IBM TS2900 Tape Autoloader

Setup, Operator, and Service Guide

Machine Type 3572

GC27-2212-08

Important

Before using this information and the product it supports, read the information in “Notices” on page 229. To ensure you have the latest publications, visit the web at http://www.ibm.com/storage/lto

This edition applies to the *IBM TS2900 Tape Autoloader Setup, Operator, and Service Guide*, GC27-2212-08, and to the subsequent releases and modifications until otherwise indicated in new editions.

Read this first

This product might not be certified in your country for connection by any means whatsoever to interfaces of public telecommunications networks. Further certification might be required by law before making any such connection. Contact IBM® for information.

Accessing online technical support

It is the customer's responsibility to set up this tape drive or library and to ensure that the drive and library have the latest firmware (unless you purchase a service contract).

For online Technical Support, visit http://www.ibm.com/support/.

For latest firmware and diagnostic procedures, visit http://www.ibm.com/support/.

Note: IBM supports higher versions of the browsers if the vendors do not remove or disable functions that the product relies upon. For browser levels higher than the versions that are certified with the product, customer support accepts usage-related and defect-related service requests. As with operating system and virtualization environments, if IBM support cannot re-create the issue in the lab. The client might be asked to re-create the problem on a certified browser version to determine whether a product defect exists. Defects are not accepted for cosmetic differences between browsers or browser versions that do not affect the functional behavior of the product. If a problem is identified in the product, defects are accepted. If a problem is identified with the browser, IBM might investigate potential solutions or workarounds that the client can implement until a permanent solution becomes available.

Registering for My Notification

My Notification registration provides email notification when new firmware levels are updated and available for download and installation. To register for My Notification:

1. Visit the web at: http://www-01.ibm.com/software/support/einfo.html.
2. Click **My Notifications**.

Note: Library firmware and tape drive firmware are verified and released together. When you are updating, verify that all installed components such as tape drive and library firmware are at the latest levels noted on the Support website. Mixing different levels of library and tape drive firmware is not supported and might cause unpredictable results.

Sending us your comments

Your feedback is important in helping IBM provide accurate and useful information. If you have comments or suggestions for improving this publication, send your comments by:

- Emailing IBM:
  - Internet or IBMLink from US: *starpubs@us.ibm.com*
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  - Exact publication title
  - Form number (for example, GA32–1234–02) or part number (on the back cover of the publication)
  - Page number to which you are referring
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Tucson, AZ 85744-0001 USA

Contacting IBM technical support

In the US: Call 1-800-IBM_SERV (1-800-426-7378).

Note: Before you call IBM, complete all the steps in "Contacting IBM technical support" on page 139

All other Countries/Regions: Visit http://www.ibm.com and complete all the steps in "Contacting IBM technical support" on page 139.

To open a Service Request online: Under **Support & downloads**, click **Open a service request**.

Summary of changes

Revision bars (|) display next to the information that was added or changed since the previous edition (GC27-2212-07).

8th edition

The following information is added to the GC27-2212-08 Setup, Operator, and Service Guide.

- The Acclimation section was added.
- The application changed from a Java-based to an HTML-based web user interface. All screens show the new interface.
- Changed the method of ordering WORM Cartridges.
- Updated the list of vendors of cartridge bar code labels.

Contents

Figures

Tables

Safety and environmental notices

Safety notices and environmental notices for this product are shown and described.

Safety notices

Observe the safety notices when this product is used. These safety notices contain danger and caution notices. These notices are sometimes accompanied by symbols that represent the severity of the safety condition.

Most danger or caution notices contain a reference number (Dxxx or Cxxx). Use the reference number to check the translation in the *IBM Systems Safety Notices*, G229-9054 manual.

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

Danger notice

A danger notice calls attention to a situation that is potentially lethal or extremely hazardous to people. A lightning bolt symbol always accompanies a danger notice to represent a dangerous electrical condition. A sample danger notice follows:

DANGER: An electrical outlet that is not correctly wired could place hazardous voltage on metal parts of the system or the 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. *(D004)*

Caution notice

A caution notice calls attention to a situation that is potentially hazardous to people because of some existing condition, or to a potentially dangerous situation that might develop because of some unsafe practice. 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 hazardous condition that is not represented by other safety symbols.
 Class I	This product contains a Class II laser. Do not stare into the beam. (*C029*) 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).
	A hazardous condition due to mechanical movement in or around the product.

If the symbol is...	It means...
	This part or unit is heavy but has a weight smaller than 18 kg (39.7 lb). Use care when lifting, removing, or installing this part or unit. (*C008*)
	A hazardous condition due to the unit's susceptibility to electrostatic discharge.

Sample caution notices follow:

Caution

The battery is a lithium ion battery. To avoid possible explosion, do not burn. Exchange only with the IBM-approved part. Recycle or discard the battery as instructed by local regulations. In the United States, IBM has a process for the collection of this battery. For information, call 1-800-426-4333. Have the IBM part number for the battery unit available when you call. (*C007*)

Caution

The system contains circuit cards, assemblies, or both that contain lead solder. To avoid the release of lead (Pb) into the environment, do not burn. Discard the circuit card as instructed by local regulations. (*C014*)

Caution

When the Modular Refrigeration Unit (MRU) is removed, immediately remove any oil residue from the MRU support shelf, floor, and any other area to prevent injuries because of slips or falls. Do not use refrigerant lines or connectors to lift, move, or remove the MRU. Use handholds as instructed by service procedures. (*C016*)

Caution

Do not connect an IBM control unit directly to a public optical network. The customer must use an extra connectivity device between an IBM control unit optical adapter (that is, fibre, ESCON, FICON®) and an external public network. Use a device such as a patch panel, a router, or a switch. You do not need an extra connectivity device for optical fibre connectivity that does not pass through a public network.

Possible safety hazards

Possible safety hazards to the operation of this product are:

Electrical

An electrically charged frame can cause serious electrical shock.

Mechanical

Hazards (for example, a safety cover missing) are potentially harmful to people.

Chemical

Do not use solvents, cleaners, or other chemicals that are not approved for use on this product.

Before the library is used, repair any of the preceding problems.

Laser safety and compliance

Table 1. Class I Laser Product

The library might contain a laser assembly that complies with the performance standards set by the US 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, complete 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 that it matches the voltage at your outlet.

Rack safety

The following general safety information must 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 because of 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 workspace. Do not place any object on top of rack-mounted devices.
- Each rack cabinet might have more than 1 power cord. Be sure to disconnect all power cords in the rack cabinet before you service any device in the rack cabinet.
- Connect all devices that are installed in a rack cabinet to power devices installed in the same rack cabinet. Do not plug a power cord from a device that is installed in one rack cabinet into a power device that is installed in a different rack cabinet.
- An electrical outlet that is not correctly wired might 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 might 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, front, or back of a unit that is used for air flow through the unit.
- Consideration must 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 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 1 drawer at a time. The rack might become unstable if you pull out more than one drawer at a time.
- (For fixed drawers) This drawer is a fixed drawer and must not be moved for servicing unless specified by the manufacturer. Attempting to move the drawer partially or out of the rack might 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 steps.
  - 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 that are 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 760 x 2032 mm (30 x 80 in.).
- Ensure that all devices, shelves, drawers, doors, and cables are secure.
- Ensure that the 4 leveling pads are raised to their highest position.
- Ensure that no stabilizer bracket is installed on the rack cabinet during movement.
- Do not use a ramp that is inclined at more than 10 degrees.
- When the rack cabinet is in the new location:
  - Lower the 4 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 the pallet and bolt the rack cabinet to the pallet.

(R002)

Power cords

For your safety, IBM provides a power cord with a grounded attachment plug to use with this IBM product. To avoid electrical shock, always use the power cord and plug with a properly grounded outlet.

For your safety, IBM provides a power cord with a grounded attachment plug to use with this IBM product. To avoid electrical shock, always use the power cord and plug with a properly grounded outlet.

IBM power cords that are used in the United States and Canada are listed by Underwriter's Laboratories (UL) and certified by the Canadian Standards Association (CSA).

For units intended to be operated at 115 volts: Use a UL-listed and CSA-certified cord set consisting of a minimum 18 AWG, Type SVT or SJT, three-conductor cord, a maximum of 15 feet in length and a parallel blade, grounding-type attachment plug rated 15 amperes, 125 volts.

For units intended to be operated at 230 volts (US use): Use a UL-listed and CSA-certified cord set consisting of a minimum 18 AWG, Type SVT or SJT, three-conductor cord, a maximum of 15 feet in length and a tandem blade, grounding-type attachment plug rated 15 amperes, 250 volts.

For units intended to be operated at 230 volts (outside the US): Use a cord set with a grounding-type attachment plug. The cord set must have the appropriate safety approvals for the country in which the equipment are installed.

IBM power cords for a specific country or region are available only in that country or region.

Cautions and regulatory compliance statements for NEBS

This library is NEBS certified. This section includes the cautions and regulatory compliance statements for the Network Equipment-Building System (NEBS) certification from the Telcordia Electromagnetic Compatibility and Electrical Safety - Generic Criteria for Network Telecommunications Equipment (A Module of LSSGR, FR-64; TSGR, FR-440; and NEBSFR, FR-2063) Telcordia Technologies Generic Requirements, GR-1089-CORE, Issue 4, June 2006.

Table 2. NEBS Compliance Statements

 **CAUTION:** **To comply with the Telcordia GR-1089-CORE standard for electromagnetic compatibility and safety, for Ethernet RJ-45 ports, use only shielded Ethernet cables that are grounded on both ends. In a NEBS installation, all Ethernet ports are limited to intra-building wiring.**
 **CAUTION:** **The intra-building ports of the equipment or subassembly are only suitable for connection to intra-building or unexposed wiring or cabling. The intra-building ports of the equipment or subassembly must NOT be metallically connected to interfaces that connect to the OSP or its wiring. These interfaces are designed for use only as intra-building interfaces (Type 2 or Type 4 ports as described in GR-1089-CORE, Issue 4), and require isolation from the exposed OSP cabling. The addition of primary protectors is not sufficient protection in order to connect these interfaces metallically to OSP wiring.**
An external Surge Protective Device (SPD) is not required for operating this library.

Table 2. NEBS Compliance Statements (continued)

This product can be installed in a network telecommunication facility or location where the NEC applies.

Preface

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

Related Publications

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

- *IBM TS2900 Tape Autoloader Installation Quick Reference* (GA76-0423) provides hardware installation instructions.
- *IBM TS2900 Tape Autoloader SCSI Reference* (GC27-2211) provides information about the SCSI commands that are supported by this library.
- *IBM Tape Device Driver Installation and User's Guide* (GA32-2130) 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 adapters, 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* (GA32-0566) 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 LTO Ultrium Tape Drive SCSI Reference* (GA32-0450) provides SCSI supported commands and protocol that governs the behavior of the SCSI interface.
- IBM Tivoli® Key Lifecycle Manager V1.0 (English) publications can be downloaded from the following website: http://www.ibm.com/software/tivoli/library.
  - *IBM Tivoli Key Lifecycle Manager Quick Start Guide* (GI11-8738)
  - *IBM Tivoli Key Lifecycle Manager Installation and Configuration Guide* (SC23-9977)
- *IBM Security Key Lifecycle Manager Knowledge Center*, located at http://www-01.ibm.com/support/knowledgecenter/SSWPVP/welcome?lang=en, contains information to help you install, configure, and use the IBM Security Key Lifecycle Manager.
- The IBM Publications Center: http://www.ibm.com/shop/publications/order.

  The Publications Center is a worldwide central repository for IBM product publications and marketing material with a catalog of 70,000 items. Extensive search facilities are provided. Payment options for orders are by way of credit card (in the US) or customer number for 20 countries. Many publications are available online in various file formats, and they can all be downloaded by all countries, free of charge.

Product description

Figure 1. TS2900 Tape Autoloader

The IBM 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 with a removable magazine. It is equipped with a SAS (Serial Attached SCSI) host adapter attachment that has a data transfer rate of up to 6.0 Gbps (S5H and S4H) or 3.0 Gbps (S4H and S3H). The TS2900 Tape Autoloader is an external stand-alone or rack-mountable unit that incorporates:

- IBMUltrium 8 Half Height Tape Drive (Model S8H)
- IBMUltrium 7 Half Height Tape Drive (Model S7H)
- IBMUltrium 6 Half Height Tape Drive (Model S6H)
- IBMUltrium 5 Half Height Tape Drive (Model S5H)
- IBMUltrium 4 Half Height Tape Drive (Model S4H)
- IBM Ultrium 3 Half Height Tape Drive (Model S3H)

Note: The Ultrium 4 Half Height tape drive in S4H libraries that are manufactured after March 2011 support 6.0 Gb/s.

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. The library data storage capacity can be further increased by using hardware compression.

See Table 3 for more information on supported tape cartridges in the TS2900 Tape Autoloader. WORM for Ultrium 3 and later is also supported.

Table 3. Data capacity and recording format

Type	Native Data Capacity	Recording Format
Ultrium 8	12 TB (30 TB at 2.5:1 compression)	Reads and writes data on 6656 tracks, 32 tracks at a time.
Ultrium M8	9 TB (22.5 TB at 2.5:1 compression)[1]	Reads and writes data on 3584 tracks, 32 tracks at a time.
Ultrium 7	6 TB (15 TB at 2.5:1 compression)	Reads and writes data on 3584 tracks, 32 tracks at a time.
Ultrium 6	2.5 TB (6.25 TB at 2.5:1 compression)	Reads and writes data on 2176 tracks, 16 tracks at a time.
Ultrium 5	1.5 TB (3 TB at 2:1 compression)	Reads and writes data on 1280 tracks, 16 tracks at a time.
Ultrium 4	800 GB (1.6 TB at 2:1 compression)	Reads and writes data on 896 tracks, 16 tracks at a time.
Ultrium 3	400 GB (800 GB at 2:1 compression)	Reads and writes data on 704 tracks, 16 tracks at a time.
Ultrium 2	200 GB (400 GB at 2:1 compression)	Reads and writes data on 512 tracks, 8 tracks at a time.
Ultrium 1	100 GB (200 GB at 2:1 compression)	Reads and writes data on 384 tracks, 8 tracks at a time.
[1]Library Firmware must be at 0080 or greater to support the LTO M8 media feature. Drive firmware must be at HB82 or greater to support the LTO M8 media feature. Ensure that any IBM device drivers are at the minimum level that is required to support the library.		

Front panel

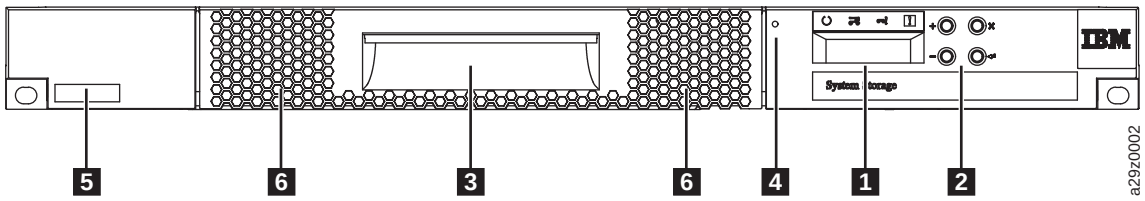


Figure 2. Front panel components

Table 4. Front panel component descriptions

Number	Component	Description
1	Operator Panel	The Operator Panel features a monochrome 16-character LCD graphic display that is on the front of the library. Library operations and service functions are completed from this screen. The Web User Interface offers some of the same functionality as the Operator Panel with a web browser for remote access to the library. For information about the Operator Panel and the Web User Interface, see "User interfaces" on page 13.
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 3 on page 4. 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 "Installation and configuration" on page 21.
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 the cartridge magazine slides past the I/O station lock.
5	Serial number label	The machine type and serial number of the library are 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

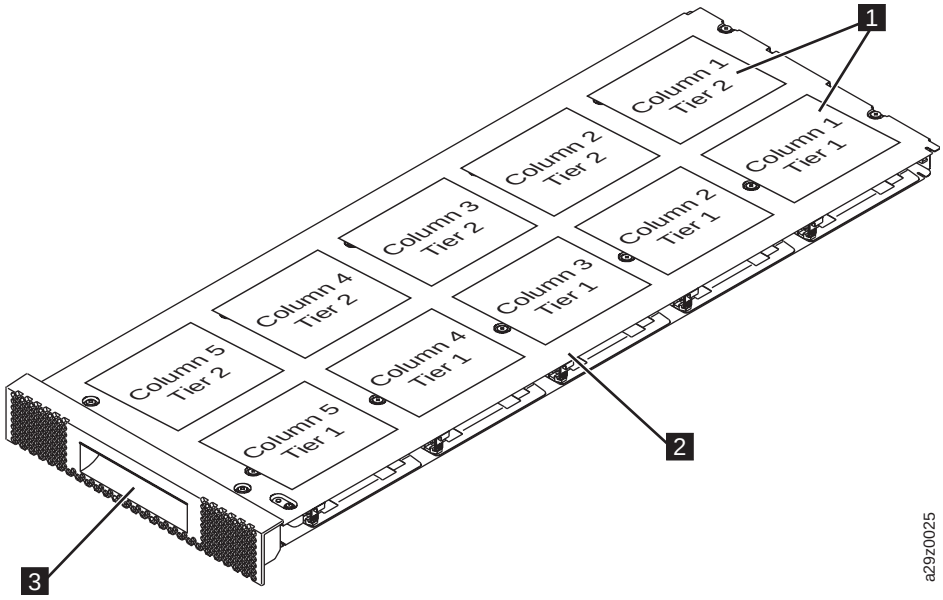


Figure 3. Cartridge Magazine

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

2 Cartridge magazine

3 Magazine handle

Figure 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 the magazine is opened or withdrawn, to the end of the magazine before it clears the front edge of the library. To prevent dropping the magazine, support both ends of the magazine before it clears the front edge of the library.

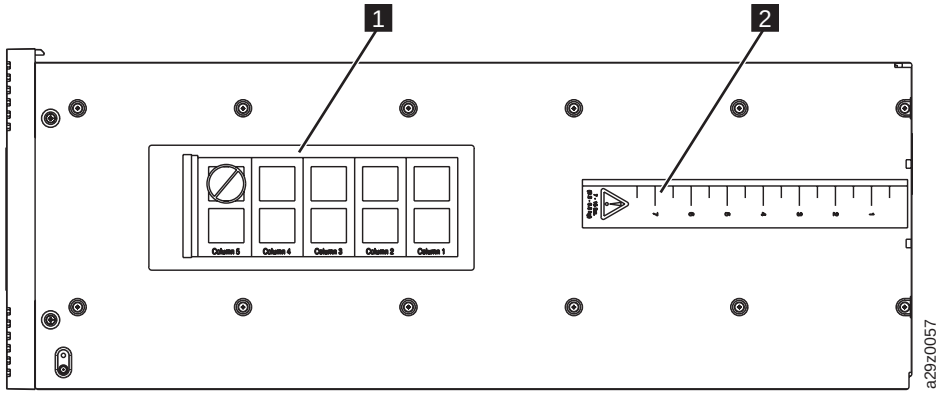


Figure 4. Cartridge magazine (top view)

Rear panel

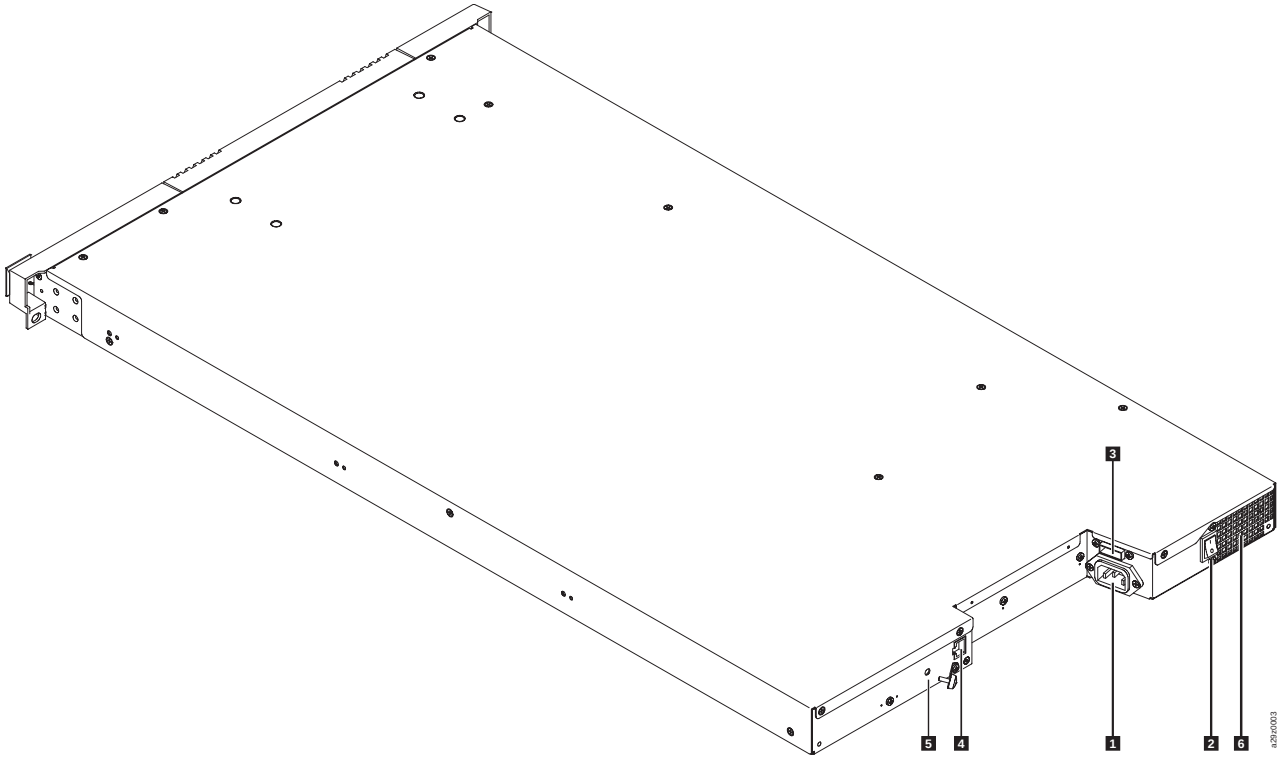


Figure 5. Rear panel components

Table 5. 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, 4, 5, 6, and 7 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.
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 the library is powered ON.
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 a part of the library accessor. The bar code reader reads each cartridge bar code label that identifies the types of cartridge magazines and tape drive that is installed in the library. It also 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 Half Height Tape Drives and later, support the Serial Attached SCSI (SAS) interface. They have one Mini-SAS (SFF-8088) connector, and are connected to a Mini-SAS (SFF-8088) or SAS (SFF-8470) at the host adapter end with the appropriate cable. The SFF-8088 SAS connectors on the Ultrium 3 and Ultrium 4 are compatible with SAS-1 cables. The SFF-8088 SAS connector on the Ultrium 5 tape drives and later, are compatible with SAS-1 or SAS-2 cables.

A drive with a SAS (Serial Attached SCSI) interface is linked directly to controllers. SAS is a performance improvement over traditional SCSI. SAS enables multiple devices (up to 128) of different sizes and types to connect simultaneously with thinner and longer cables. Its full-duplex signal transmission supports 3.0 Gb/s (S3H and S4H) or 6.0 Gb/s for S4H and later. In addition, the TS2900 Tape Autoloader is hot-plugged, if necessary. SAS drives can auto-negotiate speed.

Note: The Ultrium 4 Half Height tape drive in S4H libraries that are manufactured after March 2011 support 6.0 Gb/s.

Encryption

The LTO Ultrium 4 and later Tape Drives support host Application Managed Encryption (AME) and Library Managed Encryption (LME) with T10 encryption methods, for SAS and Fibre Channel drives. Data encryption is only supported by LTO Ultrium 4 Data Cartridges and later. Encryption is also supported by library firmware version 4.0 or later.

Note: Application Managed Encryption (AME) does not require a key. Library Managed Encryption (LME) requires 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. Encryption policy and encryption keys are provided by the host application or host server. A drive digital certificate is installed at manufacturing time. Each drive receives a unique serial number and certificate. The T10 application validates each drive instance by checking the drive's digital certificate.

The LTO Ultrium encryption environment is complex and requires knowledge beyond that of product trained Service Support Representatives (SSRs). The Encryption function on tape drives, whether it's a desktop, a stand-alone drive, or within libraries, is configured and managed by the customer. In some instances, SSRs are required to enable encryption at a hardware level when service access or service password-controlled access is required. Customer setup support is by Field Technical Sales Support (FTSS), customer documentation, and software support for encryption software problems. Customer 'how to' support is also provided by way of support line contract.

Use the encryption-capable library firmware to select **None** or **Application Managed** encryption from the Web User Interface. If you did not previously enter a valid Transparent Encryption license key, you can also select **Library Managed Encryption**. The factory default is **None**.

For more information, see *IBM Encryption Key Manager Installation, Planning, and User's Guide*. See "Related Publications" on page xxv.

Supported Internet Protocols

The TS2900 Tape Autoloader supports the Internet protocols:

- IPv4
- IPv6

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

Simple Network Management Protocol (SNMP) messaging

Occasionally, the library might 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). SNMP can 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. With the information that is 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.

All of the IBM automation products support SNMP (Simple Network Management Protocol) and all of them support SNMP read and walk capability.

The new Configuration capability of SNMP Query provides a common Management Information Base (MIB) across all of the IBM tape libraries. This capability allows a product administrator to audit the settings of all of their IBM tape libraries to ensure that they comply with their own policies.

SNMP traps

SNMP Traps are alerts or status messages that can be collected, monitored, and used to proactively manage attached libraries with SNMP protocol with the SNMP monitoring stations. 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 is monitored. 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, requests to clean the drive, excessive retries, and returning to normal operations.
- **SNMP MIBs** The library's MIB contains units of information that specifically describe an aspect of the system, such as the system name, hardware number, or communications configuration. When with SNMP to monitor your TS2900 Tape Autoloader, make sure that the TS2900 MIB file is loaded on your SNMP monitoring station. SNMP traps are sent to the SNMP monitoring stations that are defined for your library (see “Configuring trap notifications” on page 48). Download the SNMP MIB file for this library from http://www.ibm.com/storage/support.

Network Time Protocol

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 with them to adjust the client's clock.

Ultrium tape drives

The TS2900 Tape Autoloader supports the Ultrium 3 (3572-S3H) and later, half height tape drives.

The Ultrium 3 and later, half height tape drives support the Serial Attached SCSI (SAS) interface. They have one Mini-SAS (SFF-8088) connector.

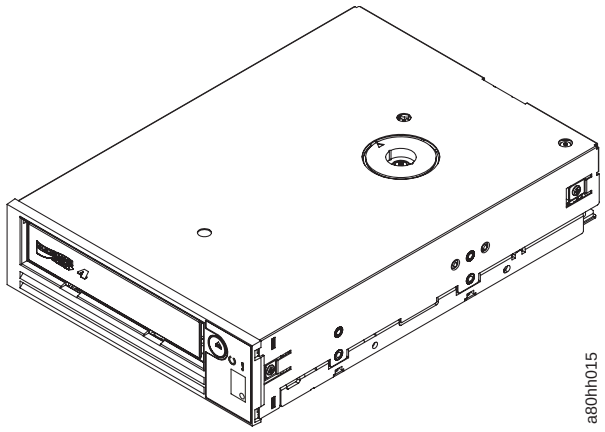


Figure 6. Ultrium half height tape drive

Speed matching

To improve system performance, the Ultrium 3 and later Tape Drives use a technique that is called *speed matching*. Speed Matching dynamically adjusts the native (uncompressed) data rate to the slower data rate of the attached server.

Channel calibration

The channel calibration feature of the Ultrium 3 and later 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 later Tape Drives feature a power management function. This function controls the drive's electronics so that part of the electronics completely turns 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 12 TB native capacity (up to 30 TB with 2.5:1 hardware data compression) for Ultrium 8 tape drives.

For more information on native data capacity, see Table 3 on page 2.

Table 6. Ultrium data cartridge compatibility with Ultrium tape drive

IBM Ultrium Tape Drive	IBM LTO Ultrium Data Cartridges								
	12 TB Ultrium 8	**9 TB LTO M8[1]**	**6 TB Ultrium 7**	**2.5 TB Ultrium 6**	**1.5 TB Ultrium 5**	**800 GB Ultrium 4**	**400 GB Ultrium 3**	**200 GB Ultrium 2**	**100 GB Ultrium 1**
LTO8	Read/ Write	Read/ Write	Read/ Write						
LTO7			Read/ Write	Read/ Write	Read only				
LTO6				Read/ Write	Read/ Write	Read only			
LTO5					Read/ Write	Read/ Write	Read only		
LTO4						Read/ Write	Read/ Write	Read only	
LTO3							Read/ Write	Read/ Write	Read only
LTO2								Read/ Write	Read/ Write
LTO1									Read/ Write

[1]Library Firmware must be at 0080 or greater to support the LTO M8 media feature. Drive firmware must be at HB82 or greater to support the LTO M8 media feature. Ensure that any IBM device drivers are at the minimum level that is required to support the library.

Note: The TS2900 Tape Autoloader supports the Ultrium 3 (3572-S3H) and laterTape Drives only.

For more information about media compatibility, see “Media” on page 107.

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 cannot scan beyond LUN 0 and fails to detect the library. It sees only 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 in Tier 1.

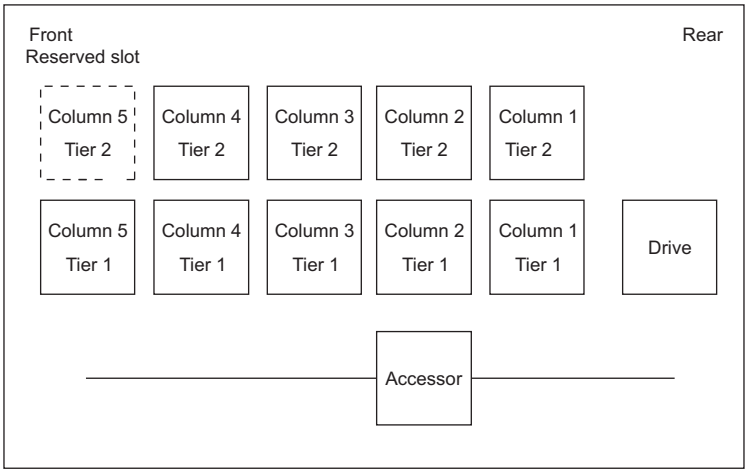


Figure 7. Location coordinates

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 7. 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 8. Electrical specifications

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

For more information about installation specifications, see "Installation and configuration" on page 21.

Table 9. Environmental specifications

Parameter	Operating (see Note)	Storage	Shipping
Temperature	10 - 38 °C (50 - 100 °F)	1 - 60 °C (34 - 140 °F)	-40 to 60 °C (-40 to 140 °F)
Temperature variation	10 °C/hour (maximum)	10 °C/hour (maximum)	10 °C/hour (maximum)
Relative humidity	20 - 80%	10 - 90%	10 - 90%
Wet bulb temperature	26 °C (78.8 °F) maximum	29 °C (84 °F) maximum	29 °C (84 °F) maximum
Altitude (meters)	0 - 2,500	0 - 2,500	0 - 2,500

Table 9. Environmental specifications (continued)

Parameter	Operating (see Note)	Storage	Shipping
Note: The operating environment of the library must not conflict with the media storage requirements. The library can operate at elevated temperatures for an extended period. However, the temperature might 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 are met. It is assumed that media that is stored in the library is approximately 2 degrees above ambient temperature when the library is powered ON.			

Table 10. Operational specifications

Parameter	Model S8H	Model S7H	Model S6H	Model S5H	Model S4H
Maximum storage capacity	108 TB (270 TB with 2.5:1 compression)	54 TB (135 TB with 2.5:1 compression)	22.5 TB (56.2 TB with 2.5:1 compression)	13.5 TB (27 TB with 2:1 compression)	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 8 Half Height	Ultrium 7 Half Height	Ultrium 6 Half Height	Ultrium 5 Half Height	Ultrium 4 Half Height
Sustained native data transfer rate	300 MB/s (750 MB/s with 2.5:1 compression)	300 MB/s (750 MB/s with 2.5:1 compression)	160 MB/s (400 MB/s with 2.5:1 compression)	140 MB/s (280 MB/s with 2:1 compression)	120 MB/s (240 MB/s with 2:1 compression)
Interface	6 Gb/s SAS				3 Gb/s SAS
Note: The Ultrium 4 Half Height tape drive in S4H libraries that are manufactured after March 2011 support 6.0 Gb/s and a sustained native data rate of 120 Gb/s.					

Table 11. 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 can 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 device. To ensure maximum longevity of your library, locate the library away from dust, dirt, and airborne particulates, as follows:

- Keep the library away from high-traffic areas, especially if the floor is carpeted. Carpeting harbors dust and walking on the carpet can cause the carpet fibers and the dust to become airborne.
- Keep the library out of printer and 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, adapters, and software. The supported attachments and software can change throughout the lifecycle of the product.

To determine the latest supported attachments:

1. Visit the web at http://www.ibm.com/storage/lto.
2. Select **Storage Systems** from the **Product Group** menu.
3. Select **Tape Systems** from the **Product Family** menu.
4. Select the appropriate link from the **Product Type** menu. For example, select **Tape autoloaders and libraries** from the **Product Type** menu, then **TS2900 Autoloader** from the **Product** menu to find links to updates.

IBM supports later versions of the browsers if the vendors do not remove or disable functions that the product relies upon. For browser levels later than the versions that are certified with the product, customer support accepts usage-related and defect-related service requests. As with operating system and virtualization environments, if IBM support cannot re-create the issue in the lab, the client might be asked to re-create the problem on a certified browser version to determine whether a product defect exists. Defects are not accepted for cosmetic differences between browsers or browser versions that do not affect the functional behavior of the product. If a problem is identified in the product, defects are accepted. If a problem is identified with the browser, IBM might investigate potential solutions or workarounds that the client can implement until a permanent solution becomes available.

Supported device drivers

Device drivers enable the drive to interact with various servers. To properly install an IBM device drive (if required), refer to the *IBM Tape Device Drivers Installation and User's Guide*. For applications that use other device drivers, see the application's documentation to determine which drivers to use.

IBM maintains the levels of device drivers and driver documentation for the drive on the Internet. You can access this material at the website: http://www.ibm.com/support/fixcentral.

Note: If you do not have Internet access and you need information about device drivers, contact your sales representative.

Note: The device driver for System i® servers is included in the OS/400® operating system.

User interfaces

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

The Operator Panel is 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.

Operator Panel

The Operator Panel is on the front bezel of the library. The Operator Panel displays library information and menu commands that are used to run library management functions in response to the control keys on the right of the LCD display.

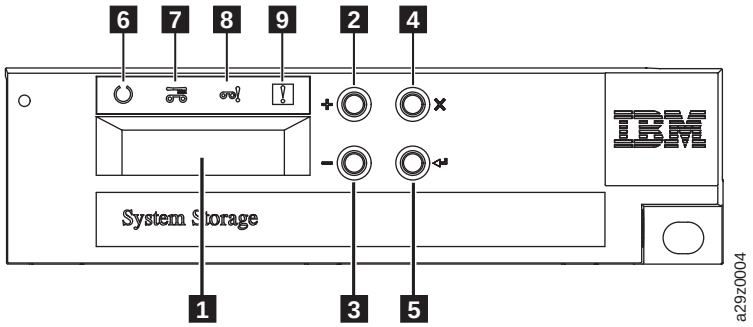


Figure 8. Operator Panel components

Table 12. Operator Panel component descriptions

Number	Component	Description
1	LCD display	16-character LCD graphic display
2	Plus key (+)	Button that is used to navigate upward (↑) through the menu items
3	Minus key (-)	Button that is used to navigate downward (↓) through the menu items
4	Cancel key (X)	Button that is used to cancel a user action and return to the last menu item
5	Enter key	Button that is 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.
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 incompatible with the drive, marginal, or invalid. The LED turns OFF when the media is removed from the drive. The LED might 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 displays on the LCD display.

The Operator Panel operates in two basic modes:

- **User Interaction mode** - Mode that is 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 changes to User Interaction mode. User Interaction mode continues 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 automatically changes to System Driven mode. When this change occurs, the library remembers what the user was doing before the display mode changed.

Any operational conflict between commands that are received over the host interface or the Web User Interface and those commands that are entered by way of 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 does not allow a user to select an impossible request. Those situations 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 that is detected by the library or drive controller and not recoverable through predetermined firmware algorithms is considered unrecoverable. 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 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 2 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 more operational details of LEDs:

- The **Ready/Activity LED** (**6** in Figure 8 on page 13) turns ON any time the unit is powered ON and functional. The Ready/Activity LED flashes whenever there is library. This LED also flashes when the library is offline.
- The **Clean Drive LED** (**7** in Figure 8 on page 13) 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 8 on page 13) turns ON to indicate that a piece of media is bad/marginal, or invalid. The LED turns OFF when all marginal and invalid cartridges are 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 8 on page 13) 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 information, see "Interpreting front panel LEDs" on page 136.

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 **Enter** to select the menu item.
2. With 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 **Enter** to apply the value.

Toggling values

Toggle values are used to switch between two different states like ON and OFF.

1. After you navigate to the menu item, press **Enter** to select the menu item.
2. With the Plus and Minus keys, select one of the various predefined states for that item.
3. Press **Enter** to apply the new state.

Entering numerical values

Numerical values are needed for network addresses, password entries, and other configuration entries.

1. After you navigate 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 or decrement the digit.
   b. Press **Enter** to highlight the next editable digit.
3. Press **Enter** at the last digit to apply the complete entry. Press **Cancel** to cancel the whole edit process and maintain the original value.

Logging in

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

Figure 9. Library ready screen

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

Figure 10. 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**. When you are logged in, you can change the password with the **Change Login Password** command. See "Configuring Operator Panel settings" on page 72.

Screen elements

Figure 11. Screen elements

The Operator Panel displays a single menu item (**1** in Figure 11) on each screen. The existence of other menu items above and below the currently displayed item is indicated by the arrows (**2** in Figure 11) on the right side of the screen.

In the **Configuration** menu, the current configuration setting is indicated by an asterisk (**3** in Figure 11) on the right side of the screen. For example, in Figure 11, the I/O station is enabled. When a configuration setting is changed, the confirmation screen in Figure 12 displays. Press **Enter** to confirm, or **Cancel** to return to the previous screen.

Figure 12. Confirmation screen

Web User Interface

You can use the Web User Interface to update the library and drive firmware, and to download error logs, drive memory dumps, and other library data.

Before the TS2900 Tape Autoloader can be managed over a network with the Web User Interface, set up the initial network configuration of the library with the Operator Panel. For information, see "Configuring network settings" on page 54.

Logging in

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

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

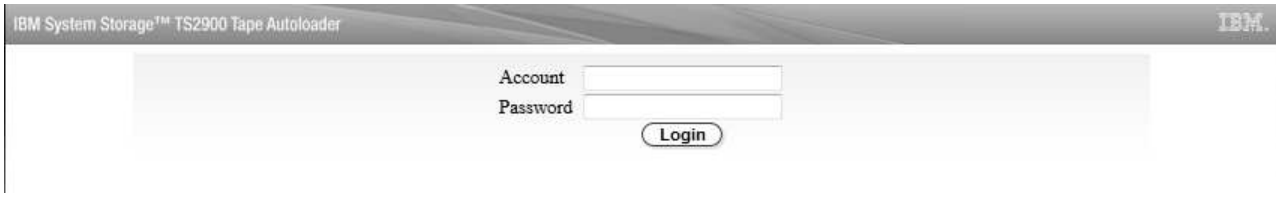


Figure 13. Login page

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 your account name and password are entered, use your mouse to click **Login** or press **Enter**.

For information about account privileges, see "User privileges" on page 20.

Common header elements

All Web User Interface windows (except for the Login screen) contain the following common elements in the header

- **Logoff** - Click to log out of the Web User Interface.
- **Help** - Click to read context-sensitive help for the associated page.

Menus available from the Web User Interface

Figure 14 on page 18 shows the **Web User Interface** window for a User account, Figure 15 on page 19 shows the window for a Superuser account, and Figure 16 on page 20 shows the window for an Administrator account.

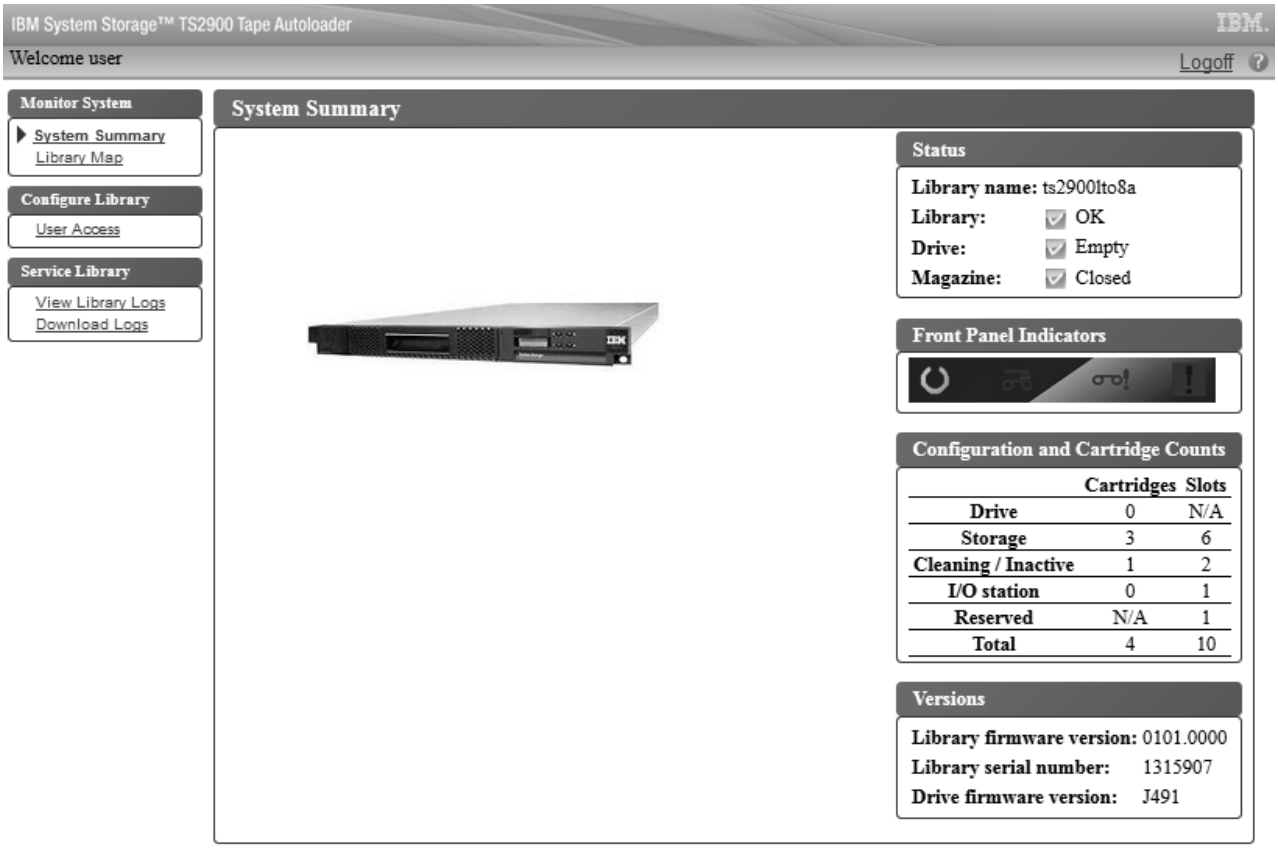


Figure 14. User account window

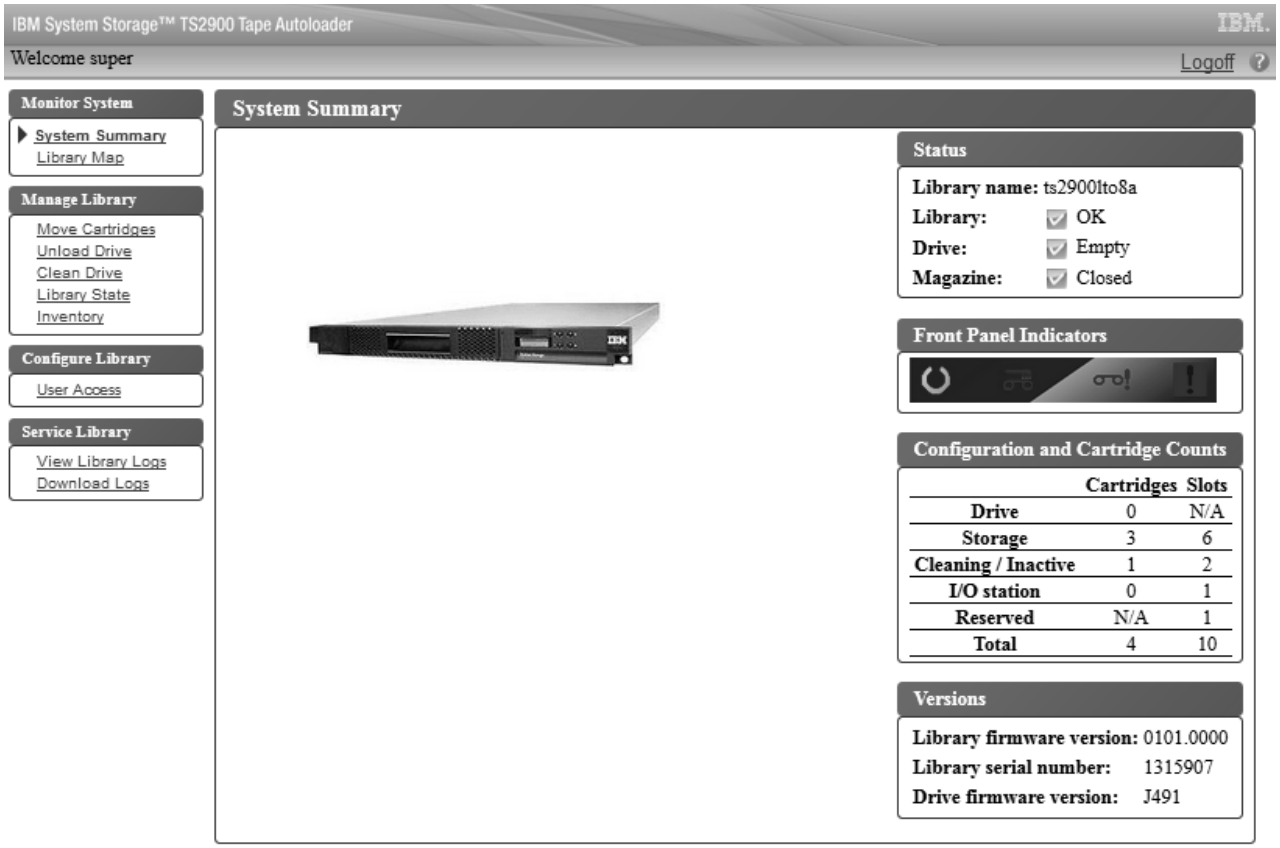


Figure 15. Superuser account window

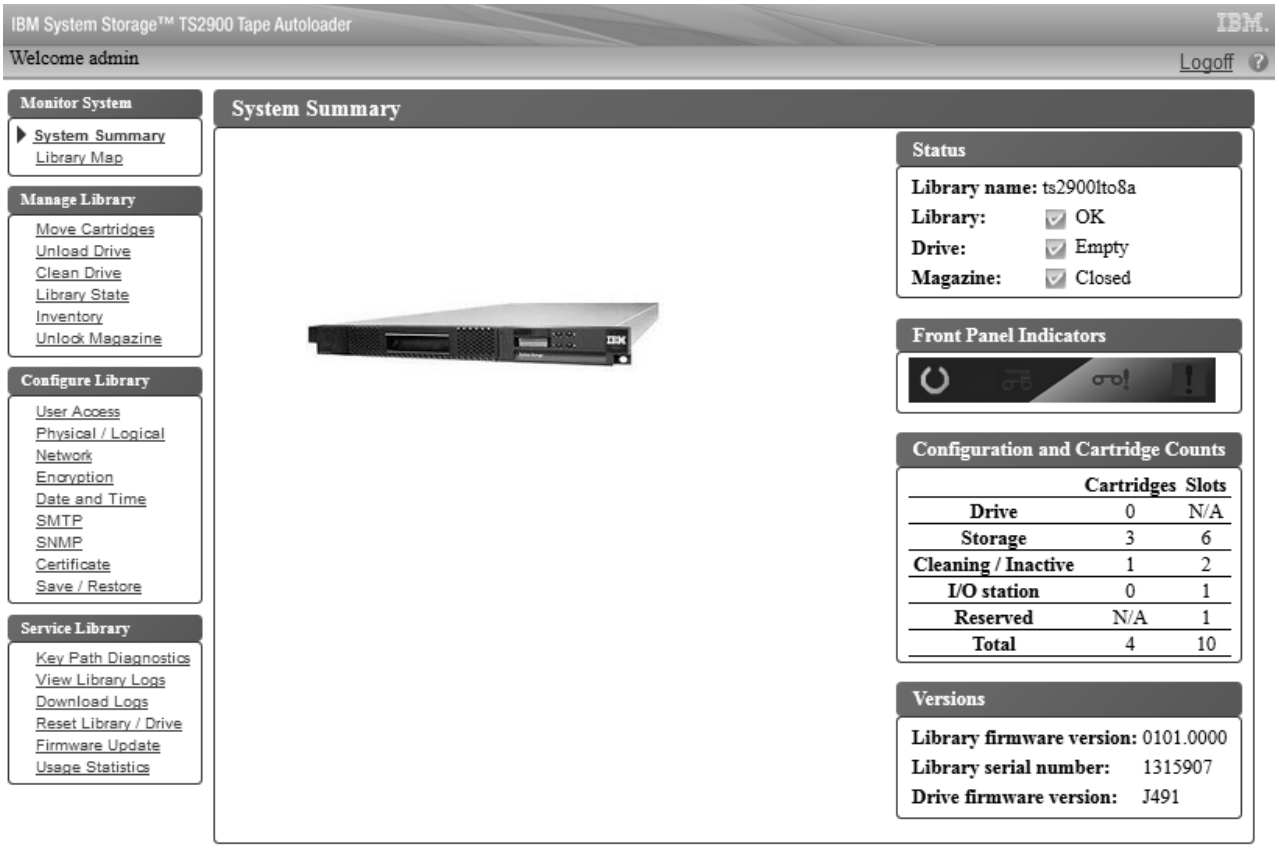


Figure 16. Administrator account window

For a complete description of all **Web User Interface** menu options, see "Operations" on page 61.

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 complete actions that affect the physical library.
- **Superusers** are allowed to operate the physical and logical library, but not complete actions that affect the library configuration.
- **Administrator** users are allowed access to the entire physical library and logical library, including configuration. 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 168.

Installation and configuration

To install and configure a desktop or rack-mounted TS2900 Tape Autoloader, complete these procedures 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 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, call the appropriate number that is listed on the Quality Hotline card.

Choosing a location

Table 13. Location criteria

Criteria	Definition
Room temperature	16 - 32 °C (60 - 90 °F)
Voltage	100 - 240 Vac. (4.0 to 1.5 A) **Note:** The power switch is on the rear of the library and must be easily accessible.
Frequency	50 - 60 Hz
Relative humidity	20 - 80% non-condensing
Air quality	The library must 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

Acclimation

Server and storage equipment (racks and frames) must be gradually acclimated to the surrounding environment to prevent condensation.

When server and storage equipment (racks and frames) is shipped in a climate where the outside temperature is below the dew point of the destination (indoor location), there is a possibility that water condensation can form on the cooler inside and outside surfaces of the equipment when the equipment is brought indoors.

Sufficient time must be allowed for the shipped equipment to gradually reach thermal equilibrium with the indoor environment before you remove the shipping bag and energize the equipment. Follow these guidelines to properly acclimate your equipment:
- Leave the system in the shipping bag. If the installation or staging environment allows it, leave the product in the full package to minimize condensation on or within the equipment.

