IBM System Storage TS2900 Tape Autoloader

Setup, Operator, and Service Guide

Machine Type 3572

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Note:

Before using this information and the product it supports, be sure to read the general information in "Notices" located in the back of this publication.

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

Read this First

Accessing Online Technical Support

For online Technical Support for your library, visit:

`http://www.ibm.com/support/`

Registering for My Notification

My Notification registration provides e-mail notification when new firmware levels have been updated and are available for download and installation.

To register for My Notification:
1. Visit the web at `http://www.ibm.com/`
2. Click **Get support**.
3. Click **My support**.

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Safety and Environmental Notices

When using this product, observe the danger, caution, and attention notices that are 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 (Dxxxx or Cxxxx). Use the reference number to check the translation in the *IBM Systems Safety Information Manual* (G229-9054) publication included in your ship group.

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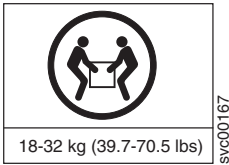
Danger Notice

	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

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 I	A hazardous condition due to the use of a laser in the product. Laser symbols are always accompanied by the classification of the laser as defined by the U. S. Department of Health and Human Services (for example, Class I, Class II, and so forth).
	A hazardous condition due to mechanical movement in or around the product.

If the symbol is…	It means…
18-32 kg (39.7-70.5 lbs)	A hazardous condition due to the weight of the unit. Weight symbols are accompanied by an approximation of the product's weight.

Laser Safety and Compliance

Before using the library, review the following laser safety information.

Class I Laser Product

The library may contain a laser assembly that complies with the performance standards set by the U.S. Food and Drug Administration for a Class I laser product. Class I laser products do not emit hazardous laser radiation. The library has the necessary protective housing and scanning safeguards to ensure that laser radiation is inaccessible during operation or is within Class I limits. External safety agencies have reviewed the library and have obtained approvals to the latest standards as they apply.

Performing the Safety Inspection Procedure

Before you service the unit, perform the following safety inspection procedure:

1. Stop all activity between the host and the library's tape drive.
2. Turn off the power to the library by switching the Power button on the rear of the tape library to the Off position.
3. Disconnect the tape drive's SAS cable.
4. Unplug the library's power cord from the electrical outlet and the library's power supply unit.
5. Check the library's power cords for damage, such as a pinched, cut, or frayed cord.
6. Check the tape drive's SAS cable for damage.
7. Check the cover of the library for sharp edges, damage, or alterations that expose its internal parts.
8. Check the cover of the library for proper fit. It should be in place and secure.
9. Check the product label at the rear of the library to make sure it matches the voltage at your outlet.

Rack Safety

The following general safety information should be used for all rack mounted devices.

DANGER

> - **Always lower the leveling pads on the rack cabinet.**
> - **Always install stabilizer brackets on the rack cabinet.**
> - **To avoid hazardous conditions due to uneven mechanical loading, always install the heaviest devices in the bottom of the rack cabinet. Always install servers and optional devices starting from the bottom of the rack cabinet.**
> - **Rack mounted devices are not to be used as a shelf or work space. Do not place any object on top of rack mounted devices.**
> - **Each rack cabinet might have more than one power cord. Be sure to disconnect all power cords in the rack cabinet before servicing any device in the rack cabinet.**
> - **Connect all devices installed in a rack cabinet to power devices installed in the same rack cabinet. Do not plug a power cord from a device installed in one rack cabinet into a power device installed in a different rack cabinet.**
> - **An electrical outlet that is not correctly wired could place hazardous voltage on the metal parts of the system or the devices that attach to the system. It is the responsibility of the customer to ensure that the outlet is correctly wired and grounded to prevent an electrical shock.**

CAUTION:
- **Do not install a unit in a rack where the internal rack ambient temperatures will exceed the manufacturer's recommended ambient temperature for all your rack mounted devices.**
- **Do not install a unit in a rack where the air flow is compromised. Ensure that air flow is not blocked or reduced on any side of the unit.**
- **Consideration should be given to the connection of the equipment to the supply circuit so that overloading of the circuits does not compromise the supply wiring or overcurrent protection. To provide the correct power connection to a rack, refer to the rating labels located on the equipment in the rack to determine the total power requirement of the supply circuit.**
- *(For sliding drawers)* **Do not pull out or install any drawer or feature if the rack stabilizer brackets are not attached to the rack. Do not pull out more than one drawer at a time. The rack may become unstable if you pull out more than one drawer at a time.**
- *(For fixed drawers)* **This drawer is a fixed drawer and should not be moved for servicing unless specified by the manufacturer. Attempting to move the drawer partially or completely out of the rack may cause the rack to become unstable or cause the drawer to fall out of the rack.**

(R001)

CAUTION:

Removing components from the upper positions in the rack cabinet improves rack stability during relocation. Follow these general guidelines whenever you relocate a populated rack cabinet within a room or building:

- **Reduce the weight of the rack cabinet by removing equipment starting at the top of the rack cabinet. When possible, restore the rack cabinet to the configuration of the rack cabinet as you received it. If this configuration is not known, you must do the following:**
  - **Remove all devices in the 32U position and above.**
  - **Ensure that the heaviest devices are installed in the bottom of the rack cabinet.**
  - **Ensure that there are no empty U-levels between devices installed in the rack cabinet below the 32U level.**
- **If the rack cabinet you are relocating is part of a suite of rack cabinets, detach the rack cabinet from the suite.**
- **Inspect the route that you plan to take to eliminate potential hazards.**
- **Verify that the route that you choose can support the weight of the loaded rack cabinet. Refer to the documentation that comes with your rack cabinet for the weight of a loaded rack cabinet.**
- **Verify that all door openings are at least 762 x 2032 mm (30 x 80 in.).**
- **Ensure that all devices, shelves, drawers, doors, and cables are secure.**
- **Ensure that the four leveling pads are raised to their highest position.**
- **Ensure that there is no stabilizer bracket installed on the rack cabinet during movement.**
- **Do not use a ramp inclined at more than ten degrees.**
- **Once the rack cabinet is in the new location, do the following:**
  - **Lower the four leveling pads.**
  - **Install stabilizer brackets on the rack cabinet.**
  - **If you removed any devices from the rack cabinet, repopulate the rack cabinet from the lowest position to the highest position.**
- **If a long distance relocation is required, restore the rack cabinet to the configuration of the rack cabinet as you received it. Pack the rack cabinet in the original packaging material, or equivalent. Also lower the leveling pads to raise the casters off of the pallet and bolt the rack cabinet to the pallet.**

(R002)

Power Cords

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

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).

Product Recycling and Disposal

This unit must be recycled or discarded according to applicable local and national regulations. IBM encourages owners of information technology (IT) equipment to responsibly recycle their equipment when it is no longer needed. IBM offers a variety of product return programs and services in several countries to assist equipment owners in recycling their IT products. Information on IBM product recycling offerings can be found on IBM's Internet site at `http://www.ibm.com/ibm/recycle/us/index.shtml` and `http://www.ibm.com/ibm/environment/products/index.shtml`.

Esta unidad debe reciclarse o desecharse de acuerdo con lo establecido en la normativa nacional o local aplicable. IBM recomienda a los propietarios de equipos de tecnología de la información (TI) que reciclen responsablemente sus equipos cuando éstos ya no les sean útiles. IBM dispone de una serie de programas y servicios de devolución de productos en varios países, a fin de ayudar a los propietarios de equipos a reciclar sus productos de TI. Se puede encontrar información sobre las ofertas de reciclado de productos de IBM en el sitio web de IBM `http://www.ibm.com/ibm/environment/products/index.shtml`.
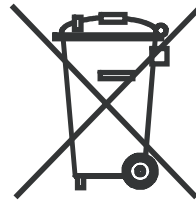
Notice: This mark applies only to countries within the European Union (EU) and Norway.

Appliances are labeled in accordance with European Directive 2002/96/EC concerning waste electrical and electronic equipment (WEEE). The Directive determines the framework for the return and recycling of used appliances as applicable throughout the European Union. This label is applied to various products to indicate that the product is not to be thrown away, but rather reclaimed upon end of life per this Directive.

Remarque: Cette marque s'applique uniquement aux pays de l'Union Européenne et à la Norvège.

L'etiquette du système respecte la Directive européenne 2002/96/EC en matière de Déchets des Equipements Electriques et Electroniques (DEEE), qui détermine les dispositions de retour et de recyclage applicables aux systèmes utilisés à travers l'Union européenne. Conformément à la directive, ladite étiquette précise que le produit sur lequel elle est apposée ne doit pas être jeté mais être récupéré en fin de vie.

注意: このマークは EU 諸国およびノルウェーにおいてのみ適用されます。

この機器には、EU 諸国に対する廃電気電子機器指令 2002/96/EC(WEEE) のラベルが貼られています。この指令は、EU 諸国に適用する使用済み機器の回収とリサイクルの骨子を定めています。このラベルは、使用済みになった時に指令に従って適正な処理をする必要があることを知らせるために種々の製品に貼られています。

In accordance with the European WEEE Directive, electrical and electronic equipment (EEE) is to be collected separately and to be reused, recycled, or recovered at end of life. Users of EEE with the WEEE marking per Annex IV of the WEEE Directive, as shown above, must not dispose of end of life EEE as unsorted municipal waste, but use the collection framework available to customers for the return, recycling and recovery of WEEE. Customer participation is important to minimize any potential effects of EEE on the environment and human health due to the potential presence of hazardous substances in EEE. For proper collection and treatment, contact your local IBM representative.

Battery Return Program

This product may contain sealed lead acid, nickel cadmium, nickel metal hydride, lithium, or a lithium ion battery. Consult your user manual or service manual for specific battery information. The battery must be recycled or disposed of properly. Recycling facilities may not be available in your area. For information on disposal of batteries outside the United States, go to `http://www.ibm.com/ibm/environment/products/index.shtml` or contact your local waste disposal facility.

In the United States, IBM has established a return process for reuse, recycling, or proper disposal of used IBM sealed lead acid, nickel cadmium, nickel metal hydride, and other battery packs from IBM Equipment. For information on proper disposal of these batteries, contact IBM at 1-800-426-4333. Please have the IBM part number listed on the battery available prior to your call.

For the European Union:
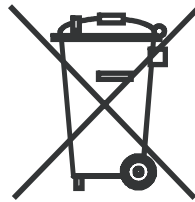
Notice: This mark applies only to countries within the European Union (EU) and Norway.

For Taiwan:

Please recycle batteries.

廢電池請回收

Batteries or packaging for batteries are labeled in accordance with European Directive 2006/66/EC concerning batteries and accumulators and waste batteries and accumulators. The Directive determines the framework for the return and recycling of used batteries and accumulators as applicable throughout the European Union. This label is applied to various batteries to indicate that the battery is not to be thrown away, but rather reclaimed upon end of life per this Directive.

Les batteries ou emballages pour batteries sont étiquetés conformémentaux directives européennes 2006/66/EC, norme relative aux batteries et accumulateurs en usage et aux batteries et accumulateurs usés. Les directives déterminent la marche à suivre en vigueur dans l'Union Européenne pour le retour et le recyclage des batteries et accumulateurs usés. Cette étiquette est appliquée sur diverses batteries pour indiquer que la batterie ne doit pas être mise au rebut mais plutôt récupérée en fin de cycle de vie selon cette norme.

In accordance with the European Directive 2006/66/EC, batteries and accumulators are labeled to indicate that they are to be collected separately and recycled at end of life. The label on the battery may also include a chemical symbol for the metal concerned in the battery (Pb for lead, Hg for mercury, and Cd for cadmium). Users of batteries and accumulators must not dispose of batteries and accumulators as unsorted municipal waste, but use the collection framework available to customers for the return, recycling and treatment of batteries and accumulators. Customer participation is important to minimize any potential effects of batteries and accumulators on the environment and human health due to the potential presence of hazardous substances. For proper collection and treatment, contact your local IBM representative.

This notice is provided in accordance with Royal Decree 106/2008 of Spain:
The retail price of batteries, accumulators, and power cells includes the cost of the environmental management of their waste.

Perchlorate Material — California:
Special handling may apply. See `http://www.dtsc.ca.gov/hazardouswaste/perchlorate/` for more information.

The foregoing notice is provided in accordance with California Code of Regulations Title 22, Division 4.5 Chapter 33. Best Management Practices for Perchlorate Materials. This product, part, or both may include a lithium manganese dioxide battery which contains a perchlorate substance.

Preface

This manual contains information and instructions necessary for the setup, operation, and servicing of the IBM® System Storage™ TS2900 Tape Autoloader (Machine Type 3572).

Related Publications

Refer to the following publications for additional information. To ensure that you have the latest publications, visit the web at `http://www.ibm.com/storage/`.

- *IBM System Storage TS2900 Tape Autoloader Installation Quick Reference* (GA76-0423) provides hardware installation instructions.
- *IBM System Storage TS2900 Tape Autoloader SCSI Reference* (GC27-2211) provides information on the SCSI commands supported by this library.
- *IBM Tape Device Driver 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. It also gives requirements for adapter cards, and tells how to configure hosts to use the device driver. All of the above are with the Ultrium family of devices.
- *IBM Tape Device Driver 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.
- *IBM TotalStorage LTO Ultrium Tape Drive SCSI Reference* (GA32-0450) provides SCSI supported commands and protocol governing the behavior of the SCSI interface.
- *IBM Encryption Key Manager component for the Java platform: Quick Start Guide* (GA76-0420) gets you started with a basic configuration for encryption on LTO 4 tape drives.*
- *IBM Encryption Key Manager component for the Java platform: Introduction, Planning and User's Guide* (GA76-0418) contains information to help you install, configure, and use the IBM Encryption Key Manager component for the Java platform.*

* This publication is not distributed in printed form. To get the latest version of this publication in PDF format, please visit `http://www.ibm.com/support/documentation/us/en`, enter "Encryption Key Manager" in the **Search across document types...** field, click the search icon, and scroll down to the publication title. You can also go to `http://www.elink.ibmlink.ibm.com/publications/servlet/pbi.wss?CTY+US/` and search for the publication form number or title.

Chapter 1. Product Description

Figure 1-1. TS2900 Tape Autoloader

The IBM System Storage TS2900 Tape Autoloader (Machine Type 3572) provides compact, high-capacity, low-cost solutions for simple, unattended data backup. The library has a compact 1U form factor with easy access to tape cartridges via a removable magazine. The TS2900 Tape Autoloader is an external stand-alone or rack-mountable unit that incorporates an IBM Ultrium 4 Half-High Tape Drive (Model S4H) or an IBM Ultrium 3 Half-High Tape Drive (Model S3H). It is equipped with a SAS (Serial Attached SCSI) host adapter attachment that has a data transfer rate of up to 3.0 Gbps.

The TS2900 Tape Autoloader has a 10-position removable cartridge magazine, providing a maximum of 9 data cartridge positions, or a maximum of 8 data cartridge positions with a configurable 1-slot I/O Station. One position is reserved as the tape drive exchange position and can be accessed by the library only. Tape cartridges supported in the TS2900 Tape Autoloader include the 800 GB native physical capacity

IBM LTO Ultrium Tape Cartridge (Ultrium 4), 400 GB Tape Cartridge (Ultrium 3), 200 GB Tape Cartridge (Ultrium 2), 100 GB Tape Cartridge (Ultrium 1), and WORM (Ultrium 4 and Ultrium 3). The library data storage capacity can be further increased using hardware compression.

Table 1-1. Data capacity and recording format

Type	Native Data Capacity	Recording Format
Ultrium 4	800 GB (1600 GB at 2:1 compression)	Reads and writes data on 896 tracks, sixteen tracks at a time.
Ultrium 3	400 GB (800 GB at 2:1 compression)	Reads and writes data on 704 tracks, sixteen tracks at a time.
Ultrium 2	200 GB (400 GB at 2:1 compression)	Reads and writes data on 512 tracks, eight tracks at a time.
Ultrium 1	100 GB (200 GB at 2:1 compression)	Reads and writes data on 384 tracks, eight tracks at a time.

Front Panel
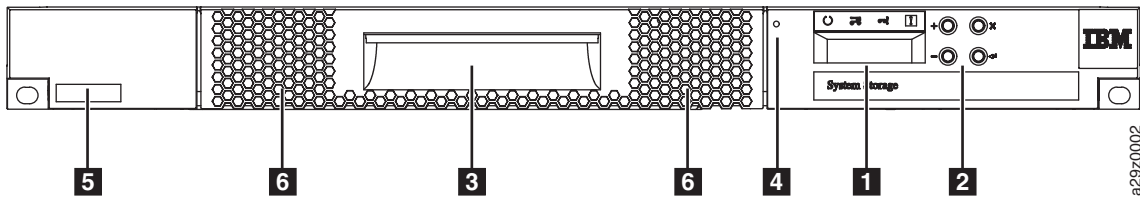
Figure 1-2. Front panel components

Table 1-2. Front panel component descriptions

Number	Component	Description
1	Operator Panel	The Operator Panel features a monochrome 16-character LCD graphic display located on the front of the library. Library operations and service functions are performed from this screen. The Web User Interface offers some of the same functionality as the Operator Panel using a web browser for remote access to the library. For more information on the Operator Panel and the Web User Interface, see Chapter 2, "User Interfaces," on page 2-1.
2	Control keys	The control keys are located to the right of the Operator Panel LCD display on the front of the library.
3	Cartridge magazine	The tape library has a single cartridge magazine that can hold up to 9 data cartridges, or 8 data cartridges with a 1-slot I/O Station. See Figure 1-3 on page 1-3. Column 5/Tier 1 in the cartridge magazine can be configured as a 1-slot I/O Station. Column 5/Tier 2 in the cartridge magazine is reserved for the exchange position and can be accessed by the library only. The I/O Station is used to import and export cartridges without interrupting normal library operation. Beginning with Column 4, a minimum of one column can be reserved for cleaning cartridges. Cleaning cartridges are used to clean the tape drive heads. For configuration details, see "Physical Library Settings" on page 3-19.

Table 1-2. Front panel component descriptions (continued)

Number	Component	Description
4	Cartridge magazine release	Emergency cartridge magazine lock release. When the I/O Station is locked, insert a large, straightened paper clip twice or hold the paper clip in place while sliding the cartridge magazine past the I/O Station lock.
5	Serial number label	The machine type and serial number of the library are located on the front bezel of the library. The serial number is the number that links the library to IBM entitlement for service.
6	Air vents	These vents draw cooler air into the library enclosure and allow warm air to escape which helps keep the library at a normal operating temperature.

Cartridge Magazine
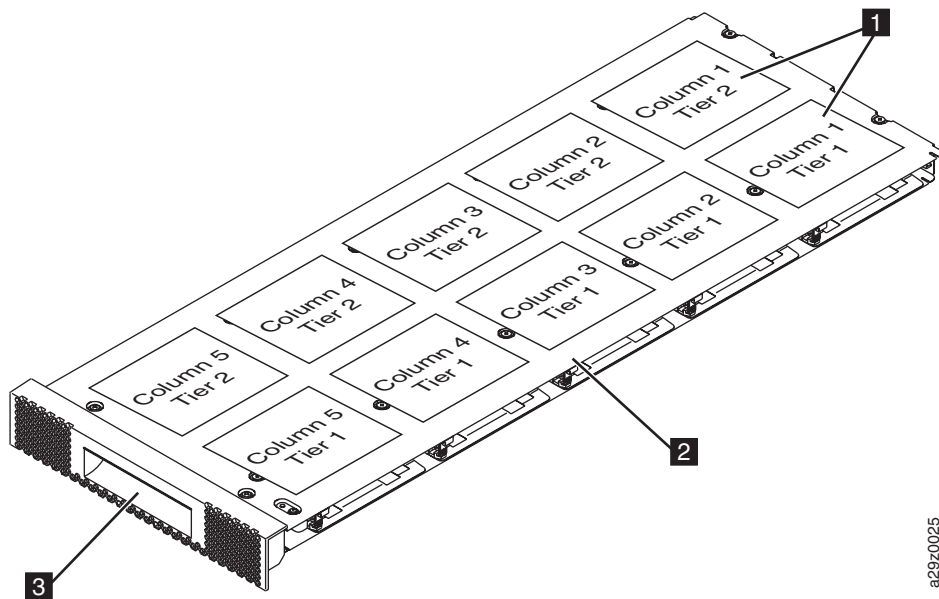
Figure 1-3. Cartridge magazine

1 Cartridge locations as they appear in the Library Map.
Note: These labels are for reference only and do not appear on the magazine.

2 Cartridge magazine

3 Magazine handle

Figure 1-4 shows the cartridge location label **1** and ruler **2** that appear on the cartridge magazine. The ruler provides an indication of the distance, when opening or withdrawing the magazine, to the end of the magazine before it clears the front edge of the library.
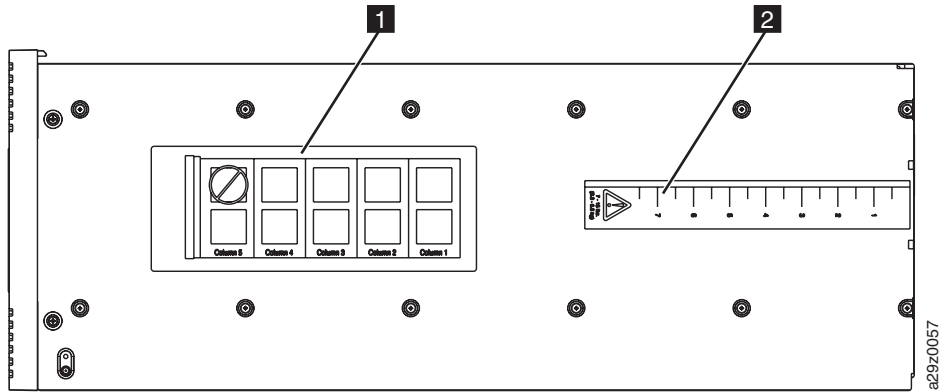
Figure 1-4. Cartridge magazine (top view)

Rear Panel
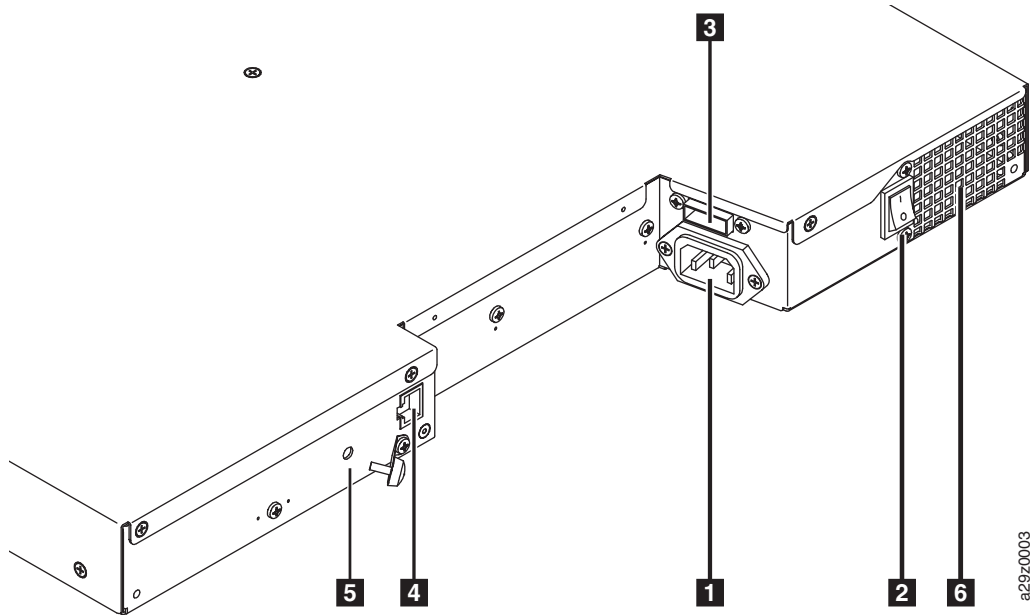
Figure 1-5. Rear panel components

Table 1-3. Rear panel component descriptions

Number	Component	Description
1	Power connector	The library connects to a 110/220 volt ac power supply.
2	Power switch	The library is powered ON when the power supply switch on the rear panel is ON (	); the library has no independent power switch on the front panel.
3	SAS host interface connector	Serial-attached SCSI host interface cable connection. The Ultrium 3 and Ultrium 4 SAS drives use the SFF-8088 connection at the drive end and SFF-8088 or SFF-8470 at the host adapter end.
4	Ethernet port	This port is used to connect the library to a network.

Table 1-3. Rear panel component descriptions (continued)

Number	Component	Description
5	Accessor locking screw	The Accessor locking screw is used to lock the accessor in place during transportation. Important: Remove the Accessor locking screw before powering ON the library.
6	Air vent	These vents allow air to escape from the power supply and tape drive sled.

Bar Code Reader

The bar code reader is an integral part of the library Accessor. The bar code reader reads each cartridge bar code label that identify the types of cartridge magazines and tape drive installed in the library and provides inventory feedback to the host application, Operator Panel, and Web User Interface. The library stores the customized inventory data in memory. Library firmware supports a 6 or 8-character volume serial number (VOLSER) on the bar code label on the tape cartridge.

SAS Host Interface

The Ultrium 3 and Ultrium 4 Half-High Tape Drives support the Serial Attached SCSI (SAS) interface. They both have one Mini-SAS (SFF-8088) connector, and can be connected to a Mini-SAS (SFF-8088) or SAS (SFF-8470) at the host adapter end with the appropriate cable.

A drive with a SAS (Serial Attached SCSI) interface can be linked directly to controllers. SAS is a performance improvement over traditional SCSI because SAS enables multiple devices (up to 128) of different sizes and types to be connected simultaneously with thinner and longer cables; its full-duplex signal transmission supports 3.0 Gb/s. In addition, the TS2900 Tape Autoloader can be hot-plugged. SAS drives will auto-negotiate speed.

Encryption

The LTO Ultrium 4 Tape Drive supports host Application Managed Encryption (AME), Library Managed Encryption (LME), and System Managed Encryption (SME). Data encryption is supported by the LTO Ultrium 4 Tape Drive (3572-S4H) only; the Ultrium 3 Tape Drive (3572-S3H) does not support encryption.

Note: Application Managed Encryption (AME) does not require a key. Library Managed Encryption (LME) and System Managed Encryption (SME) require a license key which is available by purchasing Feature Code 5901.

The encryption enabled drive contains the necessary hardware and firmware to encrypt and decrypt host tape application data.

The encryption-capable library firmware allows the user to select "None" or "Application Managed Encryption" from the Web User Interface. If a valid Transparent Encryption license key has been previously entered, "System Managed Encryption" or "Library Managed Encryption" can also be selected. The factory default is "None."

For more details, refer to the *IBM Encryption Key Manager Installation, Planning, and User's Guide*. See "Related Publications" on page xxi.

Supported Internet Protocols

The TS2900 Tape Autoloader supports the following Internet protocols:
- IPv4
- IPv6

To learn more about IPv4, visit `http://www.iana.org/`. To learn more about IPv6, visit `http://www.ipv6.org/`.

SNMP Messaging

Occasionally, the library may encounter a situation that you want to know about, such as an open magazine or a fault that causes the library to stop. The library provides a standard TCP/IP protocol called Simple Network Management Protocol (SNMP) to send alerts about conditions (such as need for operator intervention) over a TCP/IP LAN network to an SNMP monitoring station. These alerts are called SNMP traps. Using the information supplied in each SNMP trap, the monitoring station (together with customer-supplied software) can alert operations personnel of possible problems or operator interventions that occur.

SNMP Traps

SNMP Traps are alerts or status messages that can be collected, monitored and used to proactively manage attached libraries using SNMP protocol with the SNMP monitoring station(s). In summary, each trap provides the following information:

- **Product Identification** such as product name, description, manufacturer, model number, firmware level, and the URL that the trap is designated for.
- **Product Status** such as the severity of the trap, status (current and previous) and the time the trap occurred.
- **Library State** (physical device status) such as identification and status of devices that are monitored. In the case of the library, it would include enclosure, power supply, controller, magazine status, drive count, cartridge slot count, and I/O station count. Also included would be certain library statistics, and where appropriate, the fault FSC (fault symptom code) including the severity and description of that fault.
- **Drive Status** such as the identification of each drive in the library, firmware level, serial number and other address and status information.
- **Trap Definitions** such as library status change, open magazine, I/O accessed, hard fault information, drive cleaning requests, excessive retries and library returning to normal operations.
- **SNMP MIBs**: The library's Management Information Base (MIB) contains units of information that specifically describe an aspect of the system, such as the system name, hardware number or communications configuration. When using SNMP to monitor your TS2900 Tape Autoloader, make sure that the IBM TS2900 MIB file is loaded on your SNMP monitoring station. SNMP traps will be sent to the SNMP monitoring station(s) that are defined for your library (see "Configuring SNMP Trap Notifications" on page 4-27). Download the SNMP MIB file for this library from `http://www.ibm.com/storage/support`.

Network Time Protocol (NTP)

NTP is an Internet standard protocol that assures accurate synchronization of computer clock times in a network of computers. Running as a continuous background client program on a computer, NTP sends periodic time requests to a server, obtaining server time stamps, and using them to adjust the client's clock.

Ultrium Tape Drives

The TS2900 Tape Autoloader supports the Ultrium 3 (3572-3SH) and Ultrium 4 (3572-S4H) Half-High Tape Drives.

The Ultrium 3 and Ultrium 4 Half-High Tape Drives support the Serial Attached SCSI (SAS) interface. They both have one Mini-SAS (SFF-8088) connector.
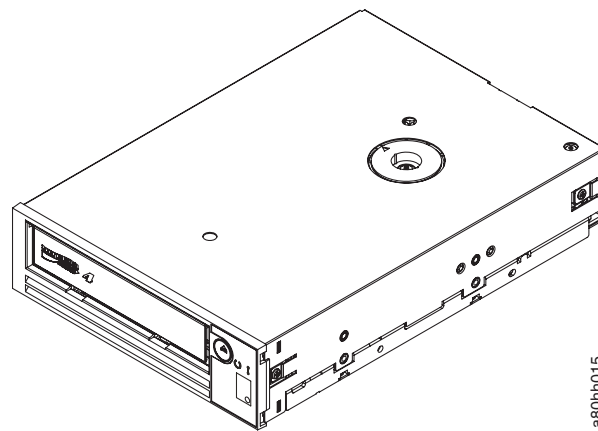
Figure 1-6. Ultrium Half-High Tape Drive

Speed Matching

To improve system performance, the Ultrium 3 and Ultrium 4 Tape Drives use a technique called speed matching to dynamically adjust its native (uncompressed) data rate to the slower data rate of the attached server.

Channel Calibration

The channel calibration feature of the Ultrium 3 and Ultrium 4 Tape Drives customizes each read/write data channel for optimum performance. The customization enables compensation for variations in the recording channel transfer function, media characteristics, and read/write head characteristics.

Power Management

The Ultrium 3 and Ultrium 4 Tape Drives feature a power management function that controls the drive's electronics so that part of the electronics completely turn OFF when circuit functions are not needed for the drive's operation.

Media

The TS2900 Tape Autoloader uses Ultrium Tape Cartridges that provide up to 800 GB native capacity (up to 1600 GB with 2:1 hardware data compression) for Ultrium 4 tape drives, and up to 400 GB native capacity (up to 800 GB with 2:1 hardware compression) for Ultrium 3 tape drives.

Table 1-4. Ultrium data and cleaning cartridge compatibility with Ultrium tape drive

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

Note: The TS2900 Tape Autoloader supports the Ultrium 3 (3572-3SH) and Ultrium 4 (3572-4SH) Tape Drives only.

For more detailed information, see Chapter 5, "Media," on page 5-1.

Logical Unit Number (LUN) Scanning

The TS2900 Tape Autoloader uses a single SCSI ID and dual LUNs to control the tape drive (LUN 0) and library accessor (LUN 1). The library requires a Host Bus Adapter (HBA) that supports LUN scanning. If it is not enabled, your host system will not scan beyond LUN 0 and will fail to detect the library. It will only see the tape drive.

Important: Some HBAs, such as RAID controllers, do not support LUN scanning.

Location Coordinates and Element Addresses

The TS2900 Tape Autoloader incorporates IBM's patented high-density (HD) slot technology, which allows multiple cartridges to be stored in a tiered architecture. The depth of a cartridge location in a high-density slot is known as a tier. High-density slots are designed to contain multiple cartridges in Tiers 1 and 2.

Note: Each column has a spring-loaded mechanism that pushes a tape cartridge into Tier 1 when it is the only cartridge in that column. A single cartridge in a column takes on the Tier 2 element address even though it is physically located in Tier 1.

```
Front                                                          Rear

  Reserved slot
  ┌ ─ ─ ─ ─ ┐  ┌─────────┐  ┌─────────┐  ┌─────────┐  ┌─────────┐
  │ Column 5 │  │ Column 4│  │ Column 3│  │ Column 2│  │ Column 1│
  │ Tier 2  │  │ Tier 2  │  │ Tier 2  │  │ Tier 2  │  │ Tier 2  │
  └ ─ ─ ─ ─ ┘  └─────────┘  └─────────┘  └─────────┘  └─────────┘

  ┌─────────┐  ┌─────────┐  ┌─────────┐  ┌─────────┐  ┌─────────┐  ┌───────┐
  │ Column 5│  │ Column 4│  │ Column 3│  │ Column 2│  │ Column 1│  │       │
  │ Tier 1  │  │ Tier 1  │  │ Tier 1  │  │ Tier 1  │  │ Tier 1  │  │ Drive │
  └─────────┘  └─────────┘  └─────────┘  └─────────┘  └─────────┘  └───────┘

                                    ┌──────────┐
                     ───────────────│ Accessor │───────────────
                                    └──────────┘
```
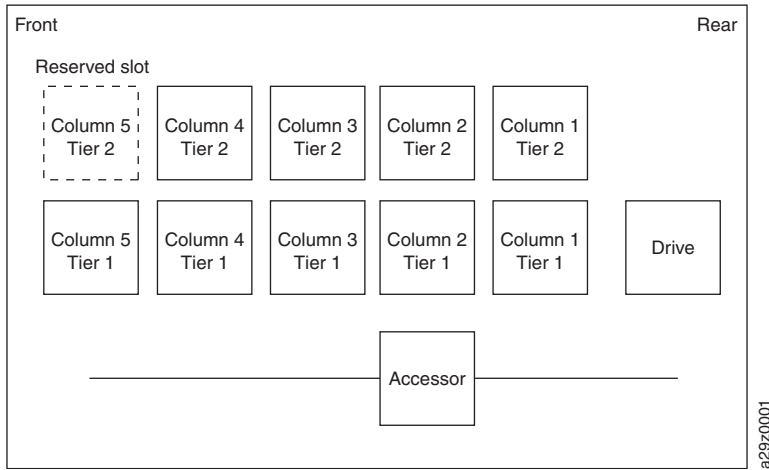
Figure 1-7. Location coordinates

A storage element address is assigned to each cartridge at the time the cartridge is inserted. Storage element addresses range from 4097 to 4105 (0x1001 to 0x1009) when the I/O Station is not enabled, and from 4097 to 4104 (0x1001 to 0x1008) when the I/O Station is enabled.

Library Specifications

Table 1-5. Physical specifications

Parameter	Measurement
Front panel width (chassis/bezel)	445 mm (17.52 in.)/483 mm (19.02 in.)
Depth	850 mm (33.46 in.)
Height	44 mm (1.73 in.)
Weight (library only)	13 kg (28.66 lbs)

Table 1-6. Electrical specifications

Parameter	Measurement
Voltage	100 to 240 Vac. (4.0 to 1.5 A)
Frequency	50 to 60 Hz
Power consumption	110 W

For additional information about installation specifications, see "Choosing a Location" on page 3-2.

Table 1-7. Environmental specifications

Parameter	Operating (see Note)	Storage	Shipping
Temperature	10 to 38 °C (50 to 100 °F)	1 to 60 °C (34 to 140 °F)	-40 to 60 °C (-40 to 140 °F)
Temperature variation	10 °C/hour (max)	10 °C/hour (max)	10 °C/hour (max)
Relative humidity	20 to 80%	10 to 90%	10 to 90%
Wet bulb temperature	26 °C (78.8 °F) max.	29 °C (84 °F) max.	29 °C (84 °F) max.

Table 1-7. Environmental specifications (continued)

Parameter	Operating (see Note)	Storage	Shipping
Altitude (meters)	0 to 2,500	0 to 2,500	0 to 2,500
Note: The operating environment of the library must not conflict with the media storage requirements. The library may be capable of operating at elevated temperatures for an extended period, however, the temperature could shorten the useful life of media that is stored in the library. If media is stored in the library for more than 10 hours, the storage temperature requirements for media should be met. It should be assumed that media stored in the library is approximately 2 degrees above ambient temperature when the library is powered ON.			

Table 1-8. Operational specifications

Parameter	Model S4H	Model 3SH
Maximum storage capacity	7.2 TB (14.4 TB with 2:1 compression)	
Maximum number of data cartridges	9 (including an optional I/O Station)	
Drive types	Ultrium 4 Half High	Ultrium 3 Half High
Sustained native data transfer rate	120 MB/s (240 MB/s with 2:1 compression)	60 MB/s (120 MB/s with 2:1 compression)
Interface	3 Gb/s SAS	

Table 1-9. Acoustical specifications

Parameter	Measurement
Idling acoustical noise sound power level LwAD in Bels (1 Bel = 10 dB)	6.6
Maximum acoustical noise sound power level LwAD in Bels (1 Bel = 10 dB)	6.8

Product Environment

The TS2900 Tape Autoloader is designed to operate in a general business environment.

The library meets the acoustical requirements for general business area category 2D. Category 2D states that the library should be installed a minimum of 4 m (13 ft.) from a permanent work station.

To allow for service access, install the library a minimum of 0.9 m (3 ft.) from all obstacles.

The library is a precision computer peripheral. To ensure maximum longevity of your library, locate the library away from dust, dirt, and airborne particulates:

- Keep the library away from high-traffic areas, especially if the floor is carpeted. Carpeting harbors dust and people walking on the carpet can cause the carpet fibers and the dust to become airborne.
- Keep the library out of printer/copier rooms because of toner and paper dust. Additionally, do not store paper supplies next to the library.
- Keep the library away from moving air caused by doorways, open windows, fans, and air conditioners.

Ensure that the machine covers are always kept closed to minimize any contamination from airborne particles.

Supported Servers, Operating Systems, and Software

The TS2900 Tape Autoloader is supported by a wide variety of servers (hosts), operating systems, and adapters. These attachments can change throughout the life cycle of the product.

To determine the latest supported attachments:
1. Visit the web at `http://www.ibm.com/`.
2. Point cursor at **Support & downloads**, then **Support by product**, then point and click **System storage**.
3. Select the appropriate **Interoperability** link.

Supported Device Drivers

IBM maintains the latest levels of device drivers and driver documentation for the library on the Internet. You can use one of the following procedures to access this material. **(Note: If you do not have Internet access and you need information about device drivers, contact your Marketing Representative.)**

- Using a browser, type one of the following:
  - `http://www.ibm.com/storage/lto`
  - `ftp://ftp.software.ibm.com/storage/devdrvr`

- Using File Transfer Protocol (FTP), enter the following specifications:
  - FTP site: `ftp.software.ibm.com`
  - IP Address: `207.25.253.26`
  - User ID: `anonymous`
  - Password: (use your current e-mail address)
  - Directory: `/storage/devdrvr`

IBM provides Portable Document Format (.pdf) and Postscript (.ps) versions of its device driver documentation in the `/storage/devdrvr/Doc` directory:
- IBM_Tape_IUG.pdf and IBM_Tape_IUG.ps contain the current version of the *IBM Tape Device Drivers Installation and User's Guide*.
- IBM_Tape_PROGREF.pdf and IBM_Tape_PROGREF.ps contain the current version of the *IBM Tape Device Drivers Programming Reference*.

A list of device drivers for each supported server appears at `/storage/devdrvr/`.

Note: The device driver for System i™ servers is included in the i5/OS® operating system.

Chapter 2. User Interfaces

The library has a local interface, the Operator Panel, and a remote Web User Interface (UI).

The Operator Panel is located on the front of the library and allows users to work locally on the library. The Web User Interface allows users and administrators to view and perform some library functions from remote sites.

The Web User Interface is implemented as a Java Applet that runs in a web browser from any PC on the network. The Java Applet requires that Java 1.5.0 or higher be installed on your host computer for full functionality, and is best viewed using Internet Explorer 6.0 or higher. Internet Explorer 7.0 or higher is required for IPv6.

Operator Panel

The Operator Panel is located on the front bezel of the library. The Operator Panel displays library information and menu commands used to execute library management functions in response to the control keys located on the right of the LCD display.
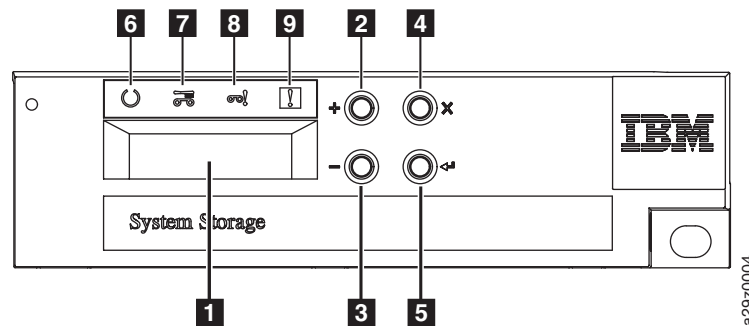
Figure 2-1. Operator Panel components

Table 2-1. Operator Panel component descriptions

Number	Component	Description
1	LCD display	16-character LCD graphic display
2	Plus key (+)	Button used to navigate upward (↑) through the menu items
3	Minus key (−)	Button used to navigate downward (↓) through the menu items
4	Cancel key (×)	Button used to cancel a user action and return to the last menu item
5	Enter key (↵)	Button used to display a submenu or to select a user action
6	Ready/Activity LED	Green LED lit when the unit is powered ON. The LED flashes when there is any library activity or the library is offline.

Table 2-1. Operator Panel component descriptions (continued)

Number	Component	Description
7	Clean Drive LED	Amber LED lit when the drive needs cleaning. The LED turns OFF after the drive is cleaned successfully.
8	Attention LED	Amber LED lit when a cartridge is bad, marginal, or invalid. The LED turns OFF when the media is removed from the drive. The LED may also be lit when there is a power supply problem.
9	Error LED	Amber LED lit when there is an unrecoverable library or drive failure. The corresponding error message appears on the LCD display.

The Operator Panel operates in two basic modes.
- **User Interaction mode** – Mode employed when a user is pushing keys on the Operator Panel.
- **System Driven mode** – Normal mode of operation where the Operator Panel displays status in response to commands issued from the drive's internal interface.

When an Operator Panel key is pressed and released, the Operator Panel automatically transitions to User Interaction mode. User Interaction mode will continue until 3 minutes after a user stops pushing keys, or the requested accessor action stops, whichever is longer, then the Operator Panel returns to System Driven mode.

If necessary, the Operator Panel will automatically transition to System Driven mode. When this occurs, the library remembers what the user was doing before the display mode changed.

Any operational conflict between commands received over the host interface or the Web User Interface and those entered via the Operator Panel are avoided with a reservation mechanism on a first-come, first-served basis. Operator Panel commands are canceled by an Operator Panel logout or timeout.

Library firmware will not allow a user to select an impossible request. Those situations will include, but are not limited to:
- Moving a cartridge from any source to a position occupied by another cartridge
- Moving a cartridge from an empty cartridge position
- Loading a cartridge from any source to a full drive
- Unloading a cartridge from an empty drive

Any error detected by the library or drive controller and not recoverable through predetermined firmware algorithms is considered fatal. When an error occurs, an error code is displayed on the Operator Panel display and the error LED is ON. The error code remains on the Operator Panel until a key is pressed, which causes the Operator Panel to return to the Home Screen. Numeric error codes are used for unrecoverable fatal errors, otherwise text status messages are displayed.

When the library powers ON or resets, it goes through several internally controlled initialization processes, called the Power-On-Self-Test (POST).

Front Panel LEDs

All LEDs are updated during power ON and reset sequences. At power ON or software reset, all LEDs turn ON as soon as POST allows. When initialization starts, all LEDs turn OFF and the Ready/Activity LED flashes at a rate of approximately two

seconds per cycle. When the mechanical initialization is complete, the Ready/Activity LED stops flashing and turns ON.

If a library failure occurs, the Ready/Activity LED turns OFF and the Error LED turns ON. The Operator Panel also displays an appropriate error code to help identify the failure.

The following are additional operational details of LEDs:
- The **Ready/Activity LED** (**6** in Figure 2-1 on page 2-1) turns ON any time the unit is powered ON and functional. The Ready/Activity LED flashes whenever there is library or drive activity. This LED also flashes when the library is offline.
- The **Clean Drive LED** (**7** in Figure 2-1 on page 2-1) turns ON when a "cleaning required" command is issued by the drive. The LED turns OFF after a successful drive cleaning operation.
- The **Attention LED** (**8** in Figure 2-1 on page 2-1) turns ON to indicate that there is a piece of media which is bad/marginal, or invalid. The LED turns OFF when all marginal and invalid cartridges have been exported from the library. The Attention LED also turns ON if Autoclean is enabled and no cleaning cartridge is in a cleaning position.
- The **Error LED** (**9** in Figure 2-1 on page 2-1) turns ON when there is an unrecoverable drive or library failure. An error message is displayed on the screen and the LED remains ON until the error state is resolved.

For more information, see "Interpreting Front Panel LEDs" on page 6-8.

Input Modes

There are several ways to enter values in the different menu items. These values are selectable predefined values, toggle values (for example, ON/OFF) and numerical values like network addresses.

Selecting Predefined Values
1. To set the predefined values, press the Enter key to select the menu item.
2. Using the Plus and Minus keys, select one of the various predefined values for that item.
3. As soon as the Operator Panel display shows the correct value, press the Enter key to apply the value.

Toggling Values
Toggle values are used to switch between two different states like ON and OFF.
1. After navigating to the menu item, press the Enter key to select the menu item.
2. Using the Plus and Minus keys, select one of the various predefined states for that item.
3. Press the Enter key to apply the new state.

Entering Numerical Values
Numerical values are needed for network addresses, password entries and other configuration entries.
1. After navigating to the menu item, the current value is displayed and the cursor highlights the first digit of the value that can be changed.
2. For each digit to be changed in the value:
   a. Use the Plus and Minus keys to increment/decrement the digit.

b. Press the Enter key to highlight the next editable digit.

3. Press the Enter key at the last digit to apply the complete entry, or press the Cancel key to cancel the whole edit process and maintain the original value.

Logging in

At power ON or software reset, the library ready screen appears when POST initialization completes successfully.

```
Push ENTER Key
     to Login
```

Figure 2-2. Library ready screen

To log in to the Operator Panel, press the Enter key. The password entry screen appears.

```
Input Password
       0***
```
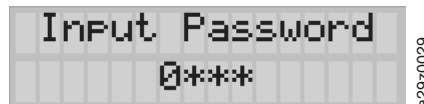
Figure 2-3. Password entry screen

Press the UP and DOWN arrow keys to change the current digit. Press the Enter key to advance to the next digit. The default password is **0000**. Once you have logged in, you can change the password using the **Change Login Password** command. See "Configuring Operator Panel Settings" on page 4-11.

Screen Elements

```
COMMANDS         ↑
1                2
```

```
ENABLE           *
I/O STATION      ↓    3
```
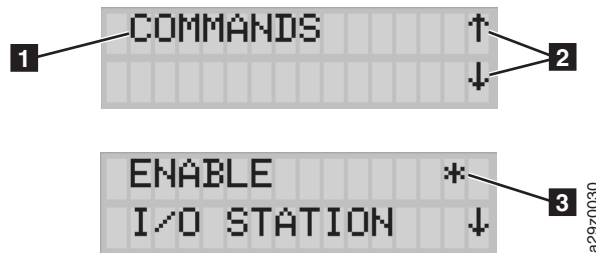
Figure 2-4. Screen elements

The Operator Panel display a single menu item (**1** in Figure 2-4) on each screen. The existence of other menu items above and below the currently displayed item is indicated by the arrows (**2** in Figure 2-4) on the right side of the screen.

In the Configuration menu, the current configuration setting is indicated by an asterisk (**3** in Figure 2-4) on the right side of the screen. For example, in Figure 2-4, the I/O Station is currently enabled. When changing a configuration setting, the confirmation screen in Figure 2-5 appears. Press the Enter key to confirm, or Cancel to return to the previous screen.

Figure 2-5. Confirmation screen

Web User Interface

The Web User Interface Java Applet requires Java 1.5.0 or higher be installed on your host computer for full functionality, and is best viewed using Internet Explorer 6.0 or higher. Internet Explorer 7.0 or higher is required for IPv6. If your computer does not have Java installed or you need to upgrade your installation, download the latest version of the Java Runtime Environment (JRE) for your platform from `http://www.java.com/` and follow the instructions provided to enable and configure the Java Runtime Environment for your browser.

The Web User Interface can also be used to update the library and drive firmware, and to download error logs, drive dumps, and other library data from the library.

Before the TS2900 Tape Autoloader can be managed over a network using the Web User Interface, you must set up the initial network configuration of the library using the Operator Panel. For more information, see "Configuring Network Settings" on page 3-29.

Logging in

To log in to the Web User Interface from Internet Explorer, you need to enter the IP address of the library. The IP address can be obtained using the **View Settings** command from the Operator Panel. For example, `http://192.168.1.1`

When the applet launches, the following warning message appears. This message is normal and **does not** indicate a problem.

Figure 2-6. Java security warning message

You can click the **Always trust content from this publisher** check box to avoid the warning message in subsequent browser sessions.

After launching the Web User Interface, the login window is displayed.

Figure 2-7. Login window

The factory default account login and password for an Administrator account is:
- Account: **admin**
- Password: **secure**

The account name and password are case sensitive. After entering your account name and password, use your mouse to click Login or press the Enter key.

For information on account privileges, see "User Privileges" on page 2-8.

Common Header Elements

All Web User Interface windows (except for the Login screen) contain the following common elements in the header:
- **Help** — Click to read context-sensitive help for the associated page.
- **Logoff** — Click to log out of the Web User Interface.

Menus Available from the Web User Interface

Figure 2-8 shows the Web User Interface window for a User account, Figure 2-9 shows the window for a Superuser account, and Figure 2-10 shows the window for an Administrator account.

Figure 2-8. User account window

Figure 2-9. Superuser account window

Figure 2-10. Administrator account window

For a complete description of all Web User Interface menu options, see Chapter 4, "Operations," on page 4-1.

User Privileges

User privilege levels are manually assigned to user accounts created within the library. Controlling access to screens and operations within the library preserves the integrity of the library and the data that is stored within the library.

There are three types of user privileges in the library.
- **Users** are allowed to monitor the library, but not perform actions that affect the physical library.
- **Superusers** are allowed to operate the physical and logical library, but not perform actions that affect the library configuration.
- **Administrator** users are allowed access to the entire physical library and logical library, including configuration. One and only one administrator user must be assigned the login name **admin**.

User privileges include:
- Multiple users can be logged in at one time on the Web User Interface.
- Any user can be logged in to only one interface at a time.

For a comparison of user privileges, see "User Privilege Comparison" on page A-3.

Chapter 3. Installation and Configuration

To install and configure a desktop or rack-mounted TS2900 Tape Autoloader, perform the procedures in this chapter in the order they are presented.

Verifying the Shipment

Verify that the following items are included in the library shipment:
- Power cord
- *IBM Translated Safety Notices*
- Safety notices pointer sheet (pointing to the CD-ROM)
- Quick Reference
- Setup, Operator, and Service guide CD-ROM
- Warranty information
- Device driver pointer sheet (pointing to the Internet)
- Quality Hotline card
- Rack mount kit or Deskside kit
- SAS wrap tool
- Optional transparent LTO encryption information

The following additional items are required for installation and library operation:

- SAS cable
- Data cartridges
- Cleaning cartridge
- Ethernet cable

Important: If any of the contents of your shipment are damaged or missing, please call the appropriate number listed on the Quality Hotline card.

Choosing a Location

Choose a location that meets the following criteria:

Table 3-1. Location criteria

Criteria	Definition
Room temperature	16 to 32 °C (60 to 90 °F)
Voltage	100 to 240 Vac. (4.0 to 1.5 A)
	Note that the power switch is located on the rear of the library and must be easily accessible at all times.
Frequency	50 to 60 Hz
Relative humidity	20 to 80% non-condensing
Air quality	The library should be placed in an area with minimal sources of particulate contamination. Avoid areas near frequently used doors and walkways, stacks of supplies that collect dust, printers, and smoke-filled rooms. Excessive dust and debris can damage cartridges and the tape drive.
Clearance	• Back: Minimum of 15 cm (6 in.)
	• Front: Minimum of 30 cm (12 in.)
	• Sides: Minimum of 5 cm (2 in.)
Rack requirements	Standard EIA 19-inch rack: 1U space

Installing the Deskside Cover

A deskside cover and six feet must be installed on the library chassis before the library can be used as a desktop unit. If you intend to install the library in a rack, skip this step and proceed to "Installing in a Rack" on page 3-5.

Table 3-2 lists the parts in the deskside assembly kit. A Phillips head screwdriver (preferably with a magnetic head) will be needed to assemble the deskside kit.

