - If the test is successful, refer to your enclosure documentation for additional troubleshooting information.

Fixing a Consistent Error with Multiple Drives on a SCSI Bus: When a consistent error occurs in a configuration that has multiple drives on the SCSI bus, you must determine if the problem exists with more than one 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 drive on the SCSI bus. Move the terminator to the first SCSI device.
3. Run a device driver utility to determine whether the error will occur.
   - If the error occurs, run the SCSI wrap test on the first drive (see "Function Code 6: Run SCSI Wrap Test" on page 20).
     - If the test runs successfully, replace the SCSI terminator first, then the SCSI cable and the interposer (if installed) to the first 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 drive.
- If the error does not occur, connect one drive at a time back to the bus and repeat step 3 for each drive until you can identify which drive is defective.

  Note: Ensure that the SCSI terminator is always on the last drive on the SCSI bus.

4. Determine if the problem is with only one drive or with two or more drives.
   - If the problem is with only one drive, run the SCSI wrap test on that drive (see "Function Code 6: Run SCSI Wrap Test" on page 20).
     - If the test runs successfully, replace the SCSI terminator first, then the SCSI cable to that drive and interposer (if installed).
     - If the test fails, replace the drive.
   - If the problem is with two or more drives, locate the first drive that has the error and replace the SCSI cable that connects the 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 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 drive.
4. Replace the drive. If the problem persists, the problem is with your server. Consult your server's documentation.

Fixing an Intermittent Error with Multiples Drives on a SCSI Bus: Refer to the server's error logs to determine which drive is the source of the problem:

- If only one drive is reporting a SCSI failure, replace that drive.
- If multiple 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 drive'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 VPD (Vital Product Data) area in NVRAM. Any failures that SARS detects are reported as TapeAlert flags on the server

Attention
If you insert the IBM LTO Ultrium Data Cartridge into another manufacturer's 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 drive. If the operation in the other drive fails and  or  displays, replace the media. If the operation succeeds, run the Test Cartridge & Media diagnostic (see "Function Code E: Test Cartridge & Media" on page 22).
2. If the Test Cartridge & Media diagnostic fails, replace the media. If it runs successfully, clean the drive and run the drive diagnostics (see "Cleaning the Drive Head" on page 14 and "Diagnostic and Maintenance Functions" on page 15. If the drive diagnostics run successfully, perform the operation that produced the initial media error.

Servicing the Drive

Manually Removing a Tape Cartridge

The purpose of this section is to assist you in determining the condition of the cartridge or the magnetic tape and to direct you to the procedure you must follow to remove the cartridge.

Attention

- Before using this procedure, you must have exhausted all other means of removing the tape cartridge from the drive. Use this procedure **only** if you cannot remove the tape cartridge by using any other means.
- Determine from the customer if the cartridge contains **critical customer data**. If the cartridge contains sensitive data that cannot leave the site, inform the customer that certain failure conditions diagnostics will be performed to test the drive for continued use.
- The following removal procedures **can destroy** customer data! Use **extreme care** when handling or removing the customer's tape cartridges to minimize tape damage and lost data.
- **DO NOT TOUCH** the magnetic tape or tape path. Both are extremely sensitive to the oil and salt from your skin. Use clean, lint-free gloves when working around magnetic tape or the tape path components.
- Electrostatic-sensitive components: Consider using an ESD Kit.
- After you remove the tape cartridge, advise the customer to copy the data to another cartridge and to remove this tape cartridge from service.
- Do not use power tools or magnetic tools to perform this procedure.
- To avoid contamination and electrostatic-discharge damage to the drive, never touch the head or electronic components inside the drive.
- If you cannot remove the cartridge from the drive using the following procedures, contact your next level of support.

Before You Begin

1. If you have not already done so, attempt to remove the cartridge with the device power ON and using library manager, a host application, or the Unload Button.
2. If you have not already done so, attempt to remove the cartridge by power cycling the drive. Look for the drive to attempt a mid-tape recovery.

   Note: It can take as long as five minutes for the cartridge to rewind and unload.
3. If the cartridge unloads, inform the operator that the cartridge is unloaded. If the cartridge does not unload, continue with this procedure.

Recommended Tools

- 2.5 mm offset hex wrench (do not use magnetized wrench)
- #1 Phillips screwdriver
- ESD Kit
- Flashlight (optional)
- #1 Flathead screwdriver (optional)

Beginning Procedure

__ Step 1. Refer to the enclosure documentation for instructions on removing the drive.

__ Step 2. Place the drive on a non-slip, sturdy work surface.

__ Step 3. Ground yourself to the drive by using an ESD Kit.

__ Step 4. Remove the cover of the drive by performing the following steps:

a. Using a Phillips screwdriver, remove the three screws and washers 1 that secure the bezel 2 to the internal drive, then remove the bezel.

b. Remove the cover of the internal drive by performing the following steps:

   1) Remove the four cover-mounting screws and washers 3 .

   2) Remove the cover by lifting it up.

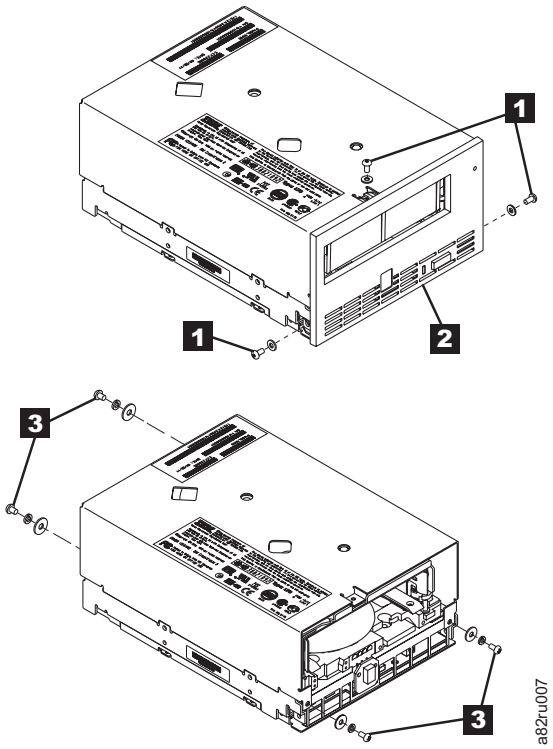


Figure 19. Removing the cover from the internal drive

__ Step 5. Inspect the drive to decide which of the following conditions most closely matches the symptom on the drive:

- **Tape spooled off the supply reel** - All the tape appears to be on the take up reel and no tape is on the supply reel (inside the cartridge). Test the drive after the procedure is completed.
- **Tape pulled from leader pin (or broken at the front end)** - All the tape appears to be on the supply reel (inside the cartridge) and very little or no tape appears to be on the take up reel. The leader block is positioned in the take up reel. Return the drive after the procedure is completed.
- **Tape broken in mid-tape** - Tape appears to be on both the supply reel (inside the cartridge) and take up reel. Test the drive after the procedure is completed.
- **Tape tangled along tape path** - Tape appears to be tangled and damaged but in tact. Return the drive after the procedure is completed.

  -- OR --

No damage to tape (or no apparent failure) - There appears to be no damage or slack to the tape. Return the drive after the procedure is completed.

Tape Spooled off Supply Reel

__ Step 1. With the front of the drive facing you, pull an arm's length of tape out of the take up reel from the left side of the drive.

__ Step 2. From the take up reel, thread tape around the rear of the tape path and over the head rollers on the left side of the drive.

__ Step 3. Set the drive on its left side with the head and tape path facing up.

__ Step 4. Moisten a cotton swab with water and wet approximately 13 mm (0.5 in.) of the tape end and feed it onto the supply reel (inside the cartridge).

__ Step 5. From the bottom of the drive, insert a 2.5 mm offset hex wrench through the bottom cover access hole and into the reel motor axle.

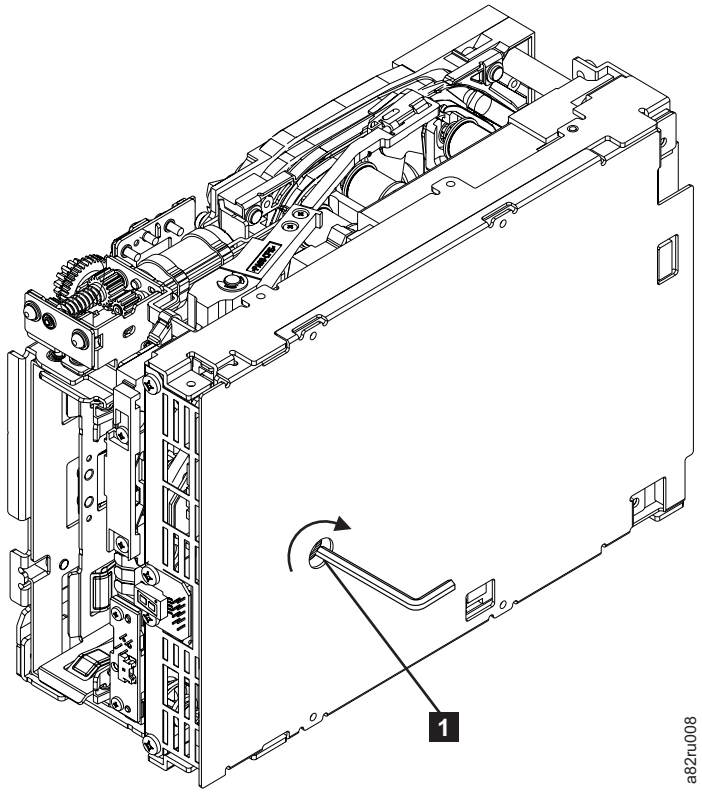


Figure 20. Using hex wrench to rewind tape into cartridge

__ Step 6. Turn the supply reel clockwise, allowing the moistened tape to adhere to the hub as it winds around the supply reel (inside the cartridge).

__ Step 7. Continue spooling into the cartridge until the tape is taut and remains within the flanges of the tape guiding rollers. Ensure that you do not stretch the tape.

__ Step 8. Reassemble the drive, reversing the steps in "Beginning Procedure" on page 53.

__ Step 9. Allow the drive to perform mid-tape recovery. This takes several minutes. When this activity completes, the cartridge ejects automatically.