- Allow the packaged product to acclimate for 24 hours.[1] If there are visible signs of condensation (either external or internal to the product) after 24 hours, acclimate the system without the shipping bag for an additional 12 - 24 hours or until no visible condensation remains.
- Acclimate the product away from perforated tiles or other direct sources of forced air convection to minimize excessive condensation on or within the equipment.

[1] Unless otherwise stated by product-specific installation instructions.

Note: Condensation is a normal occurrence, especially when you ship equipment in cold-weather climates. All IBM® products are tested and verified to withstand condensation that is produced under these circumstances. When sufficient time is provided to allow the hardware to gradually acclimate to the indoor environment, there should be no issues with long-term reliability of the product.

Installing the Deskside Cover

A deskside cover and six desktop 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 26.

Table 14 lists the parts in the deskside assembly kit. A Phillips head screwdriver (preferably with a magnetic head) is needed to assemble the deskside kit.

Table 14. Deskside Assembly Kit

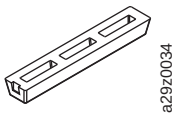
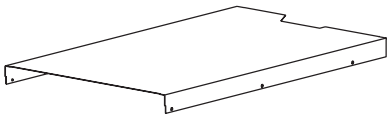
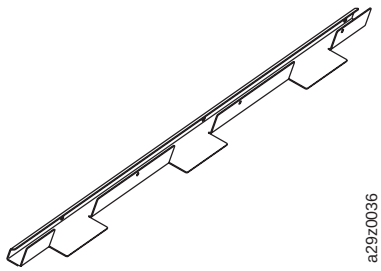
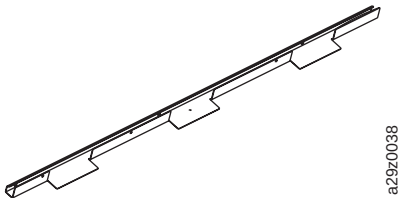
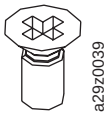
Number	Part Number	Quantity	Description	Part
1	45E3240	6	1U desktop foot	 a29z0034
2	45E3798	1	Deskside cover	 a29z0035
3	45E3799	1	Bracket, 1U library right rail	 a29z0036
4	45E3749	2	Screw, cross-recessed binding head, M4x4 (for securing the rear of the cover to the library)	 a29z0037

Table 14. Deskside Assembly Kit (continued)

Number	Part Number	Quantity	Description	Part
5	45E3801	1	Bracket, 1U library left rail	
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)	

To install the deskside cover on your library:

1. Verify that your deskside kit includes all the necessary contents. See Table 14 on page 23.
2. Attach the left 5 and right 3 rails to the chassis with 3 flat-head screws 6 on each side (Figure 17).

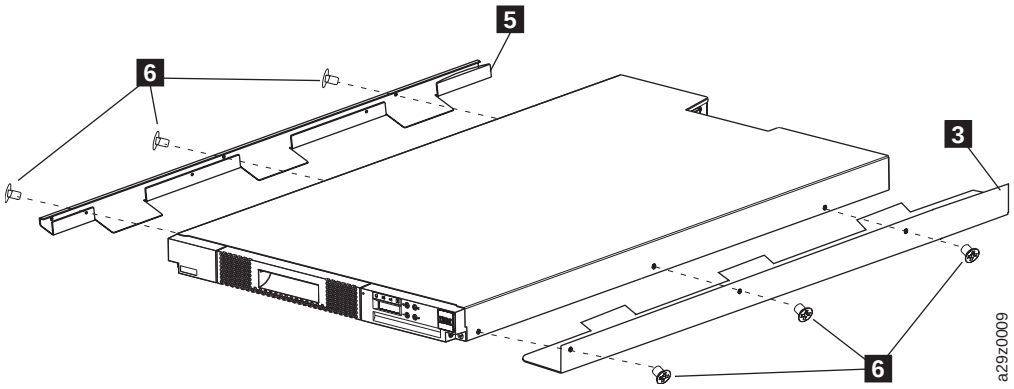


Figure 17. Attaching side rails to the library chassis

3. Turn the library over and attach the desktop feet 1 to the designated locations on the bottom of the library (Figure 18 on page 25). Return the library to the upright position.

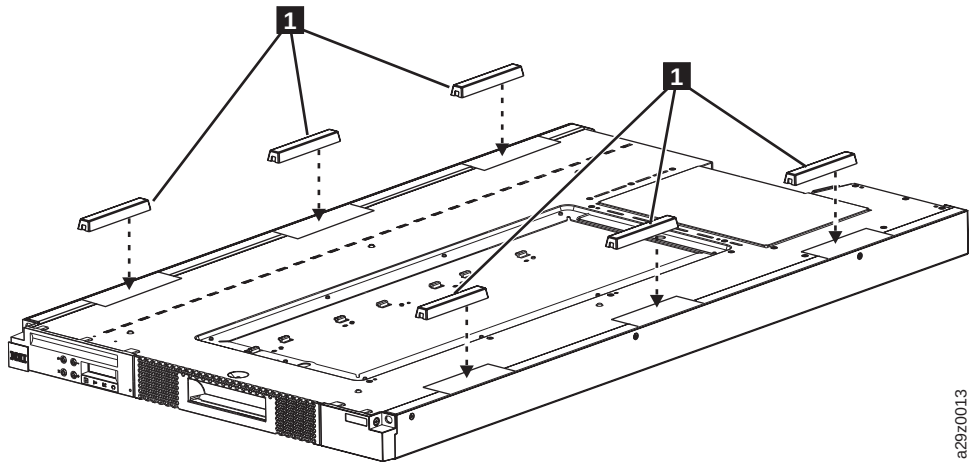


Figure 18. Attaching the desktop feet

4. Position the deskside cover **2** in the correct orientation over the library chassis and attach the cover to the library with 3 flat-head screws **6** on each side (Figure 19).

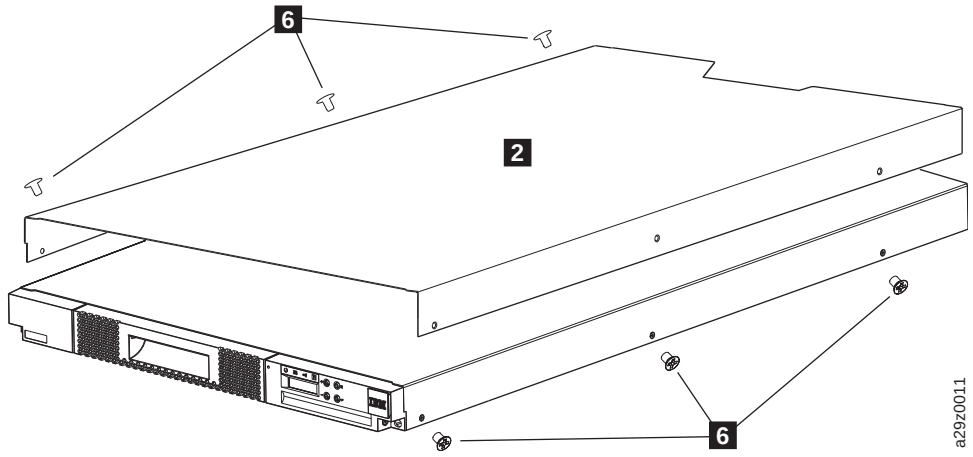


Figure 19. Attaching the cover to the library chassis (side screws)

5. Attach the deskside cover with the 2 large binding-head screws **4** on the rear of the library (Figure 20 on page 26).

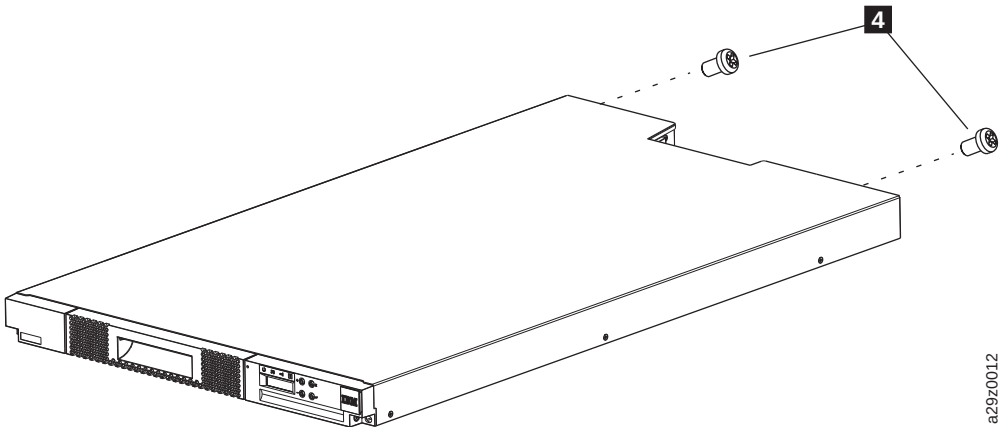


Figure 20. Attaching the cover to the library chassis (rear screws)

6. Place the library in the wanted 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 that are called EIA units as defined by the Electronics Industries Association. Each EIA unit contains three square or round holes that are 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 15 lists the parts in the rack mount assembly kit. A Phillips head screwdriver (preferably with a magnetic head) is needed to assemble the rack mount kit.

Table 15. Rack mount assembly kit

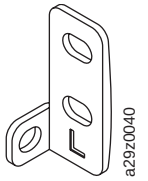
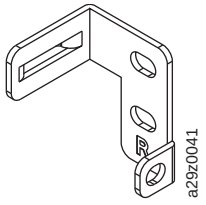
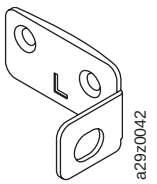
Number	Part Number	Quantity	Description	Part
1	45E3741	1	Left rear bracket	
2	45E3742	1	Right rear bracket	
3	45E3743	1	Left front bracket	

Table 15. Rack mount assembly kit (continued)

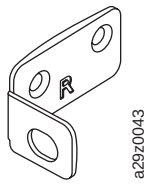
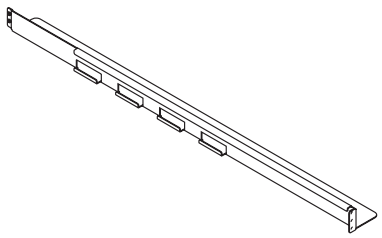
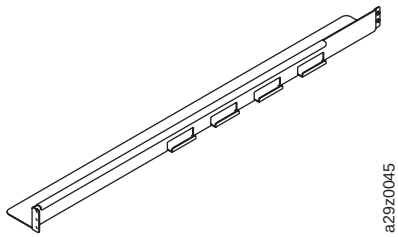
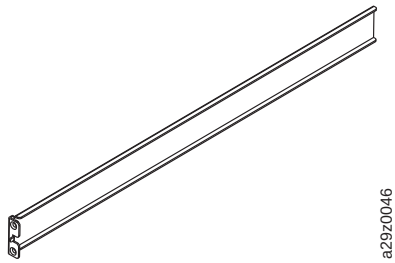
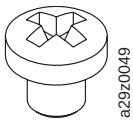
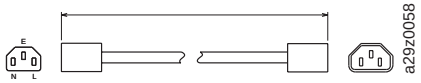
Number	Part Number	Quantity	Description	Part
4	45E3744	1	Right front bracket	 a29z0043
5	45E3745	1	Left front rail	 a29z0044
6	45E3746	1	Right front rail	 a29z0045
7	45E3747	2	Rear rail	 a29z0046
8	45E5909	4	Screw, cross-recessed flat head, M3x4	 a29z0047
9	45E3748	8	Screw, flat head, self lockable, M6x10	 a29z0048
10	45E3749	6	Screw, cross-recessed binding head	 a29z0049

Table 15. 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 power cord	 a29z0058

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

Note: Before you begin the rack installation of the library, read the safety information in "Rack safety" on page xix. Also, verify that no desktop feet are attached to the bottom of the library.

To install the library in a rack:

1. Verify that your rack kit includes all the necessary contents. See Table 15 on page 26.
2. Determine the location in your rack for your library to be installed. With a pencil, mark the location on the front vertical rails (Figure 21 on page 29) and rear vertical rails (Figure 22 on page 29) in your rack.

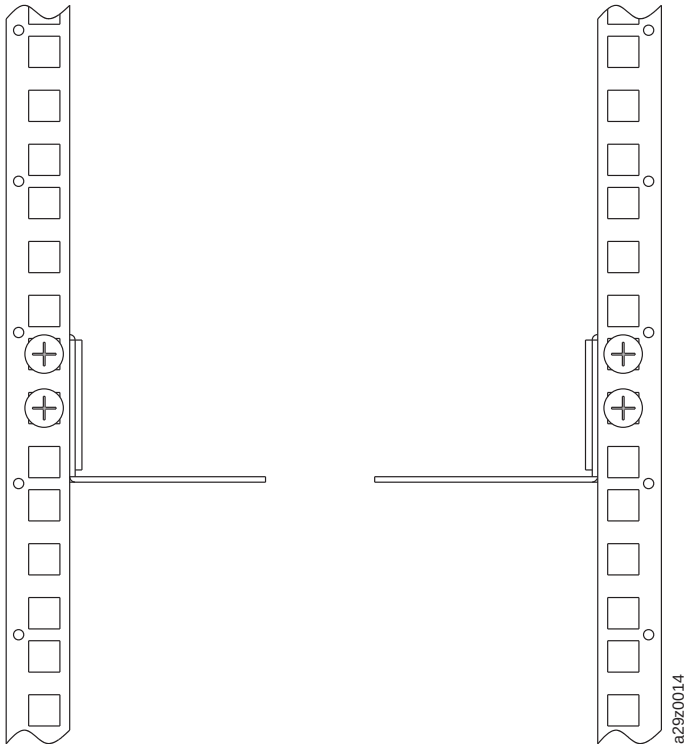


Figure 21. Rack mount screw locations for front vertical rails

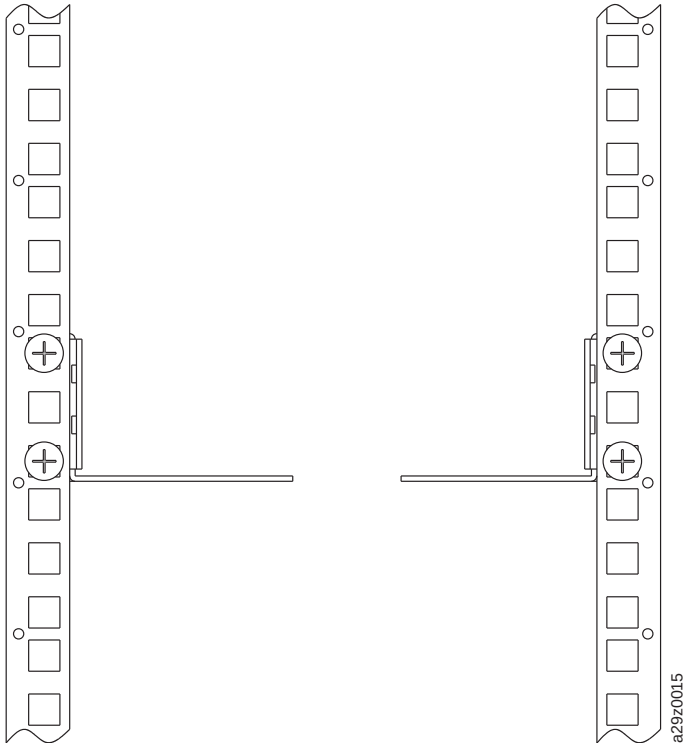


Figure 22. Rack mount screw locations for rear vertical rails

3. Attach the left **3** and right **4** (Figure 23) front brackets to the front of the library chassis with 2 flat-head screws **8** on each side. Use the bottom two screw holes on each side.

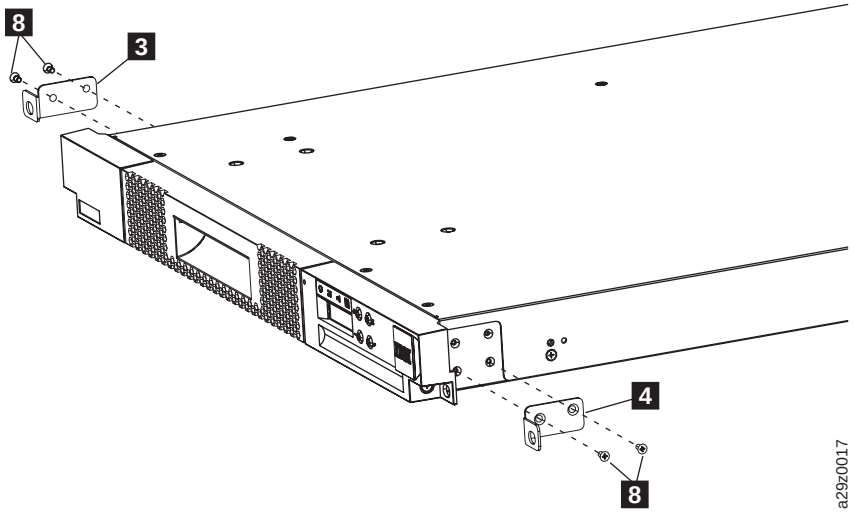


Figure 23. Attaching the front brackets to the library chassis

4. Attach the left **1** and right **2** rear brackets to the left **5** and right **6** front rails with 2 round-head screws **10** on each side (Figure 24).

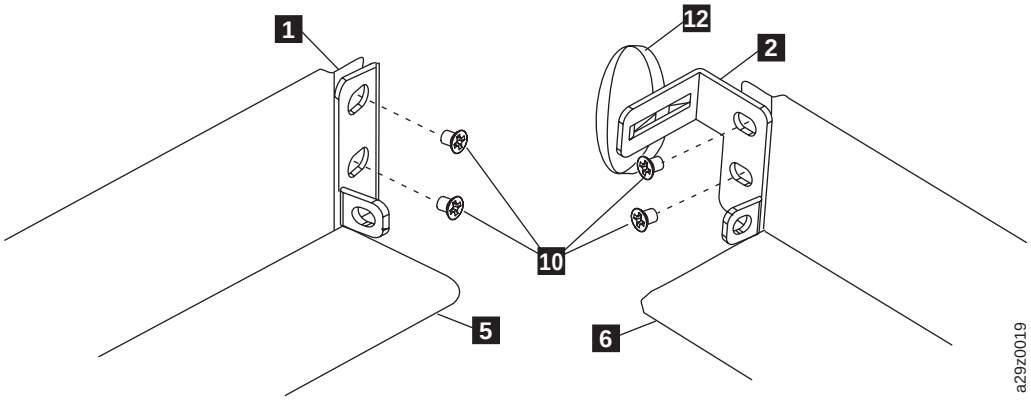


Figure 24. Attaching the rear brackets to the rails

Important: Do NOT tighten these screws completely.

5. Slide in the rear rails **7** from back to front, to create the rail assemblies. Ensure that the screw holes face outwards (Figure 25 on page 31).

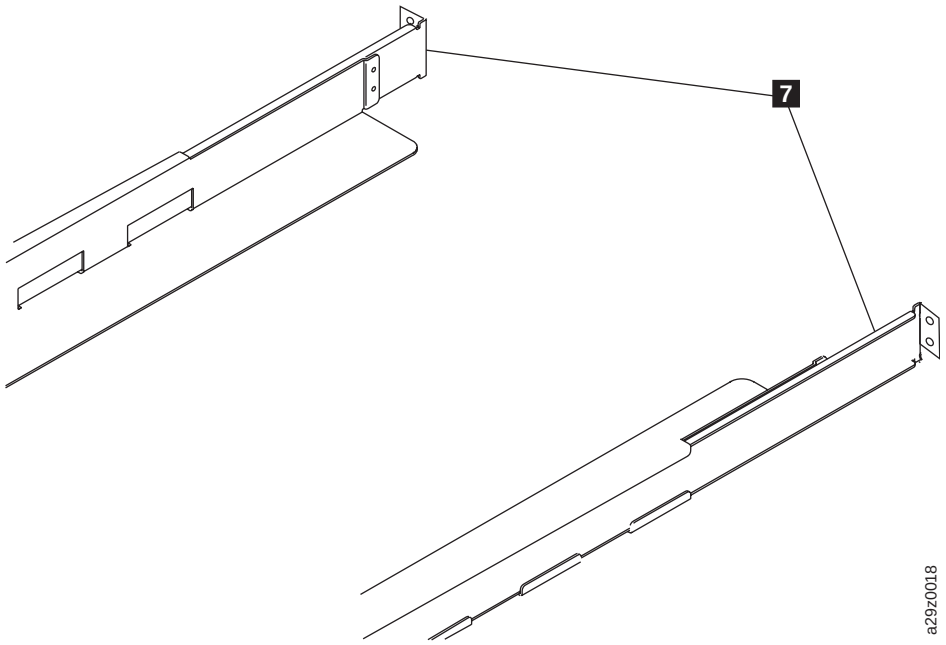


Figure 25. Creating the rail assemblies

6. Install the rail assemblies into the rack (Figure 26 on page 32). Ensure the 3 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 with 4 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 22 on page 29). Use the top and middle screw locations on the front of the rack rail (Figure 21 on page 29).

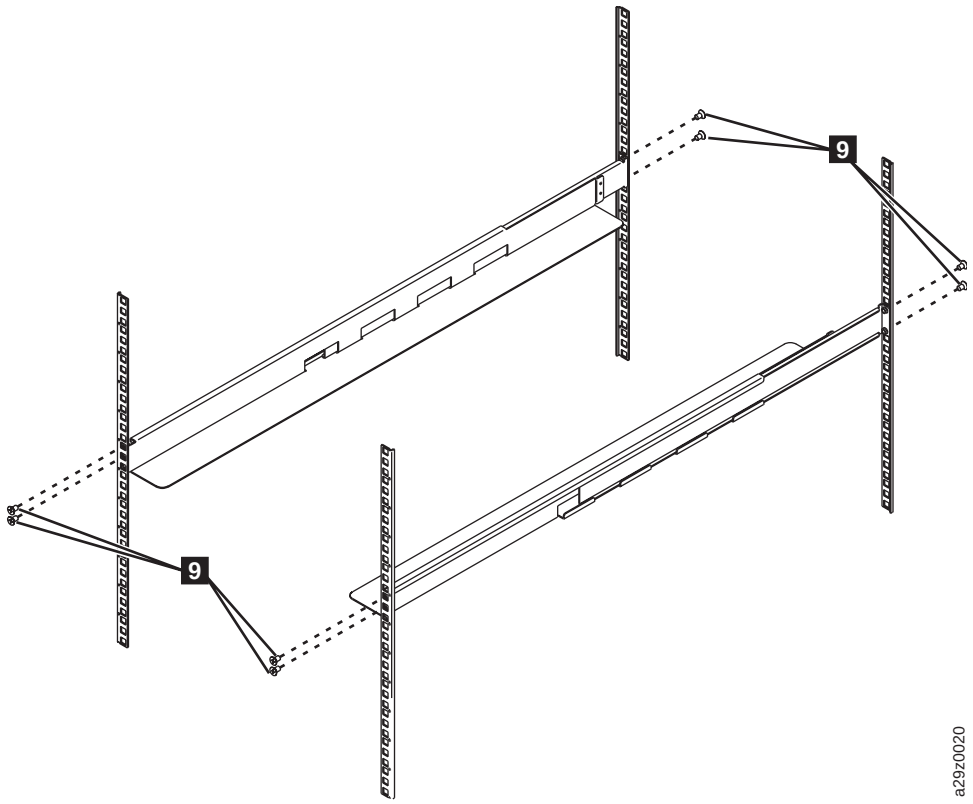


Figure 26. Installing the rail assemblies

7. Slide the library chassis into the rack. Secure the front of the library to the rack with the large black screws **11** in the bottom holes on each front bracket (Figure 27).

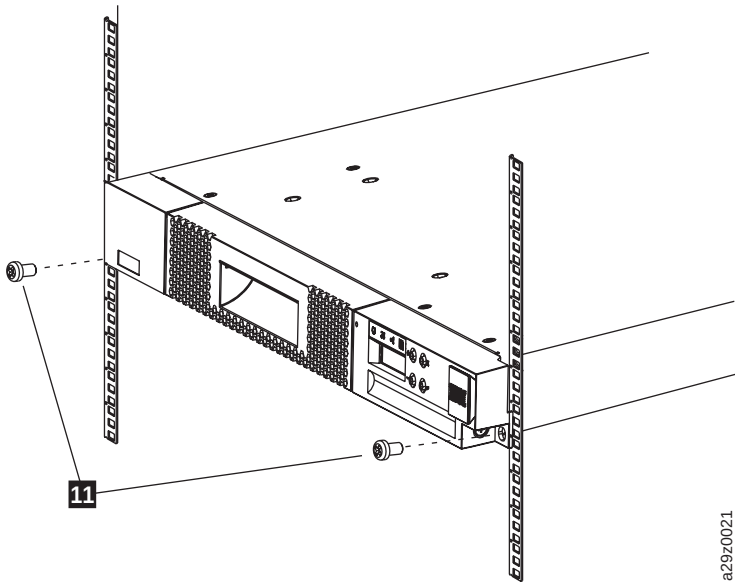


Figure 27. Securing the front of the library in the rack

8. Secure the rear of the library to the rack with a round-head screw **10** on each rear bracket (Figure 28 on page 33). Tighten the other rear bracket screws to secure the library to the rack.

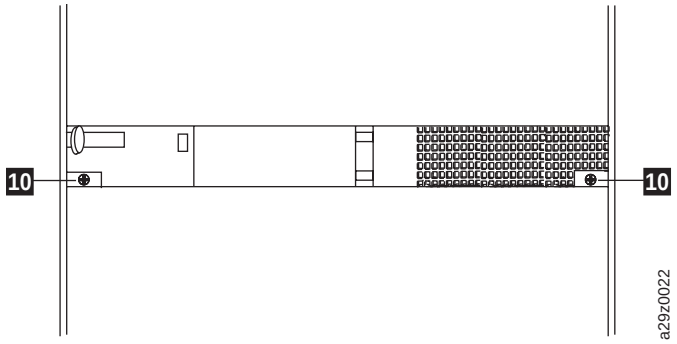


Figure 28. Securing the rear of the library in the rack

9. Run the SAS cable, power cable, and Ethernet cable through the hook-and-loop fastener strap **12** . Leave enough slack to reach the corresponding connectors, then tighten the strap (Figure 29).

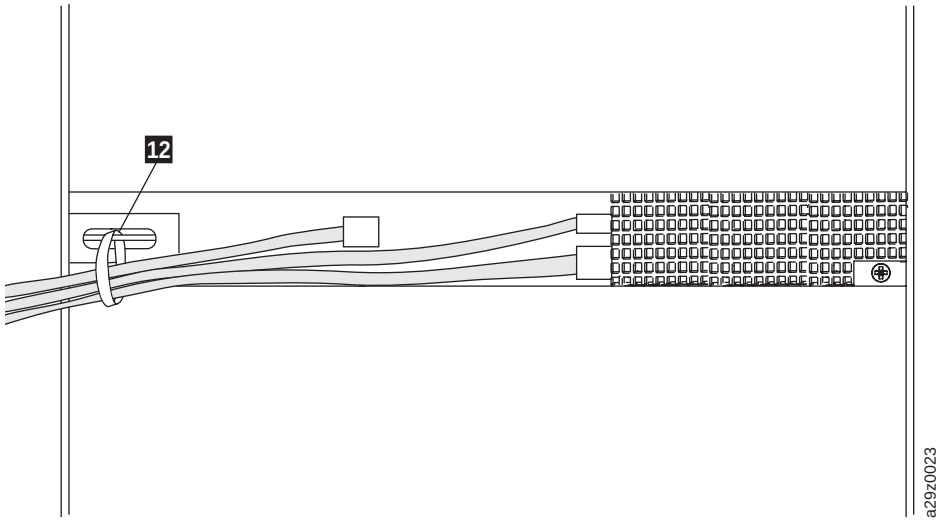


Figure 29. The cables at the rear of the library

Note: For information about converting and relocating the library, see "Removal and replacement procedures" on page 141.

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.

Remove the accessor locking screw, located on the rear panel of the library (**1** in Figure 30 on page 34).

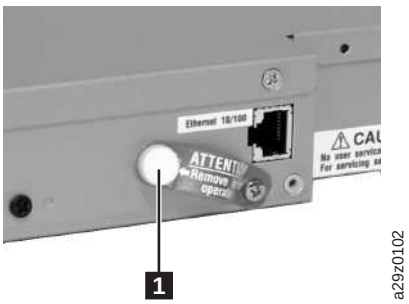


Figure 30. accessor locking screw

Attaching the library to a server

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

Connecting the Host Interface cables

To connect the host interface cable to the library:

Note: It is recommended that you shut down and turn OFF the associated server before you connect the SAS interface cable. Turn ON the associated server after the SAS interface cable is connected to the library and server, the library is powered ON, and the library completed the initialization.

Figure 31. Interface cable connection

1. Attach an ethernet cable to the ethernet port (**1** in Figure 31)

   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 31 on page 34). See "SAS host interface" on page 6 for information about the type of SAS connector that is required for attachment to the drive.

   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 modifies your server or PC network settings to match the library default settings. You can also use the library Operator Panel to change the library network settings to match the server or PC network settings before you use 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 might 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 be entered with the Operator Panel before the Web User Interface is used to access the library.

Connecting the power cord

Note: This product can ONLY be used with an approved power cord for your specific geographic region. Use of an unapproved power cord might result in

- Not meeting individual country-specific safety requirements
- Overheating with potential personal injury or property damage
- A fracture that results in internal contacts that are exposed, which might subject the user to a shock hazard

To connect a power cord:

1. Plug one end of the power cord or rack PDU power cord into the power connector (**3** in Figure 31 on page 34) on the rear panel of the library.

   Note: On rack mount installations, run the rack PDU power cord through the hook-and-loop fastener strap on the right rear bracket, and tighten the strap. The rack PDU power 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 power 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.

   During initialization, the library completes a Power ON Self Test (POST) to ensure that the library hardware is functional. The library also tests communications with the tape drive over the internal bus.

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. Ensure that the power supply switch is in the ON position. If the Operator Panel still does not initialize, see "Troubleshooting" on page 129.

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 the library is power-cycled, wait 10 seconds after the power is OFF before the library is powered ON again.

Configuring the library

The library can be configured with the Web User Interface or the Operator Panel. The preferred method for configuring your library is by using the Web User Interface. See “Configuring your library with the Operator Panel” on page 54 and “Configuring your library with the Web User Interface” on page 37.

For complete detailed information about all of the functions available on the library with the Operator Panel and the Web User Interface, see “Operations” on page 61.

The default library configuration settings are listed in Table 16.

Table 16. 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 and LATER ONLY)	
Encryption method	None
Encryption policy	Encrypt All
SSL security	Disabled
Primary EKM server address	0.0.0.0

Table 16. Default library configuration settings (continued)

Configuration Item	Default Setting
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
Advanced encryption settings	(None)
DATE and TIME	
NTP server	Disabled
NTP server address	0.0.0.0
Time zone (GMT)	+00:00
Date (MM/DD/YYYY)	01/08/2008
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 with the Operator Panel before the library can be accessed remotely with the Web User Interface. If your system is serviced by a Dynamic Host Configuration Protocol (DHCP) server, the network parameters are automatically set. Once remote access is 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 with the Operator Panel" on page 54.

Configuring your library with the Web User Interface

If you choose to use the Web User Interface to configure your library, first enter your library network settings with the Operator Panel (see "Configuring network settings" on page 71).

To configure your library with the Web User Interface:

1. "Logging in to the Web User Interface" on page 38
2. "Checking firmware level" on page 38
3. "Configuring library settings" on page 39
4. "Configuring network settings" on page 41
5. "Configuring date and time settings" on page 42
6. "Configuring encryption settings" on page 44
7. "Configuring email notifications" on page 47
8. "Configuring trap notifications" on page 48
9. "Managing user access" on page 50

10. "Saving the library configuration" on page 53

Logging in to the Web User Interface

To log in to the Web User Interface:

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. 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 start the Web User Interface applet in the browser window. For example, `http://192.168.1.1`
4. On the Web User Interface login screen, enter the administrator login account name and default password.
   - Account: **admin**
   - Password: **secure**

Figure 32. Web User Interface login screen

5. Click **Login**.

Checking firmware level

To determine the latest supported firmware level:

1. Visit the web at http://www.ibm.com/support/fixcentral.
2. Select **Storage Systems** from the **Product Group** menu.
3. Select **Tape Systems** from the **Product Family** menu.
4. Select the appropriate link from the **Product Type** menu. For example, select **Tape autoloaders and libraries** from the **Product Type** menu, then **TS2900 Autoloader** from the **Product** menu to find links to updates.

Check the current level of library firmware that is displayed in the **Versions** box of the **System Summary** page. 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 104.

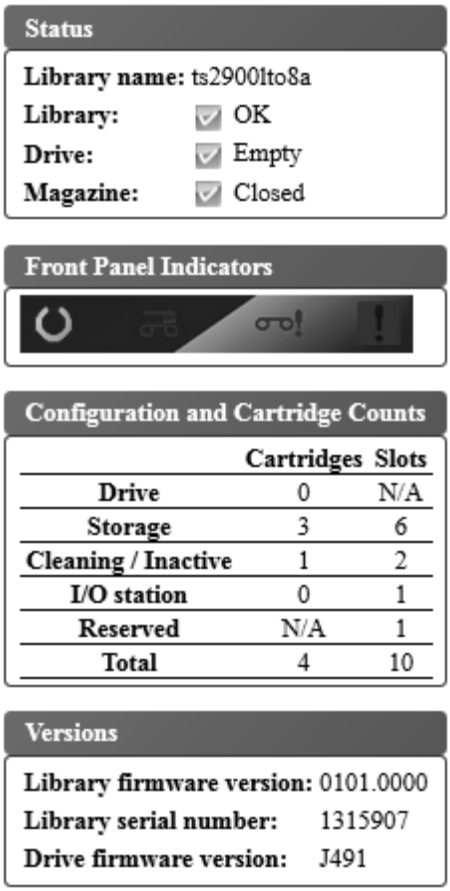


Figure 33. System summary

Configuring library settings

Physical library settings

Figure 34. Cartridge assignment settings

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

1. In the **Configure Library** menu in the left navigation pane of the Web User Interface, click **Physical/Logical**
2. In the **Physical Settings**, enter the Library settings:
   - **Library name** - Enter a name for your library.
   - **Auto Cleaning** - Automatically cleans the drive when the drive requests that cleaning and a cleaning cartridge is present in the library. Auto cleaning can be enabled only when there is at least one inactive position in the magazine in the library.

Note: It is recommended to enable the **Auto Clean** function on the library. With the **Auto Clean** function enabled, drive cleaning occurs automatically. The only time Auto Cleaning must be disabled is when your Backup Application requires that it has control.

- **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.

Logical library settings

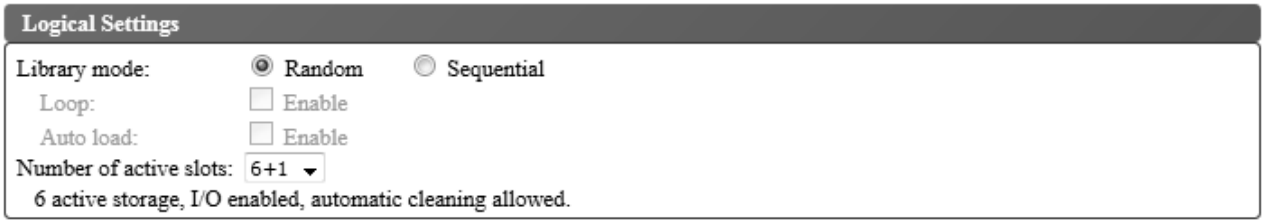


Figure 35. Logical library mode settings

To configure the library access mode settings for the logical library:

1. In the **Configure Library** menu in the left navigation pane of the Web User Interface, click **Physical/Logical**
2. In the **Logical Settings**, 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 9.
     - **Loop** - When **Library mode** is **Sequential** with **Loop** mode **Enabled**, the cartridge in the lowest Column/Tier cartridge position is loaded after the cartridge in the highest Column/Tier cartridge position is filled with data and sent back to its home position. This mode allows endless backup operations without user interaction.
     - **Auto load** - When **Library mode** is **Sequential** with **Auto load** mode **Enabled**, the first available cartridge (the lowest Column/Tier cartridge position that contains a cartridge) is loaded automatically if the library powers ON, or resets, with an empty drive. If the library powers ON with a cartridge already in the drive, sequential mode starts from the home position of that cartridge, unless the host issues a rewind and unload command to the drive. In which case the next cartridge in sequence will be loaded into the drive.

     To start Sequential mode if **Auto load** is not **Enabled**, use the **Move Cartridge** command to load the first cartridge into the drive. The sequence starts from the home position of that cartridge. Cartridges need not to be in contiguous slots.

     To stop Sequential mode, use the **Move Cartridge** command to unload the drive. This command cancels Sequential mode; the next sequential cartridge is NOT loaded.

     To restart Sequential mode, use the **Move Cartridge** command again to load a cartridge; the loading sequence resumes from the home position of that cartridge.
   - **Number of active slots** - Select the number of active slots to assign in your library. Selecting the number of active slots defines the number of storage slots, number of cleaning/inactive slots, whether the I/O Station is enabled/disabled, and whether auto cleaning is allowed. 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 one inactive position in the magazine. If **Auto Cleaning** is enabled, the inactive positions become cleaning cartridge positions.

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

Configuring network settings

Once the network settings are entered on the Operator Panel, the current network configuration of the library can be modified with the Web User Interface. The changes that are made to the network settings take effect after the library is rebooted.

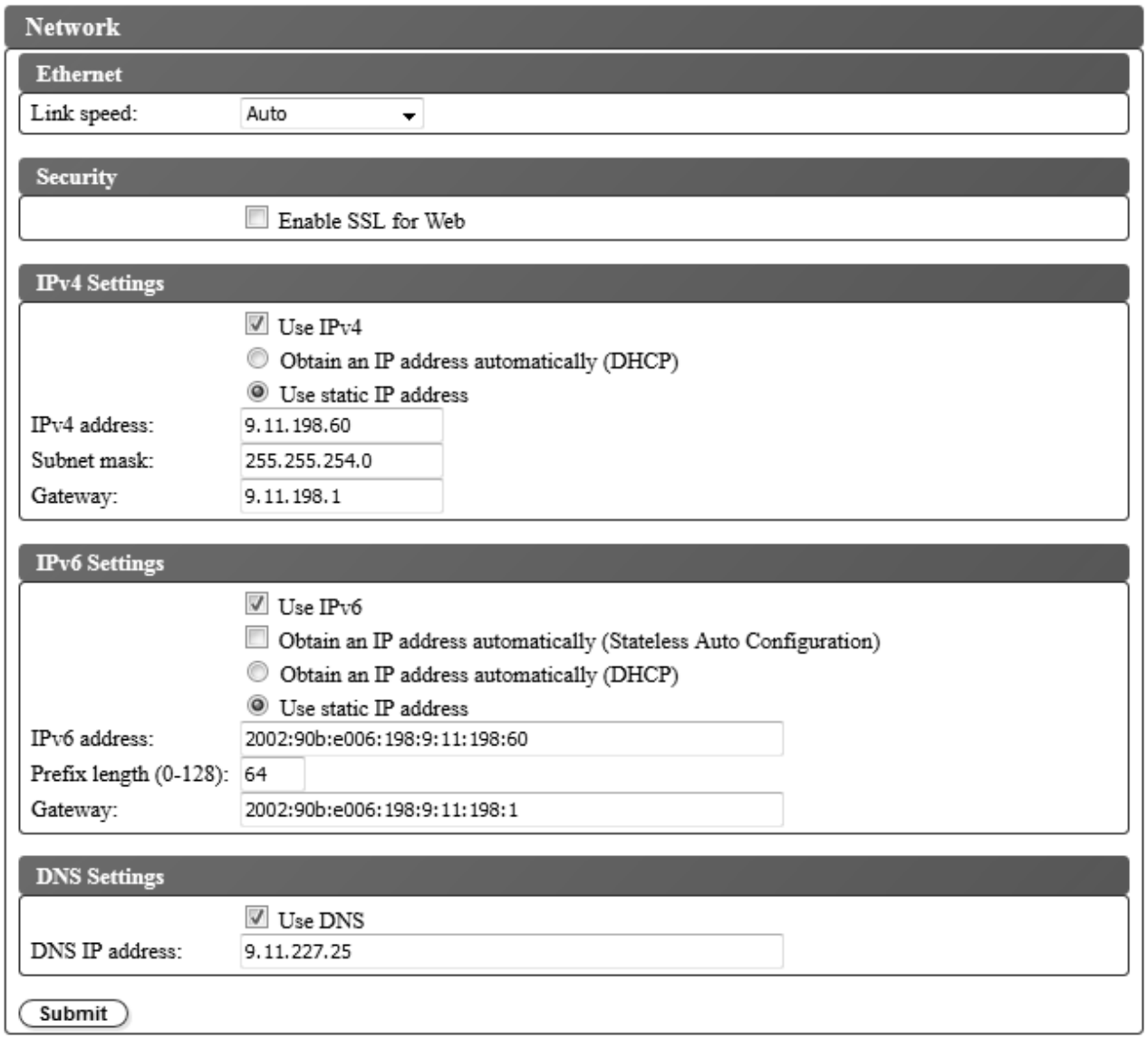


Figure 36. Network settings

To modify the network settings:

1. In the **Configure Library** menu in the left navigation pane of the Web User Interface, click **Network**.
2. Select the Ethernet **Link speed** (duplex mode).
3. In **Security**, select **Enable SSL for Web** to provide secure communications between the web browser and the tape library.
4. Select the TCP/IP settings. To enable dual IPv4/IPv6 protocol, select both **Use IPv4** and **Use IPv6** and enter parameters for both.

- **IPv4 settings** - Select **Use IPv4** to enable the IPv4 Internet Protocol. Select the corresponding button to obtain an IP address automatically (DHCP) or use static IP address settings. When with DHCP, use the Operator Panel to determine the library's assigned IP address. See "Configuring network settings" on page 71. Enter the following parameters if **Use static IP address** is selected.
  - **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 settings** - Select **Use IPv6** to enable the IPv6 Internet Protocol. Select the corresponding button or check box to obtain an IP address automatically (DHCP), to obtain an IP address with stateless auto configuration, or to use static IP address settings. Enter the following parameter if **Use static IP address** is selected.
  - **IPv6 address** - Sets the TCP/IPv6 address of the library on the network.
  - **Prefix length** - Decimal value that indicates the number of contiguous, high-order bits comprising the network portion of the address.
  - **Gateway** - Allows access outside the local network.

5. In **DNS settings**, 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 with host names instead of numerical IP addresses.
   - **DNS IP address** - Sets the IP address of the DNS server.
6. Click **Submit** to enable the settings.

Note: The changes that are made to the network settings take effect after the library is rebooted.

Configuring date and time settings

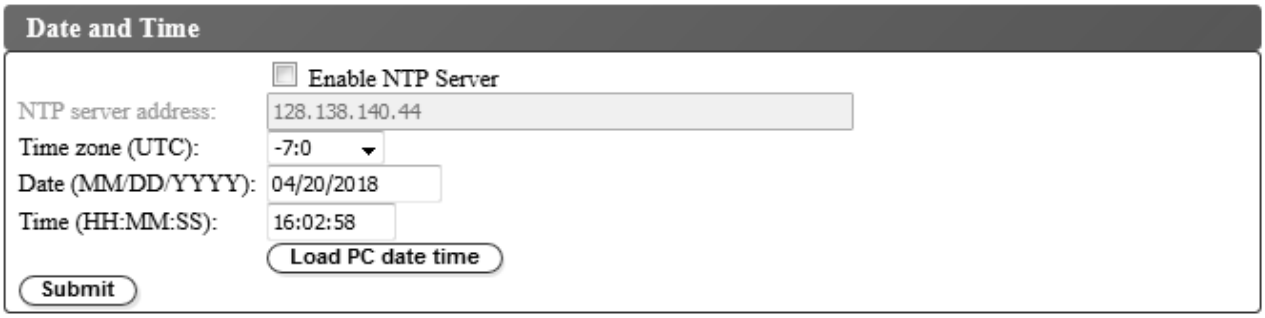


Figure 37. Date and time settings

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

Note: If you manually set your date and time, you must reset the date and time after the library is power-cycled and after a library reset.

Note: When the library is power-cycled, wait 10 seconds after the power is OFF before the library is powered ON again.

Once the network settings are entered on the Operator Panel, the current date and time can be modified with 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:

1. In the **Configure Library** menu in the left navigation pane of the Web User Interface, click **Date and Time**.
2. Select the **Date and Time** settings.
   - Select the **Enable NTP Server** check box to enable time and date control with 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. Host names 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 Coordinated Universal Time (UTC).
   - If the time server is disabled, enter the local time and date manually.
     - **Date** - Enter the date with the MM/DD/YYYY format.
     - **Time** - Enter the time with the HH:MM:SS format.
   - Click **Load PC date time** to synchronize the library with the clock on your host computer at regular intervals.
3. Click **Submit** to update the settings.

Configuring encryption settings

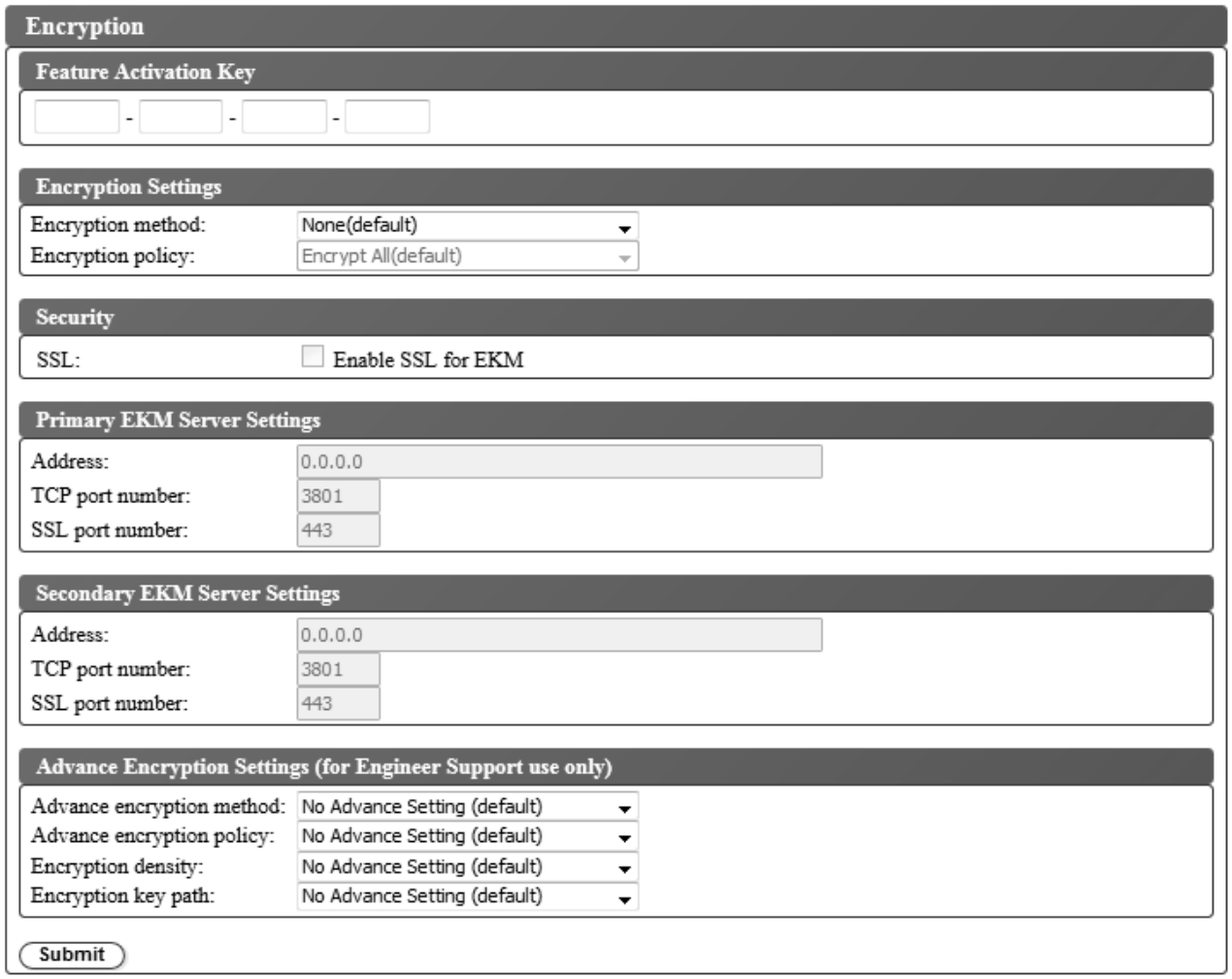


Figure 38. Encryption settings

Note: This procedure is optional if you have the Encryption Activation Key Feature Code 5901. Only the Ultrium 4 Tape Drive (3572-S4H) and later support 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 Security Key Lifecycle Manager Knowledge Center* before you continue to the next step.