Table 3-2. Deskside kit
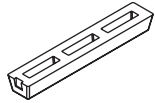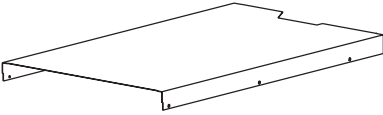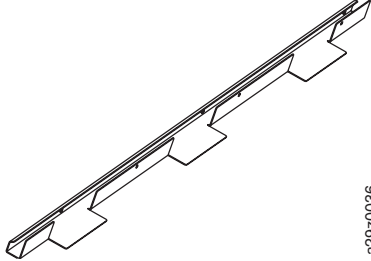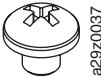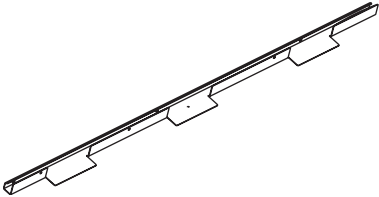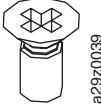
Number	Part Number	Quantity	Description	Part
1	45E3240	6	1U desktop foot	a29z0034

Table 3-2. Deskside kit (continued)

Number	Part Number	Quantity	Description	Part
2	45E3798	1	Deskside cover	a29z0035
3	45E3799	1	Bracket, 1U library right rail	a29z0036
4	45E3749	2	Screw, cross-recessed binding head, M4x4 (for securing the rear of the cover to the library)	a29z0037
5	45E3801	1	Bracket, 1U library left rail	a29z0038
6	45E3802	12	Screw, cross-recessed flat head, M3x6 (6 for securing left and right rails to library; 6 for securing sides of cover to library)	a29z0039

To install the deskside cover on your library:

1. Verify that your deskside kit includes all the necessary contents. See Table 3-2.
2. Attach the left **5** and right **3** rails to the chassis using 3 flat-head screws **6** on each side (Figure 3-1).
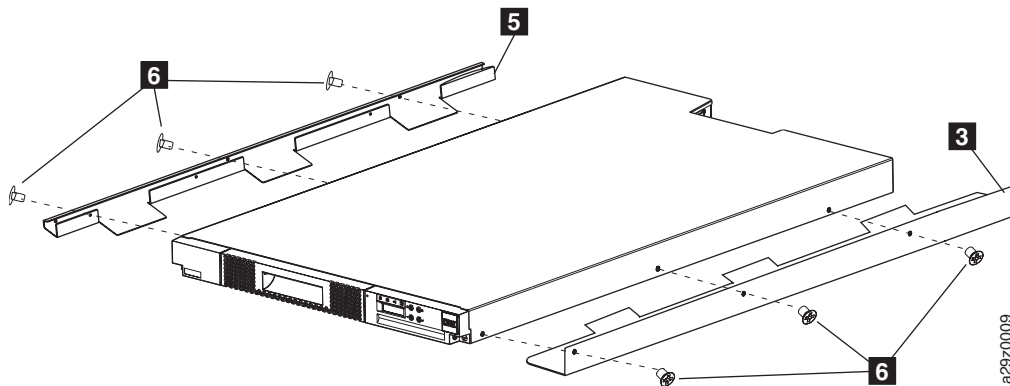
Figure 3-1. Attaching side rails to the library chassis

3. Turn the library over and attach the feet **1** to the designated locations on the bottom of the library (Figure 3-2). Return the library to the upright position.
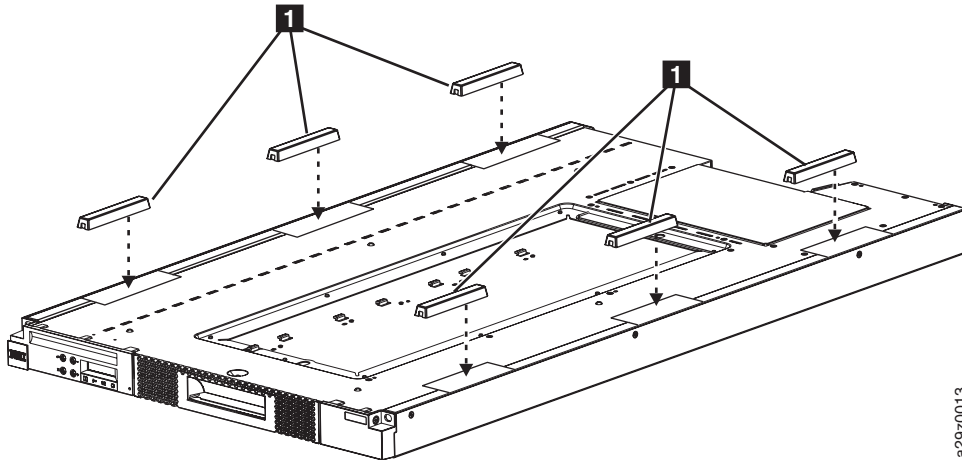
Figure 3-2. Attaching the feet

4. Position the deskside cover **2** in the correct orientation over the library chassis and attach the cover to the library using 3 flat-head screws **6** on each side (Figure 3-3).
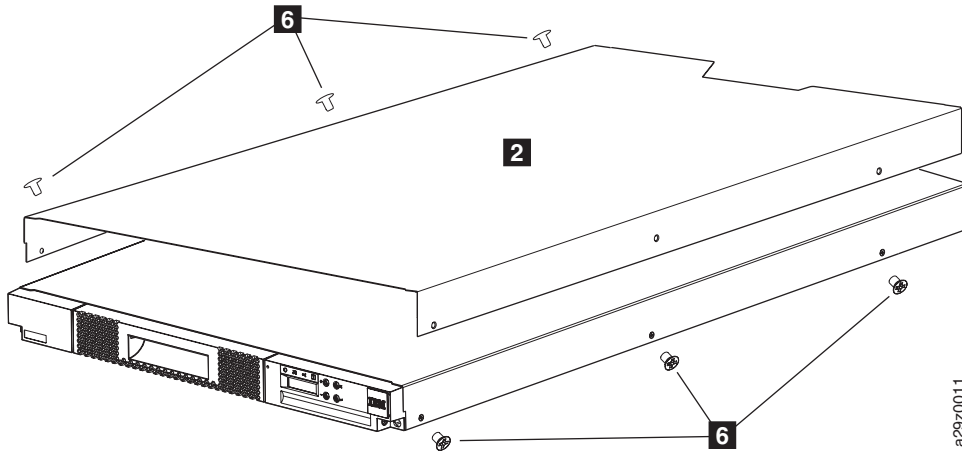
Figure 3-3. Attaching the cover to the library chassis (side screws)

5. Attach the deskside cover using the 2 large binding-head screws **4** on the rear of the library (Figure 3-4).
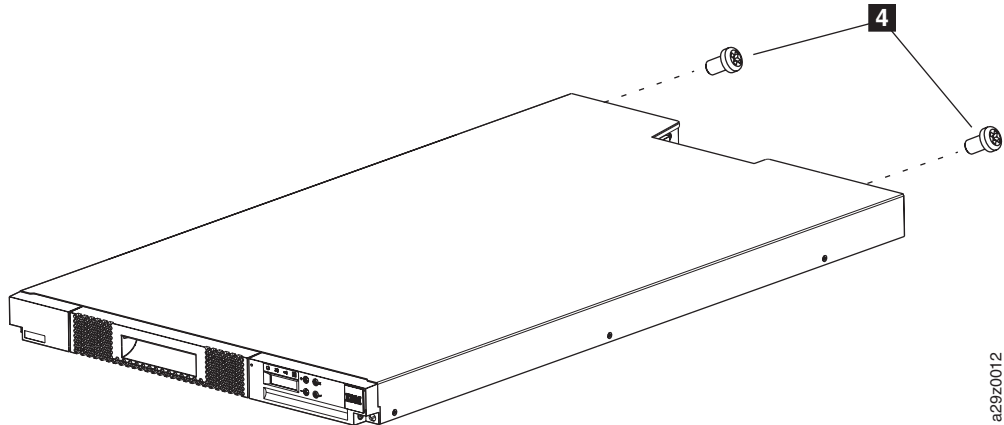
Figure 3-4. Attaching the cover to the library chassis (rear screws)

6. Place the library in the desired desktop location.

Important: Do not place the library on its side. Do not stack objects on top of the library.

Installing in a Rack

The TS2900 Tape Autoloader can be easily installed into a standard 19-inch rack system. A standard 19-inch rack system contains multiple mounting locations called EIA units as defined by the Electronics Industries Association. Each EIA unit contains three square or round holes used to mount rack designed equipment. The library requires 1 EIA unit (1U) of rack space. Each unit is separated by a small space.

Table 3-3 lists the parts in the rack mount assembly kit. A Phillips head screwdriver (preferably with a magnetic head) will be needed to assemble the rack mount kit.

Table 3-3. Rack mount assembly kit
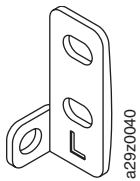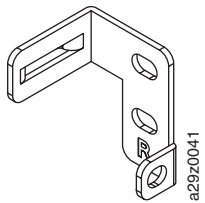
Number	Part Number	Quantity	Description	Part
1	45E3741	1	Left rear bracket	
2	45E3742	1	Right rear bracket	

Table 3-3. Rack mount assembly kit (continued)
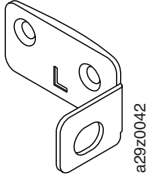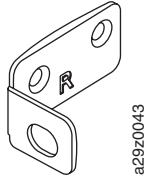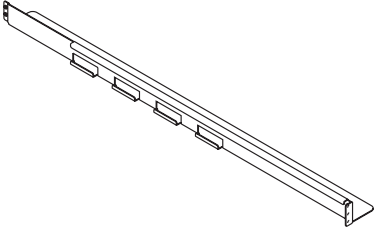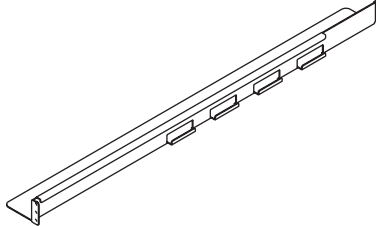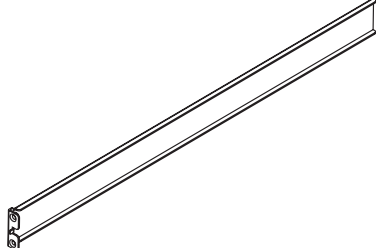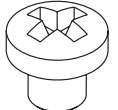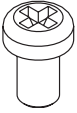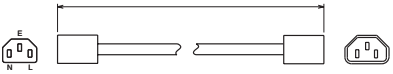
Number	Part Number	Quantity	Description	Part
3	45E3743	1	Left front bracket	a29z0042
4	45E3744	1	Right front bracket	a29z0043
5	45E3745	1	Left front rail	a29z0044
6	45E3746	1	Right front rail	a29z0045
7	45E3747	2	Rear rail	a29z0046
8	45E5909	4	Screw, cross-recessed flat head, M3x4	a29z0047
9	45E3748	8	Screw, flat head, self locking, M6x10	a29z0048
10	45E3749	6	Screw, cross-recessed binding head	a29z0049

Table 3-3. Rack mount assembly kit (continued)

Number	Part Number	Quantity	Description	Part
11	45E3867	2	Screw, cross-recessed pan head, M6x10	a29z0050
12	07H6655	1	Hook and loop fastener strap	a29z0051
13	39M5378	1	Rack device to PDU line cord	a29z0058

When deciding on a location in your rack for the library, remember that the Operator Panel has a small LCD screen and should be positioned to allow for easy viewing. The rear of the library should be free from any obstructions to allow easy access to the power switch and other rear panel components.

Note: Before beginning the rack installation of the library, read the safety information in "Rack Safety" on page xv. Also, verify that no feet are attached to the bottom of the library.

The library requires 1U rack space in an EIA standard sized rack. One unit (1U) of vertical rack space is equal to 4.45 cm (1.75 in), and contains three holes with equidistant centers of 1.59 cm (0.625 in.). The boundary between each 1U rack space is identified by two holes separated by only 1.27 cm (0.5 in.).

To install the library in a rack:
1. Verify that your rack kit includes all the necessary contents. See Table 3-3.
2. Determine the location in your rack for your library to be installed and, using a pencil, mark the location on the front vertical rails (Figure 3-5) and rear vertical rails (Figure 3-6) in your rack.
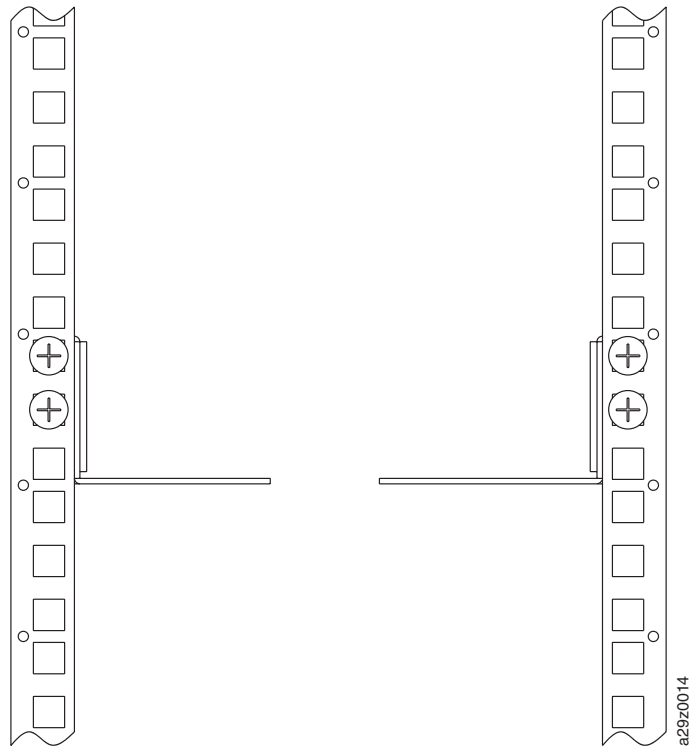
Figure 3-5. Rack mount screw locations for front vertical rails
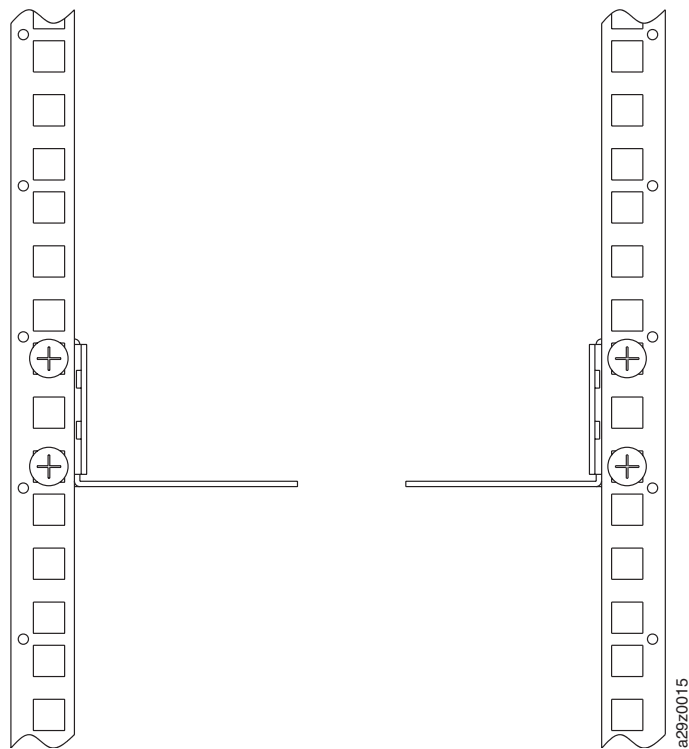
Figure 3-6. Rack mount screw locations for rear vertical rails

3. Attach the left **3** and right **4** (Figure 3-7) front brackets to the front of the library chassis using two flat-head screws **8** on each side. Use the **bottom** two screw holes on each side.
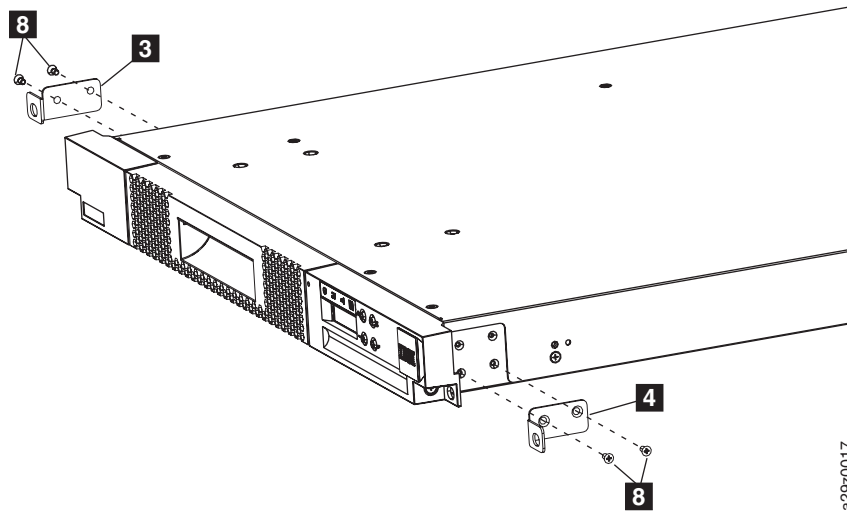
Figure 3-7. Attaching the front brackets to the library chassis

4. Attach the left **1** and right **2** rear brackets to the left **5** and right **6** front rails using two round-head screws **10** on each side (Figure 3-8).

    Note: Run the hook and loop fastener strap **12** through the slot on the right rear bracket and attach it back upon itself.
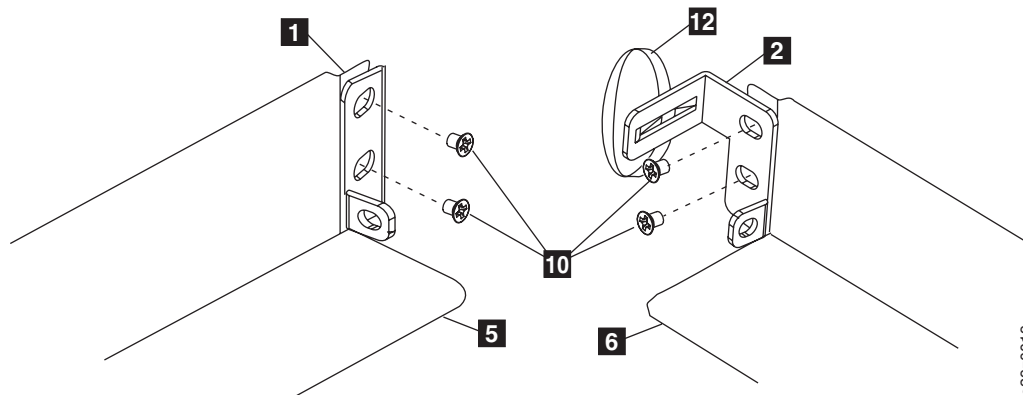
Figure 3-8. Attaching the rear brackets to the rails

Important: Do NOT tighten these screws completely at this time.

5. Slide in the rear rails **7** from back to front, to create the rail assemblies. Ensure the screw holes face outwards (Figure 3-9).
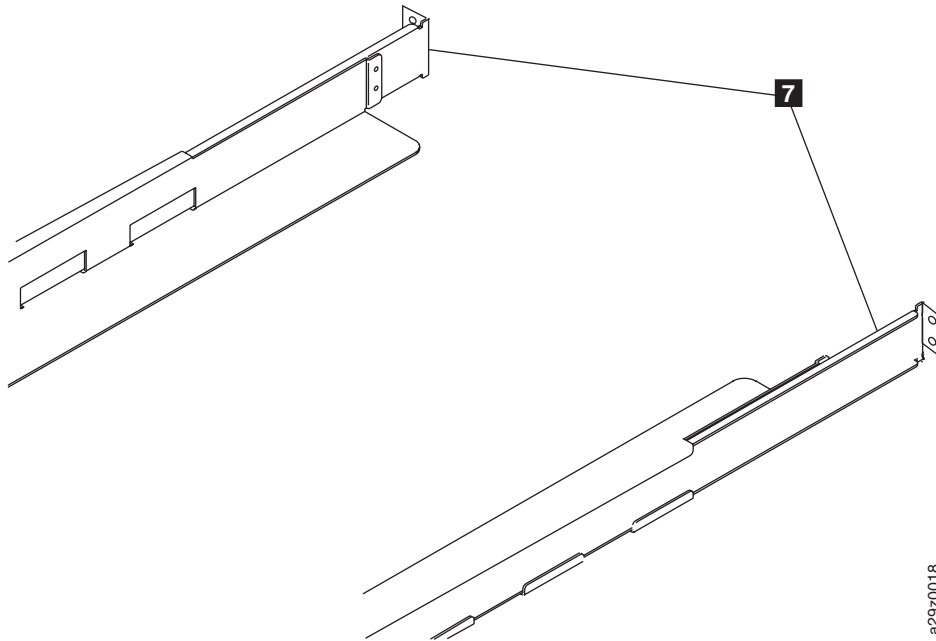
Figure 3-9. Creating the rail assemblies

6. Install the rail assemblies into the rack (Figure 3-10). Ensure the three holes in the front of the unit align with the 1U space marked on the vertical rails in Step 2. Secure the rails to the rack using four flat-head screws **9** on each side of the rack. Use both of the two screw locations on the rear of the rack rail (Figure 3-6). Use the **top** and **middle** screw locations on the front of the rack rail (Figure 3-5).
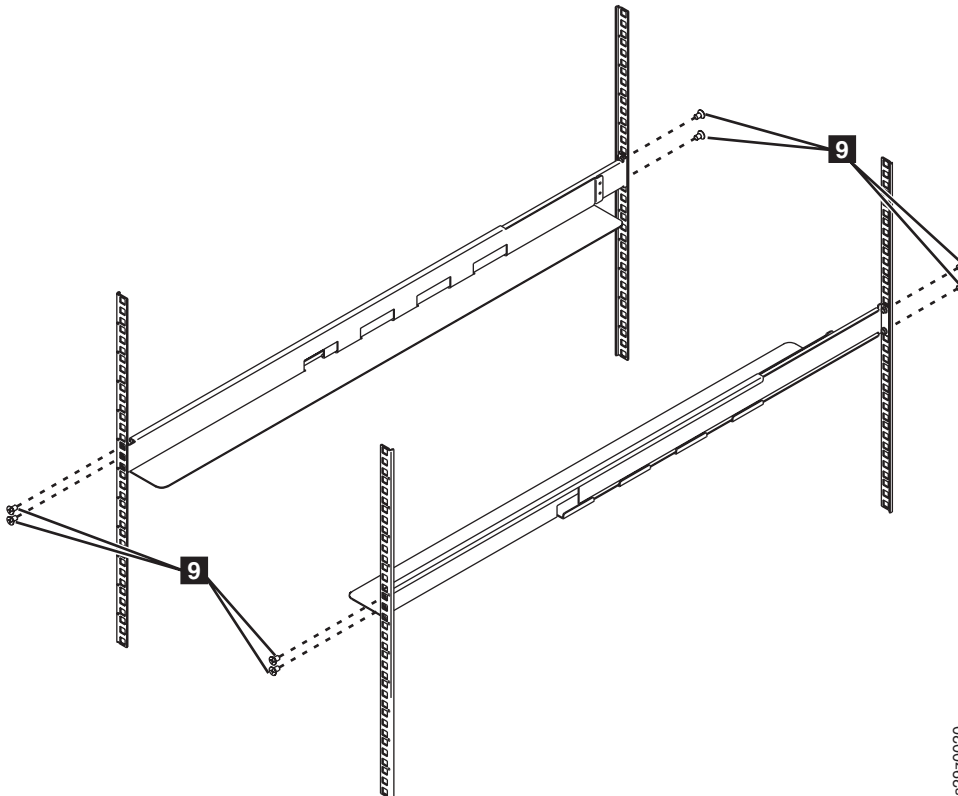
Figure 3-10. Installing the rail assemblies

7. Slide the library chassis into the rack. Secure the front of the library to the rack using the large black screws **11** in the bottom holes on each front bracket (Figure 3-11).
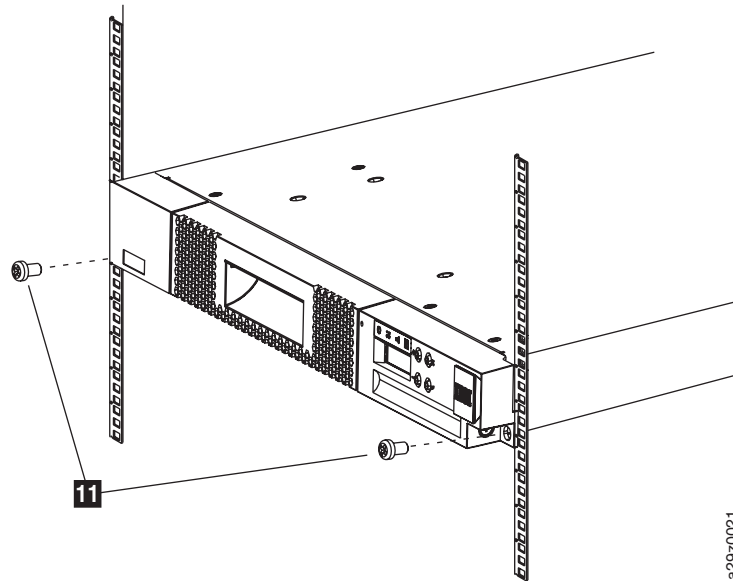
Figure 3-11. Securing the front of the library in the rack

8. Secure the rear of the library to the rack using a round-head screw **10** on each rear bracket (Figure 3-12). Tighten the other rear bracket screws to secure the library to the rack.
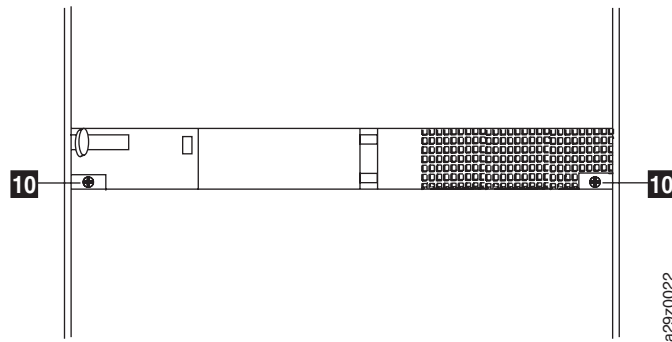
Figure 3-12. Securing the rear of the library in the rack

9. Run the SAS cable, power cable, and Ethernet cable through the hook and loop fastener strap **12**, leaving enough slack to reach the corresponding connectors, then tighten the strap (Figure 3-13).
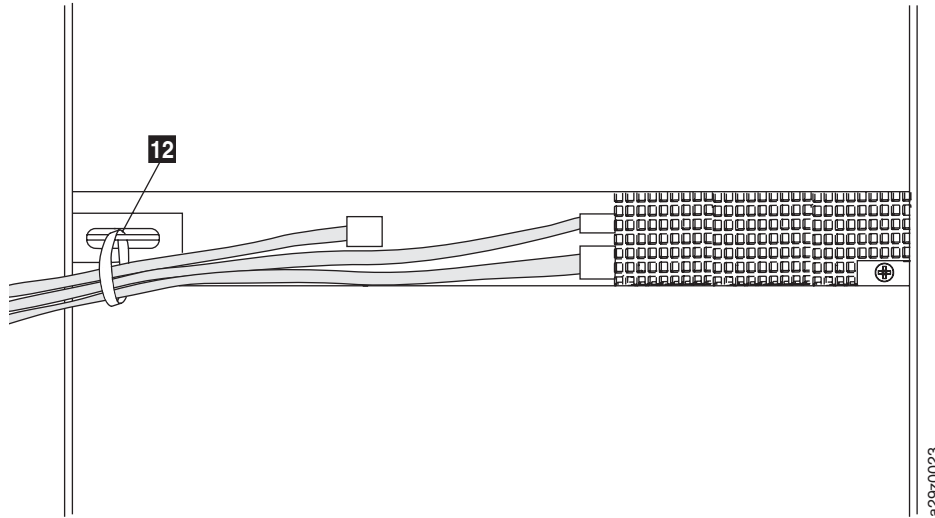
Figure 3-13. The cables at the rear of the library

> **Note:** For information about converting and relocating the library, see Chapter 8, "Removal and Replacement Procedures," on page 8-1.

Removing the Accessor Locking Screw

> **Important:** The Accessor locking screw prevents the library Accessor from moving during shipment and **must be removed before the library is powered ON**.

To remove the Accessor locking screw, unscrew the Accessor locking screw (**1** in Figure 3-14) that is attached to a label and is fastened in place on the rear panel of the library.
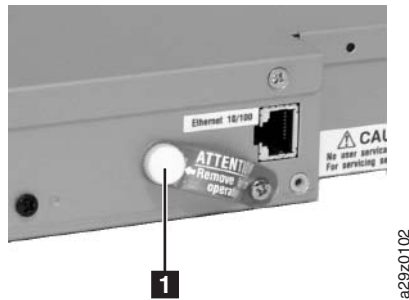
Figure 3-14. Accessor locking screw

Attaching the Library to a Server

The drive is attached to a server using the Serial Attached SCSI (SAS) interface and the Web User Interface accesses the library using an Ethernet interface.

Connecting the Host Interface Cables

To connect the host interface cable to the library:

1. It is recommended that you shut down and turn OFF the associated server. Turn OFF all attached devices. Remove the power cords from the server and all attached accessories.

Figure 3-15. Interface cable connection

> **Important:** Failure to remove the power cords from these devices before connecting the host interface cable could result in damage to the library.

1. Attach an Ethernet cable to the Ethernet port (**1** in Figure 3-15).

   Note: On rack mount installations, run the cable through the hook and loop fastener strap on the right rear bracket.

2. Attach the host end of the SAS cable to the drive's SAS connector (**2** in Figure 3-15).

   Note: On rack mount installations, run the cable through the hook and loop fastener strap on the right rear bracket.

3. Attach the other end of the host SAS interface cable to the host or to an interposer if required.

4. **Method 1**: Plug the Ethernet cable into your server or PC to access the Web User Interface directly. This method allows you to modify your server or PC network settings to match the library default settings, or use the library Operator Panel to change the library network settings to match the server or PC network settings

prior to using the Web User Interface to access the library. If the Ethernet connection is directly attached to a server or a PC, a crossover Ethernet cable may be required.

Method 2: Plug the Ethernet cable into an Ethernet switch or router to access the Web User Interface on a LAN (Local Area Network). The library network settings must first be entered using the Operator Panel prior to using the Web User Interface to access the library.

Connecting the Power Cord

Important: This product can ONLY be used with an approved power cord for your specific geographic region. Use of an unapproved power cord may result in:
- not meeting individual country specific safety requirements
- overheating with potential personal injury and/or property damage
- a fracture resulting in the internal contacts being exposed, which potentially could subject the user to a shock hazard

To connect a power cord:

1. Plug one end of the power cord or rack PDU line cord into the power connector (**3** in Figure 3-15) on the rear panel of the library.

Note: On rack mount installations, run the rack PDU line cord through the hook and loop fastener strap on the right rear bracket, and tighten the strap. The rack PDU line cord is a special power cord that plugs into a rack power strip.

2. Plug the other end of the power cord into the nearest properly grounded power outlet. On rack mount installations, plug the other end of the rack PDU line cord into the nearest rack PDU.
3. Power ON the library by toggling the power switch on the power supply to the ON (|) position.
4. Wait for the library to initialize.

Note: If the Operator Panel does not initialize, check all cable connections, and ensure that the cartridge magazine is closed and in the locked position, and that the power supply switch is in the ON position. If the Operator Panel still does not initialize, see Chapter 6, "Troubleshooting," on page 6-1.

Important: To disconnect all power from the library, turn the power switch to the OFF position, then remove the power cord from the outlet. The power switch removes power from portions of the library and the drive, but the power supply still has ac power at its input.

Note: When power cycling the library, wait 10 seconds after the power is OFF before powering ON again.

Configuring the Library

The library can be configured using the Web User Interface and/or the Operator Panel. The recommended method for configuring your library is using the Web User Interface. See "Configuring Your Library using the Operator Panel" on page 3-28 and "Configuring Your Library using the Web User Interface" on page 3-16.

For complete detailed information on all of the functions available on the library using both the Operator Panel and the Web User Interface, see Chapter 4, "Operations," on page 4-1.

The default library configuration settings are listed in the Table 3-4.

Table 3-4. Default library configuration settings

Configuration Item	Default Setting
NETWORK	
Ethernet link speed	Auto
SSL security	Disabled
IPv4 settings	Enabled
DHCP (Dynamic Host Configuration Protocol)	Enabled
Static IP address	Disabled
IPv4 address	0.0.0.0
Subnet mask	255.255.255.0
Gateway	0.0.0.0
IPv6 settings	Disabled
DHCP (Dynamic Host Configuration Protocol)	Enabled
Stateless auto-configuration	Enabled
Static IP address	Disabled
IPv6 address	0:0:0:0:0:0:0:0
Prefix length	64
Gateway	0:0:0:0:0:0:0:0
DNS setting	Disabled
DNS IP address	0.0.0.0
PHYSICAL	
Library name	(Blank)
Auto Cleaning	Disabled
Bar code label length	8 characters
LOGICAL	
Library mode	Random
Loop	Enabled
Auto Load	Enabled
Active slots	9 + 0
ENCRYPTION (S4H ONLY)	
Encryption method	None
Encryption policy	Encrypt All
SSL security	Disabled
Primary EKM server address	0.0.0.0
Primary EKM TCP port number	3801
Primary EKM SSL port number	443
Secondary EKM server address	0.0.0.0
Secondary EKM TCP port number	3801
Secondary EKM SSL port number	443

Table 3-4. Default library configuration settings (continued)

Configuration Item	Default Setting
Advanced encryption settings	(None)
DATE AND TIME	
NTP server	Disabled
NTP server address	0.0.0.0
Time zone (GMT)	+00:00
Auto adjustment by PC	Every 1 minute
NOTIFICATIONS	
SMTP (mail) settings	
Mail server address	0.0.0.0
Mail event	Error events enabled
SNMP (trap) settings	
Community	Public
Trap event	Error events enabled
SNMPv3 engine ID	(Set by library firmware)

Static library network settings must be entered using the Operator Panel before the library can be accessed remotely using the Web User Interface. If your system is serviced by a DHCP (Dynamic Host Configuration Protocol) server, the network parameters will be automatically set. Once remote access has been established, you can complete the configuration of your library remotely.

If you choose to use the Operator Panel to configure your library, go to "Configuring Your Library using the Operator Panel" on page 3-28.

Configuring Your Library using the Web User Interface

If you choose to use the Web User Interface to configure your library, first enter your library network settings using the Operator Panel (see "Configuring Network Settings" on page 3-29).

To configure your library using the Web User Interface, complete the following procedures:

1. Install Java 1.5.0 or higher on your host computer. Download the latest version of the Java Runtime Environment (JRE) for your platform from `http://www.java.com/`.
2. "Logging in to the Web User Interface" on page 3-17
3. "Checking Firmware Level" on page 3-18
4. "Configuring Library Settings" on page 3-18
5. "Configuring Network Settings" on page 3-20
6. "Configuring Date and Time Settings" on page 3-21
7. "Configuring Encryption Settings" on page 3-22
8. "Configuring E-mail Notifications" on page 3-24
9. "Configuring Trap Notifications" on page 3-25
10. "Managing User Access" on page 3-27
11. "Saving the Library Configuration" on page 3-28

Logging in to the Web User Interface

To log in to the Web User Interface, follow the steps below:

1. If necessary, obtain the IP address of the library on the Operator Panel.

   a. From the top menu of the Operator Panel, press the Minus key to select **View Current Information**, and press Enter.

   b. Press the Minus key until the **IP Address** setting is displayed and make a note of the IP address.

   c. Press the Cancel key repeatedly to log out of the Operator Panel.

2. On your host computer, open Internet Explorer.

   Note: Open Internet Explorer on your server or PC to access the Web User Interface.

3. In the browser address field, enter your library's IP Address URL to launch the Web User Interface applet in the browser window. For example, `http://192.168.1.1`

   When the applet launches, the warning message in Figure 3-16 appears. This message is normal and **does not** indicate a problem.

4. Click **Run**. To bypass the security warning message each time you start a new browser session, click the **Always trust content from this publisher** checkbox.
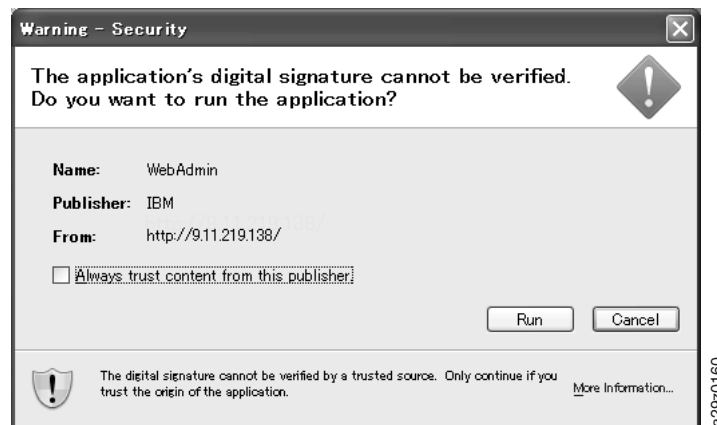
Figure 3-16. Java security warning message

5. On the Web User Interface login screen, enter the administrator login account name and default password:

   • Account: `admin`
   • Password: `secure`

Figure 3-17. Web User Interface login screen

6. Click **Login**.

Checking Firmware Level

Figure 3-18. System summary

To check the firmware level:

1. Visit the web at `http://www-03.ibm.com/servers/storage/support/index.html` to determine the latest levels of firmware for your library.

2. Check the current level of library firmware displayed in the **System Summary**. If an updated level of firmware is available, download and update the library firmware before normal operation starts. See "Updating Library and Drive Firmware" on page 4-34.

Configuring Library Settings

Logical Library Settings

Figure 3-19. Logical library mode settings

To configure the library access mode settings for the logical library, complete the following procedure:

1. Expand **Configure Library**, if necessary, and click on **Logical** in the left navigation pane of the Web User Interface.

2. Select the **Library Mode**.

   • **Random** — In random mode, the library allows the server's (host's) application software to select any data cartridge in any order.

   • **Sequential** — In sequential mode, the library's firmware predefines the selection of the cartridges. After initialization, the firmware causes the library to select the first available cartridge found (counting from the lowest Column/

Tier position through the highest cartridge position in your library) for loading into the drive. See "Location Coordinates and Element Addresses" on page 1-8.

– **Loop** — Sequential mode with loop mode ON loads the cartridge in the lowest Column/Tier cartridge position after the cartridge in the highest Column/Tier cartridge position has been filled and sent back to its home position. This allows endless backup operations without user interaction.

– **Autoload** — Sequential mode with autoload mode ON loads the first available cartridge (the lowest Column/Tier cartridge position that contains a cartridge) automatically if the library powers ON with an empty drive.

• **Number of active slots** — Select the number of active slots and the I/O Station configuration you would like to assign in your library. The first digit configures the number of active storage positions (4, 6, 8, or 9). The second digit configures Column 5, Tier 1 of the magazine as an I/O Station (0 when disabled, and 1 when enabled). The Auto Cleaning function can be enabled only if there is at least 1 inactive position in the magazine. If Auto Cleaning is enabled, the inactive positions become cleaning cartridge positions.

3. Click **Submit** to enable the settings.

Physical Library Settings

Figure 3-20. Cartridge assignment settings

To configure the library cartridge assignment settings, complete the following procedure:

1. Expand **Configure Library**, if necessary, and click on **Physical** in the left navigation pane of the Web User Interface.

2. Select the **Library** settings.

• **Library name** — Enter a name for your library.

• **Auto Cleaning** — Automatically cleans the drive when the drive requests cleaning and a cleaning cartridge is present in the library. Auto cleaning can be enabled only when there is at least 1 inactive position in the magazine in the library.

• Bar code label length — Use to choose the number of characters in the cartridge bar code that is reported to the host computer.

3. Click **Submit** to enable the settings.

Configuring Network Settings

Figure 3-21. Network settings

Once the network settings have been entered on the Operator Panel, the current network configuration of the library can be modified using the Web User Interface. The changes made to the network settings do not take affect until after the library is rebooted.

To modify the network settings, complete the following procedure:

1. Expand **Configure Library**, if necessary, and click on **Network** in the left navigation pane of the Web User Interface.
2. Select the Ethernet **Link speed** (duplex mode).
3. Select the **TCP/IP** settings. To enable dual IPv4/IPv6 protocol, select both **Use IPv4** and **Use IPv6** and enter parameters for both.
   - **Security** — Select **Enable SSL for Web** to provide secure communications between the web browser and the tape library.
   - **IPv4 setting** — Select **Use IPv4** to enable the IPv4 Internet Protocol. Select the corresponding radio button to obtain an IP address automatically (DHCP) or use static IP address settings. Enter the following parameters if using static IP address settings.
     - **IPv4 address** — Sets the TCP/IPv4 address of the library on the network.
     - **Subnet mask** — Defines and limits users within a local network.
     - **Gateway** — Allows access outside the local network.
   - **IPv6 setting** — Select **Use IPv6** to enable the IPv6 Internet Protocol. Select the corresponding radio button to obtain an IP address automatically (DHCP), to obtain an IP address using stateless auto configuration, or use static IP address settings. Enter the following parameter if using static IP address settings.
     - **IPv6 address** — Sets the TCP/IPv6 address of the library on the network.
     - **Prefix length** — Decimal value indicating the number of contiguous, high-order bits comprising the network portion of the address.
     - **Gateway** — Allows access outside the local network.

- **DNS setting** — Select **Use DNS** to use a domain name server. The DNS server, if entered, allows the encryption, date and time, and notifications IP addresses to be specified using hostnames instead of numerical IP addresses.
  - **DNS IP address** — Sets the IP address of the DNS server.
4. Click **Submit** to enable the settings.

Configuring Date and Time Settings

Figure 3-22. Date and Time settings

Configure the date and time settings using one of three methods: automatically using a remote NTP time server on the network, automatically using your the clock on your host computer, or manually.

Note: This is an optional procedure. If you choose to manually set your date and time, you will need to reset the date and time after power cycling the library.

Note: When power cycling the library, wait 10 seconds after the power is OFF before powering ON again.

Once the network settings have been entered on the Operator Panel, the current date and time can be modified using the Web User Interface.

The TS2900 Tape Autoloader communicates with an NTP server with the following conditions:
- client-server basis operation
- UDP (User Datagram Protocol) to access the NTP server
- does not use authentication keys
- library polling is every 12 hours

To modify the date and time settings, complete the following procedure:
1. Expand **Configure Library**, if necessary, and click on **Date and Time** in the left navigation pane of the Web User Interface.
2. Select the **Date and Time** settings.
   - **NTP Server** — Enables time and date control using a time server on the network.
     - **NTP server address** — Enter the IP address of the time server. IPv4 and IPv6 addresses are supported, depending on the TCP/IP settings. Hostnames can be entered instead of numerical IP addresses if **Use DNS** is selected in the Network settings.
     - **Time zone** — Enter the time zone relative to Greenwich Mean Time (GMT).
   - If the time server is disabled, enter the local time and date manually.
     - **Date** — Enter the date using the MM/DD/YYYY format.
     - **Time** — Enter the time using the HH:MM:SS format.

- **Auto Adjustment by PC** — Select a time interval and click **Start** to synchronize the library with the clock on your host computer at regular intervals. The Web User Interface Java Applet must be running continuously to use this function.

3. Click **Submit** to update the settings.

Configuring Encryption Settings

Figure 3-23. Encryption settings

Note: This is an optional procedure if you have purchased the Encryption Activation Key Feature Code 5901. Only the Ultrium 4 Tape Drive (3572-S4H) supports encryption.

Before you can use the encryption capability of the tape drive, you must be sure that certain software and hardware requirements are met. Refer to the *IBM Encryption Key Manager component for the Java platform, Introduction, Planning, and User's Guide* before continuing to the next step.

Figure 3-24. Encryption enabled settings

To modify the encryption settings, complete the following procedure:

1. Expand **Configure Library**, if necessary, and click on **Encryption** in the left navigation pane of the Web User Interface.

2. Enter the **Encryption Activation Key** and click **Submit** to enable encryption in your library.

3. Select the **Security** Settings.

   - **Enable SSL for EKM** — Select to enable secure communications between the tape library and the EKM server.

4. Select the **Encryption method** settings.

   - **Application Managed Encryption** — For encryption in operating environments that run an application capable of generating and managing encryption policies and keys. If you select application-managed encryption, no further configuration steps are necessary.

   - **System Managed Encryption** — For encryption in operating environments where no application is capable of key management runs, and encryption is set up implicitly through each instance of the IBM device driver.

   - **Library Managed Encryption** — For transparent encryption by the TS2900 Tape Autoloader tape drive.

   Note: System managed tape encryption and library managed tape encryption are transparent to one another. A tape encrypted using system managed encryption may be decrypted using library managed encryption, and vice versa, provided both have access to the same EKM keystore.

5. Select the **Primary EKM Server Settings** (*library-managed encryption only*) — The address of the primary encryption key manager on a server. IPv4 and IPv6 addresses are supported. Hostnames can be entered instead of numerical IP addresses if the DNS server is specified.

   - **Address** — The IP address of the primary encryption key manager.

   - **TCP port number** — The port number of the primary encryption key manager for TCP. The default port number is 3801.

- **SSL port number** — The port number of the primary encryption key manager for SSL. The default port number is 443.

6. Select the **Secondary EKM Server Settings** (*library-managed encryption only*) — The address of the secondary encryption key manager on a server. IPv4 and IPv6 addresses are supported. Hostnames can be entered instead of numerical IP addresses if the DNS server is specified.
   - **Address** — The IP address of the secondary encryption key manager.
   - **TCP port number** — The port number of the secondary encryption key manager for TCP. The default port number is 3801.
   - **SSL port number** — The port number of the secondary encryption key manager for SSL. The default port number is 443.

7. Select the **Encryption policy** settings (*library-managed encryption only*).
   - **Encrypt All** — All tape cartridges loaded into the tape drive are encrypted.
   - **Internal Label - Selective Encryption** — This option is used only for Symantec's Veritas NetBackup™.
   - **Internal Label - Encrypt All** — This option is used only for Symantec's Veritas NetBackup™.

8. Skip over the **Advanced Encryption Settings**. The purpose of these advanced encryption settings is to allow only IBM Support personnel (under the direction of the drive development team) to provide a solution to an unforeseen problem or to support a unique configuration. These options are not intended for use by the customer without the guidance of IBM Technical Support.

9. Click **Submit** to enable the settings.

Configuring E-mail Notifications

Figure 3-25. E-mail notifications

Note: This is an optional procedure.

To set up e-mail notifications of library events, complete the following procedure:

1. Expand **Configure Library**, if necessary, and click on **Notifications** in the left navigation pane of the Web User Interface.

2. Click on the **SMTP (Mail) Settings** tab.
3. Configure the SMTP server and header settings.
   - **SMTP server address** — SMTP mail server address. IPv4 and IPv6 addresses are supported. Hostnames can be entered instead of numerical IP addresses if the DNS server is specified in the Network settings.
   - **Sender address** — Mail header information.
   - **Subject** — Mail header information.
4. Enter the e-mail addresses to be notified when an event takes place in the **Mail To** fields.
5. Select the event level to report in the **Mail Event** field.
6. Click **Test** to send a test e-mail message to the enabled addresses.
7. Click **Submit** to enable the settings.

Configuring Trap Notifications

Figure 3-26. Trap notifications

> **Note:** This is an optional procedure.

The traps supported by the TS2900 Tape Autoloader are listed in "Trap Definitions (Types)" on page B-12.

To set up trap notifications for an SNMP server, complete the following procedure:
1. Expand **Configure Library**, if necessary, and click on **Notifications** in the left navigation pane of the Web User Interface.
2. Click on the **SNMP Settings** tab.
3. Configure the SNMP server and header settings.
   - **Community** — SNMP community name to which the library belongs.
   - **Name** — Unique SNMP name for the system.
   - **Location** — Physical location of the system.
   - **Contact** — Contact person's name.
   - **SNMPv3 engine ID** — A read-only attribute identifying the SNMPv3 engine.

4. Enter the trap IP addresses of the SNMP monitoring stations to be notified when an event takes place and the security settings in the **Trap List** pop-up menu.

Figure 3-27. Trap list settings

- **Validity** — Enable/Disable setting.
- **Trap version** — v1, v2c, or v3. For v2c and v3, the **Inform** checkbox determines whether an SNMP INFORM request is sent instead of a trap event.
- **IP address** — IPv4 and IPv6 addresses are supported. Hostnames can be entered instead of numerical IP addresses if the DNS server is specified.
- **Community** *(v1 or v2c)* — SNMP community name.
- **User name** *(v3 only)* — SNMPv3 unique user name.
- **Authentication** *(v3 only)* — Authentication algorithm, MD5 or SHA. When an algorithm is specified, an authentication password and confirmation of the password are required.
- **Privacy** *(v3 only)* — Privacy service encryption and decryption algorithm, DES or AES. When an algorithm is specified, a privacy password and confirmation of the password are required.

5. Enter the SNMPv3 users who are permitted to access the tape library in the **SNMPv3 User List** pop-up menu.

Figure 3-28. SNMPv3 user list settings

- **Validity** — Enable/Disable setting.
- **User name** — SNMPv3 unique user name.
- **Authentication** — Authentication algorithm, MD5 or SHA. When an algorithm is specified, an authentication password and confirmation of the password are required.

- **Privacy** — Privacy service encryption and decryption algorithm, DES or AES. When an algorithm is specified, a privacy password and confirmation of the password are required.
6. Select the event level to report in the **Trap event** field.
7. Click **Test** to send a test trap notification to the enabled IP addresses.
8. Click **Submit** to enable the settings.

Managing User Access

Figure 3-29. User access settings

Note: This is an optional procedure.

To add users able to access the library using the Web User Interface, complete the following procedure.
1. Expand **Configure Library**, if necessary, and click on **User Access** in the left navigation pane of the Web User Interface.
2. Select the **Add** action in the pop-up menu.
   - **Add** — To add new users.
   - **Modify** — To change the selected user's access role and/or password.
   - **Remove** — To delete the selected user from the system.

Figure 3-30. Add User dialog

3. Enter the user name and password information in the dialog box.
4. Assign a user access role.

- **User** — User access permission allows users to monitor the library, but not to perform functions that affect the library.
- **Superuser** — Superuser access permission allows users to operate the physical and logical library, but not to change configuration settings.
- **Administrator** — Administrator access permission allows users to perform tape library functions and change configuration settings.

5. Click **Submit** to enable the settings.

Saving the Library Configuration

Save / Restore Library Settings
Save   Save configuration to file
Restore   Restore configuration from file
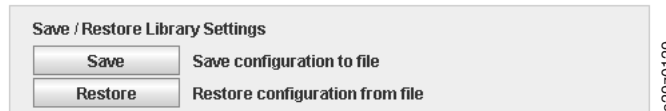
Figure 3-31. Save configuration

Note: This is a recommended procedure.

Each time you change the configuration of your library, you should save the configuration. This function also allows you to maintain several library configuration profiles that can be restored to the library when desired using the Web User Interface.

To save library configuration, complete the following procedure.

1. Expand **Configure Library**, if necessary, and click on **Save/Restore** in the left navigation pane of the Web User Interface.
2. Click **Save** to create a configuration file of your library on your computer.

Configuring Your Library using the Operator Panel

To configure your library using the Operator Panel, complete the following procedures.

1. "Logging in to the Operator Panel" on page 3-28
2. "Configuring Network Settings" on page 3-29
3. "Configuring Library Settings" on page 3-30

Logging in to the Operator Panel

In many environments, the default network settings may be sufficient to access your tape library on a network. To change the default network settings using the Operator Panel, complete the following procedure:

1. When the library is initialized, press the Enter key to move to the Password screen.
2. Enter **0000**, the default password. The top menu screen appears.
3. When finished using the Operator Panel, press Cancel to return to the top menu screen.
4. When finished, press the Minus key to select **Logout**, and press Enter.

Configuring Network Settings

In many environments, the default network settings may be sufficient to access your tape library on a network. To change the default network settings using the Operator Panel, complete the following procedure:

1. From the top menu screen, press the Minus key to select **Configuration**, and press Enter.
2. **Link speed** (Default: Auto Negotiation)
   a. Select **Configure Network Settings → Configure Link Speed**.
   b. Select the required speed and press Enter.
   c. Press Enter again to apply the setting, or Cancel to reject the setting.
      The speed must be set to **Set Auto Negotiation** for gigabit Ethernet networks.
   d. Press Cancel to backtrack through the menu hierarchy.
3. **DHCP IPv4** (Default: Enabled)
   a. Select **Configure Network Settings → Configure DHCP → Configure DHCP IPv4**.
   b. Select **Enable DHCP IPv4** and press Enter to enable, or press Down and select **Disable DHCP IPv4** to disable.
   c. Press Enter again to apply the setting, or Cancel to reject the setting.
   d. Press Cancel to backtrack through the menu hierarchy.
4. **DHCP IPv6** (Default: Disabled)
   a. Select **Configure Network Settings → Configure DHCP → Configure DHCP IPv6**.
   b. Select **Enable DHCP IPv6** and press Enter to enable, or press Down and select **Disable DHCP IPv6** to disable.
   c. Press Enter again to apply the setting, or Cancel to reject the setting.
   d. Press Cancel to backtrack through the menu hierarchy.
5. **IPv4/IPv6 Address** (Default: 0.0.0.0). If DHCP is disabled, set the IP address manually.
   a. Select **Configure Network Settings → Change IP Address**.
   b. Select **Set IP Address IPv4** to enter the IPv4 address of the tape library or **Set IP Address IPv6** to enter the IPv6 IP address (split over 4 screens).
   c. Press Enter again to apply the setting, or Cancel to reject the setting.
   d. Press Cancel to backtrack through the menu hierarchy.
6. **IPv4 Subnet Mask** (Default: 255.255.255.0). If DHCP IPv4 is disabled, set the IPv4 subnet mask manually.
   a. Select **Configure Network Settings → Change Subnet Mask → Set Subnet Mask**.
   b. Enter the IPv4 subnet mask.
   c. Press Enter again to apply the setting, or Cancel to reject the setting.
   d. Press Cancel to backtrack through the menu hierarchy.
7. **IPv6 Prefix Length** (Default: 64). If DHCP IPv6 is disabled, set the IPv6 prefix length manually.
   a. Select **Configure Network Settings → Change Subnet Mask → Set Prefix Length**.
   b. Enter the IPv4 prefix length.
   c. Press Enter again to apply the setting, or Cancel to reject the setting.
   d. Press Cancel to backtrack through the menu hierarchy.
8. **IPv4/IPv6 Gateway** (Default: 0.0.0.0). If DHCP is disabled, set the IP address manually.

a. Select **Configure Network Settings → Change Gateway**.

b. Select **Set Gateway Address IPv4** to enter the IPv4 gateway address or **Set Gateway Address IPv6** to enter the IPv6 gateway address (split over 4 screens).

c. Press Enter again to apply the setting, or Cancel to reject the setting.

d. Press Cancel to backtrack through the menu hierarchy.

9. Press Cancel to return to the **Network Settings** menu.

10. Press Cancel to return to the **Configuration** menu.

11. Press Cancel to return to the top menu screen.

Configuring Library Settings

To configure the library settings, complete the following procedure:

1. From the top menu screen, press the Minus key to select **Configuration**, and press Enter.

2. Select **Configure Library**, and press Enter.

3. **I/O Station** (Default: Disabled)

    a. Select **Configure Library → Configure I/O Station**.

    b. Select **Enable I/O Station** to enable the 1-slot I/O Station or **Disable I/O Station** to disable.

    c. Press Enter again to apply the setting, or Cancel to reject the setting.

    d. Press Cancel to backtrack through the menu hierarchy.

4. **Active Slots** (Default: All)

    a. Select **Configure Library → Set Active Slots Count**.

    b. Select the number of active slots you would like to assign for the logical library.

    c. Press Enter again to apply the setting, or Cancel to reject the setting.

5. **Library Mode** (Default: Random)

    a. Select **Configure Library → Configure Library Mode**.

    b. Select **Set Random Mode** or **Configure Sequential Mode**, and press Enter.

    Random — In random mode, the library allows the server's (host's) application software to select any data cartridge in any order.

    Sequential — In sequential mode, the library's firmware predefines the selection of the cartridges. After initialization, the firmware causes the library to select the first available cartridge found (counting from the lowest Column/Tier position through the highest cartridge position in your library) for loading into the drive.

    - **Loop** — Sequential mode with loop mode ON loads the cartridge in the lowest Column/Tier cartridge position after the cartridge in the highest Column/Tier cartridge position has been filled and sent back to its home position. This allows endless backup operations without user interaction.

    - **Autoload** — Sequential mode with autoload mode ON loads the first available cartridge (the lowest Column/Tier cartridge position that contains a cartridge) automatically if the library powers ON with an empty drive.

    c. Press Enter again to apply the setting, or Cancel to reject the setting.

    d. Press Cancel to backtrack through the menu hierarchy.

6. **Date/Time** – Enter the local time and date manually if you do not plan to use a network-based time server.

    a. Select **Configure Library → Configure Date/Time**.

    b. Select **Set Date** or **Set Time,** and press Enter.

- **Date** — Enter the date using the MM/DD/YYYY format.
- **Time** — Enter the time using the HH:MM:SS format.
    c. Press Cancel to backtrack through the menu hierarchy.

7. **Auto Cleaning** (Default: Disabled)
    a. Select **Configuration** → **Configure Auto Cleaning**.
    b. Select **Enable Auto Cleaning** or **Disable Auto Cleaning**, and press Enter. The Auto Cleaning function can only be enabled if there is at least 1 inactive position in the magazine in the library.
    c. Press Enter again to apply the setting, or Cancel to reject the setting.
    d. Press Cancel to backtrack through the menu hierarchy

Populating the Library with Cartridges

The magazine is opened using the Operator Panel.

To populate the library with data and cleaning cartridges, complete the following procedure:

1. From the top menu screen on the Operator Panel, press the Minus key to select **Unlock Magazine**, and press Enter.
2. Insert cartridges in the magazine.

   Note: A blue release gate (**1** in Figure 3-32) in the top left corner of each column in the cartridge magazine prevents each cartridge from falling out of the front of the magazine. When manually releasing the gate with one hand, position your other hand in front of the column opening to prevent cartridges being ejected by the internal column spring.

Figure 3-32. Cartridge release gate

   Note: Column 5 Tier 2 is reserved as the exchange position. This position is accessible by the library only. A locking mechanism prevents insertion of a cartridge into the reserved slot.

Each cartridge must be inserted with the indicator arrow on the leading edge of the upper surface of the cartridge pointing towards the cartridge magazine (see Figure 3-33 on page 3-32).

   Note: Do not rely on the bar code label orientation, if attached, to provide an indication of the correct cartridge orientation. The bar code label should be right side up if attached correctly.
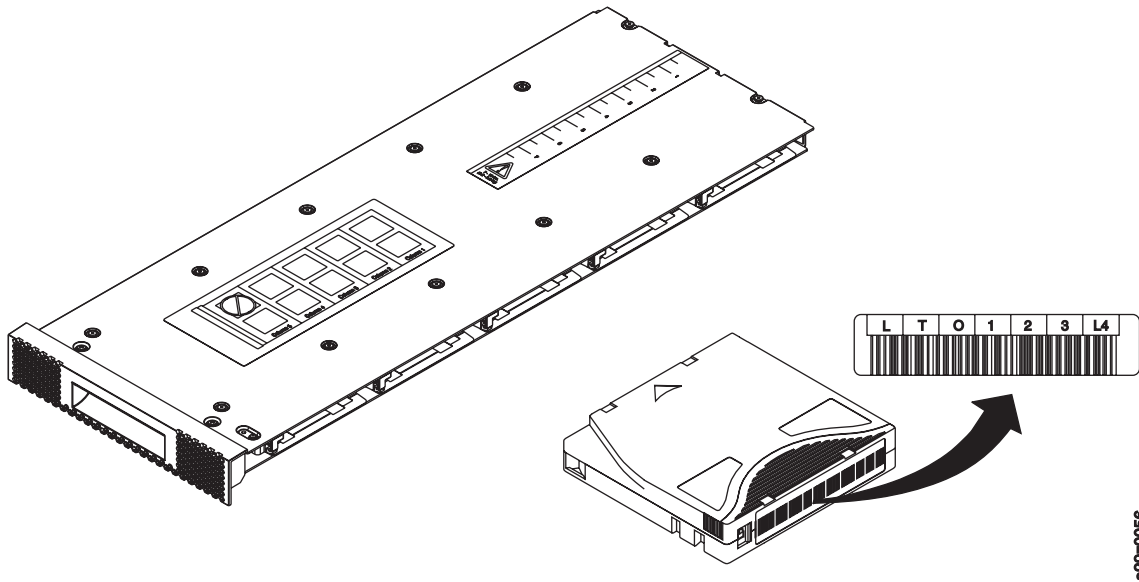
Figure 3-33. Cartridge orientation

The Auto Cleaning function can be enabled only if the number of active slots is less than the maximum available slots. The active slots are always enabled starting with the lowest numerical cartridge position number in the magazine, and are located at the drive end of the cartridge magazine. Place cleaning cartridges in inactive cartridge positions for use by the auto cleaning function.