__ Step 10. Test the drive (see "Connect and Test Power to the Drive" on page 9) to determine if it should be replaced.

Tape Pulled from or Broken near Leader Pin

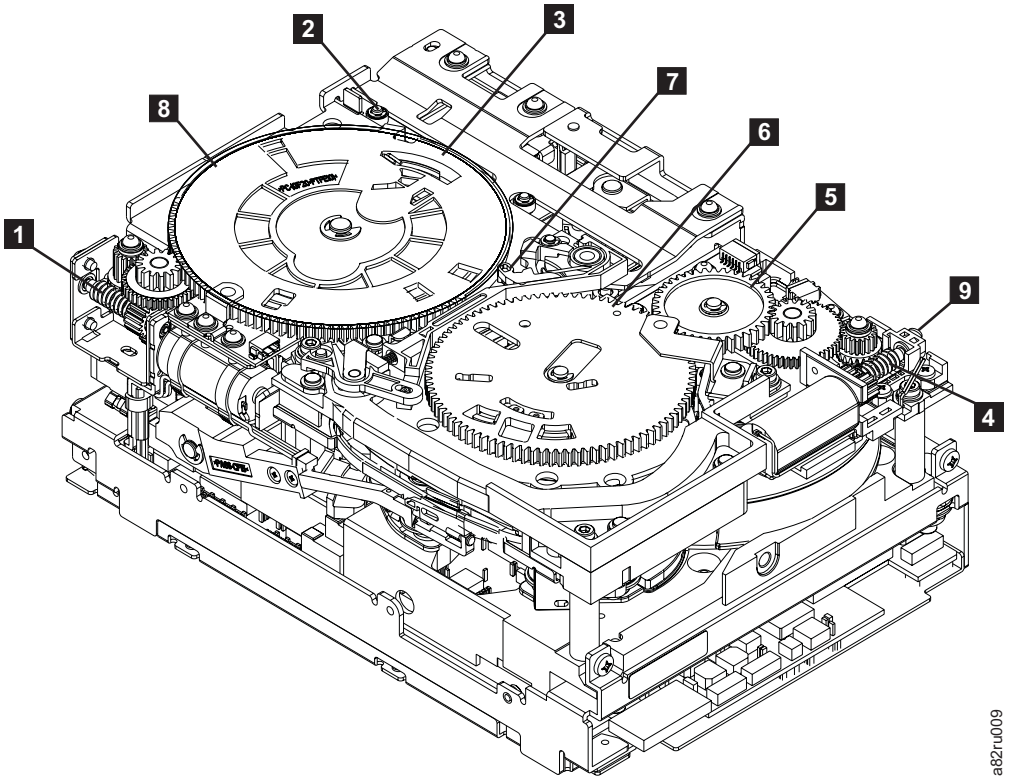


Figure 21. Drive with cover removed to reveal gear train.

1	Loader motor worm gear	6	Threader mechanism gear
2	Cartridge loader tray guide bearing	7	Lever
3	Rotator stub	8	Loader mechanism gear
4	Threader motor worm gear	9	Threader worm gear
5	Threader intermediate gear		

__ Step 1. From the left side of the drive, pull out tape from the take up reel.

Note: If there is more than approximately 0.6 m (2 ft.) of tape on the take up reel, go to "Tape Broken in Mid-tape" on page 57.

__ Step 2. If there is less than approximately 0.6 m (2 ft.) of tape on the take up reel, cut off the excess tape as close to the leader pin, as possible.

__ Step 3. Locate the threader motor worm gear 4 the rear of the drive. You can either:

a. Use your finger to rotate the threader motor worm gear and slowly rotate the threader mechanism gear 6 clockwise; or

b. Use a #1 flathead screwdriver to turn the threader worm gear 9 clockwise.

This rotates the threader motor worm gear 4 clockwise, drawing the tape leader block assembly (LBA) into the cartridge.

__ Step 4. As the LBA is secured in the cartridge, you should hear the LBA retention spring clips click into place. If you do not hear the click, continue rolling until the threader motor worm gear **4** stops. The LBA is in the correct position.

Note: Be sure to keep tension on the tape as the LBA is drawn into the cartridge by using a hex wrench as shown in the figure above.

__ Step 5. Notice the following:

a. Loader mechanism gear **8** nearest the front of the drive that actuates the cartridge loader mechanism

b. Position of the rotator stub **3** .

c. Front loader motor worm gear **1** . Rotating this gear allows the loader mechanism gear **8** to turn.

__ Step 6. Rotate the loader motor worm gear **1** to turn the loader mechanism gear **6** counterclockwise. Continue turning until the rotator stub **3** loses contact with the lever **7** . This releases the LBA leader pin.

__ Step 7. Rotate the threader motor worm gear **4** to turn the threader mechanism gear **6** counterclockwise. This moves the LBA out of the cartridge and past the read/write head. Stop this rotation when the LBA is near the tape guide roller nearest the rear of the drive **1** .

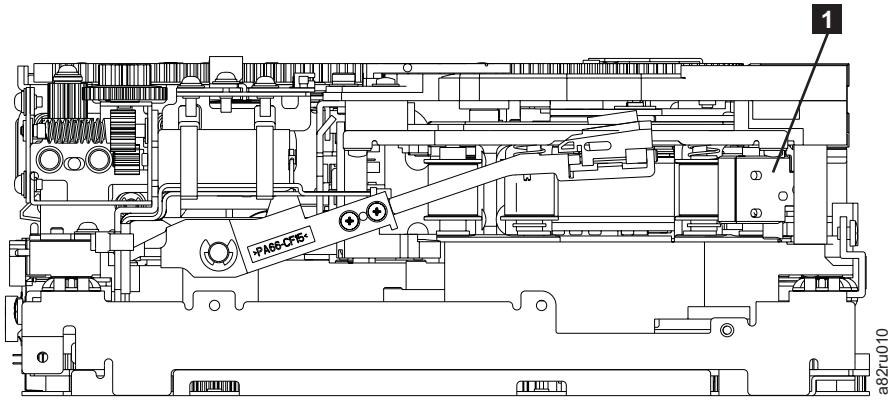


Figure 22. Leader Block Assembly (LBA)

__ Step 8. Continue rotating the loader motor worm gear **1** until the rotate stub **3** is positioned as shown. Notice that the rotator stub **3** is nearly aligned with the cartridge loader tray guide bearing **2** .

__ Step 9. Remove the cartridge from the cartridge loader tray.

__ Step 10. Reassemble the drive by reversing the procedure in Step 4 in "Beginning Procedure" on page 53.

__ Step 11. Refer to the appropriate procedure to install the new drive and return the failed drive.

Tape Broken in Mid-tape

__ Step 1. With the front of the drive facing you, pull an arm's length of tape out of the take up reel from the left side of the drive.

Note: If there is less than approximately 5 cm (2 in.) of tape on the take up reel, go to "Tape Pulled from or Broken near Leader Pin" on page 56.

__ Step 2. From the supply reel inside the cartridge, pull approximately 0.3 m (1 ft.) of tape.

__ Step 3. From the take up reel, thread tape around the rear of the tape path and over the head rollers on the left side of the drive.

__ Step 4. Moisten a cotton swab with water, and wet approximately 13 mm (0.5 in.) of the tape end. Overlap the tape ends, loosely mending them together.

__ Step 5. Set the drive on its left side with the head and tape path facing up.

__ Step 6. From the bottom of the drive, locate the access hole **1** in the bottom cover. Insert a 2.5 mm offset hex wrench through the bottom cover access hole and into the reel motor axle. begin spooling tape back into the cartridge by turning the hex wrench clockwise.

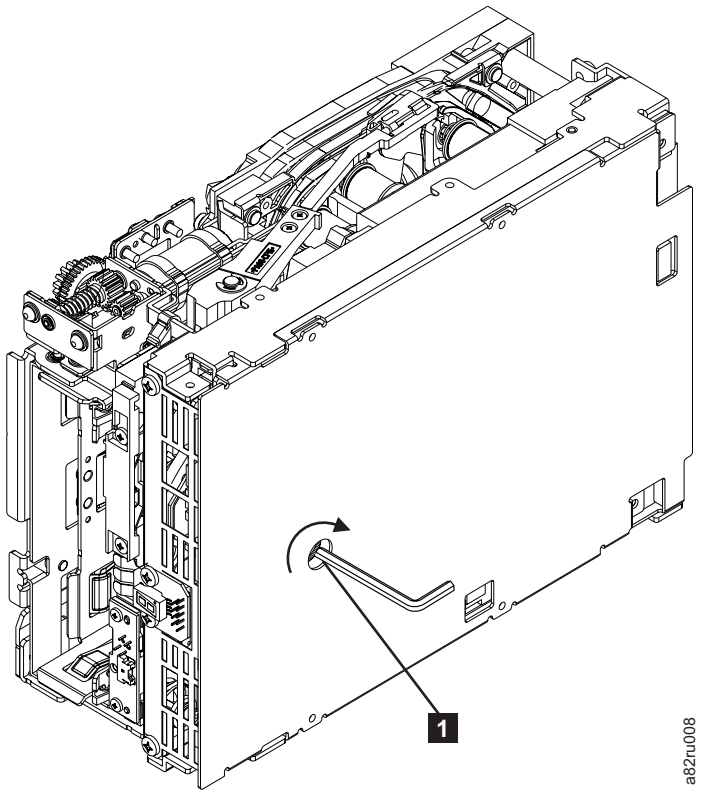


Figure 23. Using hex wrench to rewind tape into cartridge

__ Step 7. Turn the supply reel clockwise, carefully guiding the mended portion of the tape to wind around the hub of the supply reel located inside the cartridge. Continue spooling into the cartridge until the tape is taut. The tape must remain within the flanges of the tape guiding rollers. Ensure that you do not stretch the tape.

__ Step 8. Reassemble the drive by reversing the procedure in Step 4 in "Beginning Procedure" on page 53.

__ Step 9. Allow the drive to perform mid-tape recovery. This takes several minutes. When this activity completes, the cartridge ejects automatically.

__ Step 10. Test the drive (see "Function Code 1: Run Drive Diagnostics" on page 16) to determine if it should be replaced.