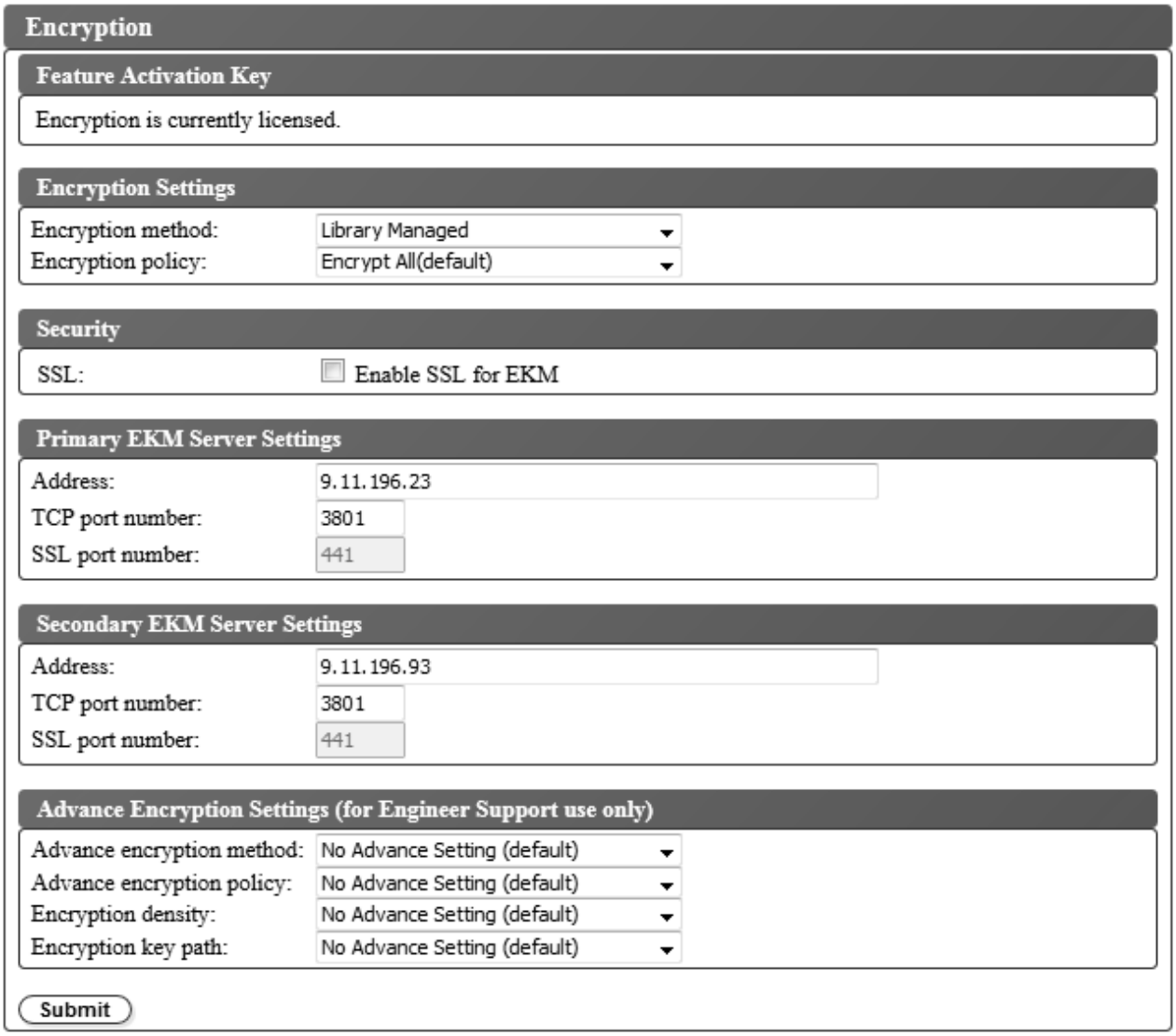


Figure 39. Encryption enabled settings

To modify the encryption settings:

1. In the **Configure Library** menu in the left navigation pane of the Web User Interface, click **Encryption**
2. Enter the **Feature Activation Key** (see Figure 38 on page 44) 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 Encryption and Library Managed Encryption are transparent to each other. A tape encrypted with System Managed Encryption might be decrypted with 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. Host names 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. Host names 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 that are loaded into the tape drive are encrypted.
   - **Internal Label - Selective Encryption** - This option is used only for Veritas Technologies NetBackup.
   - **Internal Label - Encrypt All** - This option is used only for Veritas Technologies 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 email notifications

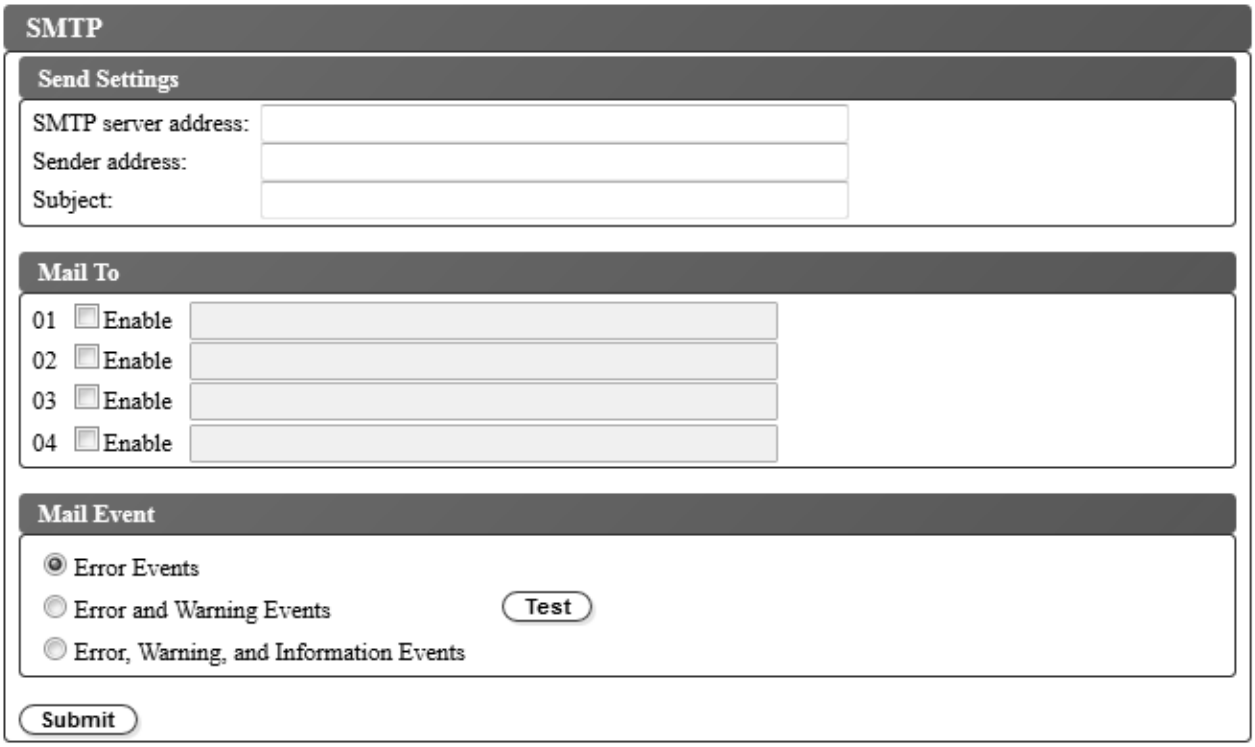


Figure 40. Email notifications

Note: This procedure is optional.

To set up email notifications of library events:

1. In the **Configure Library** menu in the left navigation pane of the Web User Interface, click **SMTP**.
2. Configure the **Send server** settings.
   - **SMTP server address** - SMTP mail server address. IPv4 and IPv6 addresses are supported. Host names 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.
3. Enter the email addresses to be notified when an event takes place in the **Mail To** fields, and click the **Enable** check boxes to select each address.
4. Select the event level to report in the **Mail Event** settings.
5. Click **Test** to send a test email message to the enabled addresses.
6. Click **Submit** to enable the settings.

Configuring trap notifications

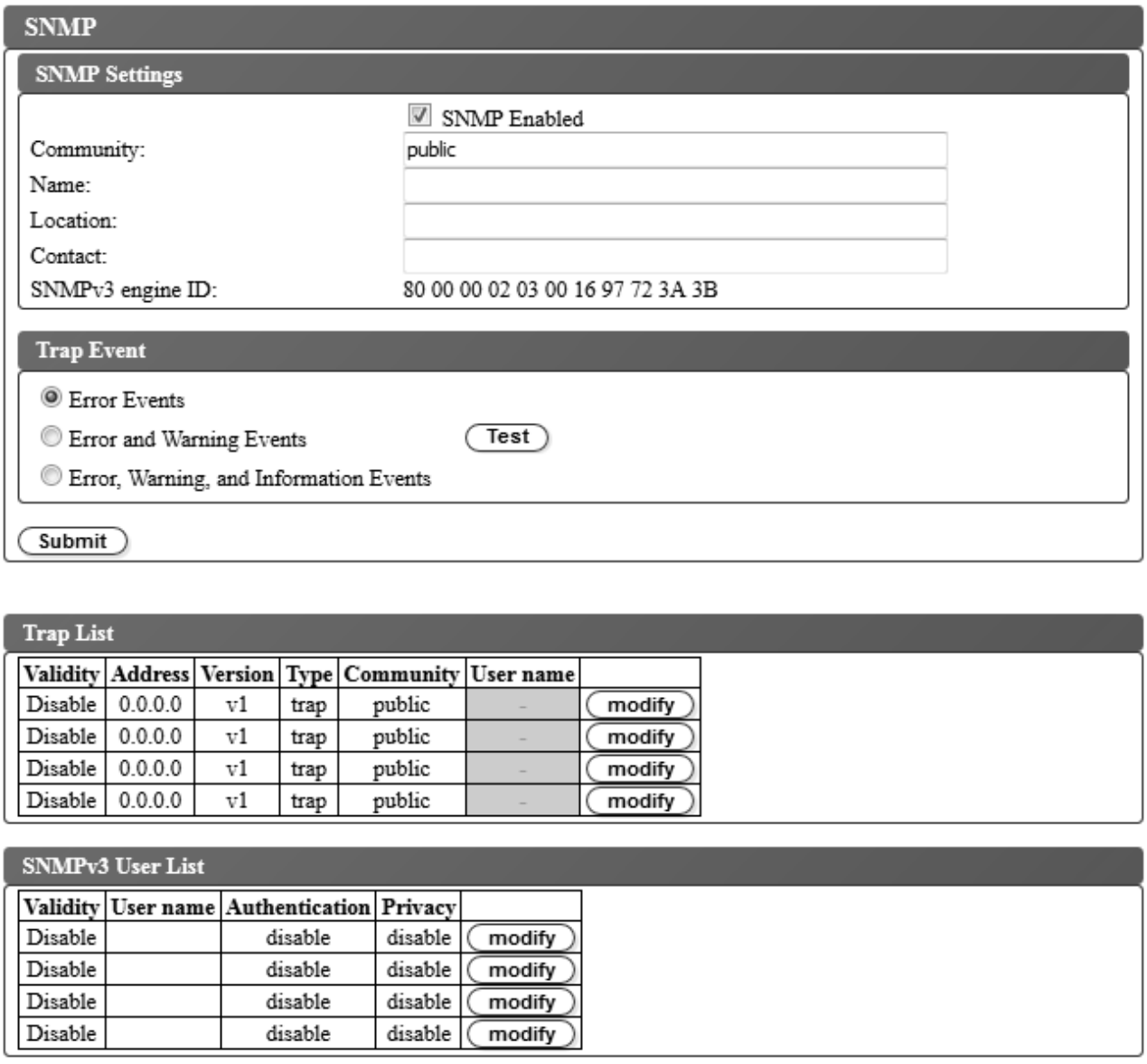


Figure 41. Trap notifications

Note: This procedure is optional. SNMP notifications are not enabled unless you have selected the **SNMP Enabled** check box. To disable SNMP notifications, clear the **SNMP Enable** check box and click **Submit**.

The traps that are supported by the TS2900 Tape Autoloader are listed in "Trap definitions (types)" on page 200.

To set up trap notifications for an SNMP server:

1. In the **Configure Library** menu in the left navigation pane of the Web User Interface, click **SNMP**
2. Select the **SNMP Enabled** check box.
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 that identifies the SNMPv3 engine.

4. Enter the settings of the SNMP monitoring stations to be notified when an event takes place by clicking the **modify** buttons in the **Trap List** box.

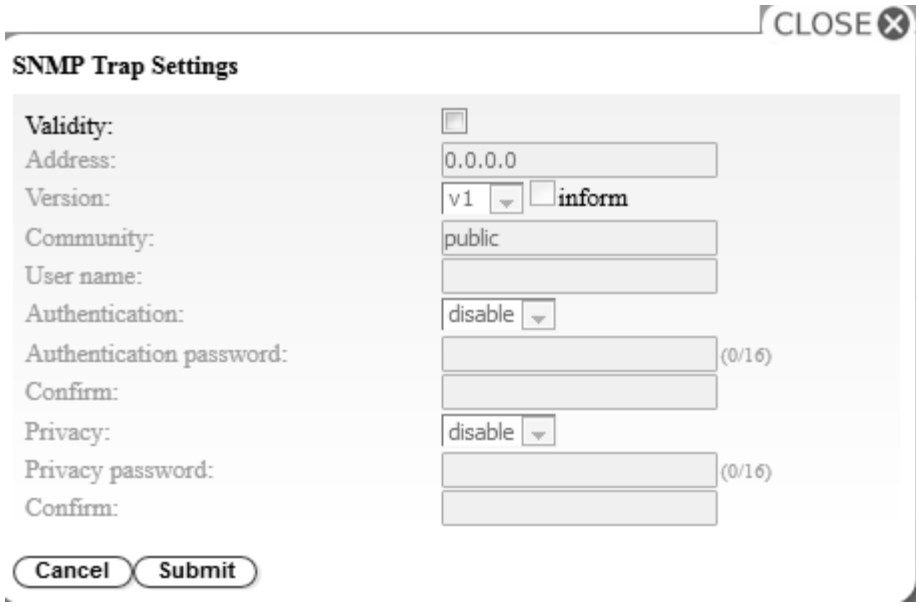


Figure 42. SNMP trap settings

- **Validity** - Select the check box to enable and clear the check box to disable.
- **Address** - IPv4 and IPv6 addresses are supported. Host names can be entered instead of numerical IP addresses if the DNS server is specified.
- **Version** - Trap version v1, v2c, or v3. For v2c and v3, the **Inform** check box determines if an SNMP INFORM request is sent instead of a trap event.
- **Community** (v1 or v2c) - SNMP community name.
- **User name** (v3 only) - SNMPv3 unique user name.
- **Authentication** (v3 only) - Authentication algorithm: **disable**, **MD5**, or **SHA**.
- **Authentication Password** - When an **Authentication** algorithm is enabled, an **Authentication Password** is required. (see "Configuring Password Rules Settings" on page 52).
- **Confirm** - Re-enter the Authentication Password to confirm it.
- **Privacy** (v3 only) - Privacy service encryption and decryption algorithm: **disable**, **DES**, or **AES**. When an algorithm is specified, a privacy password is required.
- **Privacy password** - enter a password (see "Configuring Password Rules Settings" on page 52).
- **Confirm** - Re-enter the **Privacy password** to confirm it.

5. Click **Submit** to save the SNMP Trap settings. Modify each trap's settings by repeating the previous step.
6. Enter the SNMPv3 users who are allowed to access the tape library by clicking the **modify** buttons in the **SNMPv3 User List** box.

Figure 43. SNMPv3 user settings

- **Validity** - Select the check box to enable and clear the check box to disable.
- **User name** - SNMPv3 unique user name.
- **Authentication** - Authentication algorithm: **disable**, **MD5**, or **SHA**. When an algorithm is specified, an authentication password is required.
- **Authentication password** - enter a password (see "Configuring Password Rules Settings" on page 52).
- **Confirm** - Re-enter the **Authentication password** to confirm it.
- **Privacy** - Privacy service encryption and decryption algorithm: **disable**, **DES**, or **AES**. When a privacy algorithm is specified, a privacy password is required.
- **Privacy password** - enter a password (see "Configuring Password Rules Settings" on page 52).
- **Confirm** - Re-enter the **Privacy password** to confirm it.

7. Select the event level to report in the **Trap Event** box.
8. Click **Test** to send a test trap notification to the enabled IP addresses.
9. Click **Submit** to enable the settings.

Managing user access

To add, modify, or remove users that are able to access the library with the Web User Interface:

1. In the **Configure Library** menu in the left navigation pane of the Web User Interface, click **User Access**.

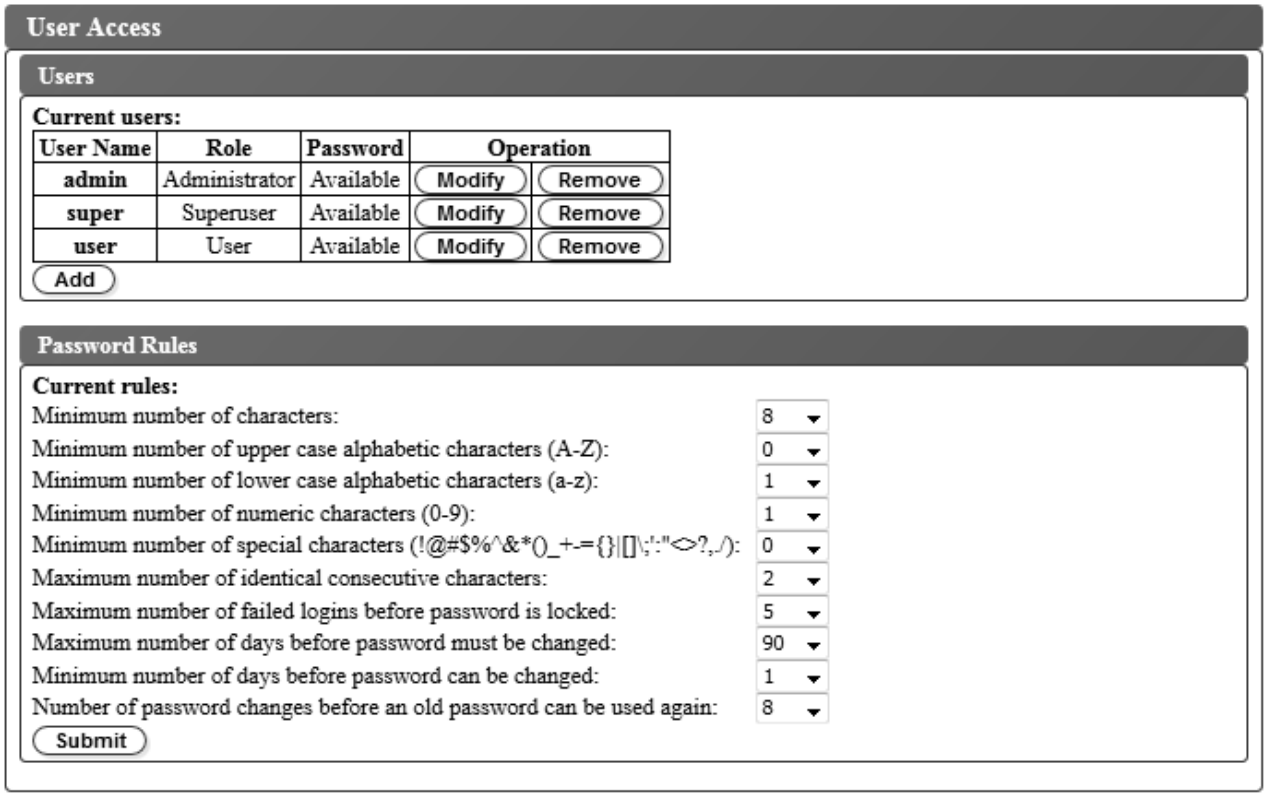


Figure 44. User access settings

2. To add, modify, or remove a user account, do the following:
   - Add a user account:
     a. Click **Add**

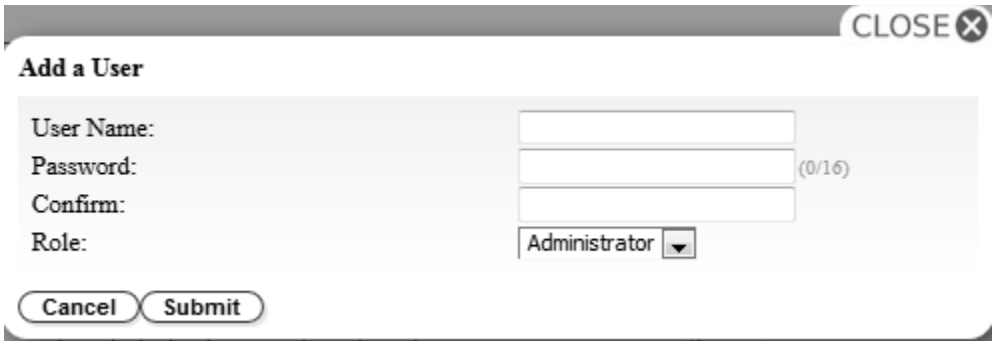


Figure 45. Add User dialog box

     b. Enter the **User Name** and **Password** into the dialog box and assign the user's role. Re-enter password to **Confirm**.
     c. Select one of the following from the **Role** menu:
        - **User** - User access permission allows users to monitor the library, but not to complete 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 complete tape library functions and change configuration settings.

d. Click **Submit** to save the new user.

Note: A new user's **Password** status is set to *Expired*. A new user is presented with a **Login failure** message and given the opportunity to create a new password.

- Modify a user account:

a. Observe the **Password** status of the user:

– **Available**: The password is available to be changed.

– **Expired**: The maximum password age was exceeded. **The password is now invalid.**

– **Unchangeable**: The minimum password age was not exceeded. **You cannot change the password.**

– **Locked**: The maximum number of failed login attempts for the account was exceeded.

Note: An administrator must unlock the account by modifying the account and entering a new password. The **Password** status changes to *Expired*.

b. Click **Modify** next to the User Name of the account.

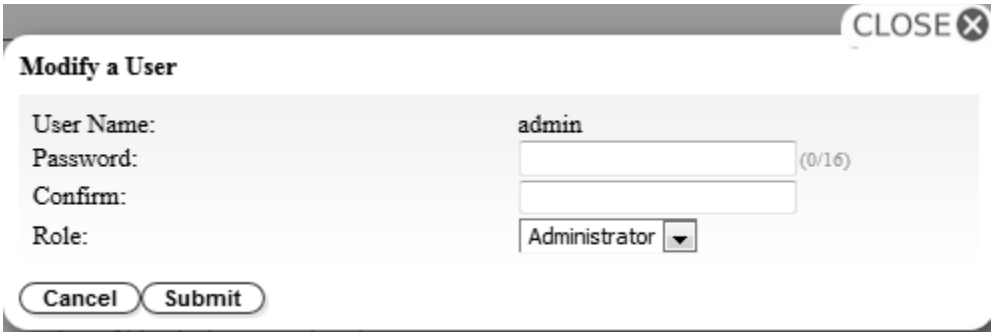


Figure 46. Modify user

c. Enter and confirm a new password (see "Configuring Password Rules Settings").

d. Select one of the following from the **Role** menu:

– **User** - User access permission allows users to monitor the library, but not to complete 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 complete tape library functions and change configuration settings.

e. Click **Submit** to save the modified user account.

- Remove a user account

a. Click **Remove** next to a **User Name** to delete the account from the system.

3. Enter all user IDs and passwords on the Library Configuration form in Appendix F, "Library Configuration Form," on page 223.

Configuring Password Rules Settings

The **Password Rules** box displays the rules for user passwords.

- **Minimum number of characters** - Choose the minimum password length. The factory default value is 8. The maximum password length is 16.

- **Minimum number of upper case alphabetic characters (A-Z)** - Choose the minimum number of uppercase alphabetic characters. The factory default value is 1.
- **Minimum number of lower case alphabetic characters (a-z)** - Choose the minimum number of lowercase alphabetic characters. The factory default value is 1.
- **Minimum number of numeric characters (0-9)** - Choose the minimum number of numeric characters. The factory default value is 1.
- **Minimum number of special characters (!@#$%^&*()_+={}|[]\;':"<>?,./)** - Choose the minimum number of special characters. The factory default value is 0.
- **Maximum number of identical consecutive characters** - Choose the maximum number of identical consecutive characters. The factory default value is 2. There is no limitation if 0 is selected.
- **Maximum number of failed logins before password is locked** - Choose the maximum number of failed logins before the password is locked. The factory default value is 5. Possible range for this configuration option is 0 - 10. There is no limitation if 0 is selected.
- **Maximum number of days before password must be changed** - Choose the maximum number of days before the password must be changed. There is no limitation if 0 is selected.
- **Minimum number of days before password can be changed** - Choose the minimum number of days before the password can be changed. A password can be changed immediately if 0 is selected.
- **Number of password changes before an old password can be used again** - Choose the number of password changes that are required before a password can be used again. A password can be reused immediately if 0 is selected.

Click **Submit** to save all the information.

Saving the library configuration

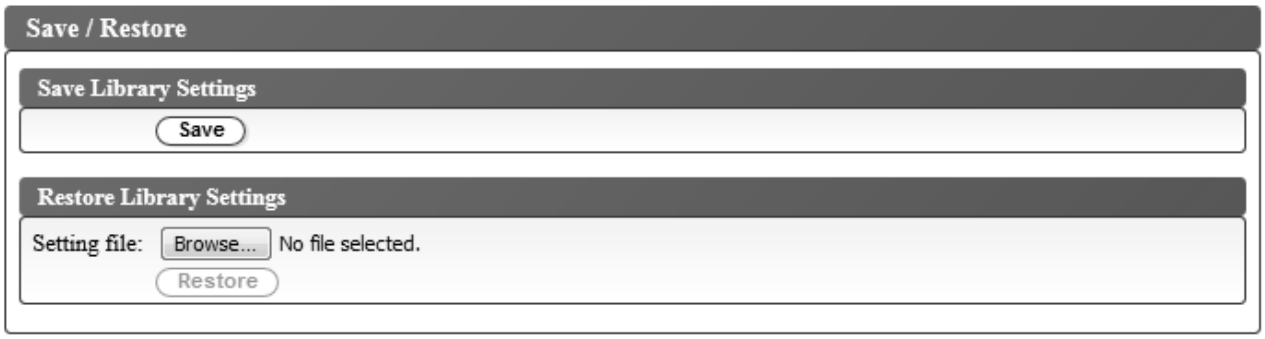


Figure 47. Save configuration

Note: This procedure is recommended.

Each time that you change the configuration of your library, save the configuration. This function also maintains several library configuration profiles that can be restored to the library when wanted with the Web User Interface.

To save a library configuration:

1. In the **Configure Library** menu in the left navigation pane of the Web User Interface, click **Save/Restore**
2. In the **Save Library Settings** box, click **Save** to create a configuration file of your library on your computer.

Configuring your library with the Operator Panel

To configure your library with the Operator Panel, complete the following procedures:

1. "Logging in to the Operator Panel"
2. "Configuring network settings"
3. "Configuring library settings" on page 55

Logging in to the Operator Panel

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

1. When the library is initialized, press **Enter** to move to the Password screen.
2. Enter `0000`, the default password. The top menu screen displays.
3. When finished with 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 might be sufficient to access your tape library on a network. To change the default network settings with 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 DHCPIPv4**.
   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 DHCPIPv6**.
   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. **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. **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. To enable I/O station, select **Active and I/O X Active + 1 I/O**.
   d. To disable I/O station, select **Active and I/O X Active + 0 I/O**.
   e. Press **Enter** again to apply the setting, or **Cancel** to reject the setting.
4. **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 is filled with data and sent back to its home position. This procedure 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, or resets, with an empty drive. If the library powers ON with a cartridge already in the drive, sequential mode starts from the home position of that cartridge, unless the host issues a rewind and unload command to the drive. In which case the next cartridge in sequence is loaded into the drive.

   To start sequential mode if autoload is OFF, use the **`Move Cartridge`** command to load the first cartridge into the drive. The sequence starts from the home position of that cartridge. Cartridges need not to be in contiguous slots.

To stop sequential mode, use the **Move Cartridge** command to unload the drive. This command cancels sequential mode; the next sequential cartridge is NOT loaded.

To restart sequential mode, use the **Move Cartridge** command again to load a cartridge; the loading sequence resumes from the home position of that cartridge.

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

d. Press **Cancel** to backtrack through the menu hierarchy.

5. 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 with the MM/DD/YYYY format.
      - **Time** - Enter the time with the HH:MM:SS format.
   c. Press **Cancel** to backtrack through the menu hierarchy.
6. Auto Cleaning (Default: Disabled)
   a. Select **Cofiguration** > **Configure Auto Cleaning**.
   b. Select **Enable Auto Cleaning** or **Disable Auto Cleaning**, and press **Enter**. The Auto Cleaning function is enabled only if there is at least one 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 with 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**, or from Web User Interface: **Manage Library** > **Unlock Magazine**.
2. Insert cartridges in the magazine.

   Note: A blue release gate (**1** in Figure 48) in the upper 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 protect cartridges that are ejected by the internal column spring.

Figure 48. Cartridge release gate

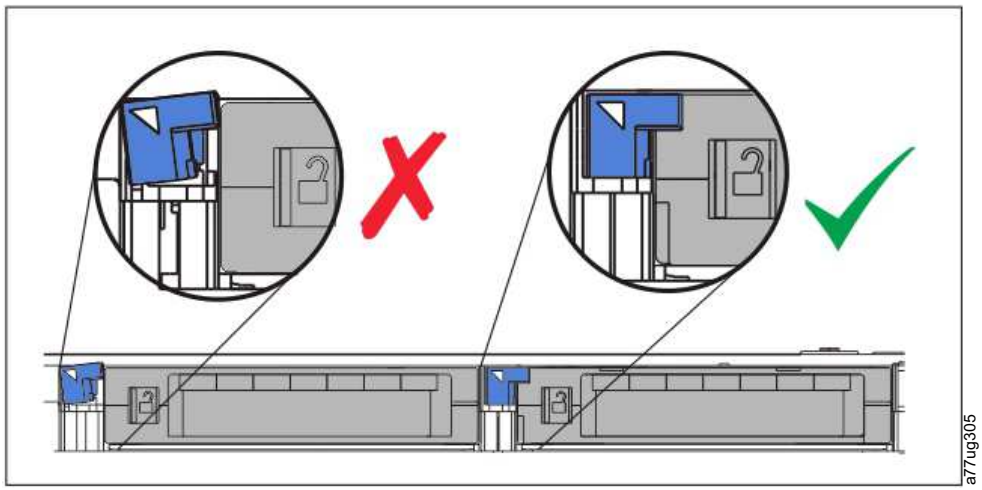


Figure 49. Incorrect (left) and correct (right) placement of release gate

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 50).

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 is right side up if attached correctly.

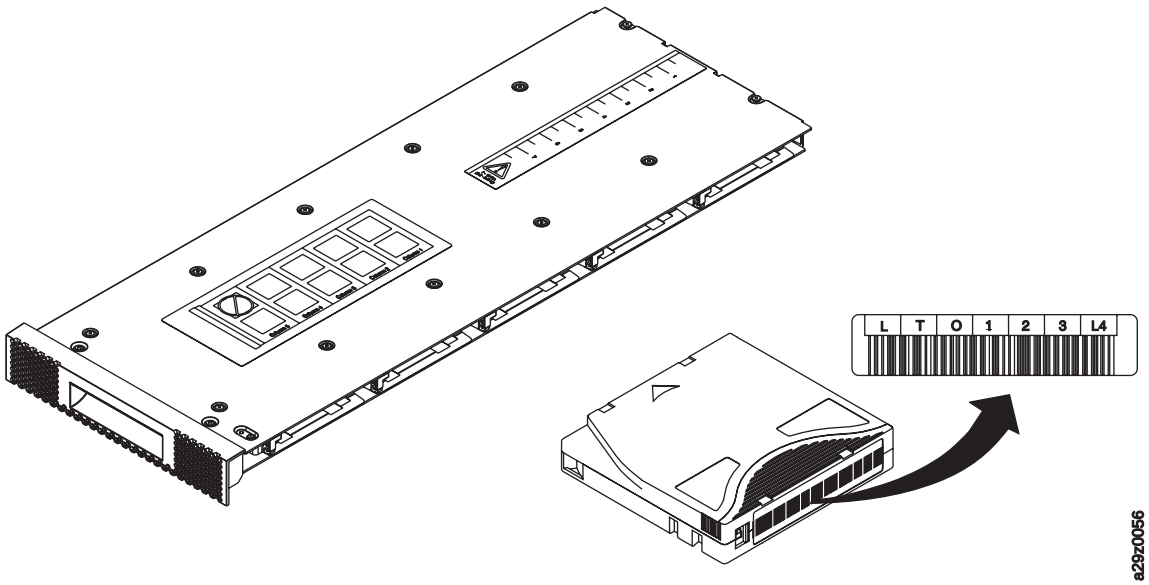


Figure 50. Cartridge orientation

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. This position is 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. Then, you can proceed 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.

   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 187.
6. Press **Cancel** to return to the top-level menu.

Taking the library online

When your library is 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 with 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 with the Web User Interface:

1. Save the library configuration.
   a. In the **Configure Library** menu in the left navigation pane of the Web User Interface, click **Save/Restore**.
   b. Click **Save**, and then enter a file name and select a location to save the configuration file.
2. Verify the library state.
   a. In the **Manage Library** menu in the left navigation pane of the Web User Interface, click **Library State**.
   b. If the library is offline, click **Bring Online**.
   c. Click **Yes** to confirm when prompted.

   A message dialog displays when the operation is completed.
3. Click **Logoff** in the upper right corner of the window.

Registering for support notification

Support notification registration provides email notification when new firmware levels are updated and are available for download and installation.

To register for support notification, visit the web at: http://www-01.ibm.com/software/support/einfo.html.

Enter your user name and password on the Appendix F, “Library Configuration Form,” on page 223.

Note: Library firmware and tape drive firmware are verified and released together. When the latest firmware is updated, verify that all installed components such as the tape drive and library are at the latest levels noted on the Support website. Mixing different levels of library and tape drive firmware is not supported and might cause unpredictable results.

IBM suggests 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 104.

Now you are ready to use your library.

Operations

"The Operator Panel" on page 62	Monitoring the Library	"Configuration settings" on page 63
		"Current information" on page 63
		"Firmware revision" on page 64
	Managing the Library	"Unlocking the I/O station" on page 64
		"Unlocking the cartridge magazine" on page 65
		"Moving cartridges" on page 65
		"Unloading the drive" on page 65
		"Cleaning the drive manually" on page 66
		"Conducting a library inventory" on page 66
		"Taking the library online and offline" on page 66
		"Powering down the library" on page 67
		"Shipping the library" on page 67
		"Rebooting the drive" on page 67
		"Rebooting the library" on page 67
		"Logging out of the library" on page 68
	Configuring the Library	"Configuring auto cleaning" on page 68
		"Configuring the number of active slots" on page 68
		"Configuring the library access mode" on page 69
		"Configuring date and time settings" on page 70
		"Configuring network settings" on page 71
		"Configuring Operator Panel settings" on page 72
		"Configuring Web GUI Settings" on page 72
		"Setting the library to factory defaults" on page 73
	Servicing the Library	"Checking the library error status" on page 73
		"Running library verify diagnostic procedures" on page 73
		"Running drive diagnostic procedures" on page 74

"The Web User Interface" on page 75	Monitoring the Library	"The system summary" on page 76
		"The library map" on page 77
	Managing the Library	"Moving cartridges" on page 79
		"Unloading the drive" on page 80
		"Cleaning the drive manually" on page 80
		"Taking the library online and offline" on page 81
		"Conducting a library inventory" on page 81
		"Unlocking the cartridge magazine" on page 81
	Configuring the Library	"Managing user access" on page 82
		"Configuring physical and logical library settings" on page 85
		"Configuring network settings" on page 88
		"Configuring encryption settings" on page 90
		"Configuring date and time settings" on page 93
		"Configuring email notifications" on page 47
		"Configuring trap notifications" on page 48
		"Uploading and configuring the SSL certificate" on page 98
		"Saving and restoring configuration settings" on page 99
	Servicing the Library	"Running encryption Key Path diagnostic procedures" on page 101
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		"Updating library and drive firmware" on page 104
		"Usage statistics" on page 105

The Operator Panel

Figure 51 on page 63 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 13.

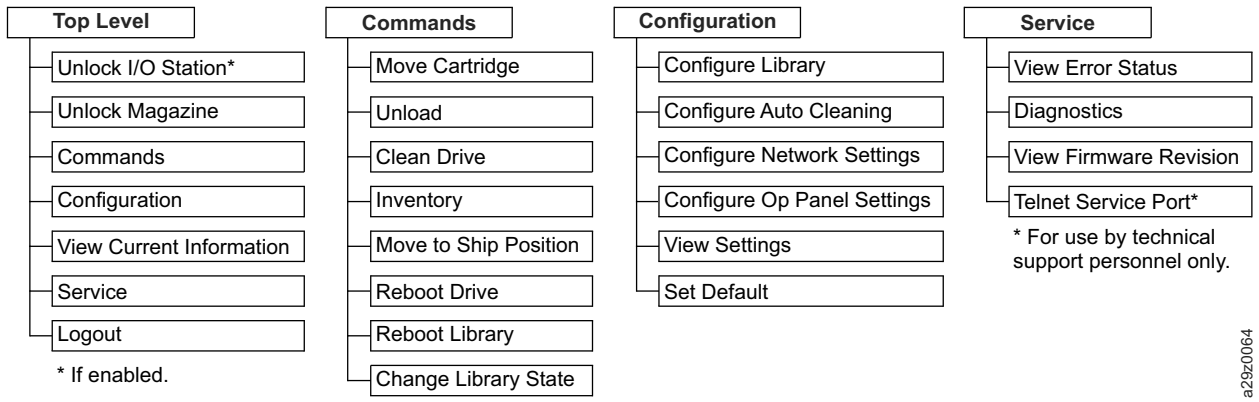

Figure 51. Operator Panel top menus

Monitoring the library

Configuration settings

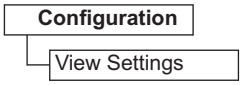

Figure 52. Configuration settings

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

The settings that are displayed include:

- Library settings
  - I/O station (On/Off)
  - Auto cleaning (On/Off)
  - Number of cleaning slots when Auto cleaning is enabled
  - 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, stateless Auto configuration)
- Drive settings
  - Model number

Current information

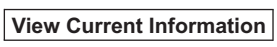

Figure 53. Current information

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

The settings that are displayed include:

- Network settings
  - Worldwide node name
  - IP address protocol stack
  - IP address

Firmware revision

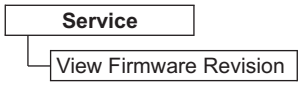

Figure 54. Firmware revision

Select **Service** > **View Firmware Revision** to display the current version of the library firmware.

Managing the library

Unlocking the I/O station

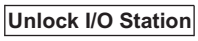

Figure 55. Unlock I/O station command

Select **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.

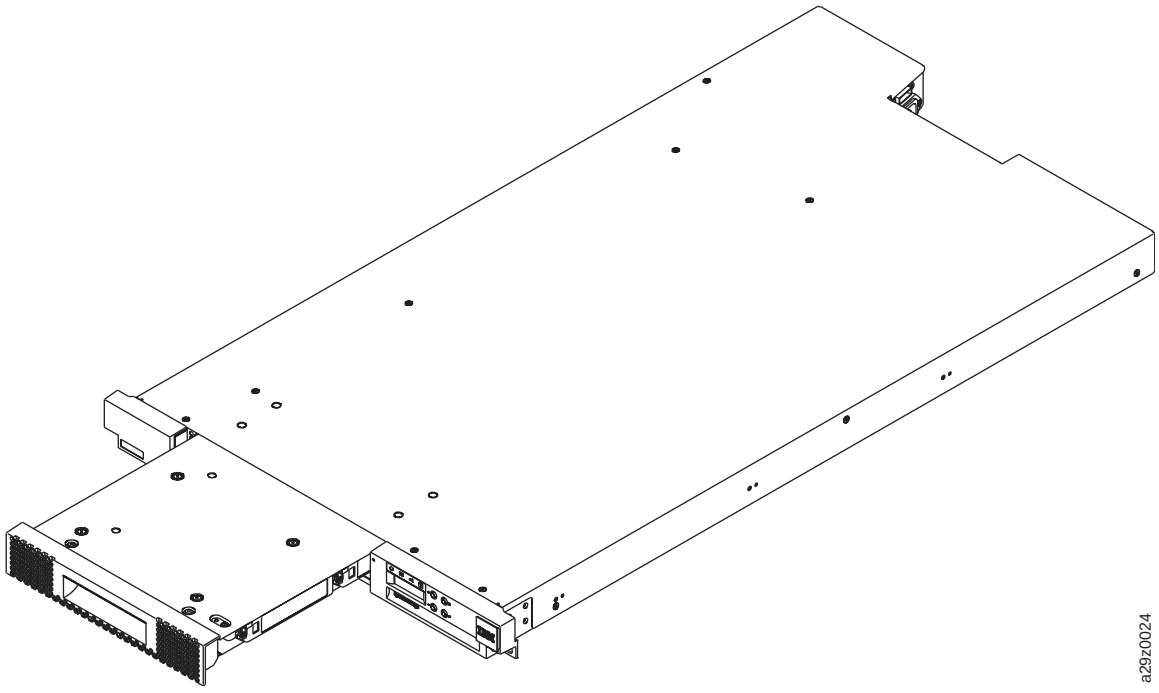

Figure 56. I/O station unlocked

After the I/O station is closed, wait for the library to complete its inventory before you proceed with normal library operations.

Note: A blue release gate in the upper 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 protect cartridges that are ejected by the internal column spring.

Unlocking the cartridge magazine

Figure 57. Unlock magazine command

Select **Unlock Magazine** to unlock and remove the cartridge magazine.

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

After the magazine is closed, wait for the library to complete its inventory before you proceed with normal library operations.

Note: A blue release gate in the upper 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 protect cartridges that are ejected by the internal column spring.

Moving cartridges

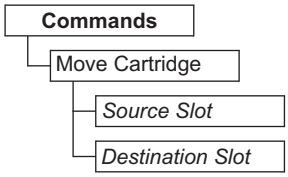

Figure 58. Move cartridge command

Select **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.

Press **Enter** to move the cartridge from the source to the destination.

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

Unloading the drive

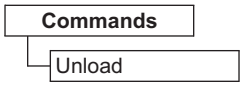

Figure 59. Unload command

Select **Commands** > **Unload** to unload the cartridge from the tape head mechanism.

Unload when library is in Random mode: The cartridge in the drive is unloaded from the tape head mechanism, but is still retained inside the tape drive housing. The **Move Cartridge** command moves the cartridge from the drive to another location. Moving a tape cartridge from a drive to another location both unloads and moves the cartridge in a single action.

Unload when library is in Sequential mode: The cartridge in the drive is unloaded from the tape head mechanism, and returned to the cartridge home position.

Press **Enter** to unload the cartridge from the tape head mechanism.

Cleaning the drive manually

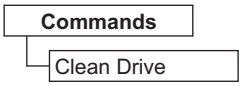

Figure 60. Clean Drive command

Select **Commands** > **Clean Drive** to clean the tape drive manually with a cleaning cartridge in either a cartridge storage position or the I/O station.

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

Conducting a library inventory

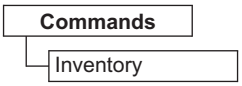

Figure 61. Inventory command

Select **Commands** > **Inventory** to force the library to run an inventory of the cartridge magazine, accessor, and tape drive to refresh the library map. An inventory is conducted automatically when power is first turned ON or when the cartridge magazine is removed and reinserted.

Press **Enter** to conduct the inventory.

Taking the library online and offline

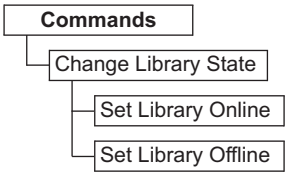

Figure 62. Online/Offline command

Select **Commands** > **Change Library State** to take the library online or offline.

It is sometimes necessary to take the library offline before servicing functions for the library are done. Once these operations are finished, it is necessary to bring the library online.

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

Powering down the library

Before powering OFF the library, ensure that the library is in an idle state with no mechanical movement of the accessor, and all data operations (for example, backup operations, accessing of log files) are complete. Then, power OFF the library with 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 might occur.

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

Shipping the library

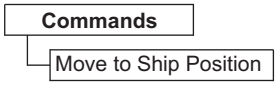

Figure 63. Move to Ship Position command

Select **Commands** > **Move to Ship Position** when the library is prepared to move 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 that are 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.

1. When **Unlock Magazine** is displayed, press **Enter** to unlock the cartridge magazine. The magazine unlocks and the display prompts the removal of the magazine.
2. Remove all cartridges from the magazine and reinsert the magazine into the slide mechanism. The library completes an inventory to verify no cartridges are in the magazine.
3. If the magazine is empty, the library moves the accessor to the ship position. The library can be powered down. If the magazine is NOT empty, the library prompts to remove cartridges. After all cartridges are removed and the magazine is replaced, start the ship position process again.

Rebooting the drive

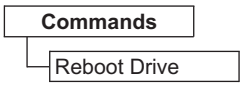

Figure 64. Reboot Drive command

Select **Commands** > **Reboot Drive** to force the drive to reboot. You also specify whether the library will come online or offline after it finishes rebooting.

Press **Enter** to reboot the drive.

Rebooting the library

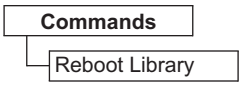

Figure 65. Reboot Library command

Select **Commands** > **Reboot Library** to force the library to reboot. You also specify whether the library will come online or offline after it finishes rebooting.

Press **Enter** to reboot the library.

Logging out of the library

Figure 66. Logout command

Select **Logout** to log out of the library. The login screen is displayed for the next user.

Configuring the library

Configuring auto cleaning

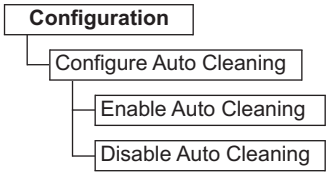

Figure 67. Auto Cleaning settings

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

Note: It is recommended that the Auto Clean function is enabled on the library. With the Auto Clean function enabled, drive cleaning occurs automatically. The only time Auto Cleaning is disabled is when your Backup Application requires that it has control.

The drive can also be cleaned manually. For details, see "Cleaning the drive manually" on page 66.

Configuring the number of active slots

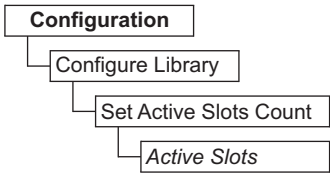

Figure 68. Active slot count settings

Select **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 with 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

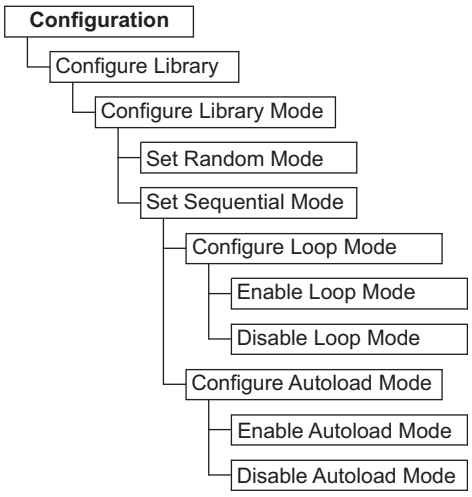

Figure 69. Library access mode settings

Select **Configuration** > **Configure Library** > **Configure Library Mode** to set the logical library access mode.

Configure the library access mode with 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 is filled with data and sent back to its home position. This mode 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, or resets, with an empty drive. If the library powers ON with a cartridge already in the drive, sequential mode will start from the home position of that cartridge, unless the host issues a rewind and unload command to the drive, in which case the next cartridge in sequence will be loaded into the drive.

  To start sequential mode if autoload is OFF, use the **Move Cartridge** command to load the first cartridge into the drive. The sequence starts from the home position of that cartridge. Cartridges do not need to be in contiguous slots.

  To stop sequential mode, use the **Move Cartridge** command to unload the drive. This mode cancels sequential mode; the next sequential cartridge is NOT loaded.

  To restart sequential mode, use the **Move Cartridge** command again to load a cartridge; the loading sequence resumes from the home position of that cartridge.

Configuring date and time settings

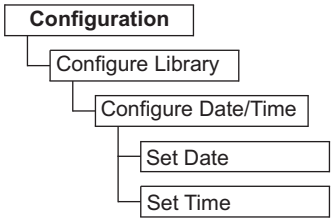

Figure 70. Date and time settings

Select **Configuration** > **Configure Library** > **Configure Date/Time** to set the date and time on your library manually after a power disruption and when daylight saving 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 is also controlled automatically with a network-based Network Time Protocol (NTP) server. For more information, see "Configuring network settings" on page 71.

Configuring network settings

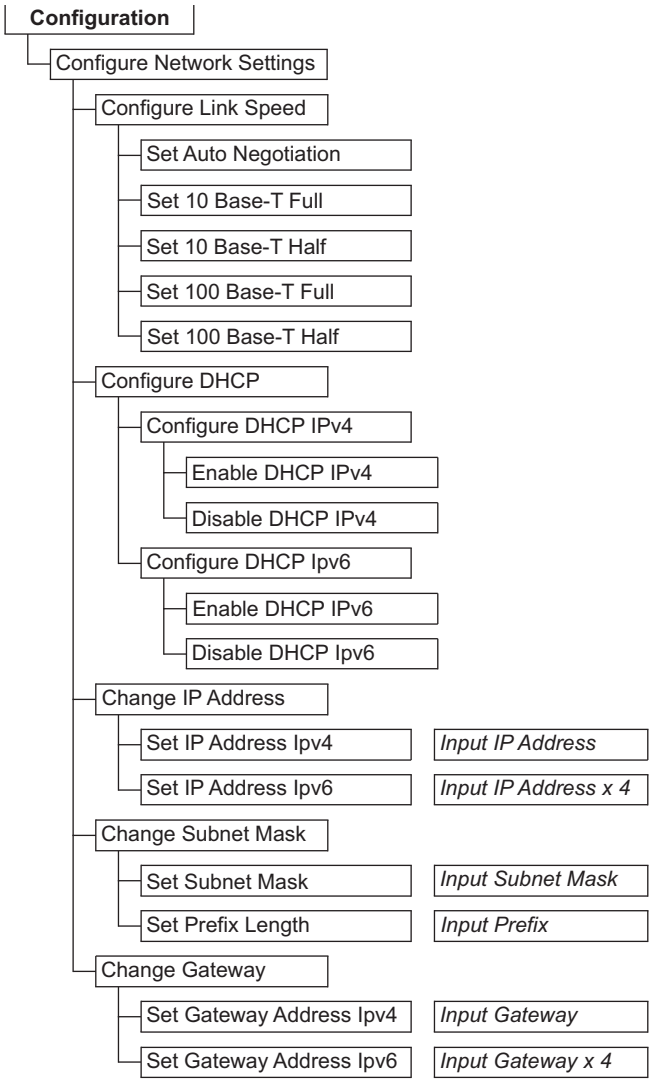

Figure 71. Network settings

Select **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 with 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 with the IPv4 protocol.
  - **IPv6** - Select to enable DHCP with 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 with the IPv4 protocol.

  - **IPv6** - Select to enter four library IP addresses with 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 with 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 with the IPv4 protocol.
  - **IPv6** - Select to enter four gateway IP addresses with the IPv6 protocol.

Configuring Operator Panel settings

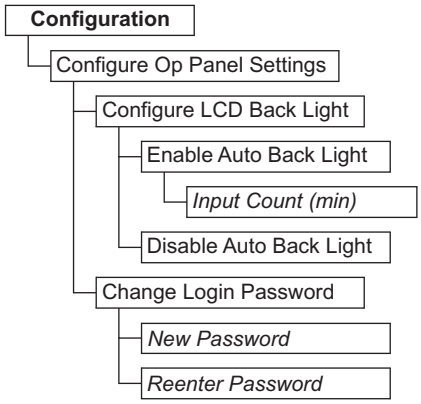

Figure 72. Operator Panel settings

Select **Configuration** > **Configure Op Panel Settings** to set the preferences when with the Operator Panel.

Configure the Operator Panel with the following settings:

- **Back light** - Select to enable the LCD back light when with 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 four-digit timer in minutes.
- **Login Password** - Select to change the Operator Panel four-character login password. The new password must be reentered for confirmation before the password is changed (default: 0000).

Configuring Web GUI Settings

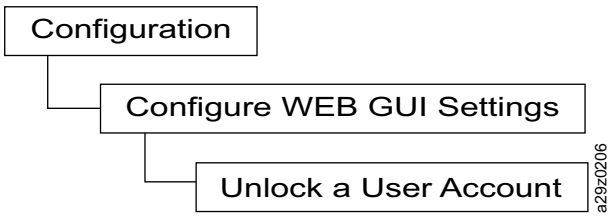

Figure 73. Configuring Web GUI settings

Use **Configuration** > **Configure Web GUI Settings** > **Unlock a User Account** to unlock a User Account.

The password of the user unlocked by **Unlock a User Account** is automatically changed to **secure**.

Setting the library to factory defaults

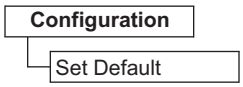

Figure 74. Factory default settings

Select **Configuration** > **Set Default** to reset the library to the factory default settings. See Table 16 on page 36. The date and time must be reset after restoring factory default settings. See "Configuring date and time settings" on page 70.

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 99.

Servicing the library

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

Checking the library error status

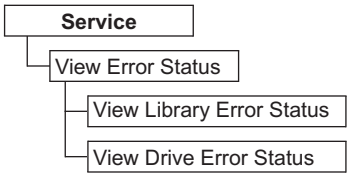

Figure 75. Error status menu

Select **Service** > **View Error Status** to check the 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 **Enter** to display specific error information. You can check the meaning of error codes in Appendix B, "Error codes," on page 187.

Running library verify diagnostic procedures

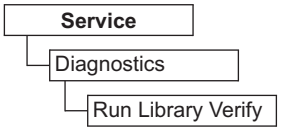

Figure 76. Run Library Verify command

Select **Service** > **Diagnostics** > **Run Library Verify** to test the library and drive hardware, communications, and the read or write capability of the library. Library Verify is the most critical and most frequently used test, and is run after all maintenance procedures to ensure correct library performance.

Note: If the host application hasn't already unloaded tape cartridges in the drives, run the Library Verify diagnostic test.

To run library verification diagnostic tests:

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

   If an error occurs, see Appendix B, "Error codes," on page 187 to identify and locate the problem.

