IBM TotalStorage Ultrium Tape Autoloader 3581
Models L13, H13, L23, and H23

# Setup, Operator, and Service Guide

GA32-0461-00

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**Note!**

Before using this information and the product it supports, read the information in "Safety and Environmental Notices" on page xi and "Notices" on page 153.

To ensure that you have the latest publications, visit the web at `http://www.ibm.com/storage/lto` and select either Technical Support or LTO Support.

**First Edition (June 2003)**

This edition applies to the *IBM 3581 Ultrium Tape Autoloader Models L13, H13, L23, and H23 Setup, Operator, and Service Guide* and to all subsequent releases and modifications until otherwise indicated in new editions.

The IBM® 3581 Ultrium Tape Autoloader Models L13, H13, L23, and H23 offer a 3-year parts-only warranty. Models L13, H13, L23, and H23 are supported by the Customer Replaceable Unit (CRU) process. For details about the CRU process and customer responsibilities, see the warranty that is included with your ship group.

# Read This First

This is the first edition of the *IBM TotalStorage Ultrium Tape Autoloader 3581 Setup, Operator, and Service Guide Models L13, H13, L23, and H23* (June 2003).

## LTO Subscriptions

Subscribe to IBM Linear Tape-Open (LTO) Technical support e-news to receive technical support information by e-mail. Some of the information you may receive includes information regarding recent downloads, FAQs, troubleshooting tips, technical documentation, Web updates, utilities and tools, and warranty information. To subscribe visit the web at `http://www.ibm.com/storage/lto` and click on Technical Support.

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- Exact publication title
- Form number (for example, GA32–1234–02) or part number (located on the back cover)
- Page numbers to which you are referring

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# Safety and Environmental Notices

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

Most danger or caution notices contain a reference number (RSFTDxxx or RSFTCxxx). Use the reference number to check the translation in *IBM Externally Attached Devices Safety Information*, SA26-2004.

The sections that follow define each type of safety notice and give examples.

## Danger Notice

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. A sample danger notice follows:

**DANGER**

**An electrical outlet that is not correctly wired could place hazardous voltage on metal parts of the system or the products that attach to the system. It is the customer's responsibility to ensure that the outlet is correctly wired and grounded to prevent an electrical shock.** *(RSFTD201)*

## Caution Notice

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 II | 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). |

| If the symbol is... | It means.... |
| --- | --- |
|  | A hazardous condition due to mechanical movement in or around the product. |
|  | A hazardous condition due to the weight of the unit. Weight symbols are accompanied by an approximation of the product's weight. |

Sample caution notices follow:

**CAUTION:**
**The controller card contains a lithium battery. To avoid possible explosion, do not burn, exchange, or charge the battery. Discard the controller card as instructed by local regulations for lithium batteries.** *(RSFTC228)*

**CAUTION:**
**Do not attempt to use the handle on the module to lift the entire device (module and enclosure) as a unit. First remove the module; then, use two hands to lift the enclosure.** *(72XXC356)*


**CAUTION:**
**This product complies with the performance standards set by the U.S. Food and Drug Administration for a Class II and IEC825 Laser Product. Avoid prolonged staring into the laser beam.**


**CAUTION:**
**The weight of this part or unit is between 18 and 32 kilograms (39.7 and 70.5 pounds). It takes two persons to safely lift this part or unit.** *(RSFTC204)*

**CAUTION:**
**This assembly contains mechanical moving parts. Use care when servicing this assembly.**

## Attention Notice

An attention notice indicates the possibility of damage to a program, device, or system, or to data. An exclamation point symbol may accompany an attention notice, but is not required. Sample attention notices follow:

**Attention:** If you use a power screwdriver to perform this procedure it could destroy the tape.

**Attention:** Do not operate the 3581 Tape Autoloader in a poor air-quality environment.

## Performing the Safety Inspection Procedure

Before you service the 3581 Tape Autoloader, perform the following safety inspection procedure:

1. Stop all activity on the SCSI bus.
2. Turn off the power to the autoloader.
3. Disconnect the SCSI cable and check the SCSI bus terminator for damage.
4. Unplug the autoloader's power cord from the electrical outlet.
5. Check the autoloader's power cord for damage, such as a pinched, cut, or frayed cord.
6. Check the autoloader's SCSI bus (signal) cable for damage.
7. Check the cover of the autoloader for sharp edges, damage, or alterations that expose its internal parts.
8. Check the cover of the autoloader for proper fit. It should be in place and secure.
9. Check the product label on the bottom of the autoloader to make sure it matches the voltage at your outlet.

## End of Life (EOL) Plan

This box 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. In some areas IBM may provide a product take-back program that ensures proper handling of the product. For more information, contact your IBM representative.

# Preface

This guide describes how to install and use the IBM 3581 Ultrium Tape Autoloader Models L13, H13, L23, and H23. The 3581 Tape Autoloader All models offers a 3-year warranty. For details about the Customer Replaceable Unit (CRU) process and customer responsibilities, see the warranty that is included with your ship group.

This guide contains the following chapters:

Chapter 1, "Introduction", on page 1 describes the 3581 Tape Autoloader, discusses requirements, and lists hardware specifications.

Chapter 2, "Installing the 3581 Tape Autoloader", on page 7 tells how to unpack and set up the 3581 Tape Autoloader.

Chapter 3, "Operating the 3581 Tape Autoloader", on page 17 describes the operator controls and indicator lights on the 3581 Tape Autoloader. It tells how to load and unload a tape cartridge, as well as how to clean the tape drive's head and the external surface of the autoloader. It also describes how to operate the 3581 Tape Autoloader in random access and sequential access mode.

Chapter 4, "Using the Media", on page 33 describes the types of tape cartridges to use in the 3581 Tape Autoloader. It describes the bar code and the bar code label used on the cartridge, and defines how to store, ship, and handle cartridges. It also gives instructions for setting the write-protect switch and ordering additional cartridges.

Chapter 5, "Troubleshooting", on page 53 gives tips about solving problems with the 3581 Tape Autoloader, describes the messages and error codes that display, and includes a flowchart to help you analyze when the 3581 Tape Autoloader requires maintenance.

Chapter 6, "Removal and Replacement Procedures", on page 73 gives procedures for removing or replacing the 3581 Tape Autoloader or the bar code reader.

Chapter 7, "Parts Lists", on page 79 lists the parts, part numbers, feature codes, ordering information, and power cable information for the 3581 Tape Autoloader.

Appendix A, "Diagnostic and Maintenance Functions", on page 85 describes the diagnostics and maintenance procedures that you can use to identify and correct problems with the 3581 Tape Autoloader.

Appendix B, "Removing a Tape Cartridge", on page 99 shows how to remove a tape cartridge that has become stuck in the tape drive.

Appendix C, "Bar Code Reader Installation (optional)", on page 109 shows how to install the device that reads the bar code on the LTO Ultrium Tape Cartridges.

Appendix D, "Rack Installation", on page 113 gives instructions for installing the 3581 Tape Autoloader into a rack.

Appendix E, “SCSI Element Addresses”, on page 125 provides the SCSI element addresses for the storage slots, drive, and robotics interface (picker) in an IBM 3581 Tape Autoloader that uses Windows 2000 or another operating system. It also describes the effect that a bar code reader has on the addresses.

Appendix F, “TapeAlert Flags”, on page 129 lists TapeAlert messages that are supported by the 3581 Tape Autoloader and that may help you to determine problems.

Appendix G, “Messages”, on page 133 lists error obtaining and error fixing information for the 3581 Tape Autoloader.

Appendix H, “Sense”, on page 143 lists library sense data, drive sense data, and information on using host sense data for the 3581 Tape Autoloader.

Store this guide with your server’s manuals.

## Related Publications

Refer to the following publications for additional information about the 3581 Tape Autoloader. To ensure that you have the latest publications, visit the web at `http://www.ibm.com/storage/lto` and select either Technical Support or LTO Support.

- *IBM 3581 Ultrium Tape Autoloader Quick Reference*, GX35-5070, illustrates how to configure and operate the 3581 Tape Autoloader.
- *IBM 3581 Ultrium Tape Autoloader SCSI Reference*, WB1105, provides the supported SCSI commands and protocol that govern the behavior of the SCSI interface for the 3581 Tape Autoloader.
- *IBM Ultrium Device Drivers Installation and User’s Guide*, GA32-0430, provides instructions for attaching IBM-supported hardware to open-systems operating systems. It indicates what devices and levels of operating systems are supported, gives the requirements for adapter cards, and tells how to configure servers to use the device driver with the Ultrium family of devices.
- *IBM TotalStorage Ultrium Device Drivers Programming Reference*, GC35-0483, supplies information to application owners 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. To order by using File Transfer Protocol (FTP), visit `ftp://ftp.software.ibm.com/storage/devdrvr`.
- *IBM Externally Attached Devices Safety Information*, SA26-2004, provides translations of danger and caution notices.
- *SCSI-3 Stream Commands (SSC)*, published by the American National Standards Institute and available on the web at `http://www.t10.org`.
- *SCSI Primary Commands-2 (SPC-2)*, published by the American National Standards Institute and available on the web at `http://www.t10.org`.

# Chapter 1. Introduction

The IBM 3581 Ultrium Tape Autoloader (see Figure 1) is a high-performance, high-capacity data-storage device that connects to and provides additional storage for a wide spectrum of open systems servers. Available as a desktop or rack-mounted unit, the autoloader can contain up to seven tape cartridges. It offers a one-line, 10-character liquid crystal display (LCD) that provides operational information, as well as diagnostics and messages. The 3581 Tape Autoloader is designed to perform unattended backups as well as to retrieve and archive files.

Models L13 and H13 feature:

- Native storage capacity of 100 GB per cartridge (200 GB at 2:1 compression)
- Native sustained data transfer rate of up to 15 MB per second (30 MB at 2:1 compression)
- Formatted capacity of 700 GB (1.4 TB at 2:1 compression)

Models L23 and H23 feature:

- Native storage capacity of 200 GB per cartridge (400 GB at 2:1 compression)
- Native sustained data transfer rate of up to 35 MB per second (70 MB at 2:1 compression)
- Formatted capacity of 1.4 TB (2.8 TB at 2:1 compression)
- Read/write capabilities with 100 GB data cartridges (200 GB at 2:1 compression) with an improved native sustained data transfer rate of up to 20 MB per second (40 MB per second with 2:1 compression)

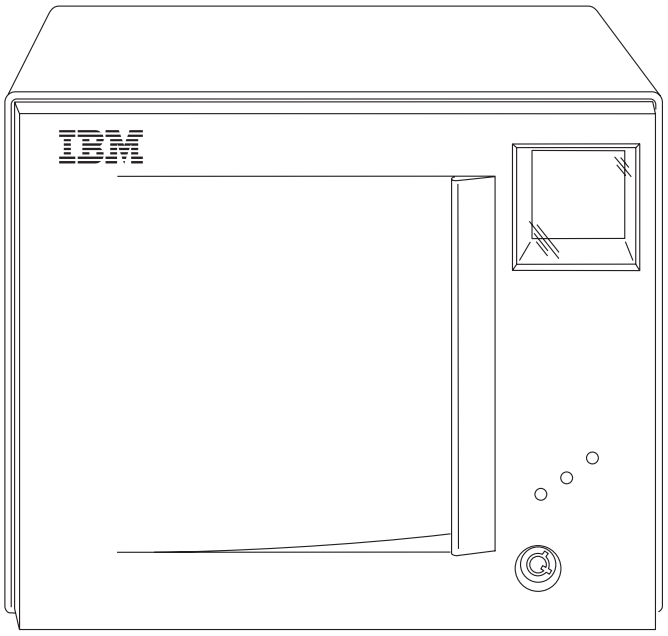


*Figure 1. The IBM 3581 Tape Autoloader*

The 3581 Tape Autoloader comes equipped with one IBM Ultrium Tape Drive and a robotics interface that moves tape cartridges to and from the drive and cartridge

storage slots. Different models of the autoloader are available and vary according to the type of Small Computer Systems Interface (SCSI) each uses to communicate with the server:

- Model L13 uses the Ultra2, Low Voltage Differential/Single Ended (LVD/SE) interface
- Model L23 uses the Ultra160, Low Voltage Differential/Single Ended (LVD/SE) interface
- Models H13 and H23 use the Ultra SCSI, High Voltage Differential (HVD/DIFF) interface

The burst data transfer rate is 80 MB per second for the Model L13 autoloader, 40 MB per second for the Model H13 autoloader, 160 MB per second for the Model L23 autoloader, and 40 MB per second for the Model H23 autoloader.

Computers that do not directly support a SCSI interface (like most personal computers) require a SCSI host adapter card to communicate with the autoloader. For a list of supported adapters, visit the web at `http://www.ibm.com/storage/lto` and select either Technical Support or LTO Support.

The 3581 Tape Autoloader operates in both random access mode (in which the server's application software manages the cartridges) and sequential access mode (in which the autoloader's firmware manages the cartridges).

## Supported Servers and Operating Systems

The 3581 Tape Autoloader is supported by a wide variety of servers (hosts) and operating systems, as well as adapters. These attachments can change throughout the product's life cycle. To determine the latest supported attachments, visit the web at `http://www.ibm.com/storage/lto` and click on Technical Support.

Attachments to the 3581 Tape Autoloader include (but are not limited to) the following:

| Server | Operating System |
|---|---|
| IBM® @server iSeries™ and AS/400® | IBM OS/400® |
| IBM @server pSeries™, RS/6000®, and RS/6000 SP™ | IBM AIX® |
| IBM @server xSeries™ and Netfinity® | Microsoft® Windows NT® and Windows® 2000, Windows 2003, and Red Hat Linux 7.1 kernel 2.4.2-2 |
| HP | Hewlett-Packard HP-UX |
| Intel®-compatible servers | Microsoft Windows NT and Windows 2000, and Red Hat Linux 7.1 kernel 2.4.2-2 |
| Sun | Sun Solaris |

**Important:** Certain AS/400 and iSeries adapters are HVD SCSI and support only one initiator per bus. A SCSI configuration must be a single autoloader and a single host when attached to the AS/400 or iSeries server. For LVD connectivity, visit the web at `http://www.ibm.com/storage/lto` and click on Technical Support.

## Supported Device Drivers

IBM maintains the latest levels of device drivers and driver documentation for the 3581 Tape Autoloader on the Internet. You can access this material from your browser or the IBM FTP site by doing the following:

- Using a browser, type one of the following:

  `http://www.ibm.com/storage/lto/` and click on Technical Support

  `ftp://ftp.software.ibm.com/storage/devdrvr`

  `ftp://207.25.253.26/storage/devdrvr`

- From an IBM FTP site, enter the following specifications:

  FTP site: `ftp.software.ibm.com`

  IP Addr: `207.25.253.26`

  Userid: `anonymous`

  Password: (use your current e-mail address)

  Directory: `/storage/devdrvr`

**Note:** If you do not have Internet access and you need information about device drivers, contact your IBM Marketing Representative.

IBM provides PostScript- and PDF-formatted versions of its documentation in the /storage/devdrvr directory:

- IBM_ultrium_tape_IUG.ps and IBM_ultrium_tape_IUG.pdf contain the current version of the *IBM Ultrium Device Drivers Installation and User's Guide*.
- IBM_ultrium_tape_PROGREF.ps and IBM_ultrium_tape_PROGREF.pdf contain the current version of the *IBM TotalStorage Ultrium Device Drivers Programming Reference*.

Device drivers for each supported server are beneath /storage/devdrvr/ in the following directories (the device driver for the AS/400 is included in the OS/400 operating system).

- AIX/
- HPUX/
- Linux/
- Solaris/
- Windows/WinNT/
- Windows/Win2000/
- Windows/Win2003/

For more information about device drivers, refer to any of the preceding device driver operating system directories.

## TapeAlert Support

The 3581 Tape Autoloader is compatible with TapeAlert technology, which provides error and diagnostic information to the server. For more information, see Appendix F, "TapeAlert Flags", on page 129.

## Specifications

Table 1 gives the specifications for the 3581 Tape Autoloader. Specifications for tape cartridges are given in "Environmental and Shipping Specifications for Tape Cartridges" on page 41.

*Table 1. Specifications for the 3581 Tape Autoloader*

| **Physical Specifications** | | | |
|---|---|---|---|
| Width | 21.9 cm (8.62 in.) | | |
| Depth | 58.1 cm (22.87 in.) | | |
| Height | 19.0 cm (7.48 in.) | | |
| Weight | 13.0 Kg (28.7 lb) | | |
| **Power Specifications** | | | |
| AC line voltage | 100 to 240 Vac | | |
| Line frequency | 50 to 60 Hz | | |
| Line current at 100 Vac | 1.3 A | | |
| Line current at 240 Vac | 0.7 A | | |
| Maximum heat output | 113 Cal/Hr (131 W) | | |
| In-rush current | 30 A at 208 Vac<br>25 A at 120 Vac | | |
| **Noise Specifications** | | | |
| Maximum noise level | 60 db (idling)<br>62 db (operating) | | |
| **Environmental Specifications** | | | |
| **Environmental Factor** | **Operating** | **Storage** | **Shipping** |
| Temperature | 10 to 38°C<br>(50 to 100°F)<br>(See Note) | –40 to 60°C<br>(–40 to 140°F) | –40 to 60°C<br>(–40 to 140°F) |
| Relative humidity (noncondensing) | 20 to 80% | 10 to 90% | 10 to 90% |
| Wet bulb | 26°C<br>(79°F) | Noncondensing | Noncondensing |
| **Note:** The operating environment of the 3581 Tape Autoloader must not conflict with the media storage requirements (see "Environmental and Shipping Specifications for Tape Cartridges" on page 41). While the autoloader may be capable of operating at elevated temperatures for an extended period of time, the temperature could shorten the useful life of media that is stored in the autoloader. If media is stored in the autoloader for more than 10 hours, the storage temperature requirements for media should be met. It should be assumed that media stored in the autoloader will be 2 degrees above ambient room temperature when the autoloader is powered on. | | | |

## Tape Drive Performance

Table 2 lists the drive performance characteristics of the Ultrium Tape Drives.

*Table 2. Performance characteristics of the Ultrium Tape Drives*

| Performance Characteristic | Tape Drive | |
|---|---|---|
| | **Ultrium 2 Tape Drive** | **Ultrium 1 Tape Drive** |
| Native sustained data rate | 35 MB/s (with Ultrium 2 media) | 15 MB/s |
| | 20 MB/s (with Ultrium 1 media) | |
| Compressed data rate (at 2:1 compression) | 70 MB/s (with Ultrium 2 media) | 30 MB/s |
| | 40 MB/s (with Ultrium 1 media) | |
| Maximum sustained data rate (at maximum compression) | 110 MB/s | 60 MB/s |
| Burst data rate for Low Voltage Differential (LVD) SCSI drives | 160 MB/s (Ultra160) | 80 MB/s (Ultra2) |
| Burst data rate for High Voltage Differential (HVD) SCSI drives | 40 MB/s (Ultra) | 40 MB/s (Ultra) |
| Nominal load-to-ready time | 15 seconds | 20 seconds |
| Nominal unload time | 15 seconds | 18 seconds |
| Average search time to first byte of data | 49 seconds | 73 seconds |
| **Note:** All sustained data rates are dependent on the capabilities of the interconnect (for example, an Ultra SCSI bus is limited to less than 40 MB/s). | | |

# Chapter 2. Installing the 3581 Tape Autoloader

**Attention:**

1. The 3581 Tape Autoloader is a customer setup unit. It is the customer's responsibility to install this product.
2. The 3581 Tape Autoloader Models L13, H13, L23 and H23 offer a 3-year warranty. These models are designed as Customer Replaceable Units (CRU). The warranty is a parts-only warranty. For details about the Customer Replaceable Unit process and customer responsibilities, see the warranty that is included with your ship group.

To ensure optimum performance, obtain the latest level of firmware from the web by visiting `http://www.ibm.com/storage/lto`. After you access the web site, select Technical Support to locate and download the firmware. Be sure to verify that you have the latest firmware installed on your machine before you contact IBM for any necessary technical support.

If you choose not to install this product yourself, IBM will install it for a fee. You can purchase installation services by contacting your local IBM Service office or your IBM Business Partner.

To install the 3581 Tape Autoloader on a desktop, complete the following steps. To install the autoloader into a rack, see Appendix D, "Rack Installation", on page 113.

If your order has missing parts or was damaged in shipment, please contact your IBM Business Partner or refer to the Quality Hotline card included with your shipment.

**DANGER**

**An electrical outlet that is not correctly wired could place hazardous voltage on metal parts of the system or the products that attach to the system. It is the customer's responsibility to ensure that the outlet is correctly wired and grounded to prevent an electrical shock.** *(RSFTD201)*

## Step 1. Unpacking the Autoloader

__ 1. If the operating environment differs from the storage environment by 15°C (30°F) or more, let the autoloader acclimate to the surrounding environment for at least 12 hours before opening the shipping carton.

__ 2. Unpack the 3581 Tape Autoloader.

__ 3. Inspect the 3581 Tape Autoloader for shipping damage. If there is damage, do not install the autoloader. Report the damage immediately by contacting your place of purchase.

__ 4. Remove the two keys (duplicates) that are taped to the rear panel, then unlock and open the front door (see the instructions in "Front Door" on page 17).

__ 5. Remove the foam shipping block from the cartridge storage area.

__ 6. Inside the 3581 Tape Autoloader and on its floor, locate the label that gives the machine type, model number and serial number of the autoloader. Make a note of these numbers and store them in an easily accessible place. Should you need to contact IBM Technical Support, you will be asked for these numbers.

## Step 2. Using the Inventory Checklist

Ensure that you have received the following items:

__ 1. Power cord (for the appropriate cord for your country or region, see "Power Cords" on page 80)
__ 2. IBM LTO Ultrium Data Cartridge
__ 3. IBM LTO Ultrium Cleaning Cartridge
__ 4. Device driver kit that includes:
   - CD that contains the device driver, the *IBM Ultrium Device Drivers Installation and User's Guide*, and the *IBM Ultrium Device Drivers Programming Reference*
   - Published copy of the *IBM Ultrium Device Drivers Installation and User's Guide*
__ 5. A host-to-device SCSI bus (signal) cable and a terminator
__ 6. SCSI wrap tool
__ 7. The *IBM 3581 Ultrium Tape Autoloader Quick Reference*, GX35-5070, illustrates how to configure and operate the 3581 Tape Autoloader
__ 8. The *IBM 3581 Ultrium Tape Autoloader Models L13, H13, L23, and H23 Setup, Operator, and Service Guide* (this guide)
__ 9. The *IBM Externally Attached Devices Safety Information* manual
__ 10. The Limited Statement of Warranty
__ 11. The Quality Hotline card

## Step 3. Positioning the Tape Autoloader

Position the 3581 Tape Autoloader in a location that is away from dust, dirt, and debris, and is convenient to the server. The only restrictions are the length of the power cord and the length of the SCSI cable. Position the autoloader in the following recommended locations:

- Away from high-traffic areas, especially if the floor is carpeted.
- Out of copy rooms to avoid toner and paper dust. Do not store paper supplies next to any unit.
- Away from moving air, such as doorways, open windows, fans, and air conditioners.
- Off the floor.
- In a horizontal position.
- Where the tape cartridge can be easily inserted.

The 3581 Tape Autoloader should not be stacked. Do not place anything on top of the 3581 Tape Autoloader.

## Step 4. Inspecting the Power Cord and Outlet

__ 1. Inspect the power cord plug to ensure that it matches the power receptacle. If it does not match, see "Power Cords" on page 80.

__ 2. Ensure that the electrical outlets that you use are properly grounded and that the circuit breaker is turned on.

## Step 5. Installing the Optional Bar Code Reader

If you ordered a bar code reader at the time that you ordered the 3581 Tape Autoloader, the reader is installed for you at the factory. If you ordered the bar code reader separately, refer to the installation instructions in Appendix C, "Bar Code Reader Installation (optional)", on page 109.

## Step 6. Connecting Power

__ 1. Install a terminator by aligning it with the unused SCSI connector at the rear of the 3581 Tape Autoloader and pushing in until the terminator is seated. Secure the terminator with the attached thumbscrews.

**Note:** The autoloader may not power-on successfully unless the terminator is installed.

__ 2. Plug the power cord into the receptacle at the rear of the 3581 Tape Autoloader (see **1** in Figure 2 on page 10), then plug the other end into a grounded electrical outlet.

__ 3. Open the front door and power-on the 3581 Tape Autoloader by pressing and releasing the POWER button ( **2** in Figure 2 on page 10). When the autoloader completes the Power-On Self Tests (POSTs) for the drive and the library, a message appears in the message display **3** . The message varies, depending on the autoloader's mode of operation:

- If the autoloader is operating in random access mode (the default mode), **LdR READY** displays.
- If the autoloader is operating in sequential access mode and is not loaded with cartridges, **SEQ dONE** displays.
- If the autoloader is operating in sequential access mode and is loaded with cartridges, **SEQ READY** displays.

For information about the autoloader's mode of operation, see "Operating in Random Access or Sequential Access Mode" on page 28.

If a failure occurred, **ROboT POST** or **dRIVE POST** displays. For assistance, contact your place of purchase for problem determination or machine replacement.

**Note:** When the 3581 Tape Autoloader is powered on, the POWER light is on (see "POWER Button" on page 18).

__ 4. Power-off the 3581 Tape Autoloader by pressing and holding the POWER button for 2 seconds.

1 Power receptacle
2 POWER button
3 Message display

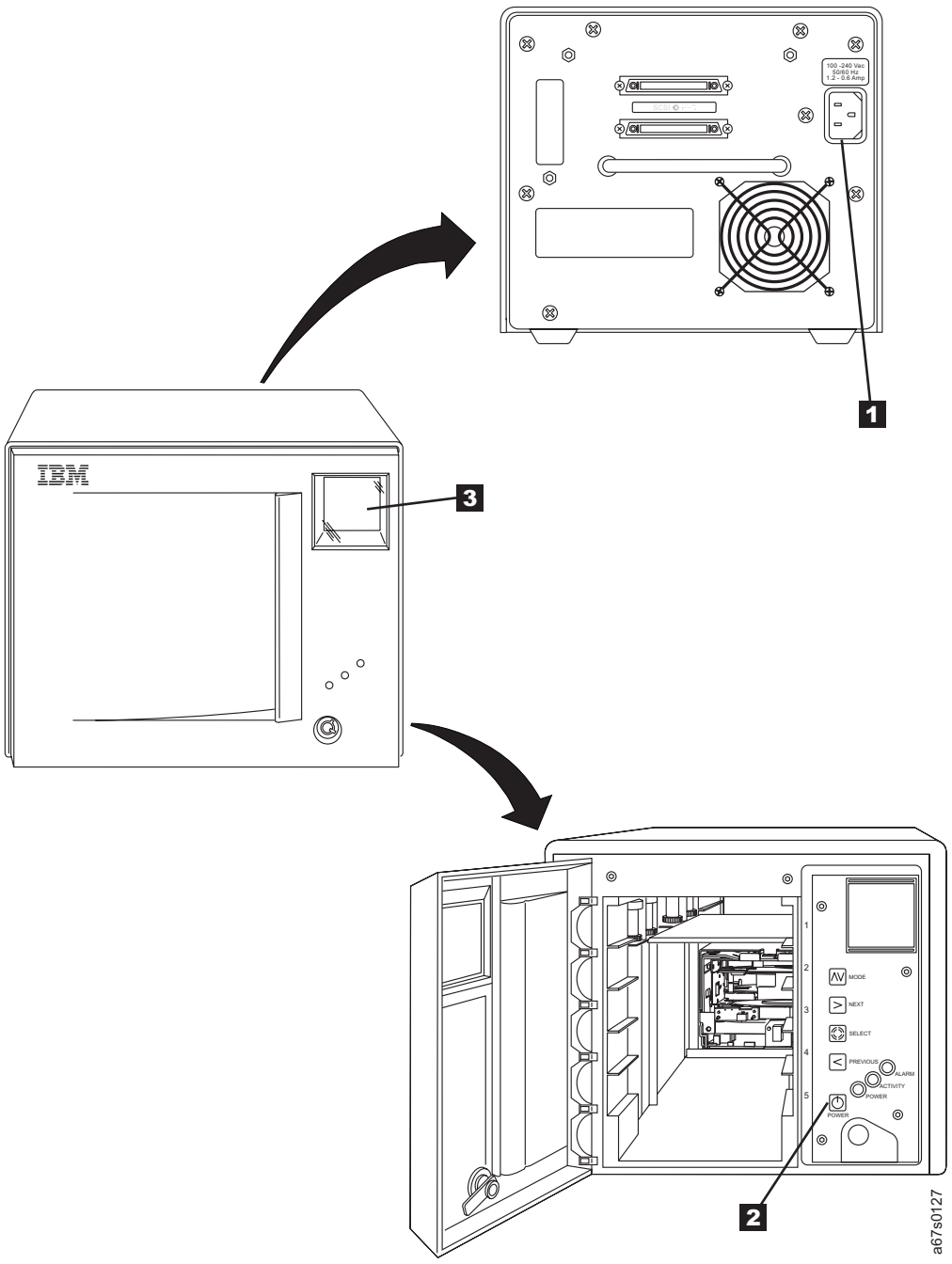


*Figure 2. Connecting power to the 3581 Tape Autoloader*

## Step 7. Setting the SCSI IDs of the Autoloader and the Drive

The 3581 Tape Autoloader consists of two SCSI devices: the autoloader and the drive. The default settings for the SCSI IDs are LdR Id 1 (for the autoloader) and dRV Id 3 (for the drive). Depending on your requirements, you may need to change the SCSI ID default settings for your installation. When setting a SCSI ID:

- Do not select an ID that is already in use.
- Do not select the SCSI ID of the SCSI host adapter card. The priority of this ID is usually higher than any device on the SCSI bus. Generally, the SCSI ID for the host adapter is set to 7.
- Unless you choose another operation, the 3581 Tape Autoloader times out 150 seconds after each operation and **LdR READY** appears in the message display (see "Message Display" on page 19).
- If you are using an AS/400 or iSeries server and you want to boot from the autoloader's drive, set the SCSI ID of the drive to 0.
- Record the SCSI IDs and all other autoloader settings on the Vital Product Data form. See Appendix I, "Vital Product Data", on page 151.

## Determining the Existing ID

To determine the existing SCSI ID for the autoloader and for the drive, perform the following steps:

1. Repeatedly press the MODE button ( **1** in Figure 3 on page 12) until **SET SCSI** appears on the message display.

   **Note:** You cannot scroll backward to view or select a previous function or message. To return to a previous item, continue to press MODE until the function or message that you want redisplays.
2. Press the SELECT button **3**. The message **LdR SCSI** displays to indicate that you are requesting the SCSI ID of the autoloader (rather than the SCSI ID of the drive).
3. Press SELECT. **LdR Id X** displays, where **X** is the current SCSI ID of the autoloader.
4. Press SELECT. The message **dRV SCSI** displays to indicate that you are requesting the SCSI ID of the drive (rather than the SCSI ID of the autoloader).
5. Press SELECT. **dRV Id XX** displays, where **XX** is the current SCSI ID of the drive.

**Note:** If you want to skip the steps for determining the SCSI ID of the autoloader and go directly to determining the SCSI ID of the drive, press NEXT **2** after step 2.

## Changing the ID

To change a SCSI ID setting, perform the following steps:

1. Repeatedly press the MODE button ( **1** in Figure 3 on page 12) until **SET SCSI** appears on the message display.
2. Press the SELECT button **3**. The message **LdR SCSI** displays to indicate that you are changing the SCSI ID of the autoloader (rather than the SCSI ID of the drive).

   **Note:** If you want to skip the steps for changing the SCSI ID of the autoloader and go directly to changing the SCSI ID of the drive, press NEXT **2**.

1 MODE button
2 NEXT button
3 SELECT button
4 PREVIOUS button

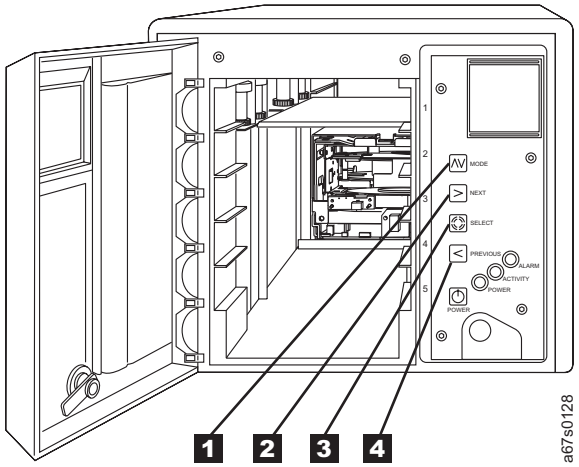


*Figure 3. Using the control buttons to determine or change a SCSI ID*

3. Press SELECT. **LdR Id X** displays (where **X** equals the current SCSI ID of the autoloader).
4. Press the NEXT or PREVIOUS 4 button until the ID that you want displays.
5. Press SELECT to accept the new ID for the autoloader. The message **dRV SCSI** displays to indicate that you may now change the SCSI ID of drive (rather than the SCSI ID of the autoloader).
6. Press SELECT. **dRV Id X** displays (where **X** equals the current SCSI ID of the drive).
7. Press the NEXT or PREVIOUS button until the ID that you want displays.
8. Press SELECT to accept the new ID for the drive. **CYCLE PWR** blinks on the message display for approximately 5 seconds.
9. Press and hold the POWER button for 2 seconds to power-off the 3581 Tape Autoloader.
10. Wait a few seconds, then press the POWER button again to power-on the 3581 Tape Autoloader.
    - If the Power-On Self Test (POST) completes successfully, **LdR READY** appears in the message display. The new SCSI ID is now in effect. Note that you may need to reconfigure your server's application software for the server to recognize the new ID.
    - If the POST fails, **ROBOT POST** or **dRIVE POST** appears in the message display. To resolve the problem, see Chapter 5, "Troubleshooting", on page 53.

## Step 8. Setting the Operating Mode

The 3581 Tape Autoloader can operate in one of two modes:

- Random access mode (in which the server controls both the tape drive and the media changer)
- Sequential access mode (in which the server controls only the tape drive)
- Record the operating mode and other autoloader settings on the Vital Product Data form. See Appendix I, "Vital Product Data", on page 151.

Most applications use random mode, which is the default and is represented on the message display as **LdR READY**. This mode enables your host application software to access any tape cartridge randomly and permits you to logically divide the cartridge usage to satisfy particular storage needs.

In sequential mode, the picker loads the first cartridge in a sequence. Then that cartridge is filled with data, the autoloader unloads the cartridge and loads the next cartridge in the sequence. This process continues until all of the cartridges have been processed. Sequential mode is represented on the message display as **SEQ READY**.

To change the mode of operation, perform the following steps:

1. Ensure that **LdR READY** or **SEQ READY** appears on the message display.
2. Press and hold the NEXT button and then the MODE button until **dIAG MENU** appears on the message display (approximately 5 seconds).
3. Press MODE until **CHG MOdE** appears on the message display.
4. Press SELECT to display the current mode of operation.
5. Press NEXT or PREVIOUS to toggle the mode between **SEQUENTIAL** and **RANdOM**.
6. Choose the mode that you want and press SELECT. **CYCLE PWR** blinks on the message display. If you changed to random mode, **LdR READY** then displays; if you changed to sequential mode, **SEQ READY** then displays.
7. To activate the new mode of operation, cycle power (turn off, then on) to the 3581 Tape Autoloader (see "POWER Button" on page 18).

## Step 9. Installing the SCSI Host Adapter Card (if required)

If there are no other devices attached to your server (host), you may need to install a SCSI host adapter card in the server. To determine whether your server uses an LVD/SE (single ended) or HVD/DIFF (differential) SCSI host adapter card, examine the label between the two SCSI connectors at the rear of the 3581 Tape Autoloader:

- If  appears on the label, your server needs an LVD/SE SCSI host adapter card.
- If  appears on the label, your server needs an HVD/DIFF SCSI host adapter card.

To install an adapter, refer to the instructions that accompany it, as well as to the section about SCSI card installation in your server's documentation. For a list of supported adapters and required interposers, visit the web at `http://www.ibm.com/storage/lto` and select Technical Support or LTO Support.

Although the LVD/SE hardware in the 3581 Tape Autoloader Model L13 and L23 is capable of operating in the single-ended (SE) mode, SE operation is not recommended or supported.

## Step 10. Installing Device Drivers

A device driver is firmware that enables the 3581 Tape Autoloader to interact with a variety of servers. Install device drivers for the 3581 Tape Autoloader as follows:

**Attention:** If you use the 3581 Tape Autoloader with a commercial software application, IBM recommends that you do not install any device driver from the CD that was shipped with the autoloader, as conflicts could occur over which driver controls the autoloader. Only install a device driver from the CD if the instructions from your commercial software application tell you to do so.

- If you intend to use the 3581 Tape Autoloader with an existing or new commercial software application (such as Tivoli® Storage Manager, Computer Associates ARCserve, VERITAS Backup Exec, or Legato NetWorker), refer to that application's installation instructions to install the device driver and configure the 3581 Tape Autoloader.
- If you do not intend to use the 3581 Tape Autoloader with a commercial software application, install the device driver from the CD that was shipped with the drive. Refer to the installation instructions in the *IBM Ultrium Device Drivers Installation and User's Guide*, which is on the CD and also included in published form. The CD contains drivers and installation instructions for supported operating systems.

For information about element addresses, see Appendix E, "SCSI Element Addresses", on page 125.

## Step 11. Connecting the SCSI Bus Cable

For maximum performance, the quantity of tape drives that you can attach to one SCSI bus is limited, and is based on the type of bus that you have and the amount of data compression achieved. See "Tape Drive Performance" on page 5. You can attach up to two Model H13 or H23 autoloaders to an Ultra SCSI bus, up to three Model L13 autoloaders to an Ultra2 SCSI bus, and up to three Model L23 autoloaders to an Ultra160 SCSI bus.

**Note:** The AS/400 and iSeries adapters are for the HVD SCSI interface and support only one initiator per bus. Also, the tape drive and changer must be attached to the same SCSI bus. For these and other drive performance reasons, a SCSI configuration must consist of a single autoloader and a single host when attached to an AS/400 or iSeries server.

The SCSI bus cable connects the 3581 Tape Autoloader to the server. You can connect the cable (or the terminator) to either SCSI connector on the 3581 Tape Autoloader. Power to the terminator on the SCSI bus (TERM POWER) is supplied by the robotics interface, not by the drive.

__ 1. Ensure that the 3581 Tape Autoloader is powered off and plugged into the electrical outlet.

__ 2. If the server's SCSI bus is in operation, stop all activity on the bus that you are connecting to (for instructions about how to stop SCSI bus activity, see your server's documentation).

__ 3. Determine the maximum allowable length of your bus cable. The maximum allowable length depends on the type of SCSI bus (LVD or HVD) that you are using:

   - For an LVD bus, do not use a total cabling length that exceeds 12 m (39 ft).
   - For an HVD bus, do not use a total cabling length that exceeds 25 m (82 ft).

   To determine whether your server uses an LVD or HVD SCSI bus, see "Step 9. Installing the SCSI Host Adapter Card (if required)" on page 13.

**Attention:**

a. Do not mix LVD and HVD SCSI host adapters, tape drives, or terminators on the same bus, as they could become damaged.

b. Data transfer protocols for tape and disk drives are very dissimilar. For that reason, IBM strongly recommends that you avoid running tape and disk drives on the same host adapter. A configuration with tape and disk on a single host adapter gives a slow and unreliable performance.

__ 4. Configure your 3581 Tape Autoloader similar to one of the following examples:

- **If the 3581 Tape Autoloader is the only Device on the SCSI Bus:** connect the SCSI bus cable to the server (see Figure 4).

  **Note:** The autoloader actually consists of two devices: the autoloader controller and the tape drive. For illustration purposes, Figure 4 represents the autoloader as one device.

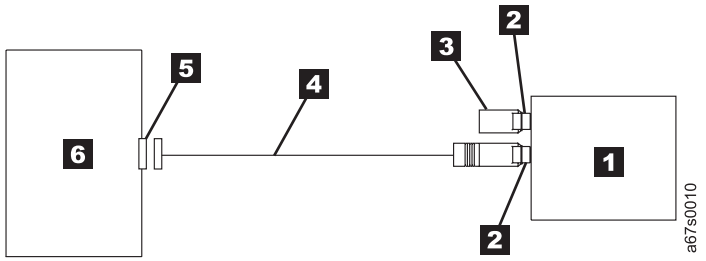


*Figure 4. Example of connecting one SCSI device to the server.* The view is from the top.

| | | | |
|---|---|---|---|
| 1 | 3581 Tape Autoloader | 5 | SCSI host adapter card |
| 2 | SCSI connectors | 6 | Server |
| 3 | Terminator | | |
| 4 | SCSI bus cable | | |

- **If the 3581 Tape Autoloader is One of Multiple Devices on the SCSI Bus:** connect the SCSI bus cable to the next device on the bus, move the terminator to the last device on the bus, then issue the host command to resume operation (see Figure 5).

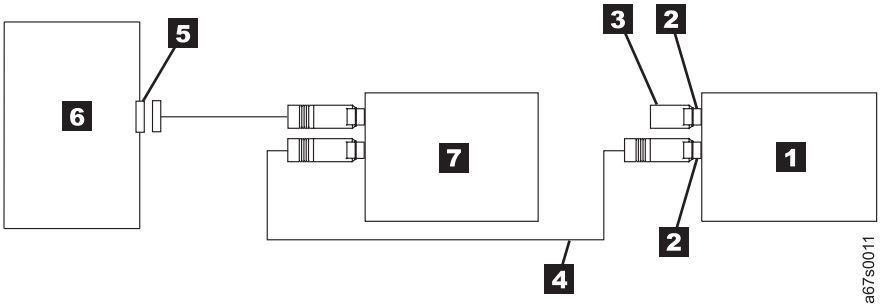


*Figure 5. Example of connecting multiple SCSI devices to the server.* The view is from the top.

| | | | |
|---|---|---|---|
| 1 | 3581 Tape Autoloader | 5 | SCSI host adapter card |
| 2 | SCSI connectors | 6 | Server |
| 3 | Terminator | 7 | Another device |
| 4 | SCSI bus cable | | |

## Step 12. Configuring the 3581 Tape Autoloader to the Server

__ 1. Power-on the 3581 Tape Autoloader.

__ 2. To configure the 3581 Tape Autoloader for use, refer to the documentation for your server and application software.

**Note:** The autoloader must be in random access mode to be configured to the server. While in sequential access mode, the autoloader's robotics is not logically connected to the SCSI bus and does not respond to SCSI commands. To change the autoloader's mode of operation, see "Operating in Random Access or Sequential Access Mode" on page 28.

# Chapter 3. Operating the 3581 Tape Autoloader

This chapter describes the operator controls and indicator lights on the 3581 Tape Autoloader. It also discusses common operating procedures.

## Front Door

The front door (see **1** in Figure 6) provides access for inserting and removing tape cartridges. The autoloader is shipped with the front door locked and two duplicate keys taped to the rear panel. To unlock the door, insert one of the keys into the keylock **2**, turn it one quarter turn clockwise, and remove it from the lock. To open the door, grasp the handle and pull it toward you and to the left. The door opens to the operator panel, cartridge storage slots, and interior of the autoloader.

To close the door, press it inward until it latches. Lock the door by inserting the key into the keylock, turning it one quarter turn counterclockwise, and removing it from the lock.

Do not open the front door of the 3581 Tape Autoloader unless you need to insert or remove media, or issue commands. Unexpected robot motion may occur.

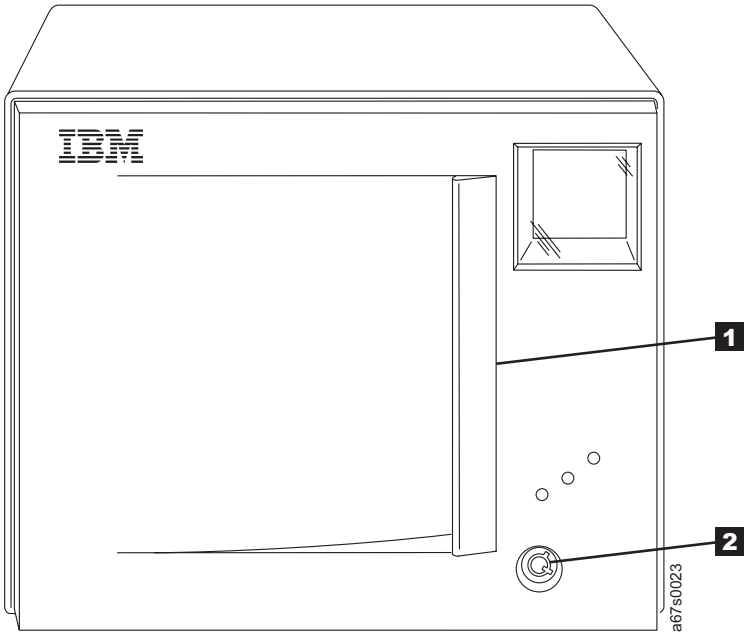


*Figure 6. Front door of the 3581 Tape Autoloader*

## Storage Slots

Open the front door of the autoloader to view the storage slots that hold the tape cartridges. The 3581 Tape Autoloader contains storage slots for up to seven tape cartridges. Five slots are located in the front and two are in the rear (see Figure 7 on page 19). From top to bottom, the front slots are numbered 1 through 5, and the rear slots are numbered 6 and 7. Figure 7 on page 19 shows the front and rear storage slots **1**.

To move media within the 3581 Tape Autoloader, the server must reference each movement with source and target designations. This is done by using element addressing, which specifies precisely which slots are to be used in the autoloader. Appendix E, “SCSI Element Addresses”, on page 125 describes the addressing scheme used by the autoloader.

## Tape Drive and Picker

The 3581 Tape Autoloader houses one IBM Ultrium Tape Drive that reads and writes data to and from tape cartridges, and a picker (robotics interface) that moves the cartridges to and from the drive and the storage slots. Whenever you issue a motion command from the operator panel or the server, the robotics interface causes the picker to move its metal tray up or down within the autoloader and use its front and back picker wheels to slide the cartridge that you specified onto the tray. It then positions the cartridge before the drive or the cartridge storage slot that you specified, and again uses its picker wheels to slide the cartridge into its destination. Figure 7 on page 19 shows the tape drive **2** and the picker **3** .

## Operator Panel

The operator panel (see **4** in Figure 7 on page 19) contains buttons, status lights, and a message display, all of which enable you to operate the 3581 Tape Autoloader. The sections that follow describe the components on the operator panel.

### POWER Button

The POWER button (see **5** in Figure 7 on page 19) is a push button switch that lets you turn the power to the 3581 Tape Autoloader on or off.

- To power-on the autoloader, press and release the POWER button. The messages **LdR INIT**, **dRIVE INIT**, and **LdR REAdY** or **SEQ REAdY** (with cartridges) or **SEQ dONE**(without cartridges) appear in succession on the message display. The ACTIVITY light blinks, then becomes solid. The activity bars appear on the display.
- To power-off the autoloader, press and hold the POWER button for 2 seconds. The message **POWER dOWN** displays. The activity bars and the ACTIVITY light blink slowly to indicate robotic activity as the picker moves to its power-off position.

When the 3581 Tape Autoloader is on, the POWER light is on (see “Status Lights”).

### Status Lights

The 3581 Tape Autoloader features three status lights on the operator panel:

**POWER** The green POWER light ( **6** in Figure 7 on page 19) comes on whenever you turn on the power to the 3581 Tape Autoloader.

**ACTIVITY** The amber ACTIVITY light ( **7** in Figure 7 on page 19) indicates robotic or drive activity. A slowly blinking light indicates robotic activity; a rapidly blinking light indicates drive activity.

**ALARM** The red ALARM light ( **8** in Figure 7 on page 19) comes on whenever an error occurs. For a description of autoloader and drive error messages, see Table 8 on page 61. For a description of drive error codes, see Table 9 on page 66.

| | | | |
|---|---|---|---|
| 1 | Front and rear storage slots | 5 | POWER button |
| 2 | Tape drive | 6 | POWER status light |
| 3 | Picker | 7 | ACTIVITY status light |
| 4 | Operator panel | 8 | ALARM status light |

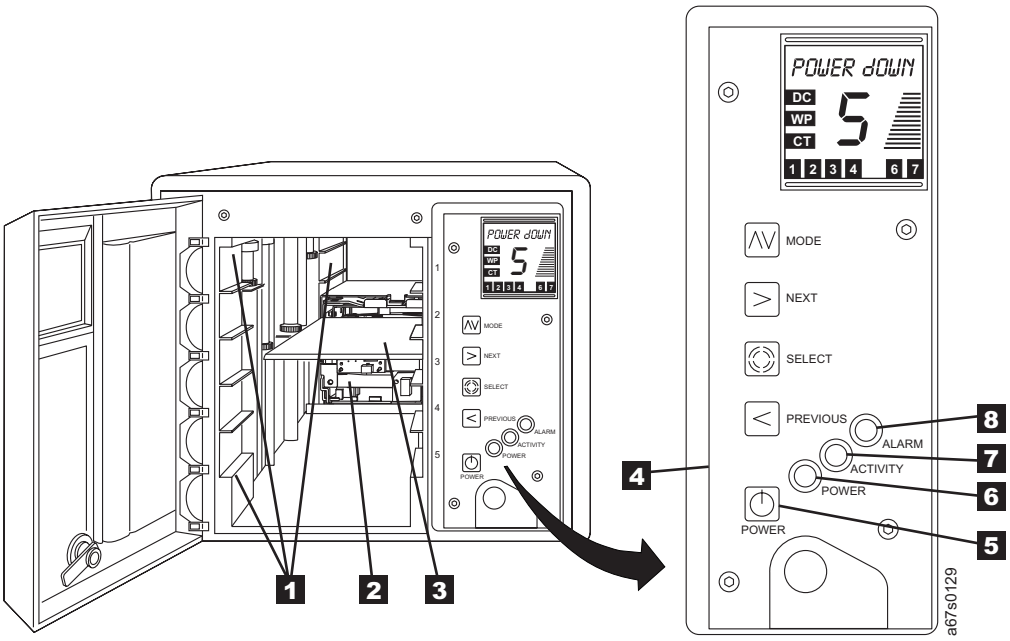


*Figure 7. The 3581 Tape Autoloader with front door open*

## Message Display

The message display ( 1 in Figure 8 on page 20) is a liquid crystal display (LCD) that provides information about the status of the 3581 Tape Autoloader and any error conditions. The message display consists of one 10-character row. When in an idle (nonoperating) state, the autoloader displays **LdR READY** or **SEQ READY** (with cartridges) or **SEQ dONE** (without cartridges). In addition, the following indicators may appear on the left side of the display:

**DC** Indicates that the server issued a command that enables the drive to perform data compression (see 2 ).

**WP** Indicates that a write-protected data cartridge is loaded in the drive (see 3 ).

**CT** Indicates that the drive head needs to be cleaned (see 4 ).

The large field in the center of the display indicates the number of the storage slot from which the picker removed a cartridge for loading into the drive. When an error occurs, **E** (see 5 ) displays in this field and an error message appears on the top line of the message display.

In conjunction with the ACTIVITY status light, the activity bars (see 6 ) indicate robotic and drive activity:

- The bottom bar blinks when no activity is taking place.
- A slow interval between the bars appearing and disappearing indicates robotic activity.

- A fast interval between the bars appearing and disappearing indicates drive activity.

The numeric, cartridge-resident sensor fields at the bottom of the display (see **7**) represent the storage slots and indicate the current cartridge inventory. A field displays only if a cartridge is present in that storage slot.

**1** Message display
**2** DC (data compression) indicator
**3** WP (write-protected) indicator
**4** CT (cleaning) indicator
**5** Error code field
**6** Activity bars
**7** Cartridge-resident sensor fields

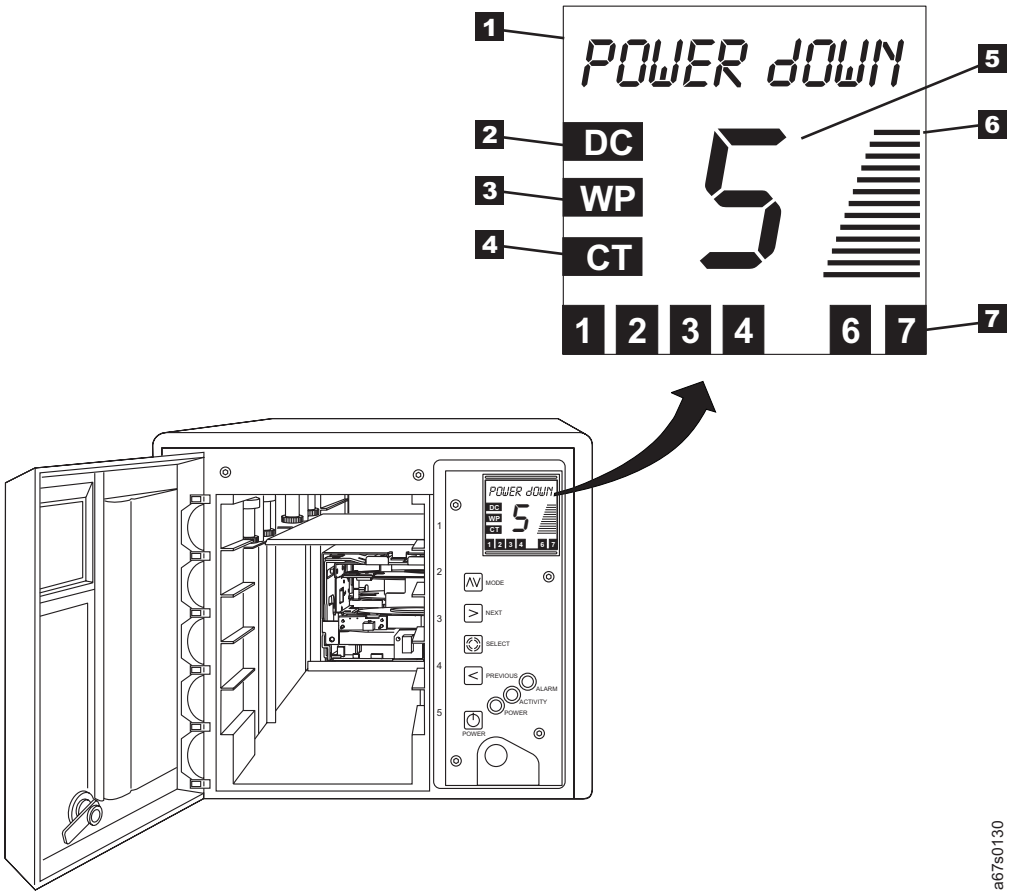


*Figure 8. Message display on the 3581 Tape Autoloader*

## Drive Status Messages

During operation, the 3581 Tape Autoloader places messages about the drive's status in the message display. Table 3 on page 21 lists the messages that can appear.

*Table 3. Drive status messages*

| Message | Description |
|---|---|
| CLEANING | The drive is cleaning the head with the cleaning cartridge. |
| EJECTING | The drive is unloading the tape. |
| ERASING | The drive is erasing the tape. |
| LOAdING | The drive is loading the tape. |
| LOCATING | The drive is locating to a position on the tape. |
| REAdING | The drive is reading from the tape. |
| REWINdING | The drive is rewinding the tape. |
| WRITING | The drive is writing to the tape. |

## Control Buttons

The control buttons (listed as follows and shown in Figure 9) are push buttons that let you interact with the choices on the message display. To operate a button, press and release it.

**MODE**
Scrolls through the commands that you can use to operate the 3581 Tape Autoloader (see **1** ).

**NEXT** Highlights the next item or value in the currently displayed menu. (see **2** ).

**SELECT**
Activates the currently displayed operation (see **3** ).

**PREVIOUS**
Highlights the previous item or value in the currently displayed menu (see **4** ).

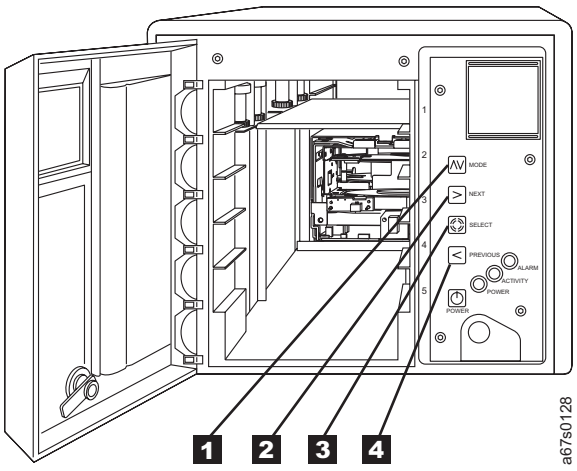


*Figure 9. Control buttons on the 3581 Tape Autoloader*

### Using the Control Buttons to Display Commands

You can use the control buttons to perform the following tasks:

- Load a tape cartridge into a drive (LOAd dRV)

- Eject a tape cartridge from the drive and put it back into the storage slot that it was loaded from (EJECT dRV)
- Load slot 6 from slot 1, or load slot 7 from slot 2 (LOAd SLOT)
- Move a tape cartridge from slot 6 to slot 1, or from slot 7 to slot 2 (EJECT SLOT)
- Eject a tape cartridge that was left in the media picker into an empty destination slot (EJECT PCKR)
- Set the SCSI ID of the autoloader or the drive (SET SCSI)

Figure 10 presents the commands that you can issue by using the control buttons and Table 4 on page 23 gives a description of each command. Note that when selecting a command you can only scroll forward through the choices. If you pass the command that you want, continue to press MODE until the command you want displays again.

**Attention:** During an operation, you must make your selection and press a control button within 150 seconds, or the 3581 Tape Autoloader exits the operation and the message display defaults to **LdR READY** or **SEQ READY** (with cartridges) or **SEQ dONE** (without cartridges).

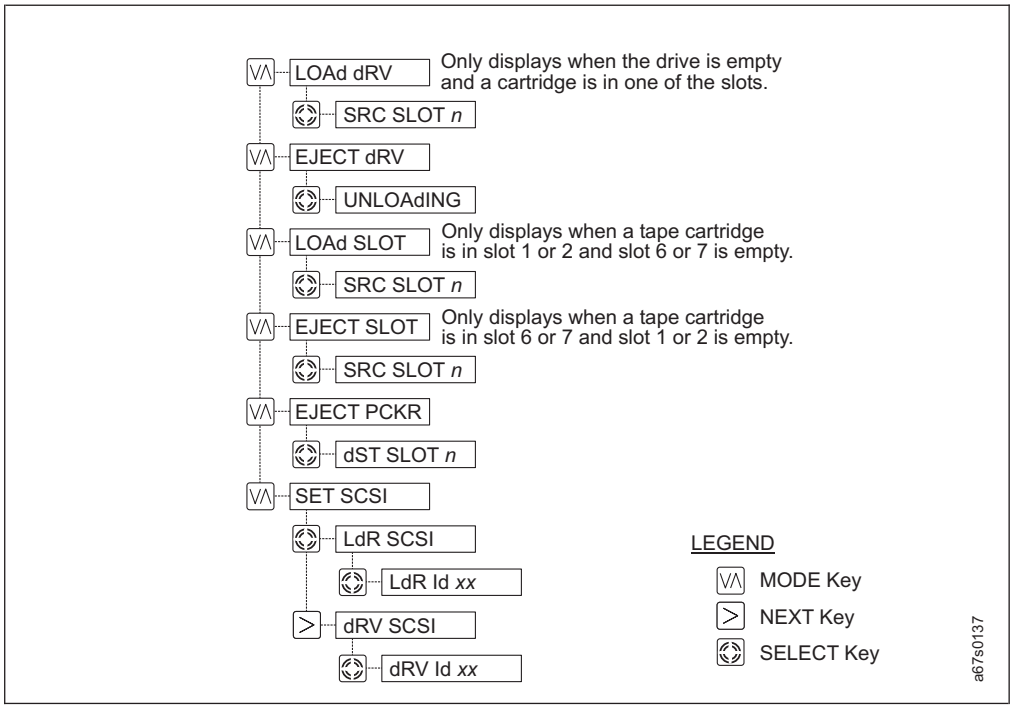


*Figure 10. Commands that are accessed by the control buttons.* Press the appropriate key for the function that you want to perform.

*Table 4. Commands for the 3581 Tape Autoloader*. Use the MODE button to scroll through the list of commands and locate the one that you want.

| **LOAd dRV** |
|---|
| Select LOAd dRV to load a tape cartridge into a drive. (If a cartridge is already in the drive, LOAd dRV is not available and does not appear in the scrolling list of choices; instead, select EJECT dRV.)<br>1. To access the LOAd dRV command, press MODE until `LOAd dRV` appears on the message display.<br>2. Press SELECT. **`SRC SLOT 1`** appears on the message display, indicating that storage slot 1 is the source slot that contains the cartridge to be loaded. If the cartridge that you want to load is not in storage slot 1, press NEXT or PREVIOUS to scroll to the slot that contains the cartridge that you want.<br>3. Press SELECT. The 3581 Tape Autoloader loads the cartridge from the source that you selected into the drive. (If the source slot that you selected is empty, **`RESELECT`** blinks on the message display, indicating that you attempted to select an invalid source slot; **`SRC SLOT 1`** then redisplays while the autoloader waits for you to select a valid source slot.)<br>After completing the task, **`LdR READY`** or **`SEQ READY`** displays and the number of the storage slot from which you selected the cartridge appears in the center of the message display. |
| **EJECT dRV** |
| Select EJECT dRV to eject a tape cartridge from a drive and place it into the storage slot from which it was loaded. If the drive is empty, EJECT dRV is not available and does not appear in the scrolling list of choices. If the storage slot from which it was loaded is occupied, **`RESELECT`** displays on the message display. Select another storage slot to house the cartridge.<br>1. To access the EJECT dRV command, press MODE until **`EJECT dRV`** appears on the message display.<br>2. Press SELECT. **`EJECTING`** appears on the message display while the drive ejects the cartridge.<br>After completing the task, **`LdR READY`** or **`SEQ READY`** displays. |
| **LOAd SLOT** |
| Select LOAd SLOT to load storage slot 6 from slot 1, or storage slot 7 from slot 2. (If both slots 6 and 7 already contain cartridges, LOAd SLOT is not available and does not appear in the scrolling list of choices.)<br>1. Insert one or more cartridges as follows:<br>• If loading slot 6, insert a cartridge into slot 1<br>• If loading slot 7, insert a cartridge into slot 2<br>• If loading both slots 6 and 7, insert cartridges into slots 1 and 2<br>2. To access the LOAd SLOT command, press MODE until **`LOAd SLOT`** appears on the message display.<br>3. Press SELECT. **`SRC SLOT N`** (where **`N`** is either 6 or 7) appears on the message display.<br>4. Press SELECT to move the cartridge from slot 1 to slot 6, or from slot 2 to slot 7.<br>After completing the task, **`LdR READY`** or **`SEQ READY`** displays. |
| **EJECT SLOT** |
| Select EJECT SLOT to move a cartridge from storage slot 6 to slot 1, or from storage slot 7 to slot 2. (If slots 1 or 2 already contain a cartridge and slots 6 or 7 are empty, EJECT SLOT is not available and does not appear in the scrolling list of choices.)<br>1. To access the EJECT SLOT command, press MODE until **`EJECT SLOT`** appears on the message display.<br>2. Press SELECT. **`SRC SLOT N`** (where N is either source slot 6 or 7) appears on the message display. If the source slot is empty, **`RESELECT`** blinks on the message display, indicating that you attempted to select an invalid source slot.<br>3. Press NEXT or PREVIOUS as necessary to choose slot 6 or 7 and to eject the cartridge. The 3581 Tape Autoloader moves the cartridge from the source slot to the destination slot. (The EJECT SLOT command always moves the cartridge in slot 6 to slot 1, and the cartridge in slot 7 to slot 2).<br>After completing the task, **`LdR READY`** or **`SEQ READY`** displays. |

*Table 4. Commands for the 3581 Tape Autoloader (continued).* Use the MODE button to scroll through the list of commands and locate the one that you want.

| **EJECT PCKR** |
|---|
| Select EJECT PCKR to eject a cartridge (which was left in the picker when the 3581 Tape Autoloader was powered-off) to any empty destination slot.<br><br>If you select EJECT PCKR when the picker does not contain a cartridge, **PCKR EMPTY** and a large **E** (indicating an error condition) appears on the message display. Press MODE to return to **LdR REAdY**).<br>1. To access the EJECT PCKR command, press MODE until **EJECT PCKR** appears on the message display.<br>2. Press SELECT. **dST SLOT N** (where **N** is the destination slot that the 3581 Tape Autoloader will move the cartridge to) appears on the message display while the drive ejects the cartridge.<br>3. Press NEXT or PREVIOUS to scroll through the slot choices, and press SELECT when the slot that you want to put the cartridge in displays. If the destination slot is full, **RESELECT** blinks on the message display, indicating that you attempted to select an invalid destination slot.<br><br>After completing the task, **LdR REAdY** or **SEQ REAdY** displays. |
| **SET SCSI** |
| Select SET SCSI to set the SCSI ID of the autoloader or the drive.<br>1. To access the SET SCSI command, press MODE until **SET SCSI** appears on the message display.<br>2. Press SELECT. **LdR SCSI** appears on the message display.<br>**Note:** If you want to skip the steps for determining or changing the SCSI ID of the autoloader and go directly to determining or changing the SCSI ID of the drive, press NEXT and go to step 5.<br>3. Press SELECT to set the SCSI ID of the autoloader. **LdR Id XX** (where **XX** is the current SCSI ID of the autoloader) appears on the message display.<br>4. Press NEXT or PREVIOUS to scroll through the ID choices, and press SELECT when the ID that you want displays. **dRV SCSI** appears on the message display.<br>5. Press SELECT to change the ID of the drive. **dRV Id XX** (where **XX** is the current SCSI ID of the drive) appears on the message display.<br>6. Press NEXT or PREVIOUS to scroll through the ID choices, and press SELECT when the ID that you want displays. **CYCLE PWR** appears on the message display and blinks for approximately 10 seconds, then **LdR REAdY** or **SEQ REAdY** displays.<br>7. Press and hold the POWER button for approximately 2 seconds to power-off the 3581 Tape Autoloader.<br>8. Wait 2 or 3 seconds and press the POWER button again. The new SCSI ID is in effect. |

## Inserting a Tape Cartridge

**CAUTION:**
**This assembly contains mechanical moving parts. Use care when servicing this assembly.**

The procedure for loading slots 1 through 5 differs from loading slots 6 and 7. If you are loading seven cartridges, load slots 6 and 7 first (see "Inserting a Cartridge into Slots 6 and 7"), then load slots 1 through 5.

### Inserting a Cartridge into Slots 6 and 7

1. Ensure that the 3581 Tape Autoloader is powered-on.
2. Ensure that **LdR REAdY**, **SEQ REAdY**, or **SEQ dONE** appears on the message display.

3. Unlock and open the front door to gain access to the cartridge storage slots (see "Front Door" on page 17).
4. Ensure that the write-protect switch (see **5** in Figure 11) is properly set (see "Setting the Write-Protect Switch" on page 37).
5. Grasp the cartridge so that the write-protect switch faces you.
6. Ensure that slot 1 is empty, then insert the cartridge into slot 1. Insert a second cartridge into slot 2. (If no bar code reader is installed, insert the cartridges into 1 and 2; if a bar code reader is installed, insert the cartridges into slots 2 and 3).
7. Verify that the message display shows that slots 1 and 2 have tapes present (the numbers of the occupied slots appear on the display).
8. Press the MODE button until **LOAd SLOT** appears on the message display, then press the SELECT button. **SRC SLOT 1** displays.
9. Press the SELECT button. The messages **LdR MOVE**, **LdR PICK**, and **LdR PLACE** display while the 3581 Tape Autoloader moves the cartridge from slot 1 to slot 6. (The LOAd SLOT command always moves the cartridge in slot 1 to slot 6, and the cartridge in slot 2 to slot 7.) When the move is complete, **LdR READY** or **SEQ READY** displays.
10. Verify that the message display shows that slots 2 and 6 have tapes present.
11. To insert a cartridge into slot 7, repeat steps 8 and 9 (**SRC SLOT 2** displays).
12. Verify that the message display shows that slots 6 and 7 have tapes present.
13. To insert additional cartridges, refer to "Inserting a Cartridge into Slots 1 - 5" on page 26 and repeat steps 1 through 5.
14. Close and lock the front door.

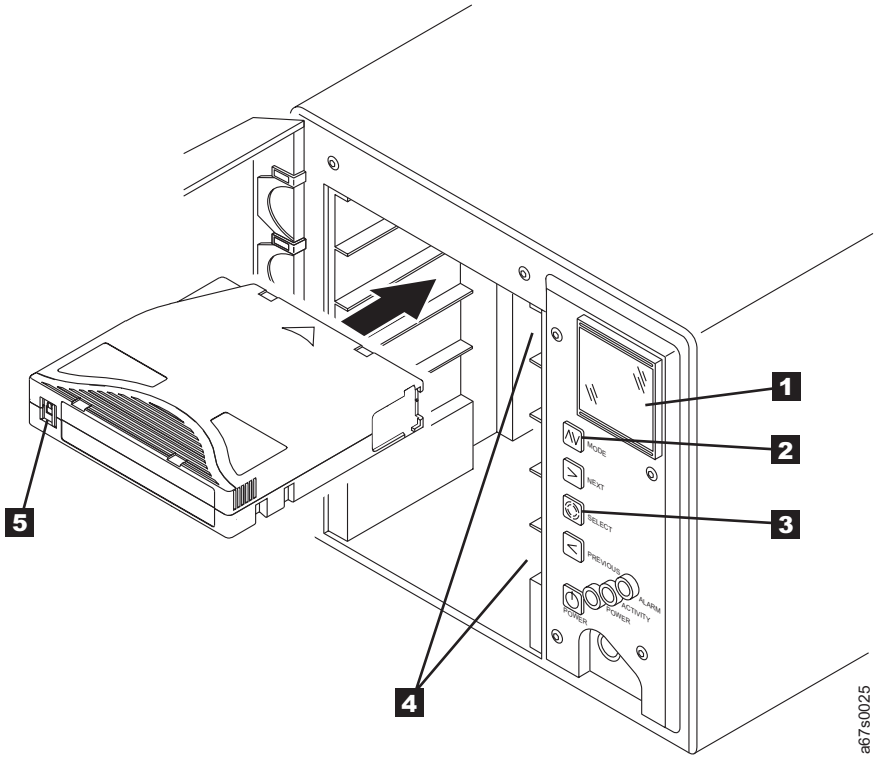


*Figure 11. Inserting a cartridge into the 3581 Tape Autoloader*

15. To operate the 3581 Tape Autoloader, see “Operating in Random Access or Sequential Access Mode” on page 28.

### Inserting a Cartridge into Slots 1 - 5

1. Ensure that the 3581 Tape Autoloader is powered-on.
2. Ensure that **LdR READY**, **SEQ READY**, or **SEQ DONE** appears on the message display.
3. Unlock and open the front door to gain access to the cartridge storage slots (see “Front Door” on page 17).
4. Ensure that the write-protect switch is properly set (see “Setting the Write-Protect Switch” on page 37).
5. Grasp the cartridge so that the write-protect switch faces you (see **5** in Figure 11 on page 25).
6. Insert the cartridge into one of the five storage slots **4** (four, if a bar code reader is installed).
7. Verify that the message display **1** shows that the slot has a tape present (the number of the slot appears on the display).
8. Close and lock the front door.
9. To operate the 3581 Tape Autoloader, see “Operating in Random Access or Sequential Access Mode” on page 28.

## Removing a Tape Cartridge

The procedure for removing cartridges from slots 1 through 5 differs from removing cartridges from slots 6 and 7. The sections that follow describe each procedure.

To manually remove a cartridge that is stuck in the drive, see Appendix B, “Removing a Tape Cartridge”, on page 99.

Whenever you remove a tape cartridge, the 3581 Tape Autoloader writes any pertinent information to the cartridge memory.

### Removing a Cartridge from Slots 1 - 5

1. Ensure that the 3581 Tape Autoloader is powered-on.
2. Ensure that **LdR READY**, **SEQ READY**, or **SEQ DONE** appears on the message display.
3. Unlock and open the front door to gain access to the cartridge storage slots (see “Front Door” on page 17).
4. Grasp the cartridge and put it towards you so that it slides from the storage slot.
5. Close and lock the front door.

### Removing a Cartridge from Slots 6 and 7

1. Perform steps 1 through 3 in “Removing a Cartridge from Slots 1 - 5”.
2. Ensure that slots 1 and 2 are empty.
3. Press the MODE button until **EJECT SLOT** appears on the message display, then press the SELECT button. **SRC SLOT X** displays (where **X** equals 6 or 7).

   **Note:** If the destination slot (1 or 2) is full, **RESELECT** blinks on the message display. To remove the cartridge, perform the steps in “Removing a Cartridge from Slots 1 - 5”. Then, return to step 3 in this section.

4. Press the NEXT or PREVIOUS button as necessary to choose slot 6 or 7.
5. Press SELECT. The 3581 Tape Autoloader moves the cartridge from the source slot to the destination slot. (The EJECT SLOT command always moves the cartridge in slot 6 to slot 1, and the cartridge in slot 7 to slot 2.)

   **Note:** If a bar code reader is installed, the destination slots become 2 and 3 (instead of 1 and 2).
6. Grasp the cartridge and pull it towards you so that it slides from the storage slot.
7. Close and lock the front door.

### Removing the Cleaning Cartridge Following AUTOCLEAN

To remove the cleaning cartridge, you must disable the AUTOCLEAN function. To disable the AUTOCLEAN function, see "Disabling the AUTOCLEAN Function" on page 91.

## Cleaning the Drive Head

**Attention:** When cleaning the drive head in the 3581 Tape Autoloader, use the IBM LTO Ultrium Cleaning Cartridge (part number 08L9124).

Keep the head of the 3581 Tape Autoloader clean to prevent errors caused by contamination. To help you keep the drive clean, IBM provides a cleaning cartridge with the autoloader. Clean the drive head in the 3581 Tape Autoloader whenever the **CT** indicator displays on the message display and the status light is off. IBM does not recommend that you clean the drive head on a periodic basis; only when **CT** displays.

The following are three methods of cleaning the drive. In all methods, the autoloader performs the cleaning after you unload the data cartridge from the drive and before the next load. However, manual cleaning requires operator intervention. Note that the tape capacity of the autoloader is reduced to six tapes whenever you enable the AUTOCLEAN function or when you select host cleaning.

**Host cleaning**
: Host cleaning enables the server to detect the need to clean an Ultrium Tape Drive and to control the cleaning process. The cleaning cartridge must be stored in one of the available storage slots within the 3581 Tape Autoloader. For more information, see the section about cleaning in your application software documentation. Host cleaning is the default method.

**Automatic cleaning (AUTOCLEAN)**
: Automatic cleaning enables the 3581 Tape Autoloader to automatically respond to any tape drive's request for cleaning and to begin the cleaning process. Automatic cleaning makes the cleaning process transparent to any host application using the autoloader. You can enable or disable automatic cleaning by using the menus on the autoloader's display. The setting is stored in non-volatile memory and becomes the default during subsequent power-on cycles. As with host cleaning, the cleaning cartridge must be stored in one of the available slots within the 3581 Tape Autoloader. For more information, see "Automatically Selecting the Cleaning Function" on page 89.

**Manual cleaning**
: Manual cleaning requires that you select a menu option from the autoloader's display to perform cleaning on the Ultrium Tape Drive.

Manual cleaning is always supported, regardless of whether host cleaning or automatic cleaning is enabled or disabled. For more information, see "Manually Selecting the Cleaning Function" on page 89.

If **CT** continues to appear on the message display:

- The cleaning cartridge may have expired. Replace the cleaning cartridge.
- The data cartridge may be damaged. Back up the data from the cartridge to another cartridge, then discard the original.

The cleaning cartridge is valid for 50 cleanings.

## Cleaning the 3581 Tape Autoloader

Clean the exterior surface of the 3581 Tape Autoloader with a damp towel. If you use a liquid all-purpose cleaner, apply it to the towel. Do not spray the enclosure.

## Performing Diagnostic and Maintenance Functions

The 3581 Tape Autoloader lets you perform the following diagnostic and maintenance functions:

- Display the current level of firmware used by the 3581 Tape Autoloader's microprocessors and drive
- Verify the 3581 Tape Autoloader's SCSI INQUIRY identity
- Change the operating mode between random access and sequential access
- Verify whether the autoloader's robotics are working properly
- Specify manual cleaning for the drive's head
- Specify automatic cleaning for the drive's head
- Update drive firmware by using a field microcode replacement (FMR) tape
- Update firmware for the 3581 Tape Autoloader's microprocessors by using the SCSI bus
- Determine the number of times certain events have occurred
- Perform maintenance tasks on the drive. The tasks include testing the drive's read/write function, displaying and clearing the drive error code log, forcing and copying a drive dump to tape, performing a Power-On Self Test (POST), and testing the SCSI functionality of the drive.

To perform the diagnostic and maintenance functions, you must access the Diagnostic Menu. For complete instructions about accessing the Diagnostic Menu and performing each operation, see Appendix A, "Diagnostic and Maintenance Functions", on page 85.

## Operating in Random Access or Sequential Access Mode

You can operate the 3581 Tape Autoloader in two modes:

- Random access mode
- Sequential access mode

The sections that follow describe each mode. To change the mode of operation, see "Changing the Mode of Operation" on page 88.

## Operating in Random Access Mode

In random access mode, the 3581 Tape Autoloader allows the server's application software to select any data cartridge in any order.

To operate the 3581 Tape Autoloader in random access mode:

1. Unlock and open the front door to gain access to the cartridge storage slots.
2. Power-on the autoloader and allow it to initialize until **LdR READY** appears in the message display.
3. Insert cartridges into the seven storage slots (for instructions about inserting cartridges, see "Inserting a Cartridge into Slots 6 and 7" on page 24 and "Inserting a Cartridge into Slots 1 - 5" on page 26.
4. Close and lock the front door.
5. Launch you server's application software. The application will control the random operation of the 3581 Tape Autoloader.

## Operating in Sequential Access Mode

In sequential access mode, the 3581 Tape Autoloader's firmware predefines the selection of the cartridges. After initialization, the firmware causes the autoloader to load the first cartridge found (counting from 1 through 7) into the drive. After the server's application software fills this cartridge with data and issues an unload command, the autoloader returns the cartridge to its storage slot and loads the next cartridge in order. Empty storage slots are ignored. The autoloader continues this process until all cartridges have been filled with data.

**Note:** While in sequential access mode, the autoloader's robotics is not logically connected to the SCSI bus and does not respond to SCSI commands.

To operate the 3581 Tape Autoloader in sequential access mode:

1. Ensure that all of the storage slots in the autoloader are empty.
2. Unlock and open the front door to gain access to the cartridge storage slots.
3. Power-on the autoloader and allow it to initialize until **SEQ dONE** appears in the message display.
4. Insert cartridges into all seven storage slots (for instructions about inserting cartridges, see "Inserting a Cartridge into Slots 6 and 7" on page 24 and "Inserting a Cartridge into Slots 1 - 5" on page 26).
5. Press MODE until **SEQ START** displays.
6. Press SELECT. The autoloader loads the first cartridge into the drive and displays **SEQ READY**.
7. Close and lock the front door.
8. Launch your server's application software. The application will control the sequential operation of the 3581 Tape Autoloader. The autoloader starts the sequence by processing the cartridge in the slot that has the lowest numeric value.

### Interrupting Cartridge Processing

To interrupt the processing of the cartridges:

1. Ensure that **SEQ READY** appears on the 3581 Tape Autoloader's message display.
2. Press MODE until **STOP SEQ** displays.
3. Press SELECT. **SEQ ENDING** displays:
   - To interrupt processing:
     a. Press MODE until **EJECT dRIVE** displays.

b. Press SELECT. **SEQ dONE** displays and the 3581 Tape Autoloader stops processing the cartridges.

   **Note:** If you decide that you want to restart sequential processing from the first cartridge, press MODE. **START SEQ** displays. Press SELECT to restart sequential processing.

- To resume processing:
  a. Press MODE until **RESUME SEQ** displays.
  b. Press SELECT. **SEQ READY** displays. The 3581 Tape Autoloader continues to process the cartridges in sequence. When the last cartridge has been processed, **SEQ dONE** displays.

# Updating Firmware

**Attention:** To ensure optimum performance from the 3581 Tape Autoloader, use the latest level of drive firmware. It is the customer's responsibility to obtain and install drive and autoloader firmware.

The sections that follow describe how to update firmware for the IBM Ultrium Tape Drive and the autoloader.

## Updating Drive Firmware

To find out whether the drive in your autoloader is loaded with the most current firmware, compare the latest level of firmware that is available with the level that is on the drive in your autoloader. To determine the latest level of firmware that is available, visit the web at `http://www.ibm.com/storage/lto` and select either Technical Support or LTO Support. To determine the level of firmware that is on the drive in your autoloader, go to "Displaying Firmware" on page 86.

You can update the drive firmware in the 3581 Tape Autoloader by:

- Obtaining the new firmware image and downloading it to the tape drive over the SCSI interface
- Loading the firmware from a field microcode replacement (FMR) tape cartridge

To update the drive firmware over the SCSI bus, obtain the new firmware image and the installation instructions by visiting the web at `http://www.ibm.com/storage/lto` and select either Technical Support or LTO Support.

To obtain an FMR tape, visit the web at `http://www.ibm.com/storage/lto` and select either Technical Support or LTO Support. To update the drive firmware with the FMR tape, see the instructions in "Updating Drive Firmware" on page 93.

**Note:** After you update the firmware, you must cycle power (turn it off, then on) to activate the new firmware.

## Updating Autoloader Firmware

To find out whether your autoloader is loaded with the most current firmware, compare the latest level of firmware that is available with the level that is on your autoloader. To determine the latest level of firmware that is available, visit the web at `http://www.ibm.com/storage/lto` and select either Technical Support or LTO Support. To determine the level of firmware that is on your autoloader, go to "Displaying Firmware" on page 86.

You can update the autoloader firmware by:

- Obtaining the new firmware image and downloading it to the autoloader over the SCSI interface
- Loading the firmware from a field microcode replacement (FMR) tape cartridge

To update the autoloader firmware over the SCSI bus, obtain the new firmware image and the installation instructions by visiting the web at `http://www.ibm.com/storage/lto` and select either Technical Support or LTO Support.

To obtain an FMR tape, visit the web at `http://www.ibm.com/storage/lto` and select either Technical Support or LTO Support. To update the autoloader firmware with the FMR tape, see the instructions in "Updating Autoloader Firmware" on page 93.

**Note:** After you update the firmware, you must cycle power (turn it off, then on) to activate the new firmware.

# Chapter 4. Using the Media

**Attention:** IBM LTO Ultrium Tape Cartridges are delicate components and require care in handling. Before using the media, be sure to read "Handling the Cartridges" on page 38.

The 3581 Tape Autoloader uses the following cartridge types:

- IBM TotalStorage LTO Ultrium 200 GB Data Cartridge (Ultrium 2)
- IBM LTO Ultrium Data Cartridge (Ultrium 1)
- IBM TotalStorage LTO Ultrium Cleaning Cartridge
- LTO Ultrium Cleaning Cartridge

The Ultrium 2 Tape Drive is compatible with the cartridges of its predecessor, the Ultrium 1 Tape Drive. When labeled according to proper IBM bar code label specifications (see "Bar Code Label" on page 35), the last character of the cartridge's volume serial number (VOLSER) indicates the generation of the media. For example, a cartridge with a VOLSER of 000764L2 is an Ultrium 2 cartridge; a cartridge with a VOLSER of 003995L1 is an Ultrium 1 cartridge. Cartridge compatibility for the Ultrium 2 Tape Drive is as follows:

- Reads and writes Ultrium 2 format on Ultrium 2 cartridges
- Reads and writes Ultrium 1 format on Ultrium 1 cartridges
- Does not write Ultrium 2 format on Ultrium 1 cartridges
- Does not write Ultrium 1 format on Ultrium 2 cartridges

Figure 12 on page 34 shows the TotalStorage™ LTO Ultrium 200 GB Data Cartridge and its components.

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

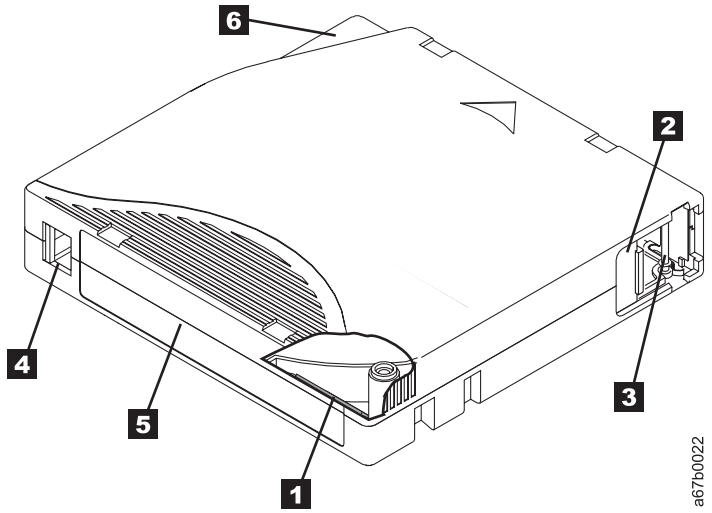


*Figure 12. The IBM TotalStorage LTO Ultrium 200 GB Data Cartridge*

In addition to using LTO Ultrium 2 Tape Cartridges with up to 200 GB capacity, the tape drive reads and writes to certified LTO Ultrium Tape Cartridges that have capacities of 100 GB. If you want to control the capacity of the cartridge (for example, if you want to limit the capacity to obtain a faster seek time) you can do so by issuing the SCSI command SET CAPACITY. For information about this command, refer to the *IBM TotalStorage Ultrium Tape Drive SCSI Reference*.

To ensure that your tape library conforms to IBM's specifications for reliability, use only IBM LTO Ultrium Tape Cartridges. You may use other LTO-certified data cartridges, but they may not meet the standards of reliability established by IBM. The IBM TotalStorage LTO Ultrium 200 GB Data Cartridge cannot be interchanged with the media used in other IBM non-LTO Ultrium tape products.

## Data Cartridge

The IBM Ultrium 2 Data Cartridge is purple, and the Ultrium 1 Data Cartridge is black. Both generations contain 1/2-inch, dual-coat, metal-particle tape. The Ultrium 1 cartridge has a native data capacity of 100 GB (200 GB at 2:1 compression); the Ultrium 2 cartridge has a native data capacity of 200 GB (400 GB at 2:1 compression).

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

Both generations of the IBM LTO Ultrium Data Cartridge includes a Linear Tape-Open Cartridge Memory (LTO-CM) chip ( 1 in Figure 12), which contains information about the cartridge and the tape (such as the name of the

manufacturer that created the tape), as well as statistical information about the cartridge's use. Whenever you unload a tape cartridge, the 3581 Tape Autoloader writes any pertinent information to the cartridge memory.

The cartridge door ( 2 in Figure 12 on page 34) protects the tape from contamination when the cartridge is out of the drive. Behind the door, the tape is attached to a leader pin 3 . When you insert the cartridge into the drive, a threading mechanism pulls the pin (and tape) out of the cartridge, across the drive head, and onto a non-removable takeup reel. The head can then read or write data from or to the tape.

The write-protect switch 4 prevents data from being written to the tape cartridge. The label area 5 provides a location for you to place a label. Affix only a bar code label or a human-writable label. When affixing a label, place it only in the recessed label area. A label that extends outside of the recessed area can cause loading problems in the internal drive or in the 3581 Tape Autoloader. The VOLSER on a cleaning cartridge's bar code label must begin with **CLN** or the library treats the cleaning cartridge as a data cartridge during an inventory. The insertion guide 6 is a large, notched area that prevents you from inserting the cartridge incorrectly.

You can order tape cartridges with the bar code labels included, or you can order custom labels. To obtain tape cartridges and bar code labels, see "Ordering Media Supplies" on page 49. The bar code and bar code label must meet predefined specifications. To determine the specifications, visit the web at `http://ssddom02.storage.ibm.com/tape/lto/documentation/labelspec.pdf` or contact your IBM Marketing Representative.

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

## Cleaning Cartridge

Each drive determines when it needs to be cleaned and alerts the library and the server's application software. Depending on which cleaning method you choose, the drive uses the cleaning cartridge to automatically clean the drive, or you are required to select menus to initiate cleaning.

**Note:** The VOLSER on the cartridge's bar code label must begin with **CLN** or the library treats the cleaning cartridge as a data cartridge during an inventory.

The IBM TotalStorage LTO Ultrium Cleaning Cartridge and the LTO Ultrium Cleaning Cartridge are downward-compatible with the Ultrium 1 drive. To enable your Ultrium 1 drive to use the cartridge, simply download and install the latest drive firmware.

Both generations of the LTO Ultrium Cleaning Cartridge are valid for 50 uses. A cartridge's LTO-CM chip tracks the number of times that the cartridge is used.

## Bar Code Label

Each data and cleaning cartridge that is processed by the 3581 Tape Autoloader must bear a bar code label. The label contains:

- A volume serial number (VOLSER) that you can read
- A bar code that the library can read

When read by the library's bar code scanner, the bar code identifies the cartridge's VOLSER to the library. The bar code tells the library whether the cartridge is a data, cleaning, or diagnostic cartridge. If a cartridge in a storage or I/O station slot does not contain a label, the bar code scanner will treat that slot as empty. In addition, the bar code includes the two-character media-type identifier Lx, where x equals 1 or 2. 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. Figure 13 shows a sample bar code label for the LTO Ultrium Tape Cartridge.

You can order tape cartridges with the labels included, or you can order custom labels. To order tape cartridges and bar code labels, see "Ordering Media Supplies" on page 49. The bar code must meet predefined specifications. To determine the specifications of the bar code and the bar code label, visit the web at http://ssddom02.storage.ibm.com/tape/lto/documentation/labelspec.pdf or contact your IBM Marketing Representative.

When attaching a bar code label to a tape cartridge, place the label only in the recessed label area (see **5** in Figure 12 on page 34). A label that extends outside of the recessed area can cause loading problems in the drive or the library.

**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 3581 Tape Autoloader from reading the label.

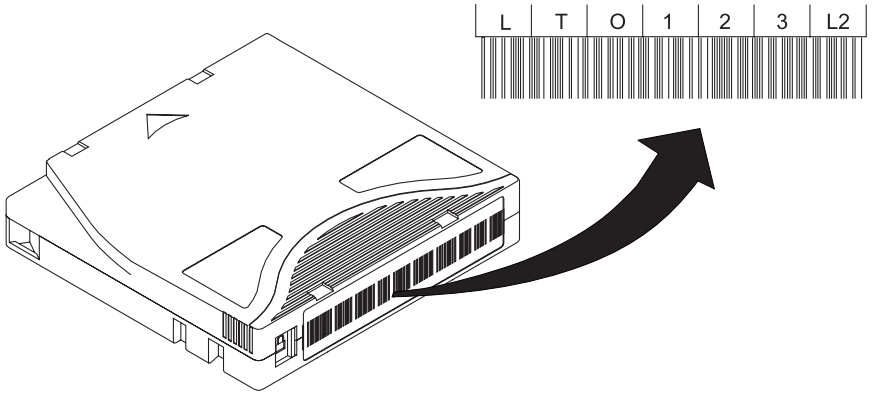


*Figure 13. Sample bar code label on the LTO Ultrium Tape Cartridge.* The volume serial number (LTO123) and bar code are printed on the label.

## Guidelines for Using Bar Code Labels

Apply the following guidelines whenever you use bar code labels:

- Use only IBM-approved 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 they are 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 other chemical to clean the label area.
- Examine the label before you apply it to the cartridge. Do not use the label if it has voids or smears in the printed characters or bar code (an application software'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 (see **5** in Figure 12 on page 34).
- 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 bar code scanner to read the bar code.

## Setting the Write-Protect Switch

The position of the write-protect switch on the tape cartridge (see **1** in Figure 14) determines whether you can write to the tape:

- If the switch is set to  , data cannot be written to the tape.
- If the switch is set to unlocked, 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 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 switch, slide it left or right to the desired position.

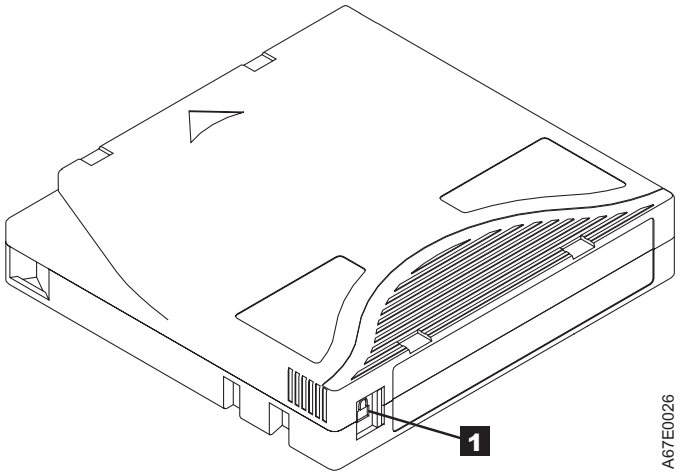


*Figure 14. Setting the write-protect switch*

## Handling the Cartridges

**Attention:** Do not insert a damaged tape cartridge into your 3581 Tape Autoloader. A damaged cartridge can interfere with the reliability of a drive and may void the warranties of the drive and the cartridge. Before inserting a tape cartridge, inspect the cartridge case, cartridge door, and write-protect switch for breaks.

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

### Provide Training

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

### Ensure Proper Packaging

- When you ship a cartridge, ship it in its original or better packaging.
- Always ship or store a cartridge in a jewel case.
- Use only a recommended shipping container that securely holds the cartridge in its jewel case during transportation. Ultrium Turtlecases (by Perm-A-Store) have been tested and found to be satisfactory (see Figure 15 on page 39). They are available at `www.turtlecase.com/`.


*Figure 15. Tape cartridges in a Turtlecase*

- Never ship a cartridge in a commercial shipping envelope. Always place it in a box or package.
- If you ship the cartridge in a cardboard box or a box of a sturdy material, ensure the following:
  - Place the cartridge in polyethylene plastic wrap or bags to protect it from dust, moisture, and other contaminants.
  - Pack the cartridge snugly; do not allow it to move around.
  - Double-box the cartridge (place it inside a box, then place that box inside the shipping box) and add padding between the two boxes (see Figure 16).

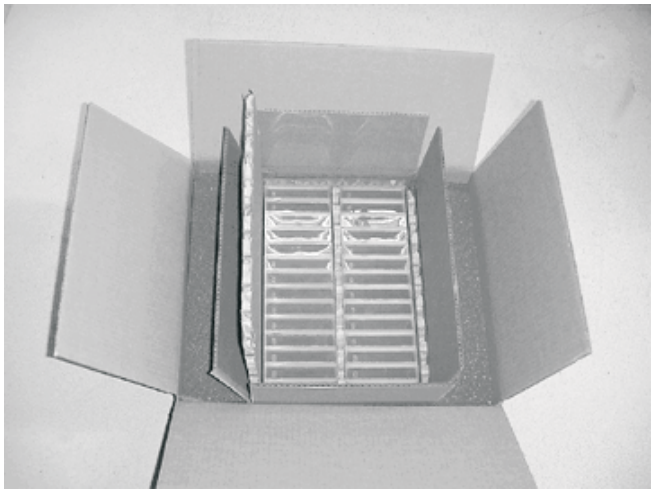


*Figure 16. Double-boxing tape cartridges for shipping*

## Provide Proper Acclimation and Environmental Conditions

- Before you use a cartridge, let it acclimate to the normal operating environment for 1 hour. If you see condensation on the cartridge, wait an additional hour.
- Ensure that all surfaces of a cartridge are dry before inserting it.

- Do not expose the cartridge to moisture or direct sunlight.
- Do not expose recorded or blank cartridges to stray magnetic fields of greater than 100 oersteds (for example, terminals, motors, video equipment, X-ray equipment, or fields that exist near high-current cables or power supplies). Such exposure can cause the loss of recorded data or make the blank cartridge unusable.
- Maintain the conditions that are described in "Environmental and Shipping Specifications for Tape Cartridges" on page 41.

## Perform a Thorough Inspection

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

- Inspect the cartridge's packaging to determine potential rough handling.
- When inspecting a cartridge, open only the cartridge door. Do not open any other part of the cartridge case. The upper and lower parts of the case are held together with screws; separating them destroys the usefulness of the cartridge.
- Inspect the cartridge for damage before using or storing it.
- Inspect the rear of the cartridge (the part that you load first into the tape load compartment) and ensure that there are no gaps in the seam of the cartridge case (see **1** in Figure 17 and **4** in Figure 19 on page 44). If there are gaps in the seam (see Figure 17), the leader pin may be dislodged. Go to "Repositioning or Reattaching a Leader Pin" on page 42.

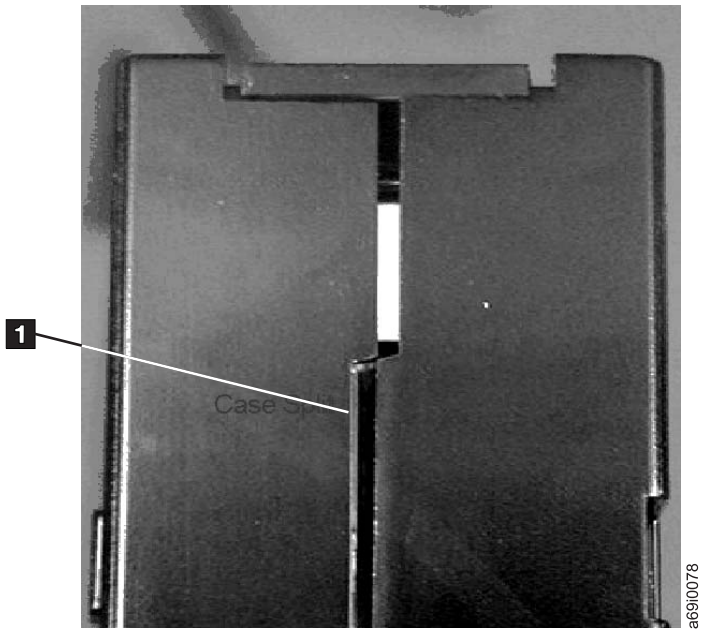


*Figure 17. Checking for gaps in the seams of a cartridge*

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

## Handle the Cartridge Carefully

- Do not drop the cartridge. If the cartridge drops, slide the cartridge door back and ensure that the leader pin is properly seated in the pin-retaining spring clips

(see 2 in Figure 18 on page 43). If the leader pin has become dislodged, go to "Repositioning or Reattaching a Leader Pin" on page 42.

- Do not handle tape that is outside the cartridge. Handling the tape can damage the tape's surface or edges, which may interfere with read or write reliability. Pulling on tape that is outside the cartridge can damage the tape and the brake mechanism in the cartridge.
- Do not stack more than six cartridges.
- Do not degauss a cartridge that you intend to reuse. Degaussing makes the tape unusable.

## Examples of Cartridge Problems

**Example: Improper Placement of Leader Pin**

The leader pin is misaligned. Perform the following steps:

1. Look for cartridge damage.
2. Use the IBM Leader Pin Reattachment Kit (part number 08L9129) to correctly seat the pin (see "Repositioning a Leader Pin" on page 42). Then, immediately use data recovery procedures to minimize chances of data loss.

**Example: Split Cartridge Case**

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

1. Look for cartridge mishandling.
2. Use the IBM Leader Pin Reattachment Kit (part number 08L9129) to correctly seat the pin (see "Repositioning a Leader Pin" on page 42). Then, immediately use data recovery procedures to minimize chances of data loss.
3. Review media-handling procedures.

# Environmental and Shipping Specifications for Tape Cartridges

Before you use a tape cartridge, acclimate it to the operating environment for 24 hours or the time necessary to prevent condensation in the drive (the time will vary, depending on the environmental extremes to which the drive was exposed).

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

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

Table 5 on page 42 gives the environment for operating, storing, and shipping IBM LTO Ultrium Tape Cartridges.

*Table 5. Environment for operating, storing, and shipping the IBM LTO Ultrium Tape Cartridge*

| Environmental Specifications | | | | |
|---|---|---|---|---|
| **Environmental Factor** | **Operating** | **Operational Storage** | **Archival Storage** | **Shipping** |
| Temperature | 10 to 45°C (50 to 113°F) | 16 to 32°C (61 to 90°F) | 16 to 25°C (61 to 77°F) | –23 to 49°C (–9 to 120°F) |
| Relative humidity (noncondensing) | 10 to 80% | 20 to 80% | 20 to 50% | 5 to 80% |
| Wet bulb temperature | 26°C (79°F) | 26°C (79°F) | 26°C (79°F) | 26°C (79°F) |

**Notes:**

1. Operational storage equals less than 1 year.
2. Archival storage equals 1 to 10 years.

# Repositioning or Reattaching a Leader Pin

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

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

## Repositioning a Leader Pin

A leader pin that is improperly seated inside a cartridge can interfere with the operation of the drive. Figure 18 on page 43 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)

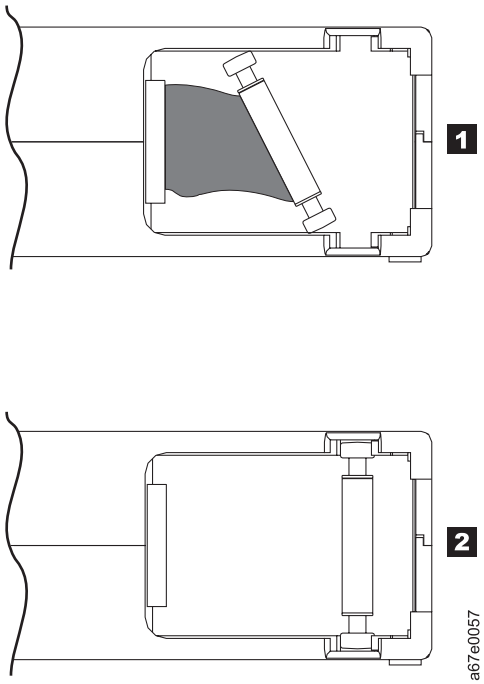


*Figure 18. Leader pin in the incorrect and correct positions.* The cartridge door is open and the leader pin is visible inside the cartridge.

To reposition the leader pin, perform the following steps.

1. Slide open the cartridge door ( **1** in Figure 19 on page 44) and locate the leader pin **2** (you may need to shake the cartridge gently to roll the pin toward the door).
2. With plastic or blunt-end tweezers, grasp the leader pin and position it in the pin-retaining spring clips **3** .
3. Press the leader pin gently into the clips until it snaps into place and is firmly seated. Ensure that there are no gaps in the seam of the cartridge **4** .

   **Attention:** If gaps exist, do not continue with this procedure and do not use the cartridge.
4. Close the cartridge door.

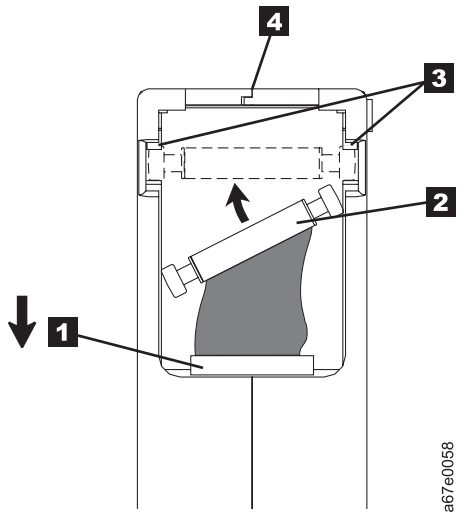


*Figure 19. Placing the dislodged leader pin into the correct position.* The cartridge door is open to show the leader pin.

5. To rewind the tape, insert the cartridge manual rewind tool ( **1** in Figure 20) into the cartridge's hub **2** and turn it clockwise until the tape becomes taut.

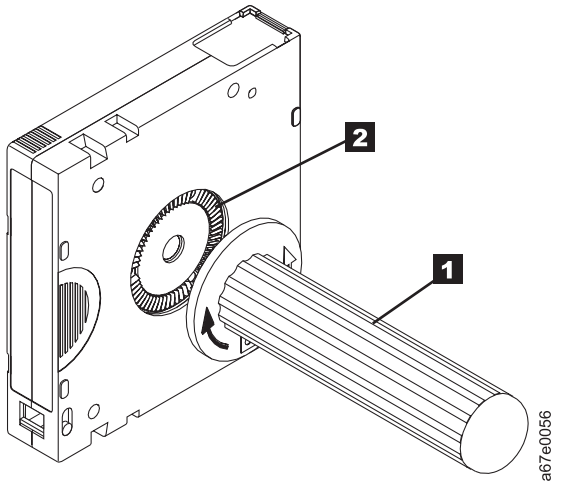


*Figure 20. Rewinding the tape into the cartridge*

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

## Reattaching a Leader Pin

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

The Leader Pin Reattachment Kit contains three parts:

- **Leader pin attach tool** (see **1** in Figure 21 on page 45). A plastic brace that holds the cartridge door open.

- **Cartridge manual rewind tool** (see 2 in Figure 21). A device that fits into the cartridge's hub and lets you wind the tape into and out of the cartridge.
- **Pin supplies** (see 3 in Figure 21). 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.

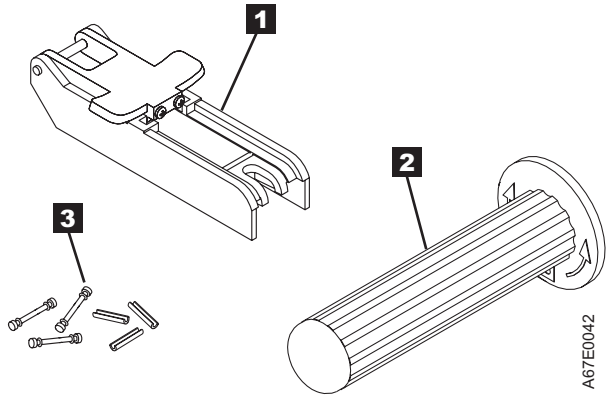


*Figure 21. Leader Pin Reattachment Kit*

The following procedure describes how to reattach a leader pin.

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

1. Attach the leader pin attach tool ( 1 in Figure 22 on page 46) 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 .

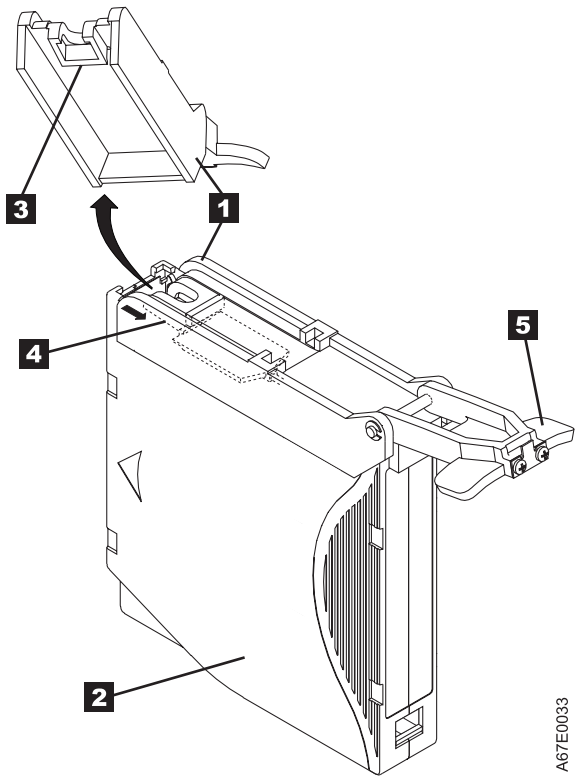


*Figure 22. Attaching the leader pin attach tool to the cartridge.* To hold the cartridge door open, hook the tool into the door and pull the tool back.

2. To find the end of the tape inside the cartridge, attach the cartridge manual rewind tool ( **1** in Figure 23 on page 47) 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.

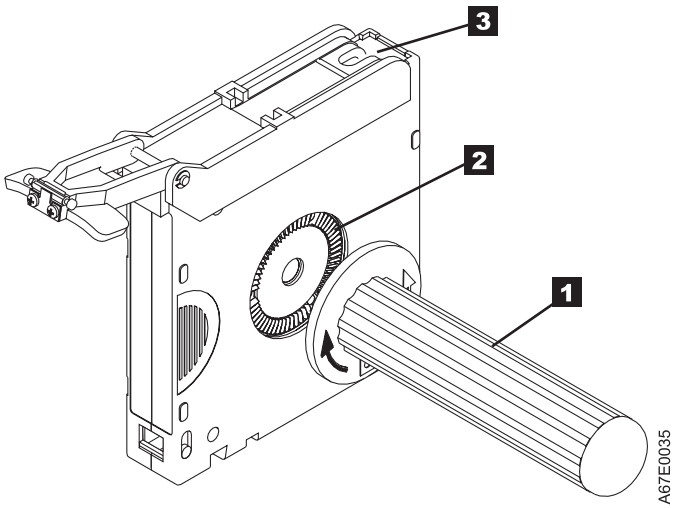


*Figure 23. Winding the tape out of the cartridge.* Turn the cartridge manual rewind tool clockwise to see the end of the tape, then turn it counterclockwise to bring the tape to the cartridge door.

5. On the leader pin ( **1** in Figure 24), 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.

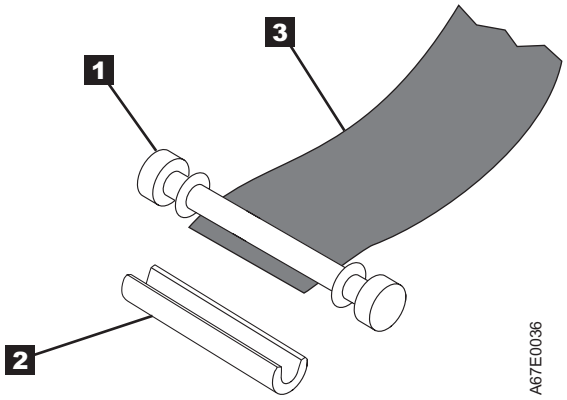


*Figure 24. Removing the C-clip from the leader pin.* Use your fingers to push the C-clip from the leader pin.

7. Position the tape in the alignment groove of the leader pin attach tool (see **1** in Figure 25 on page 48).
8. Place a new C-clip into the retention groove **2** (Figure 25 on page 48) on the leader pin attachment tool and make sure that the clip's open side faces up.
9. Place the leader pin (from step 6) into the cavity **3** (Figure 25 on page 48) 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 25 on page 48).

**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.

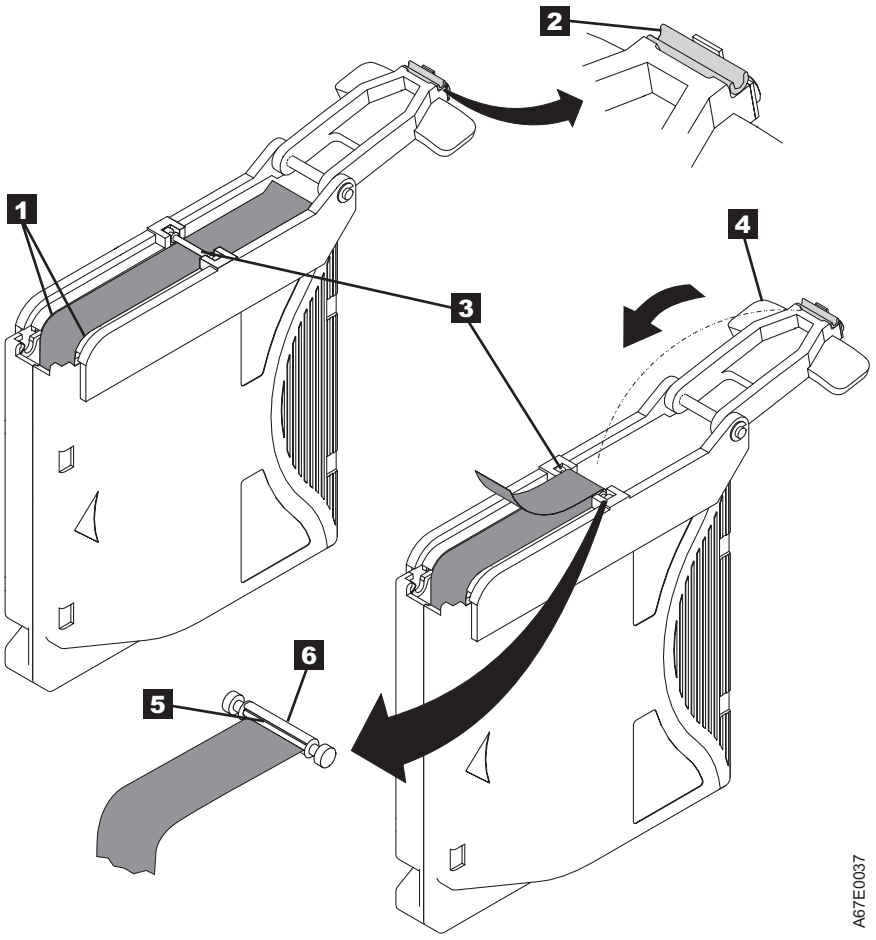


*Figure 25. Attaching the leader pin to the tape*

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 6 lists the data cartridges and media supplies that you can order for the 3581 Tape Autoloader.

*Table 6. Ordering media supplies for the 3581 Tape Autoloader*

| Supply Item | Methods of Ordering |
|---|---|
| **IBM TotalStorage LTO Ultrium 200 GB Data Cartridge**<br><br>Order VOLSER labels separately (see "Ordering Bar Code Labels" on page 50). For Models L23 and H23 only. | • Order as part number 08L9870 through an IBM-authorized distributor (for the closest distributor, visit the web at `http://www.ibm.com/storage/media`), or<br>• 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 007 , or<br>• call 1-888-IBM-MEDIA. |
| **IBM TotalStorage LTO Ultrium 200 GB Data Cartridge**<br><br>Bar code labels are preapplied to cartridges. For Models L23 and H23 only. | • Order as part number 19P5887 through an IBM-authorized distributor (for the closest distributor, visit the web at `http://www.ibm.com/storage/media`), or<br>• 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 006, or<br>• call 1-888-IBM-MEDIA. |

*Table 6. Ordering media supplies for the 3581 Tape Autoloader (continued)*

| Supply Item | Methods of Ordering |
|---|---|
| **IBM LTO Ultrium 100 GB Data Cartridge**<br><br>Order VOLSER labels separately (see "Ordering Bar Code Labels"). | • Order as part number 08L9120 through an IBM-authorized distributor (for the closest distributor, visit the web at `http://www.ibm.com/storage/media`), or<br>• if you do not have Internet access, order the cartridge from any authorized IBM Business Partner or your IBM Sales Representative., or<br>• call 1-888-IBM-MEDIA. |
| **IBM LTO Ultrium 100 GB Data Cartridge**<br><br>Bar code labels are preapplied to cartridges. | • Order from an IBM-authorized distributor (for the closest distributor, visit the web at `http://www.ibm.com/storage/media`), or<br>• 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 002, or<br>• call 1-888-IBM-MEDIA. |
| **IBM TotalStorage LTO Ultrium Cleaning Cartridge** (universal cleaning cartridge for use with Ultrium 1 and Ultrium 2 drives)<br><br>Order VOLSER labels separately (see "Ordering Bar Code Labels"). | • Order as part number 35L2086 through an IBM-authorized distributor (for the closest distributor, visit the web at `http://www.ibm.com/storage/media`), or<br>• 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 004, or<br>• call 1-888-IBM-MEDIA. |
| **IBM TotalStorage LTO Ultrium Cleaning Cartridge** (universal cleaning cartridge for use with Ultrium 1 and Ultrium 2 drives)<br><br>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`), or<br>• if you do not have Internet access, order the cartridge from any authorized IBM Business Partner or your IBM Sales Representative., or<br>• 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`). |
| **Manual Rewind Tool** | Order as part number 08L9130 through an IBM-authorized distributor (for the closest distributor, visit the web at `http://www.ibm.com/storage/media`). |

## Ordering Bar Code Labels

Bar code labels with VOLSERS are required for cartridges that are read by the 3581 Tape Autoloader. 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 7 on page 51.

*Table 7. Authorized suppliers of custom bar code labels*

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

# Chapter 5. Troubleshooting

If you encounter problems when running the 3581 Tape Autoloader, refer to the flowchart in Figure 26 on page 54. Should the autoloader need to be replaced, go to "Replacing the Autoloader" on page 60. Additional service information is available in Chapter 6, "Removal and Replacement Procedures", on page 73.

If the problem is not identified in the flowchart, visit the web at `http://www.ibm.com/storage/lto` and select either Technical Support or LTO Support. If a problem requires a call to IBM Technical Support, prior to placing the call review the pre-call checklist on page 59.

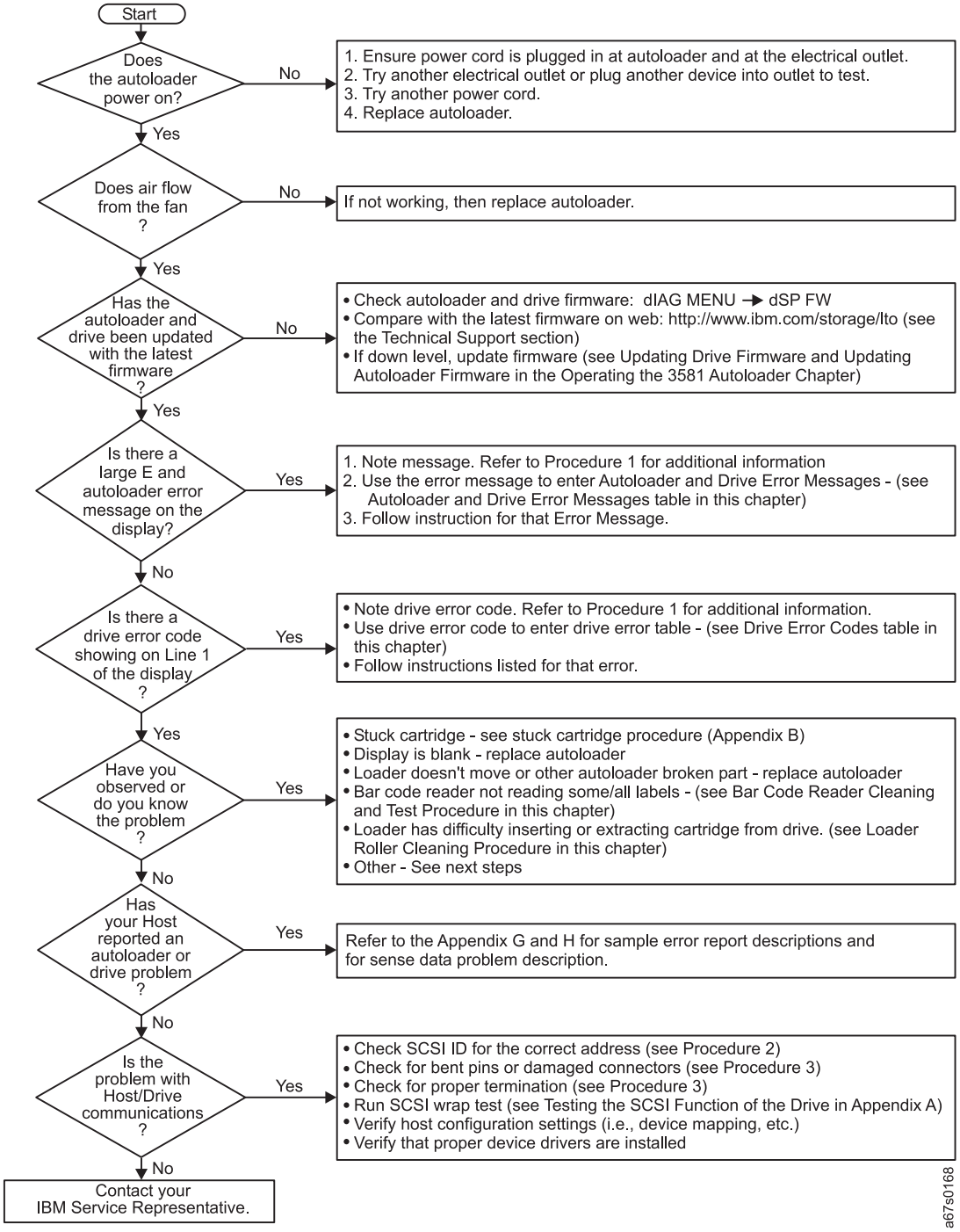


*Figure 26. Flowchart for analyzing maintenance problems*

## Procedure 1: Resolving Error Messages/Codes

If an error message or error code appears in the message display, use one or more of the following procedures to resolve the problem. Autoloader and drive error messages are listed in Table 8 on page 61; drive error codes are listed in Table 9 on page 66.

Before you attempt to resolve the error message or code, review the following:

- Refer to "Control Buttons" on page 21 to review the operator panel functions that can aid error recovery.
- Refer to Appendix A, "Diagnostic and Maintenance Functions", on page 85 to review aids that are available for isolating and verifying autoloader and drive errors.
- If you must manually remove a cartridge that has become stuck in the drive, refer to Appendix B, "Removing a Tape Cartridge", on page 99.

Based on the error condition that is present, use one or more of the following procedures.

## Resolving Autoloader and Drive Error Messages

To resolve an autoloader or drive error message, perform the following steps:

1. Open the front door of the 3581 Tape Autoloader to visually determine the source of the problem (you may have to remove some or all of the front storage cartridges to view the interior of the autoloader).
2. Write the error message down. You may need it later if service is required.
3. If a cartridge has become stuck in the picker or the drive, use the control buttons to issue the EJECT PCKR (eject picker) or EJECT dRV (eject drive) command (for instructions, see Table 4 on page 23).
4. If a cartridge is positioned incorrectly, see "Removing a Tape Cartridge" on page 26 and "Inserting a Tape Cartridge" on page 24.
5. Make sure that you have written the error message down, then cycle power to the autoloader (you may have to disconnect the power cord from its electrical outlet if the autoloader's POWER button is non-operational.
6. Perform one or more of the diagnostic and maintenance functions in Appendix A, "Diagnostic and Maintenance Functions", on page 85.
7. If you cannot resolve the problem, contact IBM Technical Support for problem determination. If IBM Technical Support determines that the machine should be replaced, it will send you a replacement. To install the replacement machine, refer to "Replacing the Autoloader" on page 60.

### Autoloader Error Messages

If an error occurs during the operation of your library, an error message will be displayed on the operator's LCD. Table 8 on page 61 lists library error messages and the required action.

### Drive Error Codes

To resolve a drive error code, write the code down (you may need it later if service is required). Then, refer to Table 9 on page 66 for a description of the error.

**Error Code 1 or 2: Cooling or Power Problem:**

1. Make sure that ambient environmental conditions are present (see Table 1 on page 4).
2. Make sure that air from the fan is not blocked.
3. Try another electrical outlet.
4. Try another power cord.
5. If the error persists, contact IBM Technical Support for problem determination. If IBM Technical Support determines that the machine should be replaced, it will send you a replacement. To install the replacement machine, refer to "Replacing the Autoloader" on page 60.

**Error Code 3, 4, 5, 6, 9 or A: Microcode, Drive, or RS-422 Problem:**

**Note:** Error code 6 may be a drive or a media problem.

1. If possible, use host utilities to transfer the drive dump to the host. Otherwise, copy the existing drive dump to tape (see "Copying a Drive Dump to Tape" on page 97), then set aside the cartridge that contains the dump (you may need it later for problem determination).
2. Determine the latest level of drive firmware that is available by visiting the web at `http://www.ibm.com/storage/lto` and select either Technical Support or LTO Support.
3. Determine the current level of drive firmware on your 3581 Tape Autoloader (see "Displaying Firmware" on page 86):
   a. If your drive firmware is outdated, download the latest firmware from the web site (instructions for downloading are available at the site). Cycle power to the autoloader (turn it off, then on again) to clear the error code, then retry the operation.
   b. If error code 3, 4, 5, 6 or A displays, run a read/write test on the drive (see "Testing the Read/Write Function" on page 94):
      - If the test succeeds, retry the operation that caused the error.
      - If the test fails and your drive firmware is at the latest level, contact IBM Technical Support for problem determination. If IBM Technical Support determines that the machine should be replaced, it will send you a replacement. To install the replacement machine, refer to "Replacing the Autoloader" on page 60.

**Error Code 6 or 7: Media Problem:**

**Note:** Error code 6 may be a drive, microcode, or RS-422 problem.

1. If your host console indicates a read error, retry the operation with a cartridge that you know to be valid.
2. Cycle power to the autoloader (turn it off, then on again), then retry the operation.
3. Run a read/write test on the drive (see "Testing the Read/Write Function" on page 94). This test will isolate the problem to the drive or the media.
4. If the problem persists, contact IBM Technical Support for problem determination. If IBM Technical Support determines that the machine should be replaced, it will send you a replacement. To install the replacement machine, refer to "Replacing the Autoloader" on page 60.

**Error Code 8: SCSI Problem:** Refer to "Procedure 2: Verifying SCSI IDs" or "Procedure 3: Checking SCSI Connections" on page 57.

## Procedure 2: Verifying SCSI IDs

If your server does not communicate with the 3581 Tape Autoloader, the SCSI ID may be set incorrectly:

1. Check whether the SCSI ID is still at the setting that you chose when you installed the autoloader (see "Determining the Existing ID" on page 11). If the setting is incorrect, follow the procedure in "Changing the ID" on page 11.
2. Make sure that the SCSI ID is not one that is used by another device or by the SCSI host adapter (note that because ID 7 is the highest priority ID on the SCSI bus, it is usually reserved for the primary host adapter).

3. If you change the SCSI ID, power off the 3581 Tape Autoloader, then power it back on to effect the change.
4. Retry the operation.
5. If the problem persists, contact IBM Technical Support for problem determination. If IBM Technical Support determines that the machine should be replaced, it will send you a replacement. To install the replacement machine, refer to "Replacing the Autoloader" on page 60.

## Procedure 3: Checking SCSI Connections

If your server does not communicate with the 3581 Tape Autoloader or the Ultrium Tape Drive, the SCSI cable or terminator connector pins may be damaged or not seated correctly, or the SCSI bus length may be incorrect.

1. Make sure that the 3581 Tape Autoloader is the proper access mode for the application that you are running (see "Operating in Random Access or Sequential Access Mode" on page 28). The typical mode is random access mode.

   **Note:** While in sequential access mode, the autoloader's robotics is not logically connected to the SCSI bus and does not respond to SCSI commands.
2. Check that the SCSI connectors are properly seated (this includes the interposers (if used), terminator, and cable connectors). Push the connectors into their receptacle connectors, and (if applicable) tighten the retention screws until firmly seated. Then, retry the operation.
3. If the problem persists, check all connector pins for damage. Remove the interposers, terminator, and cable connectors, and inspect them for bent, recessed, or missing pins. If necessary, replace the damaged component and ensure that all connectors are properly seated, then retry the operation.
4. If communication with the autoloader or drive still fails, check the length of the SCSI bus cable:
   - If your 3581 Tape Autoloader (with tape drive) uses an LVD SCSI interface, ensure that the total length of the bus does not exceed 12 m (39 ft).

     **Note:** Because the 3581 Tape Autoloader contains two SCSI devices, the autoloader and the IBM Ultrium Tape Drive, it is restricted to a maximum cable length of 12 m (39 ft).
   - If your 3581 Tape Autoloader uses an HVD SCSI interface, ensure that the total SCSI bus length does not exceed 25 m (82 ft).

   Retry the operation.
5. If the problem persists, the problem may be with the cables or the SCSI host adapter. Refer to your server's documentation and exercise a host utility to isolate the location of the problem. If the test fails, replace the terminator and run the test again. If the test passes, retry the operation.
6. If the problem persists, isolate the source by running the SCSI wrap test on the tape drive (see "Testing the SCSI Function of the Drive" on page 98).

   **Note:** Make sure to attach the LVD or HVD SCSI wrap tool prior to starting the SCSI wrap test.

   Ensure that the terminator is connected to one of the SCSI connectors (or is terminated through SCSI cables to another device that is terminated). Connect the SCSI wrap tool to the other SCSI connector.

If the test passes, retry the operation. If the test fails, contact IBM Technical Support for problem determination. If IBM Technical Support determines that the machine should be replaced, it will send you a replacement. To install the replacement machine, refer to "Replacing the Autoloader" on page 60.

## Procedure 4: Resolving Bar Code Reader Problems

If the bar code reader is not able to read the bar code label on the cartridges:

1. Wipe the lens of the bar code reader with a lint-free cloth (see **1** in Figure 27). Retry the operation.

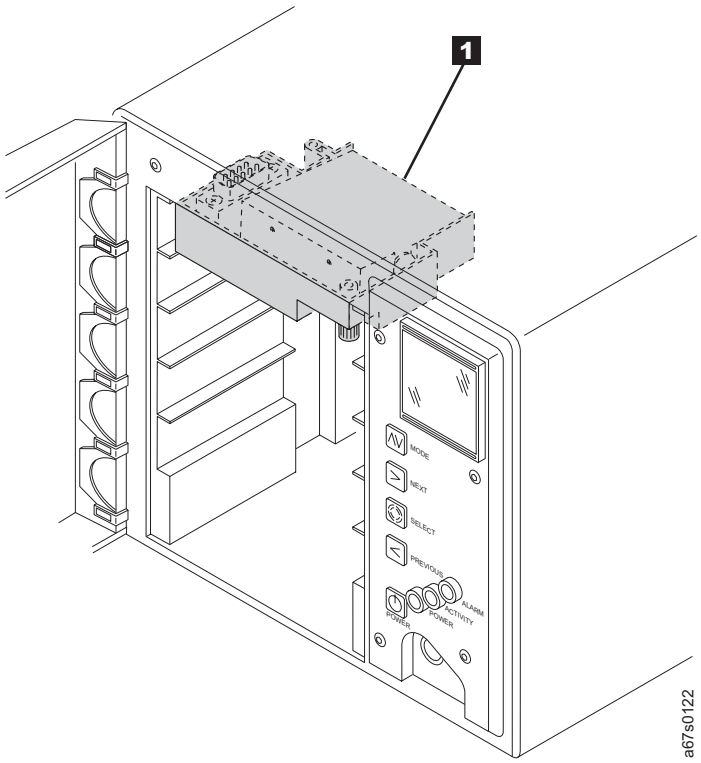


*Figure 27. Cleaning the lens of the bar code reader.* The lens is located at the rear of the installed bar code reader.

2. If the problem persists, issue the command for the drive to read the bar code labels:
   a. Make sure that no cartridge is in the drive.
   b. Ensure that **LdR READY** or **SEQ READY** appears on the message display.
   c. Press and hold the NEXT button and then the MODE button until **dIAG MENU** displays (approximately 5 seconds).
   d. Press MODE until **bARCOdE** displays.
   e. Press SELECT. **bCOdE ENAB** displays.
   f. Press NEXT until **Rd bCOdES** displays.
   g. Press SELECT to force the drive to read the bar code label on each cartridge and to briefly display each cartridge's volume serial number (VOLSER) on the message display.
      - If each cartridge bears a bar code label but **bC ERROR** or odd characters display instead of each VOLSER, replace the bar code reader ("Removal Procedure" on page 111).

- If the bar code reader reads the bar code labels on some cartridges but not others, replace the defective bar code labels.

3. If the problem persists, contact IBM Technical Support for problem determination. If IBM Technical Support determines that the machine should be replaced, it will send you a replacement. To install the replacement machine, refer to "Replacing the Autoloader" on page 60.

## Procedure 5: Loader Roller Cleaning Procedure

In some environments, the loader rollers that move the cartridges into and out of slots and the drive may collect debris, which in turn may contribute to cartridge insertion and extraction difficulty. The problem can often be helped by cleaning the surface of the four rubber rollers on the left side of the loader mechanism. The roller closest to the drive is the most critical. Because the rollers are somewhat difficult to reach, the following steps are suggested to aid in this process:

1. Remove all the cartridges from the slots. If cartridges are present in slots 6 or 7, use the **EJECT SLOT** command to move these cartridges to the front slots for removal. Be sure to record the slot each cartridge came from in order to return them to the correct slots when the cleaning procedure is complete.
2. Turn off the power and remove the power cord from the rear of the autoloader.
3. If your autoloader contains a barcode reader, remove it. Refer to "Removing and Replacing the Bar Code Reader" on page 76
4. Using a lint-free cloth very slightly dampened with either tape cleaning solution or water, wrap the cloth around a blunt object (such as a pencil or your finger), and then press and rub the cloth across each roller surface. The roller closest to the drive can best be reached from under the loader by reaching upward behind the left rear of the loader. This is the reason for removing cartridges from slots 6 and 7.

   **Note:** You may only be able to partially clean the roller surfaces because the rollers are connected to each other by way of a gear train. The gear train makes it difficult to rotate the rollers and gain access to the full roller surface.
5. Allow a few minutes for any remaining solution or water to evaporate from the roller surfaces.
6. If a barcode reader was removed, replace it.
7. Plug the power cord back in the rear of the autoloader and turn the power on.
8. Wipe down the exterior of all cartridges with a lint-free cloth and load them back into their appropriate slots. Use the **LOAd SLOT** command to load cartridges into slots 6 and 7.
9. Retry the **LOAd dRIVE** operation.

## Pre-Call Checklist

If you have questions or problems concerning the 3581 Tape Autoloader, perform the following steps before you place a call to IBM Technical Support. Where instructions refer you to the web, visit `http://www.ibm.com/storage/lto`.

1. Verify that the drive's firmware is at the most recent level. To determine the latest release of firmware, visit the web.
2. Verify that your device drivers are at the most recent level:
   - For IBM device drivers, visit the web.

- For the device drivers of independent software vendors (ISVs), visit the appropriate third-party web site.

3. Verify whether your hardware and software configuration is supported. To determine the latest supported attachments, visit the web.
4. Review "Most Frequently Asked Questions With Answers" on the web.
5. Perform a general checkup of the hardware and connections:
   - Ensure that you are using the correct SCSI terminator (LVD/HVD) and that you are not mistakenly using a SCSI wrap plug (used for the diagnostic SCSI wrap test).
   - Before attaching the SCSI cables, ensure that the connector does not contain bent or recessed pins.
   - Ensure that all retention screws for the SCSI cable and terminator are securely tightened.

## Replacing the Autoloader

To replace your 3581 Tape Autoloader, perform the following steps:

1. Remove the replacement autoloader from its packaging.
2. Locate the repair tag **1** (included with the replacement autoloader).
3. Write down the serial number of the failed autoloader on the repair tag.
4. Affix the repair tag to the replacement autoloader (inside the door and above the front tape slots **2** ).

   **Note:** The agency label **3** is located on the floor of the autoloader.
5. If your autoloader is installed with a bar code reader, remove it and install it in the replacement autoloader (refer to the instructions in Appendix C, "Bar Code Reader Installation (optional)", on page 109).
6. Place the failed autoloader into the packaging of the replacement autoloader.
7. Follow the instructions (included with the replacement autoloader) for returning the failed autoloader to IBM.

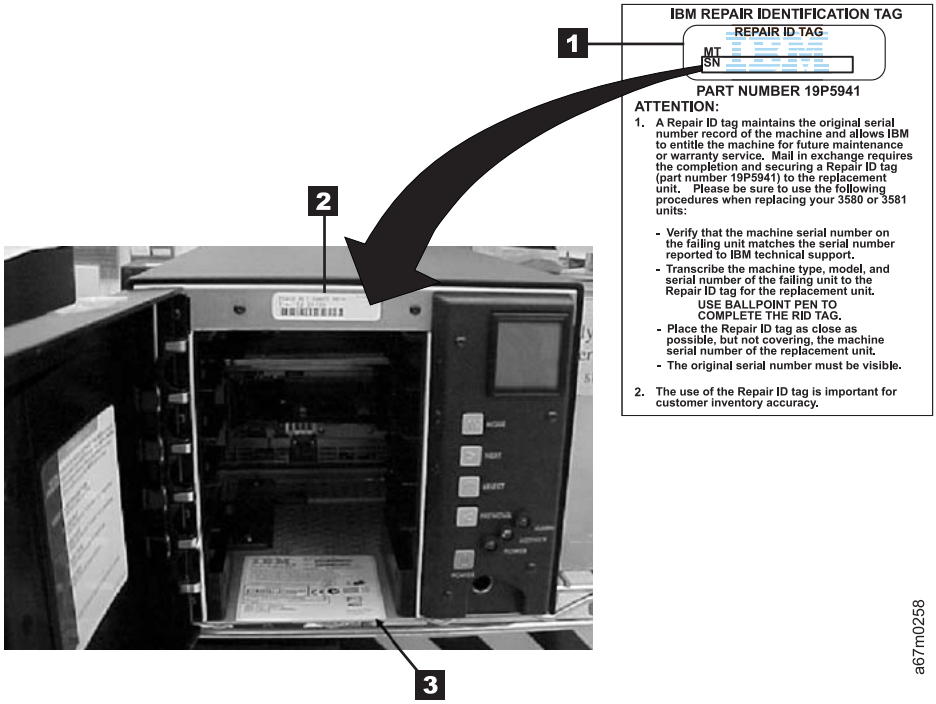


*Figure 28. Repair Identification Tag*

## Autoloader and Drive Error Messages

If an error occurs during operation, the 3581 Tape Autoloader halts the current operation and displays an error message in the message display. The message may pertain to the autoloader or the drive.

Table 8 lists the autoloader and drive error messages, and gives a description of each. If a drive error occurs during the Power-On Self Test (POST), **dRIVE POST** displays; for all other errors that occur during POST, **ROb0T POST** displays.

To resolve an error message, see "Procedure 1: Resolving Error Messages/Codes" on page 54. After you resolve the error, cycle power to the autoloader (turn off, then on) and retry the last operation.

*Table 8. Autoloader and drive error messages*

| Error Message and Description | Action |
|---|---|
| **CAM LIMIT**<br><br>The cartridge push rod (or cam) is fully extended without having the cartridge trip the presence sensor. | 1. Check the picker to determine whether a cartridge is present. If so, try to remove the cartridge by using the EJECT PCKR command.<br>2. Check the cartridge for the correct label placement. An oversized or improperly positioned label can wrap over the cartridge and prevent the sensor from functioning correctly.<br>3. Cycle the autoloader's power (turn it off, then on) to recover from the problem, then retry the operation.<br>4. If the problem persists, contact IBM Technical Support for resolution. |

*Table 8. Autoloader and drive error messages (continued)*

| Error Message and Description | Action |
|---|---|
| **CPU RX ERR**<br><br>The Motion CPU is not ready to receive motion commands from the controller. | 1. Cycle the autoloader's power (turn it off, then on) to recover from the problem, then retry the operation.<br>2. If the problem persists, contact IBM Technical Support for resolution. |
| **CPU TX ERR**<br><br>The Motion CPU is not ready to transmit motion commands to the servos (actions motors). | 1. Cycle the autoloader's power (turn it off, then on) to recover from the problem, then retry the operation.<br>2. If the problem persists, contact IBM Technical Support for resolution. |
| **CT FAILEd**<br><br>The cleaning tape failed to clean the drive. | 1. Load a different cleaning cartridge.<br>2. Cycle the autoloader's power (turn it off, then on) to recover from the problem, then retry the operation.<br>3. If the problem persists, contact IBM Technical Support for resolution. |
| **dEST FULL***<br><br>The destination location contains a cartridge. | Open the front door and look at the destination storage slot:<br>• If the slot is occupied, the problem is operator error. Cycle the autoloader's power (turn it off, then on) to recover from the problem, then retry the operation and specify an empty storage slot.<br>• If the slot is empty, look at the storage slot sensor fields at the bottom of the message display to determine whether the sensor indicates that the slot is occupied or empty.<br>– If the sensor indicates that the slot is empty, cycle the autoloader's power (turn it off, then on) to recover from the problem and retry the operation. If the error occurs again, contact IBM Technical Support for resolution.<br>– If the sensor indicates that the slot is occupied, contact IBM Technical Support for resolution. |
| **dRIVE bUSY**<br><br>The drive is busy and cannot unload the tape. | 1. Cycle the autoloader's power (turn it off, then on) to recover from the problem.<br>2. If a cartridge is loaded, eject it from the drive by using the EJECT dRV command. Then, retry the operation.<br>3. If the problem persists, contact IBM Technical Support for resolution. |
| **dRIVE FULL***<br><br>The drive contains a cartridge. | 1. Open the front door and determine whether the drive contains a tape cartridge. If it does, try to eject the cartridge by using the EJECT dRV command.<br>2. Cycle the autoloader's power (turn it off, then on) to recover from the problem, then retry the operation.<br>3. If the problem persists, contact IBM Technical Support for resolution. |

*Table 8. Autoloader and drive error messages (continued)*

| Error Message and Description | Action |
|---|---|
| **dRIVE LOAd**<br><br>The robotics was unable to load a cartridge into the drive. | 1. By maintaining a moderate temperature and humidity (20 to 27°C (68 to 80°F) and 35 to 65% humidity) and by restricting direct cold air from blowing on the autoloader, you can often prevent **dRIVE LOAd** errors. Cleaning the loader rollers with a dry, lint-free cloth has also proven to be helpful. See "Procedure 5: Loader Roller Cleaning Procedure" on page 59.<br>2. Open the front door and determine whether the picker contains a tape cartridge. If it does, try to remove the cartridge by using the EJECT PCKR command.<br>3. If a cartridge is present in the drive, try to eject it by using the EJECT dRV command.<br>4. Cycle the autoloader's power (turn it off, then on) to recover from the problem, then retry the operation.<br>5. If the problem persists, contact IBM Technical Support for resolution. |
| **dRIVE PGRM**<br><br>The attempt to set drive parameters failed. | 1. Cycle the autoloader's power (turn it off, then on) to recover from the problem, then retry the operation.<br>2. If the problem persists, contact IBM Technical Support for resolution. |
| **dRIVE POST**<br><br>The drive failed its Power-On Self Test (POST). | 1. Cycle the autoloader's power (turn it off, then on) to recover from the problem, then retry the operation.<br>2. If the problem persists, contact IBM Technical Support for resolution. |
| **FRONT SLOT**<br><br>A front slot sensor was not tripped. | • If the error message displays during a pick-cartridge operation, open the front door and look at the source storage slot to determine whether it contains a tape cartridge:<br>– If the source slot is occupied, issue a MOVE command (from the operator panel) to move the cartridge from the slot to the picker. If the error occurs again, contact IBM Technical Support for resolution.<br>– If the source slot is empty, cycle the autoloader's power (turn it off, then on) to recover from the problem, then retry the operation. If the error occurs again, contact IBM Technical Support for resolution.<br>• If the error message displays during a place-cartridge operation, cycle the autoloader's power (turn it off, then on) to recover from the problem, then retry the operation. If the error occurs again, contact IBM Technical Support for resolution. |
| **FRONT TAPE**<br><br>A front tape sensor was not tripped. | • If the error message displays during a pick-cartridge operation, open the front door and look at the picker to determine whether it contains a tape cartridge:<br>– If the picker contains a cartridge, issue a MOVE command (from the operator panel) to move the cartridge from the picker to an empty storage slot. If the error occurs again, contact IBM Technical Support for resolution.<br>– If the picker is empty, cycle the autoloader's power (turn it off, then on) to recover from the problem, then retry the operation. If the error occurs again, contact IBM Technical Support for resolution.<br>• If the error message displays during a place-cartridge operation, cycle the autoloader's power (turn it off, then on) to recover from the problem, then retry the operation. If the error occurs again, contact IBM Technical Support for resolution. |

*Table 8. Autoloader and drive error messages (continued)*

| Error Message and Description | Action |
|---|---|
| **HALT**<br><br>The Motion CPU has been halted by a low ACT line | 1. Cycle the autoloader's power (turn it off, then on) to recover from the problem, then retry the operation.<br>2. If the problem persists, contact IBM Technical Support for resolution. |
| **INV MOV OP***<br><br>An invalid MOVE operation occurred. | 1. Cycle the autoloader's power (turn it off, then on) to recover from the problem.<br>2. Run the cycle test to verify that the autoloader is working (see "Testing the Robotics" on page 88). Then, retry the operation.<br>3. If the problem persists, contact IBM Technical Support for resolution. |
| **LdR INIT**<br><br>The autoloader could not complete its initialization. | Prior to powering-on the autoloader, ensure that the SCSI terminator (and not the SCSI wrap tool) is installed. |
| **NVM SELECT**<br><br>The non-volatile random access memory (NVRAM) selection failed. | 1. Cycle the autoloader's power (turn it off, then on) to recover from the problem, then retry the operation.<br>2. If the problem persists, contact IBM Technical Support for resolution. |
| **NVM WRITE**<br><br>The NVRAM write failed. | 1. Cycle the autoloader's power (turn it off, then on) to recover from the problem, then retry the operation.<br>2. If the problem persists, contact IBM Technical Support for resolution. |
| **PCKR EMPTY***<br><br>The picker does not contain a cartridge. | 1. Check the picker to determine whether a cartridge is present. If so, try to remove the cartridge by using the EJECT PCKR command.<br>2. Check the cartridge for the correct label placement. An oversized or improperly positioned label can wrap over the cartridge and prevent the sensor from functioning correctly.<br>3. Cycle the autoloader's power (turn it off, then on) to recover from the problem, then retry the operation.<br>4. If the problem persists, contact IBM Technical Support for resolution. |
| **PCKR FULL***<br><br>The picker contains a cartridge. | 1. Check the picker to determine whether a cartridge is present. If so, try to remove the cartridge by using the EJECT PCKR command.<br>2. Cycle the autoloader's power (turn it off, then on) to recover from the problem, then retry the operation.<br>3. If the problem persists, contact IBM Technical Support for resolution. |
| **REAR SLOT**<br><br>A rear slot sensor was not tripped. | • If the error message displays during a pick-cartridge operation, open the front door and look at the source storage slot to determine whether it contains a tape cartridge:<br>– If the source slot is occupied, issue a MOVE command (from the operator panel) to move the cartridge from the slot to the picker. If the error occurs again, contact IBM Technical Support for resolution.<br>– If the source slot is empty, cycle the autoloader's power (turn it off, then on) to recover from the problem, then retry the operation. If the error occurs again, contact IBM Technical Support for resolution.<br>• If the error message displays during a place-cartridge operation, cycle the autoloader's power (turn it off, then on) to recover from the problem, then retry the operation. If the error occurs again, contact IBM Technical Support for resolution. |

*Table 8. Autoloader and drive error messages (continued)*

| Error Message and Description | Action |
|---|---|
| **REAR TAPE**<br><br>A rear tape sensor was not tripped. | • By maintaining a moderate temperature and humidity (20 to 27°C (68 to 80°F) and 35 to 65% humidity) and by restricting direct cold air from blowing on the autoloader, you can often prevent **REAR TAPE** errors. Cleaning the loader rollers with a dry, lint-free cloth has also proven to be helpful. See "Procedure 5: Loader Roller Cleaning Procedure" on page 59.<br>• If the error message displays during a pick-cartridge operation, open the front door and look at the picker to determine whether it contains a tape cartridge:<br>– If the picker contains a cartridge, issue a MOVE command (from the operator panel) to move the cartridge from the picker to an empty storage slot. If the error occurs again, contact IBM Technical Support for resolution.<br>– If the picker is empty, cycle the autoloader's power (turn it off, then on) to recover from the problem, then retry the operation. If the error occurs again, contact IBM Technical Support for resolution.<br>• If the error message displays during a place-cartridge operation, cycle the autoloader's power (turn it off, then on) to recover from the problem, then retry the operation. If the error occurs again, contact IBM Technical Support for resolution. |
| **RObOT POST**<br><br>The robotics failed its Power-On Self Test (POST). | 1. Cycle the autoloader's power (turn it off, then on) to recover from the problem, then retry the operation.<br>2. If the problem persists, contact IBM Technical Support for resolution. |
| **SRC EMPTY***<br><br>The source location does not contain a cartridge. | Open the front door and look at the source storage slot:<br>• If the slot is empty, the problem is operator error. Cycle the autoloader's power (turn it off, then on) to recover from the problem, then retry the operation and specify a storage slot that contains a cartridge.<br>• If the slot contains a cartridge, look at the storage slot sensor fields at the bottom of the message display to determine whether the sensor indicates that the slot is occupied or empty. If the sensor indicates that the slot is empty, manually remove the cartridge from the slot, then reinsert the cartridge and check the sensor again:<br>– If the sensor indicates that the slot is occupied, cycle the autoloader's power (turn it off, then on) to recover from the problem and retry the operation. If the error occurs again, contact IBM Technical Support for resolution.<br>– If the sensor indicates that the slot is empty, contact IBM Technical Support for resolution. |
| * This error does not display if the error occurred during SCSI interaction. | |

## Drive Error Codes

The 3581 Tape Autoloader presents each drive error as a single character in the message display. Table 9 on page 66 describes the codes. To resolve error codes 1 through 9, refer to "Drive Error Codes" on page 55.

*Table 9. Drive error codes*. A drive error code appears in the message display of the 3581 Tape Autoloader. It clears when you power-off the unit.

| Code | Cause and Action |
|---|---|
| 0 | No error occurred and no action is required. This code displays:<br>• When power is cycled (turned off, then on) to the autoloader.<br>• When diagnostics have finished running and no error occurred. |
| 1 | Cooling problem. The tape drive detected that the recommended operating temperature was exceeded. Perform one or more of the following actions:<br>• Ensure that the cooling fan is rotating and is quiet. If not, replace the 3581 Tape Autoloader.<br>• Remove any blockage that prevents air from flowing freely through the autoloader.<br>• Ensure that the operating temperature and airflow is within the specified range (see Table 1 on page 4).<br>• If the operating temperature is within the specified range and the problem persists, replace the 3581 Tape Autoloader.<br><br>The error code clears when you power-off the autoloader or access the Diagnostic Menu (see "Accessing the Diagnostic Menu" on page 85). |
| 2 | Power problem. The tape drive detected that the externally supplied power is either approaching the specified voltage limits (the autoloader is still operating) or is outside the specified voltage limits (the autoloader is not operating). Perform the following action:<br>1. Ensure that the power connector is properly seated.<br>2. Ensure that the proper DC voltages are being applied within the tolerances allowed (see Table 1 on page 4).<br>3. If the proper voltages are being applied but the problem persists, replace the 3581 Tape Autoloader.<br><br>The error code clears when you power-off the autoloader or access the Diagnostic Menu (see "Accessing the Diagnostic Menu" on page 85). |
| 3 | Firmware problem. The tape drive determined that a firmware error occurred. Perform the following action:<br>1. Collect a drive dump from one of the following:<br>**Note:** Do not force a new dump; the autoloader has already created one.<br>• Server's SCSI interface by using a device driver utility or system tool (for instructions about reading a drive dump from tape, visit the web at `http://www.ibm.com/storage/lto`)<br>• Ultrium Tape Drive (to copy a drive dump, see "Copying a Drive Dump to Tape" on page 97)<br>2. Power the autoloader off and on, then retry the operation that produced the error.<br>3. If the problem persists, download new firmware and retry the operation.<br>4. If the problem persists, send the drive dump that you collected in step 1 to your IBM Technical Support Center.<br><br>The error code clears when you power-off the autoloader or access the Diagnostic Menu (see "Accessing the Diagnostic Menu" on page 85). |

*Table 9. Drive error codes (continued)*. A drive error code appears in the message display of the 3581 Tape Autoloader. It clears when you power-off the unit.

| Code | Cause and Action |
|---|---|
| 4 | Firmware or tape drive problem. The tape drive determined that a firmware or tape drive hardware failure occurred. Perform the following action:<br>1. Collect a drive dump from one of the following:<br>**Note:** Do not force a new dump; the autoloader has already created one.<br>• Server's SCSI interface by using a device driver utility or system tool (for instructions about reading a drive dump from tape, visit the web at `http://www.ibm.com/storage/lto`)<br>• Ultrium Tape Drive (to copy a drive dump, see "Copying a Drive Dump to Tape" on page 97).<br>2. Power the autoloader off and on, then retry the operation that produced the error. The error code clears when you power-off the autoloader or access the Diagnostic Menu (see "Accessing the Diagnostic Menu" on page 85).<br>3. If the problem persists, download new firmware and retry the operation; if new firmware is not available, replace the 3581 Tape Autoloader. |
| 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 autoloader will not allow you to insert a cartridge if the current cartridge was successfully ejected. If the problem persists, replace the 3581 Tape Autoloader. The error code clears when you power-off the autoloader or access the Diagnostic Menu (see "Accessing the Diagnostic Menu" on page 85). |

*Table 9. Drive error codes (continued)*. A drive error code appears in the message display of the 3581 Tape Autoloader. It clears when you power-off the unit.

| 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:<br><br>**For Problems with Writing Data:**<br><br>If the problem occurred while the autoloader was writing data to the tape, and if you know the volume serial number (located on the cartridge label) of the tape cartridge loaded in the drive when the problem occurred, retry the operation with a different cartridge:<br>• If the operation succeeds, the original cartridge was defective. Copy data from the defective cartridge and discard it.<br>• If the operation fails and another autoloader is available, insert the cartridge into the other unit and retry the operation.<br>– If the operation fails, discard the defective cartridge.<br>– If the operation succeeds, insert a scratch cartridge into the first unit and run the tape drive diagnostics (see "Testing the Read/Write Function" on page 94).<br>- If the diagnostics fail, replace the 3581 Tape Autoloader.<br>- If the diagnostics succeed, the error was temporary.<br>• If the operation fails and another autoloader is not available, insert a scratch cartridge into the unit and run the tape drive diagnostics (see "Testing the Read/Write Function" on page 94).<br>– If the diagnostics fail, replace the 3581 Tape Autoloader.<br>– If the diagnostics succeed, discard the cartridge.<br><br>If the problem occurs with multiple tape cartridges or if you do not know the tape cartridge's volume serial number, run the tape drive diagnostics (see "Testing the Read/Write Function" on page 94):<br>• If the diagnostics fail, replace the 3581 Tape Autoloader.<br>• If the diagnostics succeed, run the Test Head diagnostic (see "Testing the Read/Write Function" on page 94).<br>– If the Test Head diagnostic fails, replace the 3581 Tape Autoloader.<br>– If the Test Head diagnostic succeeds, replace the cartridges that caused the problem.<br><br>**For Problems with Reading Data:**<br><br>If the problem occurred while the autoloader was reading data from the tape, and if you know the volume serial number of the tape cartridge, perform one of the following procedures:<br>• If another autoloader is available, insert the cartridge into the other unit and retry the operation:<br>– If the operation fails, discard the defective cartridge.<br>– If the operation succeeds, insert a scratch cartridge into the first unit and run the tape drive diagnostics (see "Testing the Read/Write Function" on page 94):<br>- If the diagnostics fail, replace the 3581 Tape Autoloader.<br>- If the diagnostics succeed, the error was temporary.<br>• If another autoloader is not available, insert a scratch cartridge into the unit and run the tape drive diagnostics (see "Testing the Read/Write Function" on page 94):<br>– If the diagnostics fail, replace the 3581 Tape Autoloader.<br>– If the diagnostics succeed, discard the cartridge.<br><br>If the problem occurs with multiple tape cartridges or if you do not know the tape cartridge's volume serial number, run the tape drive diagnostics (see "Testing the Read/Write Function" on page 94):<br>• If the diagnostics fail, replace the 3581 Tape Autoloader.<br>• If the diagnostics succeed, run the Test Head diagnostic (see "Testing the Read/Write Function" on page 94).<br>– If the Test Head diagnostic fails, replace the 3581 Tape Autoloader.<br>– If the Test Head diagnostic succeeds, replace the cartridges that caused the problem.<br><br>The error code clears when you remove the tape cartridge or access the Diagnostic Menu (see "Accessing the Diagnostic Menu" on page 85). |

*Table 9. Drive error codes (continued)*. A drive error code appears in the message display of the 3581 Tape Autoloader. It clears when you power-off the unit.

| Code | Cause and Action |
|---|---|
| 7 | A high probability of media error. The tape drive determined that an error occurred because of a faulty tape cartridge. Try another tape cartridge. If the problem occurs with multiple tape cartridges, use the following procedure:<br><br>**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.<br>1. If possible, run the tape cartridge in a different autoloader. If the operation in the other unit fails and **6** or **7** displays, replace the media. If the operation succeeds, run the Test Cartridge & Media diagnostic (see "Testing the Read/Write Function" on page 94).<br>2. If the Test Cartridge & Media diagnostic fails, replace the media. If it runs successfully, clean the drive head and run the tape drive diagnostics (see "Cleaning the Drive Head" on page 27).<br>3. If the tape drive diagnostics fail, replace the 3581 Tape Autoloader. If the tape drive diagnostics run successfully, perform the operation that produced the initial media error.<br><br>The error code clears when you remove the tape cartridge or access the Diagnostic Menu (see "Accessing the Diagnostic Menu" on page 85). |
| 8 | Tape drive or SCSI bus failure. The tape drive determined that a failure occurred in the tape drive's hardware or in the SCSI bus. See "Procedure 3: Checking SCSI Connections" on page 57. The error code clears 10 seconds after the drive detected the error or when you access the Diagnostic Menu (see "Accessing the Diagnostic Menu" on page 85). |
| 9 | 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 3581 Tape Autoloader. The error code clears 10 seconds after the drive detected the error or when you access the Diagnostic Menu (see "Accessing the Diagnostic Menu" on page 85). |
| o, c, b, h, E, or F | No error or message assigned. There may be a problem with the single-character display. Turn the power off, then on and determine whether all segments on the single-character display are lit. If so, you may have a down-level version of your 3581 Tape Autoloader's firmware or this book. Refer to the latest version of the firmware or this book. |
| A | Tape drive hardware problem. The tape drive determined that a problem occurred which degraded the operation of the tape drive, but it did not restrict continued use. If the problem persists, replace the 3581 Tape Autoloader. The drive is usable. The error code clears when you power-off the autoloader or access the Diagnostic Menu (see "Accessing the Diagnostic Menu" on page 85). |
| B | No error or message is assigned. See error code 8 in this table. |
| C | The tape drive needs to be cleaned. Clean the tape drive. See "Cleaning the Drive Head" on page 27.<br><br>The error code clears when you clean the tape drive or access the Diagnostic Menu (see "Accessing the Diagnostic Menu" on page 85). |
| D | No error or message assigned. See error code 0 in this table. |

## TapeAlert Flags

TapeAlert is a standard that defines status conditions and problems experienced by tape devices such as drives, autoloaders, and libraries. The standard enables a server to read TapeAlert flags from a tape drive or an autoloader over the SCSI bus. The server reads the flags from Log Sense Page 0x2E. For a list of TapeAlert flags that are supported by the IBM Ultrium Tape Drive and the 3581 Tape Autoloader, see Appendix F, "TapeAlert Flags", on page 129.

## Contacting IBM Technical Support

Prior to calling IBM Service, the customer is responsible for following IBM's published LTO diagnostic procedures including any needed update to the latest level of firmware. For details, refer to `http://ssddom02.storage.ibm.com/techsup/webnav.nsf/support/lto`.

The IBM support center will assist with problem determination and initiate shipment of a replacement part, if needed, to the customer's location. Transportation costs, both ways, are paid by IBM. The replacement part becomes the property of the customer in exchange for the failed part, which becomes the property of IBM. The customer must transfer the machine type, model, and serial number of the failing unit to the replacement unit. A Failure Analysis form is also included. The customer is responsible for packing the failed part into the shipping carton that contained the replacement part. The customer is responsible for contacting IBM to arrange for its collection in most major cities outside of PRC. Failure to return the failed part to IBM within 30 days will result in the customer being billed for the new list price. The customer is responsible for installing and setting up the replacement part. For PRC, the customers are required to bring the failed part to the nearest IBM authorized service center to obtain the replacement part.

Failure to use the carton in which the replacement part was received, or failure to otherwise properly pack the returned part, could result in charges being incurred by the customer for damage to the failed part during shipment. Failure to fill out and affix the identification tag to the replacement unit with the machine type, model, and serial number of the failing unit could result in losing the warranty for the replacement unit.

Before calling support, follow these steps which will help you take full advantage of your call:

- Review all documentation carefully. (Experience has demonstrated that most questions are answered in your documentation.)
- Be prepared to explain whether the software or hardware has worked properly at anytime in the past. Have you changed anything recently?
- Pinpoint the exact location of your problem, if possible. Note the steps that led to the problem. Can you duplicate the problem or is it a one-time occurrence?
- Note any error messages displayed on your PC monitor or file server. Write down the exact error message.
- If at all possible, call while at your computer, with the library installed and turned on.
- If running on a network, have all relevant information available (that is, type, version number, network hardware, and so on).
- Be prepared to provide:
  - Your name and your company's name
  - Model number
  - Serial number of the library (front cover, lower right corner)
  - Software version numbers
  - Device driver information
  - Host application name and version
  - Hardware configuration, including firmware versions, date, and number

- Type of host, operating system version, clock speed, RAM, network type, network version, and any special boards installed
- A brief description of the problem

Having this information available when you call for customer assistance will enable support personnel to resolve your problem in the most efficient manner possible.

# Chapter 6. Removal and Replacement Procedures

Before removing or replacing the 3581 Tape Autoloader and the bar code reader, perform the following general service procedures.

- Use Chapter 5, "Troubleshooting", on page 53 to isolate where the failure is occurring. There are several possible locations:
  - Tape drive and robotics
  - Media
  - SCSI cables and terminator
  - Server hardware
  - Application software
- Prior to cycling power to the 3581 Tape Autoloader:
  - Write down the error message or error code that appears on the message display.
  - If possible, and especially if the problem appears to be related to the tape drive, copy the existing microcode dump in the drive's memory (see "Copying a Drive Dump to Tape" on page 97).

For a list of parts for the 3581 Tape Autoloader, see Chapter 7, "Parts Lists", on page 79.

## Safety Inspection

Before you service the 3581 Tape Autoloader, perform the following safety inspection procedure:

1. Stop all activity on the SCSI bus.
2. Turn off the power to the autoloader.
3. Disconnect the SCSI cable and check the SCSI bus terminator for damage.
4. Unplug the autoloader's power cord from the electrical outlet.
5. Check the autoloader's power cord for damage, such as a pinched, cut, or frayed cord.
6. Check the autoloader's SCSI bus (signal) cable for damage.
7. Check the cover of the autoloader for sharp edges, damage, or alterations that expose its internal parts.
8. Check the cover of the autoloader for proper fit. It should be in place and secure.
9. Check the product label on the bottom of the autoloader to make sure it matches the voltage at your outlet.

## Removing and Replacing the Autoloader

**CAUTION:**
**Use care when servicing the autoloader assembly.**

If (after you have performed the troubleshooting tips) you determine that the 3581 Tape Autoloader must be exchanged, perform the following procedures:

**Note:** If the failure makes the operator panel unusable, gather information about the autoloader (such as the unit's SCSI IDs, bar code reader settings, and mode of operation) from your administrator.

## Removal Procedure

To remove the failed autoloader, perform the following steps:

1. Unpack the replacement autoloader and perform the following:
   a. Inspect the autoloader for shipping damage. If there is damage, do not install the autoloader. Report the damage immediately by contacting your place of purchase.
   b. Remove the two keys (duplicates) that are taped to the rear panel, then unlock and open the front door (see the instructions in "Front Door" on page 17).
   c. Remove the foam shipping block from the cartridge storage area.
2. Determine whether the failed autoloader is in random or sequential access mode. If it is in random mode, **LdR READY** appears on the message display; if it is in sequential mode, **SEQ READY** displays. Write the setting down.
3. Determine the SCSI IDs of the failed autoloader (in random mode) and its tape drive (in both random and sequential modes) (see "Step 7. Setting the SCSI IDs of the Autoloader and the Drive" on page 10). Write the settings down. Refer to the Vital Product Data form and update any settings that have changed since installation.
4. Write down the storage slot location of each cartridge (you will need to place them in the same locations in the replacement autoloader).
5. Remove all cartridges from the failed autoloader.

   **Note:** Use the EJECT SLOT command to remove any cartridges from rear slots 6 and 7, then use the EJECT dRV command (if necessary) to remove a cartridge from the drive (see "Using the Control Buttons to Display Commands" on page 21). If a cartridge is stuck in the tape drive, see Appendix B, "Removing a Tape Cartridge", on page 99.
6. If the failed autoloader contains a bar code reader, record whether it is enabled or disabled and whether it is set to perform a cartridge inventory during power-on. Use the following procedure to determine the settings:
   a. Make sure that no cartridge is in the drive.
   b. Ensure that **LdR READY** or **SEQ READY** appears on the message display.
   c. Press and hold the NEXT button and then the MODE button until **dIAG MENU** displays (approximately 5 seconds).
   d. Press MODE until **bARCOdE** displays.
   e. Press SELECT. **bCOdE ENAB** displays.
   f. Press SELECT. Write down whether the existing setting is **bCOdE ON** or **bCOdE OFF**.
   g. Press MODE until you return to **LdR READY** or **SEQ READY**.
   h. Press and hold the NEXT button and then the MODE button until **dIAG MENU** displays (approximately 5 seconds).
   i. Press MODE until **bARCOdE** displays.
   j. Press SELECT. **bCOdE ENAB** displays.

k. Press NEXT until **INIT bCOdE** displays.

**Note:** If you pass **INIT bCOdE**, press PREVIOUS to return to it.

l. Press SELECT. Write down whether the existing setting is **INIT ON** or **INIT OFF**.

m. Press MODE until you return to **LdR REAdY** or **SEQ REAdY**.

7. Make sure that the failed autoloader is varied offline at the server.
8. Power-off the failed autoloader by pressing and holding the POWER button for 2 seconds.
9. Disconnect the SCSI cables, terminator (if connected), and power cord from the failed autoloader (reverse the steps in "Step 11. Connecting the SCSI Bus Cable" on page 14 and "Step 6. Connecting Power" on page 9).
10. If the failed autoloader contains a bar code reader, remove it (see "Removing and Replacing the Bar Code Reader" on page 76).

## Replacement Procedure

**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.**

To replace the failed autoloader, perform the following steps:

1. If you must install a bar code reader in the replacement autoloader, see Appendix C, "Bar Code Reader Installation (optional)", on page 109.
2. Install the replacement autoloader (see Chapter 2, "Installing the 3581 Tape Autoloader", on page 7).
3. After the autoloader completes its Power-On Self Test (POST), perform a read/write test on the drive (see "Testing the Read/Write Function" on page 94).
   - If the test succeeds, go to step 4.
   - If the test fails, insert another scratch cartridge and retry the operation. If the test still fails, contact IBM Technical Support.
4. Set the SCSI IDs that you wrote down in step 3 on page 74 of "Removal Procedure" on page 74. To set the IDs, see "Step 7. Setting the SCSI IDs of the Autoloader and the Drive" on page 10.
5. If you installed a bar code reader in the replacement autoloader, set the settings that you wrote down in step 6 on page 74 of "Removal Procedure" on page 74. To set the settings, see "Enabling or Disabling the Bar Code Reader" on page 92 and "Performing an Inventory of the Cartridges During Power-on" on page 92.
6. If it is not already set, set the mode of operation (random or sequential access). To set the mode of operation, see "Step 8. Setting the Operating Mode" on page 12.
7. Vary the autoloader online at the server.
8. To verify that the autoloader operates properly, run the host utilities (if available) and an application.

# Removing and Replacing the Bar Code Reader


**CAUTION:**
**These products comply with the performance standards set by the U.S. Food and Drug Administration for a Class II and Hickey Laser Product.**

**CAUTION:**
**Use care when servicing the autoloader assembly.**

## Removal Procedure

1. Verify that the bar code reader functions improperly by performing the following:
   a. Make sure that no cartridge is in the drive.
   b. Ensure that **LdR READY** or **SEQ READY** appears on the message display.
   c. Press and hold the NEXT button and then the MODE button until **dIAG MENU** displays (approximately 5 seconds).
   d. Press MODE until **bARCOdE** displays.
   e. Press SELECT. **bCOdE ENAB** displays.
   f. Press NEXT until **Rd bCOdES** displays.
   g. Press SELECT to force the drive to read the bar code label on each cartridge and to briefly display each cartridge's volume serial number (VOLSER) on the message display.
      - If each cartridge bears a bar code label but **bC ERROR** or odd characters display instead of each VOLSER, replace the bar code reader ("Removal Procedure" on page 111).
      - If the bar code reader reads the bar code labels on some cartridges but not others, replace the defective bar code labels.
2. Unpack the replacement bar code reader and inspect it for shipping damage. If there is damage, do not install the bar code reader. Report the damage immediately by contacting your place of purchase.
3. Vary the autoloader and tape drive offline at the server.
4. Power-off the 3581 Tape Autoloader and unplug its power cord from the electrical outlet.
5. Remove all cartridges from the front slots of the 3581 Tape Autoloader. Write down the storage slot location of each cartridge (you will need to place them in their original locations).
6. Loosen the two thumbscrews (see **6** in Figure 29 on page 77) on the bar code reader's mounting bracket **4**.
7. Pull down on the bar code reader to remove its interface connector **5** from the mating connector of the 3581 Tape Autoloader.

## Replacement Procedure

You do not need tools for this procedure.

1. Referring to Figure 29, locate the mounting hole **1** and interface connector **2** on the inside top panel of the autoloader, directly above cartridge storage slot 1.

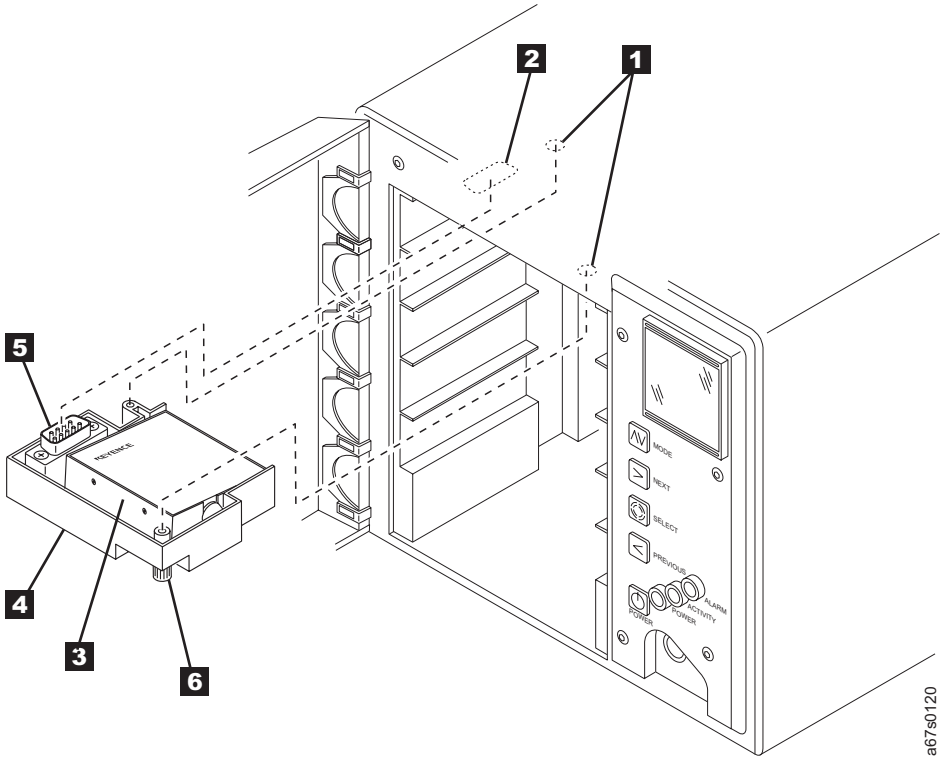


*Figure 29. Replacing the bar code reader*

2. Press the interface connector **5** of the bar code reader into the mating interface connector **2** on the inside top panel of the autoloader.
3. Push in and tighten the two thumbscrews **6** on the mounting bracket until it secures the bar code reader to the panel.
4. Connect the autoloader's power cord to an electrical outlet.
5. Press the POWER button to power-on the autoloader. Allow the autoloader to complete its POST.
6. Load the front storage slots with the cartridges that you removed in step 5 on page 76 of "Removal Procedure" on page 76.
7. Verify that the bar code reader functions properly by performing the following:
   a. Make sure that no cartridge is in the drive.
   b. Ensure that **LdR REAdY** or **SEQ REAdY** appears on the message display.
   c. Press and hold the NEXT button and then the MODE button until **dIAG MENU** displays (approximately 5 seconds).
   d. Press MODE until **bARCOdE** displays.
   e. Press SELECT. **bCOdE ENAB** displays.
   f. Press NEXT until **Rd bCOdES** displays.
   g. Press SELECT. The 3581 Tape Autoloader briefly displays each cartridge's volume serial number (VOLSER) on the message display. When the drive places the last cartridge back into its storage slot, **LdR REAdY** or **SEQ REAdY** displays.
8. Vary the autoloader and the tape drive online at the server.

# Chapter 7. Parts Lists

Table 10 lists orderable models and features, as well as replacement parts for the 3581 Tape Autoloader. To order a part by feature code, contact your local IBM Marketing Representative or Business Partner. If the part has a customer replaceable unit (CRU) number, it is available through the IBM Technical Support Center.

**Note:** Power cords are listed separately in "Power Cords" on page 80; media supplies are listed in "Ordering Media Supplies" on page 49.

## Parts for 3581 Tape Autoloader

Table 10 lists the parts for the 3581 Tape Autoloader.

*Table 10. Parts list for the 3581 Tape Autoloader*

| Feature Code (FC) or Model | Description | Notes | CRU Part Number |
|---|---|---|---|
| Model L13 | IBM 3581 Ultrium Tape Autoloader with LVD/SE SCSI interface | Formerly 35L1285; IBM part number 19P5871 | 19P5930 |
| Model H13 | IBM 3581 Ultrium Tape Autoloader with HVD/DIFF SCSI interface | Formerly 35L1286; IBM part number 19P5868 | 19P5931 |
| Model L23 | IBM 3581 Ultrium Tape Autoloader with LVD/SE SCSI interface | | 18P8532 |
| Model H23 | IBM 3581 Ultrium Tape Autoloader with HVD/DIFF SCSI interface | | 18P8533 |
| FC 7004 | Bar code reader | | 35L1287 |
| FC 7003 | Rack mount kit with two power cords | | None |
| FC 5301 | 0.41 m Universal HD68 to HD68 SCSI cable | | 19P0872 |
| FC 5302 | 2.5 m Universal HD68 to HD68 SCSI cable | | 35L1307 |
| Ship group only | 2.5 m Universal HD68 to HD68 SCSI cable | | 35L1307 |
| FC 5305 | 5 m Universal HD68 to HD68 SCSI cable | | 19P0052 |
| FC 5310 | 10 m Universal HD68 to HD68 SCSI cable | | 19P0053 |
| FC 5318 | 18 m Universal HD68 to HD68 SCSI cable | Available only with Model H13 and H23 | 19P0097 |
| FC 5325 | 25 m Universal HD68 to HD68 SCSI cable | Available only with Model H13 and H23 | 19P0054 |
| FC 5602 | 2.5 m Universal VHDCI to HD68 SCSI cable | | 19P0279 |
| Ship group only | 2.5 m Universal VHDCI to HD68 SCSI cable | | 19P0279 |
| FC 5604 | 4.5 m Universal VHDCI to HD68 SCSI cable | | 19P0050 |
| FC 5610 | 10 m Universal VHDCI to HD68 SCSI cable | | 19P0048 |
| FC 5620 | 20 m Universal VHDCI to HD68 SCSI cable | Available only with Model H13 and H23 | 19P0049 |
| FC 5625 | 25 m Universal VHDCI to HD68 SCSI cable | Available only with Model H13 and H23 | 35L1977 |

*Table 10. Parts list for the 3581 Tape Autoloader (continued)*

| Feature Code (FC) or Model | Description | Notes | CRU Part Number |
|---|---|---|---|
| Ship group only | LVD single-connector SCSI wrap tool | Comes with Model L13 and L23 | 19P0481 |
| Ship group only | HVD single-connector SCSI wrap tool | Comes with Model H13 and L23 | 19P1213 |
| FC 5099 | VHDCI to HD68 interposer cable | | 19P0482 |
| FC 2895 | AS/400 feature #6501 to HD68 interposer cable | Available only with Model H13 and H23 | 05H3834 |
| Ship group only | LVD/SE multi-mode terminator (DEC gray) | Comes with Model L13 and L23 | 19P0874 |
| FC5098 | Inline HVD SCSI terminator (black) | Comes with Model H13 and H23 | 61G8324 |
| Ship group only | Cosmetic cover set | | 35L1288 |
| Ship group only | Front door key | Comes with 3581 Ultrium Tape Autoloader; only available as a CRU | 19P1282 |
| Ship group only | *IBM 3581 Ultrium Tape Autoloader Models L13 and H13 Setup and Operator Guide*, GA32-0461-00 | | None |
| Ship group only | *IBM 3581 Ultrium Tape Autoloader Quick Reference*, GX32-5056 | | None |
| Ship group only | *IBM Externally Attached Devices Safety Information*, SA26-2004 | | None |

## Power Cords

To avoid electrical shock, a power cord with a grounded attachment plug has been provided. Use only properly grounded outlets.

Table 11 on page 81 lists the power cord part number, feature code, the country or region where the power cord can be used, and the plug's standard reference. The last column in the table contains an index number that you can match to a specific receptacle type in Figure 30 on page 83.

All power cords use an appliance coupler that complies with the International Electrotechnical Commission (IEC) Standard 320, Sheet C13.

If the power cord that you receive does not match your receptacle, contact your local dealer.

Power cords used in the United States and Canada are listed by Underwriter's Laboratories (UL), are certified by the Canadian Standards Association (CSA), and comply with the plug standards of the National Electrical Manufacturers Association (NEMA). For other worldwide geographies, plug standards are listed in Table 11 on page 81.

## Power Cord Information

*Table 11. Power cord information*

| Description, Feature Code (FC), and Part Number (PN) | Plug Standard Reference | Country or Region | Index Number in Figure 30 on page 83 |
|---|---|---|---|
| **US/Canada**<br>2.8 m, 125V<br>FC 9800<br>PN 6952300<br>(See Note) | NEMA 5-15P | Aruba, Bahamas, Barbados, Bermuda, Bolivia, Brazil, Canada, Cayman Islands, Colombia, Costa Rica, Curacao, Dominican Republic, Ecuador, El Salvador, Guatemala, Guyana, Haiti, Honduras, Jamaica, Japan, Liberia, Mexico, Netherlands Antilles, Nicaragua, Panama, Peru, Philippines, Saudi Arabia, South Korea, Suriname, Taiwan, Trinidad Tobago, Venezuela, US | 1 |
| **Chicago**<br>1.8 m, 125 V<br>FC 9986<br>PN 6952301 | NEMA 5-15P | Chicago, U.S.A. | 1 |
| **US/Canada**<br>2.8 m, 250 V<br>FC 9833<br>PN 1838574 | NEMA 6-15P | Aruba, Bahamas, Barbados, Bermuda, Bolivia, Brazil, Canada, Cayman Islands, Costa Rica, Curacao, Dominican Republic, Ecuador, El Salvador, Guatemala, Guyana, Haiti, Honduras, Jamaica, Japan, Liberia, Netherlands Antilles, Nicaragua, Panama, Peru, Philippines, Suriname, Taiwan, Thailand, Trinidad Tobago, Venezuela, US | 2 |
| **Australia**<br>2.8 m, 250V<br>FC 9831<br>PN 13F9940 | AS 3112<br>NZS 198 | Argentina, Australia, China, Colombia, New Zealand, Papua New Guinea, Paraguay, Uruguay, Western Samoa | 3 |
| **France, Germany**<br>2.8 m, 250V<br>FC 9820<br>PN 13F9979 | CEE 7 - VII | Afghanistan, Algeria, Andorra, Angola, Aruba, Austria, Belgium, Benin, Brazil, Bulgaria, Burundi, Cameroon, Central African Republic, Chad, Congo Brazzaville, Curacao, Czechoslovakia, Denmark, Egypt, Finland, France, French Guiana, Germany, Greece, Guinea, Hungary, Iceland, Indonesia, Iran, Ivory Coast, Jordan, Kenya, Korea, Lebanon, Luxumbourg, Macau, Malagasy, Mali, Martinique, Mauritania, Mauritius, Monaco, Morocco, Mozambique, Netherlands, Netherlands Antilles, New Caledonia, Niger, Norway, Poland, Portugal, Romania, Saudi Arabia, Senegal, Spain, Sweden, Sudan, Syria, Togo, Tunisia, Turkey, Upper Volta, USSR, Yugoslavia, Zaire, Zimbabwe, Vietnam | 4 |
| **Denmark**<br>2.8 m, 250V<br>FC 9821<br>PN 13F9997 | DK2-5A | Denmark | 5 |
| **South Africa**<br>2.8 m, 250V<br>FC 9829<br>PN 14F0015 | SABS 164 | Bangladesh, Burma, Pakistan, South Africa, Sri Lanka | 6 |

*Table 11. Power cord information (continued)*

| Description, Feature Code (FC), and Part Number (PN) | Plug Standard Reference | Country or Region | Index Number in Figure 30 on page 83 |
|---|---|---|---|
| **United Kingdom**<br>2.8 m, 250V<br>FC 9825<br>PN 14F0033 | BS 1363 | Antigua, Bahrain, Bermuda, Brunei, Channel Islands, China (Hong Kong S.A.R.), Cyprus, Fiji, Ghana, Guyana, India, Iraq, Ireland, Jordan, Kenya, Kuwait, Malaysia, Malawi, Malta, Nepal, Nigeria, Oman, Polynesia, Qatar, Sierra Leone, Singapore, Tanzania, Uganda, UK, United Arab Emirate (Dubai), Yemen, Zambia | 7 |
| **Switzerland**<br>2.8 m, 250V<br>FC 9828<br>PN 14F0051 | SEV SN 416534 | Liechtenstein, Switzerland | 8 |
| **Italy**<br>2.8 m, 250V<br>FC 9830<br>PN 14F0069 | CEI 23- 16 | Chile, Ethiopia, Italy, Libya, Somalia | 9 |
| **Israel**<br>2.8 m, 250V<br>FC 9827<br>PN 14F0087 | S11-32-1971 | Israel | 10 |
| **Argentina**<br>2.8 m, 250V<br>FC 9834<br>PN 36L8880 | IEC 83-A5 | Argentina, Brazil, Colombia, Paraguay, Trinidad Tobago, Uruguay | 11 |
| **China**<br>2.8 m, 250V<br>FC 9840<br>PN 02K0546 | CCEE | People's Republic of China | 12 |
| **Note:** Part number 6952300 is the default power cord for the countries or regions listed. If you do not specify a power cord when you place your order, IBM provides this power cord. | | | |

## Types of Plugs

Figure 30 on page 83 shows the plugs that are used by the power cords in Table 11 on page 81. Match the index number that is beside each plug to the index number in the table.

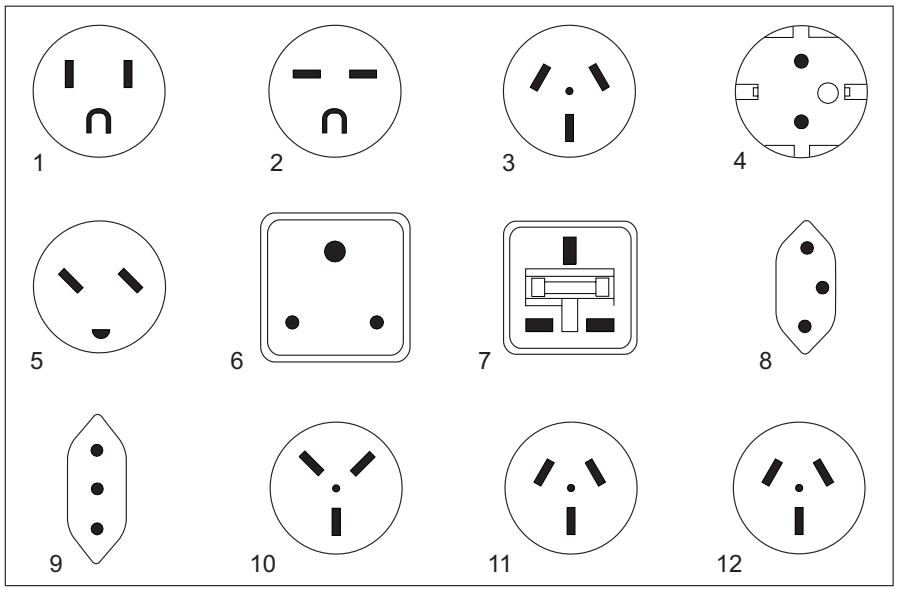


*Figure 30. Types of receptacles*

# Appendix A. Diagnostic and Maintenance Functions

This chapter describes the diagnostic and maintenance functions that you can perform on the 3581 Tape Autoloader, and tells how to perform each function.

**Attention:** It is recommended that the autoloader be in Random mode (**LdR READY**) for running all diagnostic and maintenance functions. See "Changing the Mode of Operation" on page 88.

## Accessing the Diagnostic Menu

To perform any diagnostic or maintenance function, you must access the Diagnostic Menu. To access the menu, press and hold the NEXT button and then the MODE button for approximately 5 seconds. **dIAG MENU** appears on the message display. Table 12 lists the diagnostic and maintenance functions that you can choose from the Diagnostic Menu, and directs you to the procedure for performing it. Figure 31 on page 87 gives a flowchart of the functions.

You can scroll through the functions by pressing the MODE control button. Note that you can only scroll forward through the choices. If you pass the function that you want, continue to press MODE until the function you want displays again.

**Attention:** During an operation, you must make your selection and press a control button within 150 seconds, or the 3581 Tape Autoloader exits the operation and the message display defaults to **LdR READY**.

*Table 12. Diagnostic and maintenance functions*

| Diagnostic or Maintenance Function | Menu Name | Location of Procedure |
|---|---|---|
| Displays the current level of firmware for the 3581 Tape Autoloader's microprocessors and the IBM Ultrium Tape Drive. | **dSP FW** | See "Displaying Firmware" on page 86. |
| Verifies the SCSI INQUIRY identity of the 3581 Tape Autoloader (ULT3581-TA). | **SIGN ON** | See "Verifying the SCSI INQUIRY Identity" on page 88. |
| Changes the 3581 Tape Autoloader's mode of operation between random access and sequential access. | **CHG MOdE** | See "Changing the Mode of Operation" on page 88. |
| Tests the functionality of the 3581 Tape Autoloader's robotics. | **CYCLE TEST** | See "Testing the Robotics" on page 88. |
| Manually specifies cleaning of the drive's head. | **CLEAN dRV** | See "Manually Selecting the Cleaning Function" on page 89. |
| Specifies autocleaning of the drive's head. | **AUTOCLEAN** | See "Automatically Selecting the Cleaning Function" on page 89. |
| Displays the number of times certain events have occurred. | **dSP COUNTS** | See "Displaying Counts" on page 91. |
| If it is installed, enables or disables the bar code reader. | **bARCOdE** | See "Enabling or Disabling the Bar Code Reader" on page 92. |

*Table 12. Diagnostic and maintenance functions (continued)*

| Diagnostic or Maintenance Function | Menu Name | Location of Procedure |
|---|---|---|
| Updates firmware for the drive by using a FMR tape. | **UPG dRV FW** | See "Updating Drive Firmware" on page 93. |
| Presents a selection of maintenance functions that allow you to run the Read/Write Test, display the drive's error code log, clear the drive's error code log, force a data dump, copy a data dump to tape, perform a Power-On Self Test (POST), or test the drive's SCSI functionality. | **dRV MAINT** | See "Performing Drive Maintenance Tasks" on page 94. |

## Displaying Firmware

Select **dSP FW** to display the current level of firmware for the autoloader, drive, robotics, front panel, and boot. Verify and modify, if necessary, the firmware levels on your products Vital Product Data form. To display the levels of firmware, perform the following steps:

1. Ensure that **LdR REAdY** appears on the message display.
2. Press and hold the NEXT button and then the MODE button until **dIAG MENU** displays (approximately 5 seconds).
3. Press MODE until **dSP FW** displays.
4. Press SELECT. **dSP LdR FW** displays.
5. Press SELECT. **Ld FW NNNN** displays (where NNNN is the revision number of the autoloader firmware).
6. Press NEXT. **dSP dRV FW** displays.
7. Press SELECT. **dR FW NNNN** displays (where NNNN is the revision number of the drive firmware).
8. Press NEXT. **dSP MTN FW** displays.
9. Press SELECT. **MTN FW NN** displays (where NN is the revision number of the motion firmware).
10. Press NEXT. **dSP FP FW** displays.
11. Press SELECT. **FP FW NN** displays (where NN is the revision number of the front panel firmware).
12. Press NEXT. **dSP bT FW** displays.
13. Press SELECT. **bT FW NNNN** displays (where NNNN is the revision number of the boot firmware).
14. Press SELECT. **LdR REAdY** displays.

## Functions in the Diagnostic Menu

Figure 31 summarizes the functions in the Diagnostic Menu of the 3581 Tape Autoloader.

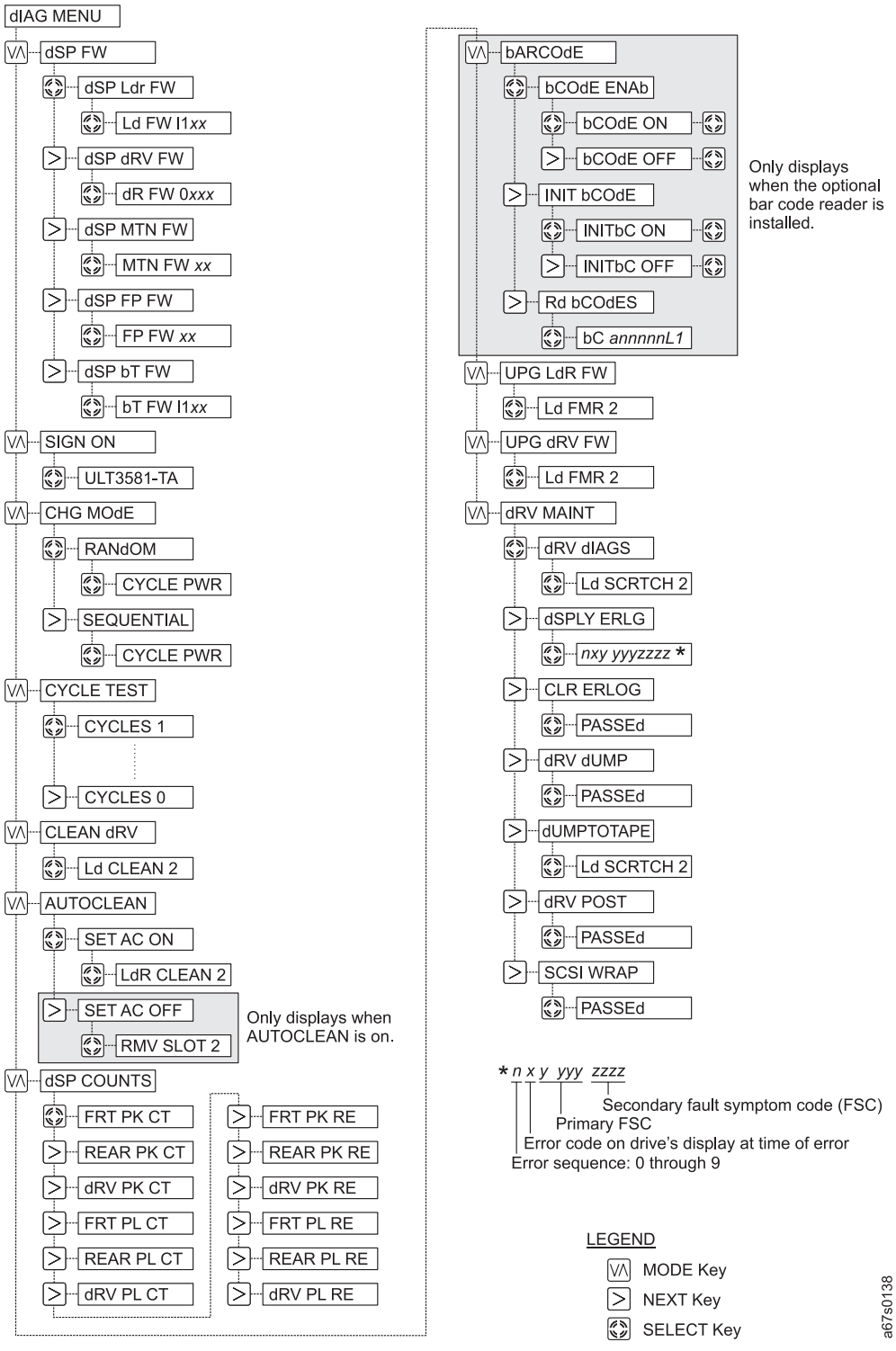


*Figure 31. Functions in the Diagnostic Menu*

## Verifying the SCSI INQUIRY Identity

Select **SIGN ON** to verify that the SCSI INQUIRY identity of your 3581 Tape Autoloader is ULT3581-TA.

**Note:** At present, the 3581 Tape Autoloader does not emulate other devices.

1. Ensure that **LdR READY** appears on the message display.
2. Press and hold the NEXT button and then the MODE button until **dIAG MENU** displays (approximately 5 seconds).
3. Press MODE until **SIGN ON** displays.
4. Press SELECT to display the current SCSI INQUIRY string for the autoloader. **ULT3581-TA** displays.
5. Press SELECT. **LdR READY** displays.

## Changing the Mode of Operation

Select **CHG MOdE** to toggle between the random access and sequential access mode of operation. Modify the operating mode on your product's Vital Product Data form.

To change the mode of operation:

1. Ensure that **LdR READY** appears on the message display.
2. Press and hold the NEXT button and then the MODE button until **dIAG MENU** displays (approximately 5 seconds).
3. Press MODE until **CHG MOdE** displays.
4. Press SELECT to display the current mode of operation.
5. Press NEXT or PREVIOUS to toggle the mode between **SEQUENTIAL** and **RANdOM**.
6. Choose the mode that you want and press SELECT. **CYCLE PWR** blinks on the message display. If you changed to random mode, **LdR READY** then displays; if you changed to sequential mode, **SEQ READY** then displays.
7. To activate the new mode of operation, cycle power (turn off, then on) to the 3581 Tape Autoloader (see "POWER Button" on page 18).
8. Consult host documentation for instruction on updating your host with the new mode of operation.

## Testing the Robotics

Select **CYCLE TEST** to verify that the 3581 Tape Autoloader's robotics is working properly. The CYCLE TEST function exercises the robotics by executing a sequence of pick and put operations to move the cartridges between the storage slots and the drive:

1. Verify that the drive is empty. If necessary, issue the EJECT dRIVE command to remove any cartridge from the drive (see "Using the Control Buttons to Display Commands" on page 21).
2. Verify that all seven cartridge storage slots have tapes installed. If required, install additional cartridges. If AUTOCLEAN is enabled and a cleaning cartridge is in slot 7, the CYCLE TEST function will not use slot 7 during the test.
3. Ensure that **LdR READY** appears on the message display.
4. Press and hold the NEXT button and then the MODE button until **dIAG MENU** displays (approximately 5 seconds).
5. Press MODE until **CYCLE TEST** displays.
6. Press SELECT. **CYCLES 1** displays.

7. Press SELECT to cause the autoloader to begin one cycle of CYCLE TEST. The autoloader moves the cartridges from one slot to another, and puts each cartridge into the drive.
   - To execute more than one cycle, press NEXT until the number of cycles you want displays, then press SELECT.
   - To execute CYCLE TEST continually, press PREVIOUS until CYCLES 0 displays, then press SELECT (to quit, press and hold MODE for approximately 10 seconds).
8. When CYCLE TEST is finished, **LdR READY** displays.

## Manually Selecting the Cleaning Function

Select **CLEAN dRIVE** to clean the drive's head if your server's application software does not support autocleaning or if you choose not to use the 3581 Tape Autoloader's AUTOCLEAN feature:

1. Ensure that **LdR READY** appears on the message display.
2. Press and hold the NEXT button and then the MODE button until **dIAG MENU** displays (approximately 5 seconds).
3. Press MODE until **CLEAN dRIVE** displays.
4. Press SELECT. **Ld CLEAN 2** blinks on the message display.
5. Insert a cleaning cartridge into storage slot 2, then press SELECT (for instructions about inserting the cartridge, see "Inserting a Cartridge into Slots 1 - 5" on page 26). The autoloader moves the cleaning cartridge to the drive and cleans the drive head. **CLEANING** displays, and the activity bars appear and disappear rapidly to indicate the drive activity. When the cleaning is finished, the drive automatically ejects the cartridge, and the autoloader puts it back into storage slot 2. When the cleaning is complete, **RMV SLOT 2** blinks on the message display.
   - If a data cartridge is already in storage slot 2 and you press SELECT, the autoloader treats it like a cleaning cartridge and moves it to the drive.
   - If a data cartridge is already in the drive when you press SELECT, **dRIVE FULL** displays. To clear this message, press MODE. Issue the EJECT dRV command to remove the cartridge from the drive (see "Using the Control Buttons to Display Commands" on page 21), then start the cleaning process again.
6. Remove the cleaning cartridge from storage slot 2 and press SELECT. **LdR READY** displays.

## Automatically Selecting the Cleaning Function

Select **AUTOCLEAN** if your server's application software does not support automated cleaning of the drive's head (such software manages the location and use of the tape cartridges, including the cleaning cartridge). If your server's application software supports automated cleaning cycles, do not use the AUTOCLEAN function.

When you enable or disable the AUTOCLEAN function, the setting remains in effect until you change it. The following sections describe how to determine the status of the AUTOCLEAN function, and how to enable, use, and disable it.

### Determining the Status of the AUTOCLEAN Function

To determine whether the AUTOCLEAN function is enabled or disabled:

1. Ensure that **LdR READY** appears on the message display.

2. Press and hold the NEXT button and then the MODE button until **dIAG MENU** displays (approximately 5 seconds).
3. Press SELECT. The message that displays acts as a query about the status that you want to set:
   - If **SET AC ON** displays, the AUTOCLEAN function is off.
   - If **SET AC OFF** displays, the AUTOCLEAN function is on.
4. Record the setting of the AUTOCLEAN function on your product's Vital Product Data form. See Appendix I, "Vital Product Data", on page 151.
5. To change the status, see the following sections. To leave the status as it is, press MODE to return to **LdR READY**.

## Enabling the AUTOCLEAN Function

The default condition for the 3581 Tape Autoloader's AUTOCLEAN function is off. To enable the AUTOCLEAN function:

1. Ensure that **LdR READY** appears on the message display.
2. Press and hold the NEXT button and then the MODE button until **dIAG MENU** displays (approximately 5 seconds).
3. Press MODE until **AUTOCLEAN** displays.
4. Press SELECT. **SET AC ON** displays.
5. Press SELECT to enable the AUTOCLEAN function. **Ld CLEAN 2** blinks on the message display.

   **Note:** To cancel the procedure to enable AUTOCLEAN, before performing the next step press MODE. **LdR READY** displays and AUTOCLEAN is not enabled.
6. Insert a cleaning cartridge into storage slot 2, then press SELECT. The autoloader moves the cleaning cartridge from slot 2 to slot 7, and enables the AUTOCLEAN function.

   **Note:** To eject a cartridge, at the **LdR READY** screen press MODE until **EJECT dRV** displays, then press SELECT.
   - If storage slot 7 contains a cartridge, **SLOT7 FULL** displays and AUTOCLEAN will not be enabled. To clear this message, press MODE. Issue the EJECT SLOT command to remove the cartridge from slot 7, then reattempt to enable AUTOCLEAN.
   - If a data cartridge is already in storage slot 2 when you press SELECT, the autoloader treats it like a cleaning cartridge and moves it to slot 7.
   - If a data cartridge is already in the drive or in the picker when you insert a cleaning cartridge into slot 2 and press SELECT, **dRIVE FULL** displays. To clear this message, press MODE. Issue the EJECT dRV or EJECT PCKR command to eject the cartridge from the drive, then reattempt to enable AUTOCLEAN.

## Using the AUTOCLEAN Function

The 3581 Tape Autoloader's AUTOCLEAN function automatically cleans the drive's head when the drive indicates that cleaning is required. After the cleaning cartridge cleans the head, the autoloader returns the cleaning cartridge to storage slot 7.

When AUTOCLEAN is enabled, the server's application software does not have access to slot 7, and the autoloader operates as a 6-slot loader. This forces the application to remap the autoloader. Although slot 7 is unavailable to the

application, the slot 7 indicator on the message display functions normally (shows the presence of a cartridge when cleaning is not being performed).

When AUTOCLEAN is enabled you still have normal access to slot 7 from the front panel, which allows you to recover from the error if the cleaning cartridge gets stuck in the picker. If the cleaning cartridge is in any slot other than slot 7, AUTOCLEAN will not function.

If, during the cleaning, the drive discovers that the cleaning cartridge has expired, **CYCLE AC** appears on the message display. To clear the message, press MODE and replace the cleaning cartridge with a new one. To replace the cartridge, disable AUTOCLEAN, then re-enable it. (For instructions, see "Disabling the AUTOCLEAN Function" and "Enabling the AUTOCLEAN Function" on page 90.)

### Disabling the AUTOCLEAN Function

To disable the AUTOCLEAN function:

1. Ensure that **LdR READY** appears on the message display.
2. Press and hold the NEXT button and then the MODE button until **dIAG MENU** displays (approximately 5 seconds).
3. Press MODE until **AUTOCLEAN** displays.
4. Press SELECT. **SET AC OFF** displays.
5. Press SELECT to disable the AUTOCLEAN function. After a series of messages display, **RMV SLOT 2** blinks on the message display. The autoloader moves the cleaning cartridge from storage slot 7 to slot 2, and disables the AUTOCLEAN function.
   - If storage slot 2 contains a cartridge, **SLOT2 FULL** appears on the message display, a large **E** appears in the display's center field, and AUTOCLEAN remains enabled. Manually remove the cartridge from slot 2, press MODE, then reattempt to disable AUTOCLEAN.
6. Remove the cleaning cartridge from storage slot 2 and press SELECT. **LdR READY** displays.

### Resetting the AUTOCLEAN Function

If the AUTOCLEAN function fails to operate properly, the autoloader may simply need to be reset. To reset the autoloader so that AUTOCLEAN is off (the default condition):

1. Ensure that the autoloader is powered off.
2. Press and hold the NEXT and PREVIOUS buttons for approximately 15 seconds while pressing and releasing the POWER button.

The AUTOCLEAN function clears and the autoloader returns to its factory settings.

## Displaying Counts

**Note:** To cancel the display counts procedure at any time, press MODE to return to the **LdR READY** screen.

Select **dSP COUNTS** to show how many times certain events have occurred. The 3581 Tape Autoloader tracks the following events:

| | | |
|---|---|---|
| Front Pick Count | Drive Place Count | Drive Pick Retries |
| Rear Pick Count | Drive Door Retries | Front Place Retries |
| Drive Pick Count | Front Pick Retries | Rear Place Retries |

| | | |
|---|---|---|
| Front Place Count | Rear Pick Retries | Drive Place Retries |
| Rear Place Count | | |

To display counts:

1. Ensure that **LdR READY** appears on the message display.
2. Press and hold the NEXT button and then the MODE button until **dIAG MENU** displays (approximately 5 seconds).
3. Press MODE until **dSP COUNTS** displays.
4. Press SELECT to access the first event (Front Pick Count). **FRT PK CT** displays.
5. Press SELECT. The autoloader displays the number of times that it picked a cartridge from any of the front slots.
6. Press NEXT to access the next event or PREVIOUS to access the previous event.

After the return value for Drive Door Retries (**dRV dR RE**) displays, **LdR READY** appears in the message display.

# Performing Bar Code Reader Functions (optional)

## Enabling or Disabling the Bar Code Reader

If the optional bar code reader is installed, select **bARCOdE** to enable or disable the reader. The default condition for the 3581 Tape Autoloader's bar code reader is on (**bCOdE ON**). If disabled, the bar code reader is not available to the server's application software.

To enable or disable the bar code reader:

1. Ensure that **LdR READY** appears on the message display.
2. Press and hold the NEXT button and then the MODE button until **dIAG MENU** displays (approximately 5 seconds).
3. Press MODE until **bARCOdE** displays.
4. Press SELECT. **bCOdE ENAb** displays.
5. Press SELECT. **bCOdE ON** displays.
6. To disable the bar code reader, press NEXT or PREVIOUS to select **bCOdE OFF**.
7. Press SELECT to activate the change. **LdR READY** displays.

## Performing an Inventory of the Cartridges During Power-on

To perform an inventory of the tape cartridges after a bar code reader has been installed and during power-on:

1. Power-on the 3581 Tape Autoloader. When the autoloader completes the Power-On Self Test (POST), **LdR READY** appears in the message display.
2. Press and hold the NEXT button and then the MODE button until **dIAG MENU** displays (approximately 5 seconds).
3. Press MODE until **bARCOdE** displays.
4. Press NEXT or PREVIOUS until **INIT bARCOdE** displays.
5. Press SELECT. **INIT ON** displays.
6. To disable the inventory when you power-on the autoloader, press NEXT or PREVIOUS to select **INIT OFF**.
7. Press SELECT to activate the change. **LdR READY**.

## Testing the Bar Code Reader

To test the bar code reader after it has been installed in the 3581 Tape Autoloader:

1. Power-on the 3581 Tape Autoloader. When the autoloader completes the Power-On Self Test (POST), **LdR READY** appears in the message display.
2. Press and hold the NEXT button and then the MODE button until **dIAG MENU** displays (approximately 5 seconds).
3. Press MODE until **bARCOdE** displays.
4. Press NEXT or PREVIOUS until **Rd bCOdES** displays.
5. Press SELECT to perform the test. The autoloader displays the volume serial number (VOLSER) of each cartridge on the message display:
   - If each cartridge bears a bar code label but **bC ERROR** or odd characters display instead of each VOLSER, replace the bar code reader ("Removal Procedure" on page 111).
   - If the bar code reader reads the bar code labels on some cartridges but not others, replace the defective bar code labels.

## Updating Drive Firmware

**Attention:** To ensure optimum performance from the 3581 Tape Autoloader, use the latest level of drive firmware. It is the customer's responsibility to obtain and install drive and autoloader firmware.

Whenever you receive a drive field microcode replacement (FMR) tape to update the firmware for the IBM Ultrium Tape Drive, select **UPG dRV FW** to perform the update. To update firmware:

1. Ensure that **LdR READY** appears on the message display.
2. Press and hold the NEXT button and then the MODE button until **dIAG MENU** appears on the message display (approximately 5 seconds).
3. Press MODE until **UPG dRV FW** appears on the message display.
4. Press SELECT. **Ld FMR 2** blinks on the message display.
5. If not already installed, insert a drive FMR tape into slot 2 then press SELECT to update the drive's firmware.
   - After a series of messages display, **READING FW** displays, the status lights alternate between on and off, and the activity bars appear and disappear rapidly to indicate drive activity. In addition, the POWER button is disabled during the update.
   - When the update process is completed, the autoloader unloads the tape and returns it to storage slot 2. **RMV SLOT 2** blinks on the message display.
6. Remove the FMR tape from slot 2, then press SELECT. The drive automatically reboots and **LdR READY** displays.
7. Record the drive firmware revision level on the Vital Product Data form.

After several minutes, if **dRIVE PGRM** and the error indicator **E** appear on the message display:

1. Verify that the tape is a valid FMR tape and not a data or cleaning cartridge.
2. Repeat the update process.

If the same messages display, contact IBM Technical Support.

## Updating Autoloader Firmware

**Attention:** To ensure optimum performance from the 3581 Tape Autoloader, use the latest level of autoloader firmware. It is the customer's responsibility to obtain and install drive and autoloader firmware.

Whenever you receive an autoloader field microcode replacement (FMR) tape to update the firmware for the 3581 Tape Autoloader, select **UPG LdR FW** to perform the update. To update firmware:

1. Ensure that **LdR READY** appears on the message display.
2. Press and hold the NEXT button and then the MODE button until **dIAG MENU** appears on the message display (approximately 5 seconds).
3. Press MODE until **UPG LdR FW** appears on the message display.
4. Press SELECT. **Ld FMR 2** blinks on the message display.
5. If not already installed, insert an autoloader FMR tape into slot 2 then press SELECT to update the drive's firmware.
   - After a series of messages display, **READING FW** displays, the status lights alternate between on and off, and the activity bars appear and disappear rapidly to indicate drive activity. In addition, the POWER button is disabled during the update.
   - When the update process is completed, the autoloader unloads the tape and returns it to storage slot 2. **RMV SLOT 2** blinks on the message display.
6. Remove the FMR tape from slot 2, then press SELECT. **LdR READY** displays.
7. Cycle power (turn it off, then on) to activate the new firmware.

   **Note:** Occasionally, after you update the autoloader's firmware, the buttons on the operator panel remain disabled (they become disabled in step 5 during the firmware update). If this happens, to cycle power and activate the new firmware you must unplug and replug the power cord from the autoloader.
8. Record the autoloader firmware revision level on the Vital Product Data form.

After several minutes, if **dRIVE PGRM** and the error indicator **E** appear on the message display:

1. Verify that the tape is a valid FMR tape and not a data or cleaning cartridge.
2. Repeat the update process.

If the same messages display, contact IBM Technical Support.

## Performing Drive Maintenance Tasks

Select **dRV MAINT** to show choose one of the following maintenance tasks:

- Tests the drive's read/write function (**dRV dIAGS**)
- Display the drive error code log (**dSPLY ERLG**)
- Clear the drive error code log (**CLR ERLG**)
- Force a drive dump (**dRV dUMP**)
- Copy a drive dump to tape (**dUMPTOTAPE**)
- Perform a Power-On Self Test on the drive (**dRV POST**)
- Test the SCSI function of the drive (**SCSI WRAP**)

The sections that follow describe how to perform each task.

### Testing the Read/Write Function

The **dRV dIAGS** task is also known as the Read/Write Test. It includes several tests to ensure that the drive can read from and write to tape. The diagnostic takes approximately 4 minutes to complete.

**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.

To test the read/write function of the 3581 Tape Autoloader:

1. Ensure that no cartridge is in the drive.
2. Ensure that **LdR READY** appears on the message display.
3. Press and hold the NEXT button and then the MODE button until **dIAG MENU** displays (approximately 5 seconds).
4. Press MODE until **dRV MAINT** displays.
5. Press SELECT. **dRV dIAGS** displays.

   **Note:** If you do not want to perform the Read/Write Test, press NEXT to go to the next task.
6. Press SELECT to choose the Read/Write Test. **Ld SCRTCH2** displays.
7. Insert a scratch (blank) data cartridge that is not write-protected into slot 2 of the autoloader (see "Inserting a Tape Cartridge" on page 24).

   **Note:** If slot 2 is already occupied, **RMV SCRTCH2** displays. Remove the cartridge from slot 2 and replace it with the scratch cartridge.
8. Press SELECT. The autoloader displays a series of messages and runs the test. The Read/Write Test takes approximately 4 minutes.
   - If no error is detected, **PASSEd** displays. Press SELECT to unload the scratch cartridge, then press MODE until you return to **LdR READY**.
   - If an error is detected, the 3581 Tape Autoloader displays an error code. To resolve the error code, see "Drive Error Codes" on page 65.

## Displaying the Drive Error Log

The **dSPLY ERLG** task displays the last 10 error codes, one at a time (the codes are ordered; the most recent is presented first and the oldest is presented last).

To display the drive error log:

1. Ensure that no cartridge is in the drive.
2. Ensure that **LdR READY** appears on the message display.
3. Press and hold the NEXT button and then the MODE button until **dIAG MENU** displays (approximately 5 seconds).
4. Press MODE until **dRV MAINT** displays.
5. Press SELECT. **dRV dIAGS** displays.
6. Press NEXT until **dSPLY ERLG** displays.

   **Note:** If you do not want to display the drive error log, press NEXT to go to the next task.
7. Press SELECT to display the most recent drive error. A message similar to the following displays:

   ```
   0514206630
   ```

The first character represents the order of the error code in this sequence. The errors are numbered sequentially from 0 to 9, with 0 the most recent and 9 the oldest. The second character is the actual code that appeared on the message display when the error occurred. If there are no errors in the log, **0** displays. The remaining eight characters may be ignored.

8. To cycle through all 10 errors, press NEXT until the tenth error (9) displays in the first position.
9. Press MODE until you return to **LdR READY**.

## Clearing the Drive Error Code Log

The **CLR ERLG** task erases the contents of the drive error code log. To clear the error log:

1. Ensure that no cartridge is in the drive.
2. Ensure that **LdR READY** appears on the message display.
3. Press and hold the NEXT button and then the MODE button until **dIAG MENU** displays (approximately 5 seconds).
4. Press MODE until **dRV MAINT** displays.
5. Press SELECT. **dRV dIAGS** displays.
6. Press NEXT until **CLR ERLG** displays.

   **Note:** If you do not want to clear the drive code error log, press NEXT to go to the next task.
7. Press SELECT to erase all of the error codes in the log. When all errors have been cleared, **PASSEd** displays.
8. Press MODE until you return to **LdR READY**.

## Forcing a Drive Dump

**Attention:** When an error occurs, the 3581 Tape Autoloader automatically performs a drive dump that contains information about the error. If you force a drive dump, the autoloader overwrites that data.

The **dRV dUMP** task performs a dump of data collected by the drive (this process is also known as saving a microcode trace). To force a drive dump:

1. Ensure that no cartridge is in the drive.
2. Ensure that **LdR READY** appears on the message display.
3. Press and hold the NEXT button and then the MODE button until **dIAG MENU** displays (approximately 5 seconds).
4. Press MODE until **dRV MAINT** displays.
5. Press SELECT. **dRV dIAGS** displays.
6. Press NEXT until **dRV dUMP** displays.

   **Note:** If you do not want to collect a data dump, press NEXT to go to the next task.
7. Press SELECT to collect a dump of the data. When all data from the dump has been collected, **PASSEd** displays.
8. Press MODE until you return to **LdR READY**.

## Copying a Drive Dump to Tape

The **dUMPTOTAPE** task copies data from a drive dump to the beginning of a scratch (blank) data cartridge.

**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.

To copy a drive dump to tape:

1. Ensure that no cartridge is in the drive.
2. Ensure that **LdR READY** appears on the message display.
3. Press and hold the NEXT button and then the MODE button until **dIAG MENU** displays (approximately 5 seconds).
4. Press MODE until **dRV MAINT** displays.
5. Press SELECT. **dRV dIAGS** displays.
6. Press NEXT until **dUMPTOTAPE** displays.

   **Note:** If you do not want to copy a data dump, press NEXT to go to the next task.
7. Press SELECT to copy the data dump to the scratch tape. **Ld SCRTCH2** displays.
8. Insert a scratch (blank) data cartridge that is not write-protected into slot 2 of the autoloader (see "Inserting a Tape Cartridge" on page 24).

   **Note:** If slot 2 is already occupied, **RMV SCRTCH2** displays. Remove the cartridge from slot 2 and replace it with the scratch cartridge.
9. Press SELECT. The autoloader displays a series of messages, then copies the dump. The operation takes approximately 1 minute.
   - If no error is detected, **PASSEd** displays. Press SELECT to unload the scratch cartridge, then press MODE until you return to **LdR READY**.
   - If an error is detected, the 3581 Tape Autoloader displays an error code. To resolve the error code, see "Drive Error Codes" on page 65.

## Performing a Power-On Self Test of the Drive

**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.**

The **dRV POST** task performs a Power-On Self Test (POST) on the drive. To perform a POST:

1. Ensure that no cartridge is in the drive.
2. Ensure that **LdR READY** appears on the message display.
3. Press and hold the NEXT button and then the MODE button until **dIAG MENU** displays (approximately 5 seconds).
4. Press MODE until **dRV MAINT** displays.
5. Press SELECT. **dRV dIAGS** displays.
6. Press NEXT until **dRV POST** displays.

**Note:** If you do not want to conduct a POST on the drive, press NEXT to go to the next task.

7. Press SELECT to begin the POST on the drive. The test takes approximately 1 minute. When the test successfully completes, **PASSEd** displays.
8. Press MODE until you return to **LdR READY**.

## Testing the SCSI Function of the Drive

The **SCSI WRAP** task tests the SCSI functionality of the tape drive in the autoloader:

1. Ensure that one of the autoloader's SCSI connectors is attached to a terminator or to a SCSI cable that is connected to another terminated device on the SCSI bus.
2. Connect the SCSI wrap tool (included in the ship group) to the autoloader's other SCSI connector.
3. Ensure that no cartridge is in the drive.
4. Ensure that **LdR READY** appears on the message display.
5. Press and hold the NEXT button and then the MODE button until **dIAG MENU** displays (approximately 5 seconds).
6. Press MODE until **dRV MAINT** displays.
7. Press SELECT. **dRV dIAGS** displays.
8. Press NEXT until **SCSI WRAP** displays.
9. Press SELECT to begin the SCSI wrap test on the drive. The test takes less than 1 second. When the test successfully completes, **PASSEd** displays.
10. Press MODE until you return to **LdR READY**.

# Appendix B. Removing a Tape Cartridge

If a tape cartridge fails to eject from an Ultrium Tape Drive in the 3581 Tape Autoloader, there are two methods to remove the cartridge: resetting the drive and ejecting the cartridge, and manually removing the cartridge. The sections that follow describe each method.

## Resetting the Drive and Ejecting the Cartridge

If a tape cartridge fails to eject from an Ultrium Tape Drive, perform the following steps to reset the drive and eject the cartridge.

1. Use the server to set the autoloader and drive offline for all attached servers.
2. Open the front door of the autoloader and locate the drive (see **1** in Figure 32).
3. Press and release the unload button **2** on the front of the drive and wait for approximately 2 minutes. If the cartridge ejects, the procedure was successful. If the cartridge does not eject, continue with the next step.
4. Press and hold the unload button **2** until the single-character display **3** changes as the drive performs a power-on self test (POST). If the drive does not perform a POST within 15 seconds, cycle power to the autoloader (turn it off, then on again).
5. After a reset or power cycle, the drive starts a slow rewind. During the slow rewind, the Activity light **4** flashes. Wait for the light to stop flashing (indicating that the slow rewind is complete). **This process may take up to 20 minutes.**
6. Use a blunt, non-metal object to press and release the unload button **2**, then wait for approximately 2 minutes. If the cartridge ejects, the procedure was successful. If the cartridge does not eject, continue with the following procedure.

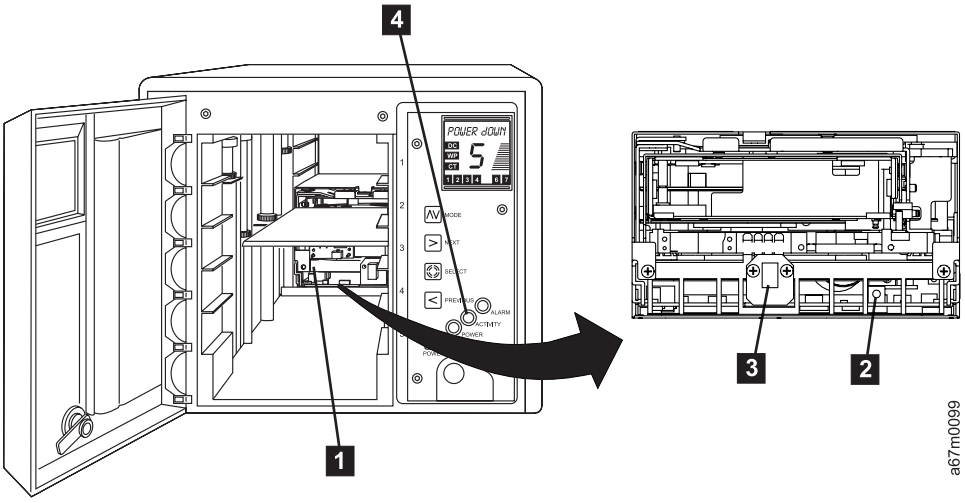


*Figure 32. Resetting the tape drive*

## Manually Removing the Cartridge

**Attention:** Perform this procedure only after you have attempted to remove the tape cartridge by pressing the unload button on the drive (see "Resetting the Drive and Ejecting the Cartridge" on page 99). Note that (depending on its location on the reel) the tape may take as much as 20 minutes to completely rewind and eject.

If a tape cartridge fails to eject from the 3581 Tape Autoloader, you can manually remove the cartridge. The procedure to do so, however, requires care. Success depends on your ability to maintain constant and appropriate tension on the tape while rewinding it into the cartridge and disengaging it from the drive's leader block. Apply too much tension and the tape may break; apply too little tension and the leader pin may fall from the leader block. IBM recommends that you read the complete instructions before starting the task, then perform the steps slowly and carefully to avoid complications.

### Required Tools

The following tools are required to manually remove a tape cartridge:

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

### Performing the Removal

**CAUTION:**
**This assembly contains mechanical moving parts. Use care when servicing this assembly.**

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

- The procedure that follows may result in damage to your tape cartridge and drive. If you use this procedure, you must replace the stuck tape cartridge after removing it and copying its data to another cartridge. If you choose to return the drive and the stuck tape to IBM for maintenance (the recommended solution), the tape cartridge will be scrapped.
- If you use a power screwdriver to perform this procedure it could destroy the tape.
- Never touch the head or electronic components within the autoloader. Touching may cause contamination or damage by electrostatic discharge.

To manually remove a tape cartridge you must first rewind the tape into the cartridge and disengage it from the drive's leader block. Then you must move the cartridge out of the drive. The sections that follow describe each operation.

## Rewinding the Tape into the Cartridge

1. Deconfigure the 3581 Tape Autoloader from the server (for instructions, see your server's documentation).
2. Turn off the power to the autoloader.
3. If the autoloader is mounted in a rack, perform the procedure to remove it (see "Removing the 3581 Tape Autoloader from a Rack" on page 123).
4. Remove the eight screws ( **1** in Figure 33) that secure the drive assembly sled **2** to the autoloader.
5. Grasp the handle of the sled and pull it toward you to slide the sled out of the autoloader.

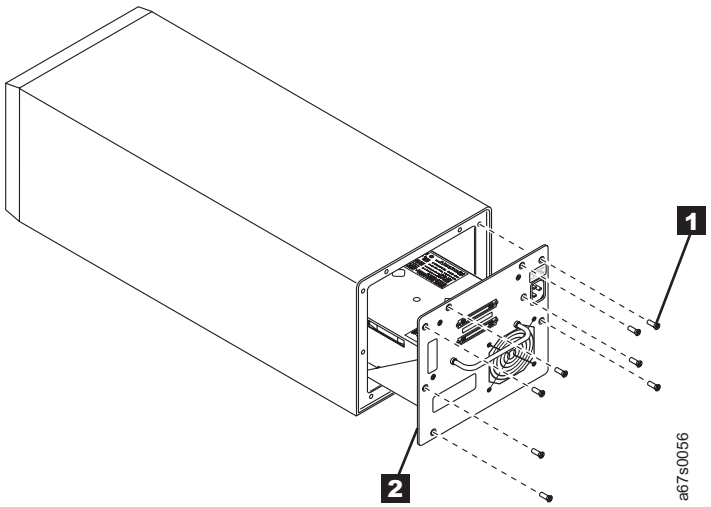


*Figure 33. Removing the drive assembly sled from the 3581 Tape Autoloader*

6. Place the drive assembly sled so that the front of the drive faces you, then stand it on its left side (see Figure 34 on page 102).
7. On the bottom of the drive assembly sled, locate the bottom access hole ( **1** in Figure 34 on page 102).
8. Insert a 2.5-mm allen wrench into the access hole and position the wrench so that it is seated in the supply reel motor screw (not visible).

**Attention:** In the following step, make sure that you rotate the supply reel motor screw clockwise, not counterclockwise. A counterclockwise motion may damage the tape.

9. Rotate the supply reel motor screw clockwise. As you rotate, shine a flashlight beam into the drive to view the takeup reel at the back **2** . The takeup reel is the small, black component that moves when you rotate the wrench.
   - If the takeup reel is turning and the allen wrench does not rotate freely, the tape is not broken. Go to step 10 on page 102.
   - If the takeup reel is not turning and the allen wrench rotates freely, the tape is broken or the tape (along with the leader pin) is completely contained in the cartridge. Insert a small-blade screwdriver or potentiometer-setting tool into the access hole of the loader motor gear ( **3** in Figure 34 on page 102).

While guarding against excessive revolutions or force that may strip the gears and cause permanent damage to the drive, rotate the screwdriver counterclockwise:

- If the cartridge immediately moves up, this means the tape is completely in the cartridge and the leader pin is in home position. Continue rotating the screwdriver until the cartridge ejects. Go to step 5 on page 107.
- If you feel resistance and the cartridge does not move up, the tape is broken. Contact IBM Technical Support.

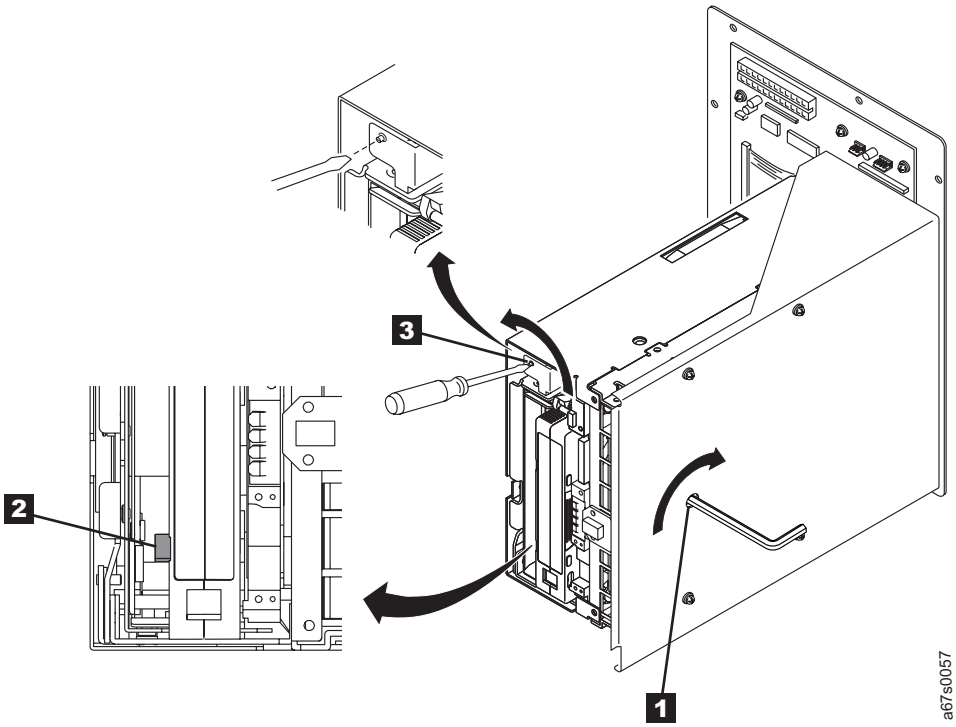


*Figure 34. Determining whether the tape is broken*

10. Continue to rotate the supply reel motor screw clockwise until you meet resistance. At this point, the tape has been rewound as far as it can go without unthreading.

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

## Disengaging the Leader Pin and Unloading the Cartridge from the Drive

1. With the allen wrench still inserted into the bottom access hole, insert a small-blade screwdriver or potentiometer-setting tool into the slotted shaft of the loader motor gear ( **3** in Figure 34).
2. Rotate the allen wrench clockwise to apply torque to the supply reel motor screw, and rotate the loader motor gear counterclockwise (see arrow). You may have to rotate the loader motor gear for a lengthy period. The rotation of the loader motor gear causes the leader pin block to move into the cartridge, disengage the leader pin, and eject the cartridge. Guard against excessive force when rotating the screwdriver in the loader motor gear, as this may strip the gears and cause permanent damage to the drive:

- If you feel no resistance to the allen wrench and the cartridge slowly moves up and out of the tape load compartment, the leader pin successfully disengaged from the leader block and slowly move out of the tape load compartment. Go to step 3.
- If you feel resistance to the allen wrench and the cartridge does not move, the leader pin probably dropped from the leader block and the loader mechanism is jammed. Go to "Fixing a Detached or Jammed Tape".

3. Remove the tape cartridge.
4. To reuse the 3581 Tape Autoloader, you must raise the drive's loader so that it is able to accept a cartridge. To raise the loader, continue to wind the loader motor gear counterclockwise with the screwdriver until you feel resistance.
5. Remove the small-blade screwdriver.
6. If you choose to replace the 3581 Tape Autoloader, return it in its original packaging or in the packaging from its replacement.
7. To reassemble the 3581 Tape Autoloader, reverse the preceding steps.

After you remove the stuck tape cartridge, copy the data on the tape to another tape. Then, discard the stuck tape cartridge.

## Fixing a Detached or Jammed Tape

**Attention: This procedure must be performed only by a trained IBM service provider.**

Use the following procedure if, in step 2 on page 102, you determined that the tape is jammed or detached from the tape drive's leader block.

**Attention:** The procedure that follows may result in damage to the tape cartridge. Perform it only if you are prohibited by the customer from sending the drive and the stuck cartridge to an off-site location. If you use this procedure, you must replace the stuck cartridge after removing it and copying its data to another cartridge. If the customer chooses to return the drive and cartridge to IBM for drive maintenance, the cartridge will be scrapped. If the customer requests that the data be recovered, contact IBM Technical Support.

If the tape cartridge did not load or unload properly, you must remove the internal drive and its cover to determine and fix the problem. Then, you must move the cartridge out of the drive. The sections that follow describe each operation.

## Removing the Internal Drive

1. Remove the drive from its sled by doing the following:
   a. Using a Phillips screwdriver, remove the four screws ( **1** in Figure 35) that secure the drive assembly sled **2** to the drive **3** . Set the screws aside.

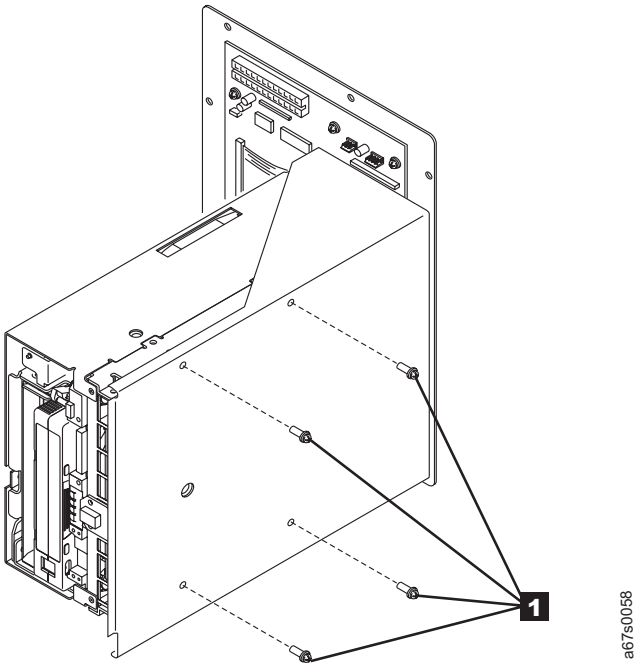


*Figure 35. Removing the drive assembly sled from the tape drive*

   b. Disconnect the following connectors from the rear of the drive (see Figure 36).

**1** SCSI connector (J1)

**2** SCSI ID connector (J1)

**3** Power connector (J1)

**4** RS-422 connector (J2)

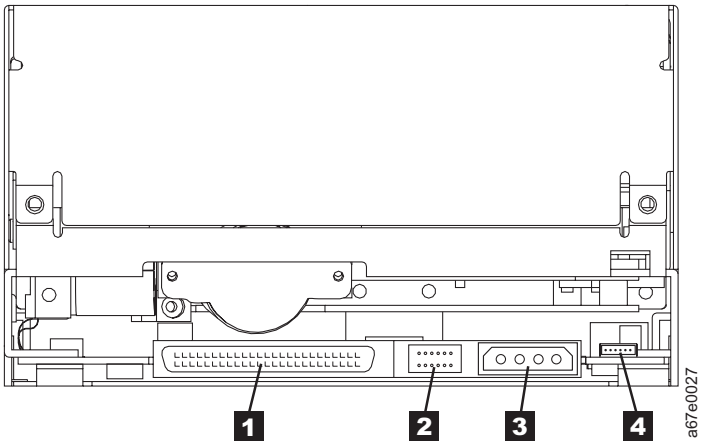


*Figure 36. Disconnecting the cables from the tape drive*

c. Remove the drive from the sled and set the sled aside.

## Removing the Cover of the Internal Drive

1. Remove the cover of the drive by doing the following:
   a. Remove the four cover-mounting screws and washers (see **1** in Figure 37).
   b. Remove the cover **2** by lifting it up. Set the cover aside.

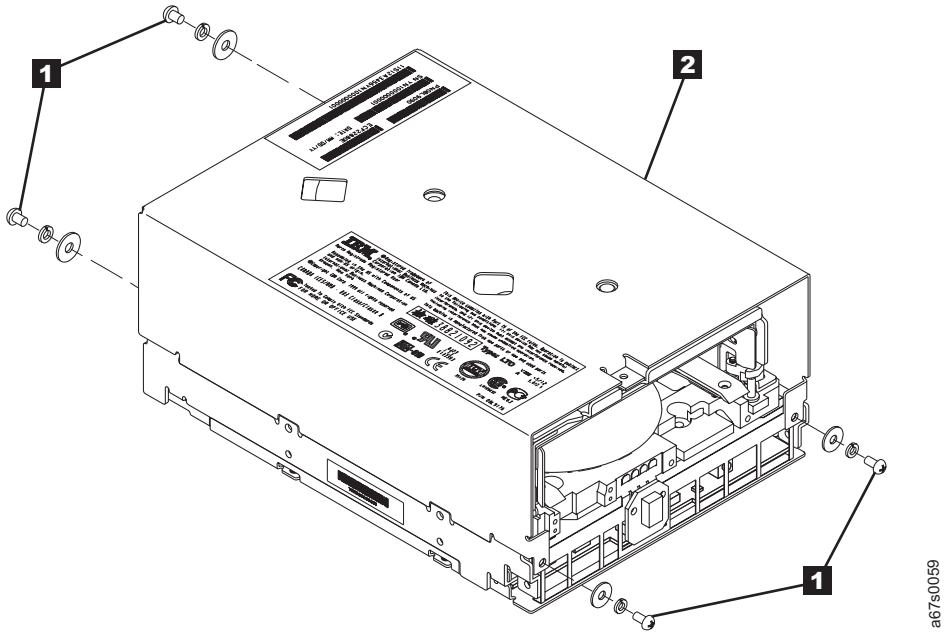


*Figure 37. Removing the cover of the tape drive*

## Fixing the Problem

1. Place the tape drive so that the front faces you, then tilt it on its left side (see Figure 38 on page 106).
2. Examine the tape to determine the source of the problem:
   - If the leader pin is jammed in the cartridge, go to the Note contained in step 4.
   - If the leader pin has become detached from the leader block and is lying in the tape path, go to step 3.
   - If the leader pin has broken away from the tape, go to "Repositioning or Reattaching a Leader Pin" on page 42.
   - If the tape has broken between the supply reel and the takeup reel, contact IBM Technical Support.
3. If necessary, use needle-nose pliers to grasp the end of the leader pin and pull it out of the cartridge so that you can grip it with your fingers (see **1** in Figure 38 on page 106).

**Reminder:** The following step requires care. Success depends on your ability to maintain constant and appropriate tension on the tape while rewinding it into the cartridge. Apply too much tension and the tape may break; apply too little tension and the leader pin may fall from the leader block. Perform the steps slowly and carefully to avoid complications.

4. While keeping the tape taut with your fingers, rotate the allen wrench clockwise **2** to wind the excess tape into the cartridge. Guide the leader pin

toward the cartridge and drop it deep inside the cartridge door; do not attempt to seat the leader pin. Remove the allen wrench.

**Note:** Ensure that the leader pin drops into the opened cartridge door, falls deeply into the cartridge, and does not jam near the cartridge door. Do not seat the pin into the cartridge's clips; this will interfere with the motion of the leader pin block (you can seat the pin after you have removed the cartridge from the drive). If the tape did not load because the leader pin was wedged in the clip area, grasp the leader pin with needle-nose pliers to free it and drop it into the cartridge.

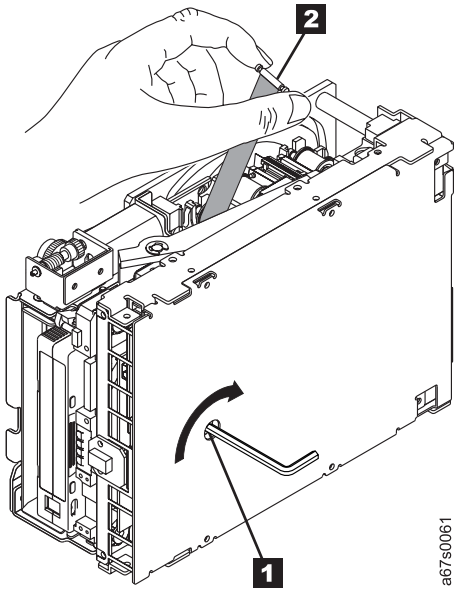


*Figure 38. Rewinding the leader pin into the tape cartridge*

## Removing the Cartridge from the Drive

1. Manually rotate the loader motor gear (see **1** in Figure 39 on page 107) in the unload direction until the leader pin block **2** reaches the last roller **3** .

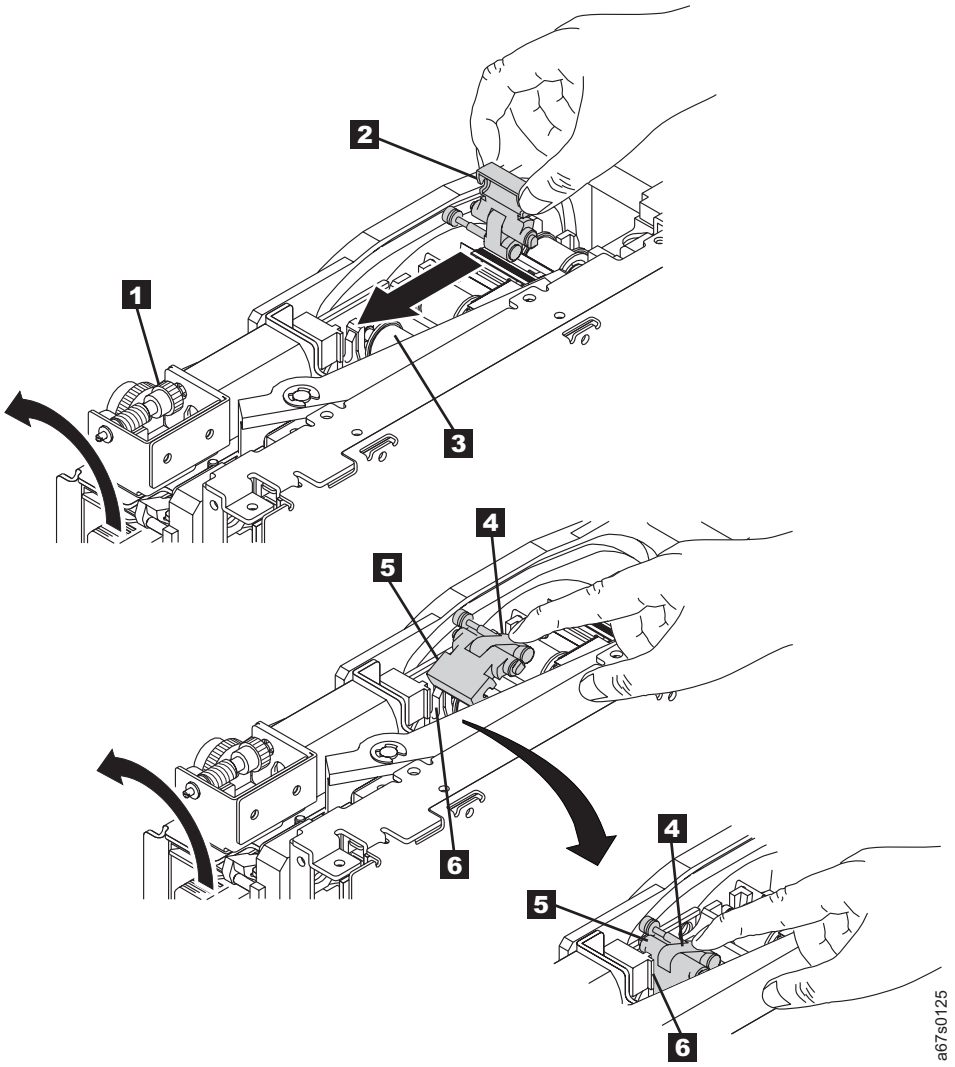


*Figure 39. Guiding the leader pin into the tape cartridge*

2. To prevent the leader pin block from jamming, press down on the linkage of the leader pin block **4** to force the hinged section of the block upward.
3. While manually rotating the loader motor gear in the unload direction, guide the end of the leader pin block **5** into the white block guide **6**.
4. Continue to rotate the loader motor gear counterclockwise until you feel resistance and the cartridge ejects.
5. Remove the tape cartridge.
6. To reuse the 3581 Tape Autoloader, you must raise the drive's loader so that it is able to accept a cartridge. To raise the loader, continue to wind the loader motor gear counterclockwise with the screwdriver until you feel resistance.
7. Remove the small-blade screwdriver.
8. If you choose to replace the 3581 Tape Autoloader, return it in its original packaging or in the packaging from its replacement.
9. To reassemble the 3581 Tape Autoloader, reverse the preceding steps.

After you remove the stuck tape cartridge, copy the data on the tape to another tape. Then, discard the stuck tape cartridge.

# Appendix C. Bar Code Reader Installation (optional)

You can install an optional bar code reader in the 3581 Tape Autoloader. The bar code reader reads the bar code labels that you or a manufacturer attach to a tape cartridge. The bar code label contains the cartridge's unique volume serial (VOLSER) number, which identifies it to the autoloader. The label also identifies the cartridge as a data or cleaning cartridge. Figure 40 shows the bar code reader.

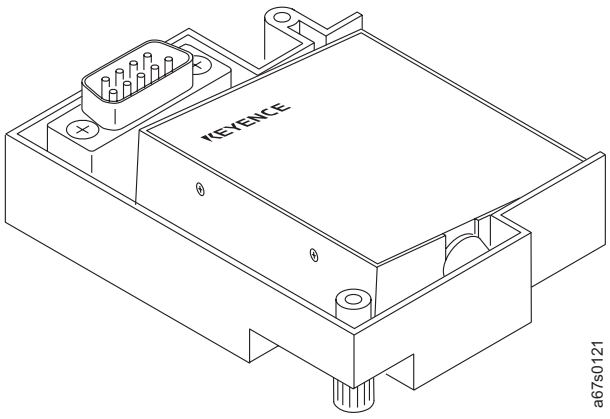


*Figure 40. Bar code reader*

The bar code reader connects to the interface connector on the inside top panel of the 3581 Tape Autoloader. This location prevents you from using cartridge storage slot 1. When you install the bar code reader, you reduce the capacity of the autoloader to 6 cartridge storage slots. The front storage slots are still numbered 1 through 5, but the autoloader's menu functions and the server's application software cannot select or use slot 1. This is best illustrated by observing that with the bar code reader installed, the LOAD SLOT function uses storage slots 2 and 3 as the cartridge source locations to load slots 6 and 7; without the bar code reader installed, the LOAD SLOT function uses storage slots 1 and 2 as the source locations.

When you power-on the 3581 Tape Autoloader, it automatically enables the bar code reader. After you power-on the autoloader, the server's application software sends a command to the autoloader to scan the bar code labels on the cartridges.

When you install the bar code reader, the **bARCOdE** function appears in the Diagnostic Menu. You can then enable or disable the bar code reader from that menu (see Appendix A, "Diagnostic and Maintenance Functions", on page 85). The **bARCOdE** function does not display in the Diagnostic Menu if the bar code reader is not installed.

## Installation Procedure

You do not need tools for this procedure.


**CAUTION:**
**These products comply with the performance standards set by the U.S. Food and Drug Administration for a Class II and IEC825 Laser Product.**

**CAUTION:**
**Use care when servicing the autoloader assembly.**

To install the bar code reader:

1. Open the front door of the autoloader and remove all data cartridges. If there is a cartridge in the drive or picker, remove it by using the EJECT dRV or EJECT PCKR command (see "Using the Control Buttons to Display Commands" on page 21).
2. Power-off the 3581 Tape Autoloader and unplug its power cord from the electrical outlet.
3. Referring to Figure 41 on page 111, locate the mounting hole **1** and interface connector **2** on the inside top panel of the autoloader, directly above cartridge storage slot 1.

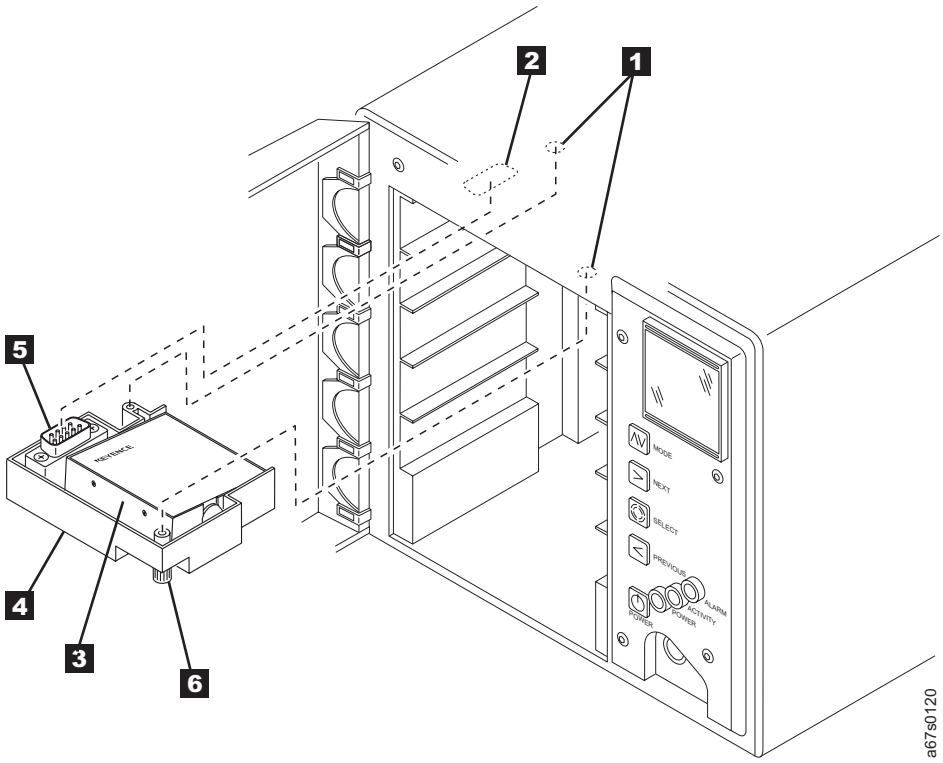


*Figure 41. Installing the bar code reader*

4. Remove the bar code reader from its packaging.
5. Check that the bar code reader ( **3** in Figure 29 on page 77) is securely attached to its mounting bracket **4** .
6. Press the interface connector **5** of the bar code reader into the mating interface connector **2** on the inside top panel of the 3581 Tape Autoloader.
7. Push in and tighten the two thumbscrews **6** on the mounting bracket until it secures the bar code reader to the panel.
8. Connect the autoloader's power cord to an electrical outlet.
9. Press the POWER button to power-on the 3581 Tape Autoloader.
10. Ensure that the bar code reader is enabled (see "Enabling or Disabling the Bar Code Reader" on page 92).
11. Record the bar code setting on the Vital Product Data form.
12. Apply bar code labels to your cartridges and load them into the 3581 Tape Autoloader (for details about labeling cartridges, see "Guidelines for Using Bar Code Labels" on page 36).

    **Note:** A sheet of IBM-approved bar code labels is included with each bar code reader.

## Removal Procedure

To remove the bar code reader, see "Removing and Replacing the Bar Code Reader" on page 76.

# Appendix D. Rack Installation

Using a rackmount kit, you can install up to two 3581 Tape Autoloaders side by side in a standard rack. To install a 3581 Tape Autoloader, you must:

- Unpack the rackmount kit
- Install the rackmount tray into the rack
- Install the 3581 Tape Autoloader onto a sled
- Install up to two sleds onto the rackmount tray

The sections that follow give instructions for completing each task in the installation.

## Guidelines for Installation

**DANGER**

**An electrical outlet that is not correctly wired could place hazardous voltage on metal parts of the system or the products that attach to the system. It is the customer's responsibility to ensure that the outlet is correctly wired and grounded to prevent an electrical shock.** *(RSFTD201)*

For proper autoloader operation and to meet regulatory requirements:

- Allow 5 U of vertical rack space for 3581 Tape Autoloader: 4 U for the autoloader and 1 U for the vertical extension of the rackmount tray. One U is equal to 4.45 cm (1.75 in.).
- Do not install the 3581 Tape Autoloader in a rack where the internal rack ambient temperature will exceed 38°C.
- Do not install the 3581 Tape Autoloader in a rack where the air flow is compromised. Any side, front, or back of the autoloader used for air flow through the autoloader must not be in indirect contact with the rack.
- Ensure that a hazardous condition is not created due to uneven mechanical loading when installing the 3581 Tape Autoloader into a rack. If the rack has a stabilizer, it must be firmly attached before you install or remove the autoloader.
- Connect the 3581 Tape Autoloader to the power supply circuit so that the overloading of circuits does not compromise the supply wiring or overcurrent protection. The autoloader requires 1.3 A of power with an input of 100 Vac, or 0.7 A with an input of 240 Vac.
- Ensure that the 3581 Tape Autoloader is properly grounded when in the rack.

*Table 13. Components of rackmount kit*

| Component Number | Description | Quantity |
|---|---|---|
| 1 | Rackmount tray | 1 |
| 2 | Left rear bracket (preattached to rackmount tray) | 1 |
| 3 | Right rear bracket (preattached to rackmount tray) | 1 |

Table 13. Components of rackmount kit (continued)

| Component Number | Description | Quantity |
|---|---|---|
| 4 | Nut plate (preattached to rackmount tray) | 2 |
| 5 | Filler panel (preattached to right sled) | 1 |
| 6 | Left sled | 1 |
| 7 | Right sled | 1 |
| 8 | Screw, pan head, M5 x 16 mm, .8 pitch | 10 |
| 9 | Panel nut, M5 x .8, steel (for rack rails that have round mounting holes) | 10 |
| 10 | Cage nut, M5 x .8 (for rack rails that have square mounting holes) | 10 |
| 11 | Finishing washer, M5, black polyamide | 10 |
| 12 | Flat-head screw, 8-32 x 3/8 in. (preattached to rackmount tray and nut plate) | 4 |
| 13 | Flat-head screw, 4-40 x 1/4 in., 82°, black | 8 |
| 14 | Washer, screw-retaining, nylon, #4 | 4 |
| 15 | Power cords for rack installation | 2 |

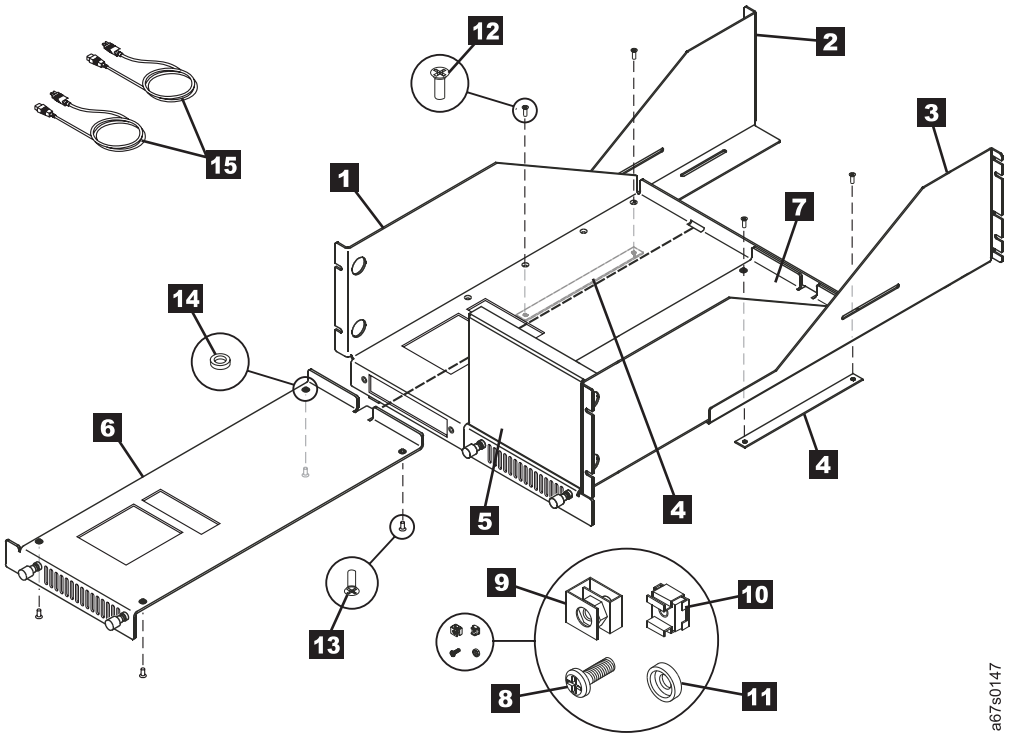


Figure 42. Components of the rackmount kit

## Required Tools

- One #1 Phillips screwdriver
- One T-10 Torx driver

## Unpacking the Rackmount Kit

To unpack the rackmount kit, perform the following steps:

1. Open the shipping carton and remove the small plastic bag that contains the mounting hardware.
2. Lift the rackmount tray (supported by foam braces) from the carton and set it on a work surface.
3. Remove the foam braces from the rackmount tray.
4. Verify that you received the following components in Table 13 on page 113

## Installing the Rackmount Tray into the Rack

To install the rackmount tray into the rack, perform the following steps:

1. Loosen the four thumbscrews (see 1 in Figure 43) on the left and right sleds ( 2 and 3 ) by turning them counterclockwise, then remove the sleds from the rackmount tray 4 .
2. Remove the four flat-head screws (8-32 x 3/8 in.) 5 that secure the left and right brackets to the rackmount tray. Set the screws aside for later use.
3. Remove the left and right brackets ( 6 and 7 ), and the two nut plates 8 that are located under the rackmount tray.

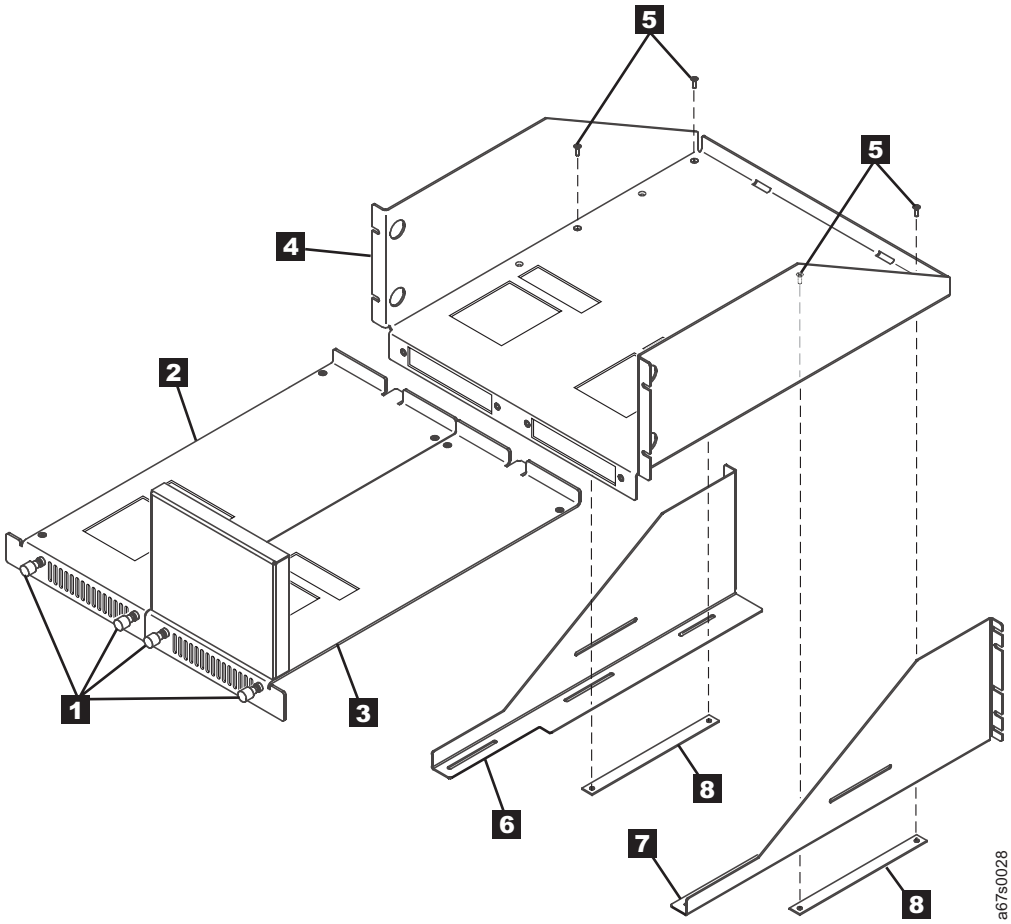


*Figure 43. Preparing the rackmount tray for installation into the rack*

4. In the rack, decide where you want the top and bottom boundaries of the 3581 Tape Autoloader to be located. In a standard rack that is 19 inches wide, the autoloader requires 6 U of vertical space (18 holes on the vertical rails). The unit itself requires 4 U and the vertical extension requires 1 U. Each U is 4.45 cm (1.75 in.) and is usually marked by three holes on the vertical rails. Figure 44 shows how to measure the vertical boundaries for the rack.

   **Note:** Ensure that the boundaries you select do not cause the rack-mounted autoloader to overlap existing bolts on the rails or other equipment mounted in the rack.

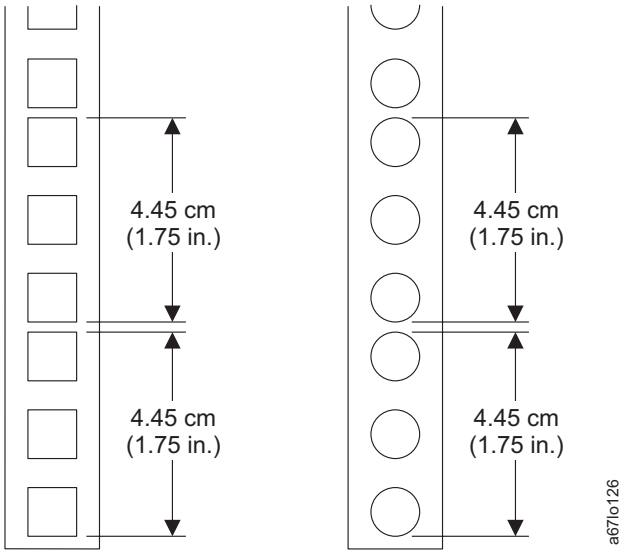


*Figure 44. Defining the vertical boundaries of the autoloader in the rack.* The figure shows how to define the boundaries for racks with round mounting holes and square mounting holes.

5. On each of the rack's four vertical rails (Figure 45 on page 117 shows the two front rails **3** and the two rear rails **4**), install a panel nut **1** or cage nut **2** at the bottom boundary.
   a. For racks with round mounting holes, install panel nuts by sliding them onto the rails.
   b. For racks with square mounting holes, install cage nuts. Pinch the flanges of the nut together until it fits into the square on the vertical rail, then release the flanges.

   Figure 45 on page 117 shows both panel nuts and cage nuts, but you must only install one type of nut.
6. On each of the rack's four vertical rails, install a panel nut or cage nut at the top boundary.
7. Lift the rackmount tray to the front vertical rails of the rack so that both of the tray's front flanges **5** are positioned outside the vertical rails.
8. While supporting the tray, secure it to the rack's front vertical rails with four pan-head screws **6** and four finishing washers **7**.
9. Secure the left and right brackets (**8** and **9**) to the rack's rear vertical rails with four pan-head screws **10** and four finishing washers **11**.
10. Insert (but do not tighten) the four flat-head screws (8-32 x 3/8 in.) **12** that secure the left and right brackets to the rackmount tray.

11. Position a nut panel **13** beneath the left bracket (ensure that the panel's hole risers face downward), then tighten the screw **12** to secure the tray, bracket, and nut panel. Repeat for the right bracket.
12. Tighten all screws.

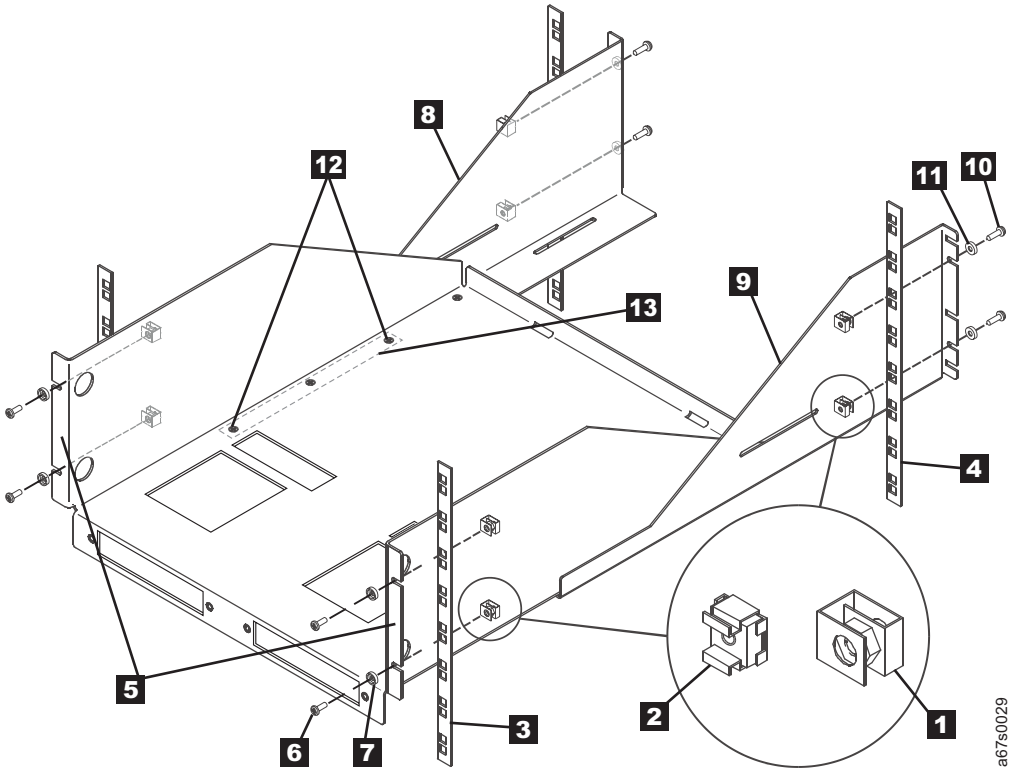


*Figure 45. Installing the rackmount tray into the rack*

## Installing the Autoloader onto the Sled

To install the 3581 Tape Autoloader onto the sled, perform the following steps:

1. Decide which sled (see **1** in Figure 46 on page 118) onto which you want to mount the 3581 Tape Autoloader. The left sled features a left ear **2** ; the right sled features a right ear. The two sleds are not interchangeable within the rackmount tray.
2. Set the sled on a flat surface, locate the recessed hole at each corner, and insert a #4 screw-retaining washer **3** into each hole.

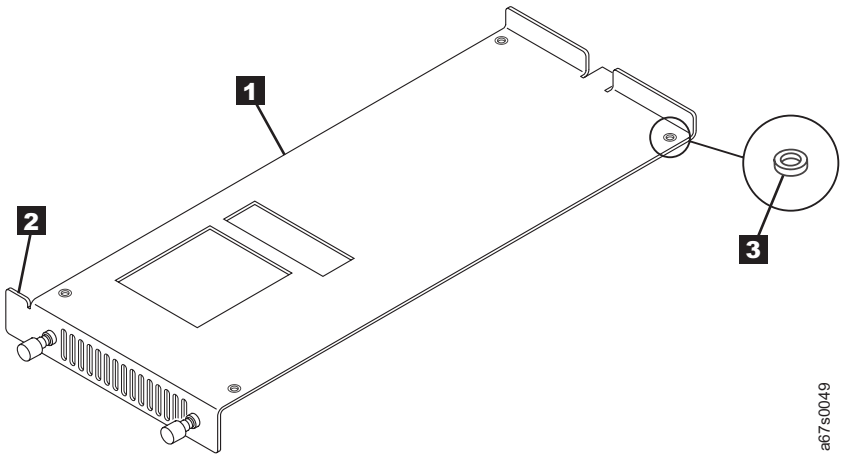


*Figure 46. Identifying the left and right sled.* The left sled features a left ear; the right sled features a right ear.

3. Remove any tape cartridges from the 3581 Tape Autoloader (see "Removing a Tape Cartridge" on page 26; if a cartridge is in the picker, refer to "Using the Control Buttons to Display Commands" on page 21 and issue the EJECT PCKR command).
4. Use a T-10 Torx driver to remove the six Torx screws (see **1** in Figure 47 that secure the left autoloader's cover **2** .
5. Remove the cover by lifting it up and away from the autoloader.

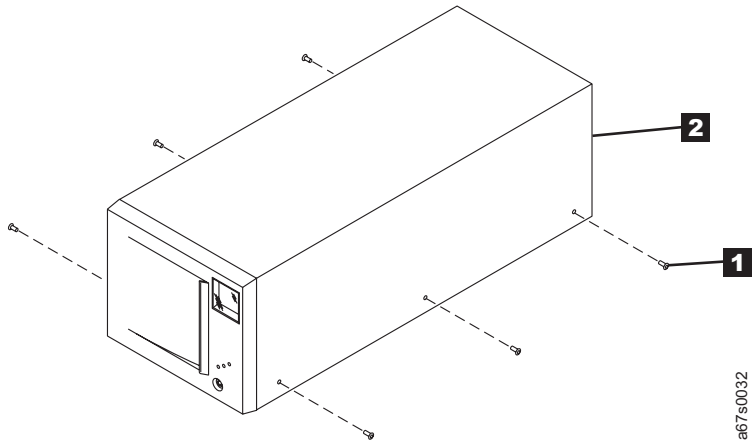


*Figure 47. Removing the covers of the 3581 Tape Autoloaders*

6. Set the 3581 Tape Autoloader upside down on a flat work surface (see **1** in Figure 48 on page 119).
7. Using a Phillips screwdriver, remove the four flat-head screws **2** .
8. Remove the four feet **3** from the autoloader and store them.

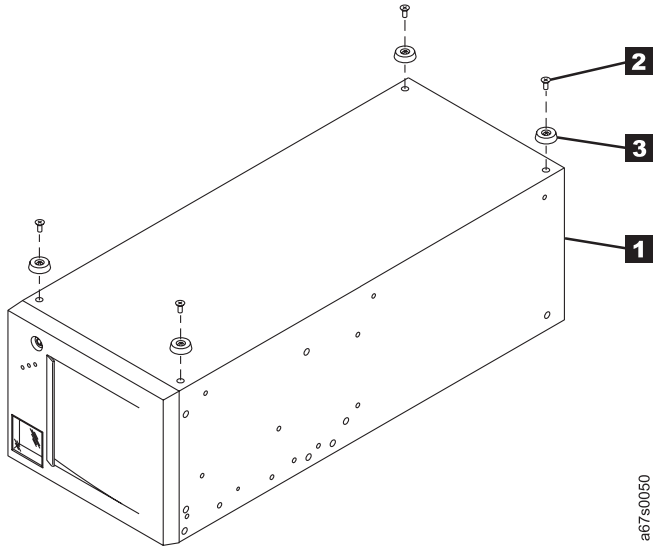


*Figure 48. Removing the feet from the 3581 Tape Autoloader.* The autoloader is upside down.

9. Turn the sled (see **1** in Figure 49 on page 120) upside down and place it onto the 3581 Tape Autoloader **2**. Secure the sled to the autoloader with four flat-head screws **3**.

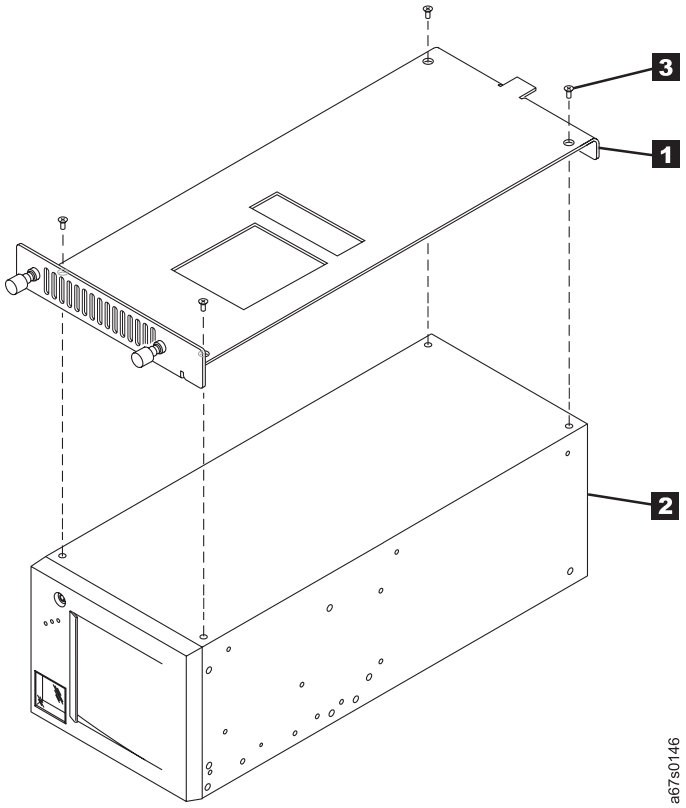


*Figure 49. Installing the 3581 Tape Autoloader onto the sled.* Both the autoloader and the sled are upside down.

10. Set the 3581 Tape Autoloader and its attached sled upright.

## Installing the Sled onto the Rackmount Tray

To install the sled onto the rackmount tray, perform the following steps:

1. Slide the sled ( **1** in Figure 50 on page 121) into position on the rackmount tray **2** .
2. Ensure that the tang (a metal protrusion) at the rear of the sled fits into the slot at the rear of the tray.
3. Secure the sled to the tray by fully tightening the thumbscrews **3** .

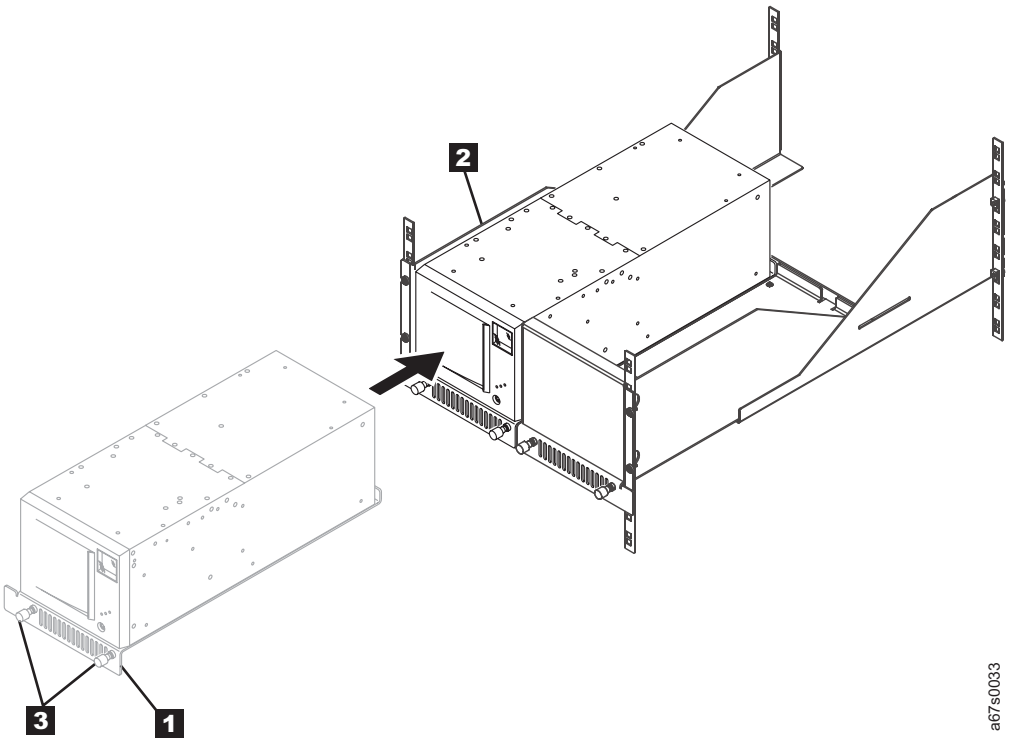


*Figure 50. Installing the sled onto the rackmount tray*

## Installing a Second Autoloader

To install a second autoloader beside a previously installed one, perform the following steps:

1. Loosen (but do not remove) the two flat-head screws (see **1** in Figure 51 on page 122) that secure the filler panel **2** to the right sled **3**.
2. Remove the filler panel.

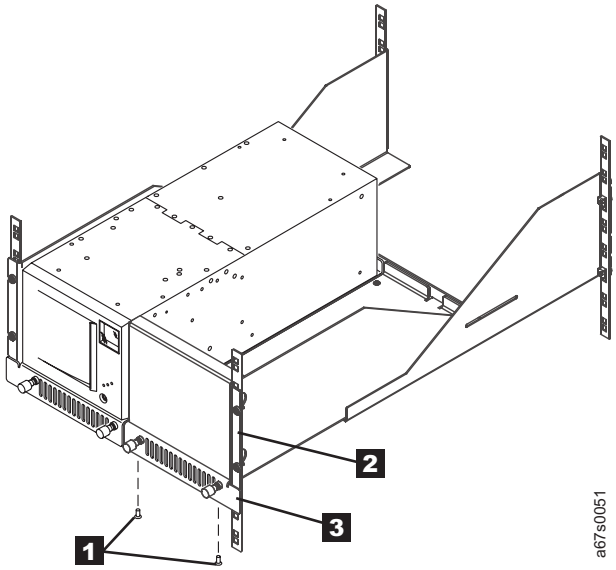


*Figure 51. Removing the filler panel to install a second 3581 Tape Autoloader*

3. To install a second 3581 Tape Autoloader onto the sled, perform steps 3 through 10 in "Installing the Autoloader onto the Sled" on page 117.
4. Slide the right sled (see **1** in Figure 52 on page 123) into position on the rackmount tray.
5. Ensure that the tang (a metal protrusion) at the rear of the sled fits into the slot at the rear of the tray.

   **Note:** If the two autoloaders are misaligned in the rackmount tray, loosen the pan-head screws on the front rails, push the sides of the tray firmly toward the rails, and retighten the screws.
6. Secure the right sled to the rackmount tray by fully tightening the thumbscrews **2**.
7. To install the power cords, SCSI cables, and terminators, review "Performing the Safety Inspection Procedure" on page xiii, then refer to the instructions in Chapter 2, "Installing the 3581 Tape Autoloader", on page 7.

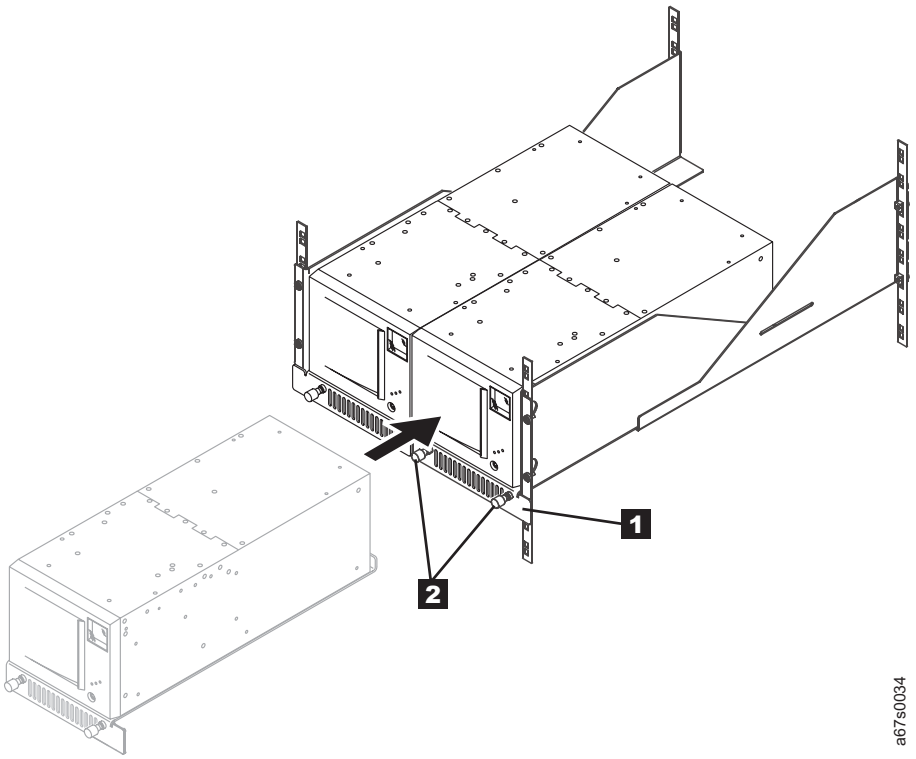


*Figure 52. Installing a second 3581 Tape Autoloader onto the rackmount tray*

## Removing the 3581 Tape Autoloader from a Rack

To remove a 3581 Tape Autoloader from a rack, you must:

- Remove the sled from the rackmount tray
- Remove the 3581 Tape Autoloader from the sled
- Remove the rackmount tray from the rack

The sections that follow give instructions for completing each task in the removal.

### Removing the Sled from the Rackmount Tray

To remove the sled from the rackmount tray, perform the following steps:

1. Disconnect the following:
   - Power cord
   - SCSI bus cable
   - RS-422 cable
2. Remove any tape cartridges from the 3581 Tape Autoloader (see "Removing a Tape Cartridge" on page 26; if a cartridge is in the picker, refer to "Using the Control Buttons to Display Commands" on page 21 and issue the EJECT PCKR command).
3. Loosen the thumbscrews that secure the sled to the rackmount tray.
4. Grasp the sled and slide it towards you from the rackmount tray.
5. Remove the sled from the rackmount tray.

## Removing the Autoloader from the Sled

To remove the 3581 Tape Autoloader from the sled, perform the following steps:

1. Set the 3581 Tape Autoloader upside down on a flat work surface.
2. Remove the four flat-head screws and #4 screw-retaining washers from each corner of the sled.
3. Remove the sled from the autoloader.
4. Using a Phillips screwdriver, reattach the four feet to the autoloader (you removed and set the feet aside in step 6 of "Installing the Autoloader onto the Sled" on page 117).
5. Set the 3581 Tape Autoloader upright.

## Removing the Rackmount Tray from the Rack

To remove the rackmount tray from the rack, perform the following steps:

1. Remove the four flat-head screws (8-32 x 3/8 in.) that secure the nut panels and left and right brackets to the rackmount tray.
2. Remove the four pan-head screws and four finishing washers that secure the left and right brackets to the rack's vertical rails.
3. Remove the four pan-head screws and four finishing washers that secure the rackmount tray to the rack's vertical rails.
4. Remove the rackmount tray from the rack.
5. Remove the panel nuts or cage nuts from each of the rack's four vertical rails (pry the panel nuts free by using a screwdriver or pinch the flanges of the cage nuts and ease them from the square holes).
6. Using the four flat-head screws (8-32 x 3/8 in.), attach the left and right brackets and the two nut plates (located under the rackmount tray) to the rackmount tray.

# Appendix E. SCSI Element Addresses

The SCSI elements in the 3581 Tape Autoloader are the cartridge storage slots, drive, and the loader mechanism (generally called the picker). To move media within the autoloader, the server must reference each movement with source and target addresses. The server uses these SCSI element addresses to specify which slots are to be used within the autoloader.

SCSI element addresses differ among operating systems. This appendix lists the SCSI element addresses for non-Windows 2000 and Windows 2000 operating systems. It also describes the effect that the bar code reader has on the addresses.

## Windows 2000 Operating System

Figure 53 shows the SCSI addresses for the elements in an autoloader that uses the Windows 2000 operating system and does not contain a bar code reader. The addresses are given in both hexadecimal and decimal (in parentheses) format. In SCSI terms, the storage slot is known as the storage element (SE), the drive is known as the data transfer element (DTE), and the picker is known as the Medium Transport Element (MTE).

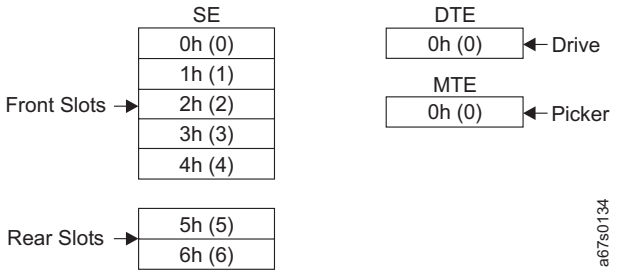


*Figure 53. SCSI element addresses for the 3581 Tape Autoloader.* The unit uses the Windows 2000 operating system and does not contain a bar code reader.

### Effect of Bar Code Reader on Element Addresses

When you install a bar code reader in your 3581 Tape Autoloader, you reduce the capacity of the autoloader to six cartridge storage slots (instead of seven). In addition, the slots' SCSI element addresses change. The element address of slot 2 becomes 0, the element address of slot 3 becomes 1, and so forth. Figure 54 on page 126 shows the revised SCSI element addresses for the storage slots after a bar code reader has been added.

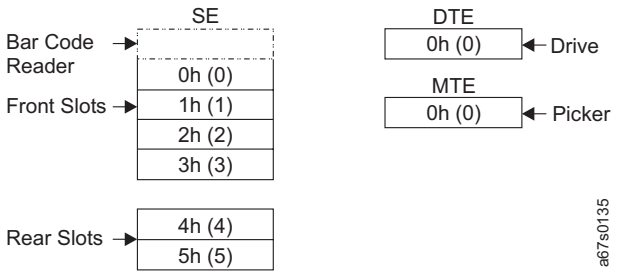


*Figure 54. SCSI element addresses for the 3581 Tape Autoloader.* The unit uses the Windows 2000 operating system and contains a bar code reader.

## Non-Windows 2000 Operating Systems

Figure 55 shows the SCSI addresses for the elements in an autoloader that does not use the Windows 2000 operating system and does not contain a bar code reader. The addresses are given in both hexadecimal and decimal (in parentheses) format.

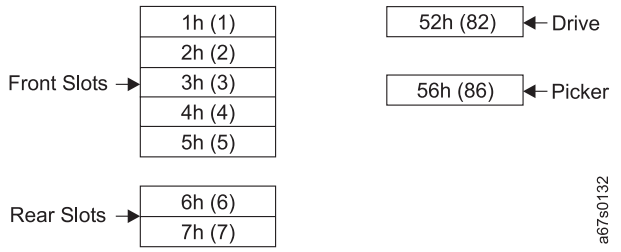


*Figure 55. SCSI element addresses for the 3581 Tape Autoloader.* The unit does not use the Windows 2000 operating system and does not contain a bar code reader.

### Effect of Bar Code Reader on Element Addresses

For configurations that use an operating system other than Windows 2000, the principles of addressing are identical to those of the Windows 2000 operating system, except that the SCSI element addresses are different.

When you install a bar code reader in your 3581 Tape Autoloader, you reduce the capacity of the autoloader to six storage slots and their SCSI element addresses change.The element address of slot 2 becomes 1, the element address of slot 3 becomes 2, and so forth. Additionally, the SCSI element addresses of the drive and picker differ from those of the Windows 2000 system.

Figure 56 on page 127 shows the revised SCSI element addresses for the storage slots after a bar code reader has been added.

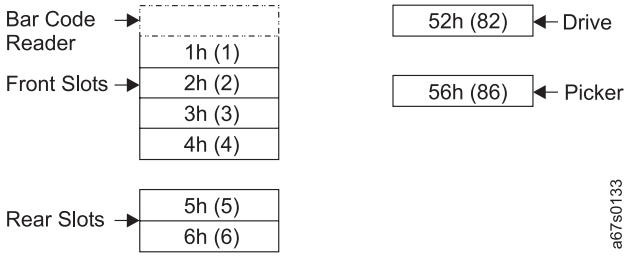


*Figure 56. SCSI element addresses for the 3581 Tape Autoloader.* The unit does not use the Windows 2000 operating system and contains a bar code reader.

# Appendix F. TapeAlert Flags

Table 14 lists the TapeAlert flags that are supported by the IBM Ultrium Tape Drive. Table 15 on page 131 lists the TapeAlert flags that are supported by the 3581 Tape Autoloader.

## TapeAlert Flags Supported by the Drive

Table 14 describes the TapeAlert flags that are supported by the drive and lists the actions that you must take to correct problems.

*Table 14. TapeAlert flags supported by the drive*

| TapeAlert Flags Supported by the IBM Ultrium Tape Drive | | | |
|---|---|---|---|
| **Flag Number** | **Flag** | **Description** | **Action Required** |
| 3 | 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 Number 4, 5, or 6 in this table. |
| 4 | Media | Set for any unrecoverable read, write, or positioning error that is due to a faulty tape cartridge. | Replace the tape cartridge. |
| 5 | 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 Chapter 5, “Troubleshooting”, on page 53. |
| 6 | Write failure | Set for any unrecoverable write or positioning error where isolation is uncertain and failure could be due to a faulty tape cartridge or to faulty drive hardware. | If Flag 9 is also set, make sure that the write-protect switch is set so that data can be written to the tape (see “Setting the Write-Protect Switch” on page 37). If Flag 4 is also set, the cartridge is defective. Replace the tape cartridge. If Flag 4 is not set, see Chapter 5, “Troubleshooting”, on page 53. |
| 8 | Not data grade | Set when severe servo errors occur while loading a tape cartridge. | Replace the tape cartridge. If this error occurs with multiple cartridges, see error code 6 in Table 9 on page 66. |
| 9 | Write protect | Set when the tape drive detects that the tape cartridge is write protected. | Make sure that the cartridge’s write-protect switch is set so that the tape drive can write data to the tape (see “Setting the Write-Protect Switch” on page 37). |
| 10 | No removal | Set when the tape drive receives an UNLOAD command after the server prevented the tape cartridge from being removed. | Refer to the documentation for your server’s operating system. |
| 11 | Cleaning media | Set when you load a cleaning cartridge into the drive. | No action required. |

*Table 14. TapeAlert flags supported by the drive (continued)*

| TapeAlert Flags Supported by the IBM Ultrium Tape Drive | | | |
|---|---|---|---|
| **Flag Number** | **Flag** | **Description** | **Action Required** |
| 12 | 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. |
| 14 | Unrecoverable snapped tape | Set when the tape split apart. | Manually remove the tape cartridge (see "Manually Removing the Cartridge" on page 100). |
| 15 | Cartridge memory chip failure | Set when a cartridge memory (CM) failure is detected on the loaded tape cartridge. | Replace the cartridge. If this error occurs on multiple tapes, see error code 6 in Table 9 on page 66. |
| 16 | Forced eject | Set when you manually unload the tape cartridge while the drive was reading or writing. | No action required. |
| 18 | Tape directory corrupted in the cartridge memory | Set when the drive detects that the tape directory in the cartridge memory has been corrupted. | Re-read data from the tape to rebuild the tape directory. |
| 20 | Clean now | Set when the tape drive detects that it needs cleaning. | Clean the tape drive. See "Cleaning the Drive Head" on page 27. |
| 21 | Clean periodic | Set when the drive detects that it needs routine cleaning. | Clean the tape drive as soon as possible. The drive can continue to operate, but you should clean the drive soon. See "Cleaning the Drive Head" on page 27. |
| 22 | Expired clean | Set when the tape drive detects a cleaning cartridge that has expired. | Replace the cleaning cartridge. |
| 23 | Invalid cleaning tape | Set when the tape drive expects a cleaning cartridge and the loaded cartridge is not a cleaning cartridge. | Use a valid cleaning cartridge. |
| 30 | Hardware A | Set when a hardware failure occurs which requires that you reset the tape drive to recover. | If resetting the drive does not recover the error, note the error code on the single-character display and see Table 9 on page 66 for the appropriate instructions. |
| 31 | Hardware B | Set when the tape drive fails its internal Power-On Self Test (POST). | Note the error code on the single-character display and see Table 9 on page 66 for the appropriate instructions. |
| 32 | Interface | Set when the tape drive detects a problem with the SCSI or RS-422 interface. | See error code 8 or 9 in Table 9 on page 66. |
| 33 | Eject media | Set when a failure occurs that requires you to unload the cartridge from the drive and discard it. | Unload and reload the tape cartridge. |
| 34 | Download fail | Set when an FMR image is unsuccessfully downloaded to the tape drive over the SCSI interface. | Download the FMR image again (ensure that it is the correct image). |

*Table 14. TapeAlert flags supported by the drive (continued)*

| TapeAlert Flags Supported by the IBM Ultrium Tape Drive | | | |
|---|---|---|---|
| **Flag Number** | **Flag** | **Description** | **Action Required** |
| 36 | Drive temperature | Set when the drive's temperature sensor indicates that the drive's temperature is exceeding the recommended temperature of the enclosure (see Table 1 on page 4). | See error code 1 in Table 9 on page 66. |
| 37 | Drive voltage | Set when the drive detects that the externally supplied voltages are approaching the specified voltage limits or are outside the voltage limits (see Table 1 on page 4). | See error code 2 in Table 9 on page 66. |
| 39 | Diagnostics required | Set when the drive detects a failure that requires diagnostics to isolate the problem. | See error code 6 in Table 9 on page 66. |
| 51 | Tape directory invalid at unload | For the tape that was unloaded, set when the tape directory on the cartridge memory is corrupted. | If the problem continues after successive loads, replace the cartridge. If the problem persists, replace the drive. |
| 52 | Tape system area write failure | Set when the tape that was unloaded could not write its system area (FID) successfully. | 1. Copy the data to another tape cartridge.<br>2. Discard the old cartridge. |

## TapeAlert Flags Supported by the Autoloader

Table 15 describes the TapeAlert flags that are supported by the autoloader and lists the actions that you must take to correct problems.

*Table 15. TapeAlert flags supported by the autoloader*

| TapeAlert Flags Supported by the 3581 Tape Autoloader | | | |
|---|---|---|---|
| **Flag Number** | **Flag** | **Description** | **Action Required** |
| 1 | Library Hardware A | The autoloader has trouble communicating with the drive over the internal serial connection. | Restart the operation. If the problem persists, contact IBM Technical Support for machine replacement. |
| 2 | Library Hardware B | The autoloader has a hardware failure. | Restart the operation. If the problem persists, contact IBM Technical Support for machine replacement. |
| 4 | Library Hardware D | The autoloader has a hardware failure that is not mechanically related. | Restart the operation. If the problem persists, contact IBM Technical Support for machine replacement. |
| 21 | Library Offline | The autoloader has been placed into the off-line mode by pressing the MODE control key. | Power the autoloader off, then power it on to place the autoloader into the on-line mode. |

# Appendix G. Messages

## Obtaining Tape Drive or Library Error Information at the Host

IBM device drivers for the pSeries, RS/6000, iSeries, and AS/400 systems log error information when an error occurs on a tape drive or library.

The error information includes the following:

1. Device VPD
2. SCSI command parameters
3. SCSI sense data (if available)

## Obtaining Error Information from an RS/6000 or pSeries

The AIX Tape and Media Changer Device Driver for the pSeries or RS/6000 provides logging to the system error log for a variety of errors. You can view the error log by following this procedure.

1. At the AIX command line, type **errpt |pg** to display a summary report, or type **errpt -a |pg** to display a detailed report. Press **[Enter]**.

   **Note:** In most cases you will use the summary report to find the date and time of any errors related to library devices, then use the detail report to obtain the sense data needed to identify the cause of the error.
2. Press **[Enter]** to scroll through the error log.
3. Type **q** and press **[Enter]**, to quit the error log at any time.

To correct a problem you noticed in the **errpt** report, determine the type of error by using the examples that follow:

- For library errors [Resource Name = **smc**n (for example, smc0) and Resource Type = 3581]), refer to Figure 57 on page 134 and locate the SCSI sense data.
- For drive errors [Resource Name = **rmt**n (for example, rmt0) and Resource Type = LTO], refer to Figure 58 on page 135 and locate the SCSI sense data.
- For SCSI bus errors (not SCSI adapter errors), refer to Figure 59 on page 136 and Figure 60 on page 137 to determine which host adapter, SCSI bus, and device or devices are affected. After you have determined which device or devices are affected, go to “Fixing Drive SCSI Bus Errors” on page 141 to resolve the problem.
- For SCSI adapter errors (not SCSI bus errors), use the maintenance package for the host.

**Note:** See Appendix H, “Sense”, on page 143 for further details on sense data.

### Library Error Log Example

```
LABEL:           TAPE_ERR2
IDENTIFIER:      476B351D

Date/Time:       Wed Oct 11 11:42:17
Sequence Number: 25265
Machine ID:      000D090D4C00
Node ID:         tsm
Error Class:     H
Error Type:      PERM
Resource Name:   smc0
Resource Class:  tape
Resource Type:   3581
Location:        40-60-00-1,1
VPD:
        Manufacturer.................IBM
        Machine Type and Model......ULT3581-TL
        Serial Number...............1323858
        Device Specific . (FW) .....I112   (Firmware Level)

Description
TAPE DRIVE FAILURE

Probable Causes
TAPE DRIVE

Failure Causes
TAPE
TAPE DRIVE
        Recommended Actions
        PERFORM PROBLEM DETERMINATION PROCEDURES

Detail Data
SENSE DATA
0C01 0000 A520 0000 0100 0010 0000 0000 0000 0000 7000 0900 0000 010A 0000 0000
FF2A 8000 0000 0000 0000 0000 0000 0000 0001 0000 0000 0000 0000 0000 0000 0000
0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
```

*Figure 57. AIX ERRPT Library Error Log Example*

*Table 16. AIX ERRPT Library Sense Data*

| Hex | Description |
|---|---|
| A5 | SCSI Command |
| 0000, 0100, 0010 | Command Parameters |
| 70 | Byte 0 of Library Sense Data |
| 09 | Sense Key |
| FF2A | ASC/ASCQ (Additional Sense Code/Additional Sense Code Qualifier) |

### Drive Error Log Example

```
LABEL:          TAPE_ERR1
IDENTIFIER:         4865FA9B

Date/Time:      Wed Oct 10 11:39:43
Sequence Number: 25264
Machine ID:     000D090D4C00
Node ID:        tsm
Class:          H
Type:           PERM
Resource Name:  rmt2
Resource Class: tape
Resource Type:  LTO
Location:       40-60-00-1,0
VPD:
        Manufacturer................IBM
        Machine Type and Model......ULT3580-TD2
        Serial Number...............1300015078
        Device Specific.(FW)........35N0  (Firmware Level)
Description
TAPE OPERATION ERROR

Probable Causes
TAPE

User Causes
MEDIA DEFECTIVE
DIRTY READ/WRITE HEAD

        Recommended Actions
        FOR REMOVABLE MEDIA, CHANGE MEDIA AND RETRY
        PERFORM PROBLEM DETERMINATION PROCEDURES

Detail Data
SENSE DATA
0602 0000 0100 0000 0200 0000 0000 0000 0000 0000 7000 0300 0000 001C 0000 0000
5200 0700 20B0 0000 0000 0000 0000 0000 0000 0000 058A 0212 0000 0000 0000 0000
0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
```

*Figure 58. AIX ERRPT Drive Error Log Example*

*Table 17. AIX ERRPT Drive Sense Data*

| Hex | Description |
|---|---|
| 01 | SCSI Command |
| 0000, 0200, 0000 | Command Parameters |
| 70 | Byte 0 of Tape Drive Sense Data |
| 03 | Sense key (Hardware error in this example) |
| 5200 | ASC/ASCQ (Additional Sense Code/Additional Sense Code Qualifier) |
| 20B0 | FSC (Fault Symptom Code) |
| 058A | Relative LPOS |
| 02 | SCSI ID |

### SCSI Bus Error Example

```
LABEL:           SCSI_ERR10
IDENTIFIER:          0BA49C99

Date/Time:       Wed Oct 17 09:55:32
Sequence Number: 16140
Machine Id:      00003ABF4C00
Node Id:         ofgtsm
Class:           H
Type:            TEMP
Resource Name:   scsi3
Resource Class:  adapter
Resource Type:   sym896
Location:        40-59
VPD:
      Product Specific.(  ).......DUAL CHANNEL PCI TO ULTRA2 SCSI
                                  ADAPTER
        Part Number.................03N3606
        EC Level....................F71335
        Manufacture ID..............A16592
        Serial Number...............0749

Description
SCSI BUS ERROR

Probable Causes
CABLE
CABLE TERMINATOR
DEVICE
ADAPTER

Failure Causes
CABLE LOOSE OR DEFECTIVE
DEVICE
ADAPTER

        Recommended Actions
        PERFORM PROBLEM DETERMINATION PROCEDURES
        CHECK CABLE AND ITS CONNECTIONS

Detail Data
SENSE DATA
0001 0017 0000 0000 0000 0091 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
0000 0000 0000 4304 0000 0000 0000 0000 2000 0003 0203 6760 9808 0000 F7FB E1B8
0000 0015 000B 0210 0678 C800 0000 8200 8277 1B20 00A2 ED00 0000 0002 FFFF FFFF
00FF 0000 111F F000 F3DF F110
```

*Figure 59. Example of Error Suggesting SCSI Bus Problem, Which Takes Down Entire Bus*

### SCSI Bus Error Example

```
LABEL:            TAPE_ERR4
IDENTIFIER:     5537AC5F

Date/Time:       Wed Oct 17 09:00:41
Sequence Number: 16101
Machine Id:      00003ABF4C00
Node Id:         ofgtsm
Class:           H
Type:            PERM
Resource Name:   smc0
Resource Class:  tape
Resource Type:   3581
Location:        40-58-00-0,1
VPD:
        Manufacturer.................IBM
        Machine Type and Model......ULT3581-TL
        Serial Number...............1323858
        Device Specific.(FW).........I112
Description
TAPE DRIVE FAILURE

Probable Causes
ADAPTER
TAPE DRIVE

Failure Causes
ADAPTER
TAPE DRIVE

        Recommended Actions
        PERFORM PROBLEM DETERMINATION PROCEDURES

Detail Data
SENSE DATA
0600 0000 1200 0000 FF00 0000 0000 0000 0200 0800 0000 0000 0000 0000 0000 0000
0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
```

*Figure 60. SCSI Problem Points to Library Control Path as Possible Cause*

### Summary Report

```
   1        2      3 4   5             6
FFE2F73A   1012150900 U H   rmt5          UNDETERMINED ERROR
0BA49C99   1012150800 T H  scsi8         SCSI BUS ERROR          7
C60BB505   1012141500  P S                  SOFTWARE PROGRAM ABNORM TERMINATED
C42F11D4   1012105200 U S VSC:DE     SOFTWARE ERROR
C42F11D4   1012105000 U S VSC:DE     SOFTWARE ERROR
FFFA352B   1012104900 U S MS:CS       SOFTWARE ERROR
FFFA352B   1012104900 U S MS:CS       SOFTWARE ERROR

5537AC5F   1012091700 P H rmt9           TAPE DRIVE FAILURE
5537AC5F   1012091700 P H rmt9           TAPE DRIVE FAILURE
5537AC5F   1012091700 P H rmt9           TAPE DRIVE FAILURE
5537AC5F   1012091600 P H rmt8           TAPE DRIVE FAILURE
5537AC5F   1012091600 P H rmt8           TAPE DRIVE FAILURE
5537AC5F   1012091600 P H rmt8           TAPE DRIVE FAILURE
C60BB505   1012082000 P S                   SOFTWARE PROGRAM ABNORM TERMINATED
C42F11D4   1011183600 U S VSC:DE         SOFTWARE ERROR
C42F11D4   1011183300 U S VSC:DE         SOFTWARE ERROR
C42F11D4   1011181800 U S VSC:DE         SOFTWARE ERROR
C42F11D4   1011174700 U S VSC:DE         SOFTWARE ERROR
FFFA352B   1011172900 U S MS:CS          SOFTWARE ERROR
FFFA352B   1011172900 U S MS:CS          SOFTWARE ERROR
C42F11D4   1011155300 U S VSC:DE         SOFTWARE ERROR
C42F11D4   1011153900 U S VSC:DE         SOFTWARE ERROR
C42F11D4   1011153800 U S VSC:DE         SOFTWARE ERROR
C42F11D4   1011150900 U S VSC:DE         SOFTWARE ERROR
```

*Figure 61. AIX ERRPT Commands Error Log Example*

| NUMBER | DESCRIPTION |
|---|---|
| 1 | Error ID |
| 2 | Timestamp |
| 3 | Error Type |
| 4 | Error Class |
| 5 | Resource Name |
| 6 | Error Description |
| 7 | How SCSI Bus Error will Display in Log |

| ERROR CLASS | DESCRIPTION |
|---|---|
| H | Hardware |
| S | Software |
| O | Informational |

| ERROR TYPE | DESCRIPTION |
|---|---|
| PEND | The availability loss of a device or component is imminent. |
| PERF | The performance of a device or component has degraded to an unacceptable level. |
| PERM | A hardware or software condition that could not be recovered from. |
| TEMP | A hardware condition that was recovered from after several unsuccessful attempts. |
| UNKN | The severity of the condition could not be determined. |

A69M0170

## Obtaining Service Information Message from an iSeries or AS/400

To gain access to the iSeries or AS/400 problem logs and error logs, sign on at any available workstation using the QSRV logon and its security password (QSRV). After sign on, the proper access authorizations will be granted and the iSeries or AS/400 MAIN MENU displays.

### iSeries or AS/400 System with RISC Processor

1. Type STRSST (Start System Service Tools) command on the command entry line on the iSeries or AS/400 Main Menu, and press **[Enter]**.
2. On the "System Service Tool (SST)" screen, select **Start a service tool**, and press **[Enter]**.
3. On the "Start a Service Tool" screen, select **Product activity log**, and press **[Enter]**.
4. On the "Product activity log" screen, select **Analyze log**, and press **[Enter]**.
5. On the "Select Subsystem Data" screen, select **Magnetic media**, enter the From and To time period for searching the error log, and press **[Enter]**.
6. On the "Select Analysis Report Options" screen, select the following, and press **[Enter]**.
   a. Report type. . . . . 1
   b. Optional entries to include
      1) Informational . . . . . YES
      2) Statistic . . . . . NO
   c. Reference code selection
      1) Option . . . . . 1
      2) Reference codes. . . . . *ALL
   d. Device selection
      1) Option . . . . . 1
      2) Device type or resource names . . *ALL
7. On the "Log Analysis Report" screen, enter a **5** on an error line that has a resource type of 3581 (autoloader) or 3580 (drive), and press **[Enter]**.
8. On the "Display Detail Report for Resource" screen, press:
   - F4=Additional Information.

     Pressing F4 will display the machine type and serial number of the device. It also will display SCSI sense data, if available.
   - F6=Hexadecimal report.

     Pressing F6 will display the device hexadecimal data (for support use).
   - F9=Address Information.

     Pressing F9 will display the SCSI address information.

## Obtaining Error Information from a Sun System

System log files are generally used to provide a time sequenced order of system events. In addition, various daemons write the file with adapter information and other information. There is always a current file and backup file. Depending on local set up, there maybe other files. If a system has been running a long time, the file may not contain the information recorded at boot time. It is highly recommended that the customer save the file that has boot time information, but at this time it is probably too late. On UNIX® based systems, the logs are typically written to a central location. On Solaris the file is found in **/var/adm/messages**. Note that there are also messages.# files, where the # is a number. When a messages file reaches a system defined limit, the file is renamed and older files are subsequently renumbered upwards. The date on the messages file is the last time the file was modified with data. The file that is required is the one that was recording information at the time of the problem.

In addition, you may use error logs from the application (such as Tivoli Storage Manager), or the Device Error Log for problem determination.

The two following service aid programs are provided with the IBM SCSI Tape Device Driver for SunOS:

- Tape service program

  A tape service program called **tapesrvc.c** is provided and contains the following service aids:

  – Query device serial number
  – Format tape cartridge
  – Force device error dump
  – Save device error dump
  – Download device code

  The tape service program is invoked by using the **/opt/stddutil/tapesrvc** command.

  **Note:** You must have root authority to run the tape service program.

  The program is menu driven. Use discretion when running this program because it opens the device in diagnostic mode.
- Sample program

  A sample program called **tapetest.c** is provided, which gives a demonstration of the device driver interface usage.

  The sample program is invoked by using the **/opt/stddutil/tapetest** command. The program is useful for verifying that the device driver and the device are functional. The program is menu driven.

## Obtaining Error Information from an HP-UX System

System log files are generally used to provide a time sequenced order of system events. In addition, various daemons write the file with adapter information and other information. There is always a current file and backup file. Depending on local set up, there maybe other files. If a system has been running a long time, the file may not contain the information recorded at boot time. It is highly recommended that the customer save the file that has boot time information, but at this time it is probably too late. On UNIX based systems, the logs are typically

written to a central location. On HP the file is found in **/var/adm/syslog/syslog.log**. There is an older version of the syslog.log file called OLDsyslog.log. The file that is required is the one that was recording information at the time of the problem.

In addition, you may use error logs from the application (such as Tivoli Storage Manager), or the Device Error Log for problem determination.

## Obtaining Error Information from a Linux System

On Linux based systems, logs are typically written to a central location. On Linux the file is found in **/var/log/messages**. Note that there are also **messages.#** files, where the **#** is a number.When a messages file reaches a system defined limit, the file is renamed and older files are subsequently renumbered upwards. The date on the messages file is the last time the file was modified with data. The command for listing a file along with the date is **ls -l**. The file that is required is the one that was recording information at the time of the problem. The IBMtape daemon also writes to two files, **/var/log/IBMtape.errorlog** and **/var/log/IBMtape.trace**. These files are archived when they reach a certain size with a timestamp date as part of the file name. Extract the required file for analysis. Consult the *IBM Ultrium Device Drivers Installation and User's Guide*, GA32-0430, for setup and operation.

In addition, you may use error logs from the application (such as Tivoli Storage Manager), or the Device Error Log for problem determination.

## Fixing Drive SCSI Bus Errors

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

1. Ensure that the power is on to the autoloader.
2. Ensure that the tape drive's SCSI address is the same as the SCSI address assigned by the server.
3. See "Testing the SCSI Function of the Drive" on page 98 and select the Wrap test.
   - If the test runs successfully, replace the SCSI cable and the interposer (if installed). Repeat the operation that caused the error. If you replaced the 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, rerun the SCSI wrap test with a new SCSI terminator.
   - If the test fails again, replace the autoloader (see Chapter 6, "Removal and Replacement Procedures", on page 73).

### Fixing an Intermittent Error with a Single Drive on a SCSI Bus

1. Replace the SCSI terminator on the tape drive.
2. Run the operation that caused the error. If the problem persists, the problem may be with the cable.
3. Isolate which cable is causing the problem by replacing one cable at a time and running the operation that caused the error after each replacement. If the problem persists after all cables have been replaced, the problem may be with the Ultrium 2 Tape Drive.
4. Replace the autoloader (see Chapter 6, "Removal and Replacement Procedures", on page 73). If the problem persists, the problem is with your server. Consult your server's documentation.

# Appendix H. Sense

## Library Sense Data

*Table 18. Sense Information Format*

| Bits / Bytes | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| 0 | Valid | 70 = Existing Error<br>71 = Deferred Error | | | | | | |
| 1 | Reserved | | | | | | | |
| 2 | Reserved | | | | Sense Key<br>(see Table 19 on page 144) | | | |
| 3<br>:<br>6 | MSB<br>Information Bytes<br>LSB | | | | | | | |
| 7 | Additional Sense Length (n–7)<br>If the sense key is 4, the additional sense length is 70. For all other errors, the additional sense length is 10. | | | | | | | |
| 8<br>:<br>11 | MSB<br>Command Specific Bytes<br>LSB | | | | | | | |
| 12 | Additional Sense Code (ASC)<br>(see Table 20 on page 144) | | | | | | | |
| 13 | Additional Sense Qualifier (ASCQ)<br>(see Table 20 on page 144) | | | | | | | |
| 14 | Service Action Code | | | | | | | |
| 15 | SKSV | C/D | Reserved | | BPV | Bit Pointer | | |
| 16<br>17 | MSB<br>Field Pointer<br>LSB | | | | | | | |

*Table 19. Sense Keys*

| Sense Key | Definition |
|---|---|
| 00h | NO SENSE |
| 02h | NOT READY |
| 04h | HARDWARE ERROR |
| 05h | ILLEGAL REQUEST |
| 06h | UNIT ATTENTION |
| 09h | VENDOR-SPECIFIC SENSE KEY |
| 0Bh | ABORTED COMMAND |

*Table 20. Additional Sense Values*

| ASC | ASCQ | Definition |
|---|---|---|
| 04 | 01 | Initializing |
| 04 | 03 | Manual intervention required |
| 04 | 8D | Unit off-line (vendor-specific) |
| 20 | 00 | Invalid command code |
| 21 | 01 | Invalid element address |
| 24 | 00 | Invalid CDB field |
| 25 | 15h | Logical unit not supported |
| 28 | 00 | Medium may have changed |
| 28 | 8D | Unit off-line to on-line (vendor-specific) |
| 29 | 00 | POR or BDR occurred |
| 39 | 00 | Saving parameters not supported |
| 3A | 00 | Medium not present |
| 3B | 0D | Destination element full |
| 3B | 0E | Source element empty |
| 3B | 90 | Drive not logically unloaded |
| 3D | 00 | Invalid bits in identify message |
| 3F | 88 | Cannot download due to flash problem |
| 48 | 00 | Initiator-detected error message received |
| 53 | 00 | Media load or eject failed |
| 5A | 00 | Illegal request |
| 83 | 03 | FULL info questionable; only used in READ ELEMENT STATUS return data |
| FF | xx | Other vendor-specific errors (xx=internal error code) |

## Drive Sense Data

*Table 21. LTO Tape Drive Sense Data*

| Byte | Bit Address or Name | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **7** | **6** | **5** | **4** | **3** | **2** | **1** | **0** |
| 0 | Address valid<br><br>When set to 1, the info byte field contains a valid logical block address. | Error Code | | | | | | |
| 1 | Segment Number (0) | | | | | | | |
| 2 | Filemark | EOM (end of medium) | ILI (Incorrect length indicator) | Reserved | Sense Key Description<br><br>0 --- No sense<br>1 --- Recovered error<br>2 --- Not ready<br>3 --- Media error<br>4 --- Hardware error<br>5 --- Illegal request<br>6 --- Unit attention<br>7 --- Data protect<br>8 --- Blank Check<br>9 --- Reserved<br>A --- Reserved<br>B --- Aborted command<br>C --- Reserved<br>D --- Volume overflow<br>E --- Reserved<br>F --- Reserved | | | |
| 3 | Information byte (most significant byte) | | | | | | | |
| 4 | Information byte | | | | | | | |
| 5 | Information byte | | | | | | | |
| 6 | Information byte (least significant byte) | | | | | | | |
| 7 | Additional Sense Length | | | | | | | |
| 8–11 | Command specific information | | | | | | | |

*Table 21. LTO Tape Drive Sense Data (continued)*

| Byte | Bit Address or Name | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| 12–13 | Additional Sense Code (ASC)<br>Additional Sense Code Qualifier (ASCQ)<br>**Byte 12 Byte 13**<br>**ASC ASCQ**<br>00 00 - No additional sense — The flags in the sense data indicate the reason for the command failure<br>00 01 - Filemark detected — A Read or Space command terminated early due to an FM The FM flag is set.<br>00 02 - EOM — A Write or Write File Marks command failed because the physical end of tape was encountered, or a Read or Space command encountered EOM The EOM flag is set<br>00 04 - BOM — A space command ended at Beginning of Tape The EOM bit is also set<br>00 05 - EOD — Read or Space command terminated early because End of Data was encountered<br>04 00 - Cause not reportable — A cartridge is present in the drive, but it is in the process of being unloaded<br>04 01 - Becoming Ready — A media access command was received during a front panel initiated load or an immediate reported load command<br>04 02 - Initializing Command Required — A cartridge is present in the drive, but is not logically loaded. A Load command is required<br>04 03 - Manual Intervention Required — A cartridge is present in the drive but could not be loaded or unloaded without manual intervention<br>0C 00 - Write Error — A Write operation has failed. This is probably due to bad media, but may be hardware related<br>11 00 - Unrecovered Read Error — A Read operation failed. This is probably due to bad media, but may be hardware related<br>14 00 - Recorded Entity Not Found — A space or Locate command failed because a format violation prevented the target from being found.<br>14 03 - End Of Data not found — A Read type operation failed because a format violation related to a missing EOD data set<br>1A 00 - Parameter list length error — The amount of parameter data sent is incorrect<br>20 00 - Invalid Command Operation Code — The Operation Code in the command was not a valid Operation Code<br>24 00 - Invalid field in CDB — An invalid field has been detected in a Command Descriptor Block<br>25 00 - LUN not supported — The command was addressed to a non-existent logical unit number<br>26 00 - Invalid Field in Parameter List — An invalid field has been detected in the data sent during the data phase<br>27 00 - Write Protect — A Write type operation has been requested on a cartridge which has been write protected<br>28 00 - Not Ready to Ready Transition — A cartridge has been loaded successfully into the drive and is now ready to be accessed<br>29 00 - Reset — The drive has powered on, received a reset signal or a bus device reset signal since the initiator last accessed it<br>2A 01 - Mode Parameters Changed — The Mode parameters for the drive have been changed by an initiator other than the one issuing the command<br>30 00 - Incompatible Media Installed — A write type operation could not be executed because it is not supported on the cartridge type that is loaded.<br>30 01 - Unknown Format — An operation could not be carried out because the cartridge in the drive is of a format not supported by the drive<br><br>(Continued on next page) | | | | | | | |

*Table 21. LTO Tape Drive Sense Data (continued)*

| Byte | Bit Address or Name | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **7** | **6** | **5** | **4** | **3** | **2** | **1** | **0** |
| 12–13 | Additional Sense Code (ASC) —<br>Additional Sense Code Qualifier (ASCQ) (Continued)<br>**Byte 12 Byte 13**<br>**ASC ASCQ**<br>30 02 - Incompatible Format — An operation could not be completed because the Logical Format is not correct<br>30 03 - Cleaning Cartridge Installed — An operation could not be carried out because the cartridge in the drive is a cleaning cartridge<br>30 07 - Cleaning Failure — A cleaning operation was attempted, but could not be completed for some reason<br>31 00 - Media format corrupted — Data could not be read because the format on tape is not valid, but is a known format. A failure occurred attempting to write the FID<br>37 00 - Rounded parameter — A Mode Select command parameter has been rounded because the drive can not store it with the accuracy of the command.<br>3A 00 - Media Not Present — A media access command has been received when there is no cartridge loaded<br>3B 00 - Sequential Positioning Error — A command has failed and left the logical position at an unexpected location<br>3D 00 - Invalid bits in identify Message — An illegal Identify Message has been received at the drive at the start of a command<br>3E 00 - Logical Unit has not Self-Configured — The drive has just powered on and has not completed its self test sequence and can not process commands<br>3F 01 - Code Download — The firmware in the drive has just been changed by a Write Buffer command<br>40 xx - Diagnostic failure — A diagnostic test has failed. The xx (ASCQ) is a vendor specific code indicating the failing component.<br>43 00 - Message Error — A message could not be sent or received due to excessive transmission errors<br>44 00 - Internal target failure — A hardware failure has been detected in the drive that has caused the command to fail<br>45 00 - Select/Reset Failure — An attempt to reselect an initiator in order to complete the command has failed<br>4B 00 - Data Phase Error — A command could not be completed because too many parity errors occurred during the Data phase<br>4E 00 - Overlapped Commands — An initiator selected the drive even though it already had a command outstanding in the drive<br>50 00 - Write Append Error — A write type command failed because the point at which to append data was unreadable<br>51 00 - Erase failure — An Erase command failed to erase the required area on the media<br>52 00 - Cartridge fault — A command could not be completed due to a fault in the tape cartridge<br>53 00 - Media Load/Eject Failed — (Sense Key 03) An attempt to load or eject the cartridge failed due to a problem with the cartridge.<br>53 00 - Media Load/Eject Failed — (Sense Key 04) An attempt to load or eject the cartridge failed due to a problem with the drive<br>53 02 - Media Removal Prevented — An Unload command has failed to eject the cartridge because media removal has been prevented<br>5D 00 - Failure Prediction Threshold — Failure Prediction thresholds have been exceeded indicating that a failure may occur soon<br>5D FF - Failure Prediction False — A Mode Select command has been used to test for Failure Prediction system.<br>82 82 - Drive requires cleaning — The drive has detected that a cleaning operation is required to maintain good operation<br>82 83 - Bad Code Detected — The data transferred to the drive during a firmware upgrade is corrupt or incompatible with drive hardware | | | | | | | |

*Table 21. LTO Tape Drive Sense Data (continued)*

| Byte | Bit Address or Name | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **7** | **6** | **5** | **4** | **3** | **2** | **1** | **0** |
| 14 | FRU code | | | | | | | |
| 15 | SKSV | C/D | Reserved | | BPV<br><br>When set to 1, the bit pointer is valid. | Bit pointer | | |
| 16 –17 | SKSV = 0: First Error Fault Symptom Code (FSC).<br>SKSV = 1: Field Pointer | | | | | | | |
| 18–19 | First Error Flag Data | | | | | | | |
| 20 | Reserved (0) | | | | | | | |
| 21 | | | | | CLN | Reserved | Reserved | VolValid |
| 22–28 | Volume Label | | | | | | | |
| 29 | Current Wrap | | | | | | | |
| 30–33 | Relative LPOS | | | | | | | |
| 34 | SCSI Address | | | | | | | |
| 35 | Reserved | | | | Reserved | | | |

The descriptions below serve only as an overview of sense reporting in the tape drive. This tape drive conforms to all sense field reporting as specified in the SCSI standards.

**Notes:**

1. The Error Code field (Byte 0) is set to 70h to indicate a current error, that is one associated with the most recently received command. It is set to 71h to indicate a deferred error which is not associated with the current command.
2. The segment number (Byte 1) is zero since the Copy, Compare, and Copy and Verify commands are not supported.
3. The File Mark flag (Byte 2, bit 7) is set if a Space, Read, or Verify command did not complete because a file mark was read.
4. The End of Media (EOM) flag (Byte 2, bit 6) is set if a Write or Write File Marks command completed in the early warning area. Spacing into BOM also causes this flag to be set. It is also set on an attempt to read or space past EOD, or if an attempt is made to space into Beginning of Media.
5. The Illegal Length Indicator (ILI) flag (Byte 2, bit 5) is set if a Read or Verify ended because a block was read from tape that did not have the block length requested in the command.
6. The Information Bytes (Bytes 3–5) are only valid if the Valid flag is set. This occurs only for current errors and not for deferred errors.
7. The Field Replaceable Unit field (Byte 14) is set to either zero or to a non-zero, vendor-specific code indicating which part of the drive is suspected of causing the failure.
8. The Clean (CLN) flag (Byte 21, bit 3) is set if the drive needs cleaning and clear otherwise.
9. The Volume Label Fields Valid (VolValid) bit (Byte 21, bit 0) is set if the Volume Label being reported is valid.

10. The Volume Label field (Bytes 22–28) reports the volume label if a cartridge is loaded in the drive and Volume Label Fields Valid is set.
11. The Current Wrap field (Byte 29) reports the physical wrap of the tape. The least significant bit reflects the current physical direction. A 0 means that the current direction is away from the physical beginning of the tape. A 1 means that the current direction is towards the physical beginning of the tape.
12. Relative LPOS fields (Bytes 30–33) reports the current physical position on the tape.
13. SCSI Address field (Byte 34) reports the SCSI Bus Address for the drive. Values returned range from 00h to 0Fh.

## Using Host Sense Data

Table 22 lists the hosts to which the tape drive attaches. It gives the operating system for each host and describes how the host records errors from the tape drive.

To determine the meaning of host sense data, refer to the *IBM Ultrium Device Drivers Installation and User's Guide*.

`http://www.ibm.com/storage/storagesmart/lto/`

*Table 22. Host Method of Recording Tape Drive Errors*

| Host | Operating System | Method of Recording Tape Drive Errors |
|---|---|---|
| IBM AS/400 or iSeries | OS/400 | Records tape drive errors and associated sense data in the AS/400 problem and error logs. View the logs by using the System Service Tools application and the userid QSRV. |
| IBM RS/6000, RS/6000/SP, or pSeries | AIX | Uses the IBM Atape device driver (provided with the tape drive) to record tape drive errors and sense data in the host error log. View the host error log by using one or more of the following utilities: tapeutil, diag, smit, or errpt. |
| HP | HP-UX | Uses the IBM device driver for HP. Error and trace logging are proprietary to Hewlett-Packard. |
| Sun Microsystems | Solaris | Uses the IBM device driver for Solaris to post sense information to the Solaris host-wide messages file */var/adm/messages*. |
| Intel-based PCs | Windows NT | Uses the NTUTIL device driver to log some sense data in the Event Viewer host log. |
| | Red Hat Linux | Uses the IBM device driver for Linux to post sense information to the Linux files */var/log/IBMtape.errorlog* and */var/log/IBMtape.trace*. |

# Appendix I. Vital Product Data

Please copy this form and fill out with your autoloader's vital product data and store in a secure location for future reference. Default settings are in bold type.

*Table 23. Vital Product Data form*

| | | | | |
|---|---|---|---|---|
| Machine Type | 3581 Tape Autoloader | | | |
| Model No. | L13 | H13 | L23 | H23 |
| Autoloader Serial No. | | | | |
| Drive Serial No. | | | | |
| Current Autoloader Firmware Level | | | | |
| Current Drive Firmware Level | | | | |
| Current Motion Firmware Level | | | | |
| Current Front Panel Firmware Level | | | | |
| Current Boot Firmware Level | | | | |
| Autoloader SCSI ID | 0 **1** 2 3 4 5 6 | | | |
| Drive SCSI ID | 0 1 2 **3** 4 5 6 8 9 10 11 12 13 14 15 16 | | | |
| SCSI Inquiry String | **ULT3581–TA** | | | |
| Operating Mode | **Random** | | Sequential | |

| | | | |
|---|---|---|---|
| Cleaning Mode | **Host Cleaning** | AutoClean | Manual Cleaning |
| Bar Code Reader Setting | bCOdE ON | bCOdE OFF | |
| Initialization | INIT ON | INIT OFF | |

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# Electronic Emission Notices

The following statement applies to this product. The statement for other products intended for use with this product will appear in their accompanying manuals.

## IBM 3581 Ultrium Tape Autoloader

### Federal Communications Commission (FCC) Class A Statement

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

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

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

### Industry Canada Class A Emission Compliance Statement

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

### Avis de conformité à la réglementation d'Industrie Canada

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

### European Union (EU) Electromagnetic Compatibility Directive

This product is in conformity with the protection requirements of EU Council Directive 89/336/EEC 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 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.

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

### Germany Electromagnetic Compatibility Directive

**Zulassungsbescheinigung laut dem Deutschen Gesetz über die elektromagnetische Verträglichkeit von Geräten (EMVG) vom 18. September 1998 (bzw. der EMC EG Richtlinie 89/336)**

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

Verantwortlich für die Konformitätserklärung nach Paragraph 5 des EMVG ist die: IBM Deutschland Informationssysteme GmbH 70548 Stuttgart.

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

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

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

Anmerkung: Um die Einhaltung des EMVG sicherzustellen, sind die Geräte wie in den IBM Handbüchern angegeben zu installieren und zu betreiben.

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# Glossary

This glossary defines the special terms, abbreviations, and acronyms that are used in this publication.

## Numbers

**2:1 compression.** The relationship between the quantity of data that can be stored with compression as compared to the quantity of data that can be stored without compression. In 2:1 compression, twice as much data can be stored with compression as can be stored without compression.

**3581 Ultrium Tape Autoloader.** A device that can be attached to a supported server and used to write data to and from magnetic tape. With its robotics, the 3581 Tape Autoloader can process up to 7 tape cartridges each with a capacity of 100 GB and at a data transfer rate of up to 15 MB per second. The drive within the device is the IBM Ultrium Tape Drive.

## A

**A.** Ampere.

**AC.** Alternating current.

**AC line voltage.** The input voltage (in volts) that is required by the 3581 Tape Autoloader for normal operation.

**activity bars.** Located on the right side of the message display on the 3581 Tape Autoloader, a graduated series of horizontal bars that appear and disappear at varying rates to signify robotic or drive activity. A slow interval between the bars appearing and disappearing indicates robotic activity; a fast interval indicates drive activity.

**ACTIVITY light.** One of three status light located on the operator panel of the 3581 Tape Autoloader. The amber ACTIVITY light indicates robotic or drive activity. A slowly blinking light represents robotic activity; a rapidly blinking light indicates drive activity.

**adapter card.** A circuit board that adds function to a computer.

**ALARM light.** One of three status light located on the operator panel of the 3581 Tape Autoloader. The red ALARM light comes on whenever an error occurs.

**alphanumeric.** Pertaining to a character set that contains letters, numerals, and usually other characters, such as punctuation marks.

**alternating current (ac).** An electric current that reverses its direction at regularly recurring intervals.

**ambient temperature.** The temperature of air or other media in a designated area, particularly the area surrounding equipment.

**amp.** Ampere.

**ampere (A, amp).** A unit of measure for electric current that is equivalent to a flow of one coulomb per second, or to the current produced by one volt applied across a resistance of one ohm.

**American Standard Code for Information Interchange (ASCII).** The predominant character-set code of present-day computers. The modern version uses 7 bits for each character (8 bits, if including parity check). The code is used for information interchange among data processing systems, data communications systems, and associated equipment.

**archive.** To collect and store files in a designated place.

**ASCII.** American Standard Code for Information Interchange.

**AUTOCLEAN function.** A choice on the 3581 Tape Autoloader's menu that lets you specify the autoloader to automatically clean the head of the tape drive with a cleaning cartridge.

## B

**bar code.** A code representing characters by sets of parallel bars of varying thickness and separation which are read optically by transverse scanning.

**bar code label.** A specially coded label that can be affixed to a tape cartridge and which enables a device to identify the cartridge and its volume serial number.

**bar code reader.** In the 3581 Tape Autoloader, a laser device specialized for scanning and reading bar codes and converting them into either the ASCII or EBCDIC digital character code.

**bit.** Either of the digits 0 or 1 when used in the binary numbering system.

**browser.** A client program that initiates requests to a web server and displays the information that the server returns.

**burst data transfer rate.** In data communications, the average number of bits, characters, or blocks per unit time passing between corresponding equipment in a data transmission system.

**bus.** See *SCSI bus*.

**byte.** A string consisting of a certain number of bits (usually 8) that are treated as a unit and represent a character. A fundamental data unit.

# C

**calibrate.** To adjust, tune.

**capacity.** The amount of data that can be contained on storage media and expressed in bytes of data.

**cartridge.** See *tape cartridge*.

**cartridge door.** On a tape cartridge, a hinged barrier that can be opened to access, or closed to protect, the magnetic tape within the cartridge.

**cartridge memory.** See *LTO cartridge memory*.

**cartridge manual rewind tool.** A device that can be fitted into the reel of a cartridge and used to rewind tape into or out of the cartridge.

**cartridge storage slot.** One of seven containers that are mounted inside the 3581 Tape Autoloader and are used to house tape cartridges.

**CD.** Compact disc.

**compact disc (CD).** A disc, usually 4.75 inches in diameter, from which data is read optically by means of a laser.

**centimeter (cm).** One one-hundredth of a meter (0.01 m). Approximately 0.39 inch.

**circuit board.** A thin plate on which chips and other electronic components are placed. Computers consist of one or more boards, often called cards or adapters.

**circuit breaker.** A switch that automatically interrupts an electric circuit under an infrequent abnormal condition.

**cleaning cartridge.** A tape cartridge that is used to clean the heads of a tape drive. Contrast with *data cartridge*.

**cm.** Centimeter.

**compression.** The process of eliminating gaps, empty fields, redundancies, and unnecessary data to shorten the length of records or blocks.

**configure.** To describe to a system the devices, optional features, and programs installed on the system.

**control buttons.** Located on the control panel of the 3581 Tape Autoloader, four push buttons that, when pressed, let you interact with the menus on the message display. The control buttons are MODE, NEXT, SELECT, and PREVIOUS.

**CRU.** See *customer replaceable unit*.

**CT.** On the left side of the 3581 Tape Autoloader's message display, one of three indicators that, when displayed, indicates that drive head needs to be cleaned.

**current.** The quantity of charge per unit time, measured in amperes (Amps, A).

**customer replaceable unit (CRU).** A part that a customer (rather than a service representative) replaces.

# D

**data.** Any representations such as characters or analog quantities to which meaning is, or might be, assigned.

**data cartridge.** A tape cartridge dedicated to storing data. Contrast with *cleaning cartridge*.

**data compression.** See *compression*.

**data transfer rate.** See *native sustained data transfer rate*.

**DC.** On the left side of the 3581 Tape Autoloader's message display, one of three indicators that, when displayed, indicates that data compression is selected on the drive.

**default setting.** The value that is assumed when none is explicitly specified.

**degauss.** To make a magnetic tape nonmagnetic by means of electrical coils carrying currents that neutralize the magnetism of the tape.

**degausser.** A device that makes magnetic tape nonmagnetic.

**device.** Any hardware component or peripheral, such as a tape drive or tape library, that can receive and send data.

**device driver.** A file that contains the code needed to use an attached device.

**diagnostic.** A software program that is designed to recognize, locate, and explain faults in equipment or errors in programs.

**Diagnostic Menu.** A collection of diagnostic and maintenance functions that the 3581 Tape Autoloader can perform. Each function has a menu name that you can choose from the message display to activate the function. The functions let you display the current level of firmware for the autoloader's microprocessors and

drive; verify the SCSI INQUIRY identity of the autoloader; choose random access or sequential access mode of operation; test the functionality of the autoloader's microprocessors; manually specify cleaning of the drive's head; automatically specify cleaning of the drive's head; update the autoloader's firmware over the SCSI bus; display the number of times certain events have occurred; update the drive's firmware by using an FMR tape; enable or disable the bar code reader; perform a read/write test; display the drive's error code log; erase the drive's error code log; force a dump of drive data; copy a dump of drive data, and perform a Power-On Self Test on the drive.

**differential.** See *High Voltage Differential (HVD/DIFF)*.

**disable.** To make nonfunctional.

**download.** To transfer programs or data from a computer to a connected device, typically a personal computer.

**drive.** See *IBM Ultrium Tape Drive*.

**drive dump.** The recording, at a particular instant, of the contents of all or part of one storage device into another storage device.

**drive head.** The component that records an electrical signal onto magnetic tape, or reads a signal from tape into an electrical signal.

# E

**eject.** To remove or force out from within.

**electronic mail.** Correspondence in the form of messages transmitted between user terminals over a computer network.

**e-mail.** See *electronic mail*.

**enable.** To make functional.

**erase.** To remove recorded matter from a magnetic tape.

# F

**field microcode replacement (FMR) tape.** A tape cartridge that contains new or revised firmware (microcode) for the *IBM Ultrium Tape Drive*.

**file.** A named set of records stored or processed as a unit.

**file transfer protocol (FTP).** In the Internet suite of protocols, an application layer protocol that uses TCP and Telnet services to transfer bulk-data files between machines or servers.

**firmware.** Proprietary code that is usually delivered as microcode as part of an operating system. Firmware is more efficient than software loaded from an alterable medium and more adaptable to change than pure hardware circuitry. An example of firmware is the Basic Input/Output System (BIOS) in read-only memory (ROM) on a PC motherboard.

**FMR tape.** See *field microcode replacement tape*.

**FTP site.** Any electronic repository of information that uses the File Transfer Protocol (FTP) for transferring files to and from servers. Use of an FTP site requires a user ID and possibly a password.

**FMR tape.** Firmware upgrade tape.

# G

**GB.** Gigabyte.

**gigabyte (GB).** 1 000 000 000 bytes.

**grounded.** Having or making an electrical connection with the earth.

# H

**head.** See *drive head*.

**hertz (Hz).** A unit of frequency equal to one cycle per second.

**High Voltage Differential (HVD/DIFF).** A logic signaling system that enables data communication between a supported server and another device, such as the 3581 Tape Autoloader. HVD/DIFF signaling uses a paired plus and minus signal level to reduce the effects of noise on the SCSI bus. Any noise injected into the signal is present in both a plus and minus state, and is thereby canceled. Synonymous with *differential*.

**host .** The controlling or highest-level system in a data communication configuration. Synonymous with *server*.

**HVD/DIFF.** High voltage differential.

**Hz.** Hertz.

# I

**IBM Ultrium Tape Drive.** Located within the 3581 Tape Autoloader, a data-storage device that controls the movement of the magnetic tape in an IBM LTO Ultrium Tape Cartridge. The drive houses the mechanism (drive head) that reads and writes data to the tape. The drive is the first of four drives planned for the Ultrium format. Its native data capacity is 100 GB per cartridge; with 2:1 compression, its capacity is up to 200 GB.

**ID.** Identifier.

**initialize.** To format a magnetic tape, write a label (VOLSER) on the tape, and leave the tape empty except for the system files containing the structure information. All former contents of the tape are lost.

**insert.** Pertaining to the 3581 Tape Autoloader, to place a tape cartridge into the cartridge storage slot in the autoloader.

**install.** To set up for use or service. The act of adding a product, feature, or function to a system or device either by a singular change or by the addition of multiple components or devices.

**Internet.** The worldwide collection of interconnected networks that use the Internet suite of protocols and permit public access.

**interposer.** An adapter-like device that allows a connector of one size and style to connect to a mating connector of a different type and style.

# K

**kg.** Kilogram.

**kilogram (kg).** One thousand grams (approximately 2.2 pounds).

# L

**label.** See *bar code label*.

**label area.** On the LTO Ultrium Tape Cartridge, a recessed area next to the write-protect switch where a label must be affixed.

**LCD.** See *liquid crystal display*.

**leader pin.** With the LTO Ultrium Tape Cartridge, a small metal column attached to the end of the magnetic tape. During tape processing the leader pin is grasped by a threading mechanism, which pulls the pin and the tape out of the cartridge, across the drive head, and onto a takeup reel. The head can then read or write data from or to the tape.

**LED.** Light-emitting diode.

**light-emitting diode (LED).** A semiconductor chip that gives off visible or infrared light when activated. Used to illuminate the message display on the 3581 Tape Autoloader.

**Linear Tape-Open (LTO).** A type of tape storage technology developed by the IBM Corporation, Hewlett-Packard, and Seagate. LTO technology is an "open format" technology, which means that its users will have multiple sources of product and media. The "open" nature of LTO technology enables compatibility between different vendors' offerings by ensuring that vendors comply with verification standards. The LTO technology is implemented in two formats: the Accelis format focuses on fast access; the Ultrium format focuses on high capacity. The Ultrium format is the preferred format when capacity (rather than fast access) is the key storage consideration. An Ultrium cartridge has a compressed data capacity of up to 200 GB (2:1 compression) and a native data capacity of up to 100 GB. The Ultrium format is designed with a 4-generation road map that provides for up to 1.6 TB per cartridge (2:1 compression) in Generation 4, with compressed transfer rate of up to 320 MB per second.

**line frequency.** The frequency (in hertz) of the ac line voltage that the 3581 Tape Autoloader requires for normal operation.

**liquid crystal display (LCD).** A low-power display technology used in computers and other I/O devices.

**load.** Pertaining to the 3581 Tape Autoloader and following the insertion of a tape cartridge into a cartridge storage slot, the act (performed by the picker) of transferring the cartridge from the storage slot to the drive and of positioning the tape (performed by the tape drive) for reading or writing by the drive head.

**load and unload cycle.** The act of inserting a cartridge into a tape drive, loading the tape to load point, rewinding the tape into the cartridge, and ejecting the cartridge from the drive.

**Low Voltage Differential/Single Ended (LVD/SE).** A low-noise, low-power, and low-amplitude electrical signaling system that enables data communication between a supported server and another device, such as the 3581 Tape Autoloader. LVD/SE signaling uses two wires to drive one signal over copper wire. The use of wire pairs reduces electrical noise and crosstalk. This method of data transmission requires a cable that is no longer than 25 meters (82 ft).

**LTO.** Linear Tape-Open.

**LTO-CM.** LTO cartridge memory.

**LTO cartridge memory (LTO-CM).** Within each IBM Ultrium Data Cartridge, an embedded electronics and interface module that can store and retrieve a cartridge's historical usage and other information.

**LVD/SE.** Low voltage differential/single ended.

# M

**m.** Meter.

**magnetic tape.** A tape with a magnetizable surface layer on which data can be stored by magnetic recording.

**MB.** Megabyte.

**media.** The plural of *medium*.

**media capacity.** See *capacity*.

**media-type identifier.** Pertaining to the bar code on the bar code label of the LTO Ultrium Tape Cartridge, a two-character code, L1, that represents information about the cartridge. L identifies the cartridge as one that can be read by devices which incorporate LTO technology; 1 indicates that it is the first generation of its type.

**medium.** A physical material in or on which data may be represented, such as magnetic tape.

**megabyte (MB).** 1 000 000 bytes.

**message display.** Located on the operator panel of the 3581 Tape Autoloader, an LCD display that provides information about the status of the autoloader and error conditions.

**metal particle tape.** In the LTO Ultrium Tape Cartridge, tape that uses very small, pure metal particles (rather than oxide coatings) in the magnetic layer.

**meter.** In the Metric System, the basic unit of length; equal to approximately 39.37 inches.

**MODE button.** Located on the operator panel of the 3581 Tape Autoloader, one of four control buttons that, when pressed, lets you scroll through the commands that you can use to operate the autoloader.

**Model H13.** One of two versions of the 3581 Tape Autoloader. The Model H13 uses the Ultra SCSI, High Voltage Differential (HVD/DIFF) SCSI interface. Contrast with *Model L13*.

**Model H23.** One of two versions of the 3581 Tape Autoloader. The Model 23 uses the Ultra SCSI, High Voltage Differential (HVD/DIFF) SCSI interface. Contrast with *Model L23*.

**Model L13.** One of two versions of the 3581 Tape Autoloader. The Model L13 uses the Ultra2, Low Voltage Differential/Single Ended (LVD/SE) interface. Contrast with *Model H13*.

**Model L23.** One of two versions of the 3581 Tape Autoloader. The Model L23 uses the Ultra160 SCSI, Low Voltage Differential/Single Ended (LVD/SE) interface. Contrast with *Model H23*.

# N

**native data capacity.** The amount of data that can be stored without compression on a tape cartridge.

**native storage capacity.** See *native data capacity*.

**native sustained data transfer rate.** Over a long period of time, the average number of bits, characters, or blocks per unit time passing between corresponding equipment in a data transmission system. The rate is expressed in bits, characters, or blocks per second, minute, or hour. The machine that transmits the data is assumed to have data compression turned off.

**NEXT button.** Located on the operator panel of the 3581 Tape Autoloader, one of four control buttons that, when pressed, highlights the next item or value in the currently displayed menu.

**noncondensing.** A controlled environment that does not permit moisture to condense on the 3581 Tape Autoloader or other devices.

# O

**oersted.** The unit of magnetic field strength in the unrationalized centimeter-gram-second (cgs) electromagnetic system. The oersted is the magnetic field strength in the interior of an elongated, uniformly wound solenoid that is excited with a linear current density in its winding of one abamper per $4\pi$ centimeters of axial length.

**operating environment.** The temperature, relative humidity rate, and wet bulb temperature of the room in which the 3581 Tape Autoloader routinely conducts processing.

**operating system.** The master computer control program that translates the user's commands and allows application programs to interact with the computer's hardware.

**operator panel.** Located behind the front door of the 3581 Tape Autoloader, the functional unit that contains buttons to control the autoloader and a display that provides information about the operation of the autoloader.

# P

**PDF.** Portable Document Format.

**pick.** Pertaining to the 3581 Tape Autoloader, to remove, by means of a robotic device, a tape cartridge from a storage slot or drive.

**picker.** A robotic mechanism located inside the 3581 Tape Autoloader that moves cartridges between the cartridge storage slots and the drive.

**Portable Document Format (PDF).** A standard specified by Adobe Systems, Incorporated, for the electronic distribution of documents. PDF files are compact, can be distributed globally (by e-mail, the web, intranets, or CD-ROM), and can be viewed with the Acrobat Reader, which is software from Adobe Systems that can be downloaded at no cost from the Adobe Systems home page.

**POST.** Power-On Self Test.

**PostScript.** A standard specified by Adobe Systems, Incorporated, that defines how text and graphics are presented on printers and display devices.

**pot-setting tool.** Normally used on a potentiometer to adjust resistance, a tool that is used during the manual removal of a tape cartridge from the 3581 Tape Autoloader. The potentiometer-setting tool slides over the shaft of the loader motor gear in the autoloader and holds the shaft for easy rotation.

**POWER button.** Located on the operator panel of the 3581 Tape Autoloader, a momentary push button switch that lets you turn the power to the autoloader on or off. When the 3581 Tape Autoloader is on, the POWER light is on.

**power cord.** A cable that connects a device to a source of electrical power.

**POWER light.** One of three status light located on the operator panel of the 3581 Tape Autoloader. The green POWER light comes on when power is applied to the autoloader.

**power-off, powered-off.** (1) To remove electrical power from a device. (2) The state of a device when power has been removed from it.

**power-on, powered-on.** (1) To apply electrical power to a device. (2) The state of a device when power has been applied to it.

**Power-On Self Test (POST).** A series of diagnostic tests that are run automatically by a device when the power to that device is turned on.

**power cord plug.** On a power cord, the male fitting for making an electrical connection to a circuit by insertion into a receptacle.

**power receptacle.** The mounted female electrical fitting that contains the live parts of the circuit.

**PREVIOUS button.** Located on the operator panel of the 3581 Tape Autoloader, one of four control buttons that, when pressed, highlights the preceding item or value in the currently displayed menu.

**put.** Pertaining to the 3581 Tape Autoloader, to place, by means of a robotic device, a tape cartridge into a storage slot or drive.

# R

**rack.** A unit that houses the components of a storage subsystem, such as the 3581 Tape Autoloader.

**rackmount kit.** A packaged collection of articles used to install the rack-mounted version of the 3581 Tape Autoloader. If purchased with the autoloader, the optional rackmount kit is shipped with the unit.

**rackmount tray.** A flat-bottomed container with a low rim that holds the 3581 Tape Autoloader when it is mounted in a rack.

**random access.** An access technique in which data is obtained from or placed in a storage device in a nonsequential manner. When the 3581 Tape Autoloader operates in random access mode, the server's application software manages the cartridges (and thus the data).

**read.** To acquire or interpret data from a storage device, from a data medium, or from another source.

**reinitialize.** To reformat a magnetic tape, write a label (VOLSER) on the tape, and leave the tape empty except for the system files containing the structure information. All former contents of the tape are lost.

**relative humidity.** The ratio of the amount of water vapor actually present in the air to the greatest amount possible at the same temperature.

**remove.** Pertaining to the 3581 Tape Autoloader, to take a tape cartridge from a cartridge storage slot.

**retention screws.** Pertaining to the connector on a cable, two screws on either side of the connector that secure it to its mating connector.

**robotics.** The picker and any associated mechanisms that move a tape cartridge within the 3581 Tape Autoloader.

**robotics interface.** See *picker*.

# S

**scratch cartridge.** A data cartridge that contains no useful data, but can be written to with new data. Synonymous with *blank cartridge*.

**SCSI.** Small computer systems interface.

**SCSI-2.** Small computer systems interface-2.

**SCSI bus.** (1) A collection of wires through which data is transmitted from one part of a computer to another. (2) In networking, a central cable that connects all devices on a local-area network (LAN). (3) A generic term that refers to the complete set of signals that define the activity of the Small Computer Systems Interface (SCSI). Synonymous with *SCSI bus cable* and *SCSI cable*.

**SCSI bus cable.** See *SCSI bus*.

**SCSI cable.** See *SCSI bus*.

**SCSI command.** An operation performed by a target (tape drive) for an initiator (server). The command is initiated by the operator from the host console.

**SCSI connector.** One of the set of all female and male connectors on the SCSI bus.

**SCSI device.** Anything that can connect into the SCSI bus and actively participate in bus activity.

**SCSI host adapter card.** The logic card that connects a host (server) to the SCSI bus cable. Synonymous with *SCSI controller*.

**SCSI ID.** The hexadecimal representation of the unique address (0-F) which a user assigns to the 3581 Tape Autoloader and which is used in SCSI protocols to identify or select the drive. The user normally assigns and sets the SCSI ID when installing the drive.

**SCSI wrap tool.** A device that attaches to the SCSI connector on the 3581 Tape Autoloader and enables internal tests on the SCSI interface.

**seat, seated.** (1) To fit to. (2) To ensure that one object is fitted to another object.

**SELECT button.** Located on the operator panel of the 3581 Tape Autoloader, one of four control buttons that, when pressed, activates the currently displayed operation.

**sensor field.** Located on the operator panel of the 3581 Tape Autoloader, one of seven numeric fields at the bottom of the display that represent each storage slot and indicate whether a cartridge is present in that slot. A numeric sensor field displays only when a cartridge is present.

**sequential access.** An access technique for retrieving or storing data during which the data is read from, written to, or removed from a file based on the logical order (sequence) of the data in the file. When the 3581 Tape Autoloader operates in sequential access mode, its firmware (not the server's application software) manages the cartridges (and thus the data).

**server.** A functional unit that provides services to one or more clients over a network. Examples include a file server , a print server, and a mail server. The RS/6000, AS/400, HP, and Sun are servers. Synonymous with *host*.

**ship group.** The group of supplies, cords, or documentation that is shipped with the 3581 Tape Autoloader.

**shipping environment.** The temperature, relative humidity rate, and wet bulb temperature of the environment to which the 3581 Tape Autoloader is exposed when being transferred from one location to another.

**sled.** Pertaining to a 3581 Tape Autoloader that has been mounted in a rack, the container that houses the autoloader in the rackmount tray. The sled allows the autoloader to easily slide into or from the tray. The tray can hold two sleds.

**Small Computer Systems Interface (SCSI).** A standard used by computer manufacturers for attaching peripheral devices (such as tape drives, hard disks, CD-ROM players, printers, and scanners) to computers (servers). Pronounced "scuzzy." Variations of the SCSI interface provide for faster data transmission rates than standard serial and parallel ports (up to 80 megabytes per second). The variations include:

- Fast/Wide SCSI: Uses a 16-bit bus, and supports data rates of up to 20 MBps.
- SCSI-1: Uses an 8-bit bus, and supports data rates of 4 MBps.
- SCSI-2: Same as SCSI-1, but uses a 50-pin connector instead of a 25-pin connector, and supports multiple devices.
- Ultra SCSI: Uses an 8- or 16-bit bus, and supports data rates of 20 or 40 MBps.
- Ultra2 SCSI: Uses an 8- or 16-bit bus and supports data rates of 40 or 80 MBps.
- Ultra3 SCSI: Uses a 16-bit bus and supports data rates of 80 or 160 MBps.

**Small Computer Systems Interface-2 (SCSI-2).** See *Small Computer Systems Interface (SCSI)*.

**status lights.** Located on the front of the 3581 Tape Autoloader, three light-emitting diodes (LEDs) that indicate whether the power to the autoloader is on or off (POWER light), whether robotic or drive activity is occurring (ACTIVITY light), or whether an error has occurred (ALARM light).

**storage environment.** The temperature, relative humidity rate, and wet bulb temperature of the environment in which the 3581 Tape Autoloader is nonoperational and being kept for future use.

**storage slot.** See *cartridge storage slot*.

# T

**TapeAlert.** A patented technology from Hewlett-Packard that monitors the status of a tape device and media, and detects problems as they occur.

**TapeAlert flags.** Status and error messages that are generated by the TapeAlert utility and display on the host console.

**tape cartridge.** A removable storage device that consists of a housing containing a belt-driven magnetic tape wound on a supply reel and a takeup reel.

**tape drive.** See *IBM Ultrium Tape Drive*.

**TB.** Terabyte.

**terabyte.** 1 000 000 000 000 bytes.

**terminate, termination.** To prevent unwanted electrical signal reflections by applying a device (a terminator) that absorbs the energy from the transmission line.

**terminator.** (1) A part used to end a SCSI bus. (2) A single-port, 75-Ω device that is used to absorb energy from a transmission line. Terminators prevent energy from reflecting back into a cable plant by absorbing the radio frequency signals. A terminator is usually shielded, which prevents unwanted signals from entering or valid signals from leaving the cable system.

**toggle.** To alternate between two states.

**track.** A linear or angled pattern of data written on a tape surface.

**transfer rate.** See *data transfer rate*.

# U

**U.** Pertaining to the rack that houses a 3581 Tape Autoloader, the amount of space between two holes in a mounting rail. One U is equal to 4.45 cm (1.75 in.).

**Ultra SCSI.** See *Small Computer Systems Interface (SCSI)*.

**Ultra-2 SCSI.** See *Small Computer Systems Interface (SCSI)*.

**Ultrium Tape Drive.** See *IBM Ultrium Tape Drive*.

**unattended backup.** The act of copying files without operator assistance.

**uniform resource locator (URL).** The address of an item on the World Wide Web. It includes the protocol followed by the fully qualified domain name (sometimes called the host name) and the request. The web server typically maps the request portion of the URL to a path and file name. For example, if the URL is http://www.networking.ibm.com/nsg/nsgmain.htm, the protocol is http; the fully qualified domain name is www.networking.ibm.com; and the request is /nsg/nsgmain.htm.

**unload.** Pertaining to the 3581 Tape Autoloader, a term used to describe the act of the drive unthreading the tape from the internal tape path and returning the leader block to the tape cartridge.

**URL.** Uniform resource locator.

# V

**Vac.** Volts of alternating current.

**Vdc.** Volts of direct current.

**VOLSER.** Volume serial number.

**volume serial number (VOLSER).** A number that a computer assigns to a tape cartridge when it prepares (initializes) the cartridge for use.

**void.** In character recognition, the inadvertent absence of ink within a character outline.

**volt.** The SI (international) unit of potential difference and electromotive force, formally defined to be the difference of electric potential between two points of a conductor carrying a constant current of one ampere, when the power dissipated between these points is equal to one watt.

**voltage.** The electric potential or potential difference expressed in volts.

# W

**W.** Watts.

**watt.** A metric unit of measure of power; the power required to keep a current of one ampere flowing under a potential drop of one volt; about 1/736 of one horsepower.

**web.** See *World Wide Web*.

**wet bulb temperature.** The temperature at which pure water must be evaporated adiabatically at constant pressure into a given sample of air in order to saturate the air under steady-state conditions. Read from a wet-bulb thermometer.

**World Wide Web.** A network of servers that contain programs and files. Many of the files contain hypertext links to other documents available through the network.

**WP.** On the left side of the 3581 Tape Autoloader's message display, one of three indicators that, when displayed, indicates that a write-protected cartridge is loaded in the drive. The drive cannot write data to the cartridge.

**write.** To make a permanent or transient recording of data in a storage device or on a data medium.

**write protected.** A tape cartridge is write protected if some logical or physical mechanism causes the device that is processing the tape to prevent the program from writing on the tape.

**write-protect switch.** Located on the LTO Ultrium Tape Cartridge, a switch that prevents accidental erasure of data. Pictures of a locked and unlocked padlock appear on the switch. When you slide the switch to the locked padlock, data cannot be written to the tape. When you slide the switch to the unlocked padlock, data can be written to the tape.

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**Models L13, H13, L23, and H23**
**Setup, Operator, and Service Guide**

**Publication No. GA32-0461-00**

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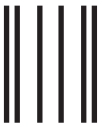

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