Tape Tangled along Tape Path

__ Step 1. Carefully pull out excess tape and untangle.

Note: If you find the tape to be broken, go to one of the following appropriate procedures:

- "Tape Spooled off Supply Reel" on page 55
- "Tape Pulled from or Broken near Leader Pin" on page 56

--OR--

"Tape Broken in Mid-tape" on page 57

__ Step 2. Set the drive on its left side with the head and tape path facing up.

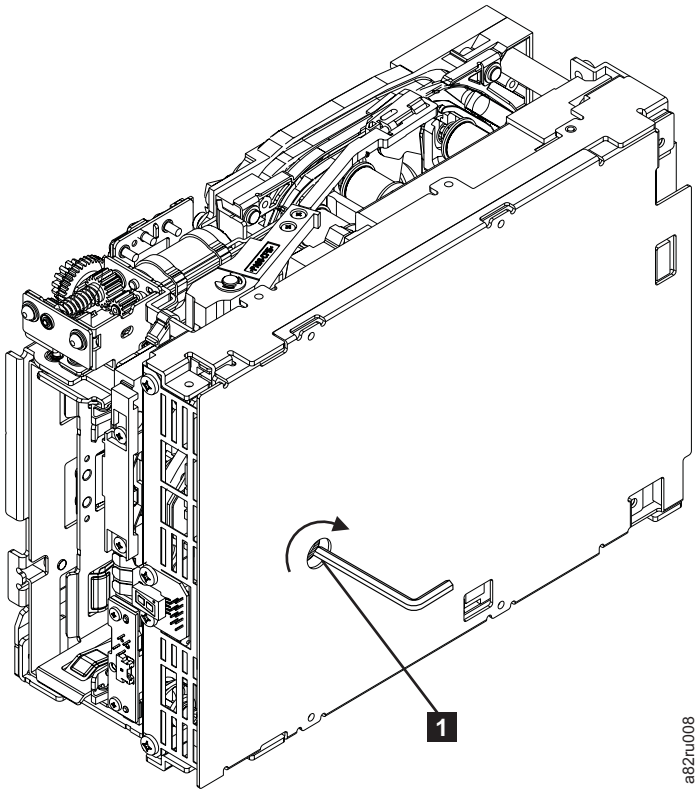


Figure 24. Using hex wrench to rewind tape into cartridge

__ Step 3. From the bottom of the drive, locate the access hole **1** .

__ Step 4. Insert a 2.5 mm offset hex wrench through the bottom cover access hole and into the reel motor axle. Begin spooling the tape back into the cartridge by turning the hex wrench clockwise.

__ Step 5. Continue spooling into the cartridge until the tape is taut and remains within the flanges of the tape guiding rollers. Ensure that you do not stretch the tape.

__ Step 6. Locate the threader motor worm gear **4** on the rear of the drive. You can either:

a. Use your finger to rotate the treader motor worm gear and slowly rotate the threader mechanism gear **6** in clockwise; OR

b. Use a #1 flathead screwdriver to turn the worm gear **9** clockwise.

This rotates the threader motor worm gear 4 clockwise, drawing the LBA into the cartridge.

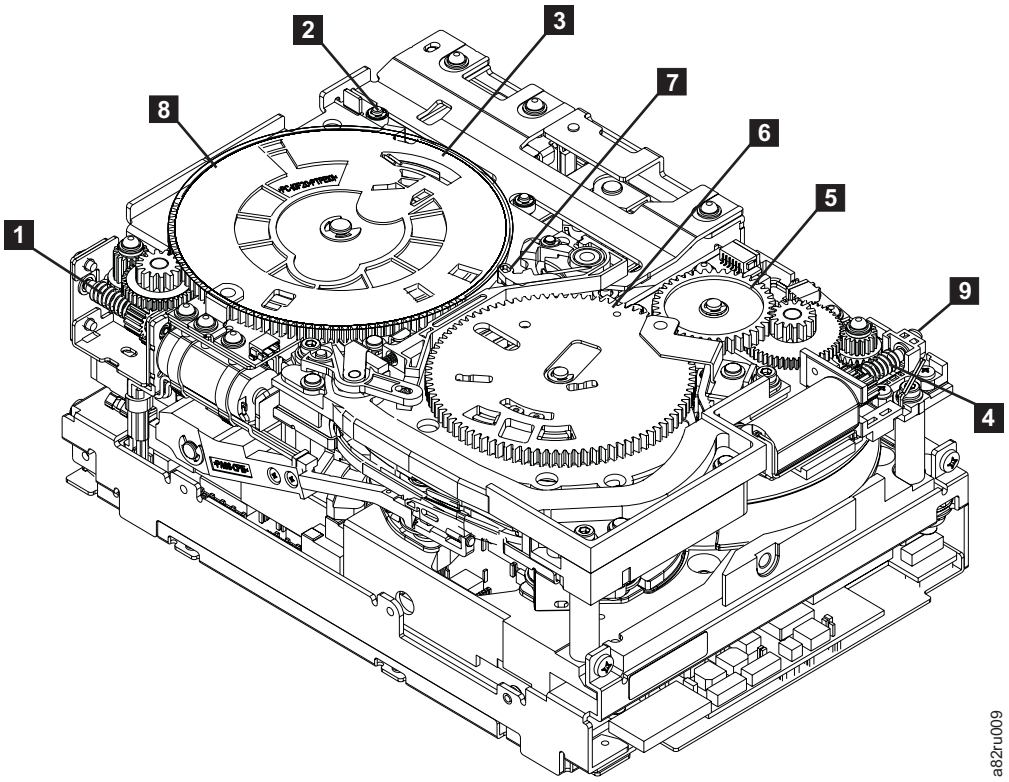


Figure 25. Drive with cover removed to reveal gear train.

1	Loader motor worm gear	6	Threader mechanism gear
2	Cartridge loader tray guide bearing	7	Lever
3	Rotator stub	8	Loader mechanism gear
4	Threader motor worm gear	9	Threader worm gear
5	Threader intermediate gear		

__ Step 7. As the tape leader block assembly (LBA) is secured in the cartridge, you should hear the LBA retention spring clips click into place. If you do not hear the click, continue rolling until the threader motor worm gear 4 stops. The LBA is in the correct position.

Note: Be sure to keep tension on the tape as the LBA is drawn into the cartridge by using a hex wrench.

__ Step 8. Notice the:

a. Loader mechanism gear 6 nearest the front of the drive that actuates the cartridge loader mechanism.

b. Position of the rotate stub 3.

c. Front loader motor worm gear 1. Rotating this gear allows the loader mechanism gear 8 to turn.

__ Step 9. Rotate the loader motor worm gear **1** to turn the threader mechanism gear **6** counterclockwise. Continue turning until the rotator stub **3** loses contact with the lever **7** . This releases the LBA leader pin.

__ Step 10. Rotate the threader motor worm gear **4** to turn the threader mechanism gear **6** counterclockwise. This moves the LBA out of the cartridge and past the read/write head. Stop this rotation when the LBA is near the tape guide roller nearest the rear of the drive shown as **1** .

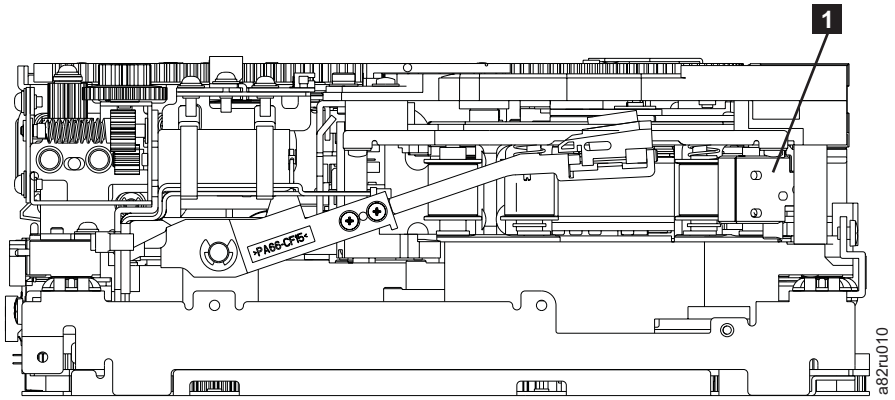


Figure 26. Leader Block Assembly (LBA)

__ Step 11. Continue rotating the loader motor worm gear **1** until the rotator stub **3** is positioned as shown. Notice that the rotator stub **3** is nearly aligned with the cartridge loader tray guide bearing **2** .

__ Step 12. Remove the cartridge from the cartridge loader tray.

__ Step 13. Reassemble the drive by reversing the procedure in Step 4 in "Beginning Procedure" on page 53.

__ Step 14. Refer to the appropriate procedure to install the new drive and return the failed drive.

No Apparent Failure or Damage to Tape

__ Step 1. Set the drive on its left side with the head and tape path facing up.

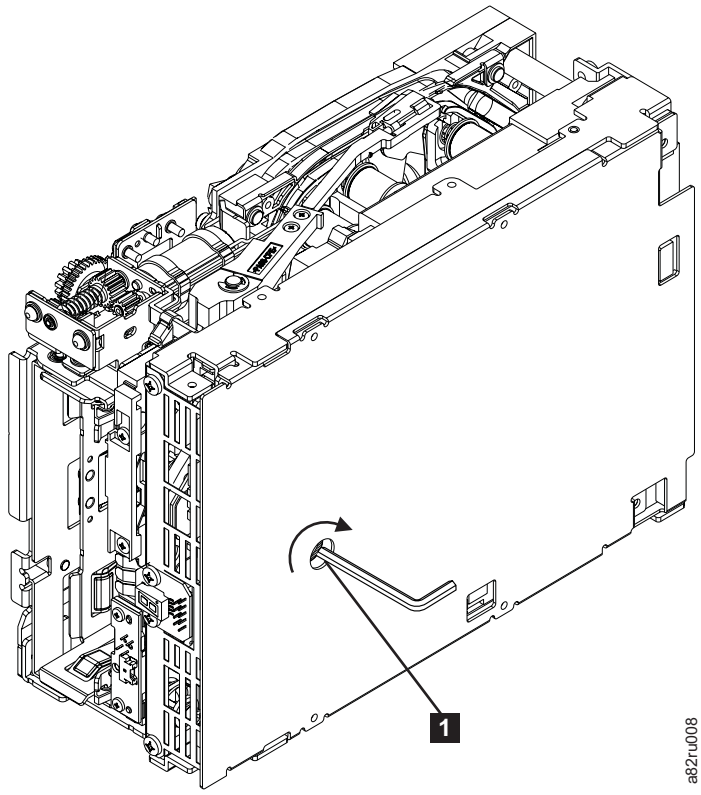


Figure 27. Using hex wrench to rewind tape into cartridge

__ Step 2. From the bottom of the drive, locate the access hole **1** .

__ Step 3. Insert a 2.5 mm offset hex wrench through the bottom cover access hole and into the reel motor axle. Begin spooling the tape back into the cartridge by turning the hex wrench clockwise.

__ Step 4. Continue spooling into the cartridge until the tape is taut and remains within the flanges of the tape guiding rollers. Ensure that you do not stretch the tape.

__ Step 5. Locate the threader motor worm gear **4** on the rear of the drive. You can either:

a. Use your finger to rotate the threader motor worm gear and slowly rotate the threader mechanism gear **6** clockwise;

--OR--

b. Use a #1 flathead screwdriver to turn the threader worm gear **9** clockwise.