Running drive diagnostic procedures

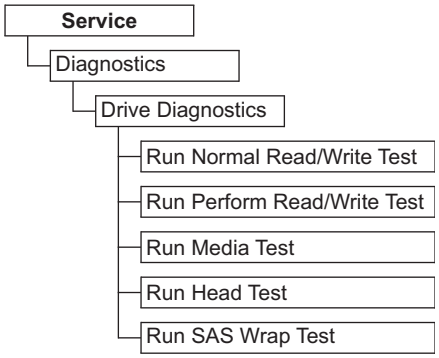

Figure 77. Drive diagnostic procedures

Select **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 R/W Test** - Runs a shortened version of the **Performance 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).
   - **Perform R/W Test** (Performance R/W Test) - Runs most of the tests that normally occur when the library is powered ON (POST). When prompted, load a CE 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 with all servo positions, and exercise all of the tape motion functions of the drive. Takes up to 30 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 78 on page 75) into the SAS host connector. Start the SAS wrap test. If the wrap test fails, contact your next level of support.

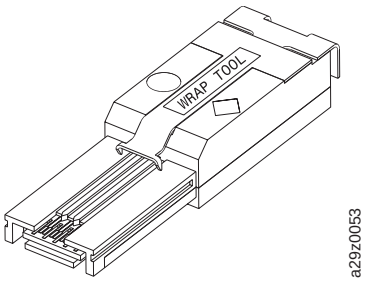

Figure 78. SAS wrap tool

- 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.
- View the **Error Log** to check if any errors occur.
  If an error occurs, see Appendix B, "Error codes," on page 187 to identify and locate the problem.

The Web User Interface

Figure 79 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 interfaces" on page 13.

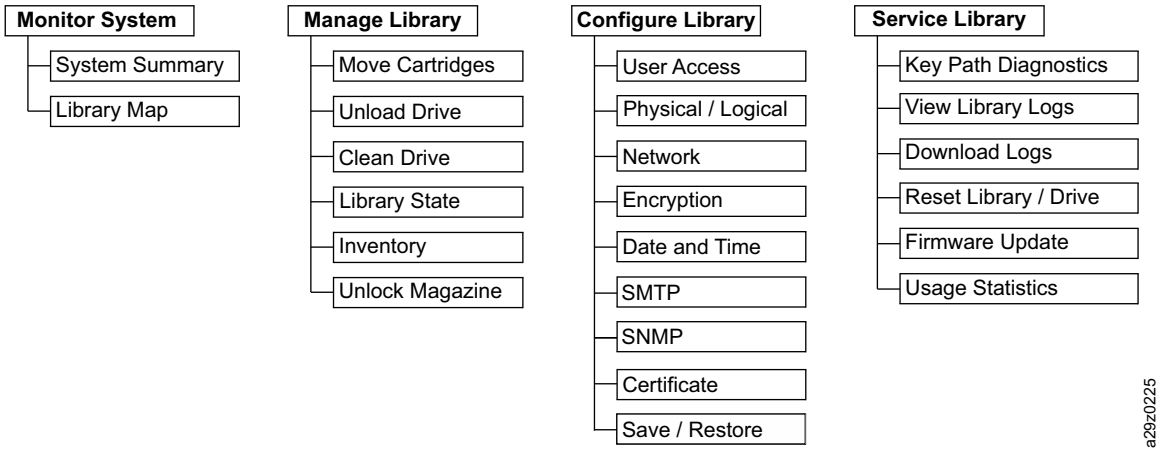

Figure 79. Web User Interface menu

Monitoring the library

The system summary

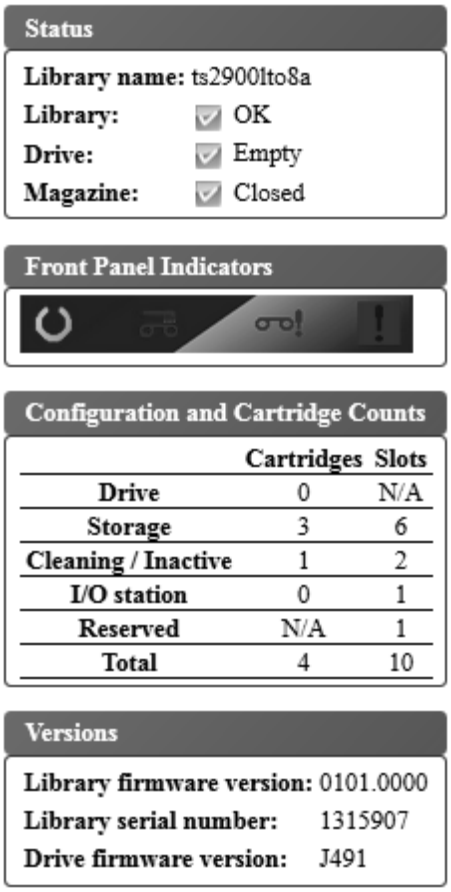

Figure 80. System Summary screen

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

- Library name
- Library status (OK, Degraded, or Failed). It displays Not Ready while initializing.
- Drive status (OK, Degraded, or Failed). It displays Empty, Loading, or Ejected when the drive is empty, loading media, or media is ejected or unloaded in the drive. It displays Cleaning when the cleaning cartridge is in the drive, and Initializing while initializing.
- Magazine status (Open/Closed, when Magazine 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 cleaning/inactive slots; Number of cleaning/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

The library map

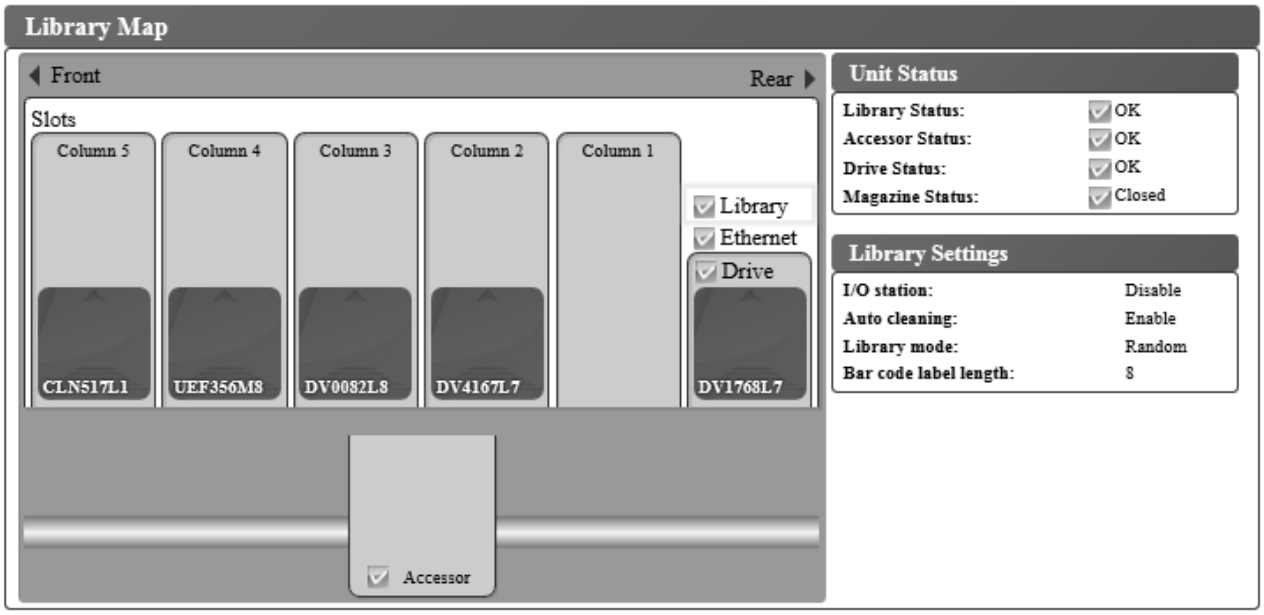

Figure 81. Library Map screen

Select **Monitor System** > **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 that is displayed varies according to the type of device selected:

- Unit Status
  - Library status (`OK`, `Degraded`, or `Failed`)
  - Accessor status (`OK`, `Degraded`, or `Failed`)
  - Drive Status (`OK`, `Degraded`, or `Failed`). Drive Status displays `Empty`, `Loading`, or `Ejected` when the drive is empty, loading media, or media is ejected/unloaded in the drive. It displays `Cleaning` when the cleaning cartridge is in the drive, and `Initializing` while initializing.
  - Magazine status (`Closed`, `Inserted`, or `Open`)
- Library Settings
  - I/O station (`Enabled` or `Disabled`)
  - Auto cleaning (`Enabled` or `Disabled`)
  - Library mode (`Random` or `Sequential`). In Sequential mode, Loop and Auto load mode are also displayed.
  - Bar code label length
- Ethernet information
  - Status (`OK`)
  - Link speed (`Auto`)
  - MAC address
  - Library WWNN (worldwide node name)
- TCP/IP Settings
  - Protocol (`IPv4 Only`)

- SSL for web (`Enable` or `Disable`)
- IPv4 Settings
  - IPv4 address
  - Subnet mask
  - Gateway address
  - DHCPv4 (`Enabled` or `Disabled`)
- Column **n**, Tier **n** Information
  - Slot type (`Storage`, `I/O station`, or `Cleaning`)
  - Element address
- Drive Information
  - Status (`OK`, `Degraded`, or `Failed`). Drive Status displays `Empty`, `Loading`, or `Ejected` when the drive is empty, loading media, or media is ejected/unloaded in the drive. It displays `Cleaning` when the cleaning cartridge is in the drive, and `Initializing` while initializing.
  - Vendor ID
  - Product ID
  - Serial number
  - F/W version (firmware)
  - World Wide ID (node name)
  - Encryption method (`None`)
- Cartridge Information
  - Media status (`OK`, `Degraded`, or `Failed`)
  - Cartridge label that is detected by the bar code reader
  - Encryption setting for data cartridges (`Not encrypted`, `Encrypted` or `Unknown`)
  - Remain - Number of uses left for cleaning cartridges. When a cleaning cartridge is added to the library (I/O station or cleaning slot) the remaining uses is displayed as 50. The actual remaining uses are updated when the cleaning cartridge is loaded into the tape drive. See “Cleaning cartridge” on page 111.
  - Write protect (`Yes` or `No`)

    Note: Write protect status is only detected and displayed when a cartridge is in a drive.
- Accessor Information
  - Status (`OK`, `Degraded`, or `Failed`)

Managing the library

Moving cartridges

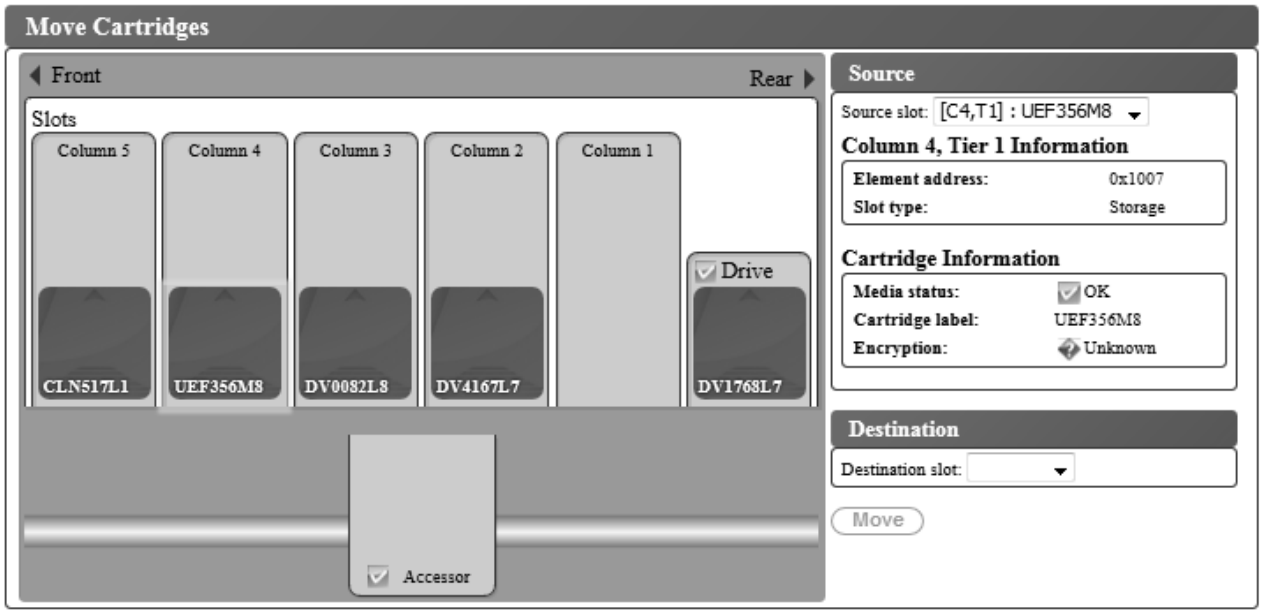

Figure 82. Move Cartridges screen

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 using either of two methods:

- Click and drag a cartridge from one location to another.
- Click a cartridge, select location coordinates from the **Destination slot** menu, and click **Move**.

clicking and dragging a cartridge from one location to another, or by clicking a cartridge and selecting a cartridge coordinate from the Destination slot menu, and clicking Move.

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 run the move.

The following information is displayed:

- Source
  - `Drive` or location coordinates (Column, Tier) in the library ([Cn,Tn] : Cartridge Label)
  - Column n, Tier n Information
    - Element address
    - Slot type (`Storage`, `I/O station`, or `Cleaning / Inactive`)
  - Drive Information
    - Status (`Ok` or `Empty`)
  - Cartridge Information
    - Media status (`OK`, `Degraded`, or `Failed`)
    - Cartridge label
    - Encryption capability for storage cartridges (`Unknown`, `Encrypted`, or `Not encrypted`)
    - Write protect (`Yes` or `No`)

Note: Write protect status is only detected and displayed when a cartridge is in a drive.

- Remaining uses for cleaning cartridges. When a cleaning cartridge is added to the library (I/O station or cleaning slot) the remaining uses are displayed as 50. The actual remaining uses are updated when the cleaning cartridge is loaded into the tape drive. See "Cleaning cartridge" on page 111.

- Destination
  - `Drive` or Location coordinates (Column, Tier) in the library ([`Cn`, `Tn`])
  - Column n, Tier n Information
    - Element address
    - Slot type (`Storage`, `I/O station`, or `Cleaning / Inactive`)

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. 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 with this command. However, cartridges can be moved from the accessor with this command if the library was powered OFF with a cartridge still held in the accessor.

Unloading the drive

Figure 83. Unload Drive screen

Select **Manage Library** > **Unload Drive**. Review the **Drive state** (Cartridge label or `Empty`) and click **Unload** to unload the tape cartridge from the tape drive head.

Unload when library is in `Random` mode: The cartridge in the drive is unloaded from the tape head mechanism, but is still retained inside the tape drive housing. The **Move Cartridges** command moves the cartridge from the drive to another location (see "Moving cartridges" on page 79). Moving a tape cartridge from a drive to another location both unloads and moves the cartridge in a single action.

Unload when library is in `Sequential` mode: The cartridge in the drive is unloaded from the tape head mechanism, and returned to the cartridge home position

Cleaning the drive manually

Figure 84. Clean Drive screen

Select **Manage Library** > **Clean Drive** to clean a drive manually.

1. Ensure that the drive is empty. (See "Moving cartridges" on page 79 to move a cartridge from the drive.)
2. Select a cleaning cartridge to use (from the magazine or from the I/O station)

3. Click **Clean**.

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

Taking the library online and offline

Figure 85. Library State screen

Select **Manage Library** > **Library State** to take the library online or offline. Check the library status, and click the button that is displayed to change the library status.

It is sometimes necessary to take the library offline before library servicing functions are completed. Once these operations are 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

Figure 86. Inventory screen

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

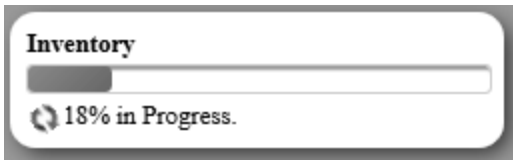

Figure 87. Inventory progress bar

An inventory is conducted automatically when the power is first turned ON or when a cartridge magazine is inserted.

Unlocking the cartridge magazine

Figure 88. Unlock magazine

Select **Manage Library** > **Unlock Magazine** to unlock and remove the cartridge magazine. When the cartridge magazine is unlocked, it can be removed from the library to insert or remove data and cleaning cartridges. When the cartridge magazine is fully inserted, the magazine locks into place. After the magazine is closed, wait for the library to complete its inventory before normal library operations resume.

Note: A blue release gate in the upper 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 protect cartridges that are ejected by the internal column spring.

Note: If the cartridge magazine is not removed within 5 minutes, it is automatically locked.

Configuring the library

Managing user access

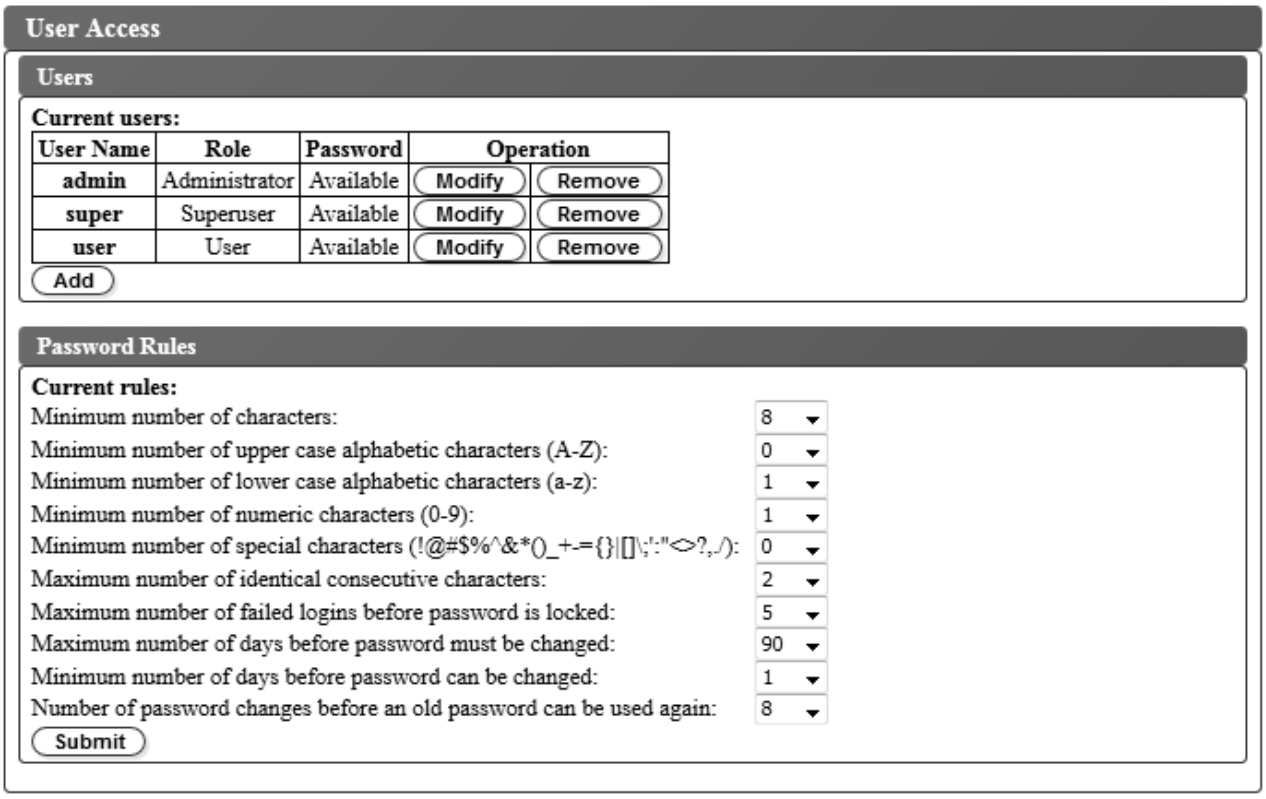

Figure 89. User Access screen

Select **Configure Library** > **User Access** to add, modify, or remove administrator, superuser, and user accounts, and to change passwords. Up to 7 users can be configured with the Web User Interface.

To add, modify, or remove users that are able to access the library with the Web User Interface:

1. In the **Configure Library** menu in the left navigation pane of the Web User Interface, click **User Access**.

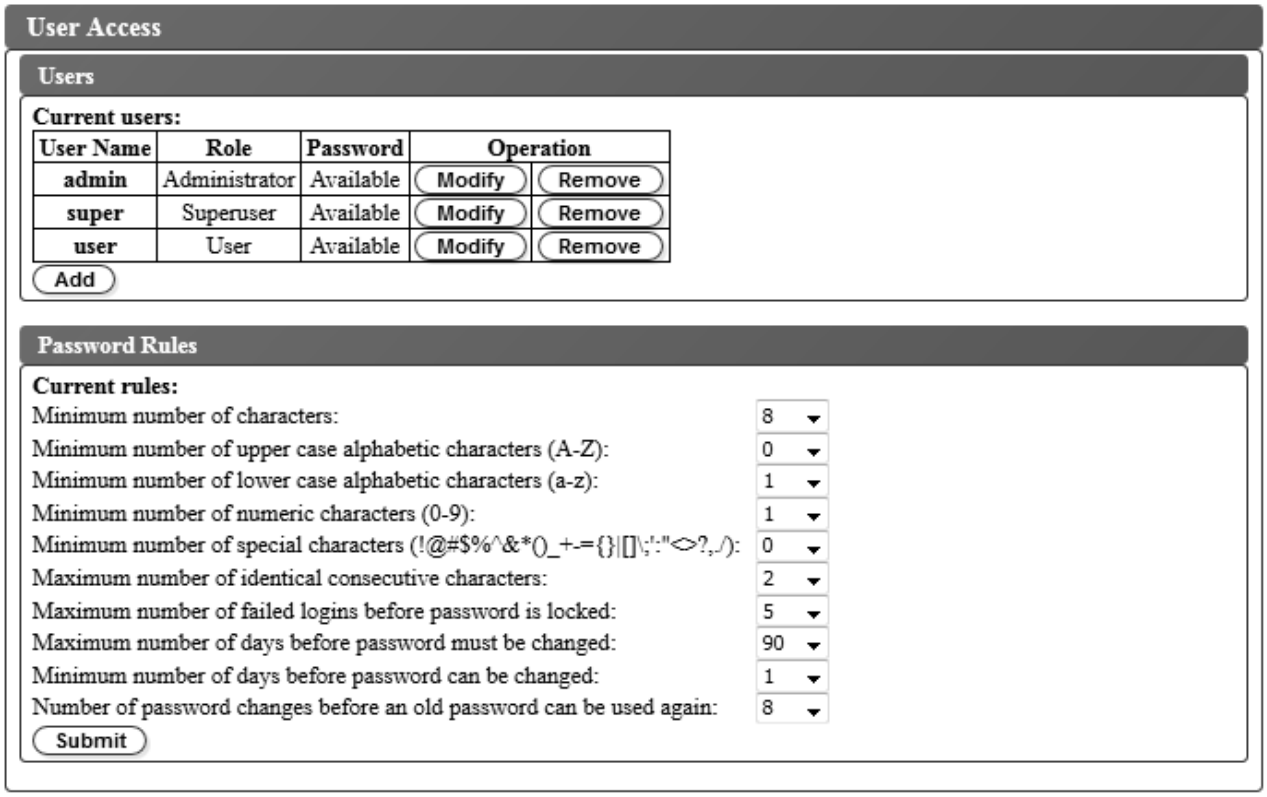

Figure 90. User access settings

2. To add, modify, or remove a user account, do the following:
   - Add a user account:
     a. Click **Add**

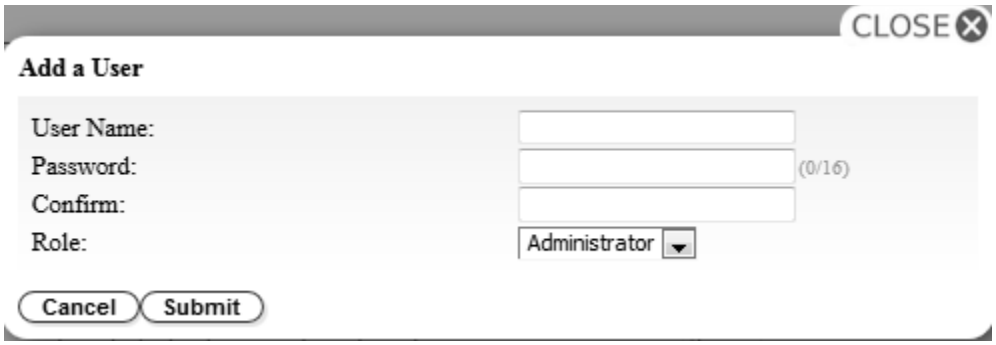

Figure 91. Add User dialog box

     b. Enter the **User Name** and **Password** into the dialog box and assign the user's role. Re-enter password to **Confirm**.
     c. Select one of the following from the **Role** menu:
        – **User** - User access permission allows users to monitor the library, but not to complete 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 complete tape library functions and change configuration settings.

d. Click **Submit** to save the new user.

Note: A new user's **Password** status is set to *Expired*. A new user is presented with a **Login failure** message and given the opportunity to create a new password.

- Modify a user account:

a. Observe the **Password** status of the user:

- **Available**: The password is available to be changed.
- **Expired**: The maximum password age was exceeded. **The password is now invalid.**
- **Unchangeable**: The minimum password age was not exceeded. **You cannot change the password.**
- **Locked**: The maximum number of failed login attempts for the account was exceeded.

Note: An administrator must unlock the account by modifying the account and entering a new password. The **Password** status changes to *Expired*.

b. Click **Modify** next to the User Name of the account.

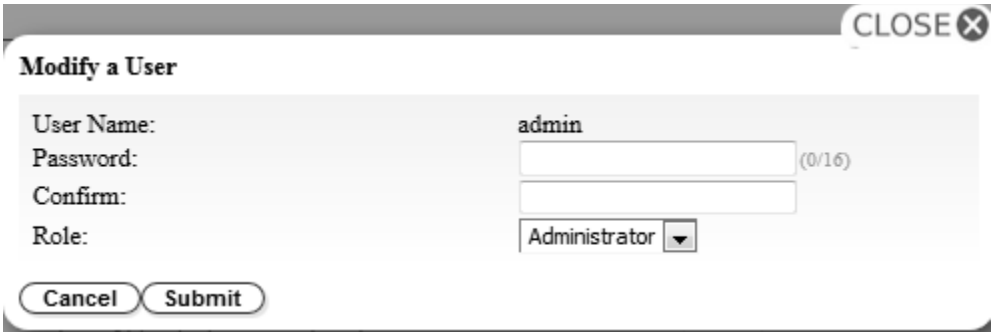

Figure 92. Modify user

c. Enter and confirm a new password (see "Configuring Password Rules Settings" on page 52).

d. Select one of the following from the **Role** menu:

- **User** - User access permission allows users to monitor the library, but not to complete 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 complete tape library functions and change configuration settings.

e. Click **Submit** to save the modified user account.

- Remove a user account

a. Click **Remove** next to a **User Name** to delete the account from the system.

Enter all user IDs and passwords on the Library Configuration form in Appendix F, "Library Configuration Form," on page 223.

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

Configuring Password Rules Settings

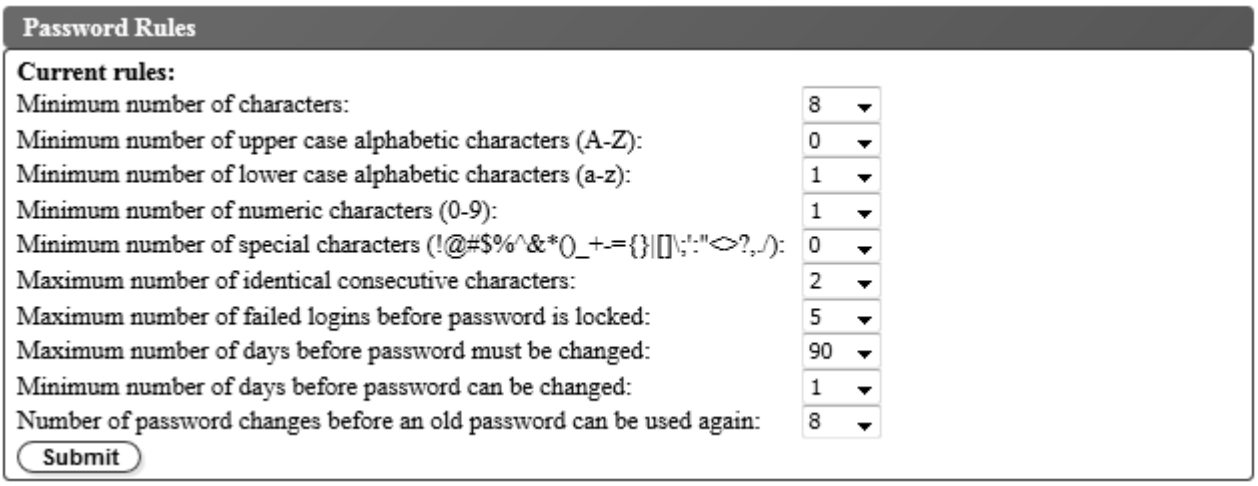

Figure 93. Password Rules screen

The **Password Rules** tab displays the rules for user passwords.

- **Minimum number of characters** - Choose the minimum password length. The factory default value is 8. The maximum password length is 16.
- **Minimum number of upper case alphabetic characters (A-Z)** - Choose the minimum number of uppercase alphabetic characters. The factory default value is 1.
- **Minimum number of lower case alphabetic characters (a-z)** - Choose the minimum number of lowercase alphabetic characters. The factory default value is 1.
- **Minimum number of numeric characters (0-9)** - Choose the minimum number of numeric characters. The factory default value is 1.
- **Minimum number of special characters (!@#$%^&*()_+={}|[]\;':"<>?,./)** - Choose the minimum number of special characters. The factory default value is 0.
- **Maximum number of identical consecutive characters** - Choose the maximum number of identical consecutive characters. The factory default value is 2. There is no limitation if 0 is selected.
- **Maximum number of failed logins before password is locked** - Choose the maximum number of failed logins before the password is locked. The factory default value is 5. Possible range for this configuration option is 0 - 10. There is no limitation if 0 is selected.
- **Maximum number of days before password must be changed** - Choose the maximum number of days before the password must be changed. There is no limitation if 0 is selected.
- **Minimum number of days before password can be changed** - Choose the minimum number of days before the password can be changed. A password can be changed immediately if 0 is selected.
- **Number of password changes before an old password can be used again** - Choose the number of password changes that are required before a password can be used again. A password can be reused immediately if 0 is selected.

Click **Submit** to save all the information.

Configuring physical and logical library settings

Physical library settings

Select **Configure Library** > **Physical/Logical** to configure the physical library settings.

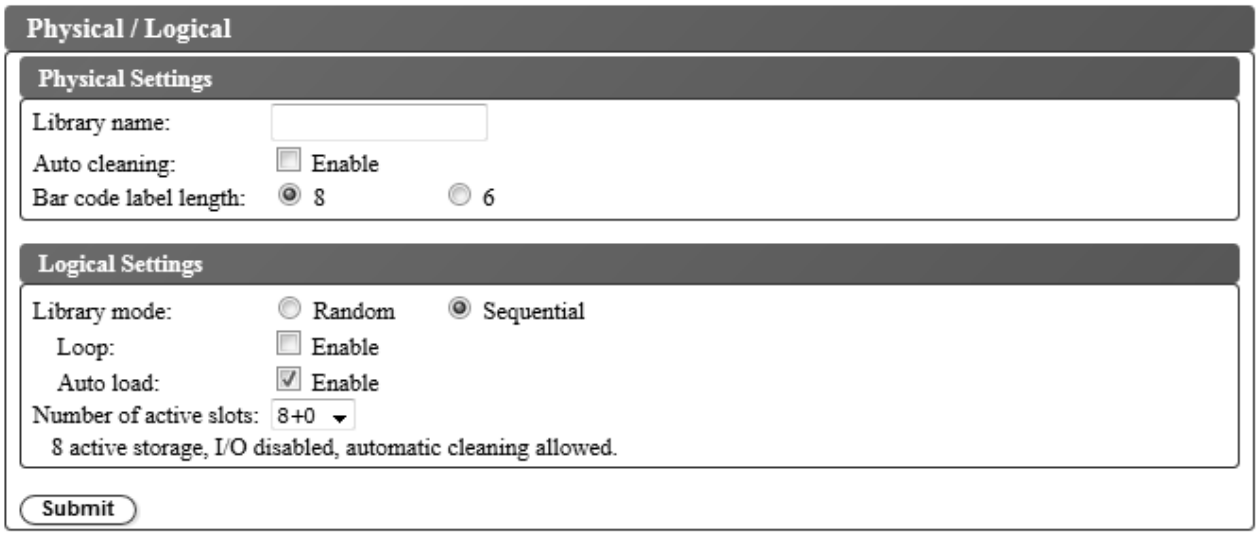

Figure 94. Physical library settings screen

The **Physical Settings** box contains settings for the library name, cleaning cartridge, and the cartridge label bar code. Do the following:

- **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. Use the **Logical Settings** box to set the number of active slots.
- **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 are updated successfully.

Logical library settings

Select **Configure Library** > **Physical/Logical** to configure the logical library settings.

The **Logical Settings** box contains settings for the library access mode and the number of active cartridge slots. Do the following:

- **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 9.

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

    Autoload - Sequential mode with auto load mode **Enabled** loads the first available cartridge (the lowest Column/Tier cartridge position that contains a cartridge) automatically if the library powers ON, or resets, with an empty drive. If the library powers ON with a cartridge already in the drive,

sequential mode will start from the home position of that cartridge, unless the host issues a rewind and unload command to the drive, in which case the next cartridge in sequence will be loaded into the drive.

To start sequential mode if autoload is OFF, select the **Move Cartridges** command to load the first cartridge into the drive. The sequence starts from the home position of that cartridge. Cartridges need not to be in contiguous slots.

To stop sequential mode, select the **Move Cartridges** command to unload the drive. This mode cancels sequential mode; the next sequential cartridge is NOT loaded.

To restart sequential mode, select the **Move Cartridges** command again to load a cartridge; the loading sequence resumes from the home position of that cartridge.

- **Number of active slots** - Select the number of active slots you would like to assign in your library. Selecting the number of active slots defines the number of storage slots, number of cleaning/inactive slots, whether the I/O station is enabled/disabled, and whether auto cleaning is allowed.

  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 one 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 are updated successfully.

Configuring network settings

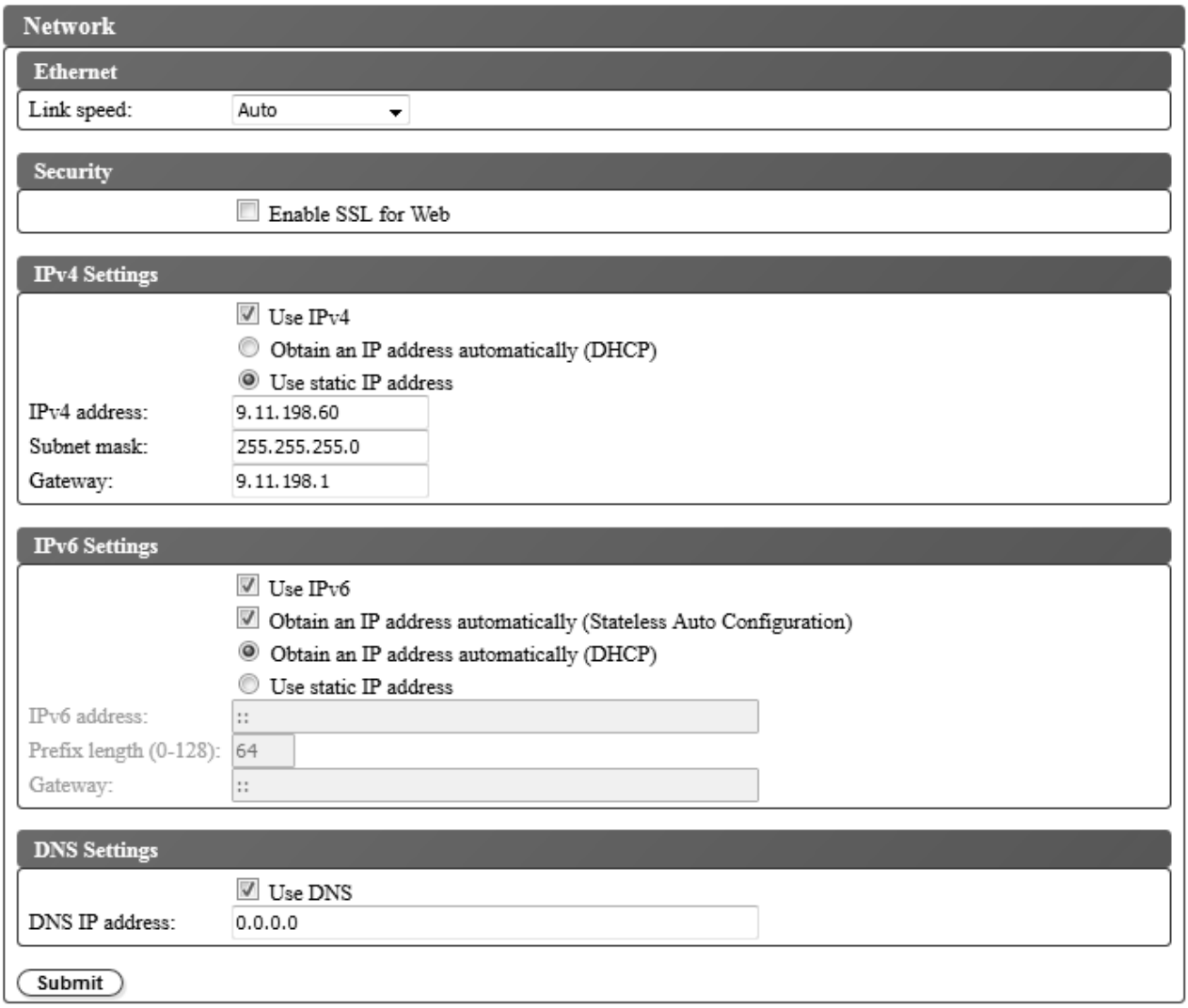

Figure 95. Network settings screen

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 with the following settings:

- **Ethernet** - Select link speed duplex mode (Auto, 10Base-T Full, 10Base-T Half, 100Base-TX Full, 100Base-TX Half).
- **Security** - Select **Enable SSL for Web** to provide secure communications between the web browser and the tape library.
- **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.
- **IPv4 Settings** - Select **Use IPv4** to enable the IPv4 Internet Protocol. Select the corresponding option to obtain an IP address automatically (DHCP) or use static IP address settings. When with DHCP, use the

Operator Panel to determine the library IP address. See “Current information” on page 63. Enter the following parameters if you are 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 Settings** - Select **Use IPv6** to enable the IPv6 Internet Protocol. Select the corresponding check box to obtain an IP address with stateless auto configuration. Select the corresponding option to obtain an IP address automatically (DHCP) or to use a static IP address. Enter the following parameters if you are using static IP address settings:
  - **IPv6 address** - Sets the TCP/IPv6 address of the library on the network.
  - **Prefix Length** - Decimal value 0 - 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 with host names 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 message is displayed when the settings are updated successfully.

Configuring encryption settings

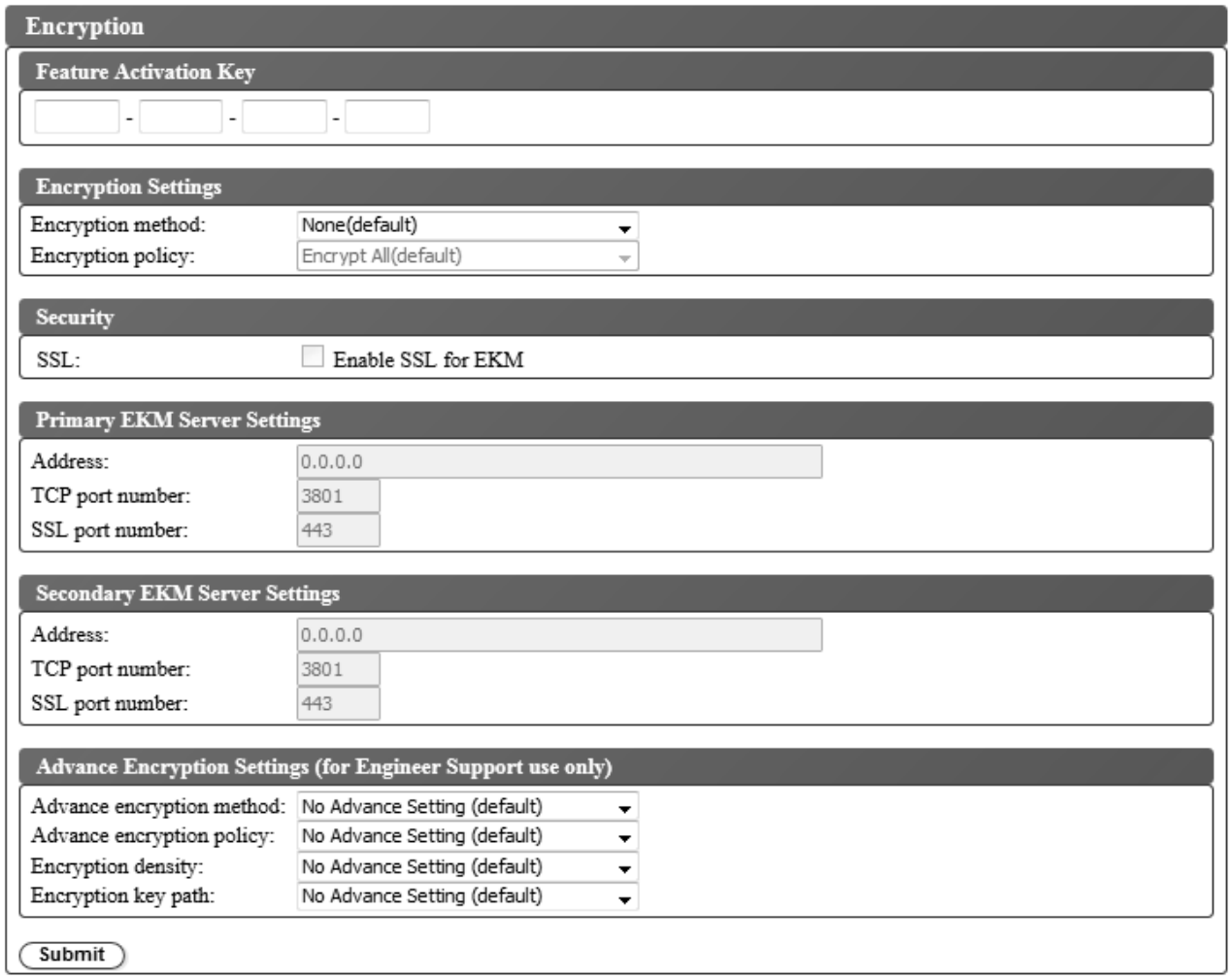

Figure 96. Encryption settings screen

Select **Configure Library** > **Encryption** to configure an encryption method for data that is stored on tape cartridges. The library supports transparent library-managed encryption by the tape drive itself (IBM Ultrium 4 (Model 3572-S4H), Ultrium 5 (Model 3572-S5H), Ultrium 6 (Model 3572-S6H, Ultrium 7 (Model 3572-S7H, and Ultrium 8 (Model 3572-S8H)) if you 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.

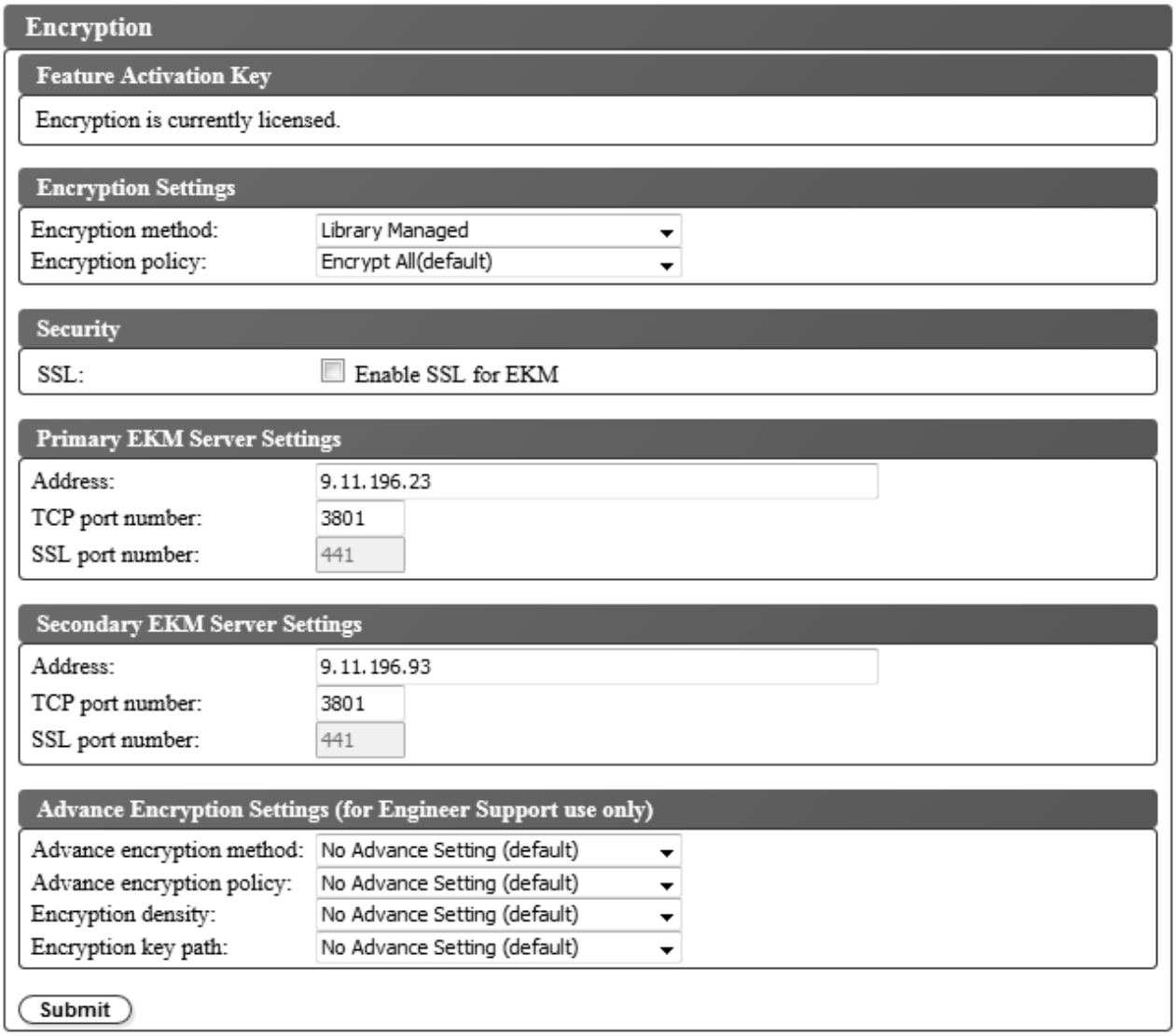

Figure 97. Encryption licensed settings screen

Note: Application Managed Encryption is the only option on a non-encryped-licensed library.

To modify the encryption settings:

1. In the **Configure Library** menu in the left navigation pane of the Web User Interface, click **Encryption**
2. Enter the **Feature Activation Key** (see Figure 38 on page 44) 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 Encryption and Library Managed Encryption are transparent to each other. A tape encrypted with System Managed Encryption might be decrypted with 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. Host names 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. Host names 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 that are loaded into the tape drive are encrypted.
   - **Internal Label - Selective Encryption** - This option is used only for Veritas Technologies NetBackup.
   - **Internal Label - Encrypt All** - This option is used only for Veritas Technologies 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.

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 are updated successfully.

Configuring date and time settings

Figure 98. Date and time settings screen

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

Note: If you manually set your date and time, you must reset the date and time after the library is power-cycled and after a library reset.

Note: When the library is power-cycled, wait 10 seconds after the power is OFF before the library is powered ON again.

Once the network settings are entered on the Operator Panel, the current date and time can be modified with 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:

1. In the **Configure Library** menu in the left navigation pane of the Web User Interface, click **Date and Time**.
2. Select the **Date and Time** settings.
   - Select the **Enable NTP Server** check box to enable time and date control with 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. Host names 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 Coordinated Universal Time (UTC).
   - If the time server is disabled, enter the local time and date manually.
     - **Date** - Enter the date with the MM/DD/YYYY format.
     - **Time** - Enter the time with the HH:MM:SS format.
   - Click **Load PC date time** to synchronize the library with the clock on your host computer at regular intervals.
3. Click **Submit** to update the settings.

Configuring email notifications

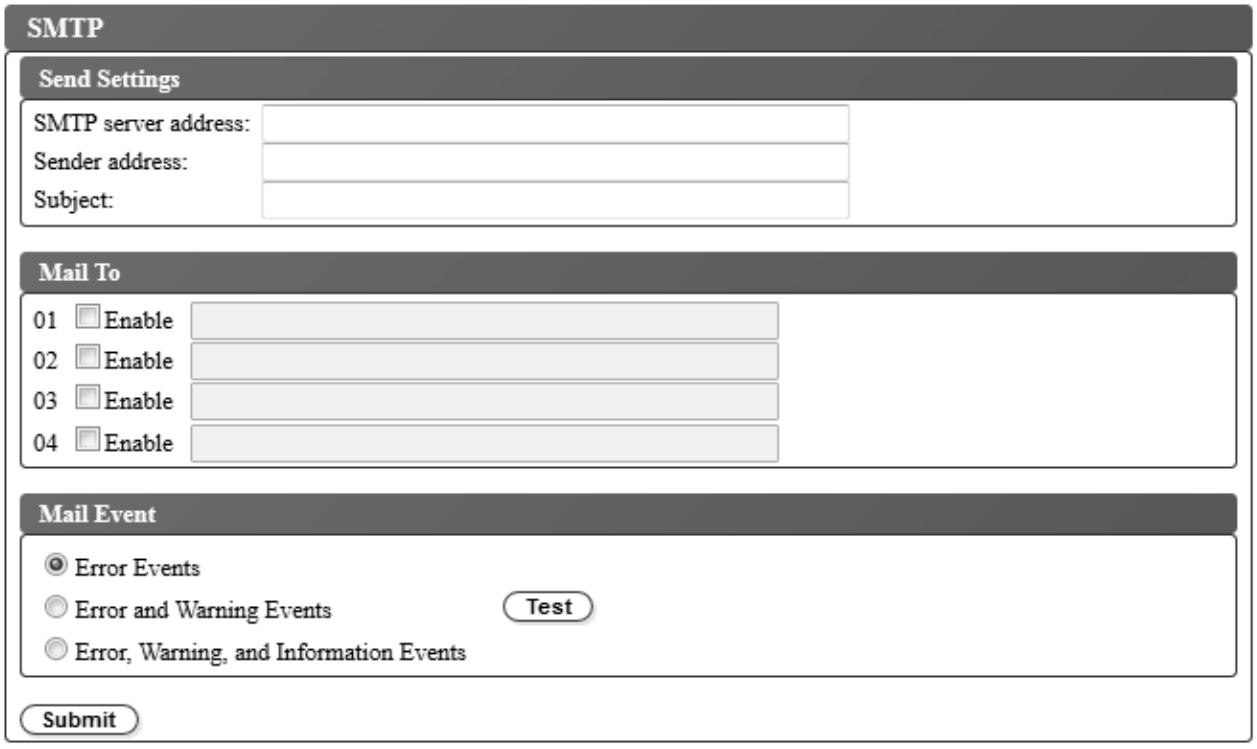

Figure 99. Email notifications

Note: This procedure is optional.