Do not store data or cleaning cartridges in the I/O Station (Column 5, Tier 1) if the I/O Station is enabled.

3. Put the magazine back into the library and wait for the library inventory to complete before proceeding to the next step.

4. Press Cancel to return to the top level menu.

Verifying Library and Drive Operation

To verify the library is operating correctly:

1. From the top menu screen on the Operator Panel, press the Minus key to select **Service**, and press Enter.

2. Press the Minus key to select **Diagnostics**, and press Enter.

3. Select **Run Library Verify**, and press Enter. Follow the on-screen instructions.

   The library performs a Power ON Self Test (POST), the normal test sequence performed when the library is turned ON, to ensure that the library hardware is functional. Then, the library tests communications with the tape drives over the internal bus. If there is a cartridge in a drive, the library moves the cartridge to its home position, or to the I/O Station if the home position is not known.

4. When prompted, insert a customer supplied scratch cartridge into the I/O Station.

   When the scratch cartridge is loaded, the bar code reader reads the bar code label on the cartridge and stores it for later comparison. The cartridge is then moved to the tape drive, where the drive runs its own write/read/verify test. When the test is done, the library tells the drive to eject the cartridge, and then the cartridge is moved back to the I/O Station. The bar code is read again and compared with the value stored earlier.

5. When prompted, remove the cartridge from the I/O Station.

The result of the test is reported on the Operator Panel.

If an error occurs, note the error code number and see Appendix B, "Error Codes," on page B-1.

6. Press Cancel to return to the top level menu.

Taking the Library Online

When your library is completely configured, you are ready to save the library configuration and take the library online.

Note: The tape drive is always online, regardless of whether the library is online or offline.

To take the library online using the Operator Panel:

1. From the top menu screen, press the Minus key to select **Commands**, and press Enter.
2. Select **Change Library State**, and press Enter.
3. Select **Set Library Online**, and press Enter.
4. Press Cancel repeatedly to return to the top level menu.
5. Press the Minus key to select **Logout**, and press Enter.

To take the library online using the Web User Interface:

1. Save the library configuration.
   a. Expand **Configure Library**, if necessary, and click on **Save/Restore** in the left navigation pane of the Web User Interface.
   b. Click **Save**, and then enter a file name and select a location to save the configuration file.
2. Verify the library state.
   a. Click on **Library State** in the left navigation pane of the Web User Interface.
   b. If the library is offline, click **Bring Online**.
   c. Click **Yes** to confirm when prompted.
   A message dialog appears when the operation is completed.
3. Click on **Logoff** in the top right corner of the window.

Registering for My Notification

My Notification registration provides e-mail notification from IBM when new firmware levels have been updated and are available for download and installation as well as other information about your library.

To register for My Notification:

• Visit the web at `http://www.ibm.com/`, click **Get support**, and then click **My support**.
• Enter your user name and password on the Appendix F, "Library Configuration Form," on page F-1.

IBM recommends that you update library and drive firmware when new levels become available. For instructions on updating library and drive firmware, see "Updating Library and Drive Firmware" on page 4-34.

Now you are ready to use your library.

Chapter 4. Operations

Web User Interface	Monitoring the Library	"Viewing the System Summary" on page 4-15
		"Viewing the Library Map" on page 4-16
	Managing the Library	"Moving Cartridges" on page 4-17
		"Unloading the Drive" on page 4-18
		"Cleaning the Drive Manually" on page 4-18
		"Taking the Library Online/Offline" on page 4-19
		"Conducting a Library Inventory" on page 4-19
	Configuring the Library	"Managing User Access" on page 4-20
		"Configuring Physical Library Settings" on page 4-21
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		"Configuring Network Settings" on page 4-22
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		"Viewing Trace Data" on page 4-32
		"Downloading Drive Logs" on page 4-33
		"Downloading Library Logs" on page 4-33
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		"Updating Library and Drive Firmware" on page 4-34
		"Viewing Accessor Statistics" on page 4-35

Using the Operator Panel

Figure 4-1 shows the top level menu tree structure of the Operator Panel on the front of the TS2900 Tape Autoloader. For details on how to select commands and options, see the description in "Operator Panel" on page 2-1.
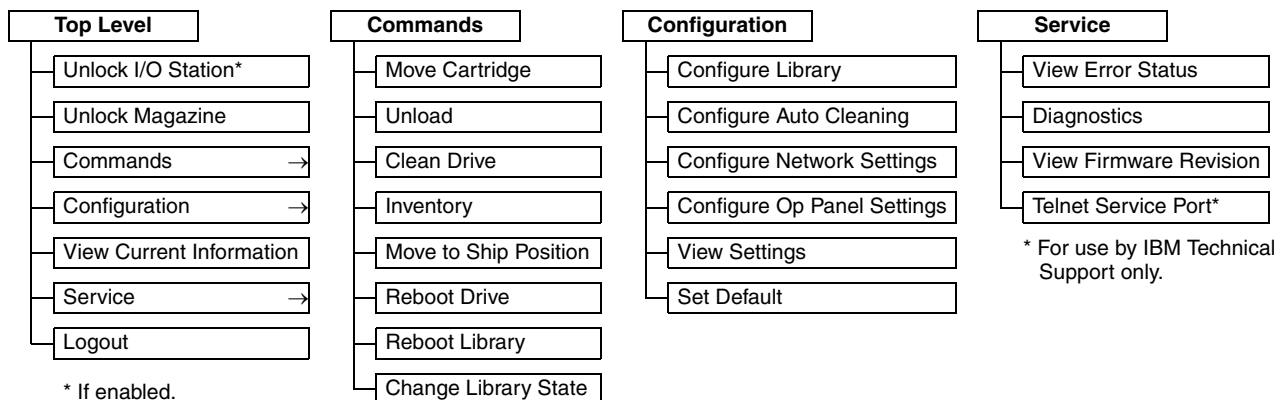
Figure 4-1. Operator Panel top level menus

Monitoring the Library

Viewing Configuration Settings

```
┌─────────────────┐
│ Configuration   │
└─────────────────┘
      └──┌──────────────┐
         │ View Settings │
         └──────────────┘
```
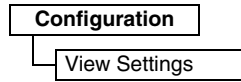
Figure 4-2. Configuration settings

Use **Configuration** → **View Settings** to display a list of the library configuration settings.

The settings displayed comprises the following:
- Library settings
  - I/O Station
  - Auto cleaning
  - Number of cleaning slots
  - Operator Panel back light setting
- Network settings
  - Link speed
  - IP address protocol
  - IPv4 settings (IP address, subnet mask address, gateway address, DHCP)
  - IPv6 settings (IP address, gateway address, prefix length, DHCP)
- Drive settings
  - Model number

Viewing Current Information

```
┌──────────────────────────┐
│ View Current Information  │
└──────────────────────────┘
```
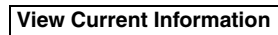
Figure 4-3. Current information

Use **View Current Information** to display the network settings information.

The settings displayed comprises the following:
- Network settings
  - Worldwide node name
  - IP address protocol stack
  - IP address

Viewing Firmware Revision

```
┌─────────────┐
│ Service     │
└─────────────┘
      └──┌──────────────────────┐
         │ View Firmware Revision │
         └──────────────────────┘
```
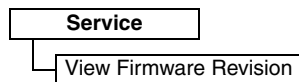
Figure 4-4. Hardware attributes

Use **Service** → **View Firmware Revision** to display the current version of the library firmware.

Managing the Library

Unlocking the I/O Station

Unlock I/O Station

Figure 4-5. Unlock I/O Station command

Use **Unlock I/O Station** to unlock the I/O Station. This menu option is available only when the I/O Station is enabled in the library configuration settings.
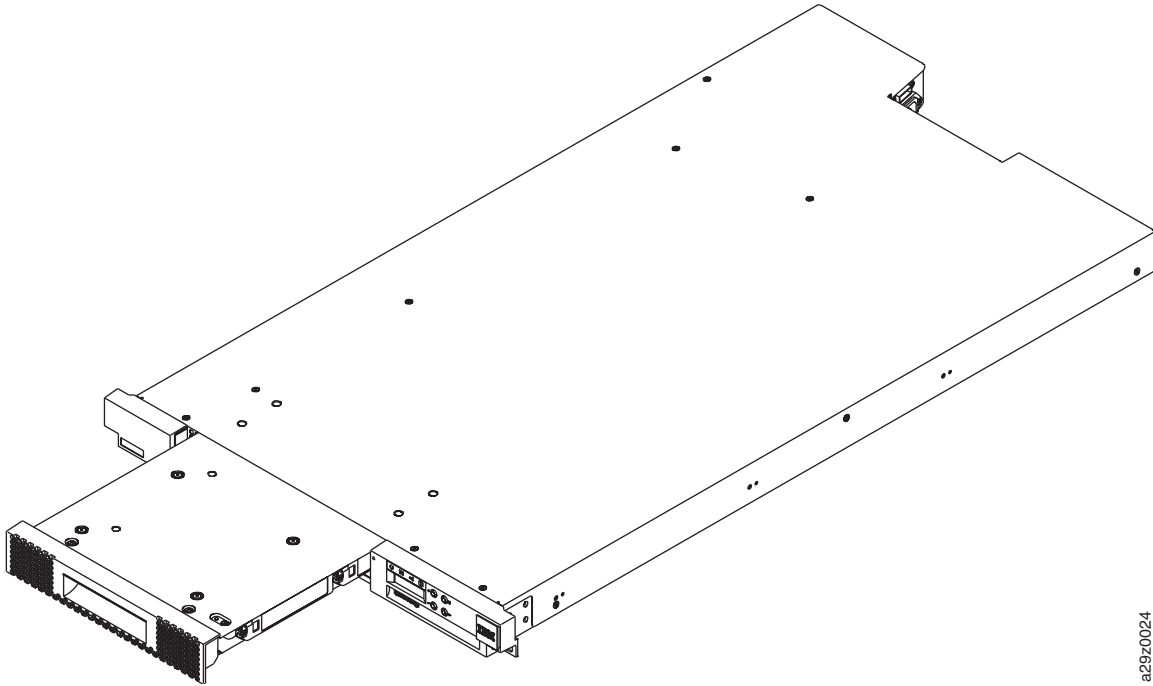
Figure 4-6. I/O Station unlocked

After closing the I/O Station, wait for the library to complete its inventory before proceeding with normal library operations.

Note: A blue release gate in the top left corner of each column in the cartridge magazine prevents each cartridge from falling out of the front of the magazine. When manually releasing the gate with one hand, position your other hand in front of the column opening to prevent cartridges being ejected by the internal column spring.

Unlocking the Cartridge Magazine

Unlock Magazine

Figure 4-7. Unlock Magazine command

Use **Unlock Magazine** to unlock and remove the cartridge magazine.
When the cartridge magazine is unlocked, it can be removed from the library to insert and/or remove data and cleaning cartridges. When the cartridge magazine is fully inserted, the magazine locks into place.

After closing the magazine, wait for the library to complete its inventory before proceeding with normal library operations.

Note: A blue release gate in the top left corner of each column in the cartridge magazine prevents each cartridge from falling out of the front of the magazine. When manually releasing the gate with one hand, position your other hand in front of the column opening to prevent cartridges being ejected by the internal column spring.

Moving Cartridges

```
┌─────────────────────┐
│ Commands            │
└─────────────────────┘
    └─┌─────────────────────┐
      │ Move Cartridge      │
      └─────────────────────┘
          └─┌─────────────────────┐
            │ Source Slot         │
            └─────────────────────┘
            ┌─────────────────────┐
            │ Destination Slot    │
            └─────────────────────┘
```
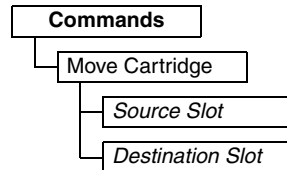
Figure 4-8. Move Cartridge command

Use **Commands → Move Cartridge** to move data cartridges and cleaning cartridges between the I/O Station, storage positions, and tape drive.

Specify the following parameters:
- **Source Slot** — Specify a source that contains a cartridge.
- **Destination Slot** — Specify the destination.

Select **Execute** to move the cartridge from the source to the destination.

Note: Cartridges cannot be moved to the Accessor using this command, but can be moved from the Accessor using this command if, for example, the library was powered OFF with a tape still held in the Picker.

Unloading the Drive

```
┌─────────────────────┐
│ Commands            │
└─────────────────────┘
    └─┌─────────────────────┐
      │ Unload              │
      └─────────────────────┘
```
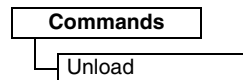
Figure 4-9. Unload command

Use **Commands → Unload** to unload the cartridge from the tape head mechanism. The cartridge is still retained inside the tape drive housing. Moving a tape cartridge from the drive to another location both unloads and moves the cartridge in a single action.

Select **Execute** to unload the cartridge from the tape head mechanism.

Cleaning the Drive Manually

```
┌─────────────────────┐
│ Commands            │
└─────────────────────┘
    └─┌─────────────────────┐
      │ Clean Drive         │
      └─────────────────────┘
          └─┌─────────────────────┐
            │ Cleaning Slot       │
            └─────────────────────┘
```
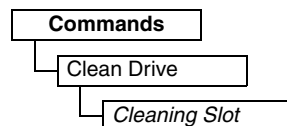
Figure 4-10. Clean Drive command

Use **Commands → Clean Drive** to clean the tape drive manually using a cleaning cartridge located in either a cartridge storage position or the I/O Station.

Specify the following parameter:
- **Cleaning Slot** — Specify the cartridge position that contains a cleaning cartridge.

Select **Execute** to move the cleaning cartridge to the drive and start drive head cleaning. The cleaning cartridge is returned to its home position when cleaning is finished.

Conducting a Library Inventory

```
┌─────────────────┐
│   Commands      │
└────┬────────────┘
     │  ┌──────────────────┐
     └──│ Inventory        │
        └──────────────────┘
```
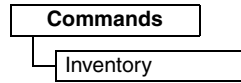
Figure 4-11. Inventory command

Use **Commands** → **Inventory** to force the library to execute an inventory of the cartridge magazine, accessor, and tape drive to refresh the library map. An inventory is conducted automatically when power is turned ON and when the cartridge magazine is inserted.

Select **Execute** to conduct the inventory.

Taking the Library Online/Offline

```
┌─────────────────┐
│   Commands      │
└────┬────────────┘
     │  ┌──────────────────────┐
     └──│ Change Library State  │
        └────┬─────────────────┘
             │  ┌────────────────────┐
             ├──│ Set Library Online │
             │  └────────────────────┘
             │  ┌────────────────────┐
             └──│ Set Library Offline│
                └────────────────────┘
```
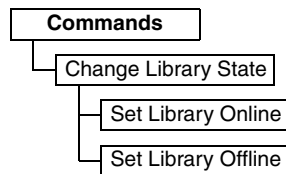
Figure 4-12. Online/Offline command

Use **Commands** → **Change Library State** to take the library online or offline.

It is sometimes necessary to take the library offline before performing some servicing functions for the library. Once these operations have finished, it is necessary to bring the library back online.

Note: The tape drive is always online, even when the library is offline.

Powering Down the Library

Before powering OFF the library, make sure that the library is in an idle state with no mechanical movement of the Accessor, and all data operations (e.g. backup operations, accessing of log files, etc.) have completed. Then, power OFF the library using the power switch on the rear panel of the library.

Important: If you switch the library power OFF while the library is being accessed, loss of data may occur.

Note: When power cycling the library, wait 10 seconds after the power is OFF before powering ON again.

Preparing to Ship the Library

```
┌─────────────────┐
│   Commands      │
└────┬────────────┘
     │  ┌──────────────────────┐
     └──│ Move to Ship Position │
        └──────────────────────┘
```
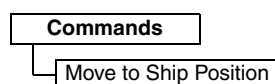
Figure 4-13. Move to Ship Position command

Use **Commands** → **Move to Ship Position** when preparing to move the library to a new location. The Accessor must be placed in a parked position within the library

housing. **Move to Ship Position** finishes all active commands received from the host application, does not process any new commands, and moves the Accessor to the parked position before the power is turned OFF.

Select **Execute** to unlock the cartridge magazine to remove the cartridges. Reinsert the cartridge magazine before moving the tape library. The Accessor assembly is secured in place using the Accessor locking screw that came with the library. The Accessor locking screw is located on the rear panel of the library.

Rebooting the Drive

Commands
Reboot Drive
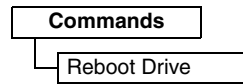
Figure 4-14. Reboot Drive command

Use **Commands** → **Reboot Drive** to force the drive to reboot. You also specify whether the library should come online/offline after it finishes rebooting.

Select **Execute** to reboot the drive.

Rebooting the Library

Commands
Reboot Library
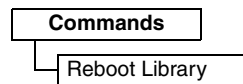
Figure 4-15. Reboot Library command

Use **Commands** → **Reboot Library** to force the library to reboot. You also specify whether the library should come online/offline after it finishes rebooting.

Select **Execute** to reboot the library.

Logging Out of the Library
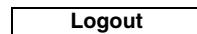
Logout

Figure 4-16. Logout command

Use **Logout** to logout of the library. The login screen is displayed for the next user.

Configuring the Library

Configuring the I/O Station

Configuration
Configure Library
Configure I/O Station
Enable I/O Station
Disable I/O Station
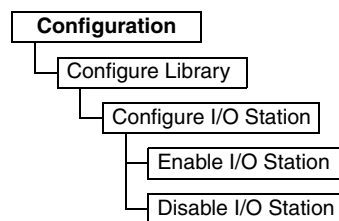
Figure 4-17. I/O Station setting

Use **Configuration** → **Configure Library** → **Configure I/O Station** to enable or disable Column 5, Tier 1 in the magazine as an I/O Station slot.

Configuring Auto Cleaning

```
┌─────────────────┐
│ Configuration   │
└─────────────────┘
     └──┌──────────────────────┐
        │ Configure Auto Cleaning│
        └──────────────────────┘
           └──┌─────────────────────┐
              │ Enable Auto Cleaning │
              └─────────────────────┘
              └──┌─────────────────────┐
                 │ Disable Auto Cleaning│
                 └─────────────────────┘
```
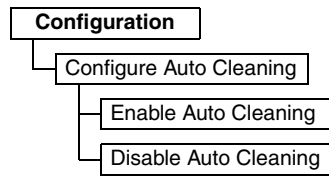
Figure 4-18. Auto Cleaning settings

Use **Configuration** → **Configure Auto Cleaning** to enable or disable automatic head cleaning of the tape drive in the library.

The drive can also be cleaned manually. For details, see "Cleaning the Drive Manually" on page 4-5.

Configuring the Number of Active Slots

```
┌─────────────────┐
│ Configuration   │
└─────────────────┘
     └──┌──────────────────┐
        │ Configure Library │
        └──────────────────┘
           └──┌──────────────────────┐
              │ Set Active Slots Count │
              └──────────────────────┘
                 └──┌───────────────┐
                    │ Active Slots  │
                    └───────────────┘
```
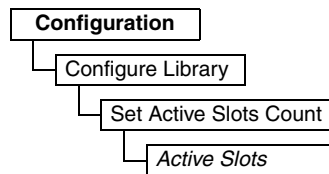
Figure 4-19. Active slot count settings

Use **Configuration** → **Configure Library** → **Set Active Slots Count** to set the number of active data cartridge positions within the logical library.

Configure the number of active slots using the following setting:
• **Active Slots** — The maximum number of active slots that can be set is dependent upon the I/O Station configuration and Auto Cleaning setting.

The active cartridge slots always begin with the cartridge position with the lowest cartridge address within the logical library.

Configuring the Library Access Mode

```
┌─────────────────┐
│ Configuration   │
└─────────────────┘
     └──┌──────────────────┐
        │ Configure Library │
        └──────────────────┘
           └──┌────────────────────────┐
              │ Configure Library Mode  │
              └────────────────────────┘
                 └──┌──────────────────┐
                    │ Set Random Mode  │
                    └──────────────────┘
                    └──┌───────────────────┐
                       │ Set Sequential Mode│
                       └───────────────────┘
                          └──┌─────────────────────┐
                             │ Configure Loop Mode  │
                             └─────────────────────┘
                                └──┌──────────────────┐
                                   │ Enable Loop Mode │
                                   └──────────────────┘
                                   └──┌───────────────────┐
                                      │ Disable Loop Mode │
                                      └───────────────────┘
                          └──┌────────────────────────┐
                             │ Configure Autoload Mode │
                             └────────────────────────┘
                                └──┌──────────────────────┐
                                   │ Enable Autoload Mode  │
                                   └──────────────────────┘
                                   └──┌───────────────────────┐
                                      │ Disable Autoload Mode │
                                      └───────────────────────┘
```
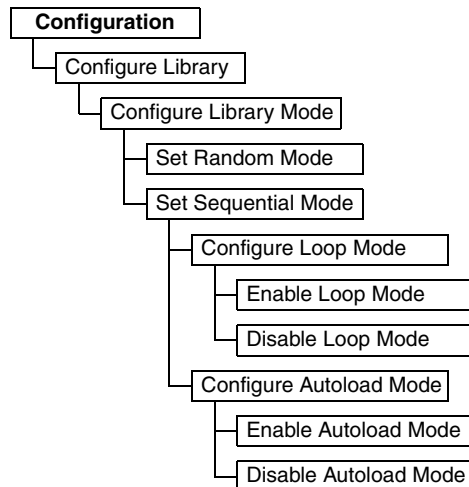
Figure 4-20. Library access mode settings

Use **Configuration** → **Configure Library** → **Configure Library Mode** to set the logical library access mode.

Configure the library access mode using the following settings:
- **Random Mode** — In random mode, the library allows the server's (host's) application software to select any data cartridge in any order.
- **Sequential Mode** — In sequential mode, the library's firmware predefines the selection of the cartridges. After initialization, the firmware causes the library to select the first available cartridge found (counting from the lowest Column/Tier position through the highest cartridge position in your library) for loading into the drive.
  - **Loop** — Sequential mode with loop mode ON loads the cartridge in the lowest Column/Tier cartridge position after the cartridge in the highest Column/Tier cartridge position has been filled and sent back to its home position. This allows endless backup operations without user interaction.
  - **Autoload** — Sequential mode with autoload mode ON loads the first available cartridge (the lowest Column/Tier cartridge position that contains a cartridge) automatically if the library powers ON with an empty drive.

Configuring Date and Time Settings

```
Configuration
   └── Configure Library
          └── Configure Date/Time
                 ├── Set Date
                 └── Set Time
```
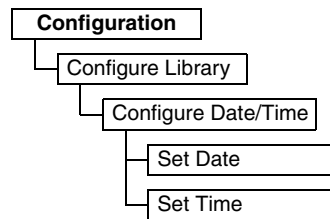
Figure 4-21. Date and Time settings

Use **Configuration** → **Configure Library** → **Configure Date/Time** to set the date and time on your library manually after a power disruption and when daylight savings time starts and ends. The date is set in MM/DD/YYYY format, and the time is set in 24-hour HH:MM:SS format.

The current date and time can also be controlled automatically using a network-based Network Time Protocol (NTP) server. For more information, see "Configuring Network Settings" on page 4-22.

Configuring Network Settings

```
┌─────────────────┐
│ Configuration   │
└─────────────────┘
    │
    └── Configure Network Settings
            │
            ├── Configure Link Speed
            │       ├── Set Auto Negotiation
            │       ├── Set 10 Base-T Full
            │       ├── Set 10 Base-T Half
            │       ├── Set 100 Base-T Full
            │       └── Set 100 Base-T Half
            │
            ├── Configure DHCP
            │       ├── Configure DHCP IPv4
            │       │       ├── Enable DHCP IPv4
            │       │       └── Disable DHCP IPv4
            │       └── Configure DHCP IPv6
            │               ├── Enable DHCP IPv6
            │               └── Disable DHCP IPv6
            │
            ├── Change IP Address
            │       ├── Set IP Address IPv4      Input IP Address
            │       └── Set IP Address IPv6      Input IP Address x 4
            │
            ├── Change Subnet Mask
            │       ├── Set Subnet Mask          Input Subnet Mask
            │       └── Set Prefix Length        Input Prefix
            │
            └── Change Gateway
                    ├── Set Gateway Address IPv4  Input Gateway
                    └── Set Gateway Address IPv6  Input Gateway x 4
```

Figure 4-22. Network settings

Use **Configuration** → **Configure Network Settings** to set the network settings for the library.

Note: The internet protocol (IPv4, IPv6 or dual IPv4/IPv6) selection is used for the TS2900 Tape Autoloader IP address, subnet mask, gateway address, time server address, mail server address, SNMP trap address, and EKM server addresses.

Configure the network using the following settings:
- **Link Speed** — Ethernet duplex mode (Auto, 10Base-T Full, 10Base-T Half, 100Base-TX Full, 100Base-TX Half).
- **DHCP** — (Dynamic Host Configuration Protocol) Enable DHCP to have the library server or router negotiate the connection with the library.
  - **IPv4** — Select to enable DHCP using the IPv4 protocol.
  - **IPv6** — Select to enable DHCP using the IPv6 protocol

- **IP Address** — If **DHCP** is disabled, set the IP address of the library manually.
  - **IPv4** — Select to enter the library IP address using the IPv4 protocol.
  - **IPv6** — Select to enter four library IP addresses using the IPv6 protocol.
- **Subnet Mask** — If **DHCP** is disabled, set the IP address of the subnet mask.
  - **Subnet Mask** — Select to enter the subnet mask address using the IPv4 protocol.
  - **Prefix Length** — Select to enter the prefix length for the IPv6 protocol.
- **Gateway** — If **DHCP** is disabled, set the IP address of the gateway.
  - **IPv4** — Select to enter the gateway IP address using the IPv4 protocol.
  - **IPv6** — Select to enter four gateway IP addresses using the IPv6 protocol.

Configuring Operator Panel Settings

```
┌─────────────────┐
│ Configuration   │
└─────────────────┘
    │
    └──┌───────────────────────────┐
       │ Configure Op Panel Settings│
       └───────────────────────────┘
           │
           └──┌─────────────────────────┐
              │ Configure LCD Back Light │
              └─────────────────────────┘
                  │
                  └──┌──────────────────────┐
                     │ Enable Auto Back Light│
                     └──────────────────────┘
                         │
                         └──┌──────────────────┐
                            │ Input Count (min) │
                            └──────────────────┘
                  │
                  └──┌──────────────────────┐
                     │ Disable Auto Back Light│
                     └──────────────────────┘
           │
           └──┌──────────────────────┐
              │ Change Login Password │
              └──────────────────────┘
                  │
                  └──┌──────────────┐
                     │ New Password │
                     └──────────────┘
                  │
                  └──┌──────────────────┐
                     │ Reenter Password │
                     └──────────────────┘
```
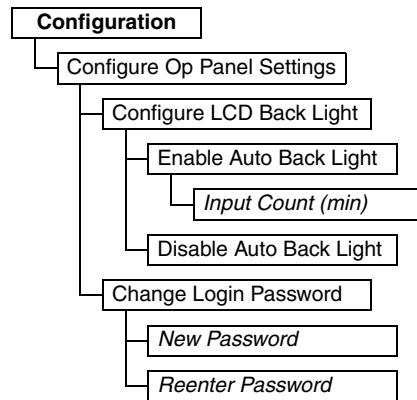
Figure 4-23. Operator Panel settings

Use **Configuration** → **Configure Op Panel Settings** to set the preferences when using the Operator Panel.

Configure the Operator Panel using the following settings:
- **Back light** — Select to enable the LCD back light when using the Operator Panel.
  - **Input Count** — If the auto back light is enabled, specify the time duration before the back light turns OFF. The setting uses a 4-digit timer in minutes.
- **Login Password** — Select to change the Operator Panel 4-character login password. The new password must be re-entered for confirmation before the password is changed (default: 0000).

Setting the Library to Factory Defaults

```
┌─────────────────┐
│ Configuration   │
└─────────────────┘
    │
    └──┌─────────────┐
       │ Set Default │
       └─────────────┘
```
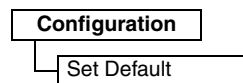
Figure 4-24. Factory default settings

Use **Configuration** → **Set Default** to reset the library to the factory default settings. See Table 3-4, "Default library configuration settings," on page 3-15. The date and time must be reset after restoring factory default settings. See "Configuring Date and Time Settings" on page 4-9.

Important: This configuration setting deletes all current library settings, and should be used with utmost caution.

To restore your library configuration, see "Saving and Restoring Configuration Settings" on page 4-28.

Servicing the Library

The Service menu on the Operator Panel gives users access to troubleshooting and maintenance diagnostic tools.

Checking the Library Error Status

```
┌──────────────┐
│   Service    │
└──────────────┘
   └──┌──────────────────┐
      │ View Error Status │
      └──────────────────┘
          ├──┌────────────────────────┐
          │  │ View Library Error Status │
          │  └────────────────────────┘
          └──┌────────────────────────┐
             │ View Drive Error Status  │
             └────────────────────────┘
```
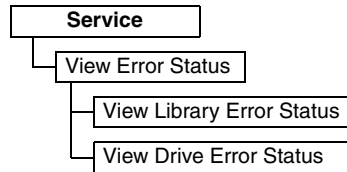
Figure 4-25. Error status menu

Use **Service → View Error Status** to check the current status of the major library components.

Select the component to view its error status:
- **Library** — Checks the error status of the library.
- **Drive** — Checks the error status of the tape drive.

If an error occurs, press the Enter key to display specific error information. You can check the meaning of error codes in Appendix B, "Error Codes," on page B-1.

Running Library Verify Diagnostics

```
┌──────────────┐
│   Service    │
└──────────────┘
   └──┌──────────────┐
      │ Diagnostics  │
      └──────────────┘
          └──┌────────────────────┐
             │ Run Library Verify │
             └────────────────────┘
```
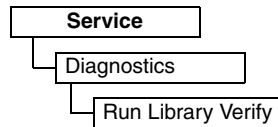
Figure 4-26. Library Verify diagnostics

Use **Service → Diagnostics → Run Library Verify** to test the library and drive hardware, communications, and the read/write capability of the library. Library Verify is the most critical and most frequently used test, and should be executed after all maintenance procedures to ensure correct library performance.

Note: Running the Library Verify diagnostic test will unload tape cartridges in the drives if the host application has not already done so.

To run library verification diagnostic tests:
1. Select **Run Library Verify**, and press Enter. Follow the on-screen instructions.

   The library performs a Power ON Self Test (POST), the normal test sequence performed when the library is turned ON, to ensure that the library hardware is functional. Then, the library tests communications with the tape drive over the internal bus. If there is a cartridge in the drive, the library moves the cartridge to its home position, or to the I/O Station if the home position is not known.
2. When prompted, insert a scratch cartridge into the I/O Station.

   When the scratch cartridge is loaded, an inventory is conducted and the bar code reader reads the bar code label on the cartridge and stores it for later comparison. The scratch cartridge is then moved to the tape drive, where the drive runs its own write/read/verify test. When the test is done, the library tells the drive to

eject the scratch cartridge, and then the cartridge is moved back to the I/O Station. The bar code is read again and compared with the value stored earlier.

3. When prompted, remove the scratch cartridge from the I/O Station.

The result of the test (PASSED or error message) is reported on the Operator Panel.

4. View the **Error Log** to check if any errors occur.

If an error occurs, see Appendix B, "Error Codes," on page B-1 to identify and locate the problem.

Running Drive Diagnostics

```
┌─────────────────┐
│     Service     │
└──────┬──────────┘
   ┌───┴─────────────┐
   │  Diagnostics    │
   └──────┬──────────┘
      ┌───┴─────────────────┐
      │  Drive Diagnostics  │
      └──────┬──────────────┘
         ┌───┴────────────────────────────┐
         │  Run Normal Read/Write Test    │
         ├────────────────────────────────┤
         │  Run Perform Read/Write Test   │
         ├────────────────────────────────┤
         │  Run Media Test                │
         ├────────────────────────────────┤
         │  Run Head Test                 │
         ├────────────────────────────────┤
         │  Run SAS Wrap Test             │
         └────────────────────────────────┘
```
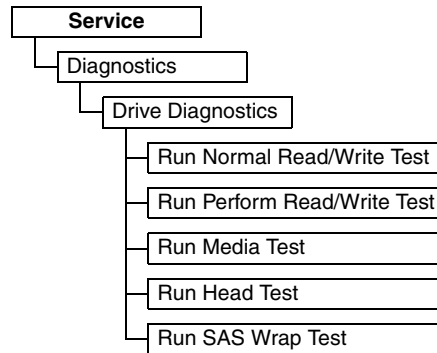
Figure 4-27. Drive diagnostics

Use **Service → Diagnostics → Drive Diagnostics** to run various drive-related diagnostic tests.

To run drive diagnostic tests:

1. Select **Drive Diagnostics**, and press Enter. Select one of the diagnostic tests and follow the on-screen instructions.

2. When prompted, insert a scratch (blank) cartridge into the I/O Station.

- **Normal Read/Write Test** — Runs most of the tests that normally occur when the library is powered ON (POST). When prompted, load a scratch cartridge to run the calibrate drive, read/write, and tape motion tests. These tests calibrate the read/write channel to optimum settings, run a long read/write test using all servo positions, and exercise all of the tape motion functions of the drive. Takes approximately 18 minutes.

- **Perform Read/Write Test** (Performance R/W Test) — Runs a shortened version of the **Normal R/W Test**. It does **not** include the POST diagnostic, calibrate drive, or unique tape motion tests. It checks the motors and head by running read/write tests on a shortened section of tape, both inbound and outbound. Takes approximately 4 minutes (if no error occurs) to 9 minutes (if calibration is required).

- **Media Test** — Runs tests on a tape cartridge. When prompted, insert the cartridge to test into the I/O Station. This test overwrites any data on the cartridge. It runs read/write tests on the outer tracks of the tape to verify the media tracking and performance. Takes approximately 9 minutes.

- **Head Test** — Runs read/write tests on the tape drive head. When prompted, insert a scratch cartridge into the I/O Station. It runs read/write tests on the inner tracks of the tape to verify the head performance. Takes approximately 6 minutes.

- **SAS Wrap Test** — Runs tests on the SAS interface SCSI controller. Remove the SAS cable from the library and insert the SAS wrap tool (see Figure 4-28 on

page 4-14) into the SAS host connector. Start the SAS wrap test. If the wrap test fails, contact your next level of support.
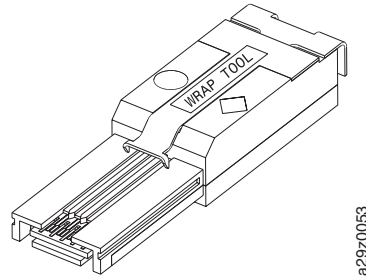
Figure 4-28. SAS wrap tool

3. When prompted, remove the cartridge from the I/O Station.

   The result of the test (PASSED or error message) is reported on the Operator Panel.

4. View the **Error Log** to check if any errors occur.

   If an error occurs, see Appendix B, "Error Codes," on page B-1 to identify and locate the problem.

Using the Web User Interface

Figure 4-1 shows all the menu options available from the Web User Interface for the Administrator User account. For information on the menu user access privileges for User, Superuser, and Administrator accounts, see "User Privileges" on page 2-8.

Monitor Library	**Manage Library**	**Configure Library**	**Service Library**
System Summary	Move Cartridges	User Access	Key Path Diagnostics
Library Map	Unload	Physical	Operator Interventions
	Clean Drive	Logical	View Library Logs
	Library State	Network	Traces
	Inventory	Encryption	Download Drive Logs
		Date and Time	Download Library Logs
		Notifications	Reset Library/Drive
		Save/Restore	Firmware Update
			Usage Statistics

Figure 4-29. Web User Interface menu

Monitoring the Library

Viewing the System Summary

Library name:	Tuscon
Library:	☑ OK
Drive:	☑ OK
I/O station:	☑ Closed

Front panel indicators:

Configuration and cartridge counts:

	Cartridges	Slots
Drive	0	N/A
Storage	6	8
Cleaning / Inactive	0	0
I/O station	0	1
Reserved	N/A	1
Total	**6**	**10**

Library firmware version:	0001.00F9
Library serial number:	3456789
Drive firmware version:	1234

Figure 4-30. System Summary screen

Use **Monitor Library → System Summary** to display a summary of the current status of the tape drive and the library, and the current configuration of the library, comprising:

- Library name
- Library status (OK, Degraded, or Failed)
- Drive status (OK, Degraded, or Failed)
- I/O Station status (Open/Closed, when I/O Station is enabled)
- Operator Panel LED indicators
- Number of cartridges and slot configuration
  - Cartridge in the drive (0 or 1); Slots value is always "N/A"
  - Number of cartridges in the active slots; Number of active slots
  - Number of cartridges in the inactive slots; Number of inactive slots
  - Number of cartridges in the I/O Station (0 or 1) when enabled; Number of I/O Station slots
  - Number of cartridges in the reserved slot; Number of reserved slots
- Library firmware version
- Library serial number
- Drive firmware version

Viewing the Library Map
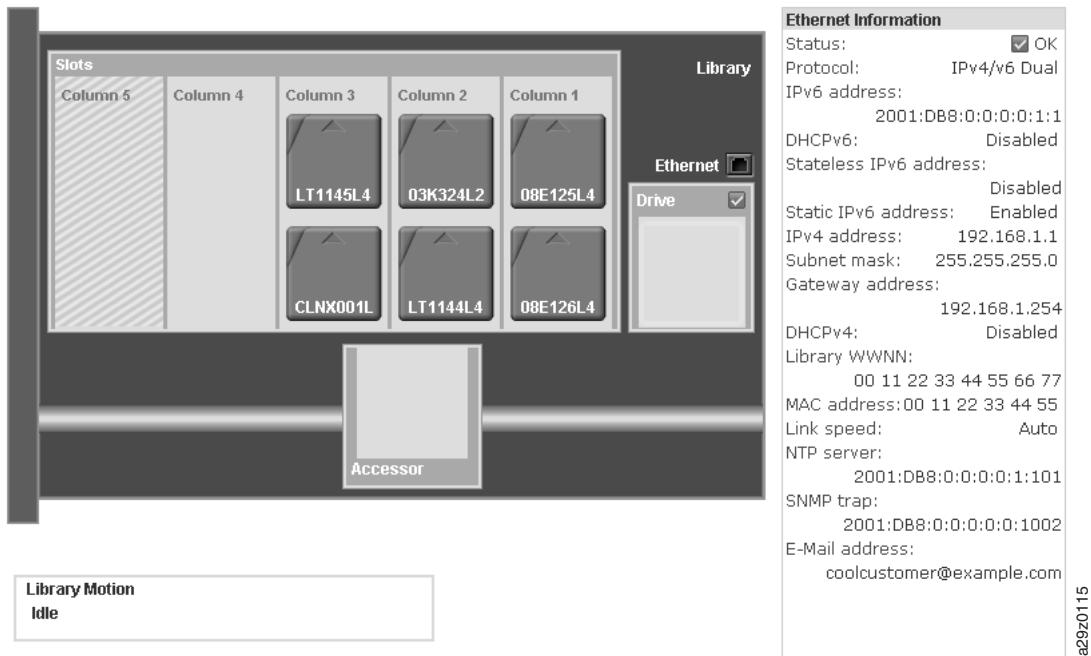
Figure 4-31. Library Map screen

Use **Monitor Library** → **Library Map** to display a graphical view of the library. Each component of the library is represented by a clickable icon. Select a component in the library map to display detailed information for that component of the library on the right side of the page. A grayed out column represents the I/O Station. The information displayed varies according to the type of device selected:

- Library information
  - Accessor status (OK, Degraded, or Failed)
  - Drive status (OK, Degraded, or Failed)
  - I/O Station (Enabled or Disabled)
  - Auto cleaning (Enabled or Disabled)
  - Magazine status (Inserted or Open)
  - Library mode (Random or Sequential. In Sequential mode, Loop and Auto load mode are also displayed)
- Ethernet information (click the Library component twice to access the Ethernet information)
  - Status
  - Protocol
  - IP addresses
  - Addressing method
  - Subnet mask
  - Gateway address
  - Library Worldwide node name
  - MAC address
  - Link speed
  - NTP server
  - SNMP trap
  - E-mail address

- Cartridge
  - Cartridge label detected by the bar code reader
  - Encryption setting (for data cartridges – Model S4H only)
  - Media status (OK, Degraded, or Failed)
  - Remaining uses (for cleaning cartridge)
- Column *n*, Tier *n*
  - Slot type (storage, I/O Station, or cleaning)
  - Element address
- Drive information
  - Status (OK, Degraded, or Failed)
  - Vendor ID
  - Product ID
  - Firmware version
  - Serial number
  - World wide node name
  - Encryption capability (Model S4H only)
- Accessor information
  - Status (OK, Degraded, or Failed)
  - Accessor event

Managing the Library
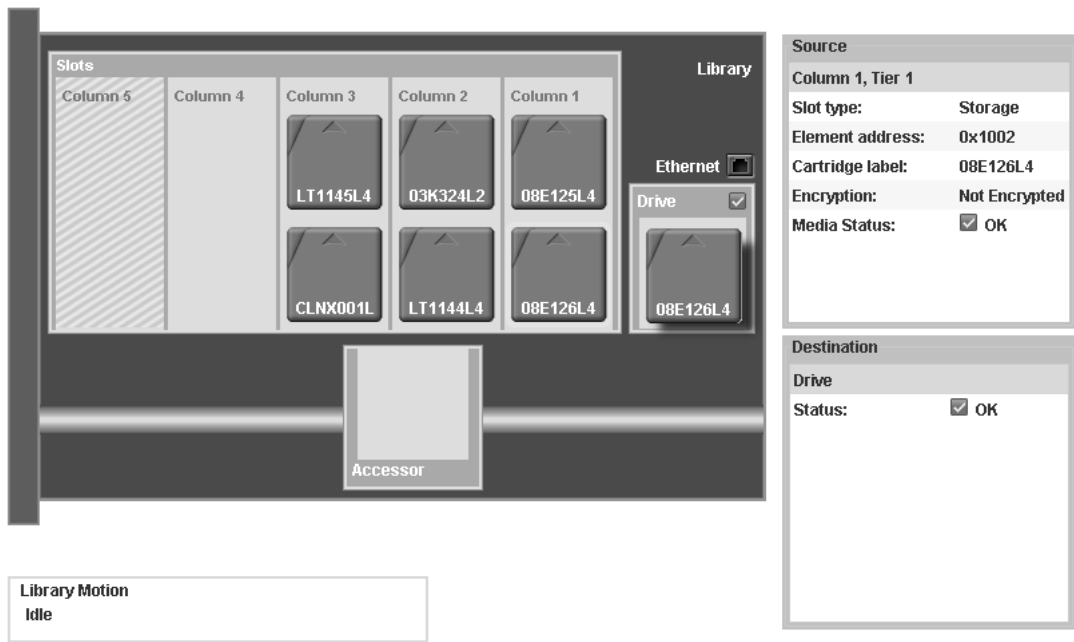
Moving Cartridges

Figure 4-32. Move Cartridges screen

Use **Manage Library** → **Move Cartridges** to move data and cleaning cartridges between the I/O Station, storage positions, inactive slots, and tape drive. Move cartridges by clicking and dragging a cartridge from one location to another, or by right-clicking a cartridge and selecting a destination.

Select a cartridge to display information for that cartridge in the Source pane on the right side of the page. Drag the cartridge to a valid destination location to display information in the Destination pane. Release the mouse button to execute the move.

The following information is displayed:
- Source
  - Location coordinates in the library (Column, Tier)
  - Slot type (storage, I/O Station, cleaning)
  - Element address
  - Cartridge label
  - Encryption capability for storage cartridges (Model S4H only)
  - Remaining uses for cleaning cartridges
  - Media status (OK, Degraded, or Failed)
- Destination
  - Status (for the tape drive)
  - Slot type and element address

Note: Each column has a spring loaded mechanism that pushes the cartridges into Tier 1. Moving a second cartridge into a column moves the first cartridge into Tier 2. Also, cartridges cannot be moved directly from Tier 1 in one column to Tier 2 in another column in a single move operation (intermediate move operations are required).

Note: Cartridges cannot be moved to the Accessor using this command, however, but can be moved from the Accessor using this command if, for example, the library was powered OFF with a cartridge still held in the Accessor.

Unloading the Drive

Figure 4-33. Unload Drive screen

Use **Manage Library → Unload Drive** and click **Unload** to unload the tape cartridge from the tape drive head.

The cartridge in the drive is unloaded from the tape head mechanism, but is still retained inside the tape drive housing. Moving a tape cartridge from a drive to another location both unloads and moves the cartridge in a single action.

Cleaning the Drive Manually
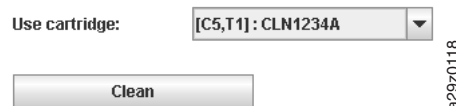
Figure 4-34. Clean Drive screen

Use **Manage Library → Clean Drive** to clean a drive manually. Select a cleaning cartridge to use (from the magazine or from the I/O Station), and click **Clean**.

The cleaning cartridge is returned to its home position when cleaning is finished.

Taking the Library Online/Offline

Current state: Online

Bring Offline

a29z0119
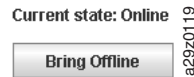
Figure 4-35. Library State screen

Use **Manage Library → Library State** to take the library online or offline. Check the current library status, and click the button displayed to change the library status.

It is sometimes necessary to take the library offline before performing some servicing functions for the library. Once these operations have finished, it is necessary to bring the library back online.

Note: The tape drive is always online, even when the library is offline.

Conducting a Library Inventory

Start

a29z0120

Figure 4-36. Inventory screen

Use **Manage Library → Inventory** to force the library to execute an inventory of the cartridge magazine, accessor, and tape drive to refresh the library map. Conduct an inventory by clicking on the **Start** button. The Inventory Progress bar indicates the process in action. Wait until the operation finishes before resuming normal library operations.

Inventory Progress

81% done.

a29z0138
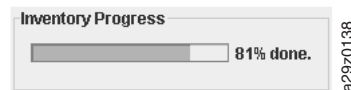
Figure 4-37. Inventory progress bar

An inventory is conducted automatically when power is turned ON and when the cartridge magazine is inserted.

Configuring the Library

Managing User Access

Figure 4-38. User Access screen

Use **Configure Library** → **User Access** to add/modify/remove additional administrator, superuser, and user accounts, and to change passwords. Up to 7 users can be configured using the Web User Interface.

Add, modify, or remove users using the following information:

- **Select action**
  - **Add** — To add new users.
  - **Modify** — To change the selected user's access role and/or password.
  - **Remove** — To delete the selected user from the system.
- **User Name** — The user name of a registered user.
- **Password** — Case-sensitive password for the registered user.
- **Role** — The user access level for the registered user.
  - **Users** are allowed to monitor the library, but not perform actions that affect the physical library.
  - **Superusers** are allowed to operate the physical and logical library, but not perform actions that affect the library configuration.
  - **Administrator** users are allowed access to the entire physical library and logical library, including configuration. One and only one administrator user must be assigned the login name **admin**.

An administrator can add/modify/remove additional administrator, superuser, and user accounts, and change passwords. User accounts are restricted to specific areas of the library. For more information, see "User Privileges" on page 2-8.

A User account can be modified by an administrator to provide a user with superuser or administrator access permissions to the library functions.

Enter all user IDs and passwords on the Library Configuration form in Appendix F, "Library Configuration Form," on page F-1.

Click **Submit** to transfer the settings to the library. A dialog message is displayed when the settings have been updated successfully.

Click **Refresh** to read the current settings from the library.

Configuring Physical Library Settings

Figure 4-39. Physical library settings screen

Use **Configure Library** → **Physical** to configure the I/O Station and auto cleaning.

Configure the I/O Station and Auto cleaning cartridge assignment using the following settings:

- **Library name** — Use to enter a name for your library.
- **Auto cleaning** — Use to enable automatic cleaning of the tape drive. Auto cleaning can be enabled only when there the number of active slots is less than the total number of available slots in the library.
- Bar code label length — Use to choose the number of characters in the cartridge bar code that is reported to the host computer.

Click **Submit** to transfer the settings to the library. A dialog message is displayed when the settings have been updated successfully.

Click **Refresh** to read the current settings from the library.

Configuring Logical Library Settings

Figure 4-40. Logical library settings screen

Use **Configure Library** → **Logical** to configure the library access mode for the logical library and the number of active cartridge slots.

Configure the library access mode using the following settings:

- **Library mode** — The library mode can be set to Random or Sequential.
  - **Random** — In random mode, the library allows the server's (host's) application software to select any data cartridge in any order.
  - **Sequential** — In sequential mode, the library's firmware predefines the selection of the cartridges. After initialization, the firmware causes the library to select the first available cartridge found (counting from the lowest Column/Tier position through the highest cartridge position in your library) for loading into the drive. See "Location Coordinates and Element Addresses" on page 1-8.

    Loop — Sequential mode with loop mode ON loads the cartridge in the lowest Column/Tier cartridge position after the cartridge in the highest Column/Tier

cartridge position has been filled and sent back to its home position. This allows endless backup operations without user interaction.

Autoload — Sequential mode with autoload mode ON loads the first available cartridge (the lowest Column/Tier cartridge position that contains a cartridge) automatically if the library powers ON with an empty drive.

- **Number of active slots** — Select the number of active slots and the I/O Station configuration you would like to assign in your library. The first digit configures the number of active storage positions (4, 6, 8, or 9). The second digit configures Column 5, Tier 1 of the magazine as an I/O Station (0 when disabled, and 1 when enabled). The Auto Cleaning function can be enabled only if there is at least 1 inactive position in the magazine. If Auto Cleaning is enabled, the inactive positions become cleaning cartridge positions.

Click **Submit** to transfer the settings to the library. A dialog message is displayed when the settings have been updated successfully.

Click **Refresh** to read the current settings from the library.

Configuring Network Settings

Figure 4-41. Network settings screen

Use **Configure Library** → **Network** to set the network settings for the library.

Note: The internet protocol (IPv4, IPv6 or dual IPv4/IPv6) selection is used for the TS2900 Tape Autoloader IP address, subnet mask, gateway address, time server address, mail server address, SNMP trap address, and EKM server addresses.

Configure the network using the following settings:

- **Link speed** — Ethernet duplex mode (Auto, 10Base-T Full, 10Base-T Half, 100Base-TX Full, 100Base-TX Half).
- **TCP/IP settings** — IPv4, IPv6, and dual stack IPv4/IPv6 are supported. To enable the dual IPv4/IPv6 protocol, select both **Use IPv4** and **Use IPv6** and enter parameters for both.

- **Security** — Select **Enable SSL for Web** to provide secure communications between the web browser and the tape library.
- **IPv4 setting** — Select **Use IPv4** to enable the IPv4 Internet Protocol. Select the corresponding radio button to obtain an IP address automatically (DHCP) or use static IP address settings. Enter the following parameters if using static IP address settings.
  - **IPv4 address** — Sets the TCP/IPv4 address of the library on the network.
  - **Subnet mask** — Defines and limits users within a local network.
  - **Gateway** — Allows access outside the local network.
- **IPv6 setting** — Select **Use IPv6** to enable the IPv6 Internet Protocol. Select the corresponding check boxes to obtain an IP address automatically (DHCP), to obtain an IP address using stateless auto configuration, or use static IP address settings. Enter the following parameter if using static IP address settings.
  - **IPv6 address** — Sets the TCP/IPv6 address of the library on the network.
  - **Prefix Length** — Decimal value between 0 and 128 indicating the number of contiguous, high-order bits comprising the network portion of the address.
  - **Gateway** — Allows access outside the local network.
- **DNS setting** — Select **Use DNS** to use a domain name server. The DNS server, if entered, allows the encryption, date and time, and notifications IP addresses to be specified using hostnames instead of numerical IP addresses.
  - **DNS IP address** — Sets the IP address of the DNS server.

Click **Submit** to transfer the settings to the library. A dialog message is displayed when the settings have been updated successfully.

Click **Refresh** to read the current settings from the library.

Configuring Encryption Settings

Figure 4-42. Encryption settings screen

Use **Configure Library → Encryption** to configure an encryption method for data being stored on tape cartridges. The library supports transparent library-managed

encryption by the tape drive itself (IBM Ultrium 4 Half-High Tape Drive Model 3572-S4H only) if you have purchased the Encryption Activation Key feature, relieving the host of the burden of managing encryption applications and systems.

Note: Application Managed Encryption (AME) does not require a key. Library Managed Encryption (LME) and System Managed Encryption (SME) require a license key which is available by purchasing Feature Code 5901.

Figure 4-43. Encryption settings enabled screen

Configure encryption using the following settings:

- **Feature Activation Key** — Optional feature of the library to activate the encryption functions in your library (Model S4H only).
- **Security** — Sets secure communications using secure sockets layer (SSL).
  - **Enable SSL for EKM** — Select to enable secure communications between the tape library and the EKM server.
- **Primary** and **Secondary EKM Server Settings** (*library-managed encryption*)
  - **IP address** — The IP address of the primary encryption key manager. IPv4, IPv6, and dual stack IPv4/IPv6 are supported.
  - **TCP port number** — The TCP port number of the encryption key manager.
  - **SSL port number** — The port number of the encryption key manager.
- **Encryption method**
  - **Application Managed** — For encryption in operating environments that run an application capable of generating and managing encryption policies and keys. If you select application-managed encryption, no further configuration steps are necessary.
  - **System Managed** — For encryption in operating environments where no application is capable of key management runs, and encryption is set up implicitly through each instance of the IBM device driver.
  - **Library Managed** — For transparent encryption by the TS2900 Tape Autoloader tape drive.

Note: System managed tape encryption and library managed tape encryption are transparent to one another. A tape encrypted using system managed encryption may be decrypted using library managed encryption, and vice versa, provided both have access to the same EKM keystore.

- **Encryption policy** (*library-managed encryption*)
  - **Encrypt All** (default) — All tape cartridges loaded into the tape drive are encrypted.
  - **Internal Label - Selective Encryption** — This option is used only for Symantec's Veritas NetBackup™.
  - **Internal Label - Encrypt All** — This option is used only for Symantec's Veritas NetBackup™.
- **Advanced Encryption Settings** — The purpose of these advanced encryption settings is to allow only IBM Support personnel (under the direction of the drive development team) to provide a solution to an unforeseen problem or to support a unique configuration. These options are not intended for use by the customer without the guidance of IBM Support.

To determine whether a cartridge is encrypted, use **Configure Library → Library Map** and select the cartridge. The screen displays whether the cartridge is encrypted, not encrypted, or unknown.

Click **Submit** to transfer the settings to the library. A dialog message is displayed when the settings have been updated successfully.

Click **Refresh** to read the current settings from the library.

Configuring Date and Time Settings

Figure 4-44. Date and Time settings screen

Use **Configure Library → Date and Time** to configure the date and time settings using one of three methods. The date and time can be automatically updated using a remote NTP time server over the network. Alternatively, the date and time can be synchronized with the clock on your host computer. And lastly, that date and times can be set manually.

The TS2900 Tape Autoloader communicates with an NTP server with the following conditions:
- client-server basis operation
- UDP (User Datagram Protocol) to access the NTP server
- does not use authentication keys
- library polling is every 12 hours

Configure the date and time using the following settings:

- **NTP Server** — Enables time and date control using a time server on the network.
  - **NTP server address** — The IP address of the time server. IPv4 and IPv6 addresses are supported, depending on the TCP/IP settings. Hostnames can be entered instead of numerical IP addresses if **Use DNS** is selected in the Network settings.
  - **Time zone** — The time zone relative to Greenwich Mean Time (GMT).
- If the time server is disabled, enter the local time and date manually.
  - **Date** — The date using the MM/DD/YYYY format.
  - **Time** — The time using the HH:MM:SS format.
- **Auto Adjustment by PC** — Select a time interval and click **Start** to synchronize the library with the clock on your host computer at regular intervals. The Web User Interface Java Applet must be running continuously to use this function.

Click **Submit** to transfer the settings to the library. A dialog message is displayed when the settings have been updated successfully.

Click **Refresh** to read the current settings from the library.

Configuring E-mail Notifications

Figure 4-45. E-mail settings screen

Use **Configure Library → Notifications → SMTP (Mail) Settings** to configure the e-mail settings for sending event information whenever an event of a certain level occurs.