This rotates the threader motor worm gear **4** clockwise, drawing the LBA into the cartridge.

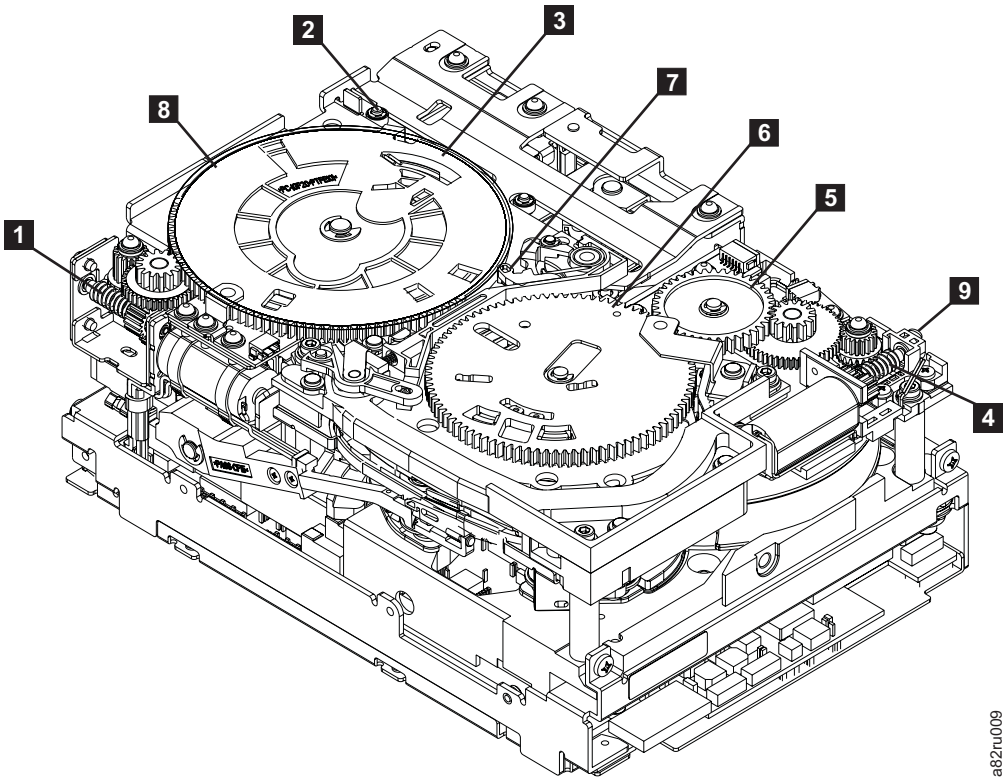


Figure 28. Drive with cover removed to reveal gear train.

1	Loader motor worm gear	6	Threader mechanism gear
2	Cartridge loader tray guide bearing	7	Lever
3	Rotator stub	8	Loader mechanism gear
4	Threader motor worm gear	9	Threader worm gear
5	Threader intermediate gear		

__ Step 6. As the tape leader block assembly (LBA) is secured in the cartridge, you should hear the LBA retention spring clips click into place. If you do not hear the click, continue rolling until the threader motor worm gear 4 stops. The LBA is in the correct position.

Note: Be sure to keep tension on the tape as the LBA is drawn into the cartridge by using a hex wrench.

__ Step 7. Notice the:

a. Loader mechanism gear 6 nearest the front of the drive that actuates the cartridge loader mechanism.

b. Position of the rotate stub 3 .

c. Front loader motor worm gear 1 . Rotating this gear allows the loader mechanism gear 8 to turn.

__ Step 8. Rotate the loader motor worm gear 1 to turn the threader mechanism gear 6 counterclockwise. Continue turning until the rotator stub 3 loses contact with the lever 7 . This releases the LBA leader pin.

__ Step 9. Rotate the threader motor worm gear **4** to turn the threader mechanism gear **6** counterclockwise. This moves the LBA out of the cartridge and past the read/write head. Stop this rotation when the LBA is near the tape guide roller nearest the rear of the drive shown as **1** .

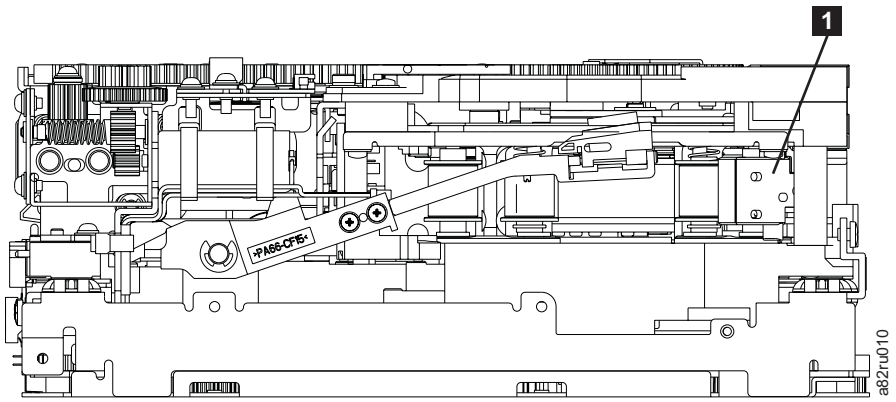


Figure 29. Leader Block Assembly (LBA)

__ Step 10. Continue rotating the loader motor worm gear **1** until the rotator stub **3** is positioned as shown. Notice that the rotator stub **3** is nearly aligned with the cartridge loader tray guide bearing **2** .

__ Step 11. Remove the cartridge from the cartridge loader tray.

__ Step 12. Reassemble the drive by reversing the procedure in Step 4 in "Beginning Procedure" on page 53.

__ Step 13. Refer to the appropriate procedure to install the new drive and return the failed drive.

Appendix A. 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 TotalStorage Ultrium Tape Drive.

Table 10. Supported TapeAlert Flags

Flag Number	Flag Parameter (in hex)	Flag	Description	Action Required
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 9 on page 45.
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. If Flag 4 is also set, the cartridge is defective. Replace the tape cartridge. If Flag 4 is not set, see error code 6 inTable 9 on page 45.
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 inTable 9 on page 45.
9	09h	Write protect	Set when the drive detects that the tape cartridge is write-protected.	Make sure that the cartridge's write-protect switch is set so that the drive can write data to the tape.
10	0Ah	No removal	Set when the 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.
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.

Table 10. Supported TapeAlert Flags (continued)

Flag Number	Flag Parameter (in hex)	Flag	Description	Action Required
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 "Error Codes and Messages" on page 45.
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 drive detects that it needs cleaning.	Clean the drive.
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.
22	16h	Expired clean	Set when the 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 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.
31	1Fh	Hardware B	Set when the drive fails its internal self tests.	Use the error code on the single-character display, library user interface, or SCSI drive sense data.
32	20h	Interface	Set when the drive detects a problem with the SCSI or LDI (RS-422) interface.	Locate error code 8 or 9 in "Error Codes and Messages" on page 45.
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.
34	22h	Download fail	Set when an FMR image is unsuccessfully downloaded to the 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 "Physical Specifications" on page 69).	See error code 1 in "Error Codes and Messages" on page 45.

Table 10. Supported TapeAlert Flags (continued)

Flag Number	Flag Parameter (in hex)	Flag	Description	Action Required
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 "Physical Specifications" on page 69).	See error code 2 in "Error Codes and Messages" on page 45.
39	27h	Diagnostics required	Set when the drive detects a failure that requires diagnostics to isolate the problem.	See error code 6 in "Error Codes and Messages" on page 45.
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 B. Specifications

The sections below give the physical, power, and environmental specifications for the drive.

Physical Specifications

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

Power Specifications

Power Supply	5 V dc	12 V dc
Tolerance	10%	10%
Voltage Ripple/Noise (50 Hz - 20 MHz)	60 mV pp	125 mV pp
Minimum Supply Current (steady state)	1.3 A	0.2 A
Maximum Supply Current (steady state)	3.0 A	1.1 A
Peak Supply Current (instantaneous power by power supply)	3.3 A for 100 ms (15 W)	4.50 A for 2 ms (49.20 W)

Power Measurements	Ultra-160 SCSI drive
Idle Mode (no cartridge)	10W
Idle Mode (Cartridge loaded)	12W
Reading and Writing (@5.46 m/s)	28W

Environmental Specifications

Environmental Factor	Operating (see Note 3)	Storage	Shipping
Drive temperature	10 to 40°C (50 to 104°F)	-40 to 60°C (-40 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)
Note: Measured in front of the bezel, near the air intake area (refer to Figure 4 on page 6).			

Other Specifications

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

Appendix C. Service and Support

The following information describes the technical support that is available for your product, during the warranty period or throughout the life of the product. Refer to your IBM Statement of Limited Warranty for a full explanation of IBM warranty terms.

Online technical support

Online technical support is available during the life of your product through the Personal Computing Support Web site at http://www.ibm.com/pc/support.

During the warranty period, assistance for replacement or exchange of defective components is available. In addition, if your IBM option is installed in an IBM computer, you might be entitled to service at your location. Your technical support representative can help you determine the best alternative.

Telephone technical support

Installation and configuration support through the IBM Support Center will be withdrawn or made available for a fee, at IBM's discretion, 90 days after the option has been withdrawn from marketing. Additional support offerings, including step-by-step installation assistance, are available for a nominal fee.

To assist the technical support representative, have available as much of the following information as possible:

- Option name
- Option number
- Proof of purchase
- Computer manufacturer, model, serial number (if IBM), and manual
- Exact wording of the error message (if any)
- Description of the problem
- Hardware and software configuration information for your system

If possible, be at your computer. Your technical support representative might want to walk you through the problem during the call.

For the support telephone number and support hours by country, refer to the following table. If the number for your country or region is not listed, contact your IBM reseller or IBM marketing representative. Response time may vary depending on the number and nature of the calls received.

For a list of Service and Support phone numbers, see "Worldwide telephone list" on page 88. Phone numbers are subject to change without notice. For the most current phone numbers, go to www.ibm.com/pc/support and click Support phone list.

Appendix D. IBM Statement of Limited Warranty Z125-4753-08 04/2004

Part 1 - General Terms

This Statement of Limited Warranty includes Part 1 - General Terms, Part 2 - Country-unique Terms, and Part 3 - Warranty Information. 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. 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. ***Nothing in this Statement of Limited Warranty affects any statutory rights of consumers that cannot be waived or limited by contract.***

What this Warranty Covers

IBM warrants that each Machine 1) is free from defects in materials and workmanship and 2) conforms to IBM's Official Published Specifications ("Specifications") which are available on request. The warranty period for the Machine starts on the original Date of Installation and is specified in Part 3 - Warranty Information. The date on your invoice or sales receipt is the Date of Installation unless IBM or your reseller informs you otherwise. 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. Unless IBM specifies otherwise, these warranties apply only in the country or region in which you purchased the Machine.