To set up email notifications of library events:

1. In the **Configure Library** menu in the left navigation pane of the Web User Interface, click **SMTP**.
2. Configure the **Send server** settings.
   - **SMTP server address** - SMTP mail server address. IPv4 and IPv6 addresses are supported. Host names 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.
3. Enter the email addresses to be notified when an event takes place in the **Mail To** fields, and click the **Enable** check boxes to select each address.
4. Select the event level to report in the **Mail Event** settings.
5. Click **Test** to send a test email message to the enabled addresses.
6. Click **Submit** to enable the settings.

Configuring trap notifications

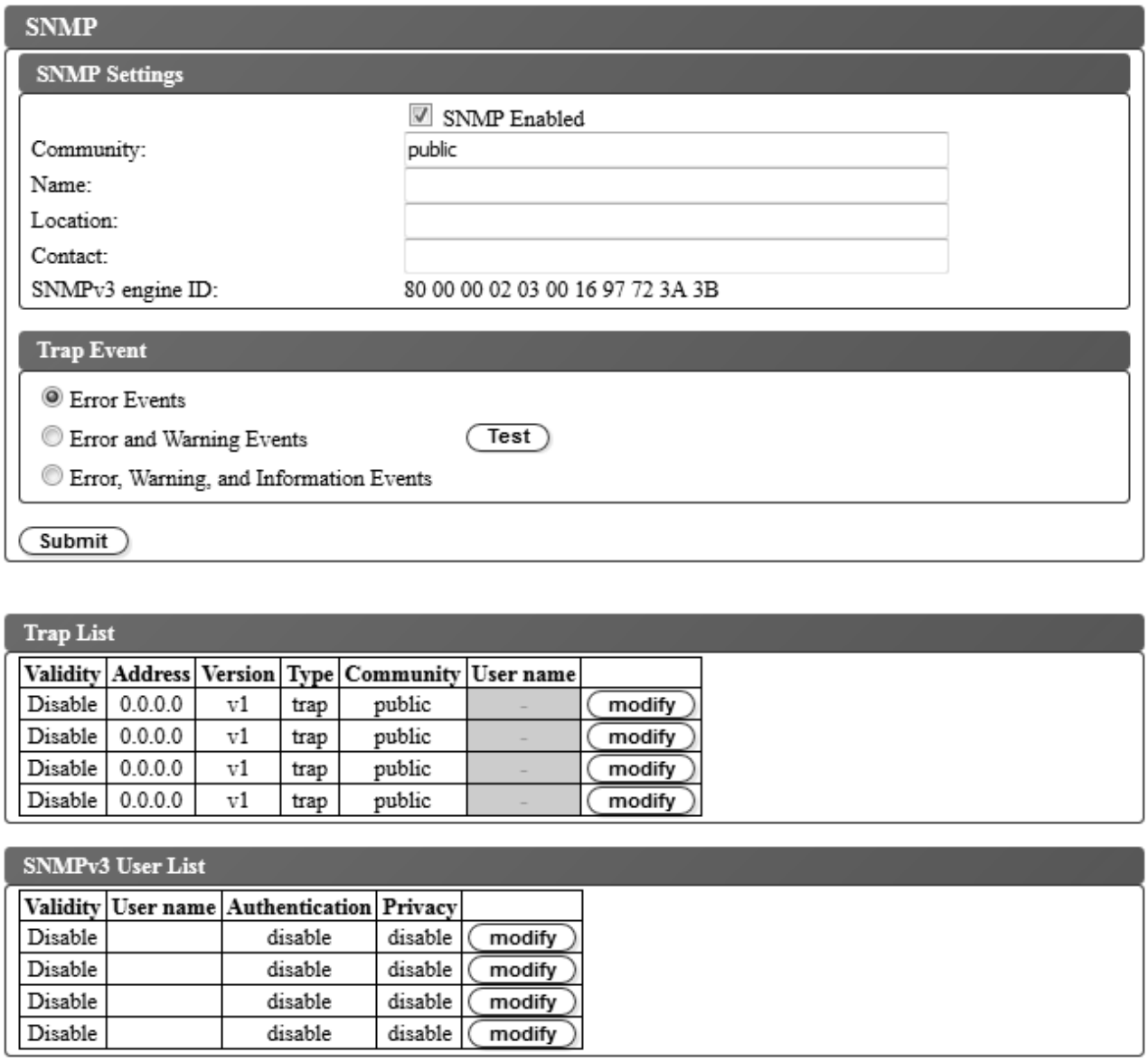

Figure 100. Trap notifications

Note: This procedure is optional. SNMP notifications are not enabled unless you have selected the **SNMP Enabled** check box. To disable SNMP notifications, clear the **SNMP Enable** check box and click **Submit**.

The traps that are supported by the TS2900 Tape Autoloader are listed in "Trap definitions (types)" on page 200.

To set up trap notifications for an SNMP server:

1. In the **Configure Library** menu in the left navigation pane of the Web User Interface, click **SNMP**
2. Select the **SNMP Enabled** check box.
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 that identifies the SNMPv3 engine.

4. Enter the settings of the SNMP monitoring stations to be notified when an event takes place by clicking the **modify** buttons in the **Trap List** box.

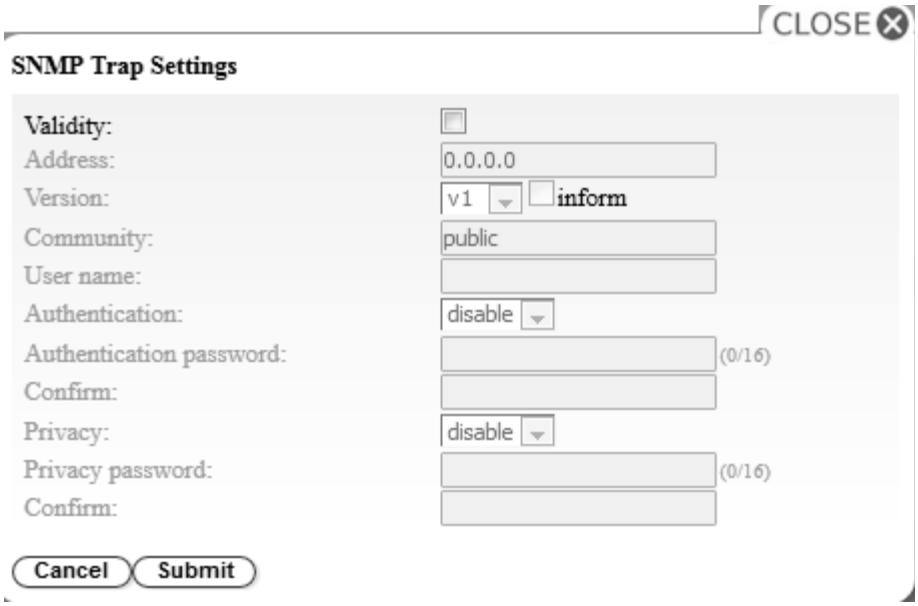

Figure 101. SNMP trap settings

- **Validity** - Select the check box to enable and clear the check box to disable.
- **Address** - IPv4 and IPv6 addresses are supported. Host names can be entered instead of numerical IP addresses if the DNS server is specified.
- **Version** - Trap version v1, v2c, or v3. For v2c and v3, the **Inform** check box determines if an SNMP INFORM request is sent instead of a trap event.
- **Community** (v1 or v2c) - SNMP community name.
- **User name** (v3 only) - SNMPv3 unique user name.
- **Authentication** (v3 only) - Authentication algorithm: **disable**, **MD5**, or **SHA**.
- **Authentication Password** - When an **Authentication** algorithm is enabled, an **Authentication Password** is required. (see "Configuring Password Rules Settings" on page 52).
- **Confirm** - Re-enter the Authentication Password to confirm it.
- **Privacy** (v3 only) - Privacy service encryption and decryption algorithm: **disable**, **DES**, or **AES**. When an algorithm is specified, a privacy password is required.
- **Privacy password** - enter a password (see "Configuring Password Rules Settings" on page 52).
- **Confirm** - Re-enter the **Privacy password** to confirm it.

5. Click **Submit** to save the SNMP Trap settings. Modify each trap's settings by repeating the previous step.
6. Enter the SNMPv3 users who are allowed to access the tape library by clicking the **modify** buttons in the **SNMPv3 User List** box.

Figure 102. SNMPv3 user settings

- **Validity** - Select the check box to enable and clear the check box to disable.
- **User name** - SNMPv3 unique user name.
- **Authentication** - Authentication algorithm: **disable**, **MD5**, or **SHA**. When an algorithm is specified, an authentication password is required.
- **Authentication password** - enter a password (see "Configuring Password Rules Settings" on page 52).
- **Confirm** - Re-enter the **Authentication password** to confirm it.
- **Privacy** - Privacy service encryption and decryption algorithm: **disable**, **DES**, or **AES**. When a privacy algorithm is specified, a privacy password is required.
- **Privacy password** - enter a password (see "Configuring Password Rules Settings" on page 52).
- **Confirm** - Re-enter the **Privacy password** to confirm it.

7. Select the event level to report in the **Trap Event** box.
8. Click **Test** to send a test trap notification to the enabled IP addresses.
9. Click **Submit** to enable the settings.

Uploading and configuring the SSL certificate

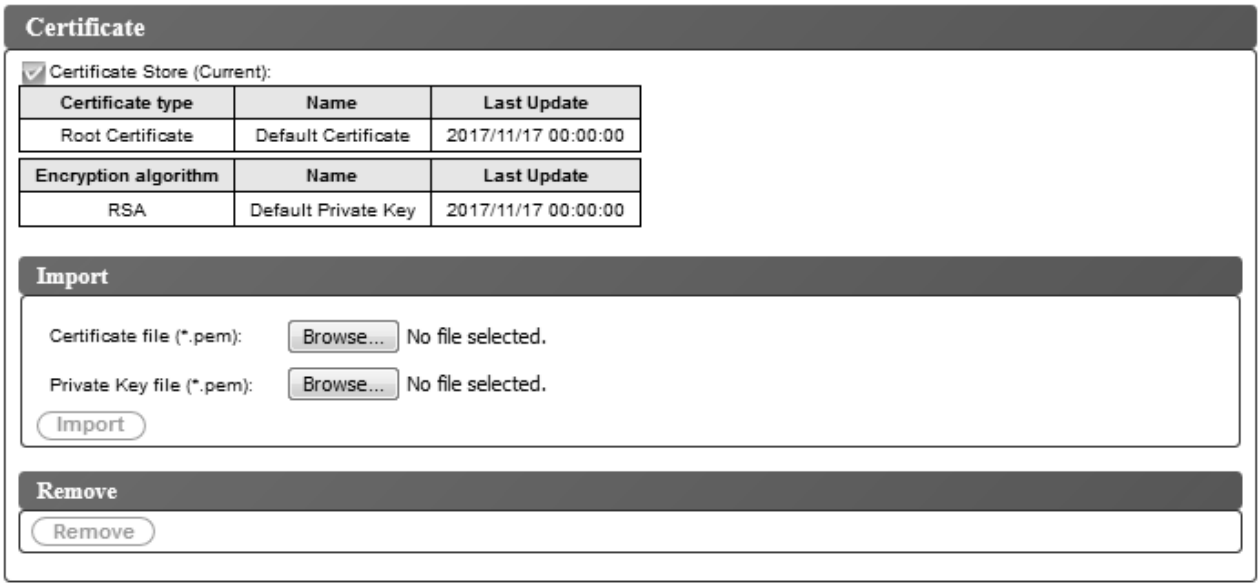

Figure 103. Certificate screen

This library takes in certificate content and key content in two separate `.pem` files. The library requires a browser restart or library power reset for a certificate change or update.

1. Use **Configure Library** > **Certificate** to upload a SSL certificate.
2. In the **Import** box, click the **Browse...** buttons to navigate to the Certificate and Private Key files to be imported.
3. When the **Certificate** and **Private Key** files are selected, click **Import** in the **Import** box.
4. Click **Ok** in the message box to start the certificate import.
5. When the import completes, an `Import was successful` message appears. Click **OK**.

   Where the current SSL session uses the previous certificate as-is, the new SSL session uses the imported Certificate. Log off, close and restart the browser, and log back in, using the new imported Certificate.
6. The information for the imported Certificate is shown.

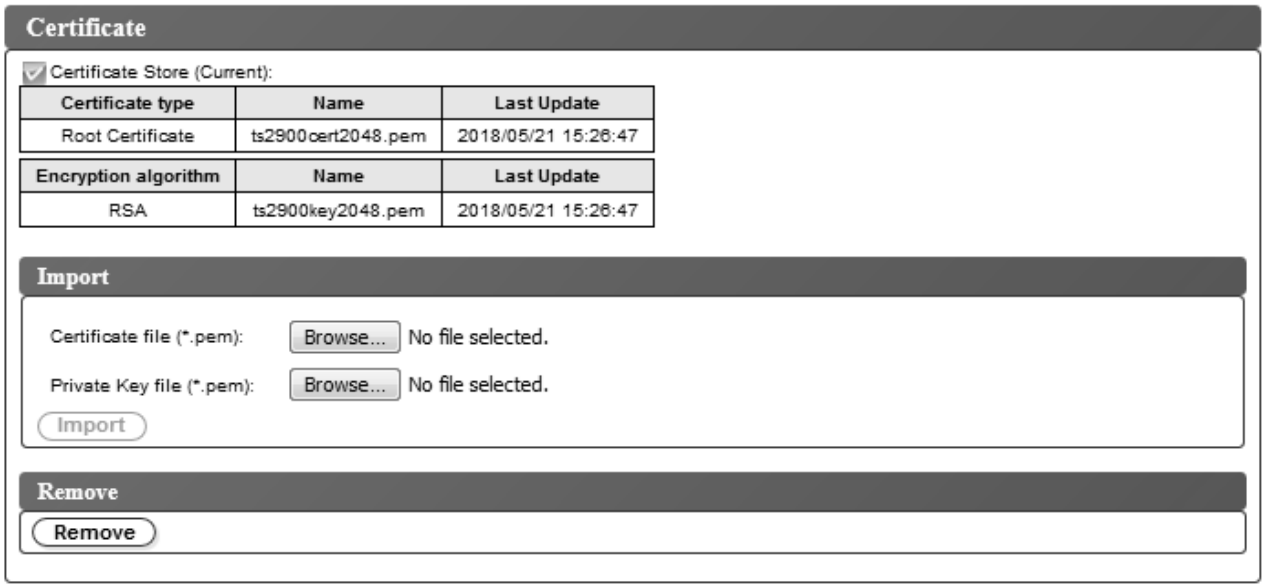

Figure 104. New certificate

7. To remove a Certificate and Private Key, click **Remove** in the **Remove** box.

   Note: When a user-provided certificate and private key are removed, the system defaults to the self-signed certificate and private key that shipped with the machine.

Note: The imported SSL Certificate/Private Key is not saved during the **Save/Restore** function on the Autoloader. If the IBM TS2900 Autoloader is replaced, the SSL Certificate and the Private Key must be imported again, if needed.

Saving and restoring configuration settings

Your library configuration can be saved and restored automatically by a cookie and manually by with the Web User Interface. It is recommended that you use the Web User Interface method whether you use the cookie method.

Important: Verify all configuration settings after your library configuration is restored. Reset the library date and time (see "Configuring date and time settings" on page 93).

Saving and restoring configuration automatically with 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 with cookies.

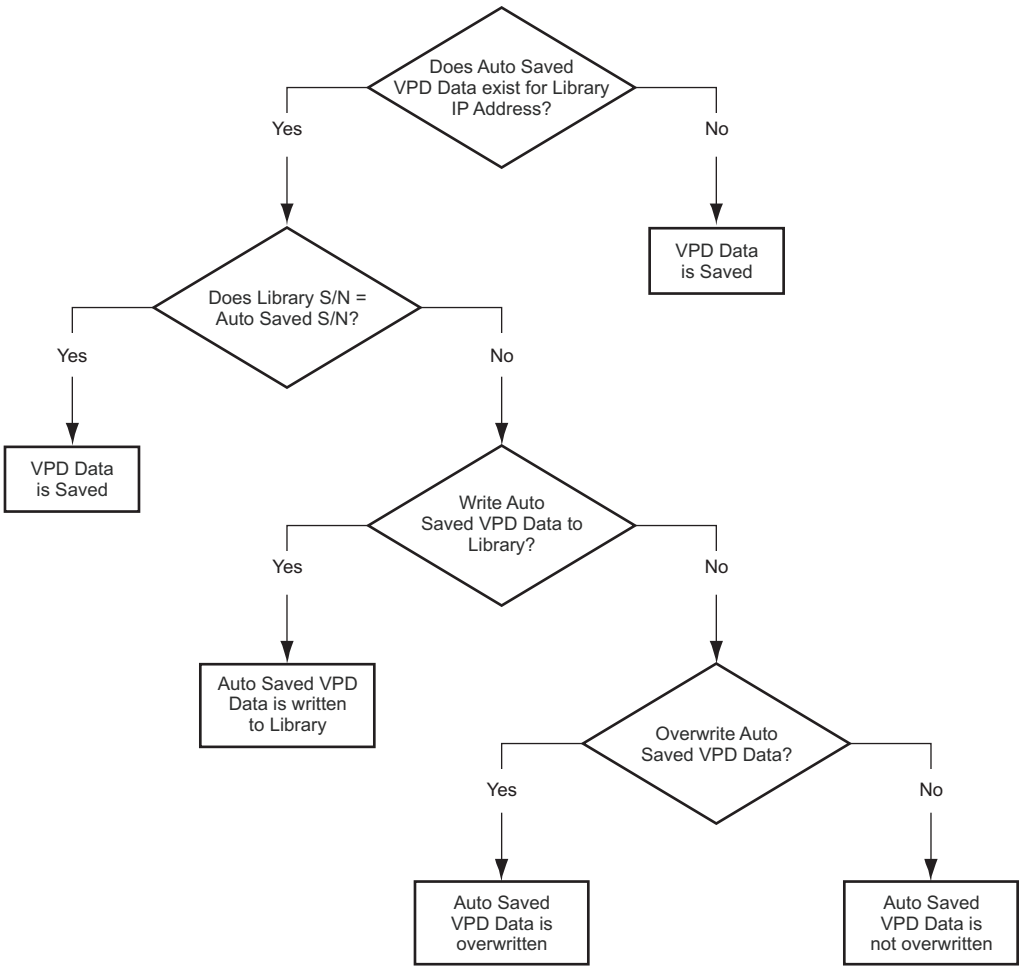

Figure 105. Save/Restore configuration with cookies

Saving and restoring configuration manually with Web User Interface

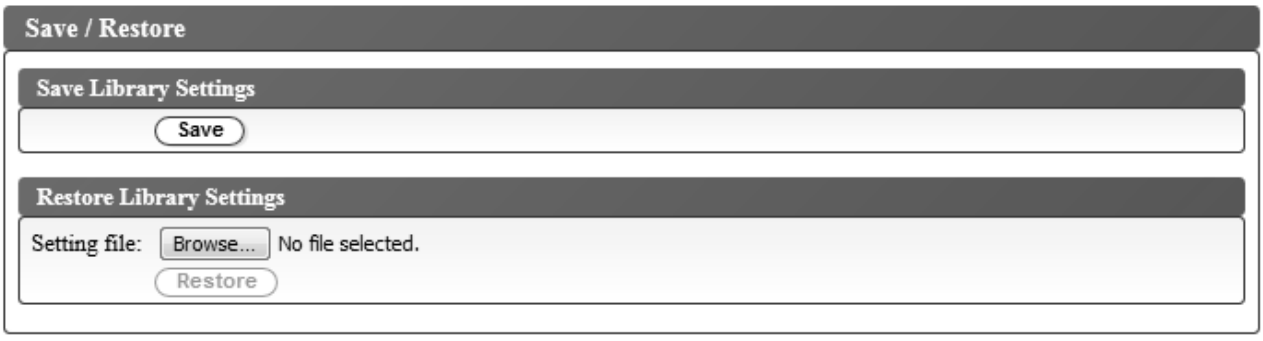

Figure 106. Save configuration

Note: This procedure is recommended.

Each time that you change the configuration of your library, save the configuration. This function also maintains several library configuration profiles that can be restored to the library when wanted with the Web User Interface.

To save a library configuration:

1. In the **Configure Library** menu in the left navigation pane of the Web User Interface, click **Save/Restore**
2. In the **Save Library Settings** box, click **Save** to create a configuration file of your library on your computer.

To restore a library configuration:

1. Click **Browse** to navigate to and select your saved configuration file.
2. Click **Restore** to load the settings from a file.

Servicing the library

Running encryption Key Path diagnostic procedures

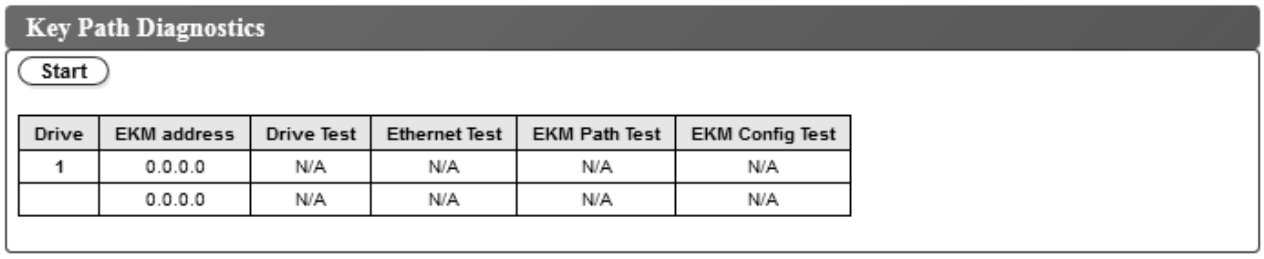

Figure 107. Key path diagnostics screen

Select **Service Library** > **Key Path Diagnostics** to run diagnostic tests of the encryption key path if the drive in your Model S4H, S5H, S6H, S7H, or S8H, library is set up for library-managed encryption. Key Path Diagnostics run tests for the tape drives, network connection, EKM path, and the EKM configuration.

Note: Verify the device is Offline at the host prior to exercising any service functions. Ensure that any media in the drive is moved from the drive.

The test consists of four parts:

- **Drive Test** - The library completes a drive communication test to confirm communication with the drive Ethernet test.
- **Ethernet Test** - The library pings each EKM server IP address and records the result.
- **EKM Path Test** - The library completes an EKM communication test for each EKM server IP address that passed the Ethernet Test. The library sends an **LDI Crypto Diagnostics** command to the drive. This drive command causes the drive to send a test message to the EKM verifying that the application is up and running.
- **EKM Config Test** - The library completes an EKM configuration test for each EKM server IP address that passed the EKM Path Test. The library sends an **LDI Crypto Diagnostics** command to the drive. This drive command causes the drive to establish a link and obtain a default key from the EKM. This test verifies that the drive is correctly configured in the EKM.

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

Library logs

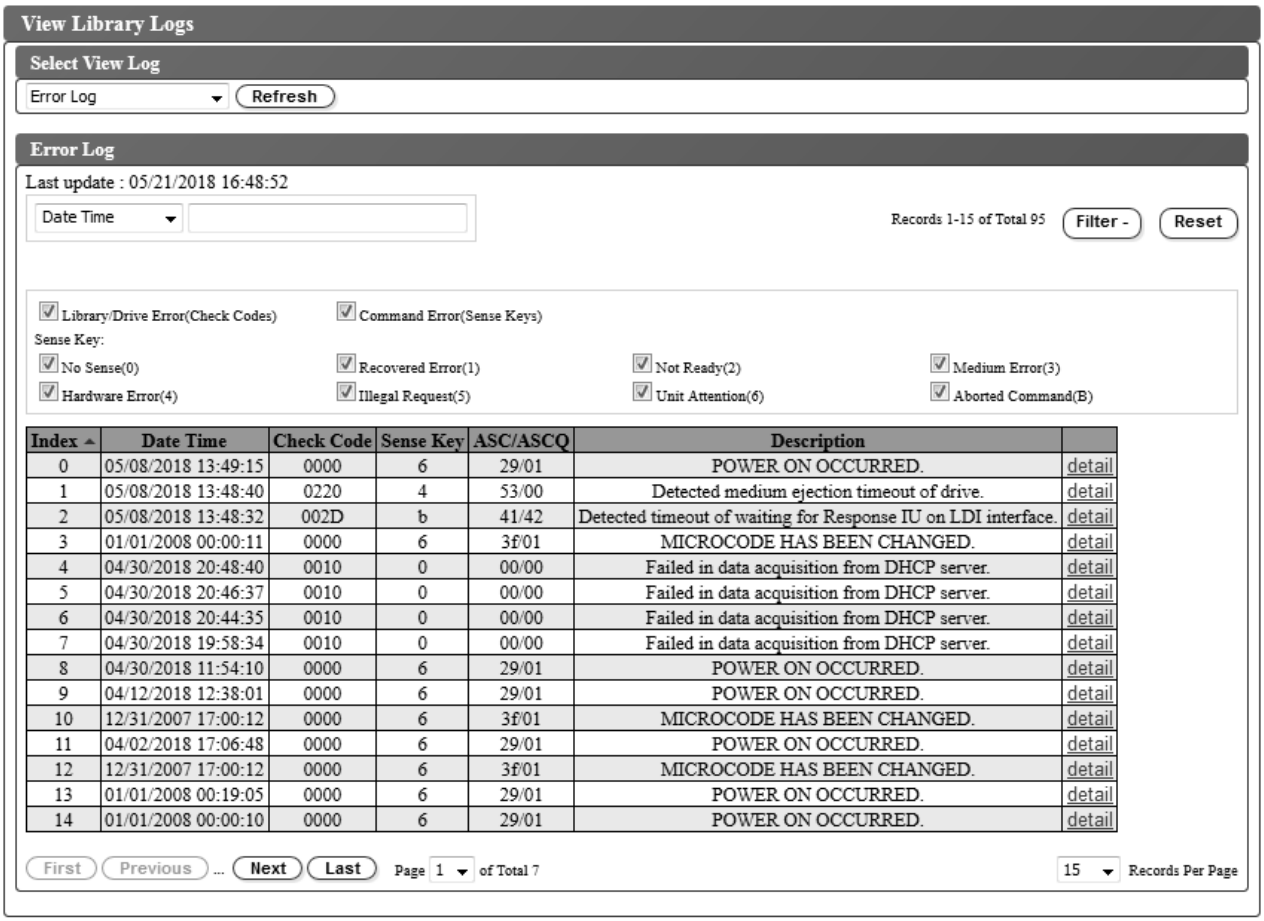

Figure 108. View Library Logs screen

Select **Service Library** > **View Library Logs** to display a log history summary of errors that 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.

Click **detail** in the index of error messages to see more information about the error.

The information that is displayed for the error comprises:

Index Index number in the error listing.

Date Time
Timestamp of the error

Check Code
Library error code. Information about errors and actions to resolve the problem is listed in Appendix B, "Error codes," on page 187

Sense Key
Sense data is generated by a drive when it encounters errors. Information about sense keys is listed in "Sense Key definitions" on page 207

ASC/ASCQ
Additional Sense Code/Additional Sense Code Qualifiers. Information about ASC/ASCQ is listed in "Library sense data" on page 208

Description
Description of the error

detail Link to more details about the error

Downloading logs

Tape library logs and drive logs may be used by support personnel to help troubleshoot problems.

Select **Service Library** > **Download Logs** to download the library log or to download the tape drive memory dump.

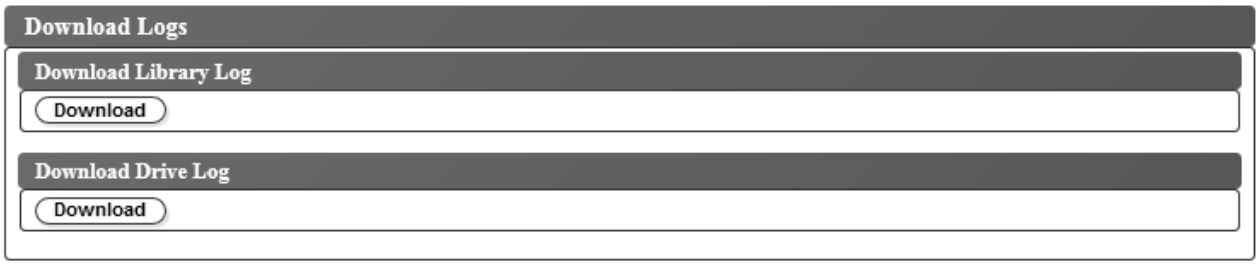

Figure 109. Download Logs screen

To download the library logs:

1. Click **Download** in the **Download Library Log** box to download the library logs and save to a file.
2. After confirming, the library goes offline and the download begins.
3. Click **Save File** in the dialog box and save the file.

To download the drive logs:

1. Click **Download** in the **Download Drive Log** box, to download the drive logs and save to a file.
2. After confirming, the library goes offline and the download begins.
3. Click **Save File** in the dialog box and save the file.

   The resulting zip file contains the Force Memory Dump Data (ForceDriveLog.dmp) and the Normal Memory Dump Data (NormalDriveLog.dmp).

Resetting the library and drives

Figure 110. Reset library and drive screen

Select **Service Library** > **Reset Library/Drive** to reset the library or the tape drive.

Select the **Target device** and click **Execute Reset**. Click **OK** to confirm. The library and tape drive status is displayed. The **Device Status** may display `Failed` until the device is back online. The **Device Status** displays a green checkmark when the device is reset. The reset operation is fully completed when the drive or tape library is taken online.

Updating library and drive firmware

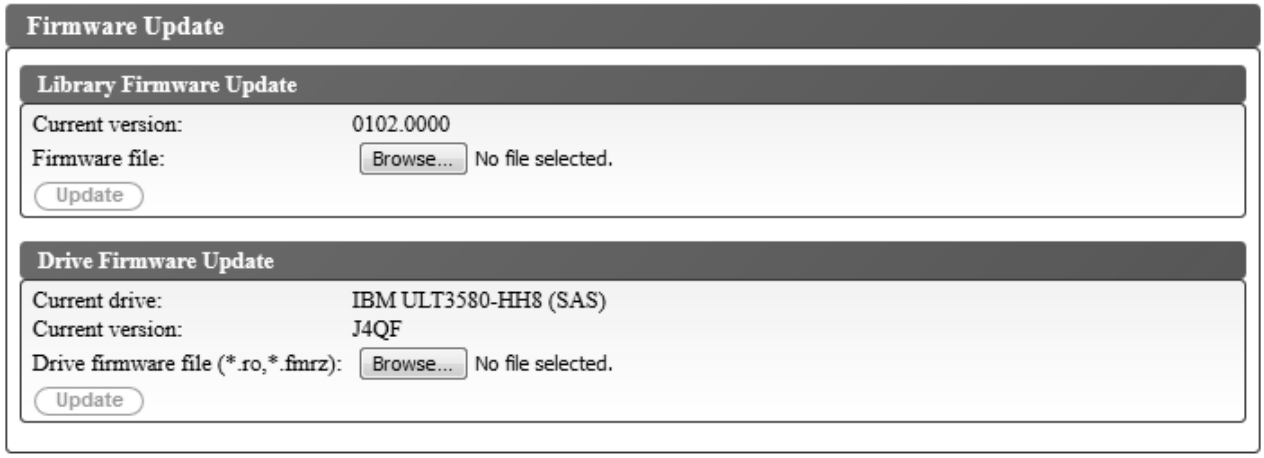

Figure 111. Firmware Update screen

Select **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.

Consider these IBM recommendations to provide maximum performance and reliability:

- The latest version of microcode must be installed on your IBM tape libraries and devices.
- The library code must be updated first, unless noted otherwise. This action supports any changes that are introduced in the library code for that drive, or any changes made to the drive for that release.
- These firmware updates are intended to increase overall reliability, improve tape handling, reduce the possibility of data errors, and enhance diagnostic capabilities.

To determine the latest supported firmware level:

1. Visit the web at http://www.ibm.com/support/fixcentral.
2. Select **Storage Systems** from the **Product Group** menu.
3. Select **Tape Systems** from the **Product Family** menu.
4. Select the appropriate link from the **Product Type** menu. For example, select **Tape autoloaders and libraries** from the **Product Type** menu, then **TS2900 Autoloader** from the **Product** menu to find links to updates.

To determine the **Current drive** and **Current version**, see the settings in the **Drive Firmware Update** box.

Note: The current drive and current version can also be found by navigating to **Monitor System** > **Library Map**. Select the **Drive** component in the library map to display the **Drive Information** box. The **Product ID** is the drive that is installed in the library.

Note: Ensure that you download and install the correct drive firmware.

- Firmware for the ULT3580-HH4 drive is not compatible with the ULT3580-HH4 V2 drive.
- Firmware for the ULT3580-HH4 V2 drive is not compatible with the ULT3580-HH4 drive.

To update library and drive firmware:

1. Unload the tape drive, if there is a cartridge in the tape drive, before the library and drive firmware are updated.

2. Use **Service Library** > **Firmware Update** and 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 indicates that the operation is complete. This means that the firmware file is successfully moved from the host computer to the library.
3. Wait for the library to reboot before normal library operations resume. It can take several minutes before the library reboots.
4. Verify the firmware update by viewing the **System Summary** on the Web User Interface.

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 Tape Diagnostic tool (ITDT) is a tool that is 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 describes the features and capabilities of the ITDT tool, and gives detailed information about how to use it. See "The IBM Tape Diagnostic tool (ITDT)" on page 139.

Usage statistics

Usage Statistics

Last update : 05/22/2018 16:04:34

Motion Counts

Move	42,645
Accessor	99,855
Picker	85,290
X Move	85,290

Retry Counts

Drive	0
C1,T2	0
C1,T1	0
C2,T2	0
C2,T1	0
C3,T2	0
C3,T1	8
C4,T2	1
C4,T1	1
C5,T1	0

Error Counts

Picker motion	10
X Move motion	1
Drive loading	2
Drive unloading	2

Figure 112. Usage Statistics screen

Select **Service Library** > **Usage Statistics** to view statistics information about the movement of the robotics of the library.

The **Last update** shows the time of the most recent library data refresh.

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 (reattempts 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.

Media

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

Figure 113 shows the IBM LTO Ultrium Data Cartridge and its components.

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

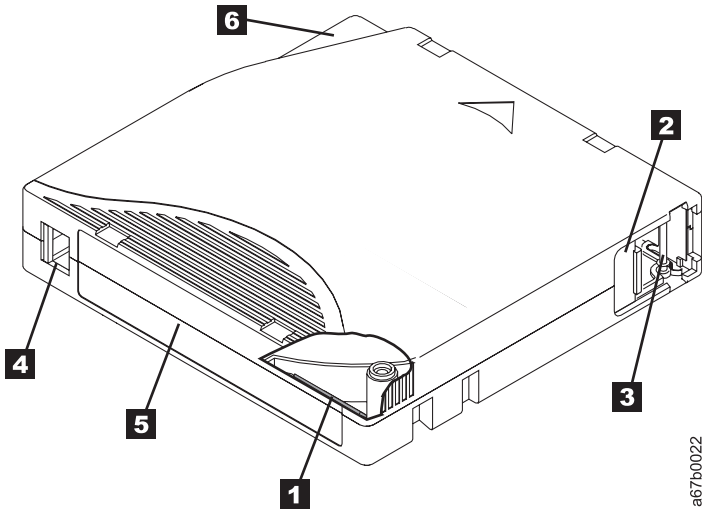

Figure 113. The IBM LTO Ultrium Data Cartridge

Note: The same components are on all the IBM LTO Ultrium Data Cartridges.

Data cartridges

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

Table 17. Cartridge types and colors

Type	Color
Ultrium 8	Burgundy
Ultrium 8 WORM	Silvery gray
Ultrium M8	Purple
Ultrium 7	Purple
Ultrium 7 WORM	Purple and Silvery gray
Ultrium 6	Black
Ultrium 6 WORM	Black and Silvery gray
Ultrium 5	Burgundy
Ultrium 5 WORM	Burgundy and Silvery gray
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, magnetic 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 125.

When tape is processed in the cartridges, Ultrium Tape Drives use a linear, serpentine recording format. For the native data capacity and recording format for Ultrium data cartridges, see Table 3 on page 2.

The first set of tracks is written from near the beginning of the tape almost to 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** in Figure 113 on page 107) protects the tape from contamination when the cartridge is out of the drive. The tape is attached to a leader pin (**3** in Figure 113 on page 107) 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** in Figure 113 on page 107 prevents data from being written to the tape cartridge. For more information, see “Write-Protect switch” on page 114.

The label area (**5** in Figure 113 on page 107) provides a location to place a label. For more information, see “Bar code labels” on page 111.

The insertion guide (**6** in Figure 113 on page 107) is a large, notched area that prevents the cartridge from being inserted incorrectly.

Table 18. Nominal cartridge life: Load/unload cycles

Type	Load/Unload Cycles
Ultrium 8	20,000 (20k)
Ultrium M8	20,000 (20k)
Ultrium 7	20,000 (20k)
Ultrium 6	20,000 (20k)
Ultrium 5	20,000 (20k)
Ultrium 4	20,000 (20k)
Ultrium 3	20,000 (20k)
Ultrium 2	10,000 (10k)
Ultrium 1	5000 (5k)

Cartridge compatibility

For information on Ultrium data cartridge compatibility with Ultrium tape drives, see Table 6 on page 9.

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 Ultrium Tape Drive SCSI Reference*.

LTO type M cartridge (M8)

The LTO Program introduced a new capability with LTO8 tape drives: the ability to write 9 TB (native) on a brand new LTO Ultrium 7 cartridge instead of 6 TB (native) as specified by the LTO7 format. Such a cartridge is called an LTO7 initialized LTO Type M cartridge. These LTO Type M cartridges are identifiable by using an automation bar code label that ends with the last 2 characters “M8”.

Table 19. LTO7 and LTO8 Cartridge Types

Cartridge/Density type	Bar code label	Cartridge Packaging/Silkscreen labeling	Native capacity	Tape Drive compatibility
L8	xxxxxxL8	LTO Ultrium 8	12 TB	LTO8
M8	xxxxxxM8	LTO Ultrium 7	9 TB	LTO8
L7	xxxxxxL7	LTO Ultrium 7	6 TB	LTO7, LTO8

From now on, these cartridges are referred to as L8, M8, and L7.

Only new, unused LTO Ultrium 7 cartridges can be initialized as M8 cartridges. When a cartridge is initialized as M8, it cannot be changed back to L7. Initialized M8 cartridges can be written and read only in an LTO8 tape drive. LTO7 tape drives cannot read initialized M8 cartridges.

M8 cartridges can be purchased as either pre-initialized (also referred to as “labeled and initialized”) M8 data cartridges or uninitialized M8 data cartridges (M8 WORM cartridges are not supported). For either option, the bar code label is included. However, the uninitialized M8 data cartridge must first be initialized in tape libraries that support the automatic initialization of uninitialized M8 cartridges while under the control of ISV applications that recognize the “M8” bar code label.

A tape cartridge is initialized when it is first loaded into a compatible tape drive and data is written by the ISV application at the beginning of tape (sometimes referred to as "labeling a tape" or "writing from BOT"). The tape drive then establishes the density of the media.

If an uninitialized M8 cartridge is not initialized in a tape library that supports uninitialized M8 cartridges, then the cartridge might inadvertently and silently be initialized at the L7 density (that is, at a 6 TB native capacity) even if the bar code label states “M8”. This action might occur with the usage of non-TS2900 Tape Autoloaders, stand-alone LTO7 tape drives, stand-alone LTO8 tape drives, earlier LTO8 tape drive firmware, earlier TS2900 Tape Autoloader firmware, or earlier ISV software that does not recognize that M8 cartridges must be mounted only in LTO8 tape drives. M8 cartridges that are inadvertently initialized at the L7 density can continue to be read and written in LTO7 and LTO8 tape drives. However, they remain limited to the 6 TB native capacity.

TS2900 Tape Autoloader firmware version 0080 added support for uninitialized M8 cartridges, in addition to support for pre-initialized M8 cartridges. In any tape product with M8 cartridges, the minimum LTO8 tape drive firmware version is HB82.

Write once, read many (WORM) cartridges

Certain Records retention and data security applications require a write once, read many (WORM) method for storing data on tape. The LTO Ultrium 4 and later drives enable 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 114) is required. Each WORM cartridge has a unique, worldwide cartridge identifier (WWCID), which consists of the unique CM chip serial number and the unique tape media serial number. For more information about how to choose and purchase the appropriate WORM tape cartridges for your tape drive, see “Ordering media supplies” on page 125.

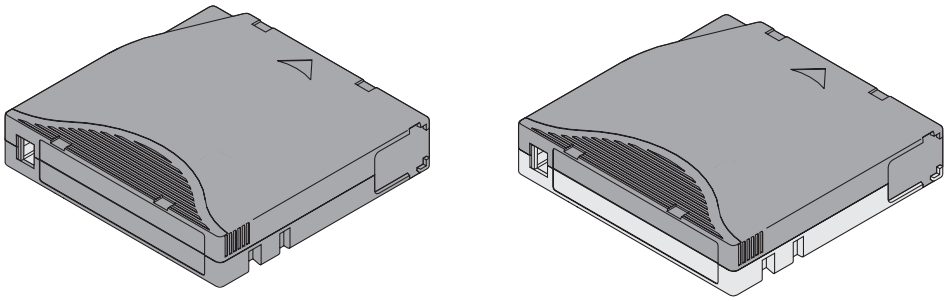

Figure 114. Ultrium data and WORM tape cartridges

Data security on WORM media

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

- The format of an Ultrium 4 and later WORM tape cartridge is unlike standard read/write media. This unique format prevents a drive that lacks WORM-capable firmware from writing on a WORM tape cartridge. For LTO 8, native data capacity is 12 TB and compressed data capacity is 30 TB.
- When the drive senses a WORM cartridge, the firmware prohibits user data from being changed or altered. The firmware tracks the last point on the tape that can be appended.

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 posts on the drive's single-character display (SCD).

- Inserting a WORM tape cartridge into a drive that is not compatible with WORM causes the cartridge to be treated as an unsupported medium. The drive reports a media error code 7. Upgrading the drive firmware to the correct code level resolves the problem.

Requirements for WORM capability

To use the WORM capability of your LTO Ultrium drive, you must use a compatible WORM tape cartridge. See “Cartridge compatibility” on page 109 for cartridge and VOLSER compatibility and “Ordering media supplies” on page 125 for media supplies.

Cleaning cartridge

An IBM Ultrium Universal Cleaning Cartridge is required to clean the tape drive. The drive itself determines when it must 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 tape drive within a library requires the use of a library menu function to either automatically or manually clean the tape drive. See “Operations” on page 61.

Important: The drive must 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 automatically ejects 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 113 on page 107), that contains information about the cartridge and the tape (such as the name of the manufacturer that created the tape), and 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 was loaded, and how many errors it 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 7 and 6 is 16320 bytes. For Generations 5 and 4, the LTO-CM is 8160 bytes. LTO Generations 3, 2, and 1 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: LTO drives do not require cartridges to have bar code labels. Specific library types or models might require cartridges to have bar code labels.

Table 20. Bar code label requirements for Ultrium tape drives and libraries

Ultrium Tape Drive/Library	Bar Code Label Requirements
3573	Required
3576	Required

Table 20. Bar code label requirements for Ultrium tape drives and libraries (continued)

Ultrium Tape Drive/Library	Bar Code Label Requirements
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 or M8, or Lx, where x equals 1, 2, 3, 4, 5, 6, 7, or 8 . The letter L identifies the cartridge as an LTO cartridge and the number represents the generation of cartridge for that cartridge type. Figure 115 on page 113 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 125. The bar code for usage in IBM tape libraries must meet predefined specifications. They include (but are not limited to):

- Eight uppercase alphanumeric characters, where the last 2 characters must be L8, L7, L6, L5, L4, L3, L2, or L1 (LY, LX, LW, LV, LU, or LT for Ultrium WORM cartridges).
- 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 21. Cartridges and VOLSERs compatible with the Ultrium Tape Drives

Cartridges	VOLSER
Ultrium 8 Data Cartridge	xxxxxxL8
Ultrium 8 WORM Cartridge	xxxxxxLY
Ultrium M8 Data Cartridge	xxxxxxM8
Ultrium 7 Data Cartridge	xxxxxxL7
Ultrium 7 WORM Cartridge	xxxxxxLX
Ultrium 6 Data Cartridge	xxxxxxL6
Ultrium 6 WORM Cartridge	xxxxxxLW
Ultrium 5 Data Cartridge	xxxxxxL5
Ultrium 5 WORM Cartridge	xxxxxxLV
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 (READ ONLY)	xxxxxxL1
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/ and enter "IBM LTO Ultrium Cartridge Label Specification" in the search box, or contact your IBM sales representative.

When a bar code label is attached to a tape cartridge, place the label only in the recessed label area (see **5** in Figure 113 on page 107). A label that extends outside of the recessed area can cause loading problems in the drive.

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

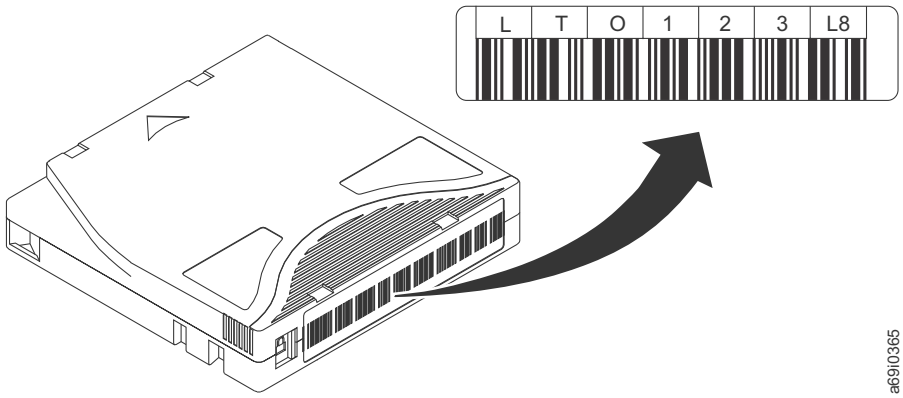

Figure 115. Sample bar code label on the LTO Ultrium 8 Tape Cartridge. The volume serial number (LTO123) and bar code are printed on the label.

Guidelines for the use of 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 they are removed. If there is glue residue on the cartridge, remove it by gently rubbing it with your finger. Do not use a sharp object, water, or a chemical to clean the label area.
- Examine the label before it is applied 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 takes much longer if the bar code label is not readable).
- Remove the label from the label sheet carefully. Do not stretch the label or cause the edges to curl.
- Position the label within the recessed label area (see **5** in Figure 113 on page 107).
- 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 might 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 (see **1**) 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 application 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 cannot write new data to them.

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

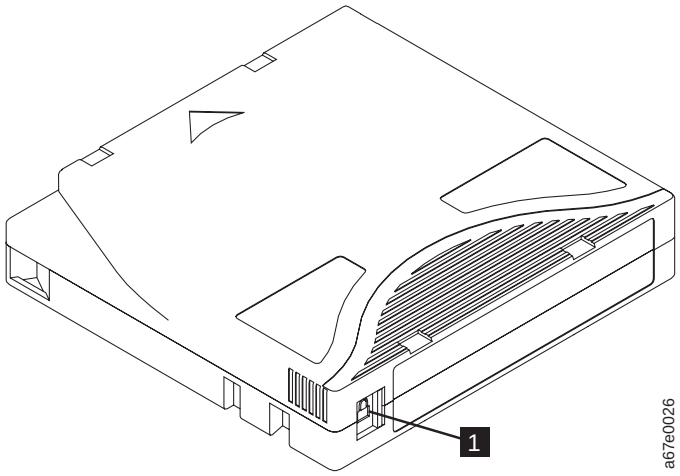

Figure 116. Setting the write-protect switch

Table 22. Location of the write-protect switch

1	Write-Protect switch

Cartridge care and handling

Attention: Do not insert a damaged tape cartridge into the drive. A damaged cartridge can interfere with the reliability of a drive and might 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

About this task

- 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) are tested and found to be satisfactory (see Figure 117). They are available at http://www.turtlecase.com.

Figure 117. 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 118 on page 116).

Figure 118. Double-boxing tape cartridges for shipping

Provide proper acclimation and environmental conditions

About this task

- 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 123.

Perform a thorough inspection

About this task

After you purchase a cartridge and before you use it, complete the following steps:

- Inspect the cartridge's packaging to determine potential rough handling.
- When a cartridge is inspected, 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 you use or store 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 (see **1** in Figure 119 on page 117 and **4** inFigure 120 on page 119). If there are gaps in the seam (see Figure 119 on page 117), the leader pin might be dislodged. Go to “Repositioning or reattaching a leader pin” on page 118.

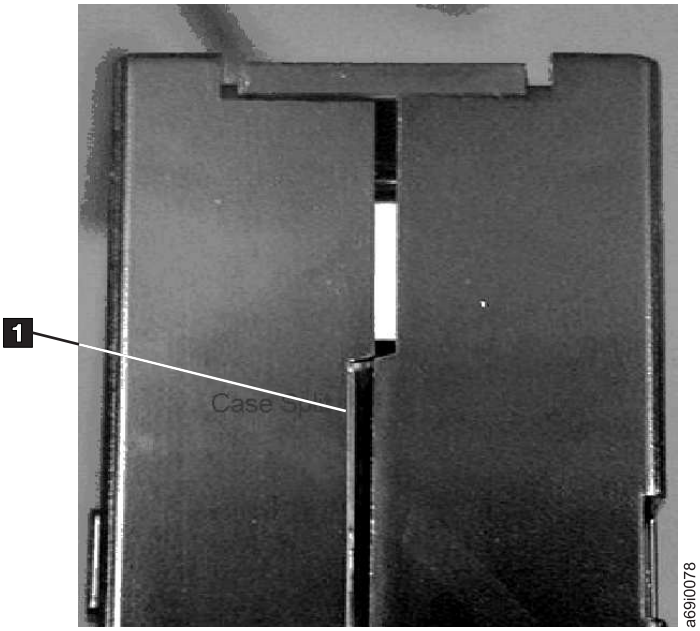

Figure 119. Checking for gaps in the seams of a cartridge

- Check that the leader pin is properly seated (see **2** in Figure 120 on page 119).
- If you suspect that the cartridge was 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

About this task

- 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 "Repositioning a leader pin" on page 118). If the leader pin is dislodged, go to "Repositioning or reattaching a leader pin" on page 118.
- Do not handle tape that is outside the cartridge. Handling the tape can damage the tape's surface or edges, which might 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

About this task

Example: Split Cartridge Case (see "Perform a thorough inspection" on page 116)

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

Procedure

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 118). Then, immediately use data recovery procedures to minimize chances of data loss.

3. Review media-handling procedures.

Results

Example: Improper Placement of Leader Pin (see “Repositioning a leader pin”)

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”). Then, immediately use data recovery procedures to minimize chances of data loss.

Repositioning or reattaching a leader pin

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

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

Repositioning a leader pin

About this task

A leader pin that is improperly seated inside a cartridge can interfere with the operation of the drive. Figure 120 on page 119 shows a leader pin in the incorrect **1** and correct **2** positions.

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

- Plastic or blunt-end tweezers
- Cartridge manual rewind tool (from Leader Pin Reattachment Kit, part number 08L9129)

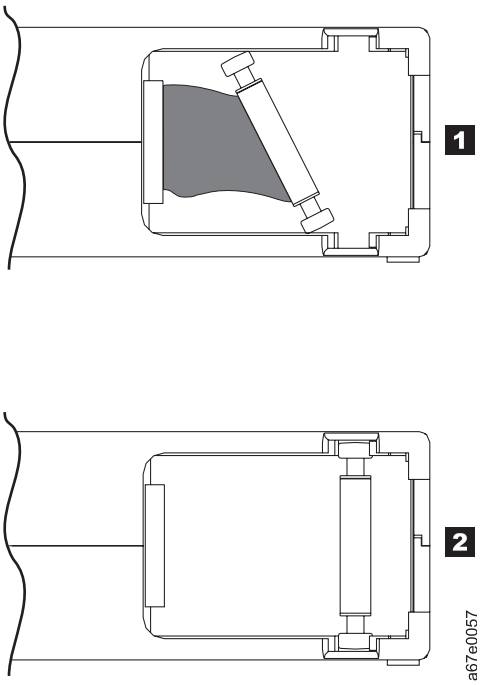

Figure 120. Leader pin in the incorrect and correct positions. The cartridge door is open and the leader pin is visible inside the cartridge.