Configure e-mail notification using the following settings:

- **SMTP server address** — SMTP mail server IPv4 or IPv6 address (depending on network configuration)
- **Sender address** — E-mail message header information
- **Subject** — E-mail message header information
- **Mail to** — E-mail addresses of contacts to be notified of the event
- **Mail event** — Event level notification threshold

– Error events
– Error and Warning events
– Error, Warning, and Information events

Click **Test** to send a test message to the addresses enabled in the **Mail to** fields.

Click **Submit** to transfer the settings to the library. A dialog message is displayed when the settings have been updated successfully.

Click **Refresh** to read the current settings from the library.

Configuring SNMP Trap Notifications

Figure 4-46. SNMP settings screen

Use **Configure Library → Notifications → SNMP Settings** to configure the trap settings for sending event information whenever an event of a certain level occurs, and to register users who are permitted to access the tape library using SNMP Version 3. The traps supported by the TS2900 Tape Autoloader are listed in "Trap Definitions (Types)" on page B-12.

Download the SNMP MIB file for this library from `http://www.ibm.com/storage/support`. Install the MIB file on your SNMP server. Refer to your server application documentation for instructions.

Configure SNMP trap notification using the following settings:
- **Community** — SNMP community name (for example, "public")
- **Name** — Device name (for example, "TS2900 Tape Autoloader")
- **Location** — Physical location of the tape library
- **Contact** — Contact individual's name
- **SNMPv3 engine ID** — A read-only attribute identifying the SNMPv3 engine.
- **Trap event** — Event level notification threshold
  – Error events
  – Error and Warning events

- Error, Warning, and Information events
- **Trap List** — IP addresses of the SNMP monitoring stations to be notified when an event takes place and the security settings.
  - **Validity** — Enable/Disable setting.
  - **Trap version** — v1, v2c, or v3. For v2c and v3, the **Inform** checkbox determines whether an SNMP INFORM request is sent instead of a trap event.
  - **IP address** — IPv4 and IPv6 addresses are supported.
  - **Community** *(v1 or v2c)* — SNMP community name.
  - **User name** *(v3 only)* — SNMPv3 unique user name.
  - **Authentication** *(v3 only)* — Authentication algorithm, MD5 or SHA. When an algorithm is specified, an authentication password and confirmation of the password are required.
  - **Privacy** *(v3 only)* — Privacy service encryption and decryption algorithm, DES or AES. When an algorithm is specified, a privacy password and confirmation of the password are required.
- **SNMPv3 User List** — SNMPv3 users who are permitted to access the tape library.
  - **Validity** — Enable/Disable setting.
  - **User name** — SNMPv3 unique user name.
  - **Authentication** — Authentication algorithm, MD5 or SHA. When an algorithm is specified, an authentication password and confirmation of the password are required.
  - **Privacy** — Privacy service encryption and decryption algorithm, DES or AES. When an algorithm is specified, a privacy password and confirmation of the password are required.

Click **Test** to send a test trap to the IP addresses enabled in the **Trap to** fields.

Click **Submit** to transfer the settings to the library. A dialog message is displayed when the settings have been updated successfully.

Click **Refresh** to read the current settings from the library.

Saving and Restoring Configuration Settings

Your library configuration can be saved and restored automatically by a cookie and manually by using the Web User Interface. It is recommended that you use the Web User Interface method regardless of whether or not you use the cookie method.

Important: Verify all configuration settings after restoring your library configuration. Reset the library date and time (see "Configuring Date and Time Settings" on page 4-25).

Saving/restoring Configuration Automatically using Cookies

If allowed by your web browser preference settings, cookies are employed to automatically save your library configuration on your host computer and automatically restore your library configuration if your library network configuration uses a static IP address. The following flowchart illustrates how VPD data is saved from and restored to a library using cookies.
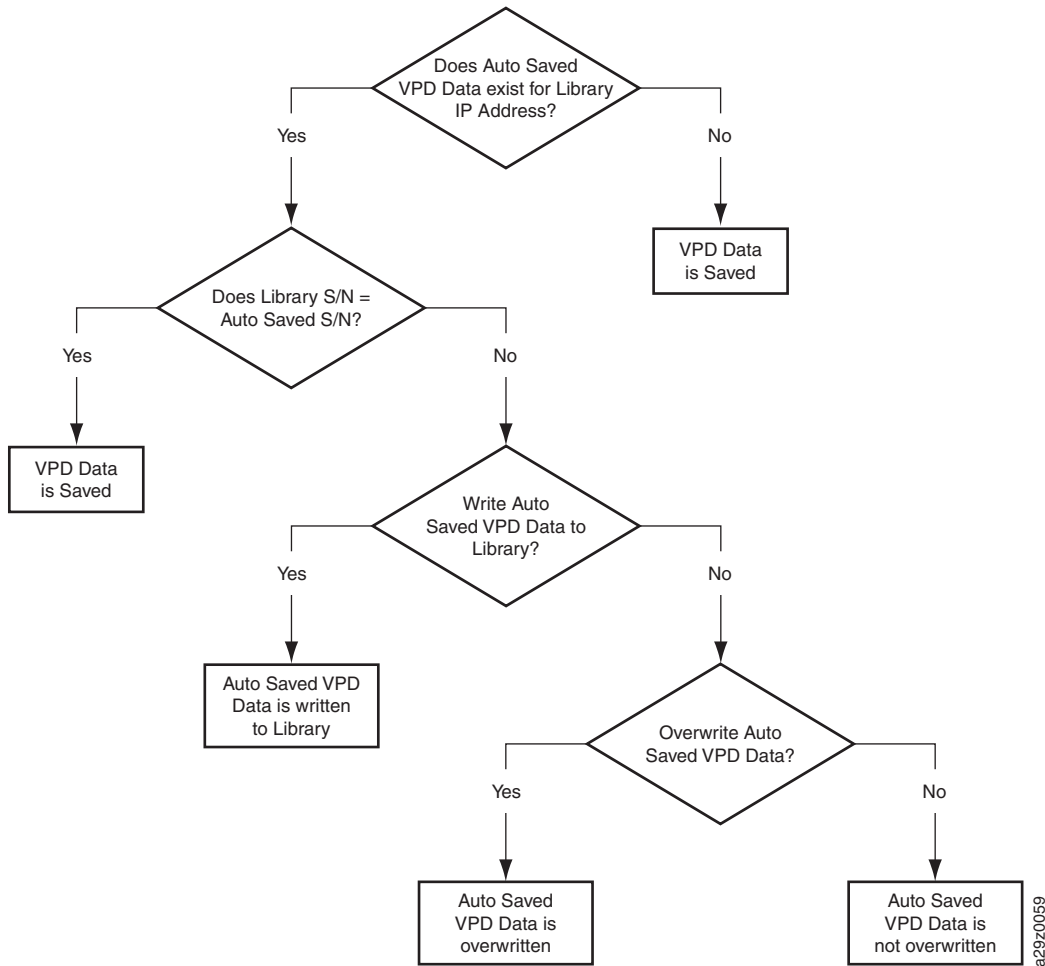
Figure 4-47. Configuration using cookies

Saving/restoring Configuration Manually using Web User Interface
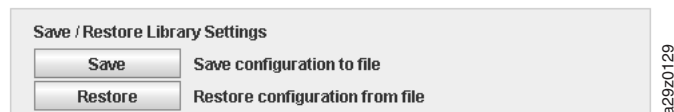
Figure 4-48. Save/Restore screen

Use **Configure Library** → **Save/Restore** to manually save library configuration settings to an external file or restore configuration settings from a file. This function is useful when you have several logical configurations for different tape storage implementations that you need to switch between on a regular basis.
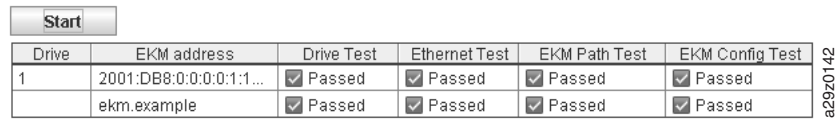
Note: When saving the library configuration manually, the library must be offline to save to files and to restore from files.

Click **Save** to save the current settings to a file.

Click **Restore** to load the settings from a file.

Servicing the Library

Running Encryption Key Path Diagnostics

Drive	EKM address	Drive Test	Ethernet Test	EKM Path Test	EKM Config Test
Start					
1	2001:DB8:0:0:0:0:1:1...	✓ Passed	✓ Passed	✓ Passed	✓ Passed
	ekm.example	✓ Passed	✓ Passed	✓ Passed	✓ Passed

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Figure 4-49. Key Path Diagnostics screen
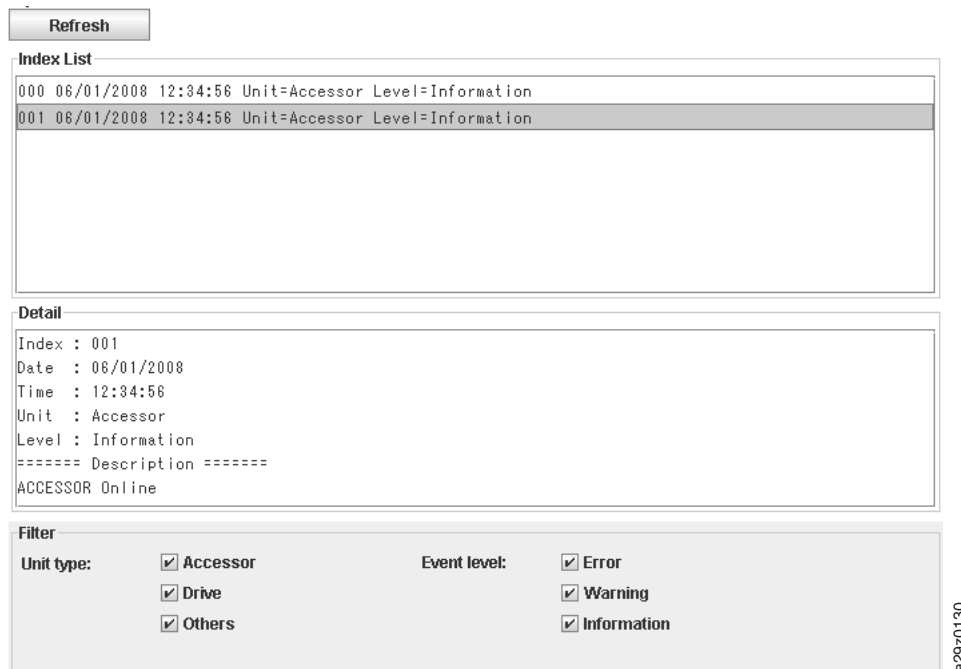
Use **Service Library → Key Path Diagnostics** to run diagnostic tests of the encryption key path if the drive in your Model S4H library is set up for library managed encryption. These run tests for the tape drives, network connection, EKM path, and the EKM configuration.

The test consists of four parts:
- **Drive Test** — This test ensures that the LDI is functioning properly.
- **Ethernet Test** — In this test, the library pings each EKM server IP address.
- **EKM Path Test** — In this test, the library performs an EKM communication test on each EKM server IP address that passed the Ethernet Test.
- **EKM Config Test** — This test confirms that a drive is correctly configured in the EKM to service key requests.

Click **Start** to run the diagnostics tests.

Viewing Operator Interventions

Figure 4-50. Operator Interventions screen

Use **Service Library → Operator Interventions** to display a log history summary of information, warning, and error events that have occurred for the selected library component units.

The summary can be filtered to display the operator intervention log for a specific hardware component and specific event levels. The log is stored in memory on the library control board. When the memory buffer is full, new events overwrite the oldest events. The log is not cleared from memory when power is turned OFF.

Click **Refresh** to read the log of operator interventions from the tape library. You can select an event in the **Index List** panel to display data specific to that event in the **Detail** panel.

The information displayed for the operator intervention event comprises:
- Index number of the event
- Date the event occurred
- Time the event occurred
- Unit in the library where the event occurred
- Event level
- Description of the event

Viewing Library Logs

Refresh

Index list
```
006 07/17/2008 16:15:06 Code=6/29/01 POWER ON OCCURRED.
007 01/01/2008 18:01:31 Code=6/29/01 POWER ON OCCURRED.
008 01/01/2008 18:01:18 Code=[0011]  Failed in time data acquisition from time server.
009 01/01/2008 19:53:34 Code=6/29/01 POWER ON OCCURRED.
010 01/01/2008 19:52:07 Code=6/29/01 POWER ON OCCURRED.
```

Detail
```
Index      : 008
Occurred at : 01/01/2008 18:01:18
Code=[0011]  : Failed in time data acquisition from time server.

      x0 x1 x2 x3 x4 x5 x6 x7  x8 x9 xA xB xC xD xE xF
0000: FF 00 00 00 00 00 00 0A  00 00 00 00 00 00 00 00
0010: 11 00 4D 00 00 00 00 00  00 00 00 00 00 11 00 00
0020: 0B 0D 11 00 00 00 01 FC  00 00 30 30 30 31 00 40
0030: 00 00 10 00 00 00 04 00  12 00 00 00 00 00 00 00
```

Filter
Code: ☑ Library/Drive Error [Check Codes]   ☑ Command Error (Sense Keys)
Sense key: ☑ No Sense (Code=0/xx/xx)   ☑ Hardware Error (Code=4/xx/xx)
                    ☑ Recovered Error (Code=1/xx/xx)   ☑ Illegal Request (Code=5/xx/xx)
                    ☑ Not Ready (Code=2/xx/xx)   ☑ Unit Attention (Code=6/xx/xx)
                    ☑ Medium Error (Code=3/xx/xx)   ☑ Aborted Command (Code=B/xx/xx)

a29z0131

Figure 4-51. View Library Logs screen

Use **Service Library** → **View Library Logs** to display a log history summary of errors that have occurred.

The error log is displayed with sense data information. The summary can be filtered to display errors with specific sense data code types.

Click **Refresh** to read the log of errors from the tape library. You can select an error in the **Index List** panel to display data specific to that error in the **Detail** panel.

The information displayed for the error comprises:
- Index number of the error
- Date and time the error occurred

- Error code
- Description of the error

There are 2 types of error data displayed in the library log with different Code attributes:

- Library/Drive sense data (Sense key/ASC/ASCQ)

  For example, a 5/3B/0D error states that an illegal request was initiated that resulted in a "medium destination element full" error being reported by the library. Selecting log entry 012 provides detailed sense data for this failure. Information on sense data is listed in Appendix D, "Sense Data," on page D-1.

- Library/Drive error code ([Code])

  For example, in log entry 010, a [0222] error states that the library cannot eject medium because drive is in state of Prevent Media Removal. Information on errors and action to resolve the problem are listed in Appendix B, "Error Codes," on page B-1.

Viewing Trace Data
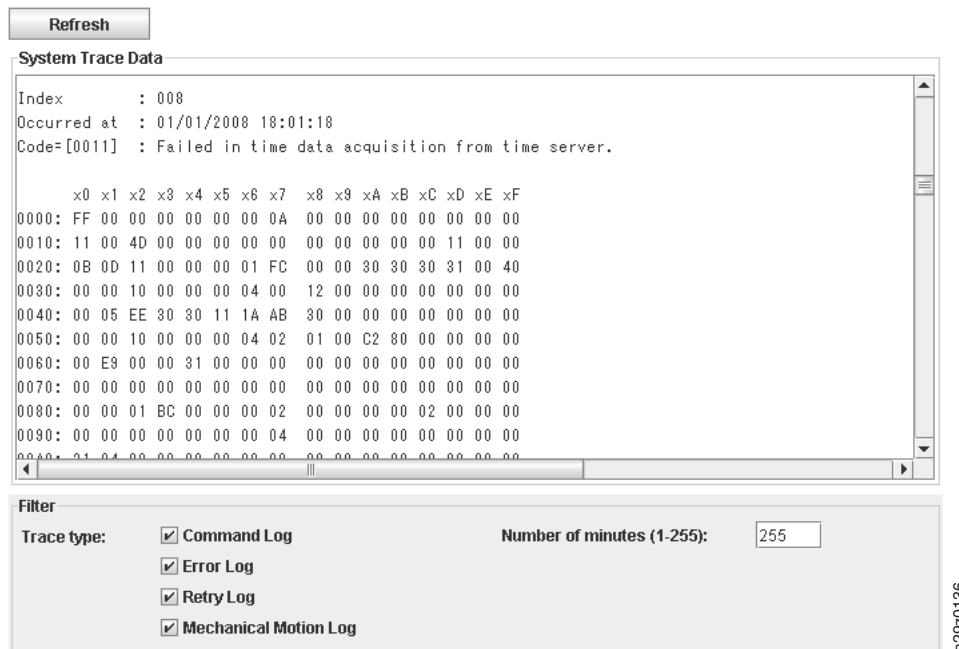
Figure 4-52. Traces screen

Use **Service Library** → **Traces** to display a trace history of errors that have occurred. The summary can be filtered to display the type of errors occurring within a given time period.

The system trace data for the interval entered in the **Number of Minutes** field is displayed. The summary can be filtered to trace data for specific system logs.

Click **Refresh** to read the system trace data from the tape library.

The information displayed in the system trace data comprises:

- Index number
- Date and time of event
- Sense data

Downloading Drive Logs

Figure 4-53. Download Drive Logs screen

Use **Service Library → Download Drive Logs** to download a tape drive dump to file for use by support personnel to help troubleshoot a problem. You can choose to create normal dump data (currently stored in flash) or force dump data (currently stored in memory and moved to flash).

To download a drive log:
1. Take the library offline.
2. For each type of dump (normal or forced), click the corresponding **Browse** button to display a dialog to enter a file name and to select a location to save the drive log.
3. Click **Download** to download the drive log and save to a file.

Downloading Library Logs

Figure 4-54. Download Library Logs screen

Use **Service Library → Download Library Logs** to download a tape library dump to file for use by support personnel to help troubleshoot a problem.

To download a library log:
1. Take the library offline.
2. Click **Browse** to display a dialog to enter a file name and to select a location to save the library log.
3. Click **Download** to download the library log and save to a file.

Resetting the Library/Drive

Figure 4-55. Reset Library/Drive screen

Use **Service Library → Reset Library/Drive** to reset the library or the tape drive.

Select the target device and click **Reset**. The library and tape drive status is displayed. A dialog message is displayed when the unit has been reset. The reset operation is only fully completed when the tape library is subsequently taken online.

Updating Library and Drive Firmware

Figure 4-56. Firmware Update screen

Use **Service Library** → **Firmware Update** to update the library and drive firmware.

Note: It is the customer's responsibility to maintain the library and drive firmware at the most recent level.

To update library and drive firmware:
1. Download the latest level of firmware to your host computer by visiting `http://www-03.ibm.com/servers/storage/support/index.html`.
2. Unload the tape drive, if there is a cartridge in the tape drive, before updating library and drive firmware.
3. After downloading the file, click **Browse** to locate the library firmware file with extension ".fmg" (for example, TS2900_0002.0000.fmg) or the LTO SAS drive firmware file with extension".ro" (for example, 85F0L3AH.ro) that you downloaded from the IBM web site, then click **Update**. The Web User Interface will indicate that the operation has completed. This means that the firmware file has been successfully moved from the host computer to the library.
4. Wait for the library to reboot before resuming normal library operations. It can take several minutes before the library reboots.

Important: After the update process starts, you must wait until the library reboots. Do not attempt to interrupt the process in any way, or the upgrade will not be successful.

Note: The IBM TotalStorage Tape Diagnostic Tool (ITDT) is a tool provided by IBM that offers multiple functional capabilities, including updating drive and library firmware. It is available for most major platforms and requires no special device drivers. In addition to the executable file, a README file is provided that describes the features and capabilities of the ITDT tool, and gives detailed information on how to use the tool. See "Using the IBM TotalStorage Diagnostic Tool (ITDT)" on page 7-1.

Viewing Accessor Statistics

```
Refresh    Last refresh: Sunday, July 6, 2008 11:06:56 AM JST

Statistics Information Data

[Motion Counts]
Move            :         909
Accessor        :       1,832
Picker          :       1,818
X Move          :       1,818

[Retry Counts]
Drive           :           1
C1,T2           :           1
C1,T1           :           1
C2,T2           :           2
C2,T1           :           0
C3,T2           :           3
C3,T1           :           0
C4,T2           :           2
C4,T1           :           3
C5,T1           :           2

[Error Counts]
Accessor motion :           0
X move   motion :           1
Drive loading   :           0
```
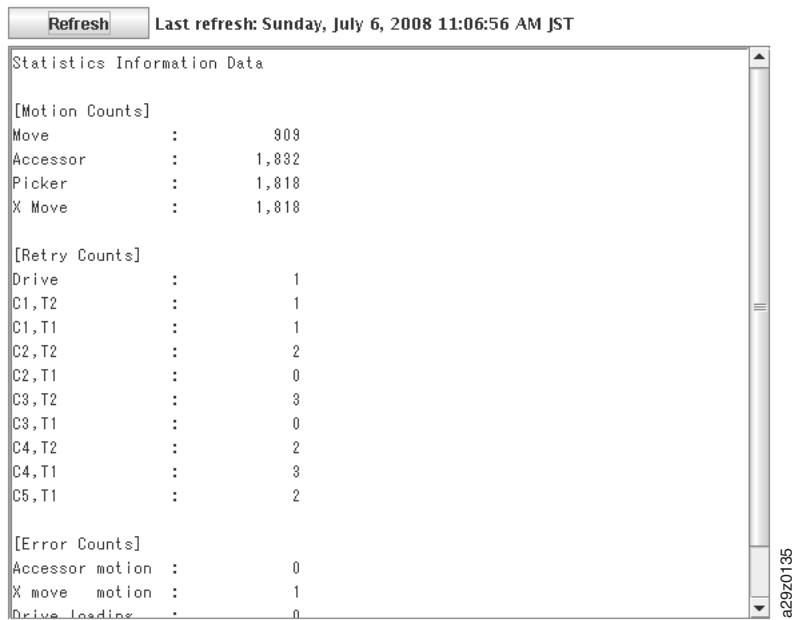
Figure 4-57. Usage Statistics screen

Use **Service Library** → **Usage Statistics** to view statistics information about the movement of the robotics of the library. The information presented is:

- Motion counts — Lists the accumulated operation count for all movements, accessor movements, picker movements, and X-axis movements.
- Retry counts — Lists the accumulated number of retries (re-attempts to load cartridges) in the drive and the cartridges positions by the accessor.
- Error counts — Lists the accumulated number of errors for the accessor, X-axis movements, and drive load and unload operations.

Click **Refresh** to read the accessor statistics from the library. The **Last refresh** shows the time of the most recent library data refresh.

Chapter 5. Media

To ensure that your IBM Ultrium Tape Drive conforms to IBM's specifications for reliability, use only IBM LTO Ultrium tape cartridges. You may use other LTO-certified data cartridges, but they may not meet the standards of reliability that are established by IBM. Neither the IBM LTO Ultrium 400 GB Data Cartridge (Ultrium 3) nor the IBM LTO Ultrium 800 GB Data Cartridge can be interchanged with the media used in other IBM non-LTO Ultrium tape products.

Figure 5-1 shows the IBM LTO Ultrium 800 GB Data Cartridge and its components.
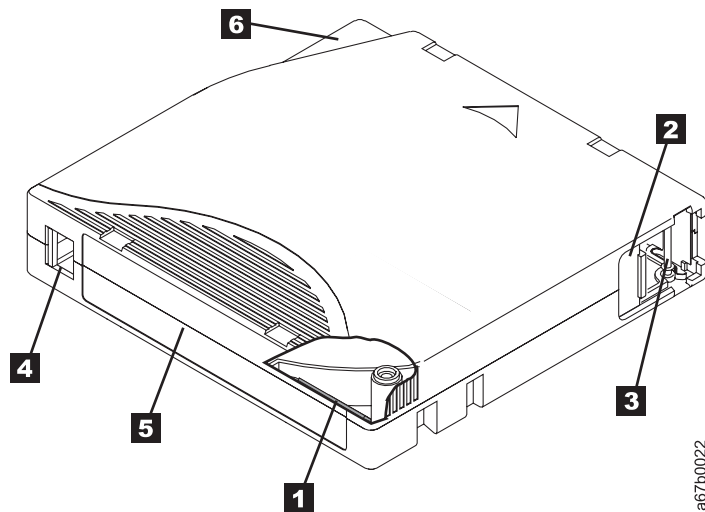
Figure 5-1. IBM LTO Ultrium 800 GB Data Cartridge

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

Data Cartridges

The different generations of IBM Ultrium data cartridges can be identified by color:

Table 5-1. Ultrium data cartridges

Type	Color
Ultrium 4	Green
Ultrium 4 WORM	Green and Silvery gray
Ultrium 3	Slate Blue
Ultrium 3 WORM	Slate Blue and Silvery gray
Ultrium 2	Purple
Ultrium 1	Black

All generations contain 1/2-inch, dual-coat, metal-particle tape.

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 5-19.

When processing tape in the cartridges, Ultrium Tape Drives use a linear, serpentine recording format. The native data capacity and recording format of Ultrium data cartridges is as follows:

Table 5-2. Data capacity and recording format

Type	Native Data Capacity	Recording Format
Ultrium 4	800 GB (1600 GB at 2:1 compression)	Reads and writes data on 896 tracks, sixteen tracks at a time.
Ultrium 3	400 GB (800 GB at 2:1 compression)	Reads and writes data on 704 tracks, sixteen tracks at a time.
Ultrium 2	200 GB (400 GB at 2:1 compression)	Reads and writes data on 512 tracks, eight tracks at a time.
Ultrium 1	100 GB (200 GB at 2:1 compression)	Reads and writes data on 384 tracks, eight tracks at a time.

The first set of tracks (sixteen for Ultrium 4 and 3; eight for Ultrium 2 and 1) is written from near the beginning of the tape to near the end of the tape. The head then repositions to the next set of tracks for the return pass. This process continues until all tracks are written and the cartridge is full, or until all data is written.

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

The write-protect switch **4** prevents data from being written to the tape cartridge. For more information, see "Write-Protect Switch" on page 5-7.

The label area **5** provides a location to place a label. For more information, see "Bar Code Labels" on page 5-5.

The insertion guide **6** is a large, notched area that prevents the cartridge from being inserted incorrectly.

Generation 3 and 4 of the LTO Ultrium Data Cartridge have a nominal cartridge life of 20,000 (20k) load and unload cycles. Generation 2 has a nominal cartridge life of 10,000 (10k) load and unload cycles. Generation 1 of the LTO Ultrium Data Cartridge has a nominal cartridge life of 5000 (5k) load and unload cycles.

Cartridge Compatibility

Table 5-3. Ultrium data and cleaning cartridge compatibility with Ultrium tape drive

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

Note: The TS2900 Tape Autoloader supports the Ultrium 3 (3572-3SH) and Ultrium 4 (3572-4SH) Tape Drives only.

Capacity Scaling

To control the capacity of the cartridge (for example, to obtain a faster seek time) issue the SCSI command SET CAPACITY. For information about this command, refer to the *IBM TotalStorage LTO Ultrium Tape Drive SCSI Reference*.

WORM (Write Once, Read Many)

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

WORM Media

Because standard read/write media are incompatible with the WORM feature, a specially formatted WORM tape cartridge (see Figure 5-2) is required. Each WORM cartridge has a unique, worldwide cartridge identifier (WWCID), which comprises the unique CM chip serial number and the unique tape media serial number. Ultrium 4 WORM cartridges are two-tone green and silvery-gray. See "Ordering Media Supplies" on page 5-19 for information on how to choose and purchase the appropriate WORM tape cartridges for your library.
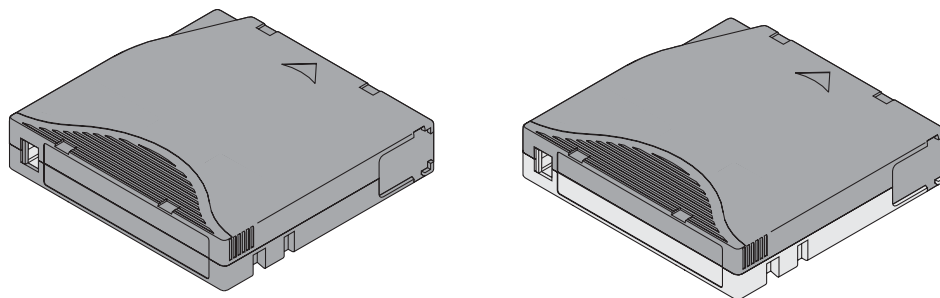
Figure 5-2. Ultrium WORM Tape Cartridge

Data Security on WORM Media

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

- The format of an Ultrium 4 800 GB or Ultrium 3 400 GB WORM Tape Cartridge is unlike that of standard read/write media. This unique format prevents a drive that lacks WORM-capable firmware from writing on a WORM tape cartridge.
- When the drive senses a WORM cartridge, the firmware prohibits the changing or altering of user data already written on the tape. The firmware keeps track of the last appendable point on the tape.

WORM Media Errors

The following conditions cause WORM media errors to occur:

- Information in the servo manufacturer's word (SMW) on the tape must match information from the cartridge memory (CM) module in the cartridge. If it does not match, a media Error Code 7 will post on the drive's single-character display (SCD). An error will also be displayed on the Operator Panel.
- Inserting a WORM tape cartridge into a drive that is not WORM capable causes the cartridge to be treated as an unsupported medium. The drive will report a media Error Code 7. Upgrading the drive firmware to the correct code level will resolve the problem.

Requirements for WORM Capability

To add WORM capability to your LTO Ultrium generation 4 drive(s), you need to have the drive firmware to the correct code level, and use either Ultrium 4 800 GB WORM tape cartridges or Ultrium 3 400 GB WORM tape cartridges (see "Ordering Media Supplies" on page 5-19).

Cleaning Cartridge

An IBM Ultrium Universal Cleaning Cartridge is required to clean the tape drive. The drive itself determines when it needs to be cleaned and notifies the library. When notified, the library indicates that the drive needs cleaning by turning ON the "Clean Drive" LED on the front panel of the library and posting a message on the library display.

A stand-alone tape drive requires manual insertion of the cleaning cartridge. A tape drive within a library requires the use of a library menu function to either automatically or manually clean the tape drive.

> **Important:** It is recommended that the drive be cleaned only when it is requested by the drive.

The IBM Ultrium Universal Cleaning Cartridge is valid for 50 uses. The cartridge's LTO-CM (Cartridge Memory) chip tracks the number of times that the cartridge is used.

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

Cartridge Memory Chip (LTO-CM)

All generations of the IBM LTO Ultrium Data Cartridges include a Linear Tape-Open Cartridge Memory (LTO-CM) chip (**1** in Figure 5-1 on page 5-1), that contains information about the cartridge and the tape (such as the name of the manufacturer that created the tape), as well as statistical information about the cartridge's use. The LTO-CM enhances the efficiency of the cartridge. For example, the LTO-CM stores the end-of-data location which, when the next time this cartridge is inserted and the Write command is issued, enables the drive to quickly locate the recording area and begin recording. The LTO-CM also aids in determining the reliability of the cartridge by storing data about its age, how many times it has been loaded, and how many errors it has accumulated. Whenever a tape cartridge is unloaded, the tape drive writes any pertinent information to the cartridge memory.

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

Bar Code Labels

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

> **Note:** The tape drive does not require bar code labels, but you should use labels for tape cartridge identification purposes.

Table 5-4. Bar code label requirements for the Ultrium tape drive and library

Ultrium Tape Drive/Library	Bar Code Label Requirements
3572	Required
3573	Required
3576	Required
3580	Not required
3581	Required with optional Bar Code Reader
3582	Required
3583	Required
3584	Required

When read by a library's bar code reader, the bar code identifies the cartridge's VOLSER to the library. The bar code also tells the library whether the cartridge is a data cartridge or cleaning cartridge. In addition, the bar code includes the two-character media-type identifier Lx, where x equals 1, 2, 3, or 4. L identifies the cartridge as an LTO cartridge and the number represents the generation of cartridge

for that cartridge type. Figure 5-3 on page 5-6 shows a sample bar code label for the LTO Ultrium Tape Cartridge.

Tape cartridges can be ordered with the labels included or with custom labels. To order tape cartridges and bar code labels, see "Ordering Media Supplies" on page 5-19. The bar code for usage in the LTO tape library must meet predefined specifications. They include (but are not limited to):

- Six or eight (the default) uppercase alphanumeric characters, where the last two characters must be L4, L3, L2, or L1
- Label and printing to be non-glossy
- Nominal narrow line or space width of 0.423 mm (0.017 in.)
- Wide to narrow ratio of 2.75:1
- Minimum bar length of 11.1 mm (0.44 in.)

Table 5-5. Cartridges and VOLSERs compatible with the Ultrium 3 and Ultrium 4 Tape Drive

Cartridges	VOLSER
Ultrium 4 Data Cartridge	xxxxxxL4
Ultrium 4 WORM Cartridge	xxxxxxLU
Ultrium 3 Data Cartridge	xxxxxxL3
Ultrium 3 WORM Cartridge	xxxxxxLT
Ultrium 2 Data Cartridge	xxxxxxL2
Ultrium 1 Data Cartridge	xxxxxxL1
IBM LTO Ultrium Cleaning Cartridge	CLNxxxLx
* An Ultrium 3 Tape Drive must have a minimum firmware level of 54xx for it to be compatible with the WORM cartridge.	

To determine the complete specifications of the bar code and the bar code label, visit the web at `http://www.ibm.com/storage/lto`, (select **LTO Support**), or contact your IBM Sales Representative.

When attaching a bar code label to a tape cartridge, place the label only in the recessed label area (**4** in Figure 5-1 on page 5-1). A label that extends outside of the recessed area can cause loading problems in the drive.

Note: Do not place any type of mark on the white space at either end of the bar code. A mark in this area may prevent the library from reading the label.
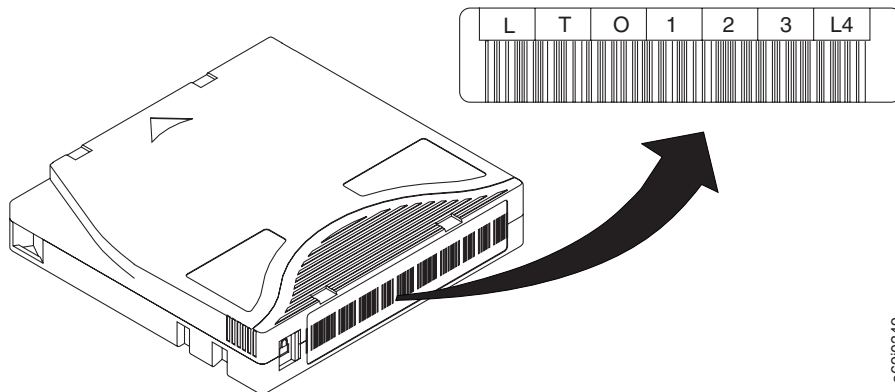
Figure 5-3. Sample bar code label on the LTO Ultrium 4 Tape Cartridge

The volume serial number (LTO123), cartridge type (L4), and bar code are printed on the label.

Guidelines for Using Bar Code Labels

Apply the following guidelines whenever using bar code labels:

- Use only IBM-approved bar code labels on cartridges to be used in an IBM tape library.
- Do not reuse a label or reapply a used label over an existing label.
- Before you apply a new label, remove the old label by slowly pulling it at a right angle to the cartridge case.
- Use peel-clean labels that do not leave a residue after being removed. If there is glue residue on the cartridge, remove it by gently rubbing it with your finger. Do not use a sharp object, water, or a chemical to clean the label area.
- Examine the label before applying it to the cartridge. Do not use the label if it has voids or smears in the printed characters or bar code (a library's inventory operation will take much longer if the bar code label is not readable).
- Remove the label from the label sheet carefully. Do not stretch the label or cause the edges to curl.
- Position the label within the recessed label area (**5** in Figure 5-1 on page 5-1).
- With light finger pressure, smooth the label so that no wrinkles or bubbles exist on its surface.
- Verify that the label is smooth and parallel, and has no roll-up or roll-over. The label must be flat to within 0.5 mm (0.02 in.) over the length of the label and have no folds, missing pieces, or smudges.
- Do not place other machine-readable labels on other surfaces of the cartridge. They may interfere with the ability of the drive to load the cartridge.

Write-Protect Switch

The position of the write-protect switch on the tape cartridge (**1** in Figure 5-4) determines whether you can write to the tape. If the switch is set to:

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

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

If you must manually set the write-protect switch, slide it left or right to the desired position.
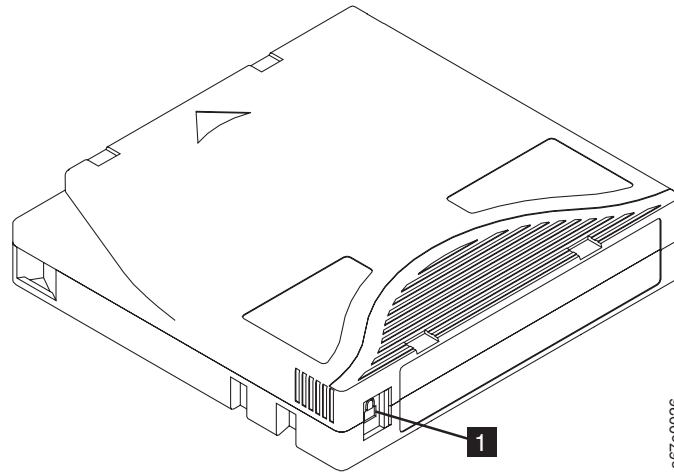
Figure 5-4. Setting the write-protect switch

Cartridge Care and Handling

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

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

Provide Training

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

Ensure Proper Packaging

- When shipping a cartridge, use the original or better packaging.
- Always ship or store a cartridge in a jewel case.
- Use only a recommended shipping container that securely holds the cartridge in its jewel case during transportation. Ultrium Turtlecases (by Perm-A-Store) have been tested and found to be satisfactory (see Figure 5-5). They are available at `http://www.turtlecase.com/`.

Figure 5-5. Tape cartridges in a Turtlecase

- Never ship a cartridge in a commercial shipping envelope. Always place it in a box or package.
- If you ship the cartridge in a cardboard box or a box of a sturdy material, ensure the following:
  - Place the cartridge in polyethylene plastic wrap or bags to protect it from dust, moisture, and other contaminants.
  - Pack the cartridge snugly; do not allow it to move around.
  - Double-box the cartridge (place it inside a box, then place that box inside the shipping box) and add padding between the two boxes (see Figure 5-6).

Figure 5-6. Double-boxing tape cartridges for shipping

Provide Proper Acclimation and Environmental Conditions

- 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 cartridge was exposed).
- Ensure that all surfaces of a cartridge are dry before inserting it.
- Do not expose the cartridge to moisture or direct sunlight.
- Do not expose recorded or blank cartridges to stray magnetic fields of greater than 100 oersteds (for example, terminals, motors, video equipment, X-ray equipment, or fields that exist near high-current cables or power supplies). Such exposure can cause the loss of recorded data or make the blank cartridge unusable.
- Maintain the conditions that are described in "Environmental and Shipping Specifications for Tape Cartridges" on page 5-18.

Perform a Thorough Inspection

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

- Inspect the cartridge's packaging to determine potential rough handling.
- When inspecting a cartridge, open only the cartridge door. Do not open any other part of the cartridge case. The upper and lower parts of the case are held together with screws; separating them destroys the usefulness of the cartridge.
- Inspect the cartridge for damage before using or storing it.
- Inspect the rear of the cartridge (the part that loads first into the tape load compartment) and ensure that there are no gaps in the seam of the cartridge case (**1** in Figure 5-7 and **4** in Figure 5-9 on page 5-13). If there are gaps in the seam (see Figure 5-7), the leader pin may be dislodged. Go to "Repositioning or Reattaching a Leader Pin" on page 5-11.
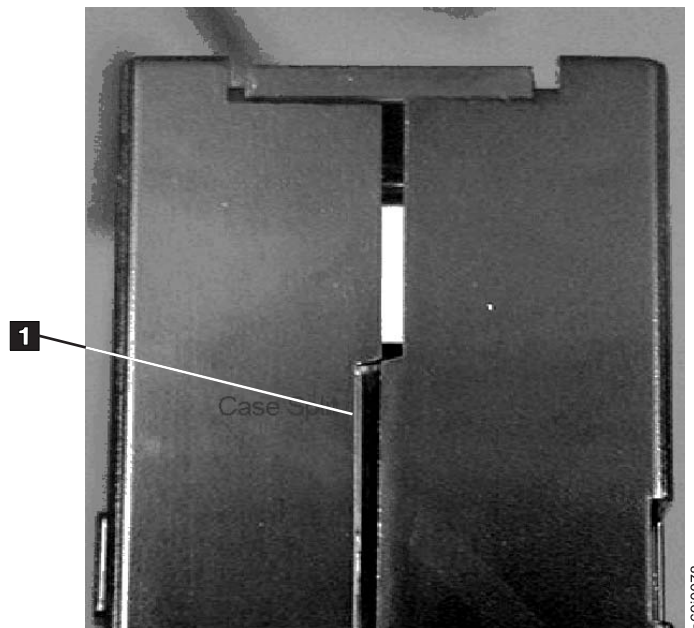
Figure 5-7. Checking for gaps in the seams of a cartridge

- Check that the leader pin is properly seated (see **2** in Figure 5-8).
- If you suspect that the cartridge has been mishandled but it appears usable, copy any data onto a good cartridge immediately for possible data recovery. Discard the mishandled cartridge.

- Review handling and shipping procedures.

Handle the Cartridge Carefully

- Do not drop the cartridge. If the cartridge drops, slide the cartridge door back and ensure that the leader pin is properly seated in the pin-retaining spring clips (see **2** in Figure 5-8). If the leader pin has become dislodged, go to "Repositioning or Reattaching a Leader Pin" on page 5-11.
- Do not handle tape that is outside the cartridge. Handling the tape can damage the tape's surface or edges, which may interfere with read or write reliability. Pulling on tape that is outside the cartridge can damage the tape and the brake mechanism in the cartridge.
- Do not stack more than six cartridges.
- Do not degauss a cartridge that you intend to reuse. Degaussing makes the tape unusable.

Examples of Cartridge Problems

Example: Split Cartridge Case (see Figure 5-7**)**

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

1. Look for cartridge mishandling.
2. Use the IBM Leader Pin Reattachment Kit (part number 08L9129) to correctly seat the pin (see "Repositioning or Reattaching a Leader Pin" on page 5-11). Then, immediately use data recovery procedures to minimize chances of data loss.
3. Review media-handling procedures.

Example: Improper Placement of Leader Pin (see Figure 5-8**)**

The leader pin is misaligned. Perform the following steps:

1. Look for cartridge damage.
2. Use the IBM Leader Pin Reattachment Kit (part number 08L9129) to correctly seat the pin (see "Repositioning or Reattaching a Leader Pin" on page 5-11). Then, immediately use data recovery procedures to minimize chances of data loss.

Repositioning or Reattaching a Leader Pin

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

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

Note: 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.

Repositioning a Leader Pin

A leader pin that is improperly seated inside a cartridge can interfere with the operation of the drive. Figure 5-8 shows a leader pin in the incorrect **1** and correct **2** positions.

To place the leader pin in its proper position, you will need the following tools:

- Plastic or blunt-end tweezers
- Cartridge manual rewind tool (from Leader Pin Reattachment Kit, part number 08L9129)
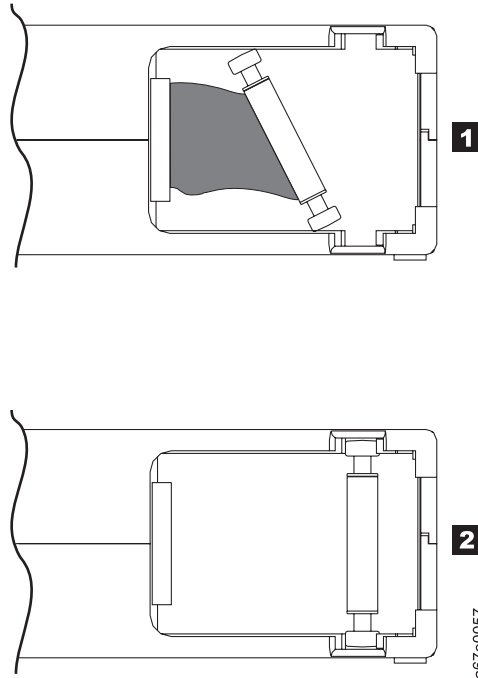
Figure 5-8. Leader pin in the incorrect and correct positions

The cartridge door is open and the leader pin is visible inside the cartridge.

To reposition the leader pin, perform the following steps.

1. Slide open the cartridge door (**1** in Figure 5-9) and locate the leader pin **2** (you may need to shake the cartridge gently to roll the pin toward the door).
2. With plastic or blunt-end tweezers, grasp the leader pin and position it in the pin-retaining spring clips **3**.
3. Press the leader pin gently into the clips until it snaps into place and is firmly seated.
4. Close the cartridge door.
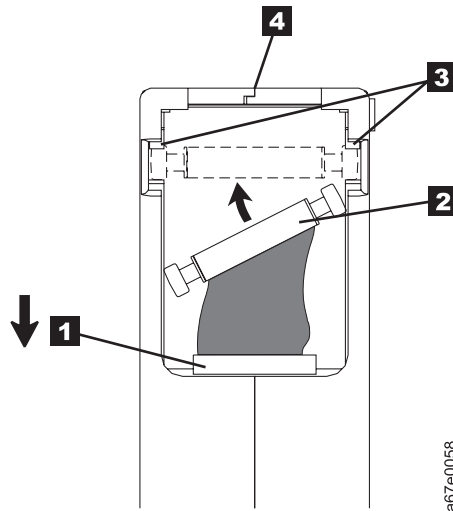
Figure 5-9. Placing the dislodged leader pin into the correct position

The cartridge door is open to show the leader pin.

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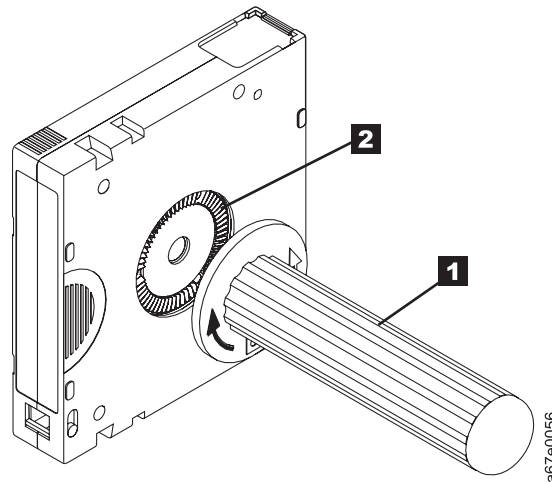
Figure 5-10. Rewinding the tape into the cartridge

6. Remove the rewind tool by pulling it away from the cartridge.
7. If you suspect that the cartridge has been mishandled but it appears usable, copy any data onto a good cartridge immediately for possible data recovery. Discard the mishandled cartridge.

Reattaching a Leader Pin

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

The Leader Pin Reattachment Kit contains three parts:

- **Leader pin attach tool** (**1** in Figure 5-11). A plastic brace that holds the cartridge door open.
- **Cartridge manual rewind tool** (**2** in Figure 5-11). A device that fits into the cartridge's hub and lets you wind the tape into and out of the cartridge.
- **Pin supplies** (**3** in Figure 5-11). Leader pins and C-clips.

Note:

- Use only the IBM Leader Pin Reattachment Kit to reattach the leader pin to the tape. Other methods of reattaching the pin will damage the tape, the drive, or both.
- Use this procedure on your tape cartridge only when the leader pin detaches from the magnetic tape and you must copy the cartridge's data onto another cartridge. Destroy the damaged cartridge after you copy the data. This procedure may affect the performance of the leader pin during threading and unloading operations.
- Touch only the end of the tape. Touching the tape in an area other than the end can damage the tape's surface or edges, which may interfere with read or write reliability.
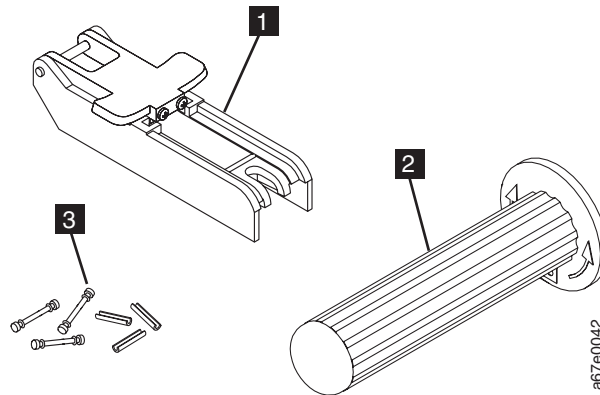
Figure 5-11. Leader Pin Reattachment Kit

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

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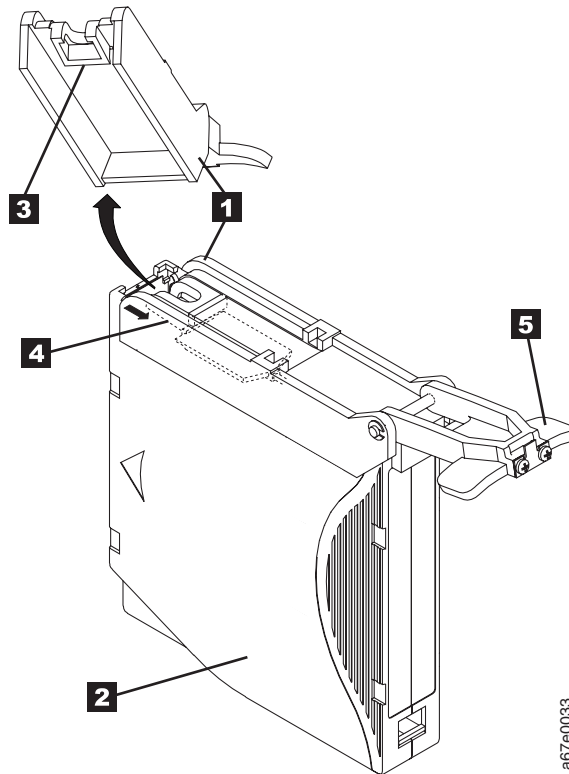
Figure 5-12. Attaching the leader pin attach tool to the cartridge

To hold the cartridge door open, hook the tool into the door and pull the tool back.

2. To find the end of the tape inside the cartridge, attach the cartridge manual rewind tool (**1** in Figure 5-13) to the cartridge's hub **2** by fitting the tool's teeth between the teeth of the hub. Turn the tool clockwise until you see the end of the tape inside the cartridge. Then, slowly turn the rewind tool counterclockwise to bring the tape edge toward the cartridge door **3**.

3. Continue to turn the rewind tool counterclockwise until approximately 13 cm (5 in.) of tape hangs from the cartridge door. If necessary, grasp the tape and pull gently to unwind it from the cartridge.

4. Remove the rewind tool by pulling it away from the cartridge. Set the tool and the cartridge aside.
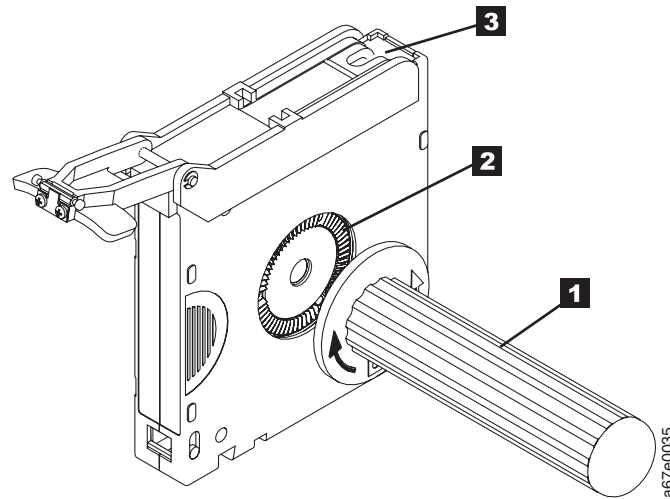
Figure 5-13. Winding the tape out of the cartridge

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

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

6. Remove the C-clip from the leader pin by using your fingers to push the clip away from the pin. Set the pin aside and discard the clip.
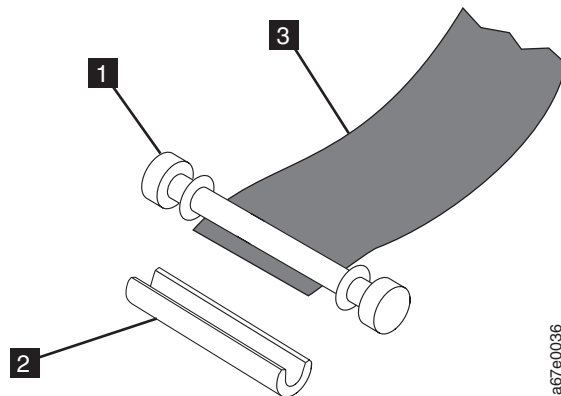
Figure 5-14. Removing the C-clip from the leader pin

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

7. Position the tape in the alignment groove of the leader pin attach tool (**1** in Figure 5-15).

8. Place a new C-clip into the retention groove (**2** in Figure 5-15) on the leader pin attachment tool and make sure that the clip's open side faces up.

9. Place the leader pin (from step 6) into the cavity (**3** in Figure 5-15) of the leader pin attach tool.

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

10. Fold the tape over the leader pin and hold it with your fingers (see Figure 5-15).

Note: Use care to ensure that the tape is centered over the leader pin. Failure to properly center the tape on the pin will cause the repaired cartridge to fail.

When the tape is properly centered, a 0.25-mm (0.01-in.) gap exists on both sides of the pin.
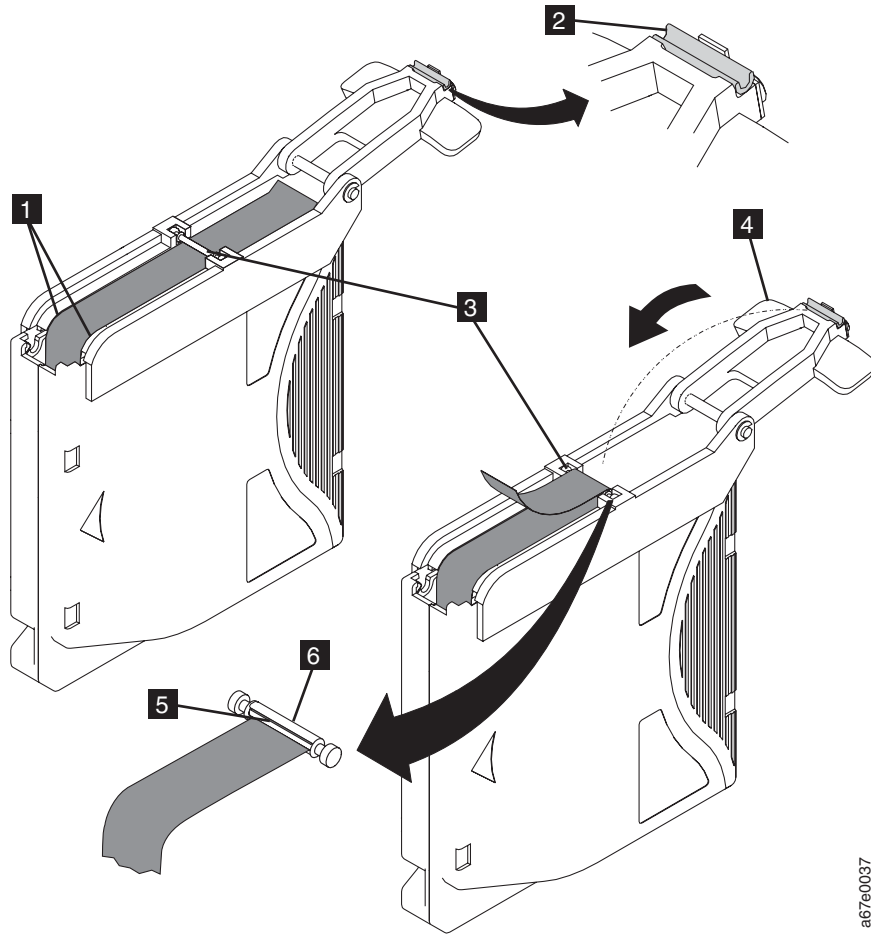
Figure 5-15. Attaching the leader pin to the tape

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

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

13. Use your fingers to remove the leader pin from the cavity **3** in the leader pin attach tool.

14. Use the cartridge manual rewind tool to wind the tape back into the cartridge (wind the tape clockwise). Ensure that the leader pin is latched by the pin-retaining spring clips on each end of the leader pin.

15. Remove the rewind tool.

16. Remove the leader pin attach tool by lifting its end up and away from the cartridge.

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 cartridge was exposed).

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

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

Table 5-6 gives the environment for operating, storing, and shipping LTO Ultrium Tape Cartridges.