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. SOME STATES OR JURISDICTIONS DO NOT ALLOW THE EXCLUSION OF EXPRESS OR IMPLIED WARRANTIES, SO THE ABOVE EXCLUSION MAY NOT APPLY TO YOU. IN THAT EVENT, SUCH WARRANTIES ARE LIMITED IN DURATION TO THE WARRANTY PERIOD. NO WARRANTIES APPLY AFTER THAT PERIOD. SOME STATES OR JURISDICTIONS DO NOT ALLOW LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY LASTS, SO THE ABOVE LIMITATION MAY NOT APPLY TO YOU.

What this Warranty Does not Cover

This warranty does not cover the following:

- any software programs, whether pre-loaded or shipped with the Machine, or installed subsequently;
- failure resulting from misuse (including but not limited to use of any Machine capacity or capability, other than that authorized by IBM in writing), accident, modification, unsuitable physical or operating environment, or improper maintenance by you;
- failure caused by a product for which IBM is not responsible; and
- any non-IBM products, including those that IBM may procure and provide with or integrate into an IBM Machine at your request.

The warranty is voided by removal or alteration of identification labels on the Machine or its parts.

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 with "how-to" questions and those regarding Machine set-up and installation, is provided **WITHOUT WARRANTIES OF ANY KIND**.

How to Obtain Warranty Service
If the Machine does not function as warranted during the warranty period, contact IBM or your reseller to obtain warranty service. If you do not register the Machine with IBM, you may be required to present proof of purchase as evidence of your entitlement to warranty service.

What IBM Will Do to Correct Problems
When you contact IBM for service, you must follow the problem determination and resolution procedures that IBM specifies. An initial diagnosis of your problem can be made either by a technician over the telephone or electronically by access to an IBM website.

The type of warranty service applicable to your Machine is specified in Part 3 - Warranty Information.

You are responsible for downloading and installing designated Machine Code (microcode, basic input/output system code (called ″BIOS″), utility programs, device drivers, and diagnostics delivered with an IBM Machine) and other software updates from an IBM Internet Web site or from other electronic media, and following the instructions that IBM provides.

If your problem can be resolved with a Customer Replaceable Unit (″CRU″) (e.g., keyboard, mouse, speaker, memory, hard disk drive), IBM will ship the CRU to you for you to install.

If the Machine does not function as warranted during the warranty period and your problem cannot be resolved over the telephone or electronically, through your application of Machine Code or software updates, or with a CRU, IBM or your reseller, if approved by IBM to provide warranty service, will either, at its discretion, 1) repair it to make it function as warranted, or 2) replace it with one that is at least functionally equivalent. If IBM is unable to do either, you may return the Machine to your place of purchase and your money will be refunded.

IBM or your reseller will also manage and install selected engineering changes that apply to the Machine.

Exchange of a Machine or Part
When the 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.

Your Additional Responsibilities
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 service request procedures that IBM or your reseller provides;
   b. backup or secure all programs, data, and funds contained in the Machine;
   c. provide IBM or your reseller with sufficient, free, and safe access to your facilities to permit IBM to fulfill its obligations; and
   d. inform IBM or your reseller of changes in the Machine's location.
4. (a) ensure all information about identified or identifiable individuals (Personal Data) is deleted from the Machine (to the extent technically possible), (b) allow IBM, your reseller or an IBM supplier to process on your behalf any remaining Personal Data as IBM or your reseller considers necessary to fulfill its obligations under this Statement of Limited Warranty (which may include shipping the Machine for such processing to other IBM service locations around the world), and (c) ensure that such processing complies with any laws applicable to such Personal Data.

Limitation of Liability

IBM is responsible for loss of, or damage to, your Machine only 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 are responsible for any of your confidential, proprietary or personal information contained in a Machine which you return to IBM for any reason. You should remove all such information from the Machine prior to its return.

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 (″LIC″).

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, ITS SUPPLIERS OR RESELLERS LIABLE FOR ANY OF THE FOLLOWING EVEN IF INFORMED OF THEIR POSSIBILITY: 1) THIRD PARTY CLAIMS AGAINST YOU FOR DAMAGES (OTHER THAN THOSE UNDER THE FIRST ITEM LISTED ABOVE); 2) LOSS OF, OR DAMAGE TO, DATA; 3) SPECIAL, INCIDENTAL, OR INDIRECT DAMAGES OR FOR ANY ECONOMIC CONSEQUENTIAL DAMAGES; OR 4) LOST PROFITS, BUSINESS REVENUE, GOODWILL OR ANTICIPATED SAVINGS. SOME STATES OR JURISDICTIONS DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATION OR EXCLUSION MAY NOT APPLY TO YOU. SOME STATES OR JURISDICTIONS DO NOT ALLOW

LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY LASTS, SO THE ABOVE LIMITATION 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 Statement of Limited Warranty, without regard to conflict of law principles.

THESE WARRANTIES GIVE YOU SPECIFIC LEGAL RIGHTS AND YOU MAY ALSO HAVE OTHER RIGHTS WHICH VARY FROM STATE TO STATE OR JURISDICTION TO JURISDICTION.

Jurisdiction
All of our rights, duties, and obligations are subject to the courts of the country in which you acquired the Machine.

Part 2 - Country-unique Terms

AMERICAS

ARGENTINA
Jurisdiction: *The following is added after the first sentence:*
Any litigation arising from this Statement of Limited Warranty will be settled exclusively by the Ordinary Commercial Court of the city of Buenos Aires.

BOLIVIA
Jurisdiction: *The following is added after the first sentence:*
Any litigation arising from this Statement of Limited Warranty will be settled exclusively by the courts of the city of La Paz.

BRAZIL
Jurisdiction: *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, RJ.

CHILE
Jurisdiction: *The following is added after the first sentence:*
Any litigation arising from this Statement of Limited Warranty will be settled exclusively by the Civil Courts of Justice of Santiago.

COLOMBIA
Jurisdiction: *The following is added after the first sentence:*
Any litigation arising from this Statement of Limited Warranty will be settled exclusively by the Judges of the Republic of Colombia.

EQUADOR
Jurisdiction: *The following is added after the first sentence:*
Any litigation arising from this Statement of Limited Warranty will be settled exclusively by the Judges of Quito.

MEXICO
Jurisdiction: *The following is added after the first sentence:*
Any litigation arising from this Statement of Limited Warranty will be settled exclusively by the Federal Courts of Mexico City, Federal District.

PARAGUAY
Jurisdiction: *The following is added after the first sentence:*
Any litigation arising from this Statement of Limited Warranty will be settled exclusively by the courts of the city of Asuncion.

PERU
Jurisdiction: *The following is added after the first sentence:*
Any litigation arising from this Statement of Limited Warranty will be settled exclusively by the Judges and Tribunals of the Judicial District of Lima, Cercado.

Limitation of Liability: *The following is added at the end of this section:*In accordance with Article 1328 of the Peruvian Civil Code the limitations and exclusions specified in this section will not apply to damages caused by IBM's willful misconduct ("dolo") or gross negligence ("culpa inexcusable").

URUGUAY
Jurisdiction: *The following is added after the first sentence:*
Any litigation arising from this Statement of Limited Warranty will be settled exclusively by the City of Montevideo Court's Jurisdiction.

VENEZUELA
Jurisdiction: *The following is added after the first sentence:*
Any litigation arising from this Statement of Limited Warranty will be settled exclusively by the Courts of the Metropolitan Area Of the City of Caracas.

NORTH AMERICA

How to Obtain 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
Limitation of Liability: *The following replaces item 1 of this section:*
1. damages for bodily injury (including death) or physical harm to real property and tangible personal property caused by IBM's negligence; and

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.

ASIA PACIFIC

AUSTRALIA
What this Warranty Covers: *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 AND LAOS

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, United States of America.

CAMBODIA, INDONESIA, AND LAOS
Arbitration: *The following is added under this heading:*
Disputes arising out of or in connection with this Statement of Limited Warranty shall be finally settled by arbitration which shall be held in Singapore in accordance with the Arbitration Rules of Singapore International Arbitration Center ("SIAC Rules") then in effect. The arbitration award shall be final and binding for the parties without appeal and shall be in writing and set forth the findings of fact and the conclusions of law.

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 who shall act as chairman of the proceedings. Vacancies in the post of chairman shall be filled by the president of the SIAC. 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.

All proceedings shall be conducted, including all documents presented in such proceedings, in the English language. The English language version of this Statement of Limited Warranty prevails over any other language version.

HONG KONG S.A.R. OF CHINA AND MACAU S.A.R. OF CHINA
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 of China.

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; and
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, the charge paid by you for the individual Machine that is the subject of the claim. For purposes of this item, the term "Machine" includes Machine Code and Licensed Internal Code ("LIC").

Arbitration: *The following is added under this heading*
Disputes arising out of or in connection with this Statement of Limited Warranty shall be finally settled by arbitration which shall be held in Bangalore, India in accordance with the laws of India then in effect. The arbitration award shall be final and binding for the parties without appeal and shall be in writing and set forth the findings of fact and the conclusions of law.

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 who shall act as chairman of the proceedings. Vacancies in the post of chairman shall be filled by the president of the Bar Council of India. 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.

All proceedings shall be conducted, including all documents presented in such proceedings, in the English language. The English language version of this Statement of Limited Warranty prevails over any other language version.

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

MALAYSIA
Limitation of Liability: The word *"**SPECIAL**"* in item 3 of the fifth paragraph is deleted.

NEW ZEALAND
What this Warranty Covers: *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 "*laws of the country in which you acquired the Machine*" in the first sentence:*
laws of the State of New York, United States of America (except when local law requires otherwise).

PHILIPPINES
Limitation of Liability: *Item 3 in the fifth paragraph is replaced by the following:*

SPECIAL (INCLUDING NOMINAL AND EXEMPLARY DAMAGES), MORAL, INCIDENTAL, OR INDIRECT DAMAGES FOR ANY ECONOMIC CONSEQUENTIAL DAMAGES; OR

Arbitration: The following is added: under this heading
Disputes arising out of or in connection with this Statement of Limited Warranty shall be finally settled by arbitration which shall be held in Metro Manila, Philippines in accordance with the laws of the Philippines then in effect. The arbitration award shall be final and binding for the parties without appeal and shall be in writing and set forth the findings of fact and the conclusions of law.