To reposition the leader pin, complete the following steps.

Procedure

1. Slide open the cartridge door (**1** in Figure 121) and locate the leader pin **2** (you might 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.

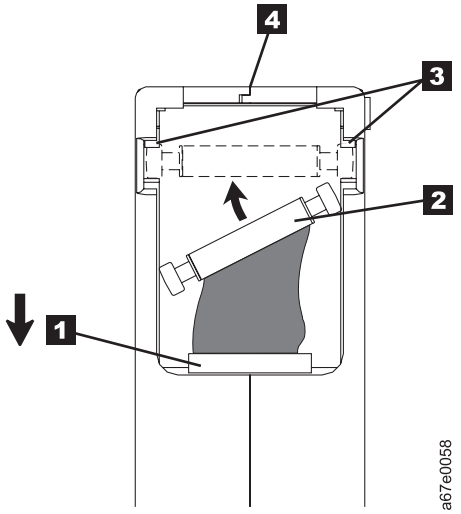

Figure 121. Placing the dislodged leader pin into the correct position. The cartridge door is open to show the leader pin.

5. To rewind the tape, insert the cartridge manual rewind tool (**1** in Figure 122) into the cartridge's hub **2** and turn it clockwise until the tape becomes taut.

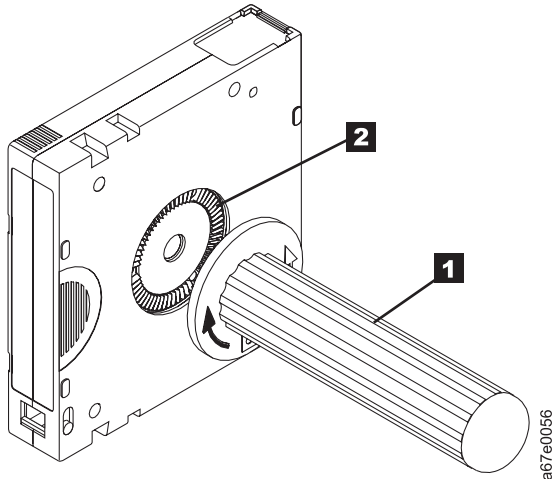

Figure 122. Rewinding the tape into the cartridge

6. Remove the rewind tool by pulling it away from the cartridge.
7. If you suspect that the cartridge was 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

About this task

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

The Leader Pin Reattachment Kit contains three parts:

- **Leader pin attach tool** (see **1** in Figure 123 on page 121). A plastic brace that holds the cartridge door open.
- **Cartridge manual rewind tool** (see **2** in Figure 123 on page 121). A device that fits into the cartridge's hub and winds the tape into and out of the cartridge.
- **Pin supplies** (see **3** in Figure 123 on page 121). Leader pins and C-clips.

Attention:

- Use only the IBM Leader Pin Reattachment Kit to reattach the leader pin to the tape. Other methods of reattaching the pin damages 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 might 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 might interfere with read or write reliability.

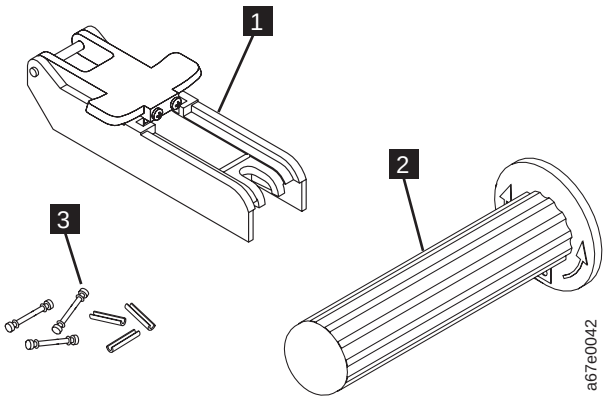

Figure 123. Leader Pin Reattachment Kit

The following procedure describes how to reattach a leader pin.

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

1. Attach the leader pin attach tool (**1** in Figure 124) 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** .

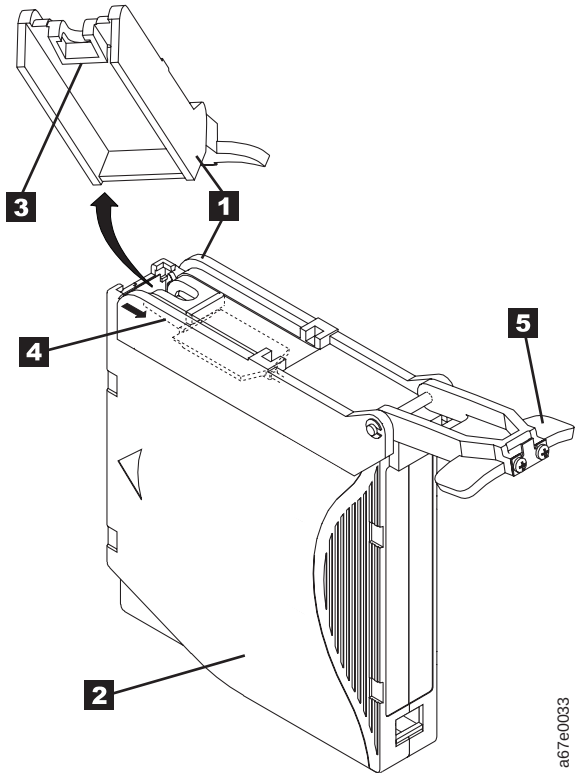

Figure 124. Attaching the leader pin attach tool to the cartridge. To hold the cartridge door open, hook the tool into the door and pull the tool back.

2. To find the end of the tape inside the cartridge, attach the cartridge manual rewind tool (**1** in Figure 125 on page 122) 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.

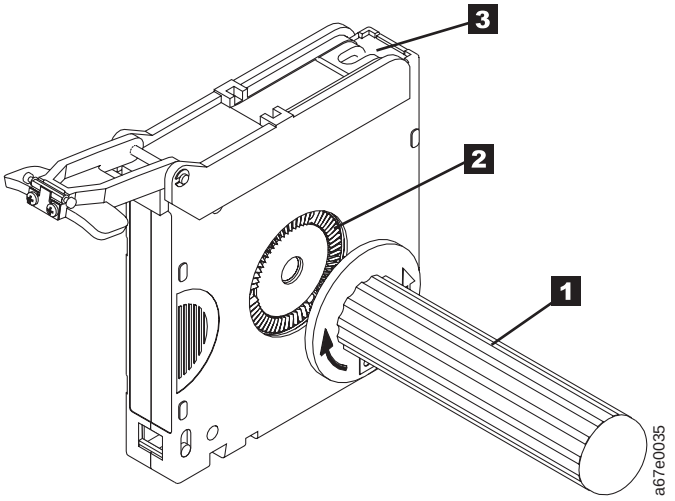

Figure 125. Winding the tape out of the cartridge. Turn the cartridge manual rewind tool clockwise to see the end of the tape, then turn it counterclockwise to bring the tape to the cartridge door.

5. On the leader pin (**1** in Figure 126), 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.

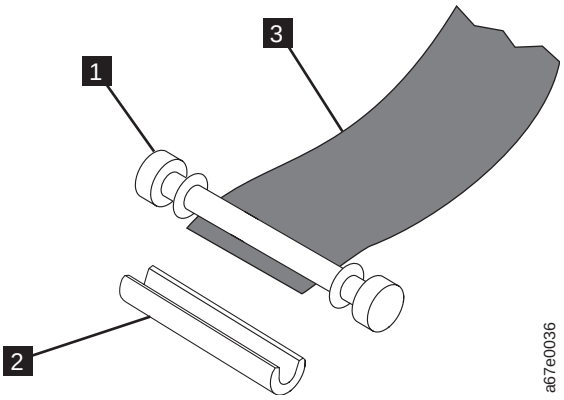

Figure 126. Removing the C-clip from the leader pin. Use your fingers to push the C-clip from the leader pin.

7. Position the tape in the alignment groove of the leader pin attach tool (see **1** in Figure 127 on page 123).
8. Place a new C-clip into the retention groove **2** (Figure 127 on page 123) on the leader pin attachment tool and make sure that the clip's open side faces up.
9. Place the leader pin (from step 6) into the cavity **3** (Figure 127 on page 123) of the leader pin attach tool.

   Attention: To prevent the leader pin from rolling into the cartridge, in the following step use care when you are folding the tape over the pin.
10. Fold the tape over the leader pin and hold it with your fingers (see Figure 127 on page 123).

Note: Use care to ensure that the tape is centered over the leader pin. Failure to properly center the tape on the pin causes 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.

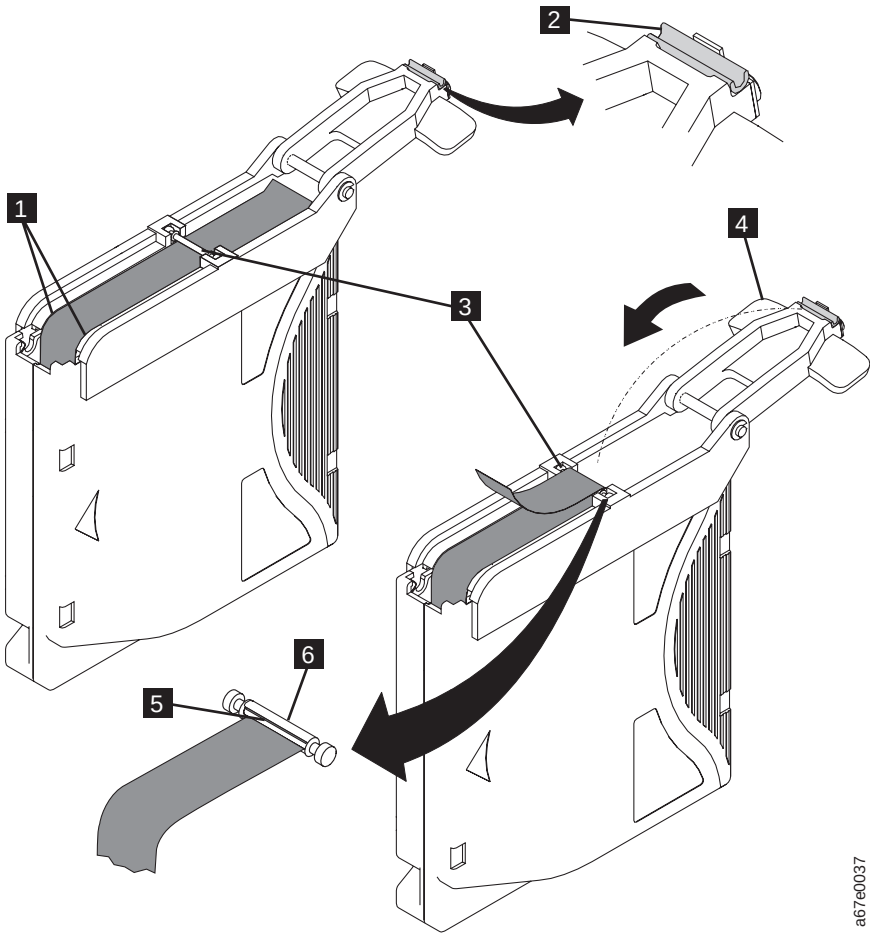

Figure 127. Attaching the leader pin to the tape

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 up its end 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 varies, 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 23 gives the environment for operating, storing, and shipping LTO Ultrium Tape Cartridges.

Table 23. Environment for operating, storing, and shipping the LTO Ultrium Tape Cartridge

	Environmental Specifications			
Environmental Factor	**Operating**	**Operational Storage[1]**	**Archival Storage[2]**	**Shipping**
Temperature	10 - 45°C (50 - 113°F)	16 - 32°C (61 - 90°F)	16 - 25°C (61 - 77°F)	-23 to 49°C (-9 to 120°F)
Relative humidity (non-condensing)	10 - 80%	20 - 80%	20 - 50%	5 - 80%
Maximum wet bulb temperature	26°C(79°F)	26°C(79°F)	26°C(79°F)	26°C(79°F)

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 10 years.

Disposing of tape cartridges

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

If your local, state, country (non-US), 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 must make two passes through the field at 90 degree orientation change for each pass to achieve complete erasure. Some commercial degaussers have one 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

About this task

Table 24 lists the cartridges and media supplies that you can order for the drive.

Table 24. Media supplies

Supply Item	Methods of Ordering
20-PACK IBM LTO Ultrium 8 6 TB 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 552. Specify the VOLSER characters that you want. You can also order through an IBM media Authorized Distributor.
20-PACK IBM LTO Ultrium 8 6 TB Data Cartridge (without labels)	Order the cartridge from your IBM Sales Representative or any authorized IBM Business Partner by specifying Machine Type 3589 Model 652. You can also order through an IBM media Authorized Distributor.
5-PACK IBM LTO Ultrium 8 6 TB Data Cartridge (black and white labels unattached)	Order as part number 01PL340 through an IBM media Authorized Distributor.
20-PACK IBM Ultrium 8 6 TB WORM Tape Cartridge (with attached labels)	Order as part number 01PL042L through an IBM media Authorized Distributor.
20-PACK IBM Ultrium 8 6 TB WORM Tape Cartridge (without labels)	Order as part number 01PL042 through an I IBM media Authorized Distributor.
20-PACK 9 TB Ultrium 7 Uninitialized Data Cartridge M8 (labeled)	Order the cartridge from your IBM Sales Representative or any authorized IBM Business Partner by specifying Machine Type 3589 Model 452. Specify the VOLSER characters that you want. You can also order through an IBM media Authorized Distributor.
20-PACK IBM LTO Ultrium 7 6 TB 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 551. Specify the VOLSER characters that you want. You can also order through an IBM media Authorized Distributor.
20-PACK IBM LTO Ultrium 7 6 TB Data Cartridge (without labels)	Order the cartridge from your IBM Sales Representative or any authorized IBM Business Partner by specifying Machine Type 3589 Model 651. You can also order through an IBM media Authorized Distributor.
5-PACK IBM LTO Ultrium 7 6 TB Data Cartridge (black and white labels unattached)	Order as part number 38L7189 through an IBM media Authorized Distributor.
20-PACK IBM Ultrium 7 6 TB WORM Tape Cartridge (with attached labels)	Order as part number 38L7303L through an IBM media Authorized Distributor.
20-PACK IBM Ultrium 7 6 TB WORM Tape Cartridge (without labels)	Order as part number 38L7303 through an IBM media Authorized Distributor.

Table 24. Media supplies (continued)

Supply Item	Methods of Ordering
20-PACK IBM LTO Ultrium 6 2.5 TB 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 550. Specify the VOLSER characters that you want. You can also order through an IBM media Authorized Distributor.
20-PACK IBM LTO Ultrium 6 2.5 TB Data Cartridge (without labels)	Order the cartridge from your IBM Sales Representative or any authorized IBM Business Partner by specifying Machine Type 3589 Model 650. You can also order through an IBM media Authorized Distributor.
5-PACK IBM LTO Ultrium 6 2.5 TB Data Cartridge (black and white labels unattached)	Order as part number 35P1902 through an IBM media Authorized Distributor.
20-PACK IBM Ultrium 6 2.5 TB WORM Tape Cartridge (with attached labels)	Order as part number 00V7591L through an IBM media Authorized Distributor.
20-PACK IBM Ultrium 6 2.5 TB WORM Tape Cartridge (without labels)	Order as part number 00V7591 through an IBM media Authorized Distributor.
20-PACK IBM LTO Ultrium 5 1.5 TB 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 014. Specify the VOLSER characters that you want. You can also order through an IBM media Authorized Distributor.
20-PACK IBM LTO Ultrium 5 1.5 TB Data Cartridge (without labels)	Order the cartridge from your IBM Sales Representative or any authorized IBM Business Partner by specifying Machine Type 3589 Model 015. You can also order through an IBM media Authorized Distributor.
5-PACK IBM LTO Ultrium 5 1.5 TB Data Cartridge (black and white labels unattached)	Order as part number 46C2084 through an IBM mediaAuthorized Distributor.
20-PACK IBM Ultrium 5 1.5 TB WORM Tape Cartridge (with attached labels)	Order as part number 46X4444 through an IBM media Authorized Distributor.
20-PACK IBM Ultrium 5 1.5 TB WORM Tape Cartridge (without labels)	Order as part number 46X1292 through an IBM media Authorized Distributor.
20-PACK IBM LTO Ultrium 4 800 GB Data Cartridge (with attached labels)	Order as part number 95P4437 through an IBM media Authorized Distributor.
20-PACK IBM LTO Ultrium 4 800 GB Data Cartridge (without labels)	Order as part number 95P4436 through an IBM media authorized distributor.
5-PACK IBM LTO Ultrium 4 800 GB Data Cartridge (black and white labels unattached)	Order as part number 95P4278 through an IBM media Authorized Distributor.
20-PACK IBM Ultrium 4 800 GB WORM Tape Cartridge (with attached labels)	Order as part number 95P4451 through an IBM media Authorized Distributor.
20-PACK IBM Ultrium 4 800 GB WORM Tape Cartridge (without labels)	Order as part number 95P4450 through an IBM media Authorized Distributor.
IBM LTO Ultrium 3 400 GB Data Cartridge Order VOLSER labels separately (see "Ordering bar code labels" on page 127).	Order as part number 24R1922 through an IBM media Authorized Distributor.

Table 24. Media supplies (continued)

Supply Item	Methods of Ordering
IBM LTO Ultrium 2 200 GB Data Cartridge Order VOLSER labels separately (see "Ordering bar code labels").	Order as part number 08L9870 through an IBM media Authorized Distributor.
IBM LTO Ultrium Cleaning Cartridge (universal cleaning cartridge for use with Ultrium drives) VOLSER labels are included.	Order as part number 35L2086 through an IBM media Authorized Distributor.
Leader Pin Reattachment Kit	Order as part number 08L9129 through an IBM media Authorized Distributor.
Manual Rewind Tool	Order as part number 08L9130 through an IBM media 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

About this task

LTO drives do not require cartridges to have bar code labels. Specific library types or models might require cartridges to have bar code labels (see Table 20 on page 111). 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 the following table.

Table 25. Authorized suppliers of custom bar code labels[1]

In the Americas	In Europe and Asia
EDP/Tri-Optic 6800 West 117th Avenue Broomfield, CO 80020 U.S.A. Telephone: 888-438-8362 or 303-464-3547 Fax: 888-438-8363 or 303-666-2166 http://www.tri-optic.com	
Netc, L.L.C.[2] 100 Corporate Drive Trumbull, CT 06611 U.S.A. Telephone: 203-372-6382 Fax: 203-372-0676 http://www.netclabels.com	Netc Europe Telephone.: +49-2151-970-900 Fax: +49-2151-970-908 Email: Vertrieb@netclabels.de http://www.netclabels.de Netc Asia Pacific Pty. Ltd. 7 Cordwood Drive Cooroy QLD 4563 Australia Telephone: +61 (0)7 5442 6263 Fax: +61 (0)7 5442 6522 http://www.netclabels.com.au

Table 25. Authorized suppliers of custom bar code labels[1] (continued)

In the Americas	In Europe and Asia
Notes: 1. These label providers have demonstrated the ability to produce finished bar code labels that meet the foregoing specifications and requirements. This information is provided for the convenience of users only and is not an endorsement or recommendation of such providers. IBM is not responsible for the quality of bar code labels that are procured from sources other than IBM. This information is applicable to bar code labels that are printed by the listed companies. IBM does not review the quality of any labels that are produced by software or services that are offered by such companies that allow users to print labels on their own printing equipment. 2. Netc is the only authorized supplier of radio frequency identification (RFID) labels. Orders for RFID labels must be placed through the U.S. office. Orders are shipped worldwide.	

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 is charged for onsite 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 the library is powered ON again.

Before you place a service call or inform 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 136. If the LEDs on all components are functioning properly, see "Diagnosing a problem" on page 130.

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 completes 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 might 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 email event notification or SNMP trap notification. The type of event that generates email 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 with the information found in "Diagnosing a problem" on page 130. If the problem is unrecoverable, the customer must contact IBM Technical Support (see "Contacting IBM technical support" on page 139).

Library error message content

When a library event occurs, the event is logged in to flash memory on the Library Control Board.

The library error log is 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 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 that is displayed in the **Detail** panel for the selected operator intervention event consists of:

- 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 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 that is displayed in the **Detail** panel for the selected error consists of:

- 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 139.
	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 187.

Problem Area	If...	Then...
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**, or Web user Interface: **Manage Library** > **Unlock Magazine**). a. If the magazine does not unlock, see "Unlocking the cartridge magazine manually" on page 141. b. If the magazine does unlock, resume normal library operations.
	The magazine can be partially removed from the library... **The magazine seems stuck on something inside the library...**	1. Verify that you 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 139.
Communication Functions	**You are experiencing difficulty with 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 a static IP address is used, make note of your library's IP address. With DHCP, proceed to the next step. 3. Restore factory defaults (Operator Panel: **Configuration** > **Set Default**). 4. With 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**). With DHCP, proceed to the next step. 5. Restore the library configuration (Web User Interface: **Configure Library** > **Save/Restore**).
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 that 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 that are returned for an encryption operation. b. Retry the encryption operation after the host application problems are resolved. 2. Reset the drive. a. Refer to the error code displayed on the Operator Panel if the drive resets and the POST fails. b. Retry the encryption operation if the drive resets and POST complete without errors. 3. Ensure that the correct media is being used. Data encryption is supported by LTO Ultrium 8, M8, 7, 6, 5, and 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.

Problem Area	If...	Then...
Encryption	**Connection problem with the Encryption Key Manager (EKM)...**	If you are using library-managed encryption, complete the Key Path Diagnostic. If the test fails, a problem might exist with the IP address, the Ethernet cable, or the EKM server. 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/storage/dsfa/. 2. Enter your machine type, serial number, and worldwide node name to display your encryption license key.
Error Codes or TapeAlert Flags	**The library issued an error code...** **An error message was received by way of email notification (if enabled)...**	1. Make note of the error code. 2. Power cycle the library. a. If the error recurs, see Appendix B, “Error codes,” on page 187. b. If the error does not recur, 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 recurs, see Appendix C, “TapeAlert flags,” on page 201. b. If the TapeAlert does not recur, resume normal library operations.
	The error code represents an unrecoverable error...	See “Contacting IBM technical support” on page 139.
	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 139.
	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 diagnostic procedures” on page 73. 2. If the problem persists, see “Contacting IBM technical support” on page 139.

Problem Area	If...	Then...
Firmware	**The Library firmware does not complete the boot-up process and appears hung...**	Failure of the login screen to display 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 1 minute before the library is powered ON to recover from the problem. 2. If a library firmware update was completed, try repeating the update procedure.
	All firmware (library and drive) is not at the latest level...	See "Updating library and drive firmware" on page 104.
Front Panel LEDs	**One or more front panel LEDs is ON or blinking...**	See "Interpreting front panel LEDs" on page 136.
Host Attachment Interface	**You are experiencing host attachment interface problems...**	See "Isolating host attachment interface problems" on page 135.
Installation and Configuration	**You are experiencing trouble installing or configuring your library...**	See "Installation and configuration problems" on page 135.
ITDT	**The Performance Test duration varies...**	Items affecting the duration of the test: • The level of adapter device driver • Your adapter model and type
Library Not Booting	**There is a blank operator panel/display...** **The accessor does not move...** **The display is stuck on initialization for extended period of time...**	Failure of the login screen to display 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 1 minute before the library is powered ON to recover from the problem. 2. If a library firmware update was completed, try repeating the update procedure.
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 217.
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."
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 134.

Isolating problems

Isolating library power problems

1. Ensure that the power cord is plugged in at the power supply and at the electrical outlet, then turn library power ON. Feel for air that is 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 is not working:
   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 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 153).
4. If the power supply seems to be delivering power to the library; but 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 153).

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**.
      1) If the test passes, resume normal library operations.
      2) If the test fails, replace the library.
5. With the host interface test tool, ITDT, run the Scan functions 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, if available, after the drive is selected. This function writes and reads data across the interface, also 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 might 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 139.

Isolating host attachment interface problems

After successfully exercising "Isolating drive problems" on page 134, and more specifically "Running library verify diagnostic procedures" on page 73 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 completed, run **SAS Wrap Test** from the Operator Panel. The test requires that a Wrap tool is installed at some point during the test procedure.
   a. If the wrap test fails, replace the library, and skip to Step 3.
   b. Proceed to Step 2 if the wrap test passes.
2. Use the ITDT utility to evaluate connectivity from the HBA through the cabling to the drive. ITDT does not require separate device drivers, thus the Operating System can 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 "The IBM Tape Diagnostic tool (ITDT)" on page 139 for a brief description of ITDT and instructions on how to download the tool from the web.
3. If ITDT successfully locates the LTO devices, 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 or updates (DLLs, PTFs) are installed and applied.

Installation and configuration problems

Problems that are encountered during the installation of the library are 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:

- **Accessor locking screw**: Ensure that the accessor locking screw on the rear panel of the library is removed before the library is powered ON. See "Removing the accessor locking screw" on page 33.
- **HBA LUN 0/1 support**: A single ID addresses 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 9 and "Supported servers, operating systems, and software" on page 12.
- **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 34.
- **Backup application installation**: Refer to the documentation included with your backup application software for instructions on how to verify installation.
- **Device driver installation**: Ensure that the correct device driver, if applicable, is installed for the library.

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

Review the information in "Installation and configuration" on page 21 to determine whether a step was missed or misread.

If you are still experiencing difficulty with installing or configuring your library, see "Contacting IBM technical support" on page 139.

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 communicate that a problem exists when operator interventions cannot.

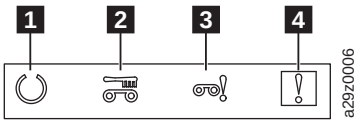

Figure 128. Front panel LEDs

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

Table 26. Front Panel LED indicators

Library Condition	Ready/Activity LED	Cleaning LED	Attention LED	Error LED	Message on Display
POST (Power ON Self Test)	Flashes 2 times every 3 seconds	OFF	OFF	OFF	INITIALIZING... INVENTORY...
Magazine open	Flashes 2 times every 3 seconds	OFF	OFF	OFF	PLEASE INSERT MAGAZINE
Magazine unlocked	Flashes 2 times every 3 seconds	OFF	OFF	OFF	MAGAZINE UNLOCKED
I/O Station open	Flashes 2 times every 3 seconds	OFF	OFF	OFF	PLEASE CLOSE I/O STATION
I/O Station unlocked	Flashes 2 times every 3 seconds	OFF	OFF	OFF	N/A
Library firmware is being updated	Flashes 2 times every 3 seconds	OFF	OFF	OFF	LOADER FIRMWARE UPDATING!
Drive firmware is being updated	Flashes 2 times every 3 seconds	OFF	OFF	OFF	DRIVE FIRMWARE UPDATING!
Drive dump is being uploaded to host computer	Flashes 2 times every 3 seconds	OFF	OFF	OFF	DRIVE DUMP DATA UPLOADING!
Library is offline	Flashes 2 times every 3 seconds	OFF	OFF	OFF	OFFLINE
Cartridge is being moved	Flashes 2 times every 3 seconds	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]

Table 26. Front Panel LED indicators (continued)

Library Condition	Ready/Activity LED	Cleaning LED	Attention LED	Error LED	Message on Display
Cartridge error occurred	ON	OFF	ON	OFF	MEDIA FAULT CODE: [X]
Cleaning cartridge expired	ON	OFF	ON	OFF	REPLACE CLEANING MEDIA
Drive requested cleaning	ON	ON	OFF	OFF	CLEAN DRIVE
Drive is being cleaned	ON	Flashes 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, complete 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 that are connected to your library.
3. Verify that there is no damage to any connector pins.

Emailing logs

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

Download current logs of the library and drive when requested by your service representative. To email 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 email message and send it to IBM technical support for further diagnosis.

Service procedures

The IBM Tape 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.

Some of the capabilities of this tool:

- Runs quick or extended diagnostic procedures on tape drives. If the library is online to the server/host where the tool is, ITDT communicates with the drive through the library to load and unload a test cartridge.
- Retrieves firmware memory dumps from tape drives and libraries.
- Completes a firmware update on tape drives or libraries. See the note about library firmware updates.
- Tests the performance of the environment by completely writing a cartridge and measuring performance.
- Retrieves and displays cartridge information.
- Verifies the encryption environment.
- Does not require special device drivers.
- Is available for most major platforms. Scans the host interface and finds and displays for selection all IBM LTO devices. The tool does not display non-IBM devices.

The IBM Tape Diagnostic tool (ITDT) v4.1 is available as a command-line utility and a graphical user interface (GUI) version.

- The *IBM Tape Diagnostic Tool (ITDT)* is a command-line utility. Start it by entering the executable command from the directory where the tool is located. The Help feature gives a brief explanation of each function and shows the required syntax.
- The *IBM Tape Diagnostic Tool (ITDT)* is a GUI version for Microsoft Windows. Microsoft Windows XP and Microsoft Windows Server 2003 (IX86, 32-bit) are supported.

Note: Be sure that you have the most current version of ITDT if you are updating firmware on a recent drive type. Before ITDT is used, verify that your library host operating system is at the latest released level. This verification ensures optimum read/write operations for diagnostic procedures.

Note: The earlier Tape Products (3580 GEN1 and GEN2, 3581, 3582, and 3583 Products) are not supported by this version of ITDT but are still supported by the older version of ITDT v1.2.

Note: If the library has a BCR (Barcode Reader) that requires 9.00 or greater firmware, the Update function stops with an error code of "Unexpected Data" if you attempt to downgrade the library firmware.

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 you call IBM technical support, complete the following steps.

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

1. Verify that all of the following troubleshooting options are exhausted:
   a. Perform all recommended diagnostic procedures. See "Troubleshooting" on page 129.
   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 website.
   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 demonstrates 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 worked properly at any time 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 that are displayed on your PC monitor or file server. Write down the exact error message.
   d. Call while at your computer, with the library installed and turned on.
   e. If your library is running on a network, have all relevant information available (that is, type, version number, network hardware).
   f. Having this information available when you call for customer assistance enables support personnel to resolve your problem in the most efficient manner possible.
      - Library machine type and model name
      - 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 circuit boards installed
3. The IBM support center assists with problem determination and initiates shipment of a replacement part, if needed, to the customer's location. To contact IBM technical support:
   - In the US: 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**.

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

Procedure

1. Remove the defective cartridge magazine from the library with the Operator Panel, the Web User Interface, or the manual method of removal.
   - Operator Panel: Use the **Unlock Magazine** command. See "Unlocking the cartridge magazine" on page 65.
   - Web UI: **Manage Library** > **Unlock Magazine**. See "Unlocking the cartridge magazine" on page 81.
   - Manual method: See "Unlocking the cartridge magazine manually."
2. After the defective magazine is removed 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 normal library operations resume.
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 and Web User Interface.

Before you begin

To unlock the cartridge magazine manually:

Procedure

1. On the front panel, locate the access hole for the cartridge magazine lock release mechanism to the left of the Operator Panel (**1** in Figure 129 on page 142).

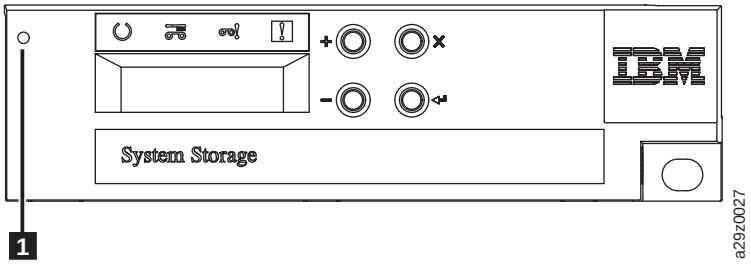

Figure 129. Cartridge magazine lock release access hole

2. Insert the end of a straightened paper clip, or similar object, into the lock release access hole. 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 is 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 139
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 that is mounted in a rack with the rack mount kit to a desktop with 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 your configuration is saved, 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 or from Web User Interface: **Manage Library** > **Unlock Magazine** (if necessary).

   Note: If the cartridge magazine fails to unlock in response to the **Unlock Magazine** command from the Operator Panel and Web User Interface, you can unlock the magazine manually. See "Unlocking the cartridge magazine manually" on page 141.
5. From the Operator Panel, select **Move to Ship Position**, and press **Enter**. This command 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** .

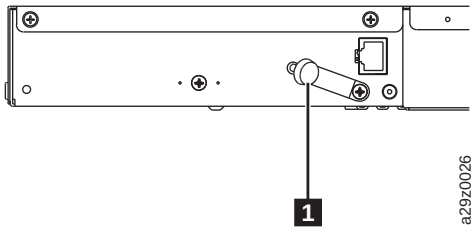

Figure 130. Insert accessor locking screw

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 131).

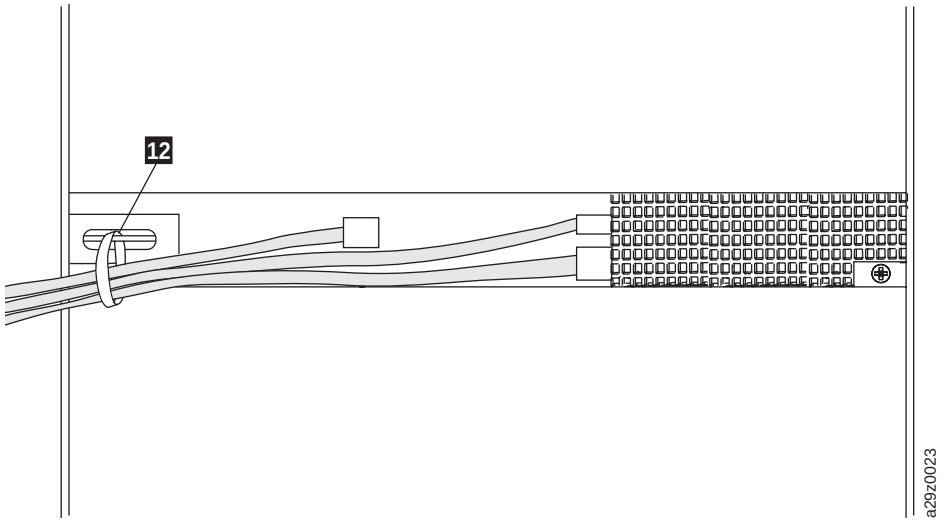

Figure 131. Removing cables at the rear of the library

10. Remove the 2 round-head screws **10** on each rear bracket that are securing the rear of the library to the rack (Figure 132).

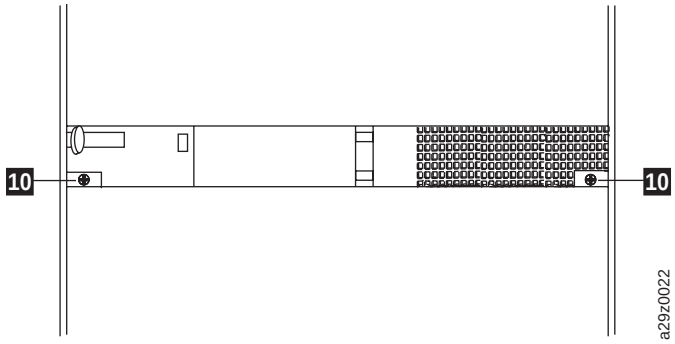

Figure 132. Removing screws at the rear of the library

11. Remove the large black screws **11** from each front bracket that is securing the front of the library to the rack, and slide the library chassis out of the rack (Figure 133 on page 144).

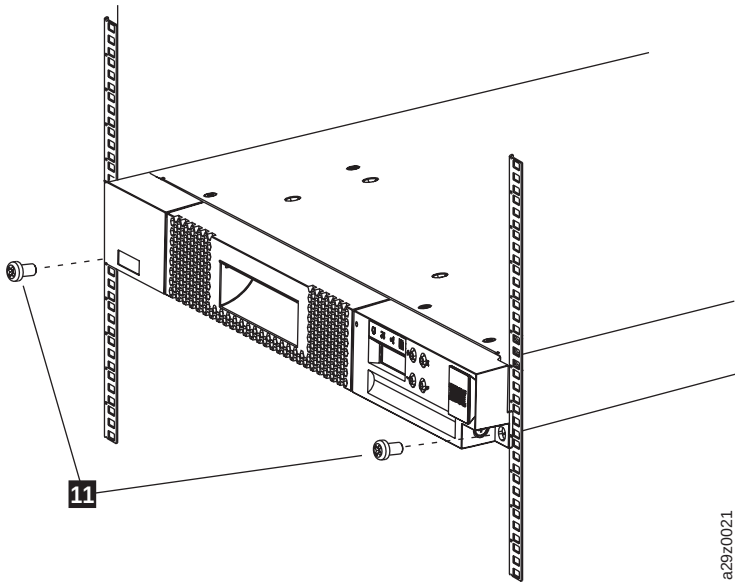

Figure 133. Removing screws at the front of the library

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 134).

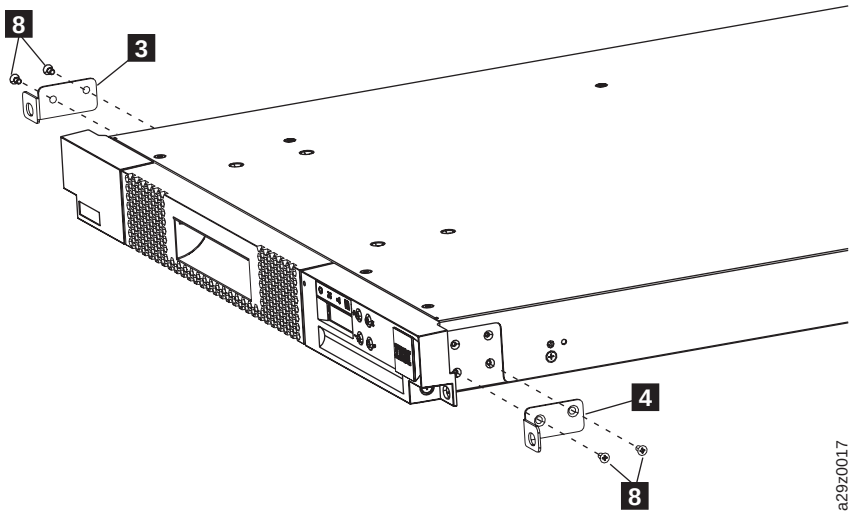

Figure 134. Removing the front brackets from the library chassis

Installing the library on a desktop

For details on the deskside kit components, see "Installing the Deskside Cover" on page 23.

1. Attach the left **5** and right **3** rails to the chassis with 3 flat-head screws 6 on each side (Figure 135 on page 145).

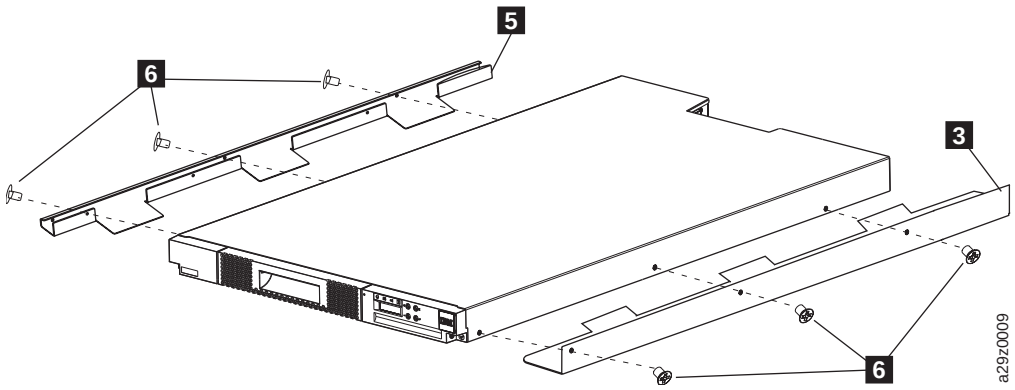

Figure 135. Attaching the side rails to the library chassis

2. Turn the library over and attach the feet **1** to the designated locations on the bottom of the library (Figure 136). Return the library to the upright position.

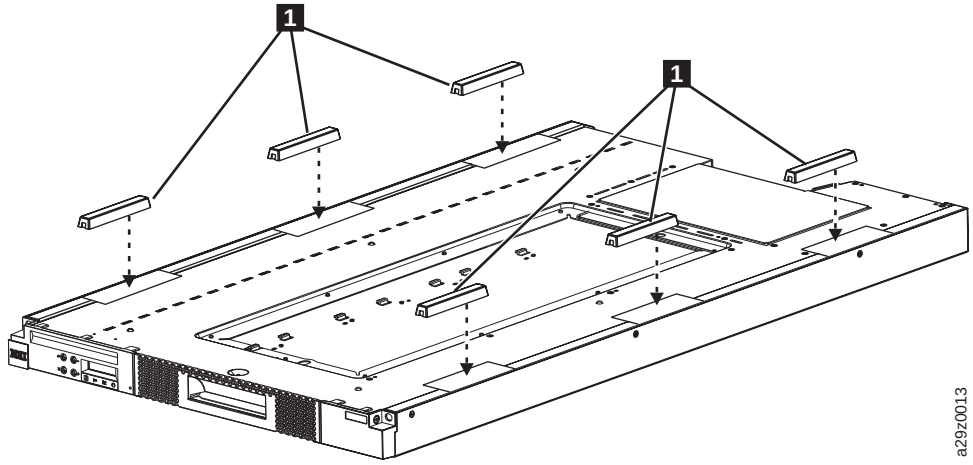

Figure 136. Attaching the feet

3. Position the deskside cover **2** in the correct orientation over the library chassis and attach the cover to the library with 3 flat-head screws **6** on each side (Figure 137).

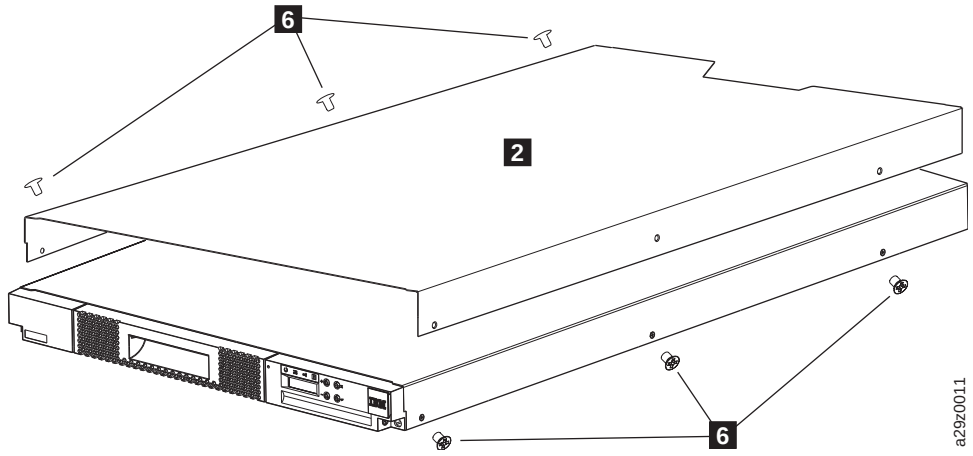

Figure 137. Attaching the cover to the library chassis (side screws)

4. Attach the deskside cover with the 2 large pan-head screws **4** on the rear of the library (Figure 138).

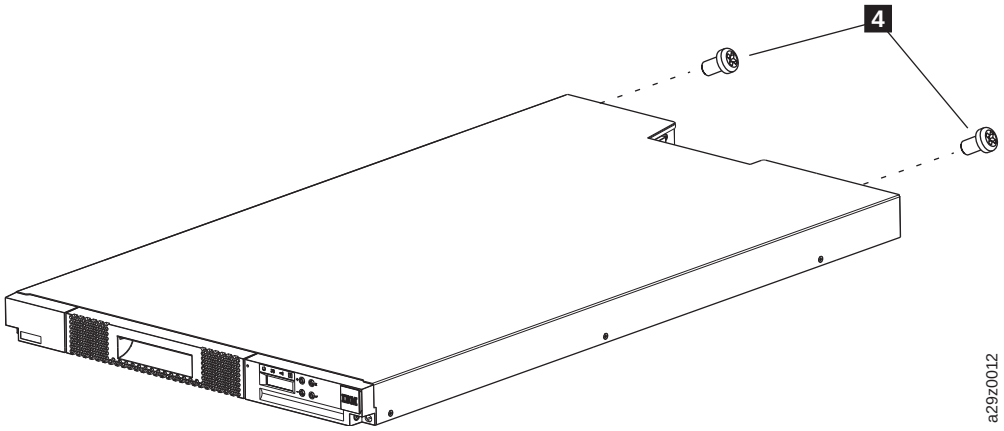

Figure 138. Attaching the cover to the library chassis (rear screws)

5. Place the library in the wanted 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** .

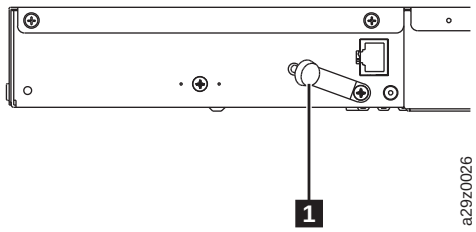

Figure 139. Removing the accessor locking screw

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 99.
10. From the Operator Panel, select **Run Library Verify**, and press **Enter** to run library diagnostic procedures. Follow the on-screen instructions. If an error occurs, see "Troubleshooting" on page 129.
11. Take the library online.

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

For detailed instructions, see "Installation and configuration" on page 21.

Moving the library from a desktop to a rack

This procedure is used to relocate a library that is mounted on the desktop with the deskside kit to a rack with 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 your configuration is saved, 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 or from Web User Interface: **Manage Library** > **Unlock Magazine** (if necessary).

   Note: If the cartridge magazine fails to unlock in response to the **`Unlock Magazine`** command from the Operator Panel and Web User Interface, you can unlock the magazine manually. See "Unlocking the cartridge magazine manually" on page 141.
5. From the Operator Panel, select **`Move to Ship Position`**, and press **Enter**. This command 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** .

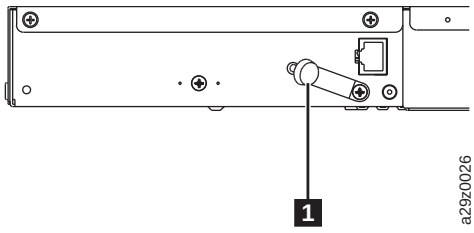

Figure 140. Insert accessor locking screw

9. Remove the large pan-head screws **4** on the rear of the library (Figure 141 on page 148).

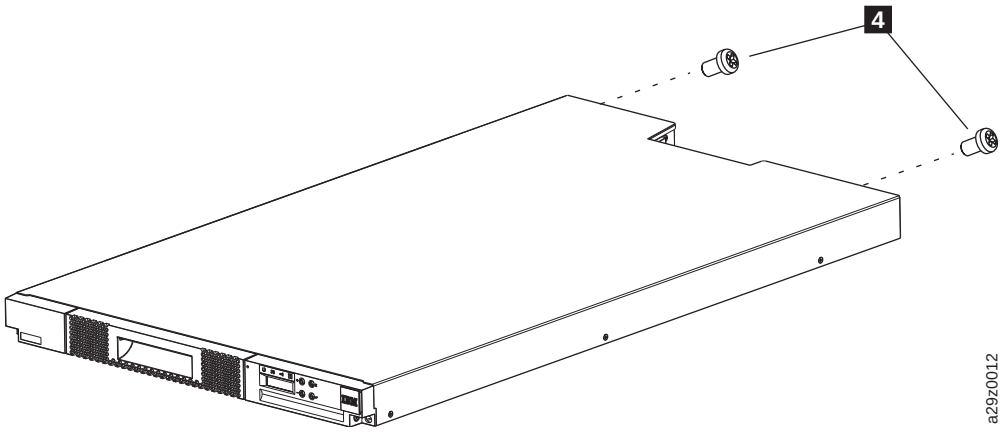

Figure 141. Removing screws from the rear of the library the cover to the library chassis (rear screws)

10. Remove the flat-head screws **6** on each side that secures the deskside cover to the library, and remove the deskside cover **2** (Figure 142).

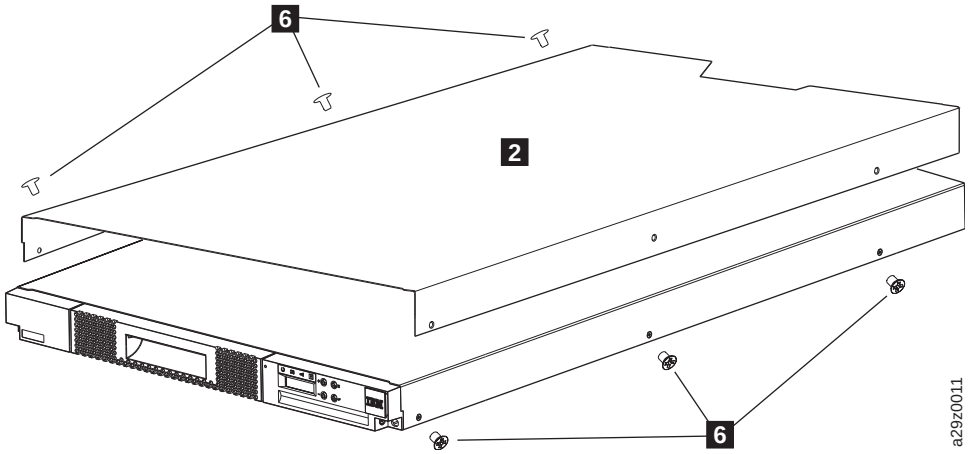

Figure 142. Removing the cover from the library chassis

11. Turn the library over and remove the feet **1** from the bottom of the library (Figure 143 on page 149). Return the library to the upright position.

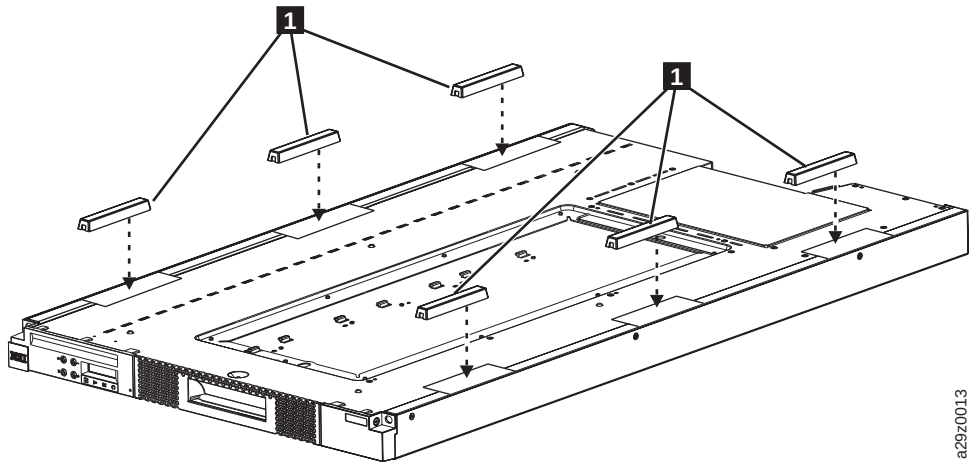

Figure 143. Removing the feet

12. Remove the flat-head screws **6** on each side to remove the left **5** and right **3** rails from the chassis (Figure 144)

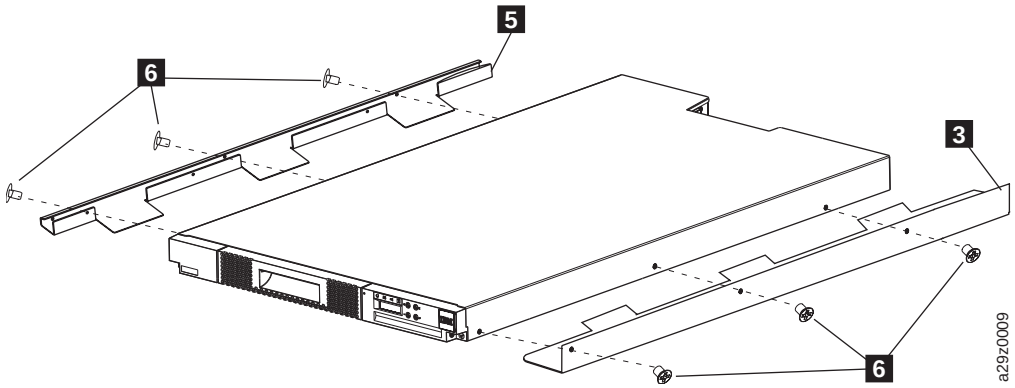

Figure 144. Removing side rails from the library chassis

Installing the library in a rack

For details on the rack mount kit components, see "Installing in a rack" on page 26.

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 26.
2. Attach the left **3** and right **4** front brackets to the front of the library chassis with 2 flat-head screws **8** on each side (Figure 145 on page 150). Use the bottom two screw holes on each side.

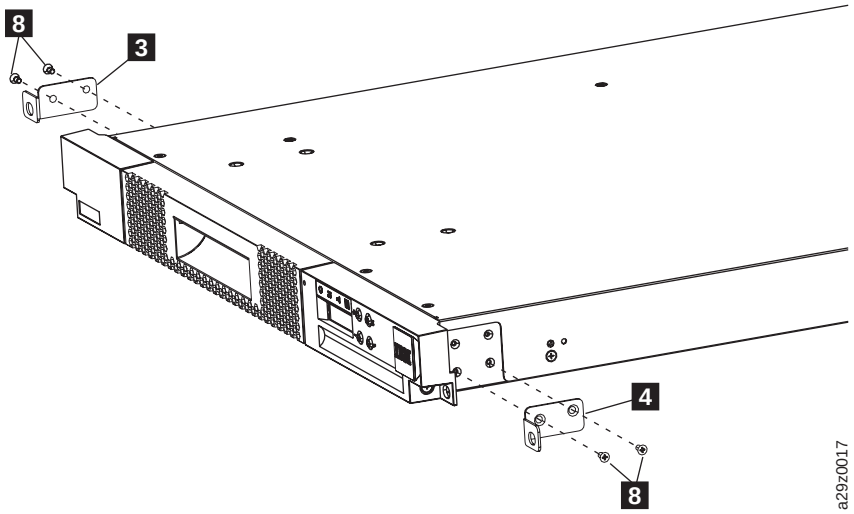

Figure 145. Attaching the front brackets to the library chassis

3. Attach the left **1** and right **2** rear brackets to the left **5** and right **6** front rails with 2 round-head screws 10 on each side (Figure 146).

   Note: Run the hook-and-loop fastener strap through the slot on the right rear bracket and attach it back upon itself.

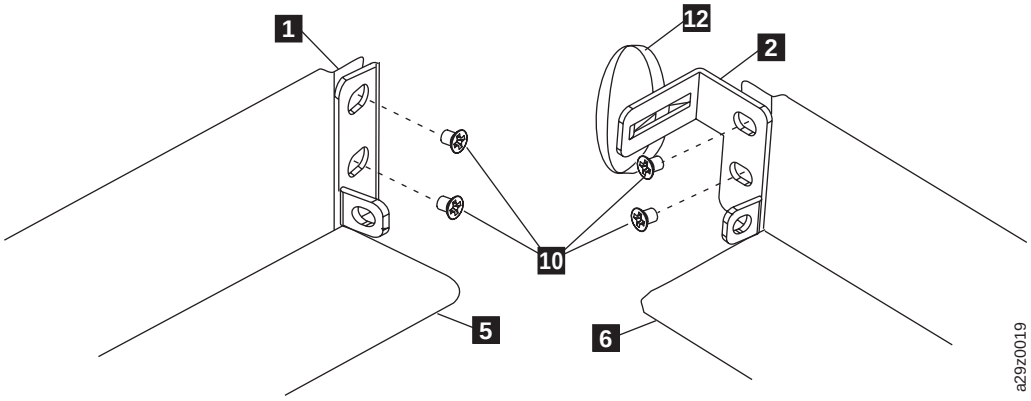

Figure 146. Attaching the rear brackets to the rails

4. Slide in the rear rails **7** from back to front to create the rail assemblies. Ensure that the screw holes face outwards (Figure 147 on page 151).

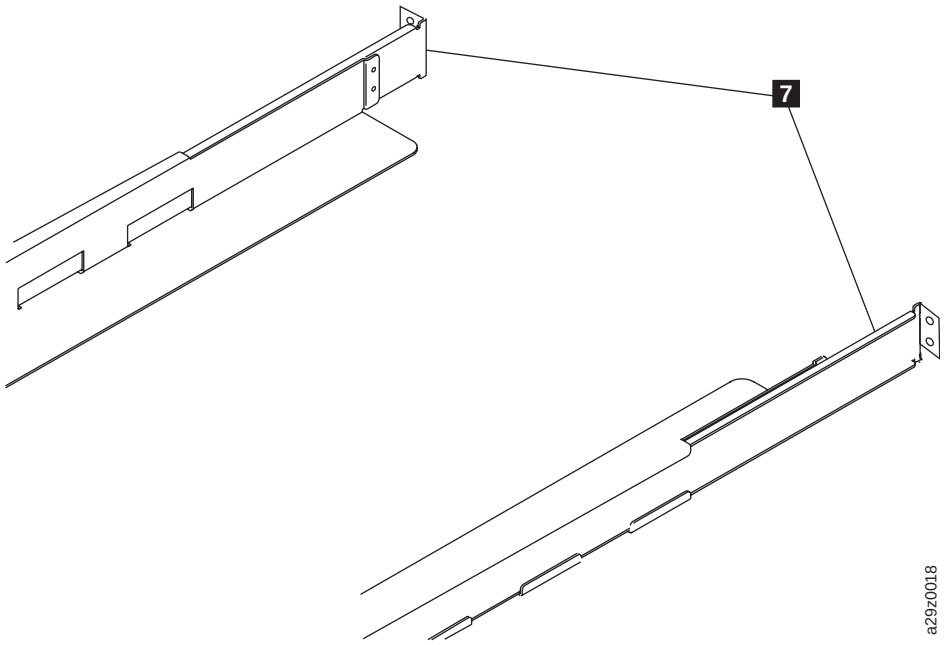

Figure 147. Attaching the rear brackets to the rails

5. Install the rail assemblies into the rack (Figure 148). Ensure the 3 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 with 4 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.

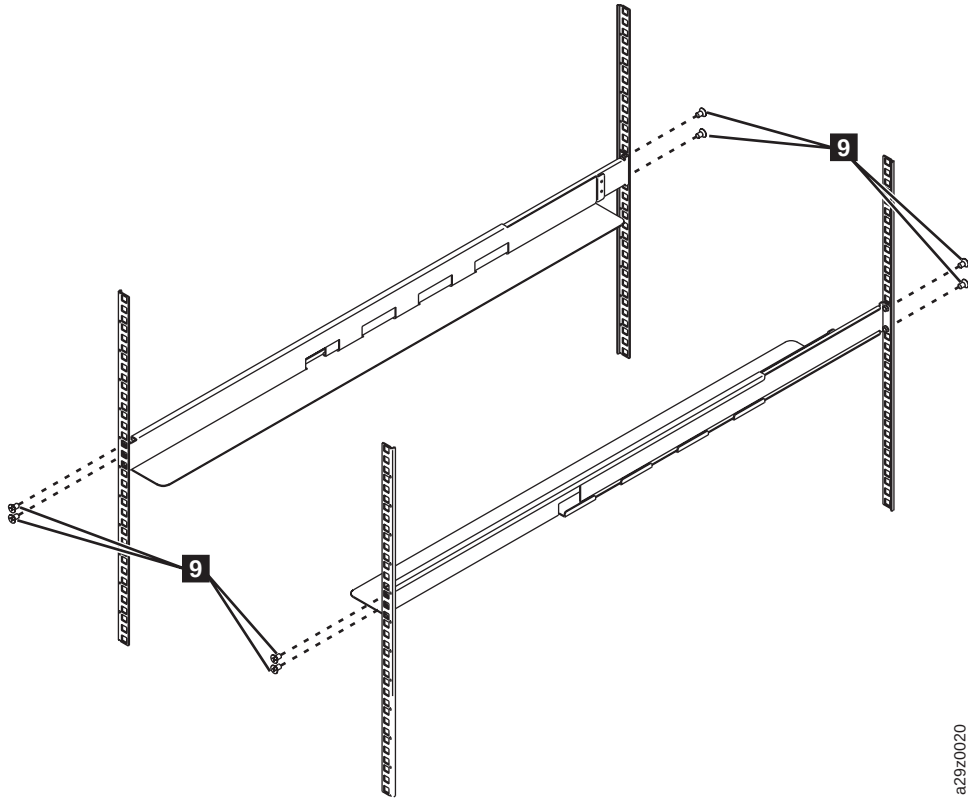

Figure 148. Installing the rail assemblies

6. Slide the library chassis into the rack. Secure the front of the library to the rack with the large black screws **11** in the bottom holes on each front bracket (Figure 149).

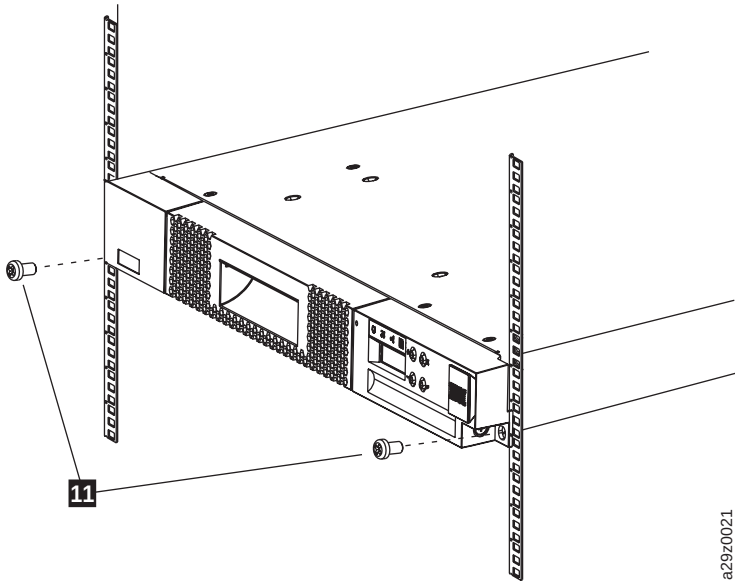

Figure 149. Securing the front of the library in the rack

7. Secure the rear of the library to the rack with 2 round-head screws **10** on each rear bracket (Figure 150). Tighten the other rear bracket screws to secure the library to the rack.

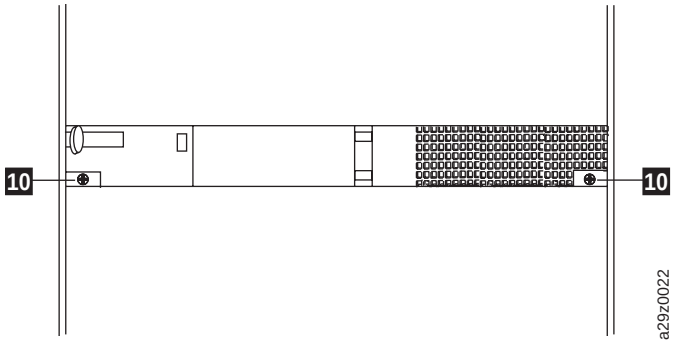

Figure 150. Securing the rear of the library in the rack

8. Run the SAS cable, power cable, and Ethernet cable through the hook-and-loop fastener strap **12**, then tighten the strap (Figure 151 on page 153)

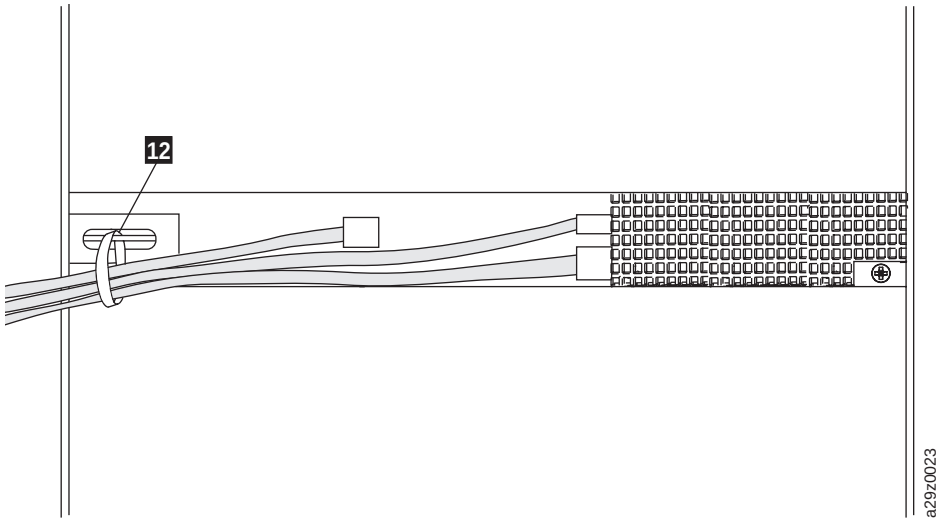

Figure 151. The cables at the rear of the library

9. Remove the accessor locking screw **1**.

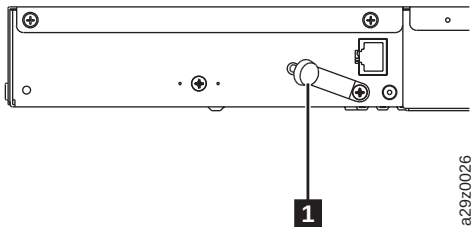

Figure 152. Removing accessor locking screw

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 power 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 99.
13. From the Operator Panel, select **Run Library Verify**, and press **Enter** to run library diagnostic procedures. Follow the on-screen instructions. If an error occurs, see "Troubleshooting" on page 129.
14. Take the library online.

For detailed instructions, see "Installation and configuration" on page 21.

Replacing the library

The entire library, including the drive, is a Customer Replaceable Unit (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 that is saved in the cookie, the Web User Interface checks the serial number of the new library against the serial number that is 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 with the Web User Interface when logged in as **service**.

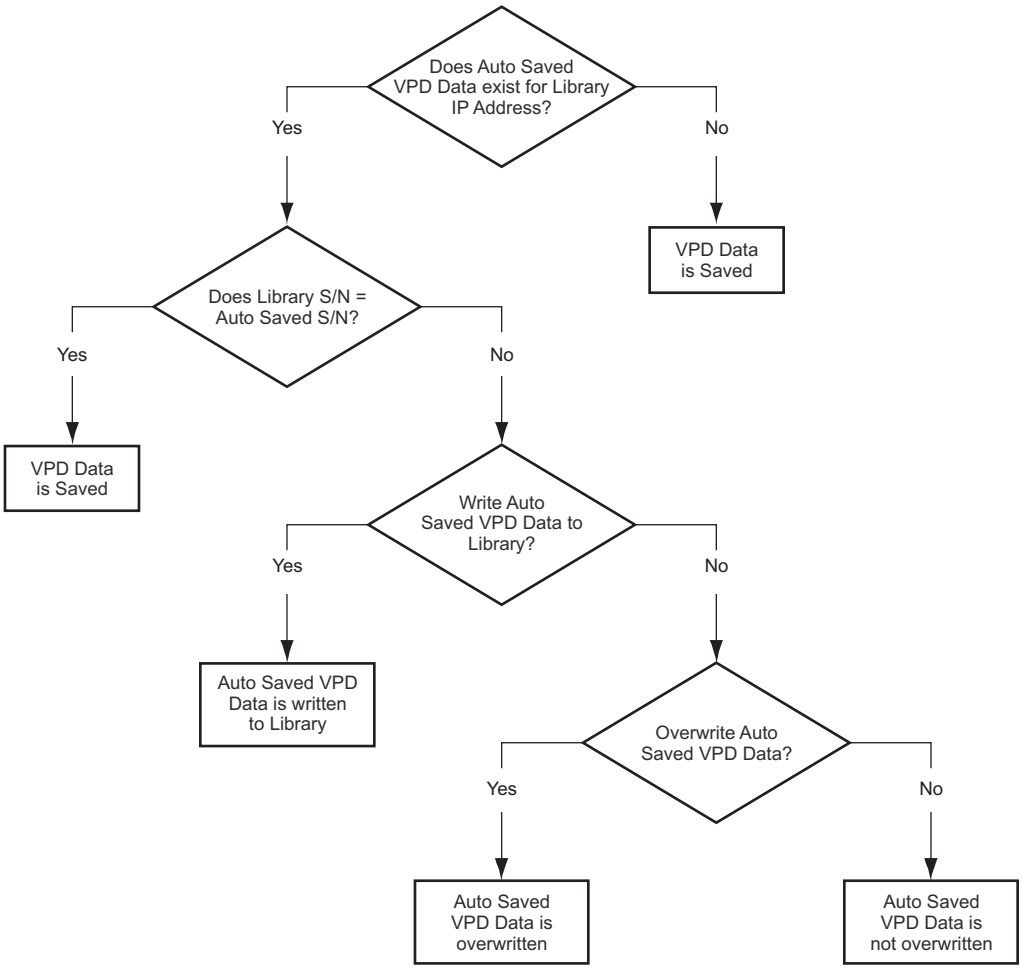

Figure 153. Library configuration with cookies

This procedure is used to replace the entire library in the event of a serious library malfunction.

1. If with a static IP address, make a note of your library's IP address. If with DHCP, proceed to the next step.
2. Remove the old library chassis with the corresponding procedure in "Removing library from a rack" on page 142 or "Removing library from a desktop" on page 147.
3. Install the new library chassis with the corresponding procedure in "Installing the library on a desktop" on page 144 or "Installing the library in a rack" on page 149.
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 with a **static IP address**, complete the following steps.
     a. With the Operator Panel, enter the network settings for the library. See "Configuring network settings" on page 71. Be sure to disable DHCP.
     b. Log in to the Web User Interface as **admin**. The following screen displays.

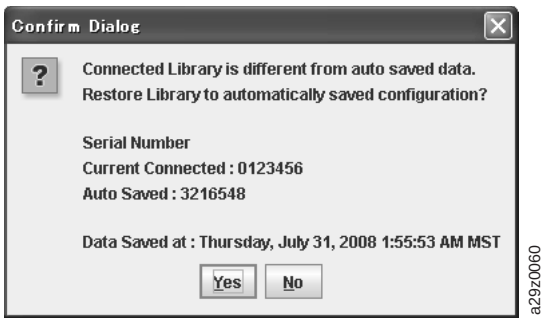

Figure 154. Auto saved data confirmation

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 155. 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 with 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 about the **Library Map**.

- If you are **with DHCP** to acquire an IP address, complete the following steps.
  a. With the Operator Panel, retrieve your new library IP address. See "Current information" on page 63.
  b. Contact IBM Technical Support for the **service** password.
     – In the US: 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 user name **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**.

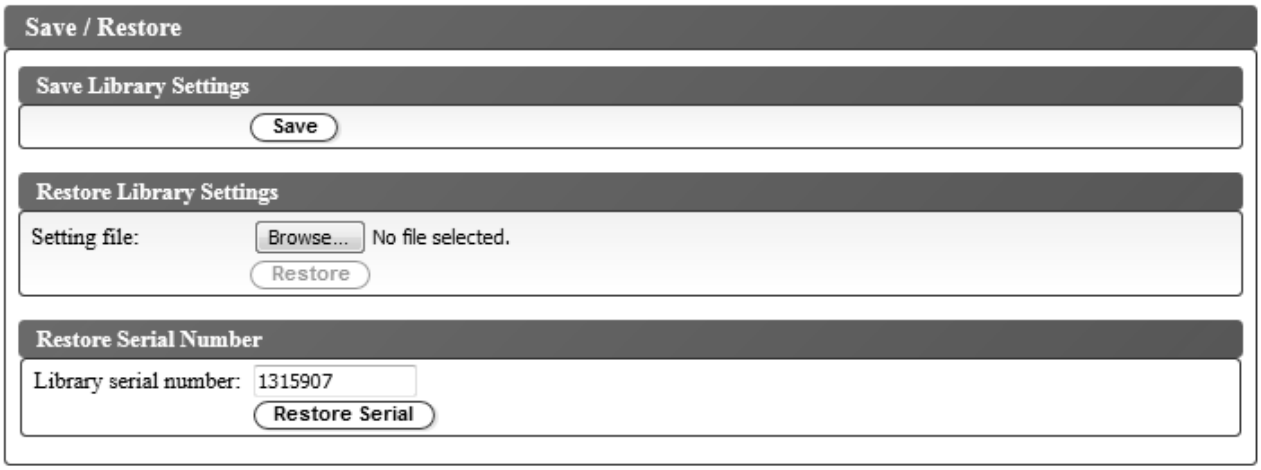

Figure 156. Save/Restore screen

e. On the same screen, click **Browse** to navigate to a saved configuration. 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 36.

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 with 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 about 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 with 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 104.
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 an RID tag to a library" on page 157.

Applying an RID tag to a library

A RID (Repair Identification) tag maintains the original serial number record and WWN of the library 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.

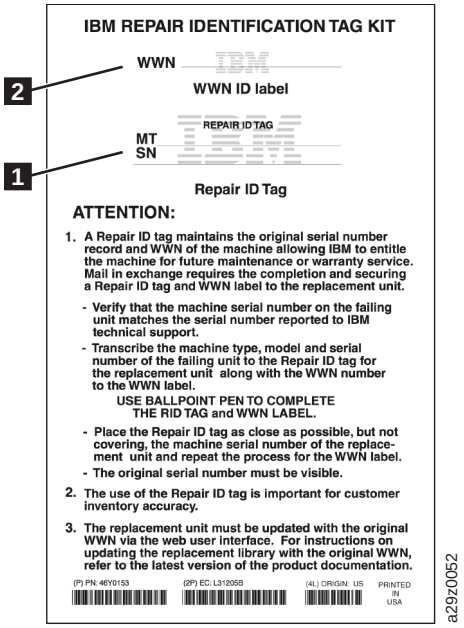

Figure 157. RID tag

1. Copy the machine type (MT) and serial number (SN) from the old library onto the Repair ID tag (**1** in Figure 157).
2. Copy the worldwide name (WWN) from the old library onto the WWN ID label (**2** in Figure 157).
3. Place the RID tag close to, but not covering, the serial number on the new library. Repeat for the WWN ID label.

Parts list

Features

Table 27. Optional features

Description	Feature Code	HVEC Part Number
2 m SAS/Mini-SAS 1x Cable (from HBA with SFF-8470 to drive with SFF-8088).	5402	95P4711
5.5 m SAS/Mini-SAS 1x Cable (from HBA with SFF-8470 to drive with SFF-8088).	5406	95P4712
2 m Mini-SAS/Mini-SAS 1x Cable (from HBA/Interposer with SFF-8088 to drive with SFF-8088).	5502	95P4713
5.5 m Mini-SAS/Mini-SAS 1x Cable (from HBA/Interposer with SFF-8088 to drive with SFF-8088).	5506	95P4714
4 m Mini-SAS HD/Mini-SAS 1x Cable Enables attachment of a single tape drive to a host with HD applications (from HD HBA with SFF-8644 to drive with SFF-8088 connector).	5507	46C2900
Transparent LTO Encryption	5901	45E3797
Rack Mount Kit with RML Line Cord	7006	45E3785
Deskside Kit	7010	45E3789
Extra Cartridge Magazine	8111	45E3793
Ultrium 8 data cartridges (5-pack)	8706	01PL340

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 is a charge for the service.

Note: There are two CRU Part Numbers for the S4H Generation 4 Tape Drive Library Chassis. Refer to the Serial Number on the S4H library that is being replaced. Use this Serial Number to determine which S4H CRU Part Number is the correct CRU.

Table 28. Customer replaceable units

Description	CRU Part Number
S3H Generation 3 Tape Drive Library Chassis	45E4824
S4H Generation 4 Tape Drive Library Chassis This CRU is for S4H libraries with a chassis serial number of 68-07999 or lower.	45E4831
S4H Generation 4 Tape Drive Library Chassis This CRU is for S4H libraries with a chassis serial number of 68-08000 or higher.	46X8578
S5H Generation 5 Tape Drive Library Chassis	46X8519
S6H Generation 6 Tape Drive Library Chassis	35P2579
S7H Generation 7 Tape Drive Library Chassis	00VJ177
S8H Generation 8 Tape Drive Library Chassis	XXXXXXX
2 m SAS/Mini-SAS 1x Cable	00VJ140
5.5 m SAS/Mini-SAS 1x Cable	00VJ141
2 m Mini-SAS/Mini-SAS 1x Cable	00VJ139
5.5 m Mini-SAS/Mini-SAS 1x Cable	00VJ138
4 m Mini-SAS HD/Mini-SAS Cable	46C2900
Cartridge Magazine	46Y0016

Power cords and receptacles

Figure 158 on page 161 shows the receptacles that are used by the power cords in Table 29 on page 161. Match the index number that is beside each plug to the index number in the table.

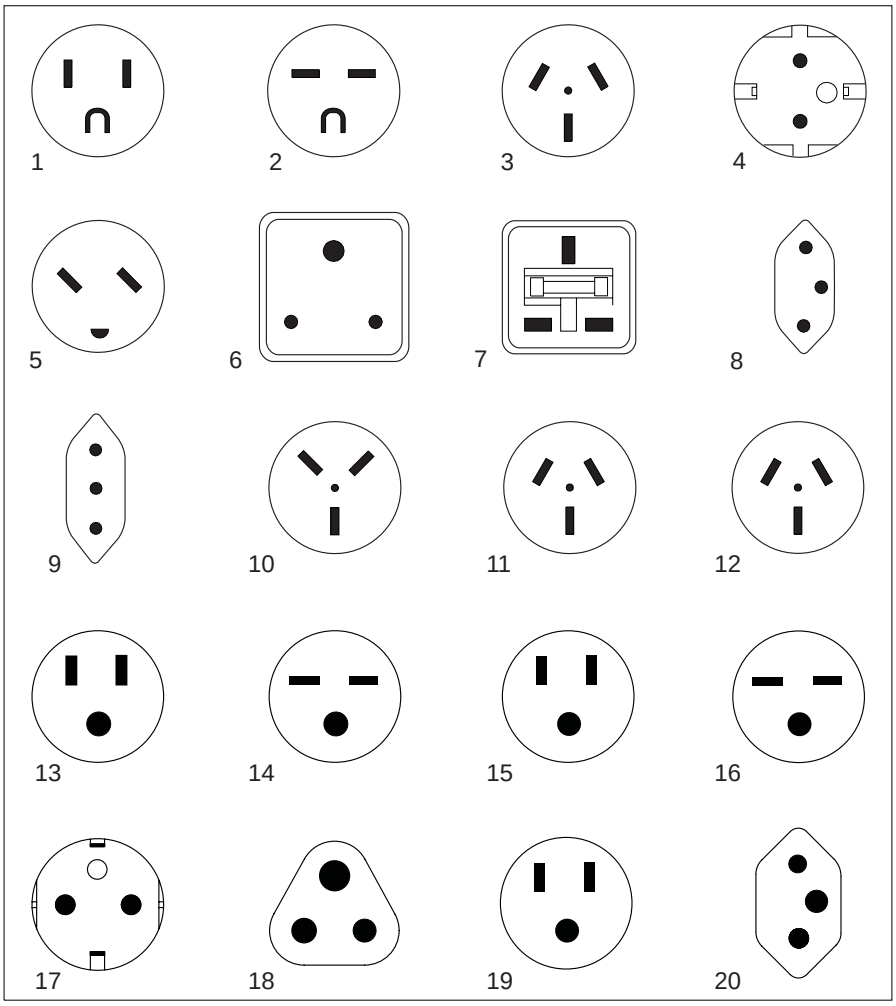

Figure 158. Types of power cord receptacles

Table 29. Power cords

Description, Feature Code (FC), and Part Number (PN)	Plug Standard Reference	Country or Region	Index Number in (Figure 153)
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

Table 29. Power cords (continued)

Description, Feature Code (FC), and Part Number (PN)	Plug Standard Reference	Country or Region	Index Number in (Figure 153)
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 29. Power cords (continued)

Description, Feature Code (FC), and Part Number (PN)	Plug Standard Reference	Country or Region	Index Number in (Figure 153)
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 29. Power cords (continued)

Description, Feature Code (FC), and Part Number (PN)	Plug Standard Reference	Country or Region	Index Number in (Figure 153)
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

Table 29. Power cords (continued)

Description, Feature Code (FC), and Part Number (PN)	Plug Standard Reference	Country or Region	Index Number in (Figure 153)
Japan HV** • 2.8 m, 250V • FC 9843 • AAS PN 39M5186 • HVEC/SAP PN 23R6983	JIS C8303, C8306	Japan	16
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 can be used to update the library and drive firmware, and to download error logs, drive memory dumps, and other library data.

Before the TS2900 Tape Autoloader can be managed over a network with the Web User Interface, you must set up the initial network configuration of the library with the Operator Panel. For more information, see "Configuring network settings" on page 54.

Logging in to the Web User Interface

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

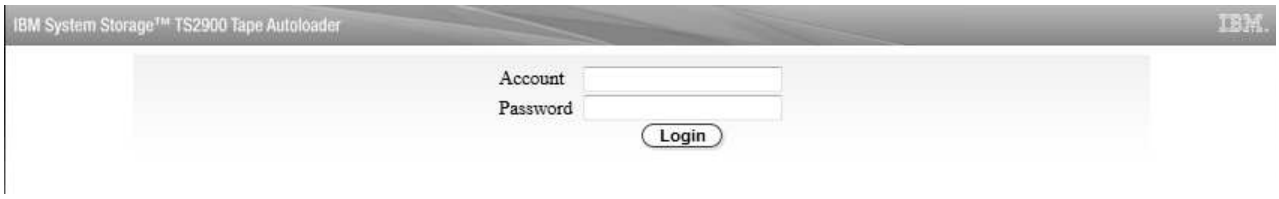

Figure 159. Login window

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 your account name and password is entered, use your mouse to click **Login** or press **Enter**.

For more information about account privileges, see "User privilege comparison" on page 168.

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 160 shows the window for a Service account.

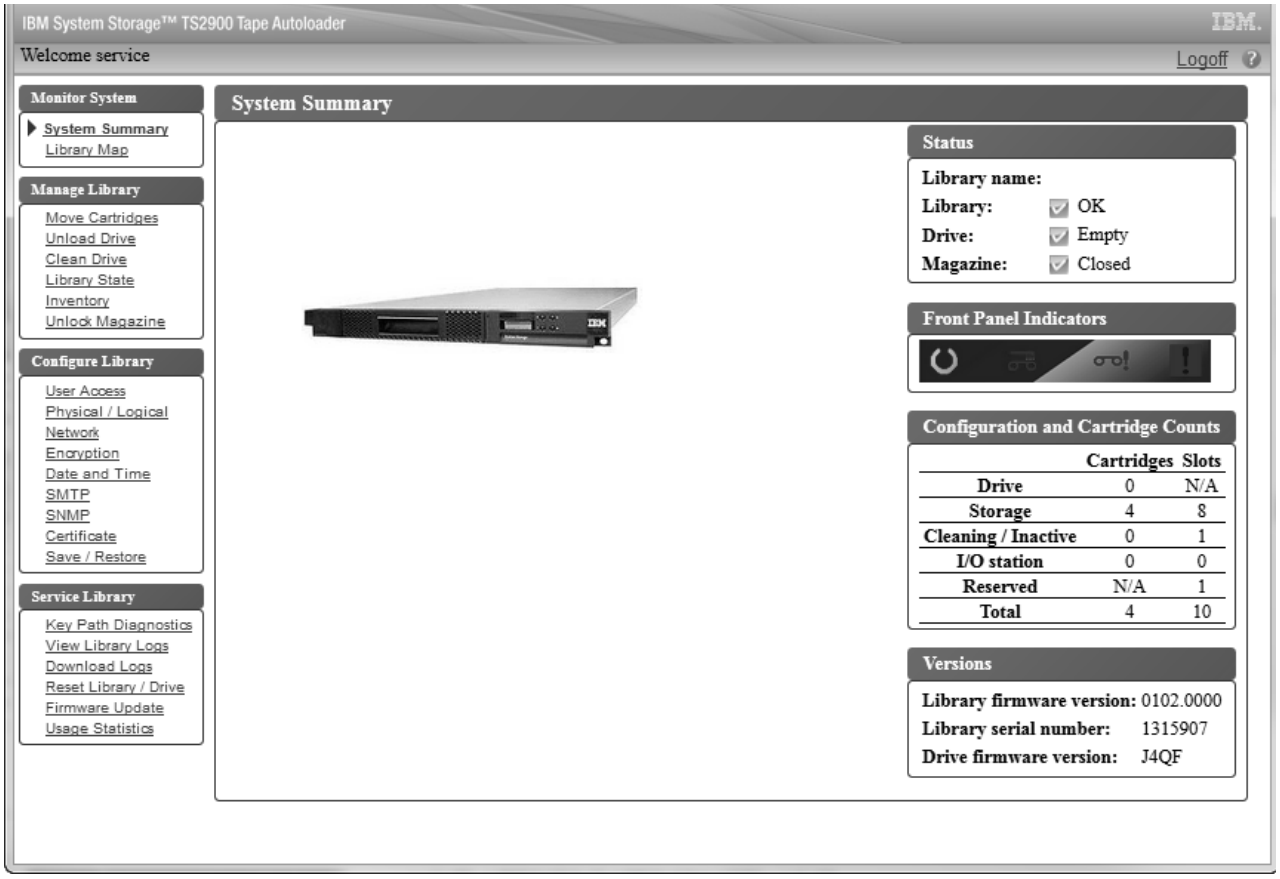

Figure 160. Service account window

For a complete description of all Web User Interface menu options, see "Operations" on page 61.

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 complete actions that affect the physical library.
- **Superusers** are allowed to operate the physical and logical library, but not complete actions that affect the library configuration.
- **Administrator** users are allowed access to the entire physical library and logical library, including configuration. 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 30. Menu commands and access privileges

Menu Command	User	Superuser	Administrator User	Service User
MONITOR SYSTEM				
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	-	-	X	X
Date and Time	-	-	X	X
Notifications	-	-	X	X
Save/Restore	-	-	X	X
SERVICE LIBRARY				
Key Path Diagnostics	-	-	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 with the Telnet service port

The Telnet service port can be enabled to allow IBM service personnel to run 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 press **Enter**.
3. When **Enable Telnet Port** shows on the display, press **Enter**.
4. When **Are you sure?** shows on the display, press **Enter**.

To disable the Telnet service port, have the library administrator power cycle the library.

Drive or cartridge removal

Important:

- **It is strongly recommended that the drive and stuck tape is returned to IBM for removal and recovery.**
- **These procedures must be completed only by a trained IBM service provider. SSRs can claim their time against service code 33 ECA 013 when they complete this procedure.**
- **Inform the customer that the following procedure has height risk of damaging the drive and height risk of not being able to recover the data.**

Removing or 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 must 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 Cartridges** command; Web User Interface: **Manage Library** > **Move Cartridges**).
2. Unconfigure 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 161).

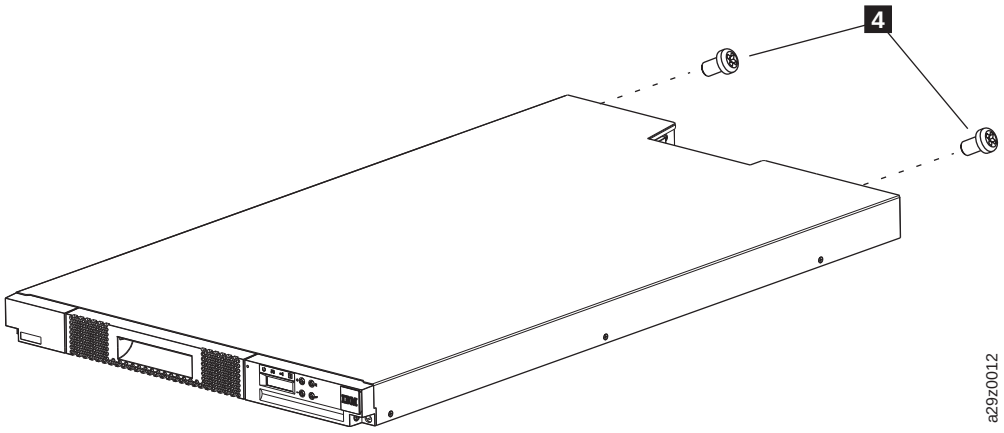

Figure 161. Removing screws from the rear of the library

     b. Remove the flat-head screws **6** on each side that secure the deskside cover to the library, and remove the deskside cover **2** (Figure 162 on page 171).

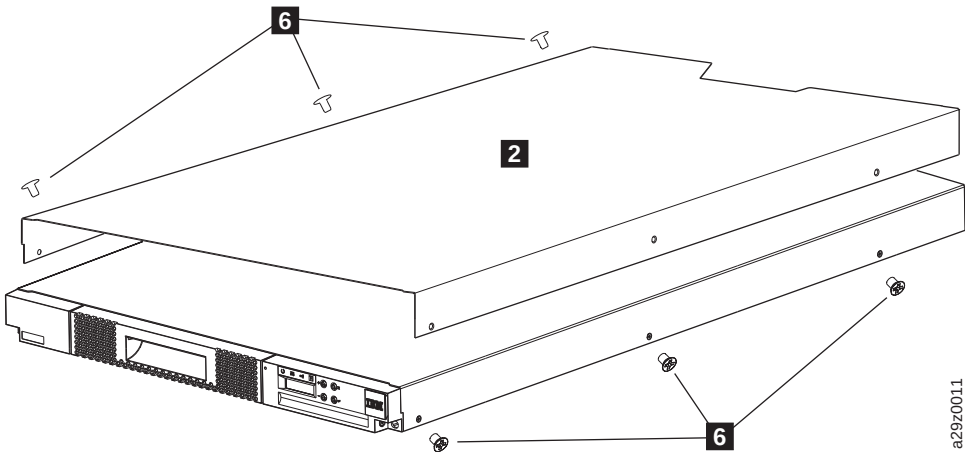

Figure 162. Removing the deskside cover

c. Remove the flat-head screws **6** on each side to remove the left **5** and right **3** rails from the chassis (Figure 163).

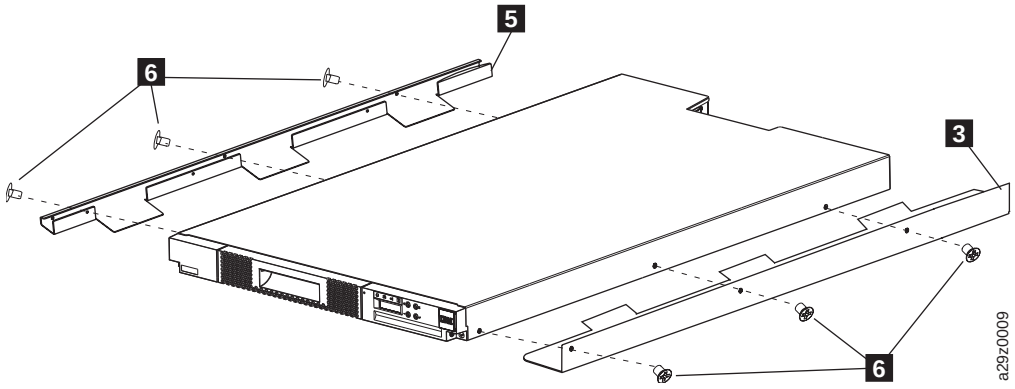

Figure 163. Removing side rails from the library chassis

- For a rack mounted library, remove the library from the rack.
  a. Remove the 2 round-head screws **10** on each rear bracket that secure the rear of the library to the rack (Figure 164).

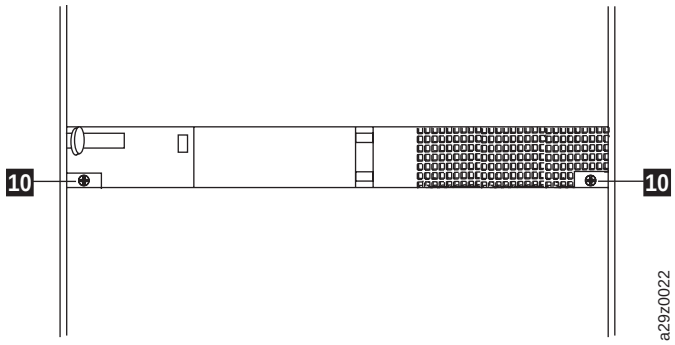

Figure 164. Removing screws at the rear of the library

b. Remove the large black screws **11** from each front bracket that secure the front of the library to the rack, and slide the library chassis out of the rack (Figure 165 on page 172).

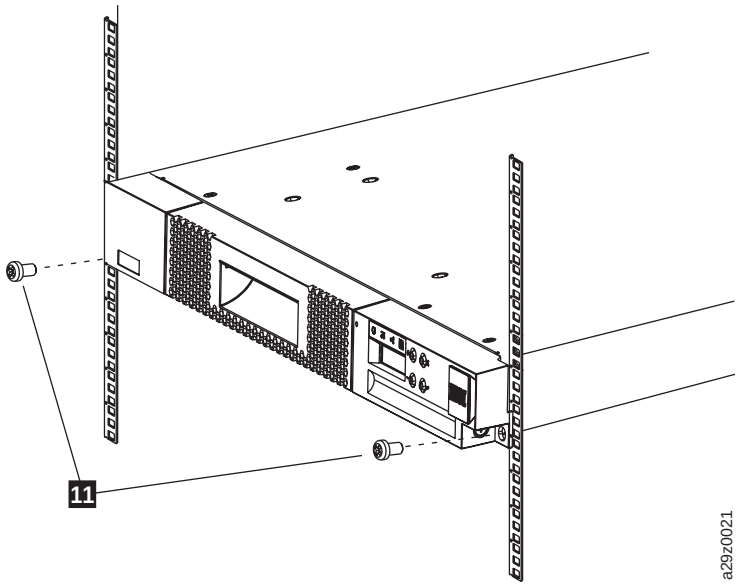

Figure 165. Removing screws at the rear of the library

5. Remove the screws that secure the library chassis cover (Figure 166).

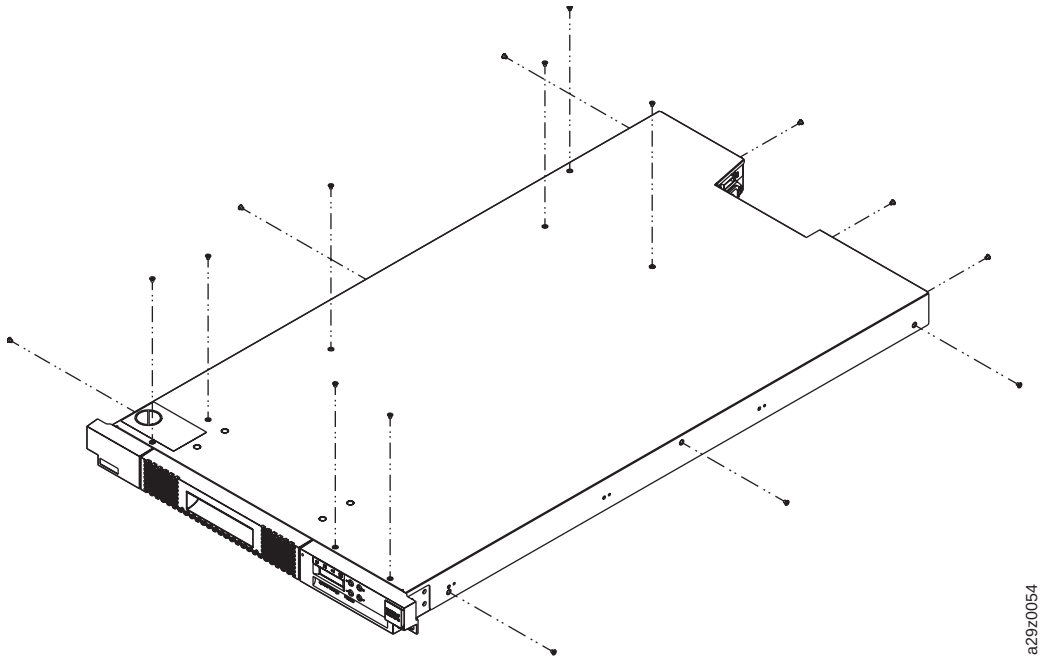

Figure 166. Library chassis cover screw locations

6. Lift the library chassis cover off vertically (Figure 167 on page 173).

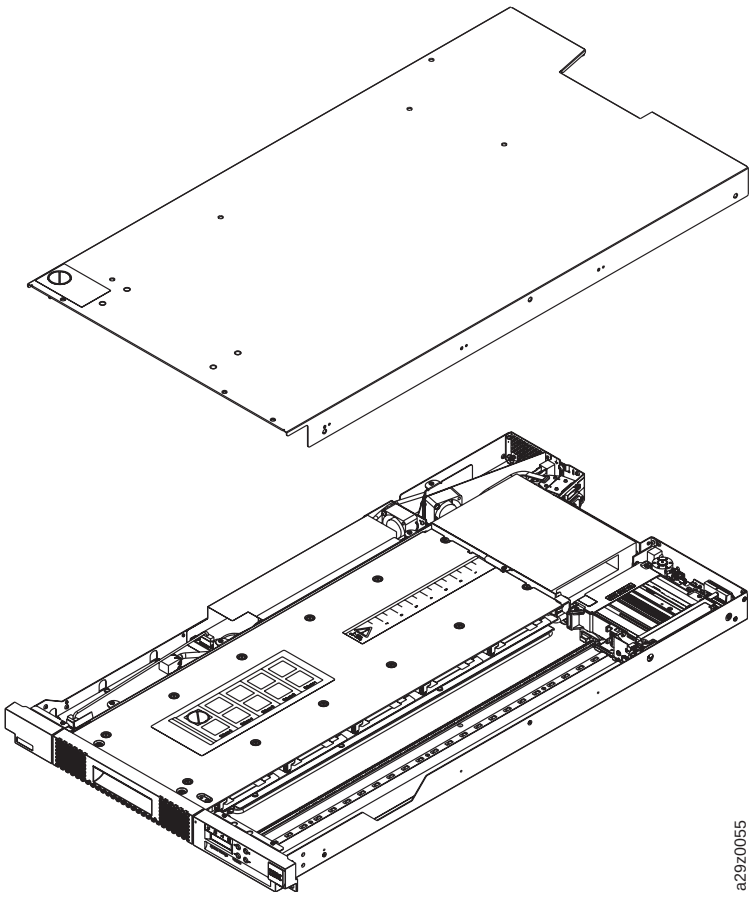

Figure 167. Library chassis cover removal

Installation is the reverse of the removal procedure.

Internal view of library

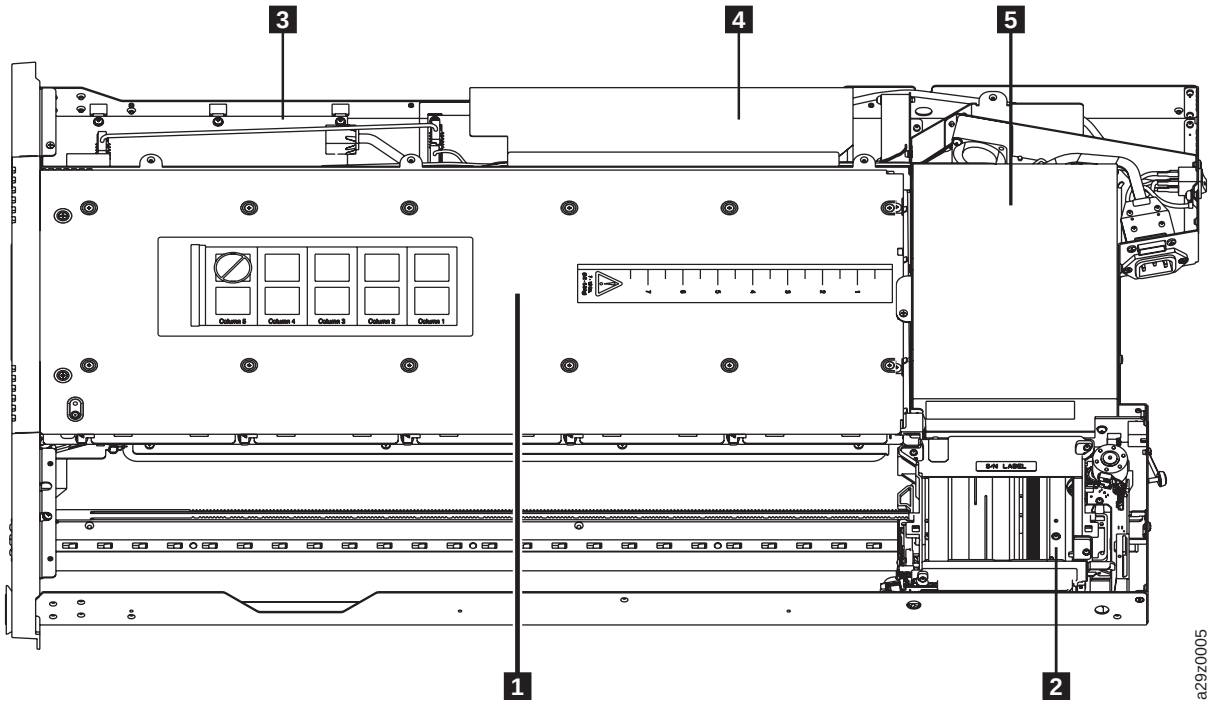

Figure 168. Internal components

Table 31. 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 39.
2	accessor	This component contains the library robot and bar code reader. The accessor moves cartridges to/from: • 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.

Table 31. Internal component descriptions (continued)

Number	Component	Description
5	Tape Drive	The library supports the Ultrium 3, 4, 5, 6, and 7 half height tape drive.

Removing the tape drive from 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. See "Removing or reinstalling the library chassis cover" on page 170.
4. Disconnect the internal SAS cable (2 in Figure 169).

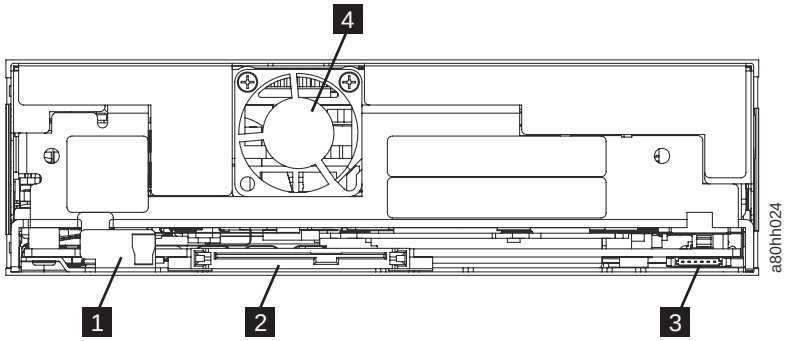

Figure 169. Rear panel of the SAS Half Height drive

5. If connected, disconnect the internal LDI (RS-422) cable from the LDI (RS-422) connector (3 in Figure 169).
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 on each side of the drive (Figure 170).

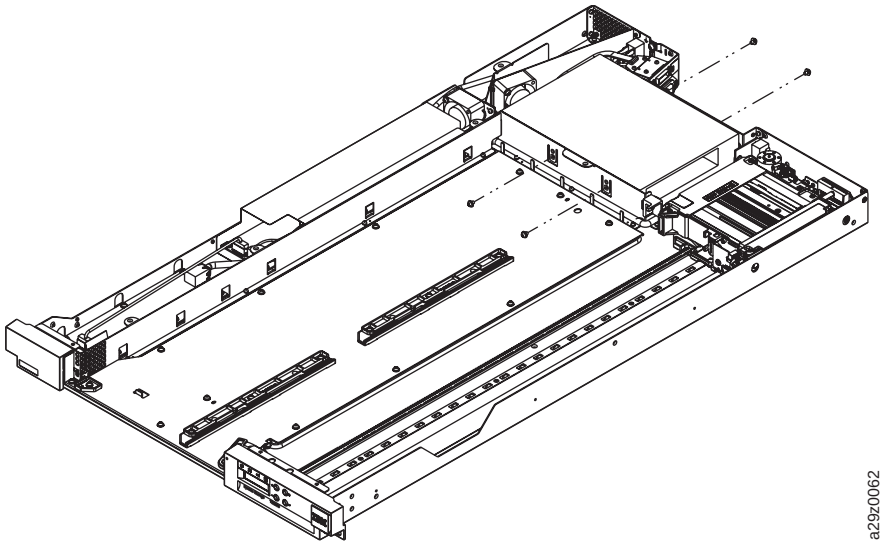

Figure 170. Drive housing screw locations

8. Lift the tape drive out of the library chassis (Figure 171).

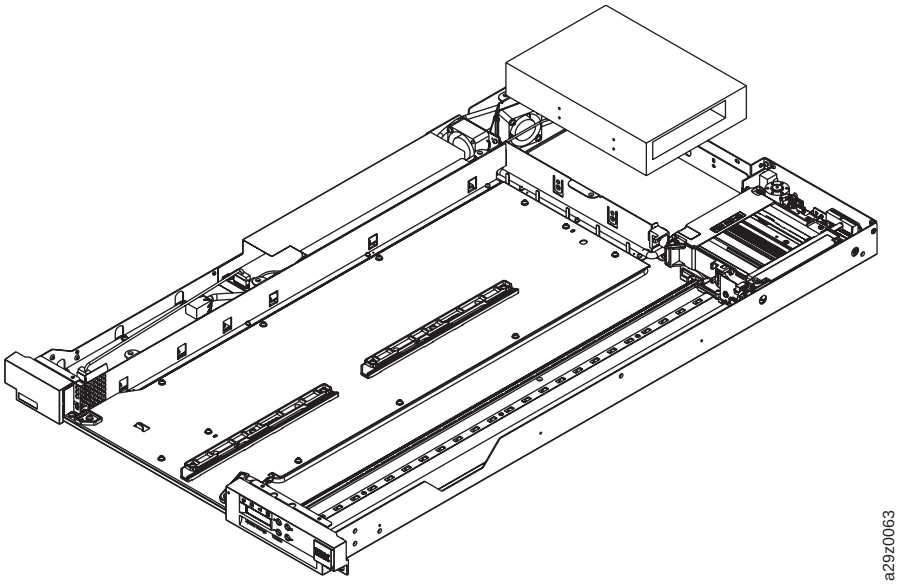

Figure 171. Tape drive removal

Reinstalling the tape drive in the library

To reinstall the tape drive in the library, reverse the directions that are found in "Removing the tape drive from the library" on page 175.

Manually removing a tape cartridge from the drive

The purpose of these directions 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.

1. **The best solution for recovering data on a damaged cartridge is to send it to IBM for professional data recovery.**
2. Before with this procedure, you must exhaust all other means of removing the tape cartridge from the drive. Use this procedure only if you cannot remove the tape cartridge by with any other means.
3. 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 diagnostic procedures are completed to test the drive for continued use.
4. The following removal procedures can destroy customer data! Use extreme care when you handle or remove the customer's tape cartridges to minimize tape damage and lost data.
5. DO NOT TOUCH the magnetic tape or tape path. Both are sensitive to the oil and salt from your skin. Use clean, lint-free gloves when you are working around magnetic tape or the tape path components.
6. Electrostatic-sensitive components: Consider with an ESD Kit.
7. After you remove the tape cartridge, advise the customer to copy the data to another cartridge and to remove this tape cartridge from service.
8. Do not use power tools or magnetic tools to perform this procedure.
9. To avoid contamination and electrostatic-discharge damage to the drive, never touch the head or electronic components inside the drive.
10. If you cannot remove the cartridge from the drive with the following procedures, contact your next level of support.

11. The cartridge does not eject automatically at the end of a mid-tape recovery. Instead, the tape is reloaded into the drive and might result in the loss of data.
12. 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. Attempt to remove the cartridge with the device power ON and with library manager, a host application, or the unload button. Press and hold the unload button for 12 seconds. This procedure causes the drive to eject the cartridge when it completes the mid-tape recovery.
2. Ensure that the operator issued the appropriate application commands to complete the rewind and unload of the cartridge. This procedure is to ensure that the stuck cartridge is not because of a hang condition in the application.
3. Attempt to remove the cartridge by power cycling the drive. Look for the drive to attempt a mid-tape 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 before you continue with this procedure.

Recommended tools

- #1 Phillips screwdriver
- ESD Kit
- Flashlight (optional)
- #1 Flathead screwdriver (optional)

Beginning procedure

1. Remove the drive. See “Removing the tape drive from the library” on page 175.
2. Place the drive on a non-slip, sturdy work surface.
3. Ground yourself to the drive by with the ESD Kit.
4. Remove the cover of the drive by completing 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 4 cover-mounting screws (**1** in (Figure 172 on page 178). Two screws are on each side of the drive. Remove the cover by lifting it up.

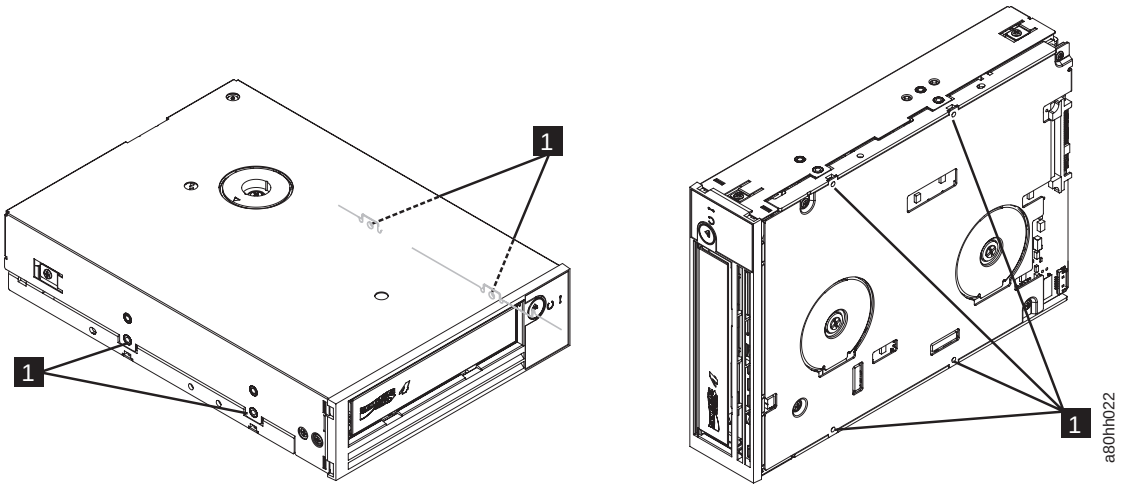

Figure 172. Removing the bezel and the cover from the internal drive

5. Inspect the drive to decide which of the following conditions most closely matches the symptom on the drive:
   - **"Tape spooled off 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 or broken near leader pin" on page 180** - All the tape appears to be on the supply reel (inside the cartridge) and 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" on page 181** - 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" on page 182** - Tape appears to be tangled and damaged but intact. Return the drive after the procedure is completed.
   - **"No apparent failure or damage to tape" on page 183** - 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 173 on page 179). 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 that 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 173 on page 179 clockwise, allowing the moistened tape to adhere to the hub as it winds around the supply reel (inside the cartridge).

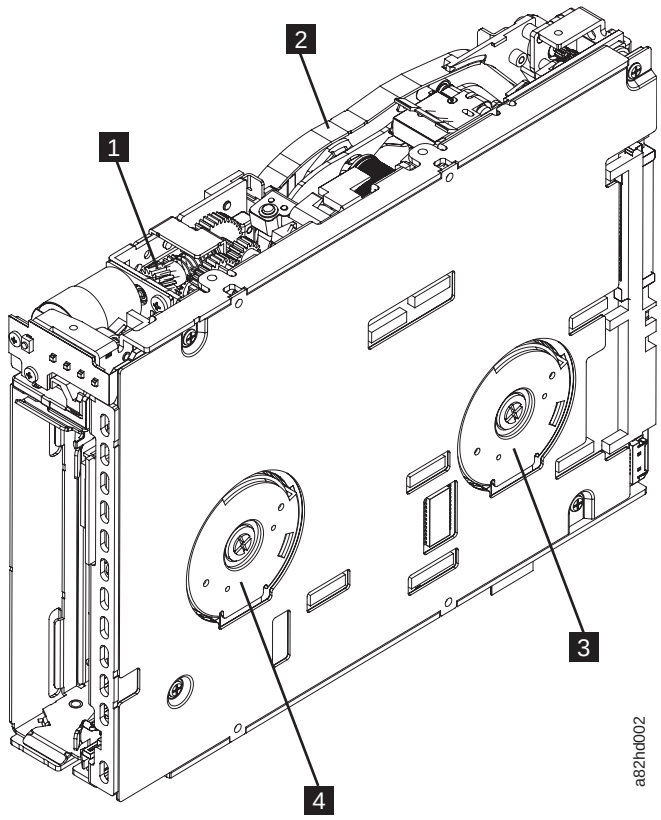

Figure 173. Rewinding tape into cartridge

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 173) 10 more turns. Ensure that you do not stretch the tape.
7. Reassemble the drive, reversing the steps in "Beginning procedure" on page 177.
8. Reassemble the library chassis. See "Ending procedure" on page 186.

Tape pulled from or broken near leader pin

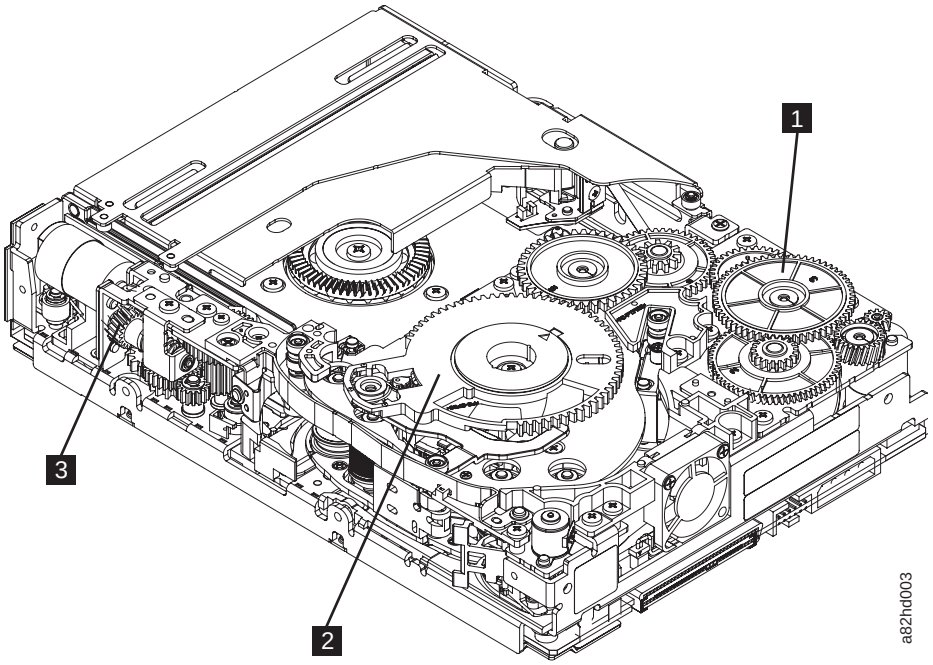

Figure 174. Drive with cover removed to reveal gear train

1 Threader intermediate gear
2 Threader mechanism gear
3 Loader motor worm 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 181.
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 174) near the rear of the drive. You can use your finger to rotate the threader intermediate gear (**1** in Figure 174) and slowly rotate the threader mechanism gear (**2** inFigure 174) clockwise. This procedure draws the tape leader block assembly (LBA) into the cartridge.
5. As the leader pin is secured in the cartridge, 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 174) 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 174 and **1** in Figure 175 on page 181) clockwise as viewed from the front of the drive until it stops. This procedure releases the LBA leader pin.
7. Rotate the threader intermediate gear (**1** in Figure 174) counterclockwise until the leader block is in front of the read/write head. This procedure moves the LBA out of the cartridge.

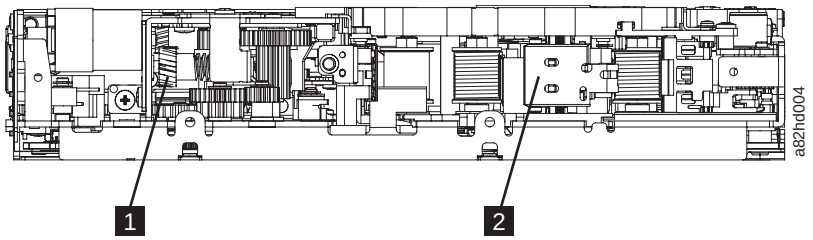

Figure 175. Leader Block Assembly (LBA)

1 Loader motor worm gear

2 Leader block assembly (LBA)

8. Rotate the loader motor worm gear (**3** in Figure 174 on page 180) 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, reversing the steps in "Beginning procedure" on page 177.
11. Reassemble the library chassis. See "Ending procedure" on page 186.

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 180.
2. From the supply reel inside the cartridge, pull approximately 0.3 m (1 ft.) of tape.
3. Make sure that 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 176 on page 182) clockwise, carefully guiding the mended portion of the tape to wind around the hub of the supply reel that is 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 176 on page 182) 10 more turns. Ensure that you do not stretch the tape.

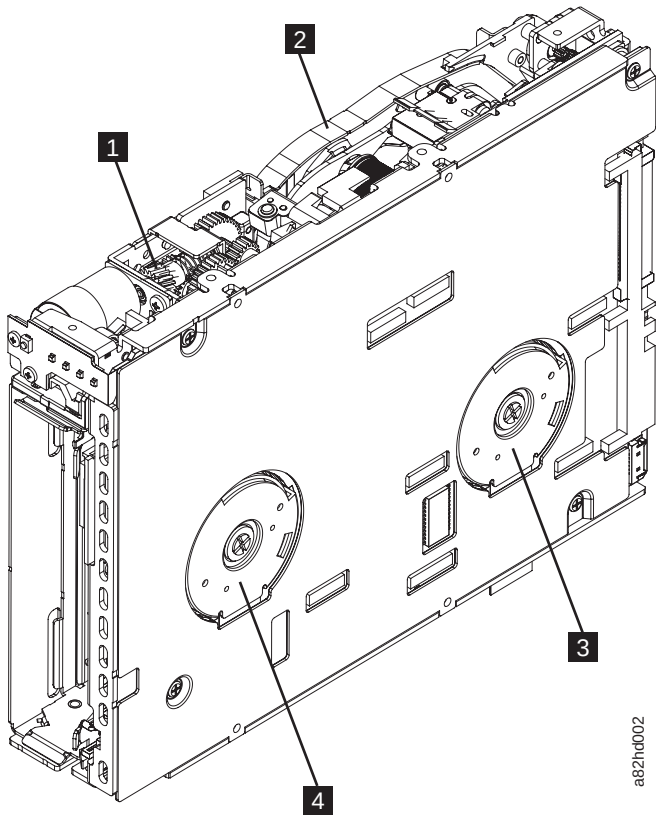

Figure 176. Rewinding tape into cartridge

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 177.
8. Reassemble the library chassis. See "Ending procedure" on page 186.

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 178
   - "Tape pulled from or broken near leader pin" on page 180
   - "Tape broken in mid-tape" on page 181
2. Set the drive on its left side with the head and tape path facing up.

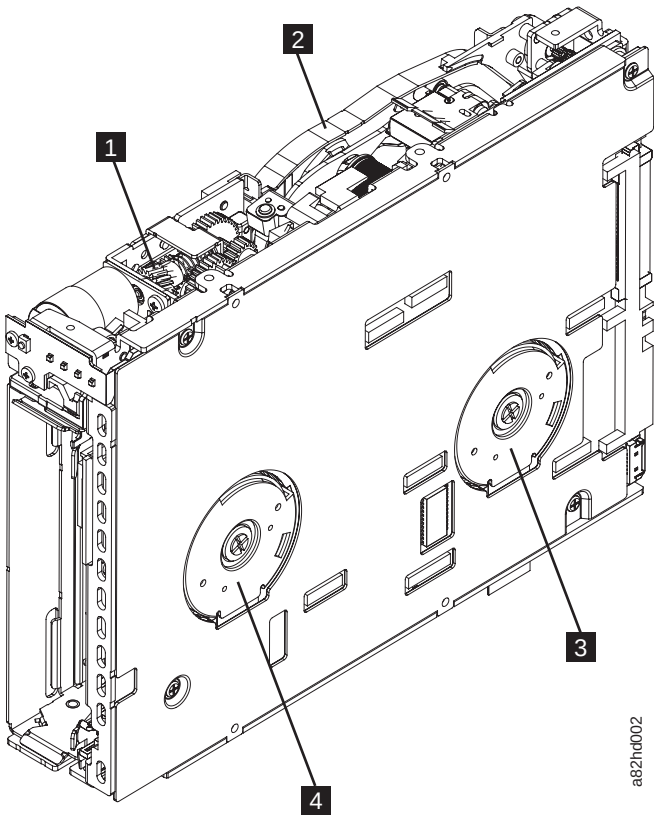

Figure 177. Rewinding tape into cartridge

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 177) 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 177) 10 turns. Ensure that you do not stretch the tape.
5. Reassemble the library chassis. See "Ending procedure" on page 186.

No apparent failure or damage to tape

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

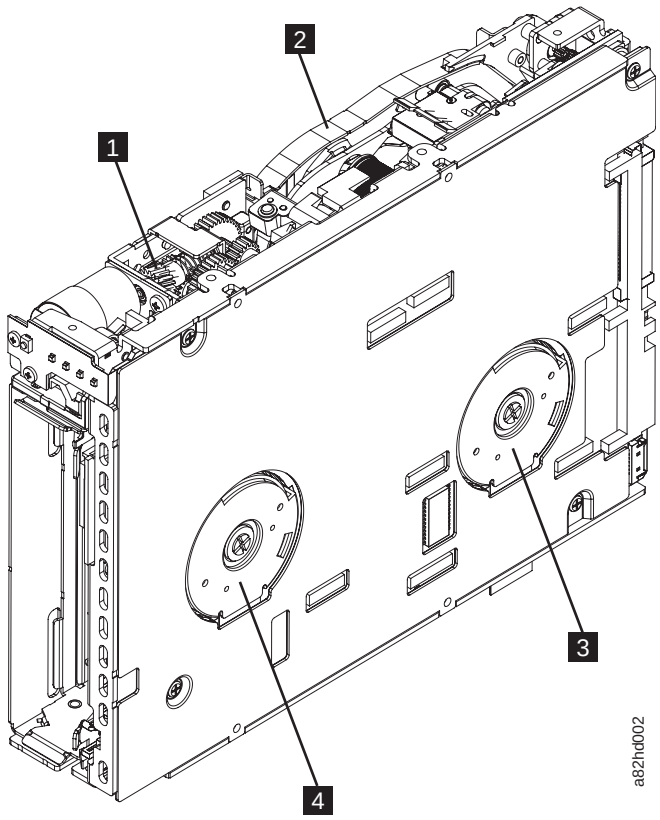

Figure 178. Rewinding tape into cartridge

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 178) 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 178).
4. Locate the threader intermediate gear (1 in Figure 179 on page 185) near the rear of the drive. You can use your finger to rotate the threader intermediate gear (1 in Figure 179 on page 185) and slowly rotate the threader mechanism gear (2 in Figure 179 on page 185) clockwise. This procedure draws the tape leader block assembly (LBA) into the cartridge.

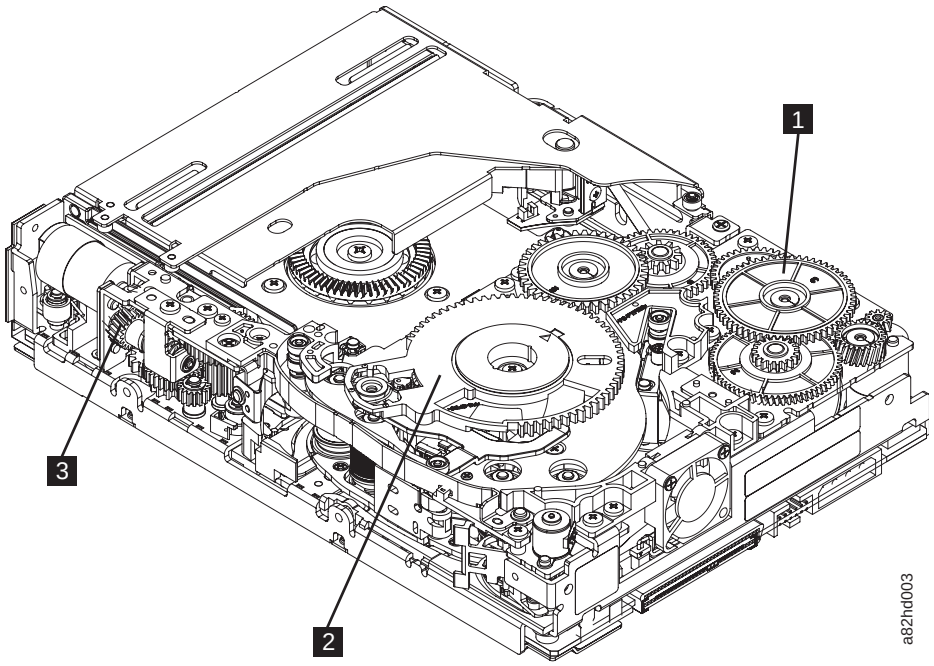

Figure 179. Drive with cover removed to reveal gear train

1 Threader intermediate gear
2 Threader mechanism gear
3 Loader motor worm gear

5. As the leader pin is secured in the cartridge, 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 179) 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 179 and **1** in Figure 180) clockwise as viewed from the front of the drive until it stops. This procedure releases the LBA leader pin.
7. Rotate the threader motor worm gear (**1** in Figure 180) counterclockwise until the leader block is in front of the read/write head. This procedure moves the LBA out of the cartridge.

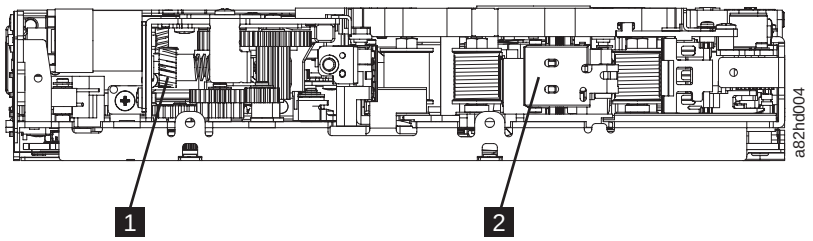

Figure 180. Leader Block Assembly (LBA)

1 Loader motor worm gear
2 Leader block assembly (LBA)

8. Rotate the loader motor worm gear (**1** in Figure 180) 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 177.
11. Reassemble the library chassis. See "Ending procedure" on page 186.

Ending procedure

1. Reinstall the drive in the library. See “Removing the tape drive from the library” on page 175.
2. Reinstall the library chassis cover. See “Removing or reinstalling the library chassis cover” on page 170.
3. Return the defective 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 when you pull on the magazine (see “Unlocking the cartridge magazine manually” on page 141). 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. See “Removing or reinstalling the library chassis cover” on page 170.
5. Remove the magazine from the library and check for any damaged cartridges.
6. Reassemble the library, reversing the steps that are 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 32. 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 normal library operations resume. • If the problem persists, see "Contacting IBM technical support" on page 139.
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 136. 2. Reseat all cables. See "Reseating cables" on page 137. 3. Cycle the power supply and try again. • If the problem is corrected, run Library Verify before normal library operations resume. • If the problem persists, see "Contacting IBM technical support" on page 139.
0009	The accessor locking screw has not been removed.	CHK 0009	1. Remove the accessor locking screws. See "Removing the accessor locking screw" on page 33. 2. Cycle the power supply and try again. • If the problem is corrected, run Library Verify before normal library operations resume. • If the problem persists, see "Contacting IBM technical support" on page 139.

Table 32. 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 136. 2. Confirm the DHCP server settings. 3. Reseat all cables. See "Reseating cables" on page 137. 4. Cycle the power supply and try again. • If the problem is corrected, run Library Verify before normal library operations resume. • If the problem persists, see "Contacting IBM technical support" on page 139.
0011	Time acquisition from the NTP server failed.	-	1. Observe LEDs. See "Interpreting front panel LEDs" on page 136. 2. Confirm the time server settings. 3. Reseat all cables. See "Reseating cables" on page 137. 4. Cycle the power supply and try again. • If the problem is corrected, run Library Verify before normal library operations resume. • If the problem persists, see "Contacting IBM technical support" on page 139.
0020	LDI I/F error. Transmit data abnormality detected (NAK reception).	-	1. Observe LEDs. See "Interpreting front panel LEDs" on page 136. 2. Reseat all cables. See "Reseating cables" on page 137. 3. Cycle the power supply and try again. • If the problem is corrected, run Library Verify before normal library operations resume. • If the problem persists, see "Contacting IBM technical support" on page 139.
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	LDI command ends abnormally.	-	1. Confirm the Encryption Key Manager settings. 2. Reseat all cables. See "Reseating cables" on page 137. 3. Cycle the power supply and try again. • If the problem is corrected, run Library Verify before normal library operations resume. • If the problem persists, see "Contacting IBM technical support" on page 139.
002A	Commands to the Encryption Key Manager over the retry limit.	-	

Table 32. Library error codes (continued)

Code (H)	Description	Panel Indication	Action Required
002B	Commands to the encryption capable drive over the retry limit.	-	1. Reseat all cables. See "Reseating cables" on page 137. 2. Cycle the power supply and try again. • If the problem is corrected, run Library Verify before normal library operations resume. • If the problem persists, see "Contacting IBM technical support" on page 139.
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 normal library operations resume. • If the problem persists, see "Contacting IBM technical support" on page 139.
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 "Cartridge compatibility" on page 109. 2. Verify that the cartridge is not write-protected. See "Write-Protect switch" on page 114. 3. If it is a cleaning cartridge, verify that the cartridge is not expired. See "Cleaning cartridge" on page 111. 4. Cycle the power supply and try again. • If the problem is corrected, run Library Verify before normal library operations resume. • If the problem persists, see "Contacting IBM technical support" on page 139.
0041	A hardware error detected upon media insertion	CHK 0041	
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 normal library operations resume. • If the problem persists, see "Contacting IBM technical support" on page 139.
0048	Incompatible medium installed.	CHK 0048	Verify that the cartridge is compatible with the drive installed in the library. See "Cartridge compatibility" on page 109. • If the problem is corrected, run Library Verify before normal library operations resume. • If the problem persists, see "Contacting IBM technical support" on page 139.

Table 32. Library error codes (continued)

Code (H)	Description	Panel Indication	Action Required
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 66 (Operator Panel) or "Conducting a library inventory" on page 81 (Web User Interface). 2. Cycle the power supply and try again. • If the problem is corrected, run Library Verify before normal library operations resume. • If the problem persists, see "Contacting IBM technical support" on page 139.
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	
005B	I^2C I/F error. A transfer retry detected. Suspect the bar code reader cable connection.	CHK 005B	
005C	I^2C I/F error. Interrupt timeout detected. Suspect the bar code reader cable connection.	CHK 005C	
005D	I^2C I/F error. Invalid signal (NAK) detected. Suspect the bar code reader cable connection.	CHK 005D	
005E	I^2C I/F error. Bus arbitration lost error detected. Suspect the bar code reader cable connection.	CHK 005E	
005F	I^2C 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 65 (Operator Panel) or "Moving cartridges" on page 79 (Web User Interface). 2. Cycle the power supply and try again. • If the problem is corrected, run Library Verify before normal library operations resume. • If the problem persists, see "Contacting IBM technical support" on page 139.

Table 32. Library error codes (continued)

Code (H)	Description	Panel Indication	Action Required
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 normal library operations resume. • If the problem persists, see "Contacting IBM technical support" on page 139.
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 with 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 normal library operations resume. • If the problem persists, see "Contacting IBM technical support" on page 139.
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 normal library operations resume. • If the problem persists, see "Contacting IBM technical support" on page 139.
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 137. 2. Cycle the power supply and try again. • If the problem is corrected, run Library Verify before normal library operations resume • If the problem persists, see "Contacting IBM technical support" on page 139.

Table 32. Library error codes (continued)

Code (H)	Description	Panel Indication	Action Required
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	1. Check the accessor locking screw and remove it if it is installed. See "Removing the accessor locking screw" on page 33. 2. Cycle the power supply and try again. • If the problem is corrected, run Library Verify before normal library operations resume. • If the problem persists, see "Contacting IBM technical support" on page 139.
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.	CHK 0088	
0089	X calibration error #2. During X calibration, centering sensor ON condition could not be detected.	CHK 0089	
008F	During X operation, the cartridge magazine was removed. Suspect the magazine set sensor.	CHK 008F	1. Confirm that the magazine is closed. 2. Cycle the power supply and try again. • If the problem is corrected, run Library Verify before normal library operations resume. • If the problem persists, see "Contacting IBM technical support" on page 139.
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 normal library operations resume. • If the problem persists, see "Contacting IBM technical support" on page 139.

Table 32. Library error codes (continued)

Code (H)	Description	Panel Indication	Action Required
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 normal library operations resume. • If the problem persists, see "Contacting IBM technical support" on page 139.
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 with 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 normal library operations resume. • If the problem persists, see "Contacting IBM technical support" on page 139.
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	1. Check the accessor locking screw and remove it if it is installed. See "Removing the accessor locking screw" on page 33. 2. Cycle the power supply and try again. • If the problem is corrected, run Library Verify before normal library operations resume. • If the problem persists, see "Contacting IBM technical support" on page 139.
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	
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	

Table 32. Library error codes (continued)

Code (H)	Description	Panel Indication	Action Required
00C0	accessor operation disabled because a cartridge magazine was removed. Suspect the magazine set sensor.	CHK 00C0	1. Confirm that the magazine is closed. 2. Cycle the power supply and try again. • If the problem is corrected, run Library Verify before normal library operations resume. • If the problem persists, see "Contacting IBM technical support" on page 139.
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 normal library operations resume. • If the problem persists, see "Contacting IBM technical support" on page 139.
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	
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 normal library operations resume. • If the problem persists, see "Contacting IBM technical support" on page 139.
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 66 (Operator Panel) or "Conducting a library inventory" on page 81 (Web User Interface). 2. Cycle the power supply and try again. • If the problem is corrected, run Library Verify before normal library operations resume. • If the problem persists, see "Contacting IBM technical support" on page 139.
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 normal library operations resume. • If damaged, replace the magazine.
00DA	I/O Station failed to unlock. Suspect the magazine or magazine sensor.	CHK 00DA	

Table 32. Library error codes (continued)

Code (H)	Description	Panel Indication	Action Required
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 66 (Operator Panel) or "Conducting a library inventory" on page 81 (Web User Interface). 2. Cycle the power supply and try again. • If the problem is corrected, run Library Verify before normal library operations resume. • If the problem persists, see "Contacting IBM technical support" on page 139.
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 normal library operations resume. • If the problem persists, see "Contacting IBM technical support" on page 139.
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 32. 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 normal library operations resume. • If the problem persists, see "Contacting IBM technical support" on page 139.
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 33. 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 137. 2. Cycle the power supply and try again. • If the problem is corrected, run Library Verify before normal library operations resumes. • If the problem persists, see "Contacting IBM technical support" on page 139.
0201	Timeout error occurred while drive is waiting for response.	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	
020E	Drive error detected.	CHK 020E	
020F	Unsupported drive detected.	CHK 020F	
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 137. 3. Cycle the power supply and try again. • If the problem is corrected, run Library Verify before normal library operations resumes. • If the problem persists, see "Contacting IBM technical support" on page 139.

Web User Interface error messages

Table 34. Web user error messages

Title	Message	Issuing Panel
Error	Users full.	User Access
	You cannot remove yourself.	User Access

Table 34. Web user error messages (continued)

Title	Message	Issuing Panel
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
	A user name unmatched.	User Access
	A user is already existing.	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 command 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 34. Web user error messages (continued)

Title	Message	Issuing Panel
Cleaning Command Error	Illegal medium.	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
	Not loaded.	Clean Drive
	Expired medium.	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. Retry download.	Download Library Logs
	Email submit failure.	Notifications
	SNMP trap submit failure.	Notifications
	Log data access failure.	Traces, View Library Logs
	Port open failure [**.**.**.**:****]. Do you want to retry?	Displayed after 3 unsuccessful attempts.
	Port open failure [**.**.**.**:****]. Check the library and the network condition setting.	Displayed after 3 unsuccessful attempts.
	Web interface version is not matched between Library and the web application. Restart the browser. There is a possibility of malfunctioning if you proceed operation from Web.	All
Library Busy	Library information updating now. Cannot access library information	All

Trap definitions (types)

The TS2900 library supports the following types of SNMP traps.

Table 35. 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

Additional information is provided to the reader about the tape library and tape drive. All error code and diagnostic information 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 187.

TapeAlert is a standard that defines status conditions and problems that are 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 might change periodically, the SNMP interface in the library does not require code changes if devices add extra TapeAlerts that are not supported today. However, if this change occurs, 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 are sent. The MIB file must 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 36. 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 with 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 139.	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 67. 2. Restart the operation. 3. If the problem persists, see "Contacting IBM technical support" on page 139.	C
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 139.	C

Table 36. TapeAlert flags supported by the library (continued)

Flag Number	Flag Name	Description	Action Required	Type[1]
06	Library Interface	The library 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 139.	C
08	Library Maintenance	Library preventive maintenance required.	Preventive maintenance of the library is required. Consult the library user's manual for device-specific preventive maintenance tasks.	W
12	Library Stray Tape	A cartridge was left in the drive inside the library by a previous hardware fault.	1. Try unloading the cartridge from the drive with 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 normal library operations resume. • 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 139.	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 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 was manually turned offline and is unavailable for use.	I
22	Library Drive Offline	Library turned internal drive offline.	The drive inside the library was taken offline. This flag is for information purposes only. No action is required.	I

Table 36. TapeAlert flags supported by the library (continued)

Flag Number	Flag Name	Description	Action Required	Type[1]
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 failed inside the library. See “Contacting IBM technical support” on page 139.	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 37. 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 with flags 4, 5, or 6).	See the action that is 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 because of a faulty tape cartridge.	Replace the tape cartridge.
5	Read failure	Set for any unrecoverable read error where the isolation is uncertain and failure might be because of 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 might be because of 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 114. 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 114.
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.

Table 37. TapeAlert flags supported by the Ultrium tape drive (continued)

Flag Number	Flag Name	Description	Action Required
11	Cleaning media	Set when a cleaning tape is loaded into the drive.	No action that is required. Status only.
12	Unsupported format	Set when a non-supported cartridge type is loaded into the drive or when the cartridge format was 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 139.
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 that is required. Status only.
17	Media that are 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 that is required. Status only.
18	Tape directory that is corrupted in cartridge memory	Set when the tape drive detects that the tape directory in the cartridge memory was 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 is 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 139.
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 139.
32	Interface	Set when the tape drive detects a problem with the host interface.	See "Contacting IBM technical support" on page 139.
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 procedure fails, use different media.

Table 37. TapeAlert flags supported by the Ultrium tape drive (continued)

Flag Number	Flag Name	Description	Action Required
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 139.
37	Drive voltage	Set when the drive detects power supply voltages that approach or exceed the specified voltage limits.	
38	Predictive failure of drive hardware	Set when a hardware failure of the tape drive is predicted.	
39	Diagnostics required	Set when the tape drive detects a failure that requires diagnostics for isolation.	
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 might 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 might 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 does 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 139. If the tape cartridge is stuck in the drive: 1. Attempt to unload the tape from the drive with the host backup application that is with the drive, or with the remote or local UI. 2. If the cartridge still does not unload, see "Contacting IBM technical support" on page 139.

Table 37. 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 with the Operator Panel or the Web User Interface. 2. Try a power cycle of the entire library. This procedure 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 with the Operator Panel or the Web User Interface. 4. If the cartridge still does not unload from the drive, see "Contacting IBM technical support" on page 139.
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 are not met. Data is appended to WORM media only. Overwrites to WORM media are not allowed.	Append the information about 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 might 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 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 LTO Ultrium Tape Drive SCSI Reference*.

Sense Key definitions

Table 38. 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

"Library sense data" 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 are 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 39. 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
	53	00	Media load or eject failed
	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
	80	21	Cartridge wrong insertion
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 39. 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 40. 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 207.			
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	For Ultrium Tape drive sense data for Bytes 12 and 13, see Table 41 on page 210.							
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.							

Table 40. Ultrium Tape drive sense data (continued)

Byte	Bit Address or Name							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
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							
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)							

Table 41. Ultrium Tape drive sense data - Bytes 12 and 13

Byte 12 ASC	Byte 13 ASCQ	Description
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.

Table 41. Ultrium Tape drive sense data - Bytes 12 and 13 (continued)

Byte 12 ASC	Byte 13 ASCQ	Description
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.
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.

Table 41. Ultrium Tape drive sense data - Bytes 12 and 13 (continued)

Byte 12 ASC	Byte 13 ASCQ	Description
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.
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.

Table 41. Ultrium Tape drive sense data - Bytes 12 and 13 (continued)

Byte 12 ASC	Byte 13 ASCQ	Description
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
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

Table 41. Ultrium Tape drive sense data - Bytes 12 and 13 (continued)

Byte 12 ASC	Byte 13 ASCQ	Description
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
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

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.

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 information, refer to the *IBM 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 that is used. Table 42 provides instructions specific to your type of device driver.

Table 42. 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 "The IBM Tape Diagnostic tool (ITDT)" on page 139. 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 various 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: Use the summary report to find the date and time of any errors that are related to library devices. Then, use the detail report to obtain the sense data that is 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 218 and the SCSI sense data in "Library sense data" on page 208.
- For drive errors [Resource Name = **rmt**n (for example, rmt0) and Resource Type = LTO], see "SCSI sense data definition" on page 218 and locate the SCSI sense data in "Tape drive sense data" on page 209.

SCSI sense data definition

The following example is of a tape drive communication failure while attached to an Open Systems host through a SAS link, with 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 represents the SCSI Sense Data that are presented by the host. The regular font data (in this case many bytes of "zero"), designated by "ssss" would normally contain device sense data. However, with the kind of failure in this example (COMMAND TIMEOUT), the host cannot collect valid device sense data, so zeros are the result and are ignored. If the host was 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, there is valid data to rely on. While the data shows a TAPE_ERR2, it might be caused by a library failure. When you attempt a **Move Medium** command ("A5"), the ASC/ASCQ points to a "Mechanical Positioning Error". For more information about sense data, see the *IBM 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,
"0C" 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 43. 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 (extra 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, there is valid data to rely on. While the data shows 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, follow the FID to make a repair. For more information about Sense Key and ASC/ASCQ fields, see the *IBM 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 44. 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 (extra 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 locate the error information, go to “Troubleshooting” on page 129.

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 locate the error information, go to “Troubleshooting” on page 129.

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:

- 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 with the QSRV logon and its security password (QSRV). After you sign on, the access authorization is 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 displays the machine type and serial number of the device. It also displays SCSI sense data, if available.)
   - F6=Hexadecimal report. (Pressing F6 displays the device hexadecimal data (for support use)).
   - F9=Address information. (Pressing F9 displays 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 that is contained on this form is important, and 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 (S8H, S7H, S6H, S5H, and 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 45 table. Modify and add extra Administrator, Superuser, and User names and passwords that are created. User names and passwords are case-sensitive.

Table 45. User Accounts

User name	Access Level	Password
admin	Administrator	secure

Support Notification

User name	
Password	

Appendix G. Accessibility

Accessibility features help a user with a physical disability, such as restricted mobility or limited vision, successfully use the HTML version of the customer documentation.

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 are tested: WebKing and Window-Eyes.
- You can operate all features with the keyboard instead of the mouse.

Navigate 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. Use the following keyboard combinations:

- http://www.dell.com/support
- To traverse to the next link, button, or topic, press **Tab** inside a frame (page).
- To move to the previous topic, press ^ or Shift+Tab.
- To scroll all the way up or down, press **Home** or **End**.
- To print the current page or active frame, press Ctrl+P.
- To select, press **Enter**.

Access the publications

You can view the publications for this library in Adobe Portable Document Format (PDF) with the Adobe Acrobat Reader. The PDFs are provided at the following website: http://www.ibm.com/storage/support/.

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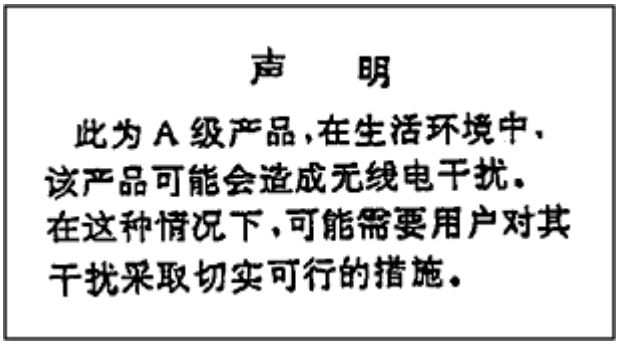

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rusemi

Glossary

This glossary defines the special terms, abbreviations, and acronyms that are used in this publication. If you do not find the term that 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.

AES Advanced Encryption Standard. A data encryption technique that improved upon and officially replaced the Data Encryption Standard (DES).

AH Authentication Header. 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 System p system, among others, uses AIX as its operating system.

alphanumeric
Pertaining to a character set that contains letters, numerals, and 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 that is surrounding equipment.

AME Application Managed Encryption.

ampere (A)
A unit of measure for electric current that is equivalent to a flow of 1 coulomb per second, or to the current produced by 1 volt applied across a resistance of 1 ohm.

ANSI American National Standards Institute.

application-managed encryption
Tape encryption that is 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 extra copies of documents or software for safekeeping.

bar code
A code that represents 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 that is 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 that are expected to be used to produce a specific 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).

BRMS Backup Recovery and Media Services.

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

buffer
A routine or storage that is used to compensate for a difference in rate of flow of data or time of occurrence of events, when data is transferred from one device to another.

bus A facility for transferring data between several devices that are located between two end points, only one device able to transmit at a specified moment.

byte A string that consists of some 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 that is 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*.

COD Capacity On Demand.

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 using 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 that is 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
*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 that is exchanged between the library and a web browser to track configuration.

CP Circuit protector.

CPF Control Path Failover.

CRU Customer Replaceable Unit.

CSA Canadian Standards Association.

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 that is dedicated to storing data. Contrast with *cleaning cartridge*.

data check
A synchronous or asynchronous indication of a condition that is caused by invalid data or incorrect positioning of data.

dc Direct current.

DCS Designated Cleaning Slot.

degauss
To make a magnetic tape nonmagnetic by using electrical coils that carry 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.

DES Data Encryption Standard. A cryptographic algorithm designed to encrypt and decrypt data using a private key.

deserialize
To change from serial-by-bit to parallel-by-byte.

detented
A part that is held in position with a catch or lever.

device Any hardware component or peripheral device, such as a tape drive or tape library, that can receive and send data.

device driver
A file that contains the code that is 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 wants 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. The Microsoft implementation of the shared library concept. These libraries usually have the file extension dll, ocs (for libraries that contain 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
To transfer programs or data from a computer to a connected device, typically a personal computer.

To transfer data from a computer to a connected device, such as a workstation or personal computer.

DPF Data Path Failover.

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 run. This message is not a real issue since it takes time for the library 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.

EEB Ethernet Expansion Blade

EEPROM
Electrically erasable programmable read-only memory.

EIA Electronics Industries Association.

EIA unit
A unit of measure, which is established by the Electronic Industries Association, equal to 44.45 millimeters (1.75 inches).

eject To remove or force out from within.

EKM Encryption Key Manager.

electronic mail
Correspondence in the form of messages that are transmitted between user terminals over a computer network.

email 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 that is written to and decrypt information that is read from tape media.

entitlement
IBMEntitlement 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 data set or file in a product or system where error information is stored for later access.

ESD Electrostatic discharge.

ESP Encapsulating Security Payload. An Internet Protocol that provides origin authenticity, integrity, and confidentiality protection of a packet. ESP also supports encryption-only and authentication-only configurations, but encryption without authentication is discouraged because it is insecure.

F

fault symptom code (FSC)
A hexadecimal code that is 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 that is 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 that are stored or processed as a unit. Also referred to as a data set.

file protection
The processes and procedures that are 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 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 system board.

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

Gbi gigabit

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

HBA Host Bus Adapter.

HD Slot Technology
High-density (HD) slot technology. Allows multiple cartridges to be stored in a tiered architecture.

hertz (Hz)
Unit of frequency. 1 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 that is injected into the signal is present in both a plus and minus state, and is 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 that are 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.

IEC International Electrotechnical Commission.

IKE Internet Key Exchange that is used in the IPsec protocol.

IML Initial microprogram load.

incompatible magazine
This message might display on the Operator Panel during library initialization. It occurs during factory restore or VPD. This message is not a real issue since it takes time for the library to configure.

initial microprogram load (IML)
The action of loading a microprogram from an external storage to writable control storage.

initiator
The component that runs 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 that is 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 that is 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 an Internet Protocol (TCP/IP) network. Networks that use the TCP/IP protocol route messages that are 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 that is 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 Tape Diagnostic tool.

ITST Idle-time self-test.

K

Kerberos
Kerberos Authentication is a standard (RFC 1510) third-party authentication protocol that provides end-to-end security for distributed computing environments.

kilogram (kg)
1000 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.

LCB Library Control Blade

LCD See *liquid crystal display*.

LDAP Lightweight Directory Access Protocol. This allows the library to use login and password information that is stored on a server to grant access to the library functionality.

LDAPS
Secure LDAP over SSL.

LDI Library Drive Interface.

LED Light-emitting diode.

library certification
In cryptography, a certificate that is provided by the library.

library-managed encryption
Tape encryption that is controlled by the tape library.

Linear Tape-Open (LTO)
A type of tape storage technology that is developed by the IBM Corporation, Hewlett-Packard, and Quantum. LTO technology is an "open format" technology, which means that its users have multiple sources of product and media. The "open" nature of LTO technology enables compatibility between different vendors' offerings by ensuring that vendors comply with verification standards. The LTO technology is implemented in two formats: the Accelis format focuses on fast access; the Ultrium format focuses on high capacity. The Ultrium format is the preferred format when capacity (rather than fast access) is the key storage consideration. An Ultrium cartridge has a compressed data capacity of up to 15 TB (2.5:1 compression) and a native data capacity of up to 6 TB.

liquid crystal display (LCD)
A low-power display technology that is used in computers and other I/O devices.

loadable
The ability to be loaded.

LME Library Managed Encryption.

LTO cartridge memory (LTO-CM)
Within each LTO Ultrium data cartridge, an embedded electronics and interface module that can store and retrieve a cartridge's historical usage and other information.

LUN Logical Unit Number.

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 that is used as an authority in a job and that is relatively permanent, even though its contents might change. Synonymous with main file.

Maximum Transmission Unit (MTU)
The size of the largest packet that a network protocol can transmit.

MB Megabyte (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
Pertaining to the bar code on the bar code label of the IBM Ultrium Tape Cartridge, a 2-character code, L1, that represents information about the cartridge. L identifies the cartridge as one that can be read by devices that incorporate LTO technology; 1 indicates that it is the first generation of its 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 that is used by SNMP.

micro One millionth of.

microcode
(1) One or more micro instructions. (2) A code, representing the instructions of an instruction set, which is 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 run performs a planned 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 that are 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 or destination addresses of IP packets as they pass through a router or firewall. Most systems that use NAT do so to enable multiple hosts on a private network to access the Internet over a single public IP address.

NEMA
National Electrical Manufacturers Association.

node In a network, a point at which one or more functional units connect channels or data circuits.

NTP Network Time Protocol. This protocol allows the library to set its internal date and time that is based on the date and time of a server.

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 unrationalized centimeter-gram-second (cgs) electromagnetic system. The oersted is the magnetic field strength in the interior of an elongated, uniformly wound solenoid that is excited with a linear current density in its winding of 1 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 might 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 using a robotic device, a tape cartridge from a storage slot or drive.

picker A robotic mechanism that is located inside the library that moves cartridges between the cartridge storage slots and the drive.

PM Preventive maintenance.

POR Power-on reset.

port A physical connection for communication between the 3590 and the host processor. The 3590 has 2 SCSI ports.

Portable Document Format (PDF)
A standard that is specified by Adobe Systems, Incorporated, for the electronic distribution of documents. PDF files are compact, can be distributed globally (by way of email, 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 that is used to decrypt a message.

PROM
Programmable read only memory.

PS Power supply.

PTF Program temporary fix. A single bugfix or group of bugfixes that are 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 that are 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, which are 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, which encompasses new research, innovations, and methodologies applicable to Internet technologies.

RH Relative humidity.

RID tag
Repair identification tag.

RML Rack Mount Line.

robot Picker.

robotics
Picker 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 that is developed to indicate possible FRU or FRUs to replace to repair the hardware.

SAN Storage area network.

SAS Serial Attached SCSI. A computer bus technology and serial communication protocol for direct attached storage devices. SAS is a replacement for parallel SCSI with higher speeds, but still utilizing SCSI commands.

scratch cartridge
A data cartridge that contains no useful data, but can be written to with new data.

SCD Single Character Display.

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, which represents 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 that is 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 that is 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 320 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.
- Ultra320 SCSI: Uses a 16-bit bus and supports data rates of 320 MBps.

SKLM (IBM Security Key Lifecycle Manager)
IBM's EKM application that assists encrypting tape drives in generating, protecting, storing, and maintaining encryption keys that encrypt information that is written to and decrypt information that is read from tape media.

SME System Managed Encryption.

SMI-S See *Storage Management Initiative Specification (SMI-S)*.

SMTP Simple Mail Transfer Protocol. SMTP is a standard for email transmissions across the internet.

SMW Servo Manufacturer's Word.

SNMP
Simple Network Management Protocol. SNMP is used by network management systems to monitor network-attached devices for conditions that warrant administrative attention.

SNTP Simple Network Time Protocol. Used to synchronize the clocks of network-attached devices.

SNS Sense.

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, email, Internet faxing, instant messaging, and other data transfer. SSL allows applications to communicate across a network in a way that is designed to prevent eavesdropping, tampering, and message forgery.

SSP Serial SCSI Protocol.

ST Store.

standard feature
The significant design elements of a product that are included as part of the fundamental product.

START
Start maintenance.

StartTLS
Secure LDAP communication that uses TLS.

Storage Management Initiative Specification (SMI-S)
A storage standard that is developed and maintained by the Storage Networking Industry Association (SNIA). It is also ratified as an ISO standard. The main objective of SMI-S is to enable broad interoperable management of heterogeneous storage vendor systems.

subsystem
A secondary or subordinate system, 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 that holds 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.

TB terabyte

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 that is 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.

UL Underwriter's Laboratories.

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 that is contained within the tape drive that requires nonvolatile storage that is used by functional areas of the drive, and information that is 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 which identifies Fibre Channel Host Bus adapters (HBA).

WORM
Write Once Read Many.

Write Write command.

WT World trade.

WWCID
Worldwide Cartridge Identifier.

WWN Worldwide Name.

WWNN
Worldwide Node Name.

WWPN
Worldwide port name.

X

XR External register.

XRA External register address register.

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V

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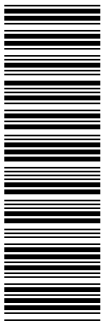

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