Table 5-6. Environment for operating, storing, and shipping the LTO Ultrium Tape Cartridge

Environmental Factor	Environmental Specifications			
	Operating	Operational Storage1	Archival Storage2	Shipping
Temperature	10 to 45ºC (50 to 113ºF)	16 to 32ºC (61 to 90ºF)	16 to 25ºC (61 to 77ºF)	-23 to 49ºC (-9 to 120ºF)
Relative humidity (non-condensing)	10 to 80%	20 to 80%	20 to 50%	5 to 80%
Maximum wet bulb temperature	26ºC (79ºF)	26ºC (79ºF)	26ºC (79ºF)	26ºC (79ºF)
Note:				
1. The short term or operational storage environment is for storage durations of up to six months.				
2. The long term or archival storage environment is for durations of six months up to ten years.				

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 4000 oersted peak field over the entire space that the cartridge occupies). The tape should make two passes through the field at 90 degree orientation change for each pass to achieve complete erasure. Some commercial degaussers have two magnetic field regions

offset 90 degrees from each other to accomplish complete erasure in one pass for higher throughput. Degaussing makes the cartridge unusable.

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

Ordering Media Supplies

Table 5-7 lists the cartridges and media supplies that you can order for the drive.

Table 5-7. Media supplies

Supply Item	Methods of Ordering
20-PACK IBM LTO Ultrium 800 GB Data Cartridge (with attached labels)	Order the cartridge from your IBM Sales Representative or any authorized IBM Business Partner by specifying Machine Type 3589 Model 010. Specify the VOLSER characters that you want. Order as part number 95P4443 (color label) or 95P4445 (black and white label) through an IBM-authorized distributor. Specify the VOLSER characters that you want.
20-PACK IBM LTO Ultrium 800 GB Data Cartridge (without attached labels)	Order the cartridge from your IBM Sales Representative or any authorized IBM Business Partner by specifying Machine Type 3589 Model 011. Order as part number 95P4447 through an IBM-authorized distributor.
5-PACK IBM LTO Ultrium 800 GB Data Cartridge	Order as part number 95P4278 through an IBM-authorized distributor.
20-PACK IBM Ultrium 4 800 GB WORM Tape Cartridge (with attached labels)	Order the cartridge from your IBM Sales Representative or any authorized IBM Business Partner by specifying Machine Type 3589 Model 032. Order as part number 95P4457 (color label) or 95P4459 (black and white label) through an IBM-authorized distributor. Specify the VOLSER characters that you want.
20-PACK IBM Ultrium 4 800 GB WORM Tape Cartridge (without attached labels)	Order the cartridge from your IBM Sales Representative or any authorized IBM Business Partner by specifying Machine Type 3589 Model 033. Order as part number 95P4461 through an IBM-authorized distributor. Specify the VOLSER characters that you want.
IBM LTO Ultrium 400 GB Data Cartridge Bar code labels are pre-applied to cartridges.	Order the cartridge from your IBM Sales Representative or any authorized IBM Business Partner by specifying Machine Type 3589 Model 008. Specify the VOLSER characters that you want. Order as part number 96Pxxxx (color label) or 96Pxxxx (black and white label) through an IBM-authorized distributor. Specify the VOLSER characters that you want.

Table 5-7. Media supplies (continued)

Supply Item	Methods of Ordering
IBM LTO Ultrium 400 GB Data Cartridge Order VOLSER labels separately.	Order the cartridge from your IBM Sales Representative or any authorized IBM Business Partner by specifying Machine Type 3589 Model 009. Order as part number 24Rxxxx through an IBM-authorized distributor. Specify the VOLSER characters that you want.
5-PACK IBM LTO Ultrium 400 GB Data Cartridge	Order as part number 95P2020 through an IBM-authorized distributor. Specify the VOLSER characters that you want.
IBM Ultrium 3 400 GB WORM Tape Cartridge (with attached labels) IBM TotalStorage 3589 Model 028/Feature Code 2820 is a 20-pack of WORM cartridges labeled with starting volume serial information and, optionally, packed in individual jewel cases. Attached labels have been preprinted with a Bar Code that ends with LT, where L stands for LTO, and T identifies the cartridge as a WORM cartridge. This media can be used with LTO 3 drives (read/write).	Order by Machine Type/Model and Feature Code through an IBM-authorized distributor.
IBM Ultrium 3 400 GB WORM Tape Cartridge (without attached labels) IBM TotalStorage 3589 Model 029/Feature Code 2920 is a 20-pack of WORM cartridges packed in individual jewel cases with unattached blank labels. This media can be used with LTO 3 drives (read/write).	Order by Machine Type/Model and Feature Code through an IBM-authorized distributor.
IBM LTO Ultrium 200 GB Data Cartridge Bar code labels are pre-applied to cartridges.	Order the cartridge from your IBM Sales Representative or any authorized IBM Business Partner by specifying Machine Type 3589 Model 006. Specify VOLSER characters you want.
IBM LTO Ultrium 200 GB Data Cartridge Order VOLSER labels separately (see "Ordering Bar Code Labels" on page 5-21).	Order the cartridge from your IBM Sales Representative or any authorized IBM Business Partner by specifying Machine Type 3589 Model 007.
IBM LTO Ultrium 100 GB Data Cartridge Order VOLSER labels separately (see "Ordering Bar Code Labels" on page 5-21).	Order as part number 08L9120 through an IBM-authorized distributor.
IBM LTO Ultrium Cleaning Cartridge (Universal cleaning cartridge for use with Ultrium 1, Ultrium 2, and Ultrium 3 drives) VOLSER labels are included.	Order as part number 35L2086 through an IBM-authorized distributor.
Leader Pin Reattachment Kit	Order as part number 08L9129 through an IBM-authorized distributor.
Manual Rewind Tool	Order as part number 08L9130 through an IBM-authorized distributor.

To find the closest IBM-authorized distributor, visit the web at `http://www.ibm.com/storage/media`) or call 1-888-IBM-MEDIA.

Ordering Bar Code Labels

The LTO Ultrium 3 and 4 Tape Drives do not require cartridge bar code labels. However, if you use your data cartridges or cleaning cartridges in an IBM tape library product, you may need cartridge bar code labels if your tape library product requires them. You can order these labels separately from the IBM Data Cartridges and Cleaning Cartridges.

You can order bar code labels directly from the authorized label suppliers in Table 5-8.

Table 5-8. Authorized suppliers of custom bar code labels

In America	In Europe and Asia
EDP/Tri-Optic 6800 West 117th Avenue Broomfield, CO 80020 U. S. A. Telephone: 888-438-8362 `http://www.tri-optic.com/`	EDP Europe, Ltd. 43 Redhills Road South Woodham Ferrers Chelmsford, Essex CM3 5UL U. K. Telephone: 44 (0) 1245-322380 `http://www.tri-optic.com/`
Dataware P.O. Box 740947 Houston, TX 77274 U. S. A. Telephone: 800-426-4844 `http://www.datawarelabels.com/`	Digital Tape Solutions 12 Ashley St. Chatswood, NSW 2067 Australia Telephone: (02) 9496-1111 `http://www.datawarelabels.com/`
Netc, L.L.C. P. O. Box 320784 Fairfield, CT 06432 U. S. A. Telephone: 203-372-6382 `http://www.netclabels.com/`	Netc Europe Ltd The Old Surgery 5a The Pavement North Curry, Taunton Somerset TA3 6LX U. K. Telephone: 44 (0) 1823 49 1439 `http://www.netclabels.co.uk/`
	Netc Asia Pacific Pty Ltd P.O. Box 609 Windsor, NSW 2756 Australia Telephone: 61 (0) 2 4577 3793 `http://www.netclabels.com.au/`

Chapter 6. Troubleshooting

The TS2900 Tape Autoloader is a customer replaceable unit (CRU). The customer is responsible for the setup and maintenance of the library. Warranty replacement of the TS2900 Tape Autoloader, if required, is provided by exchanging the old unit with a new unit. The customer will be charged for on-site service if a service contract is not in place.

When an error occurs during operation of the library, the library stops the current operation and displays an error code on the Operator Panel. Unless otherwise noted, try to resolve the problem by cycling power to the library and retrying the last operation.

Note: When power cycling the library, wait 10 seconds after the power is switched OFF before powering ON again.

Before placing a service call or informing IBM Technical Support, observe the LEDs on the front panel and error messages on the Operator Panel to determine exactly which part is failing. See "Interpreting Front Panel LEDs" on page 6-8 for more information. If the LEDs on all components are functioning properly, see "Diagnosing a Problem" on page 6-3.

How the Library Reports Problems

The library uses advanced problem detection, reporting, and notification technology to alert customers of problems as soon as they occur. It performs numerous self-tests to monitor the library's temperature, voltage and currents, and standard library operations. These tests monitor the library when the library is powered ON, and during normal operation when the library is idle.

If the test detects a problem, the library generates a message that identifies which component is likely causing the problem. The library's Error LED and Attention LED may turn ON to indicate an abnormal state. If the problem is not severe, the Attention LED turns ON and the library continues to provide full functionality to the library. If the problem is not recoverable, the Error LED turns ON and an error message is displayed on the Operator Panel.

When the library generates an attention event or an error event, support staff can be notified immediately by setting up e-mail event notification and/or SNMP trap notification. The type of event that generates e-mail notification or SNMP trap notification can be selected to limit the number of events to a specific priority level.

Customers can frequently resolve a simple problem themselves by using the information found in "Diagnosing a Problem" on page 6-3. If the problem is unrecoverable, the customer must contact IBM Technical Support (see "Contacting IBM Technical Support" on page 7-1).

Library Error Message Content

When a library event occurs, the event is logged into Flash memory on the Library Control Board.

The library error log can be viewed on the Operator Panel by selecting **Service** → **View Error Status**. The log lists all of the library error messages in the order in which they occurred, starting with the most recent at the top.

The Web User Interface can display a log history summary of information, warning, and error events that have occurred by selecting **Service Library** → **Operator Interventions**. The summary can be filtered to display the operator intervention log for a specific hardware component and specific event levels. The log is stored in memory on the Library Control Board. When the memory buffer is full, new events overwrite the oldest events. The log is not cleared from memory when power is turned OFF. The information displayed in the **Detail** panel for the selected operator intervention event comprises:

• Index number of the event
• Date the event occurred
• Time the event occurred
• Unit in the library where the event occurred
• Event level
• Description of the event

The Web User Interface can also display a log history summary of errors that have occurred by selecting **Service Library** → **View Library Logs**. The error log is displayed with sense data information. The summary can be filtered to display errors with specific sense data code types. The information displayed in the **Detail** panel for the selected error comprises:

• Index number of the error
• Date and time the error occurred
• Error code
• Description of the error

Diagnosing a Problem

Problem Area	If…	Then…
Cartridge	A cartridge is not ejecting from the drive…	1. Try unloading the drive (Operator Panel: **Commands** → **Unload**). 2. Power cycle the library. 3. If the cartridge does not eject from the drive, see "Contacting IBM Technical Support" on page 7-1.
	The cartridge case or tape inside the cartridge is damaged…	Replace the tape cartridge.
	Your cleaning cartridge expires…	Replace the cleaning cartridge.

	A bar code label cannot be read by the bar code reader…	1. Export the suspect cartridge from the library.
		2. Confirm that the bar code label is not damaged or missing. Replace the bar code label, if necessary.
		3. Import the cartridge back into the library.
		4. Inventory the library.
		   a. If no errors are reported, resume normal library operations.
		   b. If an error is reported, see Appendix B, "Error Codes," on page B-1.

Cartridge Magazine	The magazine will not unlock after issuing the Unlock Magazine command from the Operator Panel…	1. Power cycle the library.
		2. Try unlocking the magazine again (Operator Panel: **Unlock Magazine**).
		   a. If the magazine does not unlock, see "Unlocking the Cartridge Magazine Manually" on page 8-1.
		   b. If the magazine does unlock, resume normal library operations.

	The magazine can only be partially removed from the library… The magazine seems stuck on something inside the library…	1. Verify that you have requested the library to unlock the entire magazine, not just the I/O Station (if enabled) then retry the operation. 2. Carefully pull the magazine out of the library. Stop if you feel any resistance (as if something is blocking the magazine inside the library). 3. If the magazine still cannot be removed from the library, see "Contacting IBM Technical Support" on page 7-1.
Communication Functions	You are experiencing difficulty exercising some library functions (for example, updating firmware or logging in to the library remotely)…	1. If you have a recent backup of your configuration, proceed to the next step. If you do not, try to save one now (Web User Interface: **Configure Library** → **Save/Restore**). 2. If using a static IP address, make note of your library's IP address. If using DHCP, proceed to the next step. 3. Restore factory defaults (Operator Panel: **Configuration** → **Set Default**). 4. If using a static IP address, disable DHCP (the default setting) and enter the library IP address (Web User Interface: **Configure Library** → **Network**; Operator Panel: **Configuration** → **Configure Network Settings**). If using DHCP, proceed to the next step. 5. Restore the library configuration (Web User Interface: **Configure Library** → **Save/Restore**).

Problem Area	If…	Then…

Encryption	**Encryption error displayed when the drive detects an error associated with an encryption operation, if the problem occurred while the tape drive was writing data to, or reading data from, tape…**	1. Check the host application to ensure the host application is providing the correct encryption key.
		   a. Refer to the *IBM Tape Device Drivers* and the *IBM LTO Ultrium Tape Drive SCSI Reference* for the Sense Data returned for an encryption operation.
		   b. Retry the encryption operation after the host application problems have been resolved.
		 2. Reset the drive.
		   a. Refer to the error code displayed on the Operator Panel if the drive resets and POST fails.
		   b. Retry the encryption operation if the drive resets and POST completes without errors.
		 3. Ensure the correct media is being used. Data encryption is supported with LTO Ultrium 4 Data Cartridges only.

	Encryption-related error is posted…	Check the host application's error logs, device driver logs, tape library error logs, and tape drive error logs for entries that are related to encryption.
	Connection problem with the Encryption Key Manager (EKM)…	If you are using library-managed encryption, perform the Key Path Diagnostic. If the test fails, a problem could exist with the IP address, the Ethernet cable, or the EKM server. Perform the following: 1. Check the Ethernet connection between the library and the EKM server. 2. Check the TCP/IP configuration of the library and the server. 3. Check that the EKM is correctly installed and configured, and that the EKM application is properly started (refer to your EKM documentation). 4. Ensure that the tape drive is registered in the EKM (refer to your EKM documentation). 5. Ensure that a default key label is defined in the EKM (refer to your EKM documentation). If you are using application-managed encryption or system-managed encryption, check your key proxy server's documentation for a similar test.
	Lost Encryption Feature license key…	1. Visit `https://www.ibm.com/support/dsfa/`. 2. Enter your machine type, serial number, and worldwide node name to display your encryption license key.

Problem Area	If…	Then…
Error Codes or TapeAlert Flags	**The library issued an error code…**	1. Make note of the error code. 2. Power cycle the library.
	An error message was received via email notification (if enabled)…	a. If the error reoccurs, see Appendix B, "Error Codes," on page B-1. b. If the error does not reoccur, resume normal library operations.

	A TapeAlert flag was received…	1. Make note of the TapeAlert flag.
		2. Power cycle the library.
		  a. If the TapeAlert reoccurs, see Appendix C, "TapeAlert Flags," on page C-1.
		  b. If the TapeAlert does not reoccur, resume normal library operations.

	The error code represents an unrecoverable error…	See "Contacting IBM Technical Support" on page 7-1.
	You get repeated errors…	1. Reset the library. 2. If the library is still reporting errors, power cycle the library. If no errors are reported, resume normal library operations. 3. If the library still fails, reset factory defaults. If no errors are reported, resume normal library operations. 4. If the problem persists, see "Contacting IBM Technical Support" on page 7-1.
	You are experiencing a problem with your library and no error code was created…	1. Run **Library Verify** to identify and resolve the problem. See "Running Library Verify Diagnostics" on page 4-12. 2. If the problem persists, see "Contacting IBM Technical Support" on page 7-1.
Firmware	**The Library firmware does not complete the boot-up process and appears hung…**	Failure of the login screen to appear on the Operator Panel in 15 minutes indicates that the boot-up process is not completing. 1. Power OFF the library and wait at least one minute before powering ON to recover from the problem. 2. If a library firmware update was just performed, try repeating the update procedure.
	All firmware (library and drive) is not at the latest level…	See "Updating Library and Drive Firmware" on page 4-34.
Front Panel LEDs	**One or more front panel LEDs is ON or blinking…**	See "Interpreting Front Panel LEDs" on page 6-8.
Host Attachment Interface	**You are experiencing host attachment interface problems…**	See "Isolating Host Attachment Interface Problems" on page 6-7.
Installation and Configuration	**You are experiencing trouble installing or configuring your library…**	See "Installation and Configuration Problems" on page 6-8.
ITDT	**The Performance Test duration varies…**	Items affecting the duration of the test are: • The level of adapter device driver • Your adapter model and type
Library Not Booting	**There is a blank operator panel/display…** **The Accessor doesn't move…** **The display is stuck on initialization for extended period of time…**	Failure of the login screen to appear on the Operator Panel in 15 minutes indicates that the boot-up process is not completing. 1. Power OFF the library and wait at least one minute before powering ON to recover from the problem. 2. If a library firmware update was just performed, try repeating the update procedure.

Problem Area	If…	Then…
Logs	**You are required to download the library log or drive log…**	Using the Web User Interface. • Library log: **Service Library → Download Library Logs** • Drive log: **Service Library → Download Drive Logs**
	You need to acquire library or drive information at the host…	See Appendix E, "Message Retrieval at the Host," on page E-1.
Network Time Protocol (NTP)	**The library time is not being updated by the NTP server…**	Using the Web User Interface. 1. Disable NTP. 2. Set the time manually. 3. Enable NTP.
Power	**If the power supply switch is ON and the library is OFF…**	See "Isolating Library Power Problems" on page 6-6.
Web User Interface	**HTML error 404 appears on computer screen when trying to launch the Web User Interface…**	See "Isolating Web User Interface Problems" on page 6-7.

Isolating Problems

Isolating Library Power Problems

1. Ensure the power cord is plugged in at the power supply and at the electrical outlet, then turn library power ON. Feel for air flowing out of the cooling fan grill on the rear of the library. Power is good if air is flowing from the cooling fan grill.
2. If power appears to be missing:
   a. Plug the power cord into another electrical outlet.
   b. Plug another device into the outlet to test.
   c. If the outlet tests OK, try another power cord.
3. If you have verified that the electrical outlet and power cord works properly, but the power supply is still failing, replace the library (see "Replacing the Library" on page 8-13).
4. If the power supply seems to be delivering power to the library; however, air does not flow from the power supply cooling fan grill on the rear of the library, replace the library (see "Replacing the Library" on page 8-13).

Isolating Drive Problems

1. Ensure that the drive firmware is at the latest level (visit `http://www.ibm.com/storage/`).
2. Cycle library power.
3. If the drive is experiencing permanent or temporary errors or if the Clean LED is lit on the front panel of the library, clean the drive.
4. Run **Library Verify**.
   a. If the test fails, replace the library.
   b. If the test passes, run **SAS Wrap Test**.
      i. If the test passes, resume normal library operations.
      ii. If the test fails, replace the library.

5. Using the host interface test tool, ITDT, run the Scan function (s) to verify that the host application interface can detect the drive and the library. To further test the interface communication path, run the Test Device function (t), if available, after selecting the drive. This function will write/read data across the interface as well as sending a command to the drive to run the internal performance Read/Write test.

6. If the host tool, ITDT, cannot detect the drive or library, look for problems with the host interface cabling, the HBA, the device driver or the backup application software.

Isolating Web User Interface Problems

1. Verify that you entered the account name and password correctly. The account name and password are case sensitive.

2. Verify that other library users are not entering commands from the Web User Interface or Operator Panel at the same time you are issuing commands.

3. Ensure that library firmware is at the latest level (visit `http://www.ibm.com/storage/`).

4. Ensure that the Ethernet cable is securely plugged in the rear of the library at the Ethernet port.

5. Ensure that the correct IP, netmask, and gateway addresses are keyed into the network parameters.

6. Ensure that the correct IP address is being used on the web browser.

7. If the Ethernet connection is a direct connection between the PC and the library, a special "crossover" Ethernet cable is required.

   Note: On newer PCs, either straight through or crossover Ethernet cables may be used since the crossover requirement is provided internally.

8. Check the Ethernet cable carefully (or try another cable) and, if the cable is connected to a network hub or switch, try a different port.

9. If the Web User Interface is still malfunctioning, refer to "Contacting IBM Technical Support" on page 7-1.

Isolating Host Attachment Interface Problems

After successfully exercising "Isolating Drive Problems" on page 6-6, and more specifically "Running Library Verify Diagnostics" on page 4-12 from the Operator Panel (**Service** → **Library Verify**), the following procedures are suggested to help isolate the failure to properly establish connectivity to the Host Bus Adapter (HBA).

1. If not already performed, run **SAS Wrap Test** from the Operator Panel. The test will require that a proper Wrap Tool be installed at some point during the test procedure.
   a. If the wrap test fails, replace the library, and skip to Step 4.
   b. b. Proceed to Step 2 if the wrap test passes.

2. Use the utility, ITDT, to evaluate connectivity from the HBA through the cabling to the drive. ITDT does not require separate device drivers, thus the Operating System has the ability to scan and find all the LTO devices that are attached.
   a. If ITDT cannot successfully locate the LTO drive, suspect cabling or HBA problems, and skip to Step 4.
   b. If ITDT successfully located the LTO drive, proceed to Step 3. See "Using the IBM TotalStorage Diagnostic Tool (ITDT)" on page 7-1 for a brief description of ITDT and instructions on how to download the tool from the web.

3. If ITDT successfully locates the LTO device(s), verify that the correct application device drivers and backup application software is properly installed.

4. Ensure that all the required or latest available Operating System files and/or updates (dll's, PTF's, etc.) have been installed and applied.

Installation and Configuration Problems

Problems encountered during the installation of the library are usually caused by improper application software configuration errors or an incorrectly configured operating system. If the application software that you are using is not communicating with the library after installation, check the following:

- **Accessor locking screw**: Ensure that the Accessor locking screw on the rear panel of the library has been removed before powering on the library. See "Removing the Accessor Locking Screw" on page 3-12.

- **HBA LUN 0/1 support**: A single ID will address both drive and library since the drive is LUN 0 and the library is LUN 1. These models require an HBA that supports LUN scanning which must be enabled at the HBA. See "Logical Unit Number (LUN) Scanning" on page 1-8 and "Supported Servers, Operating Systems, and Software" on page 1-11.

- **Cable connections**: Ensure that there are no bent pins on cables and that all connections are securely fastened.

- **SAS cables and interposers**: Ensure that SAS cables and interposers (if any) are properly attached. See "Connecting the Host Interface Cables" on page 3-13.

- **Backup application installation**: Refer to the documentation included with your backup application software for instructions on how to verify proper installation.

- **Device driver installation**: Ensure that the proper device driver, if applicable, is installed for the library.

Note: Many backup applications use their own drivers for the library and drive. Before installing a driver, make sure it will not be in conflict with the software. Contact your backup application vendor for this information.

Review the information in Chapter 3, "Installation and Configuration," on page 3-1 to determine if a step was missed or misread.

If you are still experiencing difficulty installing or configuring your library, see "Contacting IBM Technical Support" on page 7-1.

Important: Do not disassemble the library. The warranty on your library is voided if the unit is disassembled without the approval of IBM Technical Support.

Interpreting Front Panel LEDs

Light emitting diodes (LEDs) on the front panel of the library provide a visual indication about the status of certain library components. The LEDs can sometimes communicate that a problem exists when operator interventions cannot.
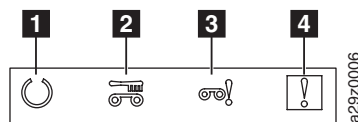
Figure 6-1. Front panel LEDs

1	Ready/Activity LED	3	Attention LED
2	Cleaning LED	4	Error LED

Table 6-1. Front Panel LED indicators

Library Condition	Ready/ Activity LED	Cleaning LED	Attention LED	Error LED	Message on Display
POST (Power ON Self Test)	Blinks 2 times per second	OFF	OFF	OFF	INITIALIZING...INVENTORY...
Magazine open	Blinks 2 times per second	OFF	OFF	OFF	PLEASE INSERT MAGAZINE
Magazine unlocked	Blinks 2 times per second	OFF	OFF	OFF	MAGAZINE UNLOCKED
I/O Station open	Blinks 2 times per second	OFF	OFF	OFF	PLEASE CLOSE I/O STATION
I/O Station unlocked	Blinks 2 times per second	OFF	OFF	OFF	I/O STATION UNLOCKED
Library firmware is being updated	Blinks 2 times per second	OFF	OFF	OFF	LOADER FIRMWARE UPDATING!
Drive firmware is being updated	Blinks 2 times per second	OFF	OFF	OFF	DRIVE FIRMWARE UPDATING!
Drive dump is being uploaded to host computer	Blinks 2 times per second	OFF	OFF	OFF	DRIVE DUMP DATA UPLOADING!
Library is offline	Blinks 2 times per second	OFF	OFF	OFF	OFFLINE
Cartridge is being moved	Blinks 1 time per second	OFF	OFF	OFF	READY
Library error occurred	ON	OFF	OFF	ON	*** CHK *** CODE: [XXXX]
Drive error occurred	ON	OFF	OFF	ON	DRIVE FAULT CODE: [X]
Cartridge error occurred	ON	OFF	ON	OFF	MEDIA FAULT CODE: [X]
Cleaning cartridge has expired	ON	OFF	ON	OFF	REPLACE CLEANING MEDIA
Drive has requested to be cleaned	ON	ON	OFF	OFF	CLEAN DRIVE
Drive is being cleaned	ON	Blinks 1 time per second	OFF	OFF	CLEANING...
Library is online and ready to receive a command	ON	OFF	OFF	OFF	READY

Reseating Cables

To reseat external library cables, perform the following steps:

1. Locate the following cables on the rear panel of the library.
    a. SAS attachment for the drive
    b. Ethernet cable for connection to a network
    c. Power supply cable
2. Check and reseat, if necessary, all of the cables connected to your library.
3. Verify that there is no damage to any connector pins.

E-mailing Logs

Logs provide a summary of the current status, warnings, and errors in the library, and include configuration settings and information provided in Operator Interventions.

Download current logs of the library and drive when requested by your service representative. To e-mail current logs:

1. Ensure that no applications are accessing the library. If a library operation is in progress, wait until it finishes before attempting to generate the logs.
2. Download the current library log from the Web User Interface by selecting **Service Library → Download Library Logs**, click **Refresh**, and click **Download**.
3. Download the current drive log from the Web User Interface by selecting **Service Library → Download Drive Logs**, click **Refresh**, and click **Download**.
4. When requested by IBM, attach the log to an e-mail message and send it to IBM Technical Support for further diagnosis.

Chapter 7. Service Procedures

Using the IBM TotalStorage Diagnostic Tool (ITDT)

ITDT is a tool with multifunction capability and is a quick, convenient, and efficient method for drive firmware updates. It can also assist with drive dump retrievals.

Below are some of the capabilities of this tool:
- Firmware update capability via host interface to all IBM LTO Tape Drive products.
- Does not require any special device drivers.
- Available for most major platforms (Windows®, AIX®, SUN, Linux™, NetWare).
- Capable of uploading drive dump files.
- The primary function is to thoroughly test a drive. However, if the library is online to the server/host where the tool resides, ITDT will communicate with the drive through the library to load and unload a test cartridge, thereby exercising some library functions.
- Scans the host interface to find and display all IBM LTO devices. The tool will not display nor allow selection of any non-IBM devices.
- The "Help" selection explains the required syntax as well as a brief explanation of each particular function.
- A Readme text file will be posted with the .exe file for a thorough explanation of initial tool download information from the web as well as explanation of tool capabilities.
- The tool is available as a command-line utility, invoked by keying in the executable name, `itdt`, from the directory where the tool is located, and as a graphical user interface (GUI) tool.

To download the ITDT tool and instructions for using the tool, visit `http://www-03.ibm.com/servers/storage/support/`.

Contacting IBM Technical Support

Before placing a call to IBM Technical Support, perform the following steps.

Note: Where instructions refer you to the web, visit `http://www-03.ibm.com/servers/storage/support/lto/`.

1. Verify that you have exhausted all of the following troubleshooting options:
   a. Perform all recommended diagnostic procedures. See Chapter 6, "Troubleshooting," on page 6-1.
   b. Verify that the library's and drive's firmware is at the most recent level. To determine the latest release of firmware, visit the web.

   c. Verify that your device drivers are at the most recent level (see your server (host) manual for instructions).

- For the latest release of IBM device drivers, visit the web.
- For the latest release of device drivers by Independent Software Vendors (ISVs), visit the appropriate third-party web site.

   d. Verify whether your hardware and software configuration is supported. To determine the latest supported attachments, visit the web.

   e. Ensure that cables and connectors are not damaged.

   f. Review all documentation carefully. (Experience has demonstrated that most questions are answered in your documentation.)

2. Follow these steps to take full advantage of your call:

   a. Be prepared to explain whether the software or hardware has worked properly at anytime in the past. Have you changed anything recently?

   b. Pinpoint the exact location of your problem, if possible. Note the steps that led to the problem. Can you duplicate the problem or is it a one-time occurrence?

   c. Note any error messages displayed on your PC monitor or file server. Write down the exact error message.

   d. If at all possible, call while at your computer, with the library installed and turned on.

   e. If running on a network, have all relevant information available (that is, type, version number, network hardware, and so on).

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

- Library Machine type and Model name(s)
- Serial number of the library (front of the library on the label underneath the power button)
- Library and drive firmware levels currently installed
- Device driver information
- Host application name and version
- Type of host, operating system version, clock speed, RAM, network type, network version, and any special boards installed

3. The IBM Support Center will assist with problem determination and initiate shipment of a replacement part, if needed, to the customer's location. To contact IBM Technical Support:

- In the USA: 1-800-IBM_SERV (1-800-426-7378)
- All other Countries/Regions: `http://www.ibm.com/planetwide/`
- To open a Service Request online: Under **Support & downloads**, click **Open a Service Request**.

Chapter 8. Removal and Replacement Procedures

Required Tools

Installing or relocating the rack mount kit or deskside kit for your library requires the following tool:

- #2 Phillips screwdriver

Replacing a Defective Cartridge Magazine

After receiving your replacement cartridge magazine, complete the following steps to replace the defective cartridge magazine. The library does not need to be powered OFF for this procedure.

1. Remove the defective cartridge magazine from the library using the Operator Panel or the manual method of removal.
   - Operator Panel: Use the **Unlock Magazine** command. See "Unlocking the Cartridge Magazine" on page 4-4.
   - Manual method: See "Unlocking the Cartridge Magazine Manually" on page 8-1.

   If you are unable to remove the defective cartridge magazine from the library using either of the above methods, see "Contacting IBM Technical Support" on page 7-1.
2. After removing the defective magazine from the library, remove all cartridges from the defective magazine and insert them into the replacement magazine.
3. Insert the new magazine with cartridges into the library. Wait for the library to complete its inventory before resuming normal library operations.
4. Properly dispose of the defective magazine.

Unlocking the Cartridge Magazine Manually

This procedure is used to remove the cartridge magazine manually when, for example, the power is turned OFF or if the magazine fails to unlock in response to the **Unlock Magazine** command from the Operator Panel.

To unlock the cartridge magazine manually:

1. On the front panel, locate the access hole for the cartridge magazine locking release mechanism to the left of the Operator Panel (**1** in Figure 8-1).
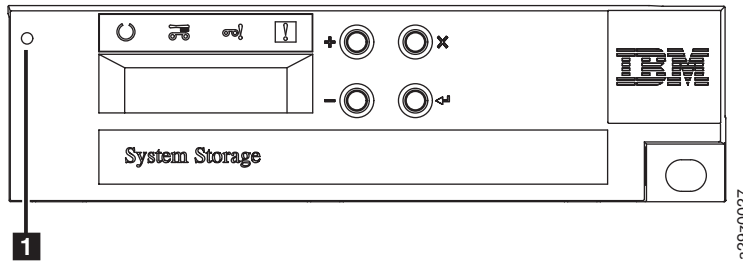
Figure 8-1. Cartridge magazine lock release access hole

2. Insert the end of a straightened paper clip, or similar object, into the lock release access hole and gently push the lock mechanism to release the lock and eject the cartridge magazine.

3. If the I/O Station is enabled, push the lock mechanism twice or push and hold the lock mechanism until the cartridge has been withdrawn far enough to clear the I/O Station lock.

4. Remove the cartridge magazine from the front of the library. If the magazine is stuck in the library and does not eject, see "Contacting IBM Technical Support" on page 7-1.

5. Examine the magazine and cartridges for damage.
   - If there is damage to a cartridge, replace that cartridge.
   - If there is damage to the magazine, replace the magazine.

Moving the Library from a Rack to a Desktop

This procedure is used to relocate a library mounted in a rack using the rack mount kit to a desktop using the deskside kit.

Removing Library from a Rack

1. Take the library offline.

   Note: If the library is processing queued requests, wait for the library to finish the current library task.

2. From the Web User Interface, select **Configure Library** → **Save/Restore** → **Save** to save the current library configuration to a file for easy restoration.

3. After saving your configuration, log out of the Web User Interface and close the Internet browser.

4. From the Operator Panel, select **Unlock Magazine**, and press Enter to remove the cartridge magazine (if necessary).

   Note: If the cartridge magazine fails to unlock in response to the **Unlock Magazine** command from the Operator Panel, you can unlock the magazine manually. See "Unlocking the Cartridge Magazine Manually" on page 8-1.

5. From the Operator Panel, select **Move to Ship Position**, and press Enter. This moves the Accessor assembly to a safe position ready for moving the library.

   Note: If the library is to be transported any distance, this move is necessary to park the Accessor in the position where it can be secured by the Accessor locking screw.

6. From the Operator Panel top menu, select **Logoff**, and press Enter.
7. On the rear panel of the library:
   a. Power OFF the library by toggling the power supply switch to the OFF (O) position.
   b. Disconnect the power cable from the library power supply.
   c. Disconnect the Ethernet cable.
   d. Disconnect the SAS host interface cable.
8. Insert and tighten the Accessor locking screw **1**.

Figure 8-2. Insert Accessor locking screw

9. Remove the SAS cable, power cable, and Ethernet cable from the hook and loop fastener strap **12** on the rear of the library (Figure 8-3).
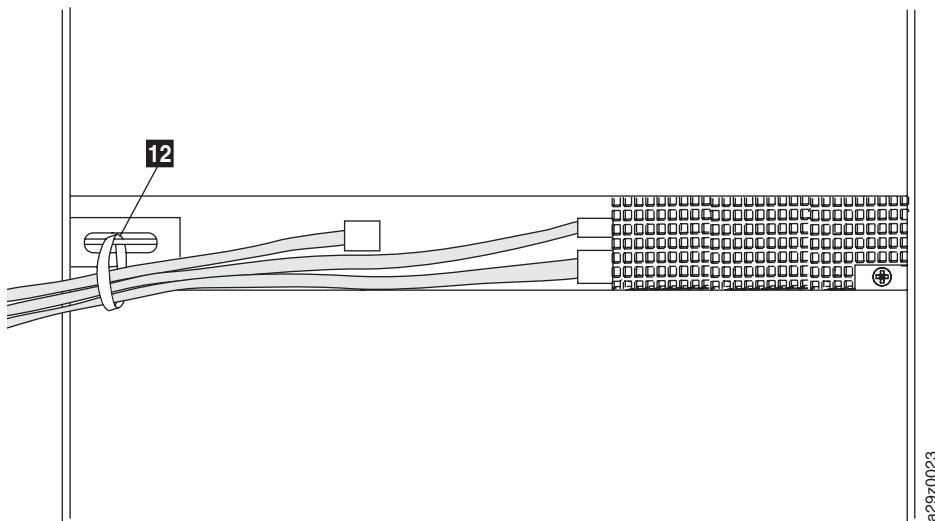
Figure 8-3. Remove cables at the rear of the library

10. Remove the two round-head screws **10** on each rear bracket securing the rear of the library to the rack (Figure 8-4).
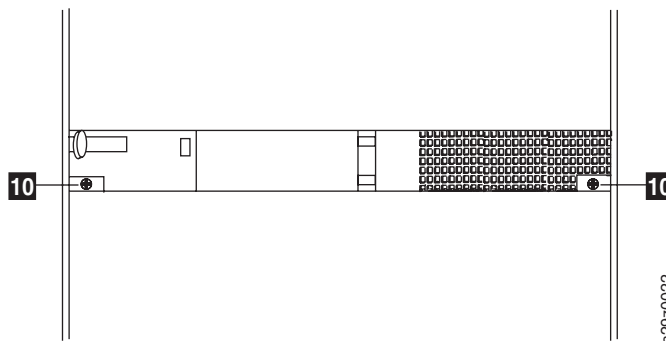
Figure 8-4. Removing screws at the rear of the library

11. Remove the large black screws **11** from each front bracket securing the front of the library to the rack, and slide the library chassis out of the rack (Figure 8-5).
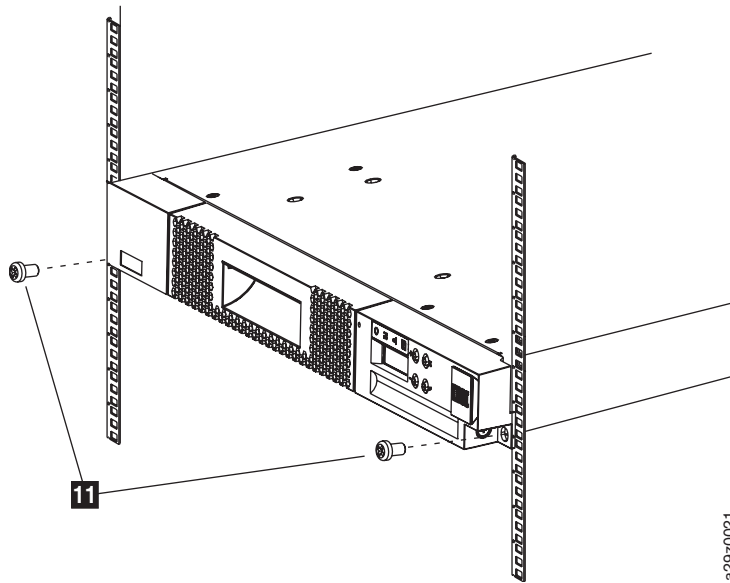
Figure 8-5. Removing screws at the front of the library

12. Remove the flat-head screws **8** to remove the left **3** and right **4** front brackets from the front of the library chassis (Figure 8-6).
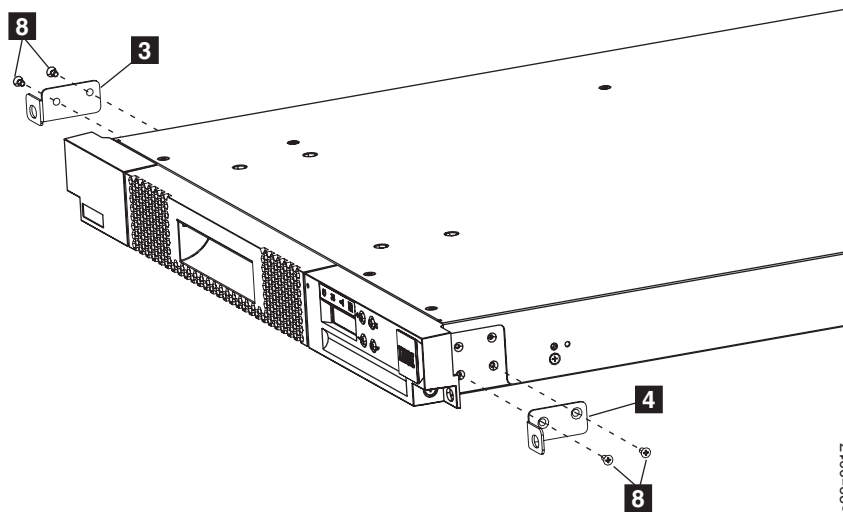
Figure 8-6. Removing the front brackets from the library chassis

Installing the Library on a Desktop

For details on the deskside kit components, see "Installing the Deskside Cover" on page 3-2.

1. Attach the left **5** and right **3** rails to the chassis using 3 flat-head screws **6** on each side (Figure 8-7).
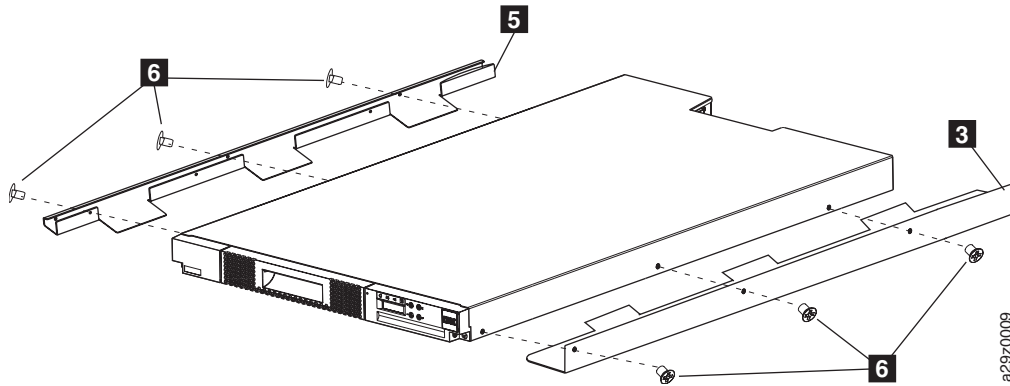
Figure 8-7. Attaching side rails to the library chassis

2. Turn the library over and attach the feet **1** to the designated locations on the bottom of the library (Figure 8-8). Return the library to the upright position.
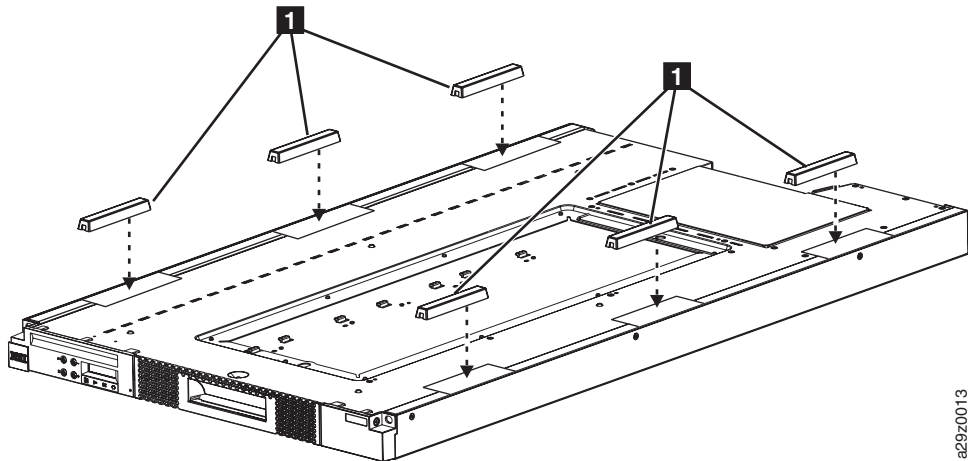
Figure 8-8. Attaching the feet

3. Position the deskside cover **2** in the correct orientation over the library chassis and attach the cover to the library using 3 flat-head screws **6** on each side (Figure 8-9).
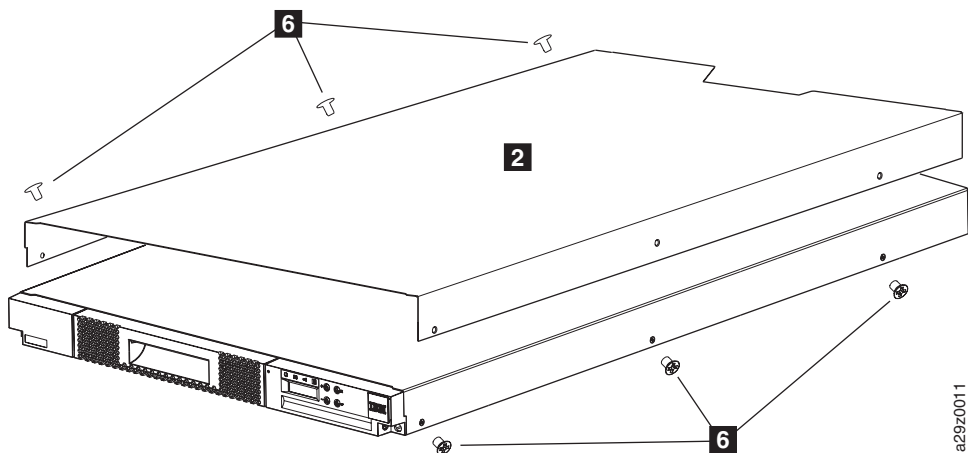
Figure 8-9. Attaching the cover to the library chassis (side screws)

4. Attach the deskside cover using the 2 large pan-head screws **4** on the rear of the library (Figure 8-10).
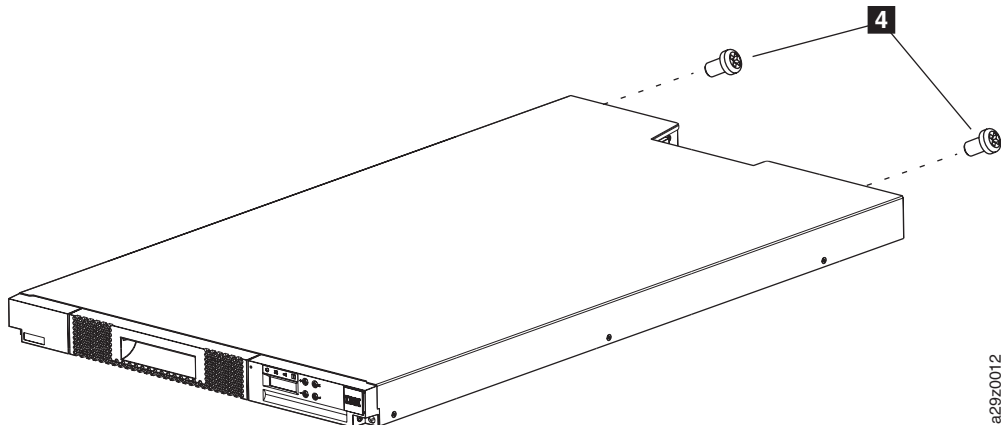
Figure 8-10. Attaching the cover to the library chassis (rear screws)

5. Place the library in the desired desktop location.

Important: Do not place the library on its side. Do not stack objects on top of the library.

6. Remove the Accessor locking screw **1**.
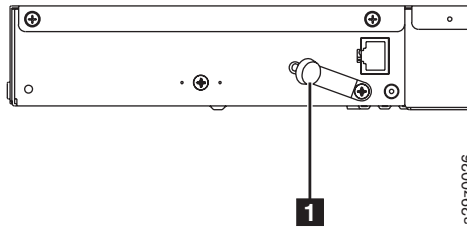
Figure 8-11. Removing Accessor locking screw

7. On the rear panel of the library:
   a. Connect the SAS host interface cable.
   b. Connect the Ethernet cable.
   c. Connect the power cable from the library power supply. Route all cables through the hook and loop fastener strap.
   d. Power ON the library by toggling the power supply switch to the ON (|) position.
8. Insert the cartridge magazine if previously removed.
9. Restore the library configuration. See "Saving and Restoring Configuration Settings" on page 4-28.
10. From the Operator Panel, select **Run Library Verify**, and press Enter to run library diagnostics. Follow the on-screen instructions. If an error occurs, see Chapter 6, "Troubleshooting," on page 6-1.
11. Take the library online.

Important: Do not stack objects on top of the library.

For more detailed instructions, see Chapter 3, "Installation and Configuration," on page 3-1.

Moving the Library from a Desktop to a Rack

This procedure is used to relocate a library mounted on the desktop using the deskside kit to a rack using the rack mount kit.

Removing Library from a Desktop

1. Take the library offline.

   Note: If the library is processing queued requests, wait for the library to finish the current library task.

2. From the Web User Interface, select **Configure Library** → **Save/Restore** → **Save** to save the current library configuration to a file for easy restoration.

3. After saving your configuration, log out of the Web User Interface and close the Internet browser.

4. From the Operator Panel, select **Unlock Magazine**, and press Enter to remove the cartridge magazine (if necessary).

   Note: If the cartridge magazine fails to unlock in response to the **Unlock Magazine** command from the Operator Panel, you can unlock the magazine manually. See "Unlocking the Cartridge Magazine Manually" on page 8-1.

5. From the Operator Panel, select **Move to Ship Position**, and press Enter. This moves the Accessor assembly to a safe position ready for moving the library.

   Note: If the library is to be transported any distance, this move is necessary to park the Accessor in the position where it can be secured by the Accessor locking screw.

6. From the Operator Panel top menu, select **Logoff**, and press Enter.

7. On the rear panel of the library:
   a. Power OFF the library by toggling the power supply switch to the OFF (O) position.
   b. Disconnect the power cable from the library power supply.
   c. Disconnect the Ethernet cable.
   d. Disconnect the SAS host interface cable.

8. Insert and tighten the Accessor locking screw **1**.

Figure 8-12. Insert Accessor locking screw

9. Remove the large pan-head screws **4** on the rear of the library (Figure 8-13).
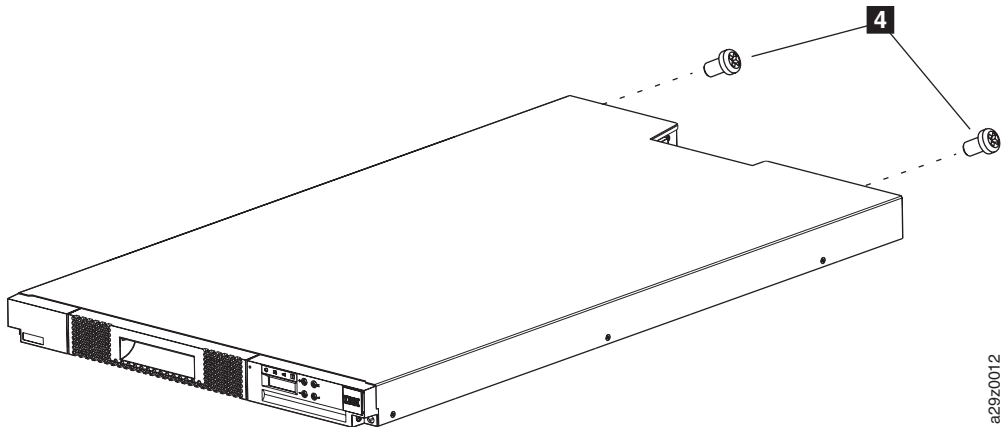
Figure 8-13. Removing screws from the rear of the library

10. Remove the flat-head screws **6** on each side securing the deskside cover to the library, and remove the deskside cover **2** (Figure 8-14).
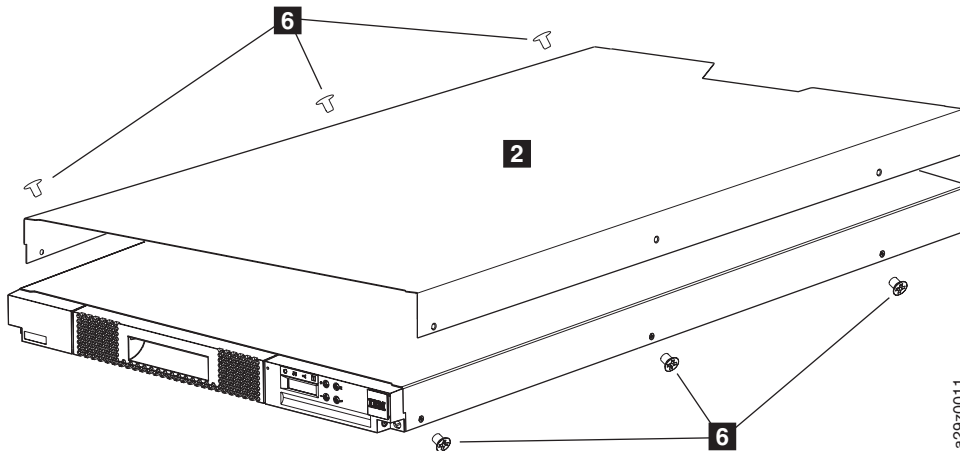
Figure 8-14. Removing the cover from the library chassis

11. Turn the library over and remove the feet **1** from the bottom of the library (Figure 8-15). Return the library to the upright position.
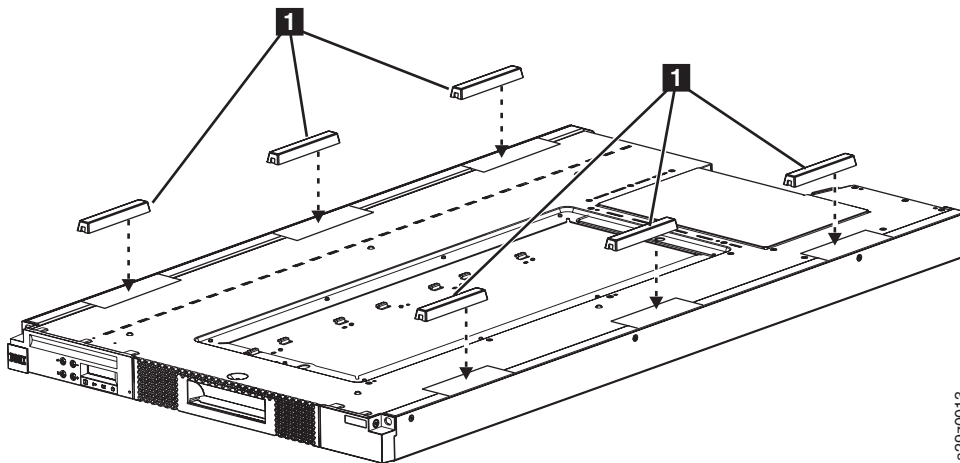
Figure 8-15. Removing the feet

12. Remove the flat-head screws **6** on each side to remove the left **5** and right **3** rails from the chassis (Figure 8-16).
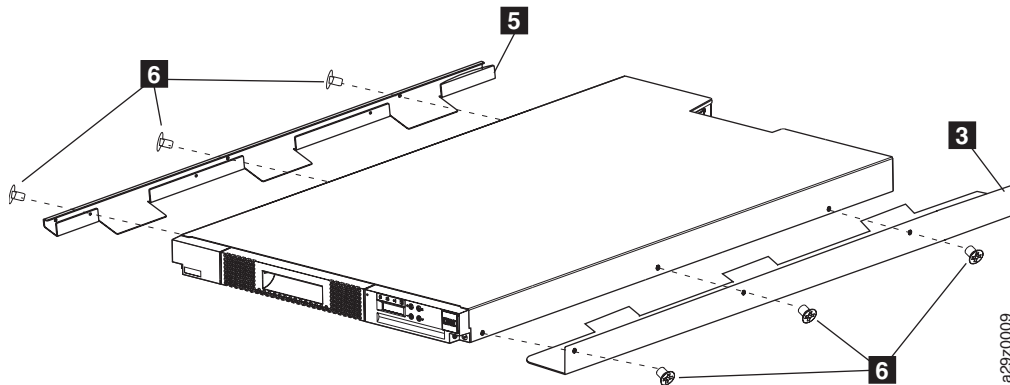
Figure 8-16. Removing side rails from the library chassis

Installing the Library in a Rack

For details on the rack mount kit components, see "Installing in a Rack" on page 3-5.

1. Determine the location in your rack for your library and mark with a pencil. For details on rack mount locations, see "Installing in a Rack" on page 3-5.
2. Attach the left **3** and right **4** front brackets to the front of the library chassis using two flat-head screws **8** on each side (Figure 8-17). Use the **bottom** two screw holes on each side.
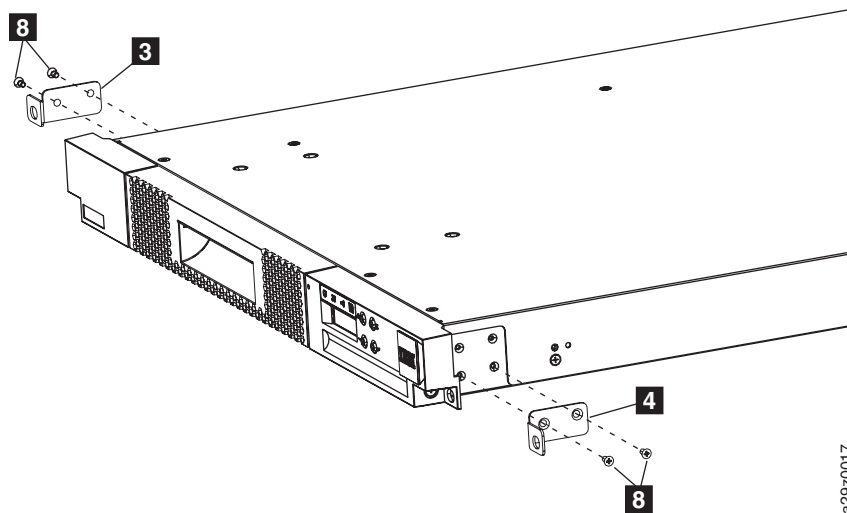
Figure 8-17. Attaching the front brackets to the library chassis

3. Attach the left **1** and right **2** rear brackets to the left **5** and right **6** front rails using two round-head screws **10** on each side (Figure 8-18).

   Note: Run the hook and loop fastener strap through the slot on the right rear bracket and attach it back upon itself.
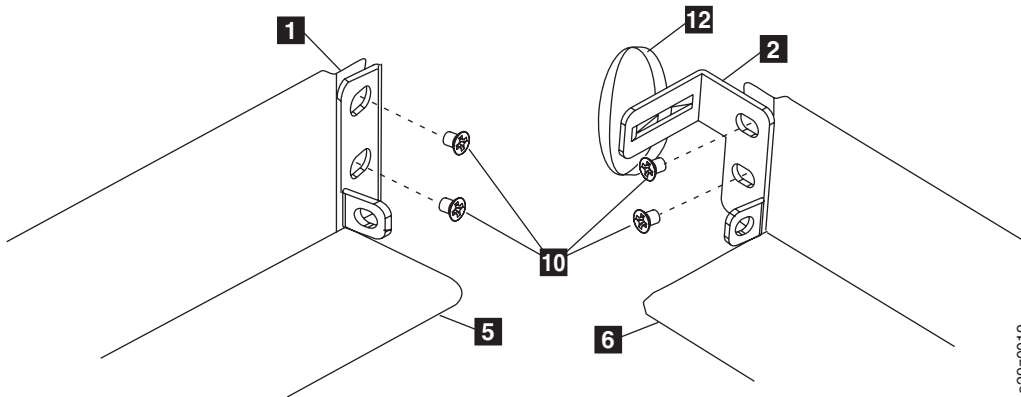
Figure 8-18. Attaching the rear brackets to the rails

Important: Do NOT tighten these screws completely at this time.

4. Slide in the rear rails **7** from back to front, to create the rail assemblies. Ensure the screw holes face outwards (Figure 8-19).
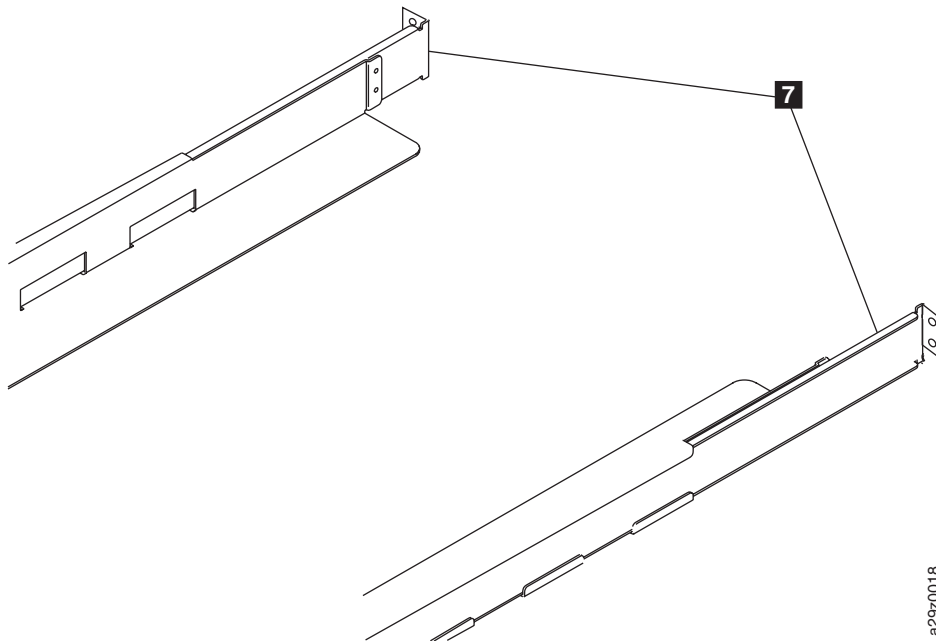
Figure 8-19. Creating the rail assemblies

5. Install the rail assemblies into the rack (Figure 8-20). Ensure the three holes in the front of the unit align with the 1U space marked on the vertical rails in Step 1. Secure the rails to the rack using four flat-head screws **9** on each side of the rack. Use both of the two screw locations on the rear of the rack rail. Use the **top** and **middle** screw locations on the front of the rack rail.
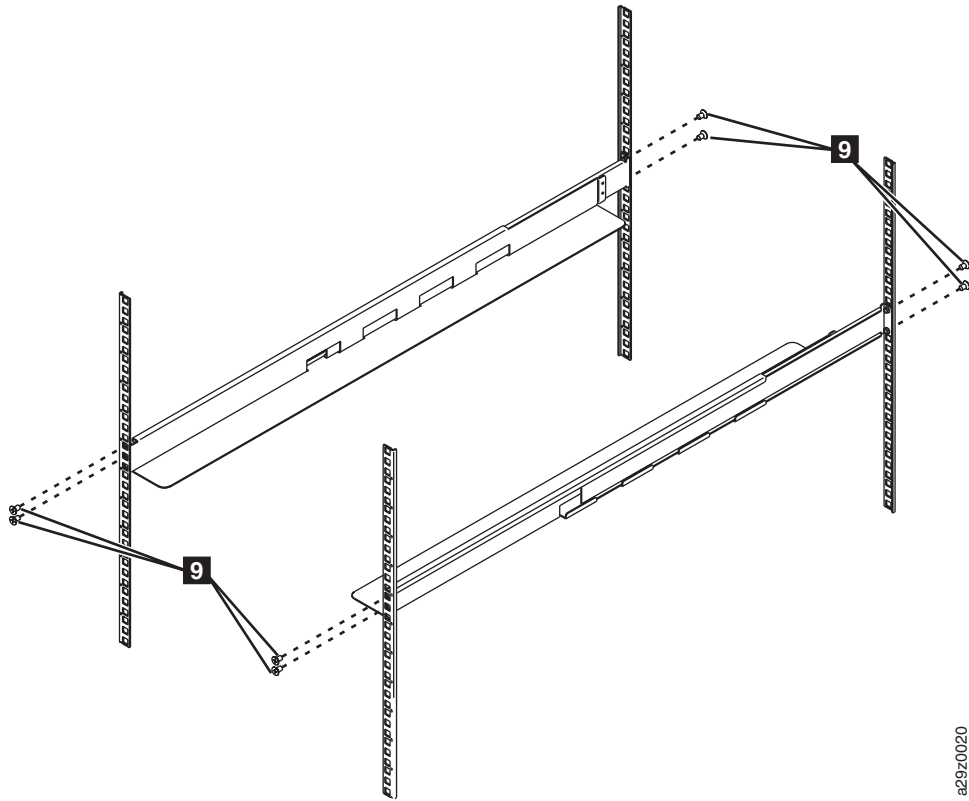
Figure 8-20. Installing the rail assemblies

6. Slide the library chassis into the rack. Secure the front of the library to the rack using the large black screws **11** in the bottom holes on each front bracket (Figure 8-21).
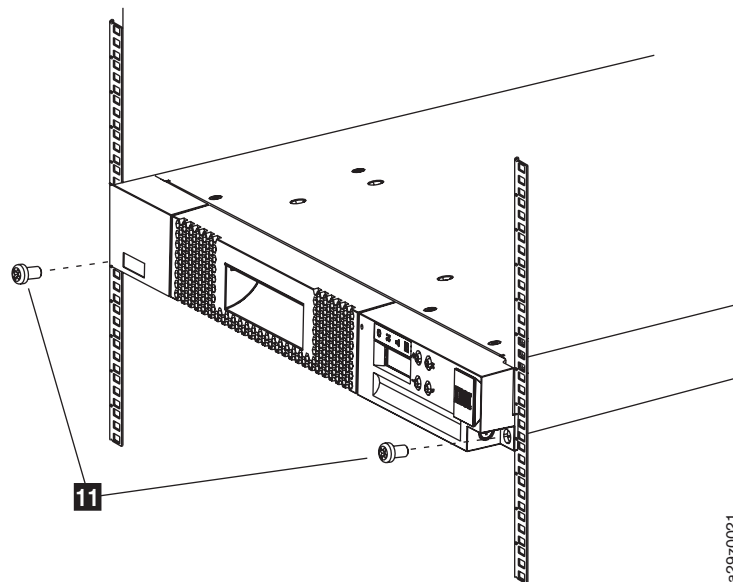
Figure 8-21. Securing the front of the library in the rack

7. Secure the rear of the library to the rack using two round-head screws **10** on each rear bracket (Figure 8-22). Tighten the other rear bracket screws to secure the library to the rack.
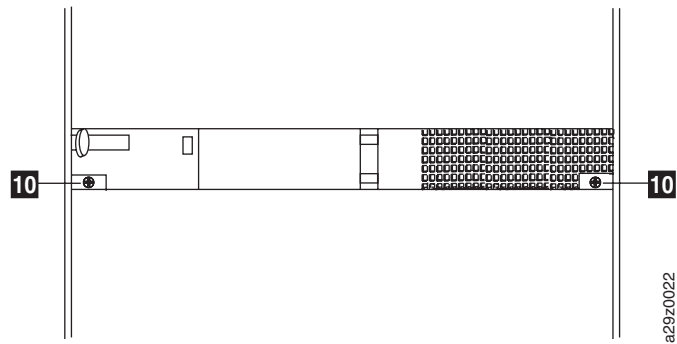
Figure 8-22. Securing the rear of the library in the rack

8. Run the SAS cable, power cable, and Ethernet cable through the hook and loop fastener strap **12**, then tighten the strap (Figure 8-23).
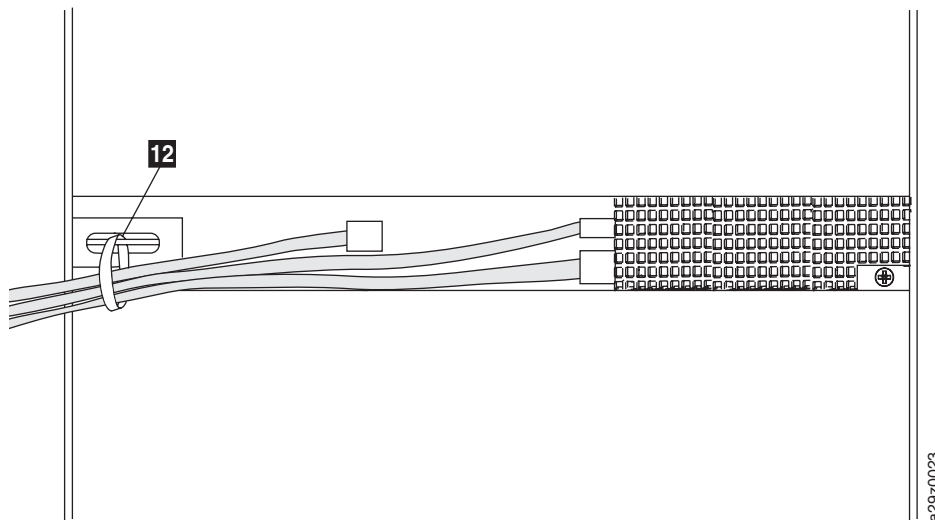
Figure 8-23. The cables at the rear of the library

9. Remove the Accessor locking screw **1**.
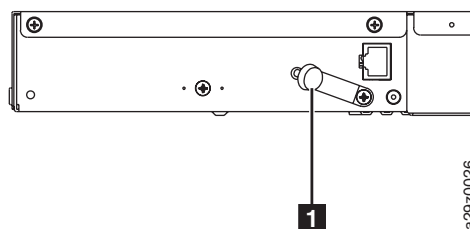
Figure 8-24. Removing Accessor locking screw

10. On the rear panel of the library:
    a. Connect the SAS host interface cable.
    b. Connect the Ethernet cable.
    c. Connect the power cable or rack PDU line cord to the library power supply.
    d. Power ON the library by toggling the power supply switch to the ON (|) position.
11. Insert the cartridge magazine if previously removed.
12. Restore the library configuration. See "Saving and Restoring Configuration Settings" on page 4-28.

13. From the Operator Panel, select **Run Library Verify**, and press Enter to run library diagnostics. Follow the on-screen instructions. If an error occurs, see Chapter 6, "Troubleshooting," on page 6-1.
14. Take the library online.

For more detailed instructions, see Chapter 3, "Installation and Configuration," on page 3-1.

Replacing the Library

The entire library, including the drive, is a CRU. At CRU replacement, the serial number of the new library must be changed to the serial number of the old library to maintain IBM entitlement to service. If the static IP address of the new library matches the static IP address saved in the cookie, the Web User Interface checks the serial number of the new library against the serial number saved in the cookie. If the new serial number is different from the saved serial number, the saved data in the cookie can be used to change the serial number of the new library and configure the new library. If the data inheritance fails or your network configuration uses DHCP, the library serial number can be changed using the Web User Interface when logged in as **service**.
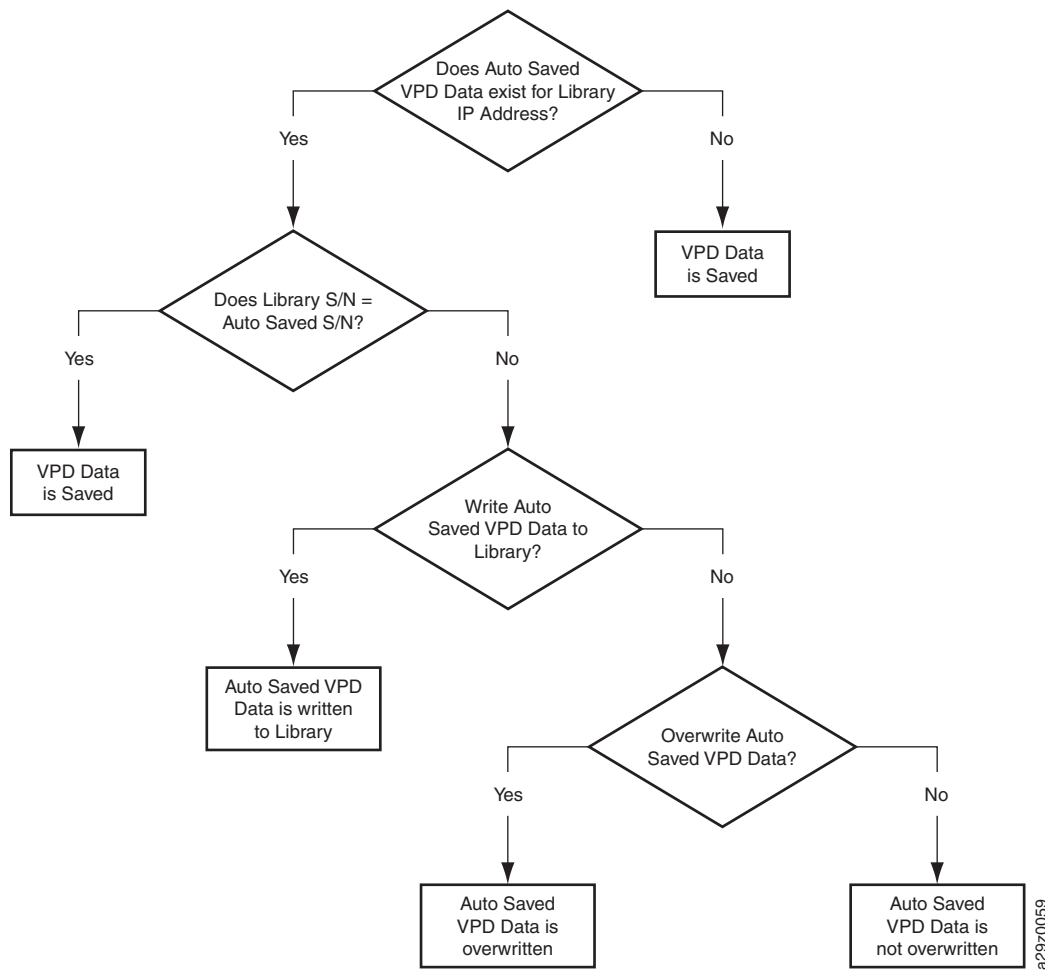
Figure 8-25. Library configuration using cookies

This procedure is used to replace the entire library in the event of a serious library malfunction.

1. If using a static IP address, make a note of your library's IP address. If using DHCP, proceed to the next step.
2. Remove the old library chassis using the corresponding procedure in "Removing Library from a Rack" on page 8-2 or "Removing Library from a Desktop" on page 8-7.
3. Install the new library chassis using the corresponding procedure in "Installing the Library on a Desktop" on page 8-4 or "Installing the Library in a Rack" on page 8-9.
4. It is necessary to change the serial number on the new library to the serial number of the old library to preserve your entitlement to IBM service.
   - If you are **using a static IP address**, complete the following steps.
     a. Using the Operator Panel, enter the network settings for the library. See "Configuring Network Settings" on page 4-10. Be sure to disable DHCP.
     b. Log in to the Web User Interface as **admin**. The following screen appears.
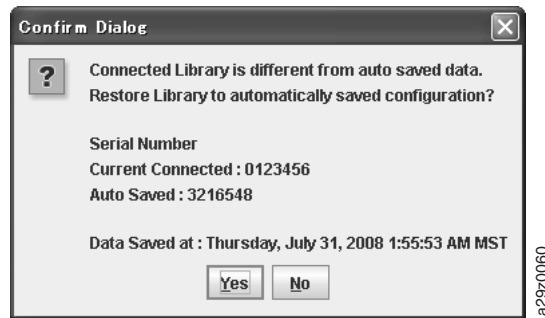
Figure 8-26. Auto saved data confirmation

     c. Answer **Yes** to restore the saved configuration from your old library to your new library. Answer **No** to maintain the current configuration of the new library and to display the next Confirm Dialog box.

Figure 8-27. Overwrite confirmation dialog box

     d. Answer **No** to maintain both configuration files. Answer **Yes** to maintain the new library configuration.
     e. Verify all configuration settings. Change any settings as required. Update the Library Configuration Form, if necessary. Save your new configuration using the Web User Interface (**Configure Library → Save/Restore**).
     f. Update your host application device table with the new drive serial number. To determine the new drive serial number, log in to the Web User Interface and refer to the drive information on the **Library Map**.
   - If you are **using DHCP** to acquire an IP address, complete the following steps.
     a. Using the Operator Panel, retrieve your new library IP address. See "Viewing Current Information" on page 4-3.

b. Contact IBM Technical Support for the **service** password.
In the USA: 1-800-IBM-SERV (1-800-426-7378)
All other countries and regions: `http://www.ibm.com/planetwide/`.

c. Log in to the Web User Interface. Use the username **service** and the password from IBM Technical Support.

d. Go to **Configure Library** → **Save/Restore**. Enter the serial number to match the serial number of your old library and click **Restore Serial**.

Save / Restore Library Settings

| Save | Save configuration to file |
| Restore | Restore configuration from file |

Restore Serial Number

Library serial number :   3216548

Restore Serial

a29z0094

Figure 8-28. Save/Restore screen

e. On the same screen, click **Restore** to restore the saved configuration from your old library to your new library. If you do not have a saved configuration on your host, you must reconfigure your library. See "Configuring the Library" on page 3-14.

f. Log out of the Web User Interface.

g. Log in to the Web User Interface as **admin**.

h. Verify all configuration settings. Change any settings as required. Update the Library Configuration Form, if necessary. Save your new configuration using the Web User Interface (**Configure Library** → **Save/Restore**).

i. Update your host application device table with the new drive serial number. To determine the new drive serial number, log in to the Web User Interface and refer to the drive information on the **Library Map**.

5. After physically installing and reconfiguring the new library, confirm that the library firmware installed is the latest version. Note the firmware revision number using the **System Summary** window of the Web User Interface and check against the latest firmware version at `http://www-03.ibm.com/servers/ storage/support`. To update the library firmware, if necessary, see "Updating Library and Drive Firmware" on page 4-34.

6. Copy the serial number and WWN from the old library onto the new library. This step is necessary to maintain a valid warranty. See "Applying a RID Tag to a Library" on page 8-16.

Applying a RID Tag to a Library

A RID (Repair Identification) Tag maintains the original serial number record and WWN of the machine to ensure that your warranty coverage, if applicable, is not interrupted. The tag is important for customer inventory accuracy. Follow the instructions on the RID tag precisely.
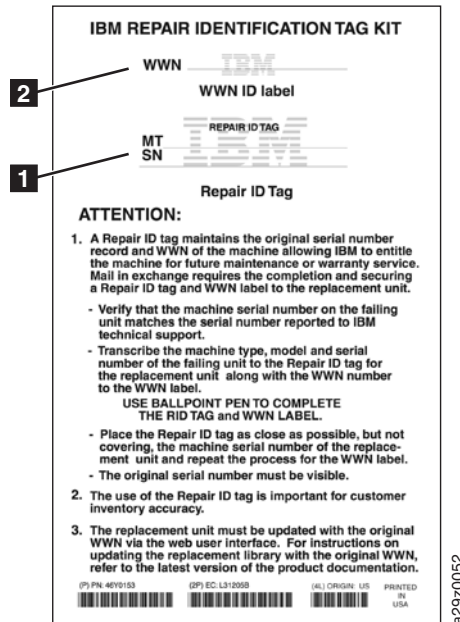
Figure 8-29. RID tag

1. Copy the machine type (MT) and serial number (SN) from the old library onto the Repair ID tag (**1** in Figure 8-29).
2. Copy the Worldwide Name (WWN) from the old library onto the WWN ID label (**2** in Figure 8-29).
3. Place the RID tag close to, but not covering, the serial number on the new library. Repeat for the WWN ID label.

Chapter 9. Parts List

Features

Table 9-1. Optional features

Description	Feature Code	HVEC Part Number
2m SAS/Mini-SAS 1x Cable (from HBA with SFF-8470 to drive with SFF-8088)	5402	95P4711
5.5m SAS/Mini-SAS 1x Cable (from HBA with SFF-8470 to drive with SFF-8088)	5406	95P4712
2m Mini-SAS 1x Cable (from HBA/Interposer with SFF-8088 to drive with SFF-8088)	5502	95P4713
5.5m Mini-SAS 1x Cable (from HBA/Interposer with SFF-8088 to drive with SFF-8088)	5506	95P4714
Transparent LTO Encryption	5901	45E3797
Rack Mount Kit with RML Line Cord	7006	45E3785
Deskside Kit	7010	45E3789
Additional Cartridge Magazine	8111	45E3793

Customer Replaceable Units (CRUs)

The TS2900 Tape Autoloader has customer replaceable units (CRUs) that must be added, removed, and replaced by the customer. If you choose to have the CRU added, removed, or replaced by an IBM Service Representative, there will be a charge for the service.

Table 9-2. Customer replaceable units

Description	CRU Part Number
S3H Generation 3 Tape Drive Library Chassis	45E4824
S4H Generation 4 Tape Drive Library Chassis	45E4831
Cartridge Magazine	46Y0016

Power Cords and Receptacles

Figure 9-1 shows the receptacles that are used by the power cords in Table 9-3. Match the index number that is beside each plug to the index number in the table.
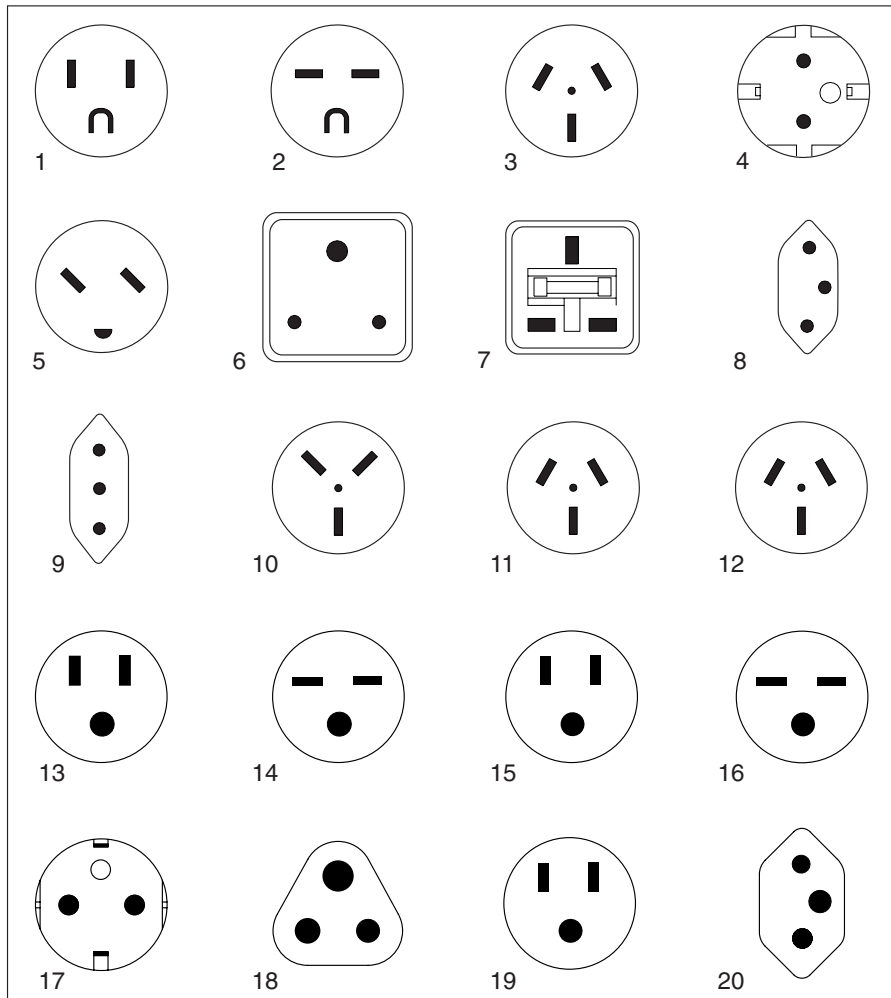
Figure 9-1. Types of power cord receptacles

Table 9-3. Power cords

Description, Feature Code (FC), and Part Number (PN)	Plug Standard Reference	Country or Region	Index Number in Figure 9-1
US/Canada • 2.8 m, 125V • FC 9800 • AAS PN 39M5081 • HVEC/SAP PN 23R7141	NEMA 5-15P	Aruba, Bahamas, Barbados, Bermuda, Bolivia, Brazil, Canada, Cayman Islands, Colombia, Costa Rica, Curacao, Dominican Republic, Ecuador, El Salvador, Guatemala, Guyana, Haiti, Honduras, Jamaica, Japan, Liberia, Mexico, Netherlands Antilles, Nicaragua, Panama, Peru, Philippines, Saudi Arabia, South Korea, Suriname, Taiwan, Trinidad Tobago, Venezuela, US	1
Chicago • 1.8 m, 125 V • FC 9986 • AAS PN 39M5080 • HVEC/SAP PN 23R7143	NEMA 5-15P	Chicago, U.S.A.	1
US/Canada • 2.8 m, 250 V • FC 9833 • AAS PN 39M5095 • HVEC/SAP PN 23R7145	NEMA 6-15P	Aruba, Bahamas, Barbados, Bermuda, Bolivia, Brazil, Canada, Cayman Islands, Costa Rica, Curacao, Dominican Republic, Ecuador, El Salvador, Guatemala, Guyana, Haiti, Honduras, Jamaica, Japan, Liberia, Netherlands Antilles, Nicaragua, Panama, Peru, Philippines, Suriname, Taiwan, Thailand, Trinidad Tobago, Venezuela, US	2
Australia • 2.8 m, 250V • FC 9831 • AAS PN 39M5102 • HVEC/SAP PN 23R7153	AS 3112 NZS 198	Argentina, Australia, China, Colombia, New Zealand, Papua New Guinea, Paraguay, Uruguay, Western Samoa	3

Table 9-3. Power cords (continued)

Description, Feature Code (FC), and Part Number (PN)	Plug Standard Reference	Country or Region	Index Number in Figure 9-1
France, Germany • 2.8 m, 250V • FC 9820 • AAS PN 39M5123 • HVEC/SAP PN 23R7146	CEE 7 - VII	Afghanistan, Algeria, Andorra, Angola, Aruba, Austria, Belgium, Benin, Brazil, Bulgaria, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, Congo-Brazzaville, Curacao, Czech Republic, Democratic Republic of Congo, Denmark, Egypt, Finland, France, French Guiana, Germany, Greece, Guinea, Hungary, Iceland, Indonesia, Iran, Ivory Coast, Jordan, Kenya, Korea, Lebanon, Luxembourg, Macau, Malagasy, Mali, Martinique, Mauritania, Mauritius, Monaco, Morocco, Mozambique, Netherlands, Netherlands Antilles, New Caledonia, Niger, Norway, Poland, Portugal, Romania, Russia, Saudi Arabia, Senegal, Spain, Sweden, Sudan, Syria, Togo, Tunisia, Turkey, Yugoslavia, Zaire, Zimbabwe, Vietnam	4
Denmark • 2.8 m, 250V • FC 9821 • AAS PN 39M5130 • HVEC/SAP PN 23R7147	DK2-5A	Denmark	5
South Africa • 2.8 m, 250V • FC 9829 • AAS PN 39M5144 • HVEC/SAP PN 23R7151	SABS 164	Bangladesh, Burma, Pakistan, South Africa, Sri Lanka	6
United Kingdom • 2.8 m, 250V • FC 9825 • AAS PN 39M5151 • HVEC/SAP PN 23R7148	BS 1363	Antigua, Bahrain, Bermuda, Brunei, Channel Islands, China (Hong Kong S.A.R.), Cyprus, Fiji, Ghana, Guyana, India, Iraq, Ireland, Jordan, Kenya, Kuwait, Malaysia, Malawi, Malta, Nepal, Nigeria, Oman, Polynesia, Qatar, Sierra Leone, Singapore, Tanzania, Uganda, UK, United Arab Emirate (Dubai), Yemen, Zambia	7

Table 9-3. Power cords (continued)

Description, Feature Code (FC), and Part Number (PN)	Plug Standard Reference	Country or Region	Index Number in Figure 9-1
Switzerland • 2.8 m, 250V • FC 9828 • AAS PN 39M5158 • HVEC/SAP PN 23R7150	SEV SN 416534	Liechtenstein, Switzerland	8
Italy • 2.8 m, 250V • FC 9830 • AAS PN 39M5165 • HVEC/SAP PN 23R7152	CEI 23- 16	Chile, Ethiopia, Italy, Libya, Somalia	9
Israel • 2.8 m, 250V • FC 9827 • AAS PN 39M5172 • HVEC/SAP PN 23R7149	S11-32-1971	Israel	10
Argentina • 2.8 m, 250V • FC 9834 • AAS PN 39M5068 • HVEC/SAP PN 23R7154	IEC 83-A5	Argentina, Brazil, Colombia, Paraguay, Trinidad Tobago, Uruguay	11
China • 2.8 m, 250V • FC 9840 • AAS PN 39M5206 • HVEC/SAP PN 23R7155	CCEE	People's Republic of China	12
Taiwan LV* • 2.8 m, 125V • FC 9835 • AAS PN 39M5247 • HVEC/SAP PN 23R7158	CNS 10917-3	Taiwan	13
Taiwan HV** • 2.8 m, 250V • FC 9841 • AAS PN 39M5254 • HVEC/SAP PN 23R6981	CNS 10917-3	Taiwan	14
Japan LV* • 2.8 m, 125V • FC 9842 • AAS PN 39M5199 • HVEC/SAP PN 23R6982	JIS C8303, C8306	Japan	15
Japan HV** • 2.8 m, 250V • FC 9843 • AAS PN 39M5186 • HVEC/SAP PN 23R6983	JIS C8303, C8306	Japan	16

Table 9-3. Power cords (continued)

Description, Feature Code (FC), and Part Number (PN)	Plug Standard Reference	Country or Region	Index Number in Figure 9-1
Korea HV** • 2.8 m, 250V • FC 9844 • AAS PN 39M5219 • HVEC/SAP PN 23R6984	KS C8305, K60884-1	Korea	17
India HV** • 2.8 m, 250V • FC 9845 • AAS PN 39M5226 • HVEC/SAP PN 23R6985	IS 6538	India	18
Brazil LV* • 2.8 m, 125V • FC 9846 • AAS PN 39M5233 • HVEC/SAP PN 23R6986	InMetro NBR 6147	Brazil	19
Brazil HV** • 2.8 m, 250V • FC 9847 • AAS PN 39M5240 • HVEC/SAP PN 23R6987	InMetro NBR 14136	Brazil	20
* Low Voltage ** High Voltage			

Appendix A. Information for Trained IBM Service Personnel

Web User Interface Service Login

The Web User Interface Java Applet requires Java 1.5.0 or higher for full functionality, and is best viewed using Internet Explorer 6.0 or higher. Internet Explorer 7.0 or higher is required for IPv6. If your computer does not have Java installed or you need to upgrade your installation, download the latest version of the Java Runtime Environment (JRE) for your platform from `http://www.java.com/` and follow the instructions provided to enable and configure the Java Runtime Environment for your browser.

The Web User Interface can also be used to update the library and drive firmware, and to download error logs, drive dumps, and other library data from the library.

Before the TS2900 Tape Autoloader can be managed over a network using the Web User Interface, you must set up the initial network configuration of the library using the Operator Panel. For more information, see "Configuring Network Settings" on page 3-29.

Logging in to the Web User Interface

To log in to the Web User Interface from Internet Explorer, you need to enter the IP address of the library. The IP address can be obtained using the **View Current Information** command from the Operator Panel. For example, `http://192.168.1.1`

When the applet launches, the following warning message appears. This message is normal and **does not** indicate a problem.

Figure A-1. Java security warning message

You can click the **Always trust content from this publisher** checkbox to avoid the warning message in subsequent browser sessions.

Click **Run** to launch the Web User Interface.
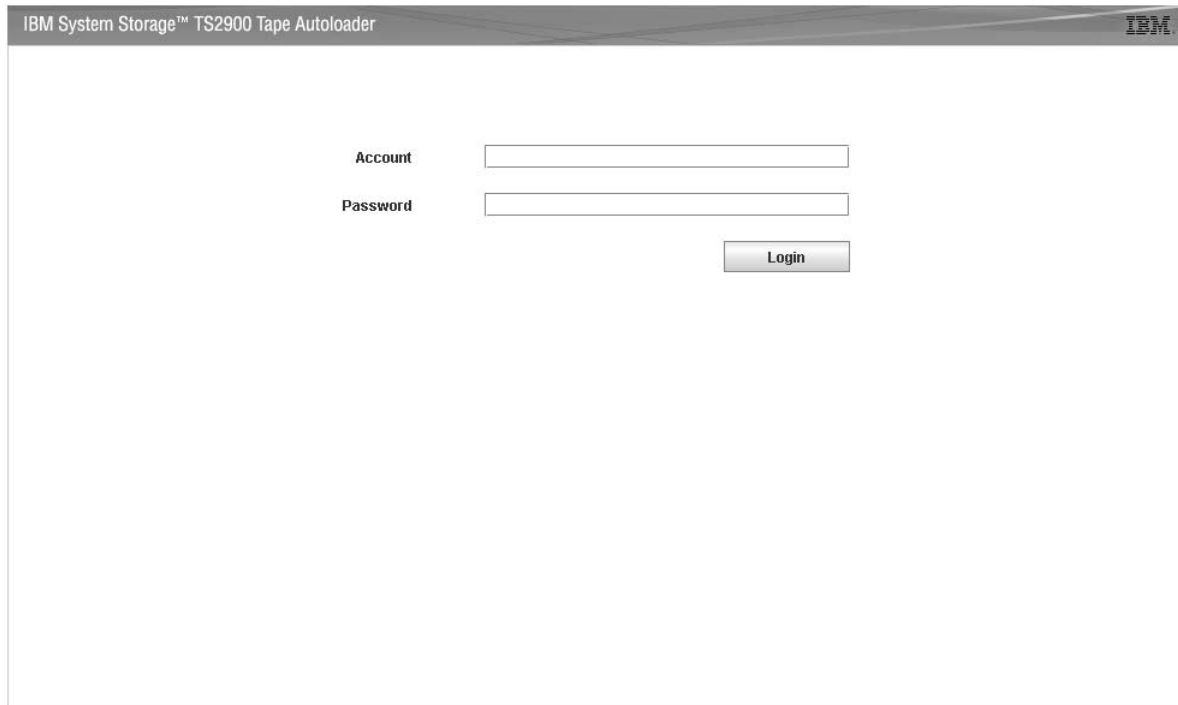
Figure A-2. Login window

The factory default account login and password for a Service account is
- Account: **service**
- Password: Contact your next level of support.

The account name and password are case sensitive. After entering your account name and password, use your mouse to click Login or press the Enter key.

For information on account privileges, see "User Privilege Comparison" on page A-3.

Common Header Elements

All Web User Interface windows (except for the Login screen) contain the following common elements in the header:
- **Help** — Click to read context-sensitive help for the associated page.
- **Logoff** — Click to log out of the Web User Interface.

Menus Available from the Web User Interface

Figure A-3 shows the window for a Service account.

Figure A-3. Service account window

For a complete description of all Web User Interface menu options, see Chapter 4, "Operations," on page 4-1.

User Privilege Comparison

User privilege levels are manually assigned to user accounts created within the library. Controlling access to screens and operations within the library preserves the integrity of the library and the data that is stored within the library.

There are four types of user privileges in the library.
- **Users** are allowed to monitor the library, but not perform actions that affect the physical library.
- **Superusers** are allowed to operate the physical and logical library, but not perform actions that affect the library configuration.

- **Administrator** users are allowed access to the entire physical library and logical library, including configuration. One and only one administrator user must be assigned the login name **admin**.
- **Service** users are allowed access to the entire physical library and logical library. In addition, the Service user account can access diagnostic tools to help identify and resolve library and drive problems. The Service user account is only displayed in the **User Access** panel if logged in with a Service user login.

User privileges include:
- Multiple users can be logged in at one time on the Web User Interface.
- Any user can be logged in to only one interface at a time.

Table A-1. Menu commands and access privileges

Menu Command	User	Superuser	Administrator User	Service User
MONITOR LIBRARY				
System Summary	X	X	X	X
Library Map	X	X	X	X
MANAGE LIBRARY				
Move Cartridges	–	X	X	X
Unload Drive	–	X	X	X
Clean Drive	–	X	X	X
Library State	–	X	X	X
Inventory	–	X	X	X
CONFIGURE LIBRARY				
User Access	–	–	X	X
Physical	–	–	X	X
Logical	–	–	X	X
Network	–	–	X	X
Encryption (3572-S4H only)	–	–	X	X
Date and Time	–	–	X	X
Notifications	–	–	X	X
Save/Restore	–	–	X	X
SERVICE LIBRARY				
Key Path Diagnostics (3572-S4H only)	–	–	X	X
Operator Interventions	X	X	X	X
View Library Logs	X	X	X	X
Traces	–	–	X	X
Download Drive Logs	–	–	X	X
Download Library Logs	X	X	X	X
Reset Library/Drive	–	–	X	X
Firmware Update	–	–	X	X
Usage Statistics	–	–	X	X

Connecting to the Library using the Telnet Service Port

The Telnet Service Port can be enabled to allow IBM service personnel to execute extended troubleshooting procedures.

To enable the Telnet Service Port, have the library administrator complete the following steps:

1. Log in to the Operator Panel.
2. Go to the **Telnet Service Port** item in the **Service** menu, and push Enter.
3. When **Enable Telnet Port** appears on the display, push Enter.
4. When **Are you sure?** appears on the display, push Enter.

To disable the Telnet Service Port, have the library administrator power cycle the library.

Drive/Cartridge Removal

Important:
- **It is strongly recommended that the drive and stuck tape be returned to IBM for removal and recovery.**
- **These procedures must be performed only by a trained IBM service provider. SSRs should claim their time against service code 33 ECA 013 when performing this procedure.**
- **Inform the customer the following procedure has high risk of damaging the drive and high risk of not being able to recover the data.**

Removing/reinstalling the Library Chassis Cover

Important: FOR REFERENCE ONLY. The customer is not authorized to remove the cover of the library. No customer serviceable components are inside the library.

If you need to access the cartridge magazine or tape drive, complete the following steps:

1. If possible, unload the tape drive and move the cartridge to its home position (Operator Panel: **Move Cartridge** command; Web User Interface: **Manage Library → Move Cartridges**).
2. Deconfigure the drive from the server (for instructions, see your server's documentation).
3. Turn OFF the power to the library.
4. Disconnect all cables from the rear panel of the library.
   - For a **desktop library**, remove the deskside cover.
     a. Remove the large pan-head screws **4** on the rear of the library (Figure A-4).
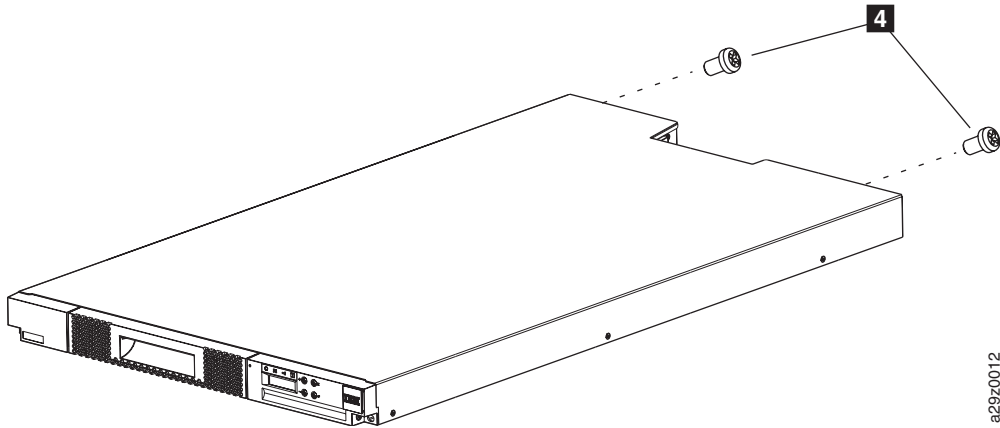
Figure A-4. Removing screws from the rear of the library

    b. Remove the flat-head screws **6** on each side securing the deskside cover to the library, and remove the deskside cover **2** (Figure A-5).
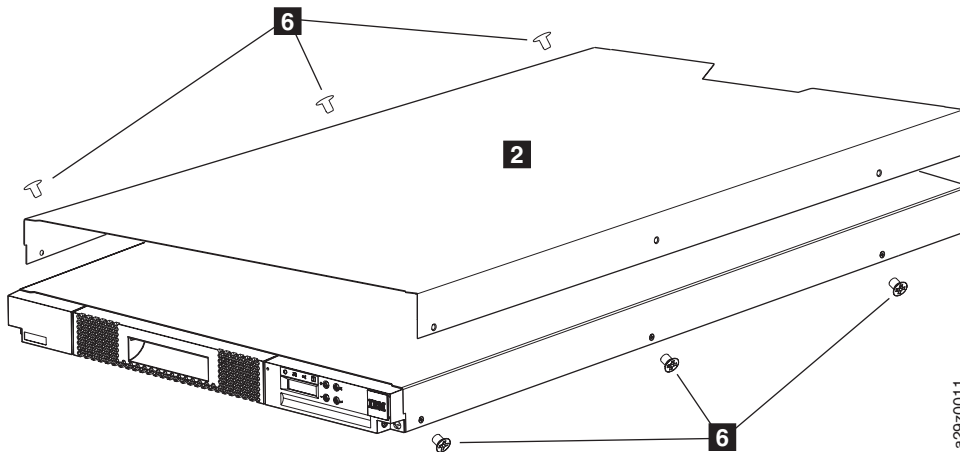
Figure A-5. Removing the deskside cover

    c. Remove the flat-head screws **6** on each side to remove the left **5** and right **3** rails from the chassis (Figure A-6).
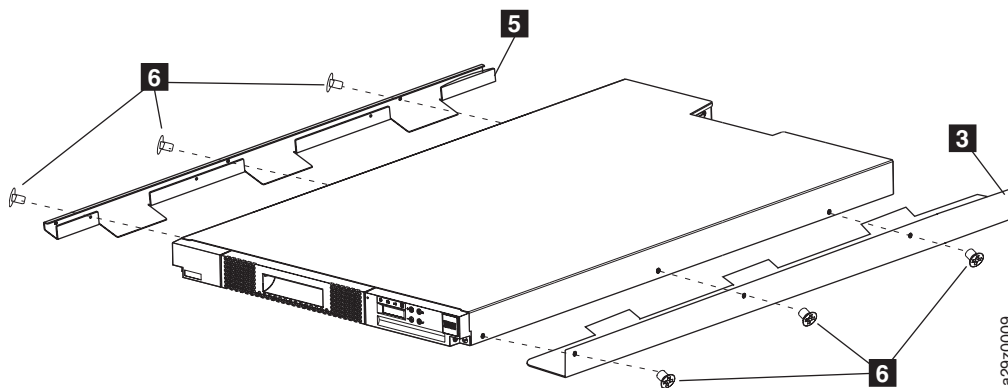
Figure A-6. Removing side rails from the library chassis

- For a **rack mounted library**, remove the library from the rack.

    a. Remove the two round-head screws **10** on each rear bracket securing the rear of the library to the rack (Figure A-7).
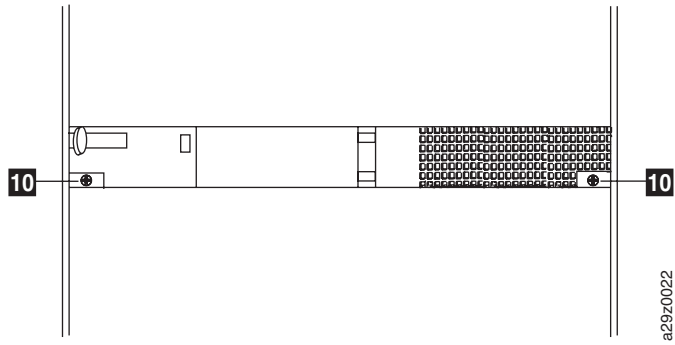
Figure A-7. Removing screws at the rear of the library

    b. Remove the large black screws **11** from each front bracket securing the front of the library to the rack, and slide the library chassis out of the rack (Figure A-8).
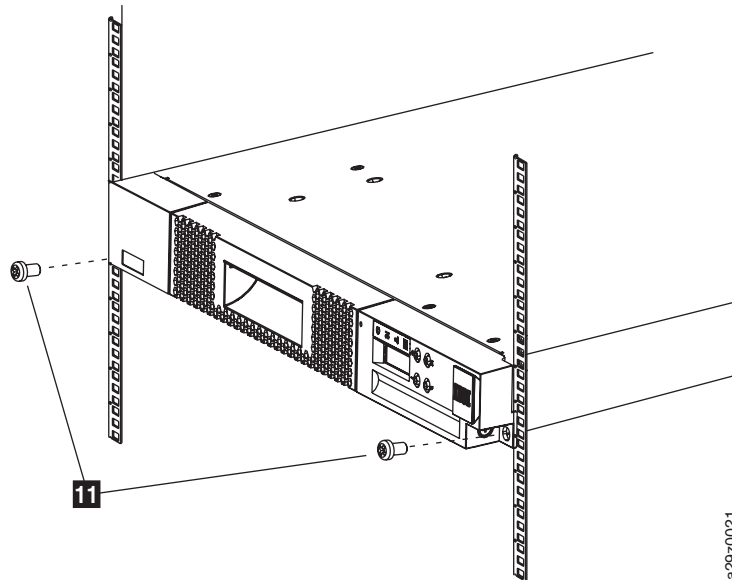
Figure A-8. Removing screws at the front of the library

    5. Remove the screws securing the library chassis cover (Figure A-9).
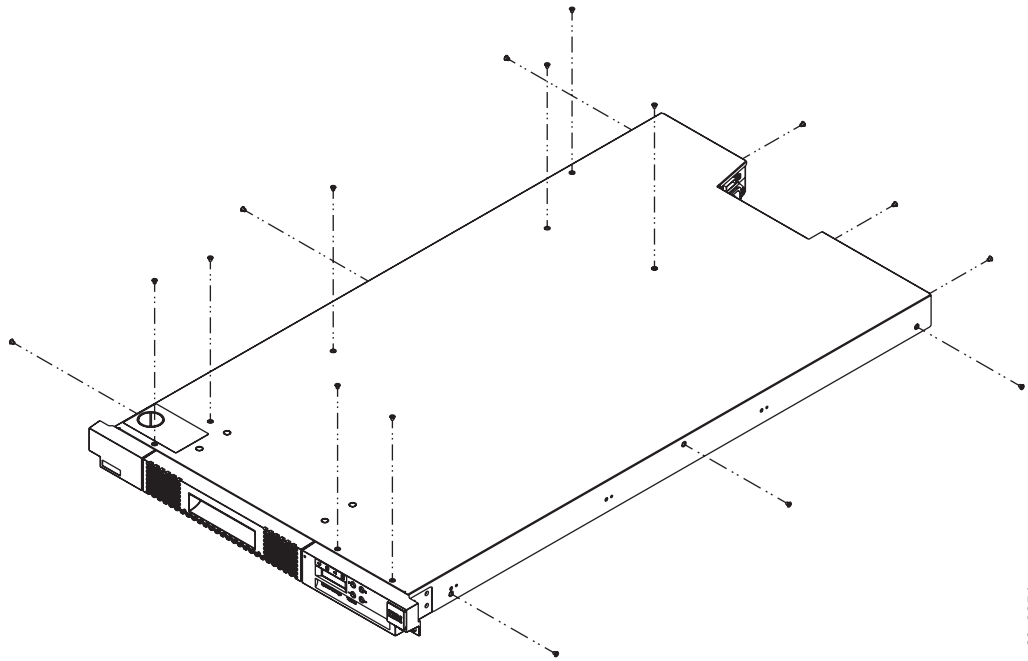
Figure A-9. Library chassis cover screw locations

6. Lift the library chassis cover off vertically (Figure A-10).
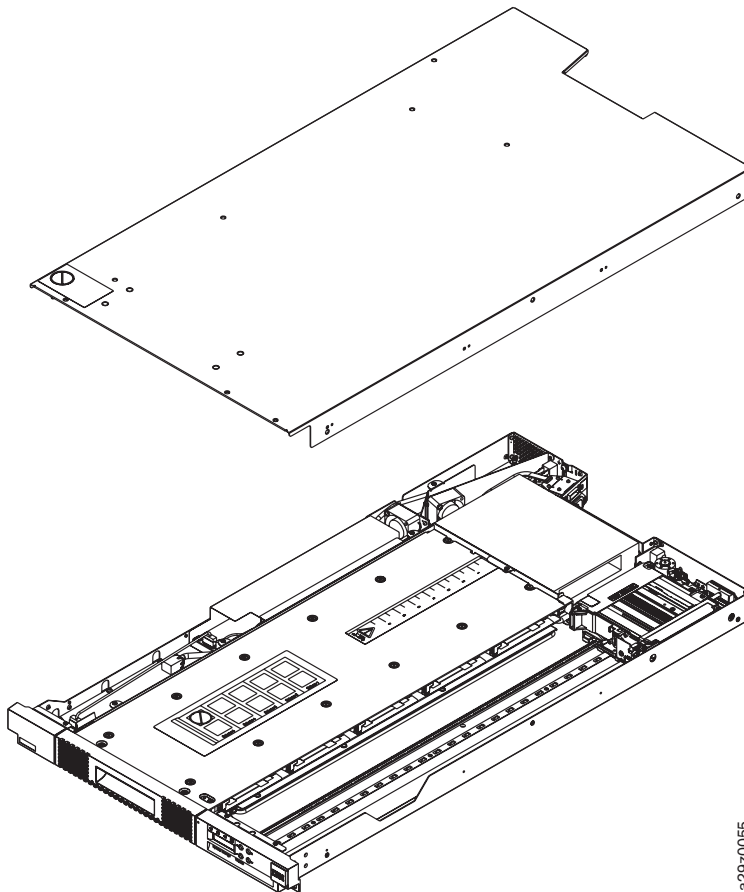
Figure A-10. Library chassis cover removal

Installation is the reverse of the removal procedure.

Internal View of Library
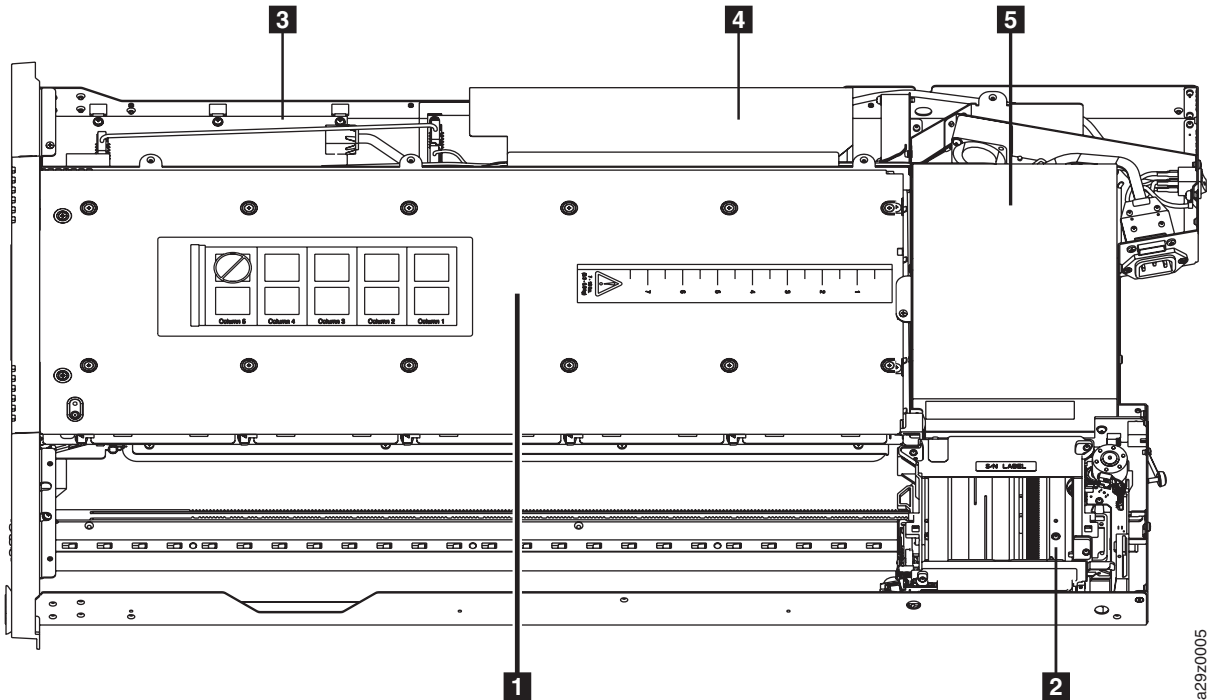
Figure A-11. Internal components

Table A-2. Internal component descriptions

Number	Component	Description
1	Cartridge magazine	The tape library has a single cartridge magazine that can hold up to 9 data cartridges, or 8 data cartridges with a 1-slot I/O Station.
		Column 5/Tier 1 in the cartridge magazine can be configured as a 1-slot I/O Station. Column 5/Tier 2 in the cartridge magazine is reserved for the exchange position and can be accessed by the library only. The I/O Station is used to import and export cartridges without interrupting normal library operation. Beginning with Column 4, a minimum of one column can be reserved for cleaning cartridges. Cleaning cartridges are used to clean the tape drive heads. For configuration details, see "Physical Library Settings" on page 3-19.
2	Accessor	This component contains the library robot and bar code reader. The accessor moves cartridges to/from the following: • I/O Station • storage slots • tape drive
3	Library control board	The library control board manages the entire library, including the Operator Panel and Accessor, and is responsible for monitoring the library to ensure that the library is functioning properly. It stores vital product data (VPD) such as library settings, serial number, library logs, and Accessor calibration backup data.
4	Power supply	The power supply is the sole source of power for the library.
5	Tape Drive	The library supports the Ultrium 3 Half-High Tape Drive and Ultrium 4 Half-High Tape Drive.

Removing/reinstalling the Tape Drive from/in the Library

To remove the SAS tape drive from the library, complete the following steps:

1. Turn OFF the power to the library.
2. Disconnect all cables from the rear panel of the library.
3. Remove the library cover(s). See "Removing/reinstalling the Library Chassis Cover" on page A-5.
4. Disconnect the internal SAS cable (**2** in Figure A-12).
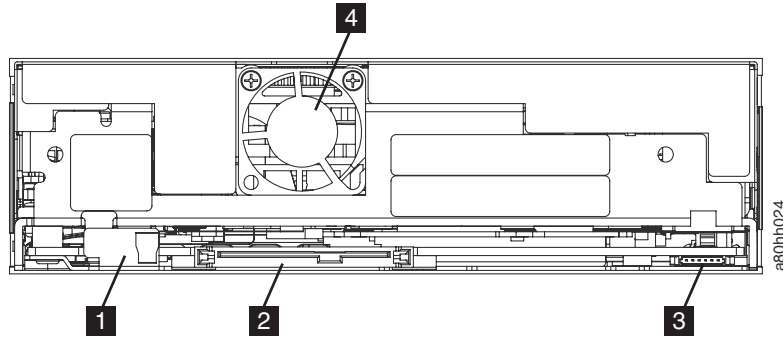
Figure A-12. Rear panel of the SAS Half-high drive

5. If connected, disconnect the internal LDI (RS-422) cable from the LDI (RS-422) connector (**3** in Figure A-12).
6. Remove the cartridge magazine from the library.
7. Remove the drive mounting screws from the sides of the tape drive housing. Two screws are located on each side of the drive (Figure A-13).
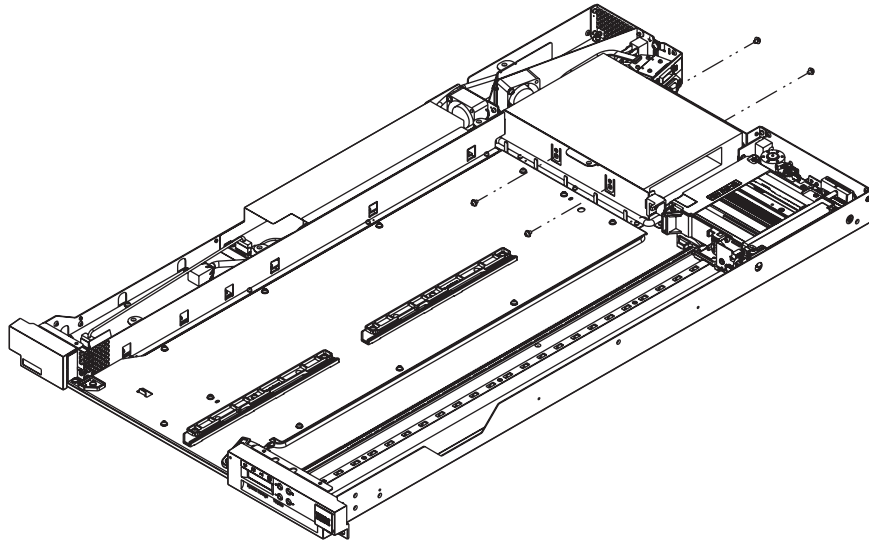
Figure A-13. Drive housing screw locations

8. Lift the tape drive out of the library chassis (Figure A-14).
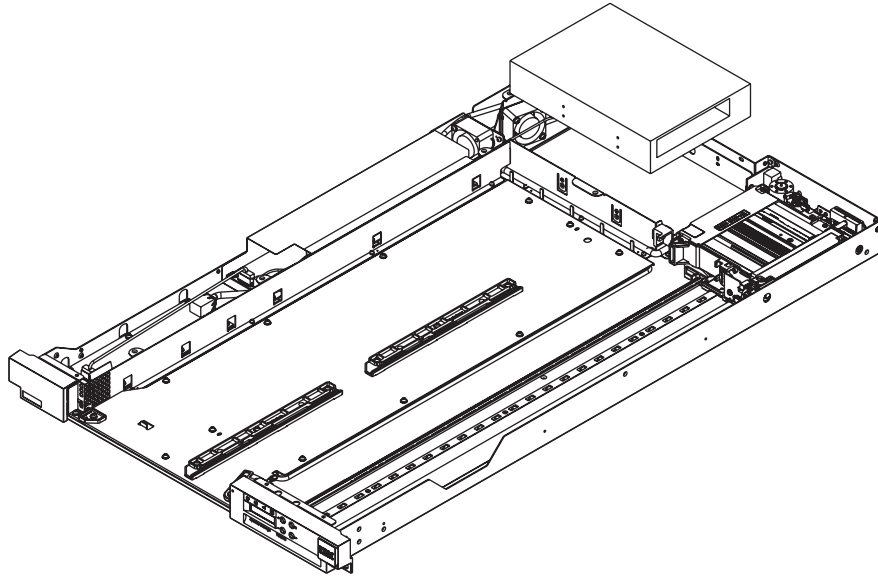
Figure A-14. Tape drive removal

Installation is the reverse of the removal procedure.

Manually Removing a Tape Cartridge from the Drive

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

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

- The cartridge will not eject automatically at the end of a mid-tape recovery. Instead, the tape will be reloaded into the drive and may result in the loss of data.
- **INTERNAL COMPONENTS OF THE DRIVE ARE DELICATE AND CAN EASILY BE DAMAGED. EXERCISE EXTREME CAUTION WHEN MANUALLY REMOVING A CARTRIDGE THAT WILL NOT EJECT AFTER PRESSING THE UNLOAD BUTTON.**

Before You Begin

1. If you have not already done so, attempt to remove the cartridge with the device power ON and using library manager, a host application, or the unload button. When using the Unload button, press and hold the button for 12 seconds. This will cause the drive to eject the cartridge when it has completed the mid-tape recovery.
2. If you have not already done so, ensure the operator has issued the appropriate application commands to perform a rewind and unload of the cartridge. This is to ensure that the stuck cartridge is not due to a hang condition in the application.
3. If you have not already done so, attempt to remove the cartridge by power cycling the drive. Look for the drive to attempt a midtape recovery.

    Note: It can take up to one hour for the cartridge to rewind and unload.

4. If the cartridge unloads, inform the operator that the cartridge is unloaded. If the cartridge does not unload, repeat steps 2 and 3 once before continuing with this procedure.

Recommended Tools

- #1 Phillips screwdriver
- ESD Kit
- Flashlight (optional)
- #1 Flathead screwdriver (optional)

Beginning Procedure

1. Remove the drive. See "Removing/reinstalling the Tape Drive from/in the Library" on page A-10.
2. Place the drive on a non-slip, sturdy work surface.
3. Ground yourself to the drive by using the ESD Kit.
4. Remove the cover of the drive by performing the following steps:
    a. To remove the drive bezel, pull the right side of the bezel from the front of the drive, then pull the left side of the bezel out of the frame of the drive.
    b. To remove the cover of the internal drive, remove the four cover-mounting screws (**1** in Figure A-15). Two screws are located on each side of the drive. Remove the cover by lifting it up.
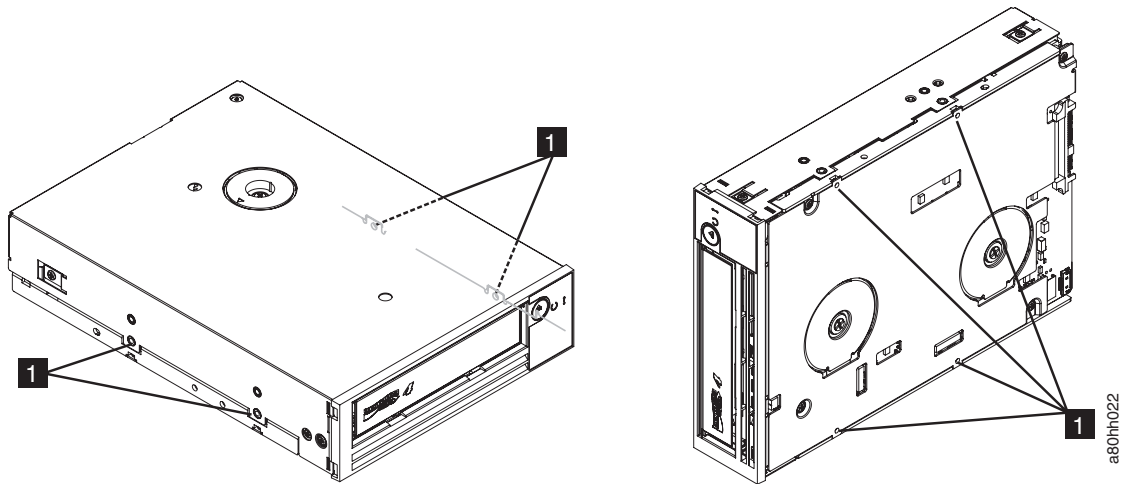
Figure A-15. Removing the bezel and the cover from the internal drive

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

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

Tape Spooled off Supply Reel

Important: DO NOT TOUCH THE OUTER GUIDE RAIL (2 in Figure A-16**).
THIS RAIL IS VERY DELICATE AND EASILY DAMAGED.**

1. From the takeup reel, pull an arm's length of tape around the rear of the tape path and over the head and rollers on the left side of the drive.
2. Set the drive on its left side with the head and tape path facing up.
3. Make sure the tape is not twisted. Untwist tape if required.
4. Moisten a cotton swab with water and wet approximately 13 mm (0.5 in.) of the tape end and feed it onto the supply reel (inside the cartridge).
5. Turn the supply reel (4 in Figure A-16) clockwise, allowing the moistened tape to adhere to the hub as it winds around the supply reel (inside the cartridge).
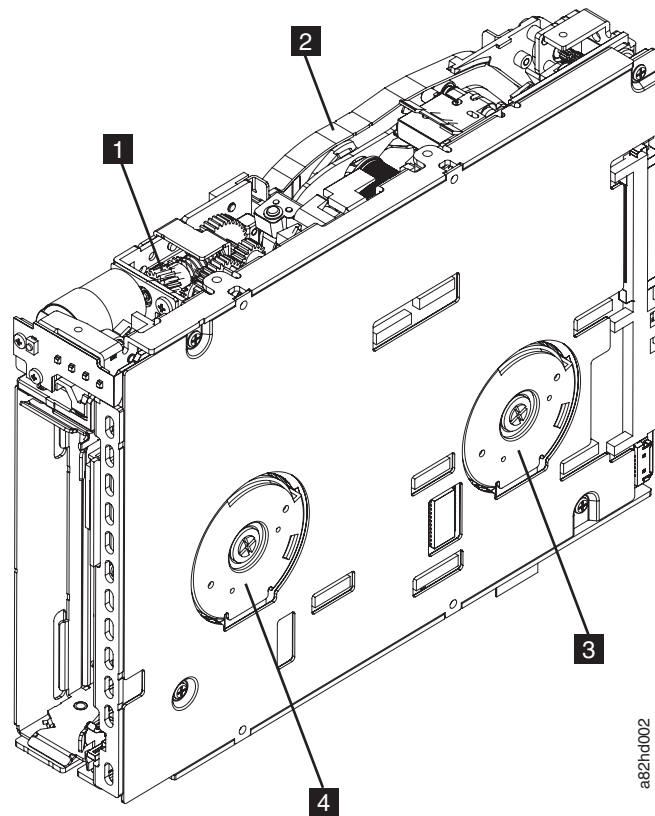
Figure A-16. Rewinding tape into cartridge

1	Loader motor worm gear	**3**	Takeup reel motor
2	Outer guide rail	**4**	Supply reel motor

6. Continue spooling into the cartridge until the tape is taut and remains within the flanges of the tape guiding rollers. Turn the supply reel (**4** in Figure A-16) 10 additional turns. Ensure that you do not stretch the tape.
7. Reassemble the drive, reversing the steps in "Beginning Procedure" on page A-12.
8. Reassemble the library chassis. See "Ending Procedure" on page A-21.

Tape Pulled from or Broken near Leader Pin
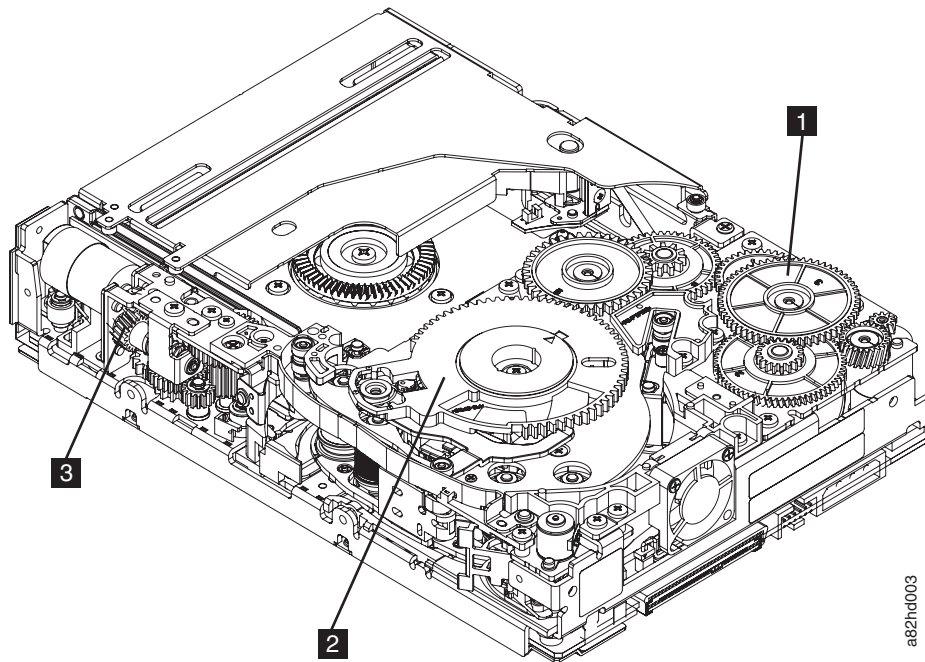
Figure A-17. Drive with cover removed to reveal gear train

1 Threader intermediate gear   **3** Loader motor worm gear
2 Threader mechanism gear

1. Pull out tape from the takeup reel.

    Note: If there is more than approximately 0.6 m (2 ft.) of tape on the takeup reel, go to "Tape Broken in Mid-tape" on page A-16.

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

3. Reattach the leader pin to the remaining tape.

4. Locate the threader intermediate gear (**1** in Figure A-17) near the rear of the drive. You can use your finger to rotate the threader intermediate gear (**1** in Figure A-17) and slowly rotate the threader mechanism gear (**2** in Figure A-17) clockwise. This draws the tape leader block assembly (LBA) into the cartridge.

5. As the leader pin is secured in the cartridge, you should hear the leader pin retention spring clips click into place. If you do not hear the click, continue rolling until the threader intermediate gear (**1** in Figure A-17) stops. The LBA is in the correct position.

    Note: Be sure to keep tension on the tape as the LBA is drawn into the cartridge.

6. Rotate the loader motor worm gear (**3** in Figure A-17 and **1** in Figure A-18) clockwise as viewed from the front of the drive until it stops. This releases the LBA leader pin.

7. Rotate the threader intermediate gear (**1** in Figure A-17) counterclockwise until the leader block is in front of the Read/Write head. This moves the LBA out of the cartridge.

Figure A-18. Leader Block Assembly (LBA)

1 Loader motor worm gear   **2** Leader block assembly (LBA)

8. Rotate the loader motor worm gear (**3** in Figure A-17) counterclockwise as viewed from the front of the drive until it stops.
9. Remove the cartridge from the cartridge loader tray.
10. Reassemble the drive by reversing the procedure in Step 4 in "Beginning Procedure" on page A-12.
11. Reassemble the library chassis. See "Ending Procedure" on page A-21.

Tape Broken in Mid-tape

1. With the front of the drive facing you, pull an arm's length of tape out of the takeup reel. From the takeup reel, thread tape around the rear of the tape path and over the head rollers on the left side of the drive.

   Note: If there is less than approximately 5 cm (2 in.) of tape on the takeup reel, go to "Tape Pulled from or Broken near Leader Pin" on page A-15.

2. From the supply reel inside the cartridge, pull approximately 0.3 m (1 ft.) of tape.
3. Make sure the tape is not twisted. Untwist tape if required.
4. Moisten a cotton swab with water, and wet approximately 13 mm (0.5 in.) of the tape end. Overlap the tape ends, loosely mending them together.
5. Set the drive on its left side with the head and tape path facing up.
6. Turn the supply reel (**4** in Figure A-19) clockwise, carefully guiding the mended portion of the tape to wind around the hub of the supply reel located inside the cartridge. Continue spooling into the cartridge until the tape is taut. The tape must remain within the flanges of the tape guiding rollers. Turn the supply reel (**4** in Figure A-19) 10 additional turns. Ensure that you do not stretch the tape.
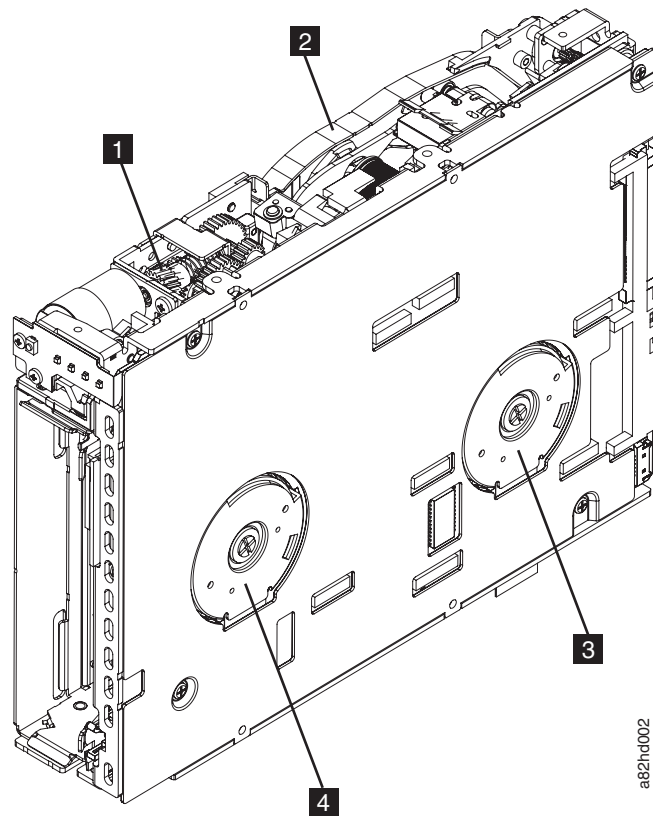
Figure A-19. Rewinding tape into cartridge

1 Loader motor worm gear   **3** Takeup reel motor

2 Outer guide rail   **4** Supply reel motor

7. Reassemble the drive by reversing the procedure in Step 4 in "Beginning Procedure" on page A-12.
8. Reassemble the library chassis. See "Ending Procedure" on page A-21.

Tape Tangled along Tape Path

1. Carefully pull out excess tape and untangle.

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

   - "Tape Spooled off Supply Reel" on page A-13
   - "Tape Pulled from or Broken near Leader Pin" on page A-15
   - "Tape Broken in Mid-tape" on page A-16
2. Set the drive on its left side with the head and tape path facing up.
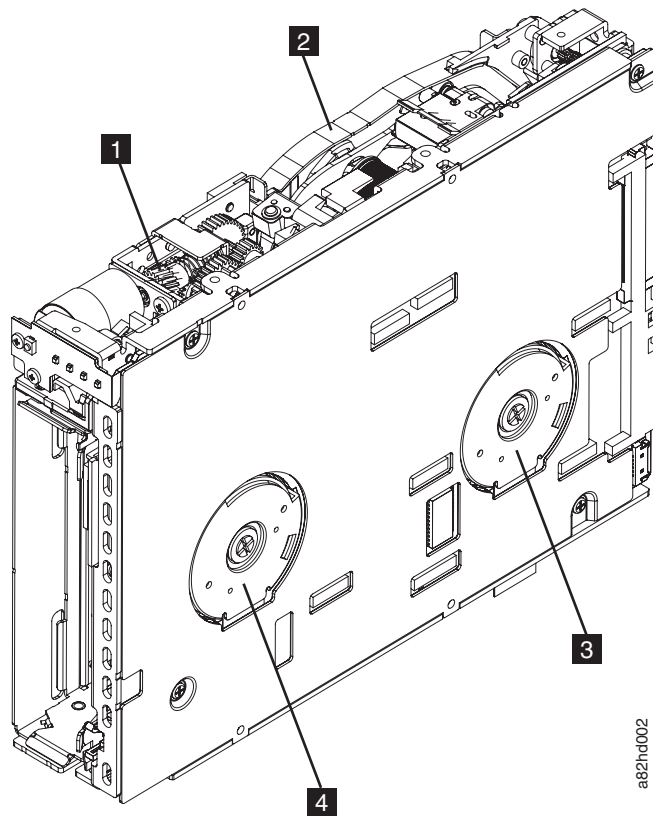
a82hd002

Figure A-20. Rewinding tape into cartridge

1	Loader motor worm gear	**3**	Takeup reel motor
2	Outer guide rail	**4**	Supply reel motor

3. Turn the supply reel (**4** in Figure A-20) clockwise.
4. Continue spooling into the cartridge until the tape is taut and remains within the flanges of the tape guiding rollers. turn the supply reel (**4** in Figure A-20) 10 turns. Ensure that you do not stretch the tape.
5. Reassemble the library chassis. See "Ending Procedure" on page A-21.

No Apparent Failure or Damage to Tape

1. Set the drive on its left side with the head and tape path facing up.
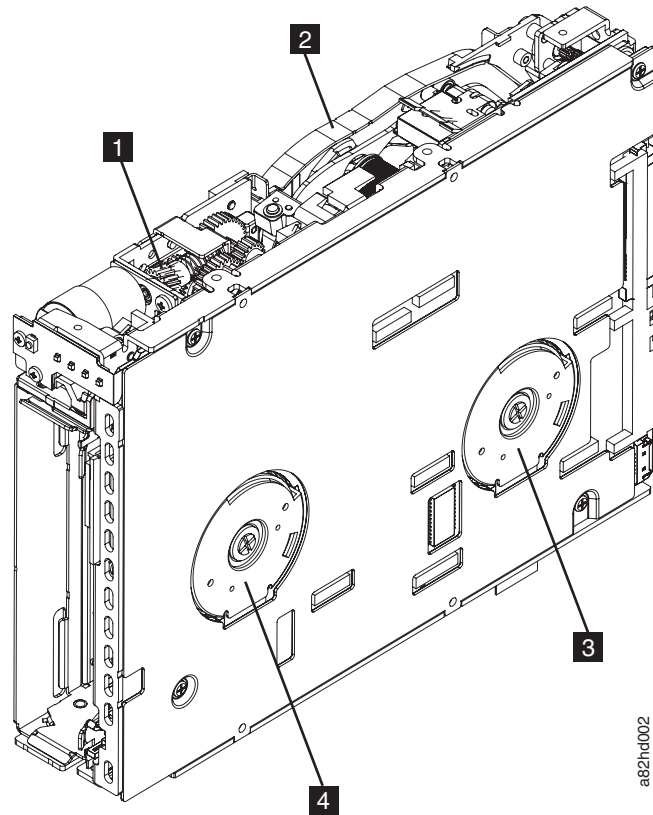
Figure A-21. Rewinding tape into cartridge

1	Loader motor worm gear	**3**	Takeup reel motor
2	Outer guide rail	**4**	Supply reel motor

2. Begin spooling the tape back into the cartridge by turning the supply reel motor (**4** in Figure A-21) clockwise.
3. Continue spooling into the cartridge until the tape is taut and remains within the flanges of the tape guiding rollers. Ensure that you do not stretch the tape. Continue spooling until all tape is removed from the takeup reel (**3** in Figure A-21).
4. Locate the threader intermediate gear (**1** in Figure A-22) near the rear of the drive. You can use your finger to rotate the threader intermediate gear (**1** in Figure A-22) and slowly rotate the threader mechanism gear (**2** in Figure A-22) clockwise. This draws the tape leader block assembly (LBA) into the cartridge.
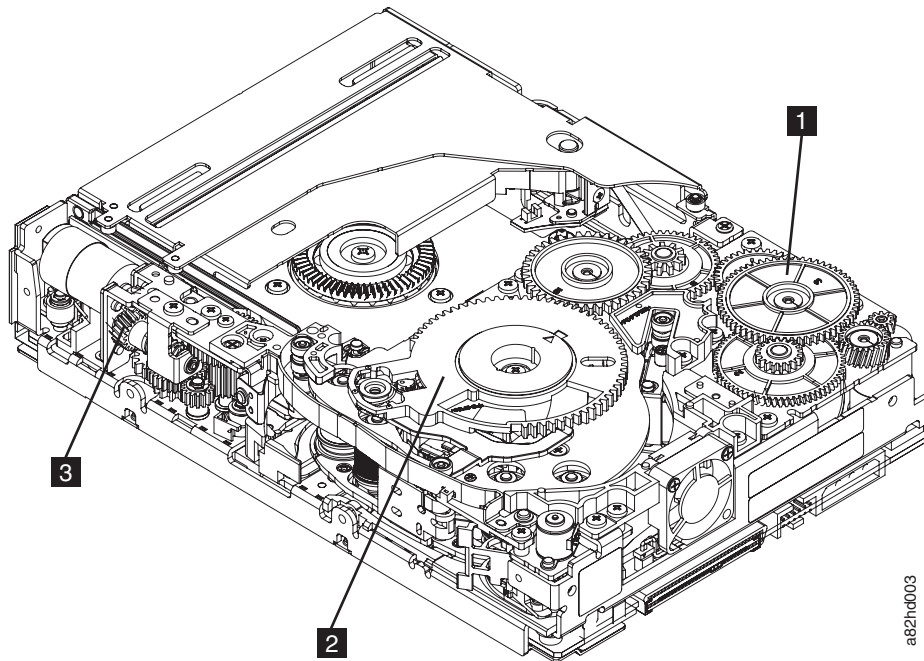
Figure A-22. Drive with cover removed to reveal gear train

1	Threader intermediate gear	**3**	Loader motor worm gear
2	Threader mechanism gear		

5. As the leader pin is secured in the cartridge, you should hear the leader pin retention spring clips click into place. If you do not hear the click, continue rolling until the threader intermediate gear (**1** in Figure A-22) stops. The LBA is in the correct position.

   Note: Be sure to keep tension on the tape as the LBA is drawn into the cartridge.

6. Rotate the loader intermediate gear (**3** in Figure A-22 and **1** in Figure A-23) clockwise as viewed from the front of the drive until it stops. This releases the LBA leader pin.
7. Rotate the threader motor worm gear (**3** in Figure A-23) counterclockwise until the leader block is in front of the Read/Write head. This moves the LBA out of the cartridge.
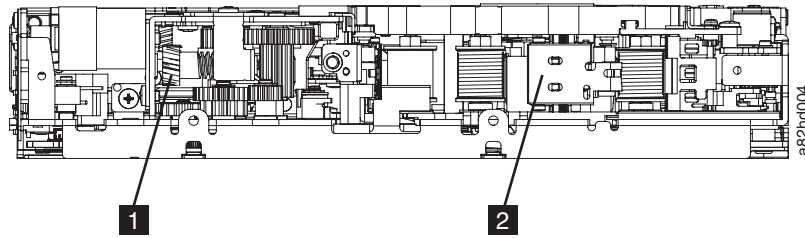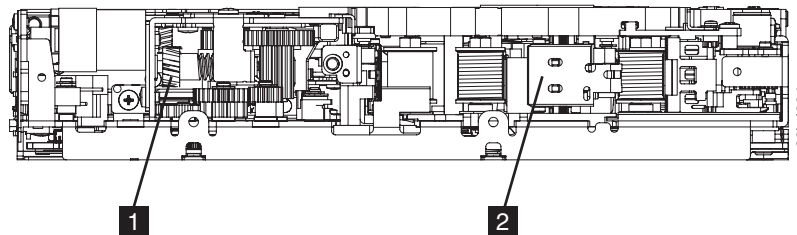

Figure A-23. Leader Block Assembly (LBA)

1	Loader motor worm gear	**2**	Leader block assembly (LBA)

8. Rotate the loader motor worm gear (**3** in Figure A-23) counterclockwise as viewed from the front of the drive until it stops.
9. Remove the cartridge from the cartridge loader tray.
10. Reassemble the drive by reversing the procedure in Step 4 in "Beginning Procedure" on page A-12.
11. Reassemble the library chassis. See "Ending Procedure" on page A-21.

Ending Procedure

1. Reinstall the drive in the library. See "Removing/reinstalling the Tape Drive from/in the Library" on page A-10.
2. Reinstall the library chassis cover. See "Removing/reinstalling the Library Chassis Cover" on page A-5.
3. Return the failed library to IBM.

Removing a Stuck Cartridge Magazine

Complete the following steps to remove a stuck cartridge magazine from the library.
1. Turn OFF the power to the library.
2. Manually unlock the cartridge magazine and try to remove it from the library. Stop if you feel any resistance while pulling on the magazine (see "Unlocking the Cartridge Magazine Manually" on page 8-1). If you cannot remove the magazine, proceed to the next step.
3. Disconnect all cables from the rear panel of the library.
4. Remove the library cover(s). See "Removing/reinstalling the Library Chassis Cover" on page A-5.
5. Remove the magazine from the library and check for any damaged cartridges.
6. Reassemble the library, reversing the steps used to disassemble the library.
7. Return the defective library to IBM.

Appendix B. Error Codes

When an error occurs during operation of the library, the library stops the current operation and displays an error code on the Operator Panel. Unless otherwise noted, try to resolve the problem by cycling power to the library and retrying the last operation.

Note: When power cycling the library, wait 10 seconds after the power is switched OFF before powering ON again.

Library Error Codes

Table B-1. Library error codes

Code (H)	Description	Panel Indication	Action Required
0000	No valid error code information.	-	
0001	At power-on initialization, a firmware error was detected.	All 4 LEDs ON	1. Upgrade/reinstall firmware and try again. 2. Cycle the power supply and try again. • If the problem is corrected, run Library Verify before resuming normal library operations. • If the problem persists, see "Contacting IBM Technical Support" on page 7-1.
0002	At power-on initialization, a RAM (base area) error was detected.	Ready/Activity LED ON and Error LED ON	
0003	At power-on initialization, a RAM (buffer area) error was detected.	CHK 0003	
0008	A usable drive could not be detected.	CHK 0008	1. Observe LEDs. See "Interpreting Front Panel LEDs" on page 6-8. 2. Reseat all cables. See "Reseating Cables" on page 6-10. 3. Cycle the power supply and try again. • If the problem is corrected, run Library Verify before resuming normal library operations. • If the problem persists, see "Contacting IBM Technical Support" on page 7-1.

Table B-1. Library error codes (continued)

Code (H)	Description	Panel Indication	Action Required
0010	Information acquisition from the DHCP server failed.	-	1. Observe LEDs. See "Interpreting Front Panel LEDs" on page 6-8. 2. Confirm the DHCP server settings. 3. Reseat all cables. See "Reseating Cables" on page 6-10. 4. Cycle the power supply and try again. • If the problem is corrected, run Library Verify before resuming normal library operations. • If the problem persists, see "Contacting IBM Technical Support" on page 7-1.
0011	Time acquisition from the NTP server failed.	-	1. Observe LEDs. See "Interpreting Front Panel LEDs" on page 6-8. 2. Confirm the time server settings. 3. Reseat all cables. See "Reseating Cables" on page 6-10. 4. Cycle the power supply and try again. • If the problem is corrected, run Library Verify before resuming normal library operations. • If the problem persists, see "Contacting IBM Technical Support" on page 7-1.
0020	LDI I/F error. Transmit data abnormality detected (NAK reception).	-	1. Observe LEDs. See "Interpreting Front Panel LEDs" on page 6-8. 2. Reseat all cables. See "Reseating Cables" on page 6-10. 3. Cycle the power supply and try again. • If the problem is corrected, run Library Verify before resuming normal library operations. • If the problem persists, see "Contacting IBM Technical Support" on page 7-1.
0021	LDI I/F error. Receive timeout detected (ACK/NAK reception).	-	
0022	LDI I/F error. Response packet reception timeout detected.	-	
0023	LDI I/F error. ENQ receive timeout detected.	-	
0024	LDI I/F error. Receive data abnormality detected.	-	
0029	Encryption command terminates unsuccessfully.	-	1. Confirm the Encryption Key Manager settings. 2. Reseat all cables. See "Reseating Cables" on page 6-10. 3. Cycle the power supply and try again. • If the problem is corrected, run Library Verify before resuming normal library operations. • If the problem persists, see "Contacting IBM Technical Support" on page 7-1.
002A	Commands to the Encryption Key Manager over the retry limit.	-	
002B	Commands to the encryption capable drive over the retry limit.	-	1. Reseat all cables. See "Reseating Cables" on page 6-10. 2. Cycle the power supply and try again. • If the problem is corrected, run Library Verify before resuming normal library operations. • If the problem persists, see "Contacting IBM Technical Support" on page 7-1.

Table B-1. Library error codes (continued)

Code (H)	Description	Panel Indication	Action Required
002C	LDI I/F error. ACK IU event timeout detected.	-	Cycle the power supply and try again. • If the problem is corrected, run Library Verify before resuming normal library operations. • If the problem persists, see "Contacting IBM Technical Support" on page 7-1.
002D	LDI I/F error. Response IU event timeout detected.	-	
002E	LDI I/F error. Transfer Ready IU event timeout detected.	-	
002F	LDI I/F error. Undefined error detected.	-	

0040	A drive media error detected upon insertion.	CHK 0040	1. Verify that the cartridge is compatible with the drive in your library. See "Media" on page 1-8.
			2. Verify that the cartridge is not write-protected. See "Write-Protect Switch" on page 5-7.
			3. If it is a cleaning cartridge, verify that the cartridge has not expired. See "Viewing the Library Map" on page 4-16.
			4. Cycle the power supply and try again.
			  • If the problem is corrected, run Library Verify before resuming normal library operations.
			  • If the problem persists, see "Contacting IBM Technical Support" on page 7-1.

0042	A drive load timeout error detected upon insertion.	CHK 0042	Cycle the power supply and try again. • If the problem is corrected, run Library Verify before resuming normal library operations. • If the problem persists, see "Contacting IBM Technical Support" on page 7-1.

0053	Response acknowledge error received from bar code reader. Suspect the bar code reader cable connection.	CHK 0053	1. Initiate an inventory. See "Conducting a Library Inventory" on page 4-6 (Operator Panel) or "Conducting a Library Inventory" on page 4-19 (Web User Interface).
			2. Cycle the power supply and try again.
			  • If the problem is corrected, run Library Verify before resuming normal library operations.
			  • If the problem persists, see "Contacting IBM Technical Support" on page 7-1.

0056	Receive data checksum error received from bar code reader. Suspect the bar code reader cable connection.	CHK 0056	
0057	Invalid data received from bar code reader. Suspect the bar code reader cable connection.	CHK 0057	
0058	A bar code reader read-error detected. Suspect the bar code reader cable connection.	CHK 0058	
0059	A bar code reader FLASH control error detected. Suspect the bar code reader cable connection.	CHK 0059	
005A	A bar code reader diagnostics error detected. Suspect the bar code reader cable connection.	CHK 005A	

Table B-1. Library error codes (continued)

Code (H)	Description	Panel Indication	Action Required
005D	I^{2}C I/F error. Invalid signal (NAK) detected. Suspect the bar code reader cable connection.	CHK 005D	1. Initiate an inventory. See "Conducting a Library Inventory" on page 4-6 (Operator Panel) or "Conducting a Library Inventory" on page 4-19 (Web User Interface). 2. Cycle the power supply and try again. • If the problem is corrected, run Library Verify before resuming normal library operations. • If the problem persists, see "Contacting IBM Technical Support" on page 7-1.
005E	I^{2}C I/F error. Bus arbitration lost error detected. Suspect the bar code reader cable connection.	CHK 005E	
005F	I^{2}C I/F error. Ready condition does not occur. Suspect the bar code reader cable connection.	CHK 005F	
0070	Calibration failed because the Accessor contains media. Suspect the centering sensor.	CHK 0070	1. Attempt to unload the cartridge from the Accessor. See "Moving Cartridges" on page 4-5 (Operator Panel) or "Moving Cartridges" on page 4-17 (Web User Interface). 2. Cycle the power supply and try again. • If the problem is corrected, run Library Verify before resuming normal library operations. • If the problem persists, see "Contacting IBM Technical Support" on page 7-1.
0071	Calibration failed due to an empty magazine. Suspect the magazine set sensor.	CHK 0071	Cycle the power supply and try again. • If the problem is corrected, run Library Verify before resuming normal library operations. • If the problem persists, see "Contacting IBM Technical Support" on page 7-1.
0072	Calibration measurement invalid data error. Suspect the centering sensor, X motor, or P motor.	CHK 0072	
0074	GET, centering check, or bar code reader read operation failed because the Accessor contains media. Suspect the centering sensor.	CHK 0074	
0075	PUT operation failed because the Accessor contains no media. Suspect the centering sensor.	CHK 0075	
007C	Drive does not enter EJECT state (and media not ejected) within 200 seconds of a GET command. Suspect the drive.	CHK 007C	1. If the cartridge does not eject, try to unload the cartridge from the drive using the Operator Panel (**Commands** → **Unload**) or the Web User Interface (**Manage Library** → **Unload**). Move the cartridge from the drive to the I/O Station. Remove the cartridge from the library and inspect for damage and replace, if necessary. 2. Cycle the power supply and try again. • If the problem is corrected, run Library Verify before resuming normal library operations. • If the problem persists, see "Contacting IBM Technical Support" on page 7-1.

Table B-1. Library error codes (continued)

Code (H)	Description	Panel Indication	Action Required
007D	Drive does not enter MOUNT state within 200 seconds of a PUT command. Suspect the drive or X motor.	CHK 007D	Cycle the power supply and try again. • If the problem is corrected, run Library Verify before resuming normal library operations. • If the problem persists, see "Contacting IBM Technical Support" on page 7-1.
007E	Drive does not enter SET state within 3 seconds of a PUT command. Suspect the drive or X motor.	CHK 007E	

007F	Drive I/F or connection error occurs during a PUT operation or GET operation. Suspect the drive.	CHK 007F	1. Reseat all cables. See "Reseating Cables" on page 6-10.
			2. Cycle the power supply and try again.
			  • If the problem is corrected, run Library Verify before resuming normal library operations.
			  • If the problem persists, see "Contacting IBM Technical Support" on page 7-1.

0080	X movement error #1. During X movement, the target stop position's origin sensor error detected. Suspect the X origin sensor or X motor.	CHK 0080	Cycle the power supply and try again. • If the problem is corrected, run Library Verify before resuming normal library operations. • If the problem persists, see "Contacting IBM Technical Support" on page 7-1.
0081	X movement error #2. During X movement, a motor sync error detected. Suspect the X encoder sensor or X motor.	CHK 0081	
0082	X movement error #3. During initialization, a motor sync error detected. Suspect the X encoder sensor or X motor.	CHK 0082	
0083	During an eject operation or move operation (to a storage position), the X origin sensor could not be detected. Suspect the X origin sensor or X motor.	CHK 0083	
0084	During initialization, the X origin position could not be detected. Suspect the X origin sensor or X motor.	CHK 0084	
0088	X calibration error #1. During X calibration, centering sensor OFF condition could not be detected. Suspect the centering sensor or X motor.	CHK 0088	
0089	X calibration error #2. During X calibration, centering sensor ON condition could not be detected.	CHK 0089	

Table B-1. Library error codes (continued)

Code (H)	Description	Panel Indication	Action Required
008A	X calibration error #3. During X-drive calibration, centering sensor OFF condition could not be detected. Suspect the centering sensor, X motor, or P motor.	CHK 008A	Cycle the power supply and try again. • If the problem is corrected, run Library Verify before resuming normal library operations. • If the problem persists, see "Contacting IBM Technical Support" on page 7-1.
008B	X calibration error #4. During X-drive calibration, centering sensor ON condition could not be detected. Suspect the centering sensor, X motor, or P motor.	CHK 008B	
008F	During X operation, the cartridge magazine was removed. Suspect the magazine set sensor.	CHK 008F	1. Confirm the magazine is closed. 2. Cycle the power supply and try again. • If the problem is corrected, run Library Verify before resuming normal library operations. • If the problem persists, see "Contacting IBM Technical Support" on page 7-1.
00B0	Failed to detect media in the Accessor at completion of GET operation. Suspect the centering sensor, X motor, or P motor.	CHK 00B0	1. Confirm the media is compatible. 2. Cycle the power supply and try again. • If the problem is corrected, run Library Verify before resuming normal library operations. • If the problem persists, see "Contacting IBM Technical Support" on page 7-1.
00B1	No media is contained in the specified cell (Cell Empty). Suspect the centering sensor, X motor, or P motor.	CHK 00B1	Cycle the power supply and try again. • If the problem is corrected, run Library Verify before resuming normal library operations. • If the problem persists, see "Contacting IBM Technical Support" on page 7-1.
00B2	Media detected in the Accessor at completion of centering check operation. Suspect the centering sensor.	CHK 00B2	1. If the cartridge remains in the Accessor, try to move the cartridge from the Accessor to the I/O Station using the Operator Panel or Web User Interface. Remove the cartridge from the library and inspect for damage and replace, if necessary. 2. Cycle the power supply and try again. • If the problem is corrected, run Library Verify before resuming normal library operations. • If the problem persists, see "Contacting IBM Technical Support" on page 7-1.
00B3	Media detected in the Accessor at completion of PUT operation. Suspect the centering sensor.	CHK 00B3	
00B8	Accessor error #1. Reverse REV position (PP1) error (Accessor origin not detected or FWD position detected). Suspect the P origin sensor, FWD sensor, or P motor.	CHK 00B8	Cycle the power supply and try again. • If the problem is corrected, run Library Verify before resuming normal library operations. • If the problem persists, see "Contacting IBM Technical Support" on page 7-1.

Table B-1. Library error codes (continued)

Code (H)	Description	Panel Indication	Action Required
00B9	Accessor error #2. Forward FWD position (PP2) error (Accessor origin detected or FWD not detected). Suspect the P origin sensor, FWD sensor, or P motor.	CHK 00B9	Cycle the power supply and try again. • If the problem is corrected, run Library Verify before resuming normal library operations. • If the problem persists, see "Contacting IBM Technical Support" on page 7-1.
00BA	Accessor error #3. PUT/GET/bar code reader position (PP4/PP5/PPBF/PPBR) error (Accessor origin or FWD detected, or cell full). Suspect the P origin sensor, FWD sensor, or P motor.	CHK 00BA	
00BC	During initialization, the Accessor origin could not be detected. Suspect the P origin sensor, FWD sensor, or P motor.	CHK 00BC	
00BD	During Accessor movement, the movement stop condition detected. Suspect the P encoder sensor or P motor.	CHK 00BD	
00BF	No gap condition detected at the completion of Accessor operation. Suspect the centering sensor, P origin sensor, FWD sensor, or P motor.	CHK 00BF	

00C0	Accessor operation disabled because a cartridge magazine was removed. Suspect the magazine set sensor.	CHK 00C0	1. Confirm the magazine is closed.
			2. Cycle the power supply and try again.
			  • If the problem is corrected, run Library Verify before resuming normal library operations.
			  • If the problem persists, see "Contacting IBM Technical Support" on page 7-1.

00C8	Centering calibration error #1. During centering calibration, centering sensor OFF condition could not be detected. Suspect the centering sensor or P motor.	CHK 00C8	Cycle the power supply and try again. • If the problem is corrected, run Library Verify before resuming normal library operations. • If the problem persists, see "Contacting IBM Technical Support" on page 7-1.
00C9	Centering calibration error #2. During centering calibration, centering sensor ON condition could not be detected. Suspect the centering sensor, X motor, or P motor.	CHK 00C9	

Table B-1. Library error codes (continued)

Code (H)	Description	Panel Indication	Action Required
00D0	Checksum error detected during firmware update.	CHK 00D0	1. Confirm the firmware file version. 2. Reinstall the firmware file. 3. Cycle the power supply and try again. • If the problem is corrected, run Library Verify before resuming normal library operations. • If the problem persists, see "Contacting IBM Technical Support" on page 7-1.
00D1	Firmware ID error detected during firmware update.	CHK 00D1	
00D2	Boot information error detected during firmware update.	CHK 00D2	
00D3	Bar code reader is not in maintenance mode during bar code reader firmware update (operation interrupted). Suspect the bar code reader cable connection.	CHK 00D3	1. Initiate an inventory. See "Conducting a Library Inventory" on page 4-6 (Operator Panel) or "Conducting a Library Inventory" on page 4-19 (Web User Interface). 2. Cycle the power supply and try again. • If the problem is corrected, run Library Verify before resuming normal library operations. • If the problem persists, see "Contacting IBM Technical Support" on page 7-1.
00D9	Magazine failed to unlock. Suspect the magazine or magazine sensor.	CHK 00D9	1. Cycle the power supply and try again. 2. Manually unlock the magazine, remove the magazine from the library, and inspect it for damage. • If not damaged, return it to the library and run Library Verify before resuming normal library operations. • If damaged, replace the magazine.
00DA	I/O Station failed to unlock. Suspect the magazine or magazine sensor.	CHK 00DA	
00DD	An error detected during bar code reader firmware check. Suspect the bar code reader cable connection.	CHK 00DD	1. Initiate an inventory. See "Conducting a Library Inventory" on page 4-6 (Operator Panel) or "Conducting a Library Inventory" on page 4-19 (Web User Interface). 2. Cycle the power supply and try again. • If the problem is corrected, run Library Verify before resuming normal library operations. • If the problem persists, see "Contacting IBM Technical Support" on page 7-1.
00E0	Write operation not finished within 1 ms when writing data to flash memory.	CHK 00E0	Cycle the power supply and try again. • If the problem is corrected, run Library Verify before resuming normal library operations. • If the problem persists, see "Contacting IBM Technical Support" on page 7-1.
00E1	Clear operation not finished within 10 seconds when clearing a sector in flash memory.	CHK 00E1	
00E2	Error detected in tape library configuration stored in flash memory.	CHK 00E2	
00E3	Checksum error detected in flash memory.	CHK 00E3	
00F0	Sensor error #1. Accessor encoder sensor B error detected during blink check. Suspect the Accessor encoder sensor B.	CHK 00F0	

Table B-1. Library error codes (continued)

Code (H)	Description	Panel Indication	Action Required
00F1	Sensor error #2. Accessor encoder sensor A error detected during blink check. Suspect the Accessor encoder sensor A.	CHK 00F1	Cycle the power supply and try again. • If the problem is corrected, run Library Verify before resuming normal library operations. • If the problem persists, see "Contacting IBM Technical Support" on page 7-1.
00F2	Sensor error #3. X encoder sensor error detected during blink check. Suspect the X encoder sensor.	CHK 00F2	
00F3	Sensor error #4. Magazine sensor error detected during blink check. Suspect the magazine sensor.	CHK 00F3	
00F8	Sensor error #5. X origin sensor error detected during blink check. Suspect the X origin sensor.	CHK 00F8	
00F9	Sensor error #6. Cartridge sensor error detected during blink check. Suspect the cartridge sensor.	CHK 00F9	
00FA	Sensor error #7. Accessor forward sensor error detected during blink check. Suspect the Accessor forward sensor.	CHK 00FA	
00FB	Sensor error #8. Accessor origin sensor error detected during blink check. Suspect the Accessor origin sensor.	CHK 00FB	

Drive Error Codes

Table B-2. Drive error codes

Code (H)	Description	Panel indication	Action Required
0200	Invalid data sent to drive. NAK detected.	CHK 0200	1. Reseat all cables. See "Reseating Cables" on page 6-10. 2. Cycle the power supply and try again. • If the problem is corrected, run Library Verify before resuming normal library operations. • If the problem persists, see "Contacting IBM Technical Support" on page 7-1.
0201	Timeout error occurred while waiting for response from drive.	CHK 0201	
0203	Drive disconnected.	CHK 0203	
0205	Drive busy.	CHK 0205	
0206	Command could not be executed because drive is not mounted.	CHK 0206	
0220	Drive media eject timeout detected.	CHK 0220	

Code (H)	Description	Panel indication	Action Required

0222	Media could not be ejected because drive is in Prevent Medium Removal state.	CHK 0222	1. Release the drive Prevent Medium Removal state from the host.
			2. Reseat all cables. See "Reseating Cables" on page 6-10.
			3. Cycle the power supply and try again.
			  • If the problem is corrected, run Library Verify before resuming normal library operations.
			  • If the problem persists, see "Contacting IBM Technical Support" on page 7-1.

Web User Interface Error Messages

Table B-3. Web user error messages

Title	Message	Issuing Panel
Error	Users full.	User Access
	You cannot remove yourself.	User Access
Parameter Error	Login failure.	Login
	Unsupported update file.	Firmware Update
	Invalid parameter found in [***].	Configure Library
	Please input parameter of [***].	Configure Library
	Password parameter error.	User Access
	User name parameter error.	User Access
	Not enough role.	User Access
	An user name unmatched.	User Access
	An user is already existed.	User Access
	Users full.	User Access
	Flush ROM write error detected.	User Access
	User information access failure.	User Access
Command Error	Move command execution failure. (Code:"****")	Move Cartridges
	Unload execution failure:[****].	Unload Drive
	Drive not ready.	Unload Drive, Download Drive Logs, Firmware Update
	Medium not present.	Unload Drive
	Online command execution failure:[****].	Library State
	Offline command execution failure:[****].	Library State
	Reset command execution failure:[****].	Reset Library/Drive
	Inventory command execution failure:[****].	Inventory
	"Normal Dump" command execution failure:[****].	Download Drive Logs
	"Force Dump" command execution failure:[****].	Download Drive Logs
	Restore failure. Library serial number is unmatched	Save/Restore
	Writing to cookie was failure. The configuration data was not saved to cookie.	All

Table B-3. Web user error messages (continued)

Title	Message	Issuing Panel
Cleaning Command Error	Illegal medium loaded.	Clean Drive
	Source element empty.	Clean Drive
	Destination element full.	Clean Drive
	Drive failure.	Clean Drive
	Prevent medium removal.	Clean Drive
	During import/export element access.	Clean Drive
	Gap detected.	Clean Drive
	Tape not loaded.	Clean Drive
	Expired medium loaded.	Clean Drive
	Write protect error.	Clean Drive
	Cleaning execution failure: [****].	Clean Drive
I/O Error	File open failure.	Download Drive Logs, Download Library Logs, Save/Restore, Firmware Update
	Unsupported file.	Save/Restore, Firmware Update
Network Error	*** command transmission failure.	Manage Library
	*** information access failure.	All
	Library logs download failure. Please retry download.	Download Library Logs
	E-mail submit failure.	Notifications
	SNMP trap submit failure.	Notifications
	Log data access failure.	Traces, View Library Logs
	Port open failure [**.**.**.**:****]. Do you wish to retry?	Applet 3 times retry
	Port open failure [**.**.**.**:****]. Please check the library and the network condition setting. Applet shutdown.	Displayed after 3 unsuccessful attempts using the Java Applet.
	Web interface version is not matched between Library and Java Applet. Please shut a browser and restart the Applet. There is a possibility of malfunctioning if you proceed operation from Web. Please clear the cache of Java when this message appears even if it restart.	All
Library Busy	Library information updating now. Can not access library information	All

Trap Definitions (Types)

The TS2900 Tape Autoloader supports the following types of SNMP traps.

Table B-4. Trap list

Trap ID	Event Type	Description	Clean Drive LED	Attention LED	Error LED
1	Emergency	• Drive error	–	–	ON
2		• Library error	–	–	ON
21	Error	• Drive error	–	–	ON
22		• Library error	–	–	ON
51 (Drive) 52 (Library)	Warning	• Drive error • Library error • Endurance frequency attainment	–	–	ON
53 (Drive)		• Cleaning demand reception from drive	ON	–	–
54 (Library)		• Cleaning cartridge demand for an exchange	–	ON	–
101 (Drive) 102 (Library)	Information	• Beginning of inventory • Change in library operation mode • Beginning of medium move • Completion of medium move • Library/Drive not ready • Library/Drive to online • Magazine unlock operation • I/O Station unlock operation	–	–	–

Appendix C. TapeAlert Flags

This appendix is intended to provide additional information to the reader about the tape library and tape drive. All error code and diagnostic information contained in this chapter cannot be accessed from the Operator Panel of the Library. The Operator Panel will, however, display other library error codes and drive error codes when problems occur. For a listing of Operator Panel error messages, see Appendix B, "Error Codes," on page B-1.

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

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

TapeAlert Flags Supported by the Library

Table C-1. TapeAlert flags supported by the library

Flag Number	Flag Name	Description	Action Required	Type[1]
01	Library Hardware A	The library mechanism is having trouble communicating with the tape drive.	1. Cycle the power supply and try again. 2. If the problem persists, see "Contacting IBM Technical Support" on page 7-1.	C
02	Library Hardware B	The library mechanism has a hardware fault.		W
03	Library Hardware C	Library mechanism has a hardware fault that requires a reset to recover.	1. Reset the library. For details, see "Rebooting the Drive" on page 4-7. 2. Restart the operation. 3. If the problem persists, see "Contacting IBM Technical Support" on page 7-1.	C

Table C-1. TapeAlert flags supported by the library (continued)

Flag Number	Flag Name	Description	Action Required	Type[1]
04	Library Hardware D	The library mechanism has a hardware fault that is not mechanism related, or requires power cycle to recover.	1. Cycle the power supply and try again. 2. If the problem persists, see "Contacting IBM Technical Support" on page 7-1.	C
06	Library Interface	The library has identified an interface fault.	1. Check all cables and cable connections. 2. Restart the operation. 3. If the problem persists, see "Contacting IBM Technical Support" on page 7-1.	C
08	Library Maintenance	Library preventative maintenance required.	Preventative maintenance of the library is required. Consult the library user's manual for device-specific preventative maintenance tasks.	W
12	Library Stray Tape	A cartridge has been left in the drive inside the library by a previous hardware fault.	1. Try unloading the cartridge from the drive using the Operator Panel or Web User Interface. • If the cartridge unloads, move the cartridge from the drive to the I/O Station. Remove the cartridge and inspect for damage. If not damaged, return the cartridge to the library. Run Library Verify before resuming normal library operations. • If the cartridge did not unload from the drive, cycle the power supply and try again. 2. If the problem persists, see "Contacting IBM Technical Support" on page 7-1.	C
13	Library Pick Retry	There is a potential problem with the drive ejecting a cartridge short or with the library mechanism picking a cartridge from a slot.	No action is required.	W
14	Library Place Retry	There is a potential problem with the library mechanism placing a cartridge into a slot.	No action is required.	W
16	Library I/O Station	The operation has failed because the library I/O Station is open.	Close the I/O Station.	W
17	Library Mailslot	Mechanical problem with the I/O Station.	There is a mechanical problem with the library I/O Station.	C
18	Library Magazine	Library magazine not present.	The library cannot operate without the magazine. 1. Insert the magazine into the library. 2. Restart the operation.	C
21	Library Offline	Library manually turned offline.	The library has been manually turned offline and is unavailable for use.	I

Table C-1. TapeAlert flags supported by the library (continued)

Flag Number	Flag Name	Description	Action Required	Type[1]
22	Library Drive Offline	Library turned internal drive offline.	The drive inside the library has been taken offline. This is for information purposes only. No action is required.	I
23	Library Scan Retry	There is a potential problem with the bar code label of the scanner hardware in the library mechanism.	No action is required.	W
28	Power Supply	PSU failure inside the library subsystem.	The power supply has failed inside the library. See "Contacting IBM Technical Support" on page 7-1.	W

1. C = Critical: Needs immediate action.
   W = Warning: Action to be taken.
   I = Information: Information for user.

TapeAlert Flags Supported by the Ultrium Tape Drive

Table C-2. TapeAlert flags supported by the Ultrium tape drive

Flag Number	Flag Name	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 for Flag Number 4, 5, or 6, if set, 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 the isolation is uncertain and failure could be due to a faulty tape cartridge or drive hardware.	If Flag Number 4 is also set, the tape cartridge is defective. Replace the tape cartridge.
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.	If Flag Number 9 is also set, make sure that the write-protect switch is set so that data can be written to the tape. See "Write-Protect Switch" on page 6-7. If Flag Number 4 is also set, the tape cartridge is defective. Replace the tape cartridge.
7	Media life	Set when the tape cartridge reaches its end of life (EOL).	1. Copy the data to another tap cartridge. 2. Discard the old (EOL) tape.
8	Not data grade	Set when the tape cartridge is not data-grade. Any data that you back up to the tape is at risk.	Replace the tape cartridge with a data-grade tape cartridge.
9	Write protect	Set when the tape drive detects that the tape cartridge is write-protected.	Ensure that the cartridge's write-protect switch is set so that data can be written to the tape. See "Write-Protect Switch" on page 6-7.

Table C-2. TapeAlert flags supported by the Ultrium tape drive (continued)

Flag Number	Flag Name	Description	Action Required
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 a cleaning tape is loaded into the drive.	No action required. Status only.
12	Unsupported format	Set when a non-supported cartridge type is loaded into the drive or when the cartridge format has been corrupted.	Replace the invalid cartridge with a supported tape cartridge.
14	Unrecoverable snapped tape	Set when the operation failed because the tape in the drive snapped.	Do not attempt to extract the tape cartridge. See "Contacting IBM Technical Support" on page 7-1
15	Cartridge memory chip failure	Set when a cartridge memory (CM) failure is detected on the loaded tape cartridge.	Replace the tape cartridge.
16	Forced eject	Set when a tape cartridge was unloaded manually while the drive was reading or writing.	No action required. Status only.
17	Media loaded is Read-only format	Set when a cartridge marked as read-only is loaded into the drive. The flag is cleared when the cartridge is ejected.	No action required. Status only.
18	Tape directory corrupted in cartridge memory	Set when the tape drive detects that the tape directory in the cartridge memory has been corrupted.	Re-read all data from the tape to rebuild the tape directory.
19	Nearing media life	Set when the tape cartridge is nearing its specified end of life. It is cleared when the cartridge is removed from the drive.	1. Copy the data to another tape cartridge. 2. Replace the tape cartridge.
20	Clean now	Set when the tape drive detects that it needs cleaning.	Clean the tape drive.
21	Clean periodic	Set when the tape drive detects that it needs routine cleaning.	Clean the tape drive as soon as possible. The drive can continue to operate, but requires cleaning soon.
22	Expired cleaning media	Set when the tape drive detects a cleaning cartridge that has expired.	Replace the cleaning cartridge.
23	Invalid cleaning cartridge	Set when the drive expects a cleaning cartridge to be loaded and the loaded cartridge is not a cleaning cartridge.	Use a valid cleaning cartridge.
30	Hardware A	Set when a hardware failure occurs that requires that you reset the tape drive to recover.	See "Contacting IBM Technical Support" on page 7-1.
31	Hardware B	Set when the tape drive fails its internal Power-On Self-Tests (POSTs).	Note the error code on the single-character display and see "Contacting IBM Technical Support" on page 7-1.
32	Interface	Set when the tape drive detects a problem with the host interface.	See "Contacting IBM Technical Support" on page 7-1.

Table C-2. TapeAlert flags supported by the Ultrium tape drive (continued)

Flag Number	Flag Name	Description	Action Required
33	Eject media	Set when a failure occurs that requires the tape cartridge to be unloaded from the drive.	Unload the tape cartridge, then reinsert and restart the operation. If this fails, use different media.
34	Download fail	Set when an FMR image is unsuccessfully downloaded to the tape drive via the SAS interface.	Check the FMR image is correct. If necessary, download the correct FMR image.
36	Drive temperature	Set when the drive temperature sensor indicates that the drive's temperature exceeds the recommended temperature of the library.	See "Contacting IBM Technical Support" on page 7-1.
37	Drive voltage	Set when the drive detects power supply voltages that approach or exceed the specified voltage limits.	See "Contacting IBM Technical Support" on page 7-1.
38	Predictive failure of drive hardware	Set when a hardware failure of the tape drive is predicted.	See "Contacting IBM Technical Support" on page 7-1.
39	Diagnostics required	Set when the tape drive detects a failure that requires diagnostics for isolation.	See "Contacting IBM Technical Support" on page 7-1.
51	Tape directory invalid at unload	Set when the tape directory on the tape cartridge that was previously unloaded is corrupted. The file-search performance is degraded.	Use your backup software to rebuild the tape directory by reading all the data.
52	Tape system area write failure	Set when the tape cartridge that was previously unloaded could not write its system area successfully.	Copy the data to another tape cartridge, then discard the old tape cartridge.
53	Tape system area read failure	Set when the tape system area could not be read successfully at load time.	Copy the data to another tape cartridge, then discard the old tape cartridge.
55	Load failure	Set when a hardware malfunction prevents the tape cartridge from being loaded into the drive, or when a tape cartridge is stuck in the drive.	If the tape cartridge will not load in the drive: 1. Remove the tape cartridge from the library and inspect it for damage. If damaged, discard it. 2. Insert another tape cartridge into the tape drive. If the problem persists, see "Contacting IBM Technical Support" on page 7-1. If the tape cartridge is stuck in the drive: 1. Attempt to unload the tape from the drive using the host backup application that is currently using the drive, or via the remote or local UI. 2. If the cartridge will still not unload, see "Contacting IBM Technical Support" on page 7-1.

Table C-2. TapeAlert flags supported by the Ultrium tape drive (continued)

Flag Number	Flag Name	Description	Action Required
56	Unload failure	Set when a drive hardware error prevents the tape cartridge from being unloaded from the tape drive, or when the tape cartridge is stuck in the drive.	1. Unload the cartridge from the drive using the Operator Panel or the Web User Interface. 2. Try a power cycle of the entire library. This causes the drive to reset and attempt to rewind and unload when power is restored. If the cartridge unloads, remove it from the library and inspect it. If damaged, discard it. 3. Try to unload the cartridge from the drive again using the Operator Panel or the Web User Interface. 4. If the cartridge will still not unload from the drive, see "Contacting IBM Technical Support" on page 7-1.
59	WORM Media integrity check failed	Set when the drive determines that the data on the tape is suspect from a WORM point of view.	1. Copy the data to another WORM tape cartridge. 2. Discard the old WORM tape.
60	WORM Media overwrite attempted	Set when the drive rejects a write operation because the rules for allowing WORM writes have not been met. Data can only be appended to WORM media. Overwrites to WORM media are not allowed.	Append the information on a WORM tape cartridge or write the data to a non-WORM cartridge.

Appendix D. Sense Data

When a drive encounters an error, it makes sense data available. You can use IBM device drivers to examine the sense data and determine errors. Instructions for downloading, installing, and properly configuring the IBM device drivers are available in the *IBM Ultrium Device Drivers Installation and User's Guide*. The IBM device drivers may conflict with some commercial software applications unless properly configured. To avoid conflicts on Windows operating systems, refer to your device driver's procedures for setting the driver to manual startup mode. For applications that use Open Systems device drivers that are provided by IBM (for example, AIX, Linux, Sun Solaris, HP-UX, Windows 2003, and Windows 2000), the *IBM Ultrium Device Drivers Installation and User's Guide* contains information about how to obtain sense data after an error has occurred.

If your application uses other device drivers, see the appropriate documentation for those drivers to obtain the sense data.

Raw sense data (as returned from the drive) is documented in the *IBM TotalStorage LTO Ultrium Tape Drive SCSI Reference*.

Sense Key Definitions

Table D-1. Sense key definitions

SK	Definition
00	No Sense
01	Recovered Error
02	Not Ready
03	Media Error
04	Hardware Error
05	Illegal Request
06	Unit Attention
07	Data Protect
08	Blank Check
09	Reserved
0A	Reserved
0B	Aborted Command
0C	Reserved
0D	Volume Overflow
0E	Reserved
0F	Reserved

Library Sense Data

Table D-2 lists the Additional Sense Codes (ASC) and Additional Sense Code Qualifiers (ASCQ) associated with the reported Sense Keys.

A sense key of 00h (no sense) has no ASC/ASCQ associated with it. A few ASC/ASCQs can be associated with more than one sense key. The sense keys that can give a particular ASC/ASCQ are indicated within the Sense Key column.

Table D-2. Library sense data

Sense Key	ASC	ASCQ	Description
No Sense (00)	00	00	No sense
	30	03	Cleaning cartridge installed
Recovered Error (01)	5B	02	Log counter at maximum
Not Ready (02)	04	00	Logical unit not ready, cause not reportable
	04	01	Logical unit is in process of becoming ready
	04	03	Manual intervention required
	3A	02	Media not present (tray open)
	80	05	During reprogramming mode
Hardware Error (04)	15	01	Mechanical position error
	40	nn	Diagnostic failure on component nn (80h-ffh)
	44	00	Internal target failure
	80	04	Fan alarm
	80	07	NVRAM failure
Illegal Request (05)	1A	00	Parameter list length error
	20	00	Invalid command operation code
	21	01	Invalid element address
	24	00	Invalid field in CDB
	25	00	Logical unit not supported
	26	00	Invalid field in parameter list
	30	00	Incompatible medium installed
	3B	0D	Media destination element full
	3B	0E	Media source element empty
	3B	83	Source drive not unloaded
	53	02	Media removal prevented
	80	10	Drive failure
	80	20	Exchange slot full
Unit Attention (06)	28	00	Not-ready to ready transition, media may have changed
	28	01	Import or export element accessed
	29	00	Power ON occurred
	2A	02	Log parameter changed
	3F	01	Microcode has been changed
	41	FE	Drive error message detected*

Table D-2. Library sense data (continued)

Sense Key	ASC	ASCQ	Description
Aborted Command (0B)	41	nn	LDI command failure**

* This code is preserved only in the library log when "FID" or "ATTN DRV" message is received from the tape drive. This code is not reported to the host server.

** This code is preserved only in the library log. This code is not reported to the host server.

Tape Drive Sense Data

Table D-3. Ultrium Tape drive sense data

Byte	Bit Address or Name							
	7	6	5	4	3	2	1	0
0	Valid Address Bit	Error Code						
1	Segment Number x'00'							
2	Filemark	EOM (End of medium)	ILI (Incorrect length indicator)	Reserved	Sense Key See "Sense Key Definitions" on page D-1.			
3	Information byte (most significant byte)							
4–5	Information bytes							
6	Information byte (least significant byte)							
7	Additional sense length							
8–11	Command specific information bytes							
12–13	Additional Sense Code (ASC) Additional Sense Code Qualifier (ASCQ)							

Byte 12 ASC	Byte 13 ASCQ	
00	00	No additional sense - The flags in the sense data indicate the reason for the command failure
00	01	Filemark detected - A Read or Space command terminated early due to an FM. The FM flag is set.
00	02	EOM - A Write or Write File Marks command failed because the physical end of tape was encountered, or a Read or Space command encountered EOM. The EOM flag is set.
00	04	BOM - A space command ended at Beginning of Tape. The EOM bit is also set.
00	05	EOD - Read or Space command terminated early because End of Data was encountered.
04	00	Cause not reportable - A cartridge is present in the drive, but it is in the process of being unloaded.
04	01	Becoming Ready - A media access command was received during a front panel initiated load or an immediate reported load command.
04	02	Initializing Command Required - A cartridge is present in the drive, but is not logically loaded. A Load command is required.
04	03	Manual Intervention Required - A cartridge is present in the drive but could not be loaded or unloaded without manual intervention.
0C	00	Write Error - A Write operation has failed. This is probably due to bad media, but may be hardware related.
11	00	Unrecovered Read Error - A Read operation failed. This is probably due to bad media, but may be hardware related.

Table D-3. Ultrium Tape drive sense data (continued)

Byte	Bit Address or Name							
	7	6	5	4	3	2	1	0
12–13	Additional Sense Code (ASC) Additional Sense Code Qualifier (ASCQ)							

Byte 12 ASC	Byte 13 ASCQ	
11	12	Auxiliary memory read error. The drive reported that it is unable to read the Auxiliary Memory in a WORM cartridge.
14	00	Recorded Entity Not Found - A space or Locate command failed because a format violation prevented the target from being found.
14	03	End Of Data not found - A Read type operation failed because a format violation related to a missing EOD data set.
14	10	Not Ready - Auxiliary memory not accessible. The drive is not able to become ready because it is unable to access the Auxiliary Memory in a WORM cartridge.
1A	00	Parameter list length error - The amount of parameter data sent is incorrect.
20	00	Invalid Command Operation Code - The Operation Code in the command was not a valid Operation Code.
24	00	Invalid field in CDB - An invalid field has been detected in a Command Descriptor Block.
25	00	LUN not supported - The command was addressed to a non-existent logical unit number.
26	00	Invalid Field in Parameter List - An invalid field has been detected in the data sent during the data phase.
27	00	Write Protect - A Write type operation has been requested on a cartridge which has been write protected.
28	00	Not Ready to Ready Transition - A cartridge has been loaded successfully into the drive and is now ready to be accessed.
29	00	Reset - The drive has powered on, received a reset signal or a bus device reset signal since the initiator last accessed it.
2A	01	Mode Parameters Changed - The Mode parameters for the drive have been changed by an initiator other than the one issuing the command.
30	00	Incompatible Media Installed - A write type operation could not be executed because it is not supported on the cartridge type that is loaded.
30	01	Unknown Format - An operation could not be carried out because the cartridge in the drive is of a format not supported by the drive.
30	02	Incompatible Format - An operation could not be completed because the Logical Format is not correct.
30	03	Cleaning Cartridge Installed - An operation could not be carried out because the cartridge in the drive is a cleaning cartridge.
30	07	Cleaning Failure - A cleaning operation was attempted, but could not be completed for some reason.
30	0C	Data Protect - WORM overwrite attempted. The drive rejected a write operation because it would have resulted in an overwrite. Overwrite is not allowed on WORM media.
30	0D	Medium Error - WORM integrity check. The drive rejected a Read or Write operation because the cartridge is a suspicious WORM cartridge.
31	00	Media format corrupted - Data could not be read because the format on tape is not valid, but is a known format. A failure occurred attempting to write the FID.
37	00	Rounded parameter - A Mode Select command parameter has been rounded because the drive can not store it with the accuracy of the command.
3A	00	Media Not Present - A media access command has been received when there is no cartridge loaded.
3B	00	Sequential Positioning Error - A command has failed and left the logical position at an unexpected location.
3D	00	Invalid bits in identify Message - An illegal Identify Message has been received at the drive at the start of a command.
3E	00	Logical Unit has not Self-Configured - The drive has just powered on and has not completed its self test sequence and can not process commands.

Table D-3. Ultrium Tape drive sense data (continued)

Byte	Bit Address or Name							
	7	6	5	4	3	2	1	0
12–13	Additional Sense Code (ASC) Additional Sense Code Qualifier (ASCQ)							

Byte 12   Byte 13

ASC	ASCQ	
3F	01	Code Download - The firmware in the drive has just been changed by a Write Buffer command.
40	xx	Diagnostic failure - A diagnostic test has failed. The xx (ASCQ) is a vendor specific code indicating the failing component.
43	00	Message Error - A message could not be sent or received due to excessive transmission errors.
44	00	Internal target failure - A hardware failure has been detected in the drive that has caused the command to fail.
45	00	Select/Reset Failure - An attempt to reselect an initiator in order to complete the command has failed.
4B	00	Data Phase Error - A command could not be completed because too many parity errors occurred during the Data phase.
4E	00	Overlapped Commands - An initiator selected the drive even though it already had a command outstanding in the drive.
50	00	Write Append Error - A write type command failed because the point at which to append data was unreadable.
51	00	Erase failure - An Erase command failed to erase the required area on the media.
52	00	Cartridge fault - A command could not be completed due to a fault in the tape cartridge.
53	00	Media Load/Eject Failed - (Sense Key 03) An attempt to load or eject the cartridge failed due to a problem with the cartridge.
53	00	Media Load/Eject Failed - (Sense Key 04) An attempt to load or eject the cartridge failed due to a problem with the drive.
53	02	Media Removal Prevented - An Unload command has failed to eject the cartridge because media removal has been prevented.
5D	00	Failure Prediction Threshold - Failure Prediction thresholds have been exceeded indicating that a failure may occur soon.
5D	FF	Failure Prediction False - A Mode Select command has been used to test for Failure Prediction system.
82	82	Drive requires cleaning - The drive has detected that a cleaning operation is required to maintain good operation.
82	83	Bad Code Detected - The data transferred to the drive during a firmware upgrade is corrupt or incompatible with drive hardware.

Sense Key 0 (No Sense)

EE	13	Encryption - Key Translate
EF	13	Encryption - Key Translate EKM

Sense Key 3 (Medium Error)

30	02	Encryption - Encryption feature is not enabled so format/processing is not supported.
EE	60	Encryption - Proxy Command Error
EE	D0	Encryption - Data Read Decryption Failure
EE	D1	Encryption - Data Read after Write Decryption Failure
EE	E0	Encryption - Key Translation Failure
EE	E1	Encryption - Key Translation Ambiguous
EE	F0	Encryption - Decryption Fenced (Read)
EE	F1	Encryption - Encryption Fenced (Write)

Sense Key 4 (Hardware Error)

EE	0E	Encryption - Key Service Timeout
EE	0F	Encryption - Key Service Failure
40	00	Encryption - Failure Hardware, POST or Module Failure

Table D-3. Ultrium Tape drive sense data (continued)

Byte	Bit Address or Name							
	7	6	5	4	3	2	1	0
12–13	Additional Sense Code (ASC) Additional Sense Code Qualifier (ASCQ) **Byte 12 Byte 13** **ASC ASCQ** **Sense Key 5 (Illegal Request)** EE 00 Encryption - Key Service Not Enabled EE 01 Encryption - Key Service Not Configured EE 02 Encryption - Key Service Not Available EE 10 Encryption - Key Required EE 20 Encryption - Key Count Exceeded EE 21 Encryption - Key Alias Exceeded EE 22 Encryption - Key Reserved EE 23 Encryption - Key Conflict EE 24 Encryption - Key Method Change EE 25 Encryption - Key Format Not Supported EE 26 Encryption - Unauthorized Request - dAK EE 27 Encryption - Unauthorized Request - dSK EE 28 Encryption - Unauthorized Request - eAK EE 29 Encryption - Authentication Failure EE 2A Encryption - Invalid RDKi EE 2B Encryption - Key Incorrect EE 2C Encryption - Key Wrapping Failure EE 2D Encryption - Sequencing Failure EE 2E Encryption - Unsupported Type EE 2F Encryption - New Key Encrypted Write Pending EE 30 Encryption - Prohibited Request EE 31 Encryption - Key Unknown EE 32 Encryption - Keystore Related Problem EE 42 Encryption - EKM Challenge Pending EE E2 Encryption - Key Translation Disallowed EE FF Encryption - Security Prohibited Function EF 01 Encryption - Key Service Not Configured 26 11 Encryption - Incomplete Key - Associate Data Set 26 12 Encryption (T10) - Vendor Specific Reference Key Not Found 55 08 Encryption (T10) - Maximum Number of Supplemental Keys Exceeded **Sense Key 6 (Unit Attention)** EE 12 Encryption - Key Change Detected EE 18 Encryption - Changed (Read) EE 19 Encryption - Changed (Write) EE 40 Encryption - EKM Identifier Changed EE 41 Encryption - EKM Challenge Changed EE 50 Encryption - Initiator Identifier Changed EE 51 Encryption - Initiator Response Changed 2A 11 Encryption - Data Encryption Parameters Changed by Another I_T Nexus 2A 12 Encryption - Data Encryption Parameters Changed by Vendor Specific Event **Sense Key 7 (Data Protect)** EF 10 Encryption - Key Required EF 11 Encryption - Key Generation EF 13 Encryption - Key Translate EF 1A Encryption - Key Optional EF C0 Encryption - No Operation 26 10 Encryption - Data Decryption Key Fail Limit								

Table D-3. Ultrium Tape drive sense data (continued)

Byte	Bit Address or Name							
	7	6	5	4	3	2	1	0
12–13	Additional Sense Code (ASC) Additional Sense Code Qualifier (ASCQ) **Byte 12** **Byte 13** **ASC** **ASCQ** 2A 13 Encryption - Data Encryption Key Instance Counter Changed 74 00 Security Error 74 01 Encryption - Unable to Decrypt Data 74 02 Encryption - Unencrypted Data Encountered While Decrypting 74 03 Encryption - Incorrect Data Encryption Key 74 04 Encryption - Cryptographic Integrity Validation Failed 74 05 Encryption - Error Decrypting Data							
14	Field Replaceable Unit (FRU) ID							
15	SKSV	C/D	Reserved		BPV (Bit pointer valid)	Bit pointer		
16–17	SKSV =0: First Error Fault Symptom Code (FSC); SKSV = 1: Field Pointer							
18–19	First Error Flag Data							
20	Reserved (0)							
21					CLN	Reserved	Reserved	VolValid
22–28	Volume Label							
29	Current Wrap							
30–33	Relative LPOS							
34	SCSI Address							
35	Frame number				Drive number			
36–39	Port Identifier (Relative Target Port Address) Reporting Sense This is the hashed SAS address of the drive port (for example, F32A94) with byte 36 being reserved.							
40	Tape Directory Valid	Reserved	Reserved	Reserved	Reserved	Relative Target Port Reporting Sense 0: Reserved 1: Relative Target Port 1 (Port 0) 2: Relative Target Port 2 (Port 1) 3: Relative Target Port 3 (Library Port)		
41	Host Command (SCSI Opcode)							
42	Density Type 0: No media present 1: Gen1 (384 track) 2: Gen2 (512 track) 3: Gen3 (704 track)				Media Type (Vendor Reserved)			
43–44	Volume Label Cartridge Type							
45–48	Logical Block Number (Current LBA that would be reported in Read Position command)							
49–52	Data Set Number							
53–54	1st Error FSC							
55–56	1st Error Flag Data							
57–58	2nd Error FSC							
59–60	2nd Error Flag Data							

Table D-3. Ultrium Tape drive sense data (continued)

Byte	Bit Address or Name							
	7	6	5	4	3	2	1	0
61–62	Next-to-Last Error FSC							
63–64	Next-to-Last Error Flag Data							
65–66	Last Error FSC							
67–68	Last Error Flag Data							
69	LPOS Region							
70–85	ERP Summary Information							
86–89	Product Revision Label: YMDV (As defined in Standard Inquiry; this is also known as the Code Level)							
90–95	Reserved (0)							

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

Note:

1. The Error Code field (Byte 0) is set to 70h to indicate a current error, that is one associated with the most recently received command. It is set to 71h to indicate a deferred error which is not associated with the current command.

2. The segment number (Byte 1) is zero since the Copy, Compare, and Copy and Verify commands are not supported.

3. The File Mark flag (Byte 2, bit 7) is set if a Space, Read, or Verify command did not complete because a file mark was read.

4. The End of Media (EOM) flag (Byte 2, bit 6) is set if a Write or Write File Marks command completed in the early warning area. Spacing into BOM also causes this flag to be set. It is also set on an attempt to read or space past EOD, or if an attempt is made to space into Beginning of Media.

5. The Illegal Length Indicator (ILI) flag (Byte 2, bit 5) is set if a Read or Verify ended because a block was read from tape that did not have the block length requested in the command.

6. The Information Bytes (Bytes 3-5) are only valid if the Valid flag is set. This occurs only for current errors and not for deferred errors.

7. The Field Replaceable Unit field (Byte 14) is set to either zero or to a non-zero, vendor-specific code indicating which part of the drive is suspected of causing the failure.

8. The Clean (CLN) flag (Byte 21, bit 3) is set if the drive needs cleaning and clear otherwise.

9. The Volume Label Fields Valid (VolValid) bit (Byte 21, bit 0) is set if the Volume Label being reported is valid.

10. The Volume Label field (Bytes 22-28) reports the volume label if a cartridge is loaded in the drive and Volume Label Fields Valid is set.

11. The Current Wrap field (Byte 29) reports the physical wrap of the tape. The least significant bit reflects the current physical direction. A0h means that the current direction is away from the physical beginning of the tape. A1h means that the current direction is towards the physical beginning of the tape.

12. Relative LPOS fields (Bytes 30-33) reports the current physical position on the tape.

13. SCSI Address field (Byte 34) reports the SCSI Bus Address for the drive. Values returned range from 00h to 0Fh.

14. This field (Byte 35) contains the frame and drive number, passed across the RS-422 serial interface.

For additional information, refer to the *IBM TotalStorage LTO Ultrium Tape Drive SCSI Reference*.

Appendix E. Message Retrieval at the Host

How error information is obtained from the host depends on the type of device driver being utilized. Table E-1 provides instructions specific to your type of device driver.

Table E-1. Device driver types

If you are…	Then…
Using an IBM device driver	Refer to the *IBM Tape Device Drivers Installation and User's Guide* (GC27-2130) for problem determination information specific to your host operating system. Visit `ftp://ftp.software.ibm.com/storage/devdrvr/Doc/` to download the latest version of the manual.
Using a non-IBM device driver	See "Using the IBM TotalStorage Diagnostic Tool (ITDT)" on page 7-21. Visit `http://www-1.ibm.com/support/docview.wss?uid=ssg1S4000662` to download the diagnostic tool.

Obtaining Error Information From an IBM™ System p

IBM device drivers for the System p operating system logs error information when an error occurs on a tape drive or library.

The error information includes the following:
- Device VPD
- SCSI command parameters
- SCSI sense data (if available)

The AIX® Tape and Media Changer Device Driver for System p provides logging to the system error log for a variety of errors. You can view the error log by following this procedure.

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

Note: In most cases you will use the summary report to find the date and time of any errors related to library devices, then use the detail report to obtain the sense data needed to identify the cause of the error.

2. Press [**Enter**] to scroll through the error log.
3. Type **q** and press [**Enter**], to quit the error log at any time.

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

- For library errors [Resource Name = **smc**n (for example, smc0) and Resource Type = 3572-TL]), see "SCSI Sense Data Definition" on page E-2 and the SCSI sense data in "Library Sense Data" on page D-2.

- For drive errors [Resource Name = **rmt**n (for example, rmt0) and Resource Type = LTO], see "SCSI Sense Data Definition" on page E-2 and locate the SCSI sense data in "Tape Drive Sense Data" on page D-3.

SCSI Sense Data Definition

The following is an example of a tape drive communication failure while attached to an Open Systems host through a SAS link, using SCSI protocol. When the host detected the failure, it built the following SCSI Sense Data record. An explanation of the SCSI Sense Data breakout in this example follows.

```
SENSE DATA
aabb xxxx ccdd eeee eeee eeee eeee eeee ffgg hhxx ssss ssss ssss ssss ssss ....

0600 0000 1200 0000 0000 0000 0000 0000 0200 0300 0000 0000 0000 0000 0000 0000 0000
0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
```

Note: The bold area above represents the SCSI Sense Data presented by the host. The regular font data (in this case many bytes of "zero"), designated by "ssss" would normally contain device sense data, but with the kind of failure in this example (COMMAND TIMEOUT), the host could not collect valid device sense data, so zeros are the result and should be ignored. If the host had been able to collect valid sense data from the drive, the first byte "ss" would be "70", "71", "F0" or "F1", and valid device sense data would be listed.

```
Detail Data

aabb xxxx ccdd eeee eeee eeee eeee eeee ffgg hhxx ssss ssss ssss ssss ssss ....

aa Length of the Command Descriptor Block (CDB) sent by the host. In this case, "06" bytes.
bb SCSI target address. In this example, SCSI address "00".
xx Unused or reserved.
cc Start of CDB, cc is the operation code (byte 0). In this case, "12" which was an "Inquiry".
```

SCSI Sense Data – Library Error

The following example of SCSI Sense Data was received from a System p Open System host and shows a Tape Drive Failure and what the sense data would look like. Unlike the previous situation with "SCSI Sense Data Definition", this data contains valid sense data as defined by the hex "70" in the first sense byte position. Therefore, instead of all zeros as in the previous example, we have valid data to rely on. While the data shows that this is a TAPE_ERR2, it could also be caused by a library failure. The ASC/ASCQ points to a "Mechanical Positioning Error" while attempting a "Move Medium" command ("A5"). For more information about Sense Data, refer to the *IBM TotalStorage LTO Ultrium Tape Drive SCSI Reference*.

```
LABEL:          TAPE_ERR2
IDENTIFIER:     476B351D

Date/Time:      Fri May 04 42:26 DFT
Sequence Number: 1665
Machine Id:     0046083B4C00
Node Id:        risc4
Class:          H
Type:           PERM
Resource Name:  smc0
Resource Class: tape
Resource Type:  3572
Location:       P1.1-I3/Q1-W5003013D38321011-L1000000000000
VPD:
        Manufacturer...............IBM
        Machine Type and Model......3572-TL
        Serial Number..............X2U78B0384
        Device Specific.(FW)........4.09 (Firmware Level)


Description
TAPE DRIVE FAILURE


Probable Causes
TAPE DRIVE


Failure Causes
TAPE
TAPE DRIVE


        Recommended Actions
        PERFORM PROBLEM DETERMINATION PROCEDURES


Detail Data


aabb xxxx ccdd eeee eeee eeee eeee eeee ffgg hhxx ssss ssss ssss ssss ssss ....


aa Length of the Command Descriptor Block (CDB) sent by the host. In this case, "OC" bytes.
bb SCSI target address. In this example, SCSI address "00".
xx Unused or reserved.
cc Start of CDB, cc is the operation code (byte 0). In this case, "A5" which was an "Move Medium".

SENSE DATA
0C00 0000 A500 0000 100F 1010 0000 0000 0102 0000 7000 0400 0000 000A 0000 0000
818F 0000 BE00 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
```

Table E-2. Library sense data example

Hex	Description
A5	SCSI Command (in this case Move Medium).
70	Byte 0 of Library Sense Data (Valid Data).
04	Sense Key (in this case Hardware Error).
818F	ASC/ASCQ (additional sense code/additional sense code qualifier), in this case a "Cannot Find Slider Block" error.

SCSI Sense Data – Tape Drive Error

The following example of SCSI Sense Data was received from a System p Open System host and shows a Tape Drive Failure and what the sense data would look like. Like the SCSI sense data in the previous example, this data contains valid sense data as defined by the hex "71" in the first sense byte position. Therefore, we have valid data to rely on. While the data shows that this is a TAPE_ERR2, further review of the ASC/ASCQ (Media Load or Eject Failed) points more to a problem with the media or the drive. The fact that a FID was listed ("86") defines the failure as "The drive detected a drive hardware or media fault". In this case, the FID should be followed to make a repair. For more information about Sense Key and ASC/ASCQ fields, refer to the *IBM TotalStorage LTO Ultrium Tape Drive SCSI Reference*.

```
LABEL:          TAPE_ERR2
IDENTIFIER:     476B351D

Date/Time:      Wed May 09 07:51:42 DFT
Sequence Number: 1669
Machine Id:     0046083B4C00
Node Id:        risc4
Class:          H
Type:           PERM
Resource Name:  rmt0
Resource Class: tape
Resource Type:  LTO
Location:       P1.1-I3/Q1-W5003013D38321011-L0

VPD:
        Manufacturer................IBM
        Machine Type and Model......ULT3573-TD4
        Serial Number...............1300000680
        Device Specific.(FW)........74H4 (Firmware Level)
        Loadable Microcode Level....A1700D5C

Description
TAPE DRIVE FAILURE

Probable Causes
TAPE DRIVE

Failure Causes
TAPE
TAPE DRIVE

Recommended Actions
        PERFORM PROBLEM DETERMINATION PROCEDURES

Detail Data
SENSE DATA
0600 0000 0000 0000 0000 0000 0000 0000 0102 0000 7100 0400 0000 0058 0000 0000
5300 8602 8E07 0000 0001 0110 0001 0000 0000 0000 0200 0000 0000 0000 0000 0000
0000 0000 0000 0000 0000 0000 0000 0000 0000 2800 01E0 0000 0000 0000 4133 3820
2020 2000 0000 0000 0000 0000 0000 8000 0000 0000 0000 0000 0000 0000 0000 0000
0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
```

Table E-3. Drive sense data example

Hex	Description
71	Byte 0 of Library Sense Data (Valid Data).
04	Sense Key (in this case Hardware Error).
5300	ASC/ASCQ (additional sense code/additional sense code qualifier).
86	FID (FRU identification number). In this case, a Drive Hardware or Media problem.

Retrieving from a Sun System

The Sun System provides information when an error occurs on a tape drive or library in `system-errolog /var/adm/messages`. When you have located the error information, go to Chapter 6, "Troubleshooting," on page 6-1.

Retrieving from an HP-UX System

The HP-UX system provides information when an error occurs on a tape drive or library in syslog `/var/adm/syslog.log`. When you have located the error information, go to Chapter 6, "Troubleshooting," on page 6-1.

Retrieving From an IBM System i™ with RISC Processor

IBM device drivers for the System i operating system logs error information when an error occurs on a tape drive or library.

The error information includes the following:
- Device VPD
- SCSI command parameters
- SCSI sense data (if available)

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

1. Type STRSST (Start System Service Tools) command on the command entry line on the System i Main Menu, and press **Enter**.
2. On the "System Service Tool (SST)" screen, select **Start a service tool**, and press **Enter**.
3. On the "Start a Service Tool" screen, select **Product activity log**, and press **Enter**.
4. On the "Product activity log" screen, select **Analyze log**, and press **Enter**.
5. On the "Select Subsystem Data" screen, select **Magnetic media**, enter the From and To time period for searching the error log, and press **Enter**.
6. On the "Select Analysis Report Options" screen, select the following, and press **Enter**.
   a. Report type 1
   b. Optional entries to include
      1) Informational . . . . YES
      2) Statistic . . . . NO
   c. Reference code selection
      1) Option 1

         2) Reference codes . . . . *ALL

    d. Device selection

         1) Option 1

         2) Device type or resource names . . . *ALL

7. On the "Log Analysis Report" screen, enter a **5** on an error line that has a resource type of 3572, and press **Enter**.

8. On the "Display Detail Report for Resource" screen, press:

- F4=Additional Information.
  Pressing F4 will display the machine type and serial number of the device. It also will display SCSI sense data, if available.
- F6=Hexadecimal report.
  Pressing F6 will display the device hexadecimal data (for support use).
- F9=Address Information.
  Pressing F9 will display the SCSI address information.

Appendix F. Library Configuration Form

Make a copy of this form, fill it out as you are installing and configuring your library. Update the form each time changes are made to the library. The information on this form is very important. Having the information on this form will be helpful if a call to IBM Service is necessary. Store this form in a secure location.

Physical Library

Machine type	3572-TL
Serial Number	
Library Name	
Auto Cleaning	
Bar code label length	

Logical Library

Library Access Mode	
Loop	
Autoload	
Active Slots	

Tape Drive

Serial Number	
Worldwide Node Name	

Network Settings

Ethernet Link Speed	
SSL Security	
IPv4	
DHCP	
Static IP Address	
Subnet Mask Address	
Gateway Address	
IPv6	
DHCP	
Stateless Auto Configuration	
Static IP Address	

Prefix Length	
Gateway	
DNS	
DNS IP Address	
NTP Date/Time Server	
NTP Server IP Address	
Time Zone	
Auto Adjustment by PC	
SMTP (Mail) Server	
SMTP Server Address	
Sender Address	
Subject	
Mail to 01	
Mail to 02	
Mail to 03	
Mail to 04	
Mail Event Level	
SNMP Server	
Community	
Name	
Location	
Contact	
Trap to 01	
Trap to 02	
Trap to 03	
Trap to 04	
User 1	
User 2	
User 3	
User 4	
Trap Event Level	

Encryption Settings (S4H only)

Encryption License Key	
Encryption Method	
Encryption Policy	
SSL Security	
Primary EKM Server IP Address	
Primary EKM TCP Port Address	
Primary EKM SSL Port Address	
Secondary EKM IP Address	
Secondary EKM TCP Port Address	

Secondary EKM SSL Port Address	
Advanced Encryption Settings	

Library and Drive Firmware

Type of Firmware	Current Firmware Level				
Library					
Drive					

Users Accounts

The Administrator (admin) password is listed in the table below. Modify and add additional Administrator, Superuser and User names and passwords that are created.

User name	Access Level	Password
admin	Administrator	secure

My Notification

User name	
Password	

Accessibility

Keyboard Accessibility

Accessibility features help a user who has a physical disability, such as restricted mobility or limited vision, to use the HTML version of the customer documentation successfully.

Features

These are the major accessibility features for the HTML version of the *IBM System Storage TS2900 Tape Autoloader Setup, Operator, and Service Guide*:

- You can use screen-reader software and a digital speech synthesizer to hear what is displayed on the screen. The following screen readers have been tested: WebKing and Window-Eyes.
- You can operate all features using the keyboard instead of the mouse.

Navigating by keyboard

You can use keys or key combinations to perform operations and initiate many menu actions that can also be done through mouse actions. You can navigate the HTML version of the *IBM System Storage TS2900 Tape Autoloader Setup, Operator, and Service Guide* help system from the keyboard by using the following key combinations:

- To traverse to the next link, button, or topic, press Tab inside a frame (page).
- To move to the previous topic node, press ^ or Shift+Tab.
- To scroll all the way up or down, press Home or End, respectively.
- To print the current page or active frame, press Ctrl+P.
- To select, press Enter.

Accessing the publications

You can view the publications for this library in Adobe Portable Document Format (PDF) using the Adobe Acrobat Reader. The PDFs are provided at the following Web site:

```
http://www.ibm.com/storage/support/
```

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Glossary

This glossary defines the special terms, abbreviations, and acronyms that are used in this publication. If you do not find the term you are looking for, refer to the index or to the *Dictionary of Computing*, 1994.

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.

A

A.   Ampere.

ac.   Alternating current.

access method.   A technique for moving data between main storage and input or output devices.

accessor.   This component contains the library robot and bar code reader. The accessor moves cartridges to and from the I/O Station, storage slots, and tape drives.

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

adj.   Adjustment.

AH.   Authentication Header. This is an Internet Protocol intended to guarantee connectionless integrity and data origin authentication of IP datagrams. Further, it can optionally protect against replay attacks by using the sliding window technique and discarding old packets.

AIX.   Advanced Interactive Executive. IBM's implementation of the UNIX® operating system. The RS/6000 system, among others, uses AIX as it's operating system.

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

alter.   To change.

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

AME.   Application Managed Encryption.

ampere (A).   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.

ANSI.   American National Standards Institute.

application-managed encryption.   Tape encryption controlled by an application.

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

ASCII.   American National Standard Code for Information Interchange. A 7 bit coded character set (8 bits including parity check) that consists of control characters and graphic characters.

assigning a device.   The establishing of the relationship of a device to a running task, process, job, or program.

assignment.   The naming of a specific device to perform a function.

asynchronous.   Pertaining to two or more processes that do not depend upon the occurrence of specific events such as common timing signals.

attention (notice).   A word for calling attention to the possibility of danger to a program, device, or system, or to data. Contrast with *caution* and *danger*.

ATTN.   Attention.

B

backup.   To make additional copies of documents or software for safekeeping.

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.   Paper bearing a bar code and having an adhesive backing. The bar code label must be affixed to a tape cartridge to enable the library to identify the cartridge and its volume serial number.

bar code reader.   A laser device specialized for scanning and reading bar codes and converting them into either the ASCII or EBCDIC digital character code.

bezel.   Decorative and safety cover.

bicolored.   Having two colors.

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

BOM or bill of materials.   A list of specific types and amounts of direct materials expected to be used to produce a given job or quantity of output.

Border Gateway Protocol (BGP).   BGP is the core routing protocol of the Internet. It works by maintaining a table of IP networks or 'prefixes' that designate network reachability among autonomous systems (AS).

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

buffer.   A routine or storage used to compensate for a difference in rate of flow of data or time of occurrence of events, when transferring data from one device to another.

bus.   A facility for transferring data between several devices located between two end points, only one device being able to transmit at a given moment.

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

CA certification.   In cryptography, a certificate from a Certificate Authority (CA).

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

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 memory (CM).   Within each data cartridge, an embedded electronics and interface module that can store and retrieve a cartridge's historical usage and other information.

cartridge storage slot.   Individual slot located within a magazine that is used to house tape cartridges.

caution (notice).   A word to call attention to possible personal harm to people. Contrast with *attention* and *danger*.

CE.   Customer engineer; field engineer; service representative.

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

channel command.   An instruction that directs a data channel, control unit, or device to perform an operation or set of operations.

char.   Character.

CHK.   Check.

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

command.   A control signal that initiates an action or the start of a sequence of actions.

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

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

concurrent.   Refers to diagnostic procedures that can be run on one control unit while the rest of the subsystem remains available for customer applications.

contingent connection.   A connection between a channel path and a drive caused when a unit check occurs during an I/O operation.

controller.   A device that provides the interface between a system and one or more tape drives.

control path drive.   A drive that communicates messages from the host computer to the library in which the drive is installed.

cookie.   A packet of data exchanged between the library and a web browser to track configuration.

CP.   Circuit protector.

CRU.   Customer replaceable unit.

ctrl.   Control.

CU.   Control unit.

D

danger (notice).   A word to call attention to possible lethal harm to people. Contrast with *attention* and *caution*.

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

data buffer.   The storage buffer in the control unit. This buffer is used to increase the data transfer rate between the control unit and the channel.

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

data check.   A synchronous or asynchronous indication of a condition caused by invalid data or incorrect positioning of data.

dc.   Direct current.

DCS.   Designated Cleaning Slot

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.

degradation.   A decrease in quality of output or throughput or an increase in machine error rate.

degraded.   Decreased in quality of output or throughput or increased machine error rate.

deserialize.   To change from serial-by-bit to parallel-by-byte.

detented.   A part being held in position with a catch or lever.

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.

DHCPv6.   The Dynamic Host Configuration Protocol for IPv6. Although IPv6's stateless address autoconfiguration removes the primary motivation for DHCP in IPv4, DHCPv6 can still be used to statefully assign addresses if the network administrator desires more control over addressing.

DH group.   Diffie-Hellman group.

DIAG.   Diagnostic section of maintenance information manual.

differential.   See *High Voltage Differential (HVD)*.

direct access storage.   A storage device in which the access time is independent of the location of the data.

display contrast.   The brightness of the display on the Operator Panel.

DLL.   Dynamic Link Library. Microsoft's implementation of the shared library concept. These libraries usually have the file extension dll, ocs (for libraries containing activeX controls, or drv (for legacy system drivers).

DNS.   Directory Name System. This allows the library to recognize text-based addresses instead of numeric IP addresses.

download.   (1) To transfer programs or data from a computer to a connected device, typically a personal computer. (2) To transfer data from a computer to a connected device, such as a workstation or microcomputer.

DRAM.   Dynamic random-access memory.

drive, magnetic tape.   A mechanism for moving magnetic tape and controlling its movement.

Drive Not Configured.   This message occurs during the first boot after a factory settings restore is executed. This is not a real issue since it takes the library a while to configure.

DRV.   Drive.

DSA key.   Encryption key type.

DSE.   Data security erase.

DSP.   Digital signal processor.

E

EBCDIC.   Extended binary-coded decimal interchange code.

EC.   Edge connector. Engineering change.

ECC.   Error correction code.

EEPROM.   Electrically erasable programmable read-only memory.

EIA.   Electronics Industries Association.

EIA unit.   A unit of measure, established by the Electronic Industries Association, equal to 44.45 millimeters (1.75 inches).

eject.   To remove or force out from within.

EKM.   See *encryption key manager*.

electronic mail.   Correspondence in the form of messages transmitted between user terminals over a computer network.

e-mail.   See *electronic mail*.

encryption.   A method of storing data in a format that helps protect data from inadvertent or deliberate compromise. An encryption-enabled drive contains the necessary hardware and firmware to encrypt and decrypt host tape application data. Encryption policy and encryption keys are provided by the host application or host server.

encryption key manager (EKM). A Java software program that assists IBM-encrypting tape drives in generating, protecting, storing, and maintaining encryption keys that encrypt information written to and decrypt information read from tape media.

entitlement. IBM entitlement is the official right to receive service and support for your tape library.

EPO. Emergency power off.

EPROM. Erasable programmable read only memory.

EQC. Equipment check.

equipment check. An asynchronous indication of a malfunction.

Error log. A dataset or file in a product or system where error information is stored for later access.

ESD. Electrostatic discharge.

ESP. Encapsulating Security Payload. This is an Internet Protocol that provides origin authenticity, integrity, and confidentiality protection of a packet. ESP also supports encryption-only and authentication-only configurations, but using encryption without authentication is strongly discouraged because it is insecure.

F

fault symptom code (FSC). A hexadecimal code generated by the drive or the control unit microcode in response to a detected subsystem error.

FC. Feature code.

FCC. Federal communications commission.

FE. Field engineer, customer engineer, or service representative.

fiducial. A target used for teaching a physical location to a robot.

field replaceable unit (FRU). An assembly that is replaced in its entirety when any one of its components fails.

file. A named set of records stored or processed as a unit. Also referred to as a dataset.

file protection. The processes and procedures established in an information system that are designed to inhibit unauthorized access to, contamination of, or deletion of a file.

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 hosts.

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.

FLASH EEPROM. An electrically erasable programmable read-only memory (EEPROM) that can be updated.

FMR. Field microcode replacement.

format. The arrangement or layout of data on a data medium.

formatter. Part of a magnetic tape subsystem that performs data conversion, speed matching, encoding, first level error recovery, and interfaces to one or more tape drives.

FP. File protect.

frayed. Damaged as if by an abrasive substance.

FRU. Field replaceable unit.

FSC. Fault symptom code.

FSI. Fault symptom index.

FTSS. Field Technical Sales Support.

functional microcode. Microcode that is resident in the machine during normal customer operation.

G

g. Gram.

GB. gigabyte.

GBIC. Gigabit Interface Converter.

Gbs. gigabits/second

gigabit (Gbit). 1 000 000 000 bits.

gigabyte (GB). 1 000 000 000 bytes.

Gigabit Interface Converter (GBIC). Converts copper interface to optic interface.

gnd. Ground.

H

HD Slot Technology.   High-density (HD) slot technology. Allows multiple cartridges to be stored in a tiered architecture.

hertz (Hz).   Unit of frequency. One hertz equals one cycle per second.

hex.   Hexadecimal.

High Voltage Differential (HVD).   A logic signaling system that enables data communication between a supported host and the library. HVD 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*.

HVD.   SCSI Bus High Voltage Differential

Hz.   Hertz (cycles per second).

I

IBM Ultrium Tape Drive.   Located within the library, 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.

ID.   Identifier.

identifier (ID).   (1) In programming languages, a lexical unit that names a language object; for example, the names of variables, arrays, records, labels, or procedures. An identifier usually consists of a letter optionally followed by letters, digits, or other characters. (2) One or more characters used to identify or name data element and possibly to indicate certain properties of that data element. (3) A sequence of bits or characters that identifies a program, device, or system to another program, device, or system.

IKE.   Internet Key Exchange used in the IPsec protocol.

IML.   Initial microprogram load.

incompatible magazine.   This message may appear on the Operator Panel during library initialization. It occurs during factory restore or VPD. This is not a real issue since it takes the library a while to configure.

initial microprogram load (IML).   The action of loading a microprogram from an external storage to writable control storage.

initiator.   The component that executes a command. The initiator can be the host system or the tape control unit.

INST.   Installation.

interface.   A shared boundary. An interface might be a hardware component to link two devices or it might be a portion of storage or registers accessed by two or more computer programs.

Internet Protocol Version 4 (IPv4).   See *IPv4*.

Internet Protocol Version 6 (IPv6).   See *IPv6*.

interposer.   The part used to convert a 68-pin connector to a 50-pin D-shell connector.

intervention required.   Manual action is needed.

INTRO.   Introduction.

I/O.   Input/output.

I/O Station.   Cartridge location dedicated for the insertion of cartridges into and the removal of cartridges from the library.

IOP.   Input/output processor.

IP.   Internet protocol

IP address.   An identifier for a computer or device on a TCP/IP network. Networks using the TCP/IP protocol route messages based on the IP address of the destination. See *IPv4* and *IPv6*.

IPL.   Initial program load.

IPsec (IP security).   A set of protocols for securing IPv6 network communications by authentication and encryption.

IP Stack.   A TCP/IP protocol stack that manages static IP addresses.

IPv4.   A network layer protocol for packet-switched networks. IPv4 supports 2^{32} (about 4.3 billion) addresses.

IPv6.   A network layer protocol for packet-switched networks. It is the designated successor of IPv4 for general use on the Internet. The main improvement brought by IPv6 is the increase in the number of addresses available for networked devices, allowing, for example, each mobile phone and mobile electronic device to have its own unique address.

ISV.   Independent Software Vendor.

ITDT.   IBM TotalStorage Diagnostic Tool.

ITST.   Idle-time self-test.

K

kilogram (kg).   One thousand grams (approximately 2.2 pounds).

km.   kilometer. 1000 Meters, Approximately 5/8 mile.

L

LAN.   Local area network. A computer network within a limited area.

LCD.   See *liquid crystal display*.

LDAP.   Lightweight Directory Access Protocol. This allows the library to use login and password information stored on a server to grant access to the library functionality.

LDI.   Library Drive Interface.

LED.   Light-emitting diode.

library certification.   In cryptography, a certificate provided by the library.

library-managed encryption.   Tape encryption controlled by the tape library.

library recovery.   Library firmware function that generally retries failed operations up to three times before posting a failure or, in some situations, proceeding with an operation that can be completed in an alternative manner.

Linear Tape-Open (LTO).   A type of tape storage technology developed by the IBM Corporation, Hewlett-Packard, and Certance. LTO 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 is the key storage consideration. Ultrium tape cartridges have a capacity of up to 800 GB (1600 GB with 2:1 hardware compression).

liquid crystal display (LCD).   A low-power display technology used in computers and other I/O devices.

loadable.   Having the ability to be loaded.

LME.   Library Managed Encryption.

LTO.   See *Linear Tape-Open*.

LVD.   SCSI Bus Low Voltage Differential.

M

MAC address.   The Media Access Control address of a computer networking device.

magnetic tape.   A tape with a magnetic surface layer on which data can be stored by magnetic recording.

MAP.   Maintenance analysis procedure.

mask.   A pattern of characters that controls the retention or elimination of portions of another pattern of characters. To use a pattern of characters to control the retention or elimination of portions of another pattern of characters.

master file.   A file used as an authority in a given job and that is relatively permanent, even though its contents may change. Synonymous with main file.

Maximum Transmission Unit (MTU).   The size of the largest packet that a network protocol can transmit.

MB.   Mega Byte (usually expressed as data rate in MB/s or MB/second).

media capacity.   The amount of data that can be contained on a storage medium, expressed in bytes of data.

media-type identifier.   Part of the bar code on an IBM Ultrium Tape Cartridge that identifies the type of cartridge (for example "L1"). "L" identifies cartridges that can be read by devices that incorporate LTO technology. The numeral indicates the generation of the type.

mega.   One million of.

meter.   In the Metric System, the basic unit of length; equal to approximately 39.37 inches.

MIB.   Management Information Base. Information repository used by SNMP.

micro.   One millionth of.

microcode.   (1) One or more micro instructions. (2) A code, representing the instructions of an instruction set, implemented in a part of storage that is not program-addressable. (3) To design, write, and test one or more micro instructions. (4) See also *microprogram*.

microdiagnostic routine.   A program that runs under the control of a supervisor, usually to identify field replaceable units.

microdiagnostic utility.   A program that is run by the customer engineer to test the machine.

microinstruction.   A basic or elementary machine instruction.

microprogram. A group of microinstructions that when executed performs a preplanned function. The term microprogram represents a dynamic arrangement or selection of one or more groups of microinstructions for execution to perform a particular function. The term microcode represents microinstructions used in a product as an alternative to hard-wired circuitry to implement certain functions of a processor or other system component.

MIM. Media information message.

mm. Millimeter.

modifier. That which changes the meaning.

mount a device. To assign an I/O device with a request to the operator.

MP. Microprocessor.

ms. Millisecond.

MSG. Message.

multipath. Pertaining to using more than one path.

N

N/A. Not applicable.

Network Address Translation (NAT). NAT involves rewriting the source and/or destination addresses of IP packets as they pass through a router or firewall. Most systems using NAT do so in order to enable multiple hosts on a private network to access the Internet using a single public IP address.

node. In a network, a point at which one or more functional units connect channels or data circuits.

NTP. Network Time Protocol. This allows the library to set its internal date and time based on the date and time of a sever.

NVS. Nonvolatile storage. A storage device whose contents are not lost when power is cut off.

O

oersted. The unit of magnetic field strength in the 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 abampere per 4π centimeters of axial length.

offline. Pertaining to the operation of a functional unit without the continual control of a computer. Contrast with *online*.

online. Pertaining to the operation of a functional unit that is under the continual control of a computer. Contrast with *offline*.

OPER. Operation.

ov. Over voltage.

overrun. Loss of data because a receiving device is unable to accept data at the rate it is transmitted.

overtightening. To tighten too much.

P

parameter. A variable that is given a constant value for a specified application and that may denote the application.

p bit. Parity bit.

PC. Parity check.

PCC. Power control compartment.

PDF. Portable Document Format.

PE. Parity error. Product engineer.

PFS. Perfect forward secrecy.

pick. Pertaining to the library, to remove, by means of a robotic device, a tape cartridge from a storage slot or drive.

picker. A robotic mechanism located inside the library that moves cartridges between the cartridge storage slots and the drive. See *accessor*.

PM. Preventive maintenance.

POR. Power-on reset.

port. A physical connection for communication between the 3590 and the host processor. The 3590 has two SCSI ports.

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 (via 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.

Private key. A cryptographic key used to decrypt a message.

PROM. Programmable read only memory.

PS. Power supply.

PTF. Program temporary fix. A single bugfix or group of bugfixes distributed in a form ready to install for customers.

PWR. Power.

R

rack. A unit that houses the components of a storage subsystem, such as the library.

rackmount kit. A packaged collection of articles used to install the rack mounted version of the library.

RAM. Random access memory.

random access memory. A storage device into which data is entered and from which data is retrieved in a nonsequential manner.

RAS. Reliability, availability, and serviceability.

record. A collection of related data or words, treated as a unit.

recording density. The number of bits in a single linear track measured per unit of length of the recording medium.

recoverable error. An error condition that allows continued execution of a program.

ref. Reference.

reg. Register.

reinventory. To inventory again.

retension. The process or function of tightening the tape onto the cartridge, if it is sensed that the tape has a loose wrap on the cartridge.

RFC (Request for Comments). Request for Comments (RFC) documents are a series of memoranda encompassing new research, innovations, and methodologies applicable to Internet technologies.

RH. Relative humidity.

RML. Rack Mount Line.

robot. Accessor.

robotics. Accessor assembly.

root CA certification. In cryptography, a root certificate from a Certificate Authority (CA).

RPQ. Request for price quotation.

RSA key. Encryption key type.

R/W. Read/write.

S

s. Seconds of time.

SAC. Service Action Code. Code developed to indicate possible FRU or FRUs to replace to repair the hardware.

SAS. See *Serial Attached SCSI*.

scratch cartridge. A data cartridge that contains no useful data, but can be written to with new data.

SCSI. Small computer system interface.

SE. Single-ended.

segment. A part.

sel. Select.

Serial Attached SCSI (SAS). A drive with a SAS interface can be linked directly to controllers. SAS is a performance improvement over traditional SCSI because SAS enables multiple devices (up to 128) of different sizes and types to be connected simultaneously with thinner and longer cables. It supports full-duplex signal transmission up to 3 Gb/s. In addition, SAS drives can be hot-plugged.

serialize. To change from parallel-by-byte to serial-by-bit.

serializer. A device that converts a space distribution of simultaneous states representing data into a corresponding time sequence of states.

servo, servos. An adjective for use in qualifying some part or aspect of a servomechanism.

servomechanism. A feedback control system in which at least one of the system signals represents mechanical motion.

signature. A digital signature used in cryptography to identify one party to ensure authenticity.

slot blocker. A slot blocker is used to restrict/close off a data cell so a data cartridge cannot be inserted.

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 160 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.
- Ultra160 SCSI: Uses a 16-bit bus and supports data rates of 80 or 160 MBps.

SME. System Managed Encryption.

SNMP. Simple Network Management Protocol. Used by network management systems to monitor network-attached devices.

SNS. Sense.

SNTP. Simple Network Time Protocol. Used to synchronize the clocks of network-attached devices.

special feature. A feature that can be ordered to enhance the capability, storage capacity, or performance of a product, but is not essential for its basic work.

SPI. Security Parameters Index.

SR. Service representative, see also *CE*.

SRAM. Static random access memory.

SS. Status store.

SSL (Secure Sockets Layer). A set of cryptographic protocols for secure communications on the Internet for such things as web browsing, e-mail, Internet faxing, instant messaging, and other data transfer. SSL allows applications to communicate across a network in a way designed to prevent eavesdropping, tampering, and message forgery.

ST. Store.

standard feature. The significant design elements of a product that are included as part of the fundamental product.

START. Start maintenance.

subsystem. A secondary or subordinate system, usually capable of operating independently of, or asynchronously with, a controlling system.

SUPP. Support.

sync. Synchronous, synchronize. Occurring with a regular or predictable time relationship.

system-managed encryption. Tape encryption is set up implicitly through the IBM device driver.

T

tachometer, tach. A device that emits pulses that are used to measure/check speed or distance.

tape cartridge. A container holding magnetic tape that can be processed without separating it from the container.

tape void. An area in the tape in which no signal can be detected.

TCP/IP. Transmission Control Protocol/Internet Protocol.

TCU. Tape control unit.

TH. Thermal.

thread/load operation. A procedure that places tape along the tape path.

TM. Tapemark.

transport mode. End-to-end communications security in which the end-point computers do the security processing.

trusted certification. In cryptography, a trustworthy certificate not registered with a Certificate Authority.

tunnel mode. Port-to-port communications security in which security is provided to several machines by a single node.

U

UART. Universal asynchronous receiver/transmitter.

unload. Prepare the tape cartridge for removal from the drive.

utilities. Utility programs.

utility programs. A computer program in general support of the processes of a computer; for instance, a diagnostic program.

uv. Under voltage.

V

VOLSER. Volume serial number.

volume. A certain portion of data, together with its data carrier, that can be handled conveniently as a unit.

VPD. Vital product data. The information contained within the tape drive that requires nonvolatile storage used by functional areas of the drive, and information required for manufacturing, RAS, and engineering.

W

word. A character string that is convenient for some purpose to consider as an entity.

World Wide Node Name (WWNN). A unique character string identifying Fiber Channel Host Bus Adapters (HBA)

Write. Write command.

WT. world trade.

X

XR. External register.

XRA. External register address register.

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Readers' Comments — We'd Like to Hear from You

IBM System Storage TS2900 Tape Autoloader
Setup, Operator, and Service Guide
Machine Type 3572

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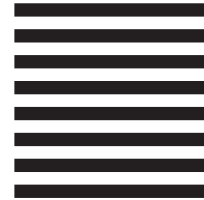Fold and Tape   **Please do not staple**   Fold and Tape

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