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 who shall act as chairman of the proceedings. Vacancies in the post of chairman shall be filled by the president of the Philippine Dispute Resolution Center, Inc.. 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.

All proceedings shall be conducted, including all documents presented in such proceedings, in the English language. The English language version of this Statement of Limited Warranty prevails over any other language version.

SINGAPORE
Limitation of Liability: *The words "**SPECIAL**" and "**ECONOMIC**" in item 3 in the fifth paragraph are deleted.*

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.

How to Obtain Warranty Service:
*Add the following paragraph in **Western Europe** (Andorra, Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Monaco, Netherlands, Norway, Poland, Portugal, San Marino, Slovakia, Slovenia, Spain, Sweden, Switzerland, United Kingdom, Vatican State, and any country subsequently added to the European Union, as from the date of accession):*

The warranty for Machines acquired in Western Europe shall be valid and applicable in all Western Europe countries provided the Machines have been announced and made available in such countries.

If you purchase a Machine in one of the Western European countries, as defined above, 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, provided the Machine has been announced and made available by IBM in the country in which you wish to obtain service.

If you purchased a Personal Computer Machine in Albania, Armenia, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Georgia, Hungary, Kazakhstan, Kyrgyzstan, 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 a 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 approved service provider. You are responsible for transportation costs for Machines located outside 50 kilometers of an IBM approved service provider.

Governing Law:
The phrase "the laws of the country in which you acquired the Machine" is replaced by:
1) ″the laws of Austria″ **in Albania, Armenia, Azerbaijan, Belarus, Bosnia-Herzegovina, Bulgaria, Croatia, Georgia, Hungary, Kazakhstan, Kyrgyzstan, FYR Macedonia, Moldova, Poland, Romania, Russia, Slovakia, Slovenia, Tajikistan, Turkmenistan, Ukraine, Uzbekistan, and FR Yugoslavia;** 2) ″the laws of France″ **in Algeria, Benin, Burkina Faso, Cameroon, Cape Verde, Central African Republic, Chad, Comoros, Congo Republic, Djibouti, Democratic Republic of Congo, Equatorial Guinea, French Guiana, French Polynesia, Gabon, Gambia, Guinea, Guinea-Bissau, Ivory Coast, Lebanon, Madagascar, Mali, Mauritania, Mauritius, Mayotte, Morocco, New Caledonia, Niger, Reunion, Senegal, Seychelles, Togo, Tunisia, Vanuatu, and Wallis & Futuna;** 3) ″the laws of Finland″ **in Estonia, Latvia, and Lithuania;** 4) ″the laws of England″ **in 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, the United Kingdom, West Bank/Gaza, Yemen, Zambia, and Zimbabwe;** and 5) ″the laws of South Africa″ **in South Africa, Namibia, Lesotho and Swaziland.**

Jurisdiction: *The following exceptions are added to this section:*
1) **In Austria** the choice of jurisdiction for all disputes arising out of this Statement of Limited Warranty and relating thereto, including its existence, will be the competent court of law in Vienna, Austria (Inner-City); 2) **in 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, West Bank/Gaza, Yemen, Zambia, and Zimbabwe** all disputes arising out of this Statement of Limited Warranty or related to its execution, including summary proceedings, will be submitted to the exclusive jurisdiction of the English courts; 3) in **Belgium** and **Luxembourg**, all disputes arising out of this Statement of Limited Warranty or related to its interpretation or its execution, the law, and the courts of the capital city, of the country of your registered office and/or commercial site location only are competent; 4) **in France, Algeria, Benin, Burkina Faso, Cameroon, Cape Verde, Central African Republic, Chad, Comoros, Congo Republic, Djibouti, Democratic Republic of Congo, Equatorial Guinea, French Guiana, French Polynesia, Gabon, Gambia, Guinea, Guinea-Bissau, Ivory Coast, Lebanon, Madagascar, Mali, Mauritania, Mauritius, Mayotte, Morocco, New Caledonia, Niger, Reunion, Senegal, Seychelles, Togo, Tunisia, Vanuatu, and**

Wallis & Futuna all disputes arising out of this Statement of Limited Warranty or related to its violation or execution, including summary proceedings, will be settled exclusively by the Commercial Court of Paris; 5) in **Russia**, all disputes arising out of or in relation to the interpretation, the violation, the termination, the nullity of the execution of this Statement of Limited Warranty shall be settled by Arbitration Court of Moscow; 6) **in South Africa, Namibia, Lesotho and Swaziland**, both of us agree to submit all disputes relating to this Statement of Limited Warranty to the jurisdiction of the High Court in Johannesburg; 7) **in Turkey** all disputes arising out of or in connection with this Statement of Limited Warranty shall be resolved by the Istanbul Central (Sultanahmet) Courts and Execution Directorates of Istanbul, the Republic of Turkey; 8) in each of the following specified countries, any legal claim arising out of this Statement of Limited Warranty will be brought before, and settled exclusively by, the competent court of a) Athens for **Greece**, b) Tel Aviv-Jaffa for **Israel**, c) Milan for **Italy**, d) Lisbon for **Portugal**, and e) Madrid for **Spain**; and 9) **in the United Kingdom**, both of us agree to submit all disputes relating to this Statement of Limited Warranty to the jurisdiction of the English courts.

Arbitration: *The following is added under this heading:*
In Albania, Armenia, Azerbaijan, Belarus, Bosnia-Herzegovina, Bulgaria, Croatia, Georgia, Hungary, Kazakhstan, Kyrgyzstan, FYR Macedonia, Moldova, Poland, Romania, Russia, Slovakia, Slovenia, Tajikistan, Turkmenistan, Ukraine, Uzbekistan, and FR Yugoslavia all disputes arising out of this Statement of Limited Warranty or related to its violation, termination or nullity will be finally settled under the Rules of Arbitration and Conciliation of the International Arbitral Center of the Federal Economic Chamber in Vienna (Vienna Rules) by three arbitrators appointed in accordance with these rules. The arbitration will be held in Vienna, Austria, and the official language of the proceedings will be English. The decision of the arbitrators will be final and binding upon both parties. Therefore, pursuant to paragraph 598 (2) of the Austrian Code of Civil Procedure, the parties expressly waive the application of paragraph 595 (1) figure 7 of the Code. IBM may, however, institute proceedings in a competent court in the country of installation.

In Estonia, Latvia and Lithuania all disputes arising in connection with this Statement of Limited Warranty will be finally settled in arbitration that will be held in Helsinki, Finland in accordance with the arbitration laws of Finland then in effect. Each party will appoint one arbitrator. The arbitrators will then jointly appoint the chairman. If arbitrators cannot agree on the chairman, then the Central Chamber of Commerce in Helsinki will appoint the chairman.

EUROPEAN UNION (EU)

THE FOLLOWING TERMS APPLY TO ALL EU COUNTRIES:
The warranty for Machines acquired in EU countries is valid and applicable in all EU countries provided the Machines have been announced and made available in such countries.
How to Obtain Warranty Service: *The following is added to this section:*
To obtain warranty service from IBM in EU countries, see the telephone listing in Part 3 - Warranty Information.
You may contact IBM at the following address:
IBM Warranty & Service Quality Dept.
PO Box 30
Spango Valley
Greenock
Scotland PA16 0AH

CONSUMERS
Consumers have legal rights under applicable national legislation governing the sale of consumer goods. Such rights are not affected by the warranties provided in this Statement of Limited Warranty.

AUSTRIA, DENMARK, FINLAND, GREECE, ITALY, NETHERLANDS, NORWAY, PORTUGAL, SPAIN, SWEDEN AND SWITZERLAND
Limitation of Liability: *The following replaces the terms of this section in its entirety:*
Except as otherwise provided by mandatory law:

1. IBM's liability for any damages and losses that may arise as a consequence of the fulfillment of its obligations under or in connection with this Statement of Limited Warranty or due to any other cause related to this Statement of Limited Warranty is limited to the compensation of only those damages and losses proved and actually arising as an immediate and direct consequence of the non-fulfillment of such obligations (if IBM is at fault) or of such cause, for a maximum amount equal to the charges you paid for the Machine. For purposes of this item, the term "Machine" includes Machine Code and Licensed Internal Code ("LIC").

   The above limitation shall not apply to damages for bodily injuries (including death) and damages to real property and tangible personal property for which IBM is legally liable.
2. **UNDER NO CIRCUMSTANCES IS IBM, ITS SUPPLIERS OR RESELLERS LIABLE FOR ANY OF THE FOLLOWING, EVEN IF INFORMED OF THEIR POSSIBILITY: 1) LOSS OF, OR DAMAGE TO, DATA; 2) INCIDENTAL OR INDIRECT DAMAGES, OR FOR ANY ECONOMIC CONSEQUENTIAL DAMAGES; 3) LOST PROFITS, EVEN IF THEY ARISE AS AN IMMEDIATE CONSEQUENCE OF THE EVENT THAT GENERATED THE DAMAGES; OR 4) LOSS OF BUSINESS, REVENUE, GOODWILL, OR ANTICIPATED SAVINGS.**

FRANCE AND BELGIUM
Limitation of Liability: *The following replaces the terms of this section in its entirety:*
Except as otherwise provided by mandatory law:

1. IBM's liability for any damages and losses that may arise as a consequence of the fulfillment of its obligations under or in connection with this Statement of Limited Warranty is limited to the compensation of only those damages and losses proved and actually arising as an immediate and direct consequence of the non-fulfillment of such obligations (if IBM is at fault), for a maximum amount equal to the charges you paid for the Machine that has caused the damages. For purposes of this item, the term "Machine" includes Machine Code and Licensed Internal Code ("LIC").

   The above limitation shall not apply to damages for bodily injuries (including death) and damages to real property and tangible personal property for which IBM is legally liable.
2. **UNDER NO CIRCUMSTANCES IS IBM, ITS SUPPLIERS OR RESELLERS LIABLE FOR ANY OF THE FOLLOWING, EVEN IF INFORMED OF THEIR POSSIBILITY: 1) LOSS OF, OR DAMAGE TO, DATA; 2) INCIDENTAL OR INDIRECT DAMAGES, OR FOR ANY ECONOMIC CONSEQUENTIAL DAMAGES; 3) LOST PROFITS, EVEN IF THEY ARISE AS AN IMMEDIATE CONSEQUENCE OF THE EVENT THAT GENERATED THE DAMAGES; OR 4) LOSS OF BUSINESS, REVENUE, GOODWILL, OR ANTICIPATED SAVINGS.**

THE FOLLOWING TERMS APPLY TO THE COUNTRY SPECIFIED:

AUSTRIA

The provisions of this Statement of Limited Warranty replace any applicable statutory warranties.

What this Warranty Covers: *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 limitation period for consumers in action for breach of warranty is the statutory period as a minimum. 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.

The second paragraph does not apply.

What IBM Will Do to Correct Problems: *The following is added to this section:*

During the warranty period, IBM will reimburse you for the transportation charges for the delivery of the failing Machine to IBM.

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 ("LIC").

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).

GERMANY

What this Warranty Covers: *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 twelve 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.

The second paragraph does not apply.

What IBM Will Do to Correct Problems: *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.

HUNGARY
Limitation of Liability: *The following is added at the end of this section:*
The limitation and exclusion specified herein shall not apply to liability for a breach of contract damaging life, physical well-being, or health that has been caused intentionally, by gross negligence, or by a criminal act.

The parties accept the limitations of liability as valid provisions and state that the Section 314.(2) of the Hungarian Civil Code applies as the acquisition price as well as other advantages arising out of the present Statement of Limited Warranty balance this limitation of liability.

IRELAND
What this Warranty Covers: *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 the terms of section in its entirety:*
For the purposes of this section, a "Default" means any act, statement, omission, or negligence on the part of IBM in connection with, or in relation to, the subject matter of this Statement of Limited Warranty in respect of which IBM is legally liable to you, whether in contract or tort. A number of Defaults which together result in, or contribute to, substantially the same loss or damage will be treated as one Default occurring on the date of occurrence of the last such Default.

Circumstances may arise where, because of a Default, you are entitled to recover damages from IBM.

This section sets out the extent of IBM's liability and your sole remedy.
1. IBM will accept unlimited liability for death or personal injury caused by the negligence of IBM
2. Subject always to the **Items for Which IBM is Not Liable** below, IBM will accept unlimited liability for physical damage to your tangible property resulting from the negligence of IBM.

3. Except as provided in items 1 and 2 above, IBM's entire liability for actual damages for any one Default will not in any event exceed the greater of 1) EUR 125,000, or 2) 125% of the amount you paid for the Machine directly relating to the Default.

Items for Which IBM is Not Liable
Save with respect to any liability referred to in item 1 above, under no circumstances is IBM, its suppliers or resellers liable for any of the following, even if IBM or they were informed of the possibility of such losses:

1. loss of, or damage to, data;
2. special, indirect, or consequential loss; or
3. loss of profits, business, revenue, goodwill, or anticipated savings.

SLOVAKIA
Limitation of Liability: *The following is added to the end of the last paragraph:*
The limitations apply to the extent they are not prohibited under §§ 373-386 of the Slovak Commercial Code.

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 the terms of this section is in its entirety:*
For the purposes of this section, a "Default" means any act, statement, omission, or negligence on the part of IBM in connection with, or in relation to, the subject matter of this Statement of Limited Warranty in respect of which IBM is legally liable to you, whether in contract or tort. A number of Defaults which together result in, or contribute to, substantially the same loss or damage will be treated as one Default.

Circumstances may arise where, because of a Default, you are entitled to recover damages from IBM.

This section sets out the extent of IBM's liability and your sole remedy.
1. IBM will accept unlimited liability for:
   a. death or personal injury caused by the negligence of IBM; and
   b. any breach of its obligations implied by Section 12 of the Sale of Goods Act 1979 or Section 2 of the Supply of Goods and Services Act 1982, or any statutory modification or re-enactment of either such Section.
2. IBM will accept unlimited liability, subject always to the **Items for Which IBM is Not Liable** below, for physical damage to your tangible property resulting from the negligence of IBM.
3. IBM's entire liability for actual damages for any one Default will not in any event, except as provided in items 1 and 2 above, exceed the greater of 1) Pounds Sterling 75,000, or 2) 125% of the total purchase price payable or the charges for the Machine directly relating to the Default.

These limits also apply to IBM's suppliers and resellers. They state the maximum for which IBM and such suppliers and resellers are collectively responsible.

Items for Which IBM is Not Liable
Save with respect to any liability referred to in item 1 above, under no circumstances is IBM or any of its suppliers or resellers liable for any of the following, even if IBM or they were informed of the possibility of such losses:
1. loss of, or damage to, data;
2. special, indirect, or consequential loss; or
3. loss of profits, business, revenue, goodwill, or anticipated savings.

Part 3 - Warranty Information

This Part 3 provides information regarding the warranty applicable to your Machine, including the warranty period and type of warranty service IBM provides.

Warranty Period

The warranty period may vary by country or region and is specified in the table below. NOTE: ″Region″ means either Hong Kong or Macau Special Administrative Region of China.

A warranty period of 1 year on parts means that IBM provides warranty service without charge for:

Machine Type	Country or Region of Purchase	Warranty Period	Type of Warranty Service
25R0023	Worldwide	Parts- 1 year	1
25R0046	Worldwide	Parts- 1 year	1
93F0041	Worldwide	Parts- 1 year	1

Types of Warranty Service

If required, IBM provides repair or exchange service depending on the type of warranty service specified for your Machine in the above table and as described below. Warranty service may be provided by your reseller if approved by IBM to perform warranty service. Scheduling of service will depend upon the time of your call and is subject to parts availability. Service levels are response time objectives and are not guaranteed. The specified level of warranty service may not be available in all worldwide locations, additional charges may apply outside IBM's normal service area, contact your local IBM representative or your reseller for country and location specific information.

1. **Customer Replaceable Unit (″CRU″) Service**

   IBM provides replacement CRUs to you for you to install. CRU information and replacement instructions are shipped with your Machine and are available from IBM at any time on your request. Installation of Tier 1 CRUs is your responsibility. If IBM installs a Tier 1 CRU at your request, you will be charged for the installation. You may install a Tier 2 CRU yourself or request IBM to install it, at no additional charge, under the type of warranty service designated for your Machine. IBM specifies in the materials shipped with a replacement CRU whether a defective CRU must be returned to IBM. When return is required, 1) return instructions and a container are shipped with the replacement CRU, and 2) you may be charged for the replacement CRU if IBM does not receive the defective CRU within 30 days of your receipt of the replacement.
2. **On-site Service**

IBM or your reseller will either repair or exchange the failing Machine at your location and verify its operation. You must provide suitable working area to allow disassembly and reassembly of the IBM Machine. The area must be clean, well lit and suitable for the purpose. For some Machines, certain repairs may require sending the Machine to an IBM service center.

3. **Courier or Depot Service ***

   You will disconnect the failing Machine for collection arranged by IBM. IBM will provide you with a shipping container for you to return your Machine to a designated service center. A courier will pick up your Machine and deliver it to the designated service center. Following its repair or exchange, IBM will arrange the return delivery of the Machine to your location. You are responsible for its installation and verification.

4. **Customer Carry-In or Mail-In Service**

   You will deliver or mail as IBM specifies (prepaid unless IBM specifies otherwise) the failing Machine suitably packaged to a location IBM designates. After IBM has repaired or exchanged the Machine, IBM will make it available for your collection or, for Mail-in Service, IBM will return it to you at IBM's expense, unless IBM specifies otherwise. You are responsible for the subsequent installation and verification of the Machine.

5. **CRU and On-site Service**

   This type of Warranty Service is a combination of Type 1 and Type 2 (see above).

6. **CRU and Courier or Depot Service**

   This type of Warranty Service is a combination of Type 1 and Type 3 (see above).

7. **CRU and Customer Carry-In or Mail-In Service**

   This type of Warranty Service is a combination of Type 1 and Type 4 (see above).

When a 5, 6 or 7 type of warranty service is listed, IBM will determine which type of warranty service is appropriate for the repair.

* This type of service is called ThinkPad EasyServ or EasyServ in some countries.

The IBM Machine Warranty worldwide web site at http://www.ibm.com/servers/support/machine_warranties/ provides a worldwide overview of IBM's Limited Warranty for Machines, a Glossary of IBM definitions, Frequently Asked Questions (FAQs) and Support by Product (Machine) with links to Product Support pages. **The IBM Statement of Limited Warranty is also available on this site in 29 languages.**

To obtain warranty service contact IBM or your IBM reseller. In Canada or the United States, call 1-800-IBM-SERV (426-7378). In other countries, see the telephone numbers below.

Worldwide telephone list

Phone numbers are subject to change without notice. For the most current phone numbers, go to www.ibm.com/pc/support and click **Support phone list**.

Country or Region	Language	Telephone Number	Hours of operation
Africa	--	Africa: +44 (0)1475 555 055 South Africa: +27 11 3028888 and 0800110756 Central Africa: Contact the nearest IBM Business Partner	--
Argentina	Spanish	0800-666-0011	9AM - 10PM Monday-Friday (Local time)
Australia	English	131-426	9AM - 9PM AEST 7 days/week
Austria	German	+43-1-24592-5901	9AM - 5:30PM, Monday - Friday (Local time)
Belgium	Dutch French	02-210-9820 02-210-9800	9AM - 5PM Monday -Friday (Local time)
Bolivia	Spanish	0800-0189	8AM - 9PM Monday -Friday (Local time)
Brazil	Portuguese	55-11-3889-8986	8AM - 6PM Monday -Friday (Local time)
Canada	English French	1-800-565-3344 1-800-565-3344 In Toronto only call: 416-383-3344	24 hours/day, 7 days/week
Chile	Spanish	800-224-488	8AM - 9PM Monday -Friday (Local time)
China	Mandarin	800 810 1818	8:30AM - 5PM Monday -Friday (Local time)
China (Hong Kong S.A.R.)	Cantonese, English, Putonghua	Home PC: 852 2825 7799 Commercial PC: 852 8205 0333 ThinkPad and WorkPad: 852 2825 6580	9AM - 5PM Monday -Friday (Local time)
Colombia	Spanish	1-800-912-3021	8AM - 9PM EST Monday -Friday
Costa Rica	Spanish	284-3911	8AM - 5PM Monday -Friday (Local time)
Cyprus	--	+357-22-841100	--
Czech Republic	--	+420-2-7213-1316	--

Country or Region	Language	Telephone Number	Hours of operation
Denmark	Danish	4520-8200	8:30AM - 4:30PM Monday -Friday (Local time)
Dominican Republic	Spanish	566-4755 566-5161 ext. 8201 Toll Free within the Dominican Republic: 1-200-1929	8AM - 5PM Monday -Friday (Local time)
Ecuador	Spanish	1-800-426911	7AM - 8PM Monday -Friday (Local time)
El Salvador	Spanish	250-5696	8AM - 5PM Monday -Friday (Local time)
Estonia	--	+386-61-1796-699	--
Finland	Finnish	+358-9-459-6960	9AM - 5PM Monday -Friday (Local time)
France	French	+33-238-557-450	9AM - 6PM Monday -Friday (Local time)
Germany	German	+49-7032-15-49201	9AM - 5:30PM Monday -Friday (Local time)
Greece	--	+30-210-680-1700	--
Guatemala	Spanish	335-8490	8AM - 5PM Monday -Friday (Local time)
Honduras	Spanish	Tegucigalpa & San Pedro Sula: 232-4222 San Pedro Sula: 552-2234	8AM - 5PM Monday -Friday (Local time)
Hungary	--	+36-1-382-5720	--
India	English	1600-44-6666	9AM - 6PM Monday -Friday (Local time) Except holidays
Indonesia	Bahasa, Indonesian, English	800-140-3555	8AM - 6PM Monday -Friday (Local time)
Ireland	English	+353-(0)1-815-9200	9AM - 5:30PM Monday -Friday (Local time)
Italy	Italian	+39-02-7031-6101	9AM - 5PM Monday -Friday (Local time)

Country or Region	Language	Telephone Number	Hours of operation
Japan	Japanese, English	Desktop Toll free: 0120-887-870; For International: +81-46-266-4724 ThinkPad Toll free: 0120-887-874; For International: +81-46-266-4724 Both of the above numbers will be answered with a Japanese language voice prompt. For telephone support in English, please wait for the Japanese voice prompt to end, and an operator will answer. Please ask for "English support please", and your call will be transferred to an English speaking operator.	ThinkPad and Desktop 10AM - 6PM Everyday Except Second Sunday of the month, Year end
	Japanese	IntelliStation and xSeries Inside Japan and Overseas calls: +81-46-266-1358	IntelliStation and xSeries 9AM - 5PM Monday - Friday Except Saturday, Sunday, Holidays, Year End
	Japanese	PC Software 0120-558-695 (Overseas calls: +81-44-200-8666)	PC Software 10AM - 6PM Monday - Friday Except Saturday, Sunday, Holidays, Year End
Korea	Korean	82-2-3284-1500	9AM - 6PM Monday - Friday 9AM - 1PM Saturday
Latvia	--	+386-61-1796-699	--
Lithuania	--	+386-61-1796-699	--
Luxembourg	French	+352-298-977-5063	9AM - 5PM Monday - Friday (Local time)
Malaysia	English	1800-88-8558	8:30AM - 5PM Monday - Friday (Local time)
Malta	--	+356-23-4175	--
Mexico	Spanish	001-866-434-2080	7AM - 8PM Monday - Friday (Local time)
Middle East	--	+44 (0)1475-555-055	--

Country or Region	Language	Telephone Number	Hours of operation
Netherlands	Dutch	+31-20-514-5770	9AM - 5PM Monday - Friday (Local time)
New Zealand	English	0800-446-149	9AM - 9PM 7 days/week
Nicaragua	Spanish	255-6658	8AM - 5PM Monday - Friday (Local time)
Norway	Norwegian	NetVista, ThinkCentre, and ThinkPad: +47 6699 8960 All products: +47 815 21550	8:30AM - 4:30PM Monday - Friday (Local time)
Panama	Spanish	206-6047	8AM - 5PM Monday - Friday (Local time)
Peru	Spanish	0-800-50-866	7AM - 8PM Monday - Friday (Local time)
Philippines	English	1800-1888-1426	9AM - 5PM Monday - Friday (Local time)
Poland	--	+48-22-878-6999	--
Portugal	Portuguese	+351-21-892-7147	9AM - 5PM Monday - Friday (Local time)
Russian Federation	Russian	+7-095-940-2000	--
Singapore	English	1800-3172-888	8AM - 6:30PM Monday - Friday (Local time)
Slovakia	--	+421-2-4954-1217	--
Slovenia	--	+386-1-5830-050	--
Spain	Spanish	+34-91-714-7983	9AM - 5PM Monday - Friday (Local time)
Sri Lanka	English	+94-11-2448-442 +94-11-2421-066 +94-11-2493-500	8:30AM - 5PM Monday - Friday (Local time) Except Holidays
Sweden	Swedish	+46-8-477-4420	8:30AM - 4:30PM Monday - Friday (Local time)
Switzerland	German, French, Italian	+41-58-333-0971	9AM - 5PM Monday - Friday (Local time)
Taiwan	Mandarin	886-2-8723-9799	24 hours/day, 7 days/week
Thailand	Thai	1-800-299-229	8AM - 6PM Monday - Friday (Local time) Except Holidays
Turkey	Turkish	00800-211-4032 +90-212-317-1760	9AM - 6PM Monday - Friday (Local time)
United Kingdom	English	+44-1475-555-055	9AM - 5:30PM Monday - Friday (Local time)

Country or Region	Language	Telephone Number	Hours of operation
United States	English	1-800-IBM-SERV (1-800-426-7378)	24 hours/day, 7 days/week
Uruguay	Spanish	000-411-005-6649	9AM - 10PM Monday - Friday (Local time)
Venezuela	Spanish	0-800-100-2011	8AM - 9PM Monday - Friday (Local time)
Vietnam	English/Vietnamese	Ho Chi Minh = (848) 824-1474 Hanoi = (844) 842-6316	9AM - 5PM Monday - Friday (Local time)

Appendix E. Guarantee supplement for Mexico

This supplement is considered part of IBM's Statement of Limited Warranty and shall be effective solely and exclusively for products distributed and commercialized within Territory of the Mexican United States. In the event of a conflict, the terms of this supplement shall apply.

All software programs pre-loaded in the equipment shall only have a thirty- (30) day guarantee for installation defects from the date of purchase. IBM is not responsible for the information in such software programs and/or any additional software programs installed by you or installed after purchase of the product.

Services not chargeable to the guarantee shall be charged to the final user, prior an authorization.

In the event that warranty repair is required please call the IBM Support Center at 001-866-434-2080, where you will be directed to the nearest Authorized Service Center. Should no Authorized Service Center exist in your city, location or within 70 kilometers of your city or location, the guarantee includes any reasonable delivery charges related to the transportation of the product to our nearest Authorized Service Center. Please call the nearest Authorized Service Center to obtain the necessary approvals or information concerning the shipment of the product and the shipment address.

To obtain a list of Authorized Service Centers, please visit:
http://www.pc.ibm.com/la/centros_de_servicio/servicio_mexico/servicio_mexico.html

Manufactured by:
SCI Systems de México, S.A. de C.V.
Av. De la Solidaridad Iberoamericana No. 7020
Col. Club de Golf Atlas
El Salto, Jalisco, México
C.P. 45680,
Tel. 01-800-3676900

Marketing by:
IBM de México, Comercialización y
Servicios, S. A. de C. V.
Alfonso Nápoles Gándara No 3111
Parque Corporativo de Peña Blanca
Delegación Álvaro Obregón
México, D.F., México
C.P. 01210,
Tel. 01-800-00-325-00

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Electronic emission notices

IBM400/800GB LTO3 Tape Drive

Federal Communications Commission (FCC) statement

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

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

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

Industry Canada Class A emission compliance statement

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

Avis de conformite a la reglementation d'Industrie Canada

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

Deutschsprachiger EU Hinweis:

Hinweis für Geräte der Klasse A EU-Richtlinie zur Elektromagnetischen Verträglichkeit Dieses Produkt entspricht den Schutzanforderungen der EU-Richtlinie 89/336/EWG zur Angleichung der Rechtsvorschriften über die

elektromagnetische Verträglichkeit in den EU-Mitgliedsstaaten und hält die Grenzwerte der EN 55022 Klasse A ein. Um dieses sicherzustellen, sind die Geräte wie in den Handbüchern beschrieben zu installieren und zu betreiben. Des Weiteren dürfen auch nur von der IBM empfohlene Kabel angeschlossen werden. IBM übernimmt keine Verantwortung für die Einhaltung der Schutzanforderungen, wenn das Produkt ohne Zustimmung der IBM verändert bzw. wenn Erweiterungskomponenten von Fremdherstellern ohne Empfehlung der IBM gesteckt/eingebaut werden. EN 55022 Klasse A Geräte müssen mit folgendem Warnhinweis versehen werden: "Warnung: Dieses ist eine Einrichtung der Klasse A. Diese Einrichtung kann im Wohnbereich Funk-Störungen verursachen; in diesem Fall kann vom Betreiber verlangt werden, angemessene Maßnahmen zu ergreifen und dafür aufzukommen."

Deutschland: Einhaltung des Gesetzes über die elektromagnetische Verträglichkeit von Geräten Dieses Produkt entspricht dem "Gesetz über die elektromagnetische Verträglichkeit von Geräten (EMVG)". Dies ist die Umsetzung der EU-Richtlinie 89/336/EWG in der Bundesrepublik Deutschland.

Zulassungsbescheinigung laut dem Deutschen Gesetz über die elektromagnetische Verträglichkeit von Geräten (EMVG) vom 18. September 1998 (bzw. der EMC EG Richtlinie 89/336) für Geräte der Klasse A Dieses Gerät ist berechtigt, in Übereinstimmung mit dem Deutschen EMVG das EG-Konformitätszeichen - CE - zu führen. Verantwortlich für die Konformitätserklärung nach Paragraf 5 des EMVG ist die IBM Deutschland GmbH, 70548 Stuttgart.

Informationen in Hinsicht EMVG Paragraf 4 Abs. (1) 4:

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

Europen Union - EMC 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 A Information Technology Equipment according to CISPR 22/European Standard EN 55022. The limits for Class A equipment were derived for commercial and industrial environments to provide reasonable protection against interference with licensed communication equipment.

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

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 A 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.

Avertissement : Ceci est un produit de Classe A. Dans un contexte résidentiel, ce produit peut causer une interférence radio exigeant que l'utilisateur prenne des mesures adéquates.

Union Europea - Normativa EMC

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.

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.

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

Avvertimento: Questso è un prodotto appartenente alla Classe A. In ambiente domestico, tale prodotto può essere causa di interferenze radio, nel qual caso l'utente deve prendere misure adeguate.

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 A de conformidad con el Estándar CISPR22 y el Estándar Europeo EN 55022. Los límites para los equipos de Clase A se han establecido para entornos comerciales e industriales a fin de proporcionar una protección razonable contra las interferencias con dispositivos de comunicación licenciados.

Advertencia: Este es un producto de Clase A. En un entorno doméstico este producto podría causar radiointerferencias en cuyo caso el usuario deberá tomar las medidas adecuadas.

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