3581 Ultrium Tape Autoloader

Setup, Operator, and Service Guide

IBM

IBM

Setup, Operator, and Service Guide

> **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 129.
>
> To ensure that you have the latest publications, visit the web at `http://www.ibm.com/storage/lto`.

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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).
	A hazardous condition due to mechanical movement in or around the product.

If the symbol is...	It means....
 > 18 kg **(40 lb)**	A hazardous condition due to the weight of the unit. Weight symbols are accompanied by an approximation of the product's weight.

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)*

Class II

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.

> 18 kg
(40 lb)

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. It 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 5 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 35 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 51 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 65 gives procedures for removing or replacing the 3581 Tape Autoloader or the bar code reader.

Appendix A, "Performing Diagnostic and Maintenance Functions" on page 71 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 87 shows how to remove a tape cartridge that has become stuck in the tape drive.

Appendix C, "Installing the Bar Code Reader (optional)" on page 99 shows how to install the device that reads the bar code on the LTO Ultrium Tape Cartridges.

Appendix D, "Installing an Autoloader into a Rack" on page 103 gives instructions for installing the 3581 Tape Autoloader into a rack.

Appendix E, "SCSI Element Addresses" on page 117 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 119 lists TapeAlert messages that are supported by the 3581 Tape Autoloader and that may help you to determine problems.

Appendix G, "Power Cords" on page 123 provides power cable information for different countries or regions.

Appendix H, "Parts Lists" on page 127 lists the parts, part numbers, feature codes, and ordering information 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`.

- *IBM 3581 Ultrium Tape Autoloader Quick Reference*, GX35-5060, 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 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 is a high-performance, high-capacity data-storage device that connects to and provides additional storage for supported server (see Figure 1). 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. Designed to perform unattended backups as well as to retrieve and archive files, the 3581 Tape Autoloader features:

- Native storage capacity of 100 GB per cartridge (200 GB at 2:1 compression)[1]
- Native sustained data transfer rate of up to 15 MB per second (30 MB at 2:1 compression)[2]
- Formatted capacity of 700 GB (1.4 TB at 2:1 compression)[3]
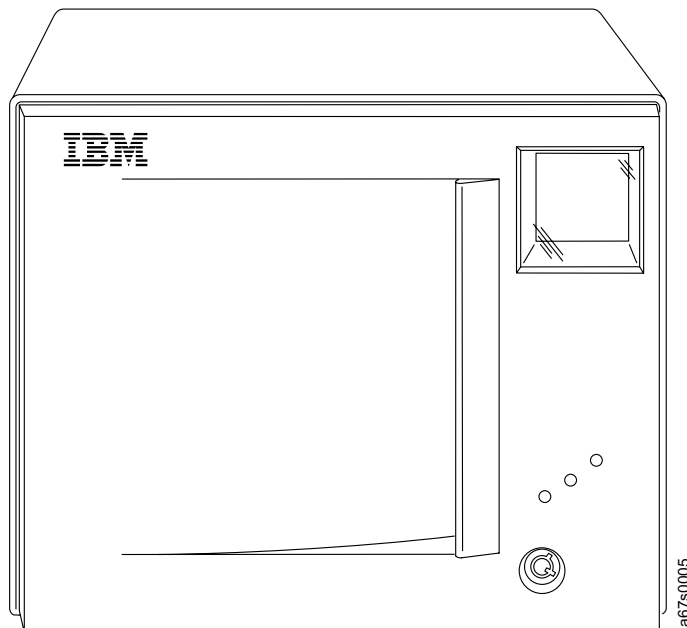
Figure 1. The IBM 3581 Tape Autoloader

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 L1x uses the Ultra2, Low Voltage Differential/Single Ended (LVD/SE) interface
- Model H1x uses the Ultra SCSI, High Voltage Differential (HVD/DIFF) interface

Note: The x in the model number equals an alphanumeric character.

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1. 1 GB = one gigabyte or 1 000 000 000 bytes

2. 1 MB = one megabyte or 1 000 000 bytes

3. 1 TB = one terabyte or 1 000 000 000 000 bytes

1

The burst data transfer rate is 80 MB per second for the Model L1x autoloader and 40 MB per second for the Model H1x 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`.

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, 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: The AS/400 and iSeries adapters are only HVD SCSI and support only one initiator per bus. In addition, the SCSI-bus-attached medium changer (an autoloader in random mode) and the tape drives must be attached on the same SCSI bus. For these and other tape drive performance reasons, a SCSI configuration must be a single drive and a single host when attached to the AS/400 or iSeries server.

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 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/
- WinNT/
- Win2000/

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 119.

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 48.

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 25 A at 120 Vac		
Noise Specifications			
Maximum noise level	60 db (idling) 62 db (operating)		
Environmental Specifications			
Environmental Factor	**Operating**	**Storage**	**Shipping**
Temperature	10 to 38°C (50 to 100°F) (See Note)	−40 to 60°C (−40 to 140°F)	−40 to 60°C (−40 to 140°F)
Relative humidity (noncondensing)	20 to 80%	10 to 90%	10 to 90%
Wet bulb	26°C (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 48). 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.			

Chapter 2. Installing the 3581 Tape Autoloader

Attention: The 3581 Tape Autoloader is a customer setup unit. It is your responsibility to install this product.

To ensure optimum performance, obtain the latest level of firmware from the web by visiting `http://www.storage.ibm.com/hardsoft/tape/lto/index.html`. 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, "Installing an Autoloader into a Rack" on page 103.

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 Service, 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 Appendix G, "Power Cords" on page 123)

__ 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*, GX35-5056, illustrates how to configure and operate the 3581 Tape Autoloader

__ 8. The *IBM 3581 Ultrium Tape Autoloader Setup, Operator, and Service Guide* (this guide)

__ 9. The *IBM Externally Attached Devices Safety Information* manual

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 computer 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 Appendix G, "Power Cords" on page 123.

__ 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, "Installing the Bar Code Reader (optional)" on page 99.

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 9), 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 9). 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 31.

   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
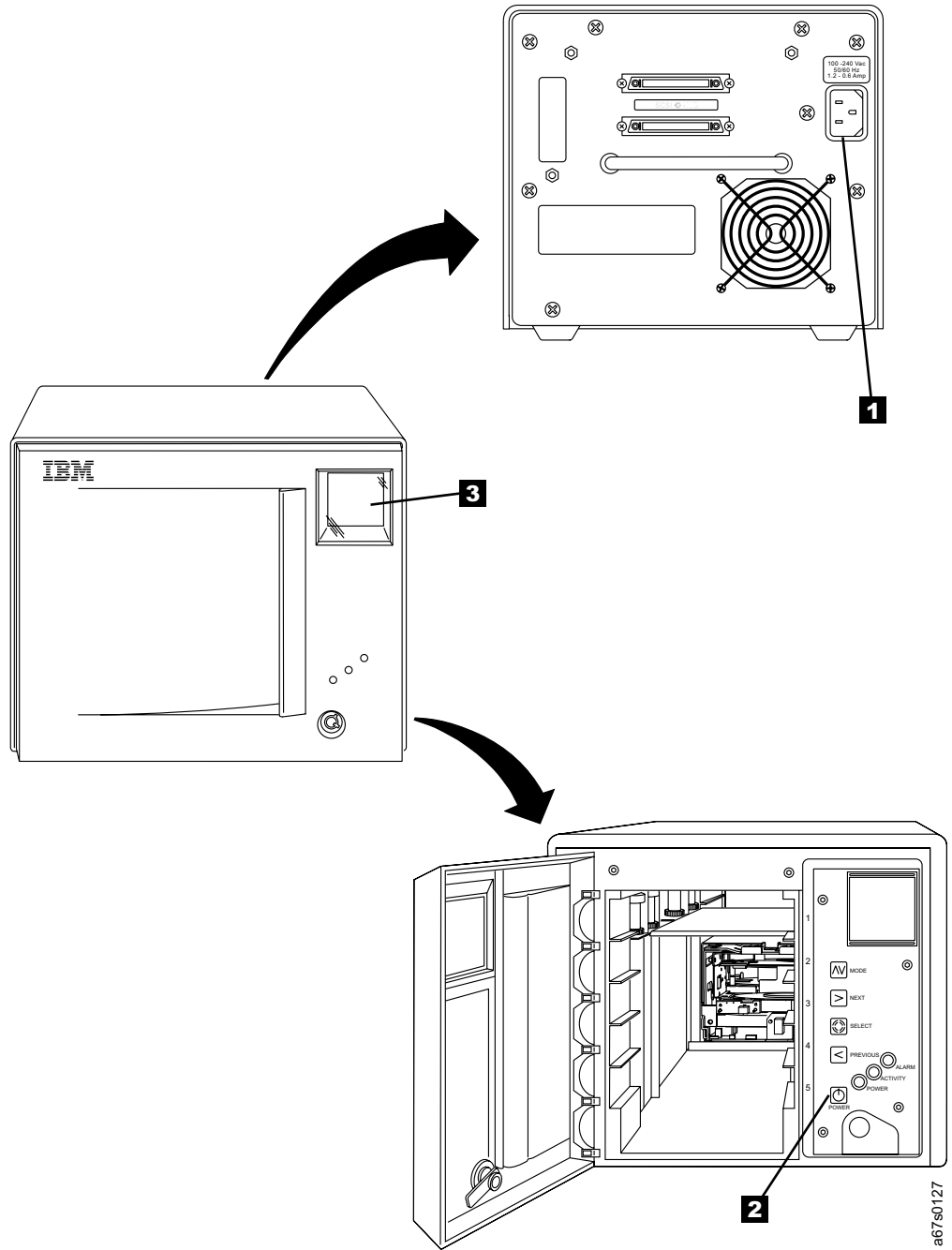
Figure 2. Connecting power to the 3581 Tape Autoloader

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 20).
- 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.

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 11) 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 11) 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	3	SELECT button
2	NEXT button	4	PREVIOUS button
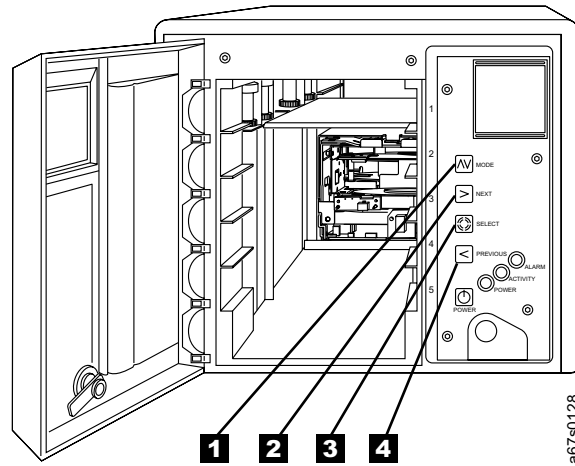
Figure 3. Using the control buttons to determine or change a SCSI ID

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. Power-off the 3581 Tape Autoloader. Note that you may need to reconfigure yourserver'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 51.

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)

Most applications use random mode, which is the default and is represented on the message display as `LdR REAdY`.

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`.

Although the LVD/SE hardware in the 3581 Tape Autoloader Model L1x 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 117.

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. Ultra HVD SCSI buses have a bandwidth of 40 MB per second; Ultra2 LVD SCSI buses have a bandwidth of 80 MB per second. The 3581 Tape Autoloader is capable of data transfer rates of up to 15 MB per second with no compression and 30 MB per second at 2:1 compression. For these reasons, you can attach only one or two Model H1x 3581 Tape Autoloaders to an Ultra SCSI bus and from one to three Model L1x 3581 Tape Autoloaders to an Ultra2 SCSI bus.

Note: The AS/400 and iSeries adapters are for the HVD SCSI interface and support only one initiator per bus. Also, all tape drives must be attached to the same SCSI bus. For these and other drive performance reasons, a SCSI configuration must consist of a single drive 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 12.

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

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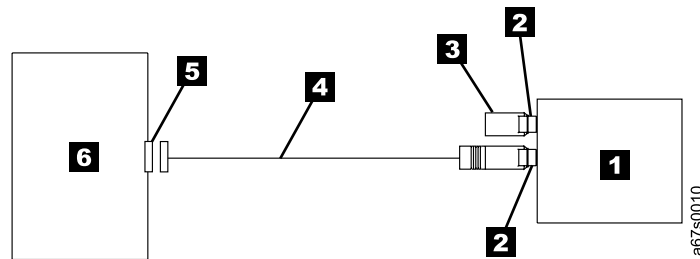
Figure 4. Example of connecting one SCSI device to the server. The view is from the top.

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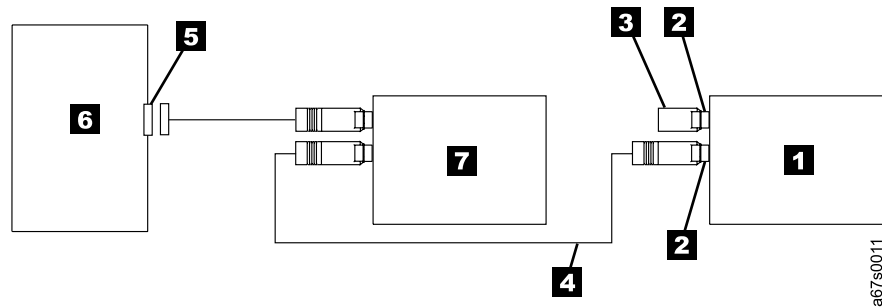
Figure 5. Example of connecting multiple SCSI devices to the server. The view is from the top.

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 are not logically connected to the SCSI bus and do not respond to SCSI commands. To change the autoloader's mode of operation, see "Operating in Random Access or Sequential Access Mode" on page 31.

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.
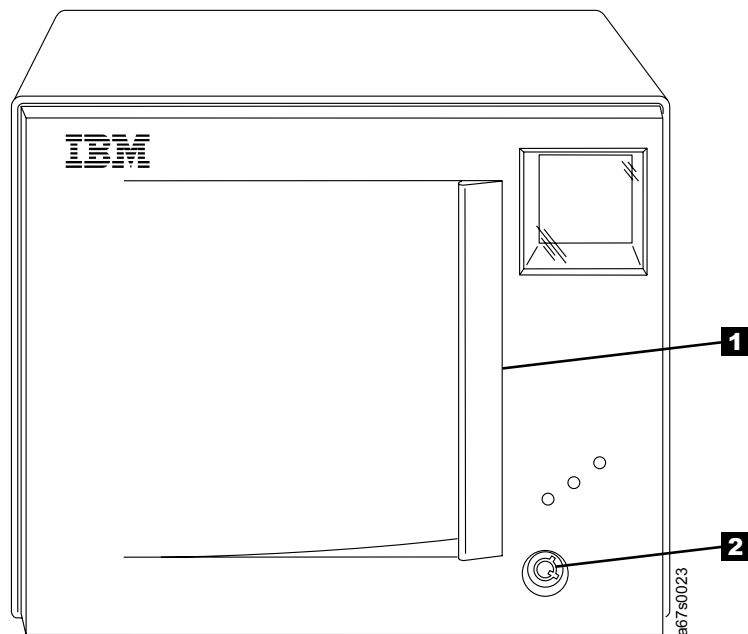
Figure 6. Front door of the 3581 Tape Autoloader

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 117 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` 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" on page 19).

Status Lights

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

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

ACTIVITY   The amber ACTIVITY light (**7** in Figure 7) 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) comes on whenever an error occurs. For a description of autoloader and drive error messages, see Table 6 on page 57. For a description of drive error codes, see Table 7 on page 61.

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
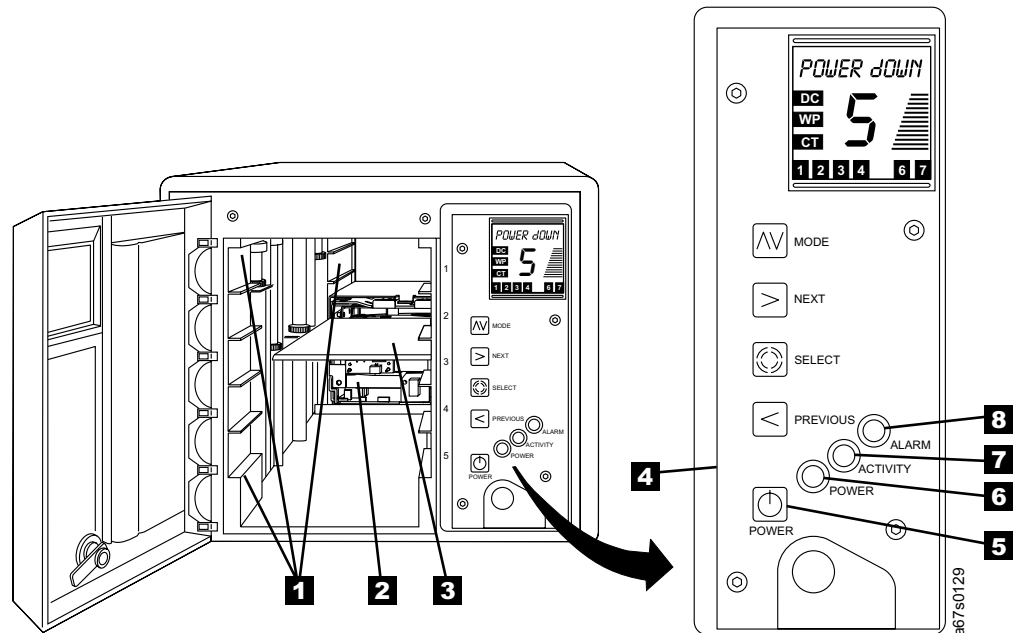
Figure 7. The 3581 Tape Autoloader with front door open

Message Display

The message display (in Figure 8 on page 21) 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**. 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	5	Error code field
2	DC (data compression) indicator	6	Activity bars
3	WP (write-protected) indicator	7	Cartridge-resident sensor fields
4	CT (cleaning) indicator		
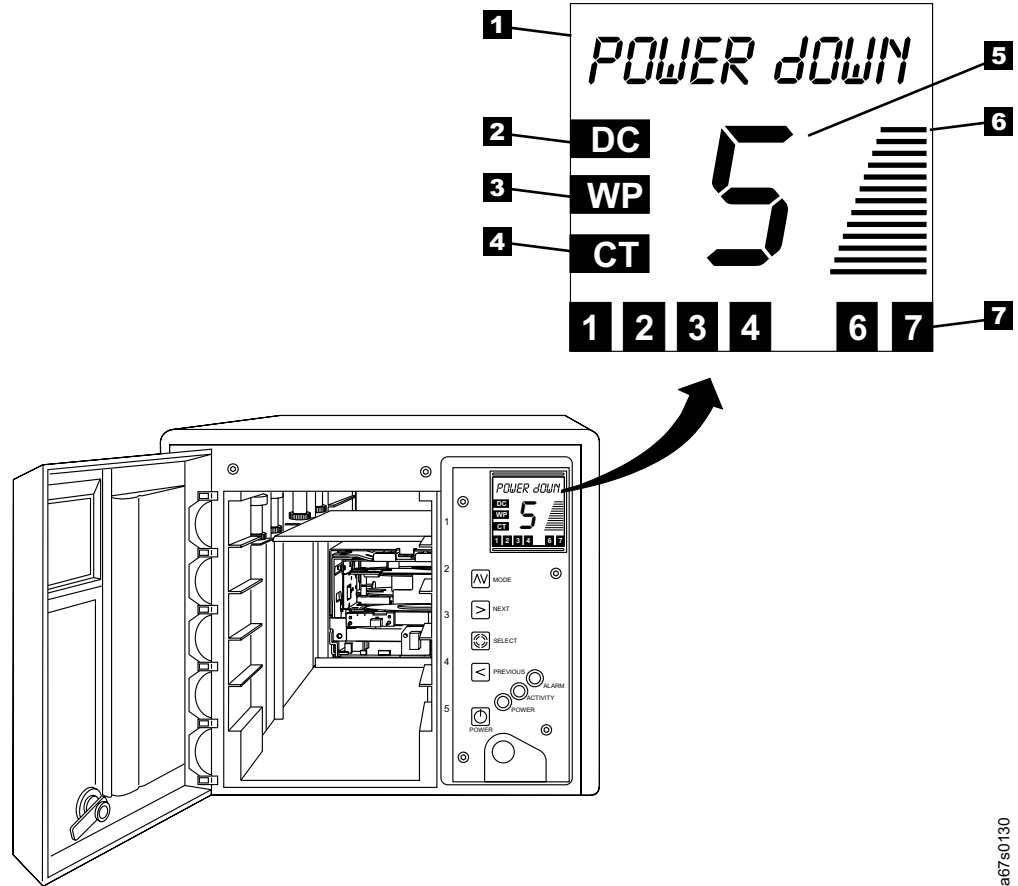
Figure 8. Message display on the 3581 Tape Autoloader

Drive Status Messages

During operation, the 3581 Tape Autoloader places messages about the drive's status in the message display. Table 2 lists the messages that can appear.

Table 2. 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**).
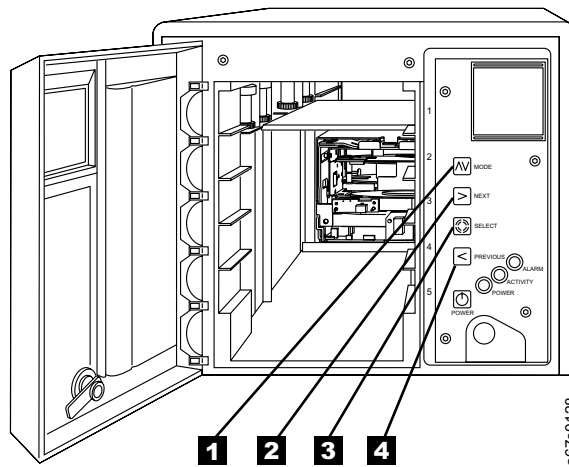
Figure 9. Control buttons on the 3581 Tape Autoloader

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 3 on page 24 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**.
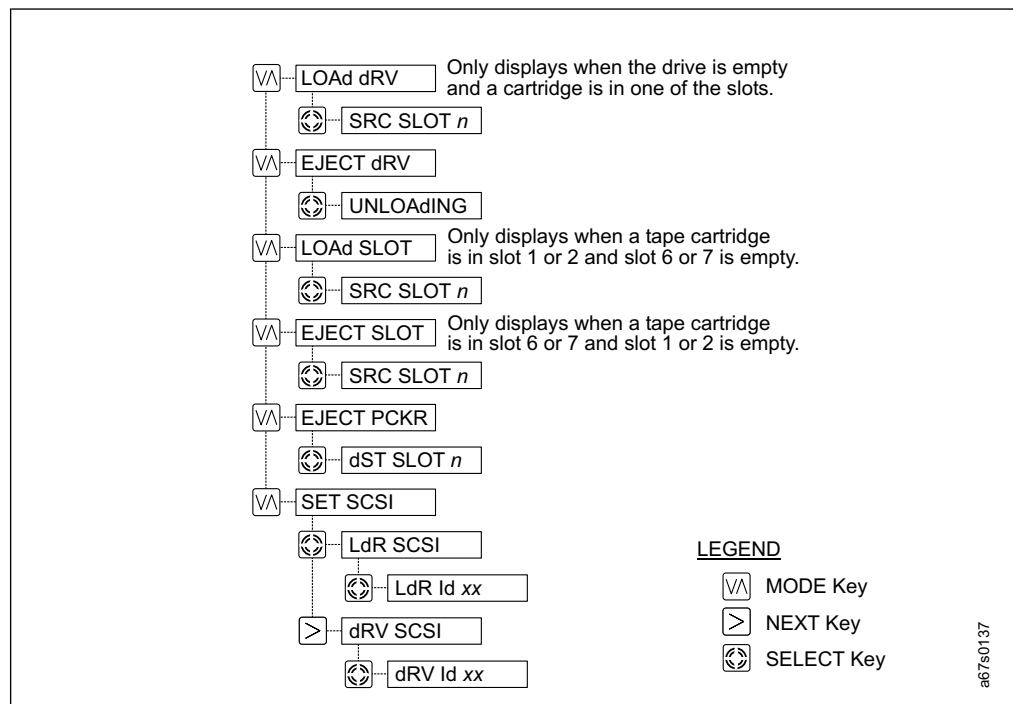
Figure 10. Commands that are accessed by the control buttons. Press the appropriate key for the function that you want to perform.

Table 3. 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.)

1. To access the LOAd dRV command, press MODE until `LOAd dRV` appears on the message display.

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.

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.)

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.

1. To access the EJECT dRV command, press MODE until `EJECT dRV` appears on the message display.

2. Press SELECT. `EJECTING` appears on the message display while the drive ejects the cartridge.

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.)

1. Insert one or more cartridges as follows:
   - If loading slot 6, insert a cartridge into slot 1
   - If loading slot 7, insert a cartridge into slot 2
   - If loading both slots 6 and 7, insert cartridges into slots 1 and 2

2. To access the LOAd SLOT command, press MODE until `LOAd SLOT` appears on the message display.

3. Press SELECT. `SRC SLOT N` (where `N` is either 6 or 7) appears on the message display.

4. Press SELECT to move the cartridge from slot 1 to slot 6, or from slot 2 to slot 7.

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.)

1. To access the EJECT SLOT command, press MODE until `EJECT SLOT` appears on the message display.

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.

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).

After completing the task, `LdR REAdY` or `SEQ REAdY` displays.

Table 3. 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.

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`).

1. To access the EJECT PCKR command, press MODE until `EJECT PCKR` appears on the message display.
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.
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.

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.

1. To access the SET SCSI command, press MODE until `SET SCSI` appears on the message display.
2. Press SELECT. `LdR SCSI` appears on the message display.
   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.
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.
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.
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.
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.
7. Press and hold the POWER button for approximately 2 seconds to power-off the 3581 Tape Autoloader.
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** or **SEQ REAdY** 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 on page 27) is properly set (see "Setting the Write-Protect Switch" on page 39).
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 in 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 27 and repeat steps 1 through 5.
14. Close and lock the front door.
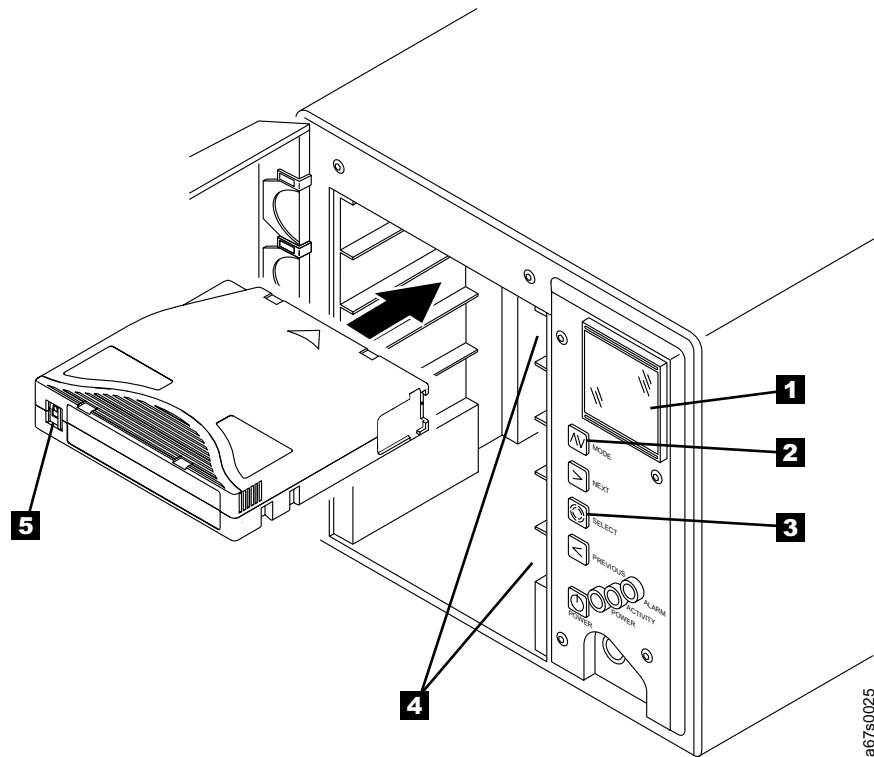
Figure 11. Inserting a cartridge into the 3581 Tape Autoloader

15. To operate the 3581 Tape Autoloader, see "Operating in Random Access or Sequential Access Mode" on page 31.

Inserting a Cartridge into Slots 1 - 5

1. Ensure that the 3581 Tape Autoloader is powered-on.

2. Ensure that **LdR 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 39).

5. Grasp the cartridge so that the write-protect switch faces you (see **5** in Figure 11).

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. Press the MODE button **2** until **LOAd SLOT** appears on the message display, then press the SELECT button **3**. **SRC SLOT X** displays (where **X** equals the number of the slot that the cartridge is in), then the picker moves the cartridge from the source slot to the drive.

9. Close and lock the front door.

10. To operate the 3581 Tape Autoloader, see "Operating in Random Access or Sequential Access Mode" on page 31.

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 87.

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** 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 following the AUTOCLEAN function, you must disable the AUTOCLEAN function. To disable the AUTOCLEAN function, see "Disabling the AUTOCLEAN Function" on page 77.

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 invention. 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 76.

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 75.

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, "Performing Diagnostic and Maintenance Functions" on page 71.

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 74.

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 dONE** 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 26 and "Inserting a Cartridge into Slots 1 - 5" on page 27.
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 are not logically connected to the SCSI bus and do 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 26 and "Inserting a Cartridge into Slots 1 - 5" on page 27).
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.storage.ibm.com/hardsoft/tape/lto/index.html`

To determine the level of firmware that is on the drive in your autoloader, go to "Displaying Firmware" on page 72.

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 firmware over the SCSI bus, obtain the new firmware image and the installation instructions by visiting the web at:

`http://www.storage.ibm.com/hardsoft/tape/lto/index.html`

Visit the same web site for information about obtaining an FMR tape. For installation instructions, see "Updating Drive Firmware" on page 80.

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.storage.ibm.com/hardsoft/tape/lto/index.html`. To determine the level of firmware that is on your autoloader, go to "Displaying Firmware" on page 72.

You can update the 3581 Tape Autoloader's firmware by obtaining the new firmware image and downloading it to the autoloader's controller firmware over the SCSI interface. To obtain the new firmware image and the installation instructions, visit the web at `http://www.storage.ibm.com/hardsoft/tape/lto/index.html`.

Visit the same web site for information about obtaining an FMR tape. For installation instructions, see "Updating Autoloader Firmware" on page 81.

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

The 3581 Tape Autoloader uses the following cartridge types:

- IBM LTO Ultrium Data Cartridge
- IBM LTO Ultrium Cleaning Cartridge

To ensure that your 3581 Tape Autoloader conforms to IBM's specifications for reliability, use only the preceding cartridges. You may use other LTO-certified data cartridges, but they may not meet the standards of reliability established by IBM. The IBM LTO Ultrium Data Cartridge cannot be interchanged with the media used in other IBM non-LTO Ultrium tape products.

In addition to using LTO Ultrium Tape Cartridges with up to 100 GB capacity, the 3581 Tape Autoloader reads and writes to certified LTO Ultrium Tape Cartridges that have capacities of 50 GB, 30 GB, and 10 GB.

Figure 12 shows the IBM LTO Ultrium Data Cartridge and its components.

1	Cartridge door	**4**	Label area
2	Leader pin	**5**	Insertion guide
3	Write-protect switch		
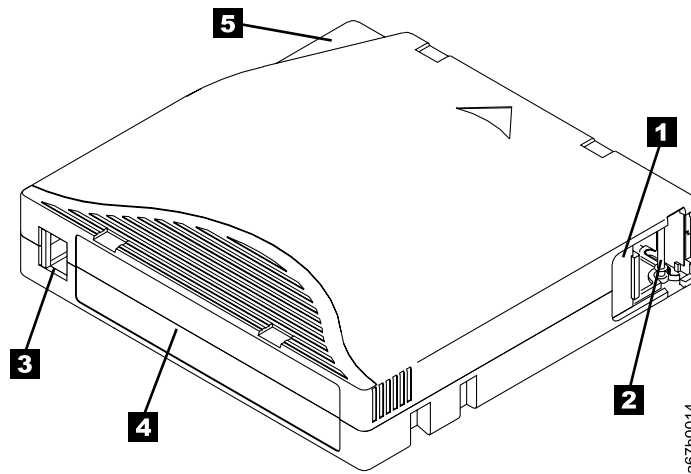
Figure 12. The IBM LTO Ultrium Data Cartridge

Attention: The IBM LTO Ultrium Tape Cartridge is a delicate component and requires care in handling. For more information, see "Handling the Cartridges" on page 40.

Data Cartridge

The IBM LTO Ultrium Data Cartridge contains 1/2-inch, metal-particle tape that has a native data capacity of 100 GB, and a compressed capacity of 200 GB (assuming 2:1 compression). When processing the tape, the Ultrium Tape Drive uses a linear, serpentine recording format, and reads and writes data on 384 tracks, 8 tracks at a time. The first set of 8 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 8 tracks for the return pass. This process continues until all tracks are written and the tape is full, or until all data is written.

The IBM LTO Ultrium Data Cartridge includes a Linear Tape-Open Cartridge Memory (LTO-CM) chip, 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 (**1** in Figure 12 on page 35) protects the tape from contamination when the cartridge is out of the drive. Behind the door, the tape is attached to a leader pin **2** . 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 **3** prevents data from being written to the tape cartridge. On the IBM LTO Ultrium Data Cartridge, the switch is red; on the IBM LTO Ultrium Cleaning Cartridge, the switch is gray. The label area **4** 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 insertion guide **5** 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` or contact your IBM Marketing Representative.

The IBM LTO Ultrium Data Cartridge has a nominal cartridge life of 5000 load and unload cycles.

Cleaning Cartridge

With each 3581 Tape Autoloader, a specially labeled IBM LTO Ultrium Cleaning Cartridge is supplied to clean the drive heads. The drive itself determines when a head needs to be cleaned. It alerts you by displaying `CT` on the message display and turning off the status light. To clean the head, insert the IBM LTO Ultrium Cleaning Cartridge into the tape load compartment (see Figure 11 on page 27). The tape drive performs the cleaning automatically. When the cleaning is finished, the drive ejects the cartridge.

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

To remove a cleaning cartridge, see "Removing a Tape Cartridge" on page 28. The IBM LTO Ultrium Cleaning Cartridge is valid for 50 uses. The cartridge's LTO-CM chip tracks the number of times that the cartridge is used.

Bar Code Label

Tape cartridges that are processed by the 3581 Tape Autoloader must bear a bar code label only if you install a bar code reader (see Appendix C, "Installing the Bar Code Reader (optional)" on page 99). The bar code label contains:

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

When read by the autoloader's bar code reader, the bar code identifies the cartridge's VOLSER to the tape autoloader. The bar code also tells the autoloader whether the cartridge is a data, cleaning, or diagnostic cartridge. In addition, the bar code includes the two-character media-type identifier, L1. `L` identifies the cartridge as an LTO cartridge; `1` indicates that the cartridge is the first generation of its type. Figure 13 shows a sample bar code label for the LTO Ultrium Tape Cartridge.
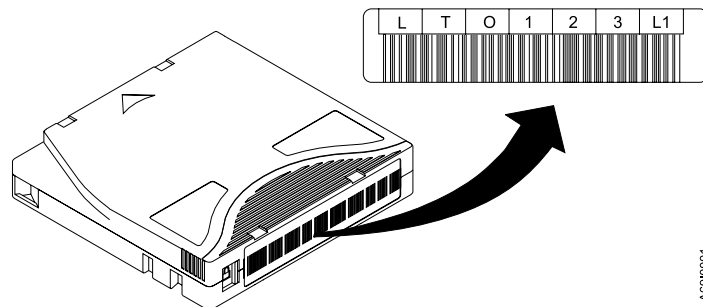
Figure 13. Sample bar code label on the LTO Ultrium Tape Cartridge. The volume serial number (LTO123) and bar code are printed on the label.

You can order tape cartridges with the bar code 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` 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 **4** in Figure 12 on page 35). A label that extends outside of the recessed area can cause loading problems in the drive or the autoloader.

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.

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 **4** in Figure 12 on page 35).
- 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 reader 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 🔒 (solid red), data cannot be written to the tape.
- If the switch is set to unlocked (black void), data can be written to the tape.

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.
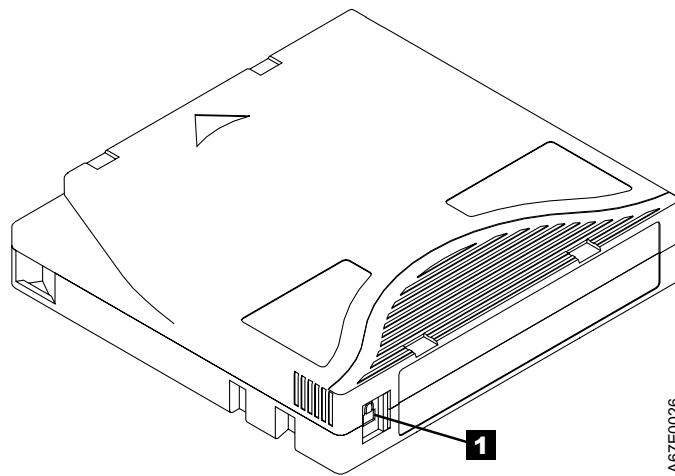
Figure 14. Setting the write-protect switch

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 the drive and may void the warranties of the drive and the cartridge. Before inserting a tape cartridge, inspect the cartridge case, cartridge door, and write-protect switch for breaks. If you need to recover data from a damaged cartridge, contact your IBM Service Representative.

Incorrect handling or an incorrect environment can damage the LTO Ultrium Tape Cartridge or its magnetic tape. To avoid damage to your tape cartridges and to ensure the continued high reliability of your 3581 Tape Autoloader, use the following guidelines:

- 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 Figure 15 on page 41). Inspect the rear of the cartridge (the part that you load first into the tape load compartment) and ensure that there are no gaps in the seam of the cartridge case (see ▉4 in Figure 16 on page 42). If the leader pin has become dislodged or if there are gaps in the seam of the cartridge case, go to "Repositioning or Reattaching a Leader Pin" on page 41.
- 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.
- 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.
- Before you use a cartridge, let it acclimate for at least 24 hours to the normal operating environment.
- Ensure that all surfaces of a cartridge are dry before inserting it.
- Do not stack more than six cartridges.
- Do not expose the tape cartridge to moisture or direct sunlight.
- Do not degauss a tape cartridge that you intend to reuse. Degaussing makes the tape unusable.
- Do not expose recorded or blank tape 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 48.

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 3 meters (10 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 autoloader. Figure 15 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)
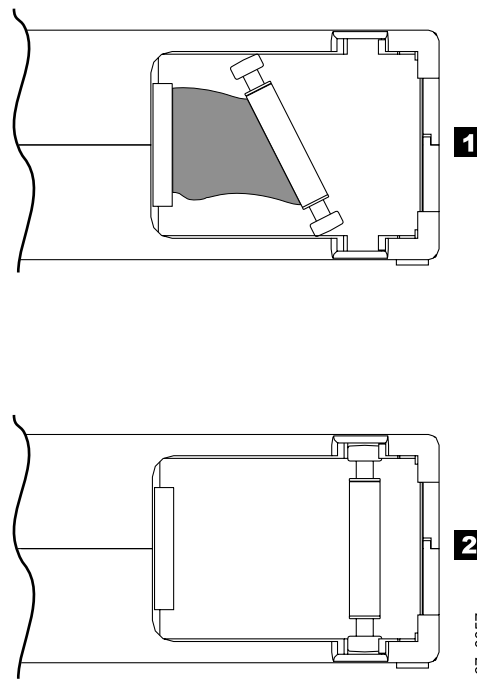
Figure 15. Leader pin in the incorrect and correct positions. The cartridge door is open and the leader pin is visible inside the cartridge.

To reposition the leader pin, perform the following steps.

1. Slide open the cartridge door (**1** in Figure 16) 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.
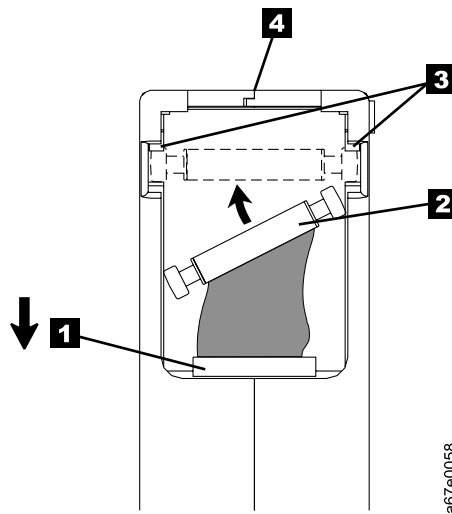
Figure 16. Placing the dislodged leader pin into the correct position. The cartridge door is open to show the leader pin.

5. To rewind the tape, insert the cartridge manual rewind tool (**1** in Figure 17) into the cartridge's hub **2** and turn it clockwise until the tape becomes taut.
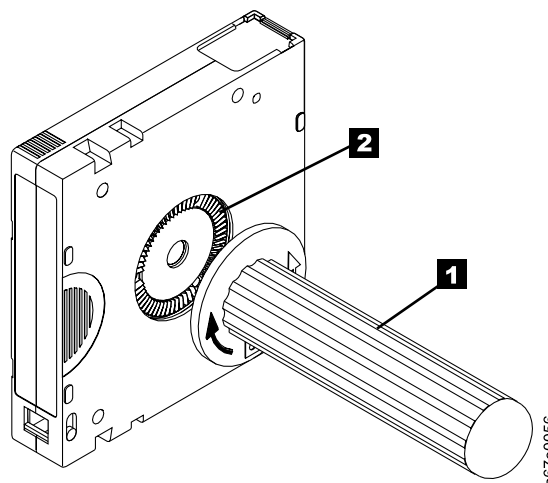
Figure 17. Rewinding the tape into the cartridge

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

Reattaching a Leader Pin

If the leader pin detaches from the tape in your cartridge, you must use the IBM Leader Pin Reattachment Kit (part number 08L9129) to reattach it.

Note: Do not reattach the pin if you must remove more than 3 meters (10 feet) of leader tape; instead, contact your Service Representative.

The Leader Pin Reattachment Kit contains three parts:
- **Leader pin attach tool** - A plastic brace that holds the cartridge door open.
- **Cartridge manual rewind tool** - A device that fits into the cartridge's hub and lets you wind the tape into and out of the cartridge.
- **Pin supplies** - 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.

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 18) 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** .
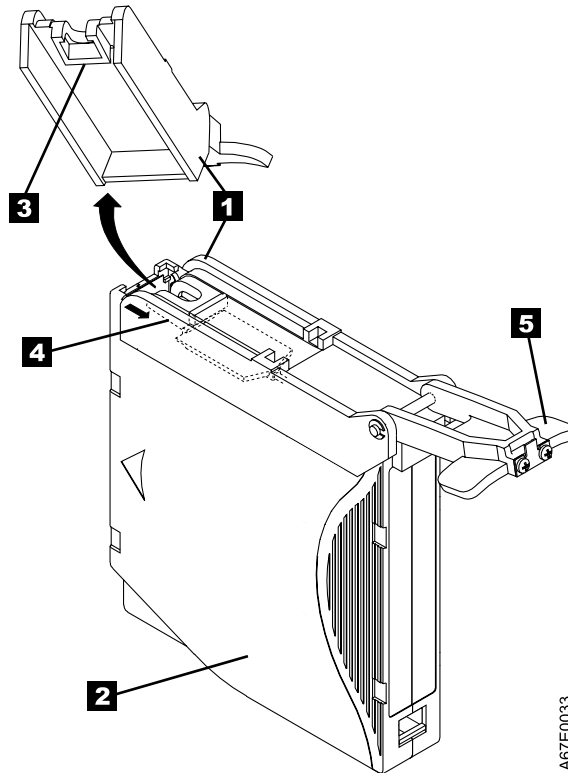
Figure 18. Attaching the leader pin attach tool to the cartridge. To hold the cartridge door open, hook the tool into the door and pull the tool back.

2. To find the end of the tape inside the cartridge, attach the cartridge manual rewind tool (**1** in Figure 19) to the cartridge's hub **2** by fitting the tool's teeth between the teeth of the hub. Turn the tool clockwise until you can 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. Continue to turn the rewind tool counterclockwise until approximately 12.7 cm (5 in.) of tape hangs from the cartridge door. If necessary, grasp the tape and pull gently to unwind it from the cartridge.

4. Remove the rewind tool by pulling it away from the cartridge. Set the tool and the cartridge aside.
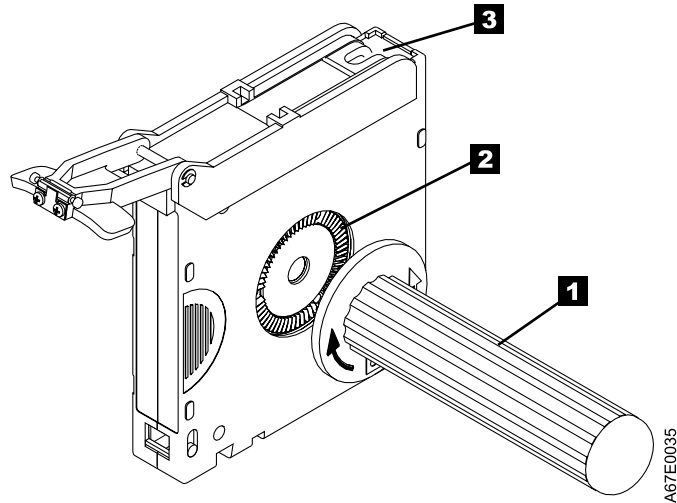
Figure 19. Winding the tape out of the cartridge. Turn the cartridge manual rewind tool clockwise to see the end of the tape, then turn it counterclockwise to bring the tape to the door.

5. On the leader pin (**1** in Figure 20), locate the open side of the C-clip **2** . The C-clip is a small black part that will secure 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.
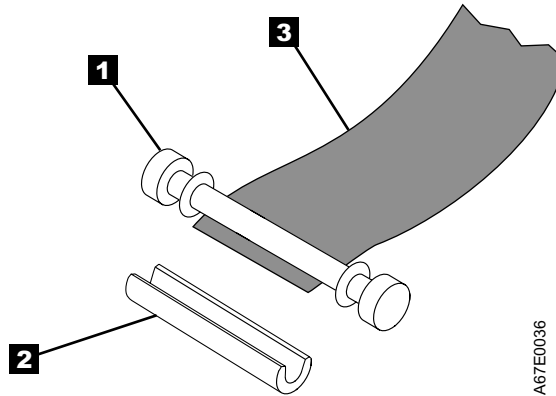
Figure 20. Removing the C-clip from the leader pin. Use your fingers to push the C-clip from the leader pin.

7. Position the tape in the alignment groove of the leader pin attach tool (see **1** in Figure 21 on page 47).

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

9. Place the leader pin (from step 6) into the cavity **3** of the leader pin attach tool.

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

10. Fold the tape over the leader pin and hold it with your fingers.

> **Note:** Use care to ensure that the tape is centered over the leader pin. Failure to properly center the tape on the leader pin will cause the repaired cartridge to fail. When the tape is properly centered, a 1.9 mm (0.075 in.) gap exists on both sides of the pin.
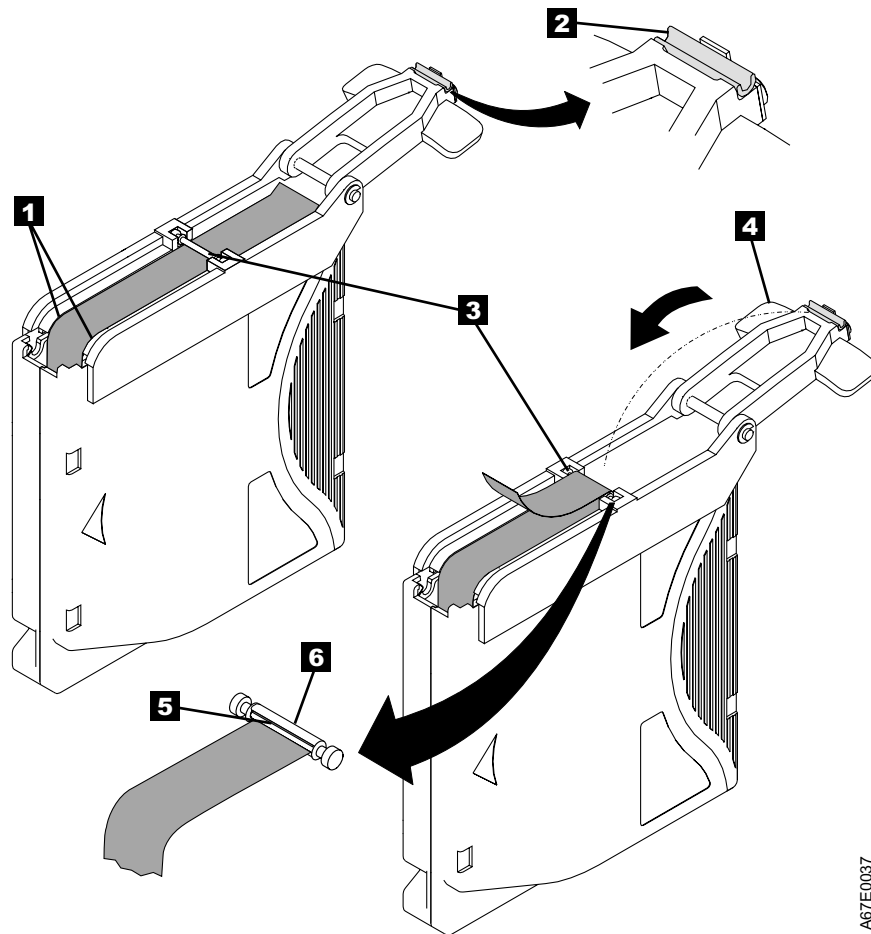
Figure 21. Attaching the leader pin to the tape

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.

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

Environmental and Shipping Specifications for Tape Cartridges

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

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

When you ship a cartridge, place it in 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 4 gives the environment for operating, storing, and shipping LTO Ultrium Tape Cartridges.

Table 4. Environment for operating, storing, and shipping the 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.				

Disposing of Tape Cartridges

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

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

If a tape cartridge must be disposed of in a secure manner, you can erase the data on the cartridge by using a high-energy ac degausser (use a minimum of 1200 oersted peak field over the entire space that the cartridge occupies). Degaussing makes the cartridge unusable.

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

Ordering Media Supplies

Table 5 lists the data cartridges and media supplies that you can order for the 3581 Tape Autoloader.

Table 5. Ordering media supplies for the 3581 Tape Autoloader

Supply Item	Method of Ordering
Standard LTO Ultrium Data Cartridge Includes human-writable 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`). If you do not have Internet access, order the cartridge from any authorized IBM Business Partner or your IBM Marketing Representative by specifying Machine Type 3589 Model 003.
Labeled IBM LTO Ultrium Data Cartridge Includes bar code labels that are pre-applied by the manufacturer.	Order through an IBM-authorized distributor (for the closest distributor, visit the web at `http://www.ibm.com/storage/media`). If you do not have Internet access, order the cartridge from any authorized IBM Business Partner or your IBM Marketing Representative by specifying Machine Type 3589 Model 002.
Standard IBM LTO Ultrium Cleaning Cartridge Includes human-writable labels.	Order as part number 08L9124 through an IBM-authorized distributor (for the closest distributor, visit the web at `http://www.ibm.com/storage/media`). If you do not have Internet access, order the cartridge from any authorized IBM Business Partner or your IBM Marketing Representative by specifying Machine Type 3589 Model 004.
Leader Pin Reattachment Kit	Order through an IBM-authorized distributor (for the closest distributor, visit the web at `http://www.ibm.com/storage/media`). If you do not have Internet access, order as IBM part number 08L9129 from your IBM Business Partner or IBM Marketing Representative.

Ordering Bar Code Labels

A sheet of IBM-approved data cartridge bar code labels is included with every bar code reader (Feature Code 7004). These can be used to label any data cartridges ordered in the initial purchase. Cleaning cartridges ordered during the initial purchase will come with bar code labels already applied.

If you need additional labels for your data or cleaning cartridges, or if you need specific label ranges, contact the following authorized label supplier:

In America and Asia	**In Europe**
Colorflex	EDP Europe, Ltd.
697 South Pierce Street	43 Redhills Road
Louisville, CO 80027	South Woodham Ferrers
U. S. A.	Chelmsford, Essex CM3 5UL
Telephone: 1-888-438-8362	U. K.
Fax: 303-266-2166	Telephone: +44-1245-322380
http://www.colorflex.com/tri-optic	Fax: +44-1245-323484
	http://www.colorflex.com/tri-optic

Chapter 5. Troubleshooting

If you encounter problems when running the 3581 Tape Autoloader, refer to the flowchart in Figure 22. If the problem is not identified in the flowchart, visit the web at `http://www.ibm.com/storage/lto`. Additional service information is also available in Chapter 6, "Removal and Replacement Procedures" on page 65.

Start

Does the autoloader power on? — No →
1. Try another electrical outlet.
2. Try another power cord.
3. Contact your IBM Service Representative for problem determination or machine replacement.

Yes ↓

Does air flow from the fan and any message appear in the display? — No →
1. Remove any objects that block airflow from the rear of the autoloader.
2. Contact your IBM Service Representative for problem determination or machine replacement.

Yes ↓

Does an error message or error code 1, 2, 3, 4, 5, 8, 9, A, E, F, o, c, d, or h appear in the message display? or Does E display and is the ALARM light on? — Yes →
1. Resolve the error message or error code (refer to Procedure 1 in this chapter).
2. Contact your IBM Service Representative for problem determination or machine replacement.

No ↓

Does the autoloader correctly communicate with the server? — No →
1. Check the SCSI ID for the correct address (refer to Procedure 2 in this chapter).
2. Check that the pins in the SCSI cable and terminator connectors are not damaged, and that the connectors are properly seated (refer to Procedure 3 in this chapter).
3. Contact your IBM Service Representative for problem determination or machine replacement.

Yes ↓

Does the autoloader communicate with the application? — No →
Go to the application's documentation and review the problem determination section.

Yes ↓

Is the bar code reader able to read the bar code labels? — No →
Go to the section about bar code reader problems (refer to Procedure 4 in this chapter).

Yes ↓

Does 6, 7, or CT appear in the message display? — Yes →
1. If CT appears, clean the drive with a cleaning cartridge.
2. Retry the failing operation with a new tape cartridge.
3. Check whether the latest level of firmware is installed on the drive (refer to Procedure 1 in this chapter).
4. Contact your IBM Service Representative for problem determination or machine replacement.

No ↓

Contact your IBM Service Representative for problem determination or machine replacement.

a67s0123

Figure 22. Flowchart for analyzing maintenance problems

Procedure 1

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 6 on page 57; drive error codes are listed in Table 7 on page 61.

Before you attempt to resolve the error message or code, review the following:
- Refer to "Control Buttons" on page 22 to review the operator panel functions that can aid error recovery.
- Refer to Appendix A, "Performing Diagnostic and Maintenance Functions" on page 71 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 87.

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 slots 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 3 on page 24).
4. If a cartridge is positioned incorrectly, see "Removing a Tape Cartridge" on page 28 and "Inserting a Tape Cartridge" on page 26.
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, "Performing Diagnostic and Maintenance Functions" on page 71.
7. If you cannot resolve the problem, contact your IBM Service Representative for problem determination or machine replacement.

Resolving 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 7 on page 61 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 your IBM Service Representative for problem determination or machine replacement.

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

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

1. Copy the existing drive dump to tape (see "Copying a Drive Dump to Tape" on page 84), 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.storage.ibm.com/hardsoft/tape/lto/index.html`.
3. Determine the current level of drive firmware on your 3581 Tape Autoloader (see "Displaying Firmware" on page 72):

   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 4, 5, or 6 displays, run a read/write test on the drive (see "Testing the Read/Write Function" on page 82):
      - 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 your IBM Service Representative for problem determination or machine replacement.

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 82). This test will isolate the problem to the drive or the media.
4. If the problem persists, contact your IBM Service Representative for problem determination or machine replacement.

Error Code 8: SCSI Problem
Refer to "Procedure 2" on page 54 or "Procedure 3" on page 54.

Procedure 2

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 10). If the setting is incorrect, follow the procedure in "Changing the ID" on page 10.

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 your IBM Service Representative for problem determination or machine replacement.

Procedure 3

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 31). The typical mode is random access mode.

    Note: While in sequential access mode, the autoloader's robotics are not logically connected to the SCSI bus and do 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 85).

   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 your IBM Service Representative for problem determination or machine replacement.

Procedure 4

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 23). Retry the operation.
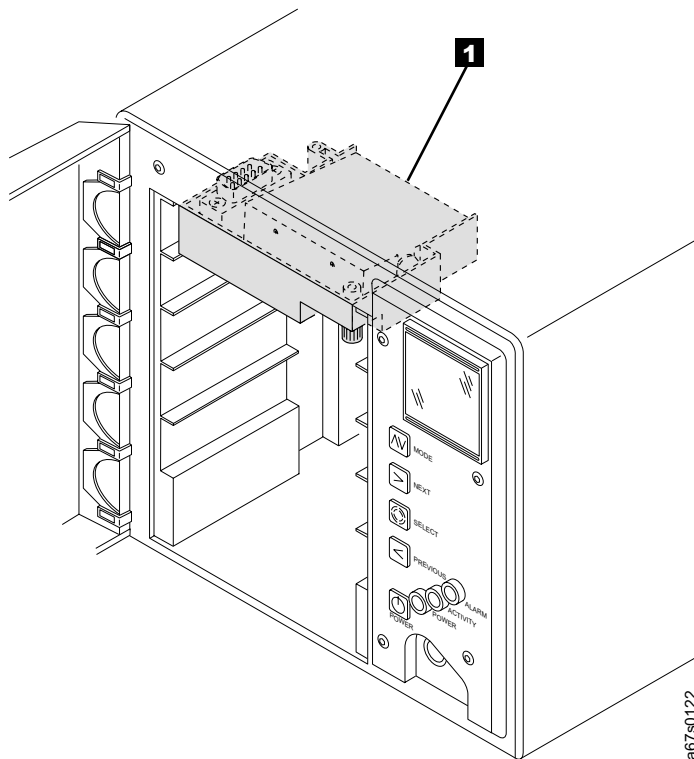
Figure 23. Cleaning the lens of the bar code reader. The lens is located at the rear of the installed bar code reader.

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** 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 101).

- 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 your IBM Service Representative for problem determination or machine replacement.

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 6 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, **R0b0T POST** displays.

To resolve an error message, see "Procedure 1" on page 52. After you resolve the error, cycle power to the autoloader (turn off, then on) and retry the last operation.

Table 6. Autoloader and drive error messages

Error Message and Description	Action
CAM LIMIT 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. 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. 3. Cycle the autoloader's power (turn it off, then on) to recover from the problem, then retry the operation. 4. If the problem persists, contact IBM Technical Support for machine replacement.
CPU RX ERR 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. 2. If the problem persists, contact IBM Technical Support for machine replacement.
CPU TX ERR 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. 2. If the problem persists, contact IBM Technical Support for machine replacement.
CT FAILEd The cleaning tape failed to clean the drive.	1. Load a different cleaning cartridge. 2. Cycle the autoloader's power (turn it off, then on) to recover from the problem, then retry the operation. 3. If the problem persists, contact IBM Technical Support for machine replacement.

dEST FULL*
 	
The destination location contains a cartridge.
	Open the front door and look at the destination storage slot:
	• 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.
	• 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.
	  – 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 machine replacement.
	  – If the sensor indicates that the slot is occupied, contact IBM Technical Support for machine replacement.

Table 6. Autoloader and drive error messages (continued)

Error Message and Description	Action
dRIVE bUSY 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. 2. If a cartridge is loaded, eject it from the drive by using the EJECT dRV command. Then, retry the operation. 3. If the problem persists, contact IBM Technical Support for machine replacement.
dRIVE FULL* The drive contains a cartridge.	1. Open the front door and look at the drive to determine whether it contains a tape cartridge. If it does, try to eject the cartridge by using the EJECT dRV command. 2. Cycle the autoloader's power (turn it off, then on) to recover from the problem, then retry the operation. 3. If the problem persists, contact IBM Technical Support for machine replacement.
dRIVE PGRM 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. 2. If the problem persists, contact IBM Technical Support for machine replacement.
dRIVE POST 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. 2. If the problem persists, contact IBM Technical Support for machine replacement.

FRONT SLOT
 	
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:
	  – 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 machine replacement.
	  – 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 machine replacement.
	• 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 machine replacement.

FRONT TAPE
 	
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:
	  – 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 machine replacement.
	  – 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 machine replacement.
	• 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 machine replacement.

Table 6. Autoloader and drive error messages (continued)

Error Message and Description	Action
HALT 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. 2. If the problem persists, contact IBM Technical Support for machine replacement.
INV MOV OP* An invalid MOVE operation occurred.	1. Cycle the autoloader's power (turn it off, then on) to recover from the problem. 2. Run the cycle test to verify that the autoloader is working (see "Testing the Robotics" on page 75). Then, retry the operation. 3. If the problem persists, contact IBM Technical Support for machine replacement.
LdR INIT 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 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. 2. If the problem persists, contact IBM Technical Support for machine replacement.
NVM WRITE The NVRAM write failed.	1. Cycle the autoloader's power (turn it off, then on) to recover from the problem, then retry the operation. 2. If the problem persists, contact IBM Technical Support for machine replacement.
PCKR EMPTY* 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. 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. 3. Cycle the autoloader's power (turn it off, then on) to recover from the problem, then retry the operation. 4. If the problem persists, contact IBM Technical Support for machine replacement.
PCKR FULL* 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. 2. Cycle the autoloader's power (turn it off, then on) to recover from the problem, then retry the operation. 3. If the problem persists, contact IBM Technical Support for machine replacement.

Table 6. Autoloader and drive error messages (continued)

Error Message and Description	Action

REAR SLOT
 	
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:
	
	  – 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 machine replacement.
	
	  – 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 machine replacement.
	
	• 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 machine replacement.

REAR TAPE
 	
A rear 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:
	
	  – 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 machine replacement.
	
	  – 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 machine replacement.
	
	• 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 machine replacement.

RObOT POST 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. 2. If the problem persists, contact IBM Technical Support for machine replacement.

SRC EMPTY*
 	
The source location does not contain a cartridge.
	Open the front door and look at the source storage slot:
	
	• 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.
	
	• 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:
	
	  – 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 machine replacement.
	
	  – If the sensor indicates that the slot is empty, contact IBM Technical Support for machine replacement.

* 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 7 describes the codes. To resolve error codes 1 through 9, refer to "Resolving Drive Error Codes" on page 52.

Table 7. 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: • When power is cycled (turned off, then on) to the autoloader. • 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: • Ensure that the cooling fan is rotating and is quiet. If not, replace the 3581 Tape Autoloader. • Remove any blockage that prevents air from flowing freely through the autoloader. • Ensure that the operating temperature and airflow is within the specified range (see Table 1 on page 4). • If the operating temperature is within the specified range and 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 71).
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: 1. Ensure that the power connector is properly seated. 2. Ensure that the proper dc voltages are being applied within the tolerances allowed (see Table 1 on page 4). 3. If the proper voltages are being applied but 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 71).
3	Firmware problem. The tape drive determined that a firmware error occurred. Perform the following action: 1. Collect a drive dump from one of the following: **Note:** Do not force a new dump; the autoloader has already created one. • 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://ssddom02.storage.ibm.com/tape/lto/`) • Ultrium Tape Drive (to copy a drive dump, see "Copying a Drive Dump to Tape" on page 84) 2. Power the autoloader off and on, then retry the operation that produced the error. 3. If the problem persists, download new firmware and retry the operation. 4. If the problem persists, send the drive dump that you collected in step 1 to your IBM Technical Support Center. The error code clears when you power-off the autoloader or access the Diagnostic Menu (see "Accessing the Diagnostic Menu" on page 71).

Table 7. 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: 1. Collect a drive dump from one of the following: **Note:** Do not force a new dump; the autoloader has already created one. • 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://ssddom02.storage.ibm.com/tape/lto/`) • Ultrium Tape Drive (to copy a drive dump, see "Copying a Drive Dump to Tape" on page 84). 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 71). 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 71).

Table 7. 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: **For Problems with Writing Data:** 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: • If the operation succeeds, the original cartridge was defective. Copy data from the defective cartridge and discard it. • If the operation fails and another autoloader is available, insert the cartridge into the other unit and retry the operation. – If the operation fails, discard the defective cartridge. – If the operation succeeds, insert a scratch cartridge into the first unit and run the tape drive diagnostics (see "Testing the Read/Write Function" on page 82). - If the diagnostics fail, replace the 3581 Tape Autoloader. - If the diagnostics succeed, the error was temporary. • 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 82). – If the diagnostics fail, replace the 3581 Tape Autoloader. – If the diagnostics succeed, discard the cartridge. If the problem occurs with multiple tape cartridges or if you do not know the tape cartridge's volume serial number, run the tape drive diagnostics (see "Testing the Read/Write Function" on page 82): • If the diagnostics fail, replace the 3581 Tape Autoloader. • If the diagnostics succeed, run the Test Head diagnostic (see "Testing the Read/Write Function" on page 82). – If the Test Head diagnostic fails, replace the 3581 Tape Autoloader. – If the Test Head diagnostic succeeds, replace the cartridges that caused the problem. **For Problems with Reading Data:** 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: • If another autoloader is available, insert the cartridge into the other unit and retry the operation: – If the operation fails, discard the defective cartridge. – If the operation succeeds, insert a scratch cartridge into the first unit and run the tape drive diagnostics (see "Testing the Read/Write Function" on page 82): - If the diagnostics fail, replace the 3581 Tape Autoloader. - If the diagnostics succeed, the error was temporary. • 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 82): – If the diagnostics fail, replace the 3581 Tape Autoloader. – If the diagnostics succeed, discard the cartridge. If the problem occurs with multiple tape cartridges or if you do not know the tape cartridge's volume serial number, run the tape drive diagnostics (see "Testing the Read/Write Function" on page 82): • If the diagnostics fail, replace the 3581 Tape Autoloader. • If the diagnostics succeed, run the Test Head diagnostic (see "Testing the Read/Write Function" on page 82). – If the Test Head diagnostic fails, replace the 3581 Tape Autoloader. – If the Test Head diagnostic succeeds, replace the cartridges that caused the problem. The error code clears when you remove the tape cartridge or access the Diagnostic Menu (see "Accessing the Diagnostic Menu" on page 71).

Table 7. 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: **Attention:** When you run the Test Cartridge & Media diagnostic, data on the suspect tape is overwritten. Use only a scratch data cartridge to run the test. 1. If possible, run the tape cartridge in a different 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 82). 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 29). 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. The error code clears when you remove the tape cartridge or access the Diagnostic Menu (see "Accessing the Diagnostic Menu" on page 71).
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" on page 54. 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 71).
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 71).
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 71).
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 29. The error code clears when you clean the tape drive or access the Diagnostic Menu (see "Accessing the Diagnostic Menu" on page 71).
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 119.

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 51 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 84).

For a list of parts for the 3581 Tape Autoloader, see Appendix H, "Parts Lists" on page 127.

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.

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 23). If a cartridge is stuck in the tape drive, see Appendix B, "Removing a Tape Cartridge" on page 87.

6. If the failed autoloader contains a bar code reader, record whether it is enabled or disabled and whether it is set to perform an 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 13 and "Step 6. Connecting Power" on page 8).

10. If the failed autoloader contains a bar code reader, remove it (see "Removing and Replacing the Bar Code Reader" on page 68).

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, "Installing the Bar Code Reader (optional)" on page 99.
2. Install the replacement autoloader (see Chapter 2, "Installing the 3581 Tape Autoloader" on page 5).
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 82).
   - 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 your IBM Service Representative.
4. Set the SCSI IDs that you wrote down in step 3 on page 66 of "Removal Procedure" on page 65. 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 66 of "Removal Procedure" on page 65. To set the settings, see "Enabling or Disabling the Bar Code Reader" on page 79 and "Performing an Inventory of the Cartridges During Power-on" on page 79.
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 offline 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.

Class II

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** 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 101).
      - 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 the same locations in the replacement autoloader).
6. Loosen the two thumbscrews (see **6** in Figure 24 on page 69) 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 24, locate the mounting hole **1** and interface connector **2** on the inside top panel of the autoloader, directly above cartridge storage slot 1.
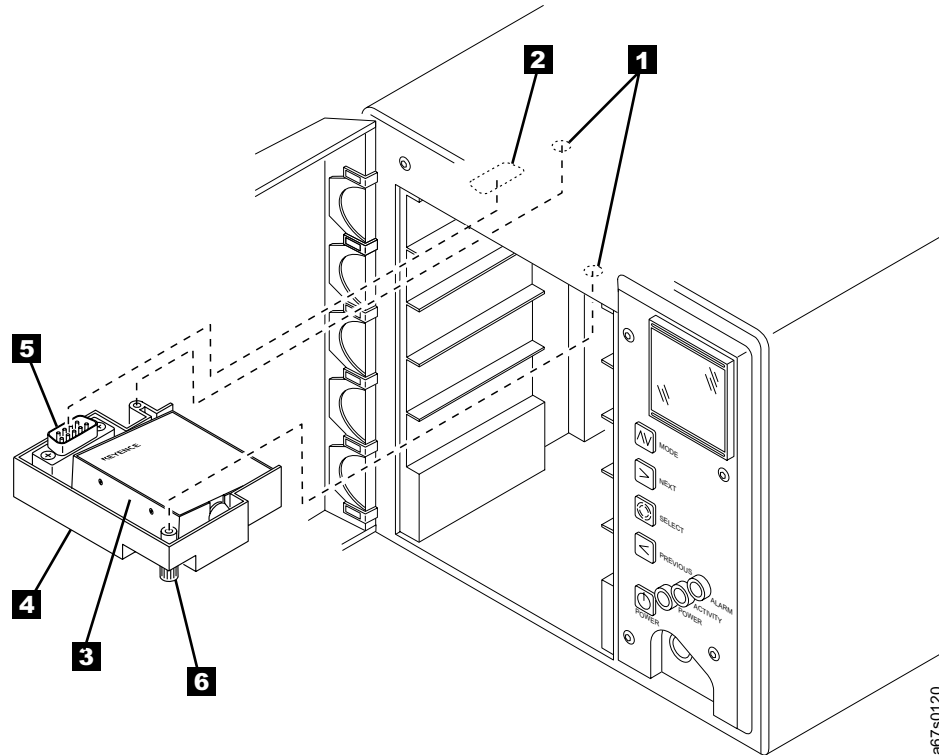
Figure 24. Replacing the bar code reader

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 68 of "Removal Procedure" on page 68.

7. 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** 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.

Appendix A. Performing 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.

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 8 lists the diagnostic and maintenance functions that you can choose from the Diagnostic Menu, and directs you to the procedure for performing it. Figure 25 on page 73 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 8. 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 72.
Verifies the SCSI INQUIRY identity of the 3581 Tape Autoloader (ULT3581-TA).	**SIGN ON**	See "Verifying the SCSI INQUIRY Identity" on page 74.
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 74.
Tests the functionality of the 3581 Tape Autoloader's robotics.	**CYCLE TEST**	See "Testing the Robotics" on page 75.
Manually specifies cleaning of the drive's head.	**CLEAN dRV**	See "Manually Selecting the Cleaning Function" on page 75.
Specifies autocleaning of the drive's head.	**AUTOCLEAN**	See "Automatically Selecting the Cleaning Function" on page 76.
Displays the number of times certain events have occurred.	**dSP COUNTS**	See "Displaying Counts" on page 78.
If it is installed, enables or disables the bar code reader.	**bARCOdE**	See "Enabling or Disabling the Bar Code Reader" on page 79.
Updates firmware for the drive by using a FMR tape.	**UPG dRV FW**	See "Updating Drive Firmware" on page 80.

Table 8. Diagnostic and maintenance functions (continued)

Diagnostic or Maintenance Function	Menu Name	Location of Procedure
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 82.

Displaying Firmware

Select **dSP FW** to display the current level of firmware for the autoloader, drive, robotics, front panel, and boot. 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 25 summarizes the functions in the Diagnostic Menu of the 3581 Tape Autoloader.
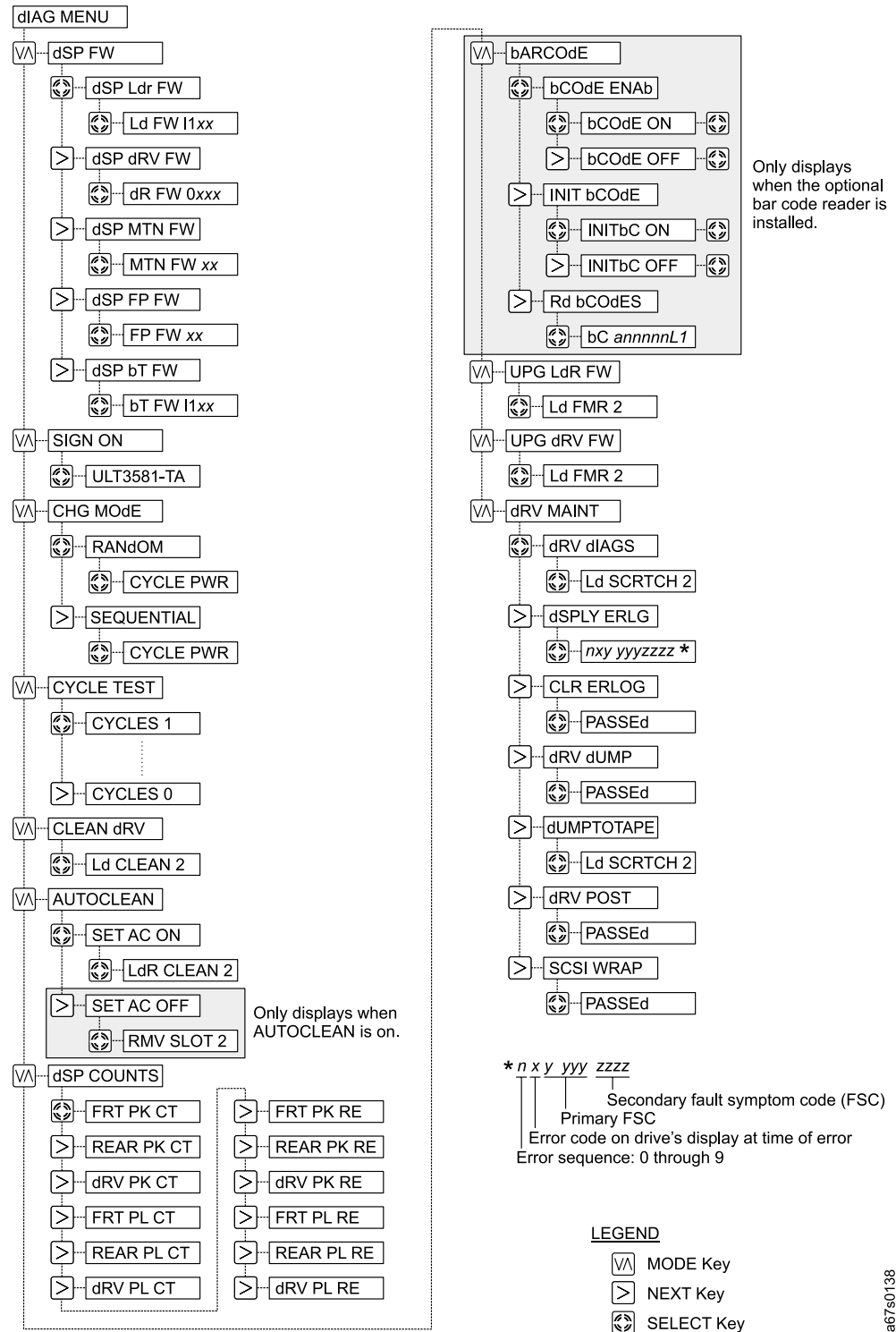
Figure 25. Functions in the Diagnostic Menu

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.

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).

Testing the Robotics

Select **CYCLE TEST** to verify that the 3581 Tape Autoloader's robotics are 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 23).

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 27). 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 23), 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. 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 76.)

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** or **SEQ 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** or **SEQ 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** or **SEQ REAdY** displays.

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** or **SEQ 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 101).
    *   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. **LdR REAdY** displays.
7. Cycle power (turn it off, then on) to activate the new firmware.

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 your IBM Service Representative.

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.

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 your IBM Service Representative.

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 26).

   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 61.

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 26).

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 61.

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 26).

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.
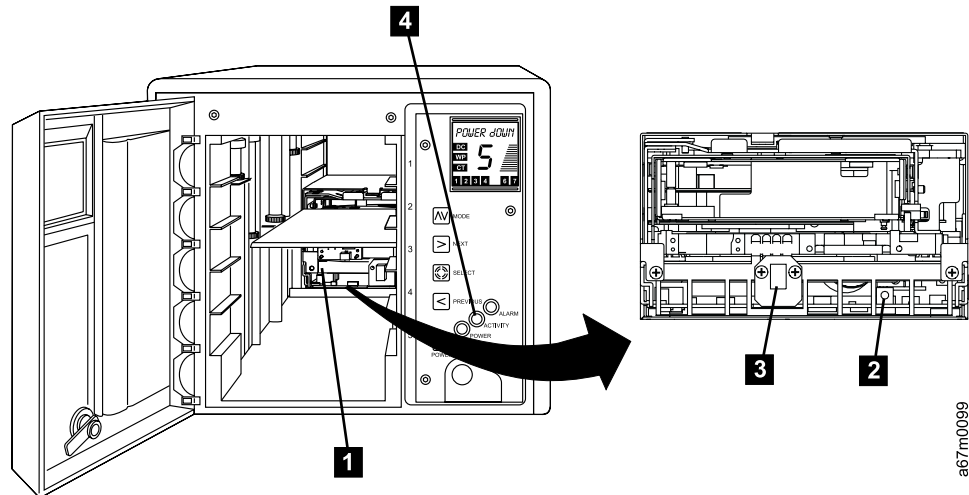

Figure 26. Resetting the tape drive

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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 87). 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 115).

4. Remove the eight screws (**1** in Figure 27) that secure the drive assembly sled **2** to the autoloader.

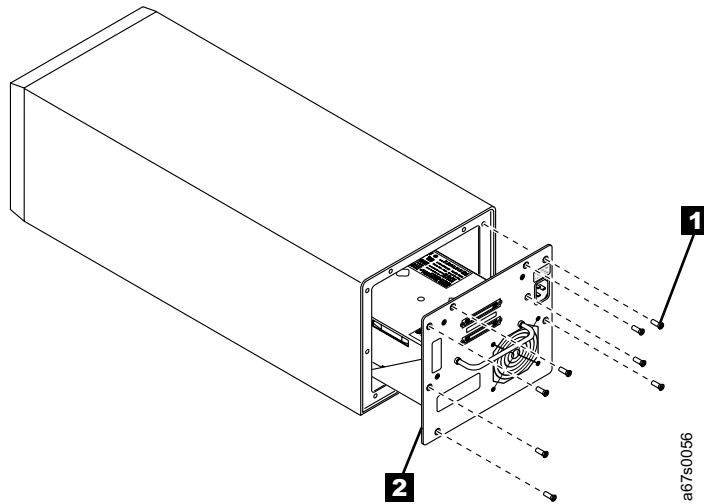5. Grasp the handle of the sled and pull it toward you to slide the sled out of the autoloader.

Figure 27. 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 28 on page 91).
7. On the bottom of the drive assembly sled, locate the bottom access hole (**1** in Figure 28 on page 91).
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 92.

   • 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 28 on page 91). 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 97.

     – If you feel resistance and the cartridge does not move up, the tape is broken. Contact IBM Technical Support.
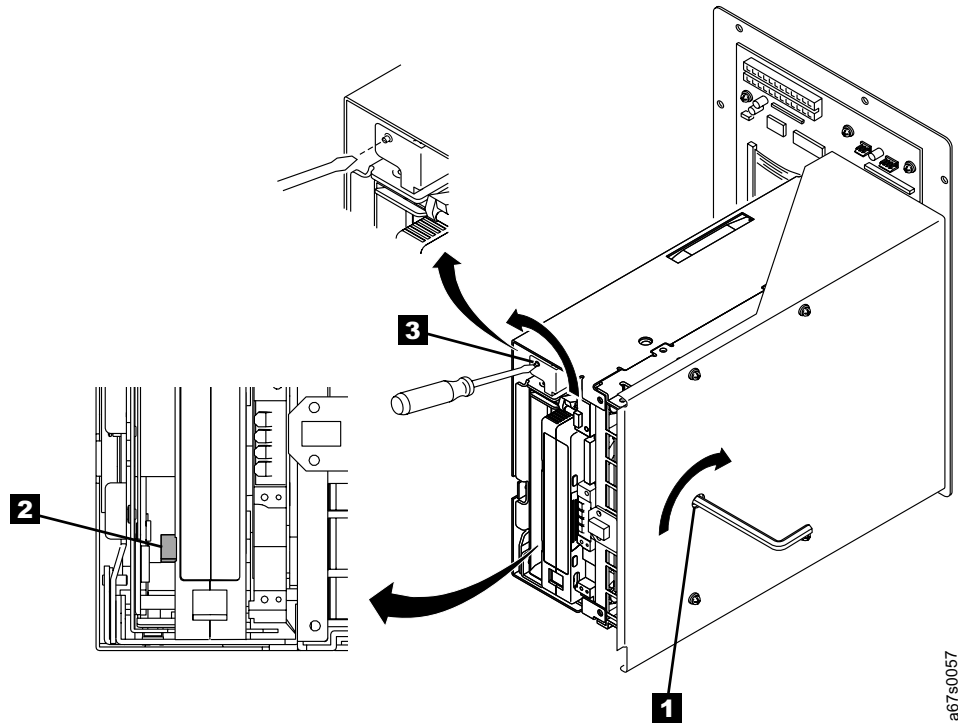
Figure 28. Determining whether the tape is broken

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 28 on page 91).

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" on page 93.

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 92, 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 29) that secure the drive assembly sled **2** to the drive **3** . Set the screws aside.

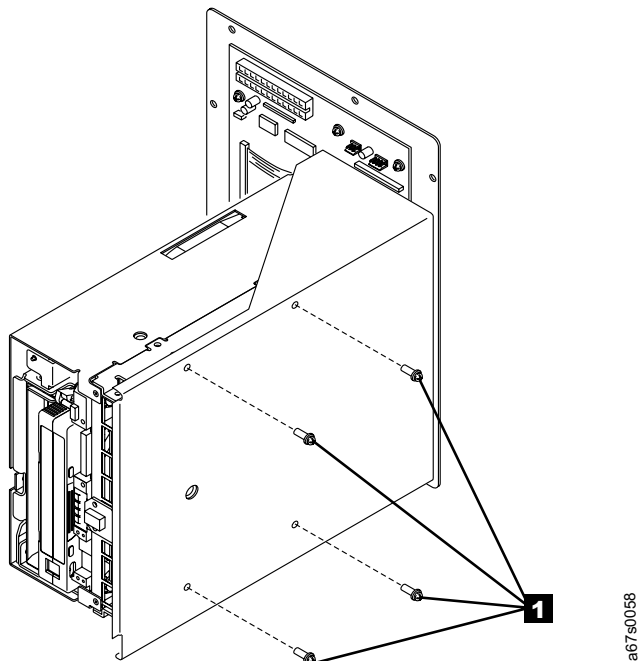*Figure 29. Removing the drive assembly sled from the tape drive*

b. Disconnect the following connectors from the rear of the drive (see Figure 30).

   1   SCSI connector (J1)

   2   SCSI ID connector (J1)

   3   Power connector (J1)

   4   RS-422 connector (J2)
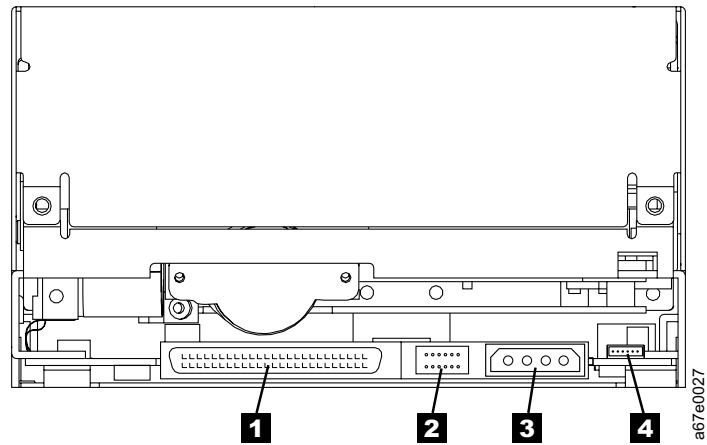
Figure 30. Disconnecting the cables from the tape drive

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 31).

   b. Remove the cover **2** by lifting it up. Set the cover aside.

Figure 31. 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 32 on page 96).

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 on page 96.

   - If the leader pin has become detached from the leader block and is lying in the tape path, go to step 3 on page 96.

   - If the leader pin has broken away from the tape, go to "Reattaching a Leader Pin" on page 43.

   - If the tape has broken between the supply reel and the takeup reel, contact your IBM Service Representative.

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 32).

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.
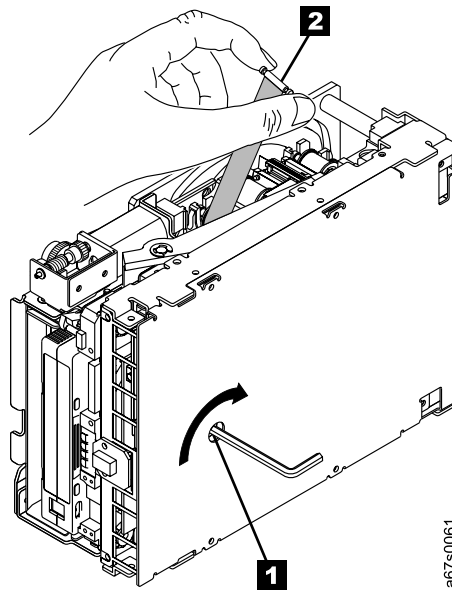

Figure 32. Rewinding the leader pin into the tape cartridge

Removing the Cartridge from the Drive

1. Manually rotate the loader motor gear (see **1** in Figure 33) in the unload direction until the leader pin block **2** reaches the last roller **3** .
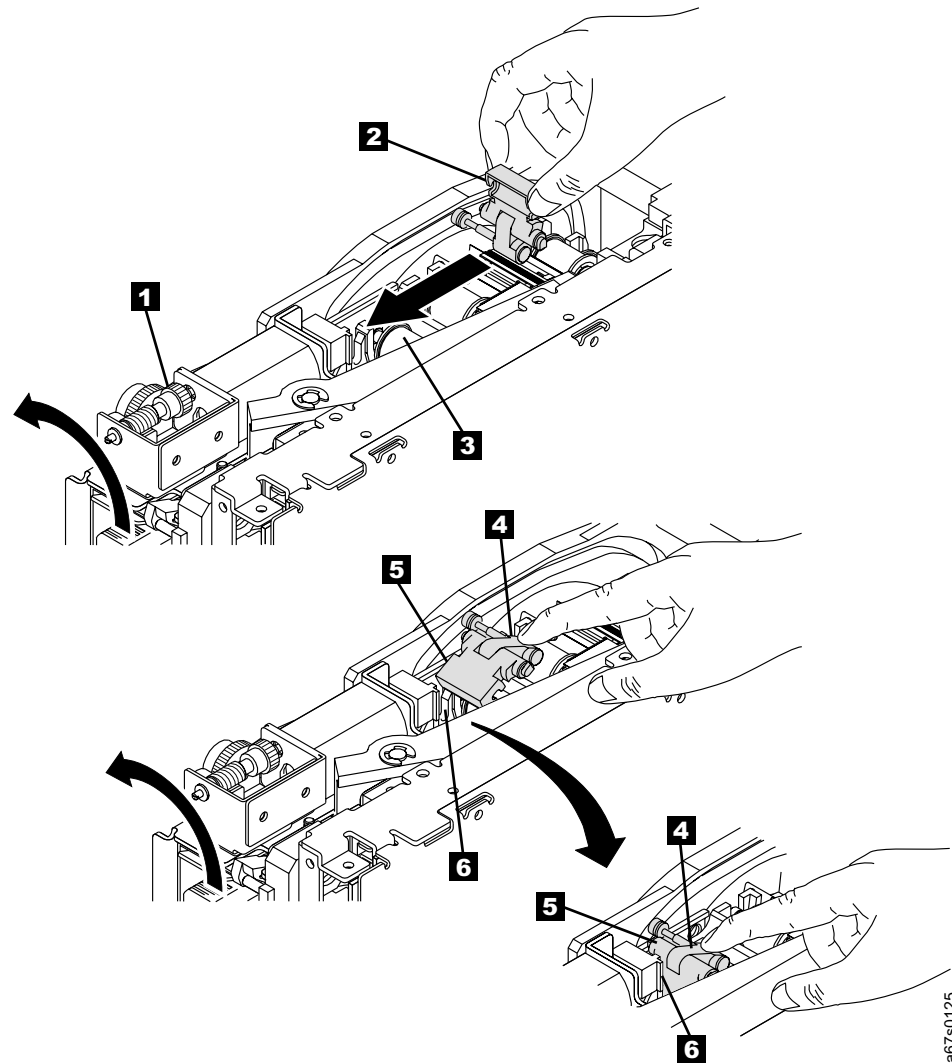

Figure 33. Guiding the leader pin into the tape cartridge

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. Installing the Bar Code Reader (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 34 shows the bar code reader.
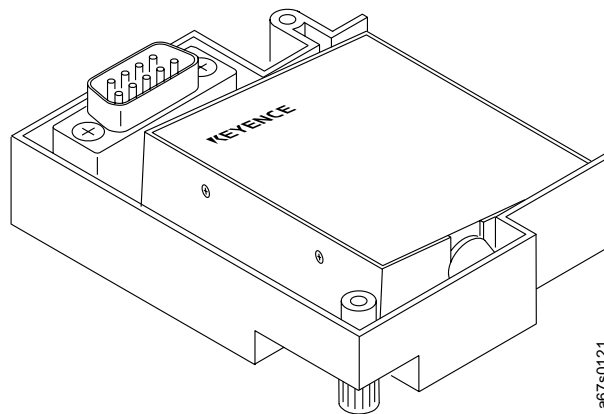

Figure 34. Bar code reader

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 **bARC0dE** function appears in the Diagnostic Menu. You can then enable or disable the bar code reader from that menu (see Appendix A, "Performing Diagnostic and Maintenance Functions" on page 71). The **bARC0dE** 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.

Class II

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 23).

2. Power-off the 3581 Tape Autoloader and unplug its power cord from the electrical outlet.

3. Referring to Figure 35 on page 101, locate the mounting hole **1** and interface connector **2** on the inside top panel of the autoloader, directly above cartridge storage slot 1.
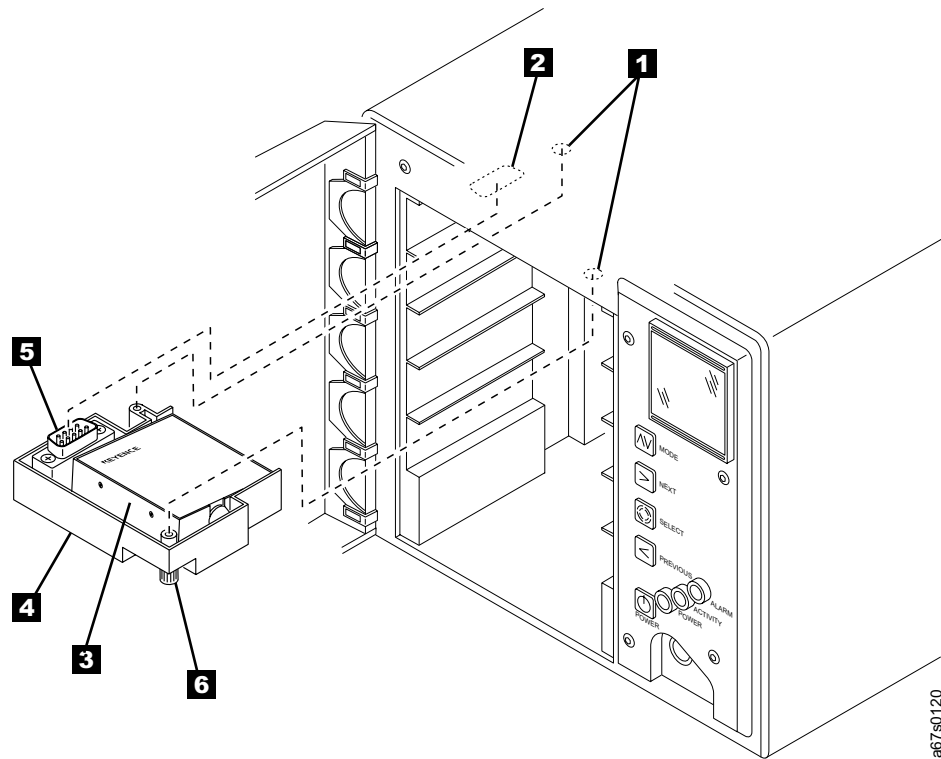
Figure 35. Installing the bar code reader

4. Remove the bar code reader from its packaging.

5. Check that the bar code reader (**3** in Figure 24 on page 69) 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 79).

11. Apply bar code labels to your cartridges and load them into the 3581 Tape Autoloader (for details about labeling cartridges, see "Bar Code Label" on page 37 and "Guidelines for Using Bar Code Labels" on page 38).

   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 68.

Appendix D. Installing an Autoloader into a Rack

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 9. 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
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

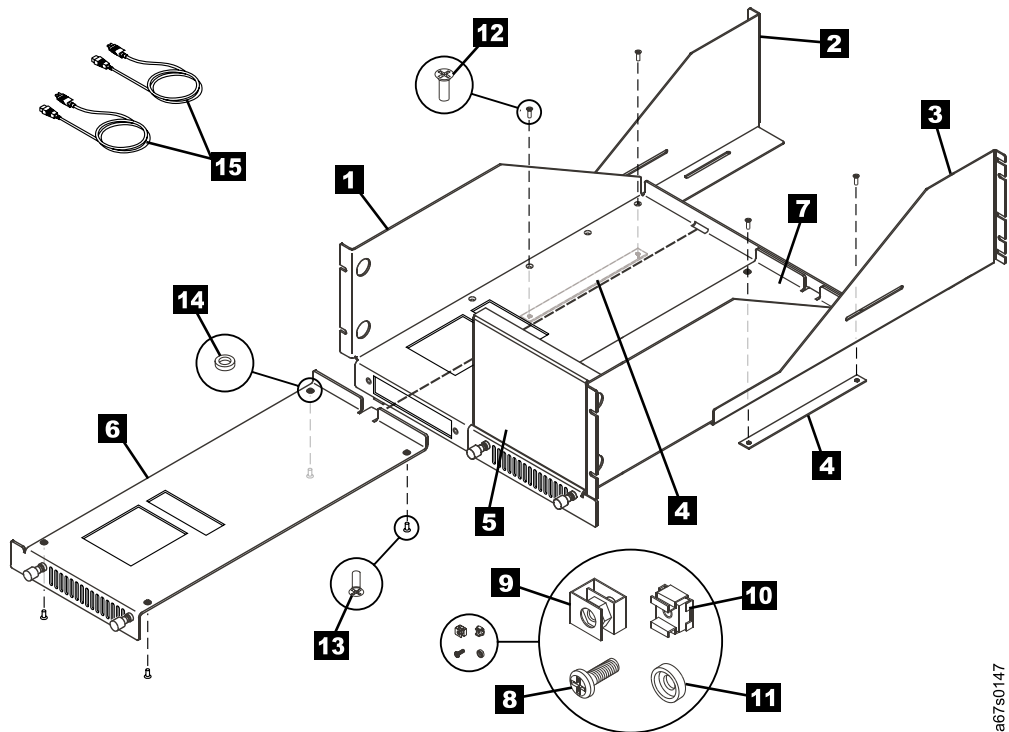*Figure 36. Components of the rackmount kit*

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 9 on page 104

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 37) 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.
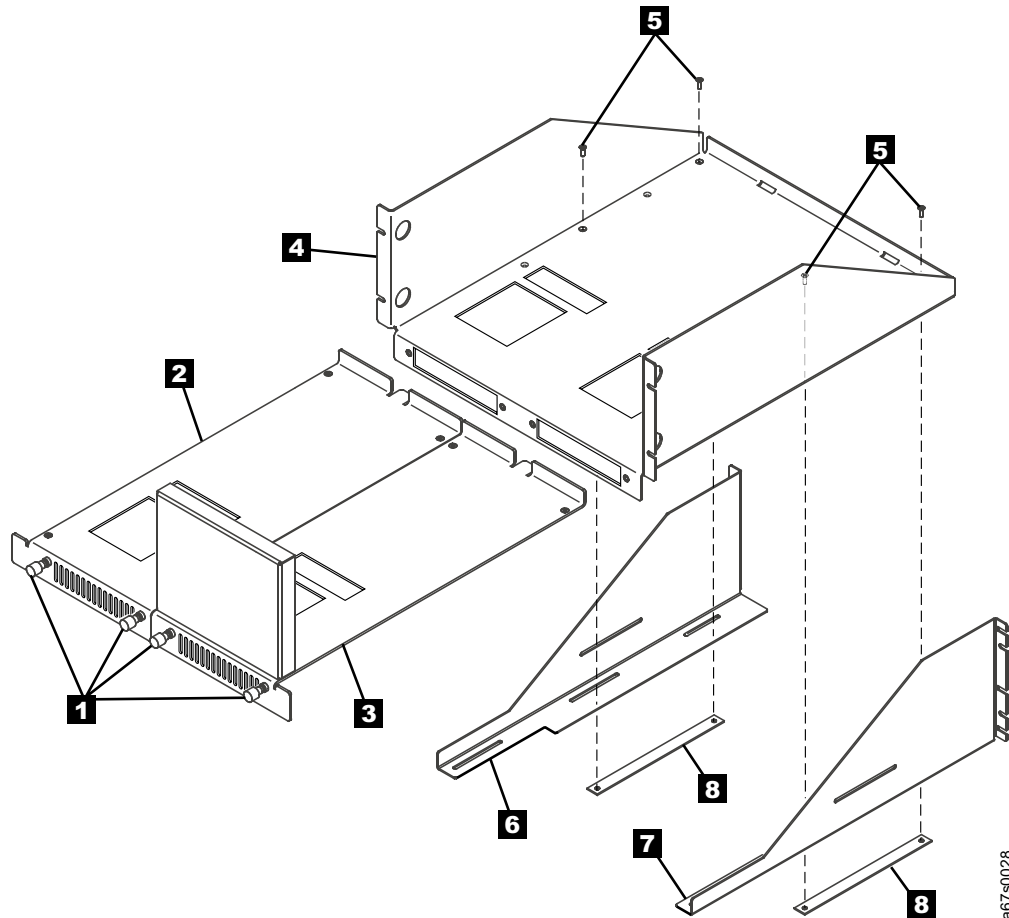

Figure 37. Preparing the rackmount tray for installation into the rack

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 5 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 38 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.
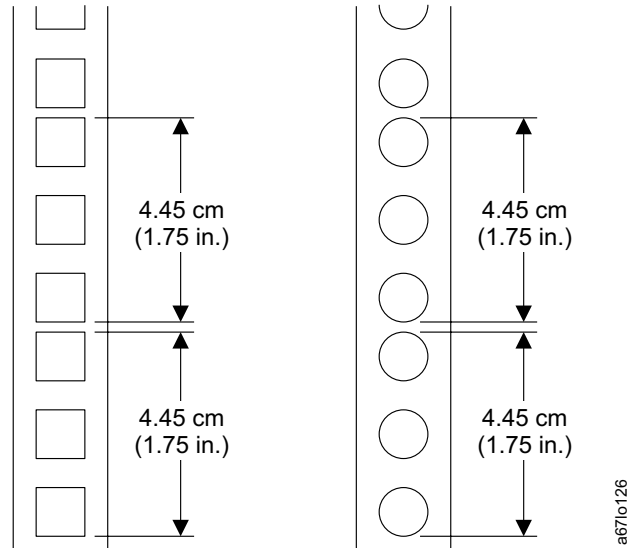
Figure 38. Defining the vertical boundaries of the autoloader in the rack. The figure shows how to define the boundaries for racks with round mounting holes and square mounting holes.

5. On each of the rack's four vertical rails (Figure 39 on page 108 shows the two front rails **1** and the two rear rails **2**), install a panel nut (**3** or cage nut **4** 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 39 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.
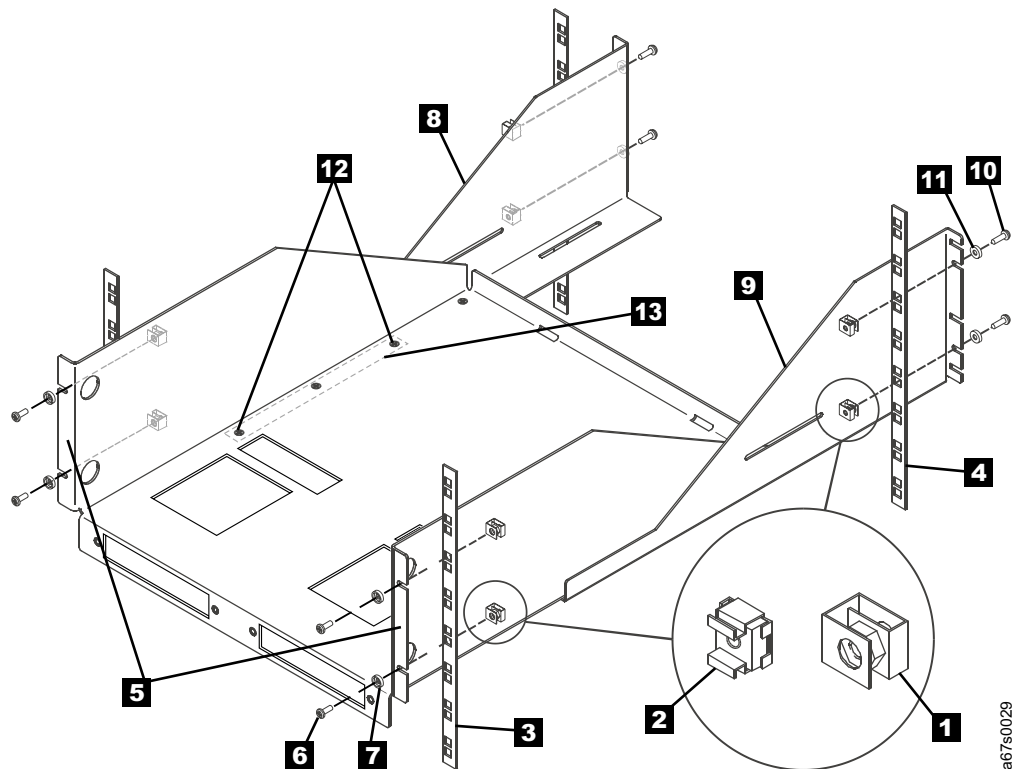
12. Tighten all screws.

Figure 39. 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 40) 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.
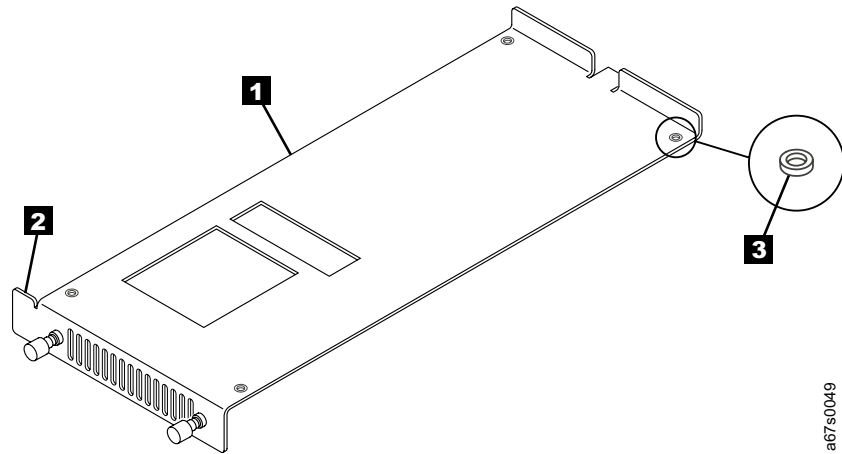

Figure 40. Identifying the left and right sled. The left sled features a left ear; the right sled features a right ear.

3. Remove any tape cartridges from the 3581 Tape Autoloader (see "Removing a Tape Cartridge" on page 28; if a cartridge is in the picker, refer to "Using the Control Buttons to Display Commands" on page 23 and issue the EJECT PCKR command).

4. Use a T-10 Torx driver to remove the six Torx screws (see **1** in Figure 41 that secure the left autoloader's cover **2** .

5. Remove the cover by lifting it up and away from the autoloader.
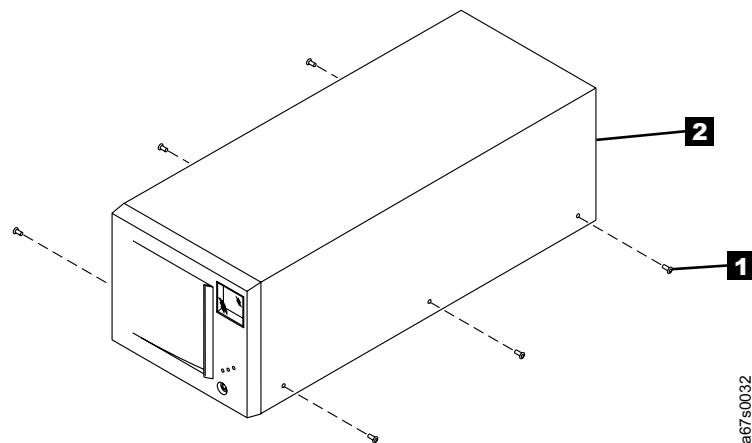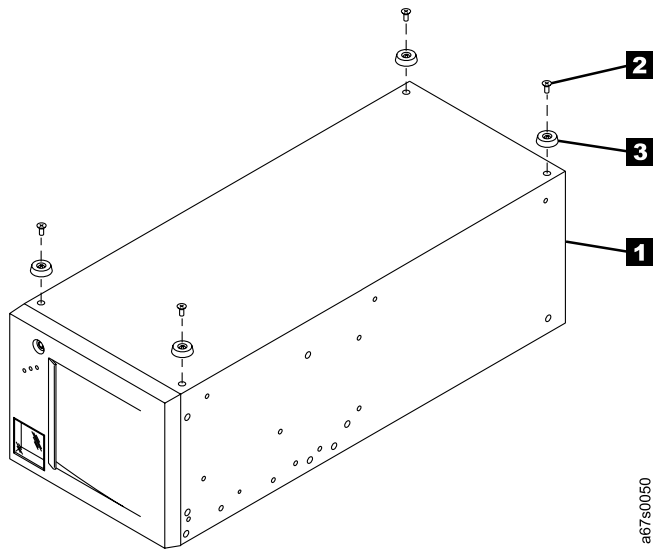

Figure 41. Removing the covers of the 3581 Tape Autoloaders

6. Set the 3581 Tape Autoloader upside down on a flat work surface (see **1** in Figure 42).

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 42. Removing the feet from the 3581 Tape Autoloader. The autoloader is upside down.

9. Turn the sled (see **1** in Figure 43) upside down and place it onto the 3581 Tape Autoloader **2**. Secure the sled to the autoloader with four flat-head screws **3**.
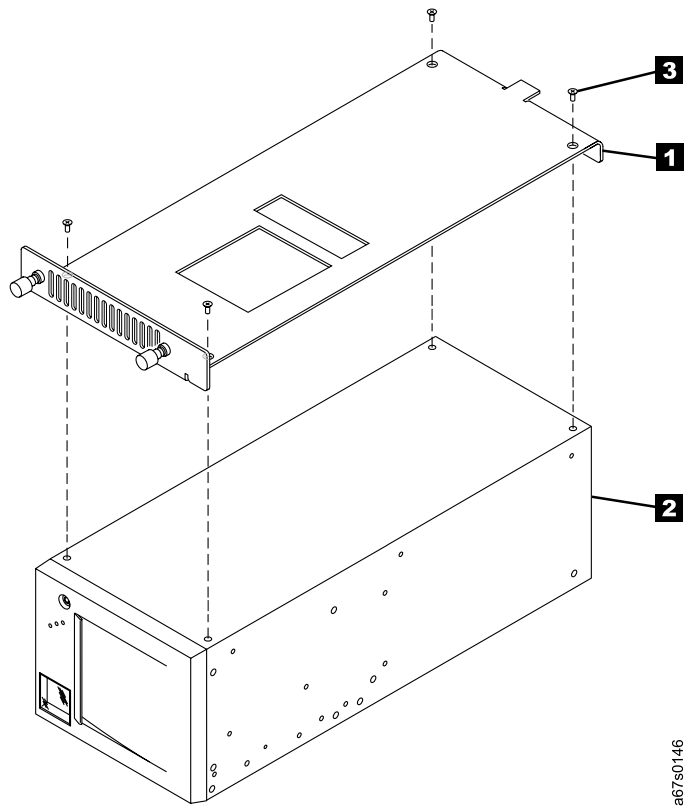
Figure 43. Installing the 3581 Tape Autoloader onto the sled. Both the autoloader and the sled are upside down.

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 44) 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** .
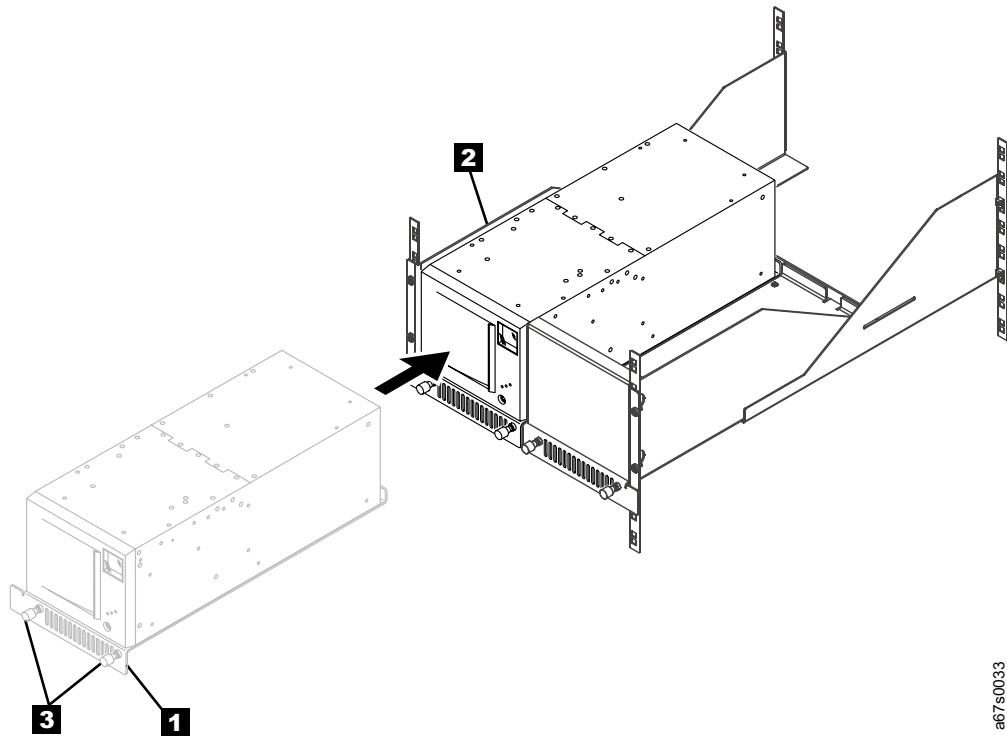
Figure 44. Installing the sled onto the rackmount tray

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 45) that secure the filler panel **2** to the right sled **3** .

2. Remove the filler panel.
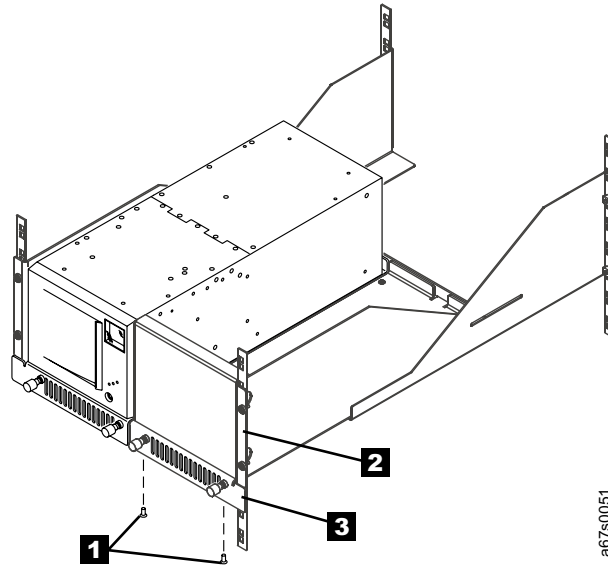
Figure 45. Removing the filler panel to install a second 3581 Tape Autoloader

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 109.
4. Slide the right sled (see **1** in Figure 46) 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 5.

Figure 46. Installing a second 3581 Tape Autoloader onto the rackmount tray

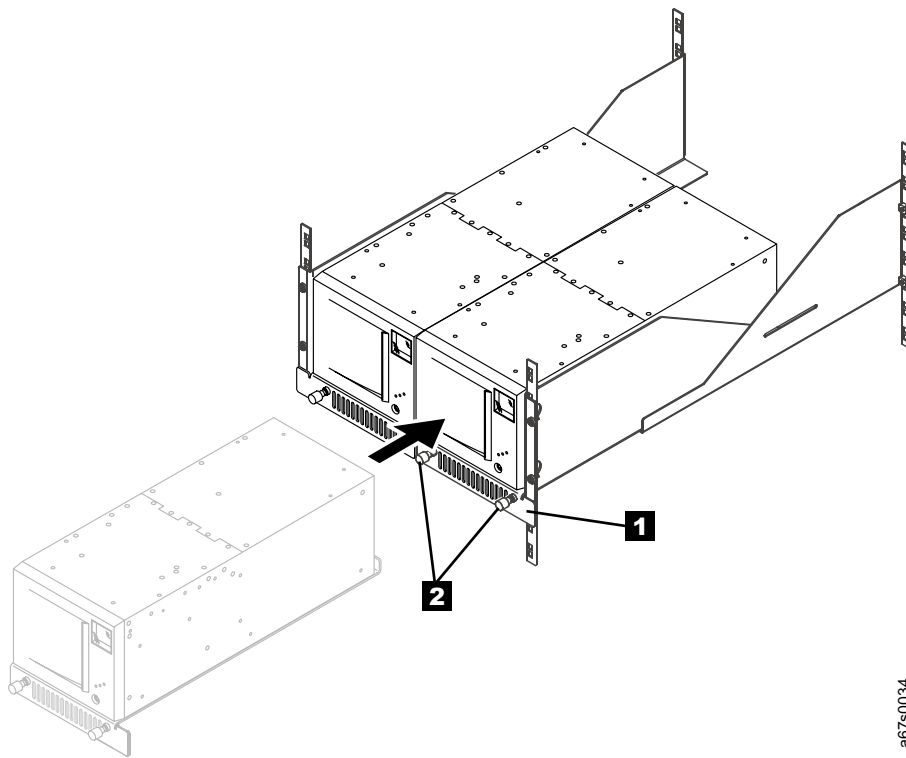# Removing the 3581 Tape Autoloader from a Rack

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 28; if a cartridge is in the picker, refer to "Using the Control Buttons to Display Commands" on page 23 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 109).
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 47 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 47. 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 48 shows the revised SCSI element addresses for the storage slots after a bar code reader has been added.

Figure 48. 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 49 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.
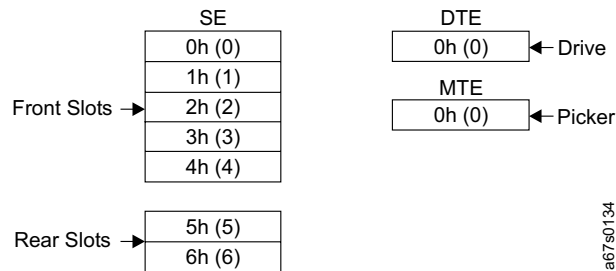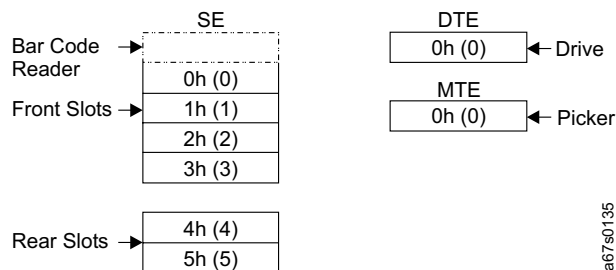

Figure 49. SCSI element addresses for the 3581 Tape Autoloader. The unit does not use the Windows 2000 operating system and does not contain a bar code reader.

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.

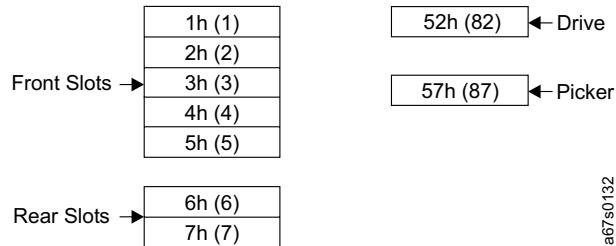Figure 50 shows the revised SCSI element addresses for the storage slots after a bar code reader has been added.
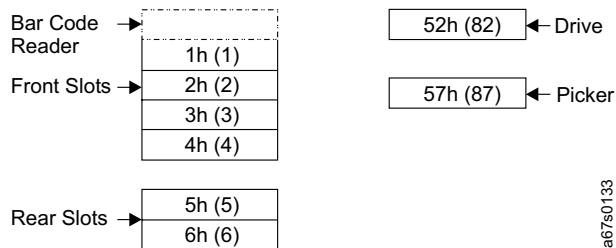

Figure 50. SCSI element addresses for the 3581 Tape Autoloader. The unit does not use the Windows 2000 operating system and contains a bar code reader.

Appendix F. TapeAlert Flags

Table 10 lists the TapeAlert flags that are supported by the IBM Ultrium Tape Drive. Table 11 on page 122 lists the TapeAlert flags that are supported by the 3581 Tape Autoloader.

TapeAlert Flags Supported by the Drive

Table 10 describes the TapeAlert flags that are supported by the drive and lists the actions that you must take to correct problems.

Table 10. 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 51.
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 39). 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 51.
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 7 on page 61.
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 39).
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 10. 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 88).
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 7 on page 61.
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 29.
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 29.
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 7 on page 61 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 7 on page 61 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 7 on page 61.
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 10. 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 7 on page 61.
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 7 on page 61.
39	Diagnostics required	Set when the drive detects a failure that requires diagnostics to isolate the problem.	See error code 6 in Table 7 on page 61.
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. 2. Discard the old cartridge.

TapeAlert Flags Supported by the Autoloader

Table 11 describes the TapeAlert flags that are supported by the autoloader and lists the actions that you must take to correct problems.

Table 11. 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. Power Cords

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

Table 12 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 51 on page 125. These power cords are only available at the time of initial purchase or as a field replaceable unit (FRU) part from your IBM Service Representative.

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 12.

Power Cable Information

Table 12. Power cable information

Description, Feature Code (FC), and Part Number (PN)	Plug Standard Reference	Country or Region	Index Number in Figure 51 on page 125
US/Canada 2.8 m, 125V FC 9800 PN 6952300 (See Note)	NEMA 5-15P	Bolivia, Brazil, Canada, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Japan, Mexico, Nicaragua, Panama, Peru, Philippines, Saudi Arabia, Taiwan, Thailand, Venezuela, US	1
Chicago 1.8 m, 125 V FC 9986 PN 6952301	NEMA 5-15P	Chicago, U.S.A.	1
US/Canada 2.8 m, 250 V FC 9833 PN 1838574	NEMA 6-15P	Bolivia, Brazil, Canada, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Japan, Mexico, Nicaragua, Panama, Peru, Philippines, Saudi Arabia, Taiwan, Thailand, Venezuela, US	2
Australia 2.8 m, 250V FC 9831 PN 13F9940	AS/NZSC112	Australia, New Zealand	3

Table 12. Power cable information (continued)

Description, Feature Code (FC), and Part Number (PN)	Plug Standard Reference	Country or Region	Index Number in Figure 51 on page 125
France 2.8 m, 250V FC 9820 PN 13F9979	CEE 7 - VII	Albania, Algeria, Andorra, Angola, Armenia, Austria, Azerbadjian, Belarus, Belgium, Benin, Bosnia, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, Comoros, Congo (Republic of), Congo (Democratic Republic of), Croatia, Czech Republic, Djibouti, Egypt, Equatorial Guinea, Eritrea, Estonia, Ethiopia, Finland, France, French Guyana, French Polynesia, Gabon, Georgia, Germany, Greece, Guadeloupe, Guinea, Guinea Bissau, Hungary, Iceland, Indonesia, Iran, Ivory Coast, Kazakhstan, Korea, Kyrgyzstan, Latvia, Lebanon, Lithuania, Luxumbourg, Macedonia, Madagascar, Mali, Martinique, Mauritania, Mauritius, Mayotte, Moldavia, Monaco, Morocco, Mozambique, Netherlands, New Caledonia, Niger, Norway, Poland, Portugal, Reunion, Romania, Russia, Rwanda, Sao Tome, Senegal, Serbia, Slovakia, Slovenia, Somalia, Spain, Sweden, Syria, Tajikistan, Togo, Tunisia, Turkey, Turkmenistan, Ukraine, Uzbekistan, Vanuatu, Wallis and Futana, Vietnam	4
Denmark 2.8 m, 250V FC 9821 PN 13F9997	DK2-5a	Denmark	5
South Africa 2.8 m, 250V FC 9829 PN 14F0015	SABS 164	India, Lesotho, Nambia, Pakistan, South Africa, Sri Lanka, Swaziland, Uganda	6
United Kingdom 2.8 m, 250V FC 9825 PN 14F0033	BS 1363/A	Bahrain, Botswana, Cyprus, Gambia, Ghana, China (Hong Kong S.A.R.), Ireland, Jordan, Kenya, Kuwait, Liberia, Malaysia, Malawi, Malta, Nigeria, Oman, Quatar, Seychelles, Sierra Leone, Singapore, Sudan, Tanzania, UK, United Arab Emirate (Dubai), Yemen, Zambia, Zimbabwe	7
Switzerland 2.8 m, 250V FC 9828 PN 14F0051	1011-S24507	Liechtenstein, Switzerland	8
Italy 2.8 m, 250V FC 9830 PN 14F0069	CEI 23- 16	Chile, Italy	9

Description, Feature Code (FC), and Part Number (PN)	Plug Standard Reference	Country or Region	Index Number in Figure 51
Israel 2.8 m, 250V FC 9827 PN 14F0087	SI 32	Israel	10
Uruguay 2.8 m, 250V FC 9834 PN 36L8880	IRSM 2073	Argentina, Paraguay, Uruguay	11
China 2.8 m, 250V FC 9840 PN 02K0546	GB 2099.1	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 Receptacles

Figure 51 shows the receptacles that are used by the power cables in Table 12 on page 123. Match the index number that is beside each receptacle to the index number in the table.
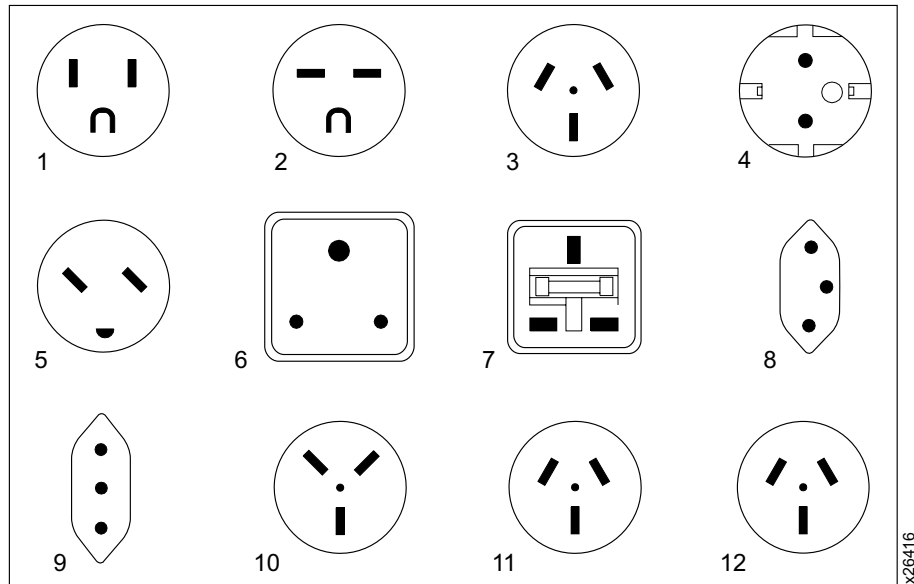

Figure 51. Types of receptacles

Appendix H. Parts Lists

Table 13 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 field replaceable unit (FRU) number, order it from your IBM Service Representative.

Note: Power cords are listed separately in Appendix G, "Power Cords" on page 123; media supplies are listed in Table 5 on page 49.

Parts for 3581 Tape Autoloader

Table 13 lists the parts for the 3581 Tape Autoloader.

Table 13. Parts list for the 3581 Tape Autoloader

Feature Code (FC) or Model	Description	Notes	FRU Part Number
Model L1x	IBM 3581 Ultrium Tape Autoloader with LVD/SE SCSI interface	Formerly 35L1285	19P3314
Model H1x	IBM 3581 Ultrium Tape Autoloader with HVD/DIFF SCSI interface	Formerly 35L1286	19P3315
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 cable		19P0872
FC 5302	2.5 m Universal HD68 to HD68 cable		35L1307
FC 5305	5 m Universal HD68 to HD68 cable		19P0052
FC 5310	10 m Universal HD68 to HD68 cable		19P0053
FC 5318	18 m Universal HD68 to HD68 cable	Available only with Model H1x	19P0097
FC 5325	25 m Universal HD68 to HD68 cable	Available only with Model H1x	19P0054
FC 5602	2.5 m Universal VHDCI to HD68 cable		19P0279
FC 5604	4.5 m Universal VHDCI to HD68 cable		19P0050
FC 5610	10 m Universal VHDCI to HD68 cable		19P0048
FC 5620	20 m Universal VHDCI to HD68 cable	Available only with Model H1x	19P0049
FC 5625	25 m Universal VHDCI to HD68 cable	Available only with Model H1x	35L1977
Ship group only	LVD single-connector SCSI wrap tool	Comes with Model L1x	19P0481
Ship group only	HVD single-connector SCSI wrap tool	Comes with Model H1x	19P1213
FC 5099	VHDCI to HD68 interposer cable		19P0482
FC 2895	AS/400 feature #6501 to HD68 interposer cable	Available only with Model H1x	05H3834
Ship group only	LVD/SE multi-mode terminator (DEC gray)	Comes with Model L1x	19P0874
Ship group only	HVD terminator (black)	Comes with Model H1x	61G8324
Ship group only	Cosmetic cover set		35L1288
Ship group only	Front door key	Comes with 3581 Ultrium Tape Autoloader; only available as a FRU	19P1282
Ship group only	*IBM 3581 Ultrium Tape Autoloader Setup, Operator, and Service Guide*, GA32-0412-01		None

Table 13. Parts list for the 3581 Tape Autoloader (continued)

Feature Code (FC) or Model	Description	Notes	FRU Part Number
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

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IBM 3581 Ultrium Tape Autoloader

Federal Communications Commission (FCC) Class B Statement

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult an IBM authorized dealer or service representative for help.

Properly shielded and grounded cables and connectors must be used in order to meet FCC emission limits. Proper cables and connectors are available from IBM authorized dealers. 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 B Emission Compliance Statement

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

Avis de conformité à la réglementation d'Industrie Canada

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

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Germany Electromagnetic Compatibility Directive

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

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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.

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).

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 L1x. One of two versions of the 3581 Tape Autoloader. The Model L1x uses the Ultra2, Low Voltage Differential/Single Ended (LVD/SE) interface. Contrast with *Model H1x*.

Model H1x. One of two versions of the 3581 Tape Autoloader. The Model H1x uses the Ultra SCSI, High Voltage Differential (HVD/DIFF) SCSI interface. Contrast with *Model L1x*.

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 4π 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

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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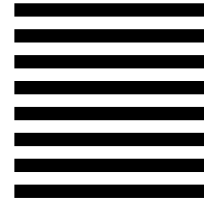
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IBM   3581 Ultrium Tape Autoloader   IBM 3581 Ultrium Tape Autoloader Setup, Operator, and Service